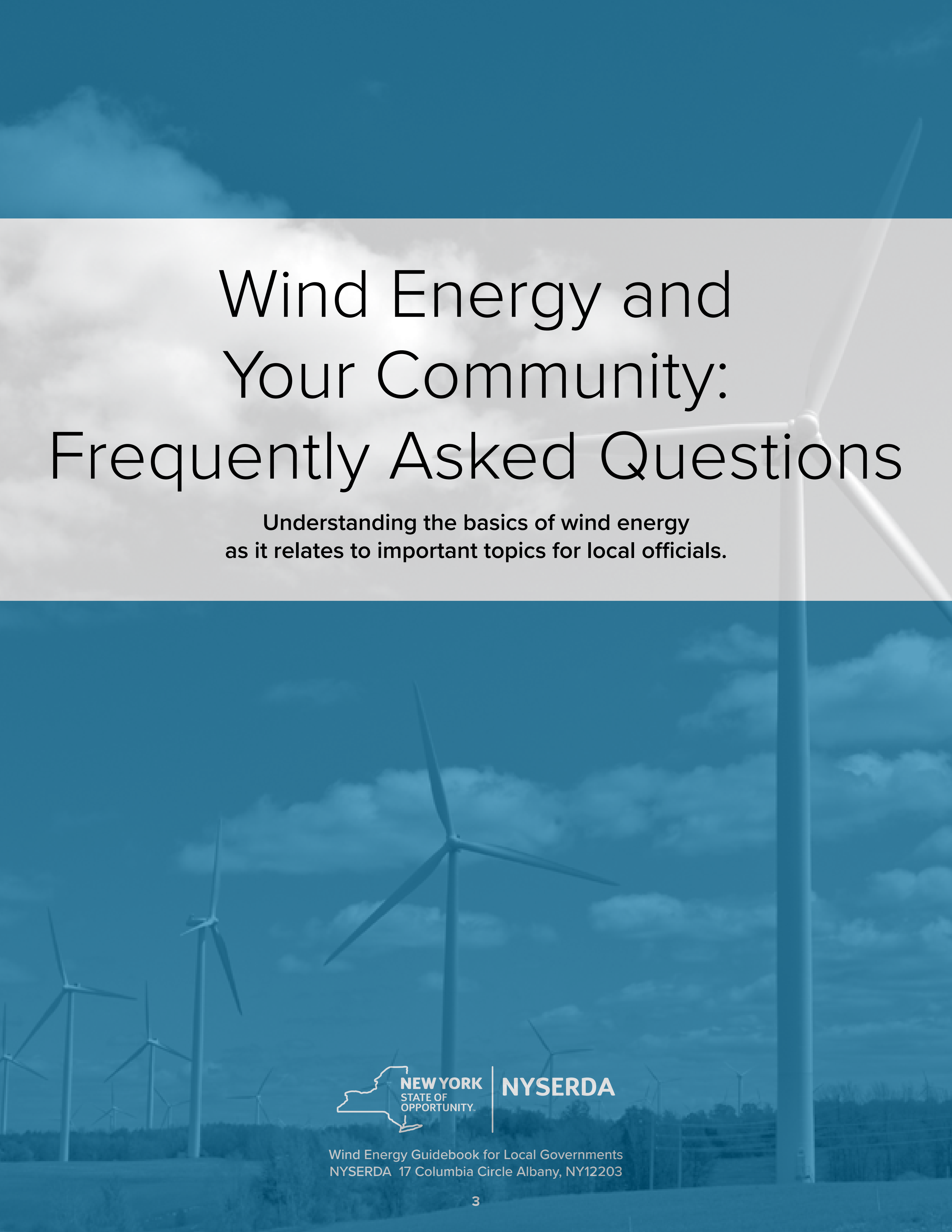


Wind Energy and Your Community: Frequently Asked Questions

Understanding the basics of wind energy as it relates to important topics for local officials.

NEW YORK STATE OF OPPORTUNITY. | NYSERDA

Wind Energy Guidebook for Local Governments
NYSERDA 17 Columbia Circle Albany, NY12203

Section Contents

Overview

This section addresses topics that are of great interest to local officials and their community members. Topics covered include local officials' role in planning and permitting, environmental impacts, health impacts, noise, shadow flicker, roads, property value, and visual impact and safety concerns.

More in-depth information and resources may be found in the subsequent sections of the Guide.

1. Local Role in Planning and Permitting

1.1 Who approves the siting and permitting of a wind project?

The majority of wind projects built in New York State will be permitted through one of two comprehensive State-level siting mechanisms: the "Article 10" process, or the Office of Renewable Energy Siting (ORES) review process. Smaller wind energy facilities may be permitted at the local level in accordance with the State Environmental Quality and Review Act (SEQR) and applicable municipal land-use regulations.

