April 24th 2017
Jefferson County Planning Training Session –
Jefferson Community College

2017 Planning & Zoning Considerations For Wind Power

John Collins, P.E.
Project Manager, MRB Group

MRB group

General Drivers of Renewable Energy

- Wind- Solar – Hydroelectric – Geothermal - Biogas/Biofuels
  - Private versus Utility Scale
- National or Personal Energy Independence
- Pollution Reduction/Environmentally Friendly
  - "Doing your part"
- Costs Decreasing
- Distributed Generation (strengthens and stabilizes grid)
- National and State (NYSERDA) incentives to stimulate
- Energy Cost Savings (private/net metering)

What's driving renewed interest in NY renewable energy?

In 2014, Governor Andrew M. Cuomo launched "Reforming the Energy Vision (REV)".

- Build an integrated energy network with clean, locally generated power.

The 2015 New York State Energy Plan coordinates REV.

2030 clean energy goals:

- 40% reduction in greenhouse gas emissions from 1990 levels
- 50% of energy generation from renewable energy sources
- 600 trillion Btu increase in statewide energy efficiency
- =23% reduction from 2012 building energy consumption
- Long term goal of decreasing carbon emissions 80% by 2050.

Recent Changes in Wind Energy

- Heights and Sizes of Units (Offshore/Land)
- Technology Improvements
- Costs dropping
- Offshore - Leasing of sea bed on Continental Shelf (Long Island, N.J., R.I.)
- Extension of Credits / Declining Scale
- Politics!
- NYSERDA Remote Site Program
- Community Wind Projects
- NY Article 10 Process (over 25 MW).

Heights and Size of Units Onshore

- 2015:
  - Ave. hub height of 82m (270 ft.),
  - Rotor diameter of 102m (335 ft.),
  - Power output of 2 MW.

- 2030: experts on average expect
  - Hub height of 115m (337 ft.),
  - Rotor diameter of 135m (443 ft.),
  - Power output of 3.25 MW.
- General Electric Model 3.6137,
  - Range of tip heights up to 223 meters (731 feet).
  - 137 m rotor height (449.5 ft.)
  - 164.5 m hub (539.7 ft.)

Get ready for 24-30% reduction in cost of wind power by 2030- Megan Geuss, 11/29/2016, Ars Technica

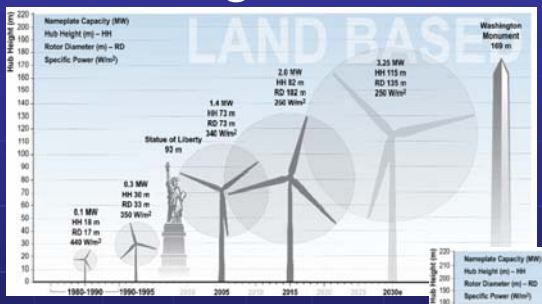
Height and Size of Units Offshore

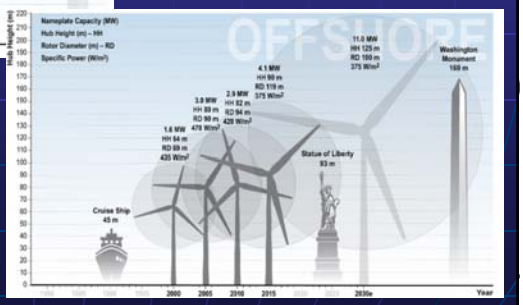
- 2015:
  - Hub height of 90m (295 ft.),
  - Rotor diameter of 119m (390 ft.),
  - Power output of 6-8 MW.

- 2030: Anticipate
  - Hub height 125m (410 ft.)
  - Rotor diameter 190m (624 ft.),
  - Power output of 11 MW on average—each.
- Larger capacity is driven by necessity
  - Costs of building offshore projects is large, suppliers driven to seek the highest power-producing hardware[1]
  - Easier to transport very large blades to sea-based locations than over routes to land-based sites.

Get ready for 24-30% reduction in cost of wind power by 2030- Megan Geuss, 11/29/2016, Ars Technica

Heights and Size of Units





Get ready for 24-30% reduction in cost of wind power by 2030- Megan Geuss, 11/29/2016, Ars Technica

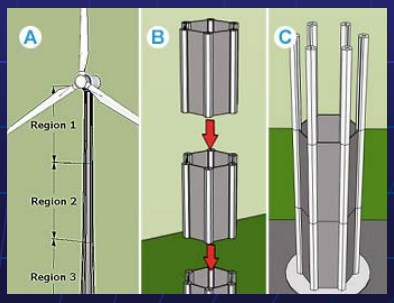
New Technology

- Siemens Concrete Towers[1]
  - 2015 MidAmerican Energy building the nation's tallest onshore wind turbine in Iowa.
    - 115 m (377 ft.) from ground to hub.
  - Concrete tower components can be cast in the field at the construction site.
  - Local labor and materials.
  - Avoids transportation costs associated with towers fashioned from steel in remote factories.

1. Taller Towers and Better Blades: The Cutting-Edge Technologies in Modern Wind Turbines, 7/20/2016, Power Engineering

New Technology

- Hexcrete Concrete Towers[1]
  - The Hexcrete system is two different concrete building blocks:
    - precast columns
    - panels made from either high-strength or ultra-high-performance concrete.
  - Transported onsite, stacked vertically in hexagon-shaped cells that are tied together by cables.
  - Attain heights of up to 460 feet.
- Eliminates expensive specialized trailers to carry steel towers, cutting turbine construction and wind production costs.
- The tower base could be built wider than 4.1 meters for taller towers.
  - Currently not done due to transportation issues.
- Concrete is widely available across the United States, which makes for shorter transport routes and reduces costs.



