Town of Enfield

BLACK OAK
WIND FARM

Supplemental Draft Environmental Impact Statement

Written Public Comments

May 11, 2016

BLACK OAK WIND FARM PROJECT
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Subject **Comment on Black Oak Wind Farm project approval**

From Leslie Hoffman <gimmeshelterny@gmail.com>

To <townclerk@townofenfield.org>

Date 03/14/2016 3:47 pm

Addressing the Town of Enfield:

I have participated in Black Oak Wind Farm since its transition from Enfield Energy. I do not live in the Ithaca area, but have now visited a handful of times and have gotten the essence of it as a very special and unique place. I believe the wind farm is a bold step in the right direction for a community that is a leader - evidenced in many ways over many decades. I believe that the Town of Enfield will come to be recognized for, and extremely proud of, progressing through the legal and regulatory process to be on the forefront of our collective move to a renewable energy future. The turning blades will become not only a visual representation of wind into energy, but a positive step in the local consumption mix of energy sources, a teaching and research tool, and a financial benefit to the town, landowners and a lot of local investors. And now, at the very last minute, there is a kerfuffle. Not a shock, a bit of drama, but ultimately a much-too-late arrival for the just and legal process that has been adhered to for so long. Many people have invested enormous amounts of time, money and energy to proceed down the path to get this small, but important, wind farm developed. There is too much at stake to allow disruptive engagement - for Enfield and Black Oak - to derail the project.

Respectfully submitted,
Leslie Hoffman
Board Member
Black Oak Wind Farm

Subject **Black Oak Windfarm**
From Emily Tavares <bebethewindmiller@gmail.com>
To <townclerk@townofenfield.org>
Date 03/20/2016 6:21 pm

I have been waiting for too long now. We need Black Oak Farm to open. Please build the windmills now. We need wind energy for us, not fossil fuels. I do not want to suffer another year of waiting for the windmills. I love windmills. They give clean energy and I love to watch them spin. They calm me down. I am autistic but even I know how important it is for us to use windpower and not rely on fossil fuels anymore. Why can't the rest of you see this? It has taken too long to approve the farm and start working on the windmills. I am trying to be patient but it has taken years and there is no good reason not to build them. They will help our community and the earth. It is the right thing to do.

--
Emily" Bebe" Tavares

Subject **SEQRA Comment: Black Oak Wind Farm**
From Joseph Wilson <wilson.joe79@gmail.com>
To <townclerk@townofenfield.org>
Date 03/21/2016 10:40 am

Dear Board Members,

I have made some review of the scientifically based information about the health effects of wind farms. I have found that there is very little that is credible science--the kind that is published in peer-reviewed journals. Among them, Dr. Pierpont's book, although claimed to demonstrate that wind farms cause negative health effects, in fact shows (1) documented health effects are extraordinarily rare and (2) apparently occur to those unfortunate few who have some rare, pre-existing condition which creates susceptibility. Such a combination of factors is so unusual, it cannot be the basis for labeling the Black Oak Wind Farm a health hazard such that the precautions already taken in terms of siting and setback require anything more before the Farm is approved.

I have also reviewed what the Farm has done to comply with the siting guidelines from the Town Law, General Electric, and the Columbia Law School model law. On balance, the Farm has complied with the spirit as well as the letter of so much of what has been stated as either required or best practice, that it would be arbitrary and capricious--the basis for a successful law suit against the Town--if the Town Board were to require more of the Farm.

I recommend approval of the Supplementary Enviornmental Impact Statement.

--

Joseph M. Wilson
75 Hunt Hill Road
Ithaca NY 14850 (in the Town of Dryden)
607-539-1159

From: townclerk@townofenfield.org
Sent: Monday, March 28, 2016 4:42 PM
To: jpippin@haleyaldrich.com; Spencer, Kathy; Frank Pavia
Subject: Fwd: BOWF

FYI - another comment.
Alice

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: BOWF
Date: 03/28/2016 9:11 am
From: Elizabeth Salon <elizasalon.np@gmail.com>
To: townclerk@townofenfield.org
Cc: lettersforbowf@gmail.com

To whom it may concern: I am enthusiastically IN FAVOR of establishing a wind farm at Black Oak farm. I strongly urge the town board to approve this project. I am a 30 year resident and landowner on nearby West Hill, and a local health care provider. I believe this project is beneficial for our community, and the world at large.
Sincerely yours,
Elizabeth Salon

--

Elizabeth G. Salon, R.N.C., M.S., F.N.P.
Family Nurse Practitioner
Integrative Health

226 S. Fulton Street Plaza

Ithaca, NY 14850
_607-277-2201_

Subject **Black Oak Wind Farm**
From Louise Braren <weezerrocks9@yahoo.com>
To townclerk@townofenfield.org <townclerk@townofenfield.org>
Date 03/28/2016 6:44 pm

Enfield Town Board,

My husband and I are residents of 691 Black Oak Rd., Newfield, NY 14867. We have lived here for four years. We had be advise of the wind farm project from the beginning of our purchase of our property. We have never received false information about setbacks or health issues.

We have been surprised by the recent adversity to the wind farm, especially since it has been in the planning phase for nine years.

We believe the future of our children and their children will be positively influenced by modern energy efforts.

Our home is located near two of the future turbine sites. Our children and grand children, and other family members and friends visit often. No one has any fear or anxiety over the turbines future proximity to our home.

We think to cancel this project, after the long hours and work, not to mention the amount of money invested, would be a step backwards for our community and those involved.

Sincerely,

Michael Haldeman and Louise Braren

The speakers opposed to this project all spoke about personal concerns. Those of us in favor spoke of the common good

Thank you!

Ray Stiefel

notes

March 28, 2016

We support the
Black Oak Wind Farm
Because we believe
it is better to shift
away from non-renewable
energy sources
thank you for
working on making
this project work

Sincerely
Gwen Daniels
[illegible]
ROBERT WILLSEY

P.S. Please make sure the
turbines are safe & not too
loud for people nearby!

Spencer, Kathy

From: townclerk@townofenfield.org
Sent: Wednesday, March 30, 2016 3:41 PM
To: jpippin@haleyaldrich.com; Spencer, Kathy; fpavia@harrisbeach.com
Subject: Fwd: Black Oak Wind Farm

Another comment...

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: Black Oak Wind Farm
Date: 03/30/2016 1:28 pm
From: Frank Zgola <frank.zgola@gmail.com>
To: townclerk@townofenfield.org

As supporters of the wind farm my wife and I are believers in alternative energy.

For all of the oft-repeated reasons we were quick to "put our money where our mouths are" and became investors in Black Oak Wind Farm four years ago. We thought we were doing our bit then and are still proud to contribute to this local and global cause.

BOWF will create local construction jobs as well as part time/on-going technician employment, plus provide income to the Town of Enfield, income to the landowners and income to the neighbors who own adjoining property.

The managers and board of directors of BOWF have been accommodating to the concerns raised by some Enfield residents; the number of turbines has been decreased, the locations have been changed and newer, quieter models have been chosen. BOWF will be a good neighbor and good for the community.

It is time to approve the plan, begin construction and generate clean electricity!

Truly yours,

Frank Zgola

Ithaca, NY

Subject **Black Oak Wind Farm**
From Jim Sharp <jimsharp1977@gmail.com>
To <townclerk@townofenfield.org>
Date 04/01/2016 2:07 pm

To: The Enfield Town Board:

I live on Black Oak Road and I am in favor of the Black Oak Wind Farm. I've reviewed the complaints by the "next door neighbors" and the response by the Farm and I think the concerns of the neighbors have been adequately addressed. I believe the wind farm will benefit the Town of Enfield and the environment. With the wind farm on Black Oak and the solar farm on Mechlanberg Road, Enfield will become a local leader in alternative energy production. Please approve the new environmental impact statement and let's move forward.

--
Jim Sharp
278 Black Oak Drive
Ithaca, NY 14850
jimsharp1977@gmail.com

Enfield Town Board
168 Enfield Main Rd
Ithaca NY 14850

Bruce Stewart, MD
288 N Applegate RD
Ithaca NY 14850

2 April 2016

Re; Proposed Wind Farm

I am 100% in favor of the Black Oak wind farm. We are running out of fossil fuels and burning them is contributing to climate change and global warming.

I believe the arguments against the wind farm proposed both here and elsewhere are either flat out wrong or are seriously overblown and at times verge on the hysterical. The argument that they kill some birds is true and steps are taken to mitigate this. On any technology there has to be a cost to benefit calculated. I believe the wind energy is clearly of great benefit.

As a physician I have never found a carefully conducted study documenting any negative health effects from wind turbines. I have stood within 15 yards of one rotating at full rpm and the noise was minimal.

For those concerned with health effects, the real culprit is the particulates, carbon monoxide, and carcinogens from fuel burning power plants.

So I can't be accused of "Not in my backyard" I would be happy to have the wind turbines on the hill behind my house as an alternative site.

Bruce Stewart MD

Bruce Stewart, MD

Subject **Public Hearing comment**

From Kathleen Pasetty <kpasetty@gmail.com>

To <townclerk@townofenfield.org>

Date 04/04/2016 5:15 pm

Hello,
I attended the meeting on Monday 28th but needed to gather my thoughts so writing is easier for me than face to face.

For the years that I've known about the Black Oak Windfarm project, I've been impressed with the research, the information, the goals for the community and the environment.

At the meeting I was struck by the fear many people expressed. I was surprised by a sense of lack of information and lack of communication - yet I have been hearing about this project for years and it's not even happening on my street. I don't understand why people in the neighborhoods are feeling this way but they sure are.

I was also struck by residents' long term connection to their land and their wishes to subdivide, share with future generations, be able to continue enjoying the area.

I too would like to have something to share with future generations. This is why I support Black Oak. I want to support endevours that cut back on the use of fossil fuels.

I really wish this windfarm was being offered to my neighborhood. I see turbines as a symbol that we are doing something different, we are taking steps to change our habits.

I do empathize with pre-existing health conditions. I have a lot of concerns about the phones and computers that many of us use every day. I think there is so much in our environments that may be effecting our health but I do not see this windfarm as a threat.

Have local residents been given the opportunity to have a bus chartered and to visit the nearest windfarms? Would talking to residents of other towns, standing beneath their turbines, learning from people who have already lived with turbines nearby- would this be of help? Maybe this has already happened.

I see a need for more connecting in Enfield. I am concerned about the chasm between supporters and non-supporters at the meeting. It was the only meeting I've attended, so maybe this was different than in the past. If it was different, then why? What has happened that people are so scared?

I thought these landowners who signed leases were already in support? If this has changed, is there information, listening, support needed?

Has CDRC or another supportive organization been part of these meetings?

I know who I can ask from Black Oak. But really I want to put it out to you, the Board, since these are my concerns as a local resident and while I do support the Black Oak project, I am concerned about the strife in the air.

People seem really scared and mistrusting but this project is not new. I'm concerned about this change or current state of tension and am hoping that all sides can come together and move through this with more support.

Thank you for the opportunity to share this with you.

Sincerely,

Kathleen Pasetty
629 Hayts Rd.

Subject	**Support for the Wind Farm**
From	Mariann G. Carpenter <mgc1@cornell.edu>
To	townclerk@townofenfield.org <townclerk@townofenfield.org>
Cc	Ann Rider <ann-rider@townofenfield.org>
Date	04/04/2016 2:15 pm

Hello, I fully support the wind farm. I'm sorry that eight years of delay has meant eight years of lost benefit to Enfield residents. Please quickly review the latest proposal, and approve it. I hope we can simply proceed and end the fear.

Thank you! Mariann Carpenter

153 Enfield Main Road
Ithaca, NY 14850
607 273 6892

Subject **Black Oak Wind Farm Comment**
From Chuck Bartosch <chuck@clarityconnect.com>
To <townclerk@townofenfield.org>
Date 04/05/2016 7:57 pm

Just a quick comment about Black Oak Wind's contribution to the Enfield Community.

Four years ago there were 907 households in Enfield with no access to high speed Internet. To rectify this situation, Clarity Connect, Inc. applied for a State grant to build out in Enfield and other unserved areas of Tompkins and Southern Cayuga County. Unfortunately, to save money, the State cut Enfield and Caroline from Clarity's otherwise successful grant application under the ConnectNY Broadband program.

Black Oak Wind Farm subsequently approached Clarity Connect about expansion into Enfield. They committed to being an anchor client for their wind turbines (which need Internet access to transmit critical engineering and performance data). Moreover, they went far beyond their own direct needs and committed funds to help expand service to Enfield's many unserved residents.

The result was to make service available to over 800 of these households, a significant benefit to the Enfield community that would not otherwise be possible.

Chuck Bartosch, CEO
Clarity Connect, Inc.

Chuck Bartosch
Clarity Connect, Inc.
200 Pleasant Grove Road
Ithaca, NY 14850
(607) 227-5500 (cell)

If you're not living for something, you're dying for nothing.

snugplanet
delivering comfort and energy savings
1730 Mecklenburg Rd., Ithaca NY 14850 • 607-277-SNUG (7684) • www.snugplanet.com

Town of Enfield
182 Enfield Main Rd.
Ithaca, NY 14850

April 11, 2016

Dear Town of Enfield Board:

Snug Planet LLC is a contracting company based in Enfield; we specialize in energy efficiency. We are proud to provide our 13 employees with stable living wage jobs. As part of our lease, we pay property taxes to the Town of Enfield. We also hire Enfield residents for support services, including snow plowing and office cleaning.

We are writing to express our support for the Black Oak Wind Farm for the following reasons:

- Payments through the Host Community and PILOT agreements will support the Town of Enfield budget and ultimately reduce the tax burden on our business. PILOT payments will also provide much-needed funds to Enfield and other ICSD schools.

- Local road improvements will increase safety and decrease wear and tear on our vehicles and those of our employees.

- Black Oak has undergone thorough study and design, rigorous environmental review, and numerous public hearings over the past eight years. The wind farm, as currently proposed, meets or exceeds the setbacks specified in Enfield Town Law. Noise and flicker exposure also within acceptable limits. By approving the Wind Farm, the Town Board will demonstrate its commitment to good science and due process.

- As a mission-driven, environmentally focused business, we are excited both by the clean energy the wind farm will provide and by the positive attention it will attract. Tompkins County is becoming a statewide leader in clean energy. By approving the wind farm, the Town Board will increase Enfield's visibility in this area.

We strongly encourage the Town Board to approve the construction of the wind farm without further delay.

Sincerely,

Elisabeth Harrod Jon Harrod

Jon and Elisabeth Harrod
Co-owners
Cc: Black Oak Wind Farm

Rec'd 4-11-16

To: Enfield Town Board, 168 Enfield, Maine Road
From: Susan Sweetnam and Jim Sweetnam, 730 Bostwick Rd, Ithaca, NY
Re: Black Oak Wind Farm

For health reasons I've not been able to attend any of the public hearings regarding the Black Oak Wind Farm. As a member of the Enfield community since 1984, I would like to express my appreciation to the Town Board for taking such care to consider all aspects of this project and to ensure that it is right for our community.

When I learned that this project is not one that is solely the idea of an outside company and that Cornell University and local citizens will be involved in the planning and management of it, I became convinced that this project is a good move for our town.

I've been very pleased to see, through recent newsletters, that Enfield citizens are considering several ways to help the United States off-set the use of fossil fuels - wind farms and solar farms. Investing in renewable fuel resources will continue to underscore the Enfield community's longevity.

Please consider that my brother Jim and I are proponents of the Black Oak Wind Farm.

Susan Sweetnam
Jim Sweetnam

Subject **Wind Farm Support**
From Alice Rockey <ar356@cornell.edu>
To townclerk@townofenfield.org <townclerk@townofenfield.org>
Date 04/12/2016 3:09 pm

I wanted to let you know that I support the Black Oak Wind Farm but cannot attend tonight's meeting.

Best,

Alice

Alice Rockey
Administrative Coordinator
Engineering Learning Initiatives
167 Olin Hall
Cornell University
Ithaca, NY 14853
ar356@cornell.edu

Rec'd 4-12-16 Les Blomberg

Noise Impacts Not Investigated in the DSEIS

NOISE IMPACT THAT SHOULD HAVE BEEN INVESTIGATED	Investigated in DSEIS?	APP. H?
How will the turbine noise change the character of the area?	X	X
Where will turbines be audible?	X	X
Where will turbine noise dominate current ambient conditions?	X	X
Will neighbors be able to escape the noise by going indoors?	X	X
Where will turbines be audible inside homes?	X	X
Where will the noise be annoying? Highly annoying?	X	✓
Where will the noise interfere with outdoor activities or their enjoyment?	X	X
How will the community react to the turbine noise?	X	X
Predicted response based on EPA's *Levels Document,* Table D-7?	X	X
Will the noise change the acceptable uses of neighbors' properties?	X	X
Where will lands be unsuitable for future residential use?	X	X
Where will health impacts of noise occur?	X	X
Cardiovascular/stress related effects?	X	X
Sleep interference, awaking, sleep stage changes, difficulty falling asleep?	X	X
Secondary sleep interference effects such as fatigue, reduced performance, irritability?	X	X
Decreased helping behavior and increased aggressive behavior?	X	X
Decreased performance?	X	X
What will be the noise effects on wildlife and where will they occur?	X	X
Will infrasound from the turbines cause impacts?	X	X

4-12-16

BLACK OAK WIND TURBINES – 12 April 2016

My name is Bill Bassett. I live on Bostwick Road. I keep up with the literature on climate change, and the more I read the more concerned I become. Meteorologists now say they are able to see direct connections between global warming and the destructive storms we have been having. Glaciologists report that ice is being lost from Greenland and Antarctica at a greater rate than they had originally projected. Oceanographers are seeing acidification of the oceans and consequent damage to coral reefs. Climatologists are convinced that human activity is largely responsible. Electrical engineers have made great strides developing alternative sources of electrical energy. A number of researchers have warned of the fragile nature of the grid and the robustness of distributed, local power sources. All of this convinces me that the Black Oaks wind turbines make a great deal of sense for our safety and safety of future generations.

William A. Bassett
765 Bostwick Road
Ithaca, NY 14850
Wab7@cornell.edu
607 351 0604

Report on Wind Turbines

Report to the Town of Enfield Town Board

Enfield Wind Farm Advisory Committee
4-12-2016

Contents

About this report

In response to the controversy surrounding the proposed Black Oak Wind Farm, the Town of Enfield created the Wind Farm Advisory Committee to:

"to advise the Town Board and other Town agencies on matters pertaining to the siting and placement of wind turbines in the Town, any potential recommended updates or amendments to the existing local law, and to strengthen and improve public understanding of wind turbines generally, including matters as pertain to public health and safety. Thus, the Committee is charged with gathering factual information regarding wind turbine health and safety issues and making this information available to the Town Board after deliberation and considered recommendations thereupon. Towards this end, the Committee should review, recommend, and prioritize strategies as they relate to Town policies and local laws for wind turbines, and to further become informed about wind farming in the Town and generally, including both their positive and negative potential impacts."

The committee was formed in January, 2016 with a balance of members supporting Black Oak Wind Farm and wind energy technology as well as those that have raised concerns about its negative effects. The committee began meeting weekly to research and discuss the science of wind turbines. In a short time, it has sought technical advice from industry, science, and technical experts. Although, the committee could spend many more months of research, the report here is the result of information it has learned so far. Not all members are in agreement this is represented by a couple different sections on wind turbine noise and its effects.

Committee Members:

Mike Carpenter
Charlie Elrod
Martha Fischer
Marcus Gingerich
Jude Lemke
Mimi Mehaffey
Michael Miles, chair
Julie Schroeder
Rob Tesori

Former Members:

Marguerite Wells
Peter Bardaglio

Clerk:

Sue Thompson

Report on Wind Turbines and Noise

Introduction

The links and publications to be found when one searches "wind turbine noise health" number in the hundreds of thousands. Peer-reviewed publications investigate wind turbine noise in Australia, Canada, the United States, and in European countries. Some conclude that noise from wind turbines may have negative effects on human health, while others conclude that it has no effect on human health. Popular literature makes claims ranging from horrible outcomes of living next to turbines to people having no problem whatsoever. Coming to any one conclusion is next to impossible, and making recommendations is challenging. In this report we outline the complicated phenomenon that is noise, list the health concerns, and try to spell out whether or not those concerns are caused by noise from wind turbines.

What is Noise and how is it measured?

Measuring noise is extremely complex. While one can measure a sound, factors such as atmospheric conditions (air temperature, moisture, wind speed and direction, etc.), the contour of landscape, propagation of sound, and the instrumentation used in acoustic studies play into the accuracy of the measurement. This subcommittee is far from competent to explain the nuances in measuring sound and in interpreting reports of sound measurement.

That said, we will do our best to explain the parts that we do understand. A couple of references stand out as aids to our understanding: Gracey & Associates Acoustic Glossary[1] and Acoustics and Vibration Terminology Glossary, Definitions and Abbreviations.[2]

Noise is basically undesirable sound. Sound originating from wind turbines exists as audible and inaudible to the human ear. Analysis of sound shows that it consists of frequencies (or pitches) measured in hertz (Hz) at varying levels of loudness (or pressure levels) measured in decibels (dB). Sound with frequencies 0 – 20Hz are known as infrasound, and are inaudible to most people. Very low frequency sound is generally between 20 to 200Hz. Humans hear best at frequencies between 300 to 16,000Hz.

Human perception of loudness is influenced by the frequency of sound. With regard to infrasound generated by wind turbines, 'loudness' should be thought of in terms of strength. Acousticians measure the strength of sound with a sound pressure level meter. Most acoustic studies measure the strength of audible sound (which the term 'loudness' can easily describe). These studies de-emphasize frequencies below and above the threshold of human hearing are written as dBA. Note that the measurements reported in the Black Oak Wind Farm Acoustic Study are A-weighted. The strength of infrasound is difficult to measure.

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[1] http://www.acoustic-glossary.co.uk/

[2] http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR030001/2.%20Post-Submission/Application%20Documents/Environmental%20Statement/File%208-12/File%2012%20-%20Vol%201%20Annexes/16%20-%20Annex/16.1%20-%20Acoustics%20Vibration%20Glossary.pdf

Complaints

Wind Turbine Syndrome

Many objections about wind farms center around noise and infrasound. Nina Pierpont coined the term Wind Turbine Syndrome (WTS) and wrote the book (published in 2009)[3] to describe a suite of symptoms in 38 individuals from 10 families. The symptoms include "disturbed sleep, headaches, tinnitus, a sense of vibration, nervousness, rapid heartbeat, nausea, difficulty with concentration, memory loss, irratibility and anger." The common thread among people with these symptoms is that they live within a mile and a quarter of wind turbines. Physically moving away from wind turbines has been the most effective antidote to the symptoms. As soon as the presence of a wind turbine is removed, people experience relief from their symptoms.[4]

Vibroacoustic Disease

Vibroacoustic Disease (VAD) is less widely known except in aviation and military circles and journals such as those of the Aerospace Medical Association, It is "a consequence of long-term (years) exposure to low frequency noise." A thorough description of the disease at the following website includes stages and symptoms of the disease. (noiseoff.org/document/vibroacoustic .disease.1.pdf) While WTS symptoms disappear after a person moves away from a turbine, VAD symptoms persist. VAD "causes direct tissue or organ damage," as written at the website https://windwisema.org/about/noise/wind-turbine-syndrome-and-vibroacoustic-disease/

What peer-reviewed literature says

Measuring infrasound and low frequency sound is a topic of much discussion among acousticians. Many agree that acoustic measurements of sounds lower than 200Hz should not be taken with A-weighted filtering mechanisms. Studies of infrasound pressure levels are more accurately measured with G-weighted filtering. Jacobsen in 2001 published recommendations on noise limits for infrasound, writing that the limit for environmental infrasound must be a sound pressure level of 85dBG.[5]

Using the G-weighting function, comparison of measurements taken at homes adjacent to wind farms before and during a planned shutdown of the 2.1MW turbines showed no noticeable difference in sound level. During low wind periods, 40dBG was measured at locations close to and far from a turbine;

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[3] Pierpont, Nina. Wind Turbine Syndrome: A Report on a Natural Experiment. K-Selected Books. Santa Fe, NM. 2009.

[4] https://windwisema.org/about/noise/wind-turbine-syndrome-and-vibroacoustic-disease/

[5] Jakobsen, Jorgen. 2001. Danish guidelines on environmental low-frequency noise, infrasound, and vibration. Journal of Low Frequency noise, Vibration, and Active Control. pp 141-148. http://docs.wind-watch.org/jakobsen-2001_danish-guidelines.pdf

during higher wind periods, levels as high as 70dBG were found at locations at wind farm sites and non-wind farm sites.[6]

Peer-reviewed journal articles were inconclusive when reporting results of studies on the adverse effects of wind turbines on human health. Schmidt and Klokker 2014[7], performed a systematic review of the literature up to the end of 2013 "with the purpose of identifying any reported associations between wind turbine noise exposure and suspected health related effects. They searched for literature from peer-reviewed scientific sources (such as PubMed, Web of Science, and Google Scholar) as well as from internet sources which were not peer-review (such as wind-watch.org, windturbinesyndrome.com, and waubrafoundation.org.au). The researchers describe their method for narrowing the plethora of search results (over 1,000 articles) down to 252 studies. They concluded that noise from wind turbines annoys some people who live near them and may disturb some people's sleep. They caution that annoyance and disturbed sleep findings may be influenced by selection and information bias. The authors state:

> "Larger cross-sectional surveys have so far been unable to document a relationship between various symptoms such as tinnitus, hearing loss, vertigo, headache and exposure to wind turbine noise. One limitation causing this could be that most studies so far have only measured L_{Aeq}* or L_{den}**. An additional focus on the measurement of low-frequency sound exposure as well as a more thorough characterization of the amplitude modulated sound and the relationship between objective and subjective health parameters could lead to different conclusions in the future. Finally, in regards to the objective measurement of health-related disorders in relation to wind turbine noise, it would be valuable to demonstrate if such health-related outcomes fluctuate depending on exposure to wind turbine noise."
>
> [[Definitions from www.acoustic-glossary.co.uk/definitions-l.htm:
>
> * LAeq is A-weighted sound measured over a period of time
>
> ** Lden is A-weighted sound measured over the 24 hour period with a 10dB penalty added to the levels between the hours of 11:00pm and 7:00am and a 5dB penalty added to the levels between 7:00pm and 11:00pm to reflect people's sextra sensitivity to noise during night and evening.]]

Other reviews of literature echo the findings of Schmidt and Klokker. The Wisconsin State Legislature asked the Public Service Commission staff to update the review done in 2014 by Wisconsin's Wind Siting

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[6] Evans, T., Cooper, J., and Lenchine, V. 2013. Infrasound levels near windfarms and in other environments. Study undertaken for the Environment Protection Authority, Adelaide, South Australia. www.epa.sa.gov.au/files/477912_infrasound.pdf

[7] Schmidt JH, Klokker M (2014) Health Effects Related to Wind Turbine Noise Exposure: A Systematic Review. PLoS ONE 9(12): e114183. doi:10.1371/journal.pone.0114183 http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0114183

Council.[8] Among other articles, it lists the Health Canada Study (http://www.hc-sc.gc.ca/ewh-semt/noise-bruit/turbine-eoliennes/summary-resume-eng.php). The Wisconsin paper also referenced a publication titled "Evaluation of community response to wind turbine related noise in Western New York State" (http://www.noiseandhealth.org/article.asp?issn=1463-1741;year=2014;volume=16;issue=71;spage=228;epage=239;aulast=Magari).

With regard to sleep disturbance attributed to noise from wind turbines, Michaud et al, 2016[9], performed subjective and objective measures of sleep with 1,238 people randomly selected from residences between .25 and 11.22 kilometers from working wind turbines. The authors could find no pattern or correlation with wind turbine noise levels. They found that sleep quality was influence by factors such as caffeine intake, other health effects (such as disease and sleep disorders), and annoyance with blinking lights on the turbines.

Conclusions and Recommendations

It appears that illness caused by noise from wind turbines is a phenomenon not proven by science at this point in time. What has been revealed clearly is that noise from turbines annoys some people. Annoyance is no trivial matter, and if enough people complain about noise from the wind farm, action should be taken with the cooperation of the town, residents, and company to investigate the origin of the noise, the intensity of the noise, and possible ways of mitigation. Resolution on the best mitigation measures should be reached and then implemented.

In the future, monitoring should follow the protocols set out in Results of an Acoustic Testing Program: Cape Bridgewater Wind Farm (The Acoustic Group Report 44.5100.R7:MSC 26th November, 2014), especially with respect to land/home owner involvement in planning and implementation. http://www.pacifichydro.com.au/files/2015/01/Cape-Bridgewater-Acoustic-Report.pdf

Any acoustic studies should be undertaken with instruments that are properly calibrated and suitable for measurements across humanly audible and inaudible (within reason) frequencies and pressure levels.

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[8] Staff of Public Service Commission. 2015. Review of Studies and Literature Relating to Wind Turbines and Human Health. https://psc.wi.gov/reports/documents/2015WindReport.pdf

[9] Michaud DS, Feder K, Keith SE, Voicescu SA, Marro L, Than J, Guay M, Denning A, Murray BJ, Weiss SK, Villeneuve PJ, van den Berg F, Bower T. Effects of wind turbine noise on self-reported and objective measures of sleep. *SLEEP* 2016;39(1):97–109. http://www.ncbi.nlm.nih.gov/pubmed/26518593

Wind Turbine Noise

Summary

The complexities related to wind turbine noise are well summed up by a quote from the Frey, Hadden report of 2012[10],

> "Wind turbine noise is especially complicated because of the 'cocktail' of physical acoustic characters that comprise the noise pollution. The pulsating noise, characteristic of wind turbines, can be more intrusive than other types of noise and the pulsations include both audible and inaudible components, i.e., low frequency noise, infrasound, and vibration. Noise with these characteristics is more intrusive, and the World Health Organization (WHO) guidelines recommend lowering the permissible decibel levels when noise contains these characteristics. WHO makes these recommendations not merely to reduce annoyance or nuisance. WHO makes these recommendations because epidemiological studies indicate clearly that environmental noise is prejudicial and injurious to health."

While there is yet no scientific consensus as to the effects of wind turbine noise on people, *the precautionary principle should be followed until definitive scientific studies can be conducted to address the questions surrounding the health risks related to wind turbine noise. If there is no clear scientific consensus regarding safety, the town must err on the side of caution and have strict sound limits and significant setbacks to protect residents.*

Based on the research of papers, reports and communications, the following conclusions and recommendations were made:

Conclusions

1. The greater the distance which wind turbines are set back from residences the less likely there is to be adverse affects for the residents.
2. Audible noise 200-20kHz is more easily monitored and controlled than lower frequencies.
3. The lower the frequency of the noise, the farther the sound will carry before being dissipated.
4. Any health risks of infrasound (sound below 20Hz in frequency) and low frequency noise (sound from approximately 20-200Hz) are generally dismissed by the wind industry as insignificant; thus, they are generally not regulated or monitored.[11]
5. Wind turbines emit infrasound, and the larger the turbine, the slower the rotation, the lower the infrasound frequency; thus, the farther the propagation.

Mitigations

1. One method of mitigation is to establish an absolute setback distance such that the risks to residents are well within an acceptable range. This method is the simplest; however, if properly implemented, this method is likely to result in the greatest setback as no consideration would be given to wind turbine size and/or design. Also, since the configuration of multiple turbines can

10 http://waubrafoundation.org.au/wp-content/uploads/2014/06/Frey-Hadden-Wind-Turbines-Proximity-to-Homes.pdf

11 s3.amazonaws.com/windaction/attachments/2510/Infasound__and_wind_turbines_final_version_4_August_2015.pdf

have a significant effect on sound attenuation,[12] the setback must be large enough to provide protection against multiple wind turbines operating simultaneously. Based on the available studies, the only safe limit seems to be that greater than about 1mi. (~1.5km)[13] minimizes the risk of adverse reactions. Distances less than that seem to have some increased risk of adverse reaction, but this depends upon many factors which are not yet fully understood.

2. A second possible method of mitigation is to establish a setback based upon the size of the wind turbine such as the rotor diameter and/or total height or some combination of both. This has the effect of allowing for different size turbines; thus, smaller turbines would require less separation from residents.

3. A third method of mitigation is to establish a setback based on predicted noise levels which the wind developer must guarantee will be met or mitigation must be implemented such that the noise levels are met. This method must include both criterion for audible or A-weighted noise levels, LFN and IS noise. There seems to be a tolerable level of audible sound around L_{Aeq} of 35dB,[14] this would be most important during the nighttime. Somewhat louder appears to be acceptable during daytime, for example 40 dBA, or some limit, such as 3-5dBA above ambient.
A method for addressing acute noise annoyance was proposed by Kelley, et al., based on the SERI/NASA/DOE studies in the 80's.[15] *Another paper developed a method of calculating a safe setback distance for a single wind turbine based on thresholds for annoyance and physiological effects threshold for different turbines and frequencies.*[16] *However, additional consideration would need to be given to multiple turbines and/or arrays of wind turbines and the 'Heightened Noise Zones' produced by the interacting noise fields. The calculations also require accurate data on the noise spectrum produced by the wind turbine(s).*

Introduction

In general, environmental noise is known to cause health problems. The question is, what levels and characteristics of noise are responsible for those adverse effects?

Wind turbines produce significant amounts of noise throughout the audible noise spectrum as well as down into the LFN range and IS range. Wind turbine noise was first studied here in the U.S. back in the late 1970s and early 1980s under a joint project between the Department of Energy (DOE), the National Aeronautics and Space Administration (NASA), and the National Renewable Energy Laboratory (NREL) which was known at that time as the Solar Energy Research Institute (SERI). The MOD-1 turbine, a downwind design, unexpectedly caused what was termed 'annoyance' among residents as far away as ~2km. A subsequent study of the MOD-2 turbine, a downwind design more comparable to wind turbines of present day, indicated that model produced less infrasound and was not expected to produce adverse effects beyond 1km.[17]

No comparable and comprehensive studies of more modern wind turbines have been found; thus, no assessments or comparisons can be made. More recent studies of wind turbines have focused on the effects on people (and animals) living in the vicinity of industrial wind turbine installations.

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12 http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19910007366.pdf
13 https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/eh57a_information_paper.pdf
14 Schmidt, et al., http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4256253/pdf/pone.0114183.pdf
15 Kelley, et. Al, http://www.nrel.gov/docs/legosti/old/3261.pdf
16 Thorne, et. al, https://www.acoustics.asn.au/conference_proceedings/INTERNOISE2014/papers/p599.pdf#page=1&zoom=auto,-12,843
17 Kelley, et. al., http://www.nrel.gov/docs/legosti/old/3036.pdf

Though not confirmed via scientific rigor, many health issues have been attributed to living near wind turbines including: tinnitus, hearing loss, vertigo, headaches, and nausea to name a few. More generally accepted effects include noise annoyance and sleep disturbance. One very significant confounding factor is the variability between individuals and the specific susceptibility of each to the different effects. A few of the notable reports of findings and effects on animals and human health are presented in the following sections.

Animal studies

There is not a large body of data available in the peer-reviewed literature on the effect of wind turbines on animals; however, there are a small number of peer-reviewed studies. Most studies are not controlled studies, rather they are specific case-studies. A couple of examples are:

1. One controlled study was conducted on the reaction of two groups of domestic geese raised at two distances from a wind turbine, one group was 50m from the WT and the second group was 500m from the WT. The study found that the closer group experienced less weight gain and an increased concentration of cortisol in blood which is a stress indicator.[18]
2. One case study, while not definitive, seemed to point toward wind turbines causing equine flexural limb deformities (as well as human health problems).[19]
3. The Army performed low frequency vibration studies on chick embryos and found serious development problems and death of the developing chick embryos. Developing chick embryos are considered a model for human embryonic development.[20]

Human studies

There are many studies involving human health, but these are primarily based on surveys of individuals living in the vicinity of industrial wind turbines. While some short term laboratory studies have been conducted on the effect of infrasound humans, these definitely do not address the reported long-term effects. There are also numerous anecdotal reports of the adverse effects attributed to wind turbine noise and LF or IS noise, in particular. These are often not accepted as valid, thus some of the more generally accepted findings and rigorous studies are described below.

1. The effect of low frequency noise (LFN) and infrasound (IS) on human physiology is a subject of some debate, but there is evidence that humans are affected and can sense sounds much lower in frequency and at much lower amplitudes that previously thought. Recent studies have demonstrated that this is true using EEG,[21] fMRI and MEG[22] to monitor brain activity. Salt, et al., showed that there is a plausible pathway for infrasound to be perceived by the inner ear.[23]
2. By directly quantifying the inner ear sensitivity to LFN through measurement of spontaneous otoacoustic emissions, another study demonstrated the potential for hearing damage as there is a significant discrepancy between perception and the risk potential of LFN.[24]
3. The annoyance of infrasound to receptors (residents) at distances as high as 2km has been noted as early is the late '70s or early '80s by a joint SERI/DOE/NASA study.[25]

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18 http://www.ncbi.nlm.nih.gov/pubmed/24597302
19 http://doc.wind-watch.org/Castelo-Branco-follow-up-WT-near-home.pdf
20 http://www.usaarl.army.mil/techreports/95-1.pdf
21 http://psjd.icm.edu.pl/psjd/element/bwmeta1.element.bwnjournal-article-appv125n4a04kz
22 http://waubrafoundation.org.au/wp-content/uploads/2015/07/Bauer-et-al.-Investigation-of-Perception-at-Infrasound-Frequencies-by-MRI-and-MEG.pdf
23 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2923251/
24 http://rsos.royalsocietypublishing.org/content/1/2/140166
25 http://www.nrel.gov/docs/legosti/old/1166.pdf

4. A recent Australian study did not establish a scientific link between wind turbine noise and health based on the body of direct evidence which was reported as being small and of poor quality. The study also indicated that, based upon parallel evidence, beyond about 1.5km any effects should be minimal except in the area of annoyance.[26]

5. One seemingly safe assessment of the literature is that greater setback distances from residences will decrease the likelihood of adverse effects such as annoyance, sleep disturbance or other health issues including tinnitus, hearing loss, vertigo or headache. While many completely disregard all effects except noise annoyance and sleep disturbance, and those are usually trivialized; sleep disturbance resulting in chronic sleep loss is a significant health issue which has been shown to have very serious ramifications including permanent neural damage and may have implications to Parkinson's and Alzheimer's disease.[27,28,29]

6. Onakpoya et al., found that the odds of being annoyed is significantly increased by wind turbine noise. The odds of sleep disturbance was also significantly increased with greater exposure to wind turbine noise. Four studies reported that wind turbine noise significantly interfered with quality of life (QOL). Visual perception of wind turbine generators was associated with greater frequency of reported negative health effects. In conclusion, there is some evidence that exposure to wind turbine noise is associated with increased odds of annoyance and sleep problems. Individual attitudes could influence the type of response to noise from wind turbines. Experimental and observational studies investigating the relationship between wind turbine noise and health are warranted.[30]

7. Prof. Alan Hedges of Cornell U. indicates that vibrations in the frequency range of 0.5 Hz to 80 Hz have significant effects on the human body because of the natural resonance frequencies of the human body and its various parts or organs. The resonant frequencies can result in as much as a 350% amplification of the vibration depending on the frequency and location in the body (20 to 30 Hz between the head and shoulders). According to Prof. Hedges, whole body vibration may create chronic stresses and sometimes even permanent damage to the affected organs or body parts. Suspected health effects of whole body vibration include:[31]

   –Blurred vision

   –Decrease in manual coordination

   –Drowsiness (even with proper rest)

   –Low back pain/injury

   –Insomnia

   –Headaches or upset stomach

   As pointed out by the Kelley studies of 30 years ago, one of the significant issues was the sensation of vibrations in the structure of the affected homes.[32] There is evidence that the strong resonances found in the acoustic pressure field measured within rooms indicates a coupling of

26 https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/eh57a_information_paper.pdf

27 https://www.urmc.rochester.edu/news/story/3584/scientists-discover-previously-unknown-cleansing-system-in-brain.aspx

28 https://www.urmc.rochester.edu/news/story/3956/to-sleep-perchance-to-clean.aspx

29 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3880190/

30 http://www.ncbi.nlm.nih.gov/pubmed/25982992

31 http://ergo.human.cornell.edu/studentdownloads/dea3500pdfs/whole-bodyvibration.pdf

32 http://www.nrel.gov/docs/legosti/old/3261.pdf

sub-audible energy to human body resonances at 5, 12, and 17-25 Hz, resulting in a sensation of whole-body vibration.[33]

8. As mentioned in the animal study section, the Army studied the potential health issues related to low frequency vibration based on their own studies of developing chick embryos (as a model for human embryos) and because of the potential health hazard restricted pregnant aviators from rotary-wing flying duties.[34]

Conclusion

With the potential life altering implications for people and, in particular, for children, the elderly and other more susceptible individuals, it is very important to err on the side of safety when determining appropriate siting for industrial wind turbine installations. Audible noise studies are very important, but it is very apparent that LFN and IS must also be strictly controlled and monitored. It is very difficult to make an accurate and/or specific minimum setback distance without knowledge of all of the variables. The variables include, but are not limited to, the specific noise power spectrum of the given wind turbine model being used, exact locations and interactions of multiple wind turbines in a given wind farm, and topography. Some variables are constantly changing such as atmospheric conditions, wind, etc., thus, a setback must always allow for a worst case scenario plus an appropriate safety margin.

33 http://docs.wind-watch.org/kelley_ASME_1982.pdf

34 http://www.usaarl.army.mil/techreports/95-1.pdf

Ice and Blade Fragment Throw

Introduction

Ice and blade fragment throw events from wind turbines can and do happen. Therefore, it is important to understand how likely these events are and how to best mitigate against them.

According to a 2005 Dutch Handbook[35] that is frequently referenced in assessing risk associated with wind turbines, the rate of wind turbine blade failure was between 1 in 2,400 and 1 in 20,000 depending on rotor speed and whether it was a partial or full blade failure. This put the rate of failure between 0.0416% and 0.005%. However, this failure rate is based on data collected between 1980 and 2001.

According to a 2015 Windpower Monthly article[36], wind turbine rotor blades fail at the rate of 3,800 per year. Out of 700,000 or so blades that are in operation worldwide, the failure rate is 0.54%, a significant increase from the Dutch Handbook rates. It's important to note that this article doesn't say how many of these blade failures resulted in a detachment event. It is likely that some blade failures are detected and corrected before a detachment event occurs.

It has been difficult to find detailed data on wind turbine icing risks for our upstate NY climate. There has been a larger body of research from European scientist and engineers on icing risk and mitigation. According to an MMI Engineer presentation[37], risks or fatality from ice have been calculated around 3 orders of magnitude (x1000) higher than from blade failure. Data collection on actual wind turbine icing events is also limited. In one study of icing events in Gütsch, Switzerland over four winters (2005 to 2009), 32 icing events were recorded with 228 fragments documented. The maximum distance was one found at 92 meters. However it was noted that:

- Not all events could be captured
- Inspection partly delayed
- Exact time of ice throw unknown

There has been more investigations of ice and blade fragment throws using advanced modeling techniques. A 2015 paper from Uppsala University in Sweden that uses advanced modeling, the author found throwing distances up to 350 meters under certain conditions. For this paper and other similar research, the models were dependent on important wind turbine characteristics such as tower height, rotor diameter, and rotational speed.

Another risk researchers try to quantify is how likely a blade fragment or ice throw will hit something or someone. While there have been no reported deaths from a flying blade or ice fragment yet, there have

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35 H Braam et al., "Hanboek Risicozonering Windturbines", 2nd Edition, January 2005

36 Annual blade failures estimated at around 3,800 (Windpower Monthly, May 14, 2005) http://www.windpowermonthly.com/article/1347145/annual-blade-failures-estimated-around-3800

37 Advances and Cases Studies in Wind Turbine Risk Assessments Icing – how big a hazard? - by Chris Robinson, MMI Engineering, presented at RenewableUK Health & Safety 2013

been incidents of houses being hit [38] [39]. Most of the research puts the probability as very low. For example, according to a 2007 report by Garrad Hassan to the Canadian Wind Energy Association[40], the following scenarios were analyzed along with the probability for each scenario:

Scenario	Probability
A fixed dwelling 300 meters from a turbine	0.0002 strikes per year (1 in 5,000 years)
A vehicle travelling on road 200 meters away	0.0000038 strikes per year (1 in 260,000 years)
A individual 300 meters away	0.000000007 strikes per year (1 in 137,500,000 years)

While the report authors made assumptions about each scenario, it should give one a reasonable understanding of likelihood of an impact.

Setback Mitigation

Using setbacks is one of the best way to mitigate against blade and ice throw risks. The further from the turbine, the less likely an impact will occur. Below are two setback calculations. Calculation 1 is a common formula that is found throughout the literature. GE uses Calculation 1 in it's guidelines for ice throw mitigation (GER-4262)[41]

Calculation 1:

Setback = 1.5 * (Rotor diameter + hub height)

Calculation 2:

Setback (meters) = (Percentage of impacts inside distance * Fragment release velocity) / 11.9

Calculation 2 is found in a 2011 paper, "A method for defining wind turbine setback standards", Jonathan Rogers et al. The authors demonstrate that Calculation 1 provides "inconsistent and inadequate protection against blade throw" and propose Calculation 2 because "the release velocity of the blade fragment is the critical factor in determining the maximum distance fragments are likely to travel.". Jonathan Rogers discussed this paper as a technical expert for the Enfield Wind Farm Advisory Committee on March 1, 2016.

Below is a table that uses both calculations to find a setback for a Vestas 2.0 MW turbine (example used in the Rogers paper) and a GE 2.3 - 107 turbine. The probabilities and risks levels were kept the same.

	Vestas 2.0 MW	GE 2.3 - 107
WIND TURBINE CHARACTERISTICS		
ROTOR RADIUS (METERS)	40 meters	53.6 meters
TOWER HEIGHT (METERS)	67 meters	94 meters
ROTATIONAL SPEED (RPM)	16.7 RPM	15.9 RPM

[38] Wind turbine's deadly ice shower, http://www.peterboroughtoday.co.uk/news/latest-news/wind-turbine-s-deadly-ice-shower-1-120837

[39] House hit by debris following blade failure, http://www.windpowermonthly.com/article/1378289/house-hit-debris-following-blade-failure

[40] Recommendations for Risk Assessments of Ice Throw and Blade Failure in Ontario, 2007, Garrad Hassan Canada Inc.

[41] Ice Shedding and Ice Throw – Risk and Mitigation (GE Power, GER 4262, 2006)

ROTATIONAL SPEED (RADIANS/SECOND)	1.75	1.67
FRAGMENT SIZE (METERS)	2 meters	2 meters
PROBABILITIES		
RISK LEVEL - BLADE THROW PROBABILITY AT OR BEYOND SETBACK	1 in 20,000	1 in 20,000
RATE OF BLADE FAILURE PER TURBINE PER YEAR	1 in 3846	1 in 3846
OUTPUT VARIABLES		
FRAGMENT RELEASE VELOCITY (METERS/SECOND)	68.34 (m/s)	87.69 (m/s)
PERCENTAGE OF IMPACTS CONTAINED WITHIN THE SETBACK DISTANCE	80.77%	80.77%
SETBACK USING CALCULATION 1	723 feet	990 feet
SETBACK USING CALCULATION 2	1520 feet	1950 feet

Other Mitigation Measures

There are several additional ways to help mitigate against ice and blade throw from a wind turbine.

Ice Sensors – Being able to detect when an icing event occurs helps turbine operators so that they can take corrective measures. Ice sensors are becoming much more sophisticated, but are not 100% capable of detecting every event. GE's warns against this in it's GER-4262 (Ice Shedding and Ice Throw – Risk and Mitigation): "Detection of ice by a nacelle-mounted ice sensor which is available for some models (with current sensor technology, ice detection is not highly reliable)."

Thermal anti- and de-icing systems – Various systems exist to help heat the blades and other components. In cold climates where ice events often occur, doing so may actually be cost-effective since it will minimize downtime and underperformance.

Anti-freeze coatings for rotor blades – This is another area that can help mitigate icing events. However, according to the 2012 IEA Wind report[42]: "Antifreeze coatings have been investigated widely in the last years. Many coatings have been promising in the laboratory tests, but none of them has proved to be functional or enough wear resistant in field conditions."

Warning Signs and Fencing – It has been mentioned in several publications and reports that warning signs and fencing be included as a mitigation measure.

Summary

Wind turbine blade failure and ice throw are not rare events. Sophisticated modeling and analyses show that ice and blade fragments can land hundreds of meters from a wind turbine. However, the risks that a person will be hit by one is relatively small. Since ice and blade throw is not a rare event, it's important to be cautious and implement mitigation strategies such as setbacks, warning signs, fences, ice sensors, and anti-freeze coatings on blades. In cold climates researchers and engineers recommend having an ice risk and mitigation analysis done.

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[42] State-of-the-Art of Wind Energy in Cold Climates, IEA (International Energy Agency) Wind, 2012

Fire, Lightning, Mechanical Failure, Flicker and Other Miscellaneous Issues

Overview – Mechanical Failure, Fire, Lightning

Like any other mechanical machine, wind turbines can and do experience mechanical failures with attendant risks resulting. In 2013, GCube, the leading provider of renewable energy insurance services published a report summarizing the most common wind energy insurance claims made in the United States. The data based on 2012 US reported claims, shows that blade damage and gearbox failure account for the greatest number of losses – accounting for 41.4% and 35.1% of the total claims reported. Meanwhile, damage to foundations came in fifth. The top two most frequently reported causes of loss were cited as poor maintenance (24.5%) and lightning strikes (23.4%). Design defect (11.5%), wear and tear (9.3%) and mechanical defect (6.2%) featured in third, fourth and fifth when it came to assessing and understanding the reason cited for the initial claim. Although the majority of wind turbine blade damage can be attributed to lightning strikes; delamination and improper handling during the construction and installation phase are also frequent causes. Since 2008, GCube alone has paid out over $200,000,000 in claims to the renewable energy industry, with the majority of this figure coming from the wind sector.[43]

Array Loss/ Bearing Failure

While the various components of turbines are designed to meet the requirements of the IEC 61400-1 20-year wind turbine design standard, there are no requirements in the design standard for the reliability of the turbine system as a whole – nor is there a requirement for the reliability of major sub-systems, such as the gearbox. So, the reliability of a gearbox system can be substantially less than 20 years. And the single largest component of a gearbox system that causes gearboxes to fail is the bearings.[44] According to the insurer GCube, with approximately 175,000 geared turbines in operation in 86 countries worldwide, there are around 1,200 incidents of gearbox failure reported each year — one failure per 145 turbines per year.[45]

If turbines are sited such that the wind blows parallel to the rows of the turbines (see, e.g., turbines 1, B and C in the Black Oak Wind Farm project), then the turbine following the lead turbine in the row will have higher turbulence as well lower wind speed. The effect of the turbulence and fluctuating wind speed is not only loss in the production of electricity (i.e., array loss), but also the reduced life of the wind turbines due to fatigue failure.[46][47]

One type of fatigue failure is axial cracking in bearing races that has become common in large megawatt turbines. This damage can shorten bearing life to as little as one to two years. Axial cracking issues in bearings were not a prominent failure mode until larger megawatt and multi-megawatt class wind

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[43] http://www.gcube-insurance.com/press/gcube-top-5-us-wind-energy-insurance-claims-report/

[44] http://nawindpower.com/online/issues/NAW1505/FEAT_01_Meet-The-Achilles-Heel-Behind-Most-Gearbox-Failures.html

[45] http://www.windsystemsmag.com/article/detail/878/gcube-targets-turbine-gearbox-failures-in-report

[46] http://www.brighthub.com/environment/renewable-energy/articles/97151.aspx

[47] http://www.windpowerengineering.com/design/how-turbulent-wind-abuse-wind-turbine-drivetrains/

turbines were put in service. It was not a common failure mode of earlier, smaller turbine models where the failure mode was more commonly bearing surface deterioration from pitting and scuffing. The issue of axial cracking grew along with turbine size.

The key to limiting fatigue failure, and the resulting dangers such as blade throw, fires, etc., is proper siting of the turbines.[48] Wind turbine studies have shown that turbines spaced eight to ten times the rotor diameter in the downwind direction and five times the rotor diameter in the crosswind direction have very little turbulence- as little as 10%.[49]

Fire

You need three things to start a fire: fuel, ignition and oxygen. And you can find all three of them in ample quantities within the nacelle of a wind turbine. Turbines catch fire because highly flammable materials such as hydraulic oil and plastics are in close proximity to machinery and electrical wires. According to Exelon, their 400 foot turbines contain 400 gallons of oil.[50] (The Final Findings Statement states that "the turbines have substantially less hydraulic fluid than most other turbines today" but doesn't disclose how much they contain.) And the nacelle itself is made with highly flammable plastics. Add high winds and you have all the ingredients for a fire.

Fires in turbines typically start one of two ways – a lightning strike (see further discussion on lightning below) or a technical fault. Once a fire starts there is little or nothing that can be done to prevent the turbine's complete destruction.[51] Catastrophic fires are not common although just how often they occur is the subject of some disagreement. The insurer, GCube, claims only 50 turbines a year or one in every 6,000 turbines go up in flames in any one year.[52] Daniel Kopte, an expert in safety systems for renewables certification at DNV GL estimates that approximately 120 turbines a year or one in every 2,000 turbines catch fire each year.[53] Kopte's number corresponds to a study done by Imperial College London which estimates that approximately 117 turbines catch fire every year.[54] Still others claim that wind farm accidents are actually much greater due to the fact that these accidents often are not reported.[55]

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[48] http://www.windpowerengineering.com/design/how-turbulent-wind-abuse-wind-turbine-drivetrains/

[49] For the GE 2.3MW-107 turbines, that translates to 2,808.4 feet to 3,510.5 feet for the downwind direction and 1,755.25 feet in the crosswind direction.

[50] https://www.wind-watch.org/news/2016/03/02/fallen-turbines-oil-spill-shouldnt-be-a-problem/#.VtcNzNrM6ao.mailto

[51] http://www.windpowermonthly.com/article/1361476/minimising-fire-risk-wind-turbines

[52] http://www.gcube-insurance.com/press/gcube-tackles-turbine-fires/

[53] http://www.windpowermonthly.com/article/1361476/minimising-fire-risk-wind-turbines. Note, however, that his estimate includes both damaged and destroyed turbines.

[54] http://www3.imperial.ac.uk/newsandeventspggrp/imperialcollege/newssummary/news_17-7-2014-8-56-10

[55] http://www.telegraph.co.uk/news/uknews/8948363/1500-accidents-and-incidents-on-UK-wind-farms.html

In the U.S., OSHA recommends that all wind turbines install fire detection and controls.[56] But, unlike Europe, the U.S. has no mandated regulations for fire suppression.[57] Given that, it is the local municipality's responsibility to develop their own fire emergency plans.[58] Most wind turbines do not have fire suppression systems installed by the manufacturers. In fact, GE's salesperson who attended the Wind Farm Advisory Committee stated that the 2.3MW-107 turbines being installed by Black Oak Wind Farm do not have such a system. However, Section 6.9.1 of the Final Findings Statement provides that the turbines will come standard with two fire extinguishers in the nacelle, and one in the base of the tower and that Black Oak will purchase an additional fire protection system from Firetrace International, LLC, which provides fire control devices in individual turbine components such as the electrical cabinets and converters. In addition, the SDEIS states there will be an updated Fire and Emergency Plan provided but it is not part of the filing.

Given the remote locations and enormous height of turbines today, there is not much a fire department can do to fight a fire in the nacelle. Gary Bowker, a retired fire professional with over 40 years of experience, including as fire chief with the U.S. Air Force and fire chief with Sumner County, Kansas, has this to say about fighting wind turbine fires:

> "..., due to the risk of falling debris over a wide area, approaching a burning turbine is usually not an option unless there is a life risk involved. If the turbine is turning, power is being generated and an electrocution hazard will be present.
>
> Typically, a good option for firefighters to consider is to evacuate any endangered areas, set up a collapse zone, and attempt to control any ground fires to prevent the fire from spreading to other units.
>
> In the case of a runaway or over-speed event, rotating turbines can throw debris thousands of feet away during a blade failure. Pieces of blades have been documented as traveling over 4,200 feet. Distance and time will fix this problem. Pre-incident planning and SOP development are keys to success for safely handling this unique danger."[59]

In addition to grass fires, the secondary fire on the ground can lead to forest fires, which can be difficult to extinguish. The remote locations of the turbines and strong winds can be factors that promote the quick spread of forest fires.[60] Section 2.8.2 of the DSEIS states: "Consultation with the Enfield Fire Company indicates that they are confident in their ability to control fires in open fields, but concerned regarding the ability to control fires if they spread to forests."

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[56] https://www.osha.gov/dep/greenjobs/windenergy_fire.html

[57] Europe's Confederation of Fire Protection Associations (CFPA E) has published its own guidelines for wind turbine fire protection. See http://en.dbi-net.dk/files/CFPA/Guidelines/CFPA_E_Guideline_No_22_2012_F.pdf

[58] http://www.windpowerengineering.com/maintenance/safety/what-regulations-exist-for-fire-protection-in-wind-turbines/

[59] http://www.firerescue1.com/fire-attack/articles/1306390-3-wind-turbine-failures-firefighters-must-know/

[60] http://en.dbi-net.dk/files/CFPA/Guidelines/CFPA_E_Guideline_No_22_2012_F.pdf

Furthermore, OSHA states: "Workers should be made aware that while fighting initial fires, toxic gases can be generated and oxygen can be depleted inside Nacelles, and they can be exposed to such gases or can be asphyxiated from lack of oxygen."[61]

In light of the risks involved, the use of safety features in the turbines whenever possible and a well-designed emergency plan are critical. The European guidelines as well as, in the U.S., the National Fire Protection Association recommend, among other things:

- Fire suppression systems in the nacelle
- Automatic early fire detection systems whereby the turbine is automatically shut down and disconnected from the power supply system
- Lightning and surge protection
- Protection systems, including measures to identify power system faults and other abnormal operating conditions
- Minimization of combustible materials in the manufacture of the turbines
- Use of cold procedures for repairs, assembling or disassembling work to avoid fire hazards or the use of mandatory fire precautions where fire hazards cannot be avoided
- Regular maintenance of mechanical and electrical systems
- Proper training
- Clearing brush and debris from around the turbine to create a fire break

Where a fire emergency arises, a plan should be in place that provides, among other things:

- 24/7 standby personnel monitoring the turbines
- Provision of emergency telephone numbers
- Notification of fire department and police
- On-site support for fire department and police
- Shut down of turbine and disconnection from power supply
- Training fire and police personnel about turbines, high-voltage components and combustible materials within the turbines[62], [63]

Lightning

As stated above, lightning is the second most frequent cause of blade failure as well as gearbox failures and fires. And for reasons that are not yet clearly understood, turbines seem to attract more than their fair share of lightning as compared with other structures of a similar size. As turbine size increases, so does vulnerability to lightning.[64] Furthermore, the move to carbon fiber in larger blades as a way of strengthening blades increases vulnerability to lightning.[65]

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61 https://www.osha.gov/dep/greenjobs/windenergy_fire.html

62 http://en.dbi-net.dk/files/CFPA/Guidelines/CFPA_E_Guideline_No_22_2012_F.pdf

63 Chapter 10 of http://www.sentry-ds.com/images/nfpa850.pdf

64 http://www.firetrace.com/wp-content/uploads/windandfirearticle.pdf

65 http://www.firetrace.com/wp-content/uploads/windandfirearticle.pdf; It is not clear whether the GE 2.MW turbines are carbon fiber as they claim the material in their blades is proprietary but recent articles indicate that GE is moving in that direction. See http://exclusive.multibriefs.com/content/plastic-materials-and-processing-advancing-wind-energy.

Recent research by scientists at the Polytechnic University of Catalonia in Barcelona has shed new light on the risks of lightning strikes and wind turbines.[66] Turbine blades experience hundreds or thousands of "near strikes", creating microscopic levels of damage, before that fatal lightning strike that causes the blade to fail.[67] The researchers, using high-speed video of thunderstorms passing near turbines, found that near strikes occur even when a lightning storm is several kilometers away. Furthermore, they demonstrated that the turbines themselves can spark lightning strikes by sending up negative leaders into the clouds.[68], [69]

A properly installed lightning protection system will dramatically improve both the cost effectiveness and reliability of a wind turbine. Without the system a lightning strike on an unprotected blade can lead to temperature increases up to 54,000 degrees Fahrenheit and result in an explosive development of air within the blade. According to the updated National Fire Protection Association handbook, "While physical blade damage is the most expensive and disruptive damage caused by lightning, by far the most common is damage to the control system." Wind turbines have a concentrated amount of very expensive technology installed in a relatively small space and the presence of many different voltages in a wind turbine installation, which can easily lead to overvoltages and surges within the system.[70] Furthermore, turbine blades can explode when struck by lightning[71], [72] causing risk of blade throw in addition to fire.

Section 6.9.1 of the Final Findings Statement and Section 2.8.3 references lightning and surge protection systems to be installed on the turbines to help protect against the impacts of lightning and electrical surges causing fires. Despite these systems which decrease the risks, the risk of fires and blade throw still exists.

Foundation Failure/Turbine Collapse

Foundation failures that lead to turbine collapse are generally caused by design flaws, construction flaws or maintenance flaws.[73] In addition, design flaws and maintenance flaws with the turbine towers themselves can lead to turbine collapse for a wide variety of reasons.[74] In all circumstances, the root

[66] http://www.windpowerengineering.com/policy/environmental/damage-control-effects-of-near-lightning-strikes-on-turbine-blades/

[67] http://www.windpowerengineering.com/policy/environmental/damage-control-effects-of-near-lightning-strikes-on-turbine-blades/

[68] http://arstechnica.com/science/2014/01/lightning-bolts-love-wind-turbines-a-little-too-much/

[69] http://www.windpowerengineering.com/policy/environmental/damage-control-effects-of-near-lightning-strikes-on-turbine-blades/

[70] http://alltecglobal.com/wp-content/uploads/Why_Wind_Farms_Need_Lightning_Protection.pdf

[71] http://www.vaisala.com/Vaisala%20Documents/Scientific%20papers/1.Leick-How%20Lightning.pdf

[72] http://alltecglobal.com/wp-content/uploads/Why_Wind_Farms_Need_Lightning_Protection.pdf

[73] http://docs.wind-watch.org/Cracks-in-onshore-wind-turbine-foundations.pdf

[74] http://khatrinternational.com/docs/awea_wt.pdf

cause of the problems arises due to the enormous stress and forces to which a wind turbine is subjected requiring that both the foundation and the turbine tower's structure are up to the task at hand.

The main reason for foundation failures has been poor structural design. Furthermore, the site investigations are sometimes not conducted properly and the findings are not properly considered when designing the foundation.[75], [76] There are many different types of foundation designs for wind turbines. The foundation design will always have to be site-specific in that it needs to be designed for the prevailing local soil conditions.[77] Other reasons for construction flaws are poor workmanship performance and inappropriate material selection. As a result, it is critical to have a third party soil engineer as well as construction engineer on site during the construction of the foundations to ensure they are being built properly.

Once the turbine foundations have been built, it is also critical that they be inspected and maintained on a regular basis to check for cracking and/or softening of the foundation which can lead to collapse. Water entering the foundation followed by subsequent freezing and thawing can have negative effects on the integrity of the turbine's foundation.

In addition to foundation failure, the design flaws can lead to turbine collapse. Some of the maintenance or operational concerns related to the design of the turbines that can lead to turbine collapse include:

- Turbine over-speed;
- E-stops;
- Soil fatigue and/or foundation fatigue or cracking;
- Weld failures;
- Blade failures;
- Imbalance due to snow or ice loads
- Poor soil drainage leading to foundation softening; and
- Corrosion of foundation bolts.[78]

All of this leads to the conclusion that, in addition to strong oversight during construction, ongoing strong oversight of the operations and maintenance of the wind farm is critical to maintaining the safety of the town's residents.

Flicker

Shadow flicker only occurs in certain specific combined circumstances, such as when the sun is shining and is at a low angle (after dawn and before sunset), the turbine is directly between the sun and the affected property, and there is enough wind energy to ensure that the turbine blades are moving. A considerable amount of international research has been undertaken on the impacts and management of

[75] http://www.windfarmbop.com/cracks-in-onshore-wind-turbines-foundation/#comment-14776

[76] http://docs.wind-watch.org/Cracks-in-onshore-wind-turbine-foundations.pdf

[77] http://home.eng.iastate.edu/~jdm/engr340-2011/ENGR%20340%20-%20Foundations%203%20-%20Ashlock%20-%20Schaefer.pdf

[78] http://khatrinternational.com/docs/awea_wt.pdf

shadow flicker. Generally in Europe[79], the standard for flicker is to place turbines at least 500 – 1,000 meters[80] from dwellings and limit the amount of flicker to no more than 30 hours per year, and in some cases, no more than 30 minutes per day. Careful site selection, design and planning, and good use of relevant software can help avoid the possibility of shadow flicker in the first instance. Research has shown that when turbines are placed at least 10 rotor diameters[81] or more from a dwelling, the potential for shadow flicker is very low.[82] However, the U.S. Bureau of Land Management has stated that shadow flicker is not considered as significant an issue in the United States as in Europe where the high latitude and low sun angle exacerbate the effect.[83] In fact, a common standard within the United States is to merely limit the amount of flicker to not more than 30 hours per year which is the standard which Black Oak Wind Farm uses in the DSEIS.

There are many complaints by residents living near wind turbines about the impacts of flicker.[84], [85], [86] These complaints and concerns include, among other things, headaches, tinnitus, nausea, dizziness, earaches, vertigo and seizures. In many cases, residents have abandoned their homes because they were unable to sell them and could no longer stand living with the effects of the flicker. But others maintain that there is no scientific proof that flicker causes adverse health effects.[87]

The document produced by the Bureau of Land Management referenced above does note that flickering effect may be considered an annoyance. With respect to seizures however, the BLM points out that modern three-bladed wind turbines are unlikely to cause epileptic seizures in the susceptible population[88] photo-sensitive epileptics due to the low blade passing frequencies.[89] The World Health Organization defines annoyance as a feeling of discomfort which is related to adverse influencing of an individual or a group by any substances or circumstances. Annoyance express itself by malaise, fear, threat, trouble, uncertainty restricted liberty experience, excitability or defencelessness.[90] While there has yet to be a direct causal link established between flicker and adverse health effects, the World

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[79] These shadow flicker recommendations are based on the survey by Predac, a European Union sponsored organisation promoting best practice at energy use and supply which draws on experience from Belgium, Denmark, France, the Netherlands and Germany.

[80] This equates to roughly 1,750 to 3,500 feet.

[81] This equates to 1,070 meters or 3,500 feet for the GE 2.3MW-107 turbines.

[82] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48052/1416-update-uk-shadow-flicker-evidence-base.pdf

[83] Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM-Administered Lands in the Western United States, US Department of the Interior – Bureau of Land Management (2005) Synopsis

[84] https://www.bostonglobe.com/metro/2013/04/04/turbine-flicker-effect-draws-complaints/UKgf7nOwMHm8CWAtZ47V5L/story.html

[85] http://www.telegraph.co.uk/news/earth/earthnews/8386273/Shadow-flicker-rotating-blades-can-cause-headaches.html

[86] https://www.youtube.com/watch?v=RD6q3ixq0-s

[87] https://nccleantech.ncsu.edu/wp-content/uploads/Health-Impacts-Factsheet-7.pdf

[88] Around 0.5 % of the population is epileptic and of these around 5 % are photo-sensitive. Of photo-sensitive epileptics less than 5 % are susceptible.

[89] http://onlinelibrary.wiley.com/doi/10.1111/j.1528-1167.2008.01563.x/epdf

[90] http://www.euro.who.int/__data/assets/pdf_file/0015/105144/WHO_Lares.pdf

Health Organization does link annoyance to various diseases such as diabetes and cardiovascular disease. Furthermore, the NIH's National Center for Biotechnology Information points out that there has been little if any research conducted on how flicker could heighten the annoyance factor of those living in proximity to turbines.[91]

Various mitigation steps can be taken to minimize the impact of flicker on nearby residents. For example, in one municipality in Alberta, Canada, the wind farm either shuts down the machines between the time the sun is rising and setting for approximately an hour, or programs their computers to control the direction of the turbine so the blades are directly parallel to the sun. Other suggested mitigation tools include the use of blinds at residential properties or tree/shrub planting to screen shadow flicker to help minimize potential impacts.[92] Nonetheless, many people complain that blinds do little to actually block the impact of flicker and do nothing to alleviate its effects while outdoors.

The Impact of Flicker on Horses

One area of particular concern related to flicker involves its impact on horses. A detailed 2012 survey by the British Horse Society establishes that as many as 20% of horses are adversely effected by the flicker of wind turbines. This is of particular concern due to the fact that Turbines B and C surround a property being used by a professional horse trainer to train horses.[93][94]

Stray voltage

In the U.S., the NEC requires that alternating current (AC) systems connected to the utility must have one of the current-carrying wires grounded to the earth at the electrical service entrance. This grounded wire is termed the "neutral" wire, and is un-fused. The other wire, termed the "hot" wire, is wired through a fuse or circuit breaker. This configuration, involving a grounded current-carrying conductor, was adopted for perceived safety reasons, essentially to protect folks working on the electrical lines or wiring from getting zapped. It is this grounded un-fused 2 "neutral" wire that actually creates two potential paths for electricity to follow: through the wire itself as well as through the earth.

Because one of the current-carrying conductors is connected to the earth, there can be situations where small amounts of electricity can flow to complete a circuit through the earth that is below the threshold that will blow a fuse or trip the circuit breaker in the hot wire. This unintentional flow of electricity is what is referred to as "stray voltage." Stray voltage is usually defined as a measurable level of voltage that may occur between a metal object and the adjacent floor or earth.[95]

Problems with the condition of the hot wire can also cause stray voltage.

One particular place where stray voltage becomes a serious issue is in a dairy barn, where you have all the components for parallel electrical paths: concrete or dirt floors that are likely wet from manure,

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91 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4063257/

92 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48052/1416-update-uk-shadow-flicker-evidence-base.pdf

93 Wind turbine experiences, 2012 Survey results, The British Horse Society

94 Advice on Wind Turbines and Horses – Guidance for Planners and Developers, The British Horse Society

95 http://www.renewwisconsin.org/wind/Toolbox-Fact%20Sheets/Stray%20voltage.pdf

urine, and moist animal breath; metal confinement structures and water systems; metal rebar in the concrete floor; and metal walls often with moisture condensed on them. In addition, it turns out that dairy cattle (with an electrical resistance of only about 500 ohms) can detect electrical currents at a level about one one-fiftieth to one one-hundredth of what humans are able to detect.

The Final Findings Statement provides the following with resepct to stray voltage:

> "While the concerns surrounding stray voltage are legitimate, it is important to note they are largely preventable with proper electrical installation and grounding practices. The Project's power collection system will be properly grounded, and will be electrically isolated (in accordance with required electricity regulations) from the local electrical distribution lines that provide electrical service to on-site structures or off-site buildings and homes. It will be physically and electrically isolated from all of the buildings in and adjacent to the Project. Additionally, the bulk of the wind farm's electrical collection lines will be located a minimum of three to four feet below ground, and will use shielded cables with multiple ground points. This type of design eliminates the potential for stray voltage."

But wind farm collector systems experience a very demanding load on cables and accessories compared to utility distribution systems. Fast deterioration of cables and cable accessories has been reported at wind farms. Joints are known to be a weak point in a cable system since it is an area which has been worked on by tools and hands. Reports suggest that failed joints are over represented compared to the cable itself in failure statistics. Typical causes of failure are moisture ingress, heating in joint ferrule and partial discharges in cracks and voids. Compression type ferrules, more often than others, have caused heating in joints by heightened contact resistance.[96]

This highlights, once again, the importance of ongoing maintenance and repair of the components of a wind farm

Lighting of turbines

The FAA requirements specific to wind turbine farms may be found in chapter 13 of FAA Advisory Circular AC 70/7460-1L.[97] The FAA defines a wind turbine farm as *"wind turbine development that contains more than three (3) turbines of heights over 200 feet above ground level."* Not every wind turbine within a farm is required to be lit. The FAA requires unlit gaps of no more than ½ statue mile.

More specifically, the AC requires:

- Nighttime wind turbine obstruction lighting should consist of FAA L-864 aviation red flashing, strobe, or pulsed obstruction lights. Studies have shown that red lights provide the most conspicuity to pilots.
- In most cases, not all wind turbine units within a wind turbine farm need to be lighted. Obstruction lights should be placed along the perimeter of the wind turbine farm so that there are no unlit separations or gaps more than 1/2 statute mile (sm) (804 m). Wind turbines within a

96 http://www.diva-portal.org/smash/get/diva2:566345/FULLTEXT01.pdf

97 http://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_70_7460-1L_.pdf

grid or cluster should not have an unlighted separation or gap of more than 1 sm (1.6 km) across the interior of a grid or cluster of turbines.

- Any array of flashing, strobe, or pulsed obstruction lighting should be synchronized to flash simultaneously (within ±1/20 second (0.05 second) of each other).
- Light shields are not permitted because of the adverse effects they have on the obstruction light fixture's photometrics. In addition, these shields can promote undesired snow accumulation, bird nesting, and wind loading.

The FAA rules requires the lights to be visually or automatically inspected once every 24 hours. In addition, FCC rules require them to be inspected quarterly

Aeroelastic Flutter Stability

See pages 10 & 11 of
http://mragheb.com/NPRE%20475%20Wind%20Power%20Systems/Safety%20of%20Wind%20Systems.pdf.

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Water Resources - Climate and Air Quality

Summary

Water resources and air quality are impacted primarily in the construction phases of the wind energy project more so than in its operational phase. Siting of access roads, construction staging areas and tower foundations must be done so as to minimize disruption, damage and permanent alteration of existing natural conditions of streams, wetlands and drainages. An inventory of these water resource elements for both the accepted project as well the potential modified layout has been documented in the DEIS and SEIS. Final site plans, as yet to be presented, will allow more specific analysis of impacts and all necessary mitigation. Monitoring of construction activities will be of critical importance to insure compliance with NYSDEC and USACE protection and restoration standards on site. Identification, analysis and mitigation plans for water resource issues that exist or may arise are addressed and documented in the DEIS, FEIS and SEIS. No water use is required in the operational phase of the completed turbines and therefore no impacts are anticipated to aquifers or groundwater resources once construction is complete.

Air quality may be impacted during construction by exhaust fumes of trucks and equipment in use on site as well as en route. Travel on unpaved roads, as well as excavation for access roads, staging areas and tower foundations may also produce significant dust depending on both weather and current road conditions on a short term and localized basis. Methods for addressing dust are outlined in the DEIS. Exhaust from trucks could be lessened by limiting the length of idling time allowed on site. There do not appear to be any methods for actual measurement of air quality changes during construction.

Numerous methods for evaluation and monitoring of water issues during the active construction phase of the project have been outlined and presented but can only be upheld in pre-construction planning and vigilant, thorough inspection and monitoring on site when excavation and building is actually underway. An Environmental Monitor will be hired for the duration of construction and will be responsible for identifying, reporting and recommending solutions to any problems as they arise, according to NYSDEC and USACE regulations and procedures. The Town of Enfield will have discretion in hiring for this position.

Geology, Soils & Topography

The approved plan had test borings done for all proposed turbine sights as well as the substation. The results of which were in Appendix D of the Draft EIS as well as the supplemental geotechnical report from Tectonic. They also had GEOPHYSICAL SURVEYS -MULTI-ANALYSIS OF SHEAR WAVE (MASW) done by ARM geophysics.

Test Borings:

No Test Borings were performed for the 3 proposed turbines A, B, C, 1 moved turbine # 5,`` the MET tower or the substation according to the Draft Supplemental EIS. On page 6 under 2.1.1 it is stated that " Similar investigations will be performed for the Modified Project prior to project approval (issuance of permit) and initiation of construction."

As was said in the Advocates for Stark letter on Trello: *"Once the lead agency approves the Final Environmental Impact Statement, the towns...and the county...are effectively trapped. They cannot withdraw. If on any issue, the towns demand more than the developer wants to give, the sponsor can simply threaten to sue the towns, and the towns will back down, because they cannot afford a lawsuit. Therefore, it is critical that the towns and the county negotiate all the terms before the SEQR process ends. Once the SEQR process ends, your negotiating powers will be significantly weakened, if not obliterated."*

The need for test borings at each turbine sight were stated in Appendix D of the Draft EIS On page 13:

9.0 RECOMMENDATIONS

The following sections provide our geotechnical recommendations for design and construction of the proposed foundations. The recommendations are based on our understanding of the proposed project as summarized in Section 3 of this report, and the results of the subsurface investigation as described previously. It is noted that if the proposed Turbine locations change, Tectonic will need to confirm the validity of the provided recommendations. This is due in part to the locally abrupt variations in bedrock depth identified by the borings and MASW surveys.

It is recommended that the test borings be done for all new or changes turbine sights as well as the substation and MET tower before the final EIS is approved so that the town will have a say in any mitigating directions.

Changes to the Turbines:

Given that not only the location, but also the size and power of the turbines have changed:

Appendix D of the Draft EIS On page 19:

12.0 LIMITATIONS

Our professional services have been performed using that degree of care and skill ordinarily exercised under similar circumstances by reputable geotechnical engineers and geologists practicing in this or similar situations. The interpretation of the field data is based on good judgment and experience; however, no matter how qualified the geotechnical engineer or detailed the investigation, subsurface conditions cannot always be predicted beyond the points of actual sampling and testing. No other warranty, expressed or implied, is made as to the professional advice included in this report.

The recommendations contained in this report are intended for design purposes only.

Contractors and others involved in the construction of this project are advised to make an independent assessment of the soil, bedrock, and groundwater conditions for the purpose of establishing quantities, schedules and construction techniques.
This report has been prepared for the exclusive use of Black Oak Wind Farm LLC for the specific application to the proposed wind farm project described in this report. We recommend that prior to construction, Tectonic review the project plans and specifications. It should be noted that upon review of those documents, some recommendations presented herein might be revised or modified. In the event that any changes in the design or location of the proposed structures are planned, Tectonic shall not consider the conclusions and recommendations contained in this report valid unless reviewed and verified in writing. It is further recommended that Tectonic be retained to provide construction monitoring and inspection services to ensure proper implementation of the recommendations contained herein, which would otherwise limit our professional liability.

It is recommended that the board ask Black Oak to inform Tectonic of the changes to turbine size, power and location to see if any revision or modifications are recommended.

Monitoring:

According to Tectonic:

11.0 CONSTRUCTION MONITORING
A geotechnical engineer familiar with the existing subsurface conditions and having the appropriate laboratory and field testing support should be engaged by the Owner to observe that all earthwork is performed in accordance with the specifications and the design criteria outlined in this report.
The following work should be performed under the supervision of a geotechnical engineer:
- Foundation subgrade preparation
- Rock anchor installation and load testing
- Fill placement and compaction
- Dewatering

19
All materials proposed for use as soil fill should be tested and approved prior to delivery to the site. Additionally, all fill materials should be tested as they are being placed to verify that the required compaction is achieved. We further recommend that the project plans and specifications be reviewed by the geotechnical consultant prior to final completion of the bid documents. It should be noted that upon review of those documents, some recommendations presented herein may be revised or modified.

It is recommended that the town board carefully vets the geotechnical engineer or firm hired to oversee and monitor the construction.

4/13/16

Everything is moving much more quickly these days and Enfield, like most other small towns, does not have the infrastructure, nor the resources, to keep up with the demands that these rapid changes ask for. The past eight years the Town has ben working with BOWF, we have seen how important it is to find other energy sources than fossil fuels and nuclear plants. Wind farms are likely an essential part of this new energy supply chain. At the same time, a lack of any State or Federal regulatory standards, combined with the fact that we are just now beginning to understand the health and safety issues that wind farms, by their very nature, bring into the lives of their neighbors, means there will be inevitable conflicts at the local level over the sighting of the turbines.

The town of Enfield seems to be a classic case, as the initial law - with larger setbacks - was discarded for one more lenient to the industry. Now we are learning as much as possible, as quickly as possible, in order to protect local residents health and safety form the likely side effects of the turbines installation. It seems to me we can take one of two courses. First, with the understanding that the setback distance is the most significant aspect of the issue, we can decide to rewrite the wind law and require BOWF with a greater setback distance. This will certainly have significant consequences to BOWF, perhaps even to an inability to continue and possibly to the Town as well, as it seems likely that in this circumstance, BOWF would take legal action against the Town.

Alternately, we could consider the current process of approving the draft and final SEIS as an opportunity to require BOWF to work with the Town to find a way to mitigate any possible health and safety problems that residents close to the turbines will likely incur from their proximity. The Town wind law does contain a provision that, according to our lawyer, allows us to enforce provision and standards beyond those contained in other parts of the law. This provision, Article 3 Section 3 states that "the Town Board shall, upon consideration of the standards contained in the local law, and the record of the SEQRA review, issue a written decision with the reasons for approval, conditional approval, or denial fully stated."

With this in mind, I think we should consider the ways we might, as the lead agency, address the health and safety needs of the nearby residents while still allowing BOWF the opportunity to continue with this project. One possibility that has been considered, and written into law, by a number of other NY municipalities, is to develop a process whereby those residents who find they can not continue to live at their homes will be helped to move from their existing residence to a new property. This would entail a financial commitment on the part of BOWF and obviously would take time to develop, and a real desire on the part of both parties. I would expect neither side to be happy with this idea - for the residents it means the possibility of leaving their long established homes, and for BOWF it will mean less long term profits.

Another, perhaps even more complicated alternative, would ask for an actual understanding by the wind farm that there will be issues and problems that will surface in the construction and long term operation phases of the facility. This would deal primarily with health and safety issues. Once there is an understanding by BOWF and an agreement that these issues need to be addressed they would need to be a complaint resolution procedure, as required in the Town wind law. As stated "the application will include a complaint resolution process to address complaints from persons who live in nearby residences. The process may use an independent mediator or arbitrator and shall include a time limit for acting upon any complaint." The existing "Community Outreach and Communication Plan",which BOWF identifies as their only complaint resolution procedure,is not,in my understanding,in keeping with the town law.It provides no time limit,and,more importantly,nothing that requires any complaint to actually be resolved.If,in fact,BOWF interprets this portion of the law as not actually requiring a mutually agreeable solution,rather than just an amorphous concept of working on a resolution,then I think the town cannot proceed any further without putting new language into the law to address this misunderstanding.If BOWF agrees ,however,that the intent of this section of the law was meant to confer a regulatory authority on the town board,then it will need to develop a procedure that actually requires a resolution to problems in a timely manner,throughout the lifetime of the facility.This would include details of standards to be met,a monitoring process to assure that they are being met,and measures to be taken when they are not.I cannot emphasize too strongly my belief that no paperwork that BOWF has submitted to date has even begun to address this issue in a substantive way.

Since none of our paid advisers have,to my knowledge, commented on this issue,I can only assume they felt it was outside their scope.As such,I see it as even more important that the town board itself deals with this issue,since it arises directly from our wind law. While we have approved a findings statement for one part of this project,we have not approved the placement of three turbines and,more importantly, the electric substation.In light of my current understanding of the health and safety issues for nearby residents,as evidenced by much of the current reevaluation of setback distances in other towns,states,and countries,I believe that now is an appropriate time for the board to inform BOWF of our updated needs.BOWF can then address these issues in their responses in the Final SEIS.I would hope that the wind farm would welcome this opportunity to be better neighbors in the future.

Mike Carpenter

Subject	**BOWF construction**
From	Marcus Gingerich <mdgingerich@yahoo.com>
To	Ann Rider <ann-rider@townofenfield.org>, Henry Hansteen <henry-hansteen@townofenfield.org>, Michael Miles <michael-miles@townofenfield.org>, Michael Carpenter <michaelcarpenter@gmail.com>, Virginia Bryant <virginia-bryant@townofenfield.org>, townclerk@townofenfield.org <townclerk@townofenfield.org>
Date	04/13/2016 1:37 pm

roundcube

Enfield Town Board Members,

I would like to follow up on what I mentioned at the public hearing last evening. According to Black Oak Wind Farm's (BOWF) own documentation, **they have already commenced construction of the wind farm.** From their own documentation they say,

> "We began initial construction three years ago, commencing with the excavation of the access road to the wind farm which was completed in December 2013. We also recently completed the excavation of a foundation hole for a permanent meteorological tower. On July 11, 2014, we entered into a balance of plant construction and service agreement with Tetra Tech Construction, Inc., Gloversville, New York, which will be responsible for the overall engineering and construction of the wind farm."

This document is available on their public website in the investor section. (pg. 6, https://s3.amazonaws.com/client_blackoak/SeriesCPPM.pdf)

This admission in BOWF's own documentation would seem to indicate that BOWF has circumvented the SEQR process and probably the town and/or state law. It would also seem to indicate that BOWF has been using the argument that they now have 'vested rights' based on, at best, questionable activity. BOWF can not rely on construction which has been done without a permit and in violation of the SEQR rules to claim 'vested rights'.

I can see no reason for the town board not to consider putting a moratorium in place at this point in time until all of these issues can be sorted out, including retroactively revising the town wind law. If the Enfield town board does not even consider a moratorium, it becomes quite clear that the town board is giving preferential treatment to corporate interests rather than protecting its own residents.

The town board **must not** continue ignoring the mounting evidence that BOWF does not really care about doing this project right or actually making it safe for the town residents. Instead, they are only about exactly what 'corporate America' is all about, making another dollar without regard to who gets stepped on in the process.

I ask that a (any) council person please write up a resolution to put a moratorium in place **as soon as possible** and bring it to the board for consideration. The safety of your town and your town residents dependent upon it probably more than you realize. If you need help writing up such a resolution, I'm sure we can find someone to help with that.

Respectfully,

Marcus Gingerich

April 13, 2016

Town of Enfield and Black Oak Wind Farm
168 Enfield Main Road
Ithaca, NY 14850

RE: DSEIS Town of Enfield

I have been put in a very unique situation in regard to the wind farm project in the Town of Enfield. I get to see this whole project through many eyes, Enfield Wind Farm Advisory Committee Clerk, Enfield Planning Board Clerk, Enfield Deputy Town Clerk, Town of Enfield Web Master, Enfield Town Historian and resident of the Town of Enfield for over 40 years.

No report or details will address the concerns thoroughly of the residents of the neighbors of the wind farm. The major concern I have observed is just the "unknown" how you address the "unknown" once there is the fear of the "unknown".

Another major concern I have heard from residents is that there has not been enough communication from the BOWF and Enfield Town Government regarding the Wind Farm project. I have suggested or pointed out items regarding this communication below.

I believe it is also time to remind our local residents that communication can go two ways. Why not call, email, or stop in at the Town Clerk's Office, or Highway Department. All Town Board, Planning Board and Wind Advisory Committee minutes have been placed on the Town's website as approved. Give your local Town Board members a call or email.

I will leave the reports from the Wind Advisory Committee to point out all the other fears and recommendations of setbacks, ice throws, noise, etc.

I would also like to recommend to anyone reading this letter to take the time to read the Wind Advisory Committee, Town Board Minutes and Planning Board Minutes (located at the Town of Enfield website (www.townofenfield.org). It will give you a total different perspective of how the people in the Town feel on both "sides".

So saying all of the above I would like to address the EIS (there are a few addressed to the town government also).

Community Outreach and Communication – Appendix U. – Referenced on page 33
This section addresses communication regarding the project but it does not give actual details on the type of communication and to whom the communication goes to not only in regard to "all" Town government but residents.

The Town Clerk's Office is the "hub" for the general public to be able to find information on activities occurring within the Town of Enfield. Communication is the key word!
I feel that the Town Clerk's Office does not seem to be included in any of this notification. It should state "Town Clerk's Office".

It should be noted that the Town Supervisor and Town Clerk's Office are two separate offices and they don't seem to always share communication which might benefit the whole of the town.

Communication - written – U.S. Mail, e-mail, town web site (includes automatic posting notification to those who sign up through the site). This communication is trackable but a phone call is always good!

- Perhaps we as a town should be asked to make sure that all "identified" residents are on this website listing for notification. Identified residents should include the property listing below.
  If these residents do not access "web" then the town should communicate through U.S. mail.
- Constant Notification of work occurring for the wind turbine project to the "neighbors" is VERY important. The BOWF can do this by sending a schedule of the work to be done involving the wind farm to the Town Clerk's Office so we can have it on hand and place it on the Town Web Page.
- Exact address listing of all property shown on the maps in the EIS. This should be on file in the Town Clerk's office as of April 6 there is no listing on File.
  The BOWF should provide this listing.
- Address listing should be included in the EIS in section.
- Exact listing of addresses and distances from each wind turbine should be added to the report.
- If a certain notification is needed it should be stated "exactly" who will be sending out the notification. I have observed that this "exact" has not been designated in most cases! Take Responsibility!
- Notification should also include road work - repair and "before" delivery road work to be given to the Town Clerk's Office.
- Notification (e-mail and phone call) to the Town Clerk's Office on the day of the delivery of the wind turbines. Notification should be before the delivery not after.
- I would also like to see a Town Board Member charged as a liaison whose directive would be to communicate with BOWF, Renovus, Finger Lakes Renewable Energy, and other Sustainable Energy programs and residents directly affected by placement of any of the Energy Farms in Enfield. They would check in on a monthly basis to collect data on mitigations, planning solar, programs of recycling, etc. and report back to the Town Board. This would perhaps give the residents of the Town a better feeling that if they have problems and feel no one is listening they have someone outside of the companies involved.
- This position would be a good check on making sure all of the "to do's" are done to take care of the Enfield Community.

Historical Impacts

After reading through all the SEQRA and Environmental Impact Statements including the new DSEIS I would like to point historic item(s) which were not included under any of the reports. This falls under 2.10 Historic, Cultural and Archeological Resources, 2.10.1 Existing Conditions.

This section states that "historically significant properties or structures and archeological sites located within the five-mile radius survey area for the Approved Project" have been listed in the project. Historically significant I guess refers to what the state or federal government feels is significant.

I feel this historical five-mile radius survey is lacking. I guess if we are going to pick on the report lets point out the fact that only two cemeteries were mentioned in this historical report both 3.9 miles (Carman Cemetery) and 4miles (Rolfe Cemetery, - Applegate Road – 1818 oldest head stone) and this was only to state the "view" of wind turbines.

I think that the following two cemeteries should be added to the historical section 2.10 -Harvey Family Cemetery – Schuyler County, Town of Hector, Buck Hill Road – approximately 1 ½ miles from wind farm. 1815 oldest head stone and the McIntyre Settlement Cemetery – Schuyler County, Town of Hector, Strong Road - approximately 3 miles from the wind farm, 1839 oldest head stone.

I would just like to note that there are other cemeteries in the Town just as close to the wind turbines. Why add cemeteries to your historical listing? I feel cemeteries will be around a lot longer, your historical aspect, than any of the houses that are listed in the EIS. These cemeteries give us a lot of history about the people and area.

Christian Cemetery – Enfield Main Road – 1827 oldest head stone
Presbyterian Cemetery – Enfield Main Road 1828 oldest head stone
Rumsey Hill Cemetery – Trumbulls Corners Road – 1821 oldest head stone
Summerton Cemetery – Hines Road – 1890 oldest head stone
Woodard Cemetery - Woodard Road – 1826 oldest head stone
Teeter Cemetery – Enfield Falls Road – 1829 oldest head stone
Budd Cemetery – Gray Road – 1834 oldest head stone

Other corrections/notes:

The Enfield Community Christian School is located at 162 Enfield Main Rd in the Village of Enfield and serves 11 students in grades 4 through12 (Education, 2013). **No longer in operation.** page 238 **Draft Environmental Impact Statement (2013)**

The Bock-Harvey Forest Preserve should be added :
3.8.1.5 Rieman Woods Rieman Woods is a 37 acre property located off Porter Hill

Road in the Town of Enfield and approximately 1.5 miles east of the Project Site. The property is owned by the Cayuga Trails Club and is used for hiking. Page 169 **Draft Environmental Impact Statement (2013).**
About half a mile of the Finger Lakes Trail runs across the preserve, connecting across Porter Hill Road with Riemen Woods, also owned by the Finger Lakes Trail Conference. **The Bock-Harvey Forest Preserve** is close to the Land Trust's Stevenson Forest Preserve, Robert H. Treman State Park, and other conserved lands. Together these lands all help make up the Emerald Necklace, an ambitious effort to link more than 50,000 acres of protected land in a continuous corridor around Ithaca.

If it is worth noting why not make the effort to determine the missing information below!
"It is worth noting that location information in this survey report was not adequate to determine the street address or exact location of these five resources. Their present condition, including whether or not they are still standing, **could not be determined** using the information available in the survey." Page 161 **Draft Environmental Impact Statement (2013)**

Fire Protection and Emergency Response. Section should be up dated from 2012.

I am so amazed at the people here in our county and town. The "fight" for their rights to have a wind farm or not has been strong. Maybe this is what the community felt in 1863 when people gathered together to fight for their beliefs in the U.S. Civil War. It should be noted that not everyone was for that war either even the town supervisor at that time quietly or not tried to fight against the enlistment of the men in the military! Maybe it's the area that has created this "fight" so much has occurred in the area of a proposed wind farm. From the settling of the area by ancestors of families who now live there and have buried their family members in the area; cutting down of the black oak trees in 1927 (this is why we have Black Oak Corners (Harvey Hill and Black Oak Corners Roads); the Cayuga Indian Land Claim Settlement in 1980 for a part of Connecticut Hill; Tompkins County Land Fill search in 1987. Enfield was listed for 3 sites one being the Black Oak and Harvey Hill roads 450 acres; numerous house fires including the loss of a barn and 500 sheep and additional livestock in 1971 to the Gunning Farm on Weatherby Road. The businesses that have operated through the years there on the hill, Teeters, Teet's and Sons, Newhart's Lodge, agricultural feed companies – Virgortone and Trojan and Smidley Livestock equipment all the farms – livestock and field crops struggling and succeeding in their ventures. Or how about the right to sign a gas lease or not! The list can go on and on as the "fight" goes as on and on.

And now just think...our battle of the "rights" will go down in history just in time for the Town of Enfield's 200th birthday in 2021!

Thanks for reading my ramblings and suggestions.

Sue Thompson
487 E. Enfield Center Road
sdt1@cornell.edu/2726412

From: townclerk@townofenfield.org
Sent: Thursday, April 14, 2016 5:14 PM
To: Jim Pippin; Spencer, Kathy; Frank Pavia; Marguerite Wells; Ann Rider; Virginia Bryant; Michael Carpenter; Michael Miles; Henry Hansteen
Subject: Fwd: Letter in support of Black Oak Wind Farm

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: Letter in support of Black Oak Wind Farm
Date: 04/14/2016 10:57 am
From: Emily Cotman <ecotman1@gmail.com>
To: townclerk@townofenfield.org

Hello,

I am writing to you as a potential resident of the Town of Enfield. My husband and I have been living in Ithaca, renting, for 2 years. We moved here for my job in 2014, and are currently looking to buy a home and put down deeper roots in Tompkins County.

I am writing because we have been looking at homes in Enfield, with some hesitation. IF THE BLACK OAK WIND FARM PROJECT DOES NOT MOVE FORWARD, WE WILL NOT WANT TO LIVE THERE. The town sorely needs revitalization - job growth, high-speed internet access, funding for Enfield Elementary. We need to see that there is a plan for this, and the Black Oak Wind Farm is a plan that makes sense to us.

I worry for the future of our family if nothing changes in Enfield. I visit Enfield Elementary often, to run an after-school program, and while the staff at the school are excellent, it is painfully obvious that Enfield Elementary lacks the financial resources that the other ICSD schools enjoy. As we plan to have our first child within the next two years, this issue is front-of-mind for us.

The Black Oak Wind Farm is not only a financial opportunity, but an opportunity for the Town of Enfield to engage in a meaningful way with the rest of the Ithaca community. When I visit Enfield, it feels like an island. It isn't farther from the center of Ithaca than Caroline, for example, but it feels much less a part of the whole. As two young professionals working in the non-profit industry, this isolation is worrisome to us. The Wind Farm is a chance for Enfield to maintain its strong identity, while gaining valuable connections to the rest of the city.

For us, it comes down to this: We could live anywhere in the Ithaca City School District, and we will choose to live in a town committed to growth and improvement. We hope that Enfield will emerge as that town, but until the matter of the Black Oak Wind Farm is settled, we're not convinced that it is.

Sincerely,

Emily Cotman

<u>An Open Letter to the Citizens and Town Board of Enfield about the Black Oak Wind Project</u>

Jude Lemke
215 Connecticut Hill Road
Enfield, New York

To the Enfield Town Board and the Citizens of Enfield:

This letter serves two purposes. It presents my comments on the Black Oak Wind Farm ("BOWF") draft Supplemental Environmental Impact Statement ("SEIS") to the Town Board as lead agency under the State Environmental Quality Review Act ("SEQR"). It also describes an expanding list of irregularities regarding the Town's review of this modified wind farm application (the "Project").

It is apparent that BOWF's owners are anxious to begin construction immediately because Congress is phasing out financial incentives (tax credits) for wind generators over the next five years, beginning in December 2016. The owner of the Project must begin construction this year to receive the full credits. Black Oak, however, not the Town, has been the sole cause of its delays. In fact, our Town Government has gone to ridiculous lengths to accommodate BOWF, by rescinding a much more protective Wind Law and then enacting a completely toothless version (as described further below) based on BOWF's complaints that the more protective law would halt the Project. The Board then approved the Project and also approved its expansion with taller towers and greater electrical capacity without any further meaningful assessment of the environmental consequences of doing so.

Certain Town Board members and their hired consultants and attorneys have showed an eagerness to accommodate Black Oak that is beyond belief. **What is worse, the Town's handling of this Project has been cloaked in secrecy, which calls into question the ability of our Town Government and its paid contractors to protect their citizens.**

Many aspects of this Project are still unclear. It is not yet known exactly where all the turbine towers and other infrastructure will be located, and it certainly is not clear that this proposal is the final expansion of the Project's footprint. Many hard questions need to be asked by the Town Board as lead agency under SEQR. I raise some of them in this letter.

I

Background

I am a lawyer by occupation. I became a resident of the Town of Enfield in July 2015, having moved to the Ithaca area from California. The Town of Enfield is beautiful and my neighbors are great. I was thrilled about my new home, a former Bed and Breakfast known as “Noble House.” It is a beautiful “Queen Anne” style structure built in 1883 that is eligible for inclusion on the National Register of Historic Places.

I purchased my home without knowledge that a large wind farm was planned in the immediate vicinity of my property. Four wind towers are proposed in close proximity to my home and it appears that all or most of the seven towers will be visible from my home. From a safety standpoint, a large portion of my yard will be within the area that even the wind industry considers a possible safety threat, as described further below.

Having lived in California which is known for various forms of alternative energy, I am well acquainted with large scale wind development. I know that wind power sounds good in theory, but in practice it has many drawbacks. I know that because of those drawbacks, wind farms must be closely scrutinized and carefully regulated.

After the initial shock of hearing about the Black Oak Project, I started researching the Project. It was originally approved in January 2015 when the Town Board issued its SEQR “Findings.” SEQR is an important law in New York which requires government agencies to assess the anticipated adverse environmental impacts from a proposed action, before they may fund, approve or undertake that action. SEQR establishes strict procedural requirements and also the substantive obligation to identify and avoid or mitigate impacts.

I believe that the Town of Enfield has failed to make Black Oak comply with the substantive and procedural requirements of SEQR. Additionally, I believe it is clear that a majority of the Town Board has placed the economic interests of Black Oak ahead of the safety of its citizens.

Further review of this Project is needed before any approval of the modification is granted.

II

The Project and the SEQR Review Is Shrouded in Secrecy in Violation of Law

The Town’s files and its communications with BOWF concerning this Project should be open and readily available for examination. New York’s Freedom of Information Law (“FOIL”) requires broad access to the inner workings of government to ensure transparency and to hold leaders accountable for their actions. The legislative declaration when FOIL was enacted says it all:

> The legislature hereby finds that a free society is maintained when government is responsive and responsible to the public, and when the public is aware of governmental actions. The more open a government is with its citizenry, the greater the understanding and participation of the public in government. NYS Public Officer's Law, § 84.

FOIL's expansive scope has been confirmed repeatedly by judicial decisions and the opinions of New York's Committee on Open Government. They instruct that FOIL is intended to ensure maximum access to government records and any exception which acts to limit access must be very narrowly construed. The burden is on government agencies that seek to limit disclosure of public records to justify denial of access to public records.

SEQR also requires public disclosure of information arising during the environmental review of an action. According to the SEQR regulations enacted by NYSDEC:

> [a]ll SEQR documents and notices, including but not limited to [Environmental Assessment Forms], negative declarations, positive declarations, scopes, notices of completion of an [Environmental Impact Statement (EIS)], EISs, notices of hearing and findings must be maintained in files that are readily accessible to the public and made available on request. 6 NYCRR § 617.12(b)(3).

After learning of the existence of the wind farm and of Black Oak's intention to modify the proposal, I attempted to review the paper trail to learn what had happened previously and what is proposed now. I found out that was no easy task. Black Oak's dealings with the Town of Enfield and its lawyers and contractors were not documented in any formal record that I was able to review. In fact, based on their public comments, it is clear that some Board Members have also been kept in the dark about many aspects of this Project.

First, it is clear that the Town of Enfield, the lead agency, maintains no document depository or website to provide immediate access to SEQR documents and correspondence. Instead, the public must visit BOWF's very incomplete website, or make specific requests to the Town Clerk. In other words, you must know what to look for and ask for it specifically. Black Oak's website contains only the most basic SEQR documents: Draft Supplemental EIS; Supplemental SEQR Findings dated July 2015; Final Findings Statement dated January 2015; Final Environmental Impact Statement dated November 2014; Draft Environmental Impact Statement dated 2013; and Final SEQRA Scope dated 2010. No other SEQR documents are available on that website; there are no notices of hearing, notices of completion of DEIS and SEIS, nor any correspondence or drafts of documents which have been exchanged between Black Oak and the Town.

Throughout the fall and winter of 2015/2016, I had heard rumors and comments by Board Members that Black Oak intended to modify its Project further and relocate certain components including towers and the electrical substation. Later, a BOWF representative admitted at a Wind Advisory Committee meeting that the Town's consultant had already received a draft of the SEIS (although a copy was not available to the public). I requested a copy of that document from the Town Clerk under FOIL. In response, I was told that **BOWF claimed** that it was a "draft" so it was not available to the public until the Town Board determined that it was "complete."

I was also told that Town Attorney, Guy Krogh, agreed with this opinion, so the Town Clerk could not release it to me.

I spoke with my attorney, who indicated that this was not a "grey" area of law with various interpretations. The issue had been repeatedly addressed by legal authorities and the answer was so clear that he was surprised that the Town was actually taking this position. On March 2, my attorney emailed Mr. Krogh with respect to this denial of access:

> Guy, this rationale has been expressly rejected by the Department of State's Committee on Open Government on several different occasions. Even though the Town has not yet determined that the EIS is complete, once an EIS has been received by a municipal agency from an applicant, **it is a public document which is subject to FOIL**. Attached is an advisory opinion from the Committee that is right on point. In fact, there are numerous Opinions by the Committee based upon similar facts. Completeness for purposes of SEQRA is separate and distinct from access for purposes of the New York State Freedom of Information Law.
>
> Please contact me to discuss this at your earliest convenience. This is a highly unusual response by the Town which violates FOIL. There is no legitimate reason not to give the public access to these documents while the Town Board considers whether to require additional information from the applicant under SEQRA (emphasis as in original email).

Mr. Krogh responded that he "neither fully agree[d] nor fully disagree[d] with" the position (never explaining his reason), but he said the issue was moot because a decision had been made to release the draft. I received the SEIS (and only the SEIS) on March 7, 2016.

Unfortunately, the damage was already done. On March 9, the Town Board voted to accept the draft SEIS as "complete and adequate for public review." The Board was delivered copies of the SEIS that very same night by Marguerite Wells of BOWF.

The importance of this point might not be obvious, but the public should have a right to review draft SEQR documents that were received from third parties, so they may express an opinion as to whether they are "complete." After the Town Board declares the SEIS to be "complete," there is a right to submit further public comments, but the decision as to completeness will have already been made. Further revisions or additions resulting from the public comments are extremely unlikely even if the Town Board were to agree with the comments that the document is missing important information.

My concern for this violation of FOIL is heightened because of the apparent relationship between Mr. Krogh and the original principal of the Project, John Rancich. According to a May 4, 2007 on-line article in National Wind Watch which was attributed to a reporter from ithacajournal.com, Guy Krogh was originally introduced to the Town Board by John Rancich, to "help answer questions" posed by residents.

Finally, on April 9 (just 13 days before the close of the public comment period), I received copies of emails and comments exchanged between and among the Town's consultant, LaBella, its SEQR attorney Frank Pavia, and representatives of BOWF and its consultant (Haley & Aldrich), about various drafts of the SEIS that were not available to the public.

The emails establish that the draft SEIS was first submitted to the Town's representatives as early as January 16, 2016, and there had been no opportunity for the public to review that document. LaBella submitted comments back to BOWF on February 1, and again on February 8, 2016, concerning the January SEIS draft. Many of LaBella's comments were not adequately addressed by BOWF, which is discussed further below.

Recently, we had a further dispute with the Town about its failure to adhere to FOIL with respect to information concerning the Project. I have retained a noise expert to review noise modeling and monitoring that had been done by Black Oak's consultant as part of the DEIS and SEIS. My consultant needed the Town's data so he could run it through his own software and verify the results. I asked the Town to provide me with such data in a usable electronic format and I was informed that the Town's SEQRA attorney, Frank Pavia, had denied that request and was only willing to provide the data in paper form (a stack of over 100 pages that was useless to my consultant).

Again, I was forced to have my own lawyer (at my expense) point out to Mr. Pavia that the express language of FOIL applies to the request:

> "Per Public Officers Law §87(5)(a), `An agency *shall provide* records *on the medium requested by a person*, if the agency can reasonably make such copy or have such copy made by engaging an outside professional service. Records provided in a computer format shall not be encrypted'

(emphasis added). Moreover, Public Officers Law §89(3)(a) provides, in relevant part:

> `When an agency has the ability to retrieve or extract a record or data maintained in a computer storage system with reasonable effort, it shall be required to do so. When doing so requires less employee time than engaging in manual retrieval or redactions from non-electronic records, the agency shall be required to retrieve or extract such record or data electronically. Any programming necessary to retrieve a record maintained in a computer storage system and to transfer that record to the medium requested by a person or to allow the transferred record to be read or printed shall not be deemed to be the preparation or creation of a new record.'"

The email to the Town also pointed out that the Committee on Open Government has already determined and stated on its website in response to "Frequently Asked Questions", that a government agency is required to produce records in the form requested, if it has the reasonable means to do so.

In response, we were advised that Frank Pavia had determined that the Town "has [already] responded to the FOIL request and that [we] will be receiving a more complete response" directly from him. Once again, the Town's position to withhold such basic and important information from its own citizens is inexplicable**.**

Instead of generally making all SEQR correspondence and documentation "readily available", I have had to submit numerous separate FOIL requests to the Town, many of which have not yet been finally responded to. The comment period for the SEIS will most likely be long over with by the time I receive requested documents or worse, a denial of access.

Among the important information that I have been trying to obtain from the Town and only recently received, is information exchanged between the Town's consultant, LaBella, and Black Oak or its consultant, as well as correspondence exchanged between LaBella and the Town. The reason I requested this information is because three members of the Town Board voted to declare the SEIS "complete" and ready for public review, purportedly based upon the recommendation of LaBella, even though Board Member Mike Carpenter stated on the record that the SEIS had just been received by the Town that very same day, and that Board Members had not even had a chance to review it yet. That means that 3 Board members (Ann Rider, Henry Hansteen and Virginia Bryant) voted to accept the SEIS as complete, WITHOUT EVEN LOOKING AT IT. The only other explanation is that they reviewed the materials outside of the public process, and without the knowledge of the other Board members.

There has been no transparency with regard to the processing of this application. It has been handled in secrecy, between Black Oak and one or two members of the Town Board, including the Supervisor and its consultant and attorney.

III

<u>Who Controlled this SEQR Review?</u>

As previously stated, I recently learned that representatives of BOWF and the Town's paid consultants have been in constant communication about the draft SEIS since as early as January 21, 2016 when BOWF first forwarded the SEIS to LaBella. **It is now clear that from that time forward, BOWF pressured LaBella to expedite its review, and both sets of consultants acted to ensure that the public was not aware of this process.**

For example, by email dated January 21, 2016, James Pippin ("Pippin"), project manager for BOWF's consultant Haley & Aldrich, forwarded the Draft SEIS (without attachments). His email directed:

> [p]lease begin your review. If you are available either tomorrow or Monday, **I would like to have a call to go over the schedule for your review. We anticipate that this should not take more than 1 week to complete** (emphasis added).

In other words, BOWF's consultant told LaBella how long the Town's review should take.

On February 1, 2016, Kathy Spencer of Haley & Aldrich advised Pippen by email, with a copy to the Town's SEQR lawyer Frank Pavia ("Pavia"), that LaBella had already submitted "preliminary comments to Haley & Aldrich about the SEIS, **and that such comments should not be leaked to the public**:

> Jim, as we discussed, here is preliminary comments from LaBella on the SEIS dated January 2016 for the Black Oak Wind Project. **These comments are an informal communication between our offices and should not be made public** (emphasis added).

On February 3, Pippen posted the following email, again pushing LaBella to complete its SEQR review quickly:

> Attached is the Visual section and supplemental visual report for your review. I will send the supplemental shadow flicker report separately. **If possible, please complete your review by Friday afternoon** (emphasis added).

On February 8, 2016, Kathy Spencer ("Spencer") of LaBella forwarded "preliminary" comments to Pippen and again confirmed that such comments should not be made available to the public:

> Jim, here are our preliminary comments on the Black Oak Wind Farm Visual Section and reports that you sent last week. **These comments are an informal communication between our offices and should not be made public.** Let me know if you have any questions (emphasis added).

On February 29, 2016, Pippen sent Spencer an email acknowledging that LaBella had concerns about the draft SEIS:

> I understand you had some concerns or comments on the SEIS prior to the scheduled Town Board meeting. Can you join us on a call this afternoon to discuss? I am available until 5PM today. Let me know a convenient time and I will send you a call in number. Thanks.

On March 1 Pippen emailed Spencer asking whether they could meet the following day. Enfield Supervisor Ann Rider and Pavia were copied on the email. Spencer scheduled the meeting for March 1 at LaBella's office in Rochester. No public information has been made available with respect to the specific matters discussed during the meeting.

On March 7, Pippen sent Spencer a revised Draft SEIS along with a "memo outlining the changes" made in response to LaBella's previous comments. I have still not received that memo from the Town, despite my FOIL request for copies of all communications between BOWF and LaBella. The email asked Labella to **"[p]lease review and let me know ASAP if there is anything substantive that needs revision or clarification in the SEIS prior to Wednesday evening's meeting"** (during which the SEIS was accepted by the Town Board) (emphasis added).

On March 8, 2016, LaBella emailed Pippen advising him that LaBella would recommend acceptance of the draft SEIS as "complete." **despite continuing reservations about the document**:

> Jim, I have reviewed the Draft SEIS dated 3-7-16, and am in agreement that **the most critical changes** to the Draft SEIS have been made in the latest set of revisions. I have indicated in a memo to Frank Pavia that the document can be accepted as adequate for public review.
>
> **Although I am prepared to conclude that the document is complete for the purpose of commencing public review, some of the issues identified during the review process remain a concern**, and I would expect that the project sponsor will address such issues as part of the Final SEIS before that later document is accepted (emphasis added).

In fact, notwithstanding this confidential and expedited review by the Town's consultant, many of LaBella's comments and concerns that were communicated to BOWF as early as February 1 and February 8, 2016, were still ignored by BOWF in the "final" version of the Draft SEIS provided to the Town Board on March 9. Exhibit 1 (attached to this letter) describes specific comments by LaBella that were ignored or inadequately addressed by BOWF.

It is clear that the Town of Enfield and its consultants bent over backwards to accommodate BOWF. It is equally clear that the Draft SEIS document was determined to be "complete" by the Town Board despite LaBella's unequivocal opinion that certain issues it had identified remained unresolved by BOWF.

Although this list of issues was forwarded to Pavia by LaBella (as indicated in an email), there is no indication that the presence of unresolved issues was ever communicated to the Town Board by the attorney. The discussion among the Town Board members in open session during the March 9 meeting only indicated that LaBella had informed them that the Draft SEIS was complete.

The Draft SEIS remains deficient. Those deficiencies cannot be addressed on faith, as part of a Final SEIS, which involves no further opportunity for public input. Once an FEIS is accepted as complete, the lead agency need only await the requisite time period before issuing Findings. Deficiencies in an SEIS, should be resolved at the EIS stage of review.

The Town Board should direct BOWF to revise the Draft SEIS now to address the deficiencies described in the memo from LaBella to Pavia, and the additional concerns described in this letter.

IV

Enactment of the Wind Law and the Need to Change the Law Again

Inadequate Setbacks

There can be little dispute that setbacks provide a basic and proven form of mitigation of many of the adverse impacts caused by wind turbines including noise, ice-throw, and mechanical failure.

The Town of Enfield initially adopted its Wind Law in December 2007 which at that time required setbacks of 1,250 feet or 1.5 times the height of the turbine whichever is greater, from property lines, communication and electrical lines, transmission facilities such as substations, inhabitable structures, public roads, the Robert Tremain State Park and neighboring municipal boundaries.

Although that law took many months to adopt, the Ithaca Journal reported that BOWF contended that the law was hastily enacted and it threatened to take legal action to nullify the law. Less than a month later, a new majority of the Town Board began their terms and voted to repeal the Wind Law. In November 2008, they enacted a new, vastly diluted version of the Wind Law, a version which was obviously much more suitable to Black Oak. It reduced the setbacks considerably to structures and property lines of non-participating landowners.

In California according to a study prepared for the California Energy Commission in 2006, setbacks are commonly established at a distance of three times the total height of a wind turbine, measured to the nearest property line. Although that study did not recommend uniform setback distances, it confirmed that turbine tower failures occur often enough that larger more protective set-backs are necessary. According to the report, the dispersal of fragments caused by blade failures presents a potential hazard to the public a significant distance away from each turbine, based upon disparate factors such as blade tip speed upon failure and weather conditions.

In fact, as recently as February 2016 in the Madison County Town of Fenner, it was reported that a 113 foot long turbine blade detached from its hub and fell over 200 feet to the ground. I spoke with a man who lives across the street from that turbine. He told me he personally measured how far the blade was thrown as a result of that incident. He said it landed 323 feet from the turbine and then bounced another 148 feet for a total distance of 471 feet. **This is a recent example of why Enfield's setbacks are not adequate to protect its citizens.**

"Ice throw" is also a significant safety concern for wind farms in the northeast. Attached is a portion of a document found on the Internet, authored by GE Energy, the manufacturer of the turbines proposed by Black Oak. The GE document discusses important setback safety considerations relating to "ice throw." It expressly states: "[i]ce shedding/ice throw, and other hazards can create risk in the vicinity of the wind turbine park."

To mitigate these hazards, even GE recommends safety guidelines that are more protective than those contained in the Town of Enfield's Wind Law. GE's policy recommends the following setbacks [i]f icing is likely at the wind turbine site: . . . 1.5 times (Hub Height + rotor diameter)", to residences and public use areas. GE also recommends a setback of 1.1 times the total height of the turbine to remote property boundaries not owned or controlled by the project sponsor. The setback in the Town's Wind Law is only 1.1 times the total height of the tower to occupied structures, and only 100 feet or 1.1 times the blade radius, whichever is larger, to any property line not controlled by the project sponsor. The law provides greater protection to other turbines (450') than it does to the property lines of nearby owners.

The paltry set-backs in the Town of Enfield's Wind Law were adopted despite the recommendation of the Tompkins County Department of Planning that set-backs should be "tied to property lines and public road right-of-ways at a distance of no less than 1.5

times total height including the rotor blade height, unless easements are obtained from property owners." The County Planning Department's recommendation indicated that it was based on the New York State Energy Research & Development Authority's ("NYSERDA") document entitled "Wind Energy – Model Ordinance Options (the "Model Wind Ordinance").

<u>Monumentally Inadequate Noise Limits</u>

In addition to setbacks, enforceable noise limits are necessary to address unforeseen noise impacts that arise during the operation of any wind farm.

The Town's Local Law establishes a noise limit of **"60 decibels above ambient sound levels measured at the nearest Off-Site Residence."** This provision was enacted despite Tompkins County Planning Department's recommendation to adopt much more protective limits of 55 dBA, measured at the boundary of the closest parcel not controlled by the project sponsor, and 50 dBA, measured at any residence. Again, the County Planning Department's recommendation was based upon NYSERDA's Model Wind Ordinance.

NYSDEC's policy document entitled "Assessing and Mitigating Noise Impacts," dated October 6, 2000, addresses consideration of noise impacts under SEQR. It provides generally that "[sound pressure level] increases approaching 10 dB result in a perceived doubling of [sound pressure level]" (pg. 14). "An increase of 10 dB(A) deserves consideration of avoidance and mitigation measures in most cases" (pg. 14). "In non-industrial settings the [sound pressure level] should probably not exceed ambient noise by more than 6 dB(A) at the receptor . . . [and a]n increase of 6 dB(A) may cause complaints" (pg. 14). Increases of 5-10 dB are described by DEC's policy to be "intrusive" and increases of 10-15 are "very noticeable." Increases of 15-20 are termed "objectionable" and over 20, "very objectionable to intolerable" (pg. 15).

Most likely, the ambient noise level in the very rural area of the project is under 40 dB. Even if you use 30 dB as "ambient", **Enfield's limit would be 90 dB (30 ambient plus 60).** According to DEC's policy, a subway station or heavy truck at 50 feet away would exhibit noise levels of 90 dB(A).

In contrast, the following limits in wind laws in other communities in New York were found on the Internet:

<u>Town of Hammond</u> (St. Lawrence County) - background (ambient) plus 5 dBA;
<u>Town of Eden</u> (Erie County) - background plus 3 dBA;
<u>Town of Jefferson</u> (Schoharie County) - 50 dBA at the nearest residence (5 less in the event of a pure tone such as a whine or screech);
<u>Cherry Valley</u> (Otsego County) - ambient plus 6 dBA; ambient plus 5 dBA in the event of a steady or pure tone;

Cohocton (Steuben County) - 45 dBA at any existing residence and 50 dBA at a non-project property line (45 at property line and 40 at residence in the event of a pure tone); and
Homer (Cortland County) - daytime limit of 45 dBA and 63 (C weighted); nighttime limit of 40 (A weighted) and 58 (C weighted). 5 less in the event of a steady pure tone.

Clearly Enfield's noise limits are completely out of touch with accepted standards and should be changed.

The Need for a Moratorium While the Wind Law is Modified

My noise expert has indicated that he has never heard of a noise limit that is even close to as high as Enfield's limit, anywhere in the Country. While I have heard Enfield's limit referred to as a mistake by some, the Town Board has never made any attempt to modify the Wind Law to provide a noise limit that is even reasonably protective of its citizens.

I have already asked individual members of the Town Board to enact a moratorium in order to prevent Black Oak from starting construction while the Board modifies the Wind Law and imposes reasonable and protective noise limits and set-backs. Consistently, certain Board members have responded that they are afraid to be sued by Black Oak, or more curiously, that it would be "unfair" to enact new limits that apply retroactively to Black Oak, because the facility was already approved.