Article 10 of New York State's Public Service Law authorizes the New York State Board on Electric Generation Siting and the Environment (Siting Board) to issue certificates approving the construction and operation of major electric generating facilities (equal to or greater than 25 megawatts [MW]), including both renewables and conventionally fueled systems. The Siting Board comprises both permanent members (consisting of State agency heads from the Public Service Commission, Department of Environmental Conservation and Health, NYSERDA, and Empire State Development) as well as ad-hoc appointees from the involved municipality(ies). The Article 10 process is unified instead of requiring separate state and local permits.

Article 10 review requires environmental and public health impact analyses, studies regarding environmental justice and public safety, and consideration of applicable local laws. It also encourages public participation in Siting Board decisions and directs project developers to provide funding for affected municipalities and other parties to hire experts to assist with application review.

ORES, as created by the Accelerated Renewable Energy Growth and Community Benefit Act in April 2020, will serve as the future forum for siting and permitting new large-scale renewable energy facilities larger than 25 MW. Additionally, proposed facilities between 20-25 MW and projects in the early stages of Article 10 review may opt-in to the ORES process in the future. Within a year of its creation, ORES will establish and promulgate comprehensive regulations and uniform permit standards and conditions to ensure that siting decisions are predictable, responsible, and timely.

1.2 What deadlines or important dates must a municipality be aware of?

For wind projects seeking permit approvals through a State-level siting process, there will be deadlines or important dates that municipalities should be aware of to stay engaged and participate fully. Key deadlines and project milestones will vary between the Article 10 and ORES review processes, as detailed below.

Article 10:

The Article 10 application process can be broken down into four key periods, spanning the start of the pre-application process to the Siting Board's final ruling. For reach of these periods, there are deadlines that a municipality should be aware of to remain engaged. These periods are:

1. The Public Involvement Plan (PIP) Process

2. The Pre-Application Process

3. The Application Process

4. The Final Decision

Public Involvement Plan Deadlines

- The applicant must submit a proposed PIP no less than 150 days before submitting a Preliminary Scoping Statement (PSS). This is important because the PIP requires applicants to include a website where the public can learn about project details and events related to the project.[1]
- The Department of Public Service (DPS) must submit written comments no more than 30 days after the PIP submission.[2]
- If the proposed PIP is deemed inadequate by DPS, the applicant shall attempt to comply with DPS recommendations no more than 30 days after comments are received.[3]

Pre-Application Process Deadlines

- A municipality must submit any comments to the applicant and the secretary of the New York State Public Service Commission (PSC) no more than 21 days after applicant submits their PSS.[4]
- The applicant has no more than 21 days to respond to the municipality's comments.[5]
- Requests for pre-application intervenor funds must be made to the presiding examiner no later than 30 days after notice of the intervenor funds.[6]
- A meeting discussing pre-application intervenor funds must be held no less than 45 days, but no later than 60 days, after the PSS has been filed.[7]
- The presiding examiner has no more than 60 days after filing of the PSS to initiate a stipulation process concerning issues relating to the PSS mediation between the applicant and all other interested parties.[8]

Application Process Deadlines

- An affected municipality has the right to be a party in an Article 10 proceeding by filing a notice of intent with the siting board no more than 45 days after the application is filed.[9]
- Requests by a party for intervenor funds must be made to the presiding examiner no later than 30 days after notice of the intervenor funds.[10]

Final Decision Deadlines

- The siting board has no more than one year to make a final decision after the application process has started.[11]
- A municipality has no more than 30 days to appeal the final decision made by the siting board.[12]

ORES:

The ORES application process also includes a number of important deadlines and protocol for municipalities to be aware of:

- Prior to filing an application for a siting permit with ORES, applicants must consult any municipality wherein the project is proposed to be located. No application shall be deemed complete without proof of consultation.[13]
- Within 60 days of receiving an application, ORES must evaluate and determine whether the application is complete and notify the applicant of its determination.[14]
- Once deemed complete, ORES has 60 days to publish draft permit conditions for public comment, and shall notify the host municipality of the commencement of the public comment period.[15]
- The public comment period shall last a minimum of 60 days following public notice.[16]
- Within this period, the municipality shall submit a statement to ORES indicating the proposed project's compliance with applicable local laws and regulations.[17]
- Depending on the received public comments, including any statements from municipalities in which the project is proposed to be located, ORES may promptly schedule adjudicatory or non-adjudicatory public hearings.[18]
- Following the public comment period and any hearings, ORES shall issue a written report addressing the preceding public comments and/or hearings.
- ORES shall issue a final determination on a siting permit application within one year from the date the application was deemed complete, or within six months if the project is to be sited on an existing or abandoned commercial location, such as a brownfield, landfill, or other underutilized site.[19]
- A municipality may seek judicial review of a final permit decision made by ORES within 90 days following the issuance of the final determination.[20]

Note: Within one year of its creation in April 2020, ORES is required to establish comprehensive regulations and uniform permit standards and conditions. NYSERDA will update this Guidebook as needed to reflect any additional key deadlines and dates for municipalities.