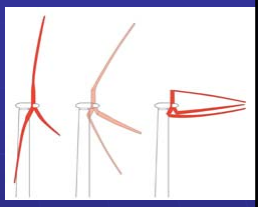
1. ASME, Tomorrow's Taller Turbine https://www.youtube.com/watch?v=XizC5spy3mg

New Technology

- Blades
  - Longer
    - Offshore better, as can build near port for shipping.
  - In 5 years, diameters have grown 20 m.[1]
  - 55% increase in swept area
  - Carbon fiber becoming cost effective
  - Modular blades being used in Europe.
  - Seimens' ATB blades twist at the tip when they experience out-of-direction winds, relieving load = reduced material/longer blade
    - Self adjusting pitch
  - Vortex generators designed into blades which increase their aerodynamic efficiency

1. Taller Towers and Better Blades: The Cutting-Edge Technologies in Modern Wind Turbines, 7/20/2016, Power Engineering

New Technology



- Blades
  - Sandia extreme-scale Segmented Ultralight Morphing Rotor Blade
    - 650 ft., 2.5x any existing blades
    - Inspired by palm trees
    - The blades align themselves to reduce cantilever forces through a trunnion hinge near the hub that responds to changes in wind speed
  - Siemens low-noise DinoTail aerodynamic blade add-on. [2]
    - Inspired by owl wings – serrated, fringed structure at back of blade
    - Substantial reduction in wind noise at all speeds.

1. Taller Towers and Better Blades: The Cutting-Edge Technologies in Modern Wind Turbines, 7/20/2016, Power Engineering
2. Low-Noise Wind Turbine Blades Inspired by Owl Wings, 11/17/2016, Power Engineering

New Technology

- Vortex Bladeless[1]
  - Takes advantage of vorticity, an aerodynamic effect that produces spinning vortices behind towers.
  - At base are two rings of repelling magnets, act as nonelectrical motor..
  - This kinetic energy is converted into electricity via an alternator
  - Gran = 1 MW, Mini = 4kW
- No gears, bolts, or mechanically moving parts, makes the Vortex cheaper to manufacture and maintain.
- Vortex Mini, around 41 feet tall, can capture up to 40% of the wind's power during ideal conditions (wind at 26 miles per hour).
- Based on field testing, the Mini captures 30% less than conventional wind turbines, but is compensated by the fact that you can put double the Vortex turbines into the same space as a propeller turbine.

1. The Future of Wind Turbines? No Blades, 5/15/15, Wired

New Technology

- New Wind (French) installing tree-shaped wind turbines at the Place de la Concorde in Paris, France.
- Exploits small air currents flowing along buildings and streets, and yards.
- Efficiency low, but more viable and less intrusive than conventional wind turbines.
- 26 foot high trees, using tiny blades inside the 'leaves', could potentially be profitable after a year of wind speeds averaging 7.8 mph.
- Can generate electricity in wind speeds as low as 4.5 mph

http://www.alternative-energy-news.info/tree-shaped-wind-turbines-paris/

Typical Private Wind Turbines

Windspire –
Vertical Axis Turbine

Jay Leno's VAWT

Skystream, Baldwinsville NY

WindTamer, Perry NY

Agricultural Wind Turbine

Typical Private Wind Turbines

Entegrity, EW50

50kW (145 ft.)

Paul De Lima Coffee

I-81 North of Syracuse

10 kw (~65 ft.)

Harbec Plastics

Ontario NY

250 kW Fuhrlander FL250,

213 feet total height

Typical Private Wind Turbines

AeroVironment, AVX1000, 1 kW.

Swift – Roof mounted

Aeroturbines by Aerotecture International Inc.

Dropping Costs

- Paper published in *Nature Energy* analyzed the opinions of wind power experts:
  - By 2030, both onshore and offshore wind turbines will get bigger = additional cost reductions and more consistent energy generation.
  - Wind power cost could be reduced by 24 to 30% by 2030.
  - In some areas wind energy already competitive with fossil fuels.
- Solar boon helping lower cost of batteries, inverters, etc. for small turbines.
- International increase production of large turbine components is reducing prices (economies of scale).
- 2017 - New construction contracts are up 39% percent.
  - Reflects declining costs and improvements in turbine technology.
  - Wind farms now in areas with lower wind levels/average speeds.

Offshore

- Cuomo has announced commitment to develop up to 2.4 gigawatts of offshore wind by 2030.
- Block Island Wind Farm[1]
  - First commercial offshore wind farm in the United States, located 3.8 miles (6.1 km) from Block Island, Rhode Island in the Atlantic Ocean.
  - Five-turbine, 30 MW project was developed by Deepwater Wind.
  - Construction began in 2015 and in late summer 2016 Alstom Haliade 150 6 MW turbines were erected. Operations were launched in December 2016
- LIPA – South Fork Wind Farm[2]
  - To meet growing electric demand in the Hamptons approved the nation's largest offshore wind farm by Deepwater Wind.
  - Set for the waters between the eastern tip of Long Island and Martha's Vineyard.
  - 15 turbines , 90 MW, is the first of several planned by the developer, Deepwater Wind.
  - 256-square-mile parcel, room for up to 200 turbines, that the company is leasing from the federal government.

1. Wikipedia.
2. Nation's Largest Offshore Wind Farm Will Be Built Off Long Island, 1/25/2017, NY Times

PTC/Politics

- Production Tax Credit
  - (PTC) is an inflation-adjusted per-kilowatt-hour (kWh) tax credit for electricity generated by qualified energy resources and sold by the taxpayer to an unrelated person during the taxable year.
  - The duration of the credit is 10 years after the date the facility is placed in service for all facilities placed in service after August 8, 2005.
  - $0.023/kWh for wind adjusted value for 2016
  - Phased down for wind facilities and expires for other technologies commencing construction after December 31, 2016.
  - The phase-down for wind facilities is described as a percentage reduction in the tax credit amount described above:
    - For wind facilities commencing construction in 2017, the PTC amount is reduced by 20%
    - For wind facilities commencing construction in 2018, the PTC amount is reduced by 40%
    - For wind facilities commencing construction in 2019, the PTC amount is reduced by 60%
- Politics
  - Favor fossil fuels
  - Removal or reduction of incentives, subsidies
  - Level responsibility for bird kills
  - Temporary, 4-8 years.
- Will retain powerful support, including Google (which seeks to run on 100 percent renewable energy).
- US politics little effect on overseas production, which will continue to reduce costs.
- Berkshire Hathaway chief Warren Buffett, according to Fortune has "fallen in love with wind energy."

