Wind 1 and Wind 2
at the Falmouth WWTF

Zoning Board of Appeals

September 17, 2015

Senie & Associates, P.C.

Representing Impacted Neighbors

Clients Represented

- Neil and Betsy Andersen (with Attorney Watt)
- Todd and Terri Drummey
- Kathy and Brian Elder
- Barry and Diane Funfar
- John Ford
- Robbie Laird
- Linda Ohkagawa
- Mark Cool

Sample of Client's Sworn Testimony

Barry Funfar

"My perception sees, hears, and feels a rather multi-faceted sometimes bewildering array of affects……Things were fine before the machines were erected....We are under continual bombardment of unwanted stimuli that has caused my quality of life, my health, and my rights to use and enjoy my own property to be severely marginalized."

Sample of Client's Sworn Testimony

Linda Ohkagawa

"Since the turbines are not running on Sundays, per an injunction in another case, I experience relief from stress, fatigue, etc. I plan my week around Sunday – to be at home to accomplish tasks, to invite others to the house. The value of this respite and knowing this is a peaceful time I can count on is incalculable."

Sample of Client's Sworn Testimony

Terry Drummey

"When I am woken up from that sleep in the background there is often a low thumping swooshing noise and or vibration, and pressure. This never occurred before the turbines were built….. Lastly, the butterfly wings description that I give is difficult to explain, but when you get settled and are trying to go to sleep or if you get woken up from sleep and are trying to get back to sleep sometimes you slightly feel the turbines, it is a very gentle weight or pressure on your chest and body cavity."

Sample of Client's Sworn Testimony

Diane Funfar

"As for me I began having symptoms soon after the turbine began. At first I did not associate some of them with the turbine. After several trips away from home, I realized many symptoms disappeared. I have experienced frequent headaches (of which pre-turbine I rarely even had a headache)"

Sample of Client's Sworn Testimony

Kathryn Elder

"I can generally predict when there will be a problem such as when there is a moderate to high wind and coming from the Southwest or from a Northerly direction but there are other times when it is not windy at all and the pressure waves of the turbine penetrate my home."

The Acoustical Studies of Wind 1 and Wind 2

Two categories:

Studies done Before Wind 1 Installed and the Distress Experienced, and Studies Done After

- Before – only 1 Study done.
- After – many studies done.

Acoustical Studies Before the Wind 1 Distress

Only 1…..

– The November 2005 KEMA Study ("KEMA").

KEMA

- Done 3+ years prior to Wind 1 construction start
- Contained sound pressure contour maps of two GE models only (not Vestas)
- The two GE models for which there are contour maps have a quieter method of shedding unwanted wind (feather instead of stall).
- Predicted exceedance of local 40 decibel ("dB A") limit at property line
- Indicated noise to be studied in fuller detail as part of required special permit process (skipped by Town)

KEMA Was About Wind Resources

The November 2005 KEMA Study was oriented toward wind resources at the site and the financial feasibility of constructing a turbine at this location. It did not claim to be, nor was it, a proper and full assessment of potential adverse acoustical/vibration impacts of Wind 1. In fact, out of a total of 55 pages, only 2 ½ addressed noise. This is why the study itself referenced further treatment of noise generated by the planned turbine as part of the Special Permit process.

The KEMA Contradiction

- “Consistent with the Town Ordinance, there should not be excessive noise from the wind turbine above 40 dB(A) at the property line of the site”.

  How does this square with what appears 8 lines earlier?

- “In both cases, the estimated maximum impact is about 42 to 44 dB(A) at the property line of residences to the west or the south”.

KEMA – A Special Use Permit is Required

Falmouth Community Wind Project
Feasibility Study

Section 5,3,1 Page 34: "A Special Use Permit is required for construction and operation of windmills in the Town of Falmouth. Issues considered in the process include setback and noise. Based on our preliminary Project assessment, the recommended location should be able to satisfy its requirements and no overly contentious permitting issues have been identified."

No Special Permit or Special Use Permit has been issued for Wind 1 or Wind 2 (the Town is presently seeking one for Wind 1)

The Zoning By-law Referred to in KEMA (Section 240-166 - Windmills)

- "The Board of Appeals shall ensure, through the use of appropriate engineering data, that there shall be no adverse impacts on the neighborhood, in terms of television interference, ice throw, prop throw, noise, etc. There shall be a rebuttable presumption that noise from the windmill in excess of 40 dba, as measured at the property line, shall not *[sic]* be excessive". [the word "not", inserted in error, was removed by the Town Clerk – with Town Counsel approval]

Who Paid for the KEMA Study, and what do they think of it now?

- The KEMA Study was paid for by the administrator of the State's Renewable Energy Trust Fund (up to 2009 this was the "Massachusetts Technology Collaborative", or "MTC"; since 2009 the administrator of the Fund has been the "Massachusetts Clean Energy Center", or "CEC (together "MTC/CEC).
- The MTC/CEC sold Wind 1 to the Town.
- Today the MTC/CEC recognizes that the KEMA Study was "insufficient".

KEMA had "not accurately or sufficiently predicted sound pressures" (MTC/CEC Staff)

- In April 2013 the MTC/CEC Staff told its board of directors that the KEMA Study had "not accurately or sufficiently predicted sound pressures in the surrounding residential neighborhoods from the proposed turbine before Wind 1 was sold to the Town and constructed".
- In March of 2015 the MTC/CEC announced that it was awarding Falmouth relief in the amount of $1,800,000 to "help the municipality mitigate the financial impacts associated with reduced operations of its town-owned wind turbine project".

WHY?

Q. Why did the MTC/CEC Staff point out the insufficiency of the KEMA Study it had funded 8 years earlier, 4 years prior to ITS sale of Wind 1 to Falmouth (the only treatment of acoustics before Wind 1 was built)?

A. To get financial support to the Town while avoiding setting a precedent.

ASSISTING FALMOUTH WILL NOT SET A PRECEDENT

"Precedent – what will be the impact on other projects that are subject of neighbor concerns? *(if the MTC/CEC helps Falmouth financially)*

"There is substantial evidence that conditions for the Falmouth wind project are unique, both justifying the action contemplated herein and providing reasonable assurance that the Falmouth resolution will not represent a precedent for other wind projects, for example:……."