2. Environment

2.1 Are there environmental impacts associated with wind turbines?

Wind turbines are environmentally low-impact compared to coal, natural gas, and nuclear power plants. In general, they do not cause air, water, or ground pollution; produce toxic chemicals or radioactive waste; or require mining or drilling for fuel. However, like any other major construction project, wind energy projects introduce the possibility of a variety of potentially harmful environmental impacts, many of which can be prevented or mitigated.

Once operating, wind project sites may also have environmental impacts. To minimize and mitigate potential impacts, developers must meet federal, state, and local guidelines and requirements for project design, construction, and operation.

2.2 Will wind turbines harm birds and bats?

Direct impacts on wildlife including birds and bats may occur as the result of collisions with the turbine blades and towers. There is also the potential for indirect impacts, which may include outright loss of habitat, or a behavioral response resulting in habitat displacement.

Surveys of scientific literature have shown that, overall, the negative impacts of wind energy on wildlife are significantly less than those of fossil fuel and nuclear generation. New York State requires both pre-and post-construction studies of birds and bats in the project area, and mitigating measures when appropriate.

2.3 What is the potential impact to birds and bats?

The rate of bird collisions is subject to a wide range of factors that include weather, seasonality, species, turbine design, and site characteristics. Typically, passerines (perching birds, including songbirds) are the group most impacted by wind turbines.

In North America, most wind facility collision fatality monitoring studies report fatality rates of three to five birds per megawatt (MW) per year, inclusive of all affected species.[21] This impact is significantly smaller than other factors, including predation by cats and collisions with other structures and vehicles. Songbird populations number in the millions, and there is no evidence that fatalities from existing wind facilities are causing measurable changes in bird populations in the U.S.

Nationally, wind facilities have reported bat fatality rates ranging from two to greater than 30 per MW per year. The reasons for differences among sites are not well understood; however, at all sites in the State, bat fatalities are generally highest among migratory species in late summer and early fall. The status of many bat populations is poorly known, and the ecological impact of current bat fatality levels is not yet understood. As a result, many projects have committed to reducing fatality rates by implementing mitigation measures such as curtailing operations during peak migration periods.

2.4 How can potential impacts be mitigated?

New York State law requires the potential environmental impacts of each proposed wind facility be assessed through a public process that includes consultation with State and federal wildlife agencies and other stakeholders. During this process, surveys to assess bird and bat activity in the project area are typically conducted to determine the potential for adverse impacts and how they can be avoided or minimized.

The New York State Department of Environmental Conservation (DEC) has provided guidelines for assessing impacts on birds and bats since 2008. In 2016, DEC released updated Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects.[22]

The DEC guidelines provide useful information for developers to help determine potential impacts to wildlife, including the following:

- Consistent and predictable methodologies, based on the latest scientific knowledge, to assist developers in the planning, development, and monitoring process
- Standards for rigorous pre-construction surveys and impact studies to estimate potential impacts in the project area
- Guidelines for post-construction studies to estimate direct and indirect impacts during operation, and help in identifying operational methods or technologies to reduce impacts as much as possible

Significant impacts are often avoided through effective wind turbine siting practices that discourage development in locations with highest risk to wildlife; for instance, locations in close proximity to bat hibernation sites should be avoided.

In some cases, operational mitigation may be implemented to limit impacts to acceptable levels. For example, bats are known to fly more frequently on nights with lower wind speeds, and the potential for bat fatalities can be reduced by increasing the cut-in speed (the wind speed at which the turbines begin to operate) at night during peak periods of bat migration (summer and fall). This low wind speed curtailment has been shown to reduce bat mortality rates by 40 to nearly 90%.[23]

Ongoing research, supported by the U.S. Department of Energy (DOE), wind turbine manufacturers, conservation organizations and others, is leading to the development of innovative technologies that can deter birds and bats from approaching operating turbines,[24] or curtail operations when their presence is detected.[25] While these technologies are not yet fully developed, they offer the possibility of better wildlife protection while minimizing lost clean energy production.

2.5 What happens to the land after the end of the wind turbine's life cycle?

When a wind project reaches the end of its useful life, the equipment may be repowered (replaced with newer equipment) or decommissioned (removed). Responsibilities for equipment salvage and removal and landscape restoration are addressed before the wind project is built.

Typically, the developer must post a bond for the cost of decommissioning. If turbines are decommissioned, the bonding will ensure the structures are removed, and the land is returned as close to its original condition as possible.

However, since the wind resource remains, and related infrastructure (roads, transmission lines, etc.) is already in place, wind project owners may prefer to repower. In repowering, old turbines at the end of their lifespan are upgraded or replaced with new ones, often in the same locations.

3. Health Impacts

3.1 Are there health impacts associated with wind turbines?

Numerous government health organizations from around the world have studied the potential health impacts of wind turbines, including the DOE, the Massachusetts Department of Public Health and Environmental Protection, Minnesota Department of Health Environmental Health Division, National Health and Medical Research Council of Australia, the UK Health Protection Agency, and the Council of Canadian Academies. These and other researchers have produced more than 80 peer-reviewed studies on the health impacts of turbines.