Article 10 Process

- August 4, 2011, Chapter 388, Laws of 2011 - Article 10 of the Public Service Law.
- Article 10 provides for the siting review of new and repowered or modified major electric generating facilities in New York State by the Board on Electric Generation Siting and the Environment (Siting Board) in a unified proceeding instead of requiring a developer or owner of such a facility to apply for numerous state and local permits.
- Key provisions of the new law include:

1. Defines a major electric generating facility as 25 megawatts or more;
2. Requires environmental and public health impact analyses, studies regarding environmental justice and public safety, and **CONSIDERATION OF LOCAL LAWS**;
3. Directs applicants to provide funding for both the pre-application and application phases. It allows funding to be used to help intervenors (affected municipalities and other parties) hire experts to participate in the review of the application and for legal fees (but not for judicial challenges);
4. Requires a utility security plan reviewed by Homeland Security and, for New York City (NYC) plants, NYC's emergency management office;
5. Provides for appointment of ad hoc public members of the Siting Board from the municipality where the facility is proposed to be sited; and,
6. Requires a public information coordinator within the Department of Public Service to assist and advise interested parties and members of the public in participating in the siting process.

http://www3.dps.ny.gov/W/PSCWeb.nsf/All/D12E078BF7A746FF85257A70004EF402

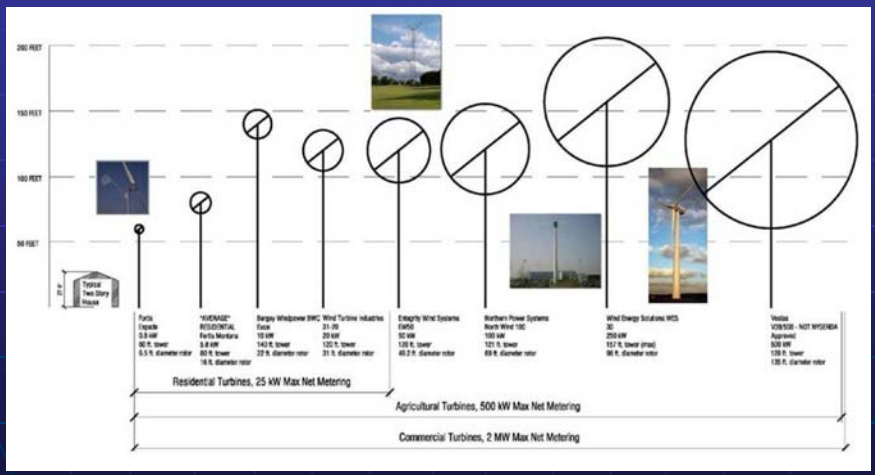
Net Metering

- Net metering is an enabling policy to foster private investment in renewable energy.
- Net Metering customers export power to the grid during times of excess generation, and receive credits applied to later electricity usage – daily, monthly, even annually.
- Grid-connected renewable energy system must have an interconnection agreement
  - Sets the terms and conditions under which a renewable energy system can be safely connected to the utility grid and outlines metering arrangements for the system
- Conventional net metering customer-sited renewable energy system connected to the grid through meter - "behind-the-meter generation."
  - Net metering uses a single, bi-directional meter - can measure current flowing either direction.
- NET METERING LIMITATIONS
  - Onsite generation systems typically limited to 110% of average annual usage for net metering.
  - Wind: 25 kW for residential; 500 kW for farm-based; 2 MW for non-residential

Remote-Net Metering

- "Remote" and/or "Community" Net Metering
  - Allow electricity generated to be distributed among many utility accounts.
  - Utilities must allow farm and non-residential customers to apply the excess net metering credits they earn under Net Metering to other accounts they own.
  - Host Account - The account to which the renewable energy system is connected
    - Must be a commercial or a farm account.
    - Residential customers cannot take advantage of remote net metering as the host turbine site.
  - Satellite Account(s) - The account or accounts that will receive the excess net metering credits
    - A satellite account cannot be a net metered account (i.e. a renewable energy source is already connected to it), but it may be a residential account.
    - All accounts must be in the same name, from the same service utility, and reasonably close to each other.
  - At the end of each billing cycle, the utility will convert the excess net metering credits (kWh) to dollars by using the host account's electric rate. The customer makes a determination of what percentage of excess generation is applied to each satellite account

Net Metering

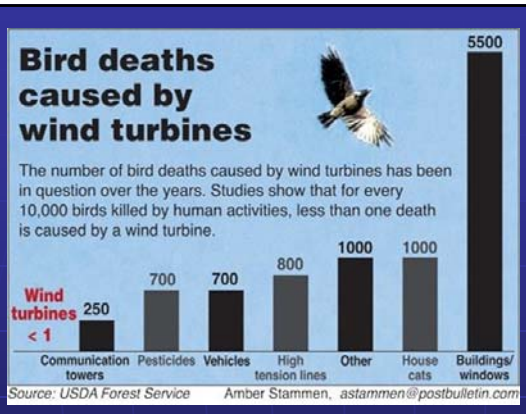


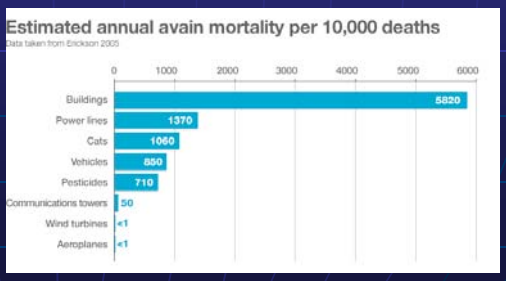
Taxation of Renewable Energy Systems

- Payment in Lieu of Taxes and/or Host Agreement?
  - Payment of additional property taxes on improvements associated with renewable energy systems are EXEMPT for a period of 15 years under the New York State Real Property Tax Law (RPTL Section 487) unless the local taxing jurisdiction has "opted-out" of that exemption.
  - Taxing jurisdictions that have not disallowed the exemption can do so at any time prior to the system being constructed, thereby making the owner pay the full tax burden.
  - If the Town does not opt-out of RPTL 487, it may enter into a contract for payments in lieu of taxes (PILOT) with the owner.
  - Provides opportunity for Town to accept PILOT as, if based on value, systems may not be feasible if fully taxed.
    - If a property owner installs a wind turbine the accessed value may increase dramatically based on value of turbine.