Why Falmouth is Different

- "Falmouth Wind 1 was one of the earliest municipally-owned megawatt scale wind turbines installed in Massachusetts. Even though the original MTC-commissioned feasibility study for Falmouth *[KEMA"]* over-estimated the likely acoustic impact, that study did not include a detailed acoustic analysis based upon sampling of ambient acoustic conditions (as is our current, more rigorous practice) which might have identified a potential exceedance of the 10 decibel limit."

- "The Falmouth wind turbines are of an older design which does not offer "low noise operations" or other retrofit options."

[April 2013 MTC/CEC Staff Report]

WHY THE FINANCIAL SUPPORT (1)

- The MTC/CEC paid for the KEMA Study in 2005
- In 2006 and 2007 the MTC/CEC had Wind 1 (and another turbine) in storage and wanted to find a buyer.
- Wind 1 came to be contracted to be sold and installed at a Town of Fairhaven facility.
- A Special Permit WAS applied for in Fairhaven, and granted by that Town's ZBA, but appealed to the Courts.
- In support of the sale to Fairhaven, the MTC/CEC paid for a 2007 acoustical analysis which considered ambient sound pressure levels and the degree to which those would be increased by the turbine (the prevailing standard of care at the time).

WHY THE FINANCIAL SUPPORT (2)

- The Town of Falmouth urged the MTC/CEC to abandon the Fairhaven project (because of the time needed to defend the granted special permit) and sell Wind 1 to Falmouth.
- The Town stated (through its consultant) that there is “no similar permitting risk in Falmouth”.
- The MTC/CEC agreed, and sold Wind 1 to Falmouth without causing to be done an acoustical analysis that met the then prevailing standard of care.
- The MTC/CEC and the Town knew that Wind 1 was being sold to the Town without such a study.
- This is why, in 2015, the MTC/CEC awarded $1,800,000 to “help the municipality mitigate the financial impacts associated with reduced operations of its town-owned wind turbine project”.

HOW DO WE KNOW THIS?

From an email sent by Jason Gifford, consultant to the Town of Falmouth, former employee of MTC/CEC. The March 28, 2008 email was addressed to the Town Manager and Assistant Town Manager of Falmouth:

> "I made sure Diedre *[Matthews]* understood that there is no similar permitting risk in Falmouth, and that arranging power and REC contracts was the only step left before Falmouth could execute a turbine supply agreement. She agrees that Falmouth is a great project, but I also sensed that MTC feels some commitment to Fairhaven."

The Consultant, Mr. Gifford

While consulting for the Town, Mr. Gifford worked as Senior Director for Sustainable Energy Advantage, LLC. While (previously) at the Massachusetts Technology Collaborative, Mr. Gifford was Industry Investment and Development Manager.

How Badly did MTC/CEC want to sell Wind 1?

The MTC/CEC was aggressively looking for buyer(s) for its two stored turbines. On December 8, 2006, the MTC/CEC issued a "Notice of Availability of Two 1.65MW Turbines". That notice addressed local permitting: "Permitting Schedule – the project proponent must present a credible and documented plan for obtaining all necessary permits in time to construct the project by December 31, 2007. MTC has a preference for projects that have completed the permitting process".

By December 31, 2007 turbines should be sold and erected.

The MTC/CEC Was Anxious

About 4 months after Wind 1 was supposed to have already been bought and installed somewhere, Falmouth approached MTC/CEC and encouraged it to not wait for the Fairhaven permit to be defended in court. With the expected time delay of it stuck with the Fairhaven project, the MTC/CEC was anxious to get Wind 1 sold.

[Fairhaven had caught an appeal, and the MTC/CEC was holding on to the 2 turbines they had in storage much longer than anticipated].

The Renewable Energy Trust Fund administered by MTC/CEC

The Massachusetts Renewable Energy Trust Fund is supported by a non-bypassable surcharge of $0.0005 per kilowatt-hour (0.5 mill/kWh), imposed on customers of all investor-owned electric utilities and competitive municipal utilities in Massachusetts.

The Fund collects millions of dollars every year from ratepayers.

The Fund does not have an expiration date.

DID EVERYONE AGREE TO SKIP The Special Permit Process in Falmouth?

Not initially. The Town's contracted professional engineer, Weston & Sampson, who's scope of work including "local permitting" (on both turbines), prepared permitting drawings and a Special Permit application for Wind 1 dated May 7, 2008.

The application now before the ZBA was actually prepared in <u>May of 2008 and not submitted</u>.

The Override

Six days after W&S prepared the ZBA application, the Falmouth Town Planner presented a memo to the Building Commissioner asking him to sign off that no permit was needed.

The Town's professional staff overrode the opinion of the Town's contracted professional engineer.

A Representation to its Board

The MTC/CEC Staff told its Board in April of 2013:

> "that study (KEMA) did not include a detailed acoustic analysis based upon sampling of ambient acoustic conditions (as is our current, more rigorous practice) which might have identified a potential exceedance of the 10 decibel limit".

Was that the Full Story?

But in 2007 MTC/CEC funded the Fairhaven Study by Tech Environmental, Inc. when Wind 1 was going to be sold by MTC/CEC for installation on Town of Fairhaven land. It does not appear that the staff explained to its Board that it had funded such a study when the turbine was considered for Fairhaven, and did not fund or require that such a study be done prior to IT selling the turbine to Falmouth.

Falmouth Also Knew What a Serious Acoustical Analysis Looked Like (1)

When the Falmouth ZBA reviewed the special permit application for the Notus Clean Energy turbine in early 2008 (same size and model as Wind 1 and Wind 2) it reviewed an acoustical analysis, dated March 4, 2008, prepared by Epsilon Associates, Inc.

The Epsilon Study

The March 4, 2008 Epsilon Study ran 23 pages and contained over a dozen charts, tables, maps and figures evaluating the potential acoustical impacts of the Notus turbine on adjacent neighbors, beginning with an analysis of existing ambient sound levels in the adjacent neighborhoods and the degree to which those would be increased by the proposed turbine. While the Epsilon study has many shortcomings, it demonstrates a standard of care knowingly skipped by the MTC/CEC and the Town of Falmouth on Wind 1 – and later on Wind 2.

Falmouth's 6dB(A) Standard

The Falmouth Zoning Board of Appeals has consistently applied a 6 dB(A) above ambient standard to wind turbine projects (not the DEP's default policy standard of 10 dB(A) above ambient):

1. Notice Clean Energy Special Permit (a condition of SP approval)
2. Scanlon Turbine Special Permit (a condition of SP approval)
3. In deciding the Appeal of Neil and Betsy Andersen (nuisance found)
4. In deciding the Appeal of Barry and Diane Funfar (nuisance found)
5. In 2013 the Town replaced the prior version of the Windmill Zoning By-law with a new version which incorporates the ZBA's 6dB(A) standard.