The general conclusion from these studies is that living near wind turbines does not pose a risk to human health. Some studies have found that individuals living in very close proximity to wind turbines can find them annoying; annoyance may lead to sleep disturbance and other effects that can adversely affect health. Studies show that a combination of measures, such as establishing responsible wind turbine siting standards, early and strong public participation, and providing benefits to the host community, resulted in greater public acceptance and less annoyance by residents.

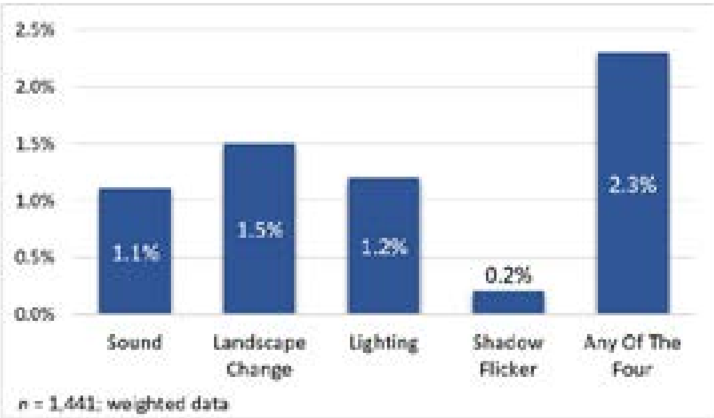
3.2 How common is annoyance for residents near wind development, and what are the main causes and considerations?

Lawrence Berkeley National Laboratory (LBNL) published a survey[26] of 1,700 residents across the country who live within five miles of one or more wind turbines. The study found that people living near wind turbines had more positive attitudes toward the development when they perceived the planning process as fair and are generally favorable toward wind technology. When asked about their attitude toward their local wind power project post-construction, 8% of the responses were very negative or negative, while 34% were neutral, and 57% were positive or very positive. Attitudes of those who lived within 0.5 miles were slightly less positive than those living between 0.5 to 3 miles away.

In the LBNL study, residents' annoyance levels increase with proximity to turbines, and the source of annoyance varied among respondents. Amongst the residents living within three miles of a turbine, 2.3% were strongly annoyed; if further broken down by source of annoyance, 1% of respondents attributed the source of annoyance to sound and 1.5% to landscape change. This is also represented in Figure 1-1.

People may be more annoyed by noise with fluctuating characteristics, such as that from wind turbines, than by a louder, more constant sound. One study found that people were more annoyed by noise from wind turbines than by transportation noise at similar decibel levels.

Figure 1-1. Source of annoyance
(Source: LBNL 2018)



3.3 What is wind turbine syndrome?

It has been suggested that wind turbine effects such as shadow flicker, audible noise, low frequency noise, and infrasound could cumulatively contribute to wind turbine syndrome. There is no scientific or medical evidence for a set of health effects from exposure to wind turbines that could be characterized as wind turbine syndrome.[27]

3.4 What is the nocebo effect?

The nocebo effect can occur when an individual expects some aspect of their environment to produce an illness or symptoms. The individual may then start to look for these symptoms and self-report signs of the illness. This effect is the opposite of the placebo effect.

In the case of wind turbines, increased exposure to misinformation seems to increase the likelihood that certain individuals will report negative health effects such as headaches, nausea, or sleep disturbance. Whether caused by wind turbines or not, the effect on the individual can be real and is best counteracted by establishing responsible wind turbine siting requirements (especially with respect to noise and setbacks), encouraging early and strong public participation, and ensuring benefits accrue across the host community.

4. Noise

4.1 What sounds do wind turbines produce?

Wind turbines produce some mechanical sound from the operation of turbine components, such as the generator and gear box. However, the aerodynamic sound resulting from air passing over rotating blades is generally the subject of regulation and concern.

While improvements in turbine design have greatly reduced the sound emitted from modern wind turbines, unwanted sound remains an important consideration in wind turbine siting, especially in rural landscapes.

4.2 How loud is a wind energy facility?

Sound is characterized by its loudness, expressed as decibels (dB) and by its tonal quality and frequency, measured in Hertz (Hz). Of primary concern are sound impacts as perceived by the human ear, which are measured using an A-weighted scale, or dB(A).

The level of noise or sound pressure level produced by a wind turbine depends on its design, wind speed, and how sound travels across the landscape. The sound pressure level decreases or attenuates as sound spreads out and travels over distance through the air.[28] Attenuation results from distance, atmospheric absorption, building materials, and terrain effects. Typically, an operating wind energy project at a distance of 1,300 feet emits sounds at 40 dB(A)—a level comparable to a kitchen refrigerator or moderately quiet room.

Wind turbines may create more sound as wind speed increases, until the wind turbine nears its maximum electricity output at around a wind speed of 10-12 meters per second at which point it levels out. Background sounds may also increase with wind speed, as the wind blows through trees and past buildings, power lines and other objects. In some cases, it may be hard to distinguish between these background sounds and the sound from operating wind turbines.