Wind Energy Potential Impacts

- Visual impact
- Sound
- Avian/Bat & Wildlife/Habitat
- Shadow Flicker
- Falling, Ice Throw & Blade Failure
- EMF Interference
- EMF Exposure
- Stray Voltage, Grounding
- Roads & Bridges, Transportation, Access
- Wetlands, Stormwater & Groundwater
- Agriculture
- Historic & Cultural Resources
- Aviation & FAA regulations
- Property Values
- Insurability
- Community Character
- Community Growth
- Jobs/Tourism
- Tax Revenue (PILOT)
- Public Services & Emergency Services
- Decommissioning
- Complaint resolution



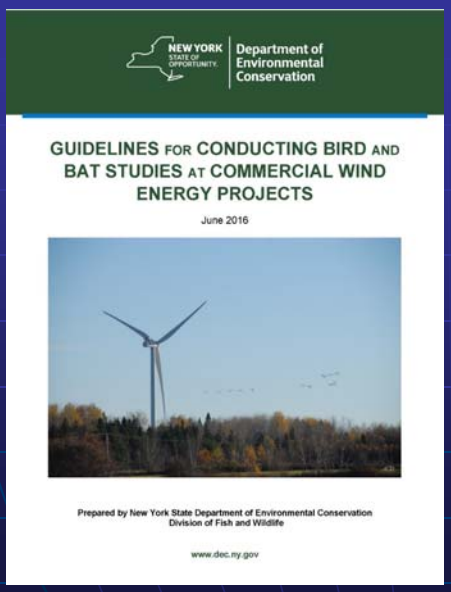


Reasons to Regulate Wind Energy Facilities

- Height (Potential fall)
  - Generally best if 35 feet above nearby obstacles
- Visual Impact (height, appearance, maintenance)
- Noise
- Maintenance / Removal / Decommissioning

Larger Turbines;

- Lighting requirements (over 200 ft.)
- Ice/Blade Throw
- Shadow flicker
- Bird and other potential environmental impacts (site disturbance, road access/construction, etc.).

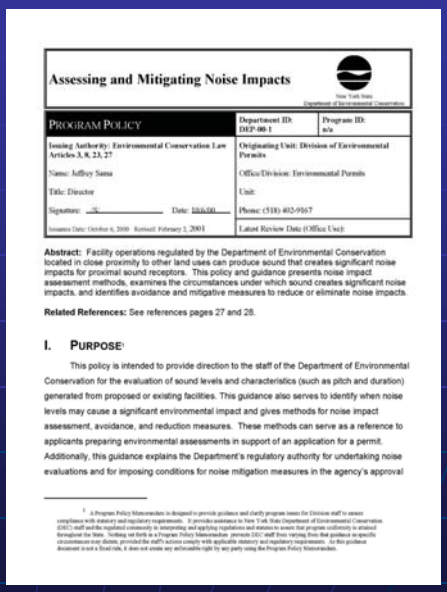

NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

GUIDELINES FOR CONDUCTING BIRD AND BAT STUDIES AT COMMERCIAL WIND ENERGY PROJECTS

June 2016

Prepared by New York State Department of Environmental Conservation
Division of Fish and Wildlife

www.dec.ny.gov


Assessing and Mitigating Noise Impacts

PROGRAM POLICY | Department ID: DEP-00-1 | Program ID: n/a

Issuing Authority: Environmental Conservation Law Articles 3, 8, 23, 27 | Originating Unit: Division of Environmental Permits

Name: Jeffrey Sama | Office/Division: Environmental Permits

Title: Director | Unit:

Signature: | Date: | Phone: (518) 402-9167

Latest Review Date (Office Use):

Abstract: Facility operations regulated by the Department of Environmental Conservation located in close proximity to other land uses can produce sound that creates significant noise impacts for proximal sound receptors. This policy and guidance presents noise impact assessment methods, examines the circumstances under which sound creates significant noise impacts, and identifies avoidance and mitigative measures to reduce or eliminate noise impacts.

Related References: See references pages 27 and 28.

I. PURPOSE[1]

This policy is intended to provide direction to the staff of the Department of Environmental Conservation for the evaluation of sound levels and characteristics (such as pitch and duration) generated from proposed or existing facilities. This guidance also serves to identify when noise levels may cause a significant environmental impact and gives methods for noise impact assessment, avoidance, and reduction measures. These methods can serve as a reference to applicants preparing environmental assessments in support of an application for a permit. Additionally, this guidance explains the Department's regulatory authority for undertaking noise evaluations and for imposing conditions for noise mitigation measures in the agency's approval

[1] A Program Policy Memorandum is designed to provide guidance and clarify program issues for Division staff to ensure compliance with statutory and regulatory requirements. It provides assistance to New York State Department of Environmental Conservation (DEC) staff and the regulated community in interpreting and applying regulations and statutes to ensure that program conformity is attained throughout the State. Nothing set forth in a Program Policy Memorandum prevents DEC staff from varying from that guidance in specific circumstances may dictate, provided the staff's actions comply with applicable statutory and regulatory requirements. As this guidance document is not a fixed rule, it does not create any enforceable right by any party using the Program Policy Memorandum.

Regulations Should:

- Define permitting process
- Indicate permissible zones
- Provide technical standards
- Indicate application requirements
- Clearly define all items
- Use consistent terms and definitions
- Specify the level of detail you need to review the application
- Be revisited and revised as more information and experience becomes available, and technology changes.

Key Considerations

- Power output vs. rotor diameter & height
- Potential Users
  - (Resid., Institutional/Educational, Commercial/Industrial)
- Zoning
  - (Residential, Agricultural, Commercial, Industrial, Overlay)
- Setback requirements
- Types - Roof-mounted, Horizontal, Vertical Axis
- Wind Measurement (MET) Towers

Definitions

- Define private wind energy
  - PRIVATE WIND ENERGY CONVERSION SYSTEM ("Private WECS"): A wind energy conversion system (WECS) consisting of one or more wind turbines with associated towers, buildings, equipment, and control or conversion electronics, whose power output is *intended to be used on-site by the property owner or tenant to reduce or offset on-site consumption of utility power*.
- Differentiate from Utility Scale
  - UTILITY SCALE WIND ENERGY CONVERSION SYSTEM ("Utility Scale WECS"): Wind energy conversion systems consisting of wind turbines, towers, and all related infrastructure including electrical lines and substations, access roads, and accessory structures *which generates original power on-site primarily to be transferred to a transmission system for distribution to customers*.
- RESIDENTIAL WECS: Private WECS whose power output serves a residence as defined above.
- Define the NON-RESIDENTIAL WECS (Commercial, industrial, institutional).
- Define Residence
  - RESIDENCE: Any dwelling suitable for habitation existing on the date that a specific application is deemed complete, including seasonal homes, but not including hotels, hospitals, motels, dormitories, sanitariums, nursing homes, senior housing, schools, correctional institutions or other buildings used for educational purposes. A residence may be part of a multi-dwelling building.