For turbine projects and appeals, this Board is bound by the standard it has applied consistently.

Why has the ZBA set the 6dB(A) Standard

Wind turbine sound pressures area unique, with infrasound and lower frequencies, and with a modulating, repetitive, impulsive, and variable character. In 2012 the Falmouth Board of Selectmen ordered a report on Wind 1 and Wind 2 by a firm known as DNV Renewables (USA), Inc. *(sometimes referred to as "DNV/KEMA" because for a short time DNV had acquired the outfit that had done the 2005 KEMA Study)*.

The report is dated March 15, 2012, and contains an excellent description of the unique attributes of wind turbine sound pressures.

Unique Sound Pressures from Wind Turbines

The DNV/KEMA report (on page 22) mentions four "often present" characteristics of wind turbine sound pressures: (1) infrasound; (2) low frequency noise, (3) amplitude modulation and (4) impulsivity (the so-called "Annex A" tests).

Neither the Town of Falmouth nor any of its consultants have ever treated (studied or analyzed) these unique sound pressure qualities in any manner for either Wind 1 or Wind 2.

The 6dB(A) standard set by the ZBA for large turbines is a way to account for the turbine sound pressures that can cause distress to nearby residents.

A “Penalty” of Several dB(A)

DNV recognizes a 5 dB **penalty** for “tonal audibilties” of turbines.

“In DNV’s experience, test data may reveal tones (or tonal audibilities) not previously predicted or included in a specification. Although not included in the DEP or town noise ordinances, in some locations turbines containing tones are penalized by adding, for example, 5 dB to the total sound power level to the turbine during the planning phase of a wind farm project, resulting in a greater setback.” *[Page 15 of DNV Report of March 15, 2012]*

In setting the 6dB(A) standard for wind turbines, the Falmuoth ZBA has assessed a 4 dB penalty, recognizing the unique character of wind turbine sound pressures.

Many Acousticians Apply such a Penalty

- Other experts call for a 5 dB penalty when amplitude modulated noise is present with wind turbines. See:

- "The Measurement of Low Frequency Noise at three UK Wind Farms" Department of Trade and Industry, 2006

- "Perspectives on Wind Turbine Noise" Fritz van den Berg, 2009

Studies Completed After the Wind 1 Distress Was Known

There have been many studies done AFTER the distress became known. While only addressing broadband sound pressures (and not the "Annex A" tests mentioned above by the Town's Consultant DNV), taken as a whole, these Studies impeach any serious claim that Wind 1 and Wind 2 can meet the zoning by-law provision the Town says applies:

"The Board of Appeals shall ensure, through the use of appropriate engineering data, that there shall be no adverse impacts on the neighborhood, in terms of television interference, ice throw, prop throw, noise, etc."

[Section 240-166 of the zoning by-laws]

The HMMH Study

Harris Miller Miller & Hanson Inc. ("HMMH"), *Falmouth Wind Turbine Noise Study*, September 2010, HMMH Report No. 304390.

HMMH reported noise levels above 40 dB(A) (town limit at property line) and average nighttime value of 8 dB(A) above background for a single operating turbine. Modelled results for both turbines operating concurrently indicated noise > 6 dB(A) for 8 of the 11 sites sampled (page 32).

The NCE Study

Noise Control Engineering, Inc. September 2010, commissioned by the neighbors.

Amplitude Modulation (AM) is present. AM is the repetitive swishing beat or thump occurring at blade rotation frequency known as Amplitude Modulation (AM) of the aerodynamic turbine noise. Furthermore the total noise violates both the 40 dB(A) Town Bylaw and the state limit of 10 db(A) above background.

The HMMH Supplement

Harris Miller Miller & Hanson Inc., Technical Memorandum to HMMH Report No. 304390 - Prepared for Mass DEP and the Town of Falmouth in response to DEP critique of the Sept, 2010 HMMH study.

HMMH reported modelled noise levels as high as 15.1 dB(A) above background for both turbines operating concurrently and > 6 dB(A) for 10 of the 11 sites sampled (table 9 last page).

The Weston & Sampson Study

Weston & Sampson Engineers, *Town of Falmouth Wind Turbine Mitigation Analysis,* December 2011, done at request of the Town of Falmouth.

Sound insulation and air conditioning would provide modest improvement in homes with windows closed but no improvement for low frequencies. Physical sound barriers are prohibitively expensive and impractical. Shadow flicker mitigated by turning off turbines.

The DNV Study

DNV Renewables (USA) Inc., *Review of the Falmouth, MA Wind-1 and Wind-2 Mitigation Report,* March 15, 2012. DNV Rpt. No.: DDRP0091. Done at request of Massachusetts Clean Energy Center (MassCEC) for the Town of Falmouth Board of Selectmen.

Recommends: (1) curtailment at wind speeds < 8 m/s at night to comply with DEP noise limits; (2) insulation of nearby homes; (3) purchase at fair market value and resale of homes of most affected abutters; (4) reduction of noise with blade modification (however no commercially available means for further noise mitigation of the V82 is available page 25).

How Many Homes

"When asked to consider how many properties would require testing to confirm the exceedances indicated by the Acentech noise model, Tony Rogers (DNV KEMA) replied to Stacie Smith (CBI Facilitator); '**DNV KEMA suggests that the number of houses to be considered for mitigation is between 20 and 40.'**"

Wind Turbine Options Analysis Process ("WTOP") Final Report to the Falmouth Board of Selectmen, January 2013

The Annex A Tests

"Infrasound…low frequency noise… amplitude modulation and impulsivity…are often present in wind turbine noise emissions….Collectively these optional tests are the 'Annex A' tests in the IEC Standard". *[DNV Study, page 22]*

"Without these Annex A test results, governmental bodies do not have a basis on which to determine realistic and appropriate noise ordinances". *[DNV Study, page 22]*

The Board of Health Review

Summary from the Falmouth Board of Health, Public Hearing 5/24/2012.

Purpose was to determine the scope of self-reported health effects from turbines. Testimony taken from 47 household members representing 63 individuals. The major health effect reported was sleep deprivation (85%) with attendant stress (53%), mental health problems (45%), hearing problems (32%), cognitive difficulties (25%), and other effects.