In addition to sound pressure level, other sound qualities matter. Sound from wind turbines often has a regular fluctuating quality caused by the rotation of the blades. The resulting sound can be as benign as a swish, although under certain conditions it can become a more intrusive thump.

4.3 Should there be a minimum distance between wind turbines and homes for noise regulations?

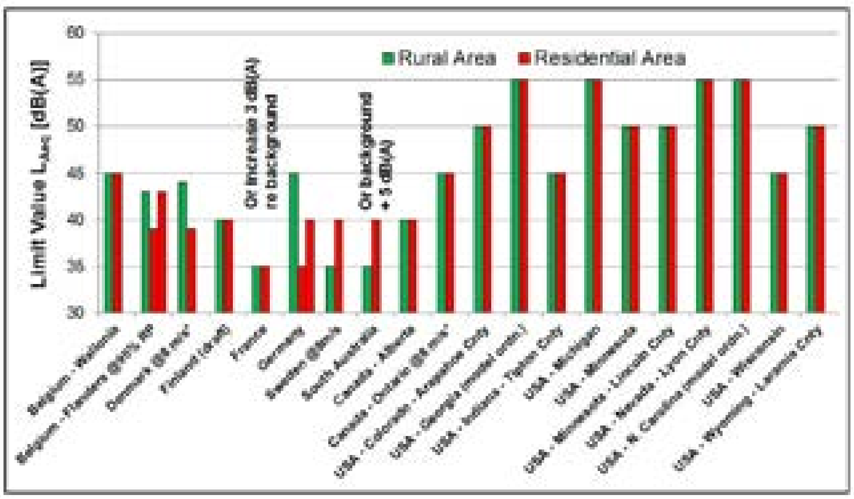
There is no simple relationship between distance and the wind turbine sound impact. As previously noted, many factors affect how sound from a wind project is perceived from any given location. Establishing a legally defensible and publicly supported noise limit is a more appropriate way to regulate noise.

4.4 What is an appropriate wind energy facility noise limit?

Since the response to noise varies by individual perception and is a subjective matter, it's difficult to define objectionable noise. One person may regard a wind turbine as noisy and disruptive while another person may not, even under the same conditions. So, while sound pressure levels can be measured and compared to regulatory limits, individual perception of sound makes control and mitigation of concerns difficult. Sound levels at locations within or around a wind energy facility may vary considerably depending on factors such as the layout of the wind energy facility, the make, model, and operating state of the turbines, the topography of the land, vegetation cover, time of year, atmospheric conditions, background noise, and the speed and direction of the wind. An effective noise standard must take all these factors into consideration.

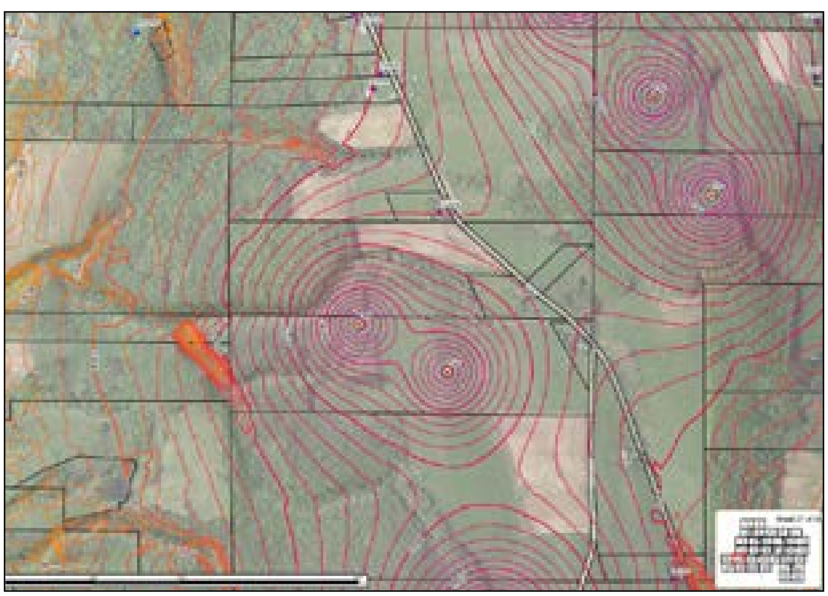
Noise standards often incorporate varied acceptable levels of sound based on the time of day (or night) and on existing land uses and background sounds (e.g., residential or industrial zones). Figure 1-2 shows a range of noise level limits from around the world.

Figure 1-2. Rural and Residential Nighttime Noise Limits Around the World
(Source: Koppen and Fowler, 2015[29])



4.5 How is noise from a wind energy facility predicted and monitored?

Figure 1-3. Cassadaga Wind Project, Sound Propagation Modeling Results, 2016
(Source: Department of Public Service, Case 14-F-0490)



A wind energy facility must operate within noise limits imposed through applicable local laws or the State-level review process through which it is permitted (Article 10 or ORES).