Definitions

- AMBIENT NOISE LEVEL:
  - The noise level which is exceeded 90 percent of the time (expressed as L90) or 54 minutes of every hour. (Quietest 10% of hour)
- WECS OPERATIONAL SOUND PRESSURE LEVEL:
  - The level which is equaled or exceeded a stated percentage of time.
    - An L10 – "X" dBA indicates that in any hour of the day "X" dBA can be equaled or exceeded only 10% of the time, or for six minutes. (Loudest 10% of hour)
    - The measurement of the sound pressure level shall be done according to the International Standard for Acoustic Noise Measurement Techniques for Wind Generators (IEC 61400-11), or other accepted procedures.
    - WECS operational sound pressure level restrictions shall mean the cumulative existing ambient sound pressure level (as defined herein) ***plus*** the sound generated by the WECS.
- DEFINE APPLICANT "SITE". Important for setbacks.
  - Ex: The parcel(s) of land where the Wind Energy Conversion Facility is to be placed. The Site may be publically or privately owned by an individual or a group of individuals controlling single or adjacent properties. Where there are multiple applicants, their joint lots shall be treated as one lot for purposes of applying the requirements of this law. Any property which has a Wind Energy Conversion Facility ***or has entered an agreement*** for said Facility or a setback agreement shall not be considered off-site.

Definitions

- Height
  - Typically tower height and blade at the highest vertical extension (rotation).
  - Consider ground level.

Drawing of the rotor and blades of a wind turbine, courtesy of IESH

- Private WECS as accessory uses
  - By definition, private WECS intended to power existing onsite uses, and therefore may be considered accessory uses.

General Provisions

- Special Use Permits
  - Discretionary. Provides for review of difficult-to-quantify aspects such as visual impact.
- Define zones where WECS (or Types of WECS) are permitted.
- Define prohibitions
  - Height, rotor diameter, power output? Utility Scale?
  - FAA lighting prohibited? Restricts to less than 200 ft..
  - Homemade WECS? Roof mounted?
- SUP or SUP and Site Plan Approval?
  - Residential maybe just SUP.
  - Non-residential SUP and Site Plan.
- PILOT? (Town opted out)

Private SUP Application

- SUP application requirements:
  - Applicant and “site” information, description of project
  - Adjacent property owners?
  - Manufacturer’s information
    - Make, model, photos, specs, noise output
  - Information demonstrating system sized, and will be used, to reduce onsite consumption of utility provided power.
  - Demonstrate tower meets structural design requirements for seismic, wind, ice. NY PE certified?
  - Consider report/letter from NY PE or manufacturer regarding potential distance and damage from ice or blade throw.
  - Provide information that turbine will not interfere with telecommunications (directional microwave, tv, telephone).

Utility SUP Application

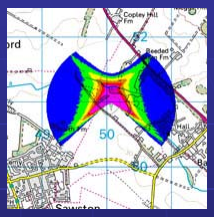
- Developer / Project Info
- Environmental Assessment Form (EAF)
- List of Properties, Owners, Authorization of Submission
- Site Plan
  - Define level of detail, items to be shown
- Construction Schedule
- Road Survey Documentation & Road Use Agreement
- Tower and Turbine Information & Drawings
- Landscaping Plan
- Lighting Plan

Utility SUP Application

- Decommissioning Plan
- Complaint Resolution Plan
- Studies
  - Avian, Noise, Visual, Flicker, Traffic, Property Value, Fire/Safety Impacts, Communications, Well Survey
- Geological Information
- Stormwater – SWPPP & Calculations

SUP Application
- Shadow Flicker -

- Usually not a concern on small turbines.
- Require study of potential impact where receptors within 10 rotor diameters?
  - Ex: Where an occupied structure (receptor) is located within 10 rotor diameters of a WECS, the applicant shall include in the application an analysis and report on potential shadow flicker by a Professional Engineer licensed in the State of New York. The report shall identify receptors where shadow flicker may be caused by the WECSs, and the expected times and durations of the flicker at these receptors. The report shall describe measures that shall be taken to eliminate or mitigate the problems, including reduction of WECS operations during shadow flicker periods.



Shadow Flicker Rosetta

SUP Application
- Noise -

- Consider study if operational noise levels may exceed 35 dBA at the property line.
  - EX: Unless manufacturer data is provided that demonstrates sound levels produced by the WECS are anticipated not to exceed 35 dBA at the property line of the Site, the applicant shall provide with the application a noise analysis and report by a professional engineer licensed in the State of New York documenting the potential noise levels associated with the proposed WECS. The report shall document noise levels at the Site property lines, and occupied structures (receptors) not on the Site within 1500 feet of the turbine. The noise analysis shall provide pre-existing ambient noise levels, combined ambient and turbine sound levels, and include low frequency noise.
- Provide for testing in response to complaints.

SUP Application
- Visual Impact -

- Provide option for waiver (small, private WECS)
- Describe documentation required
  - Color photographs with scaled turbine(s). (software).
  - Minimum number of vantage points or strategic vantage points (adjacent parcels, with permission of owners).
- Lighten requirements for residents
  - Perhaps allow balloon study.

SUP Application
- Decommissioning -

- Decommissioning Plan
  - Anticipated life of turbine
  - Estimated cost of decommissioning/removal
  - Manner in which will be removed, site restoration.
- Decommissioning bond, letter of credit or escrow?
  - Include means of updating estimated cost (1, 2, 5 yrs.).
  - Private:
    - If cost expected to exceed certain amount? ($250,000?)
    - For projects below threshold, removal at Owner's expense or if Town removes becomes lien?
- Decommissioning costs should not be offset by salvage value!

SUP Application

- Site plan (where required)
  - Provide detailed outline of information you need to know to review the project.
    - Typical information such as property lines, buildings, dimensions, zoning.
    - Equipment locations. Guys?
    - Topography. Specify 1, 2, or 5 foot contours?
    - Utilities
    - Wetlands, floodplains
    - Maximum Scale of drawings
    - Require draw circles of all setback requirements for easy review?