The DEP "Nighttime" Study

Massachusetts Department of Environmental Protection (MassDEP) *Attended Sampling of Sound from Wind Turbine #1 Falmouth, MA*, May 2012, done at request of the Falmouth Board of Selectmen:

Conclusions: "Results indicated that Wind #1 exceeds 10 decibels above background sound levels during nighttime hours, which is the limit above which MassDEP considers a noise a nuisance regulated by MassDEP's noise policy." (page 2).

Note: Measurements were made for Wind 1 only, the second turbine (Wind 2) was not yet operational. Results from 11 of the 12 field studies were > 6.0 dB(A) above background, 4 of 12 were > 10 dB(A) above background. Also, related to the Town's 40 dB(A) limit, 7 of 12 field studies showed turbine sound pressures > 40 dB(A).

The DEP "Daytime" Study

Massachusetts Department of Environmental Protection (MassDEP) *Attended Sampling of Sound from Wind Turbine #1 and Wind Turbine #2 Daytime operation Falmouth, MA* (Part 2), November 2012, done at the request of the Falmouth Board of Selectmen.

Although maximum power for both turbines was not sampled due to low wind speeds, several locations exhibited levels > 6 dB(A) above background.

The WTOP Report

Wind Turbine Options Analysis Process Final Report to the Falmouth Board of Selectmen Falmouth, MA, January, 2013, done at the request of the Falmouth Board of Selectmen, sponsored by the MassCEC and Facilitated by the Consensus Building Institute (CBI):

Multiple Perspectives Statement: How do we assess the relative weight of the 5 core interests? Should health, safety, and well-being of our neighbors carry the same weight as any of the four other interests? We conclude that it should be more heavily weighted above the other interests. Should town unity and reconciliation be weighted the same as climate action implementation or fiscal impacts? We conclude that town unity is second only to the health, safety, and well-being of our neighbors. If the Board of Selectmen seeks to end the tumult surrounding the turbines, then there is only one option.

The WTOP and the BOS

Following the WTOP Final Report (previous slide), on January 31, 2015 the Falmouth Board of Selectmen voted unanimously to remove Wind 1 and Wind 2. This decision was approved by the Representative Town Meeting but failed to garner enough referendum votes to be implemented.

The Neighbors have Studied the Annex A Tests

While the Town and its consultants have not studied the unique sound pressures from Wind 1 and Wind 2, the Neighbors have commissioned an “Annex A-type” study, and a peer review of that study.

These were turned over to the Town in February and March of this year with no reply.

Noise Control Engineering Study (1)

Page 6 of the February 27, 2015 report of Michael Bahtiarian of Noise Control Engineering:

"6.0 Conclusions

The Methods used herein allowed for the collection of infrasonic sound pressure levels within the inside of the Andersen residence. As shown in Figure 6, there is a readily identifiable acoustic signature that can be definitively attributed to Wind # 1 and possibly Wind # 2 located outside the Andersen home".

Noise Control Engineering Study (2)

Page 6 of the February 27, 2015 report of Michael Bahtiarian of Noise Control Engineering:

"To NCE's knowledge, this is the first time such measurements have been performed and reported with respect to the Falmouth wind turbines. However, this is not the first time such measurements have been performed, and other researchers have collected low frequency infrasonic acoustic signatures at other wind turbine sites in Wisconsin and Australia (references 11, 12). As reported in these other studies, the same blade passage rate infrasound and harmonic shown inside the Andersen home have been identified."

Noise Control Engineering Study (3)

Page 6 of the February 27, 2015 report of Michael Bahtiarian of Noise Control Engineering:

"Given NCE's signature analysis and the dramatic change in the acoustic signature when the wind turbine(s) are shut down, NCE can unequivocally state that the infrasonic signature captured inside the Andersen residence is 100% attributed to either one or both of the Town of Falmouth Wind Turbines….the wind turbine(s) produce acoustic emissions which are 'acoustically trespassing' into the Andersen home."

The Peer Review by Richard James

Page 3 of the March 25, 2015 report of Richard James of Ecoustics Solutions:

“These outcomes were anticipated by the wind turbine studies conducted by NASA/DOE scientists in the 1980’s. Their research was broadly disseminated through acoustical and wind energy conferences. The experiences reported by the complainants were entirely predictable in the Wisconsin and Australia projects as they were for the Falmouth project.”

The Peer Review by Richard James (2)

Page 3 of the March 25, 2015 report of Richard James of Ecoustics Solutions:

"Had the Falmouth project relied on all of the evidence about wind turbines and adverse health effects as described in this statement, had due diligence been conducted to seek out information not from the industry or its promoters the project would not have been presumed to be safe for the neighbors. The NCE report documents these conditions and supports the complaints that have been made publicly and privately by residents of Falmouth."

Richard James (3)

Page 3 of the March 25, 2015 report of Richard James of Ecoustics Solutions:

"This comparison of the findings in the NCE report and recent studies shows that the occupants of the homes near the Falmouth Wind #1 and #2 wind turbines are exposed to similar levels of acoustic energy in the same frequency range and with similar tonal characteristics as the occupants of homes in Wisconsin's Shirley Wind and Australia's Cape Bridgewater communities. Those occupants experienced sensations strong enough to result in them vacating their homes. It is reasonable and prudent to apply those findings to the homes near the Falmouth wind turbines."

Tech Environmental, Inc.

Tech Environmental, Inc. (“TE”) Performed the 2007 acoustical study of Wind 1 when it was to go to Fairhaven. It was inadequate in many respects, but it did begin with an examination of ambient sound pressure levels, and predicted the degree to which these would be increased by the turbine if installed in that location.

The Fairhaven study predicted sound pressures at the closest neighborhood of 9dB(A), which may be part of why the Fairhaven permit was appealed to the Court.

Tech Environmental, Inc. (2)

TE is the only acoustical engineer listed (so far) who will be a witness for the Town at the trials on the Wind 1 and Wind 2 turbine matters *(though no TE work related to Falmouth has been turned over to the neighbors, even thought the Town has had the reports of NCE and Rick James for months)*.

In July of 2006 the President of Tech Environmental, Inc., Mr. Peter Guldberg, testified before the State of Vermont Public Services Board regarding a wind turbine project proposed by UPC Vermont Wind, LLC. This testimony supports the claims made above that wind turbines have a unique set of characteristics that require serious consideration.