A wind project developer must conduct noise modeling studies using a standard methodology to predict sound levels from a wind energy facility in surrounding areas. Models are based on reasonable assumptions regarding turbine output, landscape, and weather conditions to ensure impacts are appropriately accounted for.

Pre-construction sound surveys are conducted to determine the normally occurring background noise levels at surrounding locations, and to later determine whether the wind project has added to those levels.

A wind project developer must conduct sound compliance tests once the wind energy facility is fully operational. The developer must have a process for receiving and addressing complaints from nearby residents during both construction and operation.

4.6 What is infrasound, and can it cause negative health impacts or annoyance?

Similar to many sound sources in the environment, sound from turbines includes low frequency and infrasound, which are defined as sound that is between 20 and 200 Hz and below 20 Hz, respectively. These levels are usually so low that they lie below the threshold of perception.

While health problems have been anecdotally attributed to infrasound generated by wind turbines, to date, expert panels reviewing research on this topic have found inadequate evidence linking infrasound to adverse effects on a person's health.

4.7 How does amplitude modulation impact nearby residents?

The fluctuating nature of sound produced by wind turbines, even at low decibel levels, may contribute to annoyance for nearby residents. This can be the primary cause of complaints about wind energy facilities.

Amplitude modulation is a characteristic of wind turbine sound resulting from the change in amplitude (loudness) occurring at the blade passing frequency, commonly described as a swish, thump, or whoosh. Multiple turbines operating within an area can have an amplifying effect on the modulation. The effect is typically most pronounced at night, when atmospheric conditions stabilize to create a temperature inversion. An increase in amplitude modulation under these conditions, though not always present or prominent at all sites, can result in higher levels of annoyance and sleep disturbance.

This issue can be mitigated through responsible siting standards, identifying worst-case scenarios in sound models, and in some cases, limiting turbine operations during periods of highest noise occurrence.

4.8 Do wind turbines produce tonal sound?

Tones are individual sound frequencies that can be discerned from the rest of the sound in a given spectrum. Examples of tones include notes on musical instruments, a flying mosquito, and an emergency siren.

Modern turbines incorporate noise control measures to avoid producing prominent tones that are distinctly noticeable in the community. Noise standards typically include limits on tonality to ensure that operating wind turbines do not exceed acceptable levels.

5. Shadow Flicker

5.1 What is shadow flicker?

Shadow flicker can occur when rotating turbine blades come between the viewer and the sun, causing a moving (flickering) shadow.

Shadow flicker usually occurs close to sunrise and sunset. Factors that determine how often a wind turbine will cast a shadow on a residence or other structure include turbine height and length of blades, site topography, distance between turbine and structure, season and time of day, wind direction and speed, and cloud cover. For instance, there is no shadow flicker on cloudy days or when the wind is not blowing. Shadow flicker becomes weaker with distance and is not likely to be noticeable farther than one mile from a wind turbine.

5.2 How does shadow flicker affect people?

Some residents living in close proximity to turbines have reported experiencing headaches and dizziness. Some residents also raise complaints because they find the moving shadows bothersome.

Concerns have been raised that flickering shadows could trigger epileptic seizures. However, studies have shown flicker-induced seizures are highly improbable because the frequency of blade rotation on utility-scale turbines is significantly lower than the flashing frequency that could trigger seizures.[30] No case of a seizure caused by shadow flicker from a wind turbine has been documented to date.

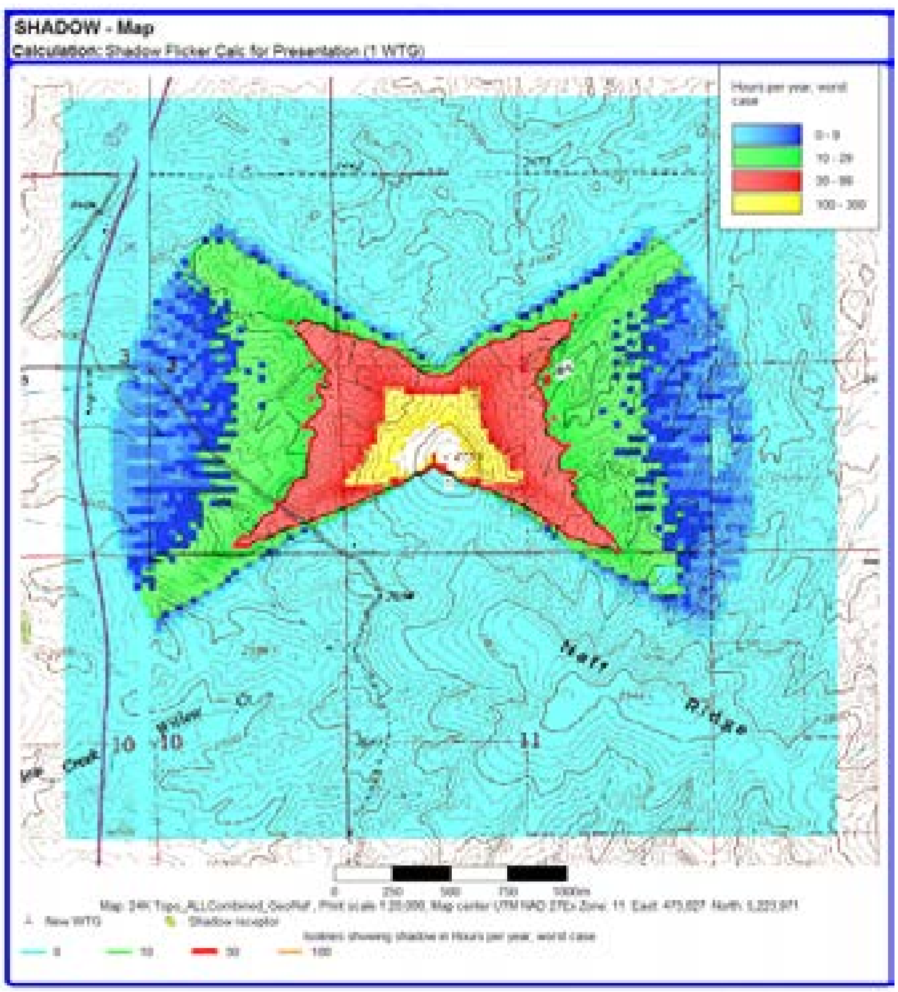
5.3 How can shadow flicker be predicted?