My attorney provided the Town with strong legal precedent demonstrating that a municipality has every right to enact legislation related to health and safety (police powers), and make such legislation apply retroactively, as long as the owner has not already acquired "vested rights." In New York, a landowner acquires "vested rights" when it has already undertaken "substantial construction and made substantial expenditures prior to the effective date of the amendment." Even if BOWF has already begun ordering turbine infrastructure (there is absolutely no evidence indicating that it has), that would not be considered a "substantial expenditure" if it can recoup its cost by reselling the equipment in the market. Additionally, the concept of "substantial expenditures" is not even relevant unless the landowner has also already undertaken "substantial construction." Obviously BOWF has not.

The only construction that has taken place on the Project is an excavation for an apparent foundation that was begun several years ago, apparently to allow BOWF to claim tax credits which were about to expire (they have since been extended). That excavation, however, was undertaken in violation of the SEQR regulations which state: "[a] project sponsor may not commence any physical alteration related to an action until the provisions of SEQR have been complied with" (6 NYCRR § 617.3(a)).

BOWF has no "vested rights." In fact, it has asked the Tompkins County IDA to extend certain deadlines in its agreements precisely because BOWF has been unable to begin the Project. The Town should modify its Wind Law before any approval of the modification is granted. Unfortunately, Town Board members, including Henry Hansteen, continue to bow to BOWF's threats to bring litigation and to accept its weak claims that it has vested rights. Apparently, the Town Board is more concerned about fairness to Black Oak than to the health and well-being of its citizens.

V

Procedural Violations of SEQR and the Town of Enfield Wind Law

Inadequate Public Notice

The Town of Enfield Wind Law requires a "complaint resolution process to address complaints from Persons who live in nearby Residences. . . [and t]he process may use an independent mediator or arbitrator and shall include a time limit for acting upon any complaint" (Wind Law Article III Section 1.A.11).

Article III, Section 2.F. of the Town's Wind Law requires that at least one public hearing be scheduled for each application under the Wind Law. The pending modification is an application requiring approval under the Wind Law. That same provision requires the notice of the public hearing be given by first class mail to all property owners within 500' of the boundary of each proposed Wind Turbine Generator (each tower), at least 7 days in advance of the public hearing. If such notice is sent by first class mail it must be mailed at least 10 days before the public hearing.

The SEQR regulations provide a very low threshold for requiring a hearing. In determining whether to schedule a hearing, the lead agency should consider the degree of interest shown in the project by the public and involved agencies (it is high), whether substantive and significant adverse environmental impacts have been identified (they have), the adequacy of the mitigation measures and alternatives proposed (they are inadequate) and the extent to which a public hearing can aid the lead agency's decision-making process (obviously it can as the Town scheduled two hearings for the SEIS). SEQR hearings should be combined with any other hearing required. The SEQR regulations further provide that if such a hearing is held, notice of hearing must be published at least 14 calendar days in advance of a public hearing, in a newspaper of general circulation in the area of the potential impacts of the action (6 NYCRR § 617.9(a)(4)(i)).

No proper notice under either the Wind Law or SEQR was provided before the March 28, 2016 public hearing for the Draft SEIS. When I brought that to the Town's attention, I was told no such notice was necessary. Nonetheless, an additional hearing was quickly scheduled by the Town Board for April 12, obviously to remedy the notice defect. I have not seen any indication whether that hearing was properly published in a newspaper of general circulation, as required by SEQR.

Violation of SEQR Procedures Involving the Turbine Located in Newfield

Although BOWF has not yet committed to any actual location for placement of the two turbines that will be relocated (it has merely identified possible combinations of locations), one of the potential sites is located in the Town of Newfield. This has important ramifications under SEQR.

First, there is no indication in the SEIS that BOWF has applied for any approval to construct any turbine in the Town of Newfield. Further, there is no indication in the SEIS or in any resolution of the Town of Enfield as to which agency will conduct the SEQR review for the turbine in the Town of Newfield or whether review will be coordinated. Because the Newfield turbine is identified in the SEIS, it appears that BOWF intends to assess its impacts along with those caused by the Enfield turbines, as part of Enfield's pending SEQR review of the Project. If true, BOWF and Enfield have violated several of SEQR's procedural requirements. The SEQR regulations provide that "[n]o agency may undertake, fund or approve the action until it has complied with the provisions of SEQR" (6 NYCRR § 617.3(a)).

The BOWF project is clearly a Type I action for purposes of SEQR (it is "deemed" a Type I action under the Enfield Wind Law). Presumably, Newfield has discretionary approval authority over construction of the turbine, either under its own wind law, or under a typical site plan review law. That "discretionary approval" authority makes Newfield an "involved agency" for purposes of SEQR (defined as "an agency [state or local] that has jurisdiction by law to fund, approve or directly undertake an action" (6 NYCRR § 617.2(s)). That same definition also provides: "[i]f an agency will ultimately make a discretionary decision to fund, approve or undertake an action then it is an `involved agency' notwithstanding that it has not received an application for funding or approval at the time the SEQR process is commenced." Any agency that does not have a "discretionary" approval authority over an action is merely an "interested agency" under SEQR (6 NYCRR § 617.2(t)). In this case, Newfield was an "interested agency" rather than an "involved agency" because until this Project expanded into Newfield, that Town had no jurisdiction over the Project. The first mention of any part of the Project in Newfield was the Draft SEIS which was received by the Town Board on March 9.

For all Type I actions, SEQR requires the lead agency to "coordinate review" with any other involved agency (6 NYCRR § 617.6(b)(2)). The lead agency must do so by transmitting a copy of the Environmental Assessment Form or an EIS if no EAF was received, to other involved agencies, along with a copy of the application for the proposed action (6 NYCRR § 617.6(3). Lead agency status must be agreed to among the involved agencies and if such agencies are unable to agree, a procedure exists for enabling the Commissioner of DEC to resolve the dispute.

Here, Newfield was not an involved agency for the original review, but it is clearly an involved agency for the review of the SEIS relating to the Project modification. It was provided no "application" for any modification under the Wind Law, and it was given no opportunity to act as lead agency for the modified Project. Newfield has not agreed to allow Enfield to act as lead agency for the portion of the Project that is located in Newfield and it has never been given the opportunity by Enfield to do so.

Having not properly coordinated review by giving Newfield proper notice and the opportunity to act as lead agency, Enfield (and BOWF) cannot assert the benefits of coordinating review (involved agencies may not later require the preparation of an EIS or issue a determination of significance - a finding that the project may have a significant adverse environmental impact as per § 617.6(3)(iii)). Moreover, allowing Newfield to conduct its own review is may also not be a proper remedy. As previously stated, "uncoordinated review" of Type I actions is not authorized by the SEQR regulations, and allowing a separate SEQR review by Newfield would result in an improperly "segmented" review (dividing the environmental review of an action into various segments as though they were independent activities) which is also prohibited by SEQR ("[c]onsidering only a part or segment of an action is contrary to the intent of SEQR"), unless the lead agency states in its determination of significance and any subsequent EIS, the supporting reasons, and demonstrates "that such review is no less protective of the environment" (6 NYCRR § 617.3(g)(1)).

There is no indication in the SEIS that a segmented review is warranted or how it will be no less protective of the environment. The Town of Enfield, as lead agency, should properly coordinate with Newfield concerning the SEIS, and ensure that all adverse environmental impacts relating to the proposed turbine in Newfield are properly addressed before any approval is issued in Enfield.

VI

<u>What Exactly does the Project Entail and Who are its Owners?</u>

At this point in the process, more than a year after the initial SEQR Findings approving the Project were issued, it is still impossible to know exactly what the Project entails, where the components will be located, and who the applicant even is.

The Project has already changed several times and there was no adequate assessment of the environmental impacts from the most recent changes. We are now told that further changes are forthcoming. The FEIS related to a Project with seven 1.7 MW turbines, with a total generating capacity of 11.9 MW. In July, the Project was modified and the height of each turbine was increased by eight feet and the capacity of each was increased to 2.3 MW for a total of 16.1 MW. In addition, the location of the electrical substation was moved from the location that was the subject of the SEQRA review. The Town Board resolved in June that further SEQRA review of that change was not necessary because the changes would not cause new, significant potential adverse environmental impacts from those that were already adequately addressed in the Findings Statement.

Apart from the expansion in the capacity of the facility that was previously proposed, it is believed that the changes to the configuration and location of the electrical substation will result in significantly more “cut and fill” of land. The owner of the parcel’s continued participation in the Project may also be unclear which might cause further design changes.

There is still uncertainty concerning the very basic issue of the height of the towers which is relevant to several different anticipated environmental impacts. For example, according to LaBella’s February 1, 2016 comments on the January 2016 draft SEIS (a version that was never made public):

> In the Acoustic Study Update (Appendix E) it is indicated that hub height of the proposed turbines is 94 meters – is this correct? (Based on our records, the hub height of the former turbine model in the FEIS/Findings statement was 96 meters or 315 feet. In June 2015, the use of the currently proposed model turbines was approved, which involved an increase in hub height of 8 feet, resulting in a total hub height of 323 ft or 98 meters.) Is the Acoustic Study accurate given this anomaly in hub height (sic).

Similarly, in its February 8 comments, LaBella continued to question BOWF as to the height of its towers in a comment on the issue of shadow flicker:

> There remains confusion with regard to the heights of the turbine which has been indicated to be 94 m . . . . More explanation is needed of the heights in the following statement in 2.8.2.1.3:
>
> > `These changes are due to shifting the Project layout, changes in turbine specifications including a net increase in overall structure height of 5 m (from 196 m to 201 m) and increase in rotor diameter (from 100 m to 107 m), which affects the intersection of the sun, turbine and receptor.’

BOWF’s current draft at page 32 creates yet a third conflicting description of the height of the turbines:

> These changes are due to shifting the layout, changes in turbine specifications including a net increase in overall structure height of 1.5 meters (from 146 meters to 147.5 meters) and increase in rotor diameter (from 100 meters to 107 meters), which affects the intersection of the sun, turbine and receptor.

With respect to the ownership of the Project, by letter dated September 17, 2015, Black Oak Wind Farm, LLC requested a transfer of Black Oak's Payment-In-Lieu of Taxes ("PILOT") and tax abatement to a "new owner" called Onyx Black Oak Wind, LLC, of 126 E.56th St., New York, NY. Nothing in the SEIS indicates a change in ownership. According to a September 17, 2015 email from Marguerite Wells of Black Oak Wind Farm, LLC to Heather McDaniel of Tompkins County Area Development concerning the status of local investors:

> The investors will still be members of the Black Oak LLC, which doesn't go away. only (sic) the assets of the company are being sold. They'll get their eventual payments as distributions according to their shares.

The matter was scheduled to be considered by the Tompkins County IDA at its September 2015 meeting. On September 19, Black Oak requested that the "revision" be put off until the Board's October meeting:

> After conferring a bit further with my board and Onyx, I think it would be better to put our PILOT revision off until the October meeting if possible, as we have been holding off making the info public (even to our investors) until after the deal closes on the 29th. I had forgotten how public the IDA meeting agenda would be. It's no matter that we're listed on the agenda on the website, if it stays that's ok, we can still forego actual public discussion of the details until after deal closure. Is that workable?

The matter was not heard at the October 2015 meeting. It was put off until November and then December and apparently it has still not been returned to the agenda.

VII

Substantive Deficiencies and Violations of SEQR

Exhibit 1 contains a list of comments from LaBella to BOWF about deficiencies in the Draft SEIS, which BOWF has failed to address.

At a minimum, BOWF's failure to address those comments indicates that the Draft SEIS is not complete, and it should be sent back to BOWF for further modification. Waiting for the Final Environmental Impact Statement ("FEIS") is not an adequate solution because it provides the public with no further opportunity to respond to the adequacy of any response by BOWF.

In addition, the following additional substantive deficiencies are noted.

Noise Impacts

I will submit a separate suite of comments that address noise impacts as will my noise expert, Les Blomberg. In short, it is clear that BOWF's SEIS does not adequately assess, avoid and/or mitigate the anticipated noise impacts from the modification of the Project. It contains no discussion of the impacts from low frequency noise and/or infrasound. Similarly, there is no adequate discussion as to mitigation of noise related impacts. Finally, there is no enforceable mechanism including realistic decibel limits to address actual noise impacts that arise during the operation of the wind farm.

Shadow Flicker

LaBella's February 8 comments to BOWF direct it to "[i]nclude text and a table summarizing the information in Section 5 of the Shadow Flicker Analysis regarding the general timing (time of year, time of day) of the shadow flicker effects for each alternative combination." The comments provide an example for BOWF to use but no such language is contained in the March 2016 draft SEIS.

With respect to proposed "mitigation" of shadow flicker, LaBella states "[g]iven that some new residences will now experience shadow flicker hours approaching the 30 hour threshold (26 and 27 hours), it is recommended that the Mitigation Section refer to the Complaint Resolution Procedure should unanticipated shadow flicker effects arise" (LaBella February 8, 2016 comments, No. 72). The source of this arbitrary 30 hour threshold is not stated except BOWF claims it is "a common standard for assessing significance of impacts" (SEIS, pg. 32).

With respect to LaBella's half-hearted attempt to mitigate shadow flicker impacts by referring to a vague "Complaint Resolution Procedure," BOWF's latest version of the draft SEIS states it "will implement a Community Outreach and Communications Plan (see DEIS Appendix U)" which will purportedly establish a "Complaint Resolution Procedure that <u>could be used</u> if complaints regarding shadow flicker arise" (draft SEIS, pg. 33, emphasis added). A review of Appendix U demonstrates that the procedure is palpably deficient as mitigation. The one-page Community Outreach and Communication Plan" requires BOWF to do no more than "set up a toll-free number for use by the local residents . . . [and u]pon receipt of a question or a concern, the Project Manager will contact the individual and work with them in good faith to resolve the issue" (DEIS, Exhibit U). The Plan contains no mandatory or enforceable process other than BOWF's own questionable notion of acting in "good faith." Furthermore, it is clear that Appendix U is only intended to apply during the construction phase of the wind farm – not after the wind farm becomes operational. Therefore, it fails to mitigate impacts from shadow flicker.

The SEIS acknowledges that "mitigation measures such as plantings to provide screenings or installation of window treatments are often considered" to mitigate shadow flicker, but because "shadow flicker from the Modified Project will not exceed the 30 hour/year threshold at any residential structures . . . **no mitigation for shadow flicker effects is warranted and none is proposed**" (Draft SEIS, pg. 33-34 (emphasis added)).

In light of the foregoing, the draft SEIS does not sufficiently mitigate the adverse impacts from shadow flicker either for the modified turbines or for any others. Substantially more analysis of the anticipated impacts are warranted in the SEIS to confirm that the arbitrary threshold of 30 hours per year is warranted, as compared to 26 or 27 hours per year (or any lesser number) experienced by residences in the area of the Project who will be impacted by the effect. At the very least, the SEIS must require mandatory mitigation if, after operation begins, shadow flicker becomes a problem for receptors near the Project.

Visual Impacts

The modification of the Project involves new locations for two towers and the substation, and construction of an intrusive MET tower, as well as a significant amount of clearing and grubbing of mature trees and land for the installation of electrical lines. Although not indicated anywhere in the SEIS narrative, it also appears clear that BOWF is moving the location of turbine 6 (that is evident from reviewing the very last page of Exhibit E of the SEIS, entitled "Project Layout Comparison" which shows that the footprint of turbine 6 has slightly changed). The movement of turbine 6 is not even mentioned in the Draft SEIS; the impact of such movement has clearly not been assessed.

Even as it relates to turbine locations A, B and C, the Draft SEIS provides no credible analysis of visual impacts from the Project. It relies primarily on very small scale Figures which divide the surrounding community into a patchwork of colors and shapes which supposedly identify the number of turbines which can be seen from each location. Such Figures are completely unusable, however, because of their small scale. Although I know where my home is located, I cannot tell from the Figure how many turbines I will actually be able to see from my home. Nowhere in the report is there a narrative I can refer to in order to determine how many turbines I will see.

In addition, there is no discussion as to the relationship between the number of turbines that can be seen and the significance of the visual impacts I will suffer. LaBella agrees. In its February 8, 2016 comments, LaBella tells BOWF's consultant that the Draft SEIS "needs to include more information than just the percentages of the area with views of the turbines" (LaBella Comments, No. 61, pg. 1).

Finally, there are very few photosimulations generally concerning the new proposed facilities and there are none depicting the view from my home or property, even though my home is eligible for inclusion on the Register of Historic Places and therefore is a resource of significant local importance.

The SEIS should be significantly supplemented.

Impacts to the Future Use of My Property and Valuation

I own a large (41.067 acre), flag-shaped parcel which begins at the intersection of Griffin Hill Road and Connecticut Hill Road in Enfield. The tax map number is 18-2-4.3. Although my parcel and my home are outside of the Town of Enfield's very meager setbacks for residences and property lines, it is important to note that GE Energy, the manufacturer of the proposed turbines, recommends a setback distance of 1.5 x (hub height + rotor diameter), "if icing is likely at the wind turbine site. The distance of that setback based upon the Project turbines is 994 feet. Much of my property is located within that GE recommended setback.

Figure 5 in the SEIS plots purported setbacks, including the GE recommended setback. It has been erroneously stated by BOWF that the 994 foot GE setback only applies to residential structures, and a much smaller GE recommended setback of 1.1 x blade length applies to the rest of my property. That is wrong. The GE recommendation for the full 994 feet applies "if icing is likely at the wind turbine site." Objects of concern include "residences" and other public areas, but it does not state "residential structures," it says "residences." My residence is located on that same property. This is not isolated land. By comparison, the smaller setback applies to "[r]emote boundaries to property not owned by wind farm participants". GE provides additional guidance as to what it considers "remote" with the following language: "Property boundaries to **vacant areas** where there is a **remote chance of any future development or inhabitance** during the life of the wind farm" (emphasis added).

My property is not vacant, it is inhabited. Moreover, I use my property and I certainly want to maintain my right to further develop it with structures. But most likely, I will never be able to develop over half of my land which is located within the 994 foot recommended setback. It is like a restrictive covenant or easement which I will never be compensated for. I have been told that once the wind farm is approved, I will most likely never be given approval to build any structure on the portion of my land which is located within that recommended protective zone.

BOWF should be required to compensate me for what is essentially a "taking" of my land without compensation. It should also compensate me for my proximity to this proposed facility, and the impact it will surely have on my property values. Currently, there is no required mitigation in the SEIS for the devaluation of my property. Other communities, such as the Town of Hammond, New York, require mandatory guarantees of property values as part of any wind farm approval. I have seen a copy of the guarantee agreement in Hammond which is a condition of any wind permit issued by the Town.

Section 2.6.1.2 of the Draft SEIS acknowledges that future development on certain properties such as mine will be curtailed due to the proximity of turbines from the Project to the property lines. That impact must be mitigated in the SEIS.

Impacts on Area Roads

Roads in the area of the Project area are already crumbling, reportedly because the Town has delayed maintenance for over nine years in anticipation of the Project. Those delays were apparently suggested or requested by John Rancich, the Project's initial sponsor, who indicated at the January 3, 2007 Town Planning meeting that the Project would degrade the condition of the road so it was better to wait.

The Town's Highway Supervisor has repeatedly expressed concerns that heavy truck traffic during construction of the Project will permanently damage the road bed. No "Road Use Agreement" has been made public yet, and the Highway Supervisor has indicated that he has yet to see any draft. The Draft SEIS should identify impacts on roads during construction and provide clear, specific and enforceable standards for mitigating impacts to such roads, not just a general and unenforceable promise that standards will be developed and adhered to. The SEIS needs to describe how BOWF will shore up the roads before construction, ensure safety during construction, and repair damage following construction.

The Highway Supervisor has acknowledged that he has not been consulted by the Town Board in over a year concerning this important issue.

Conclusion

For the reasons stated in this letter, the SEQR review of the proposed modification of the Black Oak Wind Farm has been deeply flawed. The public has been improperly excluded from participation in the process, as has certain Town Board members.

The Town and its consultants and attorneys have wrongly attempted to expedite the handling of this modification at BOWF's direction, and they have failed to follow through and require BOWF to provide the most basic responses to the obvious deficiencies in the SEIS document.

The SEIS does not adequately assess the anticipated environmental impacts of the modification. In fact, there is no way to determine what BOWF intends to build and exactly where it intends to build it. The document is wholly conclusory as to impacts, and it requires no meaningful avoidance or mitigation of the impacts as required by SEQR. Instead, it relies on vague promises of mitigation later, or baseless conclusions that impacts are not significant.

The “acceptance” of the document by the Town Board should be annulled and the SEIS must be sent back to BOWF for further modification, to address the deficiencies described by LaBella and members of the public.

Sincerely,

Jude Lemke
215 Connecticut Hill Road
Enfield, New York

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Thursday, April 21, 2016 5:37 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Additional Wind Farm Comments from Jude Lemke
Attachments: 20160421174435.pdf

Unfortunately this document wasn't sent by me with the Open Letter to the Citizens and Town Board of Enfield about the Black Oak Wind Project from Jude Lemke that I forwarded on April 14, 2016. Please add this to that document.

Thank you,
Alice

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: E-mail Message
Date: 04/21/2016 6:44 pm
From: enfieldtownclerk@gmail.com
To: "townclerk2" <townclerk@townofenfield.org>

This is an E-mail message.
Please open the attached file.
Sent from : enfieldtownclerk@gmail.com

Number of pages : 1
Date : Thu, 21 Apr 2016 17:44:36 -0500

J. Lemke document to go with Open Letter sent 4-11-16

SET BACK CONSIDERATIONS

Set back considerations depend on many factors such as population density, road usage frequency, land availability, and proximity to other publicly accessed areas and buildings.

Ice shedding/ice throw, and other hazards can create risk in the vicinity of the wind turbine park. To mitigate these hazards GE recommends the following guidelines presented in table 1.

Table 1: Setback Recommendations

Setback Distance	Objects of concern within the setback distance
If icing is likely at the wind turbine site: 1.5 x (Hub Height + Rotor Diameter)	Public use areas Residences Office buildings Public buildings Parking lots Public roads (more than lightly traveled) Railroads
All turbine sites: 1.1 x Tip Height[1]	Public use areas Residences Office Buildings Public Buildings Parking lots Public roads (more than lightly traveled) Railroads Sensitive above ground services[2]
All turbine sites: 1.1 x Blade Length[3]	Remote boundaries to property not owned by wind farm participants[4] No occupied structures allowed.

[1] The maximum height of any blade tip when the blade is straight up (hub height + ½ rotor diameter).
[2] Services that if damaged could result in significant hazard to people or the environment or extended loss of services to a significant population.
[3] Use ½ rotor diameter to approximate Blade Length for this calculation.
[4] Property boundaries to vacant areas where there is a remote chance of any future development or inhabitance during the life of the wind farm.

GE recommends using the generally applicable guidelines contained in table 1. Objects of concern within the recommended setback distance may not create significant safety risk, but warrant further analysis. The customer should perform its own safety review of the proposed turbine location(s). In addition, if the location of a particular wind turbine does not meet the guidelines, customers are requested to provide the information listed in Table 2 so that GE can complete a more detailed safety review of the proposed turbine location(s).

From: townclerk@townofenfield.org
Sent: Thursday, April 21, 2016 5:36 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Additional Wind Farm Comments from Jude Lemke
Attachments: 20160421174532.pdf

Unfortunately this document wasn't sent by me with the Open Letter to the Citizens and Town Board of Enfield about the Black Oak Wind Project from Jude Lemke that I forwarded on April 14, 2016. Please add this to that document.

Thank you,
Alice

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: E-mail Message
Date: 04/21/2016 6:45 pm
From: enfieldtownclerk@gmail.com
To: "townclerk2" <townclerk@townofenfield.org>

This is an E-mail message.
Please open the attached file.
Sent from : enfieldtownclerk@gmail.com

Number of pages : 13
Date : Thu, 21 Apr 2016 17:45:33 -0500

J. Lemke document to go with Open Letter sent 4-4-16

Should say 4-14-16

Exhibit 1 - Unresolved Comments by LaBella

The following are portions of LaBella's Comments on the BOWF Draft SEIS, and a discussion of BOWF's response in the final Draft provided on March 9 to the Town Board.

LaBella Comments – February 1, 2016

General Comment

According to LaBella:

> [s]ections of the [BOWF SEIS] need site-specific details in order to accurately understand potential impacts and mitigation measures. These sections should correspondent to those resources where significant environmental impacts potentially arise from changes proposed to the project or in circumstances related to the project. This is consistent with the guidance provided for [SEISs] in 6 NYCRR 617.9(a)(7)."
>
> * * *
>
> The acreage conversions with regard to ground disturbance, vegetative cover and land use are helpful but cannot serve as the only measure of the impacts wrought by the project changes.

Specific Comments (Numbered 1 through 57)

SEIS Section 1.0 Project Description

5. "Figure 2 needs clarification in labelling (sic) with regard to the meaning of the various setback distances. These setbacks should also be specifically discussed in the text of the SEIS (see Comment #[12])".

BOWF Response:

Although setbacks are labeled on Figure 5, the text of the SEIS contains no clear discussion of the proposed setbacks as requested in Comment 12, including "their meanings, and why they are being used (regulatory vs recommended by turbine manufacturer, non-participating vs. participating, etc.)."

6. "Throughout the document, clarification of the language with regard to the modified and approved project is needed. It should always be clear if you are talking about just the new components/areas – or – the overall components/areas of the Modified project, in total."

BOWF Response:

As noted in the body of my letter, it is still unclear exactly what the Project consists of, exactly and where it is being modified, and what its specific impacts. It does not appear the comment was addressed.

9. "Include a brief description of basic turbine model – hub height, total height, rotor height, rotor diameter, rotor swept area, nameplate capacity, total net electricity, average # households served – to update information in DEIS/FEIS."

BOWF Response:

This information appears to be completely missing from the body of the Draft SEIS. Information concerning the actual height of the tower and components is conflicting.

10. "Include a brief description of MET tower including purpose, height, visual appearance, etc."

BOWF Response:

This information appears to be missing from the body of the Draft SEIS.

11. "Include a brief description of the sites of the alternate turbine locations (A,B,C) and the substation and the MET tower location, including their current use, vegetation, elevation, slope, and general surroundings."

BOWF Response:

This information is missing from the body of the Draft SEIS. There is no meaningful discussion of the areas in the vicinity of the new towers.

12. See Comment 5 above about the SEIS requiring a discussion about setbacks.

BOWF Response:

This narrative information about setbacks has not been provided or is conflicting or erroneous. For example, page 21 of the Draft SEIS states that the project conforms to "a GE-recommended 994-foot ice throw setback from residences" but Figure 2 demonstrates the ice throw setback around the turbine impacts much of my property, and it fails to mention that the GE-recommended 193 foot property line setback only applies to "remote boundaries" (defined as "vacant areas where there is a remote chance of any future development or inhabitance during the life of the wind farm". That is clearly not the case with my property and should be stated in the narrative of the Draft SEIS.

13. "How were collection routes determined? Explain why many do not follow local roads, access roads, property boundaries, etc. What factors will be considered in final siting? Are easements necessary?"

BOWF Response:

This information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

14. "Explain the access road to Alternate Location A and why it appears disconnected from the Town road system. Where does it connect to the Cayutaville Road or the Town road system? Are other graveled roads in place?"

BOWF Response:

This information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

15. "Will the Substation be relocated even if Turbine Site A is not selected? If so, where? What changes to the collection route or any other facilities will be needed if Turbine Site A is not selected and the substation remains?"

BOWF Response:

This information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

16. "Discuss what will be involved in the crossing of the NYSEG gas pipeline if Turbine Site A is selected, including the need for permit/approvals?"

BOWF Response:

This information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

17. "Provide information regarding the project schedule and approvals, including the submittal of construction plans, SWPPP, etc."

BOWF Response:

This information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

18. "A brief description of the Community Outreach Plan (DEIS Appendix U) should be provided in this section as it is referced (sic) in portions of Section 2.0. A mention of post construction monitoring would also be helpful."

BOWF Response:

This information is completely missing from Section 1 and Appendix U is too vague and unenforceable to constitute mitigation of any impact. Additionally, it applies only to construction monitoring so it is unresponsive to LaBella's comment.

SEIS Section 2.1 Geology, Soils, and Topography

19. "Provide the results of soil and geotechnical investigations of the new turbine sites (A,B,C), the new substation location, and the MET tower location. The level of detail regarding soils, bedrock and topography should be commensurate with that provided in the DEIS and FEIS for the originally proposed locations (DEIS) or changed locations (FEIS)."

BOWF Response:

This information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

20. "Note that, as part of the FEIS, site specific investigations were undertaken of the revised interconnect routes to identify any sensitive environmental resources. The

same information is required in the SEIS for collection routes in previously unassessed locations."

BOWF Response:

This information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

Additionally, the comment confirms that BOWF continued to modify the Project after the DEIS was accepted as "complete", thereby failing to follow the procedural requirements of SEQR, and failing to provide public opportunity for input.

21. "Explain if blasting will be needed at any sites in the Modified Project and how this has been determined?"

BOWF Response:

Information needed to address this question is completely missing from the body of the Draft SEIS. BOWF indicates that blasting will not be needed but bases that opinion solely on information relating to the original tower locations, not the modified locations. Such information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

Section 2.2 Water Resources

29. "Are there any changes to the evaluation of wetlands with regard to the Staging Area?"

BOWF Response:

This information is completely missing from the body of the Draft SEIS.

Section 2.4 Biological Resources

30. "Characterize each of the new turbine sites (A,B,C) and other areas newly affected by the Modified Project with regard to the ecological communities listed in DEIS."

BOWF Response:

This information appears to be provided for certain ecological communities but not others.

31. "....Specifically, can the change to Turbine Site 5 be adjusted so that Turbine 5 is moved to the adjoining agricultural field instead of the woodland edge?"

BOWF Response:

This question is not answered. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

32. "Discuss the greater intrusion into forest habitat areas and forest fragmentation associated with the Modified Project, similar to the discussion in DEIS Section 3.4.2.2.2 regarding forest fragmentation. Discuss specific mitigation measures to minimize fragmentation of the forest community, the potential use of alternate routes to avoid forested areas, measures to reduce the intrusion of invasive species into forested areas, etc."

BOWF Response:

This information is completely missing from the body of the Draft SEIS. Instead, BOWF adopts the conclusion that such impacts cannot be avoided. This type of assertion is representative of Findings, rather than an EIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

34. "Specific updated information is needed on the bald eagle with respect to the fact that a new nest was discovered about 3 miles from the project area between the time the DEIS and FEIS were prepared. An assessment from an expert on bald eagles should be included in the SEIS to indicate any changes from the previous assessment performed by Old Bird in January 2014, due to either 1) the changes proposed in the Modified Project or 2) changes (if any) in ecological/environmental conditions since the previous assessment."

BOWF Response:

This information is completely missing from the body of the Draft SEIS. No report from an expert is provided. The document contains the mere conclusory assertion that because the Project will be shifted slightly away from the nest, no increased adverse impacts are expected. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

35. "Provide information on the Northern Long-Eared Bat, its potential presence in the entire project area, and how the project will comply with the federal and state

requirements under the Endangered Species Act and endangered species regulations, respectively."

BOWF Response:

This information was partially provided but it does not address how BOWF will comply with the cited laws and regulations. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

Section 2.4 Traffic and Transportation

36. "New transportation routes potentially along Harvey Hill Road and Cayutaville Road are not discussed in the DEIS/FEIS as they were not relevant to the Approved Project. Describe each new road affected by the Modified Project, its condition, capacity to handle construction traffic, traffic conditions, and usage (school bus traffic?) The level of detail should be commensurate with that provided in the DEIS and FEIS."

BOWF Response:

The SEIS contains only a limit discussion of these issues. It lacks the requested details about the specific roads. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

37. "Describe any needed improvements to the new roads affected by the Modified Project. The level of detail should be commensurate with that provided in the DEIS and FEIS."

BOWF Response:

This information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

38. "Describe the potential use of Cayutaville Road when it is currently described as an "un-paved road". Describe the improvements and level of construction needed to bring this road up to a condition suitable for use for construction and maintenance of a turbine if Alternative Site A is selected. Describe what specific segments and lengths will require improvement and how the connection will be made to the new access road shown on Figure 1."

BOWF Response:

This information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

Section 2.6 Land Use and Zoning

40. "Update data on vacant parcels affected by required setback distances from wind turbines for Modified Project (see Response 1X in FEIS)."

BOWF Response:

This information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

41. "If appropriate, an updated discussion of "good neighbor payments" would be helpful in this section based upon new homes that may be affected."

BOWF Response:

This information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes. I also note that "payments" made only to citizens who support the Project by agreeing to the restrictive terms of the agreement is not adequate mitigation under SEQR.

Section 2.8 Community Facilities and Services

43. "Will the Town of Newfield fire and emergency personnel be provided training? Has contact been made to establish that the emergency providers have specific concerns about the project? Is an update of draft Emergency Preparedness Plan needed?"

BOWF Response:

This information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

Section 2.10 Historic, Cultural, and Archeological Resources

46. "Summarize the information in the Summary of Cultural Resources Studies (Appendix C) within Section 2.10 in an easy-to-read and understandable way."

BOWF Response:

This information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

47. "The following statement is made in the January 13, 2016 EDR Memo:

> The SHPO Wind Guidelines are based on the assumption that additional archaeological survey work is not necessary if minor changes to the Project layout occur during the Project development process, as long as the total area of ground disturbance for the Project does not significantly increase.

No basis is provided for this statement, and none was evident following review of the SHPO Wind Guidelines. Please provide documentation of the assumption that additional archeological work is not needed if minor changes to the Project layout occur. This should include a definition of what constitutes "minor changes from the SHPO Guidelines. Please provide the schedule for re-submission of the information regarding changes to the project area/APE to SHPO to confirm this assumption."

BOWF Response:

There is no evidence that responsive information was provided by BOWF. Such information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

48. "Given the expansion of the project area to the northeast and southeast, a re-evaluation of the Historic Resources Visual Effects Analysis presented in the FEIS may be warranted. The SEIS should address this issue and obtain confirmation from SHPO of the need for and the results of such an update."

BOWF Response:

There is no evidence this comment was addressed. Such information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

Section 2.16 Noise

53. "In the Acoustic Study Update (Appendix E) it is indicated that hub height of the proposed turbines is 94 meters – is this correct? (Based on our records, the hub height of the former turbine model in the FEIS/Findings statement was 96 meters or 315 feet. In June 2015, the use of the currently proposed model turbines was approved, which involved an increase in hub height of 8 feet, resulting in a total hub height of 323 ft or 98 meters.) Is the Acoustic Study accurate given this anomaly in hub height."

BOWF Response:

This conflicting information has not been adequately discussed and remedied in the SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

54. "The Acoustic Study Update (Appendix E) indicates shifts in Turbines 4 & 5 which do not match what is indicated in Section 10.0 of the SEIS. This information should be clarified. Is the Acoustic Study accurate given this anomaly in Turbine 4 & 5 locations?"

BOWF Response:

Appendix E is now Appendix H, but there is no indication that this conflicting information has been adequately discussed and remedied in the SEIS. In addition, the slight modification to Turbine 6 which is Evident from Figure 1 is not mentioned anywhere in the body of the SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

55. "More information is needed in the Existing Conditions subsection including a discussion of ambient noise levels."

BOWF Response:

This information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

Additional Comments from LaBella dated February 8, 2016

Section 2.8 Aesthetic and Visual Resources

59. "Include Figure 5 and 6 from SEIS VIA into SEIS main document, as was done in DEIS."

BOWF Response:

It appears that only one Figure was moved into the body of the SEIS as requested by LaBella.

61. "DEIS Section 2.8.2.1.1 needs to include more information than just the percentages of the area with views of turbines. Specifically, elaborate on about potential visual impacts from aesthetic resources of statewide significance and from community centers, similar to that provided in DEIS Sections 3.6.2.2.1."

BOWF Response:

This information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

63. "SEIS Section 2.8.2.1.2 should provide the basis for why the following change was made in the "worst case" simulations and whit if any effect this has on the analysis:

> It should be noted that "worst case" photosimulations were previously prepared under clear sky conditions; however, the new photosimulations were prepared under cloudy to mostly cloudy skies typical of wintertime conditions in the western part of Tompkins County."

BOWF Response:

This comment has not been addressed. An "apples with apples" comparison should be required. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

64. "Include the Photosimulations from SEIS VIA into the main SEIS report, as was done in the DEIS (size of 8.5" x 11" is fine)."

BOWF Response:

This was not done in the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

67. "In SEIS Section 2.8.2.1.3, provide a table similar to Table 4 in FEIS (and same table in Findings) which lists receptors receiving 10 or more hours of shadow flicker per year in order from highest to lowest hours. Indicate in a new column if the residence is newly affected by the Modified Project. Also indicate in a new column if residence is owned by a non-participating landowner. A separate table should be provided for each alternative turbine combination (7A-7C, 7A-7B, and 7B-7C).

<u>BOWF Response</u>:

No column was added to indicate whether residences were participating or non-participating which is important to assessing the impacts from this Project.

70. "There remains confusion with regard to the heights of the turbine which has been indicated to be 94 m (see also Comment #53). More explanation is needed of the heights in the . . . statement in 2.8.2.1.3. . . ."

<u>BOWF Response</u>:

This confusion has not been clarified in the narrative portion of the Draft SEIS. This information regarding turbine height is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

71. "Include text and a table summarizing the information in Section 5 of the Shadow Flicker Analysis regarding the general timing (time of year, time of day) of the shadow flicker effects for each alternative combination . . . ."

<u>BOWF Response</u>:

This requested information is completely missing from the body of the Draft SEIS. This information is crucial to assessing the impacts from this Project, and whether such impacts could be avoided or mitigated as a result of Project changes.

Subject	**Black Oak Wind Farm**
From	James R. McConkey <jrm9@cornell.edu>
To	townclerk@townofenfield.org <townclerk@townofenfield.org>
Date	04/16/2016 1:30 pm

roundcube

Please add my name to the list of Enfield residents who strongly support the proposed Black Oak Wind Farm, which I'll be heartened to see from my house at the corner of Aiken and Waterbury Roads. If humanity is to survive, we must give up our reliance on oil and other fossil fuels that are responsible for global warming and replace them with power from wind and solar cells and other sustainable systems. Furthermore, the Black Oak Wind Farm will provide the town with financial support needed for a new community building.

James McConkey
402 Åiken Rd.
Trumansburg, NY 14886

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Thursday, April 21, 2016 4:02 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: In favor of Black Oak Wind Farm

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: In favor of Black Oak Wind Farm
Date: 04/17/2016 8:18 am
From: "Barbara Mahony" <bjmahony7@netzero.net>
To: townclerk@townofenfield.org

Please approve the new environmental impact study and move forward with wind farm. The climate is in great trouble, as is agriculture, bees, coastal regions, everyone's health (more bugs, virus bugs, more lyme, more unknown, nature as crazy as "man").

Thank you. Please excuse lateness and consider the project.

Sincerely,
Barbara Mahony, resident of Enfield

Links:
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[1] http://thirdpartyoffers.netzero.net/TGL3242/57137f6813b3a7f6703aest02duc

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Thursday, April 21, 2016 4:03 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: Black Oak Wind Farm concerns

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: Black Oak Wind Farm concerns
Date: 04/17/2016 6:28 pm
From: ica leonard <aciburt@hotmail.com>
To: "townclerk@townofenfield.org" <townclerk@townofenfield.org>

We live at 185 Leonard Road, and are finding orange markers for the windmill substation directly behind our house on John Straight's land.
We were shown a map by Ms. Wells where the substation would be much farther to the West on Straight's land. And now we also find that the proposed windmill will only be .47 miles from our house. Closer than we thought it would be. We are on the leeway side of the windmill. No one notified us of this change.

They plan to have a line to the substation that goes across our land using the power line. We have an agreement with the electric company and the pipeline, but can the wind farm use that right of way without our permission? We do pay taxes on the land. What are our rights in this matter? Again, no one notified us of these changes.
We have gotten a lot of misleading and incorrect information from the people running the wind farm. We're having second thoughts about the safeness of these plans.

Sincerely yours, Homer and Ica Leonard

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Thursday, April 21, 2016 4:04 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: More concerns about windmills

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: More concerns about windmills
Date: 04/18/2016 10:54 am
From: ica leonard <aciburt@hotmail.com>
To: "townclerk@townofenfield.org" <townclerk@townofenfield.org>

We are downhill from one of the windmill sites and are concerned about drainage problems if they make a large flat area for the construction of the substation just above our house and fields. There's a lot of water that comes off off John Straight's hillside . The small creeks on either side of our house get wild during a rainstorm as it is. Our 2-foot-wide stream was at least 20 feet wide during the last big storm. I posted pictures of it on Facebook last year. Imagine all that loose silt and rock rushing down past our house causing blockages and flooding. The drainage patterns could be permanently messed up as a result. In the 1930's a storm completely washed out the town road that went by our house. It has been closed ever since.. it's no longer a road.

Health experts say that the safe distance to a windmill from a dwelling is 1.24 miles. We will be only .47 miles away.

How close to a border can a substation be placed? What are the rules on that?

We are concerned about all these problems that we are being made aware of through our online investigations.

Sincerely yours, Homer and Ica Leonard, 185 Leonard Road, Newfield.

Palermo, Jean

From:	townclerk@townofenfield.org
Sent:	Thursday, April 21, 2016 4:05 PM
To:	Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject:	Fwd: Support for Wind Farm

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: Support for Wind Farm
Date: 04/18/2016 4:15 pm
From: JoAnn Huddle <jhuddle42@gmail.com>
To: townclerk@townofenfield.org, ann-rider@townofenfield.org

Dear Town Board Members:

As a taxpayer and active member of the Enfield community, I am writing to indicate my support of the Black Oak Wind Farm. I think it is good for our community and it will reduce our carbon footprint on the environment. I urge you to approve the new environmental impact study in a timely fashion to allow the project to move forward and begin construction.

Best Regards,
JoAnn M. Huddle

607-227-7115

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Thursday, April 21, 2016 4:16 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Comments from Edward Grover
Attachments: 20160421162722.pdf

Please see attached letter.

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: E-mail Message
Date: 04/21/2016 5:27 pm
From: enfieldtownclerk@gmail.com
To: "townclerk2" <townclerk@townofenfield.org>

This is an E-mail message.
Please open the attached file.
Sent from : enfieldtownclerk@gmail.com

Number of pages : 2
Date : Thu, 21 Apr 2016 16:27:23 -0500

Edward Sherman Grover
112 Rumsey Hill Road
Newfield, NY 14867

April 18, 2016

Town of Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850

This letter contains my comments to the Black Oak Wind Farm ("BOWF") draft Supplemental Environmental Impact Statement ("SEIS") to the Town Board as lead agency under the State Environmental Quality Review Act ("SEQR"). I am very concerned about the proposed BOWF project and do not think it should be sited so close to a residential area. In particular, I have the following concerns:

Noise

BOWF's SEIS says that the ambient noise level is 39.8 dBa but that seems quite high – more like an urban setting. I have lived in this area my entire life and I can attest to the fact that for much of time it is actually quite still and quiet up on Connecticut Hill. From what I understand, the ambient sound for rural areas such as ours should be closer to 25-30 dBa depending upon what time of the day or night you measure. Why is BOWF's reading so high?

My neighbor tells me that we have asked for the underlying sound data that BOWF used for their readings and they won't give them to us so we can verify that data. Why won't BOWF give that information to us?

And what about infrasound? Why hasn't BOWF measured for and addressed infrasound? What if I can't sleep? I already have significant health issues and I am worried that if my sleep is disrupted on a regular basis by these turbines, this will make those health issues much worse. What is my recourse if that happens? I don't see anything in the SEIS that addresses how BOWF will be held accountable if the noise levels are too high.

Ice throw/blade throw

The setbacks from the roads and property lines are simply inadequate and unsafe. Turbine 3 is approximately 1,300 feet from my property line. And Turbines B is about 1,200 feet from Harvey Hill Road and Turbine C is a little over 1,400 feet from Black Oak Road and about 1,350 feet from Harvey Hill Road. I drive on those roads regularly. It seems like when I read pages 13 – 15 of the Report on Wind Turbines prepared by the Town of Enfield Wind Farm Advisory Committee (see http://townofenfield.org/wp-content/uploads/2016/04/Enfield-Wind-Farm-Advisory-Committee-Reports-2016-04-12.pdf) that these turbines can throw ice or blades well beyond these distances. How can that be safe?

Doesn't allowing BOWF to place these turbines so close to my property line depriving me the full use of my property without paying me? And I never granted them the right to do that, nor do I want to grant them the right to do that.

And even if it doesn't affect me, what about my neighbors up on Harvey Hill and Black Oak Road whose houses and property lines are a lot closer to those two new turbines? Isn't their health and safety important? What about their property rights? Those two turbines are awfully close to their property lines.

Mitigation proposals

There don't seem to be many good provisions in the SEIS for how BOWF is going to fix things or compensate the residents for the negative effects of their actions. In most cases, they seem to conclude that no mitigation is necessary. But even when they do concede that some sort of mitigation is necessary, the solution they propose is really inadequate. For example, they often suggest that a resident enter into the Good Neighbor Agreement as a solution. Why would a resident have to waive his rights like that agreement says to enforce health and safety concerns?

Another idea proposed by BOWF to mitigate their adverse impacts is the Community Outreach and Communication Plan contained in Appendix U of the original Draft Environmental Impact Statement. Not only is this plan ridiculously inadequate, it only applies during the construction period. We need a good post-construction plan to address residents' concerns throughout the operation of this wind farm that holds BOWF's feet to the fire and that the town can enforce.

Those are my comments. I hope the Board members will put the safety, health and property rights of the Town of Enfield residents above those of BOWF and their investors, most of whom live in another town – not Enfield. Thank you.

Sincerely, E Sherman Grover

E. Sherman Grover

Robert Tesori, Jr.
570 Black Oak Rd.
Newfield, NY 14867

Comments on SEIS – Black Oak Wind Farm Project

April 18, 2016

Town of Enfield Town Clerk
168 Enfield Main Rd.
Ithaca, NY 14850

To the Enfield Town Board:

This letter is in response to the Supplemental Environmental Impact Study proposed by the Black Oak Wind Farm. I am stating my opposition to this SEIS because Enfield's current wind law has still not been corrected to protect non-participant land owners from property infringement and health and safety issues.

The current Enfield Wind Law is inadequate by allowing one property owner with a wind lease to place a turbine close enough to neighboring properties that it restricts the safe usage of those properties. On page 15 the law reads: **Property Line. 100' or 1.1 times the Blade Radius (Sweep) measurement, whichever is greater, from the property line(s) between Site and any adjacent property owners, unless the neighboring landowner has consented otherwise pursuant to a written lease, easement or other agreement regarding a WTG or the Wind Energy Facility.**

The proposed location for **Turbine C** in the SEIS, if allowed, would place a turbine close enough to Brad and LuAnn Fisher's property located at 377 Harvey Hill Rd. tax map number 13-2-1.1 (refer to attached **DSEIS Setback Distances** map) that GE's recommended safety setback of 994' for ice throw would cut through half of their land. I spoke at great length with the Fisher's and their plan is to divide the back half of the property into two 5 acre lots for their children to build on. Even if they wanted to take their chances and build anyway, it would be negligence on the part of The Town of Enfield to issue building permits for anyone to wanting to build within this ice throw zone. The Fishers are non-participants in the wind farm and have the added complication of family members buried on the property so a buyout or selling is not an option.

Jude Lemke of 215 Connecticut Hill Road tax map number 18-2-4.3 also has property infringement issues. The 994' recommended GE setback for ice throw as with the Fisher's property, is consuming a significant portion of her property (refer to attached **DSEIS Setback Distances** map). This property infringement is referenced in the SEIS in section 2.6.1.2 Future Land Use and states that her property will be affected by Turbine 6 set forth below:

"The Town of Enfield Wind Law establishes a turbine setback from property lines of 1.1 times the blade radius or 193 feet. The setback to occupied residences specified in the Town of Enfield Wind Law is 1.1 times the total turbine height, or 532 feet. As such, there will be portions of non-participating land beyond the 193 foot property line setback that fall within the larger setback of 532 feet. While occupied structures do not exist on the affected portions of these non-participating properties at the present time, landowners may have plans for future development in these areas. However, future development on this affected land will be curtailed or affected by the presence of the wind turbine (with respect to setting, noise, visual impacts, shadow flicker, etc.). Non-participating land affected by this setback situation includes the following properties: □ 3.9 acres of parcel 18.-1-2 located south of Turbine 4. □ **2.8 acres of parcel 18.-2-4.3 located southeast of Turbine 6**. □ 0.3 acres of parcel 12.-2-1.1 located northwest of Turbine C. A total of 7.0 acres on three properties owned by non-participating landowners will be affected. This compares to 10.6 acres that would have been affected as described in the FEIS. This is an unavoidable impact. **There is no mitigation proposed regarding these effects on the future ability to develop these lands**."

As noted above, Mrs. Lemke is not the only property affected and the 2.8 acre measurement is based on the 532' setback distance under the Enfield Wind Law not the 994' ice throw setback. The GE 994' safety setback consumes significantly more than 2.8 acres. Mrs. Lemke has made it very clear that she is a non-participant in the wind farm and all though Turbine 6 is not listed as a change in the SEIS, it has been moved slightly (refer to attached **DSIES Appendix E** map) and as such is considered a change subject to public comment.

The Enfield Wind Farm Committee has done extensive research on the health and safety issues associated with industrial wind turbines so I will not go into detail in this paper. There are many concerns being raised all across the country and around the world. The biggest health issue is related to sound (audible and infrasound) but other issues raised are flicker, lighting, fire and mechanical (blade throw). If even one of these health and safety issues with these proposed turbines exists, their close proximity to the residents are reckless, dangerous and the effects would be greatly amplified at such a short distance.

This SEIS is unacceptable as is the FEIS under Enfield's current wind law. The law forces non-participating land owners to pay taxes on property with restricted land usage, possible health and safety issues and diminished property values with no recourse if there is a problem **"There is no mitigation proposed regarding these effects on the future ability to develop these lands.**" This is eminent domain without compensation. I encourage the Town of Enfield to correct its wind law before this community project is allowed to move forward. This current law will ruin the community by pitting neighbor against neighbor and creating a diminished quality of life. Thank you.

Robert Tesori, Jr.


Harvey Hill Rd
CR 183
CR 136
Rumsey Hill Rd
Black Oak Rd
Griffin Rd
Cayutaville Rd
Tower Rd
SETBACKS
100-FOOT BUFFER (SEE NOTE 1)
193-FOOT BUFFER (SEE NOTE 2)
532-FOOT BUFFER (SEE NOTE 3)
725-FOOT BUFFER (SEE NOTE 5)
750-FOOT BUFFER (SEE NOTE 4)
994-FOOT BUFFER (SEE NOTE 6)
MET TOWER
TURBINE
ALTERNATE TURBINE
PETROLEUM PIPELINE
NYSEG TRANSMISSION LINE
ACCESS ROUTE
COLLECTION ROUTE
SUBSTATION
STAGING
DELINEATED STREAM
DELINEATED WETLAND
TOWN BOUNDARY
PARCEL BOUNDARY
NOTES:
1. Enfield and Newfield setback from wetlands.
2. Enfield setback from non-participating parcels (1.1 x blade radius = 193 feet).
3. Enfield setback from wind turbines and non-participating residences. (1.1 x total height = 532 feet).
4. Newfield setback from wind turbines, non-participating residences, and non-participating parcels.
5. NYSEG setback from electrical transmission line.
6. GE recommended setback for ice throw.
7. Basemap: ESRI Imagery web map service.
HALEY ALDRICH
TOMPKINS COUNTY, NEW YORK
SETBACK DISTANCES
MARCH 2016

Environmental Design & Research,

memorandum

To:	Marguerite Wells	**EDR Project No:**	11060
From:	Nicholas Freeland, RPA and Patrick Heaton, RPA		
Date:	January 13, 2016		
Reference:	Black Oak Wind Farm Summary of Cultural Resources Studies Relative to Modified Project Layout		

Comments:

This memorandum serves to summarize cultural resources studies conducted to date for the proposed Black Oak Wind Farm (the Project), located in the Town of Enfield, in Tompkins County, New York. Specifically, this memorandum addresses the findings and conclusions of previous cultural resources studies relative to recent changes to the Project layout that have occurred since the conclusion of the State Environmental Quality Review Act (SEQRA) permitting process. This summary was prepared by Environmental Design & Research, Landscape Architecture, Engineering, & Environmental Services, D.P.C. (EDR) cultural resources staff who meet the qualifications specified by the Secretary of the Interior's Standards for Historic Preservation and Archaeology per 36 CFR Part 61.

Following the submittal and acceptance of the Final Environmental Impact Statement (FEIS) and issuance of SEQRA Findings by the Town of Enfield Town Board (the SEQRA Lead Agency), ongoing landowner negotiations resulted in several changes to the Project layout. Therefore, a second Draft Environmental Impact Statement (DEIS 2) is being prepared to address the necessary modifications to the Project. Consistent with the requirements of SEQRA, the DEIS 2 will contain a comparative analysis of potential adverse impacts of the proposed modifications with the impacts of the permitted Project as analyzed in the original DEIS dated June 12, 2013, the FEIS dated November 12, 2014, and the Findings Statement issued by the Town of Enfield on January 14, 2015. This memorandum summarizes the information regarding cultural resources contained within the Approved Project Record.

For clarification, the Project as previously proposed and approved is referred to as the "Approved Project", whereas the currently proposed Project layout is referred to as the "Modified Project".

The Approved Project would generate 11.9 megawatts (MW) of electricity and consisted of seven GE 1.7 -100 model wind turbines, one wind measurement tower (meteorological tower), a system of gravel access roads, buried and above ground electrical collection lines (interconnect), a substation next to the existing NYSEG 115 kilovolt (kV) transmission line, and tow temporary construction staging areas. The Approved Project was addressed in the SEQRA Findings Statement issued by the Town of Enfield Town Board, as Lead Agency, on January 14, 2015. Subsequent to the issuance of the SEQRA Findings Statement, the Town Board passed a resolution on July 8, 2015, through a SEQRA review, a modification of the Approved Project wind turbine model from a GE 1.7 – 100 to a GE 2.3 – 107 which resulted in an increase in electrical generation capacity from 11.9 MW to 16.1 MW.

The Modified Project will generate 16.1 MW of electricity and consist of seven GE 2.3 – 107 model wind turbines. The Modified Project will have the same ancillary facilities as the Approved Project including access roads, electrical collection lines, a substation, and one construction staging area. However, the Applicant, Black Oak Wind LLC (Black Oak Wind), proposes minor modifications to the locations of some project components. The specific changes are:

1) Relocation of two turbines (T2 and T7) to three possible locations (designated A, B and C) with associated access roads and collection lines. Location A is in the Town of Newfield. Locations B&C are in the Town of Enfield.
2) Shift of turbine T5 approximately 100 feet to the east to comply with GE recommended setback for ice throw.
3) Relocation of substation to new location with associated access road in Town of Enfield.
4) Addition of a new permanent 308-ft (94-m) tall wind measurement (meteorological) tower just south of turbine T4.
5) Relocation of approximately 2,200 linear feet of buried collection line between turbines T4 and T5.
6) Relocation of approximately 6,200 linear feet of buried collection line between turbines T5 and T6 and new substation location.

This memorandum addresses modifications to the Black Oak Wind Farm and describes the potential impacts of those modifications to cultural resources in direct comparison to the Approved Project that was reviewed pursuant to SEQRA. The following table summarizes the Approved and Modified Project Layouts.

Table 1. Comparison of Approved and Modified Project Layouts

Project Component	Approved Project Layout	Modified (Current) Project Layout
Wind Turbine Model	GE 2.3 – 107	GE 2.3 – 107
Number of Wind Turbines	7	7 (although evaluating a total of 8 potential locations)
Number of Met Towers	0	1
Length of Access Roads	2.7	No more than 3.2 miles (depending on which alternate turbine locations are developed)
Length of Collection Lines	4.1	No more than 4.7 miles (depending on which alternate turbine locations are developed)
Staging Areas	2	1
Substation	1	1

Summary of Cultural Resources Studies to Date:

In the late winter of 2013, EDR prepared a Phase 1A Cultural Resources Survey on behalf of the Applicant which identified no previously recorded archaeological sites within the Project site or within 1 mile of the Project site (EDR, 2013). The Phase 1A report was submitted to the New York State Office of Parks, Recreation, and Historic Preservation (NYSOPRHP), in their capacity as State Historic Preservation Office (SHPO) on March 5, 2013, thereby initiating consultation with SHPO for the Project. NYSOPRHP responded on April 2, 2013, stating their concurrence with the findings and recommendations contained within the Phase 1A report (Perazio, 2013a)

On June 13, 2013, the State University of New York, Binghamton, Public Archaeology Facility (PAF), submitted a Phase 1B Methodology, Testing Proposal and Structure Visibility Estimate for the Project (PAF, 2013a) to the NYSOPRHP on behalf of the Applicant. NYSOPRHP responded to the submission on July 17, 2013 stating their concurrence with the work plan contained within the report (Perazio, 2013b)

On August 29, 2013, PAF submitted a Phase 1B archaeological reconnaissance report to NYSOPRHP (PAF, 2013b), on behalf of the Applicant. For the Phase 1B archaeological survey, PAF surveyed seven turbine locations, one meteorological tower location, one substation, one staging area, approximately 2.7 miles of access roads, and approximately 1.3 miles of interconnect, totaling approximately 38 acres. For the survey, PAF excavated 643 shovel tests at 5-meter intervals within selected areas and conducted approximately 2.8 acres of pedestrian survey. No historic or prehistoric archaeological sites were identified during the Phase 1B archaeological reconnaissance survey. In review correspondence dated October 22, 2013, NYSOPHRP concurred with the Phase 1B archaeological survey report's recommendation that no further archaeological investigation should be required for this Project (Perazio, 2013c)

On September 10, 2013, PAF submitted their Phase 1B historic building survey (PAF, 2013c) to NYSOPRHP, on behalf of the Applicant. The Phase 1B historic building survey identified 403 buildings/structures within the Project viewshed and within 5-miles (8-km) of the Project area (as defined by the locations of the seven proposed turbines). One building was listed on the National Register of Historic Places (NRHP), and 36 others (27 individual buildings and nine buildings comprising the Iradell Historic District) were recommended as eligible for listing on the NRHP. In review correspondence dated October 22, 2013, NYSOPHRP, concurred with PAF's (2013c) recommendations regarding eligibility determinations for historic buildings/structures (Perazio, 2013c). NYSOPRHP noted that visual impacts to the eligible and listed resources would need to be determined prior to the issuance of an effect determination for the Project (Perazio, 2013c).

On July 18, 2014, EDR submitted a visual effects analysis for historic structures (EDR, 2014) to NYSOPRHP, on behalf of the Applicant. The visual effects analysis found that 16 NRHP-eligible Historic Properties had potential views of the Project. However, EDR (2014:18) found that the scale of visual impacts to NRHP-eligible historic structures would be minimal, relative to other wind projects. In review correspondence dated September 18, 2014, NYSOPHRP found the Project would have No Adverse Effect on properties listed in or eligible for listing on the NRHP (Bonafide, 2014).

Conclusions and Recommendations

To conclude, a Phase 1A Cultural Resources Survey, a Phase 1B Archaeological Survey, a Historic Architectural Resources Survey, and a Visual Effects Analysis were all completed for the Approved Project Layout with a finding of No Effect issued for archaeological resources and a finding of No Adverse Effect issued for historic architectural resources. The Approved Project Layout consisted of seven proposed turbine locations, 2.7 miles of access roads, 4.1 miles of interconnect, two staging areas, and one substation; and the Modified Project Layout consists of a total of 7 proposed turbine locations, no more than 3.2 miles of access roads (depending on which alternate turbines are developed), no more than 4.7 miles of interconnect (depending on which alternate turbines are developed), one meteorological tower, one staging area, and one substation. Additionally, the areas of potential impact for the Modified Project Layout are not significantly different, in terms of archaeological sensitivity, than the Approved Project Layout (both contain areas of moderate and high archaeological sensitivity, per PAF [2013b]). Therefore, it is anticipated that the results of the previous archaeological survey are applicable to the minor Project layout changes proposed in the Modified Project Layout.

Thus far, cultural resources studies for the Project have been conducted with adherence to the *New York State Historic Preservation Office Guidelines for Wind Farm Development Cultural Resources Survey Work* (the *SHPO Wind Guidelines*; NYSOPRHP, 2006). The *SHPO Wind Guidelines* are based on the assumption that additional archaeological survey work is not necessary if minor changes to the Project layout occur during the Project development process, as long as the total area of ground disturbance for the Project does not significantly increase. No archaeological resources were identified as a result of the Phase 1B archaeological survey previously conducted for the Project, and the results of a visual effects analysis determined that the Project would not have an adverse impact on historic properties. The minor layout changes proposed in the Modified Project Layout will not change these findings.

Therefore, it is the opinion of EDR that the previous cultural resources studies conducted for the Project are sufficient for the purposes of evaluating the Project's potential effect on archaeological and historic resources. No additional cultural resources studies or analyses are recommended for the Project.

Attachments:

Figure 1. Black Oak Wind Farm Project Layout Comparison

References Cited:

Bonafide, John A. 2014. Re: ACOE, DEC: Black Oak Wind Farm/7 Turbines/11.9 MW, Enfield, Tompkins County, 10PR03387. Review Correspondence dated 4/2/2013. New York State Office of Parks, Recreation, and Historic Preservation, Division for Historic Preservation, Waterford, NY.

Environmental Design and Research (EDR). 2013. *Phase 1A Cultural Resources Survey, Black Oak Wind Farm Town of Enfield, Tompkins County*. EDR, Syracuse, NY.

EDR. 2014. *Historic Resources Visual Effects Analysis, Black Oak Wind Farm*. EDR, Syracuse, NY.

New York State Office of Parks, Recreation, and Historic Preservation (NYSOPRHP). 2006. *New York State Historic Preservation Office Guidelines for Wind Farm Development Cultural Resources Survey Work*. New York State Office of Parks, Recreation, and Historic Preservation, Waterford, NY.

Perazio, Phillip A. 2013a. Re: CORPS PERMITS, DEC: Black Oak Wind Farm / 20 Units, Town of Enfield, Tompkins County, 10PR03387. Review Correspondence dated 4/2/2013. NYSOPRHP, Division for Historic Preservation, Waterford, NY.

Perazio, Phillip A. 2013b. Re: CORPS PERMITS, DEC: Black Oak Wind Farm / 20 Units, Town of Enfield, Tompkins County, 10PR03387. Review Correspondence dated 7/17/2013. NYSOPRHP, Division for Historic Preservation, Waterford, NY.

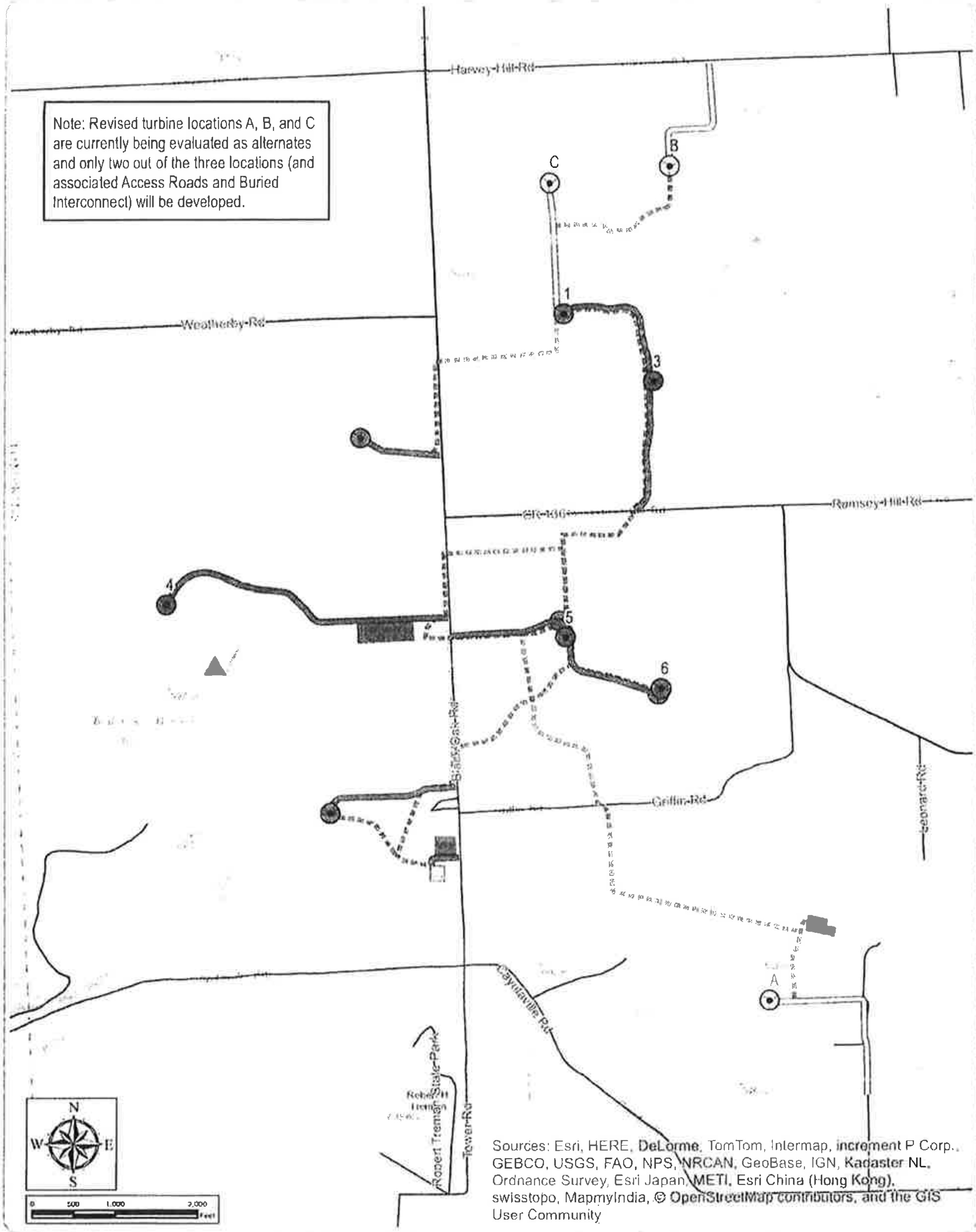
Perazio, Phillip A. 2013c. Re: CORPS PERMITS, DEC: Black Oak Wind Farm / 20 Units, Town of Enfield, Tompkins County, 10PR03387. Review Correspondence dated 10/22/2013. NYSOPRHP, Division for Historic Preservation, Waterford, NY.

Public Archaeology Facility (PAF). 2013a. *Phase 1B Methodology, Testing Proposal and Structure Visibility Estimate, Black Oak Windfarm Project, Town of Enfield, Tompkins County, New York*. PAF, State University of New York, Binghamton.

PAF. 2013b. *Phase 1B Archaeological Reconnaissance Survey: Black Oak Wind Farm Project*. PAF, State University of New York, Binghamton.

PAF. 2013c. *Phase 1B Historic Building Survey: Black Oak Wind Farm Project*. PAF, State University of New York, Binghamton.

Copies To: Project File



Black Oak Wind Farm

Towns of Enfield and Newfield, Tompkins County

Figure 1: Project Layout Comparison

January 2016

Notes: 1. Basemap: Esri ArcGIS Online World Topo Map
2. This is a color graphic. Reproduction in grayscale may misrepresent the data.

Current Project Layout

Turbine
- Modified
- Approved

Buried Interconnect
- Modified
- Approved

Meteorological Tower (Modified)
Staging Area (Approved)
Substation (Modified)

Access Road
- Modified
- Approved

Abandoned Portions of Approved Project Layout
- Turbine
- Access Road
- Buried Interconnect
- Staging Area
- Substation

Supplemental Comments to the draft Supplemental Environmental Impact Statement

Jude Lemke
215 Connecticut Hill Road
Newfield, NY 14867

April 20, 2016

Town of Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850

To the Enfield Town Board:

This letter presents supplemental comments to my earlier comments of April 12, 2016 to the Black Oak Wind Farm ("BOWF") draft Supplemental Environmental Impact Statement ("SEIS"). Capitalized terms not otherwise defined in this letter shall have the meaning as defined in the SEIS.

Email Correspondence between Black Oak and LaBella regarding the SEIS

Attached is the email correspondence between Black Oak and LaBella regarding the SEIS (Exhibit 1) that I referenced in my April 12, 2016 Open Letter to the Citizens and Town Board of Enfield about the Black Oak Wind Project (the "Open Letter").

Definition of the Modified Project

The changes listed on page 2 outlining the modifications in the Modified Project fail to include the movements of Turbines 1, 3, 4, and 6 outlined below. Furthermore, Turbine 5 has been moved a total of 219 feet, not the 160 feet indicated in the SEIS. These distances were calculated by comparing the locations of the turbines in Figure 5 of the SEIS with the locations of the corresponding turbines in the 4 pages of Figure 4 of the FEIS. GIS software was used to calculate the change in location. This work was done by Stone Environmental in Montpelier, Vermont. (See attached letter from Stone Environmental - Exhibit 2.)

Both a letter from Environmental Design & Research to Frank Pavia, dated June 24, 2015 (Exhibit 3), regarding the Black Oak Wind Project Modified Project as well as the July 2015 Town Board minutes approving the Project state unequivocally that the turbines were not moved from the locations set forth in the FEIS when BOWF requested the Town Board approve the change from the GE 1.7MW-100 turbines to the GE 2.3MW-107 turbines. So Stone Environmental compared the FEIS turbine locations directly to the SEIS turbine locations (which also correspond to the FAA coordinates online).

The SEIS does not assess the anticipated impacts of these movements.

Turbine	Measured Difference (ft)
1	40
3	76
4	367
5	219
6	75

Definition of Approved Project

The SEIS refers to the Approved Project and indicates that it refers to the Project as previously approved. It goes on to indicate that the Project Sponsor is still considering the possibility of reverting to the Approved Project but the SEIS fails to explain how it can conform to the original Approved Project since: (1) BOWF has no legal right to build the substation on Richard Teeter's property and, to date, he has refused to change his mind, (2) BOWF may not have the legal right to build Turbine 7 on Richard Teeter's property and (3) Turbine 2, as configured with a GE 2.3MW-107 turbine, cannot meet the property line setback requirements of the Town's Wind Energy Facilities Local Law (Local Law No. 1 of 2009) ("the Wind Energy Law") under the provisions of BOWF's lease with Donald Gunning which prevent the turbine from being moved enough to comply with the law. As a result, the references to the Approved Project throughout the document and to the Approved Project Record are somewhat unclear.

Cumulative Impacts

SEQR requires an EIS (including an SEIS) to identify and evaluate cumulative impacts where applicable and significant. BOWF, however, has disingenuously limited the discussion of cumulative impacts in the SEIS to cumulative impacts with other external wind projects. The SEIS completely ignores any assessment of the impacts caused by building multiple structures (turbines), each of which causes its own particular impacts, and when combined having the potential to cause increased impacts.

In addition, the fact that all of the original turbines (i.e., 1 through 7) have either moved or been eliminated and the substation and approximately 8,400 linear feet of collection line have also moved, combined with the fact that the turbines have increased in height by 8 feet (see page 4 of the letter from Environmental Design & Research to Frank Pavia, dated June 24, 2015, regarding the Black Oak Wind Project Modified Project [Exhibit 3] and the July 2015 Town Board minutes approving the Project) and the blades have increased by approximately 21 feet (i.e., from 100 meters to 107 meters) from the Final Environmental Impact Statement ("FEIS") and the Findings Statement could have a significant cumulative impact on noise, shadow flicker, and view shed, among other things. Furthermore, Section 2.12.1 of the SEIS states that the Modified Project visual study area and the Approved Project visual study area are essentially the same when, in fact, the North to South layout of the project has increased by over twice the distance (i.e., approximately .88 miles to 1.92 miles according to Google maps, using the coordinates listed on the FAA site). The cumulative effect of all these changes leads to the conclusion that the entire project should be re-evaluated in most material respects.

For the foregoing reasons, the SEIS should be modified to include an assessment of the cumulative impacts from the Project.

History of SEQRA Process/ Violations of SEQRA and Town Wind Energy Law

The history of the project, as laid out on pages 3 - 4 of the SEIS fails to point out BOWF's apparent violations of both the Town's Wind Energy Law and SEQR by commencing construction before the issuance of a permit pursuant to the Wind Energy Law, and before completion of the SEQR process. In fact, BOWF states in its own Private Placement Memorandum, dated September 20, 2014 (the "Private Placement Memo"), for $6,000,000.00 of 8,572 Class A Units (copy attached – Exhibit 4):

> "**We began initial construction three years ago,** commencing with the excavation of the access road to the wind farm which was completed in December 2013. We also recently completed the excavation of a foundation hole for a permanent meteorological tower (emphasis added)."

In addition to the construction described in the Private Placement, prior to 2015 a foundation for turbine 4 was begun (see attached photo – Exhibit 5) as well as the clear cutting of trees to prepare for the collection lines to turbines 5 and 6 (see attached photo – Exhibit 6). As noted on page 4 of the SEIS, the only approvals and authorizations received by Black Oak were in 2015 (after the construction referred to above) and no construction permits have been issued to date. Yet BOWF has cleared an area for Turbine 4 that is approximately 350 feet by approximately 180 feet (which is equivalent to about 1.45 acres).[1]

SEQRA provides: "[a] project sponsor may not commence any physical alteration related to an action until the provisions of SEQR have been complied with" (6 NYCRR § 617.3(a)). "Physical alteration" is defined to include the following activities, among others: "vegetation removal, demolition, stockpiling materials, grading and other forms of earthwork, dumping, filling or depositing . . . ." (6 NYCRR § 617.2(ab)). The only exception to this prohibition is for "Type II" or exempt actions. An industrial wind farm is not a Type II action.

According to DEC's SEQR Handbook (page 16):

> It may be possible to implement some non-physical aspects of an action which are not subject to SEQR, but it should be noted that Subdivision 617.3(a) provides that a project sponsor may not commence any physical alteration related to an action until all provisions of SEQR have been complied with (i.e. the lead agency has issued a Negative Declaration or Findings). The fact that some early activities on an overall action are not subject to review under SEQR does not remove the consequences of these decisions from consideration with respect to the whole action.

[1] To claim that this is the action of a local landowner, John Rancich, and not BOWF is disingenuous, at best. As the Town Board well knows, John Rancich was publically described as the originator of the BOWF and apparently owns an indirect, substantial economic interest in the project. According to the Private Placement Memo, Enfield Energy LLC owned over 25% of BOWF. Enfield Energy is owned by John Rancich, Marguerite Wells and Lexie Hain but in a phone conversation with Jude Lemke, Marguerite Wells admitted that neither she nor Lexie Hain had paid John Rancich for their interests to date. In addition, Enfield Energy is entitled to a $500,000 payment of which John Rancich is effectively the beneficiary through his ownership in Enfield Energy.

> For example, a site should not be cleared and graded nor should any structural demolition occur until all aspects of the overall proposed project subject to SEQR have been examined. The only exception to this would be for minor disturbances necessary for information gathering about a project; e.g. property surveys, soil sampling, test wells or temporary installation of various types of environmental monitoring equipment.

Furthermore, the Wind Energy Law itself requires a permit to begin any construction. Article II, Sections 2.A.2. and 2.A.3. of the Wind Energy Law provides that "No WTG shall be constructed or operated in the Town except pursuant to a Wind Energy Permit approved pursuant to this Local Law" and "No Wind Measurement Tower shall be constructed in the Town except pursuant to a Wind Permit issued pursuant to this Local Law." A "Wind Energy Permit" is a permit granting "the right to construct, maintain and operate a 'Wind Energy Facility'. A "Wind Energy Facility" includes any WTG or Wind Measurement Tower, "including all related infrastructure, electrical lines, substations, access roads and accessory structures."

There can be no reasonable dispute that BOWF's physical alteration (the apparent excavation of foundations for turbines and/or the met tower) was undertaken long before SEQR was concluded, and before the final permit has been issued. Yet BOWF has apparently convinced Town representatives that such illegal physical work on the Project provides it with "vested rights" which would thwart retroactive application of a more reasonable and protective wind law. That defies logic.

Noise

I am submitting detailed comments on noise in the attached report, "Critique of the Noise Analysis of the Draft Supplemental Environmental Impact Statement for the Black Oak Wind Farm, dated April 20, 2016, by Les Blomberg of the Noise Pollution Clearinghouse, dated April 20, 2016 (See attached report). However, I would like to comment on the mitigation provisions for noise which mirror those of shadow flicker by referring to the Community Outreach and Communications Plan (Appendix U of the DEIS). As stated in my earlier Open Letter on page 18, this is palpably deficient as mitigation due to its vague terms, lack of a viable enforcement mechanism and the fact that it only applies during the construction period. Furthermore, the proposal to have residents execute a Good Neighbor Agreement as mitigation is entirely unacceptable in light of the requirement that a resident must waive his or her legal rights to access this mitigation tool. That is not adequate mitigation under SEQR. It is coercion.

In addition, I would like to emphasize the following passage from the noise comments submitted by my expert acoustician which demonstrates succinctly why a further modification to the Draft SEIS is necessary, rather than simply addressing such comments in a Final SEIS:

> It is not reasonable to ignore noise impacts, including health related impacts, in a DSEIS noise analysis. The point of the EIS processes is to identify impacts early in the DSEIS process and to disclose them to the public, so that they can be mitigated if needed. This is not a problem that can be addressed by adding a couple paragraphs to the FSEIS, because the impacts would have been hidden from the public until the very final moment when the public can no longer comment or participate. A new DSEIS is needed to address these impacts (Blomberg Comments, pg. 11).

Setback Distances and Flicker Maps

The only reference point for figuring out the setback distances from residences, roads and property lines is a reference to Figure 5 in Section 2.6.1.1, Project Site Land Use and Zoning, of the SEIS. Nowhere in this Draft SEIS document or the DEIS or the FEIS does Black Oak disclose the setback distances from each residence and property line making it difficult for anyone to determine how far these turbines will be located from their property and homes or what has actually changed in the Modified Project. This is important information which should be clearly stated in the SEIS. Black Oak should amend the SEIS to list the distance of the nearest turbine from each residence and each adjacent property line in the SEIS and show the change from the FEIS for each.

Ice throw/blade throw

As a supplement to the discussion contained in pages 20 – 21 of my Open Letter, I would like to add the following comments. My earlier comments limited the discussion to the GE setback recommendations. But, as discussed in further detail in the Enfield Wind Farm Advisory Committee Report on Wind Turbines (Exhibit 7) on pages 13 to 15, studies have shown that the potential safety zone for ice throw and blade throw could be significantly greater (i.e., up to 1,950 feet in the case of the GE 2.3MW-107 turbines). And another manufacturer, Vestas, advices its workers to stay be at least 400 meters (~1,300 feet) in its safety regulations (Exhibit 8). The map attached to this paper (Exhibit 9) shows how much of my property would be impacted if the safety zone were either 1,000 feet (roughly equivalent to GE's 994 foot or Vestas' 1,300-foot setback. As you can see, a substantial portion of my property is impacted by these setbacks. And even more would be impacted using the 1,950-foot setback outlined in Alternative 2 of the committee report. Section 2.6.1.2, Future Land Use, in the SEIS states that "this is an unavoidable impact" and fails to provide any mitigation to me for this. This effectively deprives me of the use of about half my property with no compensation.

I would also point out that Turbines B and C are sited very close to both Harvey Hill Road and Black Oak Road – roads on which I drive regularly. Furthermore, these two turbines are extremely close to the property lines and residences of Brad and LuAnn Fisher at 377 Harvey Hill Road, tax map number 13.-2-1.1. Turbine C is approximately 390 feet from her property line (according to Google maps using the FAA coordinates for this turbine) and only about 1,150 feet from her home. As LuAnn Fisher indicated at the public hearing, she and her husband had intended to subdivide that back 10 acres of their land into two 5-acre parcels for each of their children to build a home. Once again Section 2.6.1.2, Future Land Use, in the SEIS states that "this is an unavoidable impact" for this parcel (which is mislabeled 12.-2-1.1) and fails to provide any mitigation to the Fishers. Even just using the 990-foot setback for icing under the GE guidelines effectively deprives them of the use of about half their property with no compensation.

Even the landowners at 435 Black Oak Rd, Trumansburg 14886, tax map number 13.-2-1.31[2], and 463 Black Oak, Trumansburg 14886, tax map number 13.-2-6.3[3], live too close to Turbine C. Turbine C is approximately 1,180 feet from each of their property lines and approximately 1,350 feet from each of their residences. Using the Vestas safety regulation setback of 1,300 feet or the 1,950-foot setback

[2] Philip Wright

[3] JoLee Carlisle and her children

outlined in Alternative 2 of the Wind Farm Advisory Committee report would significantly impact the use of their property as well. Philip Wright uses the entire back of his property to graze his horses.

BOWF's President, Peter Bardaglio, stated in a Wind Farm Advisory Committee meeting that the turbines will automatically stop when icing occurs but GE's states in its GER-4262 (Ice Shedding and Ice Throw – Risk and Mitigation): "Detection of ice by a nacelle-mounted ice sensor which is available for some models (with current sensor technology, ice detection is not highly reliable)." (Exhibit 10)

The reliability of a gearbox system of a turbine can be substantially less than 20 years. And the single largest component of a gearbox system that causes gearboxes to fail is the bearings.[4] If turbines are sited such that the wind blows parallel to the rows of the turbines such as Turbines 1, B and C, then the turbine following the lead turbine in the row will have higher turbulence as well lower wind speed. The effect of the turbulence and fluctuating wind speed is not only loss in the production of electricity (i.e., array loss), but also the reduced life of the wind turbines due to fatigue failure.[5], [6] One type of fatigue failure is axial cracking in bearing races that has become common in large megawatt turbines. This damage can shorten bearing life to as little as one to two years. Axial cracking issues in bearings were not a prominent failure mode until larger megawatt and multi-megawatt class wind turbines were put in service. The issue of axial cracking grew along with turbine size. The key to limiting fatigue failure, and the resulting dangers such as blade throw, fires, etc., is proper siting of the turbines.[7] Given the locations of Turbines 1, B and C and how they line up, BOWF needs to assess the impact of the potential wind turbulence on these turbines.

Flicker

The Wind Advisory Committee's Report describes many of the concerns and possible mitigation techniques relating to shadow flicker. The Draft SEIS should be modified to include a meaningful discussion of these concerns and to incorporate relevant mitigation techniques.

Shadow flicker only occurs in certain specific combined circumstances, such as when the sun is shining and is at a low angle (after dawn and before sunset), the turbine is directly between the sun and the affected property, and there is enough wind energy to ensure that the turbine blades are moving. A considerable amount of international research has been undertaken on the impacts and management of shadow flicker. Generally in Europe[8], the standard for flicker is to place turbines at least 500 – 1,000 meters[9] from dwellings and limit the amount of flicker to no more than 30 hours per year, and in some cases, no more than 30 minutes per day. Research has shown that when turbines are placed at least 10

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[4] http://nawindpower.com/online/issues/NAW1505/FEAT_01_Meet-The-Achilles-Heel-Behind-Most-Gearbox-Failures.html
[5] http://www.brighthub.com/environment/renewable-energy/articles/97151.aspx
[6] http://www.windpowerengineering.com/design/how-turbulent-wind-abuse-wind-turbine-drivetrains/
[7] http://www.windpowerengineering.com/design/how-turbulent-wind-abuse-wind-turbine-drivetrains/
[8] These shadow flicker recommendations are based on the survey by Predac, a European Union sponsored organisation promoting best practice at energy use and supply which draws on experience from Belgium, Denmark, France, the Netherlands and Germany.
[9] This equates to roughly 1,750 to 3,500 feet.

rotor diameters[10] or more from a dwelling, the potential for shadow flicker is very low.[11] BOWF has adopted a standard of 30 hours per year as its measure for what constitutes a significant impact but gives no support for that standard.

There are many complaints by residents living near wind turbines about the impacts of flicker.[12], [13], [14] These complaints and concerns include, among other things, headaches, tinnitus, nausea, dizziness, earaches, vertigo and seizures. In many cases, residents have abandoned their homes because they were unable to sell them and could no longer stand living with the effects of the flicker. In a document produced by the Bureau of Land Management, the BLM notes that flickering effect may be considered an annoyance.[15] With respect to seizures however, the BLM points out that modern three-bladed wind turbines are unlikely to cause epileptic seizures in the susceptible population[16] photo-sensitive epileptics due to the low blade passing frequencies.[17]

The World Health Organization defines annoyance as a feeling of discomfort which is related to adverse influencing of an individual or a group by any substances or circumstances. Annoyance express itself by malaise, fear, threat, trouble, uncertainty restricted liberty experience, excitability or defencelessness.[18] While there has yet to be a direct causal link established between flicker and adverse health effects, the World Health Organization does link annoyance to various diseases such as diabetes and cardiovascular disease. Furthermore, the NIH's National Center for Biotechnology Information points out that there has been little if any research conducted on how flicker could heighten the annoyance factor of those living in proximity to turbines.[19]

As LaBella notes in its review of the SEIS (Comment #69), the maximum number of flicker hours for any one resident is increasing by 35% (i.e., from 19:51 hours to 27:41 hours for Alternative 2 – Turbines B & C) and yet the level of detail in the SEIS for the Modified Project regarding flicker is substantially less than that included in the FEIS. As pointed out elsewhere in this letter, the level of detail provided in the shadow flicker maps is very limited so it is very difficult to determine exactly what the impact of shadow flicker will be on any one residence. But it appears that virtually all of the property at 463 Black Oak, Trumansburg 14886, tax map number 13.-2-6.3 will have shadow flicker on the property that exceeds 30 hours per year. Measuring only at the residence, where the shadow flicker is slightly below the 30 hour per year standard BOWF has set for itself, substantially understates the impact this is going to have on the Carlisles. This is especially true since the Carlisles will experience shadow flicker from not one, not

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[10] This equates to 1,070 meters or 3,500 feet for the GE 2.3MW-107 turbines

[11] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48052/1416 -update-uk-shadow-flickerevidence-base.pdf

[12] https://www.bostonglobe.com/metro/2013/04/04/turbine-flicker-effect-drawscomplaints/UKgf7nOwMHm8CWAtZ47V5L/story.htm

[13] http://www.telegraph.co.uk/news/earth/earthnews/8386273/Shadow-flicker-rotating-blades-can-cause-headaches.html

[14] https://www.youtube.com/watch?v=RD6q3ixq0-s

[15] Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM- Administered Lands in the Western United States, US Department of the Interior – Bureau of Land Management (2005) Synopsis

[16] Around 0.5 % of the population is epileptic and of these around 5 % are photo-sensitive. Of photo-sensitive epileptics less than 5 % are susceptible.

[17] http://onlinelibrary.wiley.com/doi/10.1111/j.1528-1167.2008.01563.x/epdf

[18] http://www.euro.who.int/__data/assets/pdf_file/0015/105144/WHO_Lares.pdf

[19] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4063257/

two, but three different turbines and possibly even a fourth (again it is impossible to tell from the data provided). Furthermore, since the data provides no information about what the standard deviation is for the measurements and those measurements are based solely on average amounts of sunshine and average amounts of wind for the months, the amount of flicker could vary substantially resulting at times in flicker shadow well in excess of the 30 hour per year standard BOWF has proposed. And it appears that the amount of flicker that the Carlisles could experience on any one day is well in excess of 30 minutes per day which is the standard set by European countries.[20]

The residents at 377 Harvey Hill Road, tax map number 13.-2-1.1[21], 435 Black Oak Rd, Trumansburg 14886, tax map number 13.-2-1.31[22] and 464 Black Oak Road, Trumansburg 14886, tax map number 13.-1-3.22 will all be similarly impacted and yet, as noted below, there is absolutely no mitigation provided for them in the SEIS.

One area of particular concern related to flicker involves its impact on horses. A detailed 2012 survey by the British Horse Society establishes that as many as 20% of horses are adversely effected by the flicker of wind turbines.[23], [24] This is of particular concern due to the fact that, as noted above, Philip Wright at 435 Black Oak Rd, Trumansburg 14886, tax map number 13.-2-6.1, grazes his horses on the back of his property which is quite close to Turbine C. Furthermore, the property at tax map 12.-2-1.2 is being used by a professional horse trainer to train horses.

In addition to all the issues outlined above, the revised flicker shadow report by Harris, Miller, Miller & Hanson, Inc. contained in Appendix G of the SEIS states that the locations of Turbines 1, 3, 4, 5 and 6 remain unchanged. As pointed out above, that is not true and the report should be redone to take into account the changes made in the locations of those turbines as well as to provide substantially more detail (certainly no less than that provided in the FEIS) around the impacts of shadow flicker on the residents in the area. The level of detail should be expanded to provide information on the estimated daily amounts of flicker as well as much more information regarding the assumptions used and the potential impacts of those assumptions on the results of the study.

Various mitigation steps can be taken to minimize the impact of flicker on nearby residents. Among other suggested mitigation tools are the use of blinds at residential properties or tree/shrub planting to screen shadow flicker to help minimize potential impacts.[25] While BOWF mentions these potential mitigation steps, it does not actually propose any mitigation steps in the SEIS. Nonetheless, many people complain that blinds do little to actually block the impact of flicker and do nothing to alleviate its effects while outdoors. Planting trees or shrubs will do little to mitigate the impacts in the short run before the vegetation grows to a sufficient size to mitigate. More meaningful mitigation steps would be to have BOWF shut down the turbines between the time the sun is rising and setting for approximately an hour around sunrise or sunset depending on where the residents reside in relation to the sun.

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[20] Shadow flicker recommendations are based on the survey by Predac, a European Union sponsored organisation promoting best practice at energy use and supply which draws on experience from Belgium, Denmark, France, the Netherlands and Germany.

[21] Bradford and LuAnn Fisher

[22] Philip Wright

[23] Wind turbine experiences, 2012 Survey results, The British Horse Society

[24] Advice on Wind Turbines and Horses –Guidance for Planners and Developers, The British Horse Society

[25] 92 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48052/1416 -update-uk-shadow-flickerevidence-base.pdf

Alternatively, BOWF can program their computers to control the direction of the turbine so the blades are directly parallel to the sun. The SEIS should be amended to consider these mitigations.

Traffic and Transportation Impacts

The reasonably related traffic impacts of the modified Project have not been adequately assessed. The modified Project apparently calls for the use of approximately 1,200 feet of Cayutaville Road, a gravel road,to access the substation and turbine A (DSEIS § 2.5.1). The SEIS states: "[p]reliminary analysis indicates that any additional roads required for component delivery (such as Cayutaville Road and Harvey Hill Road) are sufficient for these purposes . . . [and] [w]hile Cayutaville Road is an unpaved surface, its width and condition are consistent with and comparable to the type of roads typically used to deliver wind project components" (DSEIS § 2.5.2). No "preliminary analysis is documented in the SEIS. There is absolutely no discussion as to what improvements will be necessary. The SEIS also indicates that a "final transportation analysis" will be provided in the Supplemental FEIS, so any such analysis escapes description in the SEIS.

Viewshed/ National Historic Place Registration

My home, the Noble House Farm, is eligible to be listed in the National Register of Historic Places. As a result, the BOWF is required to address the impacts of the wind farm project on my home itself. In Appendix H of the FEIS (page 8), it states:

> "The Federal Regulations entitled "Protection of Historic Resources" (36 CFR 800) include in Section 800.5(2) a discussion of potential adverse effects on historic resources. The following types of effects apply to wind energy projects include: "Adverse effects on historic properties include, but are not limited to: [items i-iii do not apply]; (iv) Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance; (v) Introduction of visual, atmospheric ***<u>or audible elements</u>*** [emphasis supplied] that diminish the integrity of the property's significant historic features; [items vi-vii do not apply]" (CFR, 2004b).
>
> The implementing regulations for New York State Parks, Recreation and Historic Preservation Law, Section 14.09 (9NYCRR §428.7) state: a. In determining whether an undertaking will have an adverse impact on eligible or register property, the commissioner shall consider whether the undertaking is likely to cause:
>
> 1. destruction or alteration of all or part of the property;
> 2. ***<u>Isolation or alteration of the property's environment</u>*** [emphasis supplied];
> 3. introduction of visual, ***<u>audible</u>*** [emphasis supplied] or atmospheric elements which are out of character with the property or alter its setting;
> 4. neglect of the property resulting in its deterioration or destruction."

Despite this language in the FEIS, the only impact addressed with respect to the historic importance of my home is the visual impact of the turbines. The SEIS should be amended to address the isolation or alteration of my property's environment and any audible elements, in addition to the visual elements, which are out of character with this property.

With respect to visual impact, the FEIS goes on to state:

> "One historic resource (the Noble House, 215 Connecticut Hill Road, Town of Enfield) recommended to be NRHP eligible is located within 0.5 miles of the proposed turbines, and will feature turbines in the foreground of views of and from the site. In addition, there is one historic property identified in the Phase 1B building survey (235 Harvey Hill Road, in the Town of Enfield) that is located between 0.5 and two miles of the Project, which will provide near middle ground views of the Project. ***The visual impact of the Project will generally be more apparent from these properties because the turbines will appear larger and may be perceived as out of context compared to other features in the existing landscape.***[emphasis supplied]
>
> Representative views of the visual effect of the Project from locations with foreground and near middle ground views are shown in Appendix B: ***Viewpoints 17 [Noble House Farm]***, 18, 38, 54, 57 [235 Harvey Hill Road] , 63 and 64. ***At these locations, the turbines appear as the tallest structure on the horizon and disproportionate to other objects within view such as trees or buildings.***" [emphasis supplied]

The SEIS (page 30) and Appendix F (page 12) further states:

> "Local resources expected to have partial or full views of the turbines include ...the Noble House Farm Bed & Breakfast, ..."

The SEIS does not list 235 Harvey Hill as having partial or full views of the Modified Project turbines despite the fact that this property was listed as having a view of all seven turbines in the DEIS. It is not possible to determine how many turbines I will be able to see from my home since the Appendix eliminates all the detail that was included in Appendix H of the DEIS and the maps cover such a large distance that it is all but impossible to read and one certainly is unable to determine on a property by property basis the impacts on one's residence.

Furthermore, despite saying in the Appendix F of the FEIS on page 11 that I will see 6 out of 7 turbines, they only show a photosimulation for 2 of those 6 turbines in Appendix F. Moving to the SEIS, it seems likely that I can still see a large number of turbines. In light of the fact that all of the turbines have moved to some degree combined with the much larger blades, the SEIS should be amended to include a detailed discussion of the view shed of these turbines on a property by property basis similar to the way it was shown in Appendix H of the DEIS and photosimulations should be included for all turbines to be seen from a particular property of interest.

In addition, the SEIS should be amended to discuss the view shed for 235 Harvey Hill Road.

Given that I will likely be able to see a large number of turbines and they will be in the foreground, combined with the audible effects, it would appear that my property will be negatively impacted which BOWF seems to acknowledge in the conclusions. However, once again, BOWF concludes there is no real mitigation available for me. The FEIS states:

> "Mitigation options are limited, given the nature of the Project and its siting criteria (very tall structures typically located in open fields at the highest locally available elevations). Mitigation for impacts to historic properties therefore typically consist of projects that benefit historic properties and/or the public's appreciation of historic resources to offset potential impacts to historic properties resulting from the introduction of wind turbines into their visual setting. Mitigation projects that have been proposed for other wind energy projects in New York State have included activities such as additional historic resources surveys, NRHP nominations, monetary contributions to historic property restoration causes, development of heritage tourism promotional materials, development of educational materials and lesson plans, and development of public history materials, such as roadside markers. Any required mitigation measures for the Black Oak Wind Farm should be scaled relative to the Project's anticipated minimal impact on historic properties. Potential mitigation projects would need to be defined and developed in consultation with the SEQRA Lead Agency and NYSOPRHP."

And what limited mitigation there is has been left up in the air just like many other details in this project. However, fast forward to the SEIS, and it would appear that BOWF has dropped any idea to undertake some sort of mitigation project in consultation with the SEQRA Lead Agency and NYSOPRHP. Instead it says:

> "The viewing locations chosen for the photosimulations show the views of potential wind turbine sites before and after construction; however, these impacts do not meet the NYSDEC significance criteria, therefore, the Projects visual impact on these viewing locations are not significant. In addition, similar to the previous GE turbine design, the revised turbine layout will not have a detrimental effect on the perceived beauty of a place and will not cause a diminishment of the public enjoyment of a statewide significant resource including the Finger Lakes trail."

Mitigation proposals

Throughout the document, BOWF proposes a minimum number of mitigation actions, often declaring with little or no support, that mitigation is not necessary. And as I have explained above in the Noise section, there is frequent reliance on two inappropriate mitigation tools - the Good Neighbor Agreement and the Community Outreach and Communication Plan contained in Appendix U of the original DEIS. Coercing residents to enter into a Good Neighbor Agreement that requires them to waive their legal rights as the only mitigation available to them is entirely unacceptable. As for the Community Outreach and Communication Plan, the SEIS should be amended to require BOWF to propose an enforceable plan that covers both the construction period and the operations for the life of the project. That plan should require ongoing monitoring of the noise, repairs and maintenance and other health and safety issues and should impose realistic deadlines on BOWF for meaningful responses and mitigation steps for the residents.

Property value issues

Section 3.13.1 of the DEIS discusses at length a number of studies supporting BOWF's contention that the wind farm will have no impact on residents' property values. There is a myriad of conflicting studies on the impact of wind farms on property values. Many of the studies cited by the wind energy industry suffer from the same flaws. Most of these studies cover an extremely wide area (i.e., 5 miles or more) and do not control for any impacts resulting from the distance to the turbines from the home. These studies often only look at the effect of the view sheds on property values (i.e., don't factor in the negative health effects, noise, etc.). Sometimes there is an assumption that every house within the study area has an equal view of the turbines whether those houses can even see the turbines or not. Sometimes no attempt is made to sort out inappropriate transactions. Sales that are not arms-length (divorce, sales between family members, estate sales etc.) are included. By focusing only on actual sales these studies effectively screen out any houses that are unable to sell. And some studies focus on urban or industrial areas which are not equivalent to rural areas. On the other hand, some of the studies do focus on rural areas without controlling for the large farm properties with the additional revenue those participating farmers will enjoy from the turbines. We could debate which study is valid and which is not for days.

Nonetheless, the fact of the matter is that people all over the world are complaining of the same adverse health effects of wind turbines and there is a flood of anecdotal evidence that these same people are boarding up their homes and moving away because they are unable to sell their homes but they are no longer able to bear the symptoms of living near the wind turbines. Furthermore, the anecdotal evidence is that the symptoms these homeowners complain of dissipate once they have moved away. People do not board up their homes and abandon what is probably their single largest financial asset because of NIMBYism. There are many examples of society ignoring obvious signs that something was amiss – cigarettes, the AIDs epidemic, etc. For years, the people who complained about these issues were ignored or ridiculed. The effects of wind turbines are real.

Shortly after finding out that a wind farm was proposed to be built next to my farm, I hired a realtor to give me an assessment of what I could sell my property for. The news was not good. As he said, common sense tells you that given a choice people will choose to buy a property that has no wind farm nearby. It was going to take a long time to sell my property and I was likely to take a significant discount on the price I had just paid for the property which I unwittingly bought. The DEIS and SEIS provide no mitigation for me or any of my neighbors to the anticipated economic impacts of the BOWF.

Fire

The two most common causes of fires in turbines are lightning or mechanical failure. The newer, bigger turbines like GE's 2.3MW-107 have more issues with bearing and fatigue failure that can lead to fires.

It is the local municipality's responsibility to develop their own fire emergency plans.[26] Most wind turbines do not have fire suppression systems installed by the manufacturers. In fact, GE's salesperson who attended the Wind Farm Advisory Committee stated that the 2.3MW-107 turbines being installed by Black Oak Wind Farm do not have such a system. Section 6.9.1 of the Final Findings Statement provides that the GE 1.7MW-100 turbines will come standard with two fire extinguishers in the nacelle, and one in the base of the tower and that Black Oak will purchase an additional fire protection system

[26] http://www.windpowerengineering.com/maintenance/safety/what-regulations-exist-for-fire-protection-in-wind-turbines/

from Firetrace International, LLC, which provides fire control devices in individual turbine components such as the electrical cabinets and converters. However, the SEIS does not make clear whether these protections will be included with the larger GE 2.3MW-107 turbines. In addition, the SEIS states there will be an updated Fire and Emergency Plan provided **but it is not part of the filing.** The SEIS needs to be amended to clarify what the fire protection systems in these turbines will be. Furthermore, the SEIS needs to be amended to provide a detailed Fire and Emergency Plan that is acceptable to the Town.

Given the remote locations and enormous height of turbines today, there is little a fire department can do to fight a fire in the nacelle. Typically, a good option for firefighters to consider is to evacuate any endangered areas, set up a collapse zone, and attempt to control any ground fires to prevent the fire from spreading to other units. In addition to grass fires, the secondary fire on the ground can lead to forest fires, which can be difficult to extinguish. The remote locations of the turbines and strong winds can be factors that promote the quick spread of forest fires. Section 2.8.2 of the SEIS states: "Consultation with the Enfield Fire Company indicates that they are confident in their ability to control fires in open fields, but concerned regarding the ability to control fires if they spread to forests."

Furthermore, OSHA states: "Workers should be made aware that while fighting initial fires, toxic gases can be generated and oxygen can be depleted inside Nacelles, and they can be exposed to such gases or can be asphyxiated from lack of oxygen."[27] In light of the risks involved, the use of safety features in the turbines whenever possible and a well-designed emergency plan are critical.

Foundation

Foundation failures that lead to turbine collapse are generally caused by design flaws, construction flaws or maintenance flaws.[28] In addition, design flaws and maintenance flaws with the turbine towers themselves can lead to turbine collapse for a wide variety of reasons.[29] In all circumstances, the root cause of the problems arises due to the enormous stress and forces to which a wind turbine is subjected requiring that both the foundation and the turbine tower's structure are up to the task at hand.

The main reason for foundation failures has been poor structural design. Furthermore, the site investigations are sometimes not conducted properly and the findings are not properly considered when designing the foundation.[30], [31] There are many different types of foundation designs for wind turbines. The foundation design will always have to be site-specific in that it needs to be designed for the prevailing local soil conditions.[32] Other reasons for construction flaws are poor workmanship performance and inappropriate material selection. As a result, it is critical to have a third party soil engineer as well as construction engineer on site during the construction of the foundations to ensure they are being built properly.

Once the turbine foundations have been built, it is also critical that they be inspected and maintained on a regular basis to check for cracking and/or softening of the foundation which can lead to collapse.

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[27] https://www.osha.gov/dep/greenjobs/windenergy_fire.html
[28] http://docs.wind-watch.org/Cracks-in-onshore-wind-turbine-foundations.pdf
[29] http://khatrinternational.com/docs/awea_wt.pdf
[30] http://www.windfarmbop.com/cracks-in-onshore-wind-turbines-foundation/#comment- 14776
[31] http://docs.wind-watch.org/Cracks-in-onshore-wind-turbine-foundations.pdf
[32] http://home.eng.iastate.edu/~jdm/engr340-2011/ENGR%20340%20-%20Foundations%203%20-%20Ashlock%20- %20Schaefer.pdf

Water entering the foundation followed by subsequent freezing and thawing can have negative effects on the integrity of the turbine's foundation.

In addition to foundation failure, the design flaws can lead to turbine collapse. Some of the maintenance or operational concerns related to the design of the turbines that can lead to turbine collapse include:

- Turbine over-speed;
- E-stops;
- Soil fatigue and/or foundation fatigue or cracking;
- Weld failures;
- Blade failures;
- Imbalance due to snow or ice load;
- Poor soil drainage leading to foundation softening; and
- Corrosion of foundation bolts.[33]

All of this leads to the conclusion that, in addition to strong oversight during construction, ongoing strong oversight of the operations and maintenance of the wind farm is critical to maintaining the safety of the town's residents. The SEIS should be amended to address what the plans are for doing so, including:

- What the Town's plans are for making sure that the turbines are properly designed and constructed;
- Whether there will be both a design/construction engineer and a soil engineer on site during construction and who will pay for that; and
- What the maintenance plan is to make sure foundation issues don't arise during the life of the project, especially as the turbines get older.

Furthermore, in light of these issues, the SEIS should be amended to specifically address comment #19 of LaBella's review of the February 2016 draft of the SEIS that states:

> "Provide the results of soil and geotechnical investigations of the new turbine sites (A, B, C), the substation location and the new MET tower location. The level of detail regarding the soils, bedrock and topography should be commensurate with that provided in the DEIS and the FEIS for the originally proposed locations (DEIS) or changed locations (FEIS)."

In addressing this comment, the core sampling should be extended beyond Turbines A, B and C to the other turbines being moved since BOWF's engineer, Tectonic, states in Section 9.0 of Appendix D, Geotechnical Report, of the DEIS:

> "It is noted that if the proposed Turbine locations change, Tectonic will need to confirm the validity of the provided recommendations. This is due in part to the locally abrupt variations in bedrock depth identified by the borings and MASW surveys."

Stray voltage

---

[33] http://khatrinternational.com/docs/awea_wt.pdf

The Final Findings Statement provides the following with respect to stray voltage:

> "While the concerns surrounding stray voltage are legitimate, it is important to note they are largely preventable with proper electrical installation and grounding practices. The Project's power collection system will be properly grounded, and will be electrically isolated (in accordance with required electricity regulations) from the local electrical distribution lines that provide electrical service to on-site structures or off-site buildings and homes. It will be physically and electrically isolated from all of the buildings in and adjacent to the Project. Additionally, the bulk of the wind farm's electrical collection lines will be located a minimum of three to four feet below ground, and will use shielded cables with multiple ground points. This type of design eliminates the potential for stray voltage."

But wind farm collector systems experience a very demanding load on cables and accessories compared to utility distribution systems. Fast deterioration of cables and cable accessories has been reported at wind farms. Joints are known to be a weak point in a cable system since it is an area which has been worked on by tools and hands. Reports suggest that failed joints are over represented compared to the cable itself in failure statistics. Typical causes of failure are moisture ingress, heating in joint ferrule and partial discharges in cracks and voids. Compression type ferrules, more often than others, have caused heating in joints by heightened contact resistance.[34] BOWF needs to provide the town with a clear maintenance and repair plan for the turbines to demonstrate how they will mitigate this risk.

General SEIS Comments

The Draft SEIS avoids any meaningful discussion of the actual impacts associated with these new turbines at these specific locations. It is nothing but a rehash of generic impacts associated with the construction of wind turbines generally. Nothing can be learned about the modified turbine sites by looking at this document (i.e., slope, pitch, soil types (relative to construction impacts from excavation), whether there are streams or wetlands). The document appears to have been rushed and in many instances is inaccurate or conflicting (it discusses impacts to 1.7 MW turbines rather than 2.3 MW turbines). In fact, the impacts from changing from a 1.7 MW turbine to a taller, 2.3 MW turbine has never been discussed in an EIS document. At the very least, it should be discussed in the SEIS with respect to the modified turbine locations.

An SEIS requires all of the same procedural and substantive requirements of an Environmental Impact Statement, with respect to the modifications of a proposed action. All EISs "must analyze the significant adverse impacts and evaluate all reasonable alternatives." (6 NYCRR § 617.9(b)). BOWF's SEIS does not do that. It contains a very generic or generalized discussion of typical impacts from wind turbines, but no specific discussion of the three proposed sites for the two relocated turbines or the specific impacts caused by construction at those locations. It contains generalized statements that the impacts of the modified Project will be similar to the impacts from the Project as originally designed, but it contains no actual analysis of the impacts from the modified Project.

In addition, regardless of the fact that the SEIS has been prepared by BOWF and that the Town Board has engaged environmental professionals to assist in the review, Board members must exercise their own judgment in this review process. SEQR provides: "[n]otwithstanding any use of outside resources

[34] http://www.diva-portal.org/smash/get/diva2:566345/FULLTEXT01.pdf

or work, agencies shall make their own independent judgment of the scope, contents and adequacy of an environmental impact statement." (ECL § 8-0109(3).

Thank you for your attention to these issues. I hope the Board will take a long hard look at the potential impacts outlined in this letter and ask BOWF to resubmit its SEIS to address them all before moving forward with drafting the final SEIS.

Sincerely,

Judith Lemke

Jude Lemke

We have read the comments contained in this letter and as well as those of the attached report, "Critique of the Noise Analysis of the Draft Supplemental Environmental Impact Statement for the Black Oak Wind Farm, dated April 20, 2016, by Les Blomberg of the Noise Pollution Clearinghouse, dated April 20, 2016 and we adopt all of the comments contained herein as well.

Marcus Gingerich, 101 Rumsey Hill Road, Newfield, NY 14867

Mimi Mehaffey, 115 Enfield Center Road West, Ithaca, NY 14850

Sincerely,

Jude Lemke

We have read the comments contained in this letter and as well as those of the attached report, "Critique of the Noise Analysis of the Draft Supplemental Environmental Impact Statement for the Black Oak Wind Farm, dated April 20, 2016, by Les Blomberg of the Noise Pollution Clearinghouse, dated April 20, 2016 and we adopt all of the comments contained herein as well.

Marcus Gingerich, 101 Rumsey Hill Road, Newfield, NY 14867

Mimi Mehaffey, 115 Enfield Center Road West, Ithaca, NY 14850

EXHIBIT 1

Spencer, Kathy

From:	Pippin, James <JPippin@haleyaldrich.com>
Sent:	Thursday, March 17, 2016 1:22 PM
To:	Frank C. Pavia
Cc:	Spencer, Kathy
Subject:	RE: BOWF - Accepted DEIS

Yes. Will do.

From: Frank C. Pavia [mailto:fpavia@harrisbeach.com]
Sent: Thursday, March 17, 2016 1:20 PM
To: Pippin, James
Cc: Kathy Spencer
Subject: Fwd: BOWF - Accepted DEIS

Jim,
Can you please send a copy of the DSEIS to Kathy ASAP? Thanks

Frank

Frank C. Pavia
Partner
HARRIS BEACH PLLC
ATTORNEYS AT LAW
99 Garnsey Road
Pittsford, NY 14534
585.419.8709 Direct
585.419.8815 Fax
585.419.8800 Main
Website | Bio | Add to Contacts
practiceGREEN
Save a tree. Read, don't print, emails.

Begin forwarded message:

> **From:** "Spencer, Kathy" <kspencer@LaBellaPC.com>
> **Date:** March 17, 2016 at 1:09:34 PM EDT
> **To:** "Frank C. Pavia" <fpavia@harrisbeach.com>
> **Subject:** BOWF - Accepted DEIS
>
> Frank, I heard from Dan Walker that the Town Board did vote to accept the draft SEIS. Have the copies been circulated? I have not received a hard copy of the full document including appendices.
>
> **Kathy Spencer CEP**
> Principal Environmental Analyst
> Direct: 585-295-6638 | kspencer@labellapc.com
> **LABELLA ASSOCIATES, D.P.C.**
> 300 State Street, Rochester, NY 14614
> Office: 585-454-6110
> labellapc.com
> *Relationships. Resources. Results.*

Statement of Confidentiality
This electronic message may contain privileged or confidential information. If you are not the intended recipient of this e-mail, please delete it from your system and advise the sender.

Spencer, Kathy

From:	Spencer, Kathy
Sent:	Tuesday, March 08, 2016 2:46 PM
To:	'Pippin, James'
Cc:	Frank C. Pavia (fpavia@harrisbeach.com); Marguerite Wells (enfieldenergy@gmail.com); Russell S. Laplante (rlaplante@onyxrenewables.com); Martin, Michael
Subject:	RE: Black Oak Wind Project - Revised SEIS

Jim, I have reviewed the Draft SEIS dated 3-7-16, and am in agreement that the most critical changes to the Draft SEIS have been made in the latest set of revisions. I have indicated in a memo to Frank Pavia that the document can be accepted as adequate for public review.

Although I am prepared to conclude that the document is complete for the purpose of commencing public review, some of the issues identified during the review process remain a concern, and I would expect that the project sponsor will address such issues as part of the Final SEIS before that later document is accepted.

Kathy Spencer CEP
Principal Environmental Analyst
Direct: 585-295-6638 | kspencer@labellapc.com

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300 State Street, Rochester, NY 14614
Office: 585-454-6110
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From: Pippin, James [mailto:JPippin@haleyaldrich.com]
Sent: Monday, March 07, 2016 4:32 PM
To: Spencer, Kathy
Cc: Frank C. Pavia (fpavia@harrisbeach.com); Marguerite Wells (enfieldenergy@gmail.com); Russell S. Laplante (rlaplante@onyxrenewables.com); Martin, Michael
Subject: Black Oak Wind Project - Revised SEIS

Hi Kathy,

Attached is a memo outlining the changes we made to the SEIS document per your March 1, 2016 comments along with the revised narrative with track changes so you can see where we made changes to the document. We also revised Figures 1,2 and 5 per your suggestion. Please review and let me know ASAP if there is anything substantive that needs revision or clarification in the SEIS prior to Wednesday evening's meeting. Thank you.

Jim

James B. Pippin
Office: (585) 321.4212
Cell: (585) 626.8333
jpippin@haleyaldrich.com

Spencer, Kathy

From:	Pippin, James <JPippin@haleyaldrich.com>
Sent:	Monday, March 07, 2016 4:32 PM
To:	Spencer, Kathy
Cc:	Frank C. Pavia (fpavia@harrisbeach.com); Marguerite Wells (enfieldenergy@gmail.com); Russell S. Laplante (rlaplante@onyxrenewables.com); Martin, Michael
Subject:	Black Oak Wind Project - Revised SEIS
Attachments:	2016-03-07_SEIS_Revised Narrative.pdf; 2016-03-07_SEIS Figures_1_2_5.pdf; 2016-03-07_HA Response to Labella SEIS Review.pdf

Hi Kathy,

Attached is a memo outlining the changes we made to the SEIS document per your March 1, 2016 comments along with the revised narrative with track changes so you can see where we made changes to the document. We also revised Figures 1,2 and 5 per your suggestion. Please review and let me know ASAP if there is anything substantive that needs revision or clarification in the SEIS prior to Wednesday evening's meeting. Thank you.

Jim

James B. Pippin
Office: (585) 321.4212
Cell: (585) 626.8333
jpippin@haleyaldrich.com

Spencer, Kathy

From:	Pippin, James <JPippin@haleyaldrich.com>
Sent:	Monday, March 07, 2016 1:31 PM
To:	Spencer, Kathy; Martin, Michael
Subject:	RE: BOWF

Hi Kathy,

We are going to be providing you the revised narrative and figures today for your review. Just getting last review/approval completed by the client. Thanks.

Jim

-----Original Message-----
From: Spencer, Kathy [mailto:kspencer@LaBellaPC.com]
Sent: Monday, March 07, 2016 12:45 PM
To: Pippin, James; Martin, Michael
Subject: BOWF

Can you give me a sense of your schedule so I know what to expect when I get back to the office. Ann Rider also asked me for an update. Thanks!

Sent from my iPhone

Spencer, Kathy

From:	Pippin, James <JPippin@haleyaldrich.com>
Sent:	Wednesday, March 02, 2016 1:39 PM
To:	Spencer, Kathy
Cc:	Martin, Michael
Subject:	RE: BOWF - Statement of Findings

Thanks Kathy.

Jim

From: Spencer, Kathy [redacted]
Sent: Wednesday, March 02, 2016 1:38 PM
To: Pippin, James
Subject: RE: BOWF - Statement of Findings

Here it is, complete with TOC.

Kathy Spencer CEP
Principal Environmental Analyst
Direct: 585-295-6638 | kspencer@labellapc.com
LABELLA ASSOCIATES, D.P.C.
300 State Street, Rochester, NY 14614
Office: 585-454-6110
labellapc.com
Relationships. Resources. Results.

From: Spencer, Kathy
Sent: Wednesday, March 02, 2016 12:20 PM
To: Jim Pippin [redacted]
Subject: BOWF - Statement of Findings

Interesting – my pdf copy has the same issue with the table of contents. I will scan the hard copy and get a clean copy to you.

Kathy Spencer CEP
Principal Environmental Analyst
Direct: 585-295-6638 | kspencer@labellapc.com
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Spencer, Kathy

From:	Pippin, James <JPippin@haleyaldrich.com>
Sent:	Tuesday, March 01, 2016 3:35 PM
To:	Spencer, Kathy
Cc:	ann-rider@townofenfield.org; Enfield Energy (enfieldenergy@gmail.com); Frank C. Pavia; Martin, Michael
Subject:	RE: Black Oak Wind Farm SEIS - LaBella Comments 3-1-16

Yes. I just schedule a meeting from 1:00 -2:00 but, I think we can wrap up our discussion by then based on the comments you provided. If you can make it a bit earlier that may help. Mike Martin from our office will be attending as well. Thank you.

Jim

James B. Pippin
Sr. Project Manager

Haley & Aldrich, Inc.
200 Town Centre Drive, Suite 2
Rochester, New York 14623-4264

T: (585) 321.4212
C: (585) 626.8333

www.haleyaldrich.com

From: Spencer, Kathy [mailto:kspencer@LaBellaPC.com]
Sent: Tuesday, March 01, 2016 3:32 PM
To: Pippin, James
Cc: ann-rider@townofenfield.org; Enfield Energy (enfieldenergy@gmail.com); Frank C. Pavia; Martin, Michael
Subject: RE: Black Oak Wind Farm SEIS - LaBella Comments 3-1-16

Jim, can you come here at 10:30?

Kathy Spencer CEP
Principal Environmental Analyst
Direct: 585-295-6638 | kspencer@labellapc.com

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From: Pippin, James [mailto:JPippin@haleyaldrich.com]
Sent: Tuesday, March 01, 2016 3:07 PM
To: Spencer, Kathy
Cc: ann-rider@townofenfield.org; Enfield Energy (enfieldenergy@gmail.com); Frank C. Pavia; Martin, Michael
Subject: RE: Black Oak Wind Farm SEIS - LaBella Comments 3-1-16

Kathy – can we meet tomorrow? I am available anytime tomorrow. Let me know what time works best for you. Thanks.

Jim
James B. Pippin
Office: (585) 321.4212
Cell: (585) 626.8333
jpippin@haleyaldrich.com

From: Spencer, Kathy [mailto:kspencer@labellapc.com]
Sent: Tuesday, March 01, 2016 2:52 PM
To: Pippin, James
Cc: ann-rider@townofenfield.org; Enfield Energy (enfieldenergy@gmail.com); Frank C. Pavia
Subject: RE: Black Oak Wind Farm SEIS - LaBella Comments 3-1-16

Jim, I just wanted to let you know that I will be out of town starting on Thursday, March 3 through Monday, March 7. I will have some, limited access to email if you need to communicate during that time.

Much of my schedule is currently open tomorrow, as is next Tuesday and Wednesday, March 8 and 9.

Kathy Spencer CEP
Principal Environmental Analyst
Direct: 585-295-6698 | kspencer@labellapc.com

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300 State Street, Rochester, NY 14614
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Spencer, Kathy

From: Pippin, James <JPippin@haleyaldrich.com>
Sent: Monday, February 29, 2016 2:19 PM
To: Spencer, Kathy
Cc: Russell S. Laplante (rlaplante@onyxrenewables.com); Marguerite Wells (enfieldenergy@gmail.com); Martin, Michael
Subject: Black Oak SEIS

Hi Kathy,

I understand you had some concerns or comments on the SEIS prior to the scheduled Town Board meeting. Can you join us on a call this afternoon to discuss? I am available until 5PM today. Let me know a convenient time and I will send you a call in number. Thanks.

Jim
James B. Pippin
Office: (585) 321.4212
Cell: (585) 626.8333
jpippin@haleyaldrich.com

Spencer, Kathy

From: Pippin, James <JPippin@haleyaldrich.com>
Sent: Wednesday, February 24, 2016 9:05 AM
To: Spencer, Kathy
Subject: RE: Black Oak SEIS

Hi Kathy,

None of the appendices have changed except for the addition of Appendix D. Unfortunately, with the additional visual information added to the narrative everything changed from the Visual Section and on. Let me know if you have questions. Thanks Kathy.