Technical Standards

Establish minimum standards for all WECS and METs

- Lighting (site, dark sky), FAA lighting?
- Number of roof mounted turbines?
- Height restriction on roof mounted turbines.
- Tower type – tubular, lattice, guyed.
- Paint: unobtrusive color, matte/non-reflective.
- Underground all wiring?
- No advertising or television/radio/telecom antennas?
- Homemade or experimental permitted?
- Anti-climbing devices.
- Security & Safety Signage
- Equip with manual or automatic over-speed controls.
- Locate to minimize environmental impacts; flood plains, wetlands, rare species habitat, etc...
- Noise (See NYSDEC Assessing & Mitigating Noise Impacts)
- Decommissiong

Technical Standards

Establish minimum standards for all WECS and METs

- Maintenance requirements (inspections, keep in good operating condition).
- **Procedures for Replacement/Repower Work (Caution!)**
- Complaint Resolution Procedure (during and post-construction)
- Post-Construction Monitoring (Noise, Avian, Agricultural)
- Traffic (Road Use Agreement)
  - May wish to consider adjacent towns
- Avian (Address Migratory and Breeding Area Concerns)
  - Studies to comply with new NYSDEC Guidelines, USFW Guidelines
- Structural & Electrical Standards
  - (IEC) International Electrotechnical Commission
  - Other Applicable Federal, State, Local (NESC)
  - NOT covered by NYS Building Code
  - Require PE certification
  - Periodic inspections (specify intervals)
- No Communication Interference

NY Building Code

- DO...NOT...REFERENCE...FOR WIND TURBINES
- Technical Bulletin 1/1/2003 - Communication Towers, Cellular Towers, and Wind Generators
  - Section 3108.1, entitled general, states:
    - Subject to the provisions of Chapter 16 and the requirements of Chapter 15 governing the fire-resistance ratings of buildings for the support of roof structures, radio and television towers shall be designed and constructed as herein provided.
    - BCNYS Chapter 16, entitled structural design, and Chapter 15, entitled roof assemblies and rooftop structures, contains specific requirements for rooftop structures in section 1509.
  - Section 3108.4,
    - States that towers shall be designed to resist wind loads in accordance with EIA/TIA 222- E, "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures."
    - When a tower is installed on a building, section 3108.1 is applicable.
    - When a free-standing tower is accompanied by a building for equipment, ONLY the building is regulated by the code.
- Reference ANSI/TIA-222-Rev G Standard for free standing towers.

Setbacks

Met Towers and WECS

- Wetland (100 ft. from state-identified)
- Public roads
- Site boundary (property line)
- Nearest off-site occupied building?
- **Property line of vacant parcel** (to allow development)
- Schools, place of worship, hospital, other high occupancy receptors
- Guy anchor setbacks from site boundary
- Shadow flicker exposure (25 hours max, annual)
- Noise (Shall not result in increase of more than 6 dBA over pre-existing ambient).
  - "Perception based standard".
  - 6 dBA is where complaints usually begin.
  - I prefer over set value, as applicable in low and high ambient sound areas.
  - Consider at property/site line, or at residence. Property line covers all including vacant or portions of parcels that may be developed in the future.
  - If steady pure tone (screech or hum) reduce all noise restrictions by 5 dBA.

General Administrative

- Fees
- Variances
- Severability
- Permit Revocation
- Abatement process
  - Include provision to allow Town to verify if WECS is operating or not, and remove turbine. Example:
    - WECS or Met Towers which are not used for 6 successive months shall be deemed abandoned and shall be dismantled and removed from the property at the expense of the property owner. Removal and site restoration shall be completed within six (6) months of a determination of inoperability.
    - Failure to abide by and faithfully comply with this law or with any and all conditions that may be attached to the granting of any permit shall be a violation of this law and constitute grounds for the revocation of the permit by the Town and use of any decommissioning bond or fund to remove the WECS or Met Tower.
    - *Non-function or lack of operation may be proven by reports from the Public Service Commission, NYSERDA, or local utility company(s).* The applicant shall make available to the Town Planning Board all reports to and from these entities, if requested, necessary to prove the WECS is functioning, which reports may be redacted or subject to a reasonable non-disclosure agreement as necessary to protect proprietary information.

(iv) 1.5 times the total height from the property line of any vacant property adjacent to the Site.

(v) 2 times the total height from the nearest off-Site occupied building existing at the time of application, measured from the exterior of such building.

(vi) 3 times the total height from any school, place of worship, hospital, or public building including those on the Site.

3. Guy anchor points shall not be located closer than 10 feet to a Site property line.

4. Shadow flicker exposure shall be limited to a maximum of 25 hours per year at off-site occupied buildings.

5. The statistical sound pressure level generated by a WECS shall not result in a cumulative (ambient sound plus proposed turbine noise) increase of more than 6 dBA over pre-existing ambient sound levels measured at the property line.

6. In the event audible noise due to WECS operations contains a steady pure tone, such as a whine, screech, or hum, the standards for audible noise set forth in subparagraph 5) of this subsection shall be reduced by five dBA. A pure tone is defined to exist if the one-third octave band sound pressure level in the band, including the tone, exceeds the arithmetic average of the sound pressure levels of the

24

(iv) PURPOSE: As the location of potential future occupied building location on the vacant property may be unknown, this provision is included to provide a margin to allow development on the property with respect to ice and blade throw concerns. As referenced in many current publications, *Wind Energy Production in Cold Climote*: Tammelin. Cavaliere, Holttinen, Hannele, Morgan, Seifert, and Santti, 1997 provides the following formula for calculating a safe distance: 1.5 * (hub height + rotor diameter) Institut (DEWI). Or 1.5 times the total height as defined herein. The 1.5 factor, an increase over the 1x height plus 25 feet above, is used to compensate for the unknown location of any future occupied structure as identified below

(v) PURPOSE: To provide an additional safety distance to occupied buildings and dwellings with respect to potential for ice and blade throw.

(vi) PURPOSE: Intent is to provide a larger safety zone due to the higher occupancy of these structures. "Building" is used rather than property line so that schools, churches, etc. can place turbines on their property, but only at a distance that is considered to reduce potential risk to persons assembled there.

(4) NOTE: 25 hours per year is a commonly used shadow flicker restriction.