The impact of wind turbine shadow flicker on homes, roads, and populated areas can be reliably predicted using modeling software that calculates when and how long the sun will be directly behind a turbine from a given location.

A typical shadow flicker analysis will show the worst-case scenario, or the maximum amount of shadow flicker that could occur in each area. A second analysis will be conducted to estimate the expected amount or real-case scenario by factoring in variables such as expected hours of operation, wind direction, and cloud cover, all of which will lower the expected hours of shadow flicker. Shadow flicker analysis is typically conducted in the area within 10 times the rotor diameter of each wind turbine, which equates to roughly 3,000 ft for a typical 3 MW wind turbine. The analysis encompasses all times of day and all seasons during which the effect may occur.

Each turbine's affected area has a characteristic butterfly shape, oriented toward the rising and setting sun (Figure 1-4). Higher amounts of flicker occur nearest the turbine, with a diminishing effect at greater distances.

Figure 1-4. Modeled Shadow Flicker Map
(Source: (c) 2017 CH2M. Used with permission.)



The colored areas in Figure 1-4 indicate how many hours per year each location may experience a shadow flicker effect. The pattern will vary for each specific site and is mainly influenced by the topography of the land and the dimensions of the turbine. This example shows the difference between the expected worst-case and real-case at a specific site.

5.4 What are typical shadow flicker limits?

There are no specific federal or New York State regulations regarding shadow flicker from wind turbines. Figure 1-5[31] summarizes allowable shadow flicker guidance from various locations around the world.

Figure 1-5. Shadow Flicker Guidance

Limit Values		Country / State
Worst Case	**30 hours/year and 30 minutes a day**	Australia (Queensland, Tasmania, South Australia), Austria, Belgium (Walloon Region), Brazil, Canada, Germany, India, Serbia, Sweden, UK (England, Wales, some US states
	30 hours/year	Australian (New South Wales, Victoria), Ireland, Japan, Poland, US states Connecticut and Wisconsin
Real Case	**8 hours/year**	Belgium (Flanders Region)*, Germany, Sweden
	10 hours /year	Austrialia *Queensland, Tasmania, South Australia), Denmark
	Mac. 17/days/year more than 20 min.	Netherlands

**Plus 20 minutes/day*

5.5 How can shadow flicker be mitigated?

When proper planning and standards are implemented during the design process, the occurrence of shadow flicker can be minimized or entirely avoided.

The impact of shadow flicker on homes, roads, and populated areas can be mitigated through the use of appropriate setbacks, planting trees for screening, or window treatments to minimize concerns. Shadow flicker can also be limited by pausing the operation of a turbine during periods when unacceptable flicker is expected to occur.

6. Roads, Property Value, and Visual Impact

6.1 Will the construction of a wind project damage public roads?

Construction of a wind project typically involves the transport of turbine towers, blades, and other components on specialized trucks, as well as the use of large cranes and other heavy equipment to erect the turbines. Sometimes roads must be reinforced or widened to accommodate turning radiuses for oversized trailers and trucks. These changes are permanent. In addition, wind projects often require the construction of new access roads on private property.

Trucks and other heavy equipment can damage existing public roads. To ensure there is no permanent damage to existing roads, a host town and developer typically establish a Road Use Agreement. This specifies the developer's responsibility for road upgrades, repairs, or post-construction restoration.

6.2 Will wind development have an impact on my property value?

Most studies have found that well-sited wind projects with reasonable setbacks from residences do not measurably reduce property values. While these studies are valid for showing the overall average effect, they cannot be relied upon to predict the effect on individual homes.