Jim
James B. Pippin
Office: (585) 321.4212
Cell: (585) 626.8333
jpippin@haleyaldrich.com

From: Spencer, Kathy [mailto:kspencer@LaBellaPC.com]
Sent: Wednesday, February 24, 2016 9:01 AM
To: Pippin, James
Subject: Black Oak SEIS

Jim, can you let me know what appendices have changed – or are there any that have not changed? I don't want to print out a lot of paper where no changes have occurred. Thanks.

Kathy Spencer CEP
Principal Environmental Analyst
Direct: 585-295-6638 | kspencer@labellapc.com
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Spencer, Kathy

From:	Spencer, Kathy
Sent:	Monday, February 08, 2016 12:54 PM
To:	'Pippin, James'
Cc:	'Frank C. Pavia'; Walker, Dan
Subject:	RE: Visual Section and Suppl. Report
Attachments:	SEIS Review VISUAL comments 2-8-16.pdf

Jim, here are our preliminary comments on the Black Oak Wind Farm Visual Section and reports that you sent last week. These comments are an informal communication between our offices and should not be made public. Let me know if you have any questions.

Kathy Spencer CEP
Principal Environmental Analyst
Direct: 585-295-6638 | kspencer@labellapc.com

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From: Spencer, Kathy
Sent: Thursday, February 04, 2016 9:46 AM
To: 'Pippin, James'
Subject: RE: Visual Section and Suppl. Report

Hi Jim. I got the reports. I cannot promise Friday but I will shoot for Monday. Thanks.

Kathy Spencer CEP
Principal Environmental Analyst
Direct: 585-295-6638 | kspencer@labellapc.com

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Relationships. Resources. Results.

From: Pippin, James [mailto:JPippin@haleyaldrich.com]
Sent: Wednesday, February 03, 2016 9:45 PM
To: Spencer, Kathy
Cc: Russell S. Laplante (rlaplante@onyxrenewables.com); Marguerite Wells (enfieldenergy@gmail.com); Martin, Michael; Frank C. Pavia (fpavia@harrisbeach.com)
Subject: RE: Visual Section and Suppl. Report

Hi Kathy – see my original message below. Your server didn't accept the original email with the report at 15MB. Attached is a reduced version. Let me know if you have any problems accessing the information. Thank you.

Jim
James B. Pippin
Office: (585) 321.4212
Cell: (585) 626.8333
jpippin@haleyaldrich.com

Black Oak Wind Farm SEIS – Visual Resources Section
LaBella Comments - February 8, 2016

Specific Comments (Numbered 58 through 72)

SEIS Section 2.8 Aesthetic and Visual Resources

58. Check and correct subsection numbers in this section.

59. Include Figure 5 and 6 from SEIS VIA into SEIS main document, as was done in DEIS.

60. Indicate whether the Viewshed Analysis in SEIS Section 2.8.2.1.1 is indicative of leaf-off or leaf-on condition and whether that is consistent with the Viewshed Analysis in the DEIS.

61. SEIS Section 2.8.2.1.1 needs to include more information than just the percentages of the area with views of turbines. Specifically, elaborate on about potential visual impacts from the aesthetic resources of statewide significance and from community centers, similar to that provided in DEIS Sections 3.6.2.2.1

62. The SEIS should provide a drawing or model of the Met Tower with its lattice structure and guidewires to provide a visual representation of this 94 m structure.

63. SEIS Section 2.8.2.1.2 should provide the basis for why the following change was made in the "worst case" simulations and what if any effect this has on the analysis:

    > It should be noted that "worst case" photosimulations were previously prepared under clear sky conditions; however, the new photosimulations were prepared under cloudy to mostly cloudy skies typical of wintertime conditions in the western part of Tompkins County.

64. Include the Photosimulations from SEIS VIA into the main SEIS report, as was done in the DEIS (size of 8.5" x 11" is fine).

65. In SEIS Section 2.8.2.1.2, provide a basis for the two bulleted statements, with an analysis similar to that found in DEIS Section 3.6.2.2.5.

66. On Figure 7 of VIA, the Met Tower symbol and label should be included in the Legend.

67. In SEIS Section 2.8.2.1.3, provide a table similar to Table 4 in FEIS (and same table in Findings) which lists receptors receiving 10 or more hours of shadow flicker per year in order from highest to lowest hours. Indicate in a new column if the residence is newly affected by the Modified Project. Also indicate in a new column if residence is owned by a non-participating landowner. A separate table should be provided for each alternative turbine combination (7A-7C, 7A-7B, and 7B-7C).

    Optional: List in a separate table the receptors that will no longer be affected by any shadow flicker due to modification of the turbine locations and how many hours of shadow flicker they would have experienced under the Approved Project.

68. Include Figures 2, 3, and 4 from the Shadow Flicker Analysis in the SEIS, as was done in the DEIS.

69. The word "slightly" be removed from the following sentence in Section 2.8.2.1.3 as the increase varies from about 11% to 35%:

    > The maximum worst case shadow flicker hours are predicted to increase slightly from 19:51 to 27:41 hours for Alternative 2 (construction of Turbines B & C), 22:15 hours for Alternative 1 (construction of Turbines A & B), and 26:37 hours for Alternative 3 (construction of Turbines A & C).

70. There remains confusion with regard to the heights of the turbine which has been indicated to be 94 m (see also Comment #53). More explanation is needed of the heights in the following statement in 2.8.2.1.3:

    > These changes are due to shifting the Project layout, changes in turbine specifications including a net increase in overall structure height of 5 m (from 196 m to 201 m) and increase in rotor diameter (from 100 m to 107 m), which affects the intersection of the sun, turbine and receptor.

71. Include text and a table summarizing the information in Section 5 of the Shadow Flicker Analysis regarding the general timing (time of year, time of day) of the shadow flicker effects for each alternative combination.

    An example of this type of info is the following sentence: *The majority of shadow flicker at receptor CG is expected to occur from Turbine 7C in the morning during the late spring (April to June) and later summer (July to August).*

72. Given that some new residences will now experience shadow flicker hours approaching the 30 hour threshold (26 and 27 hours), it is recommended that the Mitigation Section refer to the Complaint Resolution Procedure should un-anticipated shadow flicker effects arise.

From: Pippin, James
Sent: Wednesday, February 03, 2016 9:38 PM
To: kspencer@labellapc.com
Cc: Russell S. Laplante (rlaplante@onyxrenewables.com); Marguerite Wells (enfieldenergy@gmail.com); Martin, Michael; Frank C. Pavia (fpavia@harrisbeach.com)
Subject: Visual Section and Suppl. Report

Hi Kathy,

Attached is the Visual section and supplemental visual report for your review. I will send the supplemental shadow flicker report separately. If possible, please complete your review by Friday afternoon. Thanks Kathy, I appreciate it.

Jim

James B. Pippin
Office: (585) 321.4212
Cell: (585) 626.8333
jpippin@haleyaldrich.com

Spencer, Kathy

From: Pippin, James <JPippin@haleyaldrich.com>
Sent: Wednesday, February 03, 2016 10:01 PM
To: Spencer, Kathy
Cc: Russell S. Laplante (rlaplante@onyxrenewables.com); Marguerite Wells (enfieldenergy@gmail.com); Martin, Michael; Frank C. Pavia (fpavia@harrisbeach.com)
Subject: RE: Shadow Flicker Report

Kathy – below is a link to H&A's sharefile where you can download the suppl. Shadow Flicker Report. Thanks.

https://haleyaldrich.sharefile.com/d-s44658f1655e432f8

Jim
James B. Pippin
Office: (585) 321.4212
Cell: (585) 626.8333
jpippin@haleyaldrich.com

From: Pippin, James
Sent: Wednesday, February 03, 2016 9:51 PM
To: kspencer@labellapc.com
Cc: Russell S. Laplante (rlaplante@onyxrenewables.com); Marguerite Wells (enfieldenergy@gmail.com); Martin, Michael; Frank C. Pavia (fpavia@harrisbeach.com)
Subject: Shadow Flicker Report

Attached is the suppl. shadow flicker report. I will upload to a sharefile and send a link if this doesn't go through the Labella server. Thanks.

Jim
James B. Pippin
Office: (585) 321.4212
Cell: (585) 626.8333
jpippin@haleyaldrich.com

From: Pippin, James
Sent: Wednesday, February 03, 2016 9:45 PM
To: kspencer@labellapc.com
Cc: Russell S. Laplante (rlaplante@onyxrenewables.com); Marguerite Wells (enfieldenergy@gmail.com); Martin, Michael; Frank C. Pavia (fpavia@harrisbeach.com)
Subject: RE: Visual Section and Suppl. Report

Hi Kathy – see my original message below. Your server didn't accept the original email with the report at 15MB. Attached is a reduced version. Let me know if you have any problems accessing the information. Thank you.

Jim
James B. Pippin
Office: (585) 321.4212
Cell: (585) 626.8333
jpippin@haleyaldrich.com

From: Pippin, James [redacted]
Sent: Thursday, January 21, 2016 6:11 PM
To: kspencer@labellapc.com
Cc: ann-rider@townofenfield.org; Frank C. Pavia; dwalker@labellapc.com; Marguerite Wells [redacted];
Russell S. Laplante (rlaplante@onyxrenewables.com); Martin, Michael
Subject: Black Oak Wind SEIS

Hi Kathy,

I understand that you are aware that the Black Oak Wind Project is currently being modified and that an SEIS has been prepared to assess the modification pursuant to SEQRA. On behalf of the Applicant, Black Oak Wind, LLC, attached is a draft of the SEIS narrative and accompanying figures for your review on behalf of the Town of Enfield as lead agency. I will forward you the appendices with the exception of the updated Visual Study, tomorrow for your review. Please begin your review. If you are available either tomorrow or Monday, I would like to have a call to go over the schedule for your review. We anticipate that this should not take more than 1 week to complete. Please let me know if you have any questions. Thank you Kathy.

Best Regards,

Jim
James B. Pippin
Sr. Project Manager

Haley & Aldrich, Inc.
200 Town Centre Drive, Suite 2

From: Pippin, James
Sent: Wednesday, February 03, 2016 9:38 PM
To: kspencer@labellapc.com
Cc: Russell S. Laplante (rlaplante@onyxrenewables.com); Marguerite Wells (enfieldenergy@gmail.com); Martin, Michael; Frank C. Pavia (fpavia@harrisbeach.com)
Subject: Visual Section and Suppl. Report

Hi Kathy,

Attached is the Visual section and supplemental visual report for your review. I will send the supplemental shadow flicker report separately. If possible, please complete your review by Friday afternoon. Thanks Kathy, I appreciate it.

Jim

James B. Pippin
Office: (585) 321.4212
Cell: (585) 626.8333
jpippin@haleyaldrich.com

Spencer, Kathy

From:	Spencer, Kathy
Sent:	Monday, February 01, 2016 4:09 PM
To:	'Jim Pippin (jpippin@haleyaldrich.com)'
Cc:	Frank C. Pavia
Subject:	Black Oak SEIS - LaBella Comments
Attachments:	SEIS Review comments 2-1-16.pdf
Contacts:	Jim Pippin

Jim, as we discussed, here is preliminary comments from LaBella on the SEIS dated January 2016 for the Black Oak Wind Project. These comments are an informal communication between our offices and should not be made public.

I will be happy to review any specific questions you have on the comments included herein.

Kathy Spencer CEP
Principal Environmental Analyst
Direct: 585-295-6638 | kspencer@labellapc.com
LABELLA ASSOCIATES, D.P.C.
300 State Street, Rochester, NY 14614
Office: 585-454-6110
labellapc.com
Relationships. Resources. Results.

Black Oak Wind Farm SEIS
LaBella Comments - February 1, 2016

Overall

Sections of the Black Oak Wind Farm Supplemental Environmental Impact Statement (SEIS) dated January 2016, need site-specific details in order to accurately understand potential impacts and mitigation measures. These sections should correspond to those resources where significant environmental impacts potentially arise from changes proposed to the project or in circumstances related to the project. This is consistent with the guidance provided for Supplemental Environmental Impact Statements provided in 6 NYCRR 617.9(a)(7).

It is instructive to look at the level of detail that was added in the FEIS due to the changes to the project that had occurred since DEIS preparation. At that juncture the changes included:

- Shift in location of one turbine (Turbine 4 shifted 750 ft)
- Removal of staging area
- Relocation of buried interconnect lines and access roads

The acreage conversions with regard to ground disturbance, vegetative cover and land use are helpful but cannot serve as the only measure of the impacts wrought by the project changes.

Information regarding impacts which appears in the introduction to each sub-section in Section 2 should be moved or repeated to within the actual "Comparison of Potential Impacts" sub-section.

Specific Comments (Numbered 1 through 57)

SEIS Document (General)

1. Section 3.0 Conclusion should be removed as it is not appropriate to the SEIS.

2. As discussed by Frank Pavia, a section on Cumulative Impacts should be prepared.

3. As discussed by Frank Pavia, a section discussing Alternatives should be added. The Alternative section should include at least the following:
    - Alternative Site Layout: a comparative evaluation of alternate turbine site combinations AB, AC and BC
    - No Action

4. Figure 1 needs clarification in labeling. The blue-colored components could possibly be labelled as "Abandoned Components of Approved Project Layout" and the word "unmodified" removed from the green-colored labeling.

5. Figure 2 needs clarification in labelling with regard to the meaning of the various setback distances. These setbacks should also be specifically discussed in the text of the SEIS (see Comment #11).

6. Throughout the document, clarification of the language with regard to the modified and approved project is needed. It should always be clear if you are talking about just the new components/areas of the project - or - the overall components/areas of the Modified project, in total.

Comments on specific sections follow.

<u>SEIS Section 1.0 Project Description</u>

7. Describe how the "Project Site" is defined for the Modified Project. The Project Site or Project Area is referred to throughout the SEIS but never defined or drawn. A drawing is needed to update those in the DEIS/FEIS.

8. On p. 2 of the SEIS, in the description of project changes, clarification of the last two items listed is needed, specifically:
   - Relocation of approximately 2,200 linear feet of buried collection line between T4 and T5.
   - Relocation of approximately 6,200 linear feet of buried collection line between Ts 5&6 and new substation location.

   Looking at Figure 1, it is difficult to ascertain what changes are being made in the collection lines between Turbines 4 and 5 and between Turbines 5 and 6.

9. Include a brief description of basic turbine model – hub height, total height, rotor height, rotor diameter, rotor swept area, nameplate capacity, total net electricity, average # households served – to update information in DEIS/FEIS.

10. Include a brief description of MET tower including purpose, height, visual appearance, etc.

11. Include a brief description of the sites of the alternate turbine locations (A,B,C) and the substation and the MET tower location, including their current use, vegetation, elevation, slope, and general surroundings.

12. Discuss proposed setbacks, their meanings, and why they are being used (regulatory vs recommended by turbine manufacturer, non-participating vs. participating, etc.). As stated in Comment #5, the labelling in Figure 2 is confusing and the various setbacks shown need to either be explained or removed from the figure. Also, the setback distances in Figure 2 do not match the setback distances shown in Table 5, in all instances.

13. How were collection routes determined? Explain why many do not follow local roads, access roads, property boundaries, etc. What factors will be considered in final siting? Are easements necessary?

14. Explain the access road to Alternate Location A and why it appears disconnected from the Town road system. Where does it connect to the Cayutaville Road or the Town road system? Are other graveled roads in place?

15. Will the Substation be relocated even if Turbine Site A is not selected? If so, where? What changes to the collection route or any other facilities will be needed if Turbine Site A is not selected and the Substation remains?

16. Discuss what will be involved in the crossing of the NYSEG gas pipeline if Turbine Site A is selected, including the need for permit/approvals.

17. Provide information regarding the project schedule and approvals, including the submittal of construction plans, SWPPP, etc.

18. A brief description of the Community Outreach Plan (DEIS Appendix U) should be provided in this section as it is referenced in portions of Section 2.0. A mention of post construction monitoring would also be helpful.

SEIS Section 2.1 Geology, Soils, and Topography

19. Provide the results of soil and geotechnical investigations of the new turbine sites (A,B,C), the new substation location, and the MET tower location. The level of detail regarding soils, bedrock and topography should be commensurate with that provided in the DEIS and FEIS for the originally proposed locations (DEIS) or changed locations (FEIS).

20. Note that, as part of the FEIS, site specific investigations were undertaken of the revised interconnect routes to identify any sensitive environmental resources. The same information is required in the SEIS for collection routes in previously unassessed locations.

21. Explain if blasting will be needed at any sites in the Modified Project and how this has been determined?

SEIS Section 2.2 Water Resources

22. Clarify the discussion of acreage of wetlands and streams in Table 3 and the sentences immediately preceding Table 3 and why these acreages do not match.

23. Discuss each alternative turbine site and other new areas affected by the Modified Project with regard to wetlands, streams, floodplains, groundwater, etc. The level of detail should be commensurate with that provided in the DEIS and FEIS.

24. Discuss Stormwater Management for the Modified Project. The SEIS currently has no mention of the SWPPP, an update to the SWPPP, or what the status of the SWPPP analysis is.

25. Summarize the information in the Wetland and Stream Delineation Report Update (Appendix B) within Section 2.2 in an easy-to-read and understandable way.

26. The labelling on Figure 1 in Appendix B is confusing. What is FEIS Collection Line, Alternate Collection, FEIS Access Road, Alternate Access? It is difficult to visually distinguish between FEIS Access Road and Alternate Access, and in general it would be easier to follow these maps if they were on an aerial photo base. a USGS base, or had additional landmarks.

27. The wetland labelling is difficult to understand on the Figure 1 sheets – "Wetland A, B, C, D, F, I J" vs "Wetland JMI, JME, JMC, JMD, JRC, JMA etc." If Wetlands A,B,C,D etc. are wetlands from the original report, this needs to be clarified in the drawings and in the text of the study.

28. Provide a photo key showing direction of view to tie the photos into the Figure 1 sheets.

29. Are there any changes to the evaluation of wetlands with regard to the Staging Area?

<u>SEIS Section 2.4 Biological Resources</u>

30. Characterize each of the new turbine sites (A,B,C) and other areas newly affected by the Modified Project with regard to the ecological communities listed in DEIS.

31. Be specific with regard to use of wooded areas to site the new turbine alternatives, access roads and collection routes. Discuss if turbine sites or routes can be moved to avoid disturbance of forested areas. Specifically, can the change to Turbine Site 5 be adjusted so that Turbine 5 is moved to the adjoining agricultural field instead of the woodland edge?

32. Discuss the greater intrusion into forest habitat areas and forest fragmentation associated with the Modified Project, similar to the discussion in DEIS Section 3.4.2.2.2 regarding forest fragmentation. Discuss specific mitigation measures to minimize fragmentation of the forest community, the potential use of alternate routes to avoid forested areas, measures to reduce the intrusion of invasive species into forested areas, etc.

33. Provide updated information on threatened and endangered species in the overall project area and vicinity. This should include an update of information about the species discussed in the DEIS/FEIS for which information has changed.

34. Specific updated information is needed on the bald eagle with respect to the fact that a new nest was discovered about 3 miles from the project area between the time the DEIS and the FEIS was prepared. An assessment from an expert on bald eagles should be included in the SEIS to indicate any changes from the previous assessment performed by Old Bird in January 2014, due to either 1) the changes proposed in the Modified Project or 2) changes (if any) in ecological/environmental conditions since the previous assessment.

35. Provide information on the Northern Long-Eared Bat, its potential presence in the entire project area, and how the project will comply with federal and state requirements under the Endangered Species Act and endangered species regulations, respectively.

<u>SEIS Section 2.4 Traffic and Transportation</u>

36. New transportation routes potentially along Harvey Hill Road and Cayutaville Road are not discussed in the DEIS/FEIS as they were not relevant to the Approved Project. Describe each new road affected by the Modified Project, its condition, capacity to handle construction traffic, traffic conditions, and usage (school bus traffic?) The level of detail should be commensurate with that provided in the DEIS and FEIS.

37. Describe any needed improvements to the new roads affected by the Modified Project. The level of detail should be commensurate with that provided in the DEIS and FEIS.

38. Describe the potential use of Cayutaville Road when it is currently described as an "un-paved road." Describe the improvements and level of construction needed to bring this road up to a condition suitable for use for construction and maintenance of a turbine if Alternative Site A is selected. Describe what specific segments and lengths will require improvement and how the connection will be made to the new access road shown on Figure 1.

SEIS Section 2.6 Land Use and Zoning

39. Add a discussion of the regulatory setback vs. the actual distance to property lines and to occupied structures. Show in a new table what actual setbacks are proposed and how compliance is achieved.

40. Update data on vacant parcels affected by required setback distances from wind turbines for Modified Project (see Response 1X in FEIS).

41. If appropriate, an updated discussion of "good neighbor payments" would be helpful in this section based upon new homes that may be affected.

SEIS Section 2.8 Community Facilities and Services

42. Discuss the presence of the NYSEG gas pipeline and potential impacts/mitigation.

43. Will the Town of Newfield fire and emergency personnel be provided training? Has contact been made to establish that the emergency providers have specific concerns about the project? Is an update of draft Emergency Preparedness Plan needed?

SEIS Section 2.9 Growth & Community Character

44. It is suggested that the Mitigation section make a simple one or two sentence reference to the Decommissioning Plan.

SEIS Section 2.10 Historic, Cultural, and Archeological Resources

45. Define the APE for the Modified Project vs. the Approved Project. It appears that the Modified Project APE has expanded to the northeast and southeast of Approved Project APE.

46. Summarize the information in the Summary of Cultural Resources Studies (Appendix C) within Section 2.10 in an easy-to-read and understandable way.

47. The following statement is made in the January 13, 2016 EDR Memo (SEIS Appendix C):

> The *SHPO Wind Guidelines* are based on the assumption that additional archaeological survey work is not necessary if minor changes to the Project layout occur during the Project development process, as long as the total area of ground disturbance for the Project does not significantly increase.

No basis is provided for this statement, and none was evident following review of the SHPO Wind Guidelines. Please provide documentation of the assumption that additional archeological work is not needed if minor changes to the Project layout occur. This should include a definition of what constitutes "minor changes" from the SHPO Guidelines. Please provide the schedule for re-submission of the information regarding changes to the project area/APE to SHPO to confirm this assumption.

48. Given the expansion of the project area to the northeast and southeast, a re-evaluation of the Historic Resources Visual Effects Analysis presented in the FEIS may be warranted. The SEIS should address this issue and obtain confirmation from SHPO of the need for and the results of such an update.

SEIS Section 2.11 Agricultural Resources

49. Describe agricultural land, use, and soils (Prime Farmlands, Farmlands of Statewide Importance, etc.) at each of the alternative turbine site (A,B,C), the substation site, the MET tower site, and other new lands affected by the Modified Project. The level of detail regarding should be commensurate with that provided in the DEIS and FEIS.

50. Agricultural land decreases in modified Project Area from 546 to 365 acres. However, impacted ag land increases from 23 (20.9 to be restored) acres to 31.5 (26.4 to be restored) acres. Discuss this increase relative to three alternative sites, the new access road/collector locations and the substation site. How important is the farmland that will be converted to built resources? .

51. Discuss measures and siting used to avoid of disruption to agricultural fields/resources. In addition, specifically mention the application of the NYS Dept. of Ag & Market Guidelines for Agricultural Mitigation for Windpower Projects in the Mitigation section.

SEIS Section 2.12 Aesthetic and Visual Resources

52. When are the visual analyses expected to be completed and provided for review?

SEIS Section 2.16 Noise

53. In the Acoustic Study Update (Appendix E) it is indicated that hub height of the proposed turbines is 94 meters – is this correct? (Based on our records, the hub height of the former turbine model in the FEIS/Findings statement was 96 meters or 315 feet. In June 2015, the use of the currently proposed model turbine was approved, which involved an increase in hub height of 8 feet, resulting in a total hub height of 323 ft or 98 meters.) Is the Acoustic Study accurate given this anomaly in hub height.

54. The Acoustic Study Update (Appendix E) indicates shifts in Turbines 4 & 5 which do not match what is indicated in Section 1.0 of the SEIS. This information should be clarified. Is the Acoustic Study accurate given this anomaly in Turbine 4 & 5 locations?

55. More information is needed in the Existing Conditions subsection including a discussion of ambient noise levels.

56. An analysis of potential changes in noise levels of 6 dBA or more above background levels is not provided, as it was in the DEIS/FEIS. The SEIS should include such an analysis and indicate where non-participating homes would experience noise levels equal to or greater than 45 dBA (same as the threshold used in the DEIS/FEIS). The SEIS should indicate if such homes will be offered the same mitigation measures as discussed in Section 6.17 of the Findings Statement, including an agreement to become project participants and further mitigation or curtailment if complaints arise.

57. Briefly describe the Low Noise Trailing Edge technology which is indicated to be associated with the new turbine model. What effect/mitigation does such technology provide?

EXHIBIT 2

STONE ENVIRONMENTAL INC

April 21, 2016

Enfield Town Board
Town of Enfield, NY
182 Enfield Main Road, Ithaca, NY 14850

SEI No.

RE: Changes in the Locations of Wind Turbines between the FEIS to the DSEIS for the Black Oak Wind Farm.

Dear Enfield Town Board,

The locations of the wind turbines in the DSEIS are not the same as locations of the turbines in the FEIS. In the DSEIS, Turbines 1, 3, 4, 5, and 6 have all moved relative to their position in the FEIS.

The differences, measured in feet, between the DSEIS and FEIS turbine locations are given in the table below.

Turbine	Measured Difference (ft)
1	40
3	76
4	367
5	219
6	75

These distances were calculated by comparing the locations of the turbines in Figure 5 of the DSEIS with the locations of the corresponding turbines in the 4 pages of Figure 4 of the FEIS. GIS software was used to georeferenced the two figures and measure the distance between turbine locations between the two georeferenced figures. There is likely some error in these calculations due to the georeferencing process. The georeferencing reported a root mean square error of 0.5 meters to 3.8 meters. This work was completed by Stone Environmental in Montpelier, Vermont, a consulting firm with over 20 years of experience in GIS technology and analysis.

Sincerely,

Katie Budreski

Katie Budreski, Senior GIS Specialist

535 Stone Cutters Way , Montpelier, VT 05602 / Phone: 802.229.4541 / Fax: 802.229.5417 / www.stone-env.com

EXHIBIT 3

Environmental Design & Research.
Landscape Architecture, Engineering & Environmental Services, D.P.C.
217 Montgomery Street, Suite 1000, Syracuse, New York 13202
P. 315.471.0688 • F. 315.471.1061 • www.edrdpc.com

June 24, 2015

Mr. Frank Pavia
Harris Beach LLC
99 Garnsey Rd
Pittsford, NY 14534

RE: Black Oak Wind Project
Modified Project
EDR Project No. 11060

Dear Mr. Pavia:

Black Oak Wind LLC proposes modifications to its 11.9 MW wind project recently reviewed and approved under the State Environmental Quality Review Act (SEQRA) (the Approved Project). As explained below these modifications are immaterial changes as they will not result in any material increase in any environmental impact of the Approved Project as compared to the impacts reviewed in the Environmental Impact Statement approved by the Enfield Town Board (Lead Agency). Accordingly, consistent with SEQRA, no further review action is necessary.

As the primary environmental consultant for the Black Oak Wind Power Project, Environmental Design & Research, Landscape Architecture, Engineering & Environmental Services, D.P.C. (EDR) has reviewed the Modified Project and concluded that none of the modifications represent a significant environmental impact, or cause any additional significant environmental impacts or result in any material increase in any environmental impact. In fact, the changes described in this letter further minimize and mitigate potential impacts analyzed during the SEQRA process.

APPROVED vs. MODIFIED PROJECT

The Project which was approved in the SEQRA Findings Statements had a rated capacity of 11.9 MW and consisted of seven GE 1.7 - 100 model wind turbines, one meteorological tower, a system of gravel access roads, buried and above ground gathering lines (electrical interconnection), a substation adjacent to the existing New York State Electric and Gas ("NYSEG") 115 kilovolt ("kV") transmission line, and one temporary construction staging area.

The Modified Project will have a rated capacity of 16.1 MW and consist of seven GE 2.3 - 107 model wind turbines. The Modified Project will have the same system of access roads, gathering lines and substation as the Approved Project, with minor modifications as explained in detail below. Specifically, Black Oak Wind LLC proposes the following immaterial modifications:

- A change in the model of turbine from a GE 1.7 - 100 model to a GE 2.3 - 107 model. This change will increase the maximum height of the Project Turbines by 8 feet (GE 1.7-100: 475 feet; GE 2.3-107: 483 feet).

- A shift in the location of the interconnection substation to avoid "cut and fill" impacts, and minor modifications to the alignment of the electric collection system.

DETAILS OF LAYOUT IMPROVEMENTS

As described below, the only footprint-related change is associated with a minor adjustment in the location of the substation. A comparison of the Approved Project layout to the Modified Project Layout is attached hereto in Attachment A (see Project Modification graphic), and the details of all layout improvements are discussed below.

Wind Turbines

The SEQRA Findings Statements assumed the Project would use the GE 1.7 - 100 wind turbine model, which has a 100-meter diameter rotor mounted on a 96-meter tower (total height of 475 feet). Due to market availability and site suitability analyses, the turbine to be used for the Modified Project will be the newer GE 2.3 – 107 model, which has a 107-meter diameter rotor mounted on a 94-meter tower (total height of 483 feet) (see Attachment B for manufacturer brochure). All turbines remain in the exact locations as set forth in the Final Environmental Impact Statement (FEIS) and the SEQRA Findings Statement.

Substation

The location of the interconnection substation has been shifted south as a result of surveying evaluations, as depicted in Attachment A. Specifically, a preliminary surveying report determined that a significant amount of cut/fill and earthwork was going to be required in the previous location, which was immediately north of the existing transmission line. Therefore, the substation has been relocated (immediately south of the existing transmission line) to take advantage of more favorable topography. As with the Approved Project, the modified/improved substation location for the Modified Project is located in agricultural land, and will not result in any new environmental impacts as compared to the Approved Project.

DISCUSSION

The potential impacts of the modifications, as compared to the Approved Project impacts are presented by resource category/topic below:

- **Land and Land Use:** The modifications do not alter the function or character of the Approved Project. As such, the Modified Project, like the Approved Project will be compatible with the character of the community. The Project, with the proposed modifications, will be consistent with and support the rural, open-space, farm-oriented uses in the community that surround the Project site. Project siting and construction will fully comply with NYSA&M Agricultural Protection Guidelines and be compatible with surrounding agricultural operations. In addition, the Modified Project will comply with all relevant mitigation measures and conditions set forth in the SEQRA Findings Statement.

- **Wildlife and Habitat Resources:** All Project modifications were reviewed and it was determined that no new significant adverse environmental impacts will occur. No impacts to habitat supporting threatened or endangered species will occur. All Project modifications occur in agricultural land, which provides limited habitat value. In addition, the Modified Project will comply with all relevant mitigation measures and conditions set forth in the SEQRA Findings Statement.

- **Aesthetic Resources:** The modifications do not introduce any new significant adverse impacts to aesthetic resources. Minor increase (8 feet) in the height of the turbines is not expected to represent a new adverse impact, and most individuals will not be able to notice this minor increase. Based upon similar situations and our experience with other wind projects, a change of this degree is imperceptible. In addition, the Modified Project will comply with all relevant mitigation measures and conditions set forth in the SEQRA Findings Statement.

- **Shadow Flicker:** The modifications do not introduce any new significant adverse impacts to shadow flicker. Based upon similar situations a change of this degree is not believed to be perceivable, and when considering the entire Project most individuals would not take notice of such a minor increase in height. Relatively low shadow/flicker effects are still expected at receptor locations in the project vicinity. As set forth in the FEIS and Finding Statement, there were no receptors where the total hours per year were estimated to be greater than 20 hours, and this is not expected to change. Therefore, considering the fact that industry standards identify 30 hours per year as the threshold for shadow flicker impacts, the Modified Project does not result in a new significant adverse impact. In addition, the Modified Project will comply with all relevant mitigation measures and conditions set forth in the SEQRA Findings Statement.

- **Historic, Cultural and Archaeological Resources:** The modifications will not result in any new significant adverse impacts to historic, cultural or archaeological resources. None of the Project modifications change the conclusions regarding visual impacts to historic resources. The relocated substation does not present any potential impact to archeological resources because the previously conducted field investigation, which included 643 shovel tests, did not reveal any historic or pre-historic sites. In addition, the Modified Project will comply with all relevant mitigation measures and conditions set forth in the SEQRA Findings Statement.

- **Sound:** The modifications will not result in any new adverse sound impacts. The Modified Project would use the same Low Noise Trailing Edge blades that were identified in the SEQRA Findings Statement. As a result sound power level will be the same at 105.5 dB (see Attachment C for manufacturer specifications). As with the Approved Project all predicted sound levels for the Modified Project comply with the requirements of the Town of Enfield standards. In addition, the Modified Project will comply with all relevant mitigation measures and conditions set forth in the SEQRA Findings Statement.

- **Energy Impacts:** The modifications to the Project will result in positive energy impacts. The Modified Project will increase the amount of power created, which will provide long-term beneficial effects on the use and conservation of energy resources by providing up to 16.1 MW of electricity without consuming cooling water or emitting pollutants with a resulting 10% increase in power output.

- **Public Safety:** The modifications will not result in any new adverse public safety concerns or impacts. Construction activities for the Project will continue to be conducted in accordance with applicable rules and regulations, all Project modifications remain on participating parcels (thereby eliminating legal access by the general public), and all turbine setbacks remain the same because there has been no change in any turbine locations. In addition, the Modified Project will comply with all relevant mitigation measures and conditions set forth in the SEQRA Findings Statement.

- **Transportation:** The modifications will not result in any new adverse transportation impacts. All delivery routes identified for the Approved Project will still be used for the Modified Project. In addition, the number of turbines and linear distance of access road remains the same, and therefore the number of delivery trucks will not change significantly. In addition, the Modified Project will comply with all relevant mitigation measures and conditions set forth in the SEQRA Findings Statement.

- **Geology, Blasting, Soils and Agricultural Issues:** The modifications will not result in any new adverse impacts to these resources. As indicated previously, the Project modifications further minimize impacts to these resources by shifting the substation to minimize cut and fill impacts. The substation is essentially a surface feature, and will not extend to depths that would impact the soils. In addition, the Modified Project will comply with all relevant mitigation measures and conditions set forth in the SEQRA Findings Statement, including (but not limited to) compliance with the NYS Agriculture and Markets Guidelines.

- **Socioeconomic Impacts:** The modifications will not result in any new adverse impacts to socioeconomics. The modifications do not change the conclusions in the FEIS and Findings; that the Project will have a short-term, beneficial impact on the local economy and employment during construction, and a long-term beneficial impact on the local economy, employment, and municipal budgets and taxes. As a result of the increased nameplate rating and power output, the Modified Project will increase PILOT payment amounts by 33% and land leaseholder incomes. In addition, the Modified Project will comply with all relevant mitigation measures and conditions set forth in the SEQRA Findings Statement.

- **Water Resources, Wetlands and Groundwater:** The modifications will not result in any new adverse impacts to water resources, wetlands or groundwater. The substation is essentially a surface feature, and will not extend to depths that would impact the groundwater. No new surface waters will be impacted by Project modifications. In addition, the Modified Project will comply with all relevant mitigation measures and conditions set forth in the SEQRA Findings Statement.

- **Decommissioning:** The modifications will not result in any new adverse impacts to decommissioning. The requirements for the Modified Project remain the same as for the Approved Project. All relevant mitigation measures and conditions set forth in the SEQRA Findings Statement.

- **Recommended FAA Lights:** The modifications will not result in any new adverse impacts to FAA lighting, as all FAA requirements will be met. In addition, the Modified Project will comply with all relevant mitigation measures and conditions set forth in the SEQRA Findings Statement.

- **Communications Facilities:** The modifications will not result in any new adverse impacts to communications facilities. The Project will comply with all relevant mitigation measures and conditions set forth in the SEQRA Findings Statement.

- **Setbacks:** As indicated above, the modifications, will not result in any adverse impacts to setbacks. All turbine locations remain in the same location as set forth in the FEIS and Findings Statement. The Project will comply with all relevant mitigation measures and conditions set forth in the SEQRA Findings Statement.

- **Climate and Air Quality:** The modifications do not change the Projects effect on Climate and Air Quality. Like the Approved Project, the Modified Project will have a beneficial effect on climate and air quality. The Modified Project will generate up to 16.1 MW of clean, renewable energy without emissions. In addition, the Modified Project will comply with all relevant mitigation measures and conditions set forth in the SEQRA Findings Statement.

- **Cumulative Impacts:** The modifications will not result in any new adverse cumulative impacts. The number of turbines (7) remains the same, for both the Approved and Modified Project and the associated infrastructure remains the same. In addition, the Modified Project will comply with all relevant mitigation measures and conditions set forth in the SEQRA Findings Statement.

CONCLUSION

As explained above, this Letter is submitted in support of Black Oak Wind LLC's proposed modifications to its wind project reviewed and approved under SEQRA. As demonstrated above, the modifications will not result in any material change in environmental impacts as compared to the impacts reviewed and approved by Lead Agency in the Environmental Impact Statement. Accordingly, consistent with SEQRA, no further review or approval action is necessary.

Sincerely,

Ben Brazell
Principal

Cc: Marguerite Wells, Black Oak Wind LLC

Exhibit 4

Black Oak Private Placement Memorandum can be found here:

https://s3.amazonaws.com/client_blackoak/SeriesCPPM.pdf

EXHIBIT 5

EXHIBIT 6

EXHIBIT 7

Report on Wind Turbines

Report to the Town of Enfield Town Board

Enfield Wind Farm Advisory Committee
4-12-2016

Contents

About this report

In response to the controversy surrounding the proposed Black Oak Wind Farm, the Town of Enfield created the Wind Farm Advisory Committee to:

"to advise the Town Board and other Town agencies on matters pertaining to the siting and placement of wind turbines in the Town, any potential recommended updates or amendments to the existing local law, and to strengthen and improve public understanding of wind turbines generally, including matters as pertain to public health and safety. Thus, the Committee is charged with gathering factual information regarding wind turbine health and safety issues and making this information available to the Town Board after deliberation and considered recommendations thereupon. Towards this end, the Committee should review, recommend, and prioritize strategies as they relate to Town policies and local laws for wind turbines, and to further become informed about wind farming in the Town and generally, including both their positive and negative potential impacts."

The committee was formed in January, 2016 with a balance of members supporting Black Oak Wind Farm and wind energy technology as well as those that have raised concerns about its negative effects. The committee began meeting weekly to research and discuss the science of wind turbines. In a short time, it has sought technical advice from industry, science, and technical experts. Although, the committee could spend many more months of research, the report here is the result of information it has learned so far. Not all members are in agreement this is represented by a couple different sections on wind turbine noise and its effects.

Committee Members:

Mike Carpenter
Charlie Elrod
Martha Fischer
Marcus Gingerich
Jude Lemke
Mimi Mehaffey
Michael Miles, chair
Julie Schroeder
Rob Tesori

Former Members:

Marguerite Wells
Peter Bardaglio

Clerk:

Sue Thompson

Report on Wind Turbines and Noise

Introduction

The links and publications to be found when one searches "wind turbine noise health" number in the hundreds of thousands. Peer-reviewed publications investigate wind turbine noise in Australia, Canada, the United States, and in European countries. Some conclude that noise from wind turbines may have negative effects on human health, while others conclude that it has no effect on human health. Popular literature makes claims ranging from horrible outcomes of living next to turbines to people having no problem whatsoever. Coming to any one conclusion is next to impossible, and making recommendations is challenging. In this report we outline the complicated phenomenon that is noise, list the health concerns, and try to spell out whether or not those concerns are caused by noise from wind turbines.

What is Noise and how is it measured?

Measuring noise is extremely complex. While one can measure a sound, factors such as atmospheric conditions (air temperature, moisture, wind speed and direction, etc.), the contour of landscape, propagation of sound, and the instrumentation used in acoustic studies play into the accuracy of the measurement. This subcommittee is far from competent to explain the nuances in measuring sound and in interpreting reports of sound measurement.

That said, we will do our best to explain the parts that we do understand. A couple of references stand out as aids to our understanding: Gracey & Associates Acoustic Glossary[1] and Acoustics and Vibration Terminology Glossary, Definitions and Abbreviations.[2]

Noise is basically undesirable sound. Sound originating from wind turbines exists as audible and inaudible to the human ear. Analysis of sound shows that it consists of frequencies (or pitches) measured in hertz (Hz) at varying levels of loudness (or pressure levels) measured in decibels (dB). Sound with frequencies 0 – 20Hz are known as infrasound, and are inaudible to most people. Very low frequency sound is generally between 20 to 200Hz. Humans hear best at frequencies between 300 to 16,000Hz.

Human perception of loudness is influenced by the frequency of sound. With regard to infrasound generated by wind turbines, 'loudness' should be thought of in terms of strength. Acousticians measure the strength of sound with a sound pressure level meter. Most acoustic studies measure the strength of audible sound (which the term 'loudness' can easily describe). These studies de-emphasize frequencies below and above the threshold of human hearing are written as dBA. Note that the measurements reported in the Black Oak Wind Farm Acoustic Study are A-weighted. The strength of infrasound is difficult to measure.

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[1] http://www.acoustic-glossary.co.uk/

[2] http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR030001/2.%20Post-Submission/Application%20Documents/Environmental%20Statement/File%208-12/File%2012%20-%20Vol%201%20Annexes/16%20-%20Annex/16.1%20-%20Acoustics%20Vibration%20Glossary.pdf

Complaints

Wind Turbine Syndrome

Many objections about wind farms center around noise and infrasound. Nina Pierpont coined the term Wind Turbine Syndrome (WTS) and wrote the book (published in 2009)[3] to describe a suite of symptoms in 38 individuals from 10 families. The symptoms include "disturbed sleep, headaches, tinnitus, a sense of vibration, nervousness, rapid heartbeat, nausea, difficulty with concentration, memory loss, irratibility and anger." The common thread among people with these symptoms is that they live within a mile and a quarter of wind turbines. Physically moving away from wind turbines has been the most effective antidote to the symptoms. As soon as the presence of a wind turbine is removed, people experience relief from their symptoms.[4]

Vibroacoustic Disease

Vibroacoustic Disease (VAD) is less widely known except in aviation and military circles and journals such as those of the Aerospace Medical Association, It is "a consequence of long-term (years) exposure to low frequency noise." A thorough description of the disease at the following website includes stages and symptoms of the disease. (noiseoff.org/document/vibroacoustic .disease.1.pdf) While WTS symptoms disappear after a person moves away from a turbine, VAD symptoms persist. VAD "causes direct tissue or organ damage," as written at the website https://windwisema.org/about/noise/wind-turbine-syndrome-and-vibroacoustic-disease/

What peer-reviewed literature says

Measuring infrasound and low frequency sound is a topic of much discussion among acousticians. Many agree that acoustic measurements of sounds lower than 200Hz should not be taken with A-weighted filtering mechanisms. Studies of infrasound pressure levels are more accurately measured with G-weighted filtering. Jacobsen in 2001 published recommendations on noise limits for infrasound, writing that the limit for environmental infrasound must be a sound pressure level of 85dBG.[5]

Using the G-weighting function, comparison of measurements taken at homes adjacent to wind farms before and during a planned shutdown of the 2.1MW turbines showed no noticeable difference in sound level. During low wind periods, 40dBG was measured at locations close to and far from a turbine;

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[3] Pierpont, Nina. Wind Turbine Syndrome: A Report on a Natural Experiment. K-Selected Books. Santa Fe, NM. 2009.

[4] https://windwisema.org/about/noise/wind-turbine-syndrome-and-vibroacoustic-disease/

[5] Jakobsen, Jorgen. 2001. Danish guidelines on environmental low-frequency noise, infrasound, and vibration. Journal of Low Frequency noise, Vibration, and Active Control. pp 141-148. http://docs.wind-watch.org/jakobsen-2001_danish-guidelines.pdf

during higher wind periods, levels as high as 70dBG were found at locations at wind farm sites and non-wind farm sites.[6]

Peer-reviewed journal articles were inconclusive when reporting results of studies on the adverse effects of wind turbines on human health. Schmidt and Klokker 2014[7], performed a systematic review of the literature up to the end of 2013 "with the purpose of identifying any reported associations between wind turbine noise exposure and suspected health related effects. They searched for literature from peer-reviewed scientific sources (such as PubMed, Web of Science, and Google Scholar) as well as from internet sources which were not peer-review (such as wind-watch.org, windturbinesyndrome.com, and waubrafoundation.org.au). The researchers describe their method for narrowing the plethora of search results (over 1,000 articles) down to 252 studies. They concluded that noise from wind turbines annoys some people who live near them and may disturb some people's sleep. They caution that annoyance and disturbed sleep findings may be influenced by selection and information bias. The authors state:

> "Larger cross-sectional surveys have so far been unable to document a relationship between various symptoms such as tinnitus, hearing loss, vertigo, headache and exposure to wind turbine noise. One limitation causing this could be that most studies so far have only measured L_{Aeq}* or L_{den}**. An additional focus on the measurement of low-frequency sound exposure as well as a more thorough characterization of the amplitude modulated sound and the relationship between objective and subjective health parameters could lead to different conclusions in the future. Finally, in regards to the objective measurement of health-related disorders in relation to wind turbine noise, it would be valuable to demonstrate if such health-related outcomes fluctuate depending on exposure to wind turbine noise."

[[Definitions from www.acoustic-glossary.co.uk/definitions-l.htm:

* LAeq is A-weighted sound measured over a period of time

** Lden is A-weighted sound measured over the 24 hour period with a 10dB penalty added to the levels between the hours of 11:00pm and 7:00am and a 5dB penalty added to the levels between 7:00pm and 11:00pm to reflect people's sextra sensitivity to noise during night and evening.]]

Other reviews of literature echo the findings of Schmidt and Klokker. The Wisconsin State Legislature asked the Public Service Commission staff to update the review done in 2014 by Wisconsin's Wind Siting

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[6] Evans, T., Cooper, J., and Lenchine, V. 2013. Infrasound levels near windfarms and in other environments. Study undertaken for the Environment Protection Authority, Adelaide, South Australia. www.epa.sa.gov.au/files/477912_infrasound.pdf

[7] Schmidt JH, Klokker M (2014) Health Effects Related to Wind Turbine Noise Exposure: A Systematic Review. PLoS ONE 9(12): e114183. doi:10.1371/journal.pone.0114183 http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0114183

Council.[8] Among other articles, it lists the Health Canada Study (http://www.hc-sc.gc.ca/ewh-semt/noise-bruit/turbine-eoliennes/summary-resume-eng.php). The Wisconsin paper also referenced a publication titled "Evaluation of community response to wind turbine related noise in Western New York State" (http://www.noiseandhealth.org/article.asp?issn=1463-1741;year=2014;volume=16;issue=71;spage=228;epage=239;aulast=Magari).

With regard to sleep disturbance attributed to noise from wind turbines, Michaud et al, 2016[9], performed subjective and objective measures of sleep with 1,238 people randomly selected from residences between .25 and 11.22 kilometers from working wind turbines. The authors could find no pattern or correlation with wind turbine noise levels. They found that sleep quality was influence by factors such as caffeine intake, other health effects (such as disease and sleep disorders), and annoyance with blinking lights on the turbines.

Conclusions and Recommendations

It appears that illness caused by noise from wind turbines is a phenomenon not proven by science at this point in time. What has been revealed clearly is that noise from turbines annoys some people. Annoyance is no trivial matter, and if enough people complain about noise from the wind farm, action should be taken with the cooperation of the town, residents, and company to investigate the origin of the noise, the intensity of the noise, and possible ways of mitigation. Resolution on the best mitigation measures should be reached and then implemented.

In the future, monitoring should follow the protocols set out in Results of an Acoustic Testing Program: Cape Bridgewater Wind Farm (The Acoustic Group Report 44.5100.R7:MSC 26th November, 2014), especially with respect to land/home owner involvement in planning and implementation. http://www.pacifichydro.com.au/files/2015/01/Cape-Bridgewater-Acoustic-Report.pdf

Any acoustic studies should be undertaken with instruments that are properly calibrated and suitable for measurements across humanly audible and inaudible (within reason) frequencies and pressure levels.

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[8] Staff of Public Service Commission. 2015. Review of Studies and Literature Relating to Wind Turbines and Human Health. https://psc.wi.gov/reports/documents/2015WindReport.pdf

[9] Michaud DS, Feder K, Keith SE, Voicescu SA, Marro L, Than J, Guay M, Denning A, Murray BJ, Weiss SK, Villeneuve PJ, van den Berg F, Bower T. Effects of wind turbine noise on self-reported and objective measures of sleep. *SLEEP* 2016;39(1):97–109. http://www.ncbi.nlm.nih.gov/pubmed/26518593

Wind Turbine Noise

Summary

The complexities related to wind turbine noise are well summed up by a quote from the Frey, Hadden report of 2012[10],

> "Wind turbine noise is especially complicated because of the 'cocktail' of physical acoustic characters that comprise the noise pollution. The pulsating noise, characteristic of wind turbines, can be more intrusive than other types of noise and the pulsations include both audible and inaudible components, i.e., low frequency noise, infrasound, and vibration. Noise with these characteristics is more intrusive, and the World Health Organization (WHO) guidelines recommend lowering the permissible decibel levels when noise contains these characteristics. WHO makes these recommendations not merely to reduce annoyance or nuisance. WHO makes these recommendations because epidemiological studies indicate clearly that environmental noise is prejudicial and injurious to health."

While there is yet no scientific consensus as to the effects of wind turbine noise on people, *the precautionary principle should be followed until definitive scientific studies can be conducted to address the questions surrounding the health risks related to wind turbine noise. If there is no clear scientific consensus regarding safety, the town must err on the side of caution and have strict sound limits and significant setbacks to protect residents.*

Based on the research of papers, reports and communications, the following conclusions and recommendations were made:

Conclusions

1. The greater the distance which wind turbines are set back from residences the less likely there is to be adverse affects for the residents.
2. Audible noise 200-20kHz is more easily monitored and controlled than lower frequencies.
3. The lower the frequency of the noise, the farther the sound will carry before being dissipated.
4. Any health risks of infrasound (sound below 20Hz in frequency) and low frequency noise (sound from approximately 20-200Hz) are generally dismissed by the wind industry as insignificant; thus, they are generally not regulated or monitored.[11]
5. Wind turbines emit infrasound, and the larger the turbine, the slower the rotation, the lower the infrasound frequency; thus, the farther the propagation.

Mitigations

1. One method of mitigation is to establish an absolute setback distance such that the risks to residents are well within an acceptable range. This method is the simplest; however, if properly implemented, this method is likely to result in the greatest setback as no consideration would be given to wind turbine size and/or design. Also, since the configuration of multiple turbines can

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10 http://waubrafoundation.org.au/wp-content/uploads/2014/06/Frey-Hadden-Wind-Turbines-Proximity-to-Homes.pdf

11 s3.amazonaws.com/windaction/attachments/2510/Infasound__and_wind_turbines_final_version_4_August_2015.pdf

have a significant effect on sound attenuation,[12] the setback must be large enough to provide protection against multiple wind turbines operating simultaneously. Based on the available studies, the only safe limit seems to be that greater than about 1mi. (~1.5km)[13] minimizes the risk of adverse reactions. Distances less than that seem to have some increased risk of adverse reaction, but this depends upon many factors which are not yet fully understood.

2. A second possible method of mitigation is to establish a setback based upon the size of the wind turbine such as the rotor diameter and/or total height or some combination of both. This has the effect of allowing for different size turbines; thus, smaller turbines would require less separation from residents.
3. A third method of mitigation is to establish a setback based on predicted noise levels which the wind developer must guarantee will be met or mitigation must be implemented such that the noise levels are met. This method must include both criterion for audible or A-weighted noise levels, LFN and IS noise. There seems to be a tolerable level of audible sound around L_{Aeq} of 35dB,[14] this would be most important during the nighttime. Somewhat louder appears to be acceptable during daytime, for example 40 dBA, or some limit, such as 3-5dBA above ambient.
A method for addressing acute noise annoyance was proposed by Kelley, et al., based on the SERI/NASA/DOE studies in the 80's.[15] Another paper developed a method of calculating a safe setback distance for a single wind turbine based on thresholds for annoyance and physiological effects threshold for different turbines and frequencies.[16] However, additional consideration would need to be given to multiple turbines and/or arrays of wind turbines and the 'Heightened Noise Zones' produced by the interacting noise fields. The calculations also require accurate data on the noise spectrum produced by the wind turbine(s).

Introduction

In general, environmental noise is known to cause health problems. The question is, what levels and characteristics of noise are responsible for those adverse effects?

Wind turbines produce significant amounts of noise throughout the audible noise spectrum as well as down into the LFN range and IS range. Wind turbine noise was first studied here in the U.S. back in the late 1970s and early 1980s under a joint project between the Department of Energy (DOE), the National Aeronautics and Space Administration (NASA), and the National Renewable Energy Laboratory (NREL) which was known at that time as the Solar Energy Research Institute (SERI). The MOD-1 turbine, a downwind design, unexpectedly caused what was termed 'annoyance' among residents as far away as ~2km. A subsequent study of the MOD-2 turbine, a downwind design more comparable to wind turbines of present day, indicated that model produced less infrasound and was not expected to produce adverse effects beyond 1km.[17]

No comparable and comprehensive studies of more modern wind turbines have been found; thus, no assessments or comparisons can be made. More recent studies of wind turbines have focused on the effects on people (and animals) living in the vicinity of industrial wind turbine installations.

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12 http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19910007366.pdf
13 https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/eh57a_information_paper.pdf
14 Schmidt, et al., http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4256253/pdf/pone.0114183.pdf
15 Kelley, et. Al, http://www.nrel.gov/docs/legosti/old/3261.pdf
16 Thorne, et. al, https://www.acoustics.asn.au/conference_proceedings/INTERNOISE2014/papers/p599.pdf#page=1&zoom=auto,-12,843
17 Kelley, et. al., http://www.nrel.gov/docs/legosti/old/3036.pdf

Though not confirmed via scientific rigor, many health issues have been attributed to living near wind turbines including: tinnitus, hearing loss, vertigo, headaches, and nausea to name a few. More generally accepted effects include noise annoyance and sleep disturbance. One very significant confounding factor is the variability between individuals and the specific susceptibility of each to the different effects. A few of the notable reports of findings and effects on animals and human health are presented in the following sections.

Animal studies

There is not a large body of data available in the peer-reviewed literature on the effect of wind turbines on animals; however, there are a small number of peer-reviewed studies. Most studies are not controlled studies, rather they are specific case-studies. A couple of examples are:

1. One controlled study was conducted on the reaction of two groups of domestic geese raised at two distances from a wind turbine, one group was 50m from the WT and the second group was 500m from the WT. The study found that the closer group experienced less weight gain and an increased concentration of cortisol in blood which is a stress indicator.[18]
2. One case study, while not definitive, seemed to point toward wind turbines causing equine flexural limb deformities (as well as human health problems).[19]
3. The Army performed low frequency vibration studies on chick embryos and found serious development problems and death of the developing chick embryos. Developing chick embryos are considered a model for human embryonic development.[20]

Human studies

There are many studies involving human health, but these are primarily based on surveys of individuals living in the vicinity of industrial wind turbines. While some short term laboratory studies have been conducted on the effect of infrasound humans, these definitely do not address the reported long-term effects. There are also numerous anecdotal reports of the adverse effects attributed to wind turbine noise and LF or IS noise, in particular. These are often not accepted as valid, thus some of the more generally accepted findings and rigorous studies are described below.

1. The effect of low frequency noise (LFN) and infrasound (IS) on human physiology is a subject of some debate, but there is evidence that humans are affected and can sense sounds much lower in frequency and at much lower amplitudes that previously thought. Recent studies have demonstrated that this is true using EEG,[21] fMRI and MEG[22] to monitor brain activity. Salt, et al., showed that there is a plausible pathway for infrasound to be perceived by the inner ear.[23]
2. By directly quantifying the inner ear sensitivity to LFN through measurement of spontaneous otoacoustic emissions, another study demonstrated the potential for hearing damage as there is a significant discrepancy between perception and the risk potential of LFN.[24]
3. The annoyance of infrasound to receptors (residents) at distances as high as 2km has been noted as early is the late '70s or early '80s by a joint SERI/DOE/NASA study.[25]

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18 http://www.ncbi.nlm.nih.gov/pubmed/24597302
19 http://doc.wind-watch.org/Castelo-Branco-follow-up-WT-near-home.pdf
20 http://www.usaarl.army.mil/techreports/95-1.pdf
21 http://psjd.icm.edu.pl/psjd/element/bwmeta1.element.bwnjournal-article-appv125n4a04kz
22 http://waubrafoundation.org.au/wp-content/uploads/2015/07/Bauer-et-al.-Investigation-of-Perception-at-Infrasound-Frequencies-by-MRI-and-MEG.pdf
23 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2923251/
24 http://rsos.royalsocietypublishing.org/content/1/2/140166
25 http://www.nrel.gov/docs/legosti/old/1166.pdf

4. A recent Australian study did not establish a scientific link between wind turbine noise and health based on the body of direct evidence which was reported as being small and of poor quality. The study also indicated that, based upon parallel evidence, beyond about 1.5km any effects should be minimal except in the area of annoyance.[26]
5. One seemingly safe assessment of the literature is that greater setback distances from residences will decrease the likelihood of adverse effects such as annoyance, sleep disturbance or other health issues including tinnitus, hearing loss, vertigo or headache. While many completely disregard all effects except noise annoyance and sleep disturbance, and those are usually trivialized; sleep disturbance resulting in chronic sleep loss is a significant health issue which has been shown to have very serious ramifications including permanent neural damage and may have implications to Parkinson's and Alzheimer's disease.[27,28,29]
6. Onakpoya et al., found that the odds of being annoyed is significantly increased by wind turbine noise. The odds of sleep disturbance was also significantly increased with greater exposure to wind turbine noise. Four studies reported that wind turbine noise significantly interfered with quality of life (QOL). Visual perception of wind turbine generators was associated with greater frequency of reported negative health effects. In conclusion, there is some evidence that exposure to wind turbine noise is associated with increased odds of annoyance and sleep problems. Individual attitudes could influence the type of response to noise from wind turbines. Experimental and observational studies investigating the relationship between wind turbine noise and health are warranted.[30]
7. Prof. Alan Hedges of Cornell U. indicates that vibrations in the frequency range of 0.5 Hz to 80 Hz have significant effects on the human body because of the natural resonance frequencies of the human body and its various parts or organs. The resonant frequencies can result in as much as a 350% amplification of the vibration depending on the frequency and location in the body (20 to 30 Hz between the head and shoulders). According to Prof. Hedges, whole body vibration may create chronic stresses and sometimes even permanent damage to the affected organs or body parts. Suspected health effects of whole body vibration include:[31]

   –Blurred vision

   –Decrease in manual coordination

   –Drowsiness (even with proper rest)

   –Low back pain/injury

   –Insomnia

   –Headaches or upset stomach

As pointed out by the Kelley studies of 30 years ago, one of the significant issues was the sensation of vibrations in the structure of the affected homes.[32] There is evidence that the strong resonances found in the acoustic pressure field measured within rooms indicates a coupling of

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26 https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/eh57a_information_paper.pdf
27 https://www.urmc.rochester.edu/news/story/3584/scientists-discover-previously-unknown-cleansing-system-in-brain.aspx
28 https://www.urmc.rochester.edu/news/story/3956/to-sleep-perchance-to-clean.aspx
29 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3880190/
30 http://www.ncbi.nlm.nih.gov/pubmed/25982992
31 http://ergo.human.cornell.edu/studentdownloads/dea3500pdfs/whole-bodyvibration.pdf
32 http://www.nrel.gov/docs/legosti/old/3261.pdf

sub-audible energy to human body resonances at 5, 12, and 17-25 Hz, resulting in a sensation of whole-body vibration.[33]

8. As mentioned in the animal study section, the Army studied the potential health issues related to low frequency vibration based on their own studies of developing chick embryos (as a model for human embryos) and because of the potential health hazard restricted pregnant aviators from rotary-wing flying duties.[34]

Conclusion

With the potential life altering implications for people and, in particular, for children, the elderly and other more susceptible individuals, it is very important to err on the side of safety when determining appropriate siting for industrial wind turbine installations. Audible noise studies are very important, but it is very apparent that LFN and IS must also be strictly controlled and monitored. It is very difficult to make an accurate and/or specific minimum setback distance without knowledge of all of the variables. The variables include, but are not limited to, the specific noise power spectrum of the given wind turbine model being used, exact locations and interactions of multiple wind turbines in a given wind farm, and topography. Some variables are constantly changing such as atmospheric conditions, wind, etc., thus, a setback must always allow for a worst case scenario plus an appropriate safety margin.

33 http://docs.wind-watch.org/kelley_ASME_1982.pdf

34 http://www.usaarl.army.mil/techreports/95-1.pdf

Ice and Blade Fragment Throw

Introduction

Ice and blade fragment throw events from wind turbines can and do happen. Therefore, it is important to understand how likely these events are and how to best mitigate against them.

According to a 2005 Dutch Handbook[35] that is frequently referenced in assessing risk associated with wind turbines, the rate of wind turbine blade failure was between 1 in 2,400 and 1 in 20,000 depending on rotor speed and whether it was a partial or full blade failure. This put the rate of failure between 0.0416% and 0.005%. However, this failure rate is based on data collected between 1980 and 2001.

According to a 2015 Windpower Monthly article[36], wind turbine rotor blades fail at the rate of 3,800 per year. Out of 700,000 or so blades that are in operation worldwide, the failure rate is 0.54%, a significant increase from the Dutch Handbook rates. It's important to note that this article doesn't say how many of these blade failures resulted in a detachment event. It is likely that some blade failures are detected and corrected before a detachment event occurs.

It has been difficult to find detailed data on wind turbine icing risks for our upstate NY climate. There has been a larger body of research from European scientist and engineers on icing risk and mitigation. According to an MMI Engineer presentation[37], risks or fatality from ice have been calculated around 3 orders of magnitude (x1000) higher than from blade failure. Data collection on actual wind turbine icing events is also limited. In one study of icing events in Gütsch, Switzerland over four winters (2005 to 2009), 32 icing events were recorded with 228 fragments documented. The maximum distance was one found at 92 meters. However it was noted that:

- Not all events could be captured
- Inspection partly delayed
- Exact time of ice throw unknown

There has been more investigations of ice and blade fragment throws using advanced modeling techniques. A 2015 paper from Uppsala University in Sweden that uses advanced modeling, the author found throwing distances up to 350 meters under certain conditions. For this paper and other similar research, the models were dependent on important wind turbine characteristics such as tower height, rotor diameter, and rotational speed.

Another risk researchers try to quantify is how likely a blade fragment or ice throw will hit something or someone. While there have been no reported deaths from a flying blade or ice fragment yet, there have

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[35] H Braam et al., "Hanboek Risicozonering Windturbines", 2nd Edition, January 2005
[36] Annual blade failures estimated at around 3,800 (Windpower Monthly, May 14, 2005) http://www.windpowermonthly.com/article/1347145/annual-blade-failures-estimated-around-3800

[37] Advances and Cases Studies in Wind Turbine Risk Assessments Icing – how big a hazard? - by Chris Robinson, MMI Engineering, presented at RenewableUK Health & Safety 2013

been incidents of houses being hit [38] [39]. Most of the research puts the probability as very low. For example, according to a 2007 report by Garrad Hassan to the Canadian Wind Energy Association[40], the following scenarios were analyzed along with the probability for each scenario:

Scenario	Probability
A fixed dwelling 300 meters from a turbine	0.0002 strikes per year (1 in 5,000 years)
A vehicle travelling on road 200 meters away	0.0000038 strikes per year (1 in 260,000 years)
A individual 300 meters away	0.000000007 strikes per year (1 in 137,500,000 years)

While the report authors made assumptions about each scenario, it should give one a reasonable understanding of likelihood of an impact.

Setback Mitigation

Using setbacks is one of the best way to mitigate against blade and ice throw risks. The further from the turbine, the less likely an impact will occur. Below are two setback calculations. Calculation 1 is a common formula that is found throughout the literature. GE uses Calculation 1 in it's guidelines for ice throw mitigation (GER-4262)[41]

Calculation 1:

Setback = 1.5 * (Rotor diameter + hub height)

Calculation 2:

Setback (meters) = (Percentage of impacts inside distance * Fragment release velocity) / 11.9

Calculation 2 is found in a 2011 paper, "A method for defining wind turbine setback standards", Jonathan Rogers et al. The authors demonstrate that Calculation 1 provides "inconsistent and inadequate protection against blade throw" and propose Calculation 2 because "the release velocity of the blade fragment is the critical factor in determining the maximum distance fragments are likely to travel.". Jonathan Rogers discussed this paper as a technical expert for the Enfield Wind Farm Advisory Committee on March 1, 2016.

Below is a table that uses both calculations to find a setback for a Vestas 2.0 MW turbine (example used in the Rogers paper) and a GE 2.3 - 107 turbine. The probabilities and risks levels were kept the same.

	Vestas 2.0 MW	GE 2.3 - 107
WIND TURBINE CHARACTERISTICS		
ROTOR RADIUS (METERS)	40 meters	53.6 meters
TOWER HEIGHT (METERS)	67 meters	94 meters
ROTATIONAL SPEED (RPM)	16.7 RPM	15.9 RPM

[38] Wind turbine's deadly ice shower, http://www.peterboroughtoday.co.uk/news/latest-news/wind-turbine-s-deadly-ice-shower-1-120837

[39] House hit by debris following blade failure, http://www.windpowermonthly.com/article/1378289/house-hit-debris-following-blade-failure

[40] Recommendations for Risk Assessments of Ice Throw and Blade Failure in Ontario, 2007, Garrad Hassan Canada Inc.

[41] Ice Shedding and Ice Throw – Risk and Mitigation (GE Power, GER 4262, 2006)

ROTATIONAL SPEED (RADIANS/SECOND)	1.75	1.67
FRAGMENT SIZE (METERS)	2 meters	2 meters
PROBABILITIES		
RISK LEVEL - BLADE THROW PROBABILITY AT OR BEYOND SETBACK	1 in 20,000	1 in 20,000
RATE OF BLADE FAILURE PER TURBINE PER YEAR	1 in 3846	1 in 3846
OUTPUT VARIABLES		
FRAGMENT RELEASE VELOCITY (METERS/SECOND)	68.34 (m/s)	87.69 (m/s)
PERCENTAGE OF IMPACTS CONTAINED WITHIN THE SETBACK DISTANCE	80.77%	80.77%
SETBACK USING CALCULATION 1	723 feet	990 feet
SETBACK USING CALCULATION 2	1520 feet	1950 feet

Other Mitigation Measures

There are several additional ways to help mitigate against ice and blade throw from a wind turbine.

Ice Sensors – Being able to detect when an icing event occurs helps turbine operators so that they can take corrective measures. Ice sensors are becoming much more sophisticated, but are not 100% capable of detecting every event. GE's warns against this in it's GER-4262 (Ice Shedding and Ice Throw – Risk and Mitigation): "Detection of ice by a nacelle-mounted ice sensor which is available for some models (with current sensor technology, ice detection is not highly reliable)."

Thermal anti- and de-icing systems – Various systems exist to help heat the blades and other components. In cold climates where ice events often occur, doing so may actually be cost-effective since it will minimize downtime and underperformance.

Anti-freeze coatings for rotor blades – This is another area that can help mitigate icing events. However, according to the 2012 IEA Wind report[42]: "Antifreeze coatings have been investigated widely in the last years. Many coatings have been promising in the laboratory tests, but none of them has proved to be functional or enough wear resistant in field conditions."

Warning Signs and Fencing – It has been mentioned in several publications and reports that warning signs and fencing be included as a mitigation measure.

Summary

Wind turbine blade failure and ice throw are not rare events. Sophisticated modeling and analyses show that ice and blade fragments can land hundreds of meters from a wind turbine. However, the risks that a person will be hit by one is relatively small. Since ice and blade throw is not a rare event, it's important to be cautious and implement mitigation strategies such as setbacks, warning signs, fences, ice sensors, and anti-freeze coatings on blades. In cold climates researchers and engineers recommend having an ice risk and mitigation analysis done.

[42] State-of-the-Art of Wind Energy in Cold Climates, IEA (International Energy Agency) Wind, 2012

Fire, Lightning, Mechanical Failure, Flicker and Other Miscellaneous Issues

Overview – Mechanical Failure, Fire, Lightning

Like any other mechanical machine, wind turbines can and do experience mechanical failures with attendant risks resulting. In 2013, GCube, the leading provider of renewable energy insurance services published a report summarizing the most common wind energy insurance claims made in the United States. The data based on 2012 US reported claims, shows that blade damage and gearbox failure account for the greatest number of losses – accounting for 41.4% and 35.1% of the total claims reported. Meanwhile, damage to foundations came in fifth. The top two most frequently reported causes of loss were cited as poor maintenance (24.5%) and lightning strikes (23.4%). Design defect (11.5%), wear and tear (9.3%) and mechanical defect (6.2%) featured in third, fourth and fifth when it came to assessing and understanding the reason cited for the initial claim. Although the majority of wind turbine blade damage can be attributed to lightning strikes; delamination and improper handling during the construction and installation phase are also frequent causes. Since 2008, GCube alone has paid out over $200,000,000 in claims to the renewable energy industry, with the majority of this figure coming from the wind sector.[43]

Array Loss/ Bearing Failure

While the various components of turbines are designed to meet the requirements of the IEC 61400-1 20-year wind turbine design standard, there are no requirements in the design standard for the reliability of the turbine system as a whole – nor is there a requirement for the reliability of major sub-systems, such as the gearbox. So, the reliability of a gearbox system can be substantially less than 20 years. And the single largest component of a gearbox system that causes gearboxes to fail is the bearings.[44] According to the insurer GCube, with approximately 175,000 geared turbines in operation in 86 countries worldwide, there are around 1,200 incidents of gearbox failure reported each year — one failure per 145 turbines per year.[45]

If turbines are sited such that the wind blows parallel to the rows of the turbines (see, e.g., turbines 1, B and C in the Black Oak Wind Farm project), then the turbine following the lead turbine in the row will have higher turbulence as well lower wind speed. The effect of the turbulence and fluctuating wind speed is not only loss in the production of electricity (i.e., array loss), but also the reduced life of the wind turbines due to fatigue failure.[46][47]

One type of fatigue failure is axial cracking in bearing races that has become common in large megawatt turbines. This damage can shorten bearing life to as little as one to two years. Axial cracking issues in bearings were not a prominent failure mode until larger megawatt and multi-megawatt class wind

[43] http://www.gcube-insurance.com/press/gcube-top-5-us-wind-energy-insurance-claims-report/
[44] http://nawindpower.com/online/issues/NAW1505/FEAT_01_Meet-The-Achilles-Heel-Behind-Most-Gearbox-Failures.html
[45] http://www.windsystemsmag.com/article/detail/878/gcube-targets-turbine-gearbox-failures-in-report
[46] http://www.brighthub.com/environment/renewable-energy/articles/97151.aspx
[47] http://www.windpowerengineering.com/design/how-turbulent-wind-abuse-wind-turbine-drivetrains/

turbines were put in service. It was not a common failure mode of earlier, smaller turbine models where the failure mode was more commonly bearing surface deterioration from pitting and scuffing. The issue of axial cracking grew along with turbine size.

The key to limiting fatigue failure, and the resulting dangers such as blade throw, fires, etc., is proper siting of the turbines.[48] Wind turbine studies have shown that turbines spaced eight to ten times the rotor diameter in the downwind direction and five times the rotor diameter in the crosswind direction have very little turbulence- as little as 10%.[49]

Fire

You need three things to start a fire: fuel, ignition and oxygen. And you can find all three of them in ample quantities within the nacelle of a wind turbine. Turbines catch fire because highly flammable materials such as hydraulic oil and plastics are in close proximity to machinery and electrical wires. According to Exelon, their 400 foot turbines contain 400 gallons of oil.[50] (The Final Findings Statement states that "the turbines have substantially less hydraulic fluid than most other turbines today" but doesn't disclose how much they contain.) And the nacelle itself is made with highly flammable plastics. Add high winds and you have all the ingredients for a fire.

Fires in turbines typically start one of two ways – a lightning strike (see further discussion on lightning below) or a technical fault. Once a fire starts there is little or nothing that can be done to prevent the turbine's complete destruction.[51] Catastrophic fires are not common although just how often they occur is the subject of some disagreement. The insurer, GCube, claims only 50 turbines a year or one in every 6,000 turbines go up in flames in any one year.[52] Daniel Kopte, an expert in safety systems for renewables certification at DNV GL estimates that approximately 120 turbines a year or one in every 2,000 turbines catch fire each year.[53] Kopte's number corresponds to a study done by Imperial College London which estimates that approximately 117 turbines catch fire every year.[54] Still others claim that wind farm accidents are actually much greater due to the fact that these accidents often are not reported.[55]

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[48] http://www.windpowerengineering.com/design/how-turbulent-wind-abuse-wind-turbine-drivetrains/

[49] For the GE 2.3MW-107 turbines, that translates to 2,808.4 feet to 3,510.5 feet for the downwind direction and 1,755.25 feet in the crosswind direction.

[50] https://www.wind-watch.org/news/2016/03/02/fallen-turbines-oil-spill-shouldnt-be-a-problem/#.VtcNzNrM6ao.mailto

[51] http://www.windpowermonthly.com/article/1361476/minimising-fire-risk-wind-turbines

[52] http://www.gcube-insurance.com/press/gcube-tackles-turbine-fires/

[53] http://www.windpowermonthly.com/article/1361476/minimising-fire-risk-wind-turbines. Note, however, that his estimate includes both damaged and destroyed turbines.

[54] http://www3.imperial.ac.uk/newsandeventspggrp/imperialcollege/newssummary/news_17-7-2014-8-56-10

[55] http://www.telegraph.co.uk/news/uknews/8948363/1500-accidents-and-incidents-on-UK-wind-farms.html

In the U.S., OSHA recommends that all wind turbines install fire detection and controls.[56] But, unlike Europe, the U.S. has no mandated regulations for fire suppression.[57] Given that, it is the local municipality's responsibility to develop their own fire emergency plans.[58] Most wind turbines do not have fire suppression systems installed by the manufacturers. In fact, GE's salesperson who attended the Wind Farm Advisory Committee stated that the 2.3MW-107 turbines being installed by Black Oak Wind Farm do not have such a system. However, Section 6.9.1 of the Final Findings Statement provides that the turbines will come standard with two fire extinguishers in the nacelle, and one in the base of the tower and that Black Oak will purchase an additional fire protection system from Firetrace International, LLC, which provides fire control devices in individual turbine components such as the electrical cabinets and converters. In addition, the SDEIS states there will be an updated Fire and Emergency Plan provided but it is not part of the filing.

Given the remote locations and enormous height of turbines today, there is not much a fire department can do to fight a fire in the nacelle. Gary Bowker, a retired fire professional with over 40 years of experience, including as fire chief with the U.S. Air Force and fire chief with Sumner County, Kansas, has this to say about fighting wind turbine fires:

> "..., due to the risk of falling debris over a wide area, approaching a burning turbine is usually not an option unless there is a life risk involved. If the turbine is turning, power is being generated and an electrocution hazard will be present.
>
> Typically, a good option for firefighters to consider is to evacuate any endangered areas, set up a collapse zone, and attempt to control any ground fires to prevent the fire from spreading to other units.
>
> In the case of a runaway or over-speed event, rotating turbines can throw debris thousands of feet away during a blade failure. Pieces of blades have been documented as traveling over 4,200 feet. Distance and time will fix this problem. Pre-incident planning and SOP development are keys to success for safely handling this unique danger."[59]

In addition to grass fires, the secondary fire on the ground can lead to forest fires, which can be difficult to extinguish. The remote locations of the turbines and strong winds can be factors that promote the quick spread of forest fires.[60] Section 2.8.2 of the DSEIS states: "Consultation with the Enfield Fire Company indicates that they are confident in their ability to control fires in open fields, but concerned regarding the ability to control fires if they spread to forests."

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56 https://www.osha.gov/dep/greenjobs/windenergy_fire.html

57 Europe's Confederation of Fire Protection Associations (CFPA E) has published its own guidelines for wind turbine fire protection. See http://en.dbi-net.dk/files/CFPA/Guidelines/CFPA_E_Guideline_No_22_2012_F.pdf

58 http://www.windpowerengineering.com/maintenance/safety/what-regulations-exist-for-fire-protection-in-wind-turbines/

59 http://www.firerescue1.com/fire-attack/articles/1306390-3-wind-turbine-failures-firefighters-must-know/

60 http://en.dbi-net.dk/files/CFPA/Guidelines/CFPA_E_Guideline_No_22_2012_F.pdf

Furthermore, OSHA states: "Workers should be made aware that while fighting initial fires, toxic gases can be generated and oxygen can be depleted inside Nacelles, and they can be exposed to such gases or can be asphyxiated from lack of oxygen."[61]

In light of the risks involved, the use of safety features in the turbines whenever possible and a well-designed emergency plan are critical. The European guidelines as well as, in the U.S., the National Fire Protection Association recommend, among other things:

- Fire suppression systems in the nacelle
- Automatic early fire detection systems whereby the turbine is automatically shut down and disconnected from the power supply system
- Lightning and surge protection
- Protection systems, including measures to identify power system faults and other abnormal operating conditions
- Minimization of combustible materials in the manufacture of the turbines
- Use of cold procedures for repairs, assembling or disassembling work to avoid fire hazards or the use of mandatory fire precautions where fire hazards cannot be avoided
- Regular maintenance of mechanical and electrical systems
- Proper training
- Clearing brush and debris from around the turbine to create a fire break

Where a fire emergency arises, a plan should be in place that provides, among other things:

- 24/7 standby personnel monitoring the turbines
- Provision of emergency telephone numbers
- Notification of fire department and police
- On-site support for fire department and police
- Shut down of turbine and disconnection from power supply
- Training fire and police personnel about turbines, high-voltage components and combustible materials within the turbines[62], [63]

Lightning

As stated above, lightning is the second most frequent cause of blade failure as well as gearbox failures and fires. And for reasons that are not yet clearly understood, turbines seem to attract more than their fair share of lightning as compared with other structures of a similar size. As turbine size increases, so does vulnerability to lightning.[64] Furthermore, the move to carbon fiber in larger blades as a way of strengthening blades increases vulnerability to lightning.[65]

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61 https://www.osha.gov/dep/greenjobs/windenergy_fire.html

62 http://en.dbi-net.dk/files/CFPA/Guidelines/CFPA_E_Guideline_No_22_2012_F.pdf

63 Chapter 10 of http://www.sentry-ds.com/images/nfpa850.pdf

64 http://www.firetrace.com/wp-content/uploads/windandfirearticle.pdf

65 http://www.firetrace.com/wp-content/uploads/windandfirearticle.pdf; It is not clear whether the GE 2.MW turbines are carbon fiber as they claim the material in their blades is proprietary but recent articles indicate that GE is moving in that direction. See http://exclusive.multibriefs.com/content/plastic-materials-and-processing-advancing-wind-energy.

Recent research by scientists at the Polytechnic University of Catalonia in Barcelona has shed new light on the risks of lightning strikes and wind turbines.[66] Turbine blades experience hundreds or thousands of "near strikes", creating microscopic levels of damage, before that fatal lightning strike that causes the blade to fail.[67] The researchers, using high-speed video of thunderstorms passing near turbines, found that near strikes occur even when a lightning storm is several kilometers away. Furthermore, they demonstrated that the turbines themselves can spark lightning strikes by sending up negative leaders into the clouds.[68], [69]

A properly installed lightning protection system will dramatically improve both the cost effectiveness and reliability of a wind turbine. Without the system a lightning strike on an unprotected blade can lead to temperature increases up to 54,000 degrees Fahrenheit and result in an explosive development of air within the blade. According to the updated National Fire Protection Association handbook, "While physical blade damage is the most expensive and disruptive damage caused by lightning, by far the most common is damage to the control system." Wind turbines have a concentrated amount of very expensive technology installed in a relatively small space and the presence of many different voltages in a wind turbine installation, which can easily lead to overvoltages and surges within the system.[70] Furthermore, turbine blades can explode when struck by lightning[71], [72] causing risk of blade throw in addition to fire.

Section 6.9.1 of the Final Findings Statement and Section 2.8.3 references lightning and surge protection systems to be installed on the turbines to help protect against the impacts of lightning and electrical surges causing fires. Despite these systems which decrease the risks, the risk of fires and blade throw still exists.

Foundation Failure/Turbine Collapse

Foundation failures that lead to turbine collapse are generally caused by design flaws, construction flaws or maintenance flaws.[73] In addition, design flaws and maintenance flaws with the turbine towers themselves can lead to turbine collapse for a wide variety of reasons.[74] In all circumstances, the root

[66] http://www.windpowerengineering.com/policy/environmental/damage-control-effects-of-near-lightning-strikes-on-turbine-blades/

[67] http://www.windpowerengineering.com/policy/environmental/damage-control-effects-of-near-lightning-strikes-on-turbine-blades/

[68] http://arstechnica.com/science/2014/01/lightning-bolts-love-wind-turbines-a-little-too-much/

[69] http://www.windpowerengineering.com/policy/environmental/damage-control-effects-of-near-lightning-strikes-on-turbine-blades/

[70] http://alltecglobal.com/wp-content/uploads/Why_Wind_Farms_Need_Lightning_Protection.pdf

[71] http://www.vaisala.com/Vaisala%20Documents/Scientific%20papers/1.Leick-How%20Lightning.pdf

[72] http://alltecglobal.com/wp-content/uploads/Why_Wind_Farms_Need_Lightning_Protection.pdf

[73] http://docs.wind-watch.org/Cracks-in-onshore-wind-turbine-foundations.pdf

[74] http://khatrinternational.com/docs/awea_wt.pdf

cause of the problems arises due to the enormous stress and forces to which a wind turbine is subjected requiring that both the foundation and the turbine tower's structure are up to the task at hand.

The main reason for foundation failures has been poor structural design. Furthermore, the site investigations are sometimes not conducted properly and the findings are not properly considered when designing the foundation.[75], [76] There are many different types of foundation designs for wind turbines. The foundation design will always have to be site-specific in that it needs to be designed for the prevailing local soil conditions.[77] Other reasons for construction flaws are poor workmanship performance and inappropriate material selection. As a result, it is critical to have a third party soil engineer as well as construction engineer on site during the construction of the foundations to ensure they are being built properly.

Once the turbine foundations have been built, it is also critical that they be inspected and maintained on a regular basis to check for cracking and/or softening of the foundation which can lead to collapse. Water entering the foundation followed by subsequent freezing and thawing can have negative effects on the integrity of the turbine's foundation.

In addition to foundation failure, the design flaws can lead to turbine collapse. Some of the maintenance or operational concerns related to the design of the turbines that can lead to turbine collapse include:

- Turbine over-speed;
- E-stops;
- Soil fatigue and/or foundation fatigue or cracking;
- Weld failures;
- Blade failures;
- Imbalance due to snow or ice loads
- Poor soil drainage leading to foundation softening; and
- Corrosion of foundation bolts.[78]

All of this leads to the conclusion that, in addition to strong oversight during construction, ongoing strong oversight of the operations and maintenance of the wind farm is critical to maintaining the safety of the town's residents.

Flicker

Shadow flicker only occurs in certain specific combined circumstances, such as when the sun is shining and is at a low angle (after dawn and before sunset), the turbine is directly between the sun and the affected property, and there is enough wind energy to ensure that the turbine blades are moving. A considerable amount of international research has been undertaken on the impacts and management of

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[75] http://www.windfarmbop.com/cracks-in-onshore-wind-turbines-foundation/#comment-14776

[76] http://docs.wind-watch.org/Cracks-in-onshore-wind-turbine-foundations.pdf

[77] http://home.eng.iastate.edu/~idm/engr340-2011/ENGR%20340%20-%20Foundations%203%20-%20Ashlock%20-%20Schaefer.pdf

[78] http://khatriinternational.com/docs/awea_wt.pdf

shadow flicker. Generally in Europe[79], the standard for flicker is to place turbines at least 500 – 1,000 meters[80] from dwellings and limit the amount of flicker to no more than 30 hours per year, and in some cases, no more than 30 minutes per day. Careful site selection, design and planning, and good use of relevant software can help avoid the possibility of shadow flicker in the first instance. Research has shown that when turbines are placed at least 10 rotor diameters[81] or more from a dwelling, the potential for shadow flicker is very low.[82] However, the U.S. Bureau of Land Management has stated that shadow flicker is not considered as significant an issue in the United States as in Europe where the high latitude and low sun angle exacerbate the effect.[83] In fact, a common standard within the United States is to merely limit the amount of flicker to not more than 30 hours per year which is the standard which Black Oak Wind Farm uses in the DSEIS.

There are many complaints by residents living near wind turbines about the impacts of flicker.[84], [85], [86] These complaints and concerns include, among other things, headaches, tinnitus, nausea, dizziness, earaches, vertigo and seizures. In many cases, residents have abandoned their homes because they were unable to sell them and could no longer stand living with the effects of the flicker. But others maintain that there is no scientific proof that flicker causes adverse health effects.[87]

The document produced by the Bureau of Land Management referenced above does note that flickering effect may be considered an annoyance. With respect to seizures however, the BLM points out that modern three-bladed wind turbines are unlikely to cause epileptic seizures in the susceptible population[88] photo-sensitive epileptics due to the low blade passing frequencies.[89] The World Health Organization defines annoyance as a feeling of discomfort which is related to adverse influencing of an individual or a group by any substances or circumstances. Annoyance express itself by malaise, fear, threat, trouble, uncertainty restricted liberty experience, excitability or defencelessness.[90] While there has yet to be a direct causal link established between flicker and adverse health effects, the World

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79 These shadow flicker recommendations are based on the survey by Predac, a European Union sponsored organisation promoting best practice at energy use and supply which draws on experience from Belgium, Denmark, France, the Netherlands and Germany.

80 This equates to roughly 1,750 to 3,500 feet.

81 This equates to 1,070 meters or 3,500 feet for the GE 2.3MW-107 turbines.

82 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48052/1416-update-uk-shadow-flicker-evidence-base.pdf

83 Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM-Administered Lands in the Western United States, US Department of the Interior – Bureau of Land Management (2005) Synopsis

84 https://www.bostonglobe.com/metro/2013/04/04/turbine-flicker-effect-draws-complaints/UKgf7nOwMHm8CWAtZ47V5L/story.html

85 http://www.telegraph.co.uk/news/earth/earthnews/8386273/Shadow-flicker-rotating-blades-can-cause-headaches.html

86 https://www.youtube.com/watch?v=RD6q3ixq0-s

87 https://nccleantech.ncsu.edu/wp-content/uploads/Health-Impacts-Factsheet-7.pdf

88 Around 0.5 % of the population is epileptic and of these around 5 % are photo-sensitive. Of photo-sensitive epileptics less than 5 % are susceptible.

89 http://onlinelibrary.wiley.com/doi/10.1111/j.1528-1167.2008.01563.x/epdf

90 http://www.euro.who.int/__data/assets/pdf_file/0015/105144/WHO_Lares.pdf

Health Organization does link annoyance to various diseases such as diabetes and cardiovascular disease. Furthermore, the NIH's National Center for Biotechnology Information points out that there has been little if any research conducted on how flicker could heighten the annoyance factor of those living in proximity to turbines.[91]

Various mitigation steps can be taken to minimize the impact of flicker on nearby residents. For example, in one municipality in Alberta, Canada, the wind farm either shuts down the machines between the time the sun is rising and setting for approximately an hour, or programs their computers to control the direction of the turbine so the blades are directly parallel to the sun. Other suggested mitigation tools include the use of blinds at residential properties or tree/shrub planting to screen shadow flicker to help minimize potential impacts.[92] Nonetheless, many people complain that blinds do little to actually block the impact of flicker and do nothing to alleviate its effects while outdoors.

The Impact of Flicker on Horses

One area of particular concern related to flicker involves its impact on horses. A detailed 2012 survey by the British Horse Society establishes that as many as 20% of horses are adversely effected by the flicker of wind turbines. This is of particular concern due to the fact that Turbines B and C surround a property being used by a professional horse trainer to train horses.[93][94]

Stray voltage

In the U.S., the NEC requires that alternating current (AC) systems connected to the utility must have one of the current-carrying wires grounded to the earth at the electrical service entrance. This grounded wire is termed the "neutral" wire, and is un-fused. The other wire, termed the "hot" wire, is wired through a fuse or circuit breaker. This configuration, involving a grounded current-carrying conductor, was adopted for perceived safety reasons, essentially to protect folks working on the electrical lines or wiring from getting zapped. It is this grounded un-fused 2 "neutral" wire that actually creates two potential paths for electricity to follow: through the wire itself as well as through the earth.

Because one of the current-carrying conductors is connected to the earth, there can be situations where small amounts of electricity can flow to complete a circuit through the earth that is below the threshold that will blow a fuse or trip the circuit breaker in the hot wire. This unintentional flow of electricity is what is referred to as "stray voltage." Stray voltage is usually defined as a measurable level of voltage that may occur between a metal object and the adjacent floor or earth.[95]

Problems with the condition of the hot wire can also cause stray voltage.

One particular place where stray voltage becomes a serious issue is in a dairy barn, where you have all the components for parallel electrical paths: concrete or dirt floors that are likely wet from manure,

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[91] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4063257/

[92] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48052/1416-update-uk-shadow-flicker-evidence-base.pdf

[93] Wind turbine experiences, 2012 Survey results, The British Horse Society

[94] Advice on Wind Turbines and Horses – Guidance for Planners and Developers, The British Horse Society

[95] http://www.renewwisconsin.org/wind/Toolbox-Fact%20Sheets/Stray%20voltage.pdf

urine, and moist animal breath; metal confinement structures and water systems; metal rebar in the concrete floor; and metal walls often with moisture condensed on them. In addition, it turns out that dairy cattle (with an electrical resistance of only about 500 ohms) can detect electrical currents at a level about one one-fiftieth to one one-hundredth of what humans are able to detect.

The Final Findings Statement provides the following with resepct to stray voltage:

> "While the concerns surrounding stray voltage are legitimate, it is important to note they are largely preventable with proper electrical installation and grounding practices. The Project's power collection system will be properly grounded, and will be electrically isolated (in accordance with required electricity regulations) from the local electrical distribution lines that provide electrical service to on-site structures or off-site buildings and homes. It will be physically and electrically isolated from all of the buildings in and adjacent to the Project. Additionally, the bulk of the wind farm's electrical collection lines will be located a minimum of three to four feet below ground, and will use shielded cables with multiple ground points. This type of design eliminates the potential for stray voltage."

But wind farm collector systems experience a very demanding load on cables and accessories compared to utility distribution systems. Fast deterioration of cables and cable accessories has been reported at wind farms. Joints are known to be a weak point in a cable system since it is an area which has been worked on by tools and hands. Reports suggest that failed joints are over represented compared to the cable itself in failure statistics. Typical causes of failure are moisture ingress, heating in joint ferrule and partial discharges in cracks and voids. Compression type ferrules, more often than others, have caused heating in joints by heightened contact resistance.[96]

This highlights, once again, the importance of ongoing maintenance and repair of the components of a wind farm

Lighting of turbines

The FAA requirements specific to wind turbine farms may be found in chapter 13 of FAA Advisory Circular AC 70/7460-1L.[97] The FAA defines a wind turbine farm as *"wind turbine development that contains more than three (3) turbines of heights over 200 feet above ground level."* Not every wind turbine within a farm is required to be lit. The FAA requires unlit gaps of no more than ½ statue mile.

More specifically, the AC requires:

- Nighttime wind turbine obstruction lighting should consist of FAA L-864 aviation red flashing, strobe, or pulsed obstruction lights. Studies have shown that red lights provide the most conspicuity to pilots.
- In most cases, not all wind turbine units within a wind turbine farm need to be lighted. Obstruction lights should be placed along the perimeter of the wind turbine farm so that there are no unlit separations or gaps more than 1/2 statute mile (sm) (804 m). Wind turbines within a

[96] http://www.diva-portal.org/smash/get/diva2:566345/FULLTEXT01.pdf

[97] http://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_70_7460-1L_.pdf

grid or cluster should not have an unlighted separation or gap of more than 1 sm (1.6 km) across the interior of a grid or cluster of turbines.

- Any array of flashing, strobe, or pulsed obstruction lighting should be synchronized to flash simultaneously (within ±1/20 second (0.05 second) of each other).
- Light shields are not permitted because of the adverse effects they have on the obstruction light fixture's photometrics. In addition, these shields can promote undesired snow accumulation, bird nesting, and wind loading.

The FAA rules requires the lights to be visually or automatically inspected once every 24 hours. In addition, FCC rules require them to be inspected quarterly

Aeroelastic Flutter Stability

See pages 10 & 11 of
http://mragheb.com/NPRE%20475%20Wind%20Power%20Systems/Safety%20of%20Wind%20Systems.pdf.

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Water Resources - Climate and Air Quality

Summary

Water resources and air quality are impacted primarily in the construction phases of the wind energy project more so than in its operational phase. Siting of access roads, construction staging areas and tower foundations must be done so as to minimize disruption, damage and permanent alteration of existing natural conditions of streams, wetlands and drainages. An inventory of these water resource elements for both the accepted project as well the potential modified layout has been documented in the DEIS and SEIS. Final site plans, as yet to be presented, will allow more specific analysis of impacts and all necessary mitigation. Monitoring of construction activities will be of critical importance to insure compliance with NYSDEC and USACE protection and restoration standards on site. Identification, analysis and mitigation plans for water resource issues that exist or may arise are addressed and documented in the DEIS, FEIS and SEIS. No water use is required in the operational phase of the completed turbines and therefore no impacts are anticipated to aquifers or groundwater resources once construction is complete.

Air quality may be impacted during construction by exhaust fumes of trucks and equipment in use on site as well as en route. Travel on unpaved roads, as well as excavation for access roads, staging areas and tower foundations may also produce significant dust depending on both weather and current road conditions on a short term and localized basis. Methods for addressing dust are outlined in the DEIS. Exhaust from trucks could be lessened by limiting the length of idling time allowed on site. There do not appear to be any methods for actual measurement of air quality changes during construction.

Numerous methods for evaluation and monitoring of water issues during the active construction phase of the project have been outlined and presented but can only be upheld in pre-construction planning and vigilant, thorough inspection and monitoring on site when excavation and building is actually underway. An Environmental Monitor will be hired for the duration of construction and will be responsible for identifying, reporting and recommending solutions to any problems as they arise, according to NYSDEC and USACE regulations and procedures. The Town of Enfield will have discretion in hiring for this position.

Geology, Soils & Topography

The approved plan had test borings done for all proposed turbine sights as well as the substation. The results of which were in Appendix D of the Draft EIS as well as the supplemental geotechnical report from Tectonic. They also had GEOPHYSICAL SURVEYS -MULTI-ANALYSIS OF SHEAR WAVE (MASW) done by ARM geophysics.

Test Borings:

No Test Borings were performed for the 3 proposed turbines A, B, C, 1 moved turbine # 5,`` the MET tower or the substation according to the Draft Supplemental EIS. On page 6 under 2.1.1 it is stated that " Similar investigations will be performed for the Modified Project prior to project approval (issuance of permit) and initiation of construction."

As was said in the Advocates for Stark letter on Trello: *"Once the lead agency approves the Final Environmental Impact Statement, the towns...and the county...are effectively trapped. They cannot withdraw. If on any issue, the towns demand more than the developer wants to give, the sponsor can simply threaten to sue the towns, and the towns will back down, because they cannot afford a lawsuit. Therefore, it is critical that the towns and the county negotiate all the terms before the SEQR process ends. Once the SEQR process ends, your negotiating powers will be significantly weakened, if not obliterated."*

The need for test borings at each turbine sight were stated in Appendix D of the Draft EIS On page 13:

9.0 RECOMMENDATIONS
The following sections provide our geotechnical recommendations for design and construction of the proposed foundations. The recommendations are based on our understanding of the proposed project as summarized in Section 3 of this report, and the results of the subsurface investigation as described previously. It is noted that if the proposed Turbine locations change, Tectonic will need to confirm the validity of the provided recommendations. This is due in part to the locally abrupt variations in bedrock depth identified by the borings and MASW surveys.

It is recommended that the test borings be done for all new or changes turbine sights as well as the substation and MET tower before the final EIS is approved so that the town will have a say in any mitigating directions.

Changes to the Turbines:

Given that not only the location, but also the size and power of the turbines have changed:

Appendix D of the Draft EIS On page 19:

12.0 LIMITATIONS
Our professional services have been performed using that degree of care and skill ordinarily exercised under similar circumstances by reputable geotechnical engineers and geologists practicing in this or similar situations. The interpretation of the field data is based on good judgment and experience; however, no matter how qualified the geotechnical engineer or detailed the investigation, subsurface conditions cannot always be predicted beyond the points of actual sampling and testing. No other warranty, expressed or implied, is made as to the professional advice included in this report.
The recommendations contained in this report are intended for design purposes only.

Contractors and others involved in the construction of this project are advised to make an independent assessment of the soil, bedrock, and groundwater conditions for the purpose of establishing quantities, schedules and construction techniques.
This report has been prepared for the exclusive use of Black Oak Wind Farm LLC for the specific application to the proposed wind farm project described in this report. We recommend that prior to construction, Tectonic review the project plans and specifications. It should be noted that upon review of those documents, some recommendations presented herein might be revised or modified. In the event that any changes in the design or location of the proposed structures are planned, Tectonic shall not consider the conclusions and recommendations contained in this report valid unless reviewed and verified in writing. It is further recommended that Tectonic be retained to provide construction monitoring and inspection services to ensure proper implementation of the recommendations contained herein, which would otherwise limit our professional liability.

It is recommended that the board ask Black Oak to inform Tectonic of the changes to turbine size, power and location to see if any revision or modifications are recommended.

Monitoring:

According to Tectonic:

11.0 CONSTRUCTION MONITORING

A geotechnical engineer familiar with the existing subsurface conditions and having the appropriate laboratory and field testing support should be engaged by the Owner to observe that all earthwork is performed in accordance with the specifications and the design criteria outlined in this report.
The following work should be performed under the supervision of a geotechnical engineer:

- Foundation subgrade preparation
- Rock anchor installation and load testing
- Fill placement and compaction
- Dewatering

19

All materials proposed for use as soil fill should be tested and approved prior to delivery to the site. Additionally, all fill materials should be tested as they are being placed to verify that the required compaction is achieved. We further recommend that the project plans and specifications be reviewed by the geotechnical consultant prior to final completion of the bid documents. It should be noted that upon review of those documents, some recommendations presented herein may be revised or modified.

It is recommended that the town board carefully vets the geotechnical engineer or firm hired to oversee and monitor the construction.

4/13/16

Everything is moving much more quickly these days and Enfield, like most other small towns, does not have the infrastructure, nor the resources, to keep up with the demands that these rapid changes ask for. The past eight years the Town has ben working with BOWF, we have seen how important it is to find other energy sources than fossil fuels and nuclear plants. Wind farms are likely an essential part of this new energy supply chain. At the same time, a lack of any State or Federal regulatory standards, combined with the fact that we are just now beginning to understand the health and safety issues that wind farms, by their very nature, bring into the lives of their neighbors, means there will be inevitable conflicts at the local level over the sighting of the turbines.

The town of Enfield seems to be a classic case, as the initial law - with larger setbacks - was discarded for one more lenient to the industry. Now we are learning as much as possible, as quickly as possible, in order to protect local residents health and safety form the likely side effects of the turbines installation. It seems to me we can take one of two courses. First, with the understanding that the setback distance is the most significant aspect of the issue, we can decide to rewrite the wind law and require BOWF with a greater setback distance. This will certainly have significant consequences to BOWF, perhaps even to an inability to continue and possibly to the Town as well, as it seems likely that in this circumstance, BOWF would take legal action against the Town.

Alternately, we could consider the current process of approving the draft and final SEIS as an opportunity to require BOWF to work with the Town to find a way to mitigate any possible health and safety problems that residents close to the turbines will likely incur from their proximity. The Town wind law does contain a provision that, according to our lawyer, allows us to enforce provision and standards beyond those contained in other parts of the law. This provision, Article 3 Section 3 states that "the Town Board shall, upon consideration of the standards contained in the local law, and the record of the SEQRA review, issue a written decision with the reasons for approval, conditional approval, or denial fully stated."

With this in mind, I think we should consider the ways we might, as the lead agency, address the health and safety needs of the nearby residents while still allowing BOWF the opportunity to continue with this project. One possibility that has been considered, and written into law, by a number of other NY municipalities, is to develop a process whereby those residents who find they can not continue to live at their homes will be helped to move from their existing residence to a new property. This would entail a financial commitment on the part of BOWF and obviously would take time to develop, and a real desire on the part of both parties. I would expect neither side to be happy with this idea - for the residents it means the possibility of leaving their long established homes, and for BOWF it will mean less long term profits.

Another, perhaps even more complicated alternative, would ask for an actual understanding by the wind farm that there will be issues and problems that will surface in the construction and long term operation phases of the facility. This would deal primarily with health and safety issues. Once there is an understanding by BOWF and an agreement that these issues need to be addressed they would need to be a complaint resolution procedure, as required in the Town wind law. As stated "the application will include a complaint resolution process to address complaints from persons who live in nearby residences. The process may use an independent mediator or arbitrator and shall include a time limit for acting upon any complaint." The existing "Community Outreach and Communication Plan",which BOWF identifies as their only complaint resolution procedure,is not,in my understanding,in keeping with the town law.It provides no time limit,and,more importantly,nothing that requires any complaint to actually be resolved.If,in fact,BOWF interprets this portion of the law as not actually requiring a mutually agreeable solution,rather than just an amorphous concept of working on a resolution,then I think the town cannot proceed any further without putting new language into the law to address this misunderstanding.If BOWF agrees ,however,that the intent of this section of the law was meant to confer a regulatory authority on the town board,then it will need to develop a procedure that actually requires a resolution to problems in a timely manner,throughout the lifetime of the facility.This would include details of standards to be met,a monitoring process to assure that they are being met,and measures to be taken when they are not.I cannot emphasize too strongly my belief that no paperwork that BOWF has submitted to date has even begun to address this issue in a substantive way.

Since none of our paid advisers have,to my knowledge, commented on this issue,I can only assume they felt it was outside their scope.As such,I see it as even more important that the town board itself deals with this issue,since it arises directly from our wind law. While we have approved a findings statement for one part of this project,we have not approved the placement of three turbines and,more importantly, the electric substation.In light of my current understanding of the health and safety issues for nearby residents,as evidenced by much of the current reevaluation of setback distances in other towns,states,and countries,I believe that now is an appropriate time for the board to inform BOWF of our updated needs.BOWF can then address these issues in their responses in the Final SEIS.I would hope that the wind farm would welcome this opportunity to be better neighbors in the future.

Mike Carpenter

EXHIBIT 8

1. Introduction

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

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

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

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

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

Consequently the following safety regulations must be observed.

2. Stay and Traffic by the Turbine

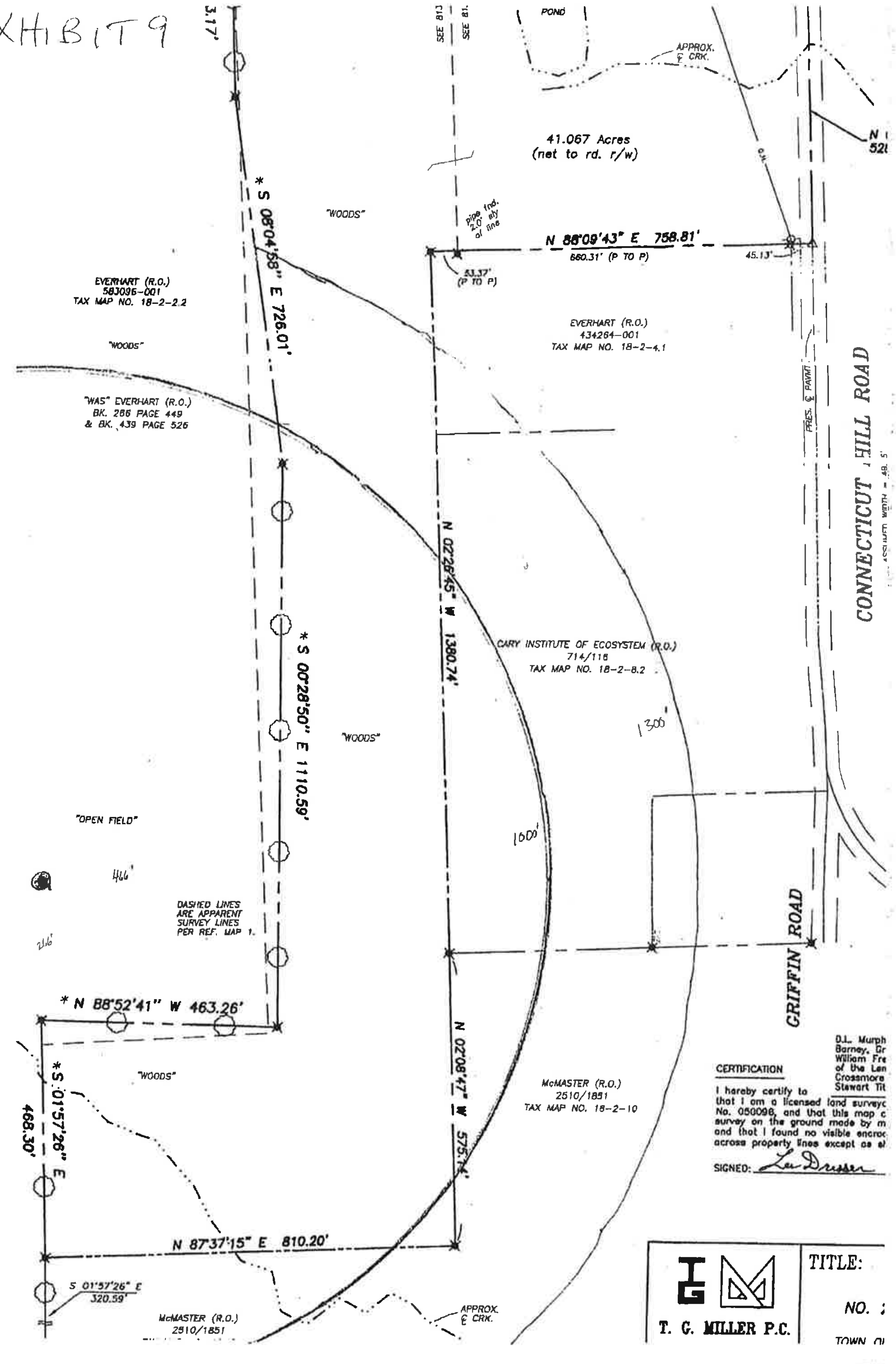
Do not stay within a radius of 400m (1300ft) from the turbine unless it is necessary. If you have to inspect an operating turbine from the ground, do not stay under the rotor plane but observe the rotor from the front.
Make sure that children do not stay by or play nearby the turbine. If necessary, fence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

This is Vestas a windmill Comp.

3. Address and Phone Number of the Turbine

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

EXHIBIT 9



3.17'
SEE 813
SEE 81.
POND
APPROX. ℄ CRK.
41.067 Acres
(net to rd. r/w)
N 88°09'43" E 758.81'
660.31' (P TO P)
45.13'
53.37' (P TO P)
pipe fnd. 2.0' sly of line
"WOODS"
* S 08°04'58" E 726.01'
EVERHART (R.O.)
583096-001
TAX MAP NO. 18-2-2.2
"WOODS"
EVERHART (R.O.)
434264-001
TAX MAP NO. 18-2-4.1
"WAS" EVERHART (R.O.)
BK. 266 PAGE 449
& BK. 439 PAGE 526
PRES. ℄ PAVMT.
CONNECTICUT HILL ROAD
N 02°26'45" W 1380.74'
* S 00°28'50" E 1110.59'
CARY INSTITUTE OF ECOSYSTEM (R.O.)
714/116
TAX MAP NO. 18-2-8.2
"WOODS"
1300'
"OPEN FIELD"
1600'
466'
DASHED LINES ARE APPARENT SURVEY LINES PER REF. MAP 1.
216'
GRIFFIN ROAD
* N 88°52'41" W 463.26'
N 02°08'47" W 575.1'
"WOODS"
* S 01°57'26" E
468.30'
McMASTER (R.O.)
2510/1851
TAX MAP NO. 18-2-10
N 87°37'15" E 810.20'
S 01°57'26" E
320.59'
McMASTER (R.O.)
2510/1851
APPROX. ℄ CRK.
CERTIFICATION
I hereby certify to
that I am a licensed land surveyo
No. 050098, and that this map c
survey on the ground made by m
and that I found no visible encroc
across property lines except as s
SIGNED:
D.L. Murph
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TITLE:
NO.
T. G. MILLER P.C.
TOWN OI

EXHIBIT 10

Energy

Ice Shedding and Ice Throw – Risk and Mitigation

David Wahl
Philippe Giguere
Wind Application Engineering

GE Energy
Greenville, SC

Ice Shedding and Ice Throw – Risk and Mitigation

Introduction

As with any structure, wind turbines can accumulate ice under certain atmospheric conditions, such as ambient temperatures near freezing (0°C) combined with high relative humidity, freezing rain, or sleet. Since weather conditions may then cause this ice to be shed, there are safety concerns that must be considered during project development and operation. The intent of this paper is to share knowledge and recommendations in order to mitigate risk.

The Risk

The accumulation of ice is highly dependent on local weather conditions and the turbine's operational state.[2,4] Any ice that is accumulated may be shed from the turbine due to both gravity and the mechanical forces of the rotating blades. An increase in ambient temperature, wind, or solar radiation may cause sheets or fragments of ice to loosen and fall, making the area directly under the rotor subject to the greatest risks[1]. In addition, rotating turbine blades may propel ice fragments some distance from the turbine—up to several hundred meters if conditions are right.[1,2,3] Falling ice may cause damage to structures and vehicles, and injury to site personnel and the general public, unless adequate measures are put in place for protection.

Risk Mitigation

The risk of ice throw must be taken into account during both project planning and wind farm operation. GE suggests that the following actions, which are based on recognized industry practices, be considered when siting turbines to mitigate risk for ice-prone project locations:

- **Turbine Siting:** Locating turbines a safe distance from any occupied structure, road, or public use area. Some consultant groups have the capability to provide risk assessment based on site-specific conditions that will lead to suggestions for turbine locations. In the absence of such an assessment, other guidelines may be used. Wind Energy Production in Cold Climate[6] provides the following formula for calculating a safe distance:

  1.5 * (hub height + rotor diameter)

  While this guideline is recommended by the certifying agency Germanischer Lloyd as well as the Deutsches Windenergie-Institut (DEWI), it should be noted that the actual distance is dependant upon turbine dimensions, rotational speed and many other potential factors. Please refer to the *References* for more resources.

- **Physical and Visual Warnings:** Placing fences and warning signs as appropriate for the protection of site personnel and the public.[4]

- **Turbine Deactivation:** Remotely switching off the turbine when site personnel detect ice accumulation. Additionally there are several scenarios which could lead to an automatic shutdown of the turbine:

  - Detection of ice by a nacelle-mounted ice sensor which is available for some models (with current sensor technology, ice detection is not highly reliable)
  - Detection of rotor imbalance caused by blade ice formation by a shaft vibration sensor; note, however, that it is possible for ice to build in a symmetric manner on all blades and not trigger the sensor[2]
  - Anemometer icing that leads to a measured wind speed below cut-in

- **Operator Safety:** Restricting access to turbines by site personnel while ice remains on the turbine structure. If site personnel absolutely must access the turbine while iced, safety precautions may include remotely shutting down the turbine, yawing to place the rotor on the opposite side of the tower door, parking vehicles at a distance of at least 100 m from the tower, and restarting the turbine remotely when work is complete. As always, standard protective gear should be worn.

References

The following are informative papers that address the topic of wind turbine icing and safety. These papers are created and maintained by other public and private organizations. GE does not control or guarantee the accuracy, relevance, timeliness, or completeness of this outside information. Further, the order of the references is not intended to reflect their importance, nor is it intended to endorse any views expressed or products or services offered by the authors of the references.

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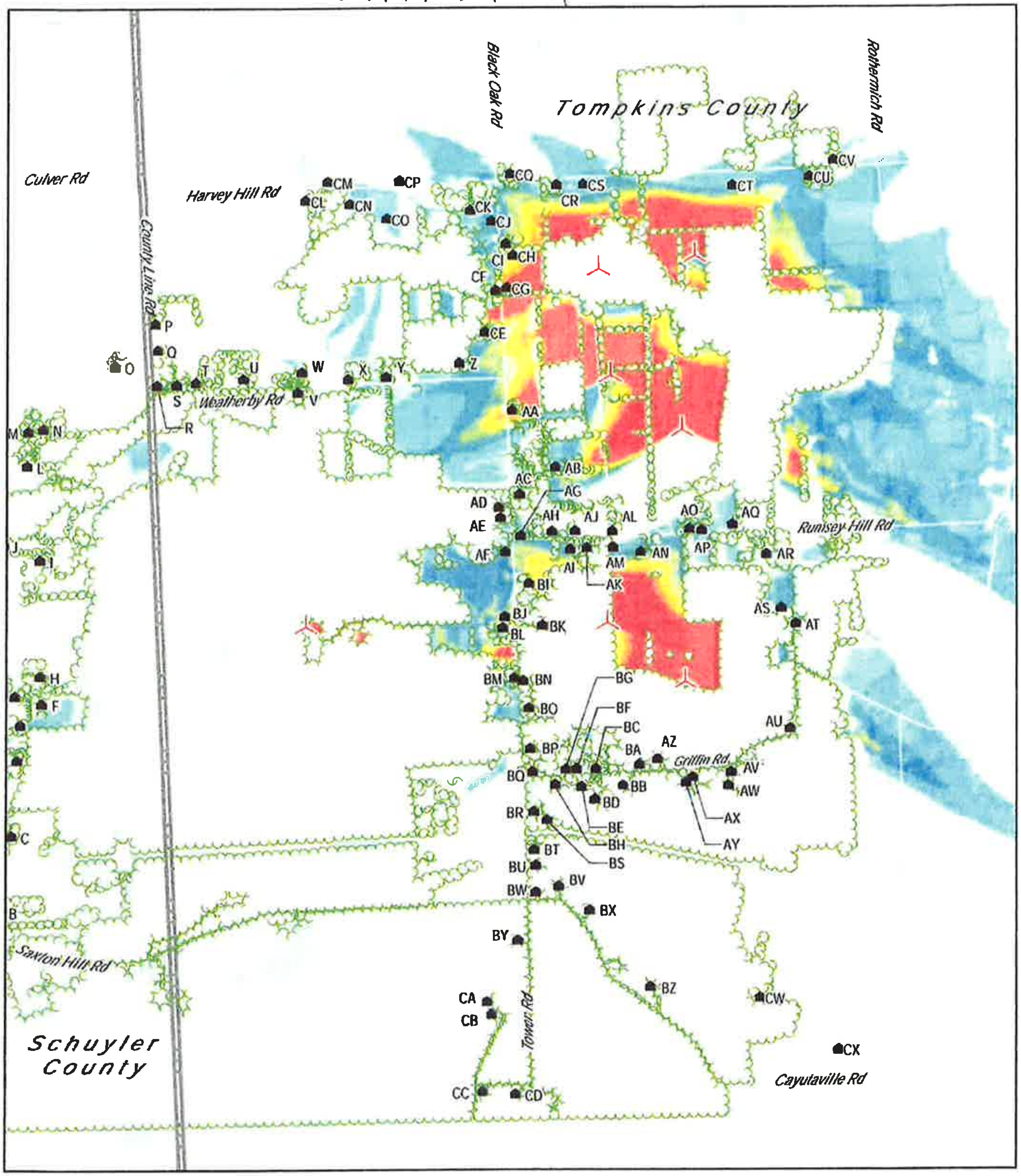
EXHIBIT 11



Proposed Wind Turbines

ID Receptor

Tree Stand

Shadow Flicker

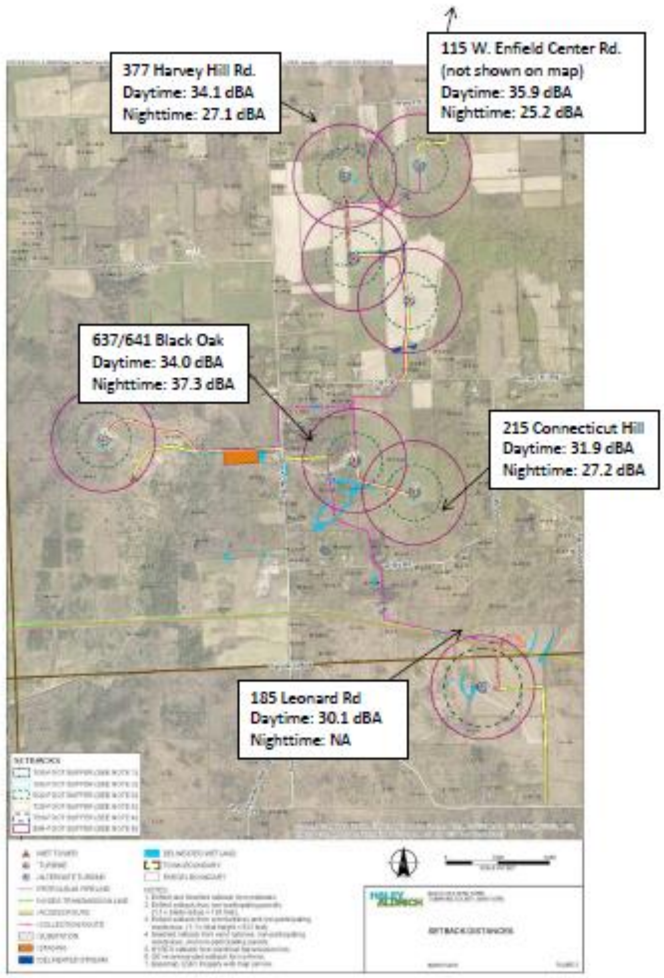
0 - 5 Hours / Year
5 - 10 Hours / Year
10 - 15 Hours / Year
15 - 20 Hours / Year
20 - 25 Hours / Year
25 - 30 Hours / Year
> 30 Hours / Year

0 2,000 4,000 Ft

Black Oak Wind Farm, LLC
Enfield, New York

Figure 11
GE 2.0-2.4 Turbine Shadow Flicker Calculations Including Turbine Location 7B & 7C

Ambient Sound Levels Near BOWF



April 22, 2016

Prepared by Les Blomberg, Noise Pollution Clearinghouse, PO Box 1137, Montpelier VT 05601

I. Introduction

On April 17th and 18th, 2016, ambient sound measurements were made in the vicinity of the proposed Black Oak Wind Farm (BOWF). Three of the five sites were chosen for their proximity to the newly proposed Turbines A, B, and C. The other sites are on property lines near Turbines 5 and 6, which have new locations since the FEIS was accepted. In addition, the character of the soundscape was observed.

II. Ambient Sound levels Near BOWF

Short term daytime and nighttime ambient sound measurements were made at five locations on April 17th and 18th, 2016. The test used the same 20 minute time frame used by HMMH and reported in the DEIS Appendix T. Measurements were made with a 3M Sound Pro sound level meter, serial number BLM060007. This meter meets ANSI Type 1 specifications. The sound level meter calibration was checked before, during, and after the measurements, using a Quest QC-10 Calibrator. The accuracy of both the sound level meter and the calibrator were checked by the manufacturer in April of 2016. A wind screen was used during measurements.