Tech Environmental, Inc. (3)

In critiquing the work of the applicant's acoustician Christopher Bajdek of HMMH, Mr. Goldburg articulated what was lacking:

"No impulsivity analysis was performed. Recent research reveals that low frequency modulated sound from wind farms at night are the most annoying audible sounds these installations produce. Mr. Bajdek failed to consider these impacts."

10 times Rotor Diameter

One reason there haven't been more "Falmouths" on the Cape is that the Cape Cod Commission adopted a Minimum Performance Standard that imposes a presumptive setback distance for turbines the size of Wind 1 and Wind 2 of 10 x rotor diameter:

Minimum Performance Standard E1.8 "Noise – All Applicants for a WECF *[wind energy conversion facility]* greater than 660 KW shall perform a noise study and fund a Cape Cod Commission approved consultant's review of the noise study, and adhere to a setback of 10 times rotor diameter of the proposed turbine from the nearest receptor, or residentially zoned parcel….."

Multiples of Rotor Diameter

The Andersen home is located 4.3 times rotor diameter from Wind 1.

The Ohkagawa home is located 4.1 times rotor diameter from Wind 2

Even the wind industry recognizes a setback between turbines (to avoid wind interference) of 7 times rotor diameter in the downwind direction).

If the industry is troubled by low productivity at 7 times rotor diameter, one can easily appreciate that a turbine the size of Wind 1 and Wind 2 can impact residents located less than 5 times rotor diameter away.

The Serious Warning from Vestas on Wind 2

Before the supply contract for Wind 2 was signed with the manufacturer, Vestas, the Town was asked by Vestas and its general contractor on the project (Lumus) to sign a letter taking full responsibility for the siting of Wind 2 in light of Vestas' articulated concerns about the sound pressures this turbine is capable of creating in this location. This request came in the form of a letter from Lumus dated August 3, 2010 (the "Lumus Letter").

The Reply the Same Day

The Town had its Wastewater Superintendent Gerald Potamis respond (the same day the Lumus letter was received), by sending a separate letter directly to Vestas. In that letter the Wastewater Superintendent assumed, for the Town, all such siting responsibility and liability (the "Potamis Letter"). An earlier draft of the Potamis letter, dated July 1, 2010 (so more than a month before the Potamis letter was sent to Vestas), called for the signature of the Falmouth Town Manager.

The Town Manager was to Sign

During this month of discussion of what to do about the Vestas refusal to sell Wind 2 because of sound pressure concerns: (1) it appears that no-one on the staff brought this to the attention of the Board of Selectmen (based on BOS meeting minutes); and (2) the signer was switched from the Town Manager to the Wastewater Superintendent (who apparently signed this letter assuming responsibility without authority).

Why Was Vestas Concerned?

The concern of the turbine supplier is easy to appreciate by reading the Lumus letter, which reads in part:

"Due to the sound concerns regarding the first wind turbine installed at the wastewater treatment facility, the manufacturer of the turbines, Vestas, is keen for the Town of Falmouth to understand the possible noise and other risks associated with the installation of the second wind turbine. The Town has previously been provided with the Octave Band Data/Sound performance for the V-82 turbine. This shows that the turbine normally operates at 103.2dB. But the manufacturer has also stated that it may produce up to 110dB under certain circumstances."

110dB(A) vs 103.2dB(A)

It is important to note that the HMMH studies commissioned by the Town AFTER the distress was known acknowledged the maximum sound power level of 110dB(A) for the Vestas V-82, but inputted the averaged Octave Band Data of 103.2 dB(A) power into its projected sound pressures. Thus, the HMMH studies are low by about 6-7 dB(A). Even so, both the main HMMH study and the supplement showed many instances of exceedances at the neighbors homes.

Mr. Potamis Replied for the Town:

"The Town of Falmouth was responsible for siting the turbines, and we:

- Recognize the published octave band date/sound performance for the V-82;
- Understand that the option to mitigate sound from the V-82 through curtailment of the operation of the turbine at certain wind speeds and directions will detrimentally effect power production; and
- Recognize the potential for ice throw from wind turbines."

The Distress Was Well Known (1)

As of August 3, 2010 Lumus warning letter, and the Potamis assumption of liability letter sent the same day (the "Warning Date"), the Town was well aware of the distress being caused by Wind 1.

By the Warning Date, the Town had received numerous complaints from neighbors. Brian and Kathryn Elder had sent the Town a registered letter (dated May 5, 2010), and met with the Assistant Town Manager and Building Commissioner at their property to show the degree of distress to Town officials. By the Warning Date the Town Planner had sent an email to neighbor Barry Funfar (dated June 3, 2010) regarding the turbine distress. Also by the Warning Date, the ZBA and the Falmouth Planning Board had held a joint meeting to discuss the problems with Wind 1 (that meeting took place on June 4, 2010).

The Distress Was Well Known (2)

By the August 3, 2010 Warning Date the Town had held a meeting to discuss the scope of a sound study (to be done by an engineering firm known as HMMH) of Wind 1 (actual) and Wind 2 (projected) sound pressures (that meeting held on June 10, 2010). Also a letter had been sent from Assistant Town Manager, Heather Harper, to neighbor Barry Funfar (dated June 15, 2010) discussing measures being taken by the Town in response to complaints. In her letter to Mr. Funfar, she indicates that the Town has instituted a mitigation measure which turns off Wind 1 in certain wind conditions, which had, by the date of that letter, been utilized 39 times, and had a "positive impact".

Vestas Asked Weston & Sampson for an "updated study" for Wind 2

Fri 5/28/2010 1:48 PM Brian Hopkins brhop@vestas.com RE: Sound / Feasibility Studies TO: Wiehe, Stephen, cc Duijvesteijn, Olle; Yanuskiewicz, Francis

"Steve, I don't believe I saw a feasibility study for Falmouth other than Site Plans. Was a sound study updated with the additional turbine? Does the information I provided in the octave band data support the conclusions that you are conservatvely within MA state sound regulations? The table highlights the fact that V82 produces greater decibels when it reaches its stall regime beyond the IEC design standard at 95% capacity. The table also helps recognize the effects of shear on the sound levels experienced at receptors which should also be considering with the sound study. My email was lost from the time we did the first turbine so I don't have a great record of information but do you have this decibel mapping for Falmouth?"

There was no “decibel mapping”

Question from Vestas: “Do you have this decibel mapping for Falmouth?”