(5) PURPOSE: This standard is preferred as it is a "perception based standard". A 6 dBA increase is typically the level of change at which complaints begin. By using an allowable increase, rather than a set value, this standard is more readily applicable to all areas (high and low ambient sound levels). Use of the "property line" rather than adjacent residences ensures minimal impact to adjacent property use, and also covers vacant land or portions of parcels that may be developed in the future.

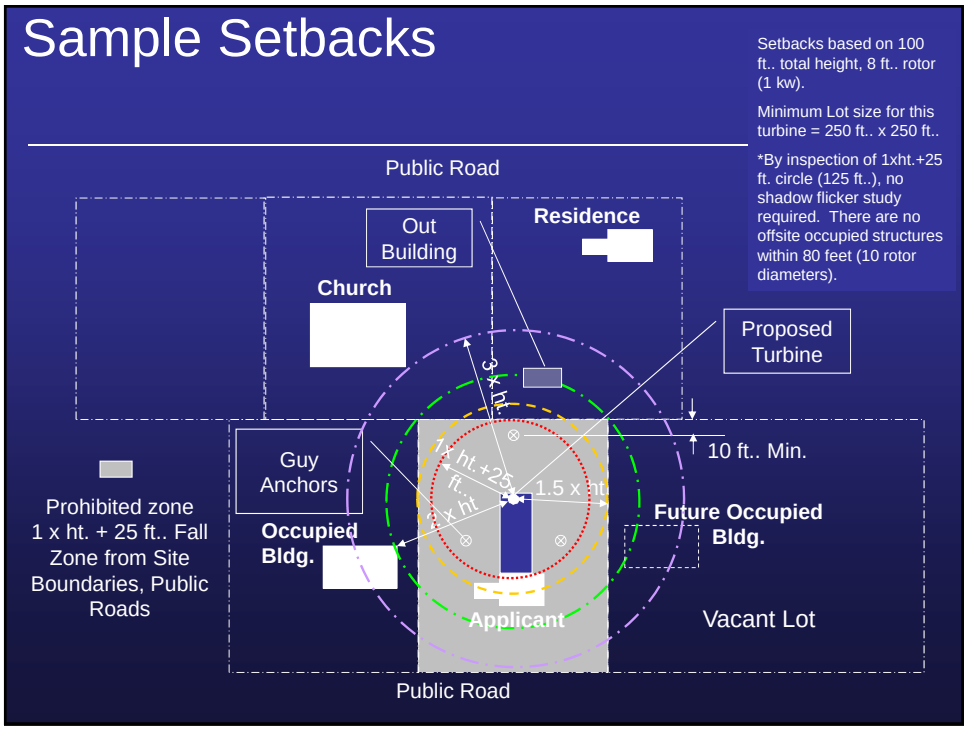
(6) PURPOSE: To reduce the permitted increase in sound level at the property line by 5 dBA. Steady pure tones are perceived as more annoying, therefore the reduction is included to minimize the noise impact and potential for complaints due to pure tones.

Sample Setbacks

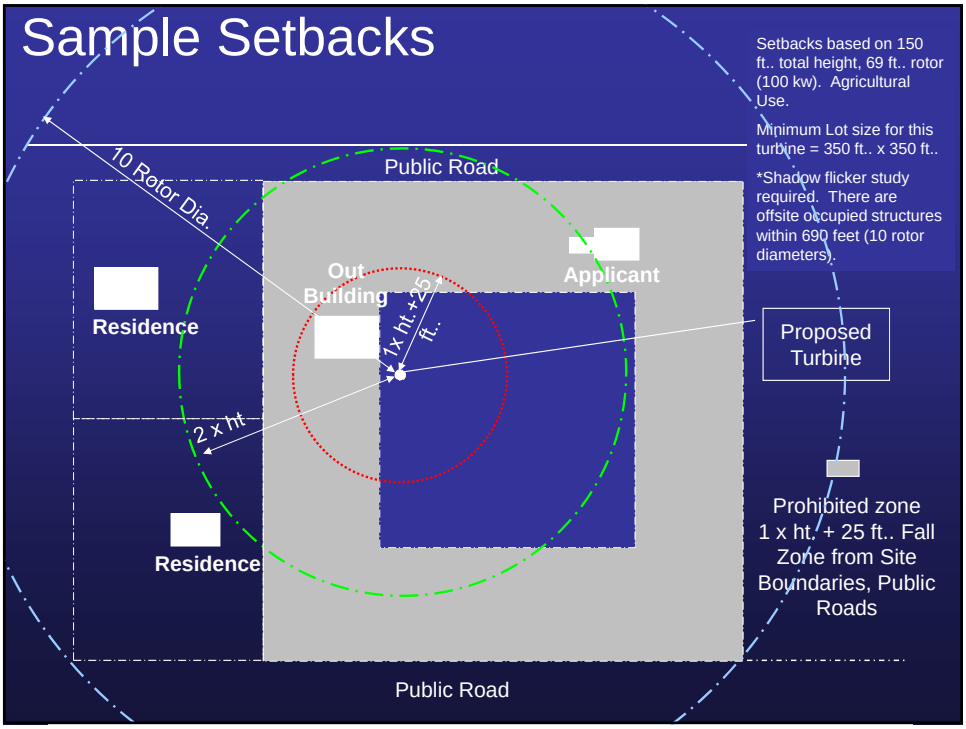
Setbacks based on 100 ft.. total height, 8 ft.. rotor (1 kw).

Minimum Lot size for this turbine = 250 ft.. x 250 ft..

*By inspection of 1xht.+25 ft. circle (125 ft..), no shadow flicker study required. There are no offsite occupied structures within 80 feet (10 rotor diameters).



Sample Setbacks



Setbacks based on 150 ft.. total height, 69 ft.. rotor (100 kw). Agricultural Use.

Minimum Lot size for this turbine = 350 ft.. x 350 ft..

*Shadow flicker study required. There are offsite occupied structures within 690 feet (10 rotor diameters).