The measurements used the "A-weighted" frequency weighting, and the fast time response. The 20 minute Leq was recorded, as well as the maximum value, the L1, L10, L50, L90 and minimum values.

The measurement locations include:

- 637/641 Black Oak Rd.
- 115 Enfield Center Rd.
- 215 Connecticut Hill Rd.
- 185 Leonard Rd.
- 377 Harvey Hill Rd.

Figure 1 shows the locations of the noise measurements. The locations and noise Leq ambient levels are shown superimposed on Figure 5 of the DSEIS.

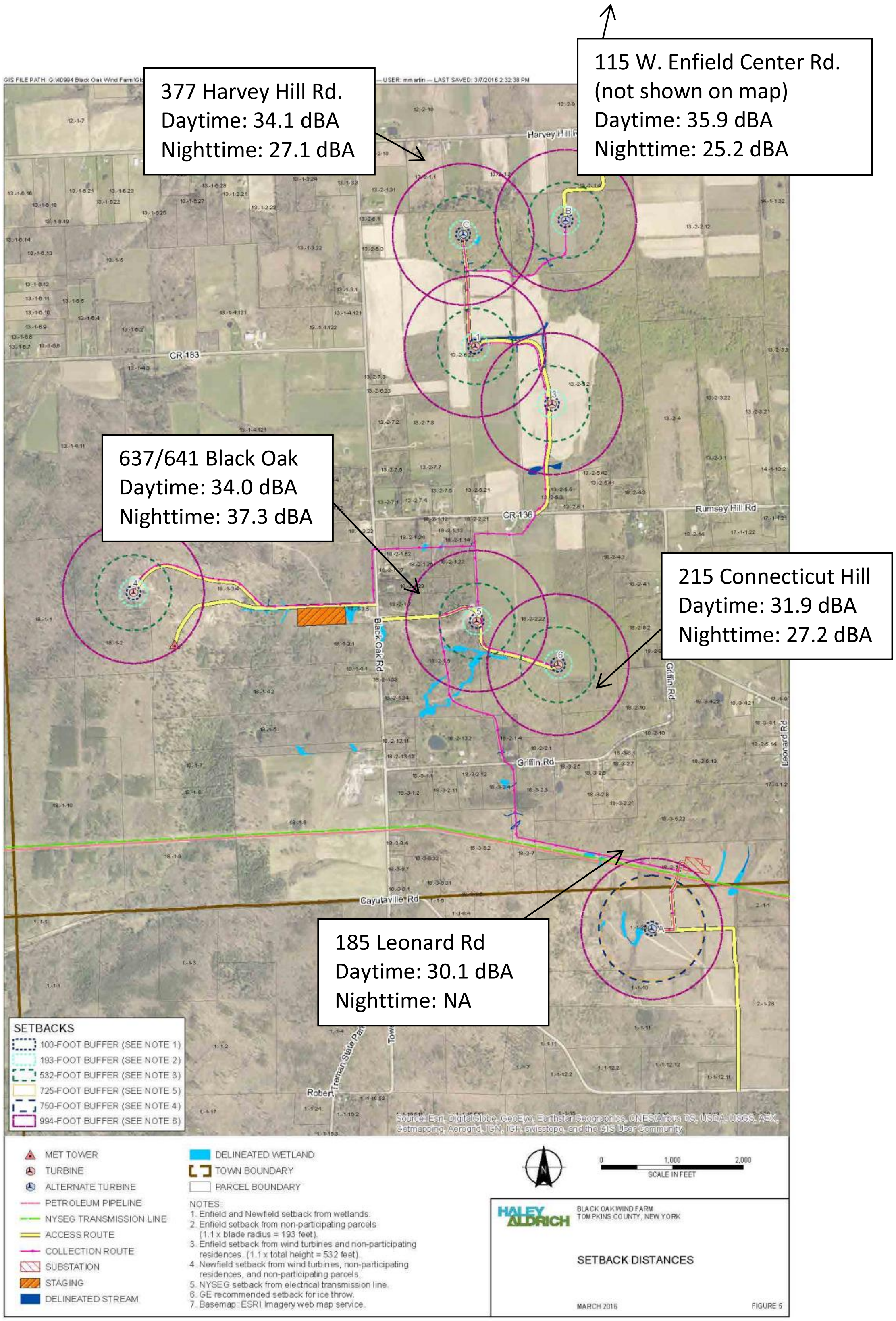


Figure 1: Approximate Measurement Locations

Figure 2 shows the measurement results.

Daytime								
Location	**Date and Time**	**Leq**	**Lmax**	**L1**	**L10**	**L50**	**L90**	**Lmin**
637/641 Black Oak Rd.	4/17/16 16:00	34.0	54.6	45.7	35.4	28.5	24.2	21.4
115 W. Enfield Center Rd.	4/18/16 11:45	35.9	58.0	47.4	38.4	29.3	25.0	21.5
215 Connecticut Hill Rd.	4/18/16 11:00	31.9	58.1	43.7	33.1	27.4	23.3	19.4
185 Leonard Rd.	4/18/16 9:55	30.1	41.3	35.4	32.6	29.3	24.3	21.7
377 Harvey Hill Rd.	4/17/16 17:10	34.1	53.3	42.0	36.9	31.4	29.1	27.2
Nighttime								
637/641 Black Oak Rd.	4/17/16 22:45	37.3	43.5	39.6	38.4	37.1	35.7	NA
115 W. Enfield Center Rd.	4/17/16 23:45	25.2	46.2	37.1	26.9	20.7	18.8	15.6
215 Connecticut Hill Rd.	4/17/16 21:15	27.2	48.1	36.5	27.5	25.2	23.6	21.6
185 Leonard Rd.	NA							
377 Harvey Hill Rd.	4/17/16 22:10	27.1	49.4	33.4	29.6	25.5	19.9	14.2

Figure 2. Ambient Sound Levels

The Leq is the "level equivalent" or average level for the period. The Lmax is the maximum value recorded. The L1 is the level exceeded 1% of the time. The L10 is the level exceeded 10% of the time. The L50 is the level exceeded 50% of the time; it is the median value. The L90 is the level exceed 90% of the time. The Lmin is the minimum value recorded. The L90 is often used as the background level because it excludes transient noises. It is more representative of the ambient because it excludes short term events such as a bird chirping nearby, which are more dependent on the nearness of the bird to the meter than the actual ambient in the area.

III. Character of the Area and Soundscape

The measured ambient sound levels were representative of a rural soundscape remote from large roads. The dominant ambient sounds were natural sounds such as wind in the trees, birds, and frogs. Intermittent sounds included vehicles on roads, jets overhead, and barking dogs. For the most part, however, the ambient level depended on how close the microphone was to a natural noise source. For example, the 58.0 dBA Lmax at the 115 Enfield Center location was due to a bird in a nearby tree. The elevated nighttime levels at the Black Oak location were due to frogs nearby. The one-third octave measures from the Black Oak location clearly show very large spikes in the 2.5 KHz and 3.15 KHz ranges.

The measurements are similar to the 20 minute measurements taken by HMMH for the DEIS. With the exception of the frogs at the Black Oak Rd. location, the nighttime measurements are very similar, between 25 and 30 dBA Leq. The daytime measurement range was about 5 dBA higher in the HMMH study. (It should be noted that the HMMH study subtracted the contribution of the frogs from the data, but the NPC study did not.)

Table 1 – Noise Monitoring Results at Short-term Measurement Sites

Site	Address	Start Time (24-hour)	Duration (min)	Lmax	Lmin	Adj Leq
				(dBA)		
Nighttime						
ST-1	655 Black Oak Rd.	3:10	20	29.9	21.3	**25.3**
ST-2	283 Connecticut Hill Rd.	3:40	20	44.3	22.7	**30.0**
ST-3	122 Giffin Rd.	4:40	20	33.4	27.5	**29.1**
ST-4	Black Oak Rd. at Cayutaville Rd.	5:10	20	36.5	23.6	**26.1**
Daytime						
ST-1	655 Black Oak Rd.	12:00	20	50.7	28.8	**36.5**
ST-2	283 Connecticut Hill Rd.	12:40	20	63.0	29.0	**40.6**
ST-3	122 Giffin Rd.	13:20	20	52.7	36.7	**37.4**
ST-4	Black Oak Rd. at Cayutaville Rd.	14:00	20	60.9	34.2	**39.4**

Figure 3. Short Term Ambient Measurements from the DSEIS Appendix T.

IV. Implications for the DSEIS

The ambient sound level data has a number of implications for the DSEIS. These include:

- Natural sounds dominate the existing soundscape. This has important implications for the DSEIS assessment of the character of the area and the impact of turbine noise on the character of the area and soundscape.
- This data provides the only ambient sound levels submitted for the DSEIS concerning the ambient sound levels near property lines affected by the new or moved turbines.
- This data provides the only ambient sound level submitted for the DSEIS concerning the ambient sound levels near the newly proposed Turbines A, B, and C.
- The ambient sound levels do not support the use of 39.8 dBA as the ambient noise level from which to judge increases in noise over ambient in the DSEIS.
- The wind turbines increase the noise at the 4 locations for which modeling data is available by more than 6 dBA.

The increase in noise at the measurement locations due to the wind turbines is shown in Figure 4. In Figure 4, the ambient sound levels are subtracted from projected noise levels shown on Figures 1, 2, and 3 of Appendix H of the DSEIS. The increase at the specific locations ranges from approximately 15 to 28 dBA.

Daytime				
			DSEIS	Increase
			Modeled	Above
Location	**Date and Time**	**Leq**	**Level**	**Ambient**
637/641 Black Oak Rd.	4/17/16 16:00	34.0	52	**18.0**
115 W. Enfield Center Rd.	4/18/16 11:45	35.9	NA	
215 Connecticut Hill Rd.	4/18/16 11:00	31.9	55	**23.1**
185 Leonard Rd.	4/18/16 9:55	30.1	45	**14.9**
377 Harvey Hill Rd.	4/17/16 17:10	34.1	53	**18.9**
Nighttime				
637/641 Black Oak Rd.	4/17/16 22:45	37.3	52	**14.7**
115 W. Enfield Center Rd.	4/17/16 23:45	25.2	NA	
215 Connecticut Hill Rd.	4/17/16 21:15	27.2	55	**27.8**
185 Leonard Rd.	NA		45	
377 Harvey Hill Rd.	4/17/16 22:10	27.1	53	**25.9**

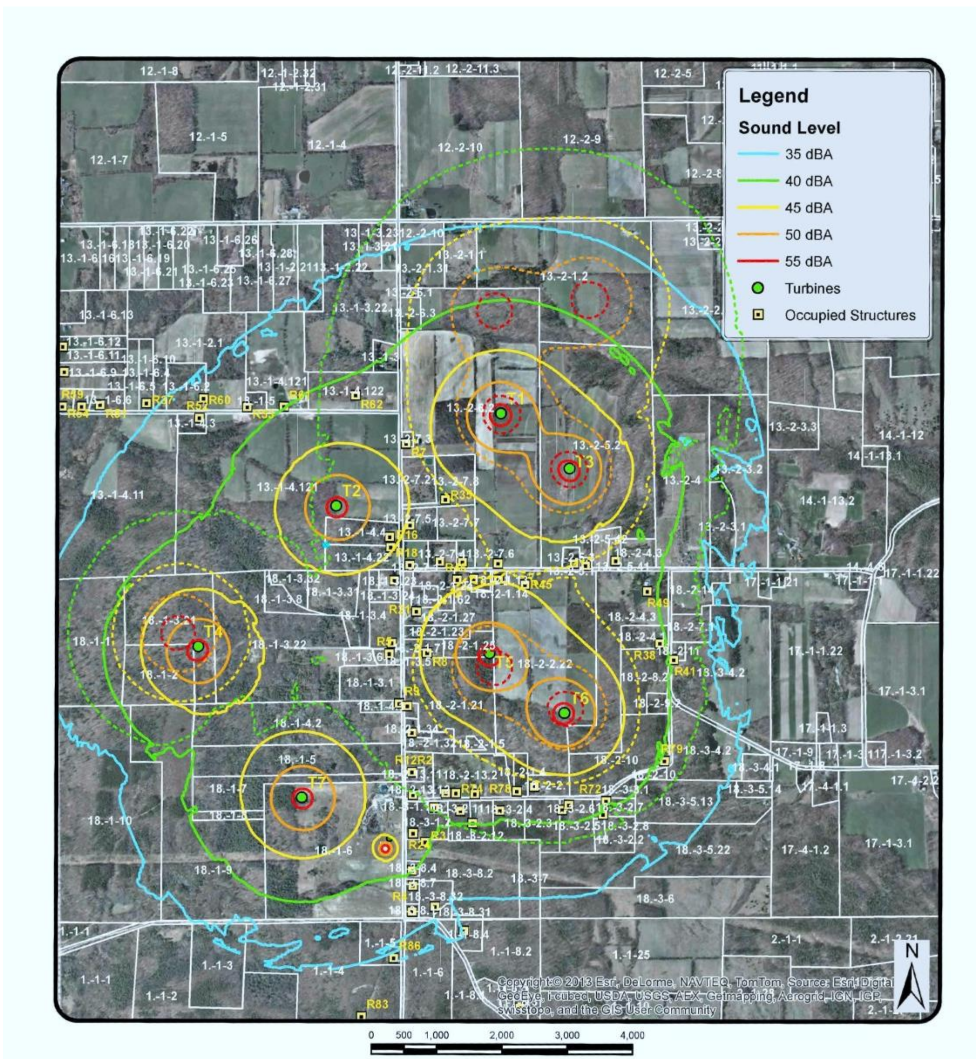
Figure 4. Increase Above Ambient Due to BOWF

Conclusion

The ambient sound levels measured by the Noise Pollution Clearinghouse are similar to those measured by HMMH, particularly in the nighttime. They are consistent with a quiet rural soundscape remote from large roads.

Note: The methods and data used in this report are not secret or proprietary. We would hope that the Town Board/BOWF would share with us the modeling and monitoring data we requested, and provide us additional time to analyze the data and comment on the DSEIS. We would be happy exchange data with the Town Board/BOWF as well as address further questions the Town Board might have.

Critique of the Noise Analysis of the Draft Supplemental Environmental Impact Statement for the Black Oak Wind Farm



April 20, 2016

Prepared by Les Blomberg, Noise Pollution Clearinghouse, PO Box 1137, Montpelier VT 05601

Contents

Introduction

This report is a critique of noise analysis in the Draft Supplemental Environmental Impact Statement for the Black Oak Wind Farm (DSEIS), submitted on February 22, 2016, and the noise appendix, Appendix H of the DSEIS. To the extent that the DSEIS relied upon the prior Final Environmental Impact Statement (FEIS) and Appendix K, and the Draft Environmental Impact Statement (DEIS) and Appendix T, those are also critiqued.

The report is divided into 12 parts (I-XII) and it describes how the DSEIS failed to take a hard look at the noise impacts of the Black Oak Wind Farm (BOWF). The DSEIS failed to thoroughly analyze turbine noise for significant adverse impacts and failed to support its determination of no significant impact. Specific problems include:

1. The DSEIS failed to actually assess noise impacts of the project. Part IV.
2. The DSEIS failed to assess noise with respect to local laws. Part V.
3. The DSEIS incorrectly compared its noise data to the New York State Department of Environmental Conservation (NYSDEC) SEQRA Criterion of Significance. Part VI.
4. The noise modeling the DSEIS used is unreliable. Part VII
5. The noise monitoring the DSEIS used is unreliable. Part VIII

The DSEIS failed to analyze BOWF with respect to its own proposed tests of significant noise impacts (Parts V-VI). Had it correctly done that analysis, it would have concluded that the project has significant noise impacts (Parts IX-XII).

Before examining the specific ways in which the DSEIS failed to take a hard look at the noise impacts of BOWF, it is important to understand noise pollution (Part I), the rural context of the existing acoustic environment (Part II) and the unique character of wind turbine noise (Part III).

I. Understanding Noise and Noise Pollution

Noise: a sound that interferes with a task, function, process, health or wellbeing; a sound that is inharmonious or out of place

The term noise has multiple definitions because it has multiple uses. We use noise to describe a large range of sounds, including very loud sounds that cause hearing loss (a threat to well-being), sounds that are too loud (out of place or inappropriate), and quiet sounds that are distracting, such as a dripping faucet in a quiet home or a distracting buzz. Even these quieter noises might also interfere with well-being because they might interfere with falling asleep or concentration.

The word "noise" is derived from the Latin word "nausea," meaning "seasickness." As its derivation suggests, noise has many unpleasant and harmful effects. It can cause hearing loss, stress, high blood pressure, sleep loss, lost productivity, and a general reduction in the quality of life and opportunity for personal and collective tranquility. It can interfere with communication and activities. Noise triggers the fight or flight response, resulting in stress related changes to our body.

Noise is an objective pollutant. It can be quantified and has known and quantifiable effects.

People discussing noise often refer to a phenomenon called habituation, and mistakenly assume people get used to noise. This is not the case. Some people do habituate to some noises, just as some people can get used to living with a yard full of litter. Habituation, however, is by no means universal. Also, habituation always comes at a cost. The underlying physiological changes in one's body, including stress related hormones, blood chemistry, etc, occur in the presence of noise, whether or not the listener is aware of them or habituated to them.

Noise sensitivity can also develop with repeated exposure to noise, resulting in a heightened awareness of the degradation of the soundscape and its effects on people.

Noise Pollution: A Noise Emitted into the Environment

In general, noise and its effects are imposed more directly on one's neighbors than the effects of acid emissions or CO_2, which are imposed at a greater distance (both temporally and spatially) and in a more generalized, societal manner. Since the impact of noise tends to be more localized than many other pollutants, noise pollution tends to have more in common with second-hand smoke and litter than, for example, acid rain or global warming. It helps to think of noise pollution as both second-hand sound and audible trash.

Noise is second-hand sound. Like second-hand smoke, second-hand sound, is a waste product of the activities of others, emitted into the environment—into the air. It negatively effects well-being, yet is emitted without the consent of the recipient.

Noise is audible trash or aural litter. Noise is to the soundscape as litter is to the landscape. It is the aural equivalent of McDonalds wrappers strewn around the environment. If one pays attention, one will realize there is much more audible litter than there are cans, bottles, paper, etc, littering our landscape. If we could see our soundscape, particularly the urban soundscape, it would look like a landfill.

When Is Noise Pollution a Problem?

There are a number of acoustical factors influencing people's response to noise and their ability to tolerate it. The most important of these includes the loudness of the noise, the character of both the noise and the neighborhood, whether it is heard in the home, and whether it interferes with activities, communication or sleep.

Noise does not occur in a vacuum, both literally and figuratively. There are always political, social, economic and psychological aspects of noise problems. Consequently, several non-acoustical factors associated with noise also shape how well people tolerate noise.

The most important of these is the reciprocity of the noise—whether the neighbors impose the same types and amount of noise on each other. Also very important are people's ability to control the noise and their attitude toward the noise source. Finally, people have varying sensitivity to noise, and people who are more noise sensitive will more likely react negatively to noise.

II. Quiet Is the Expectation in Rural Areas

Character of the neighborhood (quiet, rural, suburban, urban, etc.) can be one of the best indicators of the extent of a problem caused by intruding noise. The nature of the soundscape and the expectations of people who live there significantly shape people's reaction to noise.

In a soundscape with a quiet background, noise is much more intrusive. A 55 decibel noise, which might be around the background level in an urban area near roadways, could be 30 decibels above the background in a rural setting. As a rough approximation, each 10 decibel increase is a doubling of the loudness,[1] so the noise would dominate the soundscape, being 8 times louder than the background.

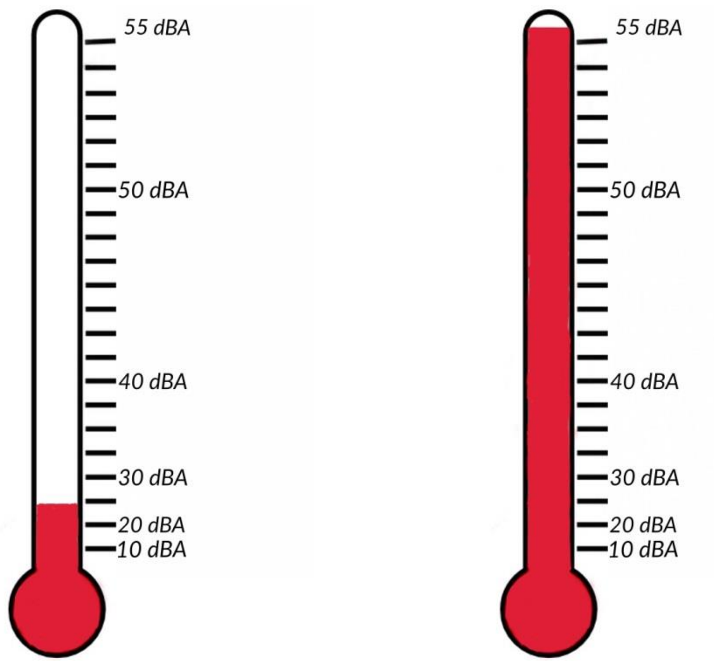


Figure 1. Graphic Noise Thermometer

The noise thermometer shows that the loudness of noise doubles with each 10 dBA increase in the noise level. The noise on the left is 25 dBA, a common level for a rural area at night. The noise on the right is 55 dBA. It is 8 times louder than the 25 dBA noise. A 45 dBA noise would be four times as loud. A 45 dBA or 55 dBA noise would absolutely dominate a rural nighttime soundscape.

The other factor important in the character of the neighborhood is the community's expectation. Rural communities tend to have a greater expectation of and place a greater value on quiet. An ISO noise standard notes that this expectation for quiet can account for a 10 decibel difference in reaction to noise.

The figure below provides the results of an interesting study that confirms the expectation for peace and quiet in rural areas. The number one expectation of rural living, among urban, suburban, and rural residents is that rural areas are quiet.

[1] EPA, 1981, Noise Effects Handbook, 7-2.

Item	Rural (N=571)[a]			Urban (N=384)			Suburban (N-284)		
	Agree	Undecided	Disagree	Agree	Undecided	Disagree	Agree	Undecided	Disagree
Rural life brings out the best in people.	63.2	20.8	15.9	46.5	27.2	26.4	48.9	26.4	24.6
Rural families are more close-knit and enduring than other families.	71.6	13.0	15.4	61.2	11.7	27.1	66.7	11.3	22.0
Because rural life is closer to nature, it is more wholesome.	85.6	7.2	7.2	73.7	8.1	18.2	72.9	7.7	19.4
Rural communities are the most satisfying of all places to live, work and play.	68.8	13.7	17.5	39.8	18.0	42.2	43.7	13.7	42.6
Rural people are more likely than other people to accept you as you are.	65.7	13.1	21.2	53.4	14.6	32.0	51.4	13.7	34.9
Neighborliness and friendliness are more characteristic of rural communities than other areas.	77.7	8.8	13.5	69.0	11.2	19.8	64.8	10.9	24.3
Life in rural communities is less stressful than life elsewhere.	69.3	8.1	22.6	60.7	8.6	30.7	63.0	8.8	28.2
There is less crime and violence in rural areas than in other areas.	73.4	8.1	18.6	67.4	9.7	23.0	70.8	10.6	18.7
Rural areas have more peace and quiet than do other areas.[b]	**94.6**	**1.9**	**3.5**	**89.3**	**3.4**	**7.3**	**91.9**	**1.8**	**6.3**

a Number of cases varies slightly from item to item due to missing data.
b Emphasis added.

Table 2. Responses in percent from rural, urban and suburban residents to items dealing with positive images of rural life (after Willits *et al.*, 1990).

Schomer, 2001, Assessment of Noise Annoyance, 27

Figure 2. Expectation of Quiet in Rural Areas

Character of the neighborhood played a central role in the EPA's development of a 55 dBA criterion. This is because their data on the community response to noise was essentially unusable before the noise levels were adjusted or normalized to an *urban residential neighborhood*.

Figure 3 below shows the EPA data on community response to noise, before it was normalized. You can see that a noise level that falls below 50 dBA might result in no reaction or widespread reaction. A noise between 50 dBA and 60 dBA might cause no reaction, sporadic complaints, widespread complaints, or several threats of legal action. There appears to be little relationship between noise level and community response.

The problem was that the EPA data focused solely on the source noise and not the existing noise level and expectation of the community. When the EPA took that existing soundscape into account, the results were much better. In this case there is a clear relationship between increasing noise and increasing community response. See Figure 4.

The EPA had to adjust or normalize its data to an urban residential situation. The adjustments to the data that the EPA made are given in Figure 5. Quiet suburban or rural communities were adjusted 10 decibels; normal suburban communities were adjusted 5 decibels. In addition, communities with no prior experience with intruding noise were adjusted another 5 decibels.

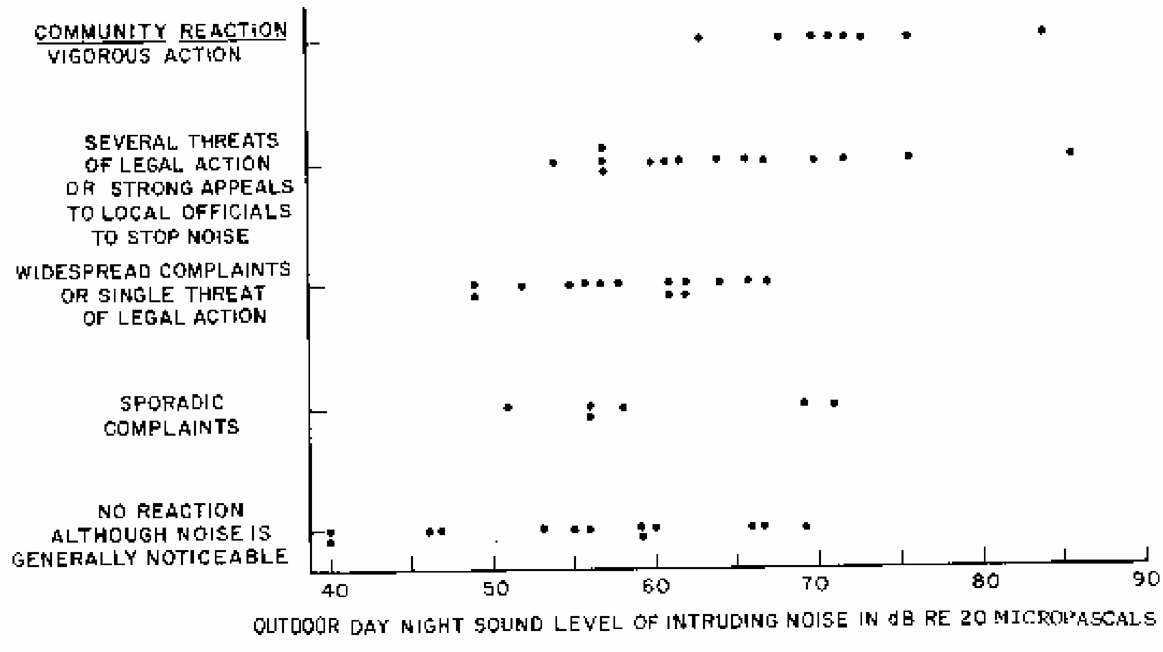


Figure 3. EPA Data: Community Reaction vs Sound Pressure Level. (Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, EPA, 1974).

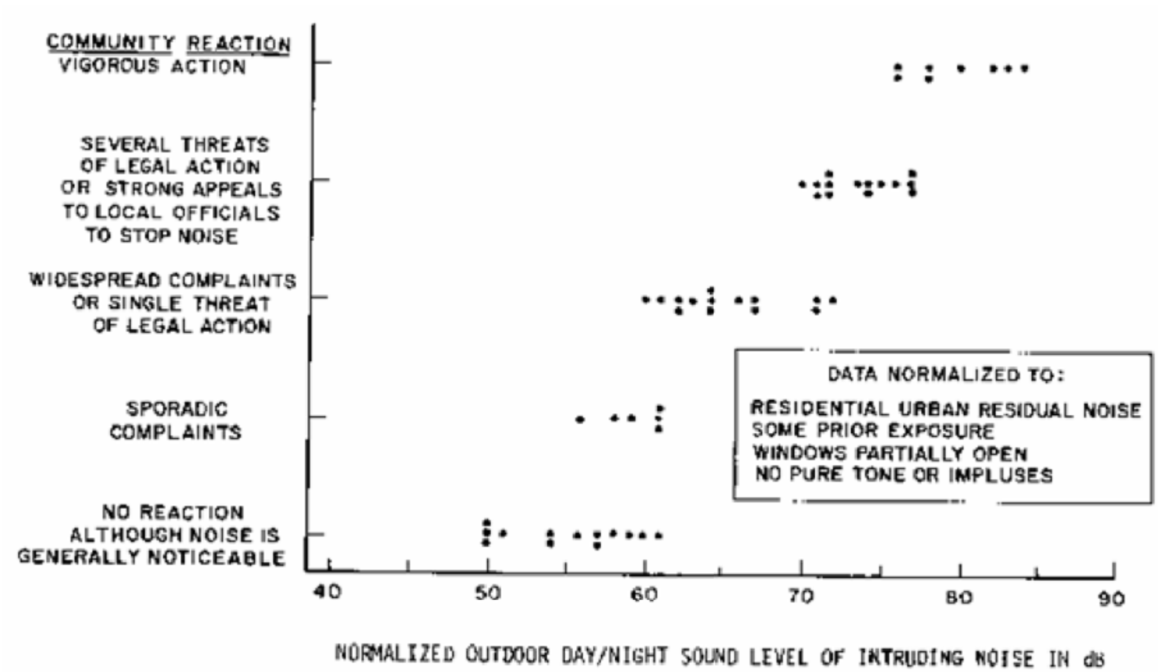


Figure 4. EPA Data: Community Reaction vs Sound Pressure Level. (Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, EPA, 1974).

CORRECTIONS TO BE ADDED TO THE MEASURED DAY-NIGHT SOUND LEVEL (L_{dn}) OF INTRUDING NOISE TO OBTAIN NORMALIZED L_{dn}

Type of Correction	Description	Amount of Correction to be Added to Measured L_{dn} in dB
Seasonal Correction	Summer (or year-round operation) Winter only (or windows always closed)	0 -5
Correction for Outdoor Noise Level Measured in Absence of Intruding Noise	Quiet suburban or rural community (remote from large cities and from industrial activity and trucking)	+10
	Normal suburban community (not located near industrial activity)	+5
	Urban residential community (not immediately adjacent to heavily traveled roads and industrial areas)	0
	Noisy urban residential community (near relatively busy roads or industrial areas)	-5
	Very noisy urban residential community	-10
Correction for Previous Exposure & Community Attitudes	No prior experience with the intruding noise	+5
	Community has had some previous exposure to intruding noise but little effort is being made to control the noise. This correction may also be applied in a situation where the community has not been exposed to the noise previously, but the people are aware that bona fide efforts are being made to control the noise.	0
	Community has had considerable previous exposure to the intruding noise and the noise maker's relations with the community are good	-5
	Community is aware that operation causing noise is very necessary and it will not continue indefinitely. This correction can be applied for an operation of limited duration and under emergency circumstances.	-10
Pure Tone or Impulse	No pure tone or impulsive character Pure tone or impulsive character present	0 +5

Figure 5. EPA Normalization Factors (EPA, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, 1974).

The EPA recommendation of 55 dBA which is found in the NYSDEC criterion of significance, is a recommendation for urban residential neighborhoods. For Enfield, New York, one would subtract 10 dBA from 55 because it is a quiet rural area, 5 dBA because it has no prior experience with wind turbine noise, and 5 dBA because of the character of turbine noise. A noise level of 35 dBA is necessary to protect the rural area using the EPA data.

The more important criterion of significance in the NYSDEC document is the 6 dBA increase criterion. The EPA noted that, "The data in Figure D-7 [Figure 4 in this report] indicates that widespread complaints may be expected when the normalized value of the outdoor day-night sound level of the intruding noise exceeds that existing without the intruding noise by approximately 5 dB, and vigorous community reaction may be expected when the excess approaches 20 dB. The standard deviation of these data is 3.3 dB about their means and an envelope of +5 dB encloses approximately 90 percent of the cases. Hence, this relationship between the normalized outdoor day-night sound level and community reaction appears to be a reasonably accurate and useful tool in assessing the probable reaction of a community to an intruding noise and in obtaining one type of measure of the impact of an intruding noise on a community." (EPA, 1974, D-20.)

III. Wind Turbine Noise is Different from Other Noise Sources

Wind turbine noise is different from traditional noise sources. Wind turbine noise elicits reactions that are more commonly associated with much higher sound pressure levels.

Some of the factors that make wind turbine noise unique are listed below.

- Wind turbines are an overhead source. Overhead sources are difficult or impossible to block with barriers, and they enter houses both from above and the sides, often requiring more insulation.
- Wind turbine noise is often more prominent in the evening and nighttime.

Typical noises tend to better correlate with when people are working. Wind turbine noise often is not masked by wind due to wind gradients (low ground wind speeds but higher turbine height wind speeds).

- Wind turbine noise is unpredictable. People cannot know ahead of time when the noise will be present, so that they can plan around the noise.
- Wind turbine noise is not reciprocal. Typical rural noises have no impact on wind turbines, but wind turbines impact rural life.
- Wind turbine noise is unique and unusual in a rural environment. There is nothing equivalent to it.
- Wind turbine noise is not constant. It has a time varying component that various people have described as beating, swishing, or thumping.
- Wind turbine noise has a low frequency that more easily penetrates homes.
- In rural areas, wind turbines are audible at a greater distance than almost every other rural noise source.

That wind turbine noise is different from other noise sources can be seen from studies of individual reactions to noise. Annoyance[2] from wind turbine noise has been studied and dose-response relationships (the quantification of how impact increases as the noise increases) for turbine noise has been developed by Pedersen and Waye, as well as other researchers. The salient aspect of this research is that the dose-response curve for wind turbine noise is much steeper than for other noise sources. For the same noise level, people find wind turbine noise much more annoying than other noise sources such as road noise or aviation noise. This is due to the unique characteristics of wind turbine noise and possibly the interaction with visual impacts that may draw people's attention to the turbine noise.

Pedersen's 2004 paper published in the Journal of the Acoustical Society of America, the premier journal in the field, compares the dose-response curves for turbine noise and other noise sources, and is shown in Figure 6.

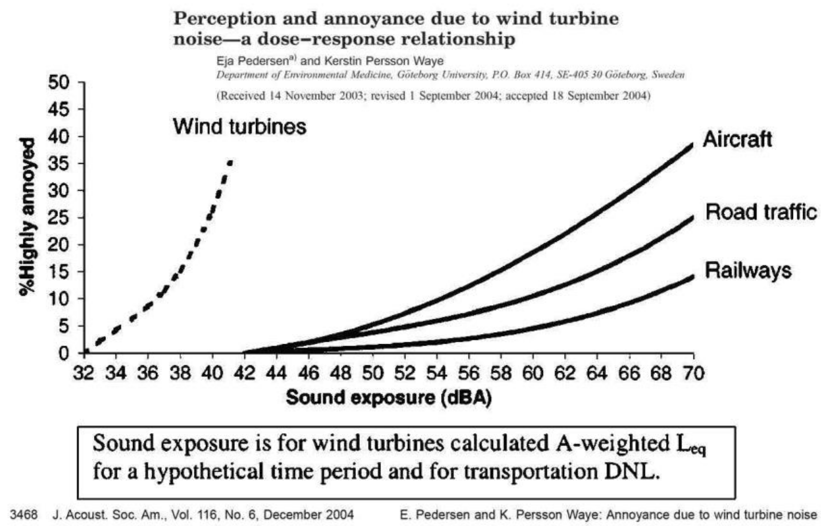


Figure 6. Wind Turbine Noise Elicits a Greater Response at Lower Noise Levels than Other Noise Sources

It is clear from Figure 6 that wind turbine noise is very different from other noise sources: it is much more annoying and at lower noise levels than other noise sources. Consequently, to protect the public from the effects of wind turbine noise, much lower noise limits are needed.

[2] The primary measure of noise effects on humans for the last 60 years has been annoyance. Annoyance is perhaps the most easily studied noise effect, and until the advent of the documentation of health effects related to noise in the 21st century and the release of World Health Organization's Burden of Disease from Environmental Noise in 2009, annoyance was the best metric to quantify noise effects. Annoyance acts as a composite measure of human response to specific health and other effects of noise. People who, for example, suffer sleep interference, communication interference, activity interference, or stress related effects will likely report that they are annoyed by noise. People are annoyed because of specific effects of noise they experience.

IV. Critical Questions the DSEIS Noise Analysis Failed to Answer

An environmental assessment is an evaluation of the known or potential environmental consequences of a proposed action. According to the SEQRA Handbook, "The draft EIS is the primary source of environmental information to help involved agencies consider environmental concerns in making decisions about a proposed action. The draft also provides a basis for public review of, and comment on, an action's potential environmental effects. The draft EIS accomplishes those goals by examining the nature and extent of identified potential environmental impacts of an action, as well as steps that could be taken to avoid or minimize adverse impacts." (SEQRA Handbook, 117.)

Noise, as discussed in Part I above, has a host of impacts. The problem is that the DSEIS didn't identify any relevant areas of environmental concern related to noise,[3] didn't thoroughly analyzed them for significant adverse impact, and provided no reason for ignoring the environmental impacts of noise.

Figure 7 lists impacts of noise that were not considered in the DSEIS and were not analyzed in the DSEIS. A red X means the question was not addressed; green check means it was addressed, and a very small green check means it was somewhat addressed. What is truly striking is that these were not even addressed in the Noise Appendix H of the DSEIS.

Noise Impacts Not Investigated in the DSEIS

NOISE IMPACT THAT SHOULD HAVE BEEN INVESTIGATED	Investigated in DSEIS?	Investigated in APP. H?
How will the turbine noise change the character of the area?	X	X
Where will turbines be audible?	X	X
Where will turbine noise dominate current ambient conditions?	X	X
Will neighbors be able to escape the noise by going indoors?	X	X
Where will turbines be audible inside homes?	X	X
Where will the noise be annoying? Highly annoying?	X	✓
Where will the noise interfere with outdoor activities or their enjoyment?	X	X
How will the community react to the turbine noise?	X	X
Predicted response based on EPA's *Levels Document,* Table D-7?	X	X
Will the noise change the acceptable uses of neighbors' properties?	X	X
Where will lands be unsuitable for future residential use?	X	X
Where will health impacts of noise occur?	X	X
Cardiovascular/stress related effects?	X	X
Sleep interference, awaking, sleep stage changes, difficulty falling asleep?	X	X
Secondary sleep interference effects such as fatigue, reduced performance, irritability?	X	X
Decreased helping behavior and increased aggressive behavior?	X	X
Decreased performance?	X	X
What will be the noise effects on wildlife and where will they occur?	X	X
Will infrasound from the turbines cause impacts?	X	X

Figure 7. Noise Impacts Not Investigated in the DSEIS.

[3] The DSEIS did mention "annoyance," but only in passing, and only with respect to noise in the 31.5 and 63 Hz frequency bands.

It is not reasonable to ignore noise impacts, including health related impacts, in a DSEIS noise analysis. The point of the EIS process is to identify impacts early in the DSEIS process and to disclose them to the public, so that they can be mitigated if needed. This is not a problem that can be addressed by adding a couple paragraphs to the FSEIS, because the impacts would have been hidden from the public until the final moment when the public can no longer comment or participate. A new DSEIS is needed to address these impacts.

V. DSEIS Fabricated a Local Regulatory Standard and Made a Mess of the Local Standard Assessment

As noted in Part IV above, the DSEIS did not analyze or even mention noise impacts, or any criteria of significant impact related to any specific noise impact. Instead, the DSEIS relied on the local wind law and the NYSDEC criterion of significance. Part V shows that the DSEIS botched the local standard noise analysis. (The critique of the NYSDEC criterion of significance analysis is found in Part VI below.) The crux of the problem related to the DSEIS, FEIS, and DSEIS treatment of the local regulatory noise limit is that these documents used as a test for significant adverse environmental impacts a criterion that is entirely fabricated. The result is that the DSEIS noise assessment is fatally flawed and needs to be corrected **before** the DSEIS can take a hard look at the noise impacts.

The DSEIS states that "[t]he criteria against which to compare the predicted noise from the Modified Project to determine if any significant adverse environmental impacts might result include the local regulatory noise limits ….The same assessment criteria described in the DEIS for the Approved Project were applied to the Modified Project…." (DSEIS, 37.)

Note that the DSEIS didn't specifically say what the Enfield regulatory noise limit in is in the DSEIS noise analysis. Appendix H of the DSEIS states: "The Town of Enfield's Local Law Number 1 of 2009, entitled 'Wind Energy Facilities Local Law' sets a sound limit of 60 A-weighted decibels (dBA) at the nearest Non-Participating residence." (DSEIS, Appendix H, 1.) Table 13 on page 21 of the DSEIS states that sound levels "[s]hall not exceed 60 decibels at nearest offsite residence." Neither of these statements, however, is true. The standard in the DSEIS is completely fabricated.

The **real** local regulatory limit can be found in Local Law Number 1 of 2009, tilted "Wind Energy Facilities Local Law." Section 17 reads as follows:

> <u>Sound Levels and WTG Setbacks.</u> The following standards and requirements shall apply to each WTG:
>
> A. <u>Sound Levels.</u> The statistical Sound Pressure Level generated by a WTG shall not exceed 60 decibels above ambient sound levels measured at the nearest off-Site Residence.

The authors of the DSEIS presumably didn't use this standard as a criterion of significance because they realized it is a totally ridiculous standard. The standard of 60 decibels above ambient sound levels is unsupported by any science. A 60 decibels above ambient standard would permitted noise levels that would lead to significant impacts including hearing loss and a host of other health consequences.

It is important to understand that a 60 dBA above ambient level is 100 dBA, at least according to the DSEIS. The DSEIS claims that the ambient levels are 39.8 dBA. If we round that to 40 dBA, 60 dBA above ambient is 100 dBA. This is so loud that noise at this level can cause numerous health problems. To protect against hearing loss, for example, the US EPA and the World Health Organization recommend people be exposed to this level for less than 90 seconds each day.

I have surveyed "above ambient" noise standards from across the United States in a fourth coming paper entitled, *Preliminary Results of an Analysis of 491 Community Noise Ordinances*.[4] "Above ambient" standards are a common and accepted regulatory tool, but the Enfield standard of 60 decibels above ambient is far from reasonable—it is an outlier of the outliers. The Town of Enfield standard did not qualify for inclusion in the survey,[5] but if it had, it would have been the worst noise ordinance in the country, by 45 decibels. Here are the rankings of the least protective "above ambient" standards in the United States, if Enfield's had been included:

1. 60 dB Enfield, NY
2. 15 dBA Norman, OK
2. 15 dBA Kenosha, WI
2. 15 dBA West Valley City, UT

In the study, a 15 dBA "above ambient" criterion was an outlier, used by only three communities. "There were 47 communities employing an over ambient standard. Over ambient standards range from 0-15 dBA over ambient, with the median and mode being 5 dBA." (Blomberg, 2016.)

Moreover, scientific research conducted by the US EPA suggests that a 5 dBA increase or greater can cause widespread complaints. According to the US EPA:

> The data … indicate that widespread complaints may be expected when the normalized value of the outdoor day-night sound level of the intruding noise exceeds that existing without the intruding noise by approximately 5 dB, and vigorous community reaction may be expected when the excess approaches 20 dB.
>
> EPA, 1974, D-20[6]

The authors of the DSEIS probably didn't realize that the local regulation was set 55 decibels above the typical level in regulations in the United States, 45 decibels above the next highest standard in the United States, and 40 decibels above the level where the EPA found vigorous community reaction.

[4] Blomberg, 2016, *Preliminary Results of an Analysis of 491 Community Noise Ordinances*, Institute of Noise Control Engineering, Noise-Con 2016.
[5] All of the regulations in the 491 ordinance sample came from communities with greater than 60,000 people.
[6] US EPA, 1974, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, D-20.

They, nonetheless, seem to realize it is a ridiculous standard because the 60 decibels above ambient standard is not mentioned in the DSEIS, but the law that contains it is referenced indirectly.[7]

Moreover, neither the FEIS (2014) nor the DEIS (2013) mention the 60 decibel above ambient local standard. The DEIS, like the DSEIS, fabricates a new standard: "The Town's Wind Energy Facilities Local Law sets a sound limit of 60 dBA at the nearest non-participating residence" (DEIS, 191). These documents make two very significant changes to the local regulatory standard: removing "above ambient" changes the standard from a relative-to-ambient standard to an absolute standard, and the addition of the "A" after "dB" adds a frequency weighting to the standard that does not appear in the text of the local regulation. These changes to the local noise limits are arbitrary and not justifiable.

Faced with a ridiculous local standard with no foundation in science, and faced with a problem that has been known since at least February 2013[8], instead of correcting the problem, the DSEIS, FEIS, and DEIS chose instead to fabricate a new noise standard. There are two problems with this. First, if the DSEIS is going to use local regulatory laws as a criterion of significance, it needs to use those laws. A fabricated local noise standard for the determination of significant impacts cannot qualify as a "hard look." Second, only the Enfield Town Board, and not the authors of the DSEIS (and earlier DEIS and FEIS), can change the noise standard, and those changes must be done in a manner consistent with local and state laws.

The town must correct its local wind turbine noise regulatory limits **before** the DSEIS can take a hard look at the noise impacts of the project, and the DSEIS must correct the fabricated local noise limits with which it judges significant noise impacts before the DSEIS can be accepted. The fabricated local regulatory limits cannot be considered a criterion for significant adverse environmental impacts.

VI. DSEIS Fabricated an Ambient Noise Level and Messed Up the NYSDEC Criterion of Significance Assessment

Parts IV, V, and VI examine the inadequacies of the DSEIS noise analysis. In Part IV we noted that the DSEIS did not consider any criteria of significance with respect to specific noise impacts. In Part V, we showed that the DSEIS used a fabricated local standard as a criterion of significance. Part VI will show that the DSEIS ignored critical parts of the NYSDEC's guidance and fabricated an ambient level with which to assess significance that vastly understated noise impacts.

[7] "The criteria against which to compare the predicted noise from the Modified Project to determine if any significant adverse environmental impacts might result include the local regulatory noise limits and the noise assessment guidelines found in the NYSDEC's Assessing and Mitigating Noise Impacts (2000). The same assessment criteria described in the DEIS for the Approved Project were applied to the Modified Project …." (DSEIS, 37.)

[8] In a February 2013 report entitled Acoustic Study of the Black Oak Wind Farm by Tech Environmental, that later became Appendix T of the DEIS, the authors state: "The Wind Energy Facilities Local Law sets a sound limit of 60 dBA at the nearest non-participating residence." In a footnote, they acknowledge changing the standard: "Actually the Local Law states '60 dBA above ambient sound levels' **which will be interpreted to mean** 60 dBA." (DEIS, Appendix T, 7, emphasis added.) **Actually**, the local law does not even say "dBA". It says "60 decibels above ambient sound levels," not 60 A-weighted decibels above ambient. Appendix T knowingly changed the standard from 60 decibels above ambient to an absolute level of 60 dBA.

The DSEIS states that "[t]he criteria against which to compare the predicted noise from the Modified Project to determine if any significant adverse environmental impacts might result include … the noise assessment guidelines found in the NYSDEC's Assessing and Mitigating Noise Impacts (2000)." (DSEIS, 37.)

As the DSEIS notes, the NYSDEC's Assessing and Mitigating Noise Impacts (2000) states that "[i]n non-industrial settings the SPL should probably not exceed ambient noise by more than 6 dB(A) at the receptor." (NYSDEC, 2000, 14.) Moreover, "[t]he goal for any permitted operation should be to minimize increases in sound pressure level above ambient levels at the chosen point of sound reception." (NYSDEC, 2000, 13.)

The NYSDEC's Assessing and Mitigating Noise Impacts (2000) notes that "[i]n order to evaluate the above factors in the appropriate context, one must identify the following: 1) appropriate receptor locations for sound level calculation or measurement; 2) ambient sound levels and characteristics at these receptor locations; and 3) the sound pressure increase and characteristics of the sound that represents a significant noise effect at a receptor location." (NYSDEC, 2000, 13.)

The DSEIS errored in the selection of receptor locations and in obtaining accurate ambient sound levels at those locations. The NYSDEC's Assessing and Mitigating Noise Impacts (2000) state:

> Appropriate receptor locations may be either at the property line of the parcel on which the facility is located or at the location of use or inhabitance on adjacent property. The solid waste regulations require the measurements of sound levels be at the property line. The most conservative approach utilizes the property line. **The property line should be the point of reference when adjacent land use is proximal to the property line.** Reference points at other locations on adjacent properties can be chosen after determining that existing property usage between the property line and the reference point would not be impaired by noise, i.e., property uses are relatively remote from the property line.

(NYSDEC, 2000, 13, emphasis added.)

The DSEIS did not use the property line locations, and did not assess the adjacent land uses proximal to the property lines. Moreover, the DSEIS and Appendix H did not show the property lines in its noise analysis. Therefore, there is no way the DSEIS could have analyzed the property line noise levels. There are, however, areas proximal to the property lines that need analysis. For example, areas that are used as hiking trails or that are intended as home sites for children of the adjoining property owner. Moreover, noise levels at the property lines exceed 50 dBA in many cases and even exceed 55 dBA according to the modeling.

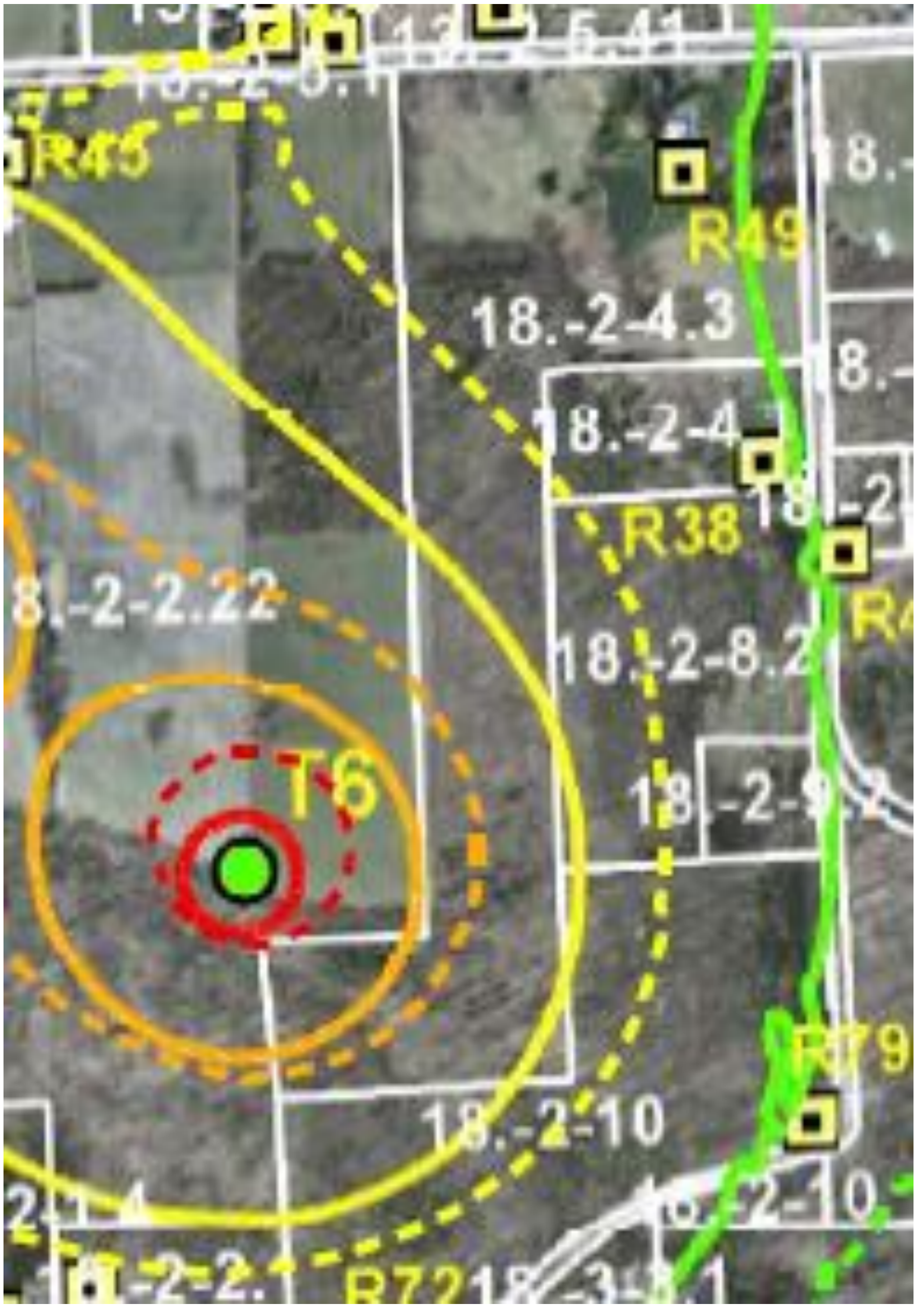


Figure 8. Predicted Noise Levels at the Property Line near Turbine 6.

Figure 8 shows the predicted noise levels near Turbine 6. It is a composite of Figure 3 from Appendix H of the DSEIS (the dotted contour lines) and Figure 2 of Appendix T of the FEIS (the solid contour lines). According to the legends of these Figures, the red line corresponds to the 55 dBA level; the orange, to the 50 dBA level. The property lines are shown in white. The red dotted line representing 55 dBA from the DSEIS turbine configuration clearly touches the property line south of Turbine 6 in Figure 8. This location has an existing hiking trail nearby.

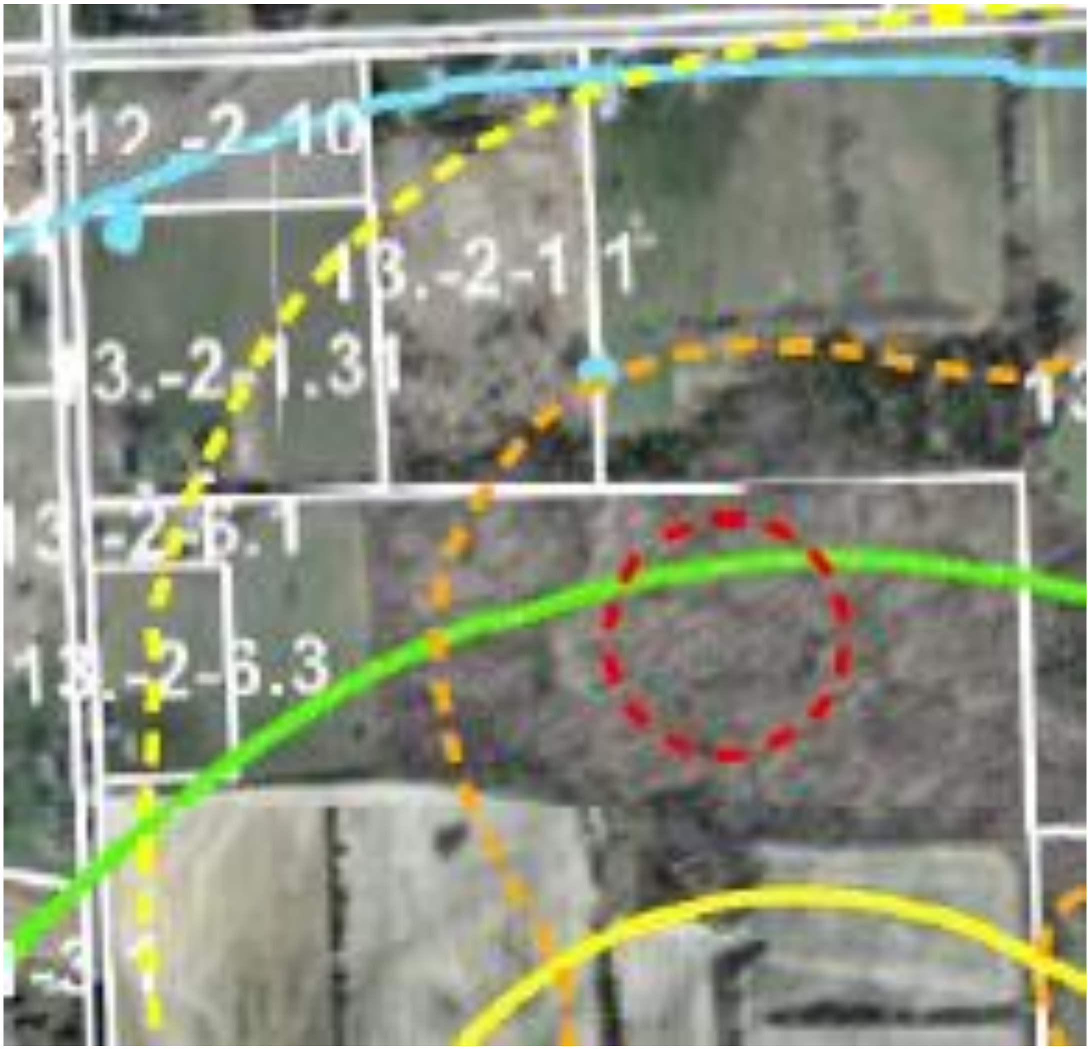


Figure 9. Predicted Noise Levels at the Property Line near Turbine C.

Figure 9 shows the predicted noise levels near Turbine C (not shown but inside the dashed red circle). It is a composite of Figure 3 from Appendix H of the DSEIS (the dotted contour lines) and Figure 2 of Appendix T of the FEIS (the solid contour lines). According to the legends of these Figures, the red line corresponds to the 55 dBA level; the orange, to the 50 dBA level. The property lines are shown in white. The orange dotted line representing 50 dBA from the DSEIS turbine configuration clearly crosses the property line northwest of Turbine C in Figure 9 marked 13.-2-1.1. This location is intended as a home site for the homeowners children, for which it would not be suitable if it were built.

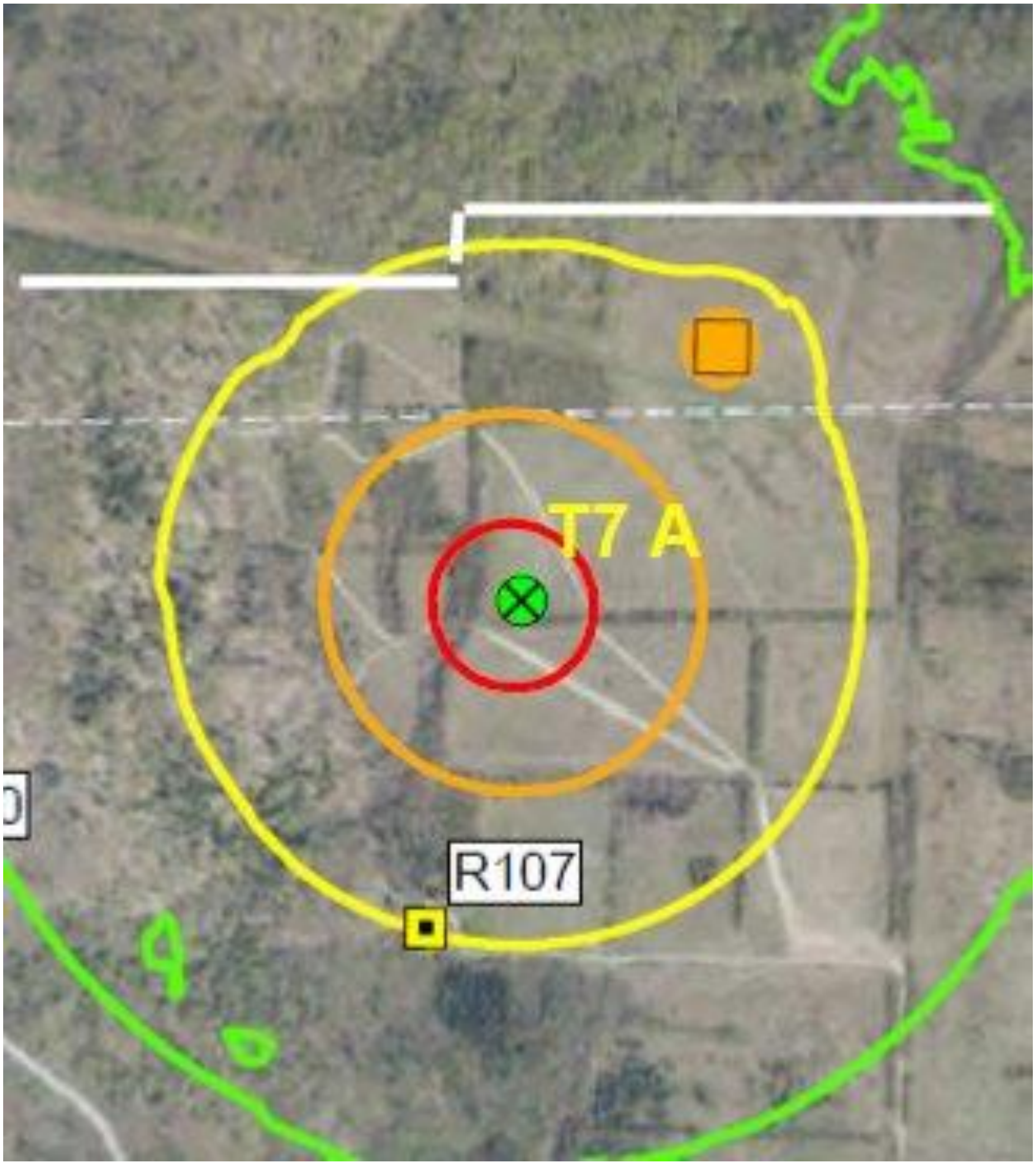


Figure 10. Predicted Noise Levels at the Property Line near Turbine A.

Figure 10 shows the predicted property line noise levels north of Turbine A from Figure 2 of the DSEIS Appendix H. The white property line of a non-participating neighbor has been added. From the figure one can see that the noise levels approach and exceed 45 dBA in this area. There is what the home owner calls his "second field" in this vicinity. It is a maintained grassy area with a structure.

Ambient levels at these and similar locations are not presented in the DSEIS. In an accompanying report from the Noise Pollution Clearinghouse, *Ambient Sound Levels Near BOWF*, ambient levels at these locations were measured, and they are shown Figure 11.

Ambient Sound Levels Near Selected Turbines

	Daytime Ambient	Nighttime Ambient
Near Turbine 6	31.9 dBA	27.2dBA
Near Turbine C	34.1 dBA	27.1 dBA
Near Turbine A	30.1 dBA	NA

Figure 11. Ambient Sound Levels Near Selected Turbines.

According to the DSEIS noise modeling, the predicted noise levels at the above locations are 55 dBA, 53 dBA, and 45 dBA. The results of subtracting the ambient sound levels from *Ambient Sound Levels Near BOWF* from the projected noise level are shown in Figure 12. The result is the approximate decibels above ambient that the turbine noise would cause, based on the modeling and the measured ambient noise levels.

Turbine Noise Level Compared to Ambient Near Selected Turbines

	Daytime	Nighttime
Near Turbine 6	~23 dBA above ambient	~28 dBA above ambient
Near Turbine C	~19 dBA above ambient	~26 dBA above ambient
Near Turbine A	~15 dBA above ambient	NA, but most likely > ~15 dBA

Figure 12. Turbine Noise Level Compared to Ambient Near Selected Turbines.

By not considering the property line as the appropriate receptor location, the DSEIS missed clear exceedances of the NYSDEC's 6 dBA above ambient criterion of significance. There are many possible examples like these around the project, since there are miles of property line around the project. These three examples clearly show that significant noise level increases do occur. The DSEIS failed to identify a significant impact of greater than a 6 decibel increase because it failed to take a hard look. In fact, it failed to take any look along property lines.

The NYSDEC document notes that increases in sound pressure level of over 20 dB are "very objectionable to intolerable." The DSEIS failed to identify a very significant increase in noise levels.

There is yet another way the DSEIS failed to take a hard look at the noise impacts. There are no ambient measurements near the three newly proposed turbine locations. The DSEIS relied on measurements taken for the original DEIS that were taken south and west of Turbines B and C, north and west of Turbine A, and generally over a mile away. The language of the NYSDEC document is clear. To assess the noise impact the DSEIS should have identified "1) **appropriate receptor locations** for sound level calculation or measurement; 2) ambient sound levels and characteristics **at these receptor locations**; and 3) the sound pressure increase and characteristics of the sound that represents a significant noise effect at a receptor location." (NYSDEC, 2000, 13.) The DSEIS assessed the increase in noise levels for three new turbines without actually measuring the ambient sound levels at any nearby receptor location.

Finally, the DSEIS used a composite ambient noise level of 39.8 dBA. Part VIII below will undermine this value more fully, but there is a specific problem with this value in that it doesn't represent a value for any particular receptor location. It is an average level over both time and space. The average of Leq values is not linear (meaning that the average of 40 dBA and 30 dBA is not 35 dBA, but 37 dBA. The average is logarithmic and more heavily weighted to the higher noise levels. Moreover, by averaging the noise levels, the impact on quieter locations and quieter times is lost. For example, Table 1 of the HMMH *Noise Study for Black Oak Wind Farm Project*, found in Appendix T of the DEIS, gives nighttime Leq values of 25.3, 30.1, 29.1 and 26.1 dBA for locations ST-1, ST-2, ST-3, and ST-4. Using 39.8 dBA as the average background over all the times and places monitored, means that nighttime impacts at the specific locations are understated by 14.5, 9.8, 10.7, and 13.7 dBA respectively. Moreover, the DSEIS made no ambient measurements in the vicinity of the proposed new turbine sites. The only ambient measurements in these areas were reported in, *Ambient Sound Levels Near BOWF*. The only ambient levels in evidence do not support the use of 39.8 dBA as the ambient near the new Turbines A, B, and C.

VII. DSEIS Modeling Is Unreliable

The DSEIS noise analysis is based on estimated future noise levels of the wind turbines derived by noise modeling. We have asked the town and applicant to provide that modeling so that we can examine it and verify that it correctly models the proposed project. Providing the noise modeling is very simple, and can be done by copying and saving a computer file to a flash drive or an internet file sharing platform. They refused, however, to provide the modeling.

In land use, planning, and EIS processes, noise modeling is routinely provided to interested parties so that they can verify the accuracy of the modeling. In fact, there is no other way to verify the accuracy of the modeling. Without our being able to examine the modeling, it is nothing more than the output of a black box. It is a black box because the inner workings and implementation are hidden from the Board and from interested parties. It is "black." It is secret. BOWF will not allow us or the Board to see how it arrived at the output. All we have is an output, a noise level, with no supporting evidence. Output without supporting evidence is really just speculation and conjecture. All reference to the output in the DSEIS should be deleted.

The opposite of a black box system is one in which the inner workings are available for inspection, a "glass box." Had the modeling been provided to us, we and the Board would be able to understand how the output was arrived at, and whether or not it was accurate.

A thought experiment will show the weakness of relying on black box modeling. If I submitted a report, claiming that the output of my modeling documented significant adverse environmental impacts, but that the modeling must remain secret, the Board would reject that claim as unverified and unverifiable. For the very same reason, BOWF's modeling output should be rejected as unverified and unverifiable. BOWF has given the Town an "answer" to a math problem, but not shown its work.

BOWF claims that the modeling data contains proprietary information. This is not true and not necessary. There is no need for secret settings and secret modeling to estimate the noise levels for the DSEIS. The only reason for BOWF to not provide the modeling data is because BOWF is afraid it will not survive scrutiny. If BOWF's black box can't survive daylight, the output of the black box has no place in the DSEIS. All reference to the output should be deleted.

VIII. DSEIS Noise Monitoring is Unreliable

The case against the reliability of BOWF's noise monitoring is the same as the one against the reliability of its noise modeling. It is impossible for the Board and us to know how the background level of 39.8 dBA was derived.

The DSEIS noise analysis is based on changes from the existing or ambient noise levels. We have asked the town and applicant to provide their monitoring data so that we can examine it and verify that it correctly represents the existing conditions. Providing the noise monitoring data is very simple and can be done by copying and saving a computer file to a flash drive or an internet file sharing platform. They refused, however, to provide the monitoring.

In land use, planning, and EIS processes, noise monitoring data is routinely provided to interested parties so that they can verify the accuracy of the monitoring. In fact, there is no other way to verify the accuracy of the monitoring. Without our being able to examine the monitoring, it is nothing more than the output of a black box. It is a black box because the inner workings and implementation is hidden from the Board and from interested parties. It is "black." It is secret. BOWF will not allow us or the Board to see how it arrived at the output. All we have is an output, a noise level, with no supporting evidence. Output without supporting evidence is really just speculation and conjecture. All reference to the modeling and modeling output in the DSEIS should be deleted.

The opposite of a black box system is one in which the inner workings are available for inspection, a "glass box." Had the monitoring data been provided to us, we and the Board would be able to understand how the output was arrived at, and whether or not it was accurate.

A thought experiment will show the weakness of relying on black box monitoring data. If I submitted a report, claiming that the output of my monitoring documented significant adverse environmental impacts, but that the monitoring data must remain secret, the Board would reject that claim as unverified and unverifiable. For the very same reason, BOWF's monitoring output should be rejected as unverified and unverifiable. BOWF has given the Town an "answer" to a math problem, but not shown its work.

BOWF claims that the monitoring data contains proprietary information. This is not true and not necessary. There is no need for secret processes to establish existing noise levels for the DSEIS. The only reason for BOWF to not provide the monitoring data is because BOWF is afraid it will not survive scrutiny. If BOWF's black box can't survive daylight, the output of the black box has no place in the DSEIS. All reference to the monitoring and monitoring output of 39.8 dBA should be deleted.

IX. DSEIS Noise Modeling Shows Significant Increases Above FEIS Noise Modeling

Parts IV-VIII have identified inadequacies in the DSEIS. The DSEIS should be rejected, not only because of what isn't there (such as a noise impacts analysis, a local regulatory law analysis, and an adequate above ambient noise analysis, and the supporting evidence as discussed in Parts IV-VIII), but also because the evidence in the DSEIS leads to the conclusion that significant noise impacts exist. Specifically, the DSEIS modeling shows significant increases in turbine noise levels and in land impacted by turbine noise over the FEIS modeling.

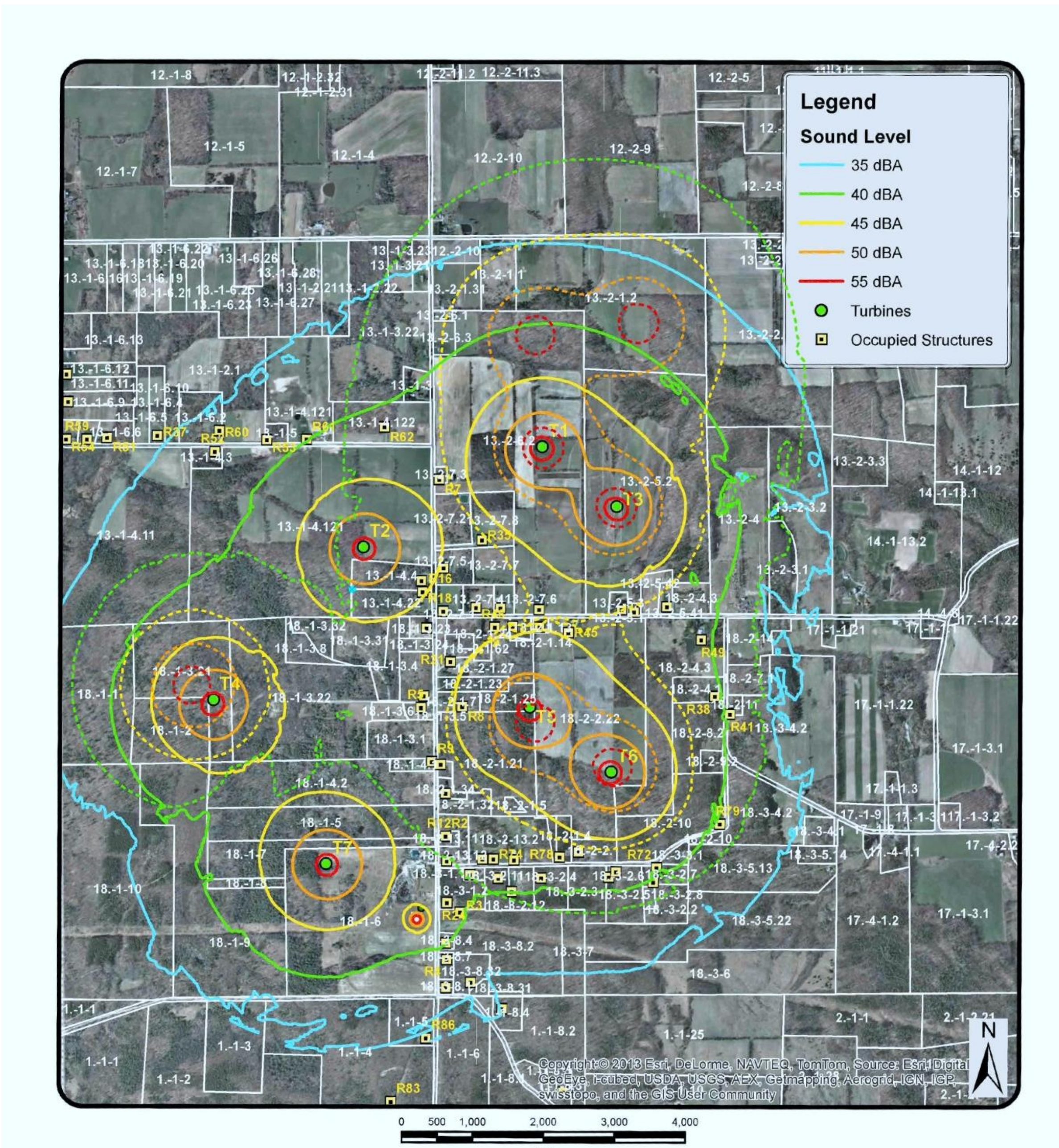


Figure 13. Predicted Noise Levels from the DSEIS and FEIS.

Figure 13 shows the predicted noise of the DSEIS and FEIS. It is a composite of Figure 3 from Appendix H of the DSEIS and Figure 2 of Appendix T of the FEIS. The dashed contour lines are the noise levels from the DSEIS. They are superimposed on top of the map from the FEIS and its solid contour lines. According to the legends of these Figures, the red line corresponds to the 55 dBA level; the orange, to the 50 dBA level; the yellow, to the 45 dBA level; and the green, to the 40 dBA level. The property lines are shown in white. Similar maps could be made for the other turbine configurations in the DSEIS.

Several indicators of significant noise impacts can be derived from this map:

1. The total area of noise impacted land is much greater in the DSEIS. This can be seen from the map, and also from analysis of the map. Figure 14 below describes percent increase in lands above 55 dBA, 50 dBA, and 45 dBA.

Contour Line	FEIS Figure 2: Area SqFt	DSEIS Figure 3: Area SqFt	% Increase
Red (Lands > 55 dBA)	552,000	1,622,000	194%
Orange (Lands > 50 dBA)	5,930,000	10,739,000	81%
Yellow (Lands > 45 dBA)	21,697,000	29,446,000	36%

Figure 14. Percent Increase in Land Impacted by Turbine Noise.

There are a number of reasons for the increase in lands impacted by turbine noise. One is that the new locations in the DSEIS result in a greater area of impact. Another possible reason is that BOWF may have misrepresented the impacts of increasing from 1.7to 2.3 MW turbines to the Board. In the June 24, 2015 letter submitted to the Board it is claimed that the changes from the 1.7 to 2.3 MW turbines "further minimize and mitigate potential impacts analyzed during the SEQRA process." The increase could also be due to errors in the modeling, either for the DSEIS or FEIS. Neither we nor the Board can know for sure because the modeling was not provided to us so that it could be verified.

2. Many areas with significant increases of 10 dBA or more can be seen by examining the map. The solid lines represent the FEIS noise level. The dashed lines represent the proposed DSEIS noise level. Areas where the solid blue 35 dBA contour line intersect the dashed yellow 45 dBA line represent areas of a 10 dBA increase. Similarly, areas where the solid green 40 dBA contour line intersect the dashed orange 50 dBA contour line represent areas of a 10 dBA increase. This is noticeable around the areas of Turbines B and C to the north, although if an option with Turbine A were considered the increase in the south would be approximately 10 dBA.

3. Every turbines location has moved enough to alter the noise contour lines. The change in the locations of Turbines 4, 5, and 6 are the easiest to see, but the location of all the turbines has moved. Again, because the noise modeling was not provided to us, we do not know if the change is due to poor modeling or the BOWF's misrepresentation of the changes being considered in the DSEIS.

X. The Project Causes Significant Noise Impacts Even If Only DSEIS Data Is Considered

Even if the problems identified in Parts IV-IX are ignored, and only DSEIS data is considered, the DSEIS shows significant noise impacts. The DSEIS sets out two tests as criteria of significant noise impact. They are the local regulatory laws and the NYSDEC 6 dBA test:

> The criteria against which to compare the predicted noise from the Modified Project to determine if any significant adverse environmental impacts might result include the local regulatory noise limits and the noise assessment guidelines found in the NYSDEC's Assessing and Mitigating Noise Impacts (2000). The same assessment criteria described in the DEIS for the Approved Project were applied to the Modified Project ….
>
> (DSEIS, 37.)

As discussed above and in the DEIS, the NYSDEC's Assessing and Mitigating Noise Impacts (2000) criterion is a 6 dBA increase in noise levels above ambient, or 45 dBA according to the DEIS. Moreover, the DSEIS actually determined that the noise at four non-participating residences exceeded the criterion of significant impact. According to the DSEIS, "[t]he noise study completed for the Modified Project predicted that each alternative under consideration would result in 4 non-participating residences exceeding the 45 dBA NYSDEC Guideline." (DSEIS, 38.)

After setting out this criterion of significant impact, the DSEIS ignores it and the four cases of significant noise impact. The DSEIS ignores this result for two reasons. 1) It suggests that "[t]he 45 dBA level is not an enforceable regulatory limit." (DSEIS, 37.) While this is true, it is irrelevant. The 45 dBA level was selected by the DSEIS as a criterion of significant impact, and it is that regardless of whether it is also a legal requirement of the town. 2) The DSEIS also dismisses this criterion because it says three non-participating residences exceeded the standard in the Findings Statement related to the FEIS. (DSEIS, 38.) This too is not a reason to ignore cases where the noise exceeds the criterion of significance. Moreover, it is not clear where this claim comes from. The actual modeling output from Appendix K of the FEIS and Appendix H of the DSEIS show different numbers. See Figure 15.

FEIS Modeling			**DSEIS Configuation 7AB**			**DSEIS Configuration AC**			**DSEIS Configuration BC**		
ID	Residence Status	Total Level (dBA)	ID	Residence Status	Total Level (dBA)	ID	Residence Status	Total Level (dBA)	ID	Residence Status	Total Level (dBA)
R14	Participating	45.9	R8	Non-Participating	46.2	R8	Non-Participating	46.2	R8	Non-Participating	46.2
R8	Non-Participating	45.8	R45	Participating	45.7	R45	Participating	45.7	R45	Participating	45.8
R16	Non-Participating	45.2	R107	Non-Participating	45.1	R107	Non-Participating	45.1	R50	Non-Participating	45.3
			R42	Non-Participating	45.1	R42	Non-Participating	45.1	R100	Non-Participating	45.1
			R44	Participating	45.1	R44	Participating	45.1	R42	Non-Participating	45.1
			R50	Non-Participating	45.1	R50	Non-Participating	45.1	R44	Participating	45.1
			R68	Non-Participating	45	R68	Non-Participating	45	R96	Participating	45.1
									R101	Non-Participating	45
Total Participating		**1**	**Total Participating**		**2**	**Total Participating**		**2**	**Total Participating**		**3**
Total Non-Participating		**2**	**Total Non-Participating**		**5**	**Total Non-Participating**		**5**	**Total Non-Participating**		**5**
Total		**3**	**Total**		**7**	**Total**		**7**	**Total**		**8**

Figure 15. Exceedances of the Criterion of Significance in the FEIS and DSEIS.

In the DSEIS there are either seven or eight homes meeting or exceeding the 45 dBA level of significance. Five of them are non-participating. With the exception of R8, these are entirely different residences from the FEIS. They clearly experience a significant impact according to the criterion selected by the DSEIS. Yet the DSEIS ignores this and does not clearly state how the impacts will be avoided or mitigated.

XI. As Many as 30 Non-Participating Residences Meet the DSEIS Criterion of Significant Noise Impact

The CADNA/A noise model used to estimate future noise levels of the wind turbines in the DSEIS implements the equations found in the international standard ISO 9313 Part 2. (Appendix H of the FEIS, 1.) This standard has an **average** error of 3 dB (see Figure 17 below from the ISO standard). This error is independent of the input uncertainty that the DSEIS claims was accounted for. (Appendix H of the FEIS, 2.) Moreover, the error is independent of the conservative modeling assumptions used in the modeling. These conservative assumptions are the way noise ought to be modeled: “it should be noted that these predictions are based on a worst case scenario with conservative assumptions required by ISO-9613-2 propagation standards.” (FEIS, 38.)

In addition, it is important to remember the caution ISO 9613 Part 2 gives concerning error:

> NOTE 24 The estimates of accuracy in table 5 are for downwind conditions averaged over independent situations (as specified in clause 5). They should not necessarily be expected to agree with the variation in measurements made at a given site on a given day. The latter can be expected to be considerably larger than the values in table 5.

ISO 9313 Part 2, page 13

Figure 16: Modeling error in ISO 9613 is an average error

The error is an **average** error. There can be a much greater error at times. Figure 17 shows Table 5 from the ISO 9613 Part 2 Standard, which describes the error.

ISO 9613-2:1996(E) © ISO

The use of equations (1) to (5) and (7) to (20) (and therefore also table 5) is limited to case a): meteorological conditions only. Case b) is relevant only to the use of equations (6), (21) and (22). There are also a substantial number of limitations (non-meteorological) in the use of individual equations. Equation (9) is, for example, limited to approximately flat terrain. These specific limitations are described in the text accompanying the relevant equation.

Table 5 — Estimated accuracy for broadband noise of L_{AT}(DW) calculated using equations (1) to (10)

Height, h *)	Distance, d *)	
	$0 < d < 100$ m	100 m $< d <$ 1 000 m
$0 < h < 5$ m	± 3 dB	± 3 dB
5 m $< h <$ 30 m	± 1 dB	± 3 dB

*) h is the mean height of the source and receiver.
d is the distance between the source and receiver.

NOTE — These estimates have been made from situations where there are no effects due to reflection or attenuation due to screening.

ISO 9613 Part 2, page 14

Figure 17: Table 5 from ISO 9613 Showing a 3 dBA Error

It is critical that the accuracy of the modeling be taken into account when assessing noise impacts with respect to a criterion of significance. The modeling error must be added to the modeled results when testing for compliance with significance criteria; otherwise the DSEIS risks missing significant noise impacts. This was not done. All of the contour lines and output noise results at the various receptor locations should be increased by 3 dBA.

The accuracy issue cannot be ignored because it is a plus or minus 3 dBA. What this means is that sometimes the value might be 3 dBA more than predicted, and sometimes 3 dBA less. The critical point is that there will be times when it is 3 dB more than the predicted output, and those times will lead to exceedances of the DSEIS criterion for significant impact.

If the accuracy of the CADNA/A modeling had been accounted for by adding 3 dBA to the output, the results would be as shown in Figure 17.

Configuation 7AB

ID	Residence Status	Total Level (dBA)
R8	Non-Participating	49.2
R45	Participating	48.7
R107	Non-Participating	48.1
R42	Non-Participating	48.1
R44	Participating	48.1
R50	Non-Participating	48.1
R68	Non-Participating	48
R40	Non-Participating	47.9
R105	Participating	47.8
R39	Non-Participating	47.7
R43	Participating	47.5
R35	Participating	47.3
R47	Participating	47.3
R97	Participating	47.2
R48	Participating	47.1
R78	Non-Participating	47.1
R20	Participating	47
R21	Non-Participating	47
R70	Non-Participating	46.7
R7	Non-Participating	46.6
R10	Non-Participating	46.5
R46	Participating	46.5
R69	Non-Participating	46.4
R22	Non-Participating	46.1
R5	Non-Participating	46
R72	Non-Participating	46
R9	Non-Participating	46
R1	Participating	45.8
R11	Non-Participating	45.8
R71	Non-Participating	45.7
R38	Non-Participating	45.6
R76	Non-Participating	45.6
R18	Participating	45.5
R49	Non-Participating	45.5
R77	Non-Participating	45.4
R13	Participating	45.2
R74	Non-Participating	45.1
R79	Participating	45
Total Participating		**14**
Total Non-Participating		**27**
Total		**38**

Configuration AC

ID	Residence Status	Total Level (dBA)
R8	Non-Participating	49.2
R45	Participating	48.7
R107	Non-Participating	48.1
R42	Non-Participating	48.1
R44	Participating	48.1
R50	Non-Participating	48.1
R68	Non-Participating	48
R40	Non-Participating	47.9
R105	Participating	47.8
R39	Non-Participating	47.7
R100	Non-Participating	47.6
R101	Non-Participating	47.6
R35	Participating	47.5
R43	Participating	47.4
R47	Participating	47.3
R20	Participating	47.1
R21	Non-Participating	47.1
R48	Participating	47.1
R78	Non-Participating	47.1
R7	Non-Participating	47
R96	Participating	47
R70	Non-Participating	46.7
R10	Non-Participating	46.6
R103	Non-Participating	46.6
R46	Participating	46.6
R95	Non-Participating	46.6
R99	Non-Participating	46.6
R102	Participating	46.4
R69	Non-Participating	46.4
R22	Non-Participating	46.2
R5	Non-Participating	46
R72	Non-Participating	46
R9	Non-Participating	46
R1	Participating	45.8
R11	Non-Participating	45.8
R71	Non-Participating	45.7
R18	Participating	45.6
R38	Non-Participating	45.6
R76	Non-Participating	45.6
R49	Non-Participating	45.5
R13	Participating	45.4
R77	Non-Participating	45.4
R74	Non-Participating	45.1
R19	Non-Participating	45
R79	Participating	45
Total Participating		**15**
Total Non-Participating		**30**
Total		**45**

Configuration BC

ID	Residence Status	Total Level (dBA)
R8	Non-Participating	49.2
R45	Participating	48.8
R50	Non-Participating	48.3
R100	Non-Participating	48.1
R42	Non-Participating	48.1
R44	Participating	48.1
R96	Participating	48.1
R101	Non-Participating	48
R40	Non-Participating	47.9
R97	Participating	47.9
R105	Participating	47.8
R39	Non-Participating	47.8
R35	Participating	47.7
R43	Participating	47.6
R68	Non-Participating	47.6
R95	Non-Participating	47.6
R47	Participating	47.5
R7	Non-Participating	47.3
R48	Participating	47.2
R20	Participating	47.1
R21	Non-Participating	47.1
R99	Non-Participating	47.1
R103	Non-Participating	47
R102	Participating	46.8
R46	Participating	46.8
R78	Non-Participating	46.8
R10	Non-Participating	46.4
R22	Non-Participating	46.2
R5	Non-Participating	46.1
R70	Non-Participating	45.9
R9	Non-Participating	45.9
R1	Participating	45.7
R11	Non-Participating	45.7
R18	Participating	45.7
R13	Participating	45.6
R49	Non-Participating	45.6
R38	Non-Participating	45.5
R69	Non-Participating	45.5
R76	Non-Participating	45.2
R94	Non-Participating	45.2
R19	Non-Participating	45.1
R14	Participating	45
R16	Non-Participating	45
Total Participating		**16**
Total Non-Participating		**27**
Total		**43**

Figure 17. DSEIS Modeling Results When the Accuracy of the Model Considered.

There are at a minimum, 38 residences exceeding the DSEIS criterion of significance of 45 dBA. The DSEIS missed these instances of significant impact because it did not take a hard look in doing its noise assessment.

XII. As Many as 53 Non-Participating Residences Meet the DSEIS Criterion for Significant Noise Impact at Night

As discussed above in Part VI, the DSEIS used a spatially and temporally averaged ambient level of 39.8 dBA. It was noted that the average is highly weighted to the loudest times and places. At night, when the ambient is lower, the impact of the noise is greatest. Had the DSEIS used a nighttime average to assess significant impact, it would have found that 51 non-participating residences experience a significant noise impact.

Appendix T of the DEIS states that "[a]t night (11:30 pm-5:30am) Leq sound levels generally ranged from about 25 to 30 dBA." Had the DSEIS used the higher 30 dBA value, a 6 dBA increase would be 36 dBA. Figure 18 shows the residences that meet or exceed a 36 dBA nighttime criterion of significant impact. The red shading indicates when the noise level is more than 10 dBA over ambient, or twice as loud as ambient. (Note that the decibel levels have not been adjusted to account for the modeling accuracy as in Part XI above.)

Configuation 7AB			Configuration AC			Configuration BC		
ID	Residence Status	Total Level (dBA)	ID	Residence Status	Total Level (dBA)	ID	Residence Status	Total Level (dBA)
R8	Non-Participating	46.2	R8	Non-Participating	46.2	R8	Non-Participating	46.2
R45	Participating	45.7	R45	Participating	45.7	R45	Participating	45.8
R107	Non-Participating	45.1	R107	Non-Participating	45.1	R50	Non-Participating	45.3
R42	Non-Participating	45.1	R42	Non-Participating	45.1	R100	Non-Participating	45.1
R44	Participating	45.1	R44	Participating	45.1	R42	Non-Participating	45.1
R50	Non-Participating	45.1	R50	Non-Participating	45.1	R44	Participating	45.1
R68	Non-Participating	45	R68	Non-Participating	45	R96	Participating	45.1
R40	Non-Participating	44.9	R40	Non-Participating	44.9	R101	Non-Participating	45
R105	Participating	44.8	R105	Participating	44.8	R40	Non-Participating	44.9
R39	Non-Participating	44.7	R39	Non-Participating	44.7	R97	Participating	44.9
R43	Participating	44.5	R100	Non-Participating	44.6	R105	Participating	44.8
R35	Participating	44.3	R101	Non-Participating	44.6	R39	Non-Participating	44.8
R47	Participating	44.3	R35	Participating	44.5	R35	Participating	44.7
R97	Participating	44.2	R43	Participating	44.4	R43	Participating	44.6
R48	Participating	44.1	R47	Participating	44.3	R68	Non-Participating	44.6
R78	Non-Participating	44.1	R20	Participating	44.1	R95	Non-Participating	44.6
R20	Participating	44	R21	Non-Participating	44.1	R47	Participating	44.5
R21	Non-Participating	44	R48	Participating	44.1	R7	Non-Participating	44.3
R70	Non-Participating	43.7	R78	Non-Participating	44.1	R48	Participating	44.2
R7	Non-Participating	43.6	R7	Non-Participating	44	R20	Participating	44.1
R10	Non-Participating	43.5	R96	Participating	44	R21	Non-Participating	44.1
R46	Participating	43.5	R70	Non-Participating	43.7	R99	Non-Participating	44.1
R69	Non-Participating	43.4	R10	Non-Participating	43.6	R103	Non-Participating	44
R22	Non-Participating	43.1	R103	Non-Participating	43.6	R102	Participating	43.8
R5	Non-Participating	43	R46	Participating	43.6	R46	Participating	43.8

R72	Non-Participating	43
R9	Non-Participating	43
R1	Participating	42.8
R11	Non-Participating	42.8
R71	Non-Participating	42.7
R38	Non-Participating	42.6
R76	Non-Participating	42.6
R18	Participating	42.5
R49	Non-Participating	42.5
R77	Non-Participating	42.4
R13	Participating	42.2
R74	Non-Participating	42.1
R79	Participating	42
R19	Non-Participating	41.9
R73	Non-Participating	41.8
R103	Non-Participating	41.7
R16	Non-Participating	41.7
R14	Participating	41.6
R41	Non-Participating	41.5
R101	Non-Participating	41.3
R81	Non-Participating	41.3
R12	Non-Participating	41.2
R2	Non-Participating	41.2
R75	Non-Participating	41.2
R104	Participating	40.8
R80	Non-Participating	40.7
R96	Participating	40.6
R102	Participating	40.5
R100	Non-Participating	40.4
R6	Participating	40.3
R62	Participating	40.3
R95	Non-Participating	40
R99	Non-Participating	39.7
R98	Non-Participating	39.4
R24	Non-Participating	39.2
R3	Non-Participating	39.1
R108	Non-Participating	38.7
R30	Non-Participating	38.6
R94	Non-Participating	38.4
R31	Non-Participating	37.7
R93	Non-Participating	37.3
R106	Non-Participating	37.1
R92	Non-Participating	37.1
R15	Non-Participating	36.9
R17	Non-Participating	36.9
R61	Non-Participating	36.6
R53	Non-Participating	36.2
Total Participating		**20**
Total Non-Participating		**52**
Total		**72**

R95	Non-Participating	43.6
R99	Non-Participating	43.6
R102	Participating	43.4
R69	Non-Participating	43.4
R22	Non-Participating	43.2
R5	Non-Participating	43
R72	Non-Participating	43
R9	Non-Participating	43
R1	Participating	42.8
R11	Non-Participating	42.8
R71	Non-Participating	42.7
R18	Participating	42.6
R38	Non-Participating	42.6
R76	Non-Participating	42.6
R49	Non-Participating	42.5
R13	Participating	42.4
R77	Non-Participating	42.4
R74	Non-Participating	42.1
R19	Non-Participating	42
R79	Participating	42
R14	Participating	41.8
R16	Non-Participating	41.8
R73	Non-Participating	41.8
R41	Non-Participating	41.5
R94	Non-Participating	41.5
R62	Participating	41.3
R81	Non-Participating	41.3
R12	Non-Participating	41.2
R2	Non-Participating	41.2
R75	Non-Participating	41.2
R104	Participating	40.9
R80	Non-Participating	40.7
R6	Participating	40.3
R93	Non-Participating	40.3
R92	Non-Participating	39.9
R24	Non-Participating	39.2
R3	Non-Participating	39.1
R97	Participating	39
R108	Non-Participating	38.7
R30	Non-Participating	38.6
R31	Non-Participating	37.7
R61	Non-Participating	37.6
R106	Non-Participating	37.1
R15	Non-Participating	36.9
R17	Non-Participating	36.9
R53	Non-Participating	36.9
R91	Non-Participating	36.3
R98	Non-Participating	36
Total Participating		**20**
Total Non-Participating		**53**
Total		**73**

R78	Non-Participating	43.8
R10	Non-Participating	43.4
R22	Non-Participating	43.2
R5	Non-Participating	43.1
R70	Non-Participating	42.9
R9	Non-Participating	42.9
R1	Participating	42.7
R11	Non-Participating	42.7
R18	Participating	42.7
R13	Participating	42.6
R49	Non-Participating	42.6
R38	Non-Participating	42.5
R69	Non-Participating	42.5
R76	Non-Participating	42.2
R94	Non-Participating	42.2
R19	Non-Participating	42.1
R14	Participating	42
R16	Non-Participating	42
R72	Non-Participating	41.9
R77	Non-Participating	41.8
R62	Participating	41.7
R74	Non-Participating	41.7
R73	Non-Participating	41.4
R41	Non-Participating	41.3
R71	Non-Participating	41.3
R79	Participating	41.2
R93	Non-Participating	41.2
R12	Non-Participating	41.1
R2	Non-Participating	41.1
R104	Participating	41
R81	Non-Participating	40.7
R92	Non-Participating	40.6
R75	Non-Participating	40.5
R98	Non-Participating	40.3
R80	Non-Participating	40.2
R6	Participating	39.9
R24	Non-Participating	38.5
R3	Non-Participating	38.2
R61	Non-Participating	37.8
R53	Non-Participating	37.3
R91	Non-Participating	37.1
R15	Non-Participating	36.5
R17	Non-Participating	36.5
R90	Non-Participating	36.5
R89	Non-Participating	36.4
R52	Non-Participating	36
Total Participating		**20**
Total Non-Participating		**51**
Total		**71**

Figure 18. DSEIS Modeling Results With Significant Nighttime Impact.

XIII. The DSEIS Understated the Scope of the Project and Shielded Noise Impacts from Scrutiny

The fact that the location of all of the turbines have moved between the FEIS and the DSEIS, and not just Turbines 5, A, B, and C as BOWF claims, greatly expands of the needed scope of the DSEIS investigation, particularly with respect to noise. The changes in turbine location change the noise off the BOWF site. When turbines that are moved nearer to each other they have cumulative effects on noise that also need to be assessed. All the changes need to be analyzed by a complete DSEIS, not just a limited number of changes.

The DSEIS cannot possibly be considered complete given this new revelation.

Conclusion

The DSEIS failed to identify and assess specific noise effects for significant noise impact (Part IV). This omission alone should disqualify the DSEIS noise assessment from being accepted as complete. It also has the effect of shifting the burden of demonstrating no significant noise impact on to the assessment of the local law and the NYSDEC 6 dBA increase criteria.

Unfortunately, the DSEIS fabricated a local law, which disqualifies the fabricated standard as a test for significance (Part V). This problem has been known for years, but has not been corrected. It must be corrected, however, before the DSEIS can proceed.

Consequently, the only remaining criterion of significant impacts is the NYSDEC 6 dBA increase criterion. The DSEIS analysis with respect to the NYSDEC 6 dBA increase criterion is also flawed. It is flawed because it failed to assess the impact at property lines. Had a property line analyses been undertaken, significant impact would have been shown at many locations. In addition, the DSEIS fabricated a spatially and temporally averaged background level that hid significant noise impacts at residences, understating nighttime noise impacts by 10-15 dBA (Part VI).

In spite of these problems, the DSEIS data and DSEIS criterion of significant impact still show significant noise impacts at five non-participating residences. The DSEIS ignored its own data and criterion of significant impact (Part X). Had the DSEIS taken a hard look at its own data it would have recognized this and found a significant noise impacts. The DSEIS cannot distance itself from the NYSDEC 6 dBA increase criterion of significant impact because this is the only remaining test of significance in the DSEIS—the DSEIS failed to analyze noise effects and botched the noise regulation assessment. By ignoring the NYSDEC 6 dBA test for significant impacts as the DSEIS has done, the DSEIS is left without any test for significant noise impacts. If there is no remaining test for significant impact, the entire noise analysis is little more than hand waving.

The refusal to provide the monitoring and modeling data as requested (Parts VII and VIII) is all of a piece with the discrepancies about the actual site plan and turbine locations and other failings of the DSEIS noise assessment. The DSEIS is replete with undocumented and unverifiable claims that render the DSEIS conclusions unreliable. The DSEIS also has a number of omissions, that when corrected, show significant noise impacts (Parts XI an XII).

The DSEIS noise analysis must be rejected as incomplete. The local noise law must be fixed by the Town. Then an analysis of noise effects, an analysis with respect to the new local law, and robust analysis with respect to the NYSDEC 6 dBA increase criterion, including night time and property line impacts, should be conducted. The modeling and monitoring data supporting the DSEIS should be provided to all parties so that the accuracy can be assessed, and the discrepancies concerning wind turbine locations and the scope of the DSEIS resolved.

Since the DSEIS already clearly shows a significant noise impact, mitigation measures to avoid the impacts should be developed so as to minimize and avoid the impacts.

After the DSEIS is truly complete, the revised DSEIS should be submitted for public comment, and the process of the public actually being able to identify and understand the environmental and noise impacts of BOWF may begin.

Note: The methods and data used in this report are not secret or proprietary. We would hope that the Town Board/BOWF would share with us the modeling and monitoring data we requested, and provide us additional time to analyze the data and comment on the DSEIS. We would be happy exchange data with the Board/BOWF as well as address further questions the Board might have.

LES BLOMBERG

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PROFESSIONAL EXPERIENCE

EXECUTIVE DIRECTOR

Noise Pollution Clearinghouse, Montpelier, VT, 1996-present

- Founded a national non-profit clearinghouse dealing with noise pollution and hearing loss issues.
- Created and maintained an extensive noise pollution library.
- Conducted research into noise and its effects.
- Wrote articles and fact sheets for magazines, journals, and web sites.
- Advised consultants, communities, and individuals about noise pollution issues.

MEMBERSHIPS AND AFFILIATIONS

Member, American National Standards Accredited Standards Committee S12, Noise.

- Evaluated, revised, and approved national standards for noise measurement as a voting member of the S12 committee and as members of specific working groups
- Member, ANSI S12 Working Group 15, Measurement and Evaluation of Outdoor Community Noise
- Member ANSI S12 Working Group 38, Noise Labeling In Products
- Member ANSI S12 Working Group 41, Model Community Noise Ordinances
- Member ANSI S12 Working Group 50, Information Technology (IT) Equipment in Classrooms

Past Memberships

- Former Member, Acoustical Society of America (ASA)
- Former Member, Acoustical Society of America Technical Committee on Noise
- Former Member, National Hearing Conservation Association (NHCA)
- Former Member, Institute of Noise Control Engineering (INCE)

PAPERS AND PUBLICATIONS (partial list)

- "Update on Regulations Adding Noise to Electric and Hybrid Vehicles," invited paper, Acoustical Society of America, 2014.
- "Noise in the 21st Century," Acoustical Society of America Lay Language Paper, 2014.
- "Noise in the 21st Century," invited paper, Acoustical Society of America, 2014.
- "Regulatory Inertia and Community Noise," invited paper, Acoustical Society of America, 2014.
- "Natural Quiet: Where to Find It, How to Increase It," invited paper, Noise in Communities and Natural Areas Workshop, Institute of Noise Control Engineering, 2013.
- "Optimizing Detection of Masked Vehicles," invited paper, Acoustical Society of America, 2013.

- "Validity of a Temporary Threshold Shift (TTS) Detector for Use in iPods and Other Portable Audio Devices," National Hearing Conservation Association, 2010.
- "Five Ways to Quiet Your Neighborhood," published in *One Square Inch of Silence*, 2009.
- "Noise Masking of Vehicles, A Comparison of Gasoline/Electric Hybrids and Conventional Vehicles," Noise Pollution Clearinghouse, 2008.
- "Wind, Noise, and Energy," Noise Pollution Clearinghouse for American Wind Energy Association, 2008.
- "What's the Ear For?" Chapter 47 of *Handbook for Sound Engineers,* 2008.
- "Hearing Damage Related to In-Ear Music Devices and other Consumer Products, "International Consumer Product Health and Safety Organization Symposium, 2007.
- "10 Ways to Quiet Our National Parks," Acoustical Society of America, 2007.
- "Criteria Levels for Non-Occupational Noise Exposure," Acoustical Society of America, 2006.
- "Consumers, Products, and Noise: The Economic, Social, and Political Barriers to Reducing Noise in Consumer Products Sold in North America," Acoustical Society of America, 2006.
- "Opportunities and Progress in Consumer Product Noise Testing and Labeling," Institute of Noise Control Engineering, 2006.
- "Noise (is) Pollution," Quiet Zone, 2006.
- "The Nature of Noise," Quiet Zone, 2006.
- "The State of State Noise Regulations in New England," Institute of Noise Control Engineering, 2005.
- "Consumer Oriented Measurement of Product Noise," Institute of Noise Control Engineering, 2005.
- "Acoustical Advocacy," National Hearing Conservation Association, 2005.
- "Barriers to Community Input to Noise Policy Decisions," Institute of Noise Control Engineering, 2004.
- "The Nature of Noise in Society," Acoustical Society of America, 2004.
- "24 Hours of Noise in a Large City; Problems and Solutions," Acoustical Society of America, 2004.
- "Why Diesel Trucks Are Quieter than Boats," Lakeline, 2004.
- "The Future of Peace and Quiet," Quiet Zone, 2003.
- "The Interest of the Public in Noise Control," Institute of Noise Control Engineering, 2002.
- "A Punch from Michael Tyson Averaged over an Hour is a Very Long Love Pat: The Problems of Averaging in Noise Measurement," MIT Seminar, 2001.
- "Noise Ordinances: the Good, the Bad, and the Ugly; An overview of more than 200 existing noise ordinances," Acoustical Society of America, 2001.
- "Soundscapes, Quiet Zoning, and a Noise Sabbath," Wisconsin Lakes Partnerships Conference, 2001.
- "Amphitheater Noise, A Community Perspective," Acoustical Society of America, 2000.
- "Educating the Public about the Effects of Noise Pollution," Acoustical Society of America, 2000.
- "Noise in the News: What the Media Is and Is Not Covering," Acoustical Society of America, 2000.
- "Sound Decisions," New Rules, 1999.
- "Noise, Civility, and Sovereignty," Noise Pollution Clearinghouse, 1999.

PATENTS

- Number 7,780,609, Temporary Threshold Shift Detector, Issued August 24, 2010, allows users of personal listening devices to determine if they have listened at levels that could damage their hearing.

CLIENTS AND CONSULTING

Assisted hundreds of communities, mayors, council members, zoning boards, and police chiefs to understand, interpret, rewrite, and enforce their noise regulations.

- Drafted modifications to noise ordinances.
- Drafted new or complete overhauls of noise regulations.
- Advised communities on appropriate monitoring equipment.

Assisted Vermont towns with understanding, enforcing, and revising noise regulations.

- St. Albans
- Montpelier
- Waitsfield

Developed noise measurement procedures, evaluated testing facilities, and tested consumer product noise levels.

- Consumer Reports
- Quiet Zone (Noise Pollution Clearinghouse publication)

Modeled noise levels from various noise sources.

- Transportation
- Resource extraction

Created online libraries of important noise-related documents and answered questions about noise from the general public.

- US EPA
- Noise Pollution Clearinghouse

Partial List of clients:

- US EPA
- Consumer Reports
- American Wind Energy Association
- East Hampton, NY Airport
- Boston, MA
- Sierra Club
- Natural Resources Defense Council

Partial list of proceedings in Vermont in which participated or testified:

- 2014, Vermont State Environmental Court, Docket No. 99-7-13 Vtec
- 2014, Vermont State Environmental Court, Docket No. 182-12-13 Vtec
- 2013, District 3 Environmental Commission, Act 250, Application #3W1049
- 2013, Vermont State Environmental Court, Docket No. 159-10-11 Vtec
- 2012, District 7 Environmental Commission, Application #7C1321

- 2012, Vermont Environmental Court, Docket Nos. 122-7-04, 210-9-08 and 136-8-10 Vtec
- 2011, Vermont Public Service Board Docket #7628
- 2010, Vermont Public Service Board Docket #7156
- 2009, Greensboro, Vermont Zoning Permit, Lakeview Inn
- 2008, Vermont Environmental Court, O'Neil Sand & Gravel, LLC Docket No. 48-2-07 Vtec, Act 250 Application #2S0214-6A
- 2008, Bristol Vermont Zoning Permit, Lathrop Gravel Pit
- 2007, Vermont Environmental Court, Wright Quarry Docket Nos. 156-7-06 Vtec and 190-8-06 Vtec
- 2007, East Calais, Vermont Zoning Permit, Gravel Pit
- 2007, District 5 Environmental Commission, Route 100 Bypass
- 2006, District 5 Environmental Commission, Application #5W1455
- 2005, State Environmental Court, Docket No. 203-11-03 Vtec
- 2005, District 3 Environmental Commission, Act 250 Application #3W0929
- 2004, Norwich, Vermont Zoning Permit, Verizon Wireless Tower
- 2004, Moretown, Vermont Zoning Permit, Quarry
- 2003, District 5 Environmental Commission, Barre Town Police Firing Range
- 2001, District Number 5 Environmental Commission, Bull's Eye Sporting Center and Case Number 5W0743-3
- 2001, Dummerston, Vermont Zoning Permit, Quarry
- 1999, Vermont State Environmental Board, OMYA, Inc. and Foster Brothers Farm, Inc., Land Use Permit #9A0107-2-EB.
- 1999, Vermont State Environmental Board, Barre Granite Quarries, LLC, Application #7C1079-EB

EDUCATION

SEMINAR CADNA A EXPERT (Noise Model)
SEMINAR CADNA A ADVANCED
SEMINAR CADNA A BASIC
Datakustic, 2013

INTEGRATED NOISE MODEL TRAINING COURSE (FAA Noise Model)
Harris, Miller, Miller, and Hanson, 2010

COMMUNITY NOISE ENFORCEMENT CERTIFICATION COURSE
Rutgers Noise Technical Assistance Center, 1997

MASTER OF ARTS in Environmental Philosophy, 1993
Colorado State University, Fort Collins, Colorado

BACHELOR OF SCIENCE in Applied Mathematics, minor in Physics, 1989
BACHELOR OF ARTS in Philosophy, with honors, 1989
University of Minnesota, Duluth, Minnesota

Susan P. Robinson
772 Bostwick Road
Ithaca, NY 14850

Enfield Town Board
182 Enfield Main Road
Ithaca, NY 14850

April 20, 2016

I have lived in the same house in Enfield for almost 40 years, a place we almost named "Windy Hill Farm," and I wish I could have some wind turbines on my land.

I am a small investor in the Black Oak Wind Farm, and am writing in support of the project moving forward. While I do care about the people who live in close proximity to the turbines, the research of which I have become aware indicates that there is little to no risk to living in an area with wind turbines that has properly sited turbines. Black Oak turbine sites have been developed according to the regulations in the Town of Enfield Wind Farm Law and the recommendations of the turbine manufacturer, GE.

An article that has influenced me is the following:
"Wind Turbines in Human Health," which appears in the Journal Frontiers in Public Health, published June 2014 by Knopper, Ollson, McCallum, Aslund, Berger, Souweine, and McDaniel.

In the abstract the authors state: ". . .Now there are roughly 60 scientific peer-reviewed articles on this issue. The available scientific evidence suggests that EMF, shadow flicker, low-frequency noise, and infrasound from wind turbines are not likely to affect human health; some studies have found that audible noise from wind turbines can be annoying to some. Annoyance may be associated with some self-reported health effects (e.g., sleep disturbance) especially at sound pressure levels >40 dB(A). . . . Subjective variables (attitudes and expectations) are also linked to annoyance and have the potential to facilitate other health complaints via the nocebo effect. Therefore, it is possible that a segment of the population may remain annoyed (or report other health impacts) even when noise limits are enforced. Based on the findings and scientific merit of the available studies, the weight of evidence suggests that when sited properly, wind turbines are not related to adverse health. . . ."

In their conclusion, the authors state: "Based on the findings and scientific merit of the research conducted to date, it is our opinion that the weight of evidence suggests that when sited properly, wind turbines are not related to adverse health effects. . . . Although annoyance is considered to be the least severe potential impact of community noise exposure (83, 85), it has been hypothesized that sufficiently high levels of annoyance could lead to negative emotional responses (e.g., anger, disappointment, depression, or anxiety) and psychosocial symptoms (e.g., tiredness, stomach discomfort, and stress) (83,

86–90). However, it is important to note that noise annoyance is known to be strongly affected by attitudinal factors such as fear of harm connected with the source and personal evaluation of the source (91–93) as well as expectations of residents (92). . . . Thus, it is likely that the adverse effects exhibited by some people who live near wind turbines are a response to stress and annoyance, which are driven by multiple environmental and personal factors, and are not specifically caused by any unique characteristic of wind turbines. This hypothesis is also supported by the observation that people who economically benefit from wind turbines have significantly decreased levels of annoyance compared to individuals that received no economic benefit, despite exposure to similar, if not higher, sound levels (17)."
[the numbers in parentheses refer to the footnotes in the article which can be found at: http://journal.frontiersin.org/article/10.3389/fpubh.2014.00063/full#h1]

As an Enfield resident and someone who is deeply concerned about reducing our reliance on fossil fuels, I fully support the Black Oak Wind Farm Draft Supplemental Environmental Impact Statement which was accepted as complete by the Enfield Town Board on March 9, 2016.

Sincerely,

Susan Robinson

Susan Robinson
272-1099

4-22

Comments to the draft Supplemental Environmental Impact Statement

April 20, 2016

Town of Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850

To the Enfield Town Board:

I adopt each and every comment in Jude Lemke's letter of April 20, 2016 which is attached, and which apply equally to my property located at 435 Black Oak Road, Trumansburg, NY 14886. I also adopt each and every comment contained in the "Critique of the Noise Analysis of the Draft Supplemental Environmental Impact Statement for the Black Oak Wind Farm" prepared by Les Blomberg of the Noise Pollution Clearinghouse, located in Montpelier, VT.

Sincerely,

Philip Wright

Phil Wright

Comments to the draft Supplemental Environmental Impact Statement

April 20, 2016

Town of Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850

To the Enfield Town Board:

I adopt each and every comment in Jude Lemke's letter of April 20, 2016 which is attached, and which apply equally to my property located at 464 Black Oak Road, Trumansburg, NY 14886. I also adopt each and every comment contained in the "Critique of the Noise Analysis of the Draft Supplemental Environmental Impact Statement for the Black Oak Wind Farm" prepared by Les Blomberg of the Noise Pollution Clearinghouse, located in Montpelier, VT.

Sincerely,

Richard Lychalk
JoAnn Lychalk

Richard and Joanne Lychalk

4-22

Comments to the draft Supplemental Environmental Impact Statement

April 20, 2016

Town of Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850

To the Enfield Town Board:

I adopt each and every comment in Jude Lemke's letter of April 20, 2016 which is attached, and which apply equally to my property located at 463 Black Oak Road, Trumansburg, NY 14886. I also adopt each and every comment contained in the "Critique of the Noise Analysis of the Draft Supplemental Environmental Impact Statement for the Black Oak Wind Farm" prepared by Les Blomberg of the Noise Pollution Clearinghouse, located in Montpelier, VT.

Sincerely,

JoLee Carlisle

Comments to the draft Supplemental Environmental Impact Statement

April 20, 2016

Town of Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850

To the Enfield Town Board:

I adopt each and every comment in Jude Lemke's letter of April 20, 2016 which is attached, and which apply equally to my property located at 377 Harvey Hill Road, Trumansburg, NY 14886. I also adopt each and every comment contained in the "Critique of the Noise Analysis of the Draft Supplemental Environmental Impact Statement for the Black Oak Wind Farm" prepared by Les Blomberg of the Noise Pollution Clearinghouse, located in Montpelier, VT.

Sincerely,

Bradford and LuAnn Fisher

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Thursday, April 21, 2016 5:57 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: Comment on the Black Oak Wind Farm

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: Comment on the Black Oak Wind Farm
Date: 04/21/2016 5:54 pm
From: Barbara Bauer Sadovnic <bsadovnic@htva.net>
To: townclerk@townofenfield.org

To the Enfield Town Board:

After ten years of careful planning and revision, all aimed at addressing concerns of neighbors, the Black Oak Wind Farm is being opposed, chiefly by residents who fear the effects of the windmills.

Evidence for these dangers comes from science that is at best uncertain, publicized nationally by groups whose interests are equally uncertain.
It is easy to find studies showing whatever position one would like to take on windmills. Estimates of the infrasound produced by windmills indicate the levels are hard to distinguish from background infrasound:
infrasound is produced when the wind is blowing hard, whether there are windmills there or not. If you live in a windy place you are already experiencing it.

What is not uncertain is the danger of global warming, the whole reason for Black Oak. We need to transition from fossil fuels as quickly as possible. Threats worldwide to coastline communities due to rising sea levels, to agriculture due to changing weather patterns, and to everyone due to an increased number of extreme weather events are undeniable.

What is also not uncertain is that Black Oak Wind Farm will change the view - the windmills are big. You can't miss them. Our choice is a NIMBY knee jerk of fear and anger that our view is changing, or one of pride and hope that our community has stepped up to the challenge of global warming, and our new view will be the evidence of that.

Also certain is the effect NOT going forward with Black Oak will have on wind projects nationwide. The fossil fuel industry would like nothing better than to be able to point to a project turned down because of community opposition - we can be sure of that. Is that the impact Enfield wants to have on the renewable energy debate and, eventually, on global warming?

Barbara Sadovnic
190 Halseyville Road

Enfield

bsadovnic@gmail.com

Euginia Givotovsky
230 Connecticut Hill RD
Newfield, NY 14867
April 21, 2016

To: Enfield Town Board
BOWF – SEIS

I am a 70+ year-old woman living with my son at 230 Connecticut Hill Road. I was not happy to learn a few months ago that there are plans to erect 2 turbines to the southwest and 2 to the northwest of our home. Turbines #1 and #3 would be approximately 2,800 ft and 1,625 ft away, and #5 & #6 about 2,500 ft from my residence. And now possibly two more, B & C, are proposed a little farther to the northwest of our place.

With my limited English, (I was born and raised in Russia) I have not been able to research wind energy extensively, but I did discover some things that concern me: the effects on the environment and wildlife, and the health effects on humans, particularly due to noise. I already have some health issues, and am worried that they will worsen or increase.

www.wind-watch.org/documents/wind-power-and-ecology

Will there be any help for me if I suffer negative health effects from living near 6 wind turbines?

Also, will there be any compensation available to me and my son if and when we ever need to move, and cannot sell the property for what it is worth now?

Thank you for hearing my concerns.

Sincerely,

E Givotovsky

Eugenia Givotovsky

We, the Enfield Residents, Are Concerned....

Cornell University was planning on conducting a windmill project on Mount Pleasant (400 ft turbines) around 2005, similar to Enfield's. However, the plan was halted because of the community and neighbors safety concerns. There was a petition conducted with over 300 signatures to stop the project, because of their safety concerns. Many residents were upset, sad, and scared, and the project didn't happen. Now CU is planning to purchase the electricity generated from this project. What about us--the Enfield residents--with our safety concerns, our fears, our sadness, our worries? Enfield residents already have over 200 signatures from the community on a petition, not to stop the project, but to simply push the setbacks to a safer distance from our homes.

This wind energy project was supposed to be a great green community project in efforts to be more Earth friendly. However, in reality, residents who will be living a mere 1000 ft from these 483 foot turbines (equivalent to two of Taughannock Falls stacked on top of each other plus another 50 ft) are worried; some might have to live with the persistent shadow flicker on their properties (which is like turning a light switch on and off for extended periods of time), possibly making them sick, and the constant hum and swoosh of the blades for the rest of their lives. Not being able to work in their gardens or have a barbecue without the constant noise is a real concern. Also, always in the back of their minds is the worry that at any moment a blade could fly off, or ice could be thrown several hundreds of feet landing in their backyards. Residents fear that they might have to move; some residents with small children may be forced to move because of the consequences of these turbines.

Residents are now not talking to their neighbors; it has completely divided this town. Drive up here and look for yourselves; some people are already trying to sell their homes for fear of living so close to them. This project was supposed to bring the community together. The members of the Black Oak wind project keep expressing that the community is supporting this project when in reality, local residents are truly scared, upset, and confused. Many of them didn't even know about this project until a few months ago.

Several of the investors and supporters of this project are clearly not informed of the danger of living so close to these giant turbines. People can voice all they want about real and not-real information, but the reality is that affected families are abandoning their homes, towns are passing laws to shut them off at night, and Australia is funding millions of dollars to research the adverse side affects from industrial wind turbines. Black Oak Wind Farm has not worked with the Enfield residents at all or listened to our concerns. The turbine now being shuffled around was breaking the current law. That is why it is being moved--not to accommodate residents. We are not scared of change; we are not scared of seeing them. What we are scared of is the constant noise, shadow flicker, ice throw, and infrasound; also the possibility of their falling over or a blade breaking off, which happens more often than one might think.

People seem to think infrasound is not a real issue. However, bats that fly too close to turbines don't usually get hit by the blades; rather, their lungs end up exploding from the infrasound, a noise the human ear cannot audibly hear, but that can travel miles. If it kills bats getting within a certain range, what might the effects be on us humans? Some people living near wind turbines go to bed every night with a ringing in their ears. Others experience headaches, nausea, and sleep disturbance. These are the effects we fear! We the residents did not ask for this! This project should not affect one person. We are a community, and as a whole it should affect 0 percent. Why should even 5 percent of people have to suffer adverse effects from this? Is this fair to residents? Why should our daily lives have to be jeopardized to accommodate this project?