The Answer: There appears to have been no answer to this Vestas email by either the Town or W&S (based on documents requested through discovery, and what has and has not been provided).

There never was any decibel mapping for the second turbine, or for both turbines operating together, as of the date of the Potamis letter accepting responsibility.

The concern of Vestas (accurate acoustical mapping) was apparently ignored.

The Representation about a "two-turbine configuration"

The entirety of the treatment by the Town and its consultants of installing a second turbine at the WWTF was a representation by the Assistant Town Manager made at Town Meeting:

"We've passed the technical feasibility test. The size of the site is over 240 acres. It can support two turbines. The distance to residences is greater than 1,000 feet from any residence. And the prior studies that we have done are relevant for a two turbine configuration". *[Transcript of June 29, 2009 meeting of Town Meeting.]*

The only "prior study" (i,.e. study done before the decision to install a second turbine), which dealt in any way with sound pressures was the KEMA Study, which was very insufficient, and which dealt with a single turbine.

Wind 2 Received no Acoustical Analysis at All

The Town did not even do a KEMA level review of the potential adverse impacts of Wind 2 (as insufficient as the KEMA Study was). There was no sound study. There was no review of the impact of two turbines operating in close proximity (and the phenomena of “beating”, that happens when adjacent turbines beat into and out of synchronization with one another). No study what-so-ever. Just the Assistant Town Manager telling Town Meeting that the prior studies “are relevant”.

The ZBA Ruled in the Funfar Appeal

This Board has previously deliberated a request to find that Wind 1 and Wind 2 constitute a nuisance under the Falmouth Zoning By-laws. The Board held:

"Therefore, the Board affirms the Appeal by Barry and Diane Funfar that the Town wind turbines located at 154 Blacksmith Shop Road in East Falmouth are a nuisance to the property located at 27 Ridgeview Drive in West Falmouth that directly and negatively effects the health and wellbeing of Barry and Diane Furfar, owners and residents as said property…"

The ZBA Ruled in the Andersen Appeal

This Board reached the same conclusion in the Andersen request for enforcement:

"The Board does find through testimony given at the hearing and through site visits by the Board members that in its collective judgment…. a nuisance does exist …. by virtue of excessive and obnoxious noise likened to the repetitive takeoff of jet planes and other objectionable features including pressure waves caused by the operation of the wind turbines and that the combinations of these conditions negatively impact the Appellant's ability to use and enjoy his home and property…."

Judge Muse' Injunction

As to the Andersen case, in November of 2013, the Barnstable Superior Court issued a Preliminary Injunction, which remains in effect, limiting operations of both Wind 1 and Wind 2 to daytime (7:00am to 7:00pm), with no operation on Sundays and three specific holidays. The bar for such an injunction is extremely high; the applicant must show irreparable harm and a strong likelihood of success in the case.

Judge Muse' Injunction (2)

The injunction reads at page 3:

"The Andersens have submitted affidavits and medical records supporting their claim that the nuisance produced by the turbines has resulted in substantial and continuous insomnia, headaches, psychological disturbances, dental injuries, and other forms of malaise. The court find the Andersens' claims that they did not experience such symptoms prior to the construction and operation of the turbines, and that each day of operation produces further injury, to be credible.

Judge Muse' Injunction (3)

The injunction reads at page 3:

Taking the evidence of irreparable harm in conjunction with the moving parties' substantial likelihood on the merits of their claim to uphold the ZBA's finding of an ongoing nuisance……the court finds there is a substantial risk that the Andersens will suffer irreparable physical and psychological harm if the injunction is not granted."

The By-law to be Applied

As stated above, the ZBA has determined that it is the proper Special Permit Granting Authority and that the Town is entitled to apply (and has applied) for a Special Permit under the old version of Section 240-166 *(a claim not accepted by the neighbors and preserved as an appeal issue)*.

The old version of Section 240-166 (like the new version) only allows turbines as ACCESSORY USES (as to the old version, it was incorporated into the Public Use District through Section 240-33-G 5, which allowed "Windmills" only as accessory uses and only by special permit).

Wind 1 and Wind 2 are NOT accessory sized turbines.

4 Times the Electricity Needed

Each of Wind 1 and Wind 2 is designed to produce over 3,000 KW Hours/per year of electricity, roughly double what is needed at WWTF (the WWTF uses about 1,500 KW Hours per year). If one turbine is double, both together can (if not mitigated) generate about 4 times the electricity needed at the WWTF. Four times the electricity needed at the WWTF renders the turbines greater than accessory-sized.

The Town Told the Neighbors that a Smaller – Accessory Sized Turbine was Planned

In 2004 the Town sent a mailing to all neighbors with a questionnaire. 7 neighbors filled out the questionnaire, indicating that noise was an important concern. This questionnaire advised the neighbors of the size turbine planned. When the Town shifted to a larger turbine, and then a second larger turbine, it did not write back to the neighbors and disclose the switch.

The Field Trip to Hull 1

Not only did the Town send such a questionnaire, but it organized several field trips to see a turbine in Hull known as Hull 1, the size turbine mentioned in the questionnaire mailed to all neighbors.

None of the warrant articles on the Town's turbines at the WWTF (the published warrants providing notice) mentioned the size turbine to be installed.

Ask the Neighbors

The ZBA is encouraged to ask neighbors Kathryn Elder and Barry Funfar, both of whom filled out the questionnaire and went to see Hull 1 with the Town, if they believed, up until the moment Wind 1 appeared above their homes, that the size turbine being installed was the size of Hull 1 (a 660KW turbine, not the 1,650KW size of both Wind 1 and Wind 2).

Each of Wind 1 and Wind 2 is three times larger than Hull 1 in terms of blade swept area.

No Additional Mailings

The following is what the questionnaire said; there were never any follow up mailings of any kind to contradict this communication about purpose and size:

The Questionnaire (1)

The Questionnaire reads:

"In the summer of 2003, the Town of Falmouth conducted an energy audit, which revealed that the Town spent over $140,000 in Fiscal Year 2002 on electricity to operate the West Falmouth wastewater treatment plant. As energy prices continue to rise and upgrades to the plant are made, these costs are estimated to increase to $200,000 per year. At this time, the Town of Falmouth is undertaking a feasibility study to evaluate the potential of installing a wind turbine at the wastewater treatment plant to provide the needed electricity."