Samples of Manufacturer Noise Information

All Aerostar wind turbines have been tested for noise, safety and performance and have been third party certified by North American Energy Laboratories (NAEL).
www.energylab.us

AEROSTAR®
6 Meter Specifications

Rotor Diameter:	22' (6.7 M)
Rotor Type:	2 Blade Teetering, Self starting
Blades:	Tapered, Twisted Fiberglass
Overspeed:	Articulating Blade Tips. Failsafe Rotor Brake.
Swept Area:	380 Sq. Ft. (35.3 Sq. M)
Generator:	10 kW Induction 240 VAC Single phase or 3 phase
Rated Capacity:	10 kW @31 MPH
Power at 25 MPH (~11 m/s):	7.7 kW
Cut-in WS:	8 MPH
Shut Down WS:	50 MPH, automatic reset
Control:	Microprocessor Otional Over/Under Voltage (+10%, -12%) Optional Over/Under Frequency (+- 0.5 Hz) Power Factor: > 0.95
Weight:	650 lbs. (281 kG)
Noise:	43 dBA at 100' at 10 MPH
Approvals:	UL/CSA - Control Box, Electrical components. Noise, Performance & Safety certification through NAEL.

Specifications subject to change without notice.

Noise Measurements on Bergey Windpower Co. XL.1

In an effort to quantify the noise level from an XL.1 wind turbine, several measurements were made on June 11 and 12, 2001 at the Bergey Windpower factory. The wind turbine is located 80 feet from the factory, with no other buildings within ¼ mile. The turbine is mounted on a 42-foot tall tower.

The turbine is located near a small airport, and there are two heavily trafficked roads within ½ mile. The background noise levels ranged from 48 dBa to 57 dBa. During aircraft take-offs the background noise levels were higher than above, no noise measurements were not made until the aircraft were out of range. A windscreen was used on the sound level meter; however, at the highest wind speeds it was not very effective.

The wind turbine produces the most noise directly downwind, with the upwind direction being only slightly quieter. To the sides and directly underneath there is very little noise. All measurements were made 42 foot downwind of the tower. This location appeared to be the noisiest.

Two turbine conditions were tested, normal operation, and unloaded. In unloaded operation the wind turbine is allowed to spin freely. To conduct the tests, the turbine was run in the condition indicated, and then rapidly shut down to note the ambient noise level. Bringing the turbine to a complete stop takes about 2 seconds, so that the ambient noise levels can be checked accurately.

Data Taken

Wind speed (MPH)	Background Noise Level (dBa)	Normal Operation Noise Level (dBa)	Unloaded Noise Level (dBa)
10	48		48
16	48	51 – 52	
17	48 - 49		54 - 56
18	47	50	
17 - 20	48	50	
20	50 - 53		56 - 59
18 - 24	50 - 53	50 - 57	
25 - 27	55 - 57	56 - 60	

Conclusions:
Under normal operation the XL.1 was found to be approximately 3 – 4 dBa above the ambient noise 42 feet from the base of the tower.
Unloaded operation was found to be 6 – 7 dBa above the ambient noise level, however the wind turbine is operated unloaded at wind speeds in excess of 28 mph (not tested) the noise levels rise and are estimated to be 15 dBa above ambient levels if tested as above.
The XL.1 should not be operated unloaded if noise is a concern. This requires the installation of an optional dump load circuit.

Impacts of Changes

- New technology may require more monitoring/inspections, certifications of design by engineers.
- Use of site constructed towers
  - Concrete, Hexcrete - more trucks, water demands, higher local labor use/ construction labor onsite/economic benefits.
  - Trucking in of panels/posts – more trips.
- Taller towers
  - Use of taller cranes – hazards of trucking in, turning radii on roads, fall/collapse hazards,
  - Impacts to:
    - View shed,
    - Rescue efforts,
    - Inspection access,
    - Bird assessment.
    - Expanded shadow flicker impacts (larger rosetta).
    - Fall radii, ice throw.
  - Less ground level noise.
- New Technology
  - Vortex Bladeless may request closer spacing/setback due to no moving parts, less ice throw.
  - But visual impact increased?

Impacts of Changes

- Improved blades
  - Lower noise,
  - More efficiency/fewer towers.
  - More durability, survivability.
- Longer blades
  - Hazards such as debris/impact in failure, ice throw, shadow flicker.
  - More efficiency = fewer towers.
- Trust/unproven technologies
  - Concrete towers, carbon fiber blades, vortex bladeless
- OFFSHORE – effects some counties/towns.
  - Becoming more potential, technology improving for construction – RI project.
- REPOWERING – Limit or require updated tech

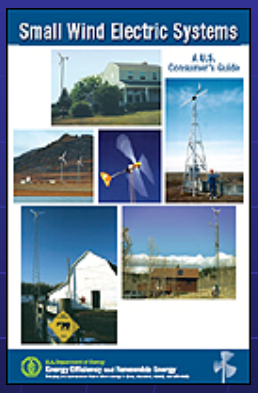
Impacts of Changes

- Large community or remote metering project
  - Is this now really a generating plant? How big a plant to allow?
  - If based on host site, but powers others, is it accessory use?

Resources

- NYSERDA Wind Toolkit

  www.powernaturally.org/Programs/Wind/toolkit.asp
  - Model Ordinance *www.powernaturally.org/Programs/Wind/toolkit/2_windenergymodel.pdf*
  - Small Wind Ordinance *www.powernaturally.org/publications/AWS_Small_Wind_Zoning.pdf*
  - Local Law Examples *www.powernaturally.org/Programs/Wind/toolkit/3_revised.pdf*
- PA Model Ordinance
  - *www.depweb.state.pa.us/energy/lib/energy/docs/wind_model_ordinance_draft_(12-8-06).doc*
- Many Local Laws available via internet
- American Wind Energy Association - http://www.awea.org/la_smallwind.cfm
  - *In the Public Interest - How and Why to Permit for Small Wind Systems; A Guide for State and Local Governments*
- US Department of Energy - http://www1.eere.energy.gov/windandhydro/
  - *(wind ordinance webinar today)*



Do's & Don'ts

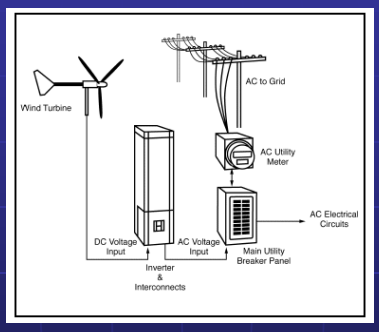
Do:

- Clearly define all items;
- Use consistent terms and definitions;
- Specify the level of detail you need to review the application;
- Extensive research, more information becoming available daily.

Don't:

- Wait for an application – enact zoning early;
- Assume will get all the information up front & prepare for a two-step review;
- Go it alone – get experienced legal and engineering consultation.

Thank You!



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