Many people visit a wind facility, think it's great, and love the turbines. They visit them for maybe several hours. They try to talk to residents who live nearby, but many may be under a gag order (under contract with the wind developer, so they cannot talk), preventing them from telling you what is truly going on in their lives. Try living day after day next to turbines; the constant swoosh of the blades is going to be enough to make anyone depressed; people won't even be able to open up a window in their own home because of the intrusive noise. This is something many of the residents are concerned about. What if we cannot get used to the noise? What are we supposed to do then? Call an 800-number and voice our problem to a machine, and for what? How are they going to address our issues? Are they going to come up with some type of resolution for the affected residents? So many unanswered questions...

We residents of Enfield are not opposing this project; we are opposing how close BOWF is squeezing these in among our homes. This project is being pushed through and forced onto the local residents. We, the people, live along these roads; some will be affected for the rest of our lives and into our children's lives. Will there be an acceptable decommissioning fund in place to deconstruct the 483 ft turbines when the time comes? If not, what will that mean? It may become the responsibility of the Town of Enfield, which may mean higher taxes for the residents who are already struggling to make a living.

Black Oak Wind Farm, along with its investors, is trying to force a project through onto a small community that is truly concerned! If this project is allowed to be pushed through the way it has thus far, it will devastate this community and tear it apart more than it has already has. Obviously, at this point Black Oak Wind Farm, along with its investors, doesn't care! So much for a "green, community, earth-friendly project." Yes, we all agree that we need to cut down on waste and be more 'green', but we ask you, the supporters and general public, is it fair for our lives to be sacrificed for this? What if you lived up here? What if this was going to affect your family? Would you then have a different opinion? The investors, the board of Black Oak Wind Farm, and the Town of Enfield board members don't live on our roads, or anywhere near where these industrial turbines would be sited; so therefore, it will not affect them or their families.

We feel the investors are pushing this project through just so they won't lose out on their investments. The reality is that when they signed on and agreed to invest in this project, they were never guaranteed a return. It is clearly stated in the paperwork they signed and agreed to, that they could lose some or all of their investment. Some of them invested money into this project before Black Oak had corporate backing, or before the town even started the approval process. So in reality, if a large investor had not been found, or if certain papers were never approved by the town board, the investors would have lost anyway, right? It was a huge risk they decided to take; it was never forced on them, much like investing in the stock market.

This project is being forced onto us. Where is our decision? What about the money we have invested into our properties, our homes, our animals? What about us? Some families have recently paid off their homes that they worked hard many years of their life to do so; for what? If these turbines get constructed by their homes, it is likely they won't be able to even sell their places and move. Their property value will decrease and they will be stuck. If living near a turbine becomes impossible and they are forced to move, they may lose their property and the money they have invested into their houses, along with giving up flowers and trees they may have planted, or other improvements they've made. If, in the end, the investors lose their money, at least they won't lose their homes like we might.

Many people are clearly uninformed about the risks of living so close to industrial wind turbines. Yes, other towns have turbines, but if people research they will discover that many of these towns are increasing their setbacks in response to the problems the residents are experiencing. We are not sure what the future holds regarding this project, but we can tell you, there are many families that are truly anxious about them being constructed so close to our homes and property.

If anyone cares to comment on the quietness of a 483 ft turbine, first go camp 1000 ft from one for 5 days. Feel the full effect! Then write your opinion, not after a half hour tour bus visit. You may return with a completely different impression of them.

Thank you for reading this. We need people to try to understand and be more informed on what is truly going on. These are our lives, our homes, our land, our animals, our retreat after work. Please become more informed before supporting a project that is tearing our town apart. We need a guarantee from Black Oak Wind Farm or the Enfield Town Board, giving us, the residents, some type of assurance that we will be okay or have options for our future.

Sincerely,

Erica Newhart, Chad Newhart, Dawn Drake, Tommy Drake, Sue Wagner, Don Wagner, Dale Marcy, James Bradford, Anne Lowe, Sue Shults, Maria Ortiz, Steve Tanner and many others living in the Immediate Vicinity of the Turbines.

Jolee Carlisle
463 Black Oak Road
Trumansburg, NY 14886 (Town of Enfield)
607-279-3630

April 21, 2016

To: The Enfield Town Board
Black Oak Wind Farm

Re: the draft "SEIS" to the Town Board under the "SEQR"

My name is Jolee Carlisle. I am the Executor of the Estate of Christopher Carlisle, who was the owner of property located at 463 Black Oak Road in the Town of Enfield at the time of his death. I had lived on that property with Chris from November of 1996 until 2011. After his death, and by virtue of his will, I am once again, the owner of this property.

You are receiving many letters on the scientific viewpoint of my residents and neighbors, but I am providing a personal viewpoint.

Before Chris and I were married, we bought an approximate 4 acre parcel of vacant farm land from Chris' grandfather, Arthur Everhart. When we returned 3 years later from a military assignment in South Dakota, Chris and I began the process of putting our home on this piece of land. We helped with most phases of this from grading the driveway to leveling out the plot to raking and watering the grass seed we planted. We planted every tree, bush and flower that we have. Chris spent hours and hours building the stone wall that runs almost the length of the southern boundary of our land. We worked many years and many hours to build our home. There are many things we like about that piece of land. It was in the country, far from any city noise. There are an abundance of wild animals and birds. We could sit out on either of our two porches and hear birds chirp, watch sun rises and sunsets or an number of wild animals play or eat in the fields surrounding our home.

Now Black Oak Wind Farm wants to put not just one, but two 450 foot wind turbines behind my home; one only 1100 +/- from my back property line. They also want to place a third one about 2000' +/- to the south of my property line. The placement of these turbines will take all of that away. I have a fundamental right to the quiet enjoyment of my property. My children have a fundamental right to the same. Future generations have this same fundamental right.

My first encounter with anyone from BOWF was not an impressive one. Chris died on September 20th. On or about the 22nd or 23rd of September, a member of BOWF came to the house with the infamous "Good Neighbor Agreement" and presented it to my 21 year old son. Now keep in mind, his father had just passed away a day or so prior. The young man (who never gave my his name) handed the Agreement to my son and told him that it needed to be signed (without reviewing it, or being given the chance to do so). When my son told him that his father had just passed away and couldn't sign it, the representative from BOWF told my son to just sign his dad's name and back date it to before he died. My son said no and took the copy of the Agreement. The explanation I received when I called BOWF to question this behavior was not satisfactory either. Ms. Wells told me something to the effect that "oh, we were just trying to be sure everyone who was entitled to get money from the project was able to before the deadline." Needless to say, this put a bad taste in my mouth that hasn't gone away with any of the actions I have seen since then by this organization or its project.

Don't get me wrong, I am all for decreasing my carbon footprint, and promoting green energy usage, if done properly and safely. I do not, however, want these wind turbines in the fields behind or around my house.

I have read and heard many articles and discussions about things such as infrasound, setbacks, flicker, ice throw, mitigation and a multitude of other things I have never heard of before. My home is going to be and will continue be affected by all of these things, and more. Some of them at the same time. What troubles me is the lack of concern for the safety of us residents whose homes are directly affected by all of these things. BOWF downplays every one of these concerns. In addition, BOWF has not been forthcoming with information that has been requested so that this Board and the residents most directly affected can make an informed decision about this project.

As far as I am concerned, no one has provided me with any evidence that my basic fundamental right to the quiet enjoyment of my property will be maintained by the placement of these turbines.

I suggest the Board put yourself in my shoes. Go home tonight, sit in your kitchen and have someone flick your light switch moderately fast for approximately 45 minutes (the average amount of time every morning I would have this happening). I tried this and lasted about 3 minutes before I started to get dizzy. As far as the noise level, I have no way to make this comparison, but I can bet it gets pretty annoying as well.

I am requesting that the Board not approve the draft SEIS or issue any permits.

Thank you.

Respectfully,

Jolee Carlisle

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Thursday, April 21, 2016 4:19 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: comment for BOWF DSEIS

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: comment for BOWF DSEIS
Date: 04/21/2016 11:59 am
From: michael-carpenter@townofenfield.org
To: townclerk@townofenfield.org

A careful reading of setback and noise information in regards to wind generators shows that the effects on close neighbors to the generators vary greatly.In all the information supplied in their filings,BOWF is careful to present that most in keeping with their own needs.A close reading of their own submittals,particularly Appendix V of the Draft EIS,however ,shows that most of the setback distances and noise standards chosen were arbitrary-as were those of the Enfield Wind Law-and not necessarily in keeping with best practice of even 5 or 6 years ago,to say nothing of today's standards,which tend to be much stricter.There is no question that noise,exacerbated by proximity to wind generators,is an issue.Whether is has been legally proven,to date,to be a "health"issue or simply an "annoyance",as BOWF states,is really beside the point.Living with something that "annoys" you,24 hours a day for the rest of your life(or waiting for it to start happening,knowing it will,perhaps even worse),cannot help but quickly become a "health"issue.It is likely that not everyone living in proximity to a generator will be adversely affected,and just as likely that some will be.BOWF needs to take take this into account ,now,in this Draft SEIS and work with the Town of Enfield to find a way to insure that the latter group will have a way to move away from this area of proximity and not suffer financial loss in doing so.To say that BOWF cannot afford to do this is not immediately relevant,as you do not know what the cost would be.When the statements made by BOWF saying studies show no loss of real estate value to houses close to wind farms are considered,then there should be very little cost involved.To answer that this is an economic issue,and therefore not covered in this process is also irrelevant,as it is a health issue with economic consequences.To argue that the wind law does not require this level of compliance,I would say that Article III ,section 3 allows for the denial of a permit based on the town boards consideration of the SEQRA review process in its entirety.This section states that "Upon completion of the review process"the board shall make its decision ,with accompanying reasons for approval or denial. Please address this issue in a substantive way.

Mike Carpenter

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Thursday, April 21, 2016 4:18 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: Public comment for Draft Supplemental Environmental Impact Statement

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Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: Public comment for Draft Supplemental Environmental Impact Statement
Date: 04/21/2016 1:47 pm
From: michael-miles@townofenfield.org
To: townclerk@townofenfield.org

Hi Alice,

Here is my public comment for Draft Supplemental Environmental Impact Statement:

Given that the original Draft Environmental Impact Statement includes a Wind Turbine Health Impact Study that states "There is sufficient evidence that falling ice is physically harmful and measures should be taken to ensure that the public is not likely to encounter such ice.", and

Given that General Electric recommends (GE-4262) locating turbines a safe distance from any occupied structure, road, or public use area and determining that a safe distance is: 1.5 * (hub height + rotor diameter), and

Given that Black Oak Wind Farm has determined that this safe distance, based on the proposed GE 2.3-107 model wind turbines is 994 feet, and

Given that property owners in the Black Oak area of the proposed turbine locations are not all "participants" that have leased their land or signed neighbor agreements with Black Oak Wind Farm, and

Given that non-participating property owners in the Black Oak area should be able to use and subdivide their land for the purpose of adding residences and other uses, and that some residents have already expressed the desired to do so, and that there is a history of residents (some multi-generational) having already done so, and

Given that the proposed locations, including the new configuration of the wind turbines, and the safe distances of 994 around them, overlap non-participating property owner's land, I am concerned that that Black Oak Wind Farm is using non-participating property owner's land to mitigate a serious and "harmful" impact without appropriate permission through a lease or contract. By doing so, they are preventing the land owners from fully utilizing their property and preventing them from subdividing and/or building additional residences. It also limits their recreational use of their land. I've heard at recent meetings a comparison to a hypothetical neighbor adding a pig farm next door or a scrap yard. I do not find this to be a fair comparison. While the pig farm or scrap yard may represent an undesirable nuisance, the potential impact of ice and blade throws onto non-participating property owner's land represents a public health and safety issue that should not be overlooked. Even is such occurrences are rare, they still do happen, and the threat of this potential will also have a negative psychological impact on residents within the 994 safety distance. I believe using non-participating property owner's land in this way is not appropriately mitigating ice throws and is and is an effective taking of land rights without permission or compensation.

Thanks you,
Michael Miles
326 Aiken Rd, Trumansburg, NY 14886
Town of Enfield Councilperson

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Saturday, April 23, 2016 4:24 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: Wind Farm Letter from Ron Riddle at 235 Harvey Hill Rd
Attachments: Wind Farm Letter .pdf

Mr. Riddle left a phone message on Friday asking that this be accepted even though it is a few hours late.

Thanks,
Alice

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: Wind Farm Letter from Ron Riddle at 235 Harvey Hill Rd
Date: 04/23/2016 6:29 am
From: Ron Riddle <ron.riddle@gmail.com>
To: townclerk@townofenfield.org

Dear Alice,

Attached please find my letter to the board concerning the wind farm.
It's a PDF.

Please let me know if you have any trouble opening it.

Thanks,

Ron--

Ron Riddle
www.ronriddle.com [1]
cell 607-280-0194
ron.riddle@gmail.com

Links:
------
[1] http://www.ronriddle.com

Ron Riddle
235 Harvey Hill Rd.
Ithaca, NY 14850
607-280-0194
ron.riddle@gmail.com

April, 21st, 2016

Town of Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
townclerk@townofenfield.org

To the Enfield Town Board:

This is Ron Riddle. I live at 235 Harvey Hill Rd. in Enfield. I'm writing in response to Wind Farm Project.

I've been out of state most of the winter caring for a family member with cancer.
I only found out recently (through a friend) that there had been a change in the proposed turbine sites which puts Towers T1 and T3 literally right next to my property. (shown in the diagram below)

After reading everything I could on wind turbines I am more than a bit concerned.

I'm a composer for film and broadcast television. I work in my home studio here on Harvey Hill Rd., where I write and record music for shows on National Geographic , The Discovery Channel, A&E, CBS, Investigation Discovery, Animal Planet, etc.

My work involves writing and recording music for TV shows. The shows are for broadcast so the audio recordings need to comply with the high-quality standards of the industry.
The sound recordings have to be made in a very quiet environment, which was a major contributing factor when the house was bought .

The process of recording high-quality audio is very sensitive. When you record, the microphones will pick up every little sound, no matter how minute. So a quiet space is of utmost importance.
I have taken great pains and money to soundproof the walls, floors, and ceilings of the studio so that no ambient noise gets into the recordings.

Wind turbine noise has an insidious low frequency that comes through the walls of homes despite insulation. The low frequency has been known to turn a home into a resonating chamber thus making the sound pollution increasingly louder.

A perfect storm of sound pollution

About 70% of the time. there is a predominate West wind that blows on Harvey Hill. When this happens the wind will carry the combined sum of the seven turbines in my direction, resulting in a perfect storm of sound pollution. This is an audio nightmare, that no doubt will have devastating effects on my business and make it impossible for me to record.

Mental and Physical Affects:

Working with sound for a living the way that I do,
has made me acutely aware of the effects that certain tones and frequencies can have on the emotional state of humans.
It gets particularly complicated when you have more than one wind turbine (and in this case seven of them), emitting harmonic frequencies and, tones. Sound waves that are pulsating and moving out of sync with each other at different rates of speed can leave a person feeling disorientated and sick. Certain frequencies in combination have the ability to make humans feel fear, disorientation, anxiety, paranoia, etc. Indisputable sounds in repetition over a period of time can make people literally go insane. Technics such as these were used for torture in POW and concentration camps. Wind Turbine Syndrome is no joke, nor is it some mass hysteria. Nausea, anxiety, sleeplessness, concentration and memory deficits, headaches, tinnitus, vertigo, etc. The number of health complaints from people who have lived among these turbines is in the thousands! We have seen these

symptoms and characteristics or WTS in residents of a suburban community in Massachusetts where the first turbines in a residential had been placed. With more turbines being located near people's homes all over the world victim numbers are increasing steadily. People becoming so sick that they have to leave their homes.

This is not a case of "not In my backyard", but I think that due to the safety and health issues, unpopulated tracts of land would be better suited for the operation of wind turbines. All one has to do is look at a map of New York State to see the vast tracts of unpopulated land that could be used that wouldn't put people at risk. If solar panels were to go up in the field next to me I would support it wholeheartedly.
I'm a conservationist and environmentalist and have been one all of my life. I have plans of putting solar panels on my property and converting largely to solar energy.

My Home As a Historic Site

My home is an immaculate Victorian from the 1870's and is arguably one of the best examples of Victorian farm architecture in upstate New York. It is not only a historic Enfield house but one of the most cared for and maintained pieces of property around. I have put my heart and soul into caring for it and literally have put hundreds of thousands of dollars in its upkeep and beautification.

My Home, eligible to be listed on the National Register of Historic Places). Requires the BOWF to address the impacts that the wind farm project on my home. Guidelines set forth by the National Register of Historic Places protect it from visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features. I believe that all of these factors are relevant to my situation given that my home is in clear view of all seven proposed turbine sites. and the levels of noise pollution, (up to 60 dBa) which Enfield has allowed the BOWF to operate at is one of the worst in the country.

Gratitude & Grace

I bought our home 17 years ago for my wife. It was her sanctuary and she

took great pride in our home. She would greet visitors by always saying "welcome to paradise"!
My wife died four years ago after fighting a brutal battle with lung cancer. After her death, I wanted to find a way to honor her by sharing the beauty & love that we experienced at our home with others. It started out with a few friends who wanted to have their wedding here or families that wanted to stay a week for their vacation. Word began to spread about the serenity, peacefulness, and beauty of the place. Now over the span of a few years "Gratitude & Grace" is not only a local favorite but couples come from all over the country to be married here! They all come for the same reasons: it's beauty, peace and tranquility. It reflects another time in history where life was slower and more graceful. It is truly a gift and nothing short of a miracle! I named it "Gratitude & Grace" in memory of my wife "Andrea Riddle".

Though "Gratitude & Grace" I directly employ carpenters, landscapers, house cleaners, electricians, plumbers, painters, architects, and furniture makers. Indirectly "Gratitude & Grace" is responsible for the employment of florist's, photographer's, officiants, local catering companies, waiters, waitress's, local B&B's and Inn's, hotels and restaurants. Over a thousand local people, a season benefit and all of these people pay taxes directly to New York State.
but with the proposed BOWF sites, the very core of what makes "Gratitude & Grace" one of the most special places is being threatened.

People come from all over because they feel the tranquility and peace but with the level of noise pollution produced by these metal giants, larger than the Statue of Liberty, will endanger the very core of why residents have chosen to live in a picturesque natural community such as Enfield. Why should we, in this community, have to suffer the consequences of those whose choice it is to live in the "urban jungle"? It is they that live in the ultra-urban society of NYC that benefit from the monstrosities of these turbines. What happens when there is no longer anywhere for people to go and be amongst nature, away from man-made edifices, and enjoy the peace of the country?
What happens when people can't get a decent nights sleep or will no longer be able to hear the birds. All they hear is constant grating of frequencies and pulsating whirring that never stops. People nerves will be

shot and tempers will become short. No one will want to have a wedding ceremony here because it will be too frustrating to try to compete with the turbine noise. Soon the people and local jobs will be gone because the peace and tranquility and drew them here to begin with will no longer exist.

Now there is a menacing dark cloud on the horizon. It comes in the form of seven giant metal turbines and threatens the very core of what makes "Gratitude & Grace" one of the most special of places. People come from all over because they feel the tranquility and peace of the place and they, in turn, can feel that in themselves and pass it onto others.

How does something of this magnitude happen without the town informing it's property owners, who are directly affected?
I didn't receive a letter or a phone call. or an email! In fact, if my friend had not personally told me about this that I may have still not known.
This begs the question as to why myself and others were kept in the dark. Why the secrecy? Obviously so that there would be little opposition to the site switch. By the time, I found out about the new site next to me, Pete DiStephano had already signed a contract allowing this to happen.

The amount of secrecy behind this brings up a lot of questions in regard to the nature of this project, who's benefiting
and why? I find it suspicious that, Enfield itself receives no direct benefit from the project and it's not even Enfield community owned.
So, why are certain town people and board members trying so desperately to push this through? What is their motive? What do they personally stand to benefit by this?

I believe, this is not really about green sustainable energy and saving the planet from climate change as much as it's about big business, payoffs, tax breaks and investors investing in the next big commodity to make a buck. These people typically try to make it appear like they are doing wonderful things for the community but really it comes down to the same old thing... big business with big money, monopolizing resources from small townspeople and getting them to sign away their rights by giving them a few crumbs of the action to keep them quiet.

What I find the most disturbing is the blatant disregard of health issues. I am outraged that Enfield and members of the town board would put the safety of its citizen's last to receiving tax breaks and wind farm money.

In summary:
I couldn't be more against the BOWF and particularly the newly proposed sites which I feel will have a devastating effect on my livelihood, property value and state of mind.

My home is my sanctuary and I will do whatever is necessary to protect it.

Sincerely,

Ron Riddle

Ron Riddle
235 Harvey Hil Rd.
Ithaca, NY 14850

cc: Law offices of Williamson, Clune & Stevens,

--
Ron Riddle
www.ronriddle.com
cell 607-280-0194
ron.riddle@gmail.com

Palermo, Jean

From:	townclerk@townofenfield.org
Sent:	Saturday, April 23, 2016 4:24 PM
To:	Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject:	Fwd: Wind Farm Letter from Ron Riddle at 235 Harvey Hill Rd
Attachments:	Wind Farm Letter .pdf

Mr. Riddle left a phone message on Friday asking that this be accepted even though it is a few hours late.

Thanks,
Alice

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: Wind Farm Letter from Ron Riddle at 235 Harvey Hill Rd
Date: 04/23/2016 6:29 am
From: Ron Riddle <ron.riddle@gmail.com>
To: townclerk@townofenfield.org

Dear Alice,

Attached please find my letter to the board concerning the wind farm.
It's a PDF.

Please let me know if you have any trouble opening it.

Thanks,

Ron--

Ron Riddle
www.ronriddle.com [1]
cell 607-280-0194
ron.riddle@gmail.com

Links:
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[1] http://www.ronriddle.com

Ron Riddle
235 Harvey Hill Rd.
Ithaca, NY 14850
607-280-0194
ron.riddle@gmail.com

April, 21st, 2016

Town of Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
townclerk@townofenfield.org

To the Enfield Town Board:

This is Ron Riddle. I live at 235 Harvey Hill Rd. in Enfield. I'm writing in response to Wind Farm Project.

I've been out of state most of the winter caring for a family member with cancer.
I only found out recently (through a friend) that there had been a change in turbine sites and that my property was in very close proximity to them. After reading everything I could on wind turbines I was more than a bit concerned.

I'm a composer for film and broadcast television. My work involves my writing music and recording with the highest of quality standards. The sound recordings have to be made in a very quiet environment. Seventeen years ago my wife and I bought our house because of its quiet surroundings A major contributing factor in our decision to buy our house seventeen years ago. I work in my home studio here on Harvey Hill Rd., writing music for National Geographic Television, The Discovery Channel, A&E, CBS, Investigation Discovery, Animal Planet, The Science Channel.

The Learning Channel, Oprah Winfrey Network. etc.
The process of recording high-quality audio is very sensitive. When you record, you hear every little sound, no matter how minute. I have taken great pains and money to soundproof the walls, floors and ceilings so that no ambient noise gets into the recordings.
In the diagram below you can see exactly how close my property is to the proposed sites.

The combined whirring noise of being so close to seven turbines is going to literally be an audio nightmare! It's certainly no comfort that Enfield has given the BOWF free reign by setting the local wind turbine noise regulatory limit to 60 dBa which is actually the worst in the country!
Wind turbine noise has an insidious low frequency that penetrates homes or buildings regardless of soundproofing. No insulation available will be able to keep out the combined unwanted noise of these turbines. This is a disastrous scenario for my business and will make it impossible for me to work.

I don't have a problem with wind energy. I think it has it places BUT wind turbines are NOT made to be used in places where people are living. There are vast tracts of unpopulated New York State land that could be used for wind farms that wouldn't put people at risk.

Just to be clear… this is not a case of NIMBYism on my part. I am not objecting or resisting developing sustainable energy. On the contrary, I am passionate about it and how important it is to phase out depleting the Earth's fossil fuels. If solar panels went up in the field next to me I would support it wholeheartedly. I'm a conservationist and environmentalist and have been one all of my life. I drive a Prius to do my part to cut down on fuel emissions and have done so for the last ten years. I have plans of putting solar panels on my property and converting largely to solar energy. So no. This is not a case of "not In my backyard".

Everything I've read about sound pollution from the wind turbines makes me very uncomfortable. Not only about it affecting the sound quality of my recordings but the effects it could have on my thinking process, my concentration, my ability to make decisions, ringing in ears etc.

Working with sound for a living the way that I do, makes you aware of what certain tones, frequencies and particularly the combination of frequencies can do to a person's mental state. Certain sounds in repetition over a period of time can make people go insane. We've all heard of these technics being used in POW and concentration camps. Wind Turbine Syndrome is no joke. Nor is it some mass hysteria. Nausea, anxiety, sleeplessness, concentration and memory deficits, headaches, tinnitus, vertigo, etc. The number of health complaints from people who have lived among these turbines is in the thousands! All over the world victim numbers are increasing steadily. People becoming so sick that they have to leave their homes.

My home is an immaculate Victorian from the 1870's and is eligible to be listed on the National Register of Historic Places. It is arguably one of the best examples of Victorian farm architecture in upstate New York. It is not only a historic Enfield house but one of the most cared for and maintained pieces of property around. I have put my heart and soul into caring for it and literally have put hundreds of thousands of dollars in its upkeep and beautification.

I bought our house 17 years ago for my wife. It was her sanctuary and she took great pride in our home. She would greet visitors by always saying "welcome to paradise"!
My wife died four years ago after fighting a brutal battle with lung cancer. After her death, I wanted to find a way to honor her by sharing the beauty & love that we experienced at our home with others. It started out with a few friends who wanted to have their wedding here or families that wanted to stay a week for their vacation. Word began to spread about the serenity, peacefulness, and beauty of the place. Now over the span of a few years "Gratitude & Grace" is not only a local favorite but couples come from all over the country to be married here! They all come for the same reasons: it's beauty, peace and tranquility. It reflects another time in history where life was slower and more graceful. It is truly a gift and nothing short of a miracle! I named it "Gratitude & Grace" in memory of my wife "Andrea Riddle".

Though "Gratitude & Grace" I directly employ carpenters, landscapers, house cleaners, electricians, plumbers, painters, architects, and furniture makers. Indirectly "Gratitude & Grace" is responsible for the employment of florist's, photographer's, officiants, local catering companies, waiters, waitress's, local B&B's and Inn's, hotels and restaurants. Over a thousand local people, a season benefit and all of these people pay taxes directly to New York State.

Now there is a menacing dark cloud on the horizon. It comes in the form of seven giant metal turbines. It threatens the very core of what makes "Gratitude & Grace" one of the most special of places. People come from all over because they feel the tranquility and peace of the place and they, in turn, can feel that in themselves and pass it on to others, but with the level of noise pollution that will be produced by these metal giants they won't even be able to hear themselves think. What happens when people can't get a decent nights sleep or will no longer be able to hear the birds. All they hear is constant grating of frequencies and pulsating whirring that never stops. People nerves will be shot and tempers will become short. No one will want to have a wedding ceremony here because it will be too frustrating to try to compete with the noise. Soon the people will be gone because the peace and tranquility and drew them here to begin with will no longer exist.

I find it extremely suspicious that, Enfield itself receives no direct benefit from the project and it's not even Enfield community owned but still some town officials are still trying desperately to rush this, though. So who is benefiting from this? What are these people's ulterior motives? It smells bad to me and I think there needs to be a thorough investigation and someone needs to be held accountable.

In my opinion, this is not really about green sustainable energy and saving the planet from climate change as much as it's about big business, payoffs, tax breaks and investors investing in the next big commodity to make a buck. They are trying to deceive us (and probably themselves) by spinning it in a light that makes them look like they are the "do-gooders", but really it comes down to the same old thing… big business with big money monopolizing resources from small townspeople and getting them to sign away their rights by giving them a few crumbs of the action to keep them quiet.

In summary:
I couldn't be more against the BOWF and particularly the newly proposed sites which I feel will have a devastating effect on my livelihood, property value and state of mind.

My home is my sanctuary and I will do whatever is necessary to protect it.

Sincerely,

Ron Riddle

Ron Riddle
235 Harvey Hil Rd.
Ithaca, NY 14850

cc: Law offices of Williamson, Clune & Stevens,

William (Brad) Connors
1057 Bostwick Rd., Ithaca, NY 14850

April 21, 2016
Enfield Town Board
Subject: question regarding wind farm

Enfield Wind Farm advocates press forward as impending deadlines crucial for project continuation are near. Vast majority of residents living near the wind turbines continue to voice their concerns with questions regarding safety, health, and unknown long term effects. Advocates continue to reassure them no significant ill effects are likely, adding that the project will provide economic benefits, including local tax revenues and other funds to benefit the community. During recent community meetings intensely emotional opinions from both sides have been observed. Residents opposed, frustrated as their concerns are not taken seriously. Advocates frustrated this project will not materialize, fearing our civilization will perish unless clean energy alternatives advance quickly.

Interesting similarities in this campaign expanding wind power, is the past expansion and development of our nation. Take for example early settlers establishing homes and communities on the open range. As always the opportunists quick to realize the opportunities available to create wealth and prosperity for those who place their own greed above all else. Technology provides the opportunist ways to overwhelm the public with selective research, and expert opinion for example. This strategy is necessary to blind all from seeing a simple truth and true agenda.

Necessary were the railroad, mining and timber industries in advancing our country forward, while offering Native Americans meager compensation for the intrusion disrupting a lifestyle and surroundings. Obviously without this change our great nation of today would not exist. Having an understanding on the traumatic effects with a family relative who was forced to relocate from the home he built and raised a family in near Horseheads, when flood control measures were implemented. In this situation the need and benefit of this project is without question. Change is good only when a measurable benefit exists exceeding the undesirable effects.

Let's take a moment and look at this from a sensible perspective. Purpose of this project is clean energy to offset other forms of electric power generation, preventing global climate change. This wind turbine project is said to be capable of 12 – 14 megawatts of power generation, with insignificant environmental impact from the manufacturing and installation process. On a global scale the environmental impact of this project is insignificant with no contribution. However, current global electric consumption is so great this project cannot provide any measurable contribution in purpose.

Unfortunate for the investors with good intentions supporting an idea declaring to reduce the threat of climate change. Disturbing those who prey on the fears of others for profit. Appealing to these concerns our government provides federal taxpayer money supporting clean energy, hybrid automobile and battery companies with funding to promote growth in clean energy companies. Short lived as many are currently in bankruptcy leaving the taxpayers with over $800 million is losses. With Ithaca recently ranking #8 in the nation of most expensive places to raise a family can we afford to support initiatives that will likely result in a local increase in tax burden?

Conclusion is the only significant contribution this project will provide is wealth, along with personal and professional recognition.

My question is simple; why is this project with no measurable contribution to the problem advocates claim it's going help, is still allowed to be forced into our community? I believe my conclusion contains the only significant facts that can be verified in regards to this controversy.

4 <<

Subject	**BOWF draft supplemental environmental impact statement**
From	Betsy Allen <ballen@ithaca.edu>
To	townclerk@townofenfield.org <townclerk@townofenfield.org>
Date	04/21/2016 7:30 pm

roundcube

Elizabeth Allen
759 Black Oak Road
Newfield, New York 14867

Has anyone on the town board read the (SEIS) all the way through. It is important to the community and especially those people impacted by the decision to go ahead and put the wind farm into place. Frank Pavia with Labella made it very clear who he is representing. The plans to replace 3 different turbines keep changing. The size and setbacks have changed dramatically. Our concerns have fallen on deaf ears. We want answers from BOWF on noise levels, like infrasound, and its impact on peoples health. We are also concerned about set backs we want to know from BOWF where they are measuring, is it from the residence or the road? How will BOWF protect citizens from ice throw/blade throw/ fires in the turbines. What are the plans for making sure that the turbines are properly designed and properly constructed and installed. Are we simply relying on BOWF or is the town taking responsibility to also oversee this project and making sure the people impacted in the area of turbine placement are protected during construction and post construction. Who is responsible, we want answers, we did not get any answers from BOWF, they never got back to us on anything we need information from Marguerite Wells and Peter Bardaglio, why did they desert the Advisory Committee? If this is such a great idea to have a wind farm on Connecticut Hill why is it shrouded in secrecy. Why do you want to destroy the environment to save the environment? All common sense has gone out the window. The town board needs to do a lot more study on wind farms. No evidence has been presented to support industry claims that production of wind generated electricity lessens fossil fuel consumption. This project would never have begun if the government didn't give huge subsidies for these projects. Town Board don't be ignorant do your home work on wind farms.

4-22

Robert Tesori, Jr.
570 Black Oak Rd.
Newfield, NY 14867

Comments on SEIS – Black Oak Wind Farm Project

April 21, 2016

Town of Enfield Town Clerk
168 Enfield Main Rd.
Ithaca, NY 14850

To the Enfield Town Board:

This letter is in response to the Supplemental Environmental Impact Study proposed by the Black Oak Wind Farm. I am concerned with the language or lack of in the SEIS with regards to the lease holder's contracts.

Figure 1. Project Modifications in the SEIS lists turbines 2 and 7 as abandoned however the word "abandoned" was poorly chosen, "on hold" is more fitting. The third paragraph in section 1.1 Summary of the Modified Project states: Following the approval of the Approved Project, the Project Sponsor has decided to explore alternative locations for two turbines and the substation location. **While the Project Sponsor continues to assess its rights under the existing contracts with the landowners and potentially develop the Approved Project**, an assessment of potential alternatives has become necessary and as a result the Project Sponsor has prepared this SEIS for the Modified Project. **The previous approvals remain valid to the extent that the Project Sponsor is able to proceed**, but in the meantime, the Project Sponsor is assessing the potential significant adverse environmental impacts of these alternative locations for two turbines and substation.

This means the seven previous contracts with lease holders are still valid and now there are three more contracts with the prospect of alternate sites A,B, and C for a total of ten. What happens to the remaining three contracts not being used?

Language needs to be added to the SEIS stating the three contracts not used will be legally released. This way, property owners will know what future plans they need to make and the leases can't be exploited at a later date. Thank you.

Robert Tesori, Jr.

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Friday, April 22, 2016 5:52 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: my comments on Black Oak Wind Farm's draft Supplemental EIS
Attachments: Wind Turbines and Health A Critical Review of the Literature JOEM 2014.pdf; Enfield BOWF.pdf

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Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: my comments on Black Oak Wind Farm's draft Supplemental EIS
Date: 04/22/2016 11:13 am
From: lory@htva.net
To: townclerk@townofenfield.org

Dear Enfield Town Board members,

Attached as .pdf files are my letter that is my formal comment on Black Oak Wind Farm's draft supplemental Environmental Impact Statement and a journal article that is to be part of my comment.

I thank you for your work (over many, many years) on this issue.

Taylor Peck

6315 States Rd.

Alpine, NY 14805

Taylor Peck
6315 States Road
Alpine, NY 14805-9716
lory@htva.net

April 22, 2016

Town Clerk
Town of Enfield
182 Enfield Main Road
Ithaca, NY 14850

Re: Black Oak Wind Farm

To the Town Board Members:

These are my formal comments on the *Draft Supplemental Environmental Impact Statement* submitted by Black Oak Wind Farm to the Enfield Town Board. I live in Cayutaville in the Town of Catharine, less than a half-mile below the Town of Enfield line. I am also in the Odessa-Montour School District and therefore might benefit a little from the PILOT that Black Oak negotiated.

I wish to comment on the sound issue raised by those opposed to the Black Oak Wind Farm. Much concern has been expressed on the "infrasound" issue. My understanding is that there is very little actual peer-reviewed science that substantiates the concerns that wind turbine infrasound could be harmful. The article that I've seen referred to the most by the opposition is four decades old.

Wind turbine and blade designs have been significantly improved in the past 40 years. In the interests of being a better neighbor, Black Oak specifically chose a blade design (at the loss of some potential production) that is quieter. I am attaching (as a .pdf file) an article dated November 2014 from the *Journal of Occupational and Environmental Health,* peer-reviewed publication that is a widely used Occupational Medicine resource. It makes clear that there are little or no health effects from living near wind turbines.

I am not denying that there are some people who do report problems living close to wind turbines. However, this is probably better explained by the "nocebo" effect (the opposite of the placebo effect). If one thinks, feels, and believes that a particular situation could be problematic, a certain percentage of the population (at most one out of six) can report problems associated with that situation. As a (now retired) mental health professional, I am well aware of how anxiety, fear, and somaticization can interplay.

The Town Board accepted the original EIS in January of last year. I strongly urge you to accept these revisions and approve this project.

Respectfully submitted,

Wind Turbines and Health

A Critical Review of the Scientific Literature

Robert J. McCunney, MD, MPH, Kenneth A. Mundt, PhD, W. David Colby, MD, Robert Dobie, MD, Kenneth Kaliski, BE, PE, and Mark Blais, PsyD

Objective: This review examines the literature related to health effects of wind turbines. **Methods:** We reviewed literature related to sound measurements near turbines, epidemiological and experimental studies, and factors associated with annoyance. **Results:** (1) Infrasound sound near wind turbines does not exceed audibility thresholds. (2) Epidemiological studies have shown associations between living near wind turbines and annoyance. (3) Infrasound and low-frequency sound do not present unique health risks. (4) Annoyance seems more strongly related to individual characteristics than noise from turbines. **Discussion:** Further areas of inquiry include enhanced noise characterization, analysis of predicted noise values contrasted with measured levels postinstallation, longitudinal assessments of health pre- and postinstallation, experimental studies in which subjects are "blinded" to the presence or absence of infrasound, and enhanced measurement techniques to evaluate annoyance.

The development of renewable energy, including wind, solar, and biomass, has been accompanied by attention to potential environmental health risks. Some people who live in proximity of wind turbines have raised health-related concerns about noise from their operations. The issue of wind turbines and human health has also now been explored and considered in a number of policy, regulatory, and legal proceedings.

This review is intended to assess the peer-reviewed literature regarding evaluations of potential health effects among people living in the vicinity of wind turbines. It will include analysis and commentary of the scientific evidence regarding potential links to health effects, such as stress, annoyance, and sleep disturbance, among others, that have been raised in association with living in proximity to wind turbines. Efforts will also be directed to specific components of noise associated with wind turbines such as infrasound and low-frequency sound and their potential health effects.

We will attempt to address the following questions regarding wind turbines and health:

1. Is there sufficient scientific evidence to conclude that wind turbines adversely affect human health? If so, what are the circumstances associated with such effects and how might they be prevented?
2. Is there sufficient scientific evidence to conclude that psychological stress, annoyance, and sleep disturbance can occur as a result of living in proximity to wind turbines? Do these effects lead to adverse health effects? If so, what are the circumstances associated with such effects and how might they be prevented?
3. Is there evidence to suggest that specific aspects of wind turbine sound such as infrasound and low-frequency sound have unique potential health effects not associated with other sources of environmental noise?

The coauthors represent professional experience and training in occupational and environmental medicine, acoustics, epidemiology, otolaryngology, psychology, and public health.

Earlier reviews of wind turbines and potential health implications have been published in the peer-reviewed literature[1–6] by state and provincial governments (Massachusetts, 2012, and Australia, 2014, among others) and trade associations.[7]

This review is divided into the following five sections:

1. Noise: The type associated with wind turbine operations, how it is measured, and noise measurements associated with wind turbines.
2. Epidemiological studies of populations living in the vicinity of wind turbines.
3. Potential otolaryngology implications of exposure to wind turbine sound.
4. Potential psychological issues associated with responses to wind turbine operations and a discussion of the health implications of continuous annoyance.
5. Governmental and nongovernmental reports that have addressed wind turbine operations.

METHODS

To identify published research related to wind turbines and health, the following activities were undertaken:

1. We attempted to identify and assess peer-reviewed literature related to wind turbines and health by conducting a review of PubMed, the National Library of Medicines' database that indexes more than 5500 peer-reviewed health and scientific journals with more than 21 million citations. Search terms were wind turbines, wind turbines and health effects, infrasound, infrasound and health effects, low-frequency sound, wind turbine syndrome, wind turbines and annoyance, and wind turbines and sleep disturbances.
2. We conducted a Google search for nongovernmental organization and government agency reports related to wind turbines and environmental noise exposure (see Supplemental Digital Content Appendix 1, available at: http://links.lww.com/JOM/A179).

From the Department of Biological Engineering (Dr McCunney), Massachusetts Institute of Technology, Cambridge; Department of Epidemiology (Dr Mundt), Environ International, Amherst, Mass; Travel Immunization Clinic (Dr Colby), Middlesex-London Health Unit, London, Ontario, Canada; Dobie Associates (Dr Dobie), San Antonio, Tex; Environment, Energy and Acoustics (Mr Kaliski), Resource Systems Group, White River Junction, Vt; and Psychological Evaluation and Research Laboratory (Dr Blais), Massachusetts General Hospital, Boston.

The Canadian Wind Energy Association (CanWEA) funded this project through a grant to the Department of Biological Engineering of the Massachusetts Institute of Technology (MIT). In accordance with MIT guidelines, members of the CanWEA did not take part in editorial decisions or reviews of the manuscript. Drs McCunney, Mundt, Colby, and Dobie and Mr Kaliski have provided testimony in environmental tribunal hearings in Canada and the USA. The Massachusetts Institute of Technology conducted an independent review of the final manuscript to ensure academic independence of the commentary and to eliminate any bias in the interpretation of the literature. All six coauthors also reviewed the entire manuscript and provided commentary to the lead author for inclusion in the final version.
The authors declare no conflicts of interest.
Supplemental digital contents are available for this article. Direct URL citation appears in the printed text and is provided in the HTML and PDF versions of this article on the journal's Web site (www.joem.org).
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3. After identifying articles obtained via these searches, they were categorized into five main areas that are noted below (section D) and referred to the respective authors of each section for their review and analysis. Each author then conducted their own additional review, including a survey of pertinent references cited in the identified articles. Articles were selected for review and commentary if they addressed exposure and a health effect—whether epidemiological or experimental—or were primary exposure assessments.
4. Identified studies were categorized into the following areas:

    I. Sound, its components, and field measurements conducted in the vicinity of wind turbines;
    II. Epidemiology;
    III. Effects of sound components such as infrasound and low-frequency sound on health;
    IV. Psychological factors associated with responses to wind turbines;
    V. Governmental and nongovernmental reports.

5. The authors are aware of reports and commentaries that are not in the scientific or medical peer-reviewed literature that have raised concern about potential health implications for people who live near wind turbines. These reports describe relatively common symptoms with numerous causes, including headache, tinnitus, and sleep disturbance. Because of the difficulties in comprehensively identifying non–peer-reviewed reports such as these, and the inherent uncertainty in the quality of non–peer-reviewed reports, they were not included in our analysis, aside from some books and government reports that are readily identified. A similar approach of excluding non–peer-reviewed literature in scientific reviews is used by the World Health Organization (WHO)'s International Agency for Research on Cancer (IARC) in its deliberations regarding identification of human carcinogens.[8] International Agency for Research on Cancer, however, critically evaluates exposure assessments not published in the peer-reviewed literature, if conducted with appropriate quality and in accordance with international standards and guidelines. International Agency for Research on Cancer uses this policy for exposure assessments because many of these efforts, although containing valuable data in evaluating health risks associated with an exposure to a hazard, are not routinely published. The USA National Toxicology Program also limits its critical analysis of potential carcinogens to the peer-reviewed literature. In our view, because of the critical effect of scientific studies on public policy, it is imperative that peer-reviewed literature be used as the basis. Thus, in this review, only peer review studies are considered, aside from exposure-related assessments.

RESULTS

Characteristics of Wind Turbine Sound

In this portion of the review, we evaluate studies in which sound near wind turbines has been measured, discuss the use of modeled sound levels in dose–response studies, and review literature on measurements of low-frequency sound and infrasound from operating wind turbines. We evaluate sound levels measured in areas, where symptoms have been reported in the context of proximity to wind turbines. We address methodologies used to measure wind turbine noise and low-frequency sound. We also address characteristics of wind turbine sound, sound levels measured near existing wind turbines, and the response of humans to different levels and characteristics of wind turbine sound. Special attention is given to challenges and methods of measuring wind turbine noise, as well as low-frequency sound (20 to 200 Hz) and Infrasound (less than 20 Hz).

Wind turbines sound is made up from both moving components and interactions with nonmoving components of the wind turbine (Fig. 1). For example, mechanical components in the nacelle can generate noise and vibration, which can be radiated from the structure, including the tower. The blade has several components that create aerodynamic noise, such as the blade leading edge, which contacts the wind first in its rotation, the trailing edge, and the blade tip. Blade/tower interactions, especially where the blades are downwind of the tower, can create infrasound and low-frequency sound. This tower orientation is no longer used in large wind turbines.[9]

Sound Level and Frequency

Sound is primarily characterized by its pitch or frequency as measured in Hertz (Hz) and its level as measured in decibels (dB). The frequency of a sound is the number of times in a second that the medium through which the sound energy is traveling (ie, air, in the case of wind turbine sound) goes through a compression cycle. Normal human hearing is generally in the range of 20 to 20,000 Hz. As an example, an 88-key piano ranges from about 27.5 to 4186 Hz with middle C at 261.6 Hz. As in music, ranges of frequencies can be described in "octaves," where the center of each octave band has a frequency of twice that of the previous octave band (this is also written as a "1/1 octave band"). Smaller subdivisions can be used such as 1/3 and 1/12 octaves. The level of sound pressure for each frequency band is reported in decibel units.

To represent the overall sound level in a single value, the levels from each frequency band are logarithmically added. Because human hearing is relatively insensitive to very low- and high-frequency sounds, frequency-specific adjustments or weightings are added to the unweighted sound levels before summing to the overall level. The most common of these is the A-weighting, which simulates the human response to various frequencies at relatively low levels (40 phon or about 50 dB). Examples of A-weighted sound levels are shown in Fig. 2.

Other weightings are cited in the literature, such as the C-weighting, which is relatively flat at the audible spectrum; G-weighting, which simulates human perception and annoyance of sound that lie wholly or partly in the range from 1 to 20 Hz; and Z-weighting, which does not apply any weighting. The weighting of the sound is indicated after the dB label. For example, an A-weighted sound level of 45 dB would be written as 45 dBA or 45 dB(A). If no label is shown, the weighting is either implied or unweighted.

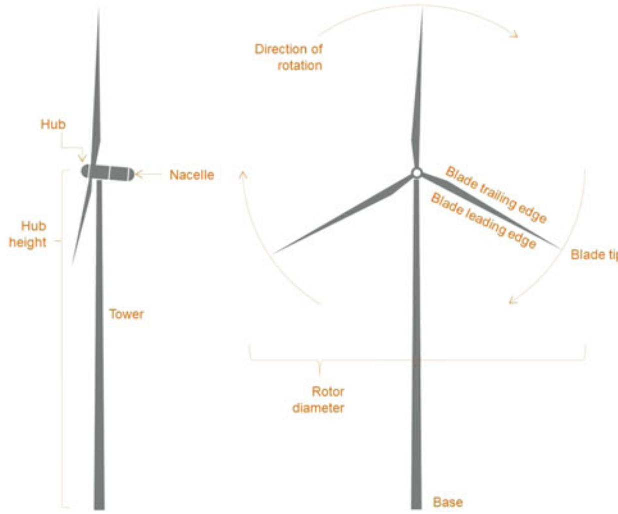

FIGURE 1 . Schematic of a modern day wind turbine.

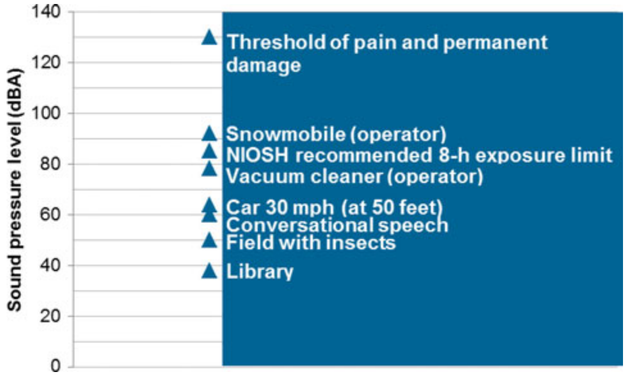

FIGURE 2. Sample A-weighted sound pressure levels.

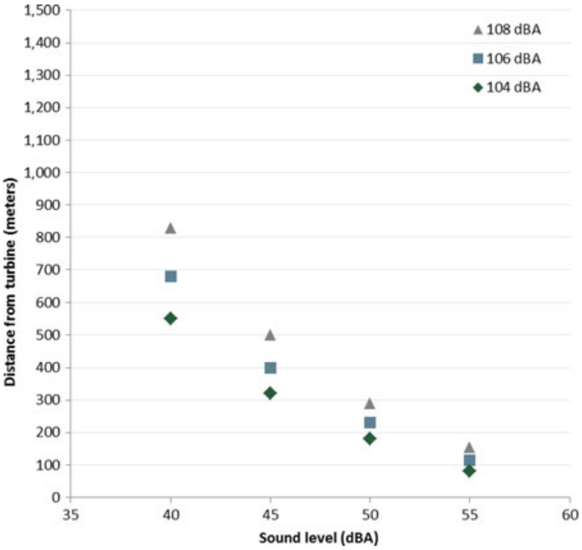

FIGURE 3. Sound levels at varying setbacks and turbine sound power levels—RSG Modeling, Using ISO 9613-2.

Beyond the overall level, wind turbine noise may be amplitude modulated or have tonal components. Amplitude modulation is a regular cycling in the level of pure tone or broadband sound. A typical three-bladed wind turbine operating at 15 RPM would have a modulation period or cycle length of about 1.3 seconds. Tones are frequencies or narrow frequency bands that are much louder than the adjacent frequencies in sound spectra. Prominent tones can be identified through several standards, including ANSI S12.9 Part 4 and IEC 61400-11. Relative high-, mid-, and low-frequency content can also define how the sound is perceived, as well as many qualitative factors unique to the listener. Consequently, more than just the overall levels can be quantified, and studies have measured the existence of amplitude modulation, prominent tones, and spectral content in addition to the overall levels.

Wind Turbine Sound Power and Pressure Levels

The sound *power* level is the intrinsic sound energy radiated by a source. It is not dependent on the particular environment of the sound source and the location of the receiver relative to the source. The sound *pressure* level (SPL), which is measured by a sound-level meter at a location, is a function of the sound *power* emitted by neighboring sources and is highly dependent on the environment and the location of the receiver relative to the sound source(s).

Wind turbine sound is typically broadband in character with most of the sound energy at lower frequencies (less than 1000 Hz). Although wind turbines produce sound at frequencies less than the 25 Hz 1/3 octave band, sound power data are rarely published below that frequency. Most larger, utility-scale wind turbines have sound power levels between 104 and 107 dBA. Measured sound levels because of wind turbines depend on several factors, including weather conditions, the number of turbines, turbine layout, local topography, the particular turbine used, distance between the turbines and the receiver, and local flora. Meteorological conditions alone can cause 7 to 14 dB variations in sound levels.[10] Examples of the SPLs because of a single wind turbine with three different sound powers, and at various distances, are shown in Fig. 3 as calculated with ISO 9613-2.[11] Measurement results of A-weighted, C-weighted, and G-weighted sound levels have confirmed that wind turbine sound attenuates logarithmically with respect to distance.[12]

With respect to noise standards, Hessler and Hessler[13] found an arithmetic average of 45 dBA daytime and 40 dBA nighttime for governments outside the United States, and a nighttime average of 47.7 dBA for US state noise regulation and siting standards. The metrics for those levels can vary. Common metrics are the day-evening-night level (Lden), day-night level (Ldn), equivalent average level (Leq), level exceeded 90% of the time (L90), and median (L50). The application of how these are measured and the time period over which they are measured varies, meaning that, from a practical standpoint, sound-level limits are even more varied than the explicit numerical level. The Leq is one of the more commonly used metric. It is the logarithmic average of the squared relative pressure over a period of time. This results in a higher weighting of louder sounds.

Owing to large number of variables that contribute to SPLs because of wind turbines at receivers, measured levels can vary dramatically. At a wind farm in Texas, O'Neal et al[14] measured sound levels with the nearest turbine at 305 m (1000 feet) and with four turbines within 610 m (2000 feet) at 50 to 51 dBA and 63 dBC (10-minute Leq), with the turbines producing sufficient power to emit the maximum sound power. During the same test, sound levels were 27 dBA and 47 dBC (10-minute Leq) inside a home that was located 290 m (950 feet) from the nearest turbine and within 610 m (2000 feet) of four turbines[15] (see Fig. 4).

Bullmore et al[16] measured wind turbine sound at distances from 100 to 754 m (330 to 2470 feet), where they found sound levels ranging from 40 to 55 dBA over various wind conditions. At typical receiver distances (greater than 300 m or 1000 feet), sound was attenuated to below the threshold of hearing at frequencies above the 1.25 kHz 1/3 octave band. In studies mentioned here, measurements were made with the microphone between 1 and 1.6 m (3 and 5 feet) above ground.

Wind Turbine Emission Characteristics

Low-Frequency Sound and Infrasound

Low-frequency sound is typically defined as sound from 20 to 200 Hz, and infrasound is sound less than 20 Hz. Low-frequency sound and infrasound measurement results at distances close to wind turbines (< 500 meters) typically show infrasound because of wind farms, but not above audibility thresholds (such as ISO 226 or as published by the authors[12,15,17–21,149]). One study found sound levels 360 m and 200 m from a wind farm to be 61 dBG and 63 dBG, respectively. The threshold of audibility for G-weighted sound levels is 85 dBG. The same paper found infrasound levels of 69 dBG 250 m from a coastal cliff face and 76 dBG in downtown Adelaide, Australia.[18] One study found that, even at distances less than 450 feet (136 m), infrasound levels were 80 dBG or less. At more typical receiver distances (greater than 300 m or 1000 feet), infrasound levels were 72 dBG or less. This corresponded to A-weighted sound

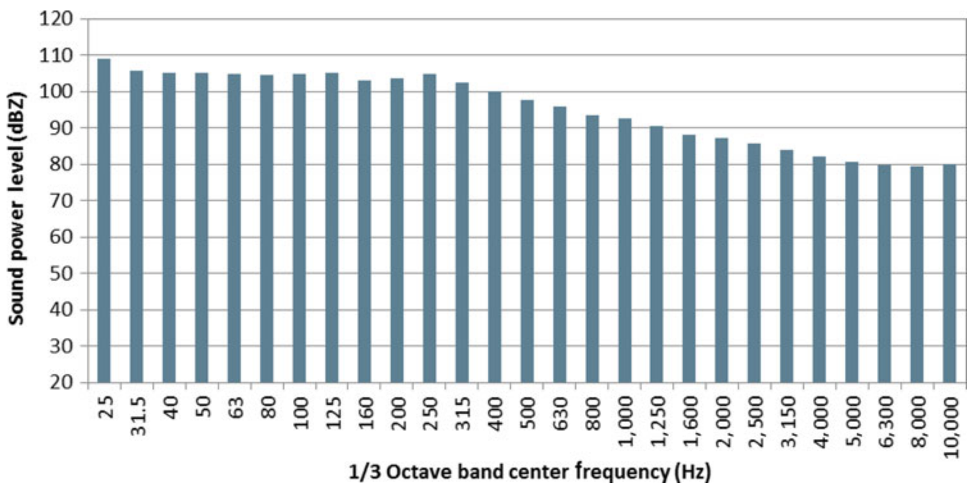

FIGURE 4. Sound power of the Siemens SWT 2.3-93 (TX) wind turbine.[15]

levels of 56 and 49 dBA, respectively, higher than most existing regulatory noise limits.[12]

Farther away from wind farms (1.5 km) infrasound is no higher than what would be caused by localized wind conditions, reinforcing the necessity for adequate wind-caused pseudosound reduction measures for wind turbine sound-level measurements.[22]

Low-frequency sound near wind farms is typically audible, with levels crossing the threshold of audibility between 25 and 125 Hz depending on the distance between the turbines and measurement location.[12,15,19,20,23] Figure 5 shows the frequency spectrum of a wind farm measured at about 3500 feet compared with a truck at 50 feet, a field of insects and birds, wind moving through vegetation, and the threshold of audibility according to ISO 387-7.

Amplitude Modulation

Wind turbine sound emissions vary with blade velocity and are characterized in part by amplitude modulation, a broadband oscillation in sound level, with a cycle time generally corresponding to the blade passage frequency. The modulation is typically located in the 1/1 octave bands from 125 Hz to 2 kHz. Fluctuation magnitudes are typically not uniform throughout the frequency range. These fluctuations are typically small (2 to 4 dB) but under more unusual circumstances can be as great as 10 dB for A-weighted levels and as much as 15 dB in individual 1/3 octave bands.[19,24] Stigwood et al[24] found that, in groups of several turbines, the individual modulations can often synchronize causing periodic increases in the modulation magnitude for periods of 6 to 20 seconds with occasional periods where the individual turbine modulations average each other out, minimizing the modulation magnitude. This was not always the case though, with periods of turbine synchronization occasionally lasting for hours under consistent high wind shear, wind strength, and wind direction.

Amplitude modulation is caused by many factors, including blade passage in front of the tower (shadowing), sound emission directivity of the moving blade tips, yaw error of the turbine blades (where the turbine blades are not perpendicular to the wind), inflow turbulence, and high levels of wind shear.[19,24,25] Amplitude modulation level is not correlated with wind speed. Most occurrences of "enhanced" amplitude modulation (a higher magnitude of modulation) are caused by anomalous meteorological conditions.[19] Amplitude modulation varies by site. Some sites rarely exhibit amplitude modulation, whereas at others amplitude modulation has been measured up to 30% of the time.[10] It has been suggested by some that amplitude modulation may be the cause of "infrasound" complaints because of confusing of amplitude modulation, the modulation of a broadband sound, with actual infrasound.[19]

Tonality

Tones are specific frequencies or narrow bands of frequencies that are significantly louder than adjacent frequencies. Tonal sound is not typically generated by wind turbines but can be found in some cases.[20,26] In most cases, the tonal sound occurs at lower frequencies (less than 200 Hz) and is due to mechanical noise originating from the nacelle, but has also been found to be due to structural vibrations originating from the tower, and anomalous aerodynamic characteristics of the blades[27] (see Fig. 5).

Sound Levels at Residences where Symptoms Have Been Reported

One recent research focus has been the sound levels at (and in) the residences of people who have complained about sound levels emitted by turbines as some have suggested that wind turbine noise may be a different type of environmental noise.[28] Few studies have actually measured sound levels inside or outside the homes of people. Several hypotheses have been proposed about the characteristics of wind turbine noise complaints, including infrasound,[28] low-frequency tones,[20] amplitude modulation,[19,29] and overall noise levels.

Overall Noise Levels

Because of the large variability of noise sensitivity among people, sound levels associated with self-reported annoyance can vary considerably. (Noise sensitivity and annoyance are discussed in more detail later in this review.) People exposed to measured external sound levels from 38 to 53 dBA (10-minute or 1-hour Leq). Department of Trade and Industry,[19] Walker et al,[28] Gabriel et al,[29] and van den Berg et al[30,149] have reported annoyance. Sound levels have also been measured inside complainant residences at between 22 and 37 dBA (10-minute Leq).[19]

Low Frequency and Infrasonic Levels

Concerns have been raised in some settings that low-frequency sound and infrasound may be special features of wind turbine noise that lead to adverse health effects.[31] As a result, noise measurements in areas of operating wind turbines have focused specifically

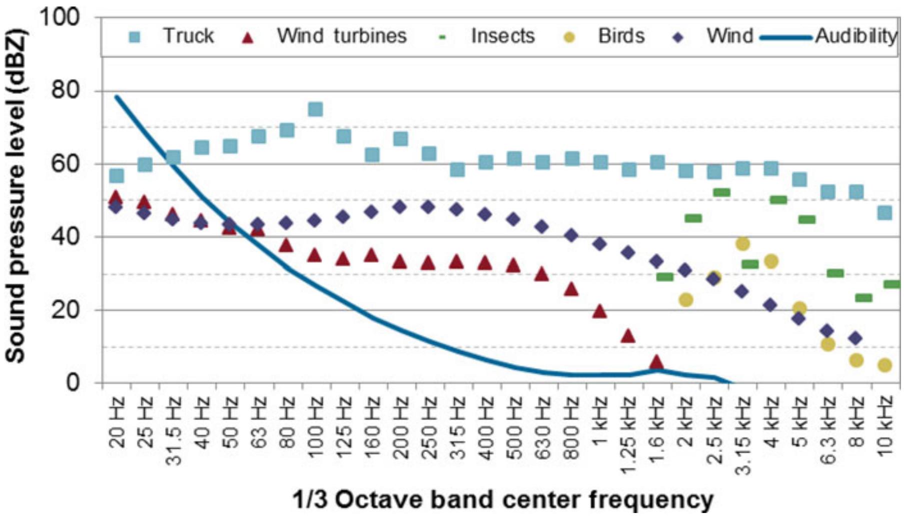

FIGURE 5. Comparison of frequency spectrum of a truck passby at 50 feet, wind turbines at 3500 feet, insects, birds, wind, and the threshold of audibility according to ISO 387-7.

on sound levels in the low-frequency range and occasionally the infrasonic range.

Infrasonic sound levels at residences are typically well below published audibility thresholds, even thresholds for those particularly sensitive to infrasound. Nevertheless, low-frequency sound typically exceeds audibility thresholds in a range starting between 25 and 125 Hz.[19,20,23] In some cases, harmonics of the blade passage frequency (about 1 Hz, ie infrasound) have been measured at homes of people who have raised concerns about health implications of living near wind turbine with sound levels reaching 76 dB; however, these are well below published audibility thresholds.[28]

Amplitude Modulation

Amplitude modulation has been suggested as a major cause of complaints surrounding wind turbines, although little data have been collected to confirm this hypothesis. A recent study of residents surrounding a wind farm that had received several complaints showed predicted sound levels at receiver distances to be 33 dBA or less. Residents were instructed to describe the turbine sound, when they found it annoying. Amplitude modulation was present in 68 of 95 complaints. Sound recorders distributed to the residents exhibited a high incidence of amplitude modulation.[29]

Limited studies have addressed the percentage of complaints surrounding utility-scale wind farms, with only one comparing the occurrence of complaints with sound levels at the homes. The complaint rate among residents within 2000 feet (610 m) of the perimeter of five mid-western United States wind farms was approximately 4%. All except one of the complaints were made at residences, where wind farm sound levels exceeded 40 dBA.[13] The authors used the LA90 metric to assess wind farm sound emissions. LA90 is the A-weighted sound level that is exceeded 90% of the time. This metric is used to eliminate wind-caused spikes and other short-term sound events that are not caused by the wind farm.

In Northern New England, 5% of households within 1000 m of turbines complained to regulatory agencies about wind turbine noise.[32] All complaints were included, even those that were related to temporary issues that were resolved. Up to 48% of the complainants were at wind farms, where at least one noise violation was found or a variance from the noise standard. A third of the all complaints were due to a single wind farm.

Sound Measurement Methodology

Collection of accurate, comparable, and useful noise data depends on careful and consistent methodology. The general methodology for environmental sound level monitoring is found in ANSI 12.9 Part 2. This standard covers basic requirements that include the type of measurement equipment necessary, calibration procedures, windscreen specifications, microphone placement guidance, and suitable meteorological conditions. Nevertheless, there are no recommendations for mitigating the effects of *high* winds (greater than 5 m/s) or measuring in the infrasonic frequency range (less than 20 Hz).[33] Another applicable standard is IEC 61400-11, which provides a method for determining the sound power of individual wind turbines. The standard gives specifications for measurement positions, the type of data needed, data analysis methods, report content requirements, determination of tonality, determination of directivity, and the definitions and descriptors of different acoustical parameters.[34] The standard specifies a microphone mounting method to minimize wind-caused pseudosound, but some have found the setup to be insufficient under gusty wind conditions, and no recommendations are given for infrasound measurement.[35] Because the microphone is ground mounted, it is not suitable for long-term measurements.

Low-Frequency Sound and Infrasound Measurement

There are no standards currently in place for the measurement of wind turbine noise that includes the infrasonic range (ie, frequencies less than 20 Hz), although one is under development (ANSI/ASA S12.9 Part 7). Consequently, all current attempts to measure low-frequency sound and infrasound have either used an existing methodology, an adapted existing methodology, or proposed a new methodology.

The main problem with measuring low-frequency sound and infrasound in environmental conditions is wind-caused pseudosound due to air pressure fluctuation, because air flows over the microphone. With conventional sound-level monitoring, this effect is minimized with a wind screen and/or elimination of data measured during windy periods (less than 5 m/s [11 mph] at a 2-m [6.5 feet] height).[36] In the case of wind turbines, where maximum sound levels may be coincident with ground wind speeds greater than 5 m/s (11 mph), this is not the best solution. With infrasound in particular, wind-caused pseudosound can influence measurements, even at wind speeds down to 1 m/s.[12] In fact, many sound-level meters do not measure infrasonic frequencies.

A common method of dealing with infrasound is using an additional wind screen to further insulate the microphone from air flow.[18,35] In some cases, this is simply a larger windscreen that further insulates the microphone from air flow.[35] One author used a windscreen with a subterranean pit to shelter the microphone, and another used wind resistant cloth.[35] A compromise to an underground microphone mounting is mounting the microphone close (20-cm height) to the ground, minimizing wind influence, or using a standard ground mounted microphone with mounting plate, as found in IEC 61400-11.[35] Low-frequency sound and infrasound differences between measurements made with dedicated specialized windscreens and/or measurement setup and standard wind screens/measurements setups can be quite large.[12,37] Nevertheless, increased measurement accuracy can come at the cost of reduced accuracy at higher frequencies using some methods.[38]

To further filter out wind-caused pseudosound, some authors have advocated a combination of microphone arrays and signal processing techniques. The purpose of the signal processing techniques is to detect elements of similarity in the sound field measured at the different microphones in the array.

Levels of infrasound from other environmental sources can be as high as infrasound from wind turbines. A study of infrasound measured at wind turbines and at other locations away from wind turbines in South Australia found that the infrasound level at houses near the wind turbines is no greater than that found in other urban and rural environments. The contribution of wind turbines to the infrasound levels is insignificant in comparison with the background level of infrasound in the environment.[22]

Conclusions

Wind turbine noise measurement can be challenging because of the necessity of measuring sound levels during high winds, and down to low frequencies. No widely accepted measurement methodologies address all of these issues, meaning that methods used in published measurements can differ substantially, affecting the comparability of results.

Measurements of low-frequency sound, infrasound, tonal sound emission, and amplitude-modulated sound show that infrasound is emitted by wind turbines, but the levels at customary distances to homes are typically well below audibility thresholds, even at residences where complaints have been raised. Low-frequency sound, often audible in wind turbine sound, typically crosses the audibility threshold between 25 and 125 Hz depending on the location and meteorological conditions.[12,15,19,20,23] Amplitude modulation, or the rapid (once per second) and repetitive increase and decrease of broadband sound level, has been measured at wind farms. Amplitude modulation is typically 2 to 4 dB but can vary more than 6 dB in some cases (A-weighted sound levels).[19,24]

A Canadian report investigated the total number of noise-related complaints because of operating wind farms in Alberta, Canada, over its entire history of wind power. Wind power capacity exceeds 1100 MW; some of the turbines have been in operation for 20 years. Five noise-oriented complaints at utility-scale wind farms were reported over this period, none of which were repeated after the complaints were addressed. Complaints were more common during construction of the wind farms; other power generation methods (gas, oil, etc) received more complaints than wind power. Farmers and ranchers did not raise complaints because of effects on crops and cattle.[41] An Australian study found a complaint rate of less than 1% for residents living within 5 km of turbines greater than 1 MW. Complaints were concentrated among a few wind farms; many wind farms never received complaints.[15]

Reviewing complaints in the vicinity of wind farms can be effective in determining the level and extent of annoyance because of wind turbine noise, but there are limitations to this approach. A complaint may be because of higher levels of annoyance (rather annoyed or very annoyed), and the amount of annoyance required for an individual to complain may be dependent on the personality of the person and the corresponding attitude toward the visual effect of the turbines, their respective attitudes toward wind energy, and whether they derive economic benefit from the turbines. (All of these factors are discussed in more detail later in this report.)

Few studies have addressed sound levels at the residents of people who have described symptoms they consider because of wind turbines. Limited available data show a wide range of levels (38 to 53 dBA [10-minute or 1-hour Leq] outside the residence and from 23 to 37 dBA [10-minute Leq] inside the residence).[19,26,28,28] The rate of complaints surrounding wind farms is relatively low; 3% for residents within 1 mile of wind farms and 4% to 5% within 1 km.[13,32,41]

Epidemiological Studies of Wind Turbines

Key to understanding potential effects of wind turbine noise on human health is to consider relevant evidence from well-conducted epidemiological studies, which has the advantage of reflecting risks of real-world exposures. Nevertheless, environmental epidemiology is an observational (vs experimental) science that depends on design and implementation characteristics that are subject to numerous inherent and methodological limitations. Nevertheless, evidence from epidemiological studies of reasonable quality may provide the best available indication of whether certain exposures—such as industrial wind turbine noise—may be harming human health. Critical review and synthesis of the epidemiological evidence, combined with consideration of evidence from other lines of inquiry (ie, animal studies and exposure assessments), provide a scientific basis for identifying causal relationships, managing risks, and protecting public health.

Methods

Studies of greatest value for validly identifying risk factors for disease include well-designed and conducted cohort studies and case–control studies—provided that specific diseases could be identified—followed by cross-sectional studies (or surveys). Case reports and case series do not constitute epidemiological studies and were not considered because they lack an appropriate comparison group, which can obscure a relationship or even suggest one where none exists.[39,40,42] Such studies may be useful in generating hypotheses that might be tested using epidemiological methods but are not considered capable of demonstrating causality, a position also taken by international agencies such as the WHO.[8]

Epidemiological studies selected for this review were identified through searches of PubMed and Google Scholar using the following key words individually and in various combinations: "wind," "wind turbine," "wind farm," "windmill," "noise," "sleep," "cardiovascular," "health," "symptom," "condition," "disease," "cohort," "case–control," "cross-sectional," and "epidemiology." In addition, general Web searches were performed, and references cited in all identified publications were reviewed. Approximately 65 documents were identified and obtained, and screened to determine whether (1) the paper described a primary epidemiological study (including experimental or laboratory-based study) published in a peer-reviewed health, medical or relevant scientific journal; (2) the study focused on or at least included wind turbine noise as a risk factor; (3) the study measured at least one outcome of potential relevance to health; and (4) the study attempted to relate the wind turbine noise with the outcome.

Results

Of the approximately 80 articles initially identified in the search, only 20 met the screening criteria (14 observational and six controlled human exposure studies), and these were reviewed in detail to determine the relative quality and validity of reported findings. Other documents included several reviews and commentaries[4,5,7,43–51]; case reports, case studies, and surveys[23,52–54]; and documents published in media other than peer-reviewed journals. One study published as part of a conference proceedings did not meet the peer-reviewed journal eligibility criterion but was included because it seemed to be the first epidemiological study on this topic and an impetus for subsequent studies.[55]

The 14 observational epidemiological studies were critically reviewed to assess their relative strengths and weaknesses on the basis of the study design and the general ability to avoid selection bias (eg, the selective volunteering of individuals with health complaints), information bias (eg, under- or overreporting of health complaints, possibly because of reliance on self-reporting), and confounding bias (the mixing of possible effects of other strong risk factors for the same disease because of correlation with the exposure).

Figure 6 depicts the 14 observational epidemiological studies published in peer-reviewed health or medical journals, all of which were determined to be cross-sectional studies or surveys. As can be seen from the figure, the 14 publications were based on analyses of data from only eight different study populations, that is, six publications were based on analyses of a previously published study (eg, Pedersen et al[56] and Bakker et al[57] were based on the data from Pedersen et al[58]) or on combined data from previously published studies (eg, Pedersen and Larsman[59] and Pedersen and Waye[60] were based on the combined data from Pedersen and Waye[61,62]; and Pedersen[63] and Janssen et al[64] were based on the combined data from Pedersen et al,[58] Pedersen and Waye,[61] and Pedersen and Waye[62]). Therefore, in the short summaries of individual studies below, publications based on the same study population(s) are grouped.

Summary of Observational Epidemiological Studies

Possibly the first epidemiological study evaluating wind turbine sound and noise annoyance was published in the proceedings of the 1993 European Community Wind Energy Conference.[55] Investigators surveyed 574 individuals (159 from the Netherlands, 216 from Germany, and 199 from Denmark). Up to 70% of the people resided near wind turbines for at least 5 years. No response rates were reported, so the potential for selection or participation bias cannot be evaluated. Wind turbine sound levels were calculated in 5 dBA intervals for each respondent, on the basis of site measurements and residential distance from turbines. The authors claimed that noise-related annoyance was weakly correlated with objective sound levels but more strongly correlated with indicators of respondents' attitudes and personality.[55]

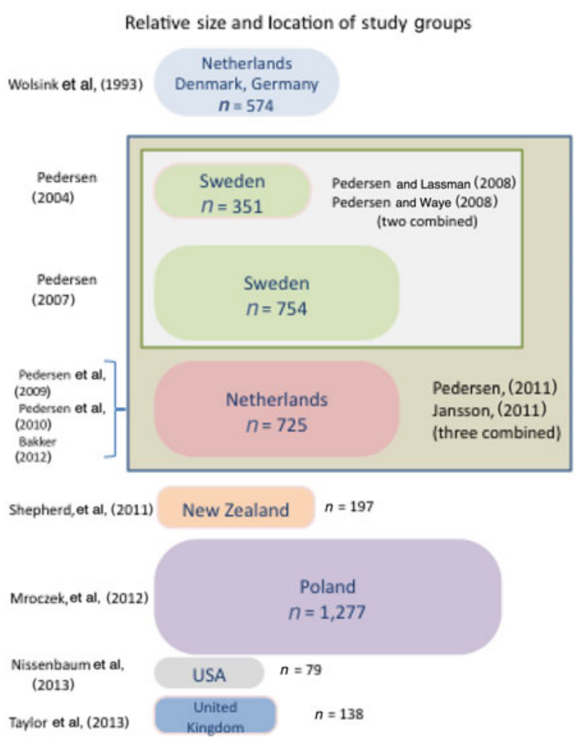

FIGURE 6. The 14 observational epidemiological studies published in peer-reviewed health or medical journals, all of which were determined to be cross-sectional studies or surveys.

In a cross-sectional study of 351 participants residing in proximity to wind turbines (power range 150 to 650 kW), Pederson (a coauthor of the Wolsink[55] study) and Persson and Waye[61] described a statistically significant association between modeled wind turbine audible noise estimates and self-reported annoyance. In this section, "statistically significant" means that the likelihood that the results were because of chance is less than 5%. No respondents among the 12 exposed to wind turbine noise less than 30 dBA reported annoyance with the sound; however, the percentage reporting annoyance increased with noise exceeding 30 dBA. No differences in health or well-being outcomes (eg, tinnitus, cardiovascular disease, headaches, and irritability) were observed. With noise exposures greater than 35 dBA, 16% of respondents reported sleep disturbance, whereas no sleep disturbance was reported among those exposed to less than 35 dBA. Although the authors observed that the risk of annoyance from wind turbine noise exposure increased statistically significantly with each increase of 2.5 dBA, they also reported a statistically significant risk of reporting noise annoyance among those self-reporting a negative attitude toward the visual effect of the wind turbines on the landscape scenery (measured on a five-point scale ranging from "very positive" to "very negative" opinion). These results suggest that attitude toward visual effect is an important contributor to annoyance associated with wind turbine noise. In addition to its reliance on self-reported outcomes, this study is limited by selection or participation bias, suggested by the difference in response rate between the highest-exposed individuals (78%) versus lowest-exposed individuals (60%).

Pederson[62] examined the association between modeled wind turbine sound pressures and self-reported annoyance, health, and well-being among 754 respondents in seven areas in Sweden with wind turbines and varying landscapes. A total of 1309 surveys were distributed, resulting in a response rate of 57.6%. Annoyance was significantly associated with SPLs from wind turbines as well as having a negative attitude toward wind turbines, living in a rural area, wind turbine visibility, and living in an area with rocky or hilly terrain. Those annoyed by wind turbine noise reported a higher prevalence of lowered sleep quality and negative emotions than those not annoyed by noise. Because of the cross-sectional design, it cannot be determined whether wind turbine noise caused these complaints or if those who experienced disrupted sleep and negative emotions were more likely to notice and report annoyance from noise. Measured SPLs were not associated with any health effects studied. In the same year, Petersen et al reported on what they called a "grounded theory study" in which 15 informants were interviewed in depth regarding the reasons they were annoyed with wind turbines and associated noise. Responses indicated that these individuals perceived the turbines to be an intrusion and associated with feelings of lack of control and influence.[65] Although not an epidemiological study, this exercise was intended to elucidate the reasons underlying the reported annoyance with wind turbines.

Further analyses of the combined data from Pedersen and Waye[61,62] (described above) were published in two additional papers.[59,60] The pooled data included 1095 participants exposed to wind turbine noise of at least 30 dBA. As seen in the two original studies, a significant association between noise annoyance and SPL was observed. A total of 84 participants (7.7%) reported being fairly or very annoyed by wind turbine noise. Respondents reporting wind turbines as having a negative effect on the scenery were also statistically significantly more likely to report annoyance to wind turbine noise, regardless of SPLs.[59] Self-reported stress was higher among those who were fairly or very annoyed compared with those not annoyed; however, these associations could not be attributed specifically to wind turbine noise. No differences in self-reported health effects such as hearing impairment, diabetes, or cardiovascular diseases were reported between the 84 (7.7%) respondents who were fairly or very annoyed by wind turbine noise compared with all other respondents.[60] The authors did not report the power of the study.

Pederson et al[56–58] evaluated the data from 725 residents in the Netherlands living within 2.5 km of a site containing at least two wind turbines of 500 kW or greater. Using geographic information systems methods, 3727 addresses were identified in the study target area, for which names and telephone numbers were found for 2056; after excluding businesses, 1948 were determined to be residences and contacted. Completed surveys were received from 725 for a response rate of 37%. Although the response rate was lower than in previous cross-sectional studies, nonresponse analyses indicated that similar proportions responded across all landscape types and sound pressure categories.[57] Calculated sound levels, other sources of community noise, noise sensitivity, general attitude, and visual attitude toward wind turbines were evaluated. The authors reported an exposure–response relationship between calculated A-weighted SPLs and self-reported annoyance. Wind turbine noise was reported to be more annoying than transportation noise or industrial noise at comparable levels. Annoyance, however, was also correlated with a negative attitude toward the visual effect of wind turbines on the landscape. In addition, a statistically significantly decreased level of annoyance from wind turbine noise was observed among those who benefited economically from wind turbines, despite equal perception of noise and exposure to generally higher (greater than 40 dBA) sound levels.[58] Annoyance was strongly correlated with self-reporting a negative attitude toward the visual effect of wind turbines on the landscape scenery (measured on a five-point scale ranging from "very positive" to "very negative" opinion). The low response rate and reliance on self-reporting of noise annoyance limit the interpretation of these findings.

Results of further analyses of noise annoyance were reported in a separate report,[56] which indicated that road traffic noise had no effect on annoyance to wind turbine noise and vice versa. Visibility of, and attitude toward, wind turbines and road traffic were significantly related to annoyance from their respective noise source; stress was significantly associated with both types of noise.[56,157]

Additional analyses of the same data were performed using a structural equation approach that indicated that, as with annoyance, sleep disturbance increased with increasing SPL because of wind turbines; however, this increase was statistically significant only at pressures of 45 dBA and higher. Results of analyses of the combined data from the two Swedish[61,62] and the Dutch[58] cross-sectional studies have been published in two additional papers. Using the combined data from these three predecessor studies, Pedersen et al[56,58] identified 1755 (ie, 95.9%) of the 1830 total participants for which complete data were available to explore the relationships between calculated A-weighted SPLs and a range of indicators of health and well-being. Specifically, they considered sleep interruption; headache; undue tiredness; feeling tense, stressed, or irritable; diabetes; high blood pressure; cardiovascular disease; and tinnitus.[63] As in the precursor studies, noise annoyance indoors and outdoors was correlated with A-weighted SPLs. Sleep interruption seemed at higher sound levels and was also related to annoyance. No other health or well-being variables were consistently related to SPLs. Stress was not directly associated with SPLs but was associated with noise-related annoyance.

Another report based on these data (in these analyses, 1820 of the 1830 total participants) modeled the relationship between wind turbine noise exposure and annoyance indoors and outdoors.[64] The authors excluded respondents who benefited economically from wind turbines, then compared their modeled results with other modeled relationships for industrial and transportation noise; they claimed that annoyance from wind turbine noise at or higher than 45 dBA is associated with more annoyance than other noise sources.

Shepherd et al,[66] who had conducted an earlier evaluation of noise sensitivity and Health Related Quality of Life (HRQL),[158] compared survey results from 39 residents located within 2 km of a wind turbine in the South Makara Valley in New Zealand with 139 geographically and socioeconomically matched individuals who resided at least 8 km from any wind farm. The response rates for both the proximal and more distant study groups were poor, that is, 34% and 32%, respectively, although efforts were made to blind respondents to the study hypotheses. No indicator of exposure to wind turbine noise was considered beyond the selection of individuals based on the proximity of their residences from the nearest wind turbine. Health-related quality-of-life (HRQOL) scales were used to describe and compare the general well-being and well-being in the physical, psychological, and social domains of each group. The authors reported statistically significant differences between the groups in some HRQOL domain scores, with residents living within 2 km of a turbine installation reporting lower mean physical HRQOL domain score (including lower component scores for sleep quality and self-reported energy levels) and lower mean environmental quality-of-life (QOL) scores (including lower component scores for considering one's environment to be less healthy and being less satisfied with the conditions of their living space). No differences were reported for social or psychological HRQOL domain scores. The group residing closer to a wind turbine also reported lower amenity but not related to traffic or neighborhood noise annoyance. Lack of actual wind turbine and other noise source measurements, combined with the poor response rate (both noted by the authors as limitations), limits the inferential value of these results because they may pertain to wind turbine emissions.[66]

Possibly the largest cross-sectional epidemiological study of wind turbine noise on QOL was conducted in an area of northern Poland with the most wind turbines.[67] Surveys were completed by a total of 1277 adults (703 women and 574 men), aged 18 to 94 years, representing a 10% two-stage random sample of the selected communities. Although the response rate was not reported, participants were sequentially enrolled until a 10% sample was achieved, and the proportion of individuals invited to participate but unable or refusing to participate was estimated at 30% (B. Mroczek, dr hab n. zdr., e-mail communication, January 2, 2014). Proximity of residence was the exposure variable, with 220 (17.2%) respondents within 700 m; 279 (21.9%) between 700 and 1000 m; 221 (17.3%) between 1000 and 1500 m; and 424 (33.2%) residing more than 1500 m from the nearest wind turbine. Indicators of QOL and health were measured using the Short Form–36 Questionnaire (SF-36). The SF-36 consists of 36 questions specifically addressing physical functioning, role-functioning physical, bodily pain, general health, vitality, social functioning, role-functioning emotional, and mental health. An additional question concerning health change was included, as well as the Visual Analogue Scale for health assessment. It is unclear whether age, sex, education, and occupation were controlled for in the statistical analyses. The authors report that, within all subscales, those living closest to wind farms reported the best QOL, and those living farther than 1500 m scored the worst. They concluded that living in close proximity of wind farms does not result in the worsening of, and might improve, the QOL in this region.[67]

A small survey of residents of two communities in Maine with multiple industrial wind turbines compared sleep and general health outcomes among 38 participants residing 375 to 1400 m from the nearest turbine with another group of 41 individuals residing 3.3 to 6.6 km from the nearest wind turbine.[68] Participants completed questionnaires and in-person interviews on a range of health and attitudinal topics. Prevalence of self-reported health and other complaints was compared by distance from the wind turbines, statistically controlling for age, sex, site, and household cluster in some analyses. Participants living within 1.4 km of a wind turbines reported worse sleep, were sleepier during the day, and had worse SF-36 Mental Component Scores compared with those living farther than 3.3 km away. Statistically significant correlations were reported between Pittsburgh Sleep Quality Index, Epworth Sleepiness Scale, SF-36 Mental Component Score, and log-distance to the nearest wind turbine. The authors attributed the observed differences to the wind turbines[68]; methodological problems such as selection and reporting biases were overlooked. This study has a number of methodological limitations, most notably that all of the "near" turbine groups were plaintiffs in a lawsuit against the wind turbine operators and had already been interviewed by the lead investigator prior to the study. None of the "far" group had been interviewed; they were "cold called" by an assistant. This differential treatment of the two groups introduces a bias in the integrity of the methods and corresponding results. Details of the far group, as well as participation rates, were not noted.[68]

In another study, the role of negative personality traits (defined by the authors using separate scales for assessing neuroticism, negative affectivity, and frustration intolerance) on possible associations between actual and perceived wind turbine noise and medically unexplained nonspecific symptoms was investigated via a mailed survey.[69] Of the 1270 identified households within 500 m of eight 0.6 kW micro-turbine farms and within 1 km of four 5 kW small wind turbine farms in two cities in the United Kingdom, only 138 questionnaires were returned, for a response rate of 10%. No association was noted between calculated and actual noise levels and nonspecific symptoms. A correlation between perceived noise and nonspecific symptoms was seen among respondents with negative personality traits. Despite the participant group's reported representativeness of the target population, the low survey response rate precludes firm conclusions on the basis of these data.[69]

In a study of residents living near a "wind park" in Western New York State, surveys were administered to 62 individuals living in 52 homes.[70] The wind park included 84 turbines. No association was noted between self-reported annoyance and short duration sound measurements. A correlation was noted between the measure of a person's concern regarding health risks and reported measures of the prevalence of sleep disturbance and stress. While a cross-sectional study is based on self-reported annoyance and health indicators, and therefore limited in its interpretation, one of its strengths is that it is one of the few studies that performed actual sound measurements (indoors and outdoors).

A small but detailed study on response to the wind turbine noise was carried out in Poland.[71] The study population consisted of 156 people, age 15–82 years, living in the vicinity of 3 wind farms located in the central and northwestern parts of Poland. No exclusion criteria were applied, and each individual agreeing to participate was sent a questionnaire patterned after the one used in the Pederson 2004 and Pederson 2007 studies and including questions on living conditions, self-reported annoyance due to noise from wind turbines, and self-assessment of physical health and well-being (such as headaches, dizziness, fatigue, insomnia, and tinnitus). The response rate was 71%. Distance from the nearest wind turbine and modeled A-weighted SPLs were considered as exposure indicators. One third (33.3%) of the respondents found wind turbine noise annoying outdoors, and one fifth (20.5%) found the noise annoying while indoors. Wind turbine noise was reported as being more annoying than other environmental noises, and self-reported annoyance increased with increasing A-weighted SPLs. Factors such as attitude toward wind turbines and "landscape littering" (visual impact) influenced the perceived annoyance from the wind turbine noise. This study, as with most others, is limited by the cross-sectional design and reliance on self-reported health and well-being indicators; however, analyses focused on predictors of self-reported annoyance, and found that wind turbine noise, attitude toward wind turbines, and attitude toward "landscape littering" explain most of the reported annoyance.

Other Possibly Relevant Studies

A publication based on the self-reporting of 109 individuals who "perceived adverse health effects occurring with the onset of an industrial wind turbine facility" indicated that 102 reported either "altered health or altered quality of life." The authors appropriately noted that this was a survey of self-selected participants who chose to respond to a questionnaire specifically designed to attract those who had health complaints they attributed to wind turbines, with no comparison group. Nevertheless, the authors inappropriately draw the conclusion that "Results of this study suggest an underlying relationship between wind turbines and adverse health effects and support the need for additional studies."[48(p.336)] Such a report cannot provide valid evidence of any relationship for which there is no comparison and is of little if any inferential value.

Researchers at the School of Public Health, University of Sydney, in Australia conducted a study to explore psychogenic explanations for the increase around 2009 of wind farm noise and/or health complaints and the disproportionate corresponding geographic distribution of those complaints.[52] They obtained records of complaints about noise or health from residents living near all 51 wind farms (1634 turbines) operating between 1993 and 2012 from wind farm companies and corroborated with documents such as government public enquiries, news media records, and court affidavits. Of the 51 wind farms, 33 (64.7%) had no record of noise or health complaints, including all wind farms in Western Australia and Tasmania. The researchers identified 129 individuals who had filed complaints, 94 (73%) of whom lived near six wind farms targeted by anti-wind advocacy groups. They observed that 90% of complaints were registered after anti-wind farm groups included health concerns as part of their advocacy in 2009. The authors concluded that their findings were consistent with their psychogenic hypotheses.

Discussion

No cohort or case–control studies were located in this updated review of the peer-reviewed literature. The lack of published case–control studies is less surprising and less critical because there has been no discrete disease or constellation of diseases identified that likely or might be explained by wind turbine noise. Anecdotal reports of symptoms associated with wind turbines include a broad array of nonspecific symptoms, such as headache, stress, and sleep disturbance, that afflict large proportions of the general population and have many recognized risk factors. Retrospectively associating such symptoms with wind turbines or even measured wind turbine noise—as would be necessary in case–control studies—does not prevent recall bias from influencing the results.

Although cross-sectional studies and surveys have the advantage of being relatively simple and inexpensive to conduct, they are susceptible to a number of influential biases. Most importantly, however, is the fact that, because of the simultaneous ascertainment of both exposure (eg, wind turbine noise) and health outcomes or complaints, the temporal sequence of exposure–outcome relationship cannot be demonstrated. If the exposure cannot be established to precede the incidence of the outcome—and not the reverse, that is, the health complaint leads to increased perception of or annoyance with the exposure, as with insomnia headaches or feeling tense/stressed/irritable—the association cannot be evaluated for a possible causal nature.

Conclusions

A critical review and synthesis of the evidence available from the eight study populations studied to date (and reported in 14 publications) provides some insights into the hypothesis that wind turbine noise harms human health in those living in proximity to wind turbines. These include the following:

- No clear or consistent association is seen between noise from wind turbines and any reported disease or other indicator of harm to human health.
- In most surveyed populations, some individuals (generally a small proportion) report some degree of annoyance with wind turbines; however, further evaluation has demonstrated:
  - Certain characteristics of wind turbine sound such as its intermittence or rhythmicity may enhance reported perceptibility and annoyance;
  - The context in which wind turbine noise is emitted also influences perceptibility and annoyance, including urban versus rural setting, topography, and landscape features, as well as visibility of the wind turbines;
  - Factors such as attitude toward visual effect of wind turbines on the scenery, attitude toward wind turbines in general, personality characteristics, whether individuals benefit financially from the presence of wind turbines, and duration of time wind turbines have been in operation all have been correlated with self-reported annoyance; and
  - Annoyance does not correlate well or at all with objective sound measurements or calculated sound pressures.
- Complaints such as sleep disturbance have been associated with A-weighted wind turbine sound pressures of higher than 40 to 45 dB but not any other measure of health or well-being. Stress was associated with annoyance but not with calculated sound pressures.[63]
- Studies of QOL including physical and mental health scales and residential proximity to wind turbines report conflicting findings–one study (with only 38 participants living within 2.0 km of the nearest wind turbine) reported lower HRQOL among those living closer to wind turbines than respondents living farther away,[66] whereas the largest of all studies (with 853 living within 1500 m of the nearest wind turbine)[67] found that those living closer to wind turbines reported higher QOL and health than those living farther away.[67]

Because these statistical correlations arise from cross-sectional studies and surveys in which the temporal sequence of the exposure and outcome cannot be evaluated, and where the effect of various forms of bias (especially selection/volunteer bias and recall bias) may be considerable, the extent to which they reflect causal relationships cannot be determined. For example, the claims such as "We conclude that the noise emissions of wind turbines disturbed the sleep and caused daytime sleepiness and impaired mental health in residents living within 1.4 km of the two wind turbines installations studied" cannot be substantiated on the basis of the actual study design used and some of the likely biases present.[70]

Notwithstanding the limitations inherent to cross-sectional studies and surveys—which alone may provide adequate explanation for some of the reported correlations—several possible explanations have been suggested for the wind turbines–associated annoyance reported in many of these studies, including attitudinal and even personality characteristics of the survey participants.[69] Pedersen and colleague,[59] who have been involved in the majority of publications on this topic, noted "The enhanced negative response [toward wind turbines] could be linked to aesthetical response, rather than to multi-modal effects of simultaneous auditory and visual stimulation, and a risk of hindrance to psycho-physiological restoration could not be excluded."[(p.389)] They also found that wind turbines might be more likely to elicit annoyance because some perceive them to be "intrusive" visually and with respect to their noise.[65] Alternative explanations on the basis of evaluation of all health complaints filed between 1993 and 2012 with wind turbine operators across Australia include the influence of anti-wind power activism and the surrounding publicity on the likelihood of health complaints, calling the complaints "communicated diseases."[52]

As noted earlier, the 14 papers meeting the selection criteria for critical review and synthesis were based on only eight independent study groups—three publications were based on the same study group from the Netherlands[58] and four additional publications were based on the combined data from the two Swedish surveys[61,62] or from the combined data from all three. The findings across studies based on analyses of the same data are not independent observations, and therefore the body of available evidence may seem to be larger and more consistent than it should. This observation does not necessarily mean that the relationships observed (or the lack of associations between calculated wind turbines sound pressures and disease or other indicators of health) are invalid, but that consistency across reports based on the same data should not be overinterpreted as independent confirmation of findings. Perhaps more important is that all eight were cross-sectional studies or surveys, and therefore inherently limited in their ability to demonstrate the presence or absence of true health effects.

Recent controlled exposure laboratory evaluations lend support to the notion that reports of annoyance and other complaints may reflect, at least in part, preconceptions about the ability of wind turbine noise to harm health[52,71,72] or even the color of the turbine[73] more than the actual noise emission.

Sixty years ago, Sir Austin Bradford Hill delivered a lecture entitled "Observations and Experiment" to the Royal College of Occupational Medicine. In his lecture, Hill stated that "The observer may well have to be more patient than the experimenter—awaiting the occurrence of the natural succession of events he desires to study; he may well have to be more imaginative—sensing the correlations that lie below the surface of his observations; and he may well have to be more logical and less dogmatic—avoiding as the evil eye the fallacy of '*post hoc ergo propter hoc*,' the mistaking of correlation for causation."[74(p.1000)]

Although it is typical and appropriate to point out the obvious need for additional research, it may be worth emphasizing that more research of a similar nature—that is, using cross-sectional or survey approaches—is unlikely to be informative, most notably for public policy decisions. Large, well-conducted prospective cohort studies that document baseline health status and can objectively measure the incidence of new disease or health conditions over time with the introduction would be the most informative. On the contrary, the phenomena that constitute wind turbine exposures—primarily noise and visual effect—are not dissimilar to many other environmental (eg, noise of waves along shorelines) and anthropogenic (eg, noise from indoor Heating Ventilation and Air Conditioning or road traffic) stimuli, for which research and practical experience indicate no direct harm to human health.

Sound Components and Health: Infrasound, Low-Frequency Sound, and Potential Health Effects

Introduction

This section addresses potential health implications of infrasound and low-frequency sound because claims have been made that the frequency of wind turbine sound has special characteristics that may present unique health risks in comparison with other sources of environmental sound.

Wind turbines produce two kinds of sound. Gears and generators can make mechanical noise, but this is less prominent than the

TABLE 1. Human Thresholds for Different Frequencies

Frequency (Hz)	Threshold (dB SPL)
100	27
25	69
10	97

SPL, sound pressure level.

aerodynamic noise of the blades, whose tips may have velocities in excess of 200 mph. Three-bladed turbines often rotate about once every 3 seconds; their "blade-pass" frequency is thus about 1 Hz (Hz: cycle per second). For this reason, the aerodynamic noise often rises and falls about once per second, and some have described the sounds as "whooshing" or "pulsing."

Several studies[44,75,76] have shown that at distances of 300 m or more, wind turbine sounds are below human detection thresholds for frequencies less than 50 Hz. The most audible frequencies (those whose acoustic energies exceed human thresholds the most) are in 500 to 2000 Hz range. At this distance from a single wind turbine, overall levels are typically 35 to 45 dBA.[77,78] These levels can be audible in a typical residence with ambient noise of 30 dBA and windows open (a room with an ambient level of 30 dBA would be considered by most people to be quiet or very quiet). In outdoor environments, sound levels drop about 6 dB for every doubling of the distance from the source, so one would predict levels of 23 to 33 dBA, that is, below typical ambient noise levels in homes, at a distance of 1200 m. For a wind farm of 12 large turbines, Møller and Pedersen[79] predicted a level of 35 dBA at a distance of 453 m.

As noted earlier in this report, sound intensity is usually measured in decibels (dB), with 0 dB SPL corresponding to the softest sounds young humans can hear. Nevertheless, humans hear well only within the frequency range that includes the frequencies most important for speech understanding—about 500 to 5000 Hz. At lower frequencies, hearing thresholds are much higher.[75] Although frequencies lower than 20 Hz are conventionally referred to as "infrasound," sounds in this range can in fact be heard, but only when they are extremely intense (a sound of 97 dB SPL has 10 million times as much energy as a sound of 27 dB; see Table 1).

Complex sounds like those produced by wind turbines contain energy at multiple frequencies. The most complete descriptions of such sounds include dB levels for each of several frequency bands (eg, 22 to 45 Hz, 45 to 90 Hz, 90 to 180 Hz, . . . , 11,200 to 22,400 Hz). It is simpler, and appropriate in most circumstances, to specify overall sound intensity using meters that give full weight to the frequencies people hear well, and less weight to frequencies less than 500 Hz and higher than 5000 Hz. The resulting metric is "A-weighted" decibels or dBA. Levels in dBA correlate well with audibility; in a very quiet place, healthy young people can usually detect sounds less than 20 dBA.

Low-Frequency Sound and Infrasound

Low-frequency noise (LFN) is generally considered frequencies from 20 to 250 Hz, as described earlier in more detail in subsection "Low Frequency and Infrasonic Levels." The potential health implications of low-frequency sound from wind turbines have been investigated in a study of four large turbines and 44 smaller turbines in the Netherlands.[17] In close proximity to the turbines, infrasound levels were below audibility. The authors suggested that LFN could be an important aspect of wind turbine noise; however, they did not link measured or modeled noise levels with any health outcome measure, such as annoyance.

A literature review of infrasound and low-frequency sound concluded that low-frequency sound from wind turbines at residences did not exceed levels from other common noise sources, such as traffic.[44] The authors concluded that a "statistically significant association between noise levels and self-reported sleep disturbance was found in two of the three [epidemiology] studies."[(p.1)]. It has been suggested that LFN from wind turbines causes other and more serious health problems, but empirical support for these claims is lacking.[44]

Sounds with frequencies lower than 20 Hz (ie, infrasound) may be audible at very high levels. At even higher levels, subjects may experience symptoms from very low-frequency sounds—ear pressure (at levels as low as 127 dB SPL), ear pain (at levels higher than 145 dB), chest and abdominal movement, a choking sensation, coughing, and nausea (at levels higher than 150 dB).[80,81] The National Aeronautics and Space Administration considered that infrasound exposures lower than 140 dB SPL would be safe for astronauts; American Conference of Governmental Industrial Hygienists recommends a threshold limit value of 145 dB SPL for third-octave band levels between 1 and 80 Hz.[81] As noted earlier, infrasound from wind turbines has been measured at residential distances and noted to be many orders of magnitude below these levels.

Whenever wind turbine sounds are audible, some people may find the sounds annoying, as discussed elsewhere in this review. Some authors, however, have hypothesized that even inaudible sounds, especially at very low frequencies, could affect people by activating several types of receptors, including the following:

1. Outer hair cells of the cochlea[82];
2. Hair cells of the normal vestibular system,[83] especially the otolith organs[84];
3. Hair cells of the vestibular system after its fluid dynamics have been disrupted by infrasound[82];
4. Visceral graviceptors acting as vibration sensors.[83]

To evaluate these hypotheses, it is useful to review selected aspects of the anatomy and physiology of the inner ear (focusing on the differences between the cochlea and the vestibular organs), vibrotactile sensitivity to airborne sound, and the types of evidence that, while absent at present, could in theory support one or more of these hypotheses.

How the Inner Ear Works

The inner ear contains the cochlea (the organ of hearing) and five vestibular organs (three semicircular canals and two otolith organs, transmitting information about head position and movement). The cochlea and the vestibular organs have one important feature in common—they both use hair cells to convert sound or head movement into nerve impulses that can then be transmitted to the brain. Hair cells are mechanoreceptors that can elicit nerve impulses only when their stereocilia (or sensory hairs) are bent.

The anatomy of the cochlea ensures that its hair cells respond well to airborne sound and poorly to head movement, whereas the anatomy of the vestibular organs optimizes hair cell response to head movement and minimizes response to airborne sound. Specifically, the cochlear hair cells are not attached to the bony otic capsule, and the round window permits the cochlear fluids to move more freely when air-conducted sound causes the stapes to move back and forth in the oval window. Conversely, the vestibular hair cells are attached to the bony otic capsule, and the fluids surrounding them are not positioned between the two windows and thus cannot move as freely in response to air-conducted sound. At the most basic level, this makes it unlikely that inaudible sound from wind turbines can affect the vestibular system.

Responding to Airborne Sound

Airborne sound moves the eardrum and ossicles back and forth; the ossicular movement at the oval window then displaces inner ear fluid, causing a movement of membranes in the cochlea, with bending of the hair cell stereocilia. Nevertheless, this displacement of the cochlear hair cells depends on the fact that there are two windows separating the inner ear from the middle ear, with the cochlear hair cells positioned between them—whenever the oval window (the bony footplate of the stapes, constrained by a thin annular ligament) is pushed inward, the round window (a collagenous membrane lined by mucous membrane) moves outward, and vice versa. When the round window is experimentally sealed,[85] the cochlea's sensitivity to sound is reduced by 35 dB.

The vestibular hair cells are not positioned between the two cochlear windows, and therefore airborne sound-induced inner ear fluid movement does not efficiently reach them. Instead, the vestibular hair cells are attached to the bone of the skull so that they can respond faithfully to head movement (the cochlear hair cells are not directly attached to the skull). As one might expect, vestibular hair cells can respond to head vibration (bone-conducted sound), such as when a tuning fork is held to the mastoid. Very intense airborne sound can also make the head vibrate; people with severe conductive hearing loss can hear airborne sound in this way, but only when the sounds are made 50 to 60 dB more intense than those audible to normal people.

The cochlea contains two types of hair cells. It is often said that we hear with our inner hair cells (IHCs) because all the "type I" afferent neurons that carry sound-evoked impulses to the brain connect to the IHCs. The outer hair cells (OHCs) are important as "preamplifiers" that make it possible to hear very soft sounds; they are exquisitely tuned to specific frequencies, and when they move they create fluid currents that then displace the stereocilia of the IHCs.

Although more numerous than the IHCs, the OHCs receive only very scanty afferent innervation, from "type II" neurons, the function of which is unknown. Salt and Hullar[82] have pointed out that OHCs generate measurable electrical responses called cochlear microphonics to very low frequencies (eg, 5 Hz) at levels that are presumably inaudible to the animals and have hypothesized that the type II afferent fibers from the OHCs might carry this information to the brain. Nevertheless, it seems that no one has ever recorded action potentials from type II cochlear neurons, nor have physiological responses other than cochlear microphonics been recorded in response to inaudible sounds.[86,87] In other words, as Salt and Hullar[82] acknowledge, "The fact that some inner ear components (such as the OHC) may respond to [airborne] infrasound at the frequencies and levels generated by wind turbines does not necessarily mean that they will be perceived or disturb function in any way."[(p.19)]

Responses of the Vestibular Organs

As previously noted, vestibular hair cells are efficiently coupled to the skull. The three semicircular canals in each ear are designed to respond to head rotations (roll, pitch, yaw, or any combination). When the head rotates, as in shaking the head to say "no," the fluid in the canals lags behind the skull and bends the hair cells. The otolith organs (utricle and saccule) contain calcium carbonate crystals (otoconia) that are denser than the inner ear fluid, and this allows even static head position to be detected; when the head is tilted, gravitational pull on the otoconia bends the hair cells. The otolith organs also respond to linear acceleration of the head, as when a car accelerates.

Many people complaining about wind turbines have reported dizziness, which can be a symptom of vestibular disorders; this has led to suggestions that wind turbine sound, especially inaudible infrasound, can stimulate the vestibular organs.[83,84] Pierpont[83] introduced a term "Wind Turbine Syndrome" based on a case series of 10 families who reported symptoms that they attributed to living near wind turbines. The author invited people to participate if they thought they had symptoms from living in the vicinity of wind turbines; this approach introduces substantial selection bias that can distort the results and their corresponding significance. Telephone interviews were conducted; no medical examination, diagnostic studies or review, and documentation of medical records were conducted as part of the case series. Noise measurements were not provided. Nonetheless, the author described a collection of nonspecific symptoms that were described as "Wind Turbine Syndrome." The case series, at the time of preparation of this review, has not been published in the peer-reviewed scientific literature. Although not medically recognized, advocates of this "disorder" suggest that wind turbines produce symptoms, such as headaches, memory loss, fatigue, dizziness, tachycardia, irritability, poor concentration, and anxiety.[88]

To support her hypotheses, Pierpont cited a report by Todd et al[89] that demonstrated human vestibular responses to bone-conducted sound at levels below those that can be heard. But as previously noted, this effect is not surprising because the vestibular system is designed to respond to head movement (including head vibration induced by direct contact with a vibrating source). The relevant issue is how the vestibular system responds to airborne sound, and here the evidence is clear. Vestibular responses to airborne sound require levels well above audible thresholds.[90,91] Indeed, clinical tests of vestibular function using airborne sound use levels in excess of 120 dB, which raise concerns of acoustic trauma.[92]

Salt and Hullar[82] acknowledge that a normal vestibular system is unlikely to respond to inaudible airborne sound—"Although the hair cells in other sensory structures such as the saccule may be tuned to infrasonic frequencies, auditory stimulus coupling to these structures is inefficient so that they are unlikely to be influenced by airborne infrasound."[(p.12)] They go on to hypothesize that infrasound may cause endolymphatic hydrops, a condition in which one of the inner ear fluid compartments is swollen and may disturb normal hair cell function. But here, too, they acknowledge the lack of evidence—" . . . it has never been tested whether stimuli in the infrasound range cause endolymphatic hydrops."[(p.19)] In previous research, Salt[93] was able to create temporary hydrops in animals using airborne sound, but only at levels (115 dB at 200 Hz) that are many orders of magnitude higher than levels that could exist at residential distances from wind turbines.

Human Vibrotactile Sensitivity to Airborne Sound

Very loud sound can cause head and body vibration. As previously noted, a person with absent middle ear function but an intact cochlea may hear sounds at 50 to 60 dB SPL. Completely deaf people can detect airborne sounds using the vibrotactile sense, but only at levels far above hearing threshold, for example, 128 dB SPL at 16 Hz.[94] Vibrotactile sensation depends on receptors in the skin and joints.

Pierpont[83] hypothesized that "visceral graviceptors,"[95,96] which contain somatosensory receptors, could detect airborne infrasound transmitted from the lungs to the diaphragm and then to the abdominal viscera. These receptors would seem to be well suited to detect body tilt or perhaps whole-body vibration, but there is no evidence that airborne sound could stimulate sensory receptors in the abdomen. Airborne sound is almost entirely reflected away from the body; when Takahashi et al[97] used airborne sound to produce chest or abdominal vibration that exceeded ambient body levels, levels had to exceed 100 dB at 20 to 50 Hz.

Further Studies of Note

The influence of preconception on mood and physical symptoms after exposure to LFN was examined by showing 54 university students one of two series of short videos that either promoted or dispelled the notion that sounds from wind turbines had health effects, then exposing subjects to 10 minutes of quiet period followed by infrasound (40 dB at 5 Hz) generated by computer software, and assessing mood and a series of physical symptoms.[71] In a double-blind protocol, participants first exposed to either a "high-expectancy" presentation included first-person accounts of symptoms attributed to wind turbines or a "low-expectancy" presentation showed experts stating scientific positions indicating that infrasound does not cause symptoms. Participants were then exposed to 10 minutes of infrasound and 10 minutes of sham infrasound. Physical symptoms were reported before and during each 10-minute exposure. The study showed that healthy volunteers, when given information designed to invoke either high or low expectations that exposure to infrasound causes symptom complaints, reported symptoms that were consistent with the level of expectation. These data demonstrate that the participants' expectations of the wind turbine sounds determined their patterns of self-reported symptoms, regardless of whether the exposure was to a true or sham wind turbine sound. The concept known as a "nocebo" response, essentially the opposite of a placebo response, will be discussed in more detail later in this report. A nocebo response refers to how a preconceived negative reaction can occur in anticipation of an event.[98]

A further study assessed whether positive or negative health information about infrasound generated by wind turbines affected participants' symptoms and health perceptions in response to wind farm sound.[72] Both physical symptoms and mood were evaluated after exposure to LFN among 60 university students first shown high-expectancy or low-expectancy short videos intended to promote or dispel the notion that wind turbines sounds impacted health. One set of videos presented information indicating that exposure to wind turbine sound, particularly infrasound, poses a health risk, whereas the other set presented information that compared wind turbine sound to subaudible sound created by natural phenomena such as ocean waves and the wind, emphasizing their positive effects on health. Students were continuously exposed during two 7-minute listening sessions to both infrasound (50.4 dB, 9 Hz) and audible wind farm sound (43 dB), which had been recorded 1 km from a wind farm, and assessed for mood and a series of physical symptoms. Both high-expectancy and low-expectancy groups were made aware that they were listening to the sound of a wind farm and were being exposed to sound containing both audible and subaudible components and that the sound was at the same level during both sessions. Participants exposed to wind farm sound experienced a placebo response elicited by positive preexposure expectations, with those participants who were given expectations that infrasound produced health benefits reporting positive health effects. They concluded that reports of symptoms or negative effects could be nullified if expectations could be framed positively.

University students exposed to recorded sounds from locations 100 m from a series of Swedish wind turbines for 10 minutes were assessed for parameters of annoyance.[99] Sound was played at a level of 40 dBAeq (the "eq" refers to the average level over the 10-minute exposure). After the initial exposure, students were exposed to an additional 3 minutes of noise while filling out questionnaires. Authors reported that ratings of annoyance, relative annoyance, and awareness of noise were different among the different wind turbine recordings played at equivalent noise levels. Various psychoacoustic parameters (sharpness, loudness, roughness, fluctuation strength, and modulation) were assessed and then grouped into profiles. Attributes such as "lapping," "swishing," and "whistling'' were more easily noticed and potentially annoying, whereas "low frequency" and "grinding" were associated with less intrusive and potentially less annoying sounds.

Adults exposed to sounds recorded from a 1.5 MV Korean wind turbine were assessed for the degree of noise annoyance.[100] Over a 40-minute period, subjects were exposed to a series of 25 random 30-second bursts of wind turbine noise, separated by at least 10 seconds of quiet between bursts. Following a 3-minute quiet period, this pattern was repeated. Participants reported their annoyance on a scale of 1 to 11. Authors found that the amplitude modulation of wind turbine noise had a statistically significant effect on the subjects' perception of noise annoyance.

The effect of psychological parameters on the perception of noise from wind turbines was also assessed in Italian adults from both urban and rural areas. Recorded sounds from different distances (150 m, 250 m, and 500 m) away from wind turbines were played while pictures of wind turbines were shown and subjects described their reaction to the pictures.[73] Pictures differed in color, the number of wind turbines, and distance from wind turbines. Pictures had a weak effect on individual reactions to the number of wind turbines; the color of the wind turbines influenced both visual and auditory individual reactions, although in different ways.

Epilepsy and Wind Turbines

Rapidly changing visual stimuli, such as flashing lights or oscillating pattern changes, can trigger seizures in susceptible persons, including some who never develop spontaneous seizures; stimuli that change at rates of 12 to 30 Hz are most likely to trigger seizures.[101] Rotating blades (of a ceiling fan, helicopter, or wind turbine) that interrupt light can produce a flicker, leading to a concern that wind turbines might cause seizures. Nevertheless, large wind turbines (2 MW or more) typically rotate at rates less than 1 Hz; with three blades, the frequency of light interruption would be less than 3 Hz, a rate that would pose negligible risk to developing a photoepileptic seizure.[102]

Smedley et al[103] applied a complex simulation model of seizure risk to wind turbines, assuming worst-case conditions—a cloudless day, an observer looking directly toward the sun with wind turbine blades directly between the observer and the sun, but with eyes closed (which scatters the light more broadly on the retina); they concluded that there would be a risk of seizures at distances up to nine times the turbine height, but only when blade frequency exceeds 3 Hz, which would be rare for large wind turbines. Smaller turbines, typically providing power for a single structure, often rotate at higher frequencies and might pose more risk of provoking seizures. At the time of preparation of this report, there has been no published report of a photoepileptic seizure being triggered by looking at a rotating wind turbine.

Sleep and Wind Turbines

Sleep disturbance is relatively common in the general population and has numerous causes, including illness, depression, stress, and the use of medications, among others. Noise is well known to be potentially disruptive to sleep. The key issue with respect to wind turbines is whether the noise is sufficiently loud to disrupt sleep. Numerous environmental studies of noise from aviation, rail, and highways have addressed sleep implications, many of which are summarized in the WHO's position paper on Nighttime Noise Guidelines (Fig. 7).[104] This consensus document is based on an expert analysis of environmental noise from sources other than wind turbines, including transportation, aviation, and railway noise. The WHO published the figure (Fig. 7) to indicate that significant sleep disturbance from environmental noise begins to occur at noise levels greater than 45 dBA. This figure is based on an analysis of pooled data from 24 different environmental noise studies, although no wind turbine–related noise studies were included in the analysis. Nonetheless, the studies provide substantial data on environmental noise exposure that can be contrasted with noise levels associated with wind turbine operations to enable one to draw reasonable inferences.

In contrast to the WHO position, an author in an editorial claimed that routine wind turbine operations that result in noise levels less than 45 dBA can have substantial effects on sleep, with corresponding adverse health effects.[105] Another author, however, challenged the basis of the assertion by pointing out that Hanning had ignored 17 reviews on the topic with alternative perspectives and different results.[106]

Sleep disturbance is a potential extra-auditory effect of noise, and research has shown a link between wind turbine noise and sleep disruption.[4,57,63,66,107] As with of the other variables reviewed, quantifying sleep quality is typically done with coarse measures. In fact, this reviewer identified no studies that used a multi-item validated sleep measure. Research studies typically rely on a single item (sometimes answered yes/no) to measure sleep quality. Such coarse measurement of sleep quality is unfortunate because impaired sleep is a plausible pathway by which wind turbine noise exposure may impact both psychological well-being and physical health.

Disturbed sleep can be associated with adverse health effects.[108] Awakening thresholds, however, depend on both physical and psychological factors. Signification is a psychological factor that refers to the meaning or attitude attached to a sound. Sound with high signification will awaken a sleeper at lower intensity than sound lacking signification.[108] As reviewed above, individuals often attach attitudes to wind turbine sound; as such, wind turbine sleep disruption may be impacted by psychological factors related to the sound source.

Shepherd et al[66] found a significant difference in perceived sleep quality between their wind farm and comparison groups, with the wind farm group reporting worse sleep quality. In the wind farm group, noise sensitivity was strongly correlated with sleep quality. In both the wind farm and comparison groups, sleep quality showed similar strong positive relationships with physical HRQL and psychological HRQL. Pedersen[63] found that sound-level exposure was associated with sleep interruption in two of three studies reviewed; however, the effect sizes associated with sound exposure were minimal.

Bakker et al[57] found that noise exposure was related to sleep disturbance in quiet areas ($d = 0.40$) but not for individuals in noisy areas ($d = 0.02$). Nevertheless, when extreme sound exposure groups were composed,[57] data showed that individuals living in high sound areas (greater than 45 dBA) had significantly greater sleep disruption than subjects in low sound areas (less than 30 dBA). Annoyance ratings were more strongly associated with sleep disruption.[57] Furthermore, when[57] structural equation models (SEMs) were applied, the direct association between sound level and sleep disruption was lost and annoyance seemed to mediate the effect of wind turbine sound on sleep disturbance. Across the reviewed studies it seems that sleep disruption was associated with sound-level exposure; however, the associations were weak and annoyance ratings were more strongly and consistently associated with self-reported sleep disruption.

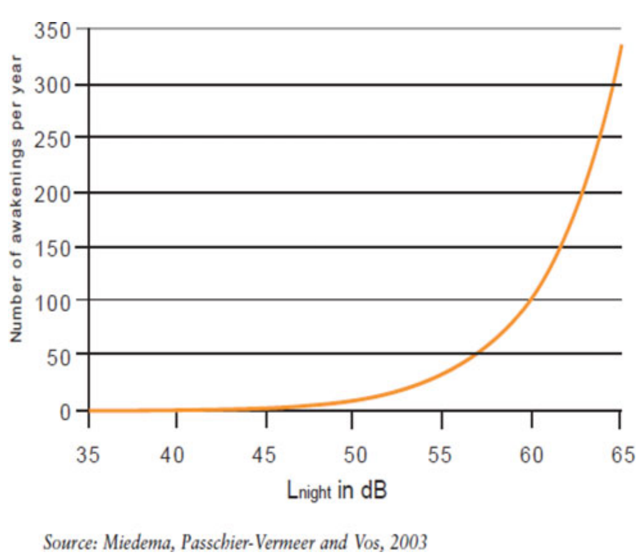

FIGURE 7. Worst-case prediction of noise-induced behavioral awakenings. Adapted from WHO[104] (Chapter 3); Miedema et al.[163]

Conclusions

Infrasound and low-frequency sound can be generated by the operation of wind turbines; however, neither low-frequency sound nor infrasound in the context of wind turbines or in experimental studies has been associated with adverse health effects.

Annoyance, Wind Turbines, and Potential Health Implications

The potential effect of noise on health may occur through both physiological (sleep disturbance) and psychological pathways. Psychological factors related to noise annoyance reported in association with wind turbine noise will be reviewed and analyzed. A critique of the methodological adequacy of the existing wind turbine research as it relates to psychological outcomes will be addressed.

As noted earlier, "annoyance" has been used as an outcome measure in environmental noise studies for many decades. Annoyance is assessed via a questionnaire. Because annoyance has been associated under certain circumstances with living in the vicinity of wind turbines, this section examines the significance of annoyance, risk factors for reporting annoyance in the context of wind turbines, and potential health implications.

For many years, it has been recognized that exposure to high noise levels can adversely affect health[109,110] and that environmental noise can adversely affect psychological and physical health.[111] Key to evaluating the health effects of noise exposure—like any hazard—is a thorough consideration of noise intensity and duration. When outcomes are broadened to include more subjective qualities like annoyance and QOL, additional psychological factors must be studied.

Noise-related annoyance is a subjective psychological condition that may result in anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation, or exhaustion.[112] Annoyance is primarily identified using standardized self-report questionnaires. Well-established psychiatric conditions like major depressive disorder are also subjective states that are most often identified by self-report questionnaires. Despite its subjective nature, noise annoyance was included as a negative health outcome by the WHO in their recent review of disease burden related to noise exposure.[112] The inclusion of annoyance with conditions like cardiovascular disease reinforces its status as a legitimate primary health outcome for environmental noise research.

This section reviews the literature on the effect of wind turbines, including noise-related annoyance and its corresponding effect on health, QOL, and psychological well-being. "Quality of life" is a multidimensional concept that captures subjective aspects of an individual's experience of functioning, well-being, and satisfaction across the physical, mental, and social domains of life. The WHO defines QOL as "an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It is a broad ranging concept affected in complex ways by the person's physical health, psychological status, personal beliefs, social relationships and their relationship to salient features of their environment".[113(p1404)] Numerous well-validated QOL measures are available, with the SF-12 and SF-36[114] and the WHO Quality of Life—Short Form (WHOQLO-BREF[115]) being among the most commonly used. Quality of life measures have been widely adopted as primary outcomes for clinical trials and cost-effectiveness research.