The Questionnaire(2)

The Questionnaire continues:

"The location currently being considered for the wind turbine is approximately 1,500 feet from any residence with dense vegetation existing in the buffer areas. **Wind turbines of the type and size being proposed stand approximately 240 feet high from the ground to the tip of the blade at its highest position ("12 o'clock").**

A 660KW

The phrase *"the type and size being proposed stand approximately 240 feet high from the ground to the tip of the blade at its highest position ("12 o'clock")*" in the questionnaire describes a 660KW Turbine, the size of Hull 1, and the turbine at the Mass Maritime Academy in Borne.

In contrast, Wind 1 and Wind 2 are 398 feet tall.

A Material Difference (1)

The difference between a 660KW and a 1,650KW turbine is material:

The sound pressures from a turbine the size of Hull 1 (660KW) are considerably less, both in terms of overall A-weighted sound pressures and (especially) the lower frequency pressures. Hull 1 is a Vestas V47 (47 meter rotor diameter), whereas Wind 1 and Wind 2 are Vestas V-82 (82 meters rotor diameter).

A Material Difference (2)

The difference between a 660KW and a 1,650KW turbine is material:

Comparing published Vestas sound pressures for the lower frequencies, the differences become very pronounced. For example, at 63 Hz (a low frequency but still audible) the sound pressures from the Vestas V47 (660KW/200KW) are 15.9 decibels **lower** than the same measurement for the Vestas V-82 (1,650KW).

Why the Switch to a Larger Turbine?

In the spring of 2005 there appears to have been a shift to "going big" within the Falmouth Town Hall. One sentence of the minutes of the Falmouth Energy Committee ("EC") meeting of March 28, 2005 sheds some light on this shift:

"Is it better have too much power if we get a Great Deal on bigger turbine"?

Comparisons

The same Energy Committee meeting minutes discuss comparisons:

"Suggestions for visuals/comparisons:

- Compare to local big things (downtown radio tower) - put things in scale
- Compare wires (foreground) to tower (background) - photo art
- **Compare Hull Turbine 660kw; to 1500kw-2300kw turbine (noise, etc.)**
- Compare to water generators; vertical wind turbines
- Compare costs of battery power backup to grid power backup.

The Hull Turbine vs a Larger Turbine

Why the need to compare the Hull 1 Turbine (660kw) to a larger size? The reason is simple; up until this point, the 660KW turbine is what the Town had told the neighbors it was planning to install (questionnaire, field trips). The Town never did prepare and present any comparison of the noise generated by a 660KW turbine with the sound pressures of a 1,500 or 2.300KW turbine (significant as described above).

Stall vs Pitch Regulated Turbines

Wind 1 and Wind 2 use an older (and disfavored) mechanical technique to shed unwanted wind – called stall regulation (the Vestas V-82 is no longer manufactured).

The State has recognized that Stall Regulated Turbines are louder.

"Wind Turbine Health Impact Study" published jointly by the State of Massachusetts Department of Public Health and Department of Environmental Protection dated January 2012, Appendix F – "Stall vs Pitch Control Noise Issues": "…pitch regulated turbines are quieter than those with stall control. This is particularly the case at higher wind speeds."

The Turbine Specifications

The authors of the November 2005 KEMA Feasibility Study (in Section 3.6.1 on page 21), state: “It should be noted that special low-noise versions exist, which as a consequence have a lower power output”. The Town did not specify the low noise version when issuing specifications for the turbines to be constructed at the WWTF.

The Town did not Follow its own Plan

The Town of Falmouth did not follow its own plan in implementing the wind energy program at the WWTF. That plan is embodied in the zoning by-laws at the time (special permit for all turbines required, not just privately-owned turbines), and the November 2005 KEMA Feasibility Study. The KEMA study specifically called out Section 240-166 of the by-laws and stated that further study of noise would be completed as part of a special permit review process required under that by-law. This was skipped, notwithstanding that the Town's engineering consultant had actually prepared the application.

The Standard of Care was not Met

Then, once the sound pressure distress caused by Wind 1 was well known, the Town ignored a serious warning from the turbine manufacturer and proceeded with no acoustical analysis of the second turbine, and no study of the combined impact of both turbines running at the same time. This fell far below the normal standard of care at the time, and constitutes negligence.

“Good Faith”

In denying the neighbors’ appeal of the June 11, 2015 Order by the ZEO, this Board accorded the Town flexibility due to its good faith in submitting an application for Special Permit.

The application is incomplete, with no treatment of acoustical impacts on neighbors (required to be shown through engineering data, as per the old version of Section 240-166).

But also, the Town has not applied for a Special Permit for Wind 2. Counsel to the Board of Selectmen has indicated that the Town may or may not apply for such a permit on Wind 2.

“Good Faith” (2)

On Aug 12, 2015, at 5:15 PM, "Mark Bobrowski" <mark@bbmatlaw.com> wrote:

“Diane – the gentlemen were asking when we might expect the 2nd special permit application? When you know, please inform us. Thank you. Mark”.

Attorney Tillotson replied: “Mark, I am not certain there will be one although we are considering it. I will of course keep everyone informed. Thanks, Diane

Wind 2 is situated exactly the same as is Wind 1 – it was constructed without proper permitting under the zoning by-laws. It was built in the same zone, and is the same type and size turbine. The Town is evidencing a lack of Good Faith by not (yet) applying for a Special Permit for Wind 2.

The Town's Wind 1 "application"

The (old) version of the Windmill By-law (240-166), which this Board says applies to the Town's Special Permit applications, contains these five requirements (A.-E. in the by-law):

A. Setback – total height plus 10 feet;

B. Adverse impacts on neighbors including noise (through engineering data);

C. Wires to be underground;

D. Use Permit Required (turbine not to be operated without one);

E. Protected from unlawful access.

The Town Skipped Acoustics Again

The Wind 1 Special Permit application addresses: (A) setback; (C) wires and (E) protecting from unlawful access.

As to the requirement of a Special Use Permit before operations, the Town is in violation.

More importantly, as it did in 2008, the Town has skipped treatment of potential sound pressure impacts. The application, which consists of: (1) a filled in form, (2) a 1-page summary, and (3) a set of plans, contains no acoustical treatment of Wind 1, and the impacts on adjacent neighbors, as required by the By-law.