Meta-analysis is a quantitative method for summarizing the relative strength of an effect or relationship as observed across multiple independent studies.[116] The increased application of meta-analysis has had a considerable effect on how literature reviews are approached. Currently, more than 20 behavioral science journals require that authors report measures of effect size along with tests of significance.[117] The use of effect size indicators enhances the comparability of findings across studies by changing the reported outcome statistics to a common metric. In behavioral health, the most frequently used effect size indicators are the Cohen d[118] and r the zero-order (univariate) correlation coefficient.[117] An additional advantage of reporting outcomes as effect size units is that benchmarks exist for judging the magnitude of these (significant) differences. Studies reviewed below report an array of statistical analyses (the t test, analysis of variances, odds ratios, and point-biserial and biserial correlations), some of which are not suitable for conversion into the Cohen d; thus, following the recommendations of McGrath and Meyer,[117] r will be used as the common effect size measure for evaluating studies. As reference points, r between 0.10 and 0.23 represents small effects, r between 0.24 and 0.36 represents medium effects, and r of 0.37 and greater represent large effects.[117] Although these values offer useful guidelines for comparing findings, it is important to realize that, in health-related research, very small effects with $r < 0.10$ can be of great importance.[119]

Noise Sensitivity

Noise sensitivity is a stable and normally distributed psychological trait,[120] but predicting who will be annoyed by sound is not a straightforward process.[121] Noise sensitivity has been raised as a major risk factor for reporting annoyance in the context of environmental noise.[156] Noise sensitivity is a psychological trait that affects how a person reacts to sound. Despite lacking a standard definition, people can usually reliably rate themselves as low (noise tolerant), average, or high on noise sensitivity questionnaires; those who rate themselves as high are by definition noise sensitive.

Noise-sensitive individuals react to environmental sound more easily, evaluate it more negatively, and experience stronger emotional reactions than noise tolerant people.[122–124,146,153–156,159–161] Noise sensitivity is not related to objectively measured auditory thresholds,[125] intensity discrimination, auditory reaction time, or power-function exponents for loudness.[120] Noise sensitivity reflects a psychophysiological process with neurocognitive and psychological features. Noise-sensitive individuals have noise "annoyance thresholds" approximately 10 dB lower than noise tolerant individuals.[123] Noise sensitivity has been described as increasing a person's risk for experiencing annoyance when exposed to sound at low and moderate levels.[4,157]

Noise-Related Annoyance

Noise sensitivity and noise-related annoyance are moderately correlated ($r = 0.32$[120]) but not isomorphic. The WHO[112] defines noise annoyance as a subjective experience that may include anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation, or exhaustion. A survey of an international group of noise researchers indicated that noise-related annoyance is multifaceted and includes both behavioral and emotional features.[126] This finding is consistent with Job's[122] definition of noise annoyance as a state associated with a range of reactions, including frustration, anger, dysphoria, exhaustion, withdrawal, and helplessness.

Annoyance and Wind Turbine Sounds

As noted elsewhere in this review, Pedersen and colleagues[58,61,62,65] conducted the world's largest epidemiological studies of people living in the vicinity of wind turbines. These studies have been discussed in detail in the epidemiological studies section of this review. Other authors have also addressed annoyance in the context of living near wind turbines.[57,61,125,127,128] Pedersen[63] later compared findings from the three cross-sectional epidemiological studies to identify common outcomes. Across all three studies, SPLs were associated with annoyance outside (r between 0.05 and 0.09) and inside of the people's homes (r between 0.04 and 0.05). These effect sizes were all less than the small effect boundary of 0.10, meaning that sound levels played a minor role in annoyance. The percentages of people reporting annoyance with wind turbine noise ranged from 7% to 14% for indoor exposure and 18% to 33% for outside exposure.[58,61] These rates are similar to those reported for exposure to other forms of environmental noise.[129]

The dynamic nature of wind turbine sound may make it more annoying than other sources of community noise according to Pedersen et al.[58] They compared self-reported annoyance from other environmental noise exposure studies (aircraft, railways, road traffic, industry, and shunting yards) with annoyance from wind turbine sound. Proportionally, more subjects were annoyed with wind turbine sound at levels lower than 50 dB than with all other sources of noise exposure, except for shunting yards. Pedersen and Waye[107,128] reported that the sound characteristics of swishing ($r = 0.70$) and whistling ($r = 0.62$) were highly correlated with annoyance to wind turbine sound. Others have reported similar findings. One author has suggested that wind turbine sound may have acoustic qualities that may make it more annoying at certain noise levels.[80] Other theories for symptoms described in association with living near wind turbines have also been proposed.[139]

Annoyance associated with wind turbine sounds tends to show a linear association. Sound levels, however, explain only between 9% ($r = 0.31$) and 13% ($r = 0.36$) of the variance in annoyance ratings.[57,61] Therefore, SPLs seem to play a significant, albeit limited, role in the experience of annoyance associated with wind turbines, a conclusion similar to that reached by Knopper and Ollson.[4]

Nonacoustical Factors Associated With Annoyance

Although noise levels and noise sensitivity affect the risk of a person reporting annoyance, nonacoustic factors also play a role, including the visual effect of the turbines, whether a person derives economic benefit from the turbines and the type of terrain where one lives.[4] Pedersen and Waye[61] assessed the effect of visual/perceptual factors on wind turbine–related annoyance; all of the variables described above were significantly related to self-reported annoyance after controlling for SPLs. Nevertheless, when these variables were evaluated simultaneously, only attitude to the visual effect of the turbines remained significantly related to annoyance ($r = 0.41$, which can be interpreted as a large effect) beyond sound exposure. Pedersen and Waye[128] also found visual effect to be a significant factor in addition to sound exposure for self-reported annoyance to wind turbine sounds. Pedersen et al[58] explored the effect of visual attitude on wind turbine sound-related annoyance. Logistic regression showed that sound levels, noise sensitivity, attitudes toward wind turbines, and visual effect were all significant independent predictors of annoyance. Nevertheless, visual attitudes showed an effect size of $r = 0.27$ (medium effect), whereas noise sensitivity had an r of 0.09. Other authors have also found the visual effect of wind turbines to be related to annoyance ratings.[130] Results from multiple studies support the conclusion that visual effect contributes to wind turbine annoyance,[4] with this review finding visual effect to have an effect size in the medium to large range. Nevertheless, given that noise sensitivity and visual attitude are consistently correlated ($r = 0.19$ and $r = 0.26$, respectively),[58,61] it is possible that visual effect enhances annoyance through multisensory (visual and auditory) activation of the noise-sensitivity trait.

Economic Benefit, Wind Turbines, and Annoyance

Some studies have indicated that people who derive economic benefit from wind turbines are less likely to report annoyance. Pedersen et al[58] found that people who benefited economically ($n = 103$) from wind turbines reported significantly less annoyance despite being exposed to relatively high levels of wind turbine noise. The annoyance mitigating effect of economic benefit was replicated in Bakker et al.[57] The mitigation effect of economic benefit seems to be within the small effect size range ($r = 0.15$).[57] In addition, because receiving economic benefit represents a personal choice to have wind turbines on their property in exchange for compensation, the involvement of subject selection factors (ie, noise tolerance) requires additional study.

Annoyance, Quality of Life, Well-being, and Psychological Distress

The largest cross-sectional epidemiological study of wind turbine noise on QOL was conducted in northern Poland.[67] Surveys were completed by 1277 adults (703 women and 574 men), aged 18 to 94 years, representing a 10% two-stage random sample of the selected communities. Although the response rate was not reported, participants were sequentially enrolled until a 10% sample was achieved, and the proportion of individuals invited to participate but unable or refusing to participate was estimated at 30% (B. Mroczek, personal communication). Proximity of residence was the exposure variable, with 220 (17.2%) respondents within 700 m, 279 (21.9%) between 700 and 1000 m, 221 (17.3%) between 1000 and 1500 m, and 424 (33.2%) residing more than 1500 m from the nearest wind turbine. Several indicators of QOL, measured using the SF-36, were analyzed by proximity to wind turbines. The SF-36 consists of 36 questions divided into the following subscales: physical functioning, role-functioning physical, bodily pain, general health, vitality, social functioning, role-functioning emotional, and mental health. An additional question concerning health change was included, as well as the Visual Analogue Scale for health assessment. It is unclear whether age, sex, education, and occupation were controlled. The authors report that within all subscales, those living closest to wind farms reported the best QOL, and those living farther than 1500 m scored the worst. They concluded that living in close proximity to wind farms does not result in worsening of the QOL.[67] The authors recommend that subsequent research evaluate the reasons for the higher QOL and health indicators associated with living in closer proximity to wind farms. They speculated that these might include economic factors such as opportunities for employment with or renting land to the wind farm companies.

Individuals living closer to wind farms reported higher levels of mental health ($r = 0.11$), physical role functioning ($r = 0.07$), and vitality ($r = 0.10$) than did those living farther away.[67] Nevertheless, the implications of the study[67] are unclear, as the authors did not estimate sound-level exposure or obtain noise annoyance ratings from their subjects. Overall, with the exception of the study by Mroczek et al,[67] noise annoyance demonstrated a consistent small to medium effect on QOL and psychological well-being.

A study a year earlier of 39 individuals in New Zealand came to different conclusions than the Polish study.[131] Survey results from 39 residents located within 2 km of a wind turbine in the South Makara Valley in New Zealand were compared with 139 geographically and socioeconomically matched individuals who resided at least 8 km from any wind farm. The response rates for both the proximal and more distant study groups were poor, that is, 34% and 32%, respectively, although efforts were made to blind respondents to the study hypotheses. No other indicator of exposure to wind turbines was included beyond the selection of individuals from within 2 km or beyond 8 km of a wind turbine, so actual or calculated wind turbine noise exposures were not available. Subjective HRQOL scales were used to describe and compare the self-reported physical, psychological, and social well-being for each group. Health-related quality of life measures are believed to provide an alternative approach to direct health assessment in that decrements in well-being are assumed to be sensitive to and reflect possible underlying health effects. The authors reported statistically significant differences between the groups in some HRQOL domain scores, with residents living within 2 km of a turbine installation reporting lower mean physical HRQOL domain score (including lower component scores for sleep quality and self-reported energy levels) and lower mean environmental QOL scores (including lower component scores for considering one's environment to be less healthy and being less satisfied with the conditions of their living space). The wind farm group scored significantly lower on physical HRQL ($r = 0.21$), environmental QOL ($r = 0.19$), and overall HRQL ($r = 0.10$) relative to the comparison group. Although the psychological QOL ratings were not significantly different ($P = 0.06$), the wind farm group also scored lower on this measure ($r = 0.16$). In the wind farm group, noise sensitivity was strongly correlated with noise annoyance ($r = 0.44$), psychological HRQL ($r = 0.40$), and social HRQOL ($r = 0.35$). These correlations approach or exceed the large effect size boundary ($r > 0.37$ suggested by Cohen).

There were no differences seen for social or psychological HRQOL domain scores. The turbine group also reported lower amenity scores, which are based on responses to two general questions—"I am satisfied with my neighborhood/living environment," and "My neighborhood/living environment makes it difficult for me to relax at home." No differences were reported between groups for traffic or neighborhood noise annoyance. Lack of actual wind turbine and other noise source measurements, combined with the low response rate (both noted by the authors as limitations), limits the inferential value of this study because it might pertain to wind turbine emissions.

Across three studies, Pedersen[63] found that outdoor annoyance with turbine sound was associated with tension and stress ($r = 0.05$ to 0.06) and irritability ($r = 0.05$ to 0.08), qualities associated with psychological distress. Bakker et al[57] also found that psychological distress was significantly related to wind turbine sound ($r = 0.16$), reported outside annoyance ($r = 0.18$) and inside annoyance ($r = 0.24$). Taylor et al[69] found that subjects living in areas with a low probability of hearing turbine noise reported significantly higher levels of positive affect than those living in moderate or high noise areas ($r = 0.24$), suggesting greater well-being for the low noise group.

Personality Factors and Wind Turbine Sound

Personality psychologists use five bipolar dimensions (neuroticism, extraversion-introversion, openness, agreeableness, and conscientiousness) to organize personality traits.[132] Two of these dimensions, neuroticism and extraversion-introversion, have been studied in relation to noise sensitivity and annoyance. Neuroticism is characterized by negative emotional reactions, sensitivity to harmful cues in the environment, and a tendency to evaluate situations as threatening.[133] Introversion (the opposite pole of extraversion) is characterized by social avoidance, timidity, and inhibition.[133] A strong negative correlation has been shown between noise sensitivity (self-ratings) and self-rated extraversion,[125] suggesting that introverts are more noise sensitive. Introverts experience a greater disruption in vigilance when exposed to low-intensity noise than do extroverts.[134] Extroverts and introverts differ in terms of stimulation thresholds with introverts being more easily overstimulated than extroverts.[135] Despite these studies, the potential link between broad personality domains and noise annoyance remains unclear.

Taylor et al[69] explored the role of neuroticism, attitude toward wind turbines, negative oriented personality (NOP) traits (negative affectivity, frustration intolerance), and self-reported nonspecific somatic symptoms (NSS) in reaction to wind turbine noise. Despite one of the few peer-reviewed studies of personality and noise sensitivity, it only achieved a 10% response rate, which raises questions as to the representativeness of the findings. Nonetheless, the study sample reported a moderately positive attitude toward wind turbines in general and seemed representative of the local community. In the study by Taylor et al,[69] zero-order correlations showed that estimated sound levels were significantly related to perceived turbine noise ($r = 0.33$) and reduced positive affect ($r = -0.32$) but not to nonspecific symptoms ($r = 0.002$), whereas neuroticism and NOP traits were significantly related to NSS (r of 0.44 and 0.34, respectively). Multivariate analysis suggested that high NOP traits moderated the relationship between perceived noise and the report of NSS; that is, subjects with higher NOP traits reported significantly more NSS than did subjects low in NOP across the range of perceived loudness of noise.

Nocebo Response

The nocebo response refers to new or worsening symptoms produced by negative expectations.[98,136] When negatively worded pretreatment information ("could lead to a slight increase in pain") was given to a group of chronic back pain patients, they reported significantly more pain ($r = 0.38$) and had worse physical performance ($r = 0.36$).[98] These effect sizes are within the moderate to large ranges and reflect a meaningful adverse effect for the negative information contributing to the nocebo response. The effect of providing negative information regarding wind turbines prior to exposure to infrasound has been experimentally explored. Crichton et al[137] exposed college students to sham and true infrasound under high-expectancy (ie, adverse health effects from wind turbines) and low-expectancy (ie, no adverse health effects) conditions. The high-expectancy group received unfavorable information from TV and Internet accounts of symptoms associated with wind farm noise, whereas the low-expectancy group heard experts stating that wind farms would not cause symptoms. Symptoms were assessed pre- and postexposure to actual and sham infrasound. The high-expectancy group reported significantly more symptoms ($r = 0.37$) and greater symptom intensity ($r = 0.37$) following both sham and true infrasound exposure ($r = 0.65$ and 0.48, respectively). The effect sizes were similar to those found in medical research on the nocebo response. These findings demonstrate that exposing individuals to negative information can increase symptom reporting immediately following exposure. The inclusion of information from TV and the Internet suggests that similar reactions may occur in real-world settings.

A study by Deignan et al[138] analyzed newspaper coverage of wind turbines in Canada and found that media coverage might contribute to nocebo responses. Newspaper coverage contained fright factor words like "dread," "poorly understood by science," "inequitable," and "inescapable exposure"; the use of "dread" and "poorly understood by science" had increased from 2007 to 2011. These results document the use of fright factor words in the popular coverage of wind turbine debates; exposure to information containing these words may contribute to nocebo reactions in some people.

Wind turbines, similar to multiple technologies, such as power lines, cell phone towers, and WiFi signals, among others, have been associated with clusters of unexplained symptoms. Research suggests that people are increasingly worried about the effect of modern life (in particular emerging technologies) on their health (modern health worries [MHW]).[140]) Modern Health Worries are moderately correlated with negative affect ($r = 0.23$) and, like the nocebo response, are considered psychogenic in origin. The expansion of wind turbine energy has been accompanied by substantial positive and negative publicity that may contribute to MHW and nocebo responses among some people exposed to this information. Health concerns have also been raised about the potential of electromagnetic fields associated with wind turbine operations; however, a recent study indicated that magnetic fields in the vicinity of wind turbines were lower than those produced by common household items.[140]

Chapman et al[52] explored the pattern of formal complaints (health and noise) made in relation to 51 wind farms in Australia from 1993 to 2012. The authors suggest that their study is a test of the psychogenic (nocebo or MHW) hypothesis. The findings showed that very few complaints were formally lodged; only 129 individuals in Australia formally or publically complained during the time period studied, and the majority of wind farms had no complaint made against them. The authors found that complaints increased around 2009 when "wind turbine syndrome" was introduced. On the basis of these findings, the authors conclude that nocebo effects likely play an important role in wind farm health complaints. But the authors do report that the vast majority of complaints (16 out of 18) were filed by individuals living near large wind farms ($r = 0.32$). So while few individuals complain, those who do almost exclusively live near large wind farms. Nevertheless, it is important to note that filing a formal or public complaint is a complex sociopolitical action, not a health-related outcome. Furthermore, analysis of data provided in Table 2 of the Chapman[54] study shows that the strongest predictor of a formal complaint was the presence of an opposition group in the area of the wind farm. A review of Table 2 shows that opposition groups were present in 15 of the 18 sites that filled complaints, whereas there was only one opposition group in the 33 areas that did not file a complaint ($r = 0.82$). Therefore, the relevance of this study for understanding health effects of wind turbines is limited. Chapman has also addressed the multitude of reasons why some Australian home owners may have left their homes and attributed the decision to wind turbines.[54] Gross[140] provides a community justice model designed to counter the potential for nocebo or psychogenic response to wind farm development. This method was pilot tested in one community and showed the potential to increase the sense of fairness for diverse community members. No empirical data were gathered during the pilot study so the effect of method cannot be formally evaluated.

Conclusions

Annoyance is a recognized health outcome measure that has been used in studies of environmental noise for many decades. Noise levels have been shown to account for only a modest portion of self-reported annoyance in the context of wind turbines ($r = 0.35$).[4] Noise sensitivity, a stable psychological trait, contributes equally to exposure in explaining annoyance levels ($r = 0.37$). Annoyance associated with wind turbine noise shows a consistent small to medium adverse effect on self-rated QOL and psychological well-being. Given the coarseness of measures used in many studies, the magnitude of these findings are likely attenuated and underestimate the effect of annoyance on QOL. Visual effect increases annoyance beyond sound exposure and noise sensitivity, but at present there is insufficient research to conclude that visual effect operates separately from noise sensitivity because the two variables are correlated. Wind turbine development is subject to the same global psychogenic health worries and nocebo reactions as other modern technologies.[139]

Economic benefit mitigates the effect of wind turbine sound; however, research is needed to clarify the potential confounding role of (self) selection in this finding. The most powerful multivariate model reviewed accounted for approximately 50% ($r = 0.69$) of the variance in reported annoyance, leaving 50% unexplained. Clearly other relevant factors likely remain unidentified. Nevertheless, it is not unusual for there to be a significant percentage of unexplained variance in biomedical or social science research. For example, a meta-analysis of postoperative pain (a subjective experience), covering 48 studies and 23,037 subjects, found that only 54% (r = 0.73) of the variance in pain ratings could be explained by the variables included in the studies.[144] Wind turbine development is subject to the same global psychogenic health worries and nocebo reactions as other modern technologies. Therefore, communities, government agency, and companies would be well advised to adopt an open, transparent, and engaging process when debating the potential effect of wind turbine sites. The vast majority of findings reviewed in this section were correlational and, therefore, do not imply causality, and that other as of yet unidentified (unmeasured) factors may be associated with or responsible for these findings.

DISCUSSION

Despite the limitations of available research related to wind turbines and health, inferences can be drawn from this information, if used in concert with available scientific evidence from other environmental noise studies, many of which have been reviewed and assessed for public policy in the WHO's Nighttime Noise Guidelines.[104] A substantial database on environmental noise studies related to transportation, aviation, and rail has been published.[147] Many of these studies have been used to develop worldwide regulatory noise guidelines, such as those of the WHO,[104] which have proposed nighttime noise levels primarily focused on preventing sleep disturbance.

Because sound and its components are the potential health hazards associated with living near wind turbines, an assessment of other environmental noise studies can offer a valuable perspective in assessing health risks for people living near wind turbines. For example, one would not expect adverse health effects to occur at lower noise levels if the same effects do not occur at higher noise levels. In the studies of other environmental noise sources, noise levels have been considerably higher than those associated with wind turbines. Noise differences as broad as 15 dBA (eg, 55 dBA in highways vs 40 dBA from wind turbines) have been regularly reported.[147] In settings where anthropogenic changes are perceived, indirect effects such as annoyance have been reported, and these must also be considered in the evaluation of health effects.

We now attempt to address three fundamental questions posed at the beginning of this review related to potential health implications of wind turbines.

Is there available scientific evidence to conclude that wind turbines adversely affect human health? If so, what are the circumstances associated with such effects and how might they be prevented?

The epidemiological and experimental literature provides no convincing or consistent evidence that wind turbine noise is associated with any well-defined disease outcome. What is suggested by this literature, however, is that varying proportions of people residing near wind turbine facilities report annoyance with the turbines or turbine noise. It has been suggested by some authors of these studies that this annoyance may contribute to sleep disruption and/or stress and, therefore, lead to other health consequences. This self-reported annoyance, however, has not been reported consistently and, when observed, arises from cross-sectional surveys that inherently cannot discern whether the wind turbine noise emissions play any direct causal role. Beyond these methodological limitations, such results have been associated with other mediating factors (including personality and attitudinal characteristics), reverse causation (ie, disturbed sleep or the presence of a headache increases the perception of and association with wind turbine noise), and personal incentives (whether economic benefit is available for living near the turbines).

There are no available cohort or longitudinal studies that can more definitively address the question about causal links between wind turbine operations and adverse health effects. Nevertheless, results from cross-sectional and experimental studies, as well as studies of other environmental noise sources, can provide valuable information in assessing risk. On the basis of the published cross-sectional epidemiological studies, "annoyance" is the main outcome measure that has been raised in the context of living in the vicinity of wind turbines. Whether annoyance is an adverse health effect, however, is disputable. "Annoyance" is not listed in the International Classification of Diseases (10th edition), although it has been suggested by some that annoyance may lead to stress and to other health consequences, such as sleep disturbance. This proposed mechanism, however, has not been demonstrated in studies using methods capable of elucidating such pathways.

The authors of this review are aware of the Internet sites and non–peer-reviewed reports, in which some people have described symptoms that they attribute to living near wind turbines. The quality of this information, however, is severely limited such that reasonable assessments cannot be made about direct causal links between the wind turbines and symptoms reported. For example, inviting only people who feel they have symptoms because of wind turbines to participate in surveys and asking people to remember events in the past in the context of a current concern (ie, postturbine installation) introduce selection and recall biases, respectively. Such major biases compromise the reliability of the information as used in any rigorous causality assessment. Nonetheless, consistent associations have been reported between annoyance, sleep disturbance, and altered QOL among some people living near wind turbines. It is not possible to properly evaluate causal links of these claims in the absence of a thorough medical assessment, proper noise studies, and a valid study approach. The symptoms reported tend to be nonspecific and associated with various other illnesses. Personality factors, including self-assessed noise sensitivity, attitudes toward wind energy, and nocebo-like reactions, may play a role in the reporting of these symptoms. In the absence of thorough medical evaluations that include a characterization of the noise exposure and a diagnostic medical evaluation, confirmation that the symptoms are due to living near wind turbines cannot be made with any reliability. In fact, the use of a proposed case definition that seemed in a journal not indexed by PubMed can lead to misleading and incorrect assessments of people's health, if performed in the absence of a thorough diagnostic evaluation.[143] We recommend that people who suspect that they have symptoms from living near wind turbines undergo a thorough medical evaluation to identify all potential causes of and contributors to the symptoms. Attributing symptoms to living near wind turbines in the absence of a comprehensive medical evaluation is not medically appropriate. It is in the person's best interest to be properly evaluated to ensure that recognized and treatable illnesses are recognized.

Available scientific evidence does not provide support for any bona fide–specific illness arising out of living in the vicinity of wind turbines. Nonetheless, it seems that an array of factors contribute to some proportion of those living in proximity to wind turbines, reporting some degree of annoyance. The effect of prolonged annoyance—regardless of its source or causes—may have other health consequences, such as increasing stress; however, this cannot be demonstrated with the existing scientific literature on annoyance associated with wind turbine noise or visibility.

Is there available scientific evidence to conclude that psychological stress, annoyance, and sleep disturbance can occur as a result of living in proximity to wind turbines? Do these effects lead to adverse health effects? If so, what are the circumstances associated with such effects and how might they be prevented?

Available research is not suitable for assessing causality because the major epidemiological studies conducted to date have been cross-sectional, data from which do not allow the evaluation of the temporal relationship between any observed correlated factors.

Cross-sectional studies, despite their inherent limitations in assessing causal links, however, have consistently shown that some people living near wind turbines are more likely to report annoyance than those living farther away. These same studies have also shown that a person's likelihood of reporting annoyance is strongly related to their attitudes toward wind turbines, the visual aspect of the turbines, and whether they obtain economic benefit from the turbines. Our review suggests that these other risk factors play a more significant role than noise from wind turbines in people reporting annoyance.

The effect of annoyance on a person's health is likely to vary considerably, based on various factors. To minimize these reactions, solutions may include informative discussions with area residents before developing plans for a wind farm along with open communications of plans and a trusted approach to responding to questions and resolving noise-related complaints.

Is there evidence to suggest that specific aspects of wind turbine sound such as infrasound and low-frequency sound have unique potential health effects not associated with other sources of environmental noise?

Both infrasound and low-frequency sound have been raised as possibly unique health hazards associated with wind turbine operations. There is no scientific evidence, however, including results from field measurements of wind turbine–related noise and experimental studies in which people have been purposely exposed to infrasound, to support this hypothesis. Measurements of low-frequency sound, infrasound, tonal sound emission, and amplitude-modulated sound show that infrasound is emitted by wind turbines, but that the levels at customary distances to homes are well below audibility thresholds, even at residences where people have reported symptoms that they attribute to wind turbines. These levels of infrasound—as close as 300 m from the turbines—are not audible. Moreover, experimental studies of people exposed to much higher levels of infrasound than levels measured near wind turbines have not indicated adverse health effects. Because infrasound is associated more with vibratory effects than high-frequency sound, it has been suggested that the vibration from infrasound may be contributing to certain physical sensations described by some people living near wind turbines. These sensations are difficult to reconcile in light of field studies that indicated that infrasound at distances more than 300 m for a wind turbine meet international standards for preventing rattling and other potential vibratory effects.[14]

Areas for Further Inquiry

In light of the limitations of available studies for drawing definitive conclusions and the need to address health-related concerns associated with wind turbines raised by some nearby residents, each author discussed potential areas of further inquiry to address current data gaps. These recommendations primarily address exposure characterization, health endpoints, and the type of epidemiological study most likely to lead to informative results regarding potential health effects associated with living near wind turbines.

Noise From Wind Turbines

As with any potential occupational or environmental hazard, further efforts at exposure characterization, that is, noise and its components such as infrasound and low-frequency sound, would be valuable. Ideally, uniform equipment and standardized methods of measurement can be used to enable comparison with results from published studies and evaluate adherence to public policy guidelines.

Efforts directed at evaluating models used to predict noise levels from wind turbines—in contrast to actual measured noise levels—would be valuable and may be helpful in informing and reassuring residents involved in public discussions related to the development of wind energy projects. Efforts at fine tuning noise models for accuracy to real-world situations can be reassuring to public health officials charged with evaluating potential health effects of noise. The development and the use of reliable and portable noise measuring devices to address components of noise near residences and evaluating symptoms and compliance with noise guidelines would be valuable.

Epidemiology

Prospective cohort studies would be most informative for identifying potential health effects of exposure to wind turbine noise before and after wind turbines are installed and operating. Ideally, substantially large populations would be evaluated for baseline health status, and subsequently part of the population would become exposed to wind turbines and part would remain unexposed, as in an area where large wind turbine farms are proposed or planned. The value of such studies is in the avoidance of several forms of bias such as recall bias, where study participants might, relying on recall, under- or overreport risk factors or diseases that occurred sometime in the past. As has been noted by several authors, the level of attention given the topic of wind turbines and possible health effects in the news and the Internet makes it difficult to study any population truly "blinded" to the hypotheses being evaluated. The main advantage of prospective cohort studies with a pre- and post–wind turbine component is the direct ability to compare changes in disease and health status among individuals subsequently exposed to wind turbine noise with those among similar groups of people not exposed. These conditions are not readily approximated by any other study approach. A similar but more complex approach could include populations about to become exposed to other anthropogenic stimuli, such as highways, railroads, commercial centers, or other power generation sources.

We note that additional cross-sectional studies may not be capable of contributing meaningfully and in fact might reinforce biases already seen in many cross-sectional studies and surveys.

Sound and Its Components

Several types of efforts can be undertaken to test hypotheses proposed about inaudible sound being a risk for causing adverse health effects. It would be simple, at least conceptually, to expose blinded subjects to inaudible sounds, especially in the infrasound range, to determine whether they could detect the sounds or whether they developed any unpleasant symptoms. Ideally, these studies would use infrasound levels that are close to hearing thresholds and comparable with real-world wind turbine levels at residential distances. Crichton et al[137,149] have begun such studies, finding that subjects could not detect any difference between infrasound and sham "exposures." The infrasound stimulus used, however, was only 40 dB at 5 Hz, more than 60 dB lower than hearing threshold and lower than levels measured at some residences near wind turbines.

The possibility of adverse effects from inaudible sound could also be tested in humans or animals in long-term studies. To date, there seem to be no reports of adverse effects in people exposed to wind turbine noise that they could never hear (such reports would require careful controls), nor are any relevant animal studies known to the authors of this review.

Controlled human exposure studies have been used to gain insight into the effects of exposure to LFN from wind turbines. Human volunteers are exposed for a short amount of time under defined conditions, sometimes following various forms of preconditioning, and different response metrics evaluated. Most of these studies addressed wind turbine noise annoyance but no direct health indicator; however, one study addressed visual reaction to the color of wind turbines in pictures,[73] and another evaluated physical symptoms in response to wind turbine noise.[137,149]

Efforts to document a potential effect of infrasound on health have been unsuccessful, including searches for responses to sound from cochlear type II afferent neurons or responses to inaudible airborne sound from the vestibular system. But in other cases, the relevant experiments (can inaudible sound cause endolymphatic hydrops?) seem not to have been conducted to date. This seemingly improbable hypothesis, however, could be tested in guinea pigs, which reliably develops endolymphatic hydrops in response to other experimental interventions.

Psychological Factors

This review has demonstrated that a complex combination of noise and personal factors contributes to some people reporting annoyance in the context of living near wind turbines. Further efforts at characterizing and understanding these issues can be directed to improvements in measurement of sound perception, data analysis, and conceptualization.

We suggest improvements in the quality and standardization of measurement for important constructs like noise sensitivity and noise annoyance across studies. We also suggest eliminating the use of single-item "measures" for primary outcomes.

Data analysis should ideally include effect size measures in all studies to supplement the significance testing (some significant differences are small when sample sizes are large). This will help improve the comparability of findings across studies.

Integrate noise sensitivity, noise annoyance, and QOL into a broader more comprehensive theory of personality or psychological functioning, such as the widely accepted five-factor model of personality.

SUMMARY

1. Measurements of low-frequency sound, infrasound, tonal sound emission, and amplitude-modulated sound show that infrasound is emitted by wind turbines. The levels of infrasound at customary distances to homes are typically well below audibility thresholds.
2. No cohort or case–control studies were located in this updated review of the peer-reviewed literature. Nevertheless, among the cross-sectional studies of better quality, no clear or consistent association is seen between wind turbine noise and any reported disease or other indicator of harm to human health.
3. Components of wind turbine sound, including infrasound and low-frequency sound, have not been shown to present unique health risks to people living near wind turbines.
4. Annoyance associated with living near wind turbines is a complex phenomenon related to personal factors. Noise from turbines plays a minor role in comparison with other factors in leading people to report annoyance in the context of wind turbines.

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4-22

Subject **SEIS - Avian & Bat Monitoring**
From Beverly Gingerich <beverlyging@yahoo.com>
To townclerk@townofenfield.org <townclerk@townofenfield.org>
Date 04/22/2016 9:03 pm

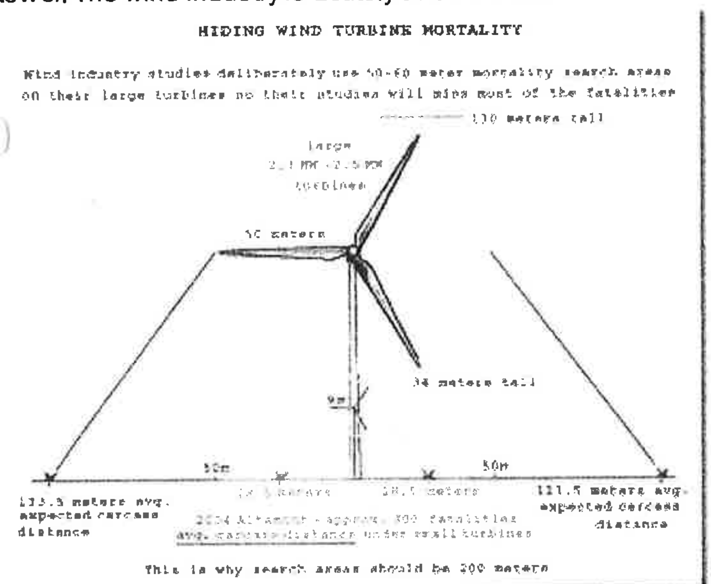
roundcube

To: Enfield Town Board
Date: April 22, 2016
Re: Avian & Bat Monitoring

Avian & Bat Monitoring is not addressed in the SDEIS, so this is a quote from the FEIS (Nov. 2014) Appendix P. Post Construction Avian and Bat Monitoring Plan. "Search areas would consist of 125 m x 125 m areas centered at each turbine. This would permit 100% search coverage out to at least 60 m from the turbine base, and partial sampling out to at least 80 m."

According to the information from the article linked below, the search areas should be increased significantly.

Developing Methods to Reduce Bird Mortality in the Altamont Pass Wind Resource Area also looked at the placement of carcasses in relation to turbine types. It documented that the distances carcasses were found from turbine towers increased significantly as turbine megawatt ratings and blade lengths increased. Based on a sample of about 800 carcasses, the report revealed that birds were found an average of 94 feet (28.5 meters) from 100Kw turbines on towers 81 feet (24.6 meters) high.
Obviously, taller turbines with longer blades and faster blade-tip speeds will catapult stricken birds much further. **Figure 1** below shows how a turbine 2.5 times larger will result in an average carcass distance of *372 feet* (113.5 meters) from the tower. The wind industry is acutely aware of this.



That is why it has restricted search areas to *165 feet* (50 meters) around its bigger turbines. This ensures that far fewer bodies will be found – and turbine operators will not need to explain away as many carcasses.
Recent mortality studies like those conducted at the Wolfe Island wind project (2.3 MW turbines) and Criterion project in Maryland (2.5 MW turbines) should have used searches 655 feet (200 meters) from turbines, just to find the bulk (75-85%) of the fatalities. Of course, they did not do so. Instead, they restricted their searches to 165 feet – ensuring that they missed most raptor carcasses, and could issue statements claiming that their turbines were having minimal or "acceptable" effects on bird populations.

The whole article is found here:
https://www.masterresource.org/cuisinarts-of-the-air/wind-avian-mortality-ii/

Will the new technology for automated aviation collision detection mentioned by Mr. William Evans of Old Bird, Inc. in his letter to BOWF dated Jan. 28, 2014, be implemented? (page 30 of the FEIS http://www.blackoakwindny.com/wp-content/uploads/Accepted-FEIS-11-12-14.pdf)

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Friday, April 22, 2016 9:53 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: SEIS - Energy Output & Consumption

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: SEIS - Energy Output & Consumption
Date: 04/22/2016 9:16 pm
From: Beverly Gingerich <beverlyging@yahoo.com>
To: "townclerk@townofenfield.org" <townclerk@townofenfield.org>

To: Enfield Town Board
Date: April 22, 2016
Re: Energy Output and Consumption

If the turbines become operational, will Black Oak/Onyx Black Oak Wind publicize the data as to how much energy is produced, how much is consumed, and the net amount?

http://www.aweo.org/windconsumption.html [8]

> ENERGY CONSUMPTION IN WIND FACILITIES
>
> Large wind turbines require a large amount of energy to operate.
> Other electricity plants generally use their own electricity, and the
> difference between the amount they generate and the amount delivered
> to the grid is readily determined. Wind plants, however, use
> electricity from the grid, which does not appear to be accounted for
> in their output figures. At the facility in Searsburg, Vermont, for
> example, it is apparently not even metered and is completely unknown
> [click here [1]].* The manufacturers of large turbines -- for example,
> Vestas, GE, and NEG Micon -- do not include electricity consumption in
> the specifications they provide.
>
> Among the wind turbine functions that use electricity are the
> following:†
>
> * yaw mechanism (to keep the blade assembly perpendicular to the wind;
> also to untwist the electrical cables in the tower when

> necessary) -- the nacelle (turbine housing) and blades together weigh
> 92 tons on a GE 1.5-MW turbine
>
> * blade-pitch control (to keep the rotors spinning at a regular rate)
>
> * lights, controllers, communication, sensors, metering, data
> collection, etc.
>
> * heating the blades -- this may require 10%-20% of the turbine's
> nominal (rated) power
>
> * heating and dehumidifying the nacelle -- according to Danish
> manufacturer Vestas, "power consumption for heating and
> dehumidification of the nacelle must be expected during periods with
> increased humidity, low temperatures and low wind speeds"
>
> * oil heater, pump, cooler, and filtering system in gearbox
>
> * hydraulic brake (to lock the blades in very high wind)
>
> * thyristors (to graduate the connection and disconnection between
> generator and grid) -- 1%-2% of the energy passing through is lost
>
> * magnetizing the stator -- the induction generators used in most
> large grid-connected turbines require a "large" amount of continuous
> electricity from the grid to actively power the magnetic coils around
> the asynchronous "cage rotor" that encloses the generator shaft; at
> the rated wind speeds, it helps keep the rotor speed constant, and as
> the wind starts blowing it helps start the rotor turning _(see next
> item)_; in the rated wind speeds, the stator may use power equal to
> 10% of the turbine's rated capacity, in slower winds possibly much
> more
>
> * using the generator as a motor (to help the blades start to turn
> when the wind speed is low or, as many suspect, to maintain the
> illusion that the facility is producing electricity when it is not,‡
> particularly during important site tours or noise testing (keeping the
> blades feathered, ie, quiet)) -- it seems possible that the
> grid-magnetized stator must work to help keep the 40-ton blade
> assembly spinning, along with the gears that increase the blade rpm
> some 50 times for the generator, not just at cut-in (or for show in
> even less wind) but at least some of the way up towards the full rated
> wind speed; it may also be spinning the blades and rotor shaft to
> prevent warping when there is no wind§
>
> Could it be that at times each turbine consumes more than 50% of its
> rated capacity in its own operation?! If so, the plant as a whole --
> which may produce only 25% of its rated capacity annually -- would be
> using (for free!) twice as much electricity as it produces and sells.
> An unlikely situation perhaps, but the industry doesn't publicize any
> data that proves otherwise; incoming power is apparently not normally
> recorded.

>
> Is there some vast conspiracy spanning the worldwide industry from
> manufacturers and developers to utilities and operators? There doesn't
> have to be, if engineers all share an assumption that wind turbines
> don't use a significant amount of power compared to their output and
> thus it is not worth noting, much less metering. Such an assumption
> could be based on the experience decades ago with small DC-generating
> turbines, simply carried over to AC generators that continue to
> metastasize. However errant such an assumption might now be, it stands
> as long as no one questions it. No conspiracy is necessary --
> self-serving laziness is enough.
>
> Whatever the actual amount of consumption, it could seriously diminish
> any claim of providing a significant amount of energy.
> Instead, it looks like industrial wind power could turn out to be a
> laundering scheme: "Dirty" energy goes in, "clean" energy comes out.
> That would explain why developers demand legislation to create a
> market for "green credits" -- tokens of "clean" energy like the
> indulgences sold by the medieval church. _Ego te absolvo._
>
> (One need only ask utilities to show how much less "dirty"
> electricity they purchase because of wind-generated power to see that
> something is amiss in the wind industry's claims. If wind worked and
> were not mere window dressing, the industry would trot out some real
> numbers. But they don't. One begins to suspect that they can't.)
>
> *Wayne Gulden has analyzed [2] the daily production reports of a
> Vestas V82 1.65-MW wind turbine at the University of Minnesota,
> Morris, from 2006 to 2008. Those records [3] include negative
> production, i.e., net consumption, as well as daily average wind
> speeds. The data suggest that the turbine consumes at a minimum rate
> of about 50 kW, or 8.3% of its reported production over those years
> (and which declined 2-4% each year).
>
> There is also the matter of reactive power (VAR). As wind facilities
> are typically built in remote areas, they are often called upon to
> provide VAR to maintain line voltage. Thus much of their production
> may go to providing only this "energy-less" power.
>
> _See also: _ "Tehachapi's four turbines may be scuttled [4]", Gordon
> Lull, Nov. 7, 2012: "[N]ow some question whether the turbines actually
> cost more money, in terms of electricity usage and maintenance
> expenses, than they generate in power." ... "[T]he turbines
> themselves, intended as renewable energy generators, must draw
> significant amounts of electricity from traditional non-renewable
> sources when being started."
>
> †Much of this information comes from a Swedish graduate student
> specializing in hydrogen and wind power, as posted in a Yes2Wind
> discussion [5]. Also see the Danish Wind Industry Association's guide
> to the technology [6]. The rest comes from personal correspondence
> with other experts and from industry spec sheets.

>
> ‡An observer in Toronto, Ontario, points out that the blades of the
> turbines installed at the Pickering nuclear plant and Exhibition Place
> turn 90% of the time, even when there is barely a breeze and when the
> blades are not properly pitched -- in a region acknowledged to have
> low wind resource.
>
> §'In large rotating power trains such as this, if allowed to stand
> motionless for any period of time, the unit will experience "bowing"
> of shafts and rotors under the tremendous weight. Therefore, frequent
> rotating of the unit is necessary to prevent this. As an example, even
> in port Navy ships keep their propeller shafts and turbine power
> trains slowly rotating. It is referred to as "jacking the shaft" to
> prevent any tendency to bow. Any bowing would throw the whole train
> out of balance with potentially very serious damage when bringing the
> power train back on line.
> 'In addition to just protecting the gear box and generator shafts and
> bearings, the blades on a large wind turbine would offer a special
> challenge with respect to preventing warping and bowing when not in
> use. For example, on a sunny, windless day, idle wind turbine blades
> would experience uneven heating from the sun, something that would
> certainly cause bowing and warping. The only way to prevent this would
> be to keep the blades moving to even out the sun exposure to all parts
> of the blade.
> 'So, the point that major amounts of incoming electrical power is used
> to turn the power train and blades when the wind is not blowing is
> very accurate, and it is not something the operators of large wind
> turbines can avoid.
> '[Also, there is] the likely need for a hefty, forced-feed lubricating
> system for the shaft and turbine blade assembly bearings.
> This would be a major hotel load. I can't imagine passive lubrication
> (as for the wheel bearings on your car) for an application like this.
> Maybe so, but I would be very surprised. Assuming they have to have a
> forced-feed lubrication system, given the weight on those bearings (40
> tons on the bearing for the rotor and blades alone) a very robust
> (energy-sucking) lubricating oil system would be required. It would
> also have to include cooling for the oil and an energy-sucking lube
> oil purification system too.'
> --Lawrence E. Miller, Gerrardstown, WV, an engineer with over 40 years
> of professional experience with large power train machinery associated
> with Navy ships.
>
> _Also: _ 'The wind farm operator ... has to keep the sensitive
> equipment -- the drives, hubs and rotor blades -- in constant motion
> ...' (The Automatic Earth, Oct. 27, 2012 [7])
>
> Beverly Gingerich
> 101 Rumsey Hill RD
> Newfield, NY 14867

Links:

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[1] http://www.aweo.org/windsearsburg.html
[2] http://windfarmrealities.org/?p=1594
[3] http://renewables.morris.umn.edu/wind/research/
[4]
http://www.examiner.com/article/tehachapi-s-four-turbines-may-be-scuttled
[5] http://www.yes2wind.co.uk/forums/showthread.php?&threadid=69
[6] http://www.windpower.org/composite-85.htm
[7]
http://theautomaticearth.com/Energy/renewable-energy-the-vision-and-a-dose-of-reality.html
[8] http://www.aweo.org/windconsumption.html

Palermo, Jean

From:	townclerk@townofenfield.org
Sent:	Friday, April 22, 2016 9:55 PM
To:	Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject:	Fwd: SEIS - Avian Studies

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: SEIS - Avian Studies
Date: 04/22/2016 9:51 pm
From: Beverly Gingerich <beverlyging@yahoo.com>
To: "townclerk@townofenfield.org" <townclerk@townofenfield.org>

To: Enfield Town Board
Date: April 22, 2016
Re: SEIS - Avian Studies

From the 2013 DEIS:

"Black Oak Wind Farm

2011 Breeding Bird Study

Old Bird Inc.

In addition, there are four WTG sites in the BOWF located east of Black Oak Rd. None of these were surveyed in the 2011 breeding bird study."

Due to the breeding bird study having been done 5 years ago, with none of the 4 turbine sites east of Black Oak Road having been surveyed, and now with the addition of 2 (out of 3 possible) turbine sites, it would seem that another more up-to-date and comprehensive survey should be done.

Beverly Gingerich
101 Rumsey Hill RD
Newfield, NY 14867

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Saturday, April 23, 2016 4:19 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: SEIS - Effects on domestic animals

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: SEIS - Effects on domestic animals
Date: 04/22/2016 10:48 pm
From: Beverly Gingerich <beverlyging@yahoo.com>
To: "townclerk@townofenfield.org" <townclerk@townofenfield.org>

To: Enfield Town Board
Date: April 22, 2016
Re: SEIS - Domestic Animals

There is no mention in the SEIS about the effects of wind turbines on domestic animals. There are at least several families, including mine, in the vicinity of the proposed wind facility who keep flocks of laying hens for sale and personal use. The possibility that our chickens might lay eggs without yolks, or stop laying altogether is more than a little disconcerting. We, along with many of the residents in the Connecticut Hill area, have a pet dog or two. We also have guinea fowl, and there are other families who own peacocks, swans, and horses.

Is BOWF willing and able to offer any kind of mitigation should our birds and/or animals be negatively impacted by their wind turbines?

https://www.windturbinesyndrome.com/2012/most-eggs-had-no-yolk-and-the-shells-were-like-jelly-australia/
[1]

DO WIND TURBINES HARM ANIMALS? [2]

http://www.windturbinewildlifehell.org/site/category/pets/ [3]

Beverly Gingerich
101 Rumsey Hill RD
Newfield, NY 14867

Links:

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[1]
https://www.windturbinesyndrome.com/2012/most-eggs-had-no-yolk-and-the-shells-were-like-jelly-australia/
[2] http://www.eastcountymagazine.org/do-wind-turbines-harm-animals
[3] http://www.windturbinewildlifehell.org/site/category/pets/

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Friday, April 22, 2016 9:53 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: SEIS - Noise

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: SEIS - Noise
Date: 04/22/2016 9:23 pm
From: Beverly Gingerich <beverlyging@yahoo.com>
To: "townclerk@townofenfield.org" <townclerk@townofenfield.org>

To: Enfield Town Board
Date: April 22, 2016
Re: SEIS - Noise

Could someone please explain to me why our residence at 101 Rumsey Hill RD is not included as a receptor on the Acoustic Study (Appendix H) in the SEIS? Every house that is within the 40 dBA range is labeled/given a designation number except ours and our neighbor Mr. Grover's at 112 Rumsey Hill RD.

I can find nothing in the Noise section (2.16) of the SEIS, that delineates between daytime and nighttime noise. The World Health Organization proposes "a guideline target limit of outdoor night noise of 40 dB (annual average defined a 'Lnight' in the Environmental Noise Directive). There is not sufficient evidence that the biological effects observed below this level are harmful to health but adverse effects are observed above 40 dB."
http://ec.europa.eu/environment/integration/research/newsalert/pdf/202na3_en.pdf
[1]

What guarantee can be offered to me that neither I nor anyone else in my family will be awakened at night by noise coming from any of the wind turbines, particularly in the summer when we often open windows? I am especially concerned about our 4 children who range in age from 5 to 14.
What recourse do I have if any of them is prevented from sleeping due to noise?

http://www.who.int/ceh/capacity/noise.pdf [2]

Beverly Gingerich
101 Rumsey Hill RD
Newfield, NY 14867

Links:
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[1]
http://ec.europa.eu/environment/integration/research/newsalert/pdf/202na3_en.pdf
[2] http://www.who.int/ceh/capacity/noise.pdf

4-22

Subject **SEIS - Energy**
From Beverly Gingerich <beverlyging@yahoo.com>
To townclerk@townofenfield.org <townclerk@townofenfield.org>
Date 04/22/2016 9:22 pm

roundcube

. Enfield Town Board
Date: April 22, 2016
Re: SEIS - Energy

The SEIS states:

2.7 ENERGY

2.7.1 Existing Condition

Existing energy conditions for the Modified Project remain as described in DEIS Section 3.10.1.

2.7.2 Comparison of Potential Impacts

As with the Approved Project and described in DEIS Section 3.10.2 and 6.8.1 of the Findings Statement, the Modified Project is not expected to result in significant adverse energy impacts. All impacts to energy are expected to be positive and will not result in the need for mitigation.

Has the energy that is required to manufacture a wind turbine been considered?

https://carboncounter.wordpress.com/2015/06/11/can-you-make-a-wind-turbine-without-fossil-fuels-2/

"This is what a typical wind turbine looks like:

What is it made of? Lots of steel, concrete and advanced plastic. Material requirements of a modern wind turbine have been reviewed by the United States Geological Survey. On average 1 MW of wind capacity requires 103 tonnes of stainless steel, 402 tonnes of concrete, 6.8 tonnes of fiberglass, 3 tonnes of copper and 20 tonnes of cast iron. The elegant blades are made of fiberglass, the skyscraper sized tower of steel, and the base of concrete.

Fossil fuel requirements of cement and steel production

For the sake of brevity I will only consider whether this steel can be produced without fossil fuels, and whether the concrete can be made without the production of carbon dioxide. However I will note at the outset that the requirement for fiberglass means that a wind turbine cannot currently be made without the extraction of oil and natural gas, because fiberglass is without exception produced from petrochemicals.

Let's begin with steel. How do we make most of our steel globally?

There are two methods: recycle old steel, or make steel from iron ore. The vast majority of steel is made using the latter method for the simple reason that there is nowhere near enough old steel lying around to be re-melted to meet global demand.

Here then is a quick summary of how we make steel. First we take iron ore out of the ground, leaving a landscape looking like this:

This is done using powerful machines that need high energy density fuels, i.e. diesel:

And the machines that do all of this work are almost made entirely of steel:

After mining, the iron ore will need to be transported to a steel mill. If the iron ore comes from Australia or Brazil then it most likely will have to be put on a large bulk carrier and transported to another country.

What powers these ships? A diesel engine. And they are big:

Simple engineering realities mean that shipping requires high energy dense fuels, universally diesel. Because of wind and solar energy's intrinsic low power density putting solar panels, or perhaps a kite, on to one of these ships will not come close to meeting their energy requirements. We are likely stuck with diesel engines for generations.

We then convert this iron ore into steel. How is this done? There are only two widely used methods. The blast furnace or direct reduction routes, and these processes are **fundamentally dependent on the provision of large amounts of coal or natural gas.**

A modern blast furnace

The **blast furnace route is used for the majority of steel production globally.** Here coal is key. Iron ore is unusable, largely because it is mostly iron oxide. This must be purified by removing the oxygen, and we do this by reacting the iron ore with carbon monoxide produced using coke:

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

Production of carbon dioxide therefore is not simply a result of the energy requirements of steel production, but of the chemical requirements of iron ore smelting.
This steel can then be used to produce the tower for a wind turbine, but as you can see, each major step of the production chain for what we call primary steel is dependent on fossil fuels.
By weight cement is the most widely used material globally. We now produce over 3.5 billion tonnes of the stuff each year, with the majority of it being produced and consumed in China. And one of the most important uses of cement is in concrete production.
Cement only makes up between 10 and 20% of concrete's mass, depending on the specific concrete. However from an embodied energy and emissions point of view it makes up more than 80%. So, if we want to make emissions-free concrete we really need to figure out how to make emissions-free cement.
make cement in a cement kiln, using a kiln fuel such as coal, natural gas, or quite often used tires. Provision of heat in cement production is an obvious source of greenhouse gases, and providing heat with low carbon sources will face multiple challenges.
These challenges may or may not be overcome, but here is a more challenging one. Approximately 50% of emissions from cement production come not from energy provision, but from chemical reactions in its production.
The key chemical reaction in cement production is the conversion of calcium carbonate (limestone) into calcium oxide (lime). The removal of carbon from calcium carbonate inevitably leads to the emission of carbon dioxide:

$$CaCO_3 \rightarrow CaO + CO_2$$

These chemical realities will make total de-carbonisation of cement production extremely difficult.

Total cement production currently represents about 5% of global carbon dioxide emissions, to go with the almost 7% from iron and steel production. Not loose change.

In conclusion we obviously cannot build wind turbines on a large scale without fossil fuels."

Has it been considered that power plants are necessary to back-up intermittent wind energy?

http://www.aweo.org/faq.html

"Because of the way the electric grid works, constantly matching supply with demand to avoid dips and surges of power, the variable production of wind turbines is treated as part of the demand side of the equation. A base level of power is provided from large plants, and other plants are kept burning to be able to provide the maximum likely power (peak load) needed as it varies through the day. As demand drops, those plants are diverted from power generation, and as demand rises they are brought back on to resume generating the needed power. These plants burn fuel whether or not they are producing electricity.

In other words, these peak load plants must continue burning fuel when demand falls or wind production rises, because either trend may reverse at any time. The effect of wind turbines, because they are out of the control of the grid's dispatchers, just like user demand, is only to bring the spinning standby plants in and out of production. But, again, the plants continue to burn their fuel. And the additional fluctuations of wind power add to the cost and inefficiency of that burning.

A further irony is that because an increase in wind power capacity is seen on the grid as an increase in demand fluctuation, it requires dedication of other grid capacity to cover it. Rather than reducing other sources, wind power requires building *more* conventional capacity, particularly natural gas–fired plants, which it then forces to operate less efficiently."

Beverly Gingerich
101 Rumsey Hill RD
Newfield, NY 14867

Palermo, Jean

From:	townclerk@townofenfield.org
Sent:	Friday, April 22, 2016 9:54 PM
To:	Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject:	Fwd: SEIS - Infrasound

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: SEIS - Infrasound
Date: 04/22/2016 9:38 pm
From: Beverly Gingerich <beverlyging@yahoo.com>
To: "townclerk@townofenfield.org" <townclerk@townofenfield.org>

To: Enfield Town Board
Date: April 22, 2016
Re: SEIS - Infrasound

I find NO mention of infrasound--the most serious potential health risk, in my opinion, related to wind turbines--in the SEIS, and that is very troubling to me. With 2 of the proposed turbines--B & C--moving closer to us than the 2 'abandoned' sites (A would be approximately the same distance from us as the closer 'abandoned' site), the possibility of infrasound affecting me and my family (husband and four children aged 5
- 14) would increase.

Our property at 101 Rumsey Hill RD can almost be considered a 'focal point' of all of the proposed sites with 2 or 3 turbines to the southwest, 3 or 4 to the northwest, and one mostly to the west at the following distances:

0.5mi. T3

0.55mi T6 (moved 12')
0.67mi to T5 (moved >150')
0.76 T1 0.87mi to TB
0.99mi to TC

1.11mi to TA (Newfield)
1.45mi to T4

There is mounting evidence from around the world that the infrasound generated by industrial wind turbines, and which can travel for miles, affects some people adversely, causing negative health issues such as headaches, fatigue, temporary feelings of dizziness, nausea, vomiting, insomnia, and palpitations.

What is BOWF prepared to do for residents who might suffer from any of these or other negative health issues?

Here are only a few of the scores of links available relating scientific and anecdotal reports of health concerns due to infrasound:

http://oto2.wustl.edu/cochlea/wind.html [1]

https://www.wind-watch.org/documents/negative-health-effects-of-noise-from-industrial-wind-turbines-some-background/
[2]

https://www.wind-watch.org/documents/negative-health-impact-of-noise-from-industrial-wind-turbines-the-evidence/
[2]

https://www.wind-watch.org/documents/negative-health-impact-of-noise-from-industrial-wind-turbines-how-the-ear-and-brain-process-infrasound/
[2]

https://www.wind-watch.org/documents/proposed-theory-to-explain-some-adverse-physiological-effects-of-the-infrasonic-emissions-at-some-wind-farm-sites/
[2]

https://www.wind-watch.org/documents/summary-of-recent-field-observations-of-adverse-health-effects-from-wind-developments-in-australia/
[2]

Beverly Gingerich
101 Rumsey Hill RD
Newfield, NY 14867

Links:
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[1] http://oto2.wustl.edu/cochlea/wind.html
[2]
https://www.wind-watch.org/documents/negative-health-effects-of-noise-from-industrial-wind-turbines-some-background/

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Friday, April 22, 2016 9:54 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: SEIS - No Action

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: SEIS - No Action
Date: 04/22/2016 9:29 pm
From: Beverly Gingerich <beverlyging@yahoo.com>
To: "townclerk@townofenfield.org" <townclerk@townofenfield.org>

To: Enfield Town Board
Date: April 22, 2016
Re: SEIS - No Action

3.1 NO ACTION

The no action alternative assumes that the Modified Project Site would continue to exist as agricultural, forested, successional and rural residential land. This no action alternative would not affect on - site ambient noise conditions, construction traffic or public road conditions, wildlife or wildlife habitat, wetlands and streams, or television/communication systems, and would maintain community character, economic and energy - generating conditions as they currently exist.

This scenario sounds awesome; let's keep it that way!

Given the short - term nature of anticipated construction impacts and the generally minor long - term impacts of operation, as compared to the significant economic benefits that the Modified Project would generate, the no - action alternative is not considered a preferred alternative.

For Black Oak, its investors, and a handful of landowners--yes, it is not; but for the majority of the residents who live along Black Oak RD, Connecticut Hill RD, Griffin RD, Weatherby RD, and Harvey Hill RD, it would be the preferred alternative.

https://www.masterresource.org/windpower/wind-loser/ [1]

http://www.resilience.org/stories/2010-11-25/how-sustainable-renewable-energy
[2]

"After the wind farm is installed and commissioned, and all the factory personnel have finally flown home, there is then the not so small matter of the continuous operation and maintenance (O&M) required throughout the life of the project to keep the show on the road. Here the fossil fuel energy intensity is reduced but there are still interminable attendance's on site required to test, tweak, adjust, replace, repair and reset along with the transporting and supply of consumables and spare parts. Once in a while there will be a major spike in fossil fuel intensity when there is a failure of a major component such as a gearbox, generator or a damaged blade needing repaired or replaced.
"In addition wind farms are now recognised as mostly having a negative effect on local resilience other than financially benefiting a very small group of people." ... "The main benefit local inhabitants get is merely the very dubious feel good privilege of looking at the wind turbines with no enhancement whatsoever of local resilience."

Beverly Gingerich
101 Rumsey Hill RD
Newfield, NY 14867

Links:
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[1] https://www.masterresource.org/windpower/wind-loser/
[2]
http://www.resilience.org/stories/2010-11-25/how-sustainable-renewable-energy

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Friday, April 22, 2016 9:52 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: SEIS - Property Values

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: SEIS - Property Values
Date: 04/22/2016 9:16 pm
From: Beverly Gingerich <beverlyging@yahoo.com>
To: "townclerk@townofenfield.org" <townclerk@townofenfield.org>

To: Enfield Town Board
Date: April 22, 2016
Re: SEIS - Property Values

With our property at 101 Rumsey Hill RD being within 1 mile of 6 of the proposed wind turbine sites, it is very likely that its value will depreciate. BOWF is totally dismissive of that possibility, but evidence worldwide would show otherwise.

http://betterplan.squarespace.com/todays-special/tag/wind-turbine-shadow-flicker
[1]

http://www.windturbinesyndrome.com/2014/wind-turbines-definitely-lower-local-property-values-the-only-question-is-how-much/?var=wts
[2]

http://www.windturbinesyndrome.com/2012/wind-industry-big-lies-no-2-your-property-values-will-not-be-affected/?var=wts
[2]

http://www.windturbinesyndrome.com/2012/wind-turbines-blow-down-property-value-says-expert/?var=wts
[2]

http://www.windturbinesyndrome.com/2011/there-is-a-measurable-and-significant-loss-of-property-values-within-2-to-3-miles/?var=wts

If we ever move, what does BOWF propose as mitigation if we cannot sell our home at its assessed value? There is no mitigation currently proposed in the SEIS.

Beverly Gingerich
101 Rumsey Hill RD
Newfield, NY 14867

Links:
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[1]
http://betterplan.squarespace.com/todays-special/tag/wind-turbine-shadow-flicker
[2]
http://www.windturbinesyndrome.com/2014/wind-turbines-definitely-lower-local-property-values-the-only-question-is-how-much/?var=wts

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Friday, April 22, 2016 9:51 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: SEIS - Raptors

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: SEIS - Raptors
Date: 04/22/2016 9:08 pm
From: Beverly Gingerich <beverlyging@yahoo.com>
To: "townclerk@townofenfield.org" <townclerk@townofenfield.org>

To: Enfield Town Board
Date: April 22, 2016
Re: SEIS - Raptors

According to the SEIS, 'no increased adverse impacts are expected' in regards to bald eagles. While bald eagle mortality may not be 'expected', it is certainly possible. Is BOWF or Onyx Black Oak Wind prepared to pay the $200,000 fine should a bald eagle be injured or killed by a wind turbine blade?

2.4.2.2

Fish and Wildlife Resources
As mentioned in the FEIS, the U.S. Fish and Wildlife Service documented the occurrence of a bald eagle next on Cayuta Lake (3+ miles from the Modified Project Site. Because the proposed changes all result in slight shifts away from this nest, no increased adverse impacts are expected.
Potential construction 18 and operation - related impacts to other wildlife resources for the Approved Project are described in Section
3.4.2 of the DEIS and Section 6.5.1 of the Findings Statement. Because the Modified Project Site is located in the same general area and impacts similar habitats as the Approved Project, these findings remain applicable to the Modified Project.

(www.fws.gov)

" The Bald and Golden Eagle Protection Act [1] (16 U.S.C. 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking"
bald eagles, including their parts, nests, or eggs. The Act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle

... [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."
"Disturb" means: “to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."
In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death or nest abandonment.

A violation of the Act can result in a fine of $100,000 ($200,000 for organizations), imprisonment for one year, or both, for a first offense.
Penalties increase substantially for additional offenses, and a second violation of this Act is a felony.”

Beverly Gingerich
101 Rumsey Hill RD
Newfield, NY 14867

Links:
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[1] http://www.fws.gov/laws/lawsdigest/BALDEGL.HTML

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Friday, April 22, 2016 9:51 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: SEIS - Shadow Flicker

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: SEIS - Shadow Flicker
Date: 04/22/2016 9:14 pm
From: Beverly Gingerich <beverlyging@yahoo.com>
To: "townclerk@townofenfield.org" <townclerk@townofenfield.org>

To: Enfield Town Board
Date: April 22, 2016
Re: SEIS - Shadow Flicker

http://www.blackoakwindny.com/wp-content/uploads/DSEIS_Fig-9_GE-2.0-2.4-Turbine-Shadow-Flicker-Calculations-Including-Turbine-Location-7A-7C.pdf
[1]

It is noted that residences along Buck Hill RD, Chapman RD, County Road 6, and the west end of Weatherby RD, are labeled on the Shadow Flicker maps, while closer residences on Rumsey Hill RD and Connecticut Hill RD, after it curves toward the southeast heading to Trumbulls Corners RD, are not. Why is that? Specifically, why were no houses on Rumsey Hill RD included on the Shadow Flicker maps?

Beverly Gingerich
101 Rumsey Hill RD
Newfield, NY 14867

Links:
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[1] http://www.blackoakwindny.com/wp-content/uploads/DSEIS_Fig-9_GE-2.0-2.4-Turbine-Shadow-Flicker-Calculations-Including-Turbine-Location-7A-7C.pdf

Palermo, Jean

From:	townclerk@townofenfield.org
Sent:	Friday, April 22, 2016 9:54 PM
To:	Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject:	Fwd: SEIS - Turbine Technical Information

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: SEIS - Turbine Technical Information
Date: 04/22/2016 9:42 pm
From: Beverly Gingerich <beverlyging@yahoo.com>
To: "townclerk@townofenfield.org" <townclerk@townofenfield.org>

To: Enfield Town Board
Date: April 22, 2016
Re: Turbine Technical Information

The FEIS (Nov. 2014) includes information about the GE 1.7-100 model wind turbine.

APPENDIX A. TURBINE TECHNICAL INFORMATION: WEIGHTS AND DIMENSIONS [1], CODES AND STANDARDS [2], TECHNICAL DESCRIPTION & DATA [3]

The SEIS does not appear to contain any technical information about the currently proposed turbine model GE 2.3-107.

From the Final Findings Statement (Jan. 2015) page 34: "In addition, the turbines have substantially less hydraulic fluid than most other turbines today."

This statement is very vague. How much hydraulic fluid do other turbines have? How much do the GE 2.3-107 models have?

Beverly Gingerich
101 Rumsey Hill RD
Newfield, NY 14867

Links:
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[1]
http://www.blackoakwindny.com/wp-content/uploads/01.2-1.x-100-Weights-and-Dimensions-r3.pdf

[2]
http://www.blackoakwindny.com/wp-content/uploads/01.3-Codes-and-Standards-r0.pdf
[3]
http://www.blackoakwindny.com/wp-content/uploads/Technical-Description-Data.pdf

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Friday, April 22, 2016 5:32 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: Comments on BOWF to the Town Board of Enfield, New York
Attachments: FinalWindFarmcomments.pdf

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: Comments on BOWF to the Town Board of Enfield, New York
Date: 04/22/2016 4:08 pm
From: Eric Gasteiger <elg3email@gmail.com>
To: townclerk@townofenfield.org

Town Clerk Alice Linton,

Please find attached a copy of my comments in consideration of the Black Oak Wind Farm and the supplemental Environmental Impact Statement.

Please contact me if this attachment file does not transmit in a readable format. I will make every effort to submit these comments so the board can add my concerns to the comments that are being submitted.

Thank you,

Eric L. Gasteiger
Videographer/Producer/Director
Dark Amber Woods
37 Connecticut Hill Rd
Newfield, NY 14867

elg3email@gmail.com

From the desk of :
Eric L. Gasteiger
37 Connecticut Hill Road
Newfield, NY 14867

April 22, 2016

To: The Town Boards of Enfield and Newfield, New York;

The proposed permit to grant Black Oak Wind Farm the right to begin construction of the wind farm is troubling. What concerns me about this project is two fold:

First: the lack of communication concerning this project including, the silent yet aggressive, even predatory manner which Black Oak Wind Farm llc has come to display or been reported at public meetings. I would also charge that those involved from the town boards have done a disservice to the residents of their townships, Enfield, and Newfield. While there have been open meetings and comment periods, a project of this size, affecting the residence within the blueprint of such a project, should have involved mass mailings and/or a door to door informational communication. Whether true or not the rumor mill is alive with a "confidentiality agreement" preventing potential leasees from speaking to neighbors and residences about the project. Controlling speech is often reported about the behaviour of Wind Farm developers which take advantage of the leasees who only look at the money offered for the use of their property.

The first information I received on the Black Oak project was via word of mouth back in 2007 about a wind survey that John Rancich was going to be undertaking on land that is located on the southwest corner of Cayutaville and Black Oak roads. Furthermore, I was lead to believe that the total Wind Farm project was to be located upon that agricultural field Mr. Rancich was testing. It wasn't until the last public meeting of 12 -17-15, that I became aware that the proposal for the wind turbines has become a hot issue in the aforementioned towns and would be spread across Connecticut hill.

Imagine my surprise that the location of the proposed substation is adjoined to my property and one of the wind turbine placement will not only cast a "flicker shadow" onto my property but may subject my quality of life to undo noise and many other issues. I ascertained this information by doing an all encompassing web search on Wind Farms and the Black Oak Wind Farm proposed for Connecticut Hill. I reiterate that no one involved in the development of this project or the town boards have contacted me.

The second part of my concerns involve the claims from both parties of the FOR and AGAINST the Wind Farm. There are many claims and misrepresentation of evidence presented from both parties. However, I am finding that the AGAINST or opposition to the Wind Farm have a much larger number of valid points with sustaining evidence that needs to be compiled and studied. The FOR group appears to be influencing the town boards with a wonderful list of "Community Benefits" which reads as a list of a form of bribery. I now personally believe that a large portion of these benefits are hyperbole.

Presented here are summations of environmental and societal studies that I strongly believe will not only express my own recommendation, but aid the town boards to reach a decision that disallows further development or enacts a moratorium to stop development of the Black Oak Wind Farm until further scientific studies can be performed and considered.

Below I list issues that I believe have not been given far enough attention in the SEQRA and the DEIS.

1. Environmental Impact Statement **Appendix C. US Fish and Wildlife Report.**

"This report is for informational purposes only and should not be used for planning or analyzing project level impacts." One would find that Appendix C. gives a basic overview of the wildlife that could be impacted by the Black Oak Wind Farm.

a} **Northern Long-eared Bat** (Myotis septentrionalis) is listed as threatened. One major factor in the decline of the Northern Long-eared Bat is "White-nose syndrome . . . currently the predominant threat to this bat, especially throughout the Northeast where the species has declined by up to 99 percent from pre-white-nose syndrome levels at many hibernation sites."[1] It is interesting to note that the U.S. Fish and Wildlife Service does not consider Wind Farms a threat. **"For the northern long-eared bat, we do not anticipate that the fatalities that will be caused by wind energy *would meaningfully change the species' status in the foreseeable future.***

If the population of the Northern Long-eared bat has had a decline of 99%, any logical assumption would think any further fatalities would have a meaningful change in the species' status. In addition "the foreseeable future" gives no real time table. Will the population of smaller roost for the Northern Long-eared bat reduce to critical levels in 1 year, 2 years, 5years?

In addition, the wind industry has recently published best management practices establishing voluntary operating protocols, which *they expect* "to reduce impacts to bats from operating wind turbines by as much as 30 percent" (AWEA 2015, unpaginated). Given the large numbers of other bat species impacted by wind energy (Hein et al. 2013, p. 12) and the economic importance of bats in controlling agricultural or forest pest species (Boyles et al. 2011, pp. 41–42; Maine and Boyles, 2015, p. 12442), *we anticipate that these new standards will be adopted by the wind-energy sector* and ultimately required by wind-energy-siting regulators at State and local levels. *We recommend that wind facilities adopt these operating protocols.*"[2]
The US Fish and Wildlife Service has no authority to enforce "best management" practices. Their own wording above states they *anticipate* the new standards will be adopted, and *they recommend* that wind facilities adopt these operating protocols.

b}**American Bald Eagle** (Haliaeetus leucocephalus.) This is a bird of conservation concern and has the highest priority for conservation. The US Fish and Wildlife Service makes it clear that the law **"prohibits**

[1] https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A0JE
[2] https://www.gpo.gov/fdsys/pkg/FR-2016-01-14/pdf/2016-00617.pdf

anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The Act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle ... [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." "A violation of the Act can result in a fine of $100,000 ($200,000 for organizations), imprisonment for one year, or both, for a first offense. Penalties increase substantially for additional offenses, and a second violation of this Act is a felony."[3]

U.S. Fish and Wildlife list "the following species of migratory birds could potentially be affected by activities in this location:

C} **American Bittern** (Botaurus lentiginosus)
Black-billed Cuckoo (Coccyzus erythropthalmus)
Blue-winged Warbler (Vermivora pinus)
Canada Warbler (Wilsonia canadensis)
Golden-winged Warbler (Vermivora chrysoptera)
Least Bittern (Ixobrychus exilis)
Louisiana Waterthrush (Parkesia motacilla)
Olive-sided Flycatcher (Contopus cooperi)
Peregrine Falcon (Falco peregrinus)
Pied-billed Grebe (Podilymbus podiceps)
Prairie Warbler (Dendroica discolor)
Prothonotary Warbler (Protonotaria citrea)
Red-headed Woodpecker (Melanerpes erythrocephalus)
Short-eared Owl (Asio flammeus)
Willow Flycatcher (Empidonax traillii)
Wood Thrush (Hylocichla mustelina)."[4]

It should be noted that all the above species, including the Bald Eagle, are "of conservation concern."[5] As the Finger Lakes are a major migratory flight path, all birds are covered by the Migratory Bird Treaty Act between Canada, The U.S. and Mexico. **"In accordance with the Migratory Bird Treaty Reform Act of 2004 (MBTRA) (Pub. L. No. 108-447, 118 Stat. 2809, 3071-72), we included all species native to the United States or its territories, which are those that occur as a result of natural biological or ecological processes (See 70 FR 12710, March 15, 2005)." "The Migratory Bird Treaty Act makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations."[5]**

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3 http://www.fws.gov/birds/policies-and-regulations/laws-legislations/bald-and-golden-eagle-protection-act.php
4 http://www.blackoakwindny.com/wp-content/uploads/DSEIS-Appendix-C_USFWS-Information-Planning-and-Conservation-System-Report.pdf
5 http://www.fws.gov/birds/policies-and-regulations/laws-legislations/migratory-bird-treaty-act.php

"According to a study in the *Wildlife Society* Bulletin, every year 573,000 birds (including 83,000 raptors) and 888,000 bats are killed by wind turbines — 30 percent higher than the federal government estimated in 2009, due mainly to increasing wind power capacity across the nation. This is likely an underestimate because these estimates were based on 51,630 megawatts of installed wind capacity in the United States in 2012 and wind capacity has grown since then to 65,879 megawatts.

Besides BP being fined $100 million for killing and harming migratory birds during the 2010 Gulf oil spill, in 2009, Exxon Mobil paid $600,000 for killing 85 birds in five states and PacifiCorp, which operates coal plants, paid more than $10.5 million for electrocuting 232 eagles that landed on power lines at its substations. The first wind farms to be fined took place in November 2013 when Duke Energy paid a $1 million fine for killing 14 eagles and 149 other birds at two wind farms in Wyoming from 2009 to 2013 . . . . The fines are related to protections in the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act."[6]

Just these finding alone make me shutter. But the sampling size of bird and bat kills as alluded to above have largely been under reported: **"Recent mortality studies like those conducted at the Wolfe Island wind project (2.3 MW turbines) and Criterion project in Maryland (2.5 MW turbines) should have used searches 655 feet (200 meters) from turbines, just to find the bulk (75-85%) of the fatalities. Of course, they did not do so. Instead, they restricted their searches to 165 feet – ensuring that they missed most raptor carcasses, and could issue statements claiming that their turbines were having minimal or "acceptable" effects on bird populations."[7]**

None of these wildlife studies and reports make me want to support the Black Oak Wind Farm.

My quality of life and that of my neighbors are paramount to me. My family has owned and managed 89 acres of woodlot on Connecticut Hill for close to 50 some years. This property is divided by the town lines of Newfield and Enfield. Simple research has shown that although the jury is still out, the quality of life can be negatively affected by Wind turbines.

2. Quality of life - Infrasound

Many issues have been spoken about or posted to the web concerning the impact of wind turbines. These are often tagged as controversial with little scientific evidence to back up the claims. In reality most finding from scientific research tends to be buried when published on the web and needs to be drilled down and cross referenced to be able to make an informed opinion as to the validity of these studies.

I found a large amount of studies that looked at issues such as, the impact on real estate values, noise and health concerns, ice-throw and recommended setbacks, the costs and effects on access roads and construction, fire hazards, stray voltage, and the list goes on.

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[6] http://instituteforenergyresearch.org/analysis/license-to-kill-wind-and-solar-decimate-birds-and-bats/
[7] https://www.masterresource.org/cuisinarts-of-the-air/wind-avian-mortality-ii/

My most personal concern is any effect on hearing due to noise. I have suffered from tinnitus for over 14 years, and take particular attention to studies that show exposure to sounds of any frequency may lead to further hearing damage. Tinnitus is one of the most damning affliction I have had to live with. It has had a huge impact on my quality of life. I suffer from depression and anxiety, and live off of prescription drugs.

A study published by Alec N. Salt, Ph.D, from Washington University School of Medicine St. Louis, titled "Wind Turbines can be Hazardous to Human Health" is a study that should not be excused when reviewing comments about the perception of sounds generated by wind turbines.

The range of human hearing is generally considered to be **40 Hz to 15 kHz**. 40 Hz is the lowest pitch or frequency most people can hear, while 15 kHz the highest pitch or frequency.

Dr. Salt's research has shown that large wind turbines generate very low frequency sounds below the edge of human hearing. These subsonic sounds or infrasounds, register below 20Hz and can not be heard by the human ear.

One might think that infrasounds are of no consequent to those that can't hear them. Other research has found this not to be so. A study from Cornell University found that Elephants communicate long distances by producing sound waves that are far below the lower threshold of human hearing. The researcher actually felt the infrasound waves that elephants produce by the vibration of her chest. To borrow a phrase: Elephants communicate in "The Twilight Zone" by use of infrasound.[8] Logically, if elephants can hear these infrasounds, and we can feel them, these infrasounds in fact may, as some studies support, cause damage to hearing structures within the human ear.

Measurements have shown the human ear is most sensitive to infrasound when other, audible sounds are at low levels or absent. "The findings show the farther away from the wind turbine the greater is the low frequency content due to a relatively larger atmospheric absorption of high frequencies. Considering the A-weighted sound level outdoors in relevant distances to neighbours, the lower frequencies constitute a substantial part of the noise."[9] "To clarify, maximum stimulation of the ear with infrasound will occur inside your home, because the audible sound of the turbines is blocked by the walls of the house."[10]

I think it best to pull the conclusions of the paper: **Low Frequency Noise, Infrasound and Wind Turbines** and the concerns of the World Health Organization to provide a perspective on infrasounds: **"Health effects due to low-frequency components in noise are estimated to be more severe than for community noises in general"**

[8] Katy Boynton Payne Bioacoustics Research Program Cornell University, Elephant Listening Project

[9] Møller, H., Pedersen C. Low Frequency Noise From Large Wind Turbines Published by: Section of Acoustics Department of Electronic Systems Aalborg University June 2010 es.aau.dk *Note: Translated from Danish: any errors or omissions are unintentional*

[10] http://oto2.wustl.edu/cochlea/wind.html

Dr. Salt provides a list of scientific conclusions in his paper based on his findings of "the best available science."

- Wind turbine noise is likely to be audible to receptors in the form of continuous low-level or intermittent swooshing, as well as low frequencies at approximately 50 Hertz.

- Exposure to audible low frequency noise can cause adverse health effects in humans.

- Humans must be protected from the adverse health effects of low frequency noise exposure.

- Wind turbine low frequency noise may induce annoyance, stress and sleep disturbance which may have other health consequences.

- International research and media reports document people exposed to wind turbines reporting adverse health effects. Reported symptoms include annoyance, stress, sleep disturbance, headaches, difficulty concentrating, irritability, fatigue, dizziness or vertigo, tinnitus and the sensation of aural pain or pressure.

- Wind turbines emit infrasound which may be audible or inaudible. There is scientific uncertainty regarding infrasound; however, it is plausible wind turbine infrasound could adversely affect human health.

- It is acknowledged infrasound can induce annoyance, stress and sleep disturbance by disturbing people inside their homes through structural vibrations.

- Based on current understanding of how low frequency sound is processed in the ear, and on reports indicating that wind turbine noise causes greater annoyance than other sounds of similar level and affects the quality of life in sensitive individuals, there is an urgent need for more research directly addressing the physiologic consequences of long-term, low level infrasound exposures on humans.

- Adverse health effects associated with low frequency noise and infrasound can be avoided with authoritative regulations that ensure protection is engineered into the design of wind turbine projects.

- Members of the wind energy industry oppose addressing wind turbine low frequency noise and infrasound. For example the Canadian Wind Energy Association has lobbied against the introduction of protective guidance designed to address wind turbine low frequency noise and infrasound. [11]

[11] http://www.windvigilance.com/about-adverse-health-effects/low-frequency-noise-infrasound-and-wind-turbines

Dr. Salt's published paper concludes with this statement: **"The wind industry has taken the position that if you cannot hear the infrasound, then it cannot affect you. As you can see above, we disagree strongly based on our understanding of how the ear works."**[12]

Other published research on turbine noise:
Bowdler, D. (2011). Why turbine noise annoys.
Proceedings of the Fourth International Meeting on Wind Turbine Noise.
Rome, Italy. April 12-14.

Broner, N. (2008). Effects of infrasound, low-frequency noise, and ultrasound on people.
In: Handbook of noise and vibration control
(Ed. MJ. Crocker), John Wiley & Sons, Inc. (Hoboken, NJ).

Jakobsen, J. (2005). Infrasound emission from wind turbines, J. Low Freq. 798 Noise
Vib. Active Control 24, 145–155.

Møller H, Pedersen CS. (2011). Low-frequency noise from large wind turbines.
J Acoust Soc Am. 129:3727-44.

Nissenbaum MA, Aramini JJ, Hanning CD. (2012). Effects of industrial wind turbine noise on sleep and health. Noise Health. Sep-Oct;14(60):237-43.

These citations are meant to show the research that has been ongoing with regards to the noise produced by wind farms on local populations. Assurances from turbine manufactures do little to placate myself and many others. As far as I can determine the turbine industry realises engineering readings of sound decibel levels not results from scientific study. For me this is conclusive evidence that I should not be exposed for long periods of time to the low and infrasounds generated by wind turbines. Unfortunately my home not only falls within the Shadow Flicker zone, but it is also directly in the path of the predominant wind pattern that blows across Connecticut Hill. Almost daily I am more than accustomed to walking my property to seek the solace from the noises of the city and local neighbors. I can only wonder how much longer my mental ability to combat tinnitus will afford me any quality of life if these turbines go in.

According to the site map published on the web site: http://www.blackoakwindny.com the wind turbine will be much closer to my home as was dicussed years ago. It also appears the placement of the substation will be even closer than the turbine, I've heard no discussion what, if any, impact the substation may have on the neighborhood. What I have found is concern of voltage leak from the buried electrical cable that will feed the substation.

3. Quality of Life - Stray Voltage, Flicker, Ice Throw, and so on.

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[12] http://oto2.wustl.edu/cochlea/wind.html

The Canadian Wind Energy Association has released a fact paper on the cause of stray voltage. By definition stray voltage is: a low level electrical current or shock (typically under 10 volts) that results primarily from an improperly grounded or, in some cases an ungrounded,
electrical distribution system. Stray voltage is unwanted electricity that in some cases can pose a safety risk to animals – and to lesser degree, humans – that come in contact with it.

Stray voltage is a potential symptom in any system of electrical distribution, regardless of source and is especially prevalent on working farms. Wind turbines are often located in agricultural areas, connecting to the provincial electricity grid with farm operators leasing the land on
which the turbines sit. Through improved regulation and electrical code enforcement, incidences of stray voltage will be increasingly detected and eliminated tom in any system of electrical distribution, regardless of source and is especially prevalent on working farms. Wind turbines are often located in agricultural areas, connecting to the provincial electricity grid with farm operators leasing the land on which the turbines sit. Through improved regulation and electrical code enforcement, incidences of stray voltage will be increasingly detected and eliminated. [13]

I concur with this Canadian fact sheet. Stray voltage as all electrical problems can be traced back to poor grounding. But there are 2 things that trouble me. The first is a repeat of what I called attention to with regards to the Fish and Wildlife Services, even in Canada the institutions talk about the ideal. This fact sheet concludes with, "Through improved regulation and electrical code enforcement. . ." Protection from Stray Voltage is dependent on a regulatory institution to enforce proper codes by inspection and enforcement. As the buried electrical lines to the substation ages they will become more susceptible to water damage (it crosses through a wetland) and the possibility of stray voltage increases.

My second concern is the number of News reports that purport to present factual stories of people that have had their lives ruined by wind farms, and the myriad of concerns on wind farm safety.
Here are but a few articles that bring to focus concerns from around the world and the lawsuits that have resulted from placing wind farms in close proximity to people.

A. Shocking-story-stray-voltage-victim-wins-4-million-against-utility.

". . . Perhaps this news will jolt operators into taking action: a California woman who was repeatedly shocked in her shower due to stray voltage from a nearby substation has won a $4 million lawsuit against Southern California Edison. Similarly, in New York, a couple has filed suit contending that a utility substation has turned their home into a "house of horrors", causing shocks when they turn on faucets or step outdoors.

. . . In Westchester, New York, Hal and Millie Mendelson say currents from a substation run by NYSEG, the local utility, is so severe that they are on the verge of abandoning their multi-million home. The utility insists there is no stray voltage. But the Mendelsons say the voltage began leaking several years after the

[13]http://canwea.ca/pdf/talkwind/StrayVoltageFactSheet.pdf

substation was built. They contend that they've been shocked in their shower, touching doorknobs and faucets."[14]

B. Accident Statistics From a study posted by the Caithness WindFarm Information Forum, 2016.

I find this Statistical study a very enlightening paper. Found in its body are many findings related to subjects concerning accidents and effects of turbines that have been presented to the town boards. Again the numbers of accidents that are recorded are found to be far underreported.

I myself have alluded to the silencing of lessees in the nondisclosure portion of the lease. This is also noted in this statistical study. "This is because the wind industry "guarantees confidentiality" of incidents reported. Please refer to **http://www.renewableuk.com/en/our-work/health-and-safety/incidents--alerts.cfm** . No other energy industry works with such secrecy regarding incidents. The wind industry should be no different, and the sooner RenewableUK makes its database available to the HSE and public, the better. The truth is out there, however RenewableUK don't like to admit it.

Some countries are finally accepting that industrial wind turbines can pose a significant public health and safety risk. In June 2014, the report of the Finnish Ministry of Health called for a minimum distance of 2 km from houses by concluding: "The actors of development of wind energy should understand that no economic or political objective must not prevail over the well being and health of individuals."

The Scottish government has proposed increasing the separation distance between wind farms and local communities from 2km to 2.5km (**http://www.bbc.co.uk/news/uk-scotland-scotland-politics-26579733**) though in reality the current 2km separation distance is often shamefully ignored during the planning process.[15]

C. German Doctors Spell Out Harm Caused by Wind Turbine Infrasound

Dr. med Johannes Mayer, Ear, Nose and Throat Specialist - ENT cited 120 scientific papers confirming the hazardous impacts of infrasound on human health in a video found on Youtube (in German)[16] "made a presentation on the serious hazards of infrasound (1 – 20 Hz) from wind turbines saying: 'It is unbelievable the flood of international scientific publications that has appeared over the last one and half years. . . Mayer blasts the lobby-backed claims (based on measurements taken by unsuitable instruments) that infrasound generated by wind turbines is harmless to humans and wildlife and presents a number of studies showing how the very opposite is true.

At 7:35 Mayer tells the audience that 5 years ago he also used to believe that infrasound was not a real factor for anyone a kilometer or further away from the source. But after having researched the new

[14] https://www.wind-watch.org/news/2013/04/17/a-shocking-story-stray-voltage-victim-wins-4-million-against-utility/
[15] http://www.caithnesswindfarms.co.uk/AccidentStatistics.htm
[16] https://www.youtube.com/watch?v=V5ZkfXbXmzo

literature on the topic he concluded that infrasound is a serious factor on the health of humans even at far greater distances.

At the 8:20 mark Mayer explains how infrasound acts on the human inner ear and interacts with the brain, and the serious effects it can have on the human organs, citing a study from medical journal Lancet. "It's confirmed by numerous scientific papers," Mayer tells the audience." Dr. Mayer goes on to call into question the current industrial setbacks by citing "Medical expert Dr. Reinhard Bartsch of the Friedrich Schiller University in Jena (20:35):

> 'From today's level of knowledge wind turbines should be placed only far away from residential areas, and better: they should not even be in sight.'[17]

D. Sucking wind in the fight for renewable energy

Robert Bryce this just past March 28, 2016 wrote for the New York Post about the battles in Upstate New York concerning the push by Gov. Andrew Cuomo and the Wind Farm developers with the townships that they would like to develop. "In January, the Town Board of Yates voted unanimously to oppose the project. Yates Supervisor James J. Simon told me the fight is "about trying to preserve our rural agricultural landscape." Simon, an associate dean at Genesee Community College, wasn't active in politics until he saw how the push for renewable energy was going to affect Yates. He said that the attitude of the pro-wind forces has been "you all are small potatoes, and we are going to cram this down your throat." . . . "Rural and suburban residents in the United States, Canada and Europe are opposing wind energy for multiple reasons: visual blight, loss of property value, potential impacts on local tourism and concerns about the low-frequency noise and infrasound generated by bird- and bat-chopping turbines."[18]

E. International Review of Policies and Recommendations for Wind Turbine Setbacks from Residences: Setbacks, Noise, Shadow Flicker, and Other Concerns

October 2011, Kathryn M. B. Haugen from the Minnesota Department of Commerce: Energy Facility Permitting office did a did a fairly inclusive survey of policies and recommendations from wind energy producing countries around the world. I think it is easy to say the United States lags behind many wind energy producing countries. Kathryn Haugen's finding suggest that small towns, counties, and state agencies need to base their regulations on foreign standards. Here are a few policies and recommendations culled from her findings:

Setbacks -

[17]https://stopthesethings.com/2016/03/23/german-doctors-spell-out-the-serious-harm-caused-by-wind-turbine-infrasound/

[18] http://nypost.com/2016/03/28/sucking-wind-in-the-fight-for-renewable-energy/

- Many German state governments recommend a 1000-meter (3,281-foot) wind turbine setback from residences, but minimum setbacks may be as small as 300 meters (984 feet).
- Saarland - goes by the German standards limiting noise emissions to determine how far wind turbines should be from residences. Based on these noise limits, turbines are usually placed a minimum of 550 and 850 meters (1,894-2,789 feet) from homes, depending on their size.
- Lower Saxony - The state usually recommends a 1,000-meter (3,281-foot) wind turbine setback distance from residences.
- Thuringia - The Thuringian Ministry of Construction, Land Development and Traffic has recommended that wind turbines be located at least 1,000 meters (3,281 feet).

Spain -

- Regional governments are responsible for determining wind turbine setback distances as well, but it is recommended that wind turbines are setback 500 meters (1,640 feet) from residences and towns.

France -

- wind turbines are required to be located at least 500 meters (1,640 feet) from all residential areas.

There are many other countries listed in Kathryn Haugen's survey most have similar setback requirements. If there is no setback requirement enacted the determination of setback distances are based on sound levels and established sound limits.

For example:

Sweden does have guidelines for noise limits, which identify a 40 dB(A) *sound limit near homes and are used to determine wind turbine setback distances.* In some cases where the environment has low background noise, the sound limit may be lowered to 35 dB(A). A five dB(A) penalty may be invoked if the wind turbines emit specific tones.

F. Impact of Wind farms on Property value -

Prorty value and the impact of Windfarms was voiced more than a few times at the public comment sessions. The Black Oak Wind Farm dismissed the residence concerns of lost value. However various governments have taken this very seriously. From Haugen's survey:

Denmark has the highest wind energy capacity per capita, per land area, and per GDP in the world . . . . People living within six times the total height of the wind turbine may request to have their property assessed for loss of value due to proximity of the wind turbines. If the value of their property is determined to have decreased by a minimum of 1%, they may be reimbursed for their loss. The value of the property is assessed by experts in property value, and *if they determine a significant decrease in the property value the wind facility developer is required to pay the difference.*[19]

Jude Clemente in Forbes Magazine tackles the issue of loss to property values in the Sep 23, 2015 online magazine.

"It surely seems logical enough, anything that would cause a potential buyer to value a property less lowers its value . . . . Markets are about supply and demand, and all things being equal, why would somebody choose to buy a home with an industrial wind farm nearby? And simply put, it seems impossible to believe that wind turbines would actually add to a property's value.

But, there's a heavily funded public relations machine to make Americans think that wind power doesn't impact property values, and it's every bit as influential as the "Big Oil" the anti-fossil fuel movement purports to be so against . . . .

Many members of the Real Estate and Appraisal businesses, however, have been clear that wind power DOES impact property values, and it would seem to me that these groups have no vested interest in supporting wind power or not supporting it.

- Michael McCann, of McCann Appraisal, LLC based in Chicago, concludes that: "Residential property values are adversely and measurably impacted by close proximity of industrial-scale wind energy turbine projects to the residential properties," up to 2 miles and a range of 25% to approximately 40% of value loss.

- **According to research in 2014 by the London School of Economics**, wind farms can cut as much as 12% off the value of homes within a 2 kilometer radius, reducing property values as far as 14 kilometers away.[20]

Jude Clemente at the end of his Real Estate and Appraisal discussion shares a link to a list of over 58 documents that have shown how wind power reduce property values.[21] [22]

G. Summary and comments -

My intention has not been to cite every study, educated opinion, or cover every concern that come with wind farm projects. Instead I have attempted to give the town board a broad palate of research and findings that should help to understand the research and problematic communications that have lead to the negative emotions found in the townships to this proposed wind farm project.

There is no question that I am against the town board's voting to allow this project to go forward. Jude Clemente from Forbes has presented a very compelling article that can best sum up the tenor of the relationships between the wind industry and residents. I quote, ". . . wind power has less "green" credentials that many care to admit. And don't forget it's oil that fuels the trucks that move wind turbines tens or hundreds of miles to their remote locations.

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19 http://mn.gov/commerce/energyfacilities/documents/International_Review_of_Wind_Policies_and_Recommendations.pdf
20 http://www.forbes.com/sites/judeclemente/2015/09/23/do-wind-turbines-lower-property-values/#6c15ec427e36
21 http://www.lakeontarioturbines.com/PDF/REValues.pdf
22 http://www.forbes.com/sites/judeclemente/2015/09/23/do-wind-turbines-lower-property-values/#6c15ec427e36

And the pro-wind, anti-fossil fuel business appears completely oblivious to the fact that wind turbines are made from steel, which is mostly made from coal. There are about 170 tons of coal in an onshore wind turbine, and about 280 tons of coal in an offshore one.
Thus, a simple question illustrates the absurdity of the pro-wind, anti-fossil fuel position: does the coal miner that mines the coal…that makes the steel… that makes the wind turbine… have a "green job?"[23]

I realize that the open public comment sessions were structured around the SEQRA and many including myself may have ventured from addressing concerns with that document. I would like to point out a major assumption that Black Oak Wind Farm has made concerning the amount of electricity to be produced with this project. Page 2, section 3 reads " The purpose of the Project is to create a wind-powered electrical-generating facility that will provide a significant source of renewable energy to the New York State power grid." Furthermore the document states Page 2, section 3, "The Project will generate approximately 11.9 MW of electricity . . . This greatly exceeds the energy required to construct and operate the Project, and the output is enough to power approximately 6,000 homes in New York State (on an average annual basis)."

From my understanding of their 11.9 MW of electricity generation assumption for this wind farm represents the maximum amount of electricity this project would generate at full capacity 24 hours/day, 7 day/week. This is like a radio station selling advertising to an uninformed client that their commercial will reach the potential listening audience of 135,000 in the station's broadcast area. A listening audience is far smaller and can be broken down by the number of other local stations, television viewer that are not listening to the radio, those that don't listen, and stations from other markets that can be received in the area.

Claiming that this wind farm project will generate 11.9 MW of electricity seems disingenuous. These turbines will be affected by low wind speeds, high wind speeds, maintenance, possible restricted hours of operation, and other reasons an individual turbine is taken offline. It has been shown that Wind Farms are dependent, because of their shortfall in output to have this lack of generated electricity madeup by other power producers. These include coal and other non-green power plants.

On page 3 is the list of agencies that participated in the SEQRA review. With the exception of the U.S. Army Corps of Engineers I find no Federal Agencies were consulted. As Connecticut Hill is in the flight path of small and commercial aircraft, I believe the Federal Aviation Administration (FAA) should have a revised statement or waiver of concern and impact on record. I would also have liked to see the United States Environmental Protection Agency (EPA) review of the proposed sites though I realize that they will most likely defer to the State.

A few remarks about responses that were presented to the Enfield town board. The first comment is a response to the statement that the sound files were turned over for an independent sound engineer could evaluate the files. A paper that contains diagrams of a sound waveform at different frequencies is a waste of paper and a dismissal of anyone's expertise with sound evaluation experience. A sound file must be "played" into equipment so its frequency, attenuation, distortion, background noises, and the like can be evaluated over near field speakers. I know of no "paper file" converter to a sound file such as a .wav, .mpg3, .mpg4, and so forth. This request should have been taken seriously.

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[23] http://www.forbes.com/sites/judeclemente/2015/09/23/do-wind-turbines-lower-property-values/#6c15ec427c36

My second comment concerns the total misrepresentation on radon gas. Radon gas is not a product of burning natural, propane, coal, or other sources of heat in a house. Radon gas a is colorless, odorless, radioactive element that is a noble gas. It is produced by the radioactive decay of radium and occurs in minute amounts in soil, rocks, and the air near the ground. Radon gas is a cause of lung cancer and depending on which part of Tompkins County a home is located in, a radon gas test is required before a sale of the home. The test results must be disclosed in a real estate transaction.

I am disturbed to learn that without a building permit Black Oak Wind Farm has violated the trust and law of the Enfield township by starting construction on the site of turbine 4. Claiming that they needed to bull doze for a blasting survey when the core sample records were readily available shows the disregard for the process required for the granting of the building permit. If I am not mistaken there should be a fine levied for violation of the building code.

As the rumor mill is rampant with stories about mitigation, I'd like to question what are the plans and procedures to decommission the wind turbines if the Black Oak Wind Farm llc or the parties that follow go out of business. Will the cost of the removal of the turbines be passed on to the taxpayers? Is there any financial consideration to reimburse property owners that are negatively impacted by this wind farm, and if not, why not? I'd go as far that health care expenses due to health issues directly attributed to the wind farm be passed on to the developer if determined appropriate. Once again, is there a financial consideration that insures that these type of costs are not passed on to the taxpayer. I have read disturbing trends that wind farm developers can take out a mortgage on the lease, if the developer or future owner goes bankrupt the banks can foreclose on the lessee's property. There have been instances where neighbors have filed lawsuits against neighbors that signed leases, because of damages to the first party which the developer has dissolved or such, making the leasee responsible for allowing the development of the project on their land. These kind of situations makes me mistrust the transparence of this wind farm "revolution." It certainly doesn't help preserve good strong neighborhoods.

I urge the board to look out 15 years with open eyes to when the promised money for the school districts and towns run out. Is there a binding contract that follows the sale of the Black Oak Wind Farm llc to another party that provides for the continued payments to the schools and towns?

Finally I will end with the last few paragraphs from Jude Clemente' Forbes articles:

"Along with the requirement for fossil fuel backup generally from natural gas, wind is unavailable much more than it's available, wind power has less "green" credentials that many care to admit. And don't forget it's oil that fuels the trucks that move wind turbines tens or hundreds of miles to their remote locations.

And the pro-wind, anti-fossil fuel business appears completely oblivious to the fact that wind turbines are made from steel, which is mostly made from coal. There are about 170 tons of coal in an onshore wind turbine, and about 280 tons of coal in an offshore one.

Thus, a simple question illustrates the absurdity of the pro-wind, anti-fossil fuel position: does the coal miner that mines the coal…that makes the steel… that makes the wind turbine… have a "green job?" . . . .

And of course, the opportunity costs of renewables go ignored. An obsession with wind and solar power at all costs, for instance, **has Germany paying $26.2 billion for electricity that has a market value of just $5 billion**.

Such grand illusions must be stopped…immediately.

Thank you,

Eric L. Gasteiger

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Friday, April 22, 2016 5:34 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: pro wind farm

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: pro wind farm
Date: 04/22/2016 2:47 pm
From: Greg Mol <gregomol@gmail.com>
To: townclerk@townofenfield.org

Hello,

I would like to voice my support for the Black Oak Wind Farm project.
As a business owner and taxpayer in the town of Enfield, I think it's a worthwhile project that we should be supporting. It's the right thing for us to do as citizens. I support compensating the nearby residents in some form, but wind turbines have been proven to be safe at the appropriate distances from residences.

thank you,

Greg Mol
manager
Farmer Ground Flour, LLC
240 Aiken Rd.
607 327 0166

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Friday, April 22, 2016 5:49 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: Public comment for Draft Supplemental Environmental Impact Statement

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Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: Public comment for Draft Supplemental Environmental Impact Statement
Date: 04/22/2016 10:37 am
From: henry-hansteen@townofenfield.org
To: townclerk@townofenfield.org

Hi Alice,

Here is my public comment regarding the Black Oak Wind Farm.

There are a significant number of people who have suffered negative health issues as a result of living near industrial wind turbines. While the exact biological or scientific cause of these negative health issues may be difficult to identify, the fact remains that they do occur in a significant number of people living near industrial wind turbines.

I find the prospect of putting people in a situation where they are unable to live in the their homes due to the negative health issues caused by nearby turbines, and unable to move because of lost property values to be very unsettling. At this time, I would support a resolution or an amendment to our wind law that would require BOWF to reimburse people living within 3000 feet of a turbine the difference between the current appraised value of their homes and the maximum offer after a year on the market. Since BOWF's position is that the negative health affects are not a legitimate concern, and that there is no evidence that property values will drop, BOWF should be willing to accept this proposal.
Selling
one's home and relocating is still a heavy burden to bear, but it is better than being trapped in an unhealthy environment, unable to leave because of financial reasons.

Henry Hansteen
374 South Van Dorn Road
Enfield Councilperson.

Jerad Stevens

I am writing this letter to Enfield with my question about the efficiency of these wind turbines, since there is very little information in the SDEIS or any of the other parts of the original document, I went online to find something relating to my question, there are many out there but some seem more informative than others, the information I have attached is a large wind farm proposed off the coast of England, it is hard for me to understand some of it but it seems to me that this study proved that the wind farm project was in fact more harmful to the environment overall if it had been built when compared to any benefits it will have, if that large project was a loosing proposition, how can this small one be any different. In fact, most experts agree that offshore wind farms are always more efficient than land based farms, as a result of the studies that were done, that wind project at Navitus Bay was refused consent for construction by the department for energy and climate change. The biggest argument by people is that it is a necessary sacrifice to place the large Turbines for the future of our planet, but these studies claim the energy produced will not offset the carbon footprint of there construction in there lifetime, I would like to know if this is true? Can Black Oak create efficiency reports that prove they are going to help the environment if they are constructed? It seems only fair that if this community is going to be thrown under the bus for the sake of the planet, then we have a right to know how much our sacrifice will actually help the Environment.

Thank You

NAVITUSBAY

On 11 September 2015 the Department for Energy and Climate Change refused consent for the Navitus Bay wind park. After careful consideration, Navitus Bay has chosen not to challenge this decision.

We would like to thank the communities on the South Coast and all our stakeholders for their engagement throughout the project. We would also like to extend a thank you to the potential suppliers, who worked incredibly hard to inform our proposal.

Over the course of the project we have gathered data from a wide range of offshore surveys and studies. This wealth of information includes environmental material such as bird and mammal surveys, human activity evaluations including shipping, navigation and archaeological data, and physical environmental detail like geotechnical data and sediment sampling.

We recognise that this marine data is valuable and can provide a legacy by helping to stimulate research, support academia and contribute towards the sustainable management of the seabed. We will therefore be making this data available via The Crown Estate's Marine Data Exchange once transfer and quality assurance processes have been completed, at www.marinedataexchange.co.uk.

All pain, no gain

Environmental economics of the Navitus Bay wind farm

Christopher Monckton of Brenchley

ENVIRONMENTAL AND ECONOMICS CONSULTING

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+44 131 225 5551

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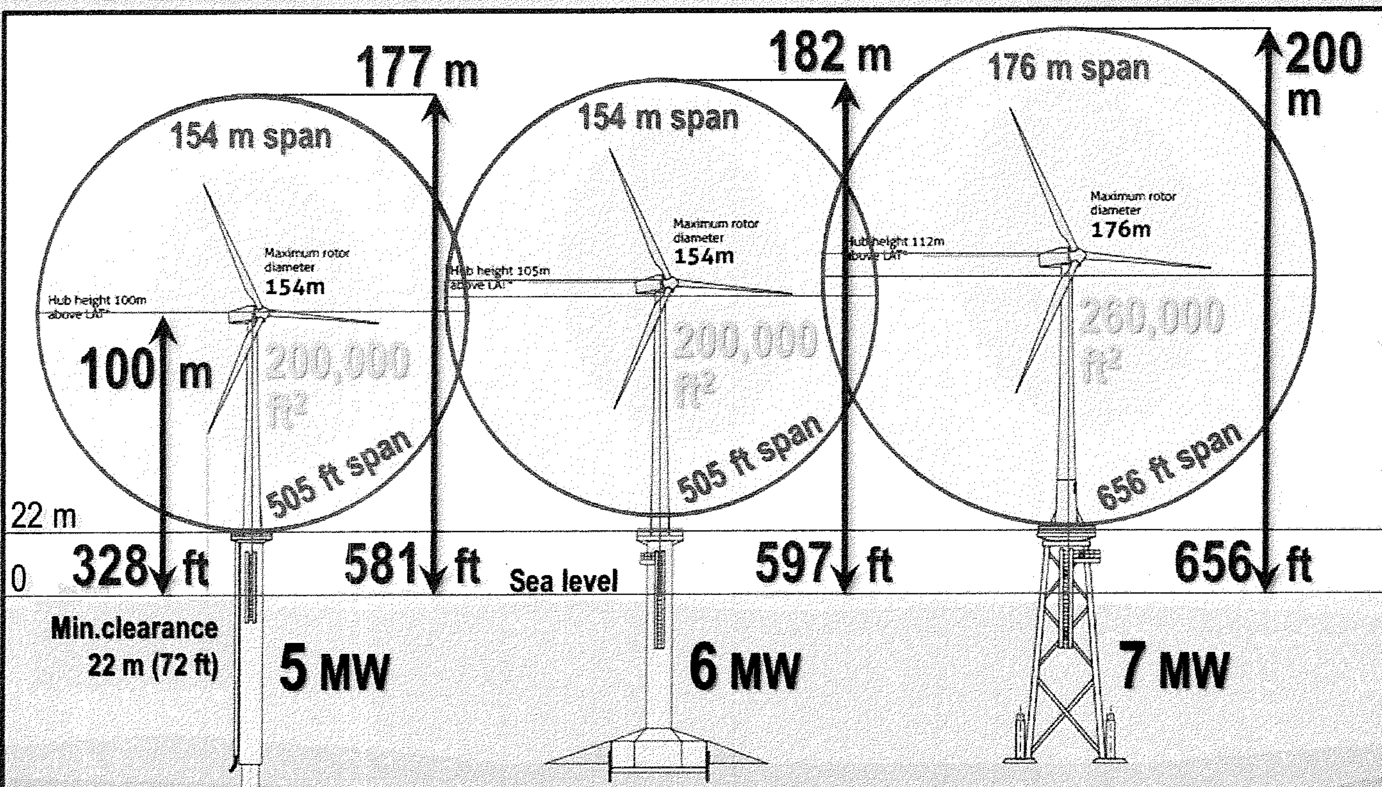


Navitus' website shows the turbine blades and grey swept areas at half their true sizes and areas. Here, corrected swept areas have been overlaid on Navitus' image in red.

2

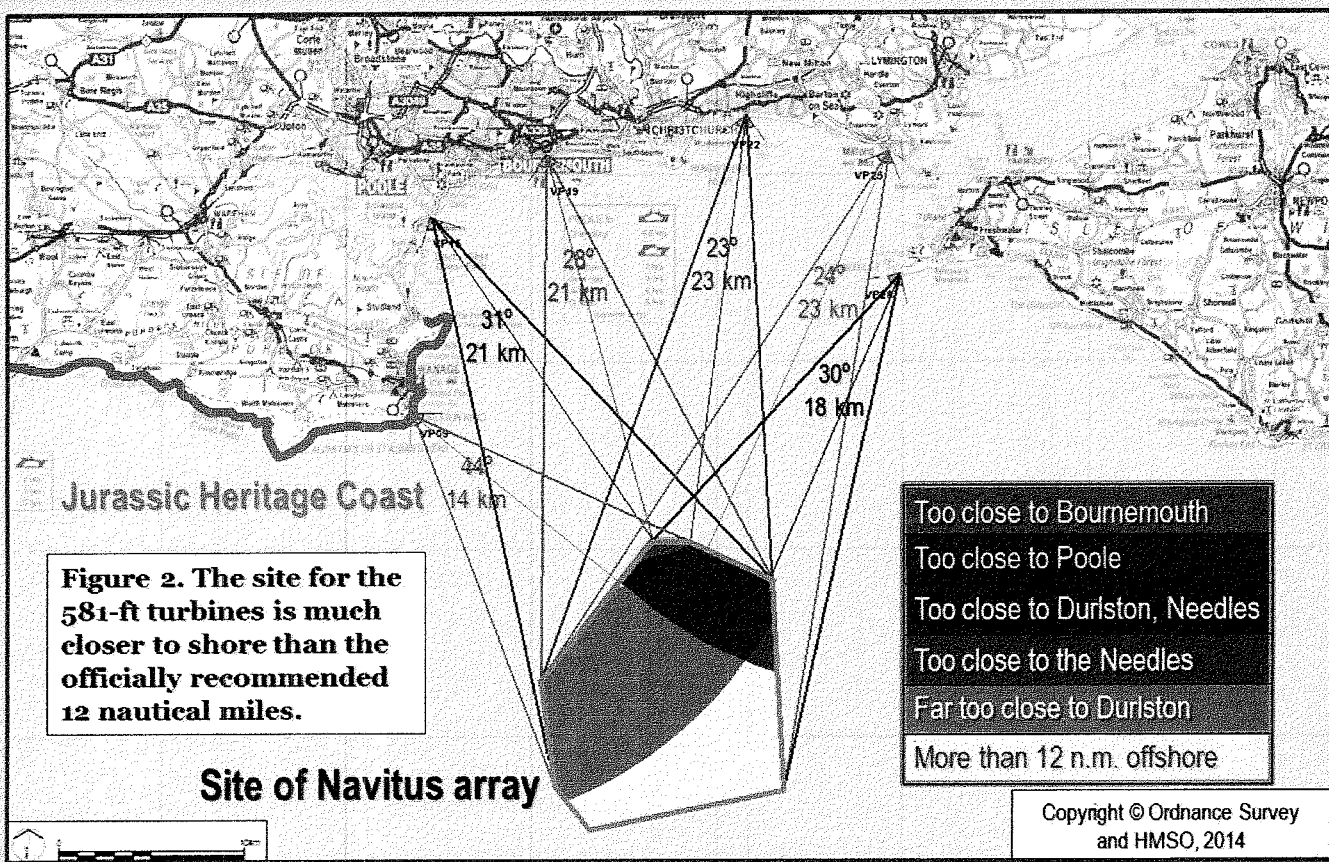


Figure 2. The site for the 581-ft turbines is much closer to shore than the officially recommended 12 nautical miles.

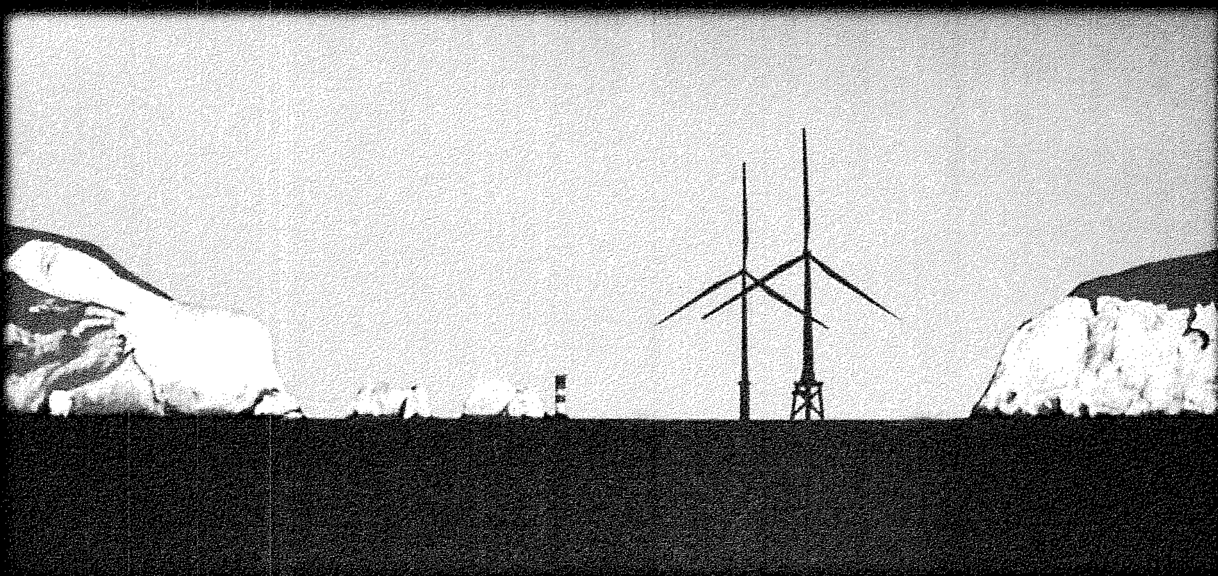


Figure 3. The sheer size of the proposed Navitus Bay Wind Array wind farm is disproportionate to and intrusive upon the fragile and important landscape of the area. The illustration, kindly supplied by the Poole and Christchurch Bays Association, shows the scale of a 5 MW and a 7 MW turbine set against the Needles Light, one of Britain's most-loved landmarks. The array of 194 turbines each 581 feet high and sweeping an area of 200,000 square feet will be within 11 miles of the Needles, an important feature of Britain's coastal heritage. The UK Government's minimum offshore distance for wind farms is 12 miles.

Environmental economics is the discipline that puts a price on the negative environmental externalities of a project such as Navitus Bay and compares that price with the potential benefits of the project.

Summary

All pain, no gain

The Intergovernmental Panel on Climate Change (IPCC, 2014), having halved its 1990 near-term projection of global warming, now estimates the cost of adaptation to unmitigated warming (the "do-nothing option") as 0.2-2.0% of global GDP (cf. 0.0-3.0% GDP in Stern (2006). Will mitigation today cost less than adaptation the day after tomorrow? Unfamiliarity with relevant climatology can compromise inter-generational benefit-cost appraisal. To assist non-specialists, essential mainstream climatological inputs are described, quantified and deployed here in a benefit-cost model that had first been applied illustratively to several case studies (Monckton of Brenchley, 2013).

HM Government's projection of the cost of its own climate mitigation program has the highest unit mitigation cost reviewed, at \$4 quadrillion per Kelvin mitigated. Mitigating all projected global warming in 2012 by measures of equivalent unit cost might have consumed three-quarters of global GDP. Proposed CO_2 capture and storage in the United States was found to have the least unit mitigation cost, at \$120 trillion K^{-1}, or 2% of 30 years' global GDP – which is about the same as the IPCC's estimated maximum cost of doing nothing now and adapting later. All other strategies tested, which act indirectly and mitigate little but cost much, were 1-2 orders of magnitude costlier than adaptation and are not justifiable solely on grounds of the welfare benefit from mitigation. Navitus Bay is no exception.

The unit mitigation cost of the Navitus Bay project over its first five years in operation is found to be \$1 quadrillion per Kelvin of global warming abated by mitigation strategies of unit mitigation cost identical to that of Navitus Bay.

The global aggregate mitigation cost – the cost of mitigating the 0.08 K projected global warming over the first five years of Navitus' life, is found to be \$80 trillion, or \$11,500 per head of global population, or 18% of GDP.

The cost of the do-nothing option – taking no action now to mitigate global warming – is approximately 1% GDP per Kelvin of global warming (assuming not more than 3-4 K warming this century). Accordingly, if the IPCC is right to expect 3 K global warming this century, the cost of adaptation to that warming is 3% of GDP, making mitigation strategies such as Navitus Bay – even on the generous assumptions adopted here – six times costlier than adaptation.

Assumning just 1 K global warming this century, mitigation the Navitus way is 18 times costlier than adaptation.

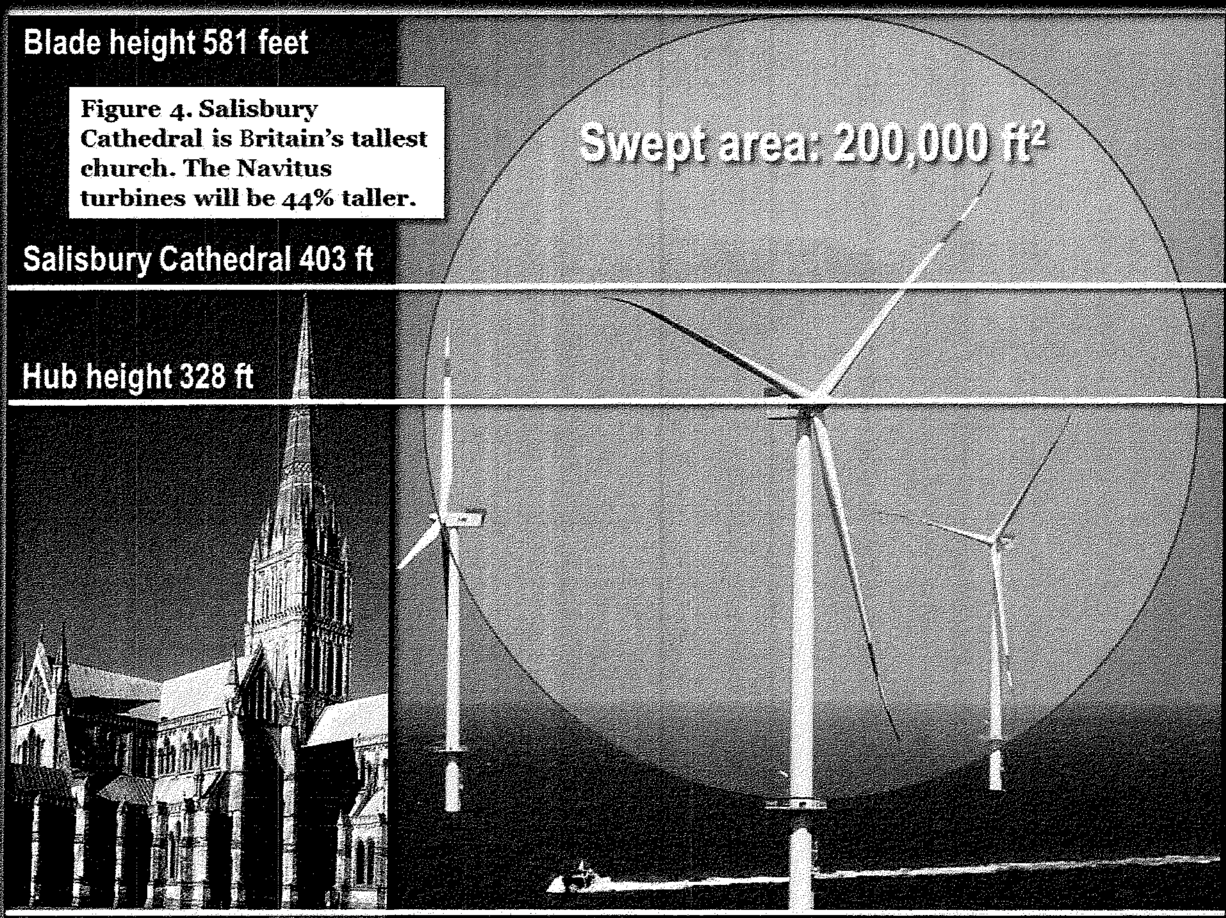
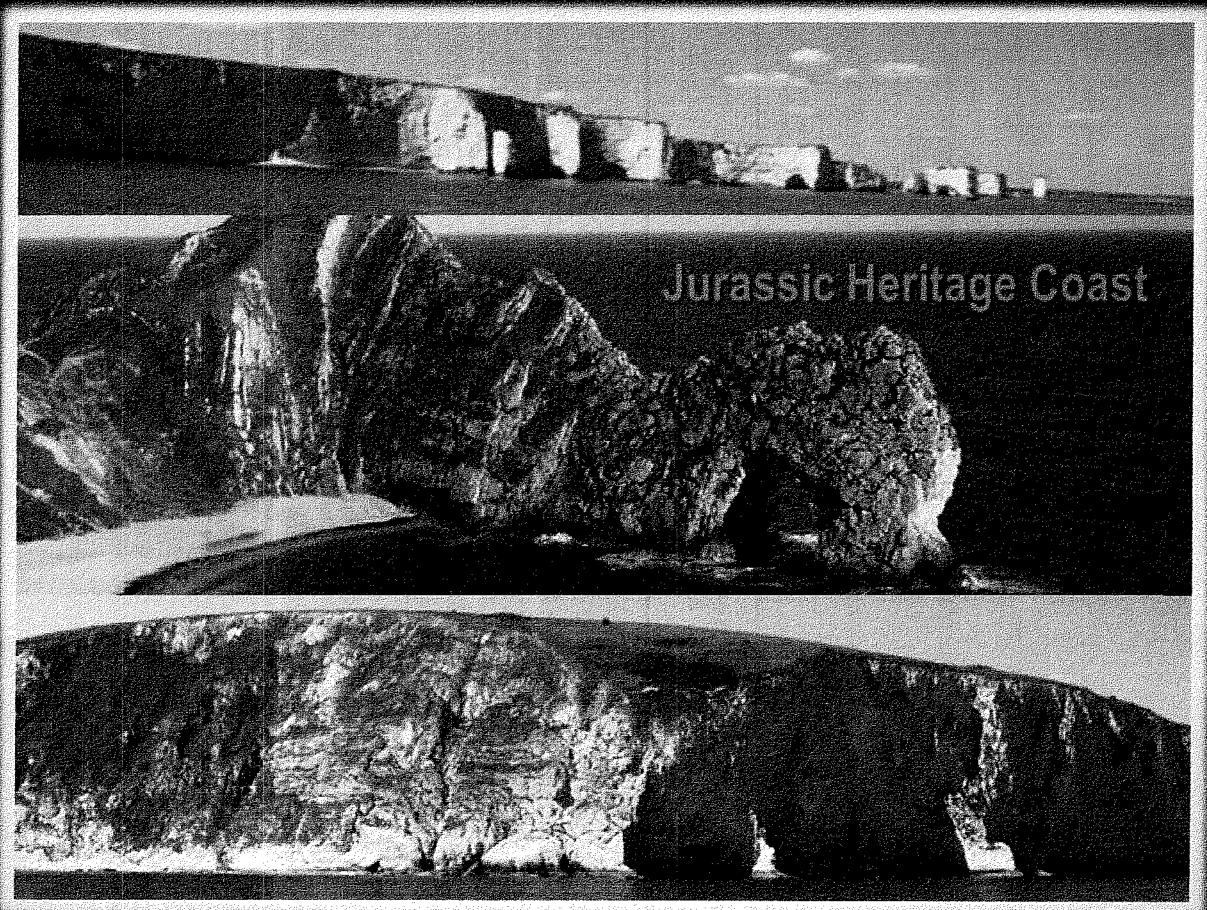


Figure 4. Salisbury Cathedral is Britain's tallest church. The Navitus turbines will be 44% taller.

The developers' proposals in outline

According to the developers' website, the Navitus Bay wind array will –

- "Be a multi-million-pound investment";
- Be an offshore wind array of 194 turbines each standing 581 feet high and delivering 5 MW;
- Deliver 970 MW at capacity;
- Deliver a mean 339.5 MW at an estimated mean capacity factor of 35%;
- Generate close to 3 GWh of electricity per year;
- Power 700,000 homes at mean annual domestic energy consumption of 4.2 MWh;
- Support 140 permanent jobs over the 25-year lifetime of the array;
- Add £1.62 billion to the region in economic value over 25 years [£65 m/year];
- Offset 1,290,000 tonnes of CO_2 a year, assuming fossil-fuel generation emits 430 g CO_2 per KWh;
- "Help the UK to meet its climate-change targets";
- "Contribute to security of energy supply";
- "Stabilize electricity prices in the future".



8

A first-order benefit-cost model applied to the Navitus Bay Wind Array

The three conditions precedent to the justification of any climate mitigation strategy, such as a renewable-energy programme, are that unmitigated CO2-driven global warming may eventually prove damaging; that the cost of mitigating projected warming will be sufficiently below the expected benefit in the avoided welfare loss in adapting to its consequences; and that the proposed strategy will be cost-competitive with other approaches. It is here assumed that the first condition is met, though allowance is made for the probability that it is not.

A first-order benefit-cost model adaptable to any proposed CO2 abatement strategy is described and applied to an environmental-economic analysis of the Navitus Bay project with the aim of determining quantitatively and rigorously the extent to which the project satisfies the second and third conditions and is thus justifiable in economic terms.

Uncertainties in climate-mitigation modeling

The climatic impact of Man has proven difficult to quantify reliably. Uncertainties as to temperature outturn, CO2 forcing, temperature feedbacks, climate sensitivity, clouds, aerosols, climate impacts, and the effect of mathematical chaos on the predictability of climate are addressed by modeling values across a generous interval for 21^{st}-century warming and thus for the cost of adaptation to unmitigated climate change. Feedback uncertainties are constrained by confining the analysis to a five-year period, over which feedbacks, if present, will operate only to a limited extent. For caution, the now-demonstrated uncertainty as to the extent of the scientific consensus on the magnitude of the anthropogenic contribution to global warming in recent decades (Legates *et al.*, 2013) is not taken into account.

The utility of stakeholder consent

Agreement among stakeholders is arguably maximized by adopting a precautionary approach through adopting as normative *ad argumentum* not only the mainstream climatological projections of the models relied upon by the IPCC but also the central economic projections of those economists (such as Stern, 2006) who argue for an avowedly interventionist stance on grounds of inter-generational equity.

Initial conditions: climatological

The climatological initial conditions in the benefit-cost model embody the minimum mainstream-science physical inputs necessary to determine how much warming a mitigation strategy may abate; the unit cost per C° of warming mitigated; and the cost of mitigating all projected warming over the strategy's life by worldwide measures of equivalent unit cost, allowing direct comparison between competing anthropogenic-warming mitigation strategies.

Climate sensitivity: Warming ΔT_t in response to rising CO_2 concentration over t years is described by (1), where ΔT_t is the product of three quantities: the reciprocal of the fraction q of total anthropogenic forcing that is driven by CO_2; a time-dependent climate-sensitivity parameter λ_t, which is itself the product of the instantaneous or Planck sensitivity parameter λ_0 and a time-dependent temperature-feedback gain factor G_t; and the CO_2 radiative forcing ΔF_t.

$$\Delta T_t = q^{-1}\lambda_t \Delta F_t = q^{-1}\lambda_0 G_t \Delta F_t \quad | \quad \text{K or C}^\circ. \tag{1}$$

Centennial-scale projected warming ΔT_{100} on business as usual, will be 3.7 C°, the mid-range projection in IPCC (2013, table SPM.2), based on 8.5 W m^{-2} CO_2 forcing in 2100 against 1750, of which 2.3 W m^{-2} has arisen to date.

Near-term projected warming ΔT_5: IPCC has reduced its business-as-usual projection of warming to 2035 from 0.35 [0.20, 0.50] K decade^{-1} in the 1990 *First Assessment Report* via 0.23 [0.13, 0.33] K decade^{-1} in the pre-final draft of the *Fifth Report* to 0.17 [0.10, 0.23] K decade^{-1} in the published version. The mid-range near-term projection is thus below half what it was in 1990. IPCC dates its current near-term temperature projection from 2005. Over the decade 2005-2014, the discrepancy between the warming trend projected by IPCC and the slight observed cooling is already appreciable (Fig. 5). The present appraisal will, however, assume that IPCC's projections are not exaggerated.

Though IPCC's near-term projection of global warming has been greatly reduced, its centennial projection remains unchanged. Its projected 3.7 K 21st-century warming on a business-as-usual CO_2 emissions scenario is now perhaps only realistic as an upper bound. Warming at rates of 0.5-4.5 K century^{-1} in increments of 0.5 K century^{-1} will be considered in the present model.

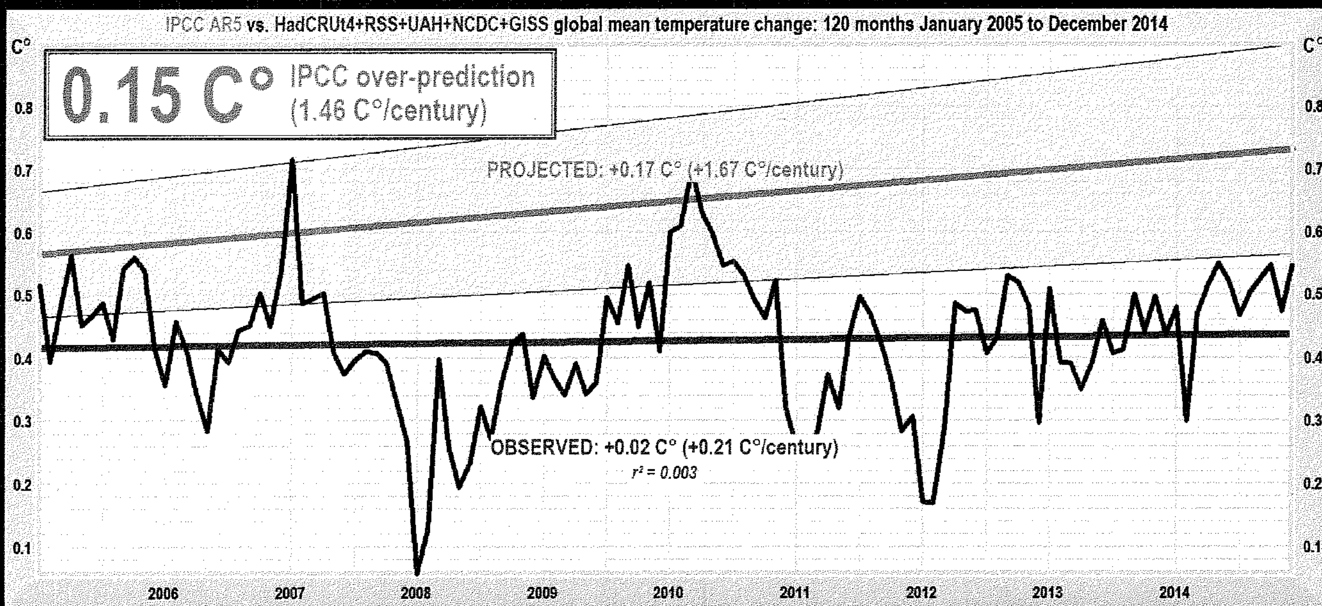


Figure 5. Monthly global mean surface temperature anomalies (dark blue) and trend (bright blue), January 2001 to December 2014, as the mean of the GISS, HadCRUT4 and NCDC surface temperature data taken with the RSS and UAH lower-troposphere dataIPCC's projection from its 2013 *Fifth Assessment Report,* which it backcast to 2005, already shows an overstatement of the warming trend by 0.15 C°, equivalent to 1.5 C° over a century.

Global warming outturn: Until 1950, the anthropogenic influence was negligible. There have been three periods of global warming since 1659 (Fig. 6): the recovery from 1694-1733 following the very cold period known as the Maunder Minimum, and two periods of warming in the 20th century – from 1925-1946 and from 1977-2000 – that coincided with the positive or warming phases of the naturally-occurring weather cycle known as the Pacific Decadal Oscillation.

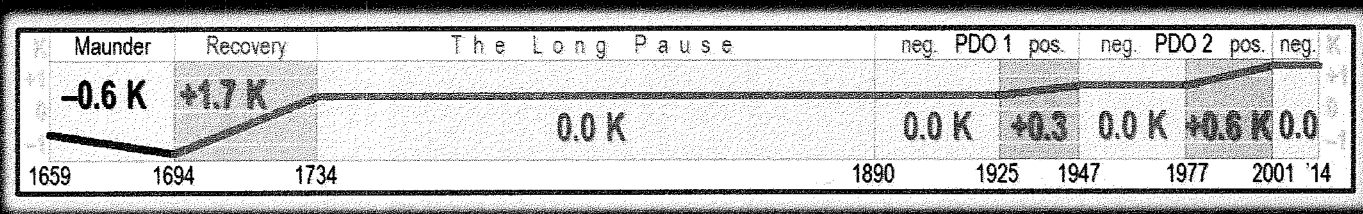


Figure 6: Only the last of three warming periods since 1659 was after 1950, since when there has been just 0.6 C° warming. The trend from January 1950 to February 2014 was 0.76 C°, equivalent to 1.2 C°/century. Yet the warming can also be seen as a difference of just 0.6 C°, equivalent to 0.9 C°/century, between two periods of constant temperature. Since January 2001 there has been virtually no global warming for 14 years, on the mean of the five temperature datasets.

CO_2 concentration: Business-as-usual CO_2 concentration will rise from 412 ppmv in 2020 to 423 ppmv in 2025.

CO_2 forcing: According to IPCC, a radiative forcing is an external perturbation in a presumed pre-existing climatic radiative equilibrium, leading to a transient radiative imbalance that will eventually settle toward a new equilibrium at a different global temperature. The CO_2 radiative forcing ΔF_t is approximated by the logarithmic relation (2),

$$\Delta F_t = k \ln(C_t/C_0) \quad | \quad \text{Watts per square meter,} \tag{2}$$

where (C_t/C_0) is a proportionate change in CO_2 concentration, with C_0 the unperturbed value. Myhre *et al.* (1998), followed by IPCC (2001), give the coefficient k as 5.35, so that, for example, the CO_2 forcing that arises from doubled concentration is 5.35 ln 2, or 3.708 W m^{-2}. From 411 ppmv in 2018, CO_2 concentration will rise to 422 ppmv over the five years 2019-2023. Thus, the CO_2 radiative forcing will be 5.35 ln (428/413) = 0.191 W m^{-2}.

CO_2 fraction: The fraction q = 0.84 of total anthropogenic forcing implicitly attributable to CO_2 emissions is based on the finding in IPCC (2013) that CO_2 represented 84% of the total anthropogenic forcing over the past decade .

Planck parameter λ_0: Immediately after a perturbation by an external radiative forcing such as anthropogenically-increased CO_2 concentration, the climate sensitivity parameter by which the forcing is multiplied to yield the global temperature response will take its instantaneous or Planck value λ_0 = 0.313 K W^{-1} m^2 (expressed reciprocally as 3.2 W m^{-2} K^{-1} in IPCC, 2007, p. 361 fn.).

Sub-centennial sensitivity parameter $\lambda_{1 \le n < 100}$: To allow for the incremental operation of temperature feedbacks, considered by the IPCC to be strongly net-positive, λ_n is projected to increase over time. Taking λ_n as rising linearly from the instantaneous value λ_0 = 0.31 K W^{-1} m^2 by annual increments 0.0021 K W^{-1} m^2 to the centennial value λ_{100} = 0.52 K W^{-1} m^2, derived below. Thus, over five years the parameter λ_5 = 0.323 K W^{-1} m^2.

Centennial sensitivity parameter λ_{100}: This and longer-term values of λ_n allow for longer-term mitigation benefit-cost appraisals. The IPCC projects CO_2 concentration of 936 ppmv in 2100 against 368 ppmv in 2000 (Annex, Table A1), and a mid-range estimate of 3.7 K warming by 2100 (IPCC, 2014, RCP 8.5), of which 0.6 K is pre-committed (IPCC, 2007, table SPM.3), leaving 3.1 K of new warming, of which 84%, or 2.6 K, is CO_2-driven. Therefore, the IPCC's implicit centennial climate sensitivity parameter λ_{100} is 2.6 K divided by 5.35 ln(936/368) W m^{-2}, or 0.52 K W^{-1} m^2, representing an increase of 0.21 K W^{-1} m^2 in a century against the Planck value λ_0 = 0.31 K W^{-1} m^2.

Equilibrium sensitivity parameter λ_∞: Dividing the 3.26 K central estimate of sensitivity to a CO_2 doubling (IPCC, 2007, p. 798, box 10.2) by the 3.71 W m^{-2} forcing at a CO_2 doubling gives the implicit central estimate of the equilibrium sensitivity parameter λ_∞ as 0.88 K W^{-1} m^2, attained after 1000-3000 years (Solomon *et al.*, 2009).

Projected business-as-usual warming $\Delta T_{1 \le n \le t}$ over a term of years t is given by (3) as long as $y_t \le 2050$, based on the interval of near-term global warming estimates in IPCC (2013, fig. 11.25a):

$$\Delta T_{t,\mathrm{bau}} = mt \quad | \quad C^\circ; \; m = 0.0167\,[0.0100,\, 0.0233] \qquad (3)$$

Initial conditions: economic

Projected global GDP in US dollars is taken as the sum of annual GDP values over the term, where each annual value is the $63 tn global GDP in 2010 (World Bank, 2011) raised by 3% yr^{-1} compound to allow for real GDP growth.

Adaptation cost: The benefit of action is the avoided cost of inaction. IPCC (2014, WG2 SPM, p. 19), estimates the cost of adaptation to unmitigated climate change as 0.2-2.0% of global GDP:

> "Global economic impacts from climate change are difficult to estimate. Economic impact estimates completed over the past 20 years vary in their coverage of subsets of economic sectors and depend on a large number of assumptions, many of which are disputable, and many estimates do not account for catastrophic changes, tipping points, and many other factors. Within these recognized limitations, the incomplete estimates of global annual economic losses for additional temperature increases of ~2 C° are between 0.2 and 2% of income (±1 standard deviation around the mean) (*medium evidence, medium agreement*). Losses are *more likely than not* to be greater, rather than smaller, than this range (*limited evidence, high agreement*).

The IPCC's estimates are similar to that of Stern (2006, Executive Summary, p. ix) says the cost of allowing global warming to occur at 2-3 K $century^{-1}$ and paying to adapt fully to its net-adverse consequences, is 0-3% of global GDP:

> "Most formal modelling in the past has used as a starting point a scenario of 2-3 C° warming. In this temperature range, the cost of climate change could be equivalent to a permanent loss of around 0-3% in global world output compared with what could have been achieved in a world without climate change."

The global benefit of mitigation in the avoided cost of adaptation to unmitigated business-as-usual warming is assumed to arise a uniform rate throughout the century, even though the mid-range projection of the global warming rate to 2050, equivalent to 1.67 K $century^{-1}$ (IPCC, 2013, Fig. 11.25ab), is below half the mid-range projected warming rate of 3.7 K over the entire century (IPCC, 2007, table SPM.3).

In the light of the growing discrepancy between previous IPCC projections of global warming and the substantially lesser warming rates that have been observed, 1 K global warming over the 21st century will be taken as the best estimate. Of this, little or none has occurred to date. It will be assumed, consistently with Stern (2006) and IPCC (2013), that the cost of adaptation is 1% of global GDP per 1 K global warming. Accordingly, any mitigation measure or program whose unit mitigation cost significantly exceeds 1% of GDP will not be justified solely on grounds of minimizing welfare loss arising from climate change. Other values can of course be adopted, and values on the interval [0.5, 4.5] % GDP, representing [0.5, 4.5] K 21st-century global warming, will be considered here.

Uniformity: It will be assumed that climate-damage costs rise *pari passu* with global temperature. In practice, up to 1.1 K global warming compared with today's global mean surface temperature (i.e., 2 K compared with the pre-industrial temperature in 1750) may be net-beneficial via CO_2 fertilization, which has already enhanced crop yields as well as net plant primary productivity and drought resistance. However, it is here assumed, *per impossibile*, that harm will arise at once in response to any increment in CO_2 concentration, however small.

Mitigation benchmark: The 1%-of-GDP benchmark cost of mitigating projected global warming is given by Stern (2006, Executive Summary, p. xiii):

> "... [the] central estimate is that stabilization of greenhouse gases at levels of 500-550 ppmv CO_2e [mid-range estimate 525 ppmv] will cost, on average, around 1% of annual global GDP by 2050."

Stern's indicative mitigation cost falls on his [1, 3]%-of-GDP adaptation cost interval, implying that, if global warming does not exceed the IPCC's central estimate this century, the net benefit of mitigation today against that of adaptation later will in any event be small.

On business as usual the IPCC projects a mid-range 514 ppmv CO_2 by 2050 (Annex, Table A2). To this value, 43% of the 236 ppmv increase above the pre-industrial 278 ppmv, or about 101 ppmv, is added to allow for other anthropogenic greenhouse-gas emissions, giving a mid-range business-as-usual estimate 615 ppmv CO_2e.

Accordingly, Stern's benchmark global mitigation-cost estimate implies that 1% of global GDP buys an abatement of 90 ppmv CO_2e. Pro rata, the cost of abating the centrally-estimated 910 ppmv CO_2e business-as-usual concentration in 2100 by 385 ppmv to keep it stabilized below 525 ppmv CO_2e could reach 4.25% of global GDP by 2100, exceeding Stern's 3%-of-GDP high-end 21st-century estimate of the benefit in the avoided cost of adaptation to unmitigated global warming, and representing more than double the IPCC's 2%-of-GDP maximum cost of the do-nothing option.

Discount rate: Dietz *et al.* (2007), following Stern (2006), say,

> "The discount factor (the relative weight on an investment in consumption at time t, relative to now) in this context is given by (4)
>
> $$u'_c \, e^{-\delta t}, \qquad (4)$$
>
> where u'_c is the marginal utility of consumption per head at time t and δ is a 'pure time discount rate' ... describing a lower weight on the future, simply *because* it is in the future. ... The consumption discount rate r is the rate of fall of the discount factor (5):
>
> $$r = \eta g + \delta, \qquad (5)$$
>
> where η is the elasticity of marginal utility of consumption and g is per-capita consumption growth. ...
>
> "The most straightforward and defensible interpretation (as argued in the Review) of δ is the probability of existence of the world. In the Review, we took as our base case δ = 0.1% per year, which gives roughly a one-in-ten chance of the planet not seeing out this century. ... Across the infinite horizon of our analysis in Chapter 6, g is on average around 1.3% in a world without climate change, giving an average consumption or social discount rate across the entire period of 1.4% (being lower where the impacts of climate change depress consumption growth."

A 10% probability of planetary annihilation extinguishes consumption growth, so that the mean value of r will scarcely exceed zero. Thus, a zero social discount rate is adopted here. This choice maximally favors the interventionist case, though by perhaps needlessly depriving future generations of much of their inheritance it may not favour them at all.

Immediacy: It is assumed that the benefits of a mitigation strategy will arise at once, although the IPCC's assessment that CO_2 persists in the atmosphere for 40-200 years rules out any significant fall in CO_2 concentration this century.

Causality: It is assumed that anthropogenic emissions are and will remain the sole cause of the observed increase in CO_2 concentration since 1950.

Opportunity loss: The model takes no account of the opportunity losses, including the losses to future generations, occasioned by the pre-emptive diversion of otherwise-productive resources to meet the cost of mitigation measures to the extent that they may be neither necessary nor cost-effective.

Exclusions: No allowance is made for the following: emissions intensity of energy consumption significantly lower in the West than elsewhere; capital and current costs external but essential to the project, in particular the provision of spinning-reserve generation for wind turbines on windless days; emissions from project construction and installation, such as burning lime for the turbines' concrete foundations; and imported emissions. In April 2013 the Climate Change Committee reported that, though direct UK CO2 emissions in the UK had fallen by 20% in 20 years, emissions imported in goods from foreign suppliers had resulted in a net 10% increase in the UK's emissions over the period. It is here assumed, *per impossibile*, that expenditure will achieve the stated net reductions in CO2 emissions.

Initial conditions: case-specific

The two case-specific initial conditions are the fraction of global CO2 emissions the project may abate, and its cost.

Fraction of global CO2 emissions abated: The 194 turbines of the Navitus Bay project will have a capacity of 970 MW, or, at the stated 35% capacity factor, 339.5 MW, or less than 0.8% of the 43.2 GW mean total UK demand. Electricity is 33% of UK CO_2 emissions, which, at 142.6 MtC (522 Mt CO2) in 2008, represented 1.72% of global CO2 emissions. Therefore, Navitus Bay will abate 0.0045% of global CO2 emissions over the five-year period of study.

Project cost: The annual subsidy for 339.5 MW over 8766 hours, at 1.8 times the current Renewable Obligation Certificate price of \$72.15 (£43.30) MWh^{-1} , is \$387 million, or close to \$2 bn over five years. The subsidy regime is too uncertain for reliable costing thereafter. The subsidy is partly paid-for by twolevies: a Climate Change Levy of ~\$0.09 kWh^{-1} on non-exempt consumers of electricity, and a Carbon Price Floor. These raised £700 million (\$1.17 bn) in 2013 (HMRC, 2013b). The 2.975 TWh generated annually by Navitus Bay is equivalent to 7.235% of the 41.132 TWh generated by levy-subsidized renewables. Thus, some \$87 million of the annual cost of the levies is attributable to the Navitus Bay project and, as a market distortion intended to favor renewables at the expense of fossil-fueled generation, is properly treated as a further subsidy, bringing the five-year gross subsidy cost of the project to \$2 billion.

Method

The initial conditions having been set, the fraction p of global CO2 emissions expected to be abated determines a new and somewhat abated value $C_{t,\mathrm{aba}}$ of the projected end-of-term business-as-usual CO2 concentration C_t at y_t, via (6):

$$C_{t,\mathrm{aba}} = C_t - p(C_t - C_0) \quad | \quad \text{ppmv} \qquad (6)$$

CO2 radiative forcing abated: From the CO2 concentration growth abated, the CO2-forcing function (2) is applied to determine how much of the business-as-usual CO2 forcing that would otherwise have occurred over the term the project may abate. In (7), at year t, ΔF_t is business-as-usual CO2, and $\Delta F_{t,aba}$ is the diminished forcing:

$$\Delta F_{t,\mathrm{aba}} = k \ln(C_t / C_{t,\mathrm{aba}}) \quad | \quad \text{W m}^{-2};\ k = 5.35. \qquad (7)$$

Global warming abated by the projectover the term is the product of the CO2 forcing abated and the time-dependent sensitivity parameter λ_t.

Unit mitigation cost per C° of warming mitigated is the ratio of total project cost over the term to the quantum of global warming mitigated in C°.

Global lifetime mitigation cost, i.e. the total cost of mitigating all projected warming over the term by the adoption worldwide of projects of equivalent unit cost, is the product of the unit mitigation cost and the projected business-as-usual global warming. It may be compared with the avoided cost of adapting to unmitigated warming.

The benefit-cost ratio r of a mitigation strategy is the ratio of the avoided cost of adaptation to the cost of mitigation. Where $r \ll 1$, the strategy cannot be justified on mitigation grounds alone and, unless other benefits justifying the cost can be prayed in aid, comparison of its unit mitigation cost with those of competing strategies will not be worthwhile. Where $r > 1$, it becomes worthwhile to determine mitigation cost-effectiveness by comparing the benefit-cost ratios of competing strategies.

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The benefits and costs of the Navitus Bay project

Period of study: Navitus Bay is to come onstream by 2021. The period of study will be the first five years of the project, from 2021-2025. Beyond that period, the subsidy regime is uncertain.

CO_2 concentration, on business as usual, will increase by 11 pmv from from 412 to 423 ppmv over the five years. Of this 11 ppmv, the 0.0045% abated by Navitus Bay is **0.0005 ppmv.**

The global CO_2 forcing abated by Navitus Bay over the period, using equation (2), is $5.25 \ln(423/422.9995)$, or **0.000006 Watts per square metre.**

The fraction of global warming abated is 0.000006 W m^{-2} multiplied by the five-year Planck sensitivity parameter 0.323 K W^{-1} m^2, or 0.000002 C°. That is approximately **2 millionths of a degree.**

The unit mitigation cost, which is the cost of mitigating just 1 C° of global warming by measures of equivalent unit cost worldwide, is the five-year subsidy of £2 bn divided by the 0.000002 C° global warming abated by Navitus Bay over the five-year period, or **\$1,000,000,000,000,000, i.e. \$1 million billion, or \$1 quadrillion.**

The global total mitigation cost, which is the cost of mitigating the 0.08 C° projected global warming over the five years, is 0.08 C° mutiplied by the unit mitigation cost of £1 quadrillion, or \$80 trillion, which is \$11,500 per head of global population or, as a percentage of projected global GDP of \$436 trillion, **18%.**

The benefit-cost ratio, assuming that adapting to 1 C° unmitigated global warming over the 21st century would cost 1% of GDP, is 18. It is **18 times costlier** to address global warming with mitigation projects such as Navitus Bay than to allow the global warming to occur and meet the costs and damages of adapting to its consequences.

The climatic context

There has been little or no global warming for up to 18 years (Remote Sensing Systems, 2015: Fig.)

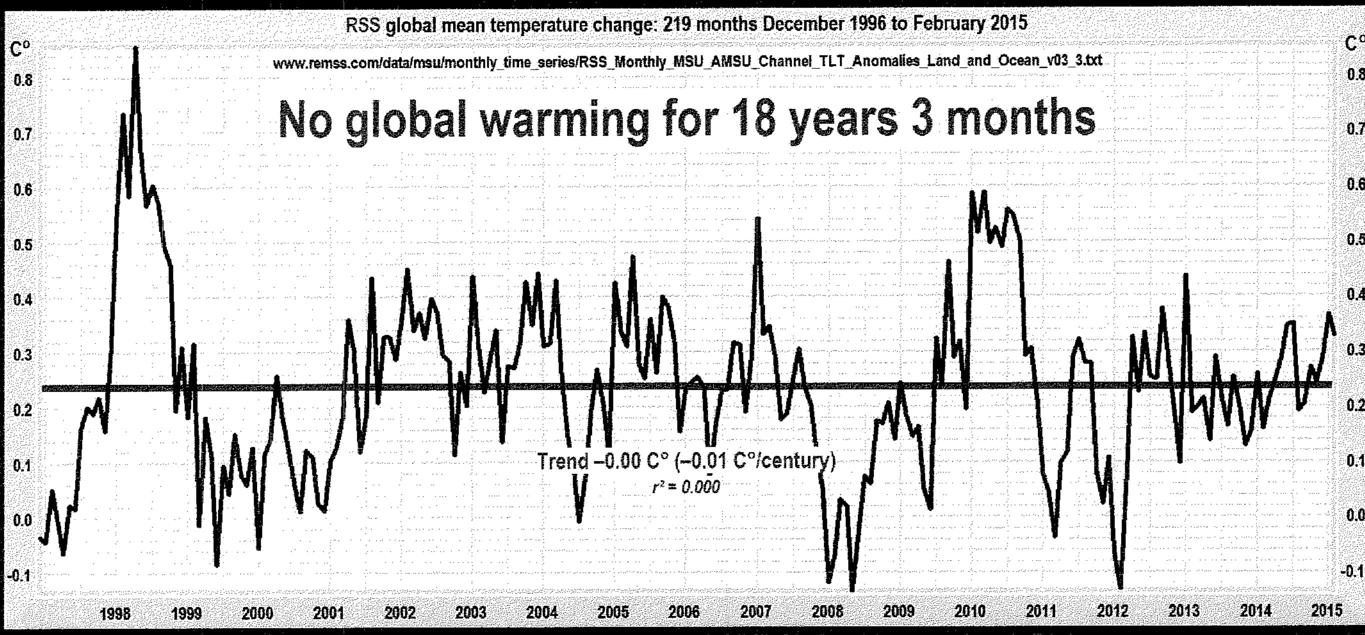

Figure 7. The least-squares linear-regression trend on the RSS satellite monthly global mean surface temperature anomaly dataset shows no global warming for 18 years 3 months from December 1996 to February 2015.

The RSS satellite data series shows less warming in the past decade or two than the other four: however, its estimate of the magnitude of the 1998 Great el Niño was probably more accurate than most, and all the others are within statistical striking distance of it.

However, it is arguably more useful to examine the extent to which the IPCC's original predictions of global warming made in its *First Assessment Report* (1990) have come to pass (Fig. 8).

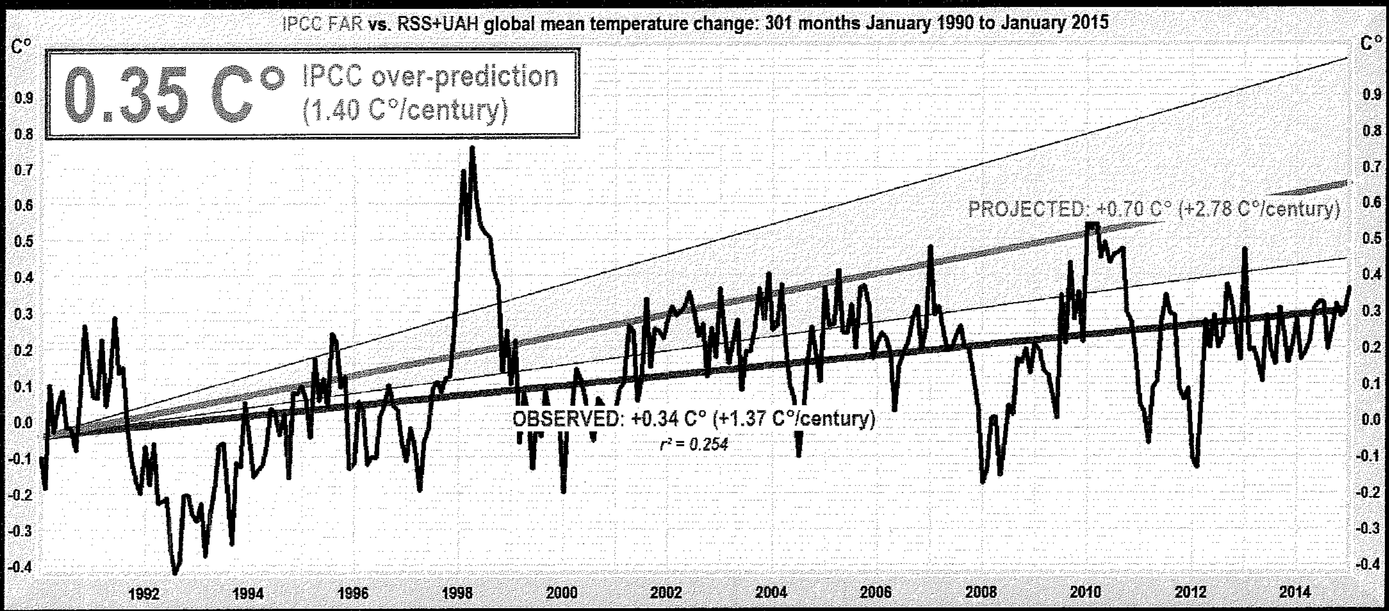

Figure 8. Near-term projections of warming at a rate equivalent to 2.8 [1.9, 4.2] K/century, made with "substantial confidence" in IPCC (1990), January 1990 to January 2015 (orange region and red trend line), vs. observed anomalies (dark blue) and trend (bright blue) at less than 1.4 K/century equivalent, taken as the mean of the RSS and UAH satellite monthly mean lower-troposphere temperature anomalies.

It will be seen that the observed warming rate is entirely below the orange region representing the IPCC's prediction interval, and represents approximately half of the centrally-estimated "business-as-usual" warming, even though CO2 emissions have actually exceed the IPCC's 1990 business-as-usual projection.

The IPCC has realized the growing discrepancy between even its more recent predictions and observed reality (Fig. 9):

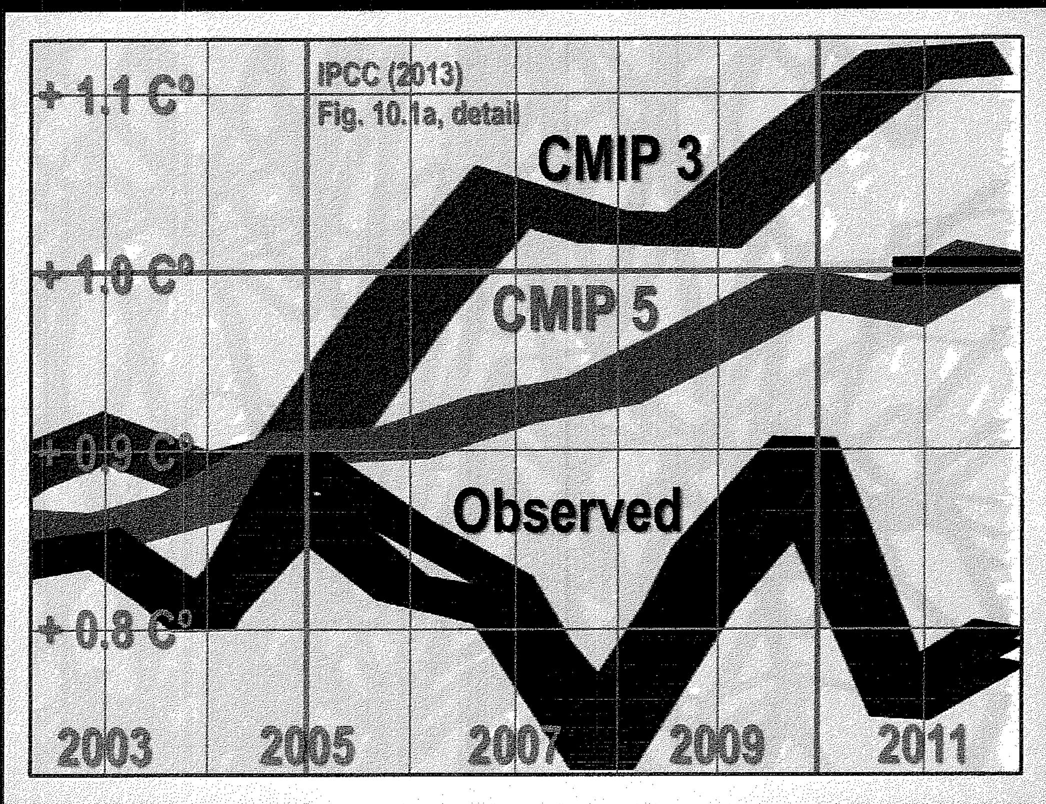

Figure 9. CMIP3 (2007) and CMIP5 (2013) model projections of global temperature change against observation.

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The IPCC has, therefore, greatly reduced its predictions of future warming in the short to medium term, while inconsistently leaving the long-term predictions of very substantial warming unaltered (Fig. 10):

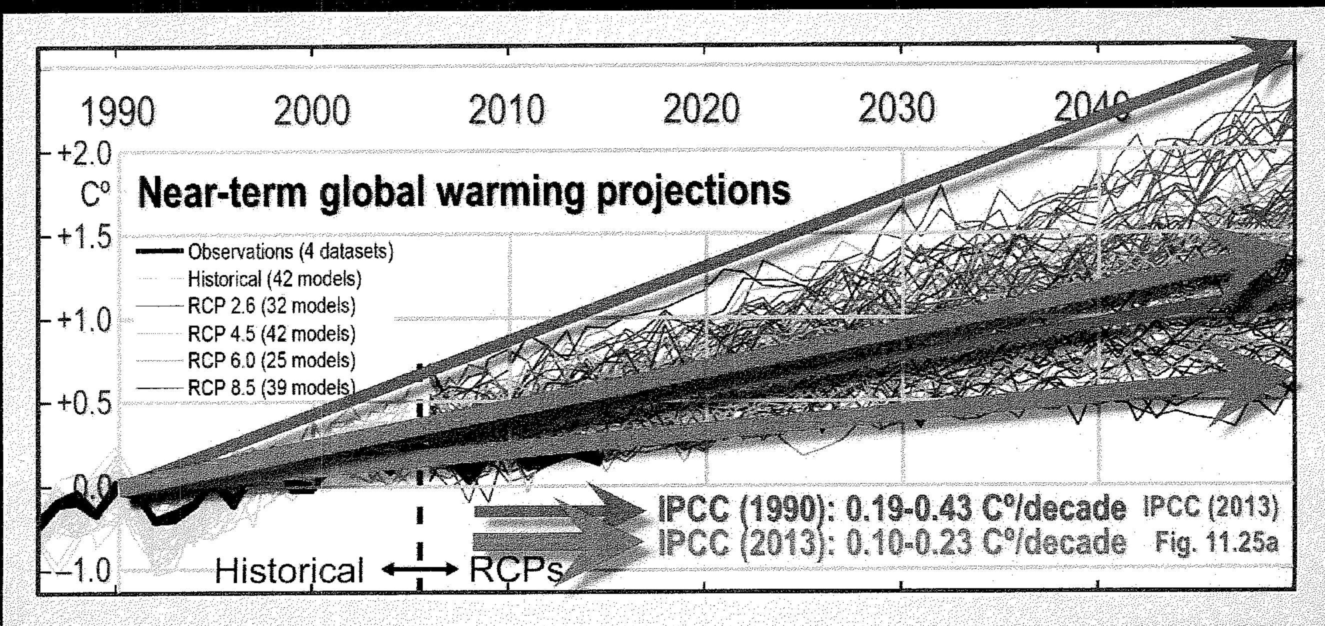

Figure 10. IPCC near-term global warming projections in 1990 (red arrows) and 2013 (green arrows), compared with a spaghetti-graph of models' projections. The IPCC has now explicitly abandoned its faith in the models, and has substituted what it calls "expert assessment" for them. Within the lifetime of Navitus Bay, therefore, the officially-predicted warming rate will be little more than half of that on which the U.K. Government based its case for climate interventionism in 2008.

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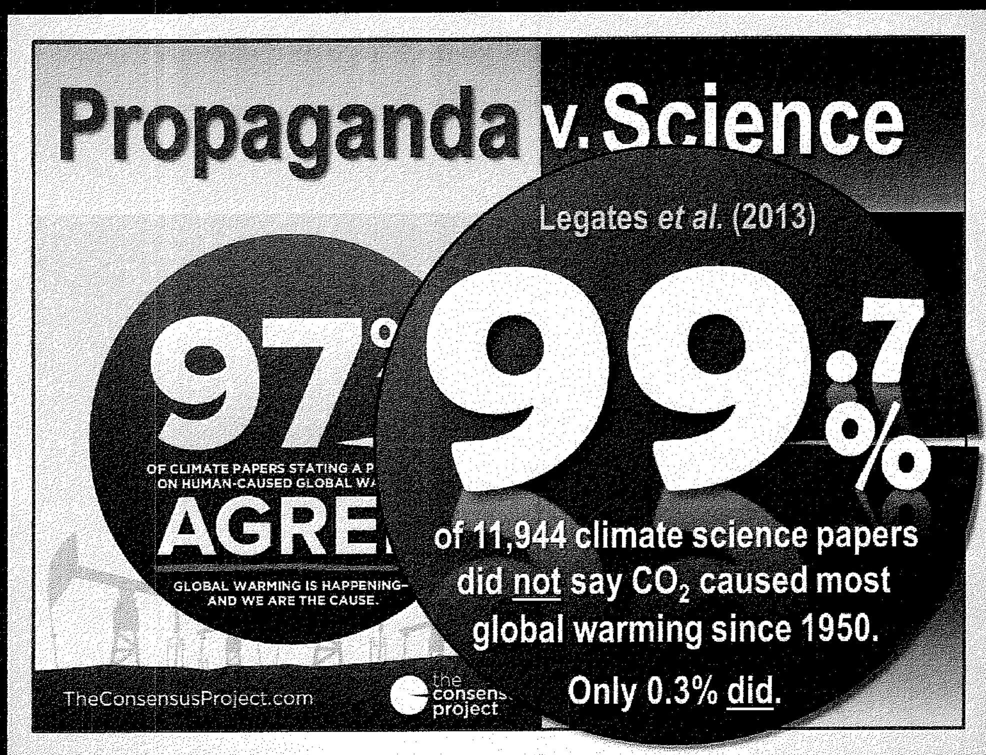

Figure 11. The dwindling consensus. Legates *et al.* (2013) demonstrated that only 41 of 11,944 papers on climate and related topics published in learned journals over the 21 years 1991-2011 stated that most of the global warming since 1950 was manmade. That is 0.3%. The long pause in global warming has made the scientific community considerably more cautious than is presented in the media.

One consequence of the continuing failure of the world to warm at much more than half the rate predicted by the IPCC a quarter of a century ago is that various extreme-weather consequences of global warming are not occurring. For instance, the extent of global sea ice has remained more or less unchanged throughout the 35-year period of satellite observation, and reached a satellite-era maximum for the time of year as recently as September 2014, as the growth in Antarctic sea ice throughout the period of observation has offset much of the decline in summer sea ice in the Arctic.

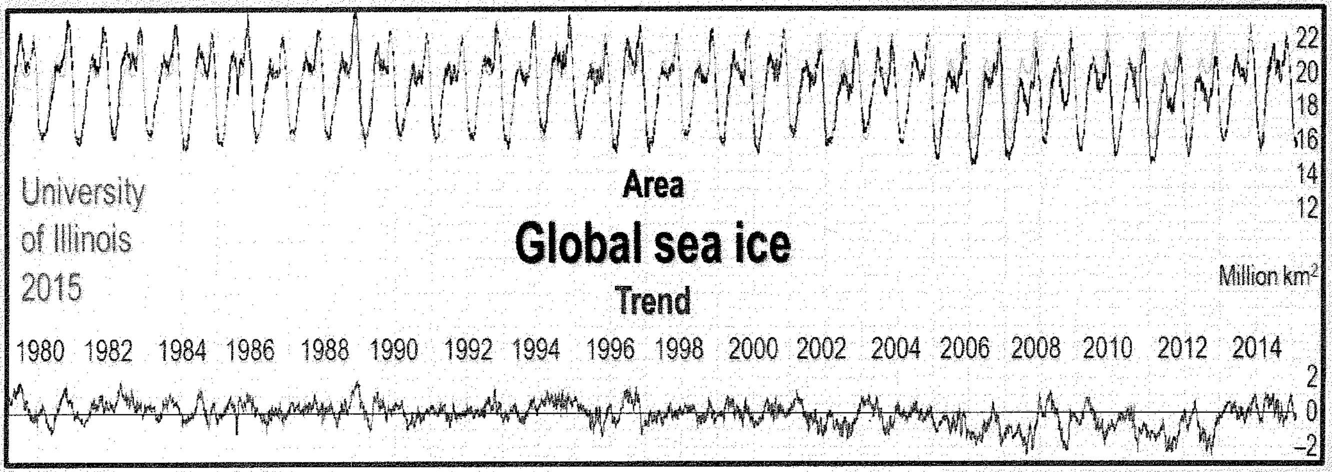

Figure 12. The area (blue) and trend (red) in global sea ice, compiled by the Cryosphere Today project of the University of Illinois (2015). There has been very little change in either the area or the zero trend throughout the 35-year period of satellite observation.

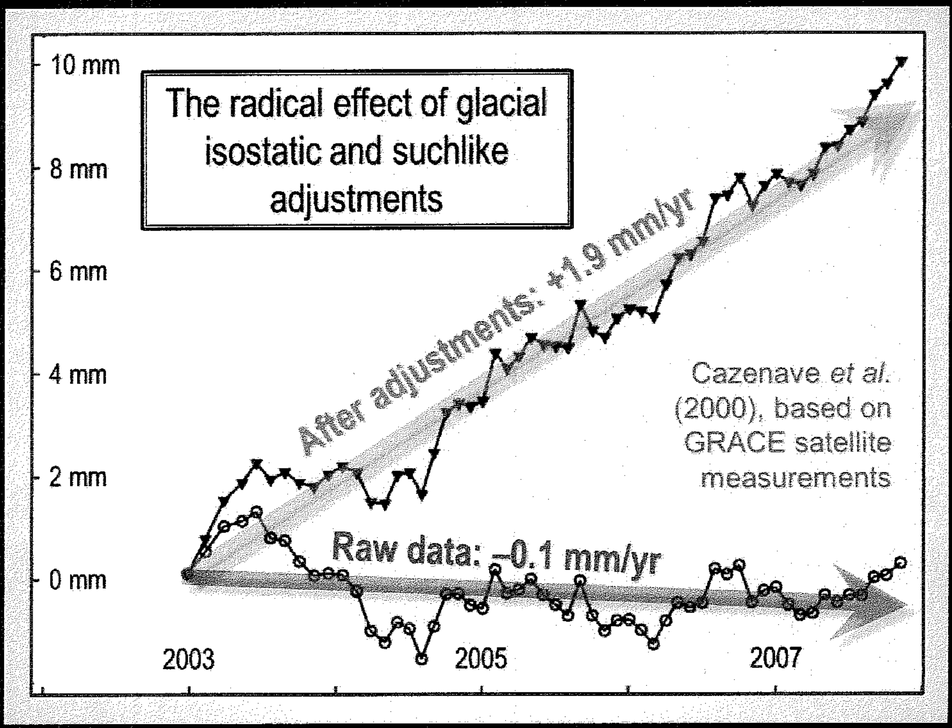

Figure 13. Since there has been no global warming in the past decade and more, there is no reason to expect global sea level to rise. Nor, according to the ARGO data, has it risen by much. From 2003-2009 its unadjusted level actually fell, according to the GRACE gravitational-recovery satellites. The astonishing discrepancy between the raw data and the steep increase after "adjustments" is shown in Cazenave *et al.* (2000).

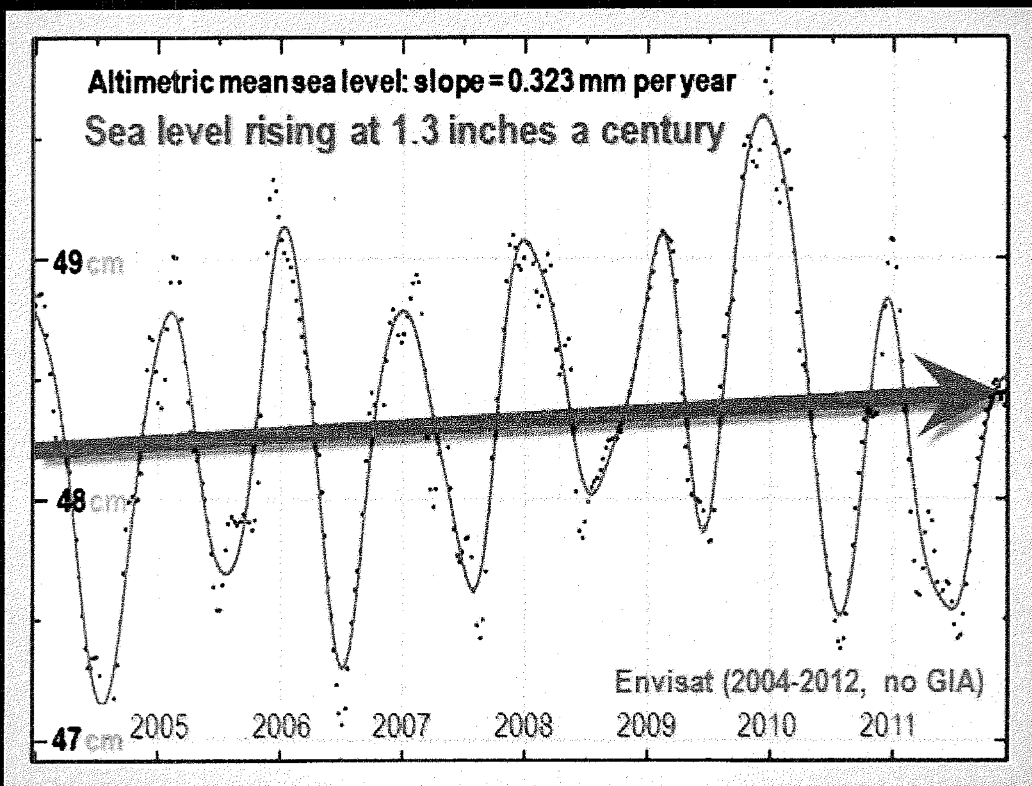

Figure 14. The results from the gravitational-recovery satellites (Fig. 13) are largely supported by the entire sea-level output of the ENVISAT satellite over eight years from 2004-2012, which showed sea level rising at 3.3 cm (1.3 inches) per century equivalent.

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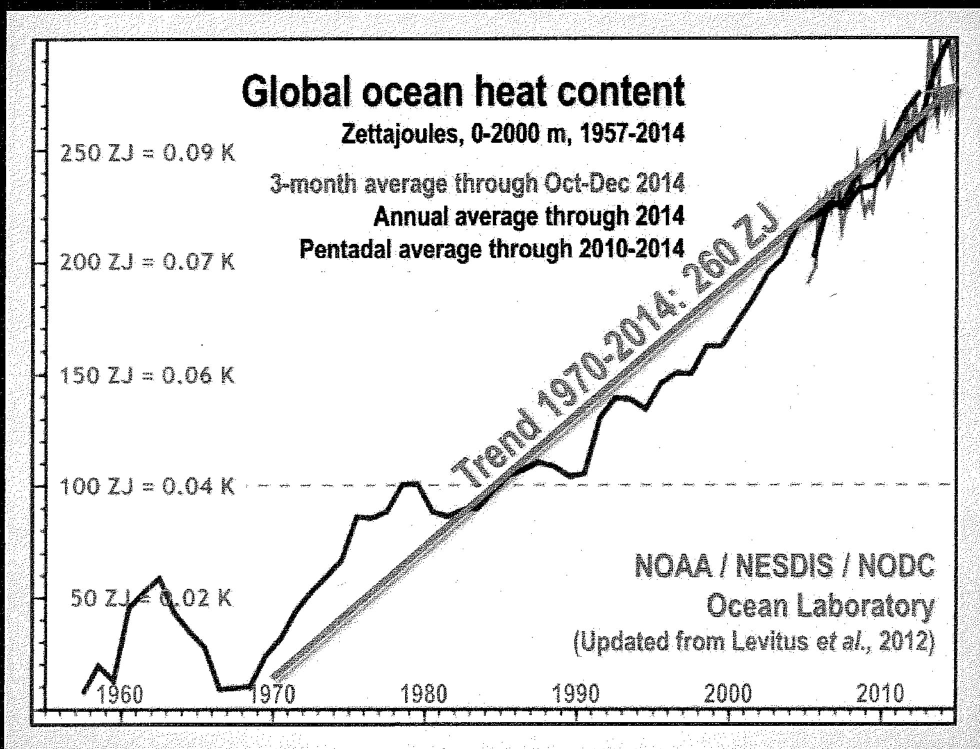

Figure 15. Ocean heat content change, 1957-2013, in Zettajoules from NODC Ocean Climate Lab: http://www.nodc.noaa.gov/OC5/3M_HEAT_CONTENT. The heat content has been converted back to the ocean temperature changes in fractions of a Kelvin that were originally measured. NOAA's conversion of the minuscule temperature change data to Zettajoules, combined with the exaggerated vertical aspect of the graph, has the effect of making a very small change in ocean temperature seem considerably more significant than it is. The oceans have warmed since 1970 at a rate equivalent to 0.2 K/century.

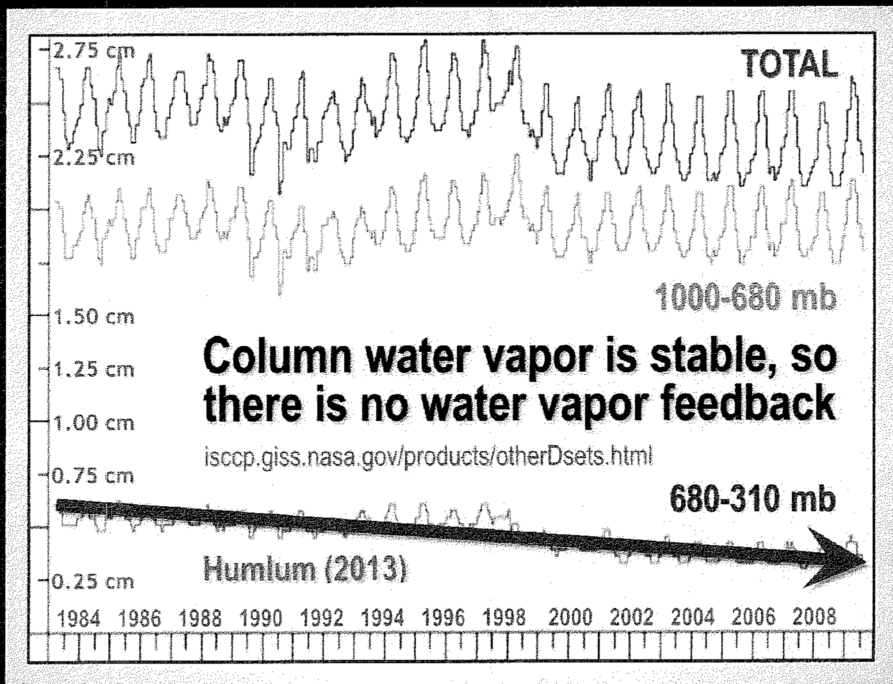

Figure 16. Column water vapour, which the models had predicted would increase as the world warmed, providing a "positive feedback" that would on its own double the 1 K-per-CO_2-doubling warming rate, has remained stable since the early 1980s and, in the crucial mid-troposphere, has declined as the world has warmed, suggesting that the water-vapour feedback may be net-negative – a result that appears in many published scientific papers, suggesting a small temperature response to greenhouse gases.

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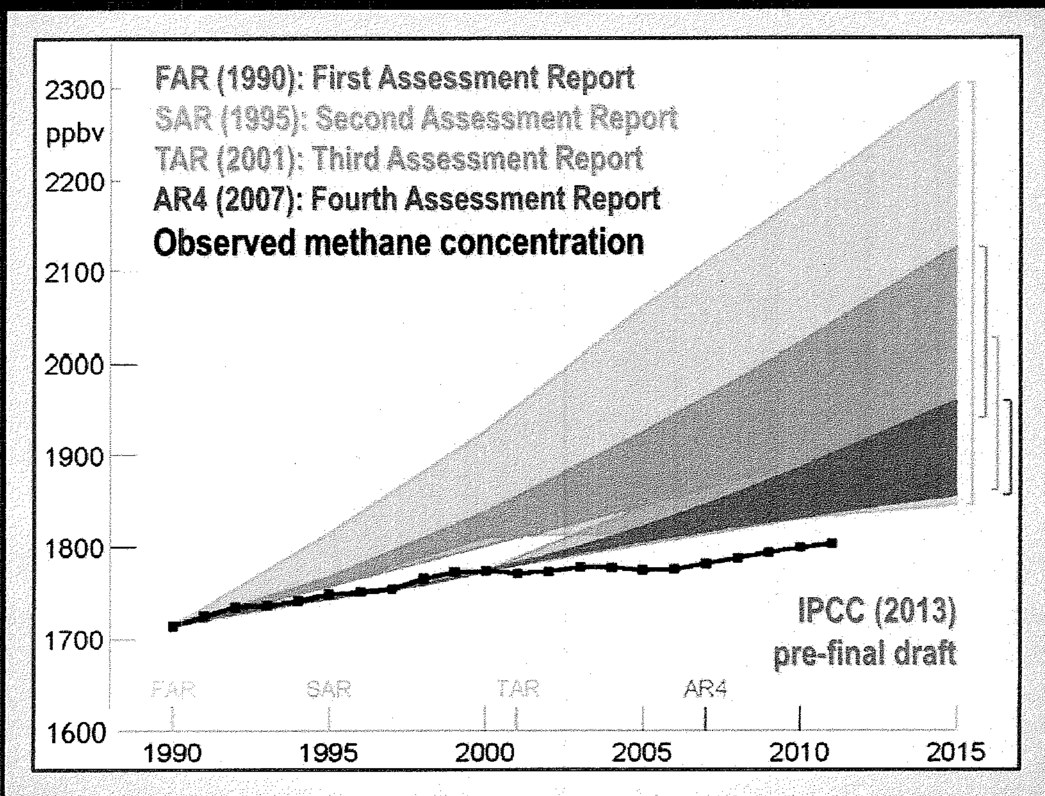

Figure 17. Methane concentration was predicted to rise very steeply in each of the four previous IPCC *Assessment Reports*. Instead, however, it has risen at a rate below even the least prediction. Methane is a greenhouse gas 23 times more potent than CO2, so its failure to rise as expected is significant.

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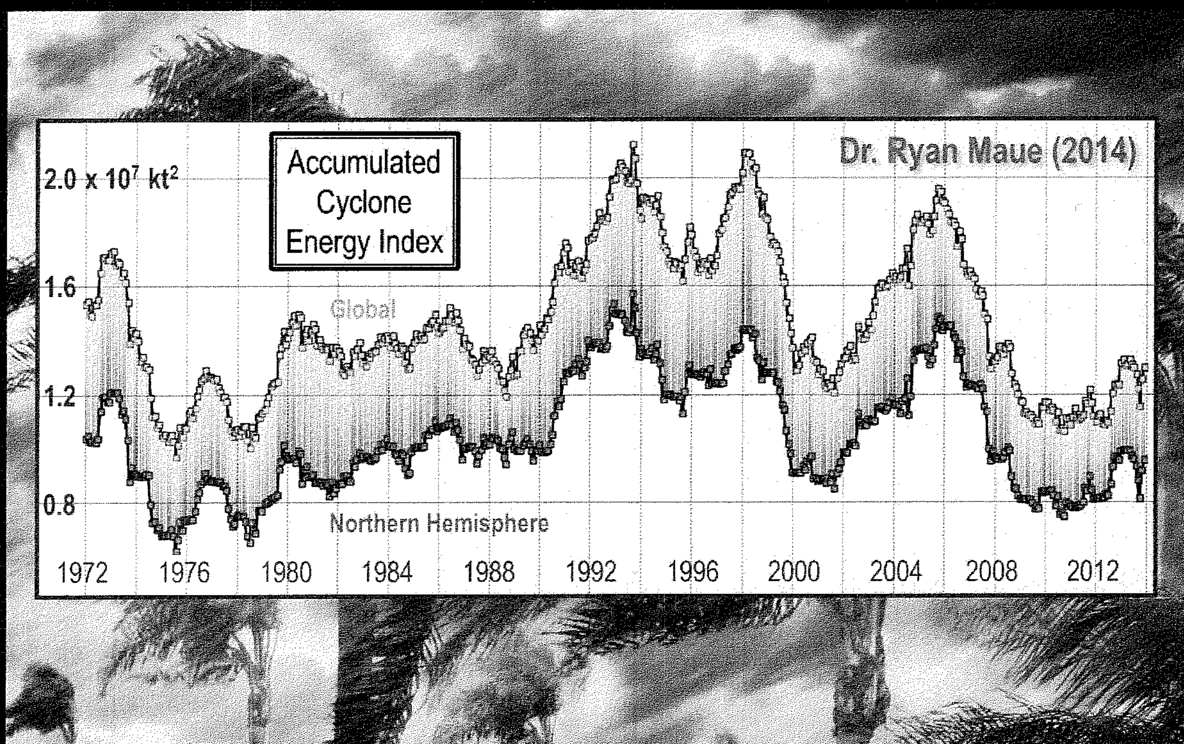

Figure 18. Hurricanes, tropical cyclones, typhoons and extra-tropical storms show no particular trend in frequency, intensity or duration over the satellite era since 1972, contrary to media reports. The IPCC, both in its special report of 2012 on extreme weather and in its 2013 *Fifth Assessment Report,* concedes that there has been no trend in global storminess.

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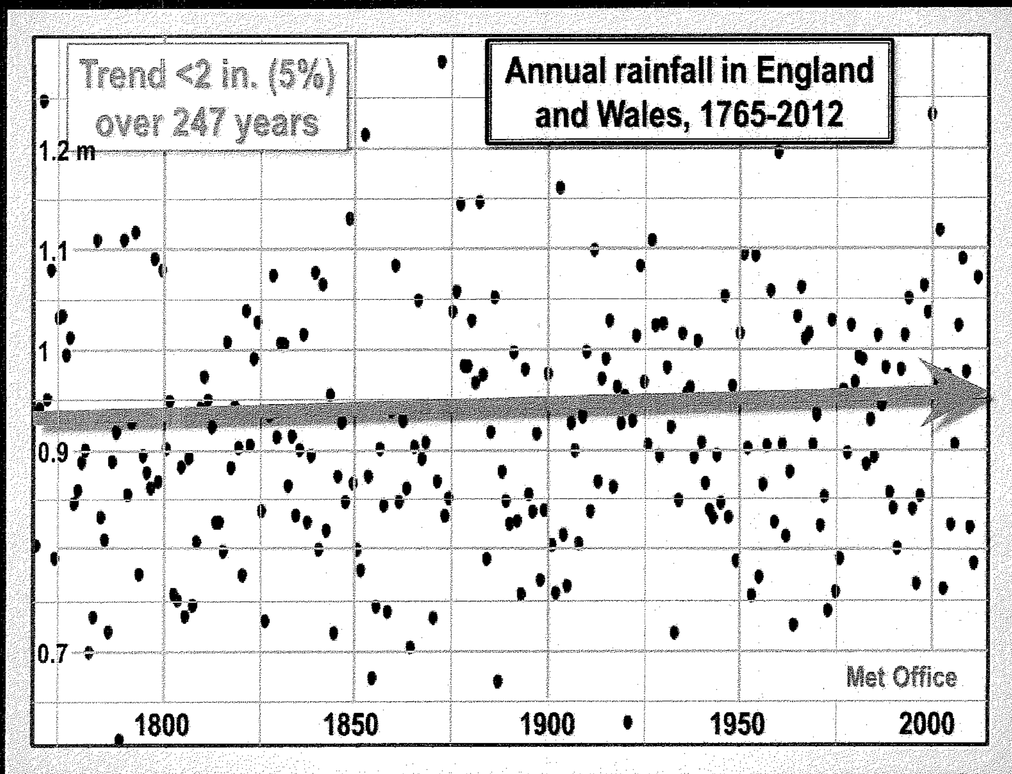

Figure 19. Though it is often said that wet weather in Britain is on the increase because of global warming, one would in fact expect extra-tropical storminess to decrease in a warming climate. The annual rainfall figures for England and Wales – the longest continuous record of its kind – show no particular trend in almost a quarter of a millennium.

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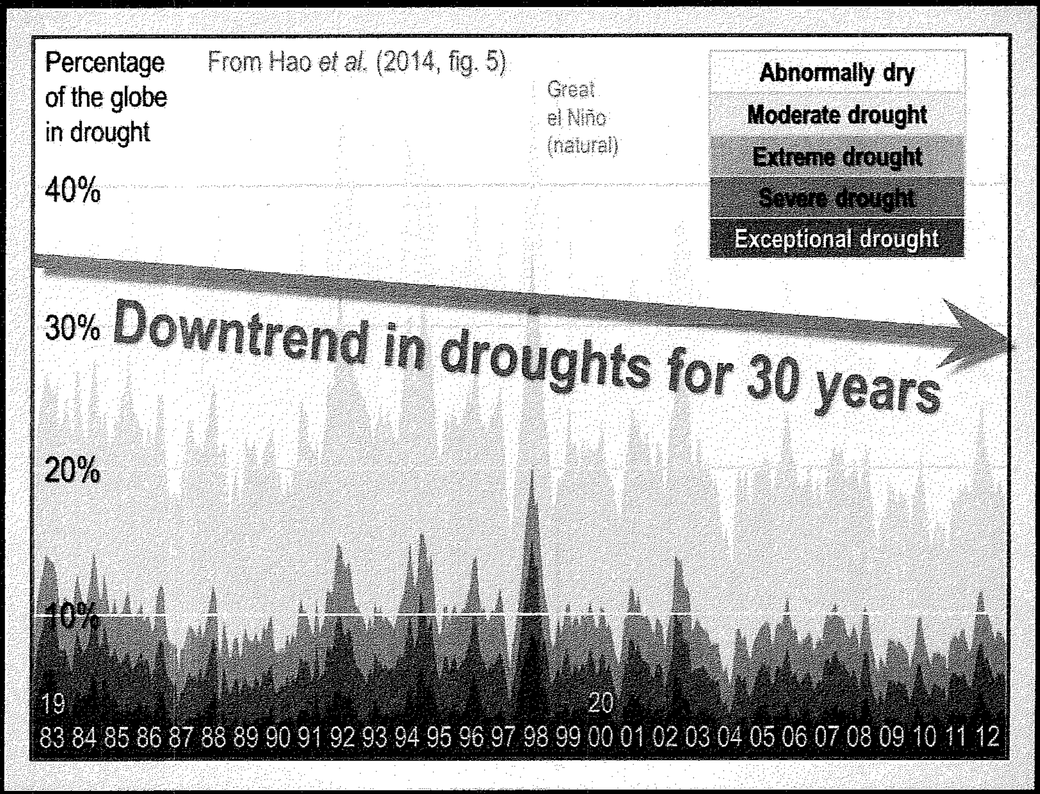

Figure 20. As with flooding and rainfall, so with droughts: there has been no global increase in the land area under drought since the satellite monitoring began in 1983. If anything, there has been something of a downtrend – as one would expect in a warmer and hence slightly wetter world.

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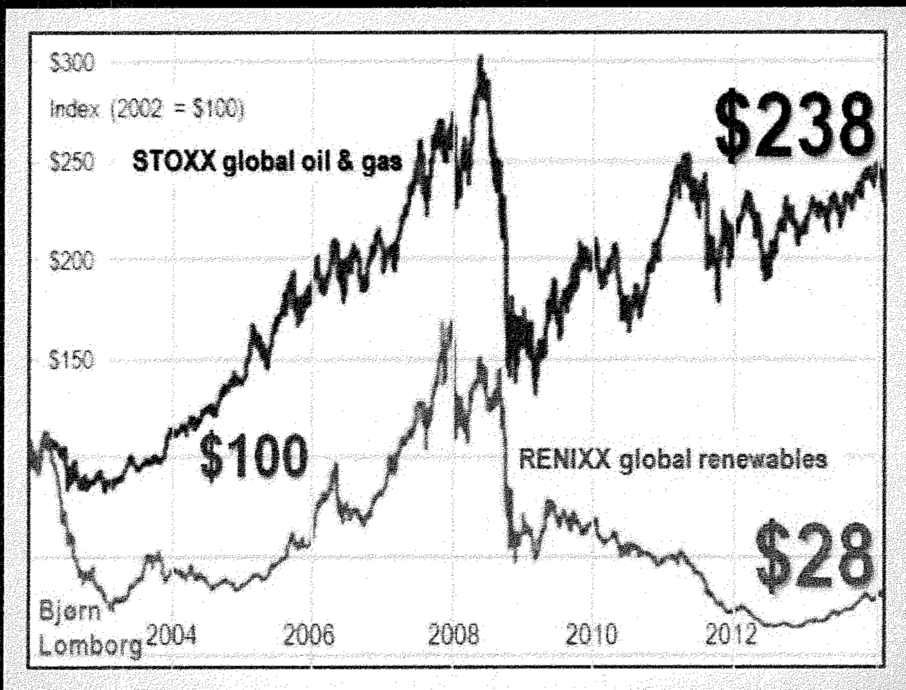

Figure 21. In the light of the economic modelling results presented here, the Government would do well to be very cautious before "investing" in "green" technology – particularly where it is likely to prove as costly and unproductive, as well as environmentally damaging, as Navitus Bay. This cautionary graph from Dr Bjorn Lomborg shows the fate of $100 invested in "renewables" and in oil and gas from 2002-2014. "Renewables" – *even after Government subsidy* – show a loss to investors of almost three-quarters of their buy-in, while investors in oil and gas would have more than doubled their money.

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Conclusion: There is no rational justification for Navitus Bay

In the light of the simple but mainstream and robust calculations performed by us in this analysis, and in the light of our conclusion that Navitus Bay has a unit mitigation cost 6-18 times the cost of not taking any mitigation action at all and simply waiting to adapt to global warming even at the predicted rate, it should be clear that there is no rational economic justification either for asking taxpayers to subsidize the project or for enduring the environmental damage and degradation that the project would entail.

A rational policy, given the actual data on climate outturn compared with prediction that is demonstrated in the graphs reproduced here, would be to spend no taxpayers' money at all on attempting to mitigate increases in atmospheric CO_2 concentration. On the outturn of the past 25 years, and for powerful reasons arising from fundamental errors discovered in the feedback amplification mechanism within the general-circulation models (*Why models run hot: results from an irreducibly simple climate model,* Monckton of Brenchley, 2015, *Science Bulletin,* vol. 60 no. 1), it is now no longer at all likely that significant global warming will arise even from a doubling or quadrupling of the present atmospheric concentration of CO_2. For guidance, to the nearest tenth of one per cent, there is no CO_2 in the atmosphere at all.

The influence of adding CO_2 to what is already there is logarithmic. Each additional molecule has less warming effect than its predecessors.

Given the uncertainties in the underlying science, combined with the certainty (near-unanimously expressed in the reviewed economic literature) that mitigation today is extravagantly costlier than adaptation the day after tomorrow even if the science – *per impossibile* – is right, principled inaction on global warming is the rational economic choice.

Economic decisions should be taken rationally, not for mere fashion. Navitus Bay should be rejected out of hand.

The author

Lord Monckton was an expert reviewer for the *Fifth Assessment Report* (2013) of the Intergovernmental Panel on Climate Change and is chief policy adviser to the Science and Public Policy Institute in Washington DC.

He has lectured on climate sensitivity and economics worldwide and has published several reviewed papers on climate change, especially on climate sensitivity, modeling, and environmental economics.

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Saturday, April 23, 2016 4:22 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: SDEIS comments
Attachments: Marcus Gingerich SDEIS Comments Final.pdf; Ambient Measurement Final.pdf; Les Blomberg resume.pdf; Final DSEIS analysis.pdf

I just realized this should have been sent instead of the previous e-mail. Please use this later version.

Thank you.

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: SDEIS comments
Date: 04/22/2016 11:57 pm
From: Marcus Gingerich <mdgingerich@yahoo.com>
To: "townclerk@townofenfield.org" <townclerk@townofenfield.org>

Ms. Linton,

I just noticed a problem that I needed fix. If this is not submitted in time just use the previous submission. Otherwise please use the comment file from this message. The other 3 are the same.

Thanks
Marcus Gingerich

Comments to the Draft Supplemental Environmental Impact Statement

Marcus Gingerich, PhD
101 Rumsey Hill Road
Newfield, NY 14867

April 22, 2016

Town of Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850

To the Enfield Town Board:

This letter presents my comments to the Black Oak Wind Farm (BOWF) Draft Supplemental Environmental Impact Statement (DSEIS).

Personal Impacts

1. The Modified Project now potentially places two additional turbines (B and C) within 0.87mi and 0.99mi. of my home, see Table 1. What this means is that there are now potentially 6 turbines within less than 1mi. of my home where my family spends a great deal of time due to being homeschooled. In particular, during the winter months when the wind speeds tend to be the highest, my wife and children will be subjected to an elevated probability of being exposed to low frequency noise (LFN) and infrasound (IS) for long periods of time due to being predominately downwind from one or more turbines. This will be exacerbated by the additional 2 turbines (B and C) located to the northwest which is the direction from which the wind is often blowing from during the winter.

2. With 6 turbines located in an array extending from the southwest to the northwest, our home will be often subjected to the elevated effects of noise, in particular, infrasound, due to being downwind from a wind turbine a high percentage time based on the prevailing wind direction. Our single greatest concern is the potential adverse effects of infrasound upon the health of my children whether it a result of annoyance or sleep disturbance. While many people completely disregard all reported effects except noise annoyance and sleep disturbance, and those are usually trivialized; sleep disturbance resulting in chronic sleep loss is a significant health issue which has been shown to have very serious ramifications including permanent neural damage and may have implications to Parkinson's and Alzheimer's disease.[1,2,3] With no consideration for these possible effects in the DSEIS, is doesn't seem that a real hard look was given to the

1 https://www.urmc.rochester.edu/news/story/3584/scientists-discover-previously-unknown-cleansing-system-in-brain.aspx
2 https://www.urmc.rochester.edu/news/story/3956/to-sleep-perchance-to-clean.aspx
3 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3880190/

environmental impacts. Since no real consideration was given, obviously, no mitigation was deemed necessary. This issue should have been addressed in the DSEIS since it is becoming recognized as a real and significant problem.

3. Another great personal concern is the potential loss of real estate value and/or the complete incapability of selling our home if living in it becomes impossible. There are cases in this country and around the world of people simply boarding up their homes and abandoning them because they can no longer tolerate the effects of wind turbine noise and they can not sell their homes. Many claim that studies show that there is no loss of property value; however, Denmark recognizes the problem and has a national law which requires that homeowners be compensated for their loss in property value depending upon how close the property is located to wind turbines. There is no consideration given in this DSEIS to the possibility of such an occurrence in the vicinity of this project even though the distances between turbines and residents are very short. This impact must be considered and mitigation proposed.

Turbine	Distance to my home*
T1	0.76mi
T3	0.50mi.
T4	1.45mi.
T5	0.67mi.
T6	0.55mi.
TA	1.11mi.
TB	0.87mi
TC	0.99mi.

Table 1: Distance between my home and the various turbines. It is clear from the DSEIS that the Turbines in bold have moved.
*as indicated on Google Earth based on coordinates from FAA website.

4. Based on the DSEIS, it is unclear whether shadow flicker may affect our home due to the lack of specific simulation data and the poor resolution of the overall shadow flicker map. From the map, it appears to fall on my property at least somewhat and in an area where my family raises a garden and utilizes the field for recreation. In particular, it appears to fall across an area of our property which is used as an ice skating rink in the winter and that is the season when the flicker would be expected to be most prevalent due to the sun passing low in the southwestern sky behind turbine 6. Based on the DSEIS, it is unclear what the impact might be because there is a lack of data or enough detail to make a definitive assessment.

5. The FAA lighting on the top of the nacelle has the potential to cause a problem year round, but particularly during the winter months with 'leaf off' conditions. The DSEIS only considers the 'leaf on' conditions for almost all of the evaluations which is not the case for 6 months of the year. In fact, during the winter any snow cover is likely to increase the effect of flashing tower

lights due to reflection and may cause sleep disturbance since my children's bedrooms have windows in the direction of the towers. No consideration is given to the impact of the wind turbines during the 'leaf off' conditions. The DSEIS can not be considered to be complete if it does not take into consideration these potential impacts. Possible mitigation for visual effects during the leaf off half of the year need to be included in the DSEIS.

The Modified Project

1. The modified project includes a number of changes, but without the benefit of exact locations of the various components it is difficult to ascertain the validity of the claims made. The DSEIS does indicate the relocation of two turbines (Turbine 2 and Turbine 7) and states that there is a "Shift of Turbine 5 approximately 160 feet to the south-southeast to comply with GE recommended setback for ice throw;" however, it does not acknowledge the shift of Turbine 6 by approximately 75 feet (shown on pg. 5, Appendix E) or the apparent shift of all of the remaining turbines by small amounts as indicated in the attached reports by Les Blomberg.

2. The actual movement of Turbine 5 is not clear because depending on where it is mentioned in the DSEIS, it ranges from 100ft. to 160ft. Is the exact proposed location even known? Without knowing the exact location, how can an accurate assessment of the impact of such things as shadow flicker, ice/blade throw, and to some extent noise, be properly assessed. The DSEIS should not be considered until consistently accurate details are included in the document. The DSEIS should be corrected by the sponsor and then presented to the public again for review and substantive comments.

3. The modified project indicates that there is an increase in electrical generation capacity (nameplate capacity) from 11.9 MW to 16.1 MW, but it does not indicate what the actual production is expected to be. For the proposed region, it is going to be significantly less than the name plate capacity and based on various estimates, it will possibly be 25% or even as low as 12-15% of name plate capacity. Thus, there may be a gross overestimation of the beneficial environmental impact of clean energy. Without a knowledge of the real benefits of the wind turbines, a real assessment of the trade-offs between adverse impacts and benefits cannot be made.

   According to the online resource Biodiversity and Wind Energy Siting in New York[4], most of the proposed wind farm and in particular Turbines B and C are located in areas which are rated as having marginal wind resource potential although this data does reflect a 50m height. There is no indication in the DSEIS that the wind resource in the modified layout has high enough energy potential to warrant the environmental impacts that are caused by the modified location of the turbines. The move must be justified with data that shows there is a reasonable expectation of beneficial returns given the environmental impacts. There is no cost/benefit analysis even qualitatively much less quantitatively. The assumption seems to be made that

4 http://www.ebd.mapny.info/

wind energy is clean thus any impacts on the environment and the local residents is justified no matter what the actual energy production.

Avian and Bat Studies

1. There has been a significant change in the project layout with Turbines B and C being much farther north than any turbines previously and Turbine A much farther south. Turbines B and C are well away, more than a 1 mile, from the location where the bat acoustic study was conducted near the intersection of Black Oak Road and Cayutaville Road in 2009. (see DEIS, Appendix O) This study needs to be redone in the proximity of the new turbine locations as there are barns and trees in the proposed areas which could house bats in general, and endangered bats, in particular. This should be redone and included in the DSEIS since it is impossible to assess the true impact of the modified project on these areas.

2. Bat populations could certainly be expected to move several miles within 7 years. As the NYSDEC noted in their 2013 DEIS comments, "Bat acoustical monitoring took place only during August 24-October 9, 2009. This time frame does not cover the spring migratory, summer breeding or early fall swarming/migratory periods. Bats in NY are active April through October, and are particularly susceptible to impacts from turbines July through September. Acoustical monitoring should be a component of post-construction monitoring surveys." This should also be done and included in the DSEIS to ascertain that there are no potential impacts prior to commencing the project rather than simply picking up the dead bats after the project is in operation. There can be no substantive assessment of the impact on the bat population if there is no study on them in the local vicinity.

   There is also no real proposed mitigation except to participate in a post-construction study. If there are problems, how will the impact on birds and bats be mitigated? Possible solutions would be to shut down the turbines during critical times/seasons; however, no such mitigation measures are presented. If the mitigation includes shutting down or reducing operation of the turbines, how does this impact the benefit of project? A hard look requires knowing the potential trade-offs between adverse impacts on the local environment and residents versus the potential benefits of the green energy provided by the wind turbines.

3. The Fish and Wildlife Service also had many recommendations for the DEIS, but only after the close of the public comment period because they were not even notified. There is no mention of mitigation of bat fatalities by adjusting turbine cut-in speeds as recommended by the Fish and Wildlife Service. The Service also recommended radar studies to determine wildlife use of the project area which is of particular concern due to its location between two lakes and the nearby Connecticut Hill Wildlife Management Area among other nearby significant natural wildlife areas. Fish and Wildlife Service goes on to say, "no other wind energy projects have been constructed in a similar setting." Since at least 2 turbines are in completely new areas, a

new set of studies including bird surveys needs to be done.

4. The Post Construction Avian Bat Monitoring Study Plan (FEIS, Appendix P) specifies a search area of 125m x 125m under each turbine which doesn't even cover the extent of the turbine blades on the GE2.3-107. This is convenient for the wind farm operator as then there are fewer carcasses to be found due to being struck by the turbines and fewer carcasses means fewer impacts to have to explain. There is also no mention of an acoustic monitoring study post-construction as recommended by the Fish and Wildlife Service.

5. There were many recommendations by the Fish and Wildlife Service with regard to the DEIS and the FEIS, but it seems that many were simply disregarded up to and including the current DSEIS. The bottom line is that it appeared to that the Fish and Wildlife Service found that there was a general lack of data which does not appear to have improved with the latest DSEIS related to the Modified Project layout. The Town of Enfield needs to be sure that all of the relevant points are addressed before accepting the DSEIS for the Modified Project. In particular, the additional avian and bat studies must be done prior to producing an FSEIS.

6. The proposed assessment of Threatened and Endangered Species is to include in the FEIS the response of a letter to the New York Natural Heritage Program regarding threatened and endangered species in the Modified Project Site and in its vicinity. This is not an assessment of the environmental impact nor does it propose any mitigation. As discussed above, at minimum, an acoustic study needs to be conducted in the vicinity of Turbines B and C as well as Turbine A. These locations are a significant distance away from the original study location conducted in 2009 and both areas include features that would be conducive the habitation of bats including the endangered Long Eared Bat. This must be done before the DSEIS can realistically be considered complete or having taken a hard look at the environmental impact.

Shadow Flicker

1. The DSEIS shadow flicker study indicates that 30 hours per year is the typical threshold (not actually true, 30hrs/yr. is the typical MAX); however, there is no assessment of the daily amount of shadow flicker on all residences, in particular, my home or my neighbors on Rumsey Hill Road. Germany establishes a daily limit of 30min. of shadow flicker. No exact amount is indicated at my residence and due to the poor resolution of the shadow flicker maps it is difficult to make a reasonable assessment of the impact of flicker upon my home and property.

   There are any number of homes which do receive a very significant amount of shadow flicker. The study indicates that none will receive more than 30hrs per year; however, it never acknowledges that this assessment is based on a statistical model which makes assumptions such as to the wind direction (turbine orientation) and sunny days per year. It is very unlikely that the number of hours of shadow flicker will actually be what was modeled. In fact, it could be several times higher during any given year.

The only safe way to evaluate the impact is to assume that all days will be sunny and the turbines will be oriented in such a way that they produce maximum flicker to the receptor. Under that scenario, a number of the residents near turbines B and C will likely receive shadow flicker several times as much as predicted. A simple Google Sketchup model indicates that receptor CG could receive almost an hour of shadow flicker per day depending on the time of year. This would be considered completely unacceptable by German standards. Yet again, the true environmental impacts are not considered by the DSEIS and again, no mitigation is deemed necessary except for a complaint hotline. That is not mitigation.

NOISE

1. The noise study does not include updated ambient sound levels for the Modified Project areas. As noted in the attached reports by Les Blomberg, the DSEIS itself is significantly flawed with respect to its noise analysis. Not only does the DSEIS utilize an excessively high ambient noise figure, it makes numerous other errors which need to be corrected before the DSEIS can be considered to have taken a hard look at the at the environmental impact of noise.

2. It is also noted that there has been little assessment of the ambient noise on the eastern slope of Connecticut Hill. All but one of the measurements were done on the western slope which is where the prevailing winds tend to come from. Therefore it would seem likely that the western slope would be noisier due to any wind during sound monitoring. If this same measurement is used as the ambient noise level on the eastern slope, this will give the effect of an ambient noise level which is higher than it actually is. With 6 turbines within 1mi. of my home it is very conceivable that the noise level will be significantly higher than predicted, but the level above the reported ambient will be minimized by referencing to an inflated ambient measured from the west slope of Connecticut Hill.

3. There can be compounded effects depending upon the configuration of multiple turbines particularly if they line up in a row as that can have a significant effect on sound attenuation. The sound source becomes more like a line source which has a lower decay rate than is normally seen with a point source.[5] Of even more significance is the modeling used which is not accurate for a noise source more than 30m above the ground.[6] The computer simulations typically use this flawed model, but without access to the input data or the actual modeling, it is impossible to assess the accuracy of the modeling, thus is should be considered of no value.

4. With the addition of 2 turbines to the northwest of my home and one to the south, one would think that the specific noise level would be evaluated at my home. With 6 proposed turbines less than 1mi. from my home, it would be reasonable to think that it would receive a specific predicted noise level much like other receptors which are located at greater distances and in the

5 http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19910007366.pdf
6 Richard James, INCE, Enfield Wind Farm Advisory Committee Meeting Expert Testimony

noise band of similar or lower predicted noise levels. With 4 turbines located to the northwest of my home and the prevailing winds from the NW, it seems very likely that wind carried noise may be a particular problem for my family's home. Instead, there are many receptors delineated farther from the project, but to the northwest. This is very peculiar and might suggest plans to expand the wind farm in that direction in the future. Any such plans must be indicated. It should also be noted that a comparison of the DEIS and DSEIS noise contour maps shows that the noise at my property is likely to have increased by several dBA though again, the exact amount is difficult to ascertain due to the low resolution and lack of specific data.

5. The stated ambient noise level is an averaged A-weighted noise level which is not indicative of the very quiet nature of this rural area. Rural areas are typically much quieter than that. The figures should be much lower including down into the 20-30dBA range. If the monitoring was not done properly or was done when there was rain or wind (as was indicated at one point in the monitoring study) then the ambient noise levels will average out to be much higher than it should. These measurements should be redone during various seasons of the year to get a more accurate representation of the soundscape of the area. This should be done, included in the DSEIS and made available for public review and comment.

6. The claims are made that the LNTE blades will decrease the noise levels by 2dBA, but there is no indication what portion of the frequency spectrum is actually affected. Without any indication of the specific effect on the various portions of the noise spectrum, it is unclear whether this might actually cause more problems as it could push the noise into a range which is more problematic or otherwise objectionable.

7. All data is given in bands which average out any individual peaks that might be occurring at specific frequencies. Without the use of narrow band data across the frequency spectrum, it is difficult to assess whether there might be very high peaks at specific frequencies which might prove to be particularly annoying or harmful. A recent study by Cooper has shown that the wind turbine noise does have very distinct peaks particularly in the low frequency and infrasound range.[7] This data for the GE2.3-107 turbine needs to be included in the DSEIS and made available for public scrutiny, comment and use.

Infrasound and Vibration

1. There is no data included in the DSEIS regarding the sound power produced by the GE2.3-107. In order to make any reasonable assessment of the noise impacts or the modeling results, these data are absolutely necessary and the DSEIS should not be considered as completely reviewed until such time as that data is made available with appropriate time for scrutiny and use in modeling and simulations. The sound power needs to be included down into the <20Hz range

7 http://www.pacifichydro.com.au/english/our-communities/communities/cape-bridgewater-acoustic-study-report/?language=en

and measured in (Sound Pressure Level) SPL or C-weighted rather than A-weighted as A-weighting (audible weighting) the low frequency and infrasound ranges hides the true power in the air pressure waves which have been attributed to causing annoyance, sleep disturbance, and indirectly, if not directly, health related problems for individuals living more than a mile from industrial wind turbine facilities.

2. Wind developers generally dismiss the health risks of infrasound and low frequency noise as insignificant; thus, they generally not regulated or monitored.[8] In keeping, there is no evaluation in this DSEIS or DEIS of infrasound at all except to refer to a scientist who makes the claim that because individuals can not audibly hear infrasound produced by wind turbines, it will not be perceived by the individual. However, this has been shown to be incorrect based upon recent studies which monitored brain activity using EEG,[9] fMRI and MEG[10] while subjecting the individual to inaudible infrasound. Salt, et al., showed that there is a plausible pathway for infrasound to be perceived by the inner ear.[11] By directly quantifying the inner ear sensitivity to LFN through measurement of spontaneous otoacoustic emissions, another study demonstrated the potential for hearing damage as there is a significant discrepancy between perception and the risk potential of LFN.[12] Thus, there is no substantive reason to completely dismiss infrasound as a potential source of significant impact upon the environment around wind turbines. Information and studies need to be included in the DSEIS and evaluated properly. Mitigation measures need to be considered.

3. Infrasound is claimed by some to be a non-issue because modern wind turbines are upwind design versus downwind. A NASA/DOE/SERI study of 3 wind turbine configurations including downwind, upwind and vertical showed that all wind turbines produce infrasound although upwind is better than the other two configurations.[13] No mitigation is proposed except to coerce the residents into a Good Neighbor Agreement thereby giving up their rights. The use of a community outreach and communication plan does not provide an acceptable mitigation as there is no proposed resolution except to escalate any complaint that may arise up the chain of command within the company. With only an 800 number to call, this is not an acceptable form of mitigation. Real mitigation must be proposed and included in the DSEIS.

4. There is no assessment of the impact of larger turbine blades and likely slower rotation which pushes the infrasound frequency even lower. Residents near turbines A, B and C have the potential to be suffer adverse effects if only annoyance and sleep interruption as a result of the greater infrasound amplitude and lower frequencies generated by the larger blades. The

8 Stelling et al., 2015, s3.amazonaws.com/windaction/attachments/2510/Infasound__and_wind_turbines_final_version_4_August_2015.pdf
9 Kasprzak, 2014, http://psjd.icm.edu.pl/psjd/element/bwmeta1.element.bwnjournal-article-appv125n4a04kz
10 Bauer, et al., 2015, http://waubrafoundation.org.au/wp-content/uploads/2015/07/Bauer-et-al.-Investigation-of-Perception-at-Infrasound-Frequencies-by-MRI-and-MEG.pdf
11 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2923251/
12 http://rsos.royalsocietypublishing.org/content/1/2/140166
13 Hubbard, et al., http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19910007366.pdf

distance is less than 1mi. to my home and thus it is very possible that my home could be a significant receptor of the infrasound due to the lower rate of dissipation associated with lower frequency and longer wavelength of the generated noise.

5. Infrasound has been found to cause vibration in structures which can effectively amplify the pressure waves, thereby making the problem more significant inside structures than outside. Prof. Alan Hedges of Cornell U. indicates that vibrations in the frequency range of 0.5 Hz to 80 Hz have significant effects on the human body because of the natural resonance frequencies of the human body and its various parts or organs. The resonant frequencies can result in as much as a 350% amplification of the vibration depending on the frequency and location in the body (20 to 30 Hz between the head and shoulders). According to Prof. Hedges, whole body vibration may create chronic stresses and sometimes even permanent damage to the affected organs or body parts. Suspected health effects of whole body vibration include:[14]

   –Blurred vision
   –Decrease in manual coordination
   –Drowsiness (even with proper rest)
   –Low back pain/injury
   –Insomnia
   –Headaches or upset stomach

   As pointed out by the Kelley studies of 30 years ago, one of the significant issues was the sensation of vibrations in the structure of the affected homes.[15] There is evidence that the strong resonances found in the acoustic pressure field measured within rooms indicates a coupling of sub-audible energy to human body resonances at 5, 12, and 17-25 Hz, resulting in a sensation of whole-body vibration.[16]

   The Army investigated the potential health issues related to low frequency vibration based on their own studies of developing chick embryos (as a model for human embryos) and because of the potential health hazard restricted pregnant aviators from rotary-wing flying duties.[17] There is no acknowledgment or discussion of the potential impact of infrasound and whole body vibration much less a proposed mitigation. This impact should be considered in the DSEIS and mitigation proposed.

6. Another potential environmental impact which should be included in the DSEIS is an analysis of the coupling of vibrations from the wind turbine into the ground and propagation to residences. There are several sources of vibration including the machinery in the nacelle which would in general be of higher frequency in nature. If they couple directly to the bedrock, these vibrations could propagate for very long distances.

   An even more significant potential source of ground vibration is the natural resonant frequency

14 http://ergo.human.cornell.edu/studentdownloads/dea3500pdfs/whole-bodyvibration.pdf
15 http://www.nrel.gov/docs/legosti/old/3261.pdf
16 http://docs.wind-watch.org/kelley_ASME_1982.pdf
17 http://www.usaarl.army.mil/techreports/95-1.pdf

of the tower with the very heavy nacelle attached to the top. It acts much like a giant tuning fork when excited by wind. No analysis of what frequency this might resonate at is included. This is likely to be a very low frequency much like the infrasound. With the very low frequency and thus long wavelength, it is not inconceivable that the pressure waves could propagate for very long distances through the ground and/or bedrock. These traveling pressure waves could couple into the structures of residences through the foundation and cause structural vibration. Without an analysis of the natural resonant frequeny of these particular wind turbine and how they might propagate locally, it is very difficult to make a reasonable assessment of the impact. The impact of these vibrations on wildlife is not addressed in the DSEIS. This analysis should be developed, included and presented to the public for further scrutiny and comments.

Cumulative Impacts

1. The cumulative impacts are not correctly assessed. While the DSEIS indicates that 2 turbines are being completely relocated to 2 of 3 possible sites and one turbine (Turbine 5) is moving a small distance. The reality is that almost all of the turbines appear to be moving at least a small amount. In particular, turbine 6 is moving a small amount as shown in Appendix E, Summary of Cultural Resources Studies Relative to Modified Project Layout. A careful overlay of the project reveals that turbines 3 and 6 have moved by about the same amount whereas turbine 1 has moved by about half as much. So, what we have is a situation where virtually all of the components of this project have moved. So, either the project does not have an accurate site plan, or the developer is hiding the fact that they are moving the turbines to avoid conducting a more comprehensive environmental impact assessment. Again, since the developer fails to disclose the exact location of the turbines in the previous FEIS or the current DSEIS, it is easy for them to do so without anyone noticing it. The exact location data needs to be included and resubmitted to the public for scrutiny and comments.

2. The DSEIS states in section 2.12.1 that the Modified Project visual study area and the Approved Project study are essentially the same. The reality is that the north-to-south extent has increased from approximately 0.88 mi to 1.92 mi. (according to Google Earth, and depending on the configuration ultimately chosen for the project layout), this is over a 100% increase in potential visual impact when viewed from the east or west though primarily east.

3. The DSEIS compares the proposed modified project to other proposed or future projects, but it doesn't really look at the cumulative effect of the Modified Project itself. Due to the placement of turbines A and B in close proximity to each other as well as to turbines 1 and 3, the cumulative effect upon the nearby residents is likely to be very significant. In particular, properties R101 and R102 are virtually at a focal point or the intersection of where a straight line drawn through turbines A and B intersects with a straight line drawn through turbines 1 and 3. This focal point has the potential to result in several very significant impacts. This could

easily become a "heightened noise zone"[18] depending upon wind direction and prevailing atmospheric conditions as well as a point where shadow flicker is absolutely excessive.

Depending on the relative rotational speed, blade synchronization and distance between the turbines and the receptors, the combined effects could be completely intolerable. There is no discussion of this potential extreme impact nor are any possible mitigation factors presented or considered. If the worst case becomes reality, what mitigation would the developer propose? Would it shut down the turbines as necessary when conditions cause problems at those receptors? How much of the time will that be necessary? Depending upon the amount of lost production time, is the environmental impact of those turbines even worth the minimal benefit of the reduced energy production? What is the break even point and upon which side of the equation is the configuration currently fall? These hard questions need to be answered properly and exposed to public scrutiny and comment.

4. A similar, but not as extreme, situation occurs at 101 Rumsey Hill Road where there is an array of 6 turbines arranged from north-to-south which have the potential to cause multiple problems at my home. What are the answers to the cumulative problems and how might they be mitigated? I would like to hear answers to those questions before the modified project is approved.

5. There is no assessment of the potential impact of the cumulative mitigation measures on the projected output of the seven turbines. If mitigation measures necessitate the shutdown or reduction in output of some or all of the turbines at various times, what is the effect on power output of the project. If necessary mitigation measures reduce the energy output of the project by too much, then there comes a point when cost (environmental impact) of the project outweighs the benefit. No hard look at the cost-benefit relationship of the project is presented and considered where the break even point might be. At what point does this project fall in that analysis? Is it above the break even point or below it? At what point does mitigation push the cost-benefit equation to the point of being too costly to the local environment/residents to be of any use? The DSEIS needs to take a hard look at the environmental impacts and truly assess whether the benefits outweigh the costs. This needs to be presented to the public for comment.

6. The Modified Project does not include new core boring for the turbine foundation locations. This needs to be done to assess the geology for proper placement of the turbine foundation. Another issue is there is no indication that the previous core drillings were ever properly sealed in order to protect the water table. Left unsealed, there is now a direct path for surface contamination at numerous bore locations around the Black Oak area. This has the potential to be a very adverse environmental impact.

18 Thorne, et. al, https://www.acoustics.asn.au/conference_proceedings/INTERNOISE2014/papers/p599.pdf#page=1&zoom=auto,-12,843

Mitigation

1. Throughout the DSEIS, the proposed mitigation measures are very minimal and generally dismissive. The most prominent method of mitigation is to make an affected resident a project participant through a 'Good Neighbor Agreement' (GNA). While this might provide a minimal amount of monetary compensation for the affected residents, it is highly unlikely to cover significant medical expenses which might be incurred by residents who suffer health issues as a result of the proximity to the turbines. Also, since the GNA requires that individuals sign away their rights for minimal monetary benefits, it is essentially coercion.

2. In several cases, one mitigation simply utilizes the property of nonparticipants to provide the necessary safety zone around the turbines to gain protection from physical dangers such as ice throw or blade failure. This is not a proper form of mitigation, it is an uncompensated easement onto a neighboring property. The neighboring property owner is now forced to give up safe access and usable right to their property. Other means of mitigation must be developed or the turbines must be moved so as not to infringe upon the property rights of nonparticipating neighbors.

3. Until the DSEIS actually proposes useful and real measures of mitigation, the DSEIS cannot be considered complete or as having taken a hard look at the environmental impact and truly propose alternatives and/or mitigation measures. A hard look raises the real issues. A hard look then proposes alternatives or mitigation to those real issues. This DSEIS does not.

Community Character

The DSEIS indicates that “the Modified Project is not anticipated to result in any additional adverse impacts to growth and community character.” The DSEIS obviously did not consider the additional traffic on the community roads due to 'gawkers' visiting the community and likely trespassing on private property in order to get close to wind turbines. This effect will contribute to the already significant loss of a serene and private environment for which the proposed area is known. This quiet country setting is why many of the residents chose to live here. With the intrusion of large industrial wind turbines and the likely incursion of added road traffic and loss of privacy for the area residents, many of those residents will have lost a significant and important characteristic of their chosen community.

Summary

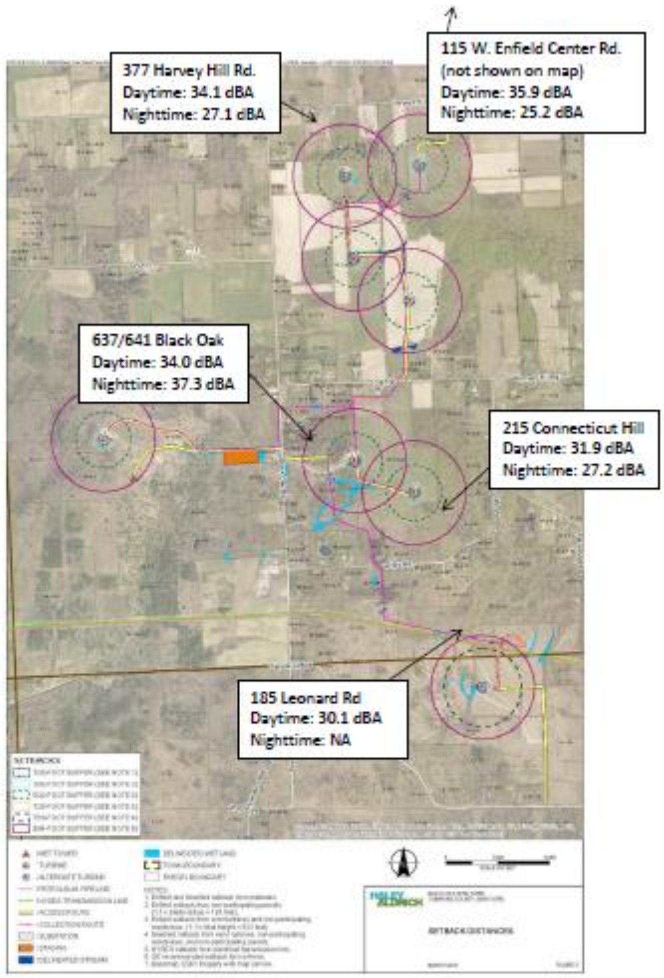
In summary, the DSEIS in its current form is cursory at best. Extensive consideration must be given to the various impacts and look at possible mitigation measures. Based on the cumulative changes to the entire project as well as the poor evaluation of the actual environmental impacts, the DSEIS should be completely revised to include the results of additional studies of the actual presence of and effects on wildlife including birds and bats. Real consideration should actually be given to the location of the turbines rather than just placing them at the location that seems to be feasible. It should also take a real look at the potential health and safety impacts of the turbines and where they are located relative to residents. The setback distances from those residents should be increased or some other method of mitigating the potential adverse health effects enlisted. If they cannot be located in the proposed locations while still maintaining the health and safety of the residents, then they need to be located somewhere else where the adverse effects will not harm residents.

Sincerely,

Marcus Gingerich

Marcus Gingerich, PhD

Ambient Sound Levels Near BOWF



April 22, 2016

Prepared by Les Blomberg, Noise Pollution Clearinghouse, PO Box 1137, Montpelier VT 05601

I. Introduction

On April 17th and 18th, 2016, ambient sound measurements were made in the vicinity of the proposed Black Oak Wind Farm (BOWF). Three of the five sites were chosen for their proximity to the newly proposed Turbines A, B, and C. The other sites are on property lines near Turbines 5 and 6, which have new locations since the FEIS was accepted. In addition, the character of the soundscape was observed.

II. Ambient Sound levels Near BOWF

Short term daytime and nighttime ambient sound measurements were made at five locations on April 17th and 18th, 2016. The test used the same 20 minute time frame used by HMMH and reported in the DEIS Appendix T. Measurements were made with a 3M Sound Pro sound level meter, serial number BLM060007. This meter meets ANSI Type 1 specifications. The sound level meter calibration was checked before, during, and after the measurements, using a Quest QC-10 Calibrator. The accuracy of both the sound level meter and the calibrator were checked by the manufacturer in April of 2016. A wind screen was used during measurements.

The measurements used the “A-weighted” frequency weighting, and the fast time response. The 20 minute Leq was recorded, as well as the maximum value, the L1, L10, L50, L90 and minimum values.

The measurement locations include:

- 637/641 Black Oak Rd.
- 115 Enfield Center Rd.
- 215 Connecticut Hill Rd.
- 185 Leonard Rd.
- 377 Harvey Hill Rd.

Figure 1 shows the locations of the noise measurements. The locations and noise Leq ambient levels are shown superimposed on Figure 5 of the DSEIS.

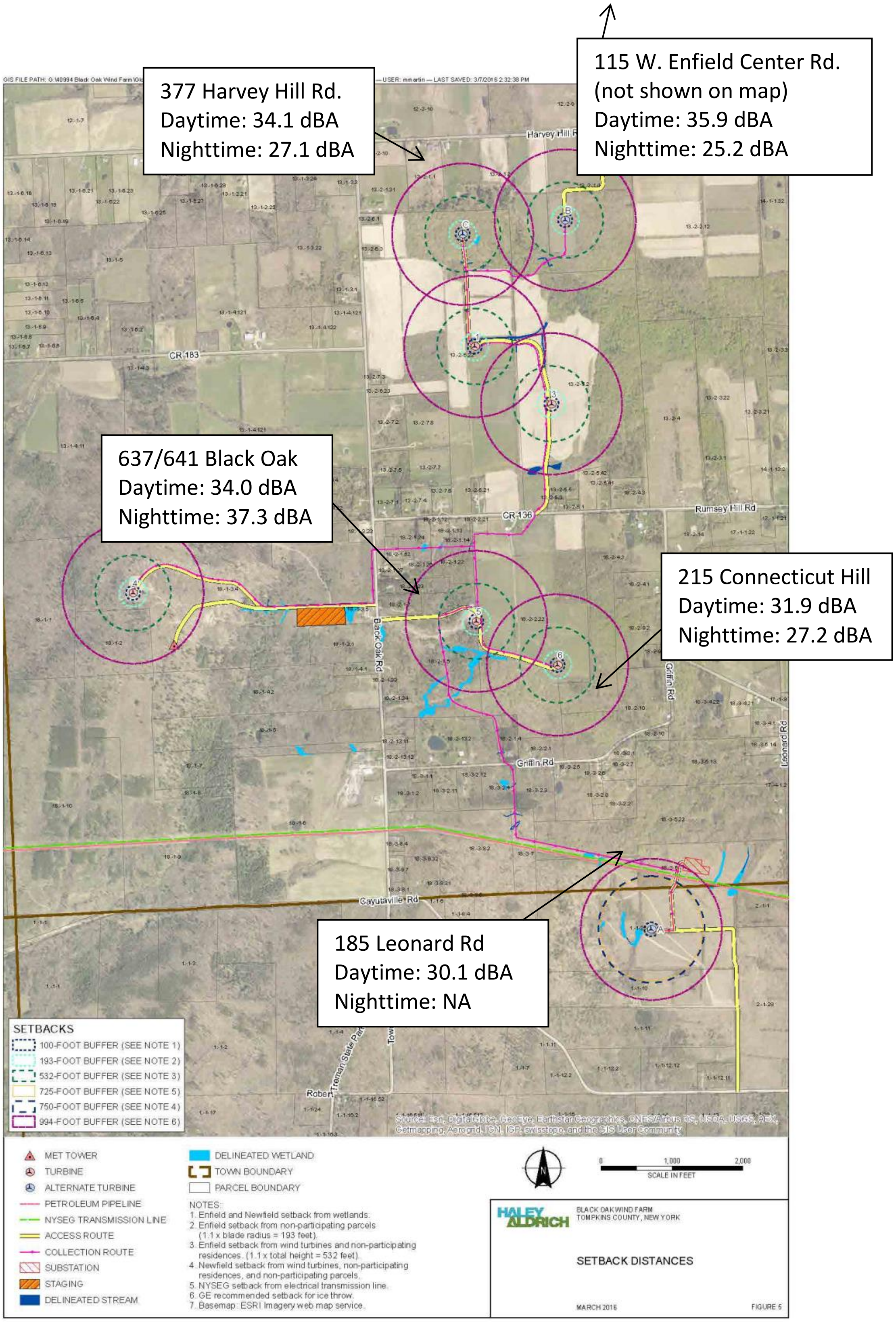


Figure 1: Approximate Measurement Locations

Figure 2 shows the measurement results.

Daytime								
Location	**Date and Time**	**Leq**	**Lmax**	**L1**	**L10**	**L50**	**L90**	**Lmin**
637/641 Black Oak Rd.	4/17/16 16:00	34.0	54.6	45.7	35.4	28.5	24.2	21.4
115 W. Enfield Center Rd.	4/18/16 11:45	35.9	58.0	47.4	38.4	29.3	25.0	21.5
215 Connecticut Hill Rd.	4/18/16 11:00	31.9	58.1	43.7	33.1	27.4	23.3	19.4
185 Leonard Rd.	4/18/16 9:55	30.1	41.3	35.4	32.6	29.3	24.3	21.7
377 Harvey Hill Rd.	4/17/16 17:10	34.1	53.3	42.0	36.9	31.4	29.1	27.2
Nighttime								
637/641 Black Oak Rd.	4/17/16 22:45	37.3	43.5	39.6	38.4	37.1	35.7	NA
115 W. Enfield Center Rd.	4/17/16 23:45	25.2	46.2	37.1	26.9	20.7	18.8	15.6
215 Connecticut Hill Rd.	4/17/16 21:15	27.2	48.1	36.5	27.5	25.2	23.6	21.6
185 Leonard Rd.	NA							
377 Harvey Hill Rd.	4/17/16 22:10	27.1	49.4	33.4	29.6	25.5	19.9	14.2

Figure 2. Ambient Sound Levels

The Leq is the "level equivalent" or average level for the period. The Lmax is the maximum value recorded. The L1 is the level exceeded 1% of the time. The L10 is the level exceeded 10% of the time. The L50 is the level exceeded 50% of the time; it is the median value. The L90 is the level exceed 90% of the time. The Lmin is the minimum value recorded. The L90 is often used as the background level because it excludes transient noises. It is more representative of the ambient because it excludes short term events such as a bird chirping nearby, which are more dependent on the nearness of the bird to the meter than the actual ambient in the area.

III. Character of the Area and Soundscape

The measured ambient sound levels were representative of a rural soundscape remote from large roads. The dominant ambient sounds were natural sounds such as wind in the trees, birds, and frogs. Intermittent sounds included vehicles on roads, jets overhead, and barking dogs. For the most part, however, the ambient level depended on how close the microphone was to a natural noise source. For example, the 58.0 dBA Lmax at the 115 Enfield Center location was due to a bird in a nearby tree. The elevated nighttime levels at the Black Oak location were due to frogs nearby. The one-third octave measures from the Black Oak location clearly show very large spikes in the 2.5 KHz and 3.15 KHz ranges.

The measurements are similar to the 20 minute measurements taken by HMMH for the DEIS. With the exception of the frogs at the Black Oak Rd. location, the nighttime measurements are very similar, between 25 and 30 dBA Leq. The daytime measurement range was about 5 dBA higher in the HMMH study. (It should be noted that the HMMH study subtracted the contribution of the frogs from the data, but the NPC study did not.)

Table 1 – Noise Monitoring Results at Short-term Measurement Sites

Site	Address	Start Time (24-hour)	Duration (min)	Lmax	Lmin	Adj Leq
				(dBA)		
Nighttime						
ST-1	655 Black Oak Rd.	3:10	20	29.9	21.3	25.3
ST-2	283 Connecticut Hill Rd.	3:40	20	44.3	22.7	30.0
ST-3	122 Giffin Rd.	4:40	20	33.4	27.5	29.1
ST-4	Black Oak Rd. at Cayutaville Rd.	5:10	20	36.5	23.6	26.1
Daytime						
ST-1	655 Black Oak Rd.	12:00	20	50.7	28.8	36.5
ST-2	283 Connecticut Hill Rd.	12:40	20	63.0	29.0	40.6
ST-3	122 Giffin Rd.	13:20	20	52.7	36.7	37.4
ST-4	Black Oak Rd. at Cayutaville Rd.	14:00	20	60.9	34.2	39.4

Figure 3. Short Term Ambient Measurements from the DSEIS Appendix T.

IV. Implications for the DSEIS

The ambient sound level data has a number of implications for the DSEIS. These include:

- Natural sounds dominate the existing soundscape. This has important implications for the DSEIS assessment of the character of the area and the impact of turbine noise on the character of the area and soundscape.
- This data provides the only ambient sound levels submitted for the DSEIS concerning the ambient sound levels near property lines affected by the new or moved turbines.
- This data provides the only ambient sound level submitted for the DSEIS concerning the ambient sound levels near the newly proposed Turbines A, B, and C.
- The ambient sound levels do not support the use of 39.8 dBA as the ambient noise level from which to judge increases in noise over ambient in the DSEIS.
- The wind turbines increase the noise at the 4 locations for which modeling data is available by more than 6 dBA.

The increase in noise at the measurement locations due to the wind turbines is shown in Figure 4. In Figure 4, the ambient sound levels are subtracted from projected noise levels shown on Figures 1, 2, and 3 of Appendix H of the DSEIS. The increase at the specific locations ranges from approximately 15 to 28 dBA.

Daytime				
			DSEIS	Increase
			Modeled	Above
Location	**Date and Time**	**Leq**	**Level**	**Ambient**
637/641 Black Oak Rd.	4/17/16 16:00	34.0	52	**18.0**
115 W. Enfield Center Rd.	4/18/16 11:45	35.9	NA	
215 Connecticut Hill Rd.	4/18/16 11:00	31.9	55	**23.1**
185 Leonard Rd.	4/18/16 9:55	30.1	45	**14.9**
377 Harvey Hill Rd.	4/17/16 17:10	34.1	53	**18.9**
Nighttime				
637/641 Black Oak Rd.	4/17/16 22:45	37.3	52	**14.7**
115 W. Enfield Center Rd.	4/17/16 23:45	25.2	NA	
215 Connecticut Hill Rd.	4/17/16 21:15	27.2	55	**27.8**
185 Leonard Rd.	NA		45	
377 Harvey Hill Rd.	4/17/16 22:10	27.1	53	**25.9**

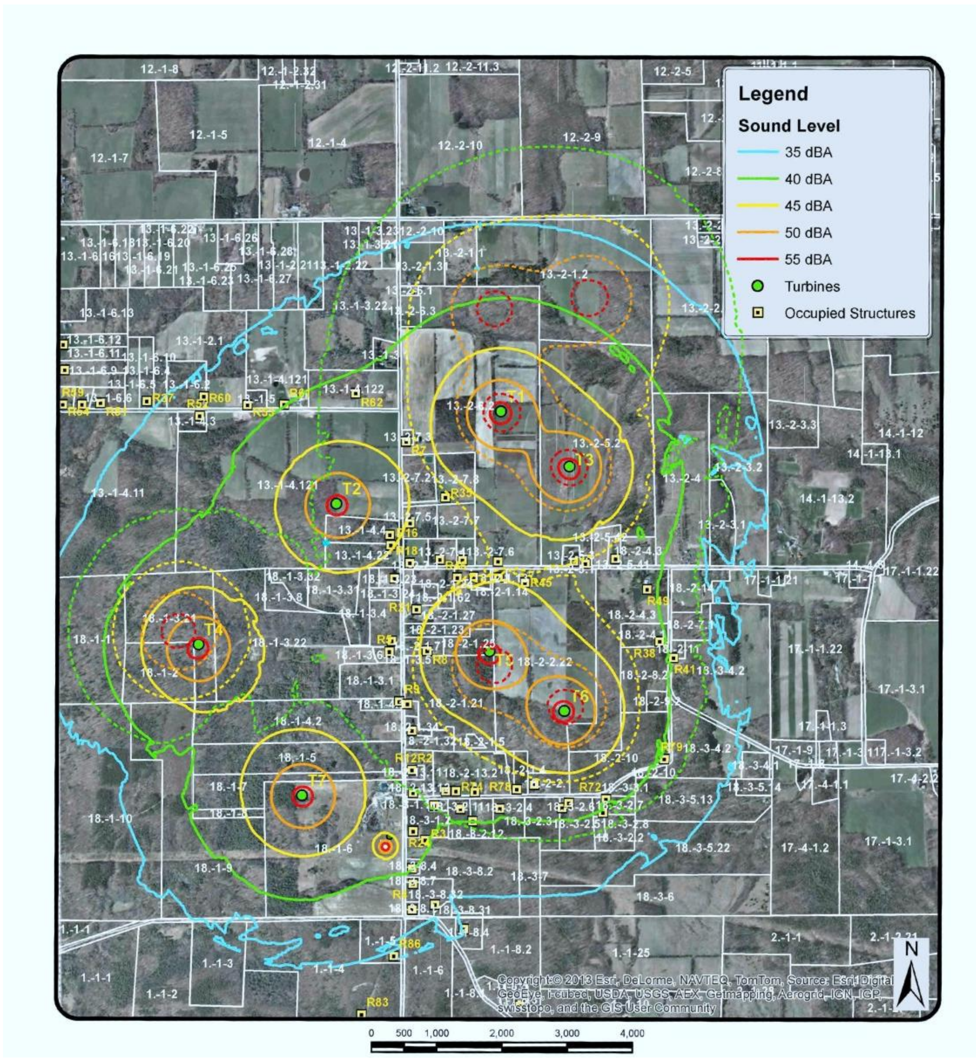
Figure 4. Increase Above Ambient Due to BOWF

Conclusion

The ambient sound levels measured by the Noise Pollution Clearinghouse are similar to those measured by HMMH, particularly in the nighttime. They are consistent with a quiet rural soundscape remote from large roads.

Note: The methods and data used in this report are not secret or proprietary. We would hope that the Town Board/BOWF would share with us the modeling and monitoring data we requested, and provide us additional time to analyze the data and comment on the DSEIS. We would be happy exchange data with the Town Board/BOWF as well as address further questions the Town Board might have.