A 1-Page Summery, Compare to the Notus Application

The Town has submitted one page of substantive information about Wind 1. This is a sharp contract to the application filed in 2008 by Notus Clean Energy when it applied for a special permit from the ZBA for the sister turbine to Wind 1 (sister turbine because it is the other turbine that the MTC/CEC had in storage, and is the same model and size).

The Notus Special Permit application was lengthy and included a full (though faulty) acoustical analysis beginning with an evaluation of the existing sound pressures in the neighborhood, and treatment of by how much these would be increased by the proposed turbine.

The Town might supply an acoustic study later (1)

In order for an application for Special Permit for a turbine under either version of Section 240-166 to be considered complete, and ready for a public hearing, it must include an acoustical analysis that shows NO ADVERSE IMPACTS ON NEIGHBORS. The Town has submitted none.

The public hearing should not have been started without this study, so the public has time to hire its own consultants to critique the study *(The Town of Peru, MA ZBA recently refused to commence a ZBA public hearing until the turbine application was made complete with the necessary acoustical study)*.

The Town might supply an acoustic study later (2)

The Town can't delay its study, and submit it later in the Special Permit process, which would limit the ability of other parties to critique.

If the Town files a late acoustical analysis, some questions arise: (1) will the public and the neighbors be given time to have a peer review done; (2) will it apply a penalty due to the unique character of wind turbine sound pressures; and (3) will it address the Annex A Tests?

The ZEO's Refusal to Cease Operation Until Turbines are Permitted

As to Wind 1 – the ZEO responded to the present request for enforcement that: "It is my opinion that any deviation from those parameters will constitute a violation of the Court Order" *(referring to Judge Muse' Injunction)*.

This reasoning is empty and illogical. Judge Muse did not know that Wind 1 and Wind 2 were operating without lawful permits when he issued his injunction order. Issuing a Cease & Desist Order would EXPAND on and not conflict with an order prohibiting operations at night and on Sundays.

The ZEO's Refusal to Cease Operation Until Turbines are Permitted

As to Wind 2 – the ZEO responded to the present request for enforcement that: "To date there has been no decision from any Court of competent jurisdiction relative to Wind II and therefore no enforcement action shall be taken at this time".

This is: (1) an abdication of a duty which, at this stage, belongs only to the ZEO; and (2) a pretext to hoping that the neighbors will have to endure another set of years litigating the same legal question as has just been resolved by the Courts as to Wind 1.

This is more evidence of a lack of good faith.

The Town Attorney's Guidance

In February of this year, Town Counsel Frank Duffy gave the Building Commissioner and the ZBA an opinion favorable to the granting of Cease & Desist Orders (this was the case of Tavares: 104-14, where such an order was issued).

From the February 12, 2015 email from Frank Duffy to Sari Budrow

"The Building Commissioner has authority to issue cease and desists orders when he observes a violation of the zoning by-law…the power in inherent in the office……Where there is a violation of a town's zoning bylaw, issuance of a cease and desist order is an acceptable and common enforcement practice among municipal officials charged with enforcing zoning by-laws."

The ZEO should be consistent in the exercise of his authority and issue a Cease & Desist Order to the Town since it is very clear that Wind 1 and Wind 2 are operating in violation of the zoning by-laws.

Other Neighbors

The Twelve Neighbors of Wind 1 and Wind 2 listed at the start of this presentation are not all of the Falmouth residents distressed by the sound pressures and shadow flicker caused by the Town's turbines.

One neighbor represents himself in the litigation.

Two couples dropped out of the litigation process for financial reasons, but were listed as parties in lawsuits.

There are other neighbors not comfortable participating publicly, but who have reported distress.

“He Can’t Turn Them Off”

Sent: Thu, Feb 21, 2013 08:14 PM
Subject: Re: Nuisance complaint filed January 31, 2013

Neil,

*I saw Eladio Gore this afternoon. He said he got my e-mail. He said he can't turn it off although he understands the flicker situation. He said he has been to Barry's house and does not hear the WT over traffic. I said that today it sounded like a jet plane - clearly very audible at the receptor's location even when there is traffic. I explained that the **really** bad days for me are when it is running in high winds and even over nameplate. Then the blades are sending off little tornados that hurt your ears. He said that he understands what I am saying, but he can't turn it off. I said that the WTOP group had said flicker mitigation is needed (cited study and explained that I have experienced excesses over what model predicted). He won't address it - "can't turn it off." I said if you are not going to help, send me a note, and I'll go to the Board of Appeals - this is a nuisance!*

Linda”

The Standard of Section 240-166 Simply can't be Met

- "The Board of Appeals shall ensure, through the use of appropriate engineering data, that there shall be no adverse impacts on the neighborhood, in terms of television interference, ice throw, prop throw, noise, etc. There shall be a rebuttable presumption that noise from the windmill in excess of 40 dba, as measured at the property line, shall be excessive".

The ZBA Authority on an Appeal

Chapter 40A § 14, which reads in relevant part:

"In exercising the powers granted by this section, a board of appeals may, in conformity with the provisions of this chapter, make orders or decisions, reverse or affirm in whole or in part, or modify any order or decision, and to that end shall have all the powers of the officer from whom the appeal is taken and may issue or direct the issuance of a permit."

Appreciating that the issuance of a Special Permit for either Wind 1 or Wind 2 might well be legally untenable, given the evidence of adverse impacts, and the long history of failing to meet the prevailing standard of care, this Board should use the powers provided by Chapter 40A § 14 and issue the Cease and Desist Orders (for Wind 1 and Wind 2) sought by the neighbors. Until Wind 1 and Wind 2 complete the Special Permit process, they should remain out of operation.

Conclusion

The Board should issue Cease & Desist Orders for Wind 1 and Wind 2 recognizing:

1. We are in this situation not by oversight, but by intentional decisions to skip critical analyses and ignore serious warnings.
2. The Town customarily uses this enforcement tool where it is clear that at zoning by-law is being violated.
3. Wind 1 and Wind 2 are operating without any permits (a building permit without a special permit where required is not a legal building permit).
4. The Haddad and Schey cases sited in the Board's initial treatment of this question are focused on allowing time to avoid an order to remove a structure, not cease operations until permits are procured.
5. The neighbors continue to experience distress on a daily basis.
6. The likelihood that the Town can meet the applicable standard (no adverse impacts) is slim, given the ZBA's past recognition that the turbines constitute a nuisance, and the conclusions of many studies in hand, including those commissioned by the Town.

Thank you

I thank the Board of allowing this full presentation.

Christopher Senie