Critique of the Noise Analysis of the Draft Supplemental Environmental Impact Statement for the Black Oak Wind Farm



April 20, 2016

Prepared by Les Blomberg, Noise Pollution Clearinghouse, PO Box 1137, Montpelier VT 05601

Contents

Introduction

This report is a critique of noise analysis in the Draft Supplemental Environmental Impact Statement for the Black Oak Wind Farm (DSEIS), submitted on February 22, 2016, and the noise appendix, Appendix H of the DSEIS. To the extent that the DSEIS relied upon the prior Final Environmental Impact Statement (FEIS) and Appendix K, and the Draft Environmental Impact Statement (DEIS) and Appendix T, those are also critiqued.

The report is divided into 12 parts (I-XII) and it describes how the DSEIS failed to take a hard look at the noise impacts of the Black Oak Wind Farm (BOWF). The DSEIS failed to thoroughly analyze turbine noise for significant adverse impacts and failed to support its determination of no significant impact. Specific problems include:

1. The DSEIS failed to actually assess noise impacts of the project. Part IV.
2. The DSEIS failed to assess noise with respect to local laws. Part V.
3. The DSEIS incorrectly compared its noise data to the New York State Department of Environmental Conservation (NYSDEC) SEQRA Criterion of Significance. Part VI.
4. The noise modeling the DSEIS used is unreliable. Part VII
5. The noise monitoring the DSEIS used is unreliable. Part VIII

The DSEIS failed to analyze BOWF with respect to its own proposed tests of significant noise impacts (Parts V-VI). Had it correctly done that analysis, it would have concluded that the project has significant noise impacts (Parts IX-XII).

Before examining the specific ways in which the DSEIS failed to take a hard look at the noise impacts of BOWF, it is important to understand noise pollution (Part I), the rural context of the existing acoustic environment (Part II) and the unique character of wind turbine noise (Part III).

I. Understanding Noise and Noise Pollution

Noise: a sound that interferes with a task, function, process, health or wellbeing; a sound that is inharmonious or out of place

The term noise has multiple definitions because it has multiple uses. We use noise to describe a large range of sounds, including very loud sounds that cause hearing loss (a threat to well-being), sounds that are too loud (out of place or inappropriate), and quiet sounds that are distracting, such as a dripping faucet in a quiet home or a distracting buzz. Even these quieter noises might also interfere with well-being because they might interfere with falling asleep or concentration.

The word "noise" is derived from the Latin word "nausea," meaning "seasickness." As its derivation suggests, noise has many unpleasant and harmful effects. It can cause hearing loss, stress, high blood pressure, sleep loss, lost productivity, and a general reduction in the quality of life and opportunity for personal and collective tranquility. It can interfere with communication and activities. Noise triggers the fight or flight response, resulting in stress related changes to our body.

Noise is an objective pollutant. It can be quantified and has known and quantifiable effects.

People discussing noise often refer to a phenomenon called habituation, and mistakenly assume people get used to noise. This is not the case. Some people do habituate to some noises, just as some people can get used to living with a yard full of litter. Habituation, however, is by no means universal. Also, habituation always comes at a cost. The underlying physiological changes in one's body, including stress related hormones, blood chemistry, etc, occur in the presence of noise, whether or not the listener is aware of them or habituated to them.

Noise sensitivity can also develop with repeated exposure to noise, resulting in a heightened awareness of the degradation of the soundscape and its effects on people.

Noise Pollution: A Noise Emitted into the Environment

In general, noise and its effects are imposed more directly on one's neighbors than the effects of acid emissions or CO_2, which are imposed at a greater distance (both temporally and spatially) and in a more generalized, societal manner. Since the impact of noise tends to be more localized than many other pollutants, noise pollution tends to have more in common with second-hand smoke and litter than, for example, acid rain or global warming. It helps to think of noise pollution as both second-hand sound and audible trash.

Noise is second-hand sound. Like second-hand smoke, second-hand sound, is a waste product of the activities of others, emitted into the environment—into the air. It negatively effects well-being, yet is emitted without the consent of the recipient.

Noise is audible trash or aural litter. Noise is to the soundscape as litter is to the landscape. It is the aural equivalent of McDonalds wrappers strewn around the environment. If one pays attention, one will realize there is much more audible litter than there are cans, bottles, paper, etc, littering our landscape. If we could see our soundscape, particularly the urban soundscape, it would look like a landfill.

When Is Noise Pollution a Problem?

There are a number of acoustical factors influencing people's response to noise and their ability to tolerate it. The most important of these includes the loudness of the noise, the character of both the noise and the neighborhood, whether it is heard in the home, and whether it interferes with activities, communication or sleep.

Noise does not occur in a vacuum, both literally and figuratively. There are always political, social, economic and psychological aspects of noise problems. Consequently, several non-acoustical factors associated with noise also shape how well people tolerate noise.

The most important of these is the reciprocity of the noise—whether the neighbors impose the same types and amount of noise on each other. Also very important are people's ability to control the noise and their attitude toward the noise source. Finally, people have varying sensitivity to noise, and people who are more noise sensitive will more likely react negatively to noise.

II. Quiet Is the Expectation in Rural Areas

Character of the neighborhood (quiet, rural, suburban, urban, etc.) can be one of the best indicators of the extent of a problem caused by intruding noise. The nature of the soundscape and the expectations of people who live there significantly shape people's reaction to noise.

In a soundscape with a quiet background, noise is much more intrusive. A 55 decibel noise, which might be around the background level in an urban area near roadways, could be 30 decibels above the background in a rural setting. As a rough approximation, each 10 decibel increase is a doubling of the loudness,[1] so the noise would dominate the soundscape, being 8 times louder than the background.

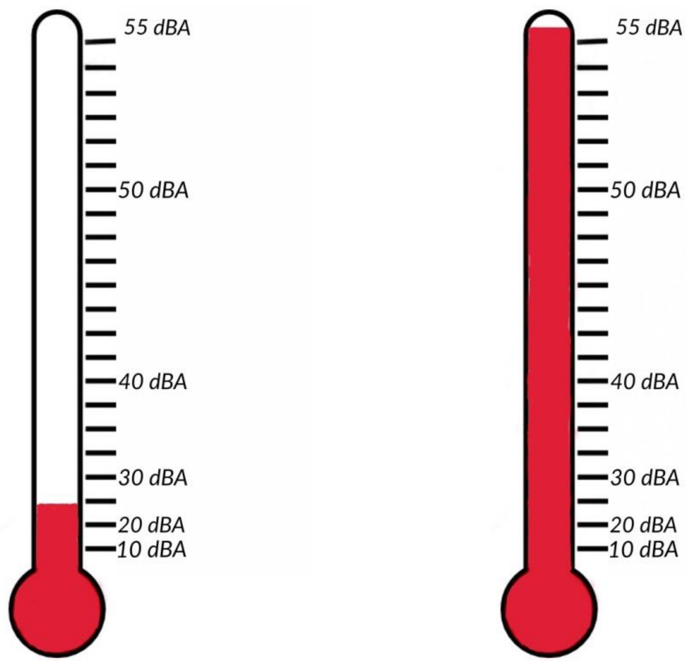


Figure 1. Graphic Noise Thermometer

The noise thermometer shows that the loudness of noise doubles with each 10 dBA increase in the noise level. The noise on the left is 25 dBA, a common level for a rural area at night. The noise on the right is 55 dBA. It is 8 times louder than the 25 dBA noise. A 45 dBA noise would be four times as loud. A 45 dBA or 55 dBA noise would absolutely dominate a rural nighttime soundscape.

The other factor important in the character of the neighborhood is the community's expectation. Rural communities tend to have a greater expectation of and place a greater value on quiet. An ISO noise standard notes that this expectation for quiet can account for a 10 decibel difference in reaction to noise.

The figure below provides the results of an interesting study that confirms the expectation for peace and quiet in rural areas. The number one expectation of rural living, among urban, suburban, and rural residents is that rural areas are quiet.

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[1] EPA, 1981, Noise Effects Handbook, 7-2.

Item	Rural (N=571)[a]			Urban (N=384)			Suburban (N-284)		
	Agree	Undecided	Disagree	Agree	Undecided	Disagree	Agree	Undecided	Disagree
Rural life brings out the best in people.	63.2	20.8	15.9	46.5	27.2	26.4	48.9	26.4	24.6
Rural families are more close-knit and enduring than other families.	71.6	13.0	15.4	61.2	11.7	27.1	66.7	11.3	22.0
Because rural life is closer to nature, it is more wholesome.	85.6	7.2	7.2	73.7	8.1	18.2	72.9	7.7	19.4
Rural communities are the most satisfying of all places to live, work and play.	68.8	13.7	17.5	39.8	18.0	42.2	43.7	13.7	42.6
Rural people are more likely than other people to accept you as you are.	65.7	13.1	21.2	53.4	14.6	32.0	51.4	13.7	34.9
Neighborliness and friendliness are more characteristic of rural communities than other areas.	77.7	8.8	13.5	69.0	11.2	19.8	64.8	10.9	24.3
Life in rural communities is less stressful than life elsewhere.	69.3	8.1	22.6	60.7	8.6	30.7	63.0	8.8	28.2
There is less crime and violence in rural areas than in other areas.	73.4	8.1	18.6	67.4	9.7	23.0	70.8	10.6	18.7
Rural areas have more peace and quiet than do other areas.[b]	**94.6**	**1.9**	**3.5**	**89.3**	**3.4**	**7.3**	**91.9**	**1.8**	**6.3**

a Number of cases varies slightly from item to item due to missing data.
b Emphasis added.

Table 2. Responses in percent from rural, urban and suburban residents to items dealing with positive images of rural life (after Willits *et al.*, 1990).

Schomer, 2001, Assessment of Noise Annoyance, 27

Figure 2. Expectation of Quiet in Rural Areas

Character of the neighborhood played a central role in the EPA's development of a 55 dBA criterion. This is because their data on the community response to noise was essentially unusable before the noise levels were adjusted or normalized to an *urban residential neighborhood*.

Figure 3 below shows the EPA data on community response to noise, before it was normalized. You can see that a noise level that falls below 50 dBA might result in no reaction or widespread reaction. A noise between 50 dBA and 60 dBA might cause no reaction, sporadic complaints, widespread complaints, or several threats of legal action. There appears to be little relationship between noise level and community response.

The problem was that the EPA data focused solely on the source noise and not the existing noise level and expectation of the community. When the EPA took that existing soundscape into account, the results were much better. In this case there is a clear relationship between increasing noise and increasing community response. See Figure 4.

The EPA had to adjust or normalize its data to an urban residential situation. The adjustments to the data that the EPA made are given in Figure 5. Quiet suburban or rural communities were adjusted 10 decibels; normal suburban communities were adjusted 5 decibels. In addition, communities with no prior experience with intruding noise were adjusted another 5 decibels.

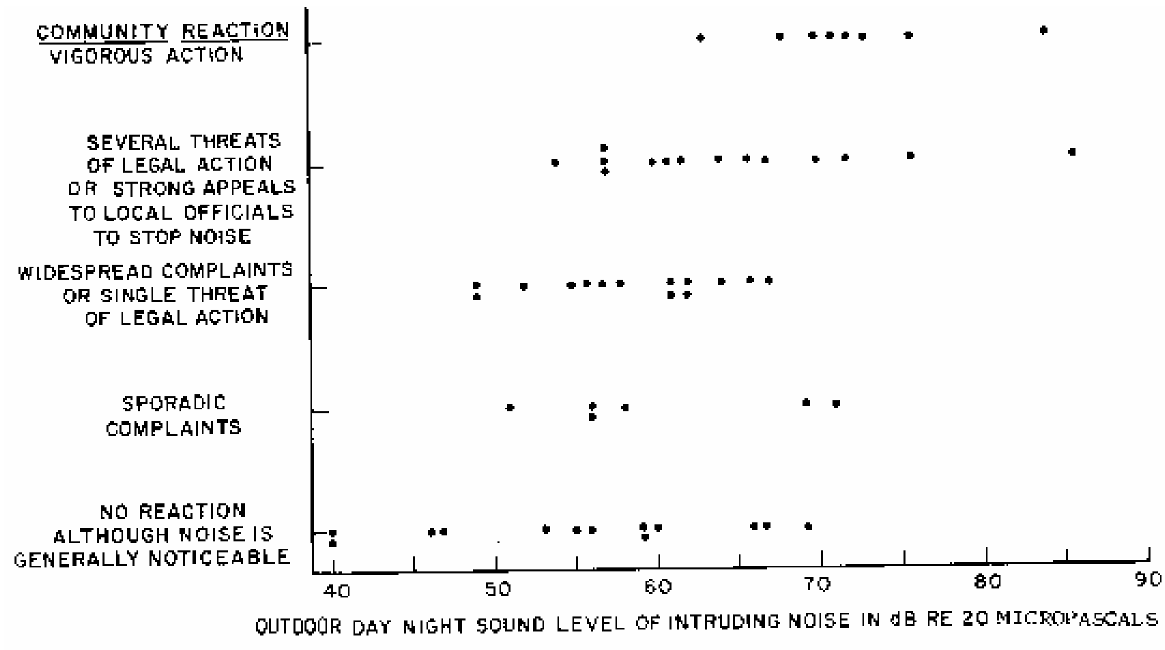

Figure 3. EPA Data: Community Reaction vs Sound Pressure Level. (Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, EPA, 1974).

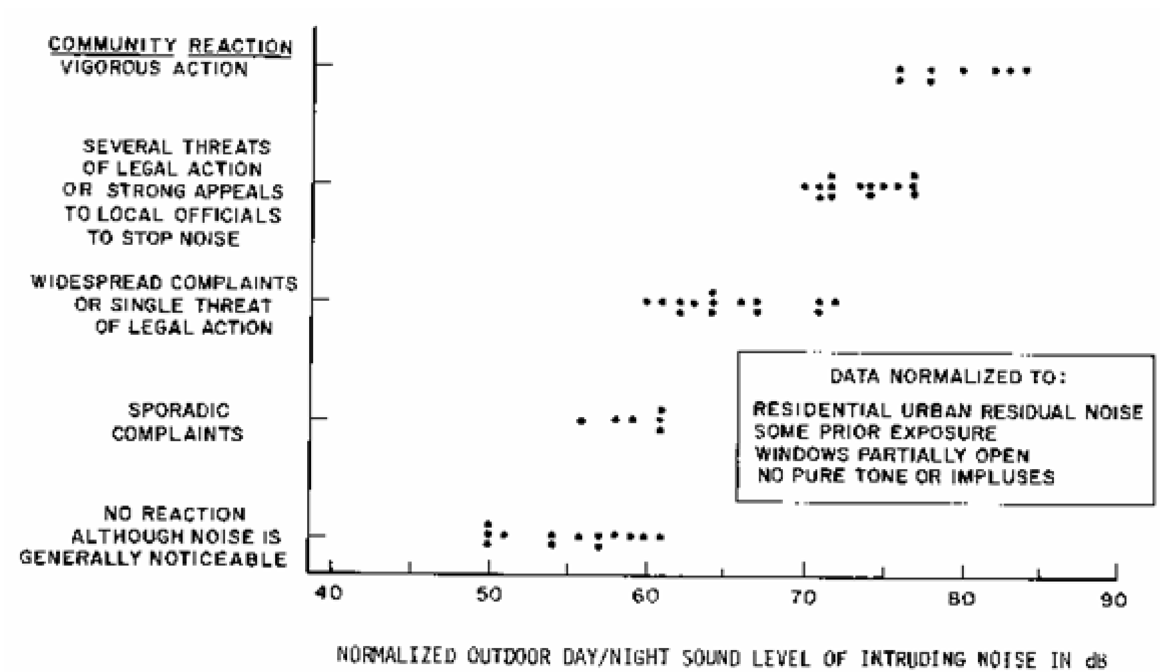

Figure 4. EPA Data: Community Reaction vs Sound Pressure Level. (Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, EPA, 1974).

CORRECTIONS TO BE ADDED TO THE MEASURED DAY-NIGHT SOUND LEVEL (L_{dn}) OF INTRUDING NOISE TO OBTAIN NORMALIZED L_{dn}

Type of Correction	Description	Amount of Correction to be Added to Measured L_{dn} in dB
Seasonal Correction	Summer (or year-round operation)	0
	Winter only (or windows always closed)	-5
Correction for Outdoor Noise Level Measured in Absence of Intruding Noise	Quiet suburban or rural community (remote from large cities and from industrial activity and trucking)	+10
	Normal suburban community (not located near industrial activity)	+5
	Urban residential community (not immediately adjacent to heavily traveled roads and industrial areas)	0
	Noisy urban residential community (near relatively busy roads or industrial areas)	-5
	Very noisy urban residential community	-10
Correction for Previous Exposure & Community Attitudes	No prior experience with the intruding noise	+5
	Community has had some previous exposure to intruding noise but little effort is being made to control the noise. This correction may also be applied in a situation where the community has not been exposed to the noise previously, but the people are aware that bona fide efforts are being made to control the noise.	0
	Community has had considerable previous exposure to the intruding noise and the noise maker's relations with the community are good	-5
	Community is aware that operation causing noise is very necessary and it will not continue indefinitely. This correction can be applied for an operation of limited duration and under emergency circumstances.	-10
Pure Tone or Impulse	No pure tone or impulsive character	0
	Pure tone or impulsive character present	+5

Figure 5. EPA Normalization Factors (EPA, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, 1974).

The EPA recommendation of 55 dBA which is found in the NYSDEC criterion of significance, is a recommendation for urban residential neighborhoods. For Enfield, New York, one would subtract 10 dBA from 55 because it is a quiet rural area, 5 dBA because it has no prior experience with wind turbine noise, and 5 dBA because of the character of turbine noise. A noise level of 35 dBA is necessary to protect the rural area using the EPA data.

The more important criterion of significance in the NYSDEC document is the 6 dBA increase criterion. The EPA noted that, "The data in Figure D-7 [Figure 4 in this report] indicates that widespread complaints may be expected when the normalized value of the outdoor day-night sound level of the intruding noise exceeds that existing without the intruding noise by approximately 5 dB, and vigorous community reaction may be expected when the excess approaches 20 dB. The standard deviation of these data is 3.3 dB about their means and an envelope of +5 dB encloses approximately 90 percent of the cases. Hence, this relationship between the normalized outdoor day-night sound level and community reaction appears to be a reasonably accurate and useful tool in assessing the probable reaction of a community to an intruding noise and in obtaining one type of measure of the impact of an intruding noise on a community." (EPA, 1974, D-20.)

III. Wind Turbine Noise is Different from Other Noise Sources

Wind turbine noise is different from traditional noise sources. Wind turbine noise elicits reactions that are more commonly associated with much higher sound pressure levels.

Some of the factors that make wind turbine noise unique are listed below.

- Wind turbines are an overhead source. Overhead sources are difficult or impossible to block with barriers, and they enter houses both from above and the sides, often requiring more insulation.
- Wind turbine noise is often more prominent in the evening and nighttime. Typical noises tend to better correlate with when people are working. Wind turbine noise often is not masked by wind due to wind gradients (low ground wind speeds but higher turbine height wind speeds).
- Wind turbine noise is unpredictable. People cannot know ahead of time when the noise will be present, so that they can plan around the noise.
- Wind turbine noise is not reciprocal. Typical rural noises have no impact on wind turbines, but wind turbines impact rural life.
- Wind turbine noise is unique and unusual in a rural environment. There is nothing equivalent to it.
- Wind turbine noise is not constant. It has a time varying component that various people have described as beating, swishing, or thumping.
- Wind turbine noise has a low frequency that more easily penetrates homes.
- In rural areas, wind turbines are audible at a greater distance than almost every other rural noise source.

That wind turbine noise is different from other noise sources can be seen from studies of individual reactions to noise. Annoyance[2] from wind turbine noise has been studied and dose-response relationships (the quantification of how impact increases as the noise increases) for turbine noise has been developed by Pedersen and Waye, as well as other researchers. The salient aspect of this research is that the dose-response curve for wind turbine noise is much steeper than for other noise sources. For the same noise level, people find wind turbine noise much more annoying than other noise sources such as road noise or aviation noise. This is due to the unique characteristics of wind turbine noise and possibly the interaction with visual impacts that may draw people's attention to the turbine noise.

Pedersen's 2004 paper published in the Journal of the Acoustical Society of America, the premier journal in the field, compares the dose-response curves for turbine noise and other noise sources, and is shown in Figure 6.

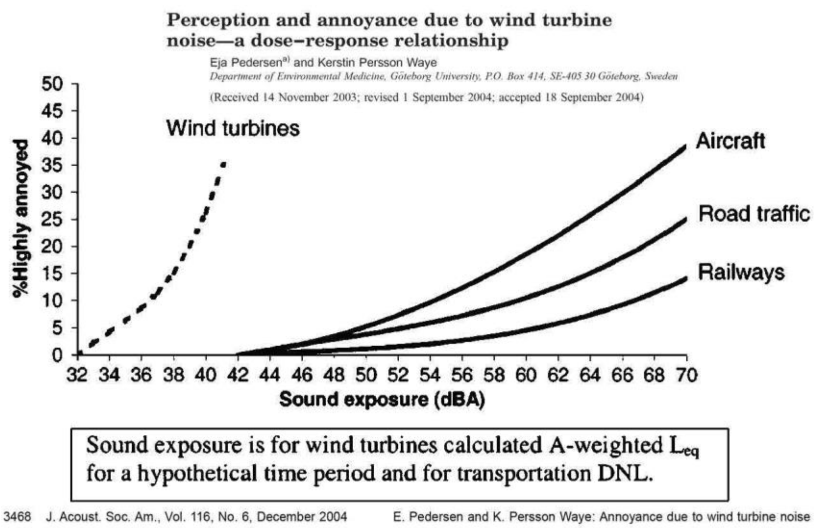

Figure 6. Wind Turbine Noise Elicits a Greater Response at Lower Noise Levels than Other Noise Sources

It is clear from Figure 6 that wind turbine noise is very different from other noise sources: it is much more annoying and at lower noise levels than other noise sources. Consequently, to protect the public from the effects of wind turbine noise, much lower noise limits are needed.

[2] The primary measure of noise effects on humans for the last 60 years has been annoyance. Annoyance is perhaps the most easily studied noise effect, and until the advent of the documentation of health effects related to noise in the 21st century and the release of World Health Organization's Burden of Disease from Environmental Noise in 2009, annoyance was the best metric to quantify noise effects. Annoyance acts as a composite measure of human response to specific health and other effects of noise. People who, for example, suffer sleep interference, communication interference, activity interference, or stress related effects will likely report that they are annoyed by noise. People are annoyed because of specific effects of noise they experience.

IV. Critical Questions the DSEIS Noise Analysis Failed to Answer

An environmental assessment is an evaluation of the known or potential environmental consequences of a proposed action. According to the SEQRA Handbook, “The draft EIS is the primary source of environmental information to help involved agencies consider environmental concerns in making decisions about a proposed action. The draft also provides a basis for public review of, and comment on, an action's potential environmental effects. The draft EIS accomplishes those goals by examining the nature and extent of identified potential environmental impacts of an action, as well as steps that could be taken to avoid or minimize adverse impacts.” (SEQRA Handbook, 117.)

Noise, as discussed in Part I above, has a host of impacts. The problem is that the DSEIS didn’t identify any relevant areas of environmental concern related to noise,[3] didn’t thoroughly analyzed them for significant adverse impact, and provided no reason for ignoring the environmental impacts of noise.

Figure 7 lists impacts of noise that were not considered in the DSEIS and were not analyzed in the DSEIS. A red X means the question was not addressed; green check means it was addressed, and a very small green check means it was somewhat addressed. What is truly striking is that these were not even addressed in the Noise Appendix H of the DSEIS.

Noise Impacts Not Investigated in the DSEIS

NOISE IMPACT THAT SHOULD HAVE BEEN INVESTIGATED	Investigated in DSEIS?	Investigated in APP. H?
How will the turbine noise change the character of the area?	✗	✗
Where will turbines be audible?	✗	✗
Where will turbine noise dominate current ambient conditions?	✗	✗
Will neighbors be able to escape the noise by going indoors?	✗	✗
Where will turbines be audible inside homes?	✗	✗
Where will the noise be annoying? Highly annoying?	✗	✓
Where will the noise interfere with outdoor activities or their enjoyment?	✗	✗
How will the community react to the turbine noise?	✗	✗
Predicted response based on EPA's *Levels Document,* Table D-7?	✗	✗
Will the noise change the acceptable uses of neighbors’ properties?	✗	✗
Where will lands be unsuitable for future residential use?	✗	✗
Where will health impacts of noise occur?	✗	✗
Cardiovascular/stress related effects?	✗	✗
Sleep interference, awaking, sleep stage changes, difficulty falling asleep?	✗	✗
Secondary sleep interference effects such as fatigue, reduced performance, irritability?	✗	✗
Decreased helping behavior and increased aggressive behavior?	✗	✗
Decreased performance?	✗	✗
What will be the noise effects on wildlife and where will they occur?	✗	✗
Will infrasound from the turbines cause impacts?	✗	✗

Figure 7. Noise Impacts Not Investigated in the DSEIS.

[3] The DSEIS did mention “annoyance,” but only in passing, and only with respect to noise in the 31.5 and 63 Hz frequency bands.

It is not reasonable to ignore noise impacts, including health related impacts, in a DSEIS noise analysis. The point of the EIS process is to identify impacts early in the DSEIS process and to disclose them to the public, so that they can be mitigated if needed. This is not a problem that can be addressed by adding a couple paragraphs to the FSEIS, because the impacts would have been hidden from the public until the final moment when the public can no longer comment or participate. A new DSEIS is needed to address these impacts.

V. DSEIS Fabricated a Local Regulatory Standard and Made a Mess of the Local Standard Assessment

As noted in Part IV above, the DSEIS did not analyze or even mention noise impacts, or any criteria of significant impact related to any specific noise impact. Instead, the DSEIS relied on the local wind law and the NYSDEC criterion of significance. Part V shows that the DSEIS botched the local standard noise analysis. (The critique of the NYSDEC criterion of significance analysis is found in Part VI below.) The crux of the problem related to the DSEIS, FEIS, and DSEIS treatment of the local regulatory noise limit is that these documents used as a test for significant adverse environmental impacts a criterion that is entirely fabricated. The result is that the DSEIS noise assessment is fatally flawed and needs to be corrected **before** the DSEIS can take a hard look at the noise impacts.

The DSEIS states that "[t]he criteria against which to compare the predicted noise from the Modified Project to determine if any significant adverse environmental impacts might result include the local regulatory noise limits ….The same assessment criteria described in the DEIS for the Approved Project were applied to the Modified Project…." (DSEIS, 37.)

Note that the DSEIS didn't specifically say what the Enfield regulatory noise limit in is in the DSEIS noise analysis. Appendix H of the DSEIS states: "The Town of Enfield's Local Law Number 1 of 2009, entitled 'Wind Energy Facilities Local Law' sets a sound limit of 60 A-weighted decibels (dBA) at the nearest Non-Participating residence." (DSEIS, Appendix H, 1.) Table 13 on page 21 of the DSEIS states that sound levels "[s]hall not exceed 60 decibels at nearest offsite residence." Neither of these statements, however, is true. The standard in the DSEIS is completely fabricated.

The **real** local regulatory limit can be found in Local Law Number 1 of 2009, tilted "Wind Energy Facilities Local Law." Section 17 reads as follows:

> Sound Levels and WTG Setbacks. The following standards and requirements shall apply to each WTG:
>
> A. Sound Levels. The statistical Sound Pressure Level generated by a WTG shall not exceed 60 decibels above ambient sound levels measured at the nearest off-Site Residence.

The authors of the DSEIS presumably didn't use this standard as a criterion of significance because they realized it is a totally ridiculous standard. The standard of 60 decibels above ambient sound levels is unsupported by any science. A 60 decibels above ambient standard would permitted noise levels that would lead to significant impacts including hearing loss and a host of other health consequences.

It is important to understand that a 60 dBA above ambient level is 100 dBA, at least according to the DSEIS. The DSEIS claims that the ambient levels are 39.8 dBA. If we round that to 40 dBA, 60 dBA above ambient is 100 dBA. This is so loud that noise at this level can cause numerous health problems. To protect against hearing loss, for example, the US EPA and the World Health Organization recommend people be exposed to this level for less than 90 seconds each day.

I have surveyed "above ambient" noise standards from across the United States in a fourth coming paper entitled, *Preliminary Results of an Analysis of 491 Community Noise Ordinances*.[4] "Above ambient" standards are a common and accepted regulatory tool, but the Enfield standard of 60 decibels above ambient is far from reasonable—it is an outlier of the outliers. The Town of Enfield standard did not qualify for inclusion in the survey,[5] but if it had, it would have been the worst noise ordinance in the country, by 45 decibels. Here are the rankings of the least protective "above ambient" standards in the United States, if Enfield's had been included:

1. 60 dB Enfield, NY
2. 15 dBA Norman, OK
2. 15 dBA Kenosha, WI
2. 15 dBA West Valley City, UT

In the study, a 15 dBA "above ambient" criterion was an outlier, used by only three communities. "There were 47 communities employing an over ambient standard. Over ambient standards range from 0-15 dBA over ambient, with the median and mode being 5 dBA." (Blomberg, 2016.)

Moreover, scientific research conducted by the US EPA suggests that a 5 dBA increase or greater can cause widespread complaints. According to the US EPA:

> The data … indicate that widespread complaints may be expected when the normalized value of the outdoor day-night sound level of the intruding noise exceeds that existing without the intruding noise by approximately 5 dB, and vigorous community reaction may be expected when the excess approaches 20 dB.
>
> EPA, 1974, D-20[6]

The authors of the DSEIS probably didn't realize that the local regulation was set 55 decibels above the typical level in regulations in the United States, 45 decibels above the next highest standard in the United States, and 40 decibels above the level where the EPA found vigorous community reaction.

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[4] Blomberg, 2016, *Preliminary Results of an Analysis of 491 Community Noise Ordinances*, Institute of Noise Control Engineering, Noise-Con 2016.
[5] All of the regulations in the 491 ordinance sample came from communities with greater than 60,000 people.
[6] US EPA, 1974, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, D-20.

They, nonetheless, seem to realize it is a ridiculous standard because the 60 decibels above ambient standard is not mentioned in the DSEIS, but the law that contains it is referenced indirectly.[7]

Moreover, neither the FEIS (2014) nor the DEIS (2013) mention the 60 decibel above ambient local standard. The DEIS, like the DSEIS, fabricates a new standard: "The Town's Wind Energy Facilities Local Law sets a sound limit of 60 dBA at the nearest non-participating residence" (DEIS, 191). These documents make two very significant changes to the local regulatory standard: removing "above ambient" changes the standard from a relative-to-ambient standard to an absolute standard, and the addition of the "A" after "dB" adds a frequency weighting to the standard that does not appear in the text of the local regulation. These changes to the local noise limits are arbitrary and not justifiable.

Faced with a ridiculous local standard with no foundation in science, and faced with a problem that has been known since at least February 2013[8], instead of correcting the problem, the DSEIS, FEIS, and DEIS chose instead to fabricate a new noise standard. There are two problems with this. First, if the DSEIS is going to use local regulatory laws as a criterion of significance, it needs to use those laws. A fabricated local noise standard for the determination of significant impacts cannot qualify as a "hard look." Second, only the Enfield Town Board, and not the authors of the DSEIS (and earlier DEIS and FEIS), can change the noise standard, and those changes must be done in a manner consistent with local and state laws.

The town must correct its local wind turbine noise regulatory limits **before** the DSEIS can take a hard look at the noise impacts of the project, and the DSEIS must correct the fabricated local noise limits with which it judges significant noise impacts before the DSEIS can be accepted. The fabricated local regulatory limits cannot be considered a criterion for significant adverse environmental impacts.

VI. DSEIS Fabricated an Ambient Noise Level and Messed Up the NYSDEC Criterion of Significance Assessment

Parts IV, V, and VI examine the inadequacies of the DSEIS noise analysis. In Part IV we noted that the DSEIS did not consider any criteria of significance with respect to specific noise impacts. In Part V, we showed that the DSEIS used a fabricated local standard as a criterion of significance. Part VI will show that the DSEIS ignored critical parts of the NYSDEC's guidance and fabricated an ambient level with which to assess significance that vastly understated noise impacts.

[7] "The criteria against which to compare the predicted noise from the Modified Project to determine if any significant adverse environmental impacts might result include the local regulatory noise limits and the noise assessment guidelines found in the NYSDEC's Assessing and Mitigating Noise Impacts (2000). The same assessment criteria described in the DEIS for the Approved Project were applied to the Modified Project …." (DSEIS, 37.)

[8] In a February 2013 report entitled Acoustic Study of the Black Oak Wind Farm by Tech Environmental, that later became Appendix T of the DEIS, the authors state: "The Wind Energy Facilities Local Law sets a sound limit of 60 dBA at the nearest non-participating residence." In a footnote, they acknowledge changing the standard: "Actually the Local Law states '60 dBA above ambient sound levels' **which will be interpreted to mean** 60 dBA." (DEIS, Appendix T, 7, emphasis added.) **Actually**, the local law does not even say "dBA". It says "60 decibels above ambient sound levels," not 60 A-weighted decibels above ambient. Appendix T knowingly changed the standard from 60 decibels above ambient to an absolute level of 60 dBA.

The DSEIS states that "[t]he criteria against which to compare the predicted noise from the Modified Project to determine if any significant adverse environmental impacts might result include … the noise assessment guidelines found in the NYSDEC's Assessing and Mitigating Noise Impacts (2000)." (DSEIS, 37.)

As the DSEIS notes, the NYSDEC's Assessing and Mitigating Noise Impacts (2000) states that "[i]n non-industrial settings the SPL should probably not exceed ambient noise by more than 6 dB(A) at the receptor." (NYSDEC, 2000, 14.) Moreover, "[t]he goal for any permitted operation should be to minimize increases in sound pressure level above ambient levels at the chosen point of sound reception." (NYSDEC, 2000, 13.)

The NYSDEC's Assessing and Mitigating Noise Impacts (2000) notes that "[i]n order to evaluate the above factors in the appropriate context, one must identify the following: 1) appropriate receptor locations for sound level calculation or measurement; 2) ambient sound levels and characteristics at these receptor locations; and 3) the sound pressure increase and characteristics of the sound that represents a significant noise effect at a receptor location." (NYSDEC, 2000, 13.)

The DSEIS errored in the selection of receptor locations and in obtaining accurate ambient sound levels at those locations. The NYSDEC's Assessing and Mitigating Noise Impacts (2000) state:

> Appropriate receptor locations may be either at the property line of the parcel on which the facility is located or at the location of use or inhabitance on adjacent property. The solid waste regulations require the measurements of sound levels be at the property line. The most conservative approach utilizes the property line. **The property line should be the point of reference when adjacent land use is proximal to the property line.** Reference points at other locations on adjacent properties can be chosen after determining that existing property usage between the property line and the reference point would not be impaired by noise, i.e., property uses are relatively remote from the property line.

(NYSDEC, 2000, 13, emphasis added.)

The DSEIS did not use the property line locations, and did not assess the adjacent land uses proximal to the property lines. Moreover, the DSEIS and Appendix H did not show the property lines in its noise analysis. Therefore, there is no way the DSEIS could have analyzed the property line noise levels. There are, however, areas proximal to the property lines that need analysis. For example, areas that are used as hiking trails or that are intended as home sites for children of the adjoining property owner. Moreover, noise levels at the property lines exceed 50 dBA in many cases and even exceed 55 dBA according to the modeling.

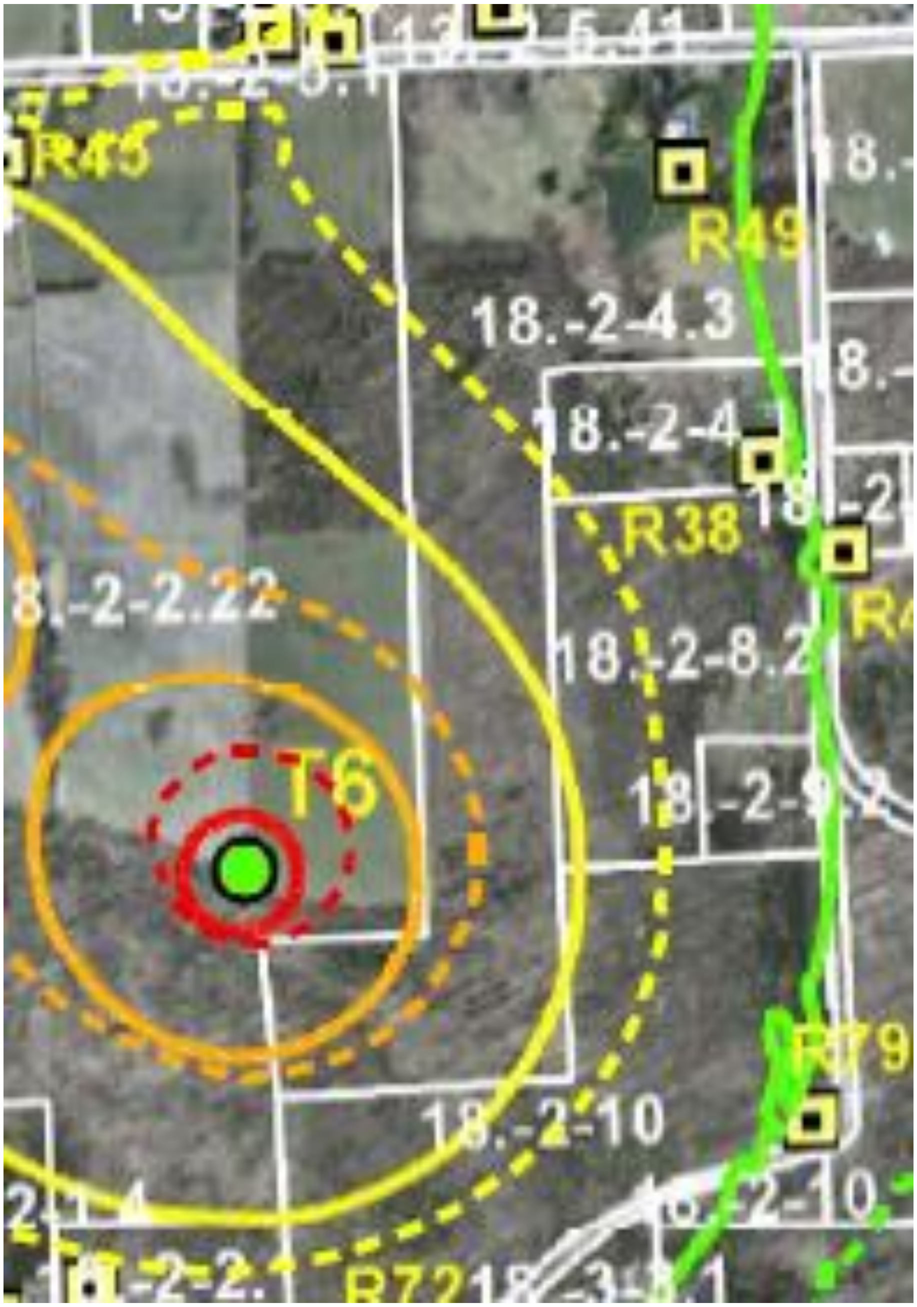

Figure 8. Predicted Noise Levels at the Property Line near Turbine 6.

Figure 8 shows the predicted noise levels near Turbine 6. It is a composite of Figure 3 from Appendix H of the DSEIS (the dotted contour lines) and Figure 2 of Appendix T of the FEIS (the solid contour lines). According to the legends of these Figures, the red line corresponds to the 55 dBA level; the orange, to the 50 dBA level. The property lines are shown in white. The red dotted line representing 55 dBA from the DSEIS turbine configuration clearly touches the property line south of Turbine 6 in Figure 8. This location has an existing hiking trail nearby.

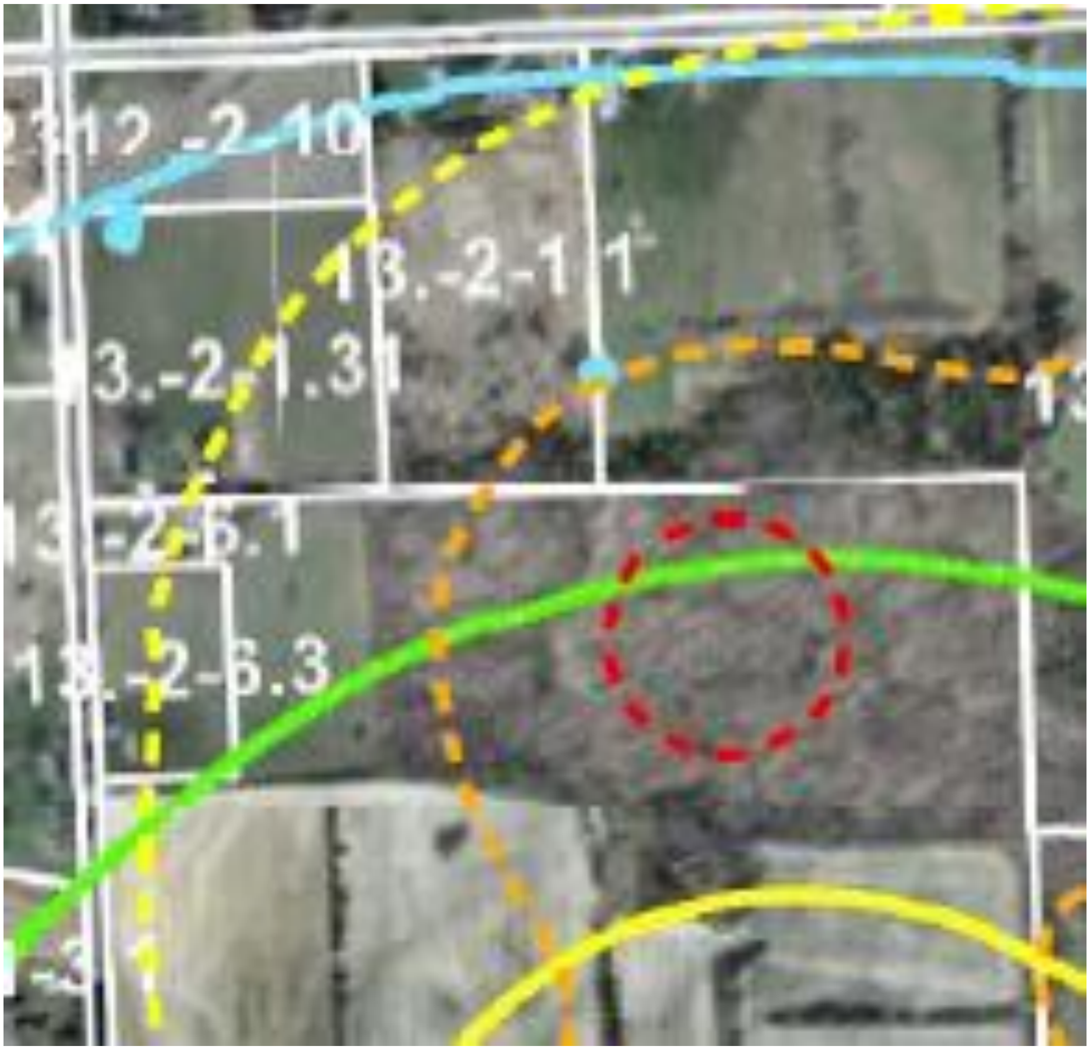

Figure 9. Predicted Noise Levels at the Property Line near Turbine C.

Figure 9 shows the predicted noise levels near Turbine C (not shown but inside the dashed red circle). It is a composite of Figure 3 from Appendix H of the DSEIS (the dotted contour lines) and Figure 2 of Appendix T of the FEIS (the solid contour lines). According to the legends of these Figures, the red line corresponds to the 55 dBA level; the orange, to the 50 dBA level. The property lines are shown in white. The orange dotted line representing 50 dBA from the DSEIS turbine configuration clearly crosses the property line northwest of Turbine C in Figure 9 marked 13.-2-1.1. This location is intended as a home site for the homeowners children, for which it would not be suitable if it were built.

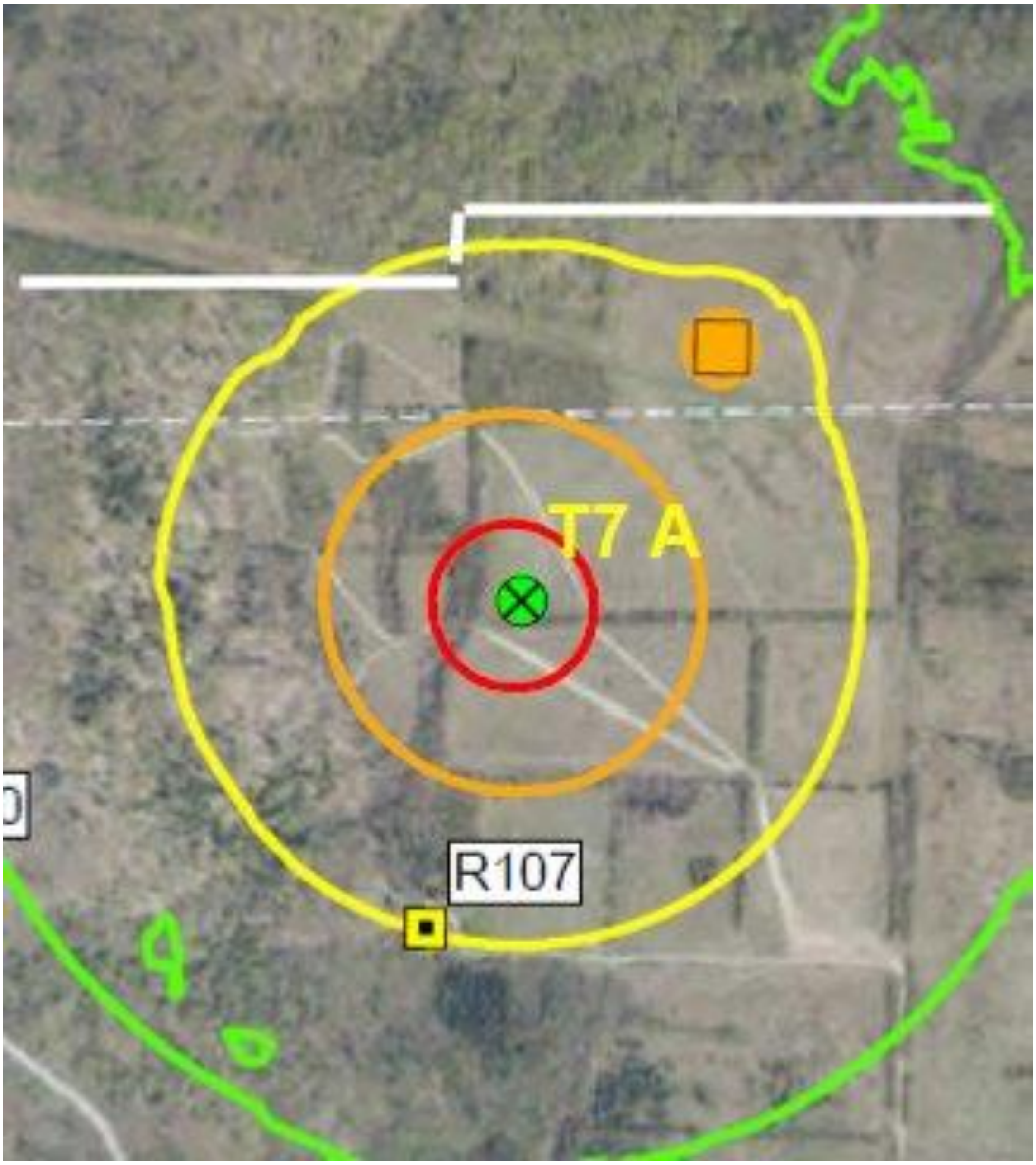

Figure 10. Predicted Noise Levels at the Property Line near Turbine A.

Figure 10 shows the predicted property line noise levels north of Turbine A from Figure 2 of the DSEIS Appendix H. The white property line of a non-participating neighbor has been added. From the figure one can see that the noise levels approach and exceed 45 dBA in this area. There is what the home owner calls his "second field" in this vicinity. It is a maintained grassy area with a structure.

Ambient levels at these and similar locations are not presented in the DSEIS. In an accompanying report from the Noise Pollution Clearinghouse, *Ambient Sound Levels Near BOWF*, ambient levels at these locations were measured, and they are shown Figure 11.

Ambient Sound Levels Near Selected Turbines

	Daytime Ambient	Nighttime Ambient
Near Turbine 6	31.9 dBA	27.2dBA
Near Turbine C	34.1 dBA	27.1 dBA
Near Turbine A	30.1 dBA	NA

Figure 11. Ambient Sound Levels Near Selected Turbines.

According to the DSEIS noise modeling, the predicted noise levels at the above locations are 55 dBA, 53 dBA, and 45 dBA. The results of subtracting the ambient sound levels from *Ambient Sound Levels Near BOWF* from the projected noise level are shown in Figure 12. The result is the approximate decibels above ambient that the turbine noise would cause, based on the modeling and the measured ambient noise levels.

Turbine Noise Level Compared to Ambient Near Selected Turbines

	Daytime	Nighttime
Near Turbine 6	~23 dBA above ambient	~28 dBA above ambient
Near Turbine C	~19 dBA above ambient	~26 dBA above ambient
Near Turbine A	~15 dBA above ambient	NA, but most likely > ~15 dBA

Figure 12. Turbine Noise Level Compared to Ambient Near Selected Turbines.

By not considering the property line as the appropriate receptor location, the DSEIS missed clear exceedances of the NYSDEC's 6 dBA above ambient criterion of significance. There are many possible examples like these around the project, since there are miles of property line around the project. These three examples clearly show that significant noise level increases do occur. The DSEIS failed to identify a significant impact of greater than a 6 decibel increase because it failed to take a hard look. In fact, it failed to take any look along property lines.

The NYSDEC document notes that increases in sound pressure level of over 20 dB are "very objectionable to intolerable." The DSEIS failed to identify a very significant increase in noise levels.

There is yet another way the DSEIS failed to take a hard look at the noise impacts. There are no ambient measurements near the three newly proposed turbine locations. The DSEIS relied on measurements taken for the original DEIS that were taken south and west of Turbines B and C, north and west of Turbine A, and generally over a mile away. The language of the NYSDEC document is clear. To assess the noise impact the DSEIS should have identified "1) **appropriate receptor locations** for sound level calculation or measurement; 2) ambient sound levels and characteristics **at these receptor locations**; and 3) the sound pressure increase and characteristics of the sound that represents a significant noise effect at a receptor location." (NYSDEC, 2000, 13.) The DSEIS assessed the increase in noise levels for three new turbines without actually measuring the ambient sound levels at any nearby receptor location.

Finally, the DSEIS used a composite ambient noise level of 39.8 dBA. Part VIII below will undermine this value more fully, but there is a specific problem with this value in that it doesn't represent a value for any particular receptor location. It is an average level over both time and space. The average of Leq values is not linear (meaning that the average of 40 dBA and 30 dBA is not 35 dBA, but 37 dBA. The average is logarithmic and more heavily weighted to the higher noise levels. Moreover, by averaging the noise levels, the impact on quieter locations and quieter times is lost. For example, Table 1 of the HMMH *Noise Study for Black Oak Wind Farm Project*, found in Appendix T of the DEIS, gives nighttime Leq values of 25.3, 30.1, 29.1 and 26.1 dBA for locations ST-1, ST-2, ST-3, and ST-4. Using 39.8 dBA as the average background over all the times and places monitored, means that nighttime impacts at the specific locations are understated by 14.5, 9.8, 10.7, and 13.7 dBA respectively. Moreover, the DSEIS made no ambient measurements in the vicinity of the proposed new turbine sites. The only ambient measurements in these areas were reported in, *Ambient Sound Levels Near BOWF*. The only ambient levels in evidence do not support the use of 39.8 dBA as the ambient near the new Turbines A, B, and C.

VII. DSEIS Modeling Is Unreliable

The DSEIS noise analysis is based on estimated future noise levels of the wind turbines derived by noise modeling. We have asked the town and applicant to provide that modeling so that we can examine it and verify that it correctly models the proposed project. Providing the noise modeling is very simple, and can be done by copying and saving a computer file to a flash drive or an internet file sharing platform. They refused, however, to provide the modeling.

In land use, planning, and EIS processes, noise modeling is routinely provided to interested parties so that they can verify the accuracy of the modeling. In fact, there is no other way to verify the accuracy of the modeling. Without our being able to examine the modeling, it is nothing more than the output of a black box. It is a black box because the inner workings and implementation are hidden from the Board and from interested parties. It is "black." It is secret. BOWF will not allow us or the Board to see how it arrived at the output. All we have is an output, a noise level, with no supporting evidence. Output without supporting evidence is really just speculation and conjecture. All reference to the output in the DSEIS should be deleted.

The opposite of a black box system is one in which the inner workings are available for inspection, a "glass box." Had the modeling been provided to us, we and the Board would be able to understand how the output was arrived at, and whether or not it was accurate.

A thought experiment will show the weakness of relying on black box modeling. If I submitted a report, claiming that the output of my modeling documented significant adverse environmental impacts, but that the modeling must remain secret, the Board would reject that claim as unverified and unverifiable. For the very same reason, BOWF's modeling output should be rejected as unverified and unverifiable. BOWF has given the Town an "answer" to a math problem, but not shown its work.

BOWF claims that the modeling data contains proprietary information. This is not true and not necessary. There is no need for secret settings and secret modeling to estimate the noise levels for the DSEIS. The only reason for BOWF to not provide the modeling data is because BOWF is afraid it will not survive scrutiny. If BOWF's black box can't survive daylight, the output of the black box has no place in the DSEIS. All reference to the output should be deleted.

VIII. DSEIS Noise Monitoring is Unreliable

The case against the reliability of BOWF's noise monitoring is the same as the one against the reliability of its noise modeling. It is impossible for the Board and us to know how the background level of 39.8 dBA was derived.

The DSEIS noise analysis is based on changes from the existing or ambient noise levels. We have asked the town and applicant to provide their monitoring data so that we can examine it and verify that it correctly represents the existing conditions. Providing the noise monitoring data is very simple and can be done by copying and saving a computer file to a flash drive or an internet file sharing platform. They refused, however, to provide the monitoring.

In land use, planning, and EIS processes, noise monitoring data is routinely provided to interested parties so that they can verify the accuracy of the monitoring. In fact, there is no other way to verify the accuracy of the monitoring. Without our being able to examine the monitoring, it is nothing more than the output of a black box. It is a black box because the inner workings and implementation is hidden from the Board and from interested parties. It is "black." It is secret. BOWF will not allow us or the Board to see how it arrived at the output. All we have is an output, a noise level, with no supporting evidence. Output without supporting evidence is really just speculation and conjecture. All reference to the modeling and modeling output in the DSEIS should be deleted.

The opposite of a black box system is one in which the inner workings are available for inspection, a "glass box." Had the monitoring data been provided to us, we and the Board would be able to understand how the output was arrived at, and whether or not it was accurate.

A thought experiment will show the weakness of relying on black box monitoring data. If I submitted a report, claiming that the output of my monitoring documented significant adverse environmental impacts, but that the monitoring data must remain secret, the Board would reject that claim as unverified and unverifiable. For the very same reason, BOWF's monitoring output should be rejected as unverified and unverifiable. BOWF has given the Town an "answer" to a math problem, but not shown its work.

BOWF claims that the monitoring data contains proprietary information. This is not true and not necessary. There is no need for secret processes to establish existing noise levels for the DSEIS. The only reason for BOWF to not provide the monitoring data is because BOWF is afraid it will not survive scrutiny. If BOWF's black box can't survive daylight, the output of the black box has no place in the DSEIS. All reference to the monitoring and monitoring output of 39.8 dBA should be deleted.

IX. DSEIS Noise Modeling Shows Significant Increases Above FEIS Noise Modeling

Parts IV-VIII have identified inadequacies in the DSEIS. The DSEIS should be rejected, not only because of what isn't there (such as a noise impacts analysis, a local regulatory law analysis, and an adequate above ambient noise analysis, and the supporting evidence as discussed in Parts IV-VIII), but also because the evidence in the DSEIS leads to the conclusion that significant noise impacts exist. Specifically, the DSEIS modeling shows significant increases in turbine noise levels and in land impacted by turbine noise over the FEIS modeling.

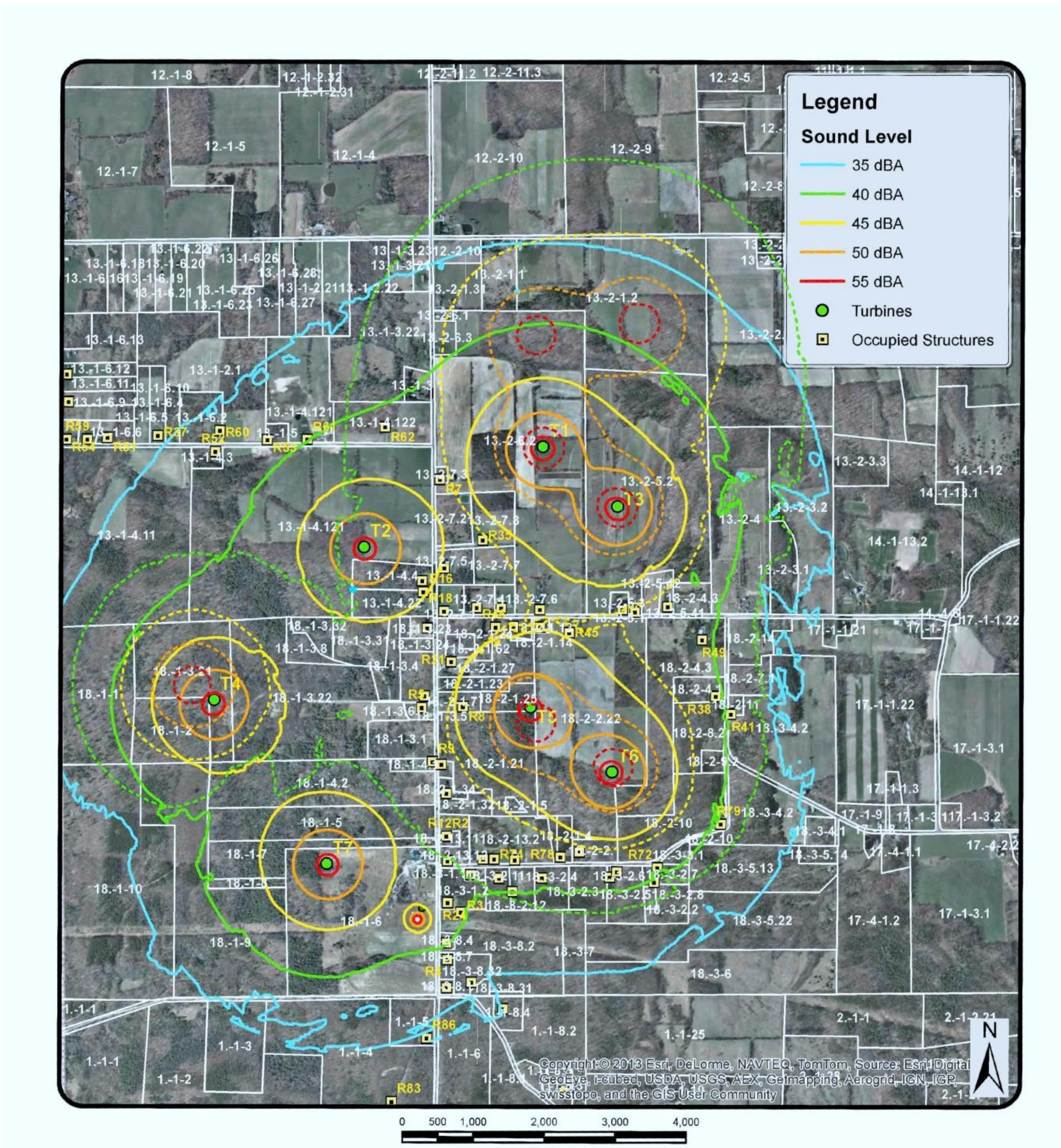

Figure 13. Predicted Noise Levels from the DSEIS and FEIS.

Figure 13 shows the predicted noise of the DSEIS and FEIS. It is a composite of Figure 3 from Appendix H of the DSEIS and Figure 2 of Appendix T of the FEIS. The dashed contour lines are the noise levels from the DSEIS. They are superimposed on top of the map from the FEIS and its solid contour lines. According to the legends of these Figures, the red line corresponds to the 55 dBA level; the orange, to the 50 dBA level; the yellow, to the 45 dBA level; and the green, to the 40 dBA level. The property lines are shown in white. Similar maps could be made for the other turbine configurations in the DSEIS.

Several indicators of significant noise impacts can be derived from this map:

1. The total area of noise impacted land is much greater in the DSEIS. This can be seen from the map, and also from analysis of the map. Figure 14 below describes percent increase in lands above 55 dBA, 50 dBA, and 45 dBA.

Contour Line	FEIS Figure 2: Area SqFt	DSEIS Figure 3: Area SqFt	% Increase
Red (Lands > 55 dBA)	552,000	1,622,000	194%
Orange (Lands > 50 dBA)	5,930,000	10,739,000	81%
Yellow (Lands > 45 dBA)	21,697,000	29,446,000	36%

Figure 14. Percent Increase in Land Impacted by Turbine Noise.

There are a number of reasons for the increase in lands impacted by turbine noise. One is that the new locations in the DSEIS result in a greater area of impact. Another possible reason is that BOWF may have misrepresented the impacts of increasing from 1.7to 2.3 MW turbines to the Board. In the June 24, 2015 letter submitted to the Board it is claimed that the changes from the 1.7 to 2.3 MW turbines "further minimize and mitigate potential impacts analyzed during the SEQRA process." The increase could also be due to errors in the modeling, either for the DSEIS or FEIS. Neither we nor the Board can know for sure because the modeling was not provided to us so that it could be verified.

2. Many areas with significant increases of 10 dBA or more can be seen by examining the map. The solid lines represent the FEIS noise level. The dashed lines represent the proposed DSEIS noise level. Areas where the solid blue 35 dBA contour line intersect the dashed yellow 45 dBA line represent areas of a 10 dBA increase. Similarly, areas where the solid green 40 dBA contour line intersect the dashed orange 50 dBA contour line represent areas of a 10 dBA increase. This is noticeable around the areas of Turbines B and C to the north, although if an option with Turbine A were considered the increase in the south would be approximately 10 dBA.

3. Every turbines location has moved enough to alter the noise contour lines. The change in the locations of Turbines 4, 5, and 6 are the easiest to see, but the location of all the turbines has moved. Again, because the noise modeling was not provided to us, we do not know if the change is due to poor modeling or the BOWF's misrepresentation of the changes being considered in the DSEIS.

X. The Project Causes Significant Noise Impacts Even If Only DSEIS Data Is Considered

Even if the problems identified in Parts IV-IX are ignored, and only DSEIS data is considered, the DSEIS shows significant noise impacts. The DSEIS sets out two tests as criteria of significant noise impact. They are the local regulatory laws and the NYSDEC 6 dBA test:

> The criteria against which to compare the predicted noise from the Modified Project to determine if any significant adverse environmental impacts might result include the local regulatory noise limits and the noise assessment guidelines found in the NYSDEC's Assessing and Mitigating Noise Impacts (2000). The same assessment criteria described in the DEIS for the Approved Project were applied to the Modified Project ….
>
> (DSEIS, 37.)

As discussed above and in the DEIS, the NYSDEC's Assessing and Mitigating Noise Impacts (2000) criterion is a 6 dBA increase in noise levels above ambient, or 45 dBA according to the DEIS. Moreover, the DSEIS actually determined that the noise at four non-participating residences exceeded the criterion of significant impact. According to the DSEIS, "[t]he noise study completed for the Modified Project predicted that each alternative under consideration would result in 4 non-participating residences exceeding the 45 dBA NYSDEC Guideline." (DSEIS, 38.)

After setting out this criterion of significant impact, the DSEIS ignores it and the four cases of significant noise impact. The DSEIS ignores this result for two reasons. 1) It suggests that "[t]he 45 dBA level is not an enforceable regulatory limit." (DSEIS, 37.) While this is true, it is irrelevant. The 45 dBA level was selected by the DSEIS as a criterion of significant impact, and it is that regardless of whether it is also a legal requirement of the town. 2) The DSEIS also dismisses this criterion because it says three non-participating residences exceeded the standard in the Findings Statement related to the FEIS. (DSEIS, 38.) This too is not a reason to ignore cases where the noise exceeds the criterion of significance. Moreover, it is not clear where this claim comes from. The actual modeling output from Appendix K of the FEIS and Appendix H of the DSEIS show different numbers. See Figure 15.

FEIS Modeling			**DSEIS Configuation 7AB**			**DSEIS Configuration AC**			**DSEIS Configuration BC**		
ID	Residence Status	Total Level (dBA)	ID	Residence Status	Total Level (dBA)	ID	Residence Status	Total Level (dBA)	ID	Residence Status	Total Level (dBA)
R14	Participating	45.9	R8	Non-Participating	46.2	R8	Non-Participating	46.2	R8	Non-Participating	46.2
R8	Non-Participating	45.8	R45	Participating	45.7	R45	Participating	45.7	R45	Participating	45.8
R16	Non-Participating	45.2	R107	Non-Participating	45.1	R107	Non-Participating	45.1	R50	Non-Participating	45.3
			R42	Non-Participating	45.1	R42	Non-Participating	45.1	R100	Non-Participating	45.1
			R44	Participating	45.1	R44	Participating	45.1	R42	Non-Participating	45.1
			R50	Non-Participating	45.1	R50	Non-Participating	45.1	R44	Participating	45.1
			R68	Non-Participating	45	R68	Non-Participating	45	R96	Participating	45.1
									R101	Non-Participating	45
Total Participating		**1**	**Total Participating**		**2**	**Total Participating**		**2**	**Total Participating**		**3**
Total Non-Participating		**2**	**Total Non-Participating**		**5**	**Total Non-Participating**		**5**	**Total Non-Participating**		**5**
Total		**3**	**Total**		**7**	**Total**		**7**	**Total**		**8**

Figure 15. Exceedances of the Criterion of Significance in the FEIS and DSEIS.

In the DSEIS there are either seven or eight homes meeting or exceeding the 45 dBA level of significance. Five of them are non-participating. With the exception of R8, these are entirely different residences from the FEIS. They clearly experience a significant impact according to the criterion selected by the DSEIS. Yet the DSEIS ignores this and does not clearly state how the impacts will be avoided or mitigated.

XI. As Many as 30 Non-Participating Residences Meet the DSEIS Criterion of Significant Noise Impact

The CADNA/A noise model used to estimate future noise levels of the wind turbines in the DSEIS implements the equations found in the international standard ISO 9313 Part 2. (Appendix H of the FEIS, 1.) This standard has an **average** error of 3 dB (see Figure 17 below from the ISO standard). This error is independent of the input uncertainty that the DSEIS claims was accounted for. (Appendix H of the FEIS, 2.) Moreover, the error is independent of the conservative modeling assumptions used in the modeling. These conservative assumptions are the way noise ought to be modeled: "it should be noted that these predictions are based on a worst case scenario with conservative assumptions required by ISO-9613-2 propagation standards." (FEIS, 38.)

In addition, it is important to remember the caution ISO 9613 Part 2 gives concerning error:

> NOTE 24 The estimates of accuracy in table 5 are for downwind conditions averaged over independent situations (as specified in clause 5). They should not necessarily be expected to agree with the variation in measurements made at a given site on a given day. The latter can be expected to be considerably larger than the values in table 5.

ISO 9313 Part 2, page 13

Figure 16: Modeling error in ISO 9613 is an average error

The error is an **average** error. There can be a much greater error at times. Figure 17 shows Table 5 from the ISO 9613 Part 2 Standard, which describes the error.

ISO 9613-2:1996(E) © ISO

The use of equations (1) to (5) and (7) to (20) (and therefore also table 5) is limited to case a): meteorological conditions only. Case b) is relevant only to the use of equations (6), (21) and (22). There are also a substantial number of limitations (non-meteorological) in the use of individual equations. Equation (9) is, for example, limited to approximately flat terrain. These specific limitations are described in the text accompanying the relevant equation.

Table 5 — Estimated accuracy for broadband noise of L_{AT}(DW) calculated using equations (1) to (10)

Height, h *)	Distance, d *)	
	$0 < d < 100$ m	100 m $< d <$ 1 000 m
$0 < h < 5$ m	± 3 dB	± 3 dB
5 m $< h <$ 30 m	± 1 dB	± 3 dB

*) h is the mean height of the source and receiver.
d is the distance between the source and receiver.

NOTE — These estimates have been made from situations where there are no effects due to reflection or attenuation due to screening.

ISO 9613 Part 2, page 14

Figure 17: Table 5 from ISO 9613 Showing a 3 dBA Error

It is critical that the accuracy of the modeling be taken into account when assessing noise impacts with respect to a criterion of significance. The modeling error must be added to the modeled results when testing for compliance with significance criteria; otherwise the DSEIS risks missing significant noise impacts. This was not done. All of the contour lines and output noise results at the various receptor locations should be increased by 3 dBA.

The accuracy issue cannot be ignored because it is a plus or minus 3 dBA. What this means is that sometimes the value might be 3 dBA more than predicted, and sometimes 3 dBA less. The critical point is that there will be times when it is 3 dB more than the predicted output, and those times will lead to exceedances of the DSEIS criterion for significant impact.

If the accuracy of the CADNA/A modeling had been accounted for by adding 3 dBA to the output, the results would be as shown in Figure 17.

Configuation 7AB

ID	Residence Status	Total Level (dBA)
R8	Non-Participating	49.2
R45	Participating	48.7
R107	Non-Participating	48.1
R42	Non-Participating	48.1
R44	Participating	48.1
R50	Non-Participating	48.1
R68	Non-Participating	48
R40	Non-Participating	47.9
R105	Participating	47.8
R39	Non-Participating	47.7
R43	Participating	47.5
R35	Participating	47.3
R47	Participating	47.3
R97	Participating	47.2
R48	Participating	47.1
R78	Non-Participating	47.1
R20	Participating	47
R21	Non-Participating	47
R70	Non-Participating	46.7
R7	Non-Participating	46.6
R10	Non-Participating	46.5
R46	Participating	46.5
R69	Non-Participating	46.4
R22	Non-Participating	46.1
R5	Non-Participating	46
R72	Non-Participating	46
R9	Non-Participating	46
R1	Participating	45.8
R11	Non-Participating	45.8
R71	Non-Participating	45.7
R38	Non-Participating	45.6
R76	Non-Participating	45.6
R18	Participating	45.5
R49	Non-Participating	45.5
R77	Non-Participating	45.4
R13	Participating	45.2
R74	Non-Participating	45.1
R79	Participating	45
Total Participating		**14**
Total Non-Participating		**27**
Total		**38**

Configuration AC

ID	Residence Status	Total Level (dBA)
R8	Non-Participating	49.2
R45	Participating	48.7
R107	Non-Participating	48.1
R42	Non-Participating	48.1
R44	Participating	48.1
R50	Non-Participating	48.1
R68	Non-Participating	48
R40	Non-Participating	47.9
R105	Participating	47.8
R39	Non-Participating	47.7
R100	Non-Participating	47.6
R101	Non-Participating	47.6
R35	Participating	47.5
R43	Participating	47.4
R47	Participating	47.3
R20	Participating	47.1
R21	Non-Participating	47.1
R48	Participating	47.1
R78	Non-Participating	47.1
R7	Non-Participating	47
R96	Participating	47
R70	Non-Participating	46.7
R10	Non-Participating	46.6
R103	Non-Participating	46.6
R46	Participating	46.6
R95	Non-Participating	46.6
R99	Non-Participating	46.6
R102	Participating	46.4
R69	Non-Participating	46.4
R22	Non-Participating	46.2
R5	Non-Participating	46
R72	Non-Participating	46
R9	Non-Participating	46
R1	Participating	45.8
R11	Non-Participating	45.8
R71	Non-Participating	45.7
R18	Participating	45.6
R38	Non-Participating	45.6
R76	Non-Participating	45.6
R49	Non-Participating	45.5
R13	Participating	45.4
R77	Non-Participating	45.4
R74	Non-Participating	45.1
R19	Non-Participating	45
R79	Participating	45
Total Participating		**15**
Total Non-Participating		**30**
Total		**45**

Configuration BC

ID	Residence Status	Total Level (dBA)
R8	Non-Participating	49.2
R45	Participating	48.8
R50	Non-Participating	48.3
R100	Non-Participating	48.1
R42	Non-Participating	48.1
R44	Participating	48.1
R96	Participating	48.1
R101	Non-Participating	48
R40	Non-Participating	47.9
R97	Participating	47.9
R105	Participating	47.8
R39	Non-Participating	47.8
R35	Participating	47.7
R43	Participating	47.6
R68	Non-Participating	47.6
R95	Non-Participating	47.6
R47	Participating	47.5
R7	Non-Participating	47.3
R48	Participating	47.2
R20	Participating	47.1
R21	Non-Participating	47.1
R99	Non-Participating	47.1
R103	Non-Participating	47
R102	Participating	46.8
R46	Participating	46.8
R78	Non-Participating	46.8
R10	Non-Participating	46.4
R22	Non-Participating	46.2
R5	Non-Participating	46.1
R70	Non-Participating	45.9
R9	Non-Participating	45.9
R1	Participating	45.7
R11	Non-Participating	45.7
R18	Participating	45.7
R13	Participating	45.6
R49	Non-Participating	45.6
R38	Non-Participating	45.5
R69	Non-Participating	45.5
R76	Non-Participating	45.2
R94	Non-Participating	45.2
R19	Non-Participating	45.1
R14	Participating	45
R16	Non-Participating	45
Total Participating		**16**
Total Non-Participating		**27**
Total		**43**

Figure 17. DSEIS Modeling Results When the Accuracy of the Model Considered.

There are at a minimum, 38 residences exceeding the DSEIS criterion of significance of 45 dBA. The DSEIS missed these instances of significant impact because it did not take a hard look in doing its noise assessment.

XII. As Many as 53 Non-Participating Residences Meet the DSEIS Criterion for Significant Noise Impact at Night

As discussed above in Part VI, the DSEIS used a spatially and temporally averaged ambient level of 39.8 dBA. It was noted that the average is highly weighted to the loudest times and places. At night, when the ambient is lower, the impact of the noise is greatest. Had the DSEIS used a nighttime average to assess significant impact, it would have found that 51 non-participating residences experience a significant noise impact.

Appendix T of the DEIS states that "[a]t night (11:30 pm-5:30am) Leq sound levels generally ranged from about 25 to 30 dBA." Had the DSEIS used the higher 30 dBA value, a 6 dBA increase would be 36 dBA. Figure 18 shows the residences that meet or exceed a 36 dBA nighttime criterion of significant impact. The red shading indicates when the noise level is more than 10 dBA over ambient, or twice as loud as ambient. (Note that the decibel levels have not been adjusted to account for the modeling accuracy as in Part XI above.)

Configuation 7AB			**Configuration AC**			**Configuration BC**		
ID	Residence Status	Total Level (dBA)	ID	Residence Status	Total Level (dBA)	ID	Residence Status	Total Level (dBA)
R8	Non-Participating	46.2	R8	Non-Participating	46.2	R8	Non-Participating	46.2
R45	Participating	45.7	R45	Participating	45.7	R45	Participating	45.8
R107	Non-Participating	45.1	R107	Non-Participating	45.1	R50	Non-Participating	45.3
R42	Non-Participating	45.1	R42	Non-Participating	45.1	R100	Non-Participating	45.1
R44	Participating	45.1	R44	Participating	45.1	R42	Non-Participating	45.1
R50	Non-Participating	45.1	R50	Non-Participating	45.1	R44	Participating	45.1
R68	Non-Participating	45	R68	Non-Participating	45	R96	Participating	45.1
R40	Non-Participating	44.9	R40	Non-Participating	44.9	R101	Non-Participating	45
R105	Participating	44.8	R105	Participating	44.8	R40	Non-Participating	44.9
R39	Non-Participating	44.7	R39	Non-Participating	44.7	R97	Participating	44.9
R43	Participating	44.5	R100	Non-Participating	44.6	R105	Participating	44.8
R35	Participating	44.3	R101	Non-Participating	44.6	R39	Non-Participating	44.8
R47	Participating	44.3	R35	Participating	44.5	R35	Participating	44.7
R97	Participating	44.2	R43	Participating	44.4	R43	Participating	44.6
R48	Participating	44.1	R47	Participating	44.3	R68	Non-Participating	44.6
R78	Non-Participating	44.1	R20	Participating	44.1	R95	Non-Participating	44.6
R20	Participating	44	R21	Non-Participating	44.1	R47	Participating	44.5
R21	Non-Participating	44	R48	Participating	44.1	R7	Non-Participating	44.3
R70	Non-Participating	43.7	R78	Non-Participating	44.1	R48	Participating	44.2
R7	Non-Participating	43.6	R7	Non-Participating	44	R20	Participating	44.1
R10	Non-Participating	43.5	R96	Participating	44	R21	Non-Participating	44.1
R46	Participating	43.5	R70	Non-Participating	43.7	R99	Non-Participating	44.1
R69	Non-Participating	43.4	R10	Non-Participating	43.6	R103	Non-Participating	44
R22	Non-Participating	43.1	R103	Non-Participating	43.6	R102	Participating	43.8
R5	Non-Participating	43	R46	Participating	43.6	R46	Participating	43.8

R72	Non-Participating	43
R9	Non-Participating	43
R1	Participating	42.8
R11	Non-Participating	42.8
R71	Non-Participating	42.7
R38	Non-Participating	42.6
R76	Non-Participating	42.6
R18	Participating	42.5
R49	Non-Participating	42.5
R77	Non-Participating	42.4
R13	Participating	42.2
R74	Non-Participating	42.1
R79	Participating	42
R19	Non-Participating	41.9
R73	Non-Participating	41.8
R103	Non-Participating	41.7
R16	Non-Participating	41.7
R14	Participating	41.6
R41	Non-Participating	41.5
R101	Non-Participating	41.3
R81	Non-Participating	41.3
R12	Non-Participating	41.2
R2	Non-Participating	41.2
R75	Non-Participating	41.2
R104	Participating	40.8
R80	Non-Participating	40.7
R96	Participating	40.6
R102	Participating	40.5
R100	Non-Participating	40.4
R6	Participating	40.3
R62	Participating	40.3
R95	Non-Participating	40
R99	Non-Participating	39.7
R98	Non-Participating	39.4
R24	Non-Participating	39.2
R3	Non-Participating	39.1
R108	Non-Participating	38.7
R30	Non-Participating	38.6
R94	Non-Participating	38.4
R31	Non-Participating	37.7
R93	Non-Participating	37.3
R106	Non-Participating	37.1
R92	Non-Participating	37.1
R15	Non-Participating	36.9
R17	Non-Participating	36.9
R61	Non-Participating	36.6
R53	Non-Participating	36.2
Total Participating		**20**
Total Non-Participating		**52**
Total		**72**

R95	Non-Participating	43.6
R99	Non-Participating	43.6
R102	Participating	43.4
R69	Non-Participating	43.4
R22	Non-Participating	43.2
R5	Non-Participating	43
R72	Non-Participating	43
R9	Non-Participating	43
R1	Participating	42.8
R11	Non-Participating	42.8
R71	Non-Participating	42.7
R18	Participating	42.6
R38	Non-Participating	42.6
R76	Non-Participating	42.6
R49	Non-Participating	42.5
R13	Participating	42.4
R77	Non-Participating	42.4
R74	Non-Participating	42.1
R19	Non-Participating	42
R79	Participating	42
R14	Participating	41.8
R16	Non-Participating	41.8
R73	Non-Participating	41.8
R41	Non-Participating	41.5
R94	Non-Participating	41.5
R62	Participating	41.3
R81	Non-Participating	41.3
R12	Non-Participating	41.2
R2	Non-Participating	41.2
R75	Non-Participating	41.2
R104	Participating	40.9
R80	Non-Participating	40.7
R6	Participating	40.3
R93	Non-Participating	40.3
R92	Non-Participating	39.9
R24	Non-Participating	39.2
R3	Non-Participating	39.1
R97	Participating	39
R108	Non-Participating	38.7
R30	Non-Participating	38.6
R31	Non-Participating	37.7
R61	Non-Participating	37.6
R106	Non-Participating	37.1
R15	Non-Participating	36.9
R17	Non-Participating	36.9
R53	Non-Participating	36.9
R91	Non-Participating	36.3
R98	Non-Participating	36
Total Participating		**20**
Total Non-Participating		**53**
Total		**73**

R78	Non-Participating	43.8
R10	Non-Participating	43.4
R22	Non-Participating	43.2
R5	Non-Participating	43.1
R70	Non-Participating	42.9
R9	Non-Participating	42.9
R1	Participating	42.7
R11	Non-Participating	42.7
R18	Participating	42.7
R13	Participating	42.6
R49	Non-Participating	42.6
R38	Non-Participating	42.5
R69	Non-Participating	42.5
R76	Non-Participating	42.2
R94	Non-Participating	42.2
R19	Non-Participating	42.1
R14	Participating	42
R16	Non-Participating	42
R72	Non-Participating	41.9
R77	Non-Participating	41.8
R62	Participating	41.7
R74	Non-Participating	41.7
R73	Non-Participating	41.4
R41	Non-Participating	41.3
R71	Non-Participating	41.3
R79	Participating	41.2
R93	Non-Participating	41.2
R12	Non-Participating	41.1
R2	Non-Participating	41.1
R104	Participating	41
R81	Non-Participating	40.7
R92	Non-Participating	40.6
R75	Non-Participating	40.5
R98	Non-Participating	40.3
R80	Non-Participating	40.2
R6	Participating	39.9
R24	Non-Participating	38.5
R3	Non-Participating	38.2
R61	Non-Participating	37.8
R53	Non-Participating	37.3
R91	Non-Participating	37.1
R15	Non-Participating	36.5
R17	Non-Participating	36.5
R90	Non-Participating	36.5
R89	Non-Participating	36.4
R52	Non-Participating	36
Total Participating		**20**
Total Non-Participating		**51**
Total		**71**

Figure 18. DSEIS Modeling Results With Significant Nighttime Impact.

XIII. The DSEIS Understated the Scope of the Project and Shielded Noise Impacts from Scrutiny

The fact that the location of all of the turbines have moved between the FEIS and the DSEIS, and not just Turbines 5, A, B, and C as BOWF claims, greatly expands of the needed scope of the DSEIS investigation, particularly with respect to noise. The changes in turbine location change the noise off the BOWF site. When turbines that are moved nearer to each other they have cumulative effects on noise that also need to be assessed. All the changes need to be analyzed by a complete DSEIS, not just a limited number of changes.

The DSEIS cannot possibly be considered complete given this new revelation.

Conclusion

The DSEIS failed to identify and assess specific noise effects for significant noise impact (Part IV). This omission alone should disqualify the DSEIS noise assessment from being accepted as complete. It also has the effect of shifting the burden of demonstrating no significant noise impact on to the assessment of the local law and the NYSDEC 6 dBA increase criteria.

Unfortunately, the DSEIS fabricated a local law, which disqualifies the fabricated standard as a test for significance (Part V). This problem has been known for years, but has not been corrected. It must be corrected, however, before the DSEIS can proceed.

Consequently, the only remaining criterion of significant impacts is the NYSDEC 6 dBA increase criterion. The DSEIS analysis with respect to the NYSDEC 6 dBA increase criterion is also flawed. It is flawed because it failed to assess the impact at property lines. Had a property line analyses been undertaken, significant impact would have been shown at many locations. In addition, the DSEIS fabricated a spatially and temporally averaged background level that hid significant noise impacts at residences, understating nighttime noise impacts by 10-15 dBA (Part VI).

In spite of these problems, the DSEIS data and DSEIS criterion of significant impact still show significant noise impacts at five non-participating residences. The DSEIS ignored its own data and criterion of significant impact (Part X). Had the DSEIS taken a hard look at its own data it would have recognized this and found a significant noise impacts. The DSEIS cannot distance itself from the NYSDEC 6 dBA increase criterion of significant impact because this is the only remaining test of significance in the DSEIS—the DSEIS failed to analyze noise effects and botched the noise regulation assessment. By ignoring the NYSDEC 6 dBA test for significant impacts as the DSEIS has done, the DSEIS is left without any test for significant noise impacts. If there is no remaining test for significant impact, the entire noise analysis is little more than hand waving.

The refusal to provide the monitoring and modeling data as requested (Parts VII and VIII) is all of a piece with the discrepancies about the actual site plan and turbine locations and other failings of the DSEIS noise assessment. The DSEIS is replete with undocumented and unverifiable claims that render the DSEIS conclusions unreliable. The DSEIS also has a number of omissions, that when corrected, show significant noise impacts (Parts XI an XII).

The DSEIS noise analysis must be rejected as incomplete. The local noise law must be fixed by the Town. Then an analysis of noise effects, an analysis with respect to the new local law, and robust analysis with respect to the NYSDEC 6 dBA increase criterion, including night time and property line impacts, should be conducted. The modeling and monitoring data supporting the DSEIS should be provided to all parties so that the accuracy can be assessed, and the discrepancies concerning wind turbine locations and the scope of the DSEIS resolved.

Since the DSEIS already clearly shows a significant noise impact, mitigation measures to avoid the impacts should be developed so as to minimize and avoid the impacts.

After the DSEIS is truly complete, the revised DSEIS should be submitted for public comment, and the process of the public actually being able to identify and understand the environmental and noise impacts of BOWF may begin.

Note: The methods and data used in this report are not secret or proprietary. We would hope that the Town Board/BOWF would share with us the modeling and monitoring data we requested, and provide us additional time to analyze the data and comment on the DSEIS. We would be happy exchange data with the Board/BOWF as well as address further questions the Board might have.

LES BLOMBERG

Box 1137, Montpelier, Vermont 05601
802-229-1659

PROFESSIONAL EXPERIENCE

EXECUTIVE DIRECTOR

Noise Pollution Clearinghouse, Montpelier, VT, 1996-present

- Founded a national non-profit clearinghouse dealing with noise pollution and hearing loss issues.
- Created and maintained an extensive noise pollution library.
- Conducted research into noise and its effects.
- Wrote articles and fact sheets for magazines, journals, and web sites.
- Advised consultants, communities, and individuals about noise pollution issues.

MEMBERSHIPS AND AFFILIATIONS

Member, American National Standards Accredited Standards Committee S12, Noise.

- Evaluated, revised, and approved national standards for noise measurement as a voting member of the S12 committee and as members of specific working groups
- Member, ANSI S12 Working Group 15, Measurement and Evaluation of Outdoor Community Noise
- Member ANSI S12 Working Group 38, Noise Labeling In Products
- Member ANSI S12 Working Group 41, Model Community Noise Ordinances
- Member ANSI S12 Working Group 50, Information Technology (IT) Equipment in Classrooms

Past Memberships

- Former Member, Acoustical Society of America (ASA)
- Former Member, Acoustical Society of America Technical Committee on Noise
- Former Member, National Hearing Conservation Association (NHCA)
- Former Member, Institute of Noise Control Engineering (INCE)

PAPERS AND PUBLICATIONS (partial list)

- “Update on Regulations Adding Noise to Electric and Hybrid Vehicles,” invited paper, Acoustical Society of America, 2014.
- “Noise in the 21st Century,” Acoustical Society of America Lay Language Paper, 2014.
- “Noise in the 21st Century,” invited paper, Acoustical Society of America, 2014.
- “Regulatory Inertia and Community Noise,” invited paper, Acoustical Society of America, 2014.
- “Natural Quiet: Where to Find It, How to Increase It,” invited paper, Noise in Communities and Natural Areas Workshop, Institute of Noise Control Engineering, 2013.
- “Optimizing Detection of Masked Vehicles,” invited paper, Acoustical Society of America, 2013.

- “Validity of a Temporary Threshold Shift (TTS) Detector for Use in iPods and Other Portable Audio Devices,” National Hearing Conservation Association, 2010.
- “Five Ways to Quiet Your Neighborhood,” published in *One Square Inch of Silence*, 2009.
- “Noise Masking of Vehicles, A Comparison of Gasoline/Electric Hybrids and Conventional Vehicles,” Noise Pollution Clearinghouse, 2008.
- “Wind, Noise, and Energy,” Noise Pollution Clearinghouse for American Wind Energy Association, 2008.
- “What’s the Ear For?” Chapter 47 of *Handbook for Sound Engineers,* 2008.
- “Hearing Damage Related to In-Ear Music Devices and other Consumer Products, “International Consumer Product Health and Safety Organization Symposium, 2007.
- “10 Ways to Quiet Our National Parks,” Acoustical Society of America, 2007.
- “Criteria Levels for Non-Occupational Noise Exposure,” Acoustical Society of America, 2006.
- “Consumers, Products, and Noise: The Economic, Social, and Political Barriers to Reducing Noise in Consumer Products Sold in North America,” Acoustical Society of America, 2006.
- “Opportunities and Progress in Consumer Product Noise Testing and Labeling,” Institute of Noise Control Engineering, 2006.
- “Noise (is) Pollution,” Quiet Zone, 2006.
- “The Nature of Noise,” Quiet Zone, 2006.
- “The State of State Noise Regulations in New England,” Institute of Noise Control Engineering, 2005.
- “Consumer Oriented Measurement of Product Noise,” Institute of Noise Control Engineering, 2005.
- “Acoustical Advocacy,” National Hearing Conservation Association, 2005.
- “Barriers to Community Input to Noise Policy Decisions,” Institute of Noise Control Engineering, 2004.
- “The Nature of Noise in Society,” Acoustical Society of America, 2004.
- “24 Hours of Noise in a Large City; Problems and Solutions,” Acoustical Society of America, 2004.
- “Why Diesel Trucks Are Quieter than Boats,” Lakeline, 2004.
- “The Future of Peace and Quiet,” Quiet Zone, 2003.
- “The Interest of the Public in Noise Control,” Institute of Noise Control Engineering, 2002.
- “A Punch from Michael Tyson Averaged over an Hour is a Very Long Love Pat: The Problems of Averaging in Noise Measurement,” MIT Seminar, 2001.
- “Noise Ordinances: the Good, the Bad, and the Ugly; An overview of more than 200 existing noise ordinances,” Acoustical Society of America, 2001.
- “Soundscapes, Quiet Zoning, and a Noise Sabbath,” Wisconsin Lakes Partnerships Conference, 2001.
- “Amphitheater Noise, A Community Perspective,” Acoustical Society of America, 2000.
- “Educating the Public about the Effects of Noise Pollution,” Acoustical Society of America, 2000.
- “Noise in the News: What the Media Is and Is Not Covering,” Acoustical Society of America, 2000.
- “Sound Decisions,” New Rules, 1999.
- “Noise, Civility, and Sovereignty,” Noise Pollution Clearinghouse, 1999.

PATENTS

- Number 7,780,609, Temporary Threshold Shift Detector, Issued August 24, 2010, allows users of personal listening devices to determine if they have listened at levels that could damage their hearing.

CLIENTS AND CONSULTING

Assisted hundreds of communities, mayors, council members, zoning boards, and police chiefs to understand, interpret, rewrite, and enforce their noise regulations.

- Drafted modifications to noise ordinances.
- Drafted new or complete overhauls of noise regulations.
- Advised communities on appropriate monitoring equipment.

Assisted Vermont towns with understanding, enforcing, and revising noise regulations.

- St. Albans
- Montpelier
- Waitsfield

Developed noise measurement procedures, evaluated testing facilities, and tested consumer product noise levels.

- Consumer Reports
- Quiet Zone (Noise Pollution Clearinghouse publication)

Modeled noise levels from various noise sources.

- Transportation
- Resource extraction

Created online libraries of important noise-related documents and answered questions about noise from the general public.

- US EPA
- Noise Pollution Clearinghouse

Partial List of clients:

- US EPA
- Consumer Reports
- American Wind Energy Association
- East Hampton, NY Airport
- Boston, MA
- Sierra Club
- Natural Resources Defense Council

Partial list of proceedings in Vermont in which participated or testified:

- 2014, Vermont State Environmental Court, Docket No. 99-7-13 Vtec
- 2014, Vermont State Environmental Court, Docket No. 182-12-13 Vtec
- 2013, District 3 Environmental Commission, Act 250, Application #3W1049
- 2013, Vermont State Environmental Court, Docket No. 159-10-11 Vtec
- 2012, District 7 Environmental Commission, Application #7C1321

- 2012, Vermont Environmental Court, Docket Nos. 122-7-04, 210-9-08 and 136-8-10 Vtec
- 2011, Vermont Public Service Board Docket #7628
- 2010, Vermont Public Service Board Docket #7156
- 2009, Greensboro, Vermont Zoning Permit, Lakeview Inn
- 2008, Vermont Environmental Court, O'Neil Sand & Gravel, LLC Docket No. 48-2-07 Vtec, Act 250 Application #2S0214-6A
- 2008, Bristol Vermont Zoning Permit, Lathrop Gravel Pit
- 2007, Vermont Environmental Court, Wright Quarry Docket Nos. 156-7-06 Vtec and 190-8-06 Vtec
- 2007, East Calais, Vermont Zoning Permit, Gravel Pit
- 2007, District 5 Environmental Commission, Route 100 Bypass
- 2006, District 5 Environmental Commission, Application #5W1455
- 2005, State Environmental Court, Docket No. 203-11-03 Vtec
- 2005, District 3 Environmental Commission, Act 250 Application #3W0929
- 2004, Norwich, Vermont Zoning Permit, Verizon Wireless Tower
- 2004, Moretown, Vermont Zoning Permit, Quarry
- 2003, District 5 Environmental Commission, Barre Town Police Firing Range
- 2001, District Number 5 Environmental Commission, Bull's Eye Sporting Center and Case Number 5W0743-3
- 2001, Dummerston, Vermont Zoning Permit, Quarry
- 1999, Vermont State Environmental Board, OMYA, Inc. and Foster Brothers Farm, Inc., Land Use Permit #9A0107-2-EB.
- 1999, Vermont State Environmental Board, Barre Granite Quarries, LLC, Application #7C1079-EB

EDUCATION

SEMINAR CADNA A EXPERT (Noise Model)
SEMINAR CADNA A ADVANCED
SEMINAR CADNA A BASIC
Datakustic, 2013

INTEGRATED NOISE MODEL TRAINING COURSE (FAA Noise Model)
Harris, Miller, Miller, and Hanson, 2010

COMMUNITY NOISE ENFORCEMENT CERTIFICATION COURSE
Rutgers Noise Technical Assistance Center, 1997

MASTER OF ARTS in Environmental Philosophy, 1993
Colorado State University, Fort Collins, Colorado

BACHELOR OF SCIENCE in Applied Mathematics, minor in Physics, 1989
BACHELOR OF ARTS in Philosophy, with honors, 1989
University of Minnesota, Duluth, Minnesota

Palermo, Jean

From: townclerk@townofenfield.org
Sent: Friday, April 22, 2016 5:48 PM
To: Virginia Bryant; Michael Carpenter; Enfield Energy; Henry Hansteen; Michael Miles; Frank Pavia; Jim Pippin; Ann Rider; Spencer, Kathy
Subject: Fwd: Black Oak Wind Farm Public Comments

Alice Linton
Enfield Town Clerk
168 Enfield Main Road
Ithaca, NY 14850
(607) 273-8256

-------- Original Message --------
Subject: Black Oak Wind Farm Public Comments
Date: 04/22/2016 10:24 am
From: Nancy Spero <nspero@lightlink.com>
To: Ann Rider <ann-rider@townofenfield.org>, virginia-bryant@townofenfield.org, michael-carpenter@townofenfield.org,
henry-hansteen@townofenfield.org, michael-miles@townofenfield.org, vera-howe-strait@townofenfield.org, townclerk@townofenfield.org
Cc: Nancy Spero <nspero@lightlink.com>

I am writing to express my comments on the Black Oak Wind Farm Draft SEIS. I understand that today is the last day open for public comment on this document. I am appreciative of all the work that has gone in to this project, but I still have many concerns.

As I have stated in the public meetings, I feel that the concerns of the Enfield residents living by the wind farm need to be taken seriously.
These are massive sized industrial wind mills and they will affect the lives of those living near them. I also believe they will affect the natural environment in the area. This is a huge industrial development for Enfield. I am not an expert in wind power, but I have been trying to follow the information which has been presented to the public by the experts and community members as much as possible. I live approximately
5 miles from the proposed site, so I am hoping that I will not be affected directly on a daily basis. But we live in a community, and if this affects some of our residents adversely, it will have impacts on us all.

It is not clear from looking at the Draft SEIS where the two windmills and the substation which are being moved will actually end up being placed. This information alone should be enough to slow down this process. How can you approve and fully understand the environmental impact when the total picture is not yet clear? I understand that if turbines B & C are chosen that they are so close together that they will have a cumulative impact on each other and this has not been addressed at all in the Draft SEIS. Does this mean more noise and vibration? I know this has been a long process, but it must be done correctly, and not be motivated by financial concerns.

The turbines model has been changed and the Draft SEIS should address all the impacts of this change on the 7 windmills, not just the ones which are being moved. The new turbines are more powerful and there are other changes

including the hub height, the sound, the speed. All these things will affect the shadow flicker, noise, and vibration for people.
I do not see that there has been adequate acoustic testing done. These are factors which will affect the residents daily, and it is not adequately addressed how these concerns will be mitigated, or how the affected individuals will be assisted financially if they are unable to live in their homes. There needs to be a mandatory, enforceable process to mitigate the impacts and compensate the owners if they are adversely affected. I would have trouble living close to these massive turbines.
The town is responsible for the health and safety of its residents and should be very concerned that they are provided with adequate protection.

The changes could also affect the forested areas and also bird and bat migration. The changes may make migrating and resident populations more vulnerable to being killed by the blades. New study should be part of the Draft SEIS. These are not minor changes. How will they affect sensitive environmental areas and the forested habitat? Is turbine 5 or other turbines too close to the wooded areas? I feel a full assessment should be performed again since the changes and since bald eagles have been discovered to be nesting in the area. The last assessment was done in 2014. What has changed since then? How will the new turbines affect these changes? This is an amazing natural area in Enfield and important to all of New York State. I do not wish to see it harmed.

It is also important to make sure the safety of all residents are taken into account. Has there been an adequate emergency plan should one of the turbines fail and lose a blade? Can the local fire departments respond to fires and contain them so they do not get out of control? How do people deal with ice throw by their homes? Are they able to safely be on certain parts of their land when ice is on the blades?

This is a major project being undertaken in the town of Enfield, and we are being asked to make a sacrifice in the quality of life in our town in the name of renewable energy. It is important that this process, if it is to continue forward, is done with thoughtfulness and due diligence on the part of the town to ensure the health and safety of all residents. Please consider all the ramifications of your decisions carefully.

Thank you all for the time and effort you have been putting into this massive and complex project.

Sincerely,
Nancy Spero
68 North Van Dorn Road
Ithaca, NY 14850

607-273-6603

4-22

Subject	**Comment for the DSEIS**
From	Gene T <postgene@hotmail.com>
To	townclerk@townofenfield.org <townclerk@townofenfield.org>, windadvisory@townofenfield.org <windadvisory@townofenfield.org>
Date	04/22/2016 8:19 am

roundcube

From: Eugene Tighe
423 West Enfield Center Road
Enfield

To: Enfield Town Board

Purpose: Comment for the DSEIS

As a 25 year resident of Enfield and the Connecticut hill area, I strongly urge the town to call a moratorium on the proposed Wind Turbine project to further study the effects of these large industrial machines on the community and the quality of life in Enfield, as well as hire an independent acoustician to do fair and proper ambient noise measurements and make recommendations for constant monitoring should these turbines go in. These new machines are the largest made and not in use anywhere close to judge the effects, the infra-sound effects of these larger blades may be felt for miles even affecting the children at the Enfield school. The current wind law was drafted years ago and the legislation is out of date with the current wind technology. (Precedence: Town of Orleans on the St. Lawrence April 2016)

Some Facts I've learned about Wind Turbine use

——These turbines will not affect carbon footprint and therefore do nothing to address global warming. Due to the intermittent, and unpredictable nature of wind generated power traditional power plants must be kept up and running (burning 90% fuel even if none of its power potential is used) Furthermore the burden of balancing wind power as it cycles up and down, with traditional sources is up to the power plants, this often uses more fuel. (as with stop and go driving in a car) The net result is the wind industry is unable to show any evidence that wind power reduces the use of other fuels, but customers must pay for the increased cost of running both sources.

——Wind turbines are economically unfeasible, they never pay for themselves. These projects can only be done with government subsidies of 66% to 75% of project cost. After which utility companies are required to purchase the power. In addition wind companies can sell 'renewable energy credits' or 'green tags' (an invention of Enron), and are thus able to sell the energy twice. (It has already been set up to sell the Black Oak Wind Farm to a large corporate concern). If your not on the gravy train this can only be viewed as a huge misappropriation of public and private funds which should be going to solving the global warming crisis.

SOME COMMON ECOLOGICAL IMPACTS

——Start with poor practices in the mining of the rare earth metals to make the large magnets needed for the turbines.

——Interruption of wildlife habitats starting with the construction of these huge towers to support massive turbines in excess of 450,000 pounds.

——483 foot diameter turbine blade sweep will cut through over 4 acres of sky with blade tips traveling at speeds of 150 - 200 miles per hour.

——These machines are loud 107 to 110 db on average, add 3 db to the din for each of the 6 addition turbines after the first for a total of 125 to 128 db average. This is way over OSHA standards for healthy noise levels and should not be allowed.

——Infrasound - as the 240 foot turbine blades pass the supporting tower the wind pressure on the blade is momentarily gone, then back again. This causes the blade to snap back then forward again causing a 1000+ foot pressure wave. (also known as turbine thump) Even though these waves don't come frequently enough the be detected as sound by the human ear, they stimulate and effect the inner ear, a major balance mechanism for all mammals, birds and amphibians. The wildlife will tend to migrate away. In the human population symptoms include:

- sleep disturbance
- headache
- ringing or buzzing in the ears (tinnitus)
- ear pressure
- dizziness, vertigo
- nausea - - (similar to car, sea, or air sickness it has even been compared to meniere's disease all inner ear disturbances. Suffers are likely candidates to feel the effects of the turbines)
-

- visual blurring
- racing heartbeat (tachycardia)
- irritability
- problems with concentration and memory
- panic episodes with sensations of internal pulsation or quivering which arise while awake or asleep

Segments of the population most affected by these w aves are senior citizens and children. These w aves have been measured as far as 30 miles from the source turbines, how ever in New York's varied topography 6 miles has been taken as a safe distance. This puts the Enfield school at risk.

Thank you for your concern

Eugene Tighe
423 Enfield Center Road West
Ithaca, New York

Sources:
https://w w w .w ind-w atch.org
http://w aubrafoundation.org.au
http://w iseenergy.org
http://w w w .sw lg.org.uk/uploads/6/3/3/8/6338077/spw In final small.pdf
http://w w w .blackoakw indny.com/environmental-impact-statement/final-eis/

Comments on the DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT for the Black Oak Wind Farm

Submitted by:
Mimi Mehaffey
115 West Enfield Ctr Rd

Impact Mitigation:

"The central purpose of Environmental Impact Assessment is to identify potentially significant adverse impacts at the pre-consent stage and to propose measures to mitigate or ameliorate such impacts. This section describes the range of methods which are available for mitigation. There are three established strategies for impact mitigation -avoidance, reduction and remedy."

Monitoring of the effectiveness of mitigation measures put forward in the EIS, both by the competent authorities and the developer, is an integral part of the process. Monitoring of environmental media and indicators arise either from undertakings or from conditions. In either case it is important for all parties to be aware of the administrative, technical, legal and financial burdens that can accompany inflexible or unresponsive monitoring regimes. It is important to ensure that, where monitoring is provided for, it is clearly related to thresholds, which if exceeded cause a clearly defined set of actions to be implemented."

https://www.epa.ie/pubs/advice/ea/guidelines/EPA_Guidelines_EIS_2002.pdf

There seems to be very few places in the DSEIS where thresholds are clearly defined or that a clearly defined set of actions to be implemented are defined.

Comments on the DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT for the Black Oak Wind Farm

Submitted by:
Mimi Mehaffey
115 West Enfield Ctr Rd

Purpose and Need.

The Purpose and Need Section of an EIS is one of the most important and should therefore be clear and well documented. The purpose and need drives the development of the range of alternatives.

The purpose and need for all the modifications should be clearly and honestly stated in the DSEIS

I cannot find where the BOWF has documented a purpose and need for the new met tower to be constructed.

As stated on page 4 of the DSEIS:

#4 "Addition of a new permanent wind measurement tower just south of turbine 4. This tower will consist of a 94 meter lattice structure, which will be self-supported, bolted to a foundation embedded in a concrete base. A visual representation of the meteorological tower is presented in figure 2. The meteorological tower will collect data such as wind speed, wind direction, and temperature.

Yet in the original Draft EIS: page 15

"2.2.4 Meteorological Towers

There currently is an existing 60-meter guyed meteorological tower installed just northwest of the Black Oak Road and Cayutaville Road intersection. This meteorological tower will be disassembled and removed from the Project Site during construction. During operation of the Project meteorological equipment will be installed on top of the nacelle on each turbine to collect wind data and support performance testing of the Project."

Moreover on page 1 of the DSEIS there is the statement:
"an assessment of potential alternatives has become necessary and as a result the project sponsor has prepared this SEIS for the Modified Project."

I cannot find where in the report the purpose and need of the changes is stated. This is important in that, if for some reason or reasons the "approved plan" is not viable or legal then their statement "While the Project Sponsor continues to assess its rights ....and potentially develop the Approved Project is also not correct.

Comments on the
DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
for the Black Oak Wind Farm

Submitted by:
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115 West Enfield Ctr Rd

Noise

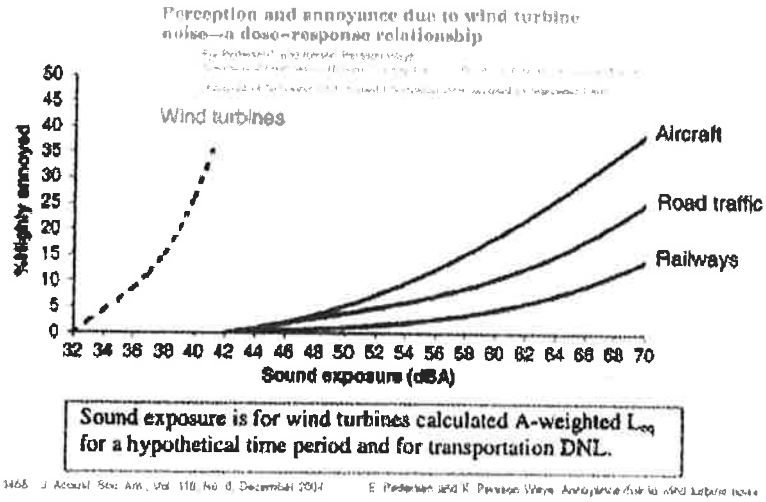
On page 38 of the DSEIS:
"The noise study completed for the Modified Project predicted that each alternative under consideration would result in 4 non - participating residences exceeding the 45 dBA NYSDEC Guideline. This compares to 3 non - participating residences that were predicted to exceed the NYSDEC Guideline in Section 6.17.1 of the Findings Statement.
In summary, no significant increases in sound impacts are anticipated as a result of the Modified Project"

By their own admission the noise levels for the Modified Project will be higher than the levels in the "Approved Plan". and will effect more people. (which I would argue were already too high)

The primary measure of noise effects on humans for the last 60 years has been annoyance. Annoyance is perhaps the most easily studied noise effect, and until the advent of the documentation of health effects related to noise in the 21st century and the release of World Health Organization's *Burden of Disease from Environmental Noise* in 2009, annoyance was the best metric to quantify noise effects. Annoyance acts as a composite measure of human response to specific health and other effects of noise. People who, for example, suffer sleep interference, communication interference, activity interference, or stress related effects will likely report that they are annoyed by noise. People are annoyed because of specific effects of noise they experience.

Annoyance from wind turbine noise has been studied and dose-response relationships (the quantification of how impact increases as the noise increases) for turbine noise has been developed by Pedersen and Waye, as well as other researchers. The salient aspect of this research is that the dose-response curve for wind turbine noise is much steeper than for other noise sources. For the same noise level, people find wind turbine noise very much more annoying than other noise sources such as road noise or aviation noise. This is due to the unique characteristics of wind turbine noise and possibly the interaction with visual impacts that may draw people's attention to the turbine noise.

Pedersen's 2004 paper published in the Journal of the Acoustical Society of America, the premier journal in the field, compares the dose-response curves for turbine noise and other noise sources, and is shown below.



It is clear from the above that wind turbine noise is very different from other noise sources: it is much more annoying and at lower noise levels than other noise sources. Consequently, to protect the public from the effects of wind turbine noise, much lower noise limits are needed.

Given the ambiguity of the sound level limits in the wind law - I would like to see a reasonable "not to exceed" level set for non-participating properties, with clear mitigation steps to be taken if they are exceeded. (like turning off the turbines)

Comments on the
DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
for the Black Oak Wind Farm

Submitted by:
Mimi Mehaffey
115 West Enfield Ctr Rd

Communication Facilities:

On page 38 and 39 of the DSEIS 2.17.1

It appears that no new Comsearch analysis was provided for anything but microwave communication systems. They do state that "Because there is no significant increase in the number of structures within the same general area, impacts to off-air television, AM and FM radio, cellular, or government radar will remain as described ...of the Findings Statement." Which modified plan are they referring to? A & B, or A & C or B& C and did they include the Met tower in that analysis. I would also like to know what "significant increase" means to BOWF. Households potentially being adversely affected should be identified by address. The land owners being affected will have a hard time weighing in, as there is no way to know who may or may not be affected and how.

An analysis should be done so landowners know the likelihood of whether or not they will have a disruption of their radio, internet, TV and/or cell phone and what the mitigation procedure would look like. If, as in the DEIS the proposed mitigation is that the land owner can purchase cable or satellite for something they are presently not paying for, I would like to see BOWF have to compensate the landowner for additional expenses. I have personally spent a great deal of money on expensive antenna for cell phone, TV, and internet reception.

Subject	**Black Oak Wind Farm DSEIS Comments**
From	Richard Entlich <gsg@twcny.rr.com>
To	Alice Linton <townclerk@townofenfield.org>
Date	04/22/2016 6:33 pm

roundcube

To the Enfield Town Clerk,

I'm submitting the following comments to the Enfield Town Board as part of the public comment process on the Draft Supplemental Environmental Impact Statement for the Black Oak Wind Farm.

My name is Richard Entlich, and I am a 40-year resident of Tompkins County currently residing at 320 Linn St in the City of Ithaca.

I have reviewed the public comments received in response to the original Draft Environmental Impact Statement, the responses to those comments in the Final Environment Impact Statement (dated November 2014), and the Findings Statement issued by the Enfield Town Board (approved January 2015).

In the approved Findings Statement from 2015, the Enfield Town Board described the purpose of the Environmental Impact Statement as "to identify and evaluate the potential significant adverse environmental impacts of the Project, compare the reasonable alternatives, and, where applicable, to identify reasonable mitigation measures to reduce the effect of those impacts to the maximum extent practicable while weighing the substantial potential social and economic benefits of the Project." In doing so, the Town Board sought to weigh the pros and cons of the project before coming to a final conclusion. It considered alternatives, including a "no action" alternative that would have left everything as it is and avoided all environmental impacts. In the end, the Town Board concluded that because of "the short-term nature of anticipated construction impacts and the generally minor long-term impacts of Project operation, as compared to the significant economic benefits that the Project would generate, the no action alternative is not considered a preferred alternative." Instead, an alternative that achieved a balance between pros and cons was favored.

The project as detailed in the Supplemental Environmental Impact Statement is little changed from the one that resulted in the Findings Statement. In fact, the project is nearly identical, with changes primarily involving relocation of two turbines and the substation, and installation of a permanent met (meteorological measurement) tower. For the most part, these changes have been proposed in order to accommodate concerns of local residents and to further reduce adverse impacts of the project.

Relocation of the turbines and substation are being proposed primarily as a result of the desire of some existing leaseholders to withdraw from their contractual agreements. The project is not obligated to release these residents from their contracts, but has offered to do so at considerable time and expense in order to accommodate the residents' wishes. Environmental impact studies that are affected by turbine/substation siting have been revised and updated to reflect the alternative locations.

The permanent met tower will provide additional data that will aid compliance with post-construction mitigation measures as well as anticipated educational and research uses of the site.

The many economic benefits of the project to the people of Enfield are all preserved, including

- Local road improvements
- Broadband internet services to Enfield
- Jobs to local labor for construction and long-term maintenance
- Money to the town of Enfield (Host community agreement and PILOT payments)
- Money for the Odessa & Enfield/Ithaca city school districts (PILOT payments)
- Money to leaseholders (local residents)
- Money for good neighbor agreements (local residents)
- Tourism benefits related to the educational and research aspects of the project

The project's environmental benefits, which are acknowledged on a number of occasions in the 2015 Findings Statement are, if anything, more important than ever, in light of the recently revised Tompkins County Energy Roadmap, and increasing evidence that the effects of global warming are accelerating and will likely be felt sooner than previously anticipated.

All in all, the changes described in the Supplemental Environmental Impact Statement are net positives in terms of the balance between pros and cons. As was the case with the original Environmental Impact Statement, this revised version merits acceptance for the reasons already so well-articulated by the Town Board in its Findings Statement of 2015.

Sincerely,

Richard Entlich

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Environmental Permits & Pollution Prevention
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www.dec.ny.gov

April 27, 2016

Attn: Town of Enfield Town Board
168 Enfield Main Road
Ithaca NY 14850
Attn: Ann Rider, Supervisor

Re: Black Oak Wind Project, DEC Comments on Supplemental Environmental Impact Statement (SEIS)

Dear Ms. Ann Rider,

The New York State Department of Environmental Conservation (DEC or Department) appreciates the opportunity to submit comments on the February 22, 2016 Supplemental Environmental Impact Statement (SEIS) for the modified project site at the Black Oak Wind Farm Project. The project is a proposed 16.1 megawatt (MW), seven-turbine, wind powered electric generating facility located in the Towns of Enfield and Newfield, Tompkins County, New York. As an involved agency in this process, DEC is submitting these comments related primarily to our permitting authority with an emphasis on wetland, stream, invasive species, state-listed threatened and endangered species, and storm water impacts. At this time, DEC has no requirements for Permits except for the SPDES Construction General Permit.

The comments are provided referencing the subject matter, or specific Section of the SEIS to the matter under discussion. This correspondence only addresses those additional environmental concerns which are a part of the Modified project, and which the SEIS also addresses.

Operations and Maintenance Plan

An Operations and Maintenance (O&M) Plan for the project should include an environmental management component incorporating environmental considerations for the maintenance of the facility. The plan should also describe procedures to assess and minimize environmental impacts during major repairs, emergencies, and decommissioning of the project. DEC recommends that opportunities to create additional environmental enhancements during the life of the project, beyond those required for restoration and mitigation, should be explored through cooperative partnerships with landowners, local governments, educational, and conservation organizations.

Water Resources

As with the Approved Project, DEC has found that the Modified Project does not cross or impact any protected streams as indicated in Table 4. The SEIS reports that there will be temporary impacts to intermittent streams. A Stormwater Pollution Prevention Plan (SWPPP), as a DEC SPDES Permit, is required and described below, and a Notice of Intent (NOI) must be submitted to DEC, prior to the commencement of construction or clearing activities.

Wetlands

As stated in the SEIS, the Modified Project will result in permanent wetland impacts from the construction of access roads. The wetlands, however, are not State Freshwater Wetlands. DEC recommends that that Black Oak contact the US Army Corps of Engineers (ACOE) for any possible federal wetland concerns they may have or permits they may require.

Climate/ Air Quality

The modified project will have similar results to the approved project, regarding improved air quality, to the extent that the energy to be provided would offset amounts of energy, if formerly provided by a fossil fuel source(s).

Section 2.4 Biological Resources - Section 2.4.2.1 Vegetation

Direct impacts occur in all forested areas cleared for the construction and operation of the project, and are considered permanent impacts. Indirect impacts occur to interior forests that are adjacent to areas cleared for the construction and operation of the project. Indirect impacts can be difficult to quantify, though many studies have shown that measureable impacts are found at least 300 feet, and up to 2000 feet, into the forest from the boundary of a disturbance. Such impacts include increased presence of nest parasites, predators, invasive species, and human disturbance. These, as well as changes in temperature, light penetration, humidity, soil moisture, plant composition, noise levels, prey availability, and other factors may cause birds to avoid forest edges during nesting, feeding, and migration periods. This can lead to increased intra-and inter-species competition for preferred interior forest habitat, changes in food availability, decreased fledging rates, and increased energy expenditure during foraging and territory defense in sub-par habitat.

To minimize direct impacts to breeding birds and bats, DEC recommends that all tree clearing take place outside of the primary bird nesting season (April 1-August 31) and bat breeding, roosting, and swarming period (April 1-October 31). Black Oak Wind should communicate with DEC and US Fish and Wildlife Service (USFWS) regarding options to mitigate for direct and indirect loss of forest interior habitat that may occur as a result of project construction and operation.

Section 2.4.1.3 Threatened and Endangered Species

There is one known bald eagle nest less than 10 miles west of the project boundary, one nest approximately 9 miles to the northeast of the project (as reported in the March 20, 2012 Avian Risk Assessment), and one nest about 11 miles southeast of the project. Black Oak Wind should coordinate with USFWS and DEC to determine the need for additional eagle use surveys.

The pre-construction bat acoustical survey was done from August 24 to October 9, 2009, and did not cover the entirety of peak bat activity, which is mid-July through the end of September. Additionally, the survey was done before the northern long-eared bat (NLEB) was listed as state and federally threatened in spring 2015. There are no known NLEB roost sites within 1.5 miles, nor is there aknown winter hibernaculum within 5 miles of the project. To minimize and avoid direct take of bats during construction, all tree clearing should be done between November 1 and March 31. DEC has concerns that any wind turbine project which operates in the State may have a direct impact on NLEB; therefore, we recommend operational curtailment during periods when bats are known to be present and are most active, and at greater risk of collision with turbines. Black Oak Wind should discuss with DEC the potential need for an incidental take permit, and the measures to avoid, minimize, and mitigate for take of NLEB, including following appropriate construction timeframes, and periods of operational curtailment.

DEC received a draft post-construction monitoring plan January 2015. Black Oak Wind should submit an updated plan to DEC and USFWS, and have a final plan in place prior to project operation. Post-construction monitoring should include ground searches and breeding bird displacement surveys.

Stormwater Pollution Prevention Plan

Before commencing construction activity, the owners or operator of a construction project that will involve soil disturbance of one or more acres must obtain coverage under the State Pollutant Discharge Elimination System (SPDES) General Permit for Storm water Discharges from Construction Activity. The SWPPP subject to the SPDES General Permit for Stormwater Discharges from Construction Activity (GP-0-15-002) shall include Erosion and Sediment Controls designed, installed and maintained in accordance with the most current version of the "New York Standards and Specifications for Erosion and Sediment Control." Additionally, for projects that include the construction of permanent gravel access roads, the SWPPP shall include post-construction storm water management practices designed in accordance with the most current version of the "New York State Storm water Management Design Manual (Manual)" (see Table 2, Appendix B of GP-0-15-002). Chapter 4 of the Design Manual should be used to determine the *minimum* sizing criteria for these post-construction controls. Black Oak must file with the DEC, a SWPPP in conformance with the GP-0-15-002, and submit an NOI to DEC prior to construction.

If you have any questions, please contact Betsy Hohenstein at (518) 402-9174, or by email at Betsy.Hohenstein@dec.ny.gov

Sincerely,

Betsy Hohenstein

Betsy Hohenstein
Environmental Analyst
Major Projects Bureau

Cc: M. Wells, Black Oak Wind farm project manager
M. Crawford, USACE
T. Sullivan, USFWS
B. Gary, DEC Biologist