6.3 Will a proposed project drive down property values?

Some experts theorize that a decrease in property values can occur during the period after a project is announced but prior to construction, before the actual effects on properties are known. This has prompted research into changes in property prices during each phase of a wind facility's development: pre-announcement, post-announcement/pre-construction, and post-construction.

Overall, there is some evidence for an effect termed anticipation stigma. Lawrence Berkeley National Laboratory's (LBNL) 2013 study examined home sales from more than 50,000 homes, near 67 wind facilities across nine states.

This study found that home prices dropped by 8% after the wind project announcement but before construction. Home prices subsequently returned to normal after the wind project was constructed and commenced normal operations.[32]

6.4 Have any studies considered the distance to the project?

LBNL's 2013 study is the most comprehensive on the subject to date. Of the 50,000 home sales studied, 11,900 occurred across seven New York counties. The large data set helped account for non-wind project related factors on home sale prices such as house age, square footage, condition, and lot acreage.

Although this study found no statistical evidence that home prices near wind turbines were affected, it also indicated that the margins of error were +/- 4.9% within a mile of existing turbines, and +/- 9.0% for homes within a half-mile. In other words, prices of homes not near wind turbines may vary up to 4.9% and still be within the model prediction.

6.5 What can be done to mitigate the visual impacts of wind development?

Aesthetics and visual impacts are among the greatest concerns raised about proposed wind projects. Because wind resources in the Northeast tend to be best at high elevations or near large bodies of water, turbines can sometimes be visible for long distances and may alter scenic vistas. Therefore, it's important to consider ways to minimize and mitigate unavoidable adverse aesthetic and visual impacts during the preconstruction planning and permitting process.

Wind projects subject to Article 10 are required to conduct an assessment of the project's visual impact. As part of the study, developers must seek community input in identifying important features of the surrounding landscape that contribute to the visual quality of the community.

Modern software can digitally simulate the view of a wind energy project from a variety of locations and in different light conditions. This tool helps communities understand the visual impact and helps project developers identify areas that may need a mitigation plan.

Examples of mitigation measures include changing a project's turbine layout, minimization of glare, and lower-impact nighttime lighting. Turbine layout may be adjusted to best fit the landscape; for example, an orderly or linear arrangement may be preferable to some communities. Due to the use of low-reflective materials on the blades and towers, glint or glare is rarely an issue with wind turbines.

The nighttime impact of lighting for aviation safety is often of concern to the community. The Federal Aviation Administration requires structures above 200 feet to have red or white obstruction lighting.[33] Recently developed technology now allows for lighting on wind turbines to be radar-activated. As a result, the obstruction lights turn on only when an aircraft is detected nearby. Such systems allow lighting to remain off up to 98% of the night.

As options to minimize visual impacts of wind turbines are limited, a developer may be required to develop and implement a cultural resource mitigation plan in consultation with the NYS Historic Preservation Office. This plan provides for developer funding of offset projects that provide benefits for local cultural resources, historic properties, and public appreciation of historic resources.

7. Safety Concerns

7.1 What are the safety concerns related to wind development?

Safety concerns most commonly expressed by the public with respect to large-scale wind turbines include ice throw, blade throw, and tower collapse. The frequency with which any one of these events occur is extremely rare.

7.2 What is the best way to ensure my community's safety?

Many concerns associated with safety can be addressed by placing distance between wind turbines and people, property lines, roads, or scenic areas. Each municipality can determine and establish their own setback distance. Setback distances are commonly defined in terms of a multiple of the turbine structure height (e.g., 1.5 times the turbine structure height).

The setback distance is measured as a straight line from the vertical centerline of the wind turbine tower to the nearest point of an occupied building, property line, or private or public way. The total height of the turbine is measured as the tip of the upward-pointing vertical blade at its fullest upward extent.

7.3 What are examples of safety setbacks around the country?

Required setback distances vary across the country. Ohio, Wisconsin, Wyoming, Pennsylvania, Illinois, and Utah recommend a setback distance of 1.1 times total turbine height; while Connecticut and Maine have established a setback of 1.5 times total turbine height. Most ordinances will allow setback requirements to be waived or modified under the terms of a legal agreement between an adjacent property owner and the wind development company.

7.4 What other factors contribute to safety?

Commercial wind turbines are generally certified in accordance with International Electrotechnical Commission Standards (IEC). The IEC is a global nonprofit organization that provides third-party certification of a turbine's safety systems. IEC standards certify that a wind turbine can operate for 20 years under testing conditions. Meeting these standards helps to ensure turbine reliability and public safety.

Safety concerns are most relevant during extreme weather events that have the potential to cause damage to property and harm to residents nearby. Under the most extreme weather conditions, automated controls shut turbines down and orient blades to minimize wind resistance. Turbines are typically connected to a remote operations center and monitored 24 hours a day.

8. Radar and Communications

8.1 Will wind development impact communications and radar?

Wind turbines, like many structures, may have an impact on communication and radar signals. Turbine towers and blades can cause TV and radio signal interference as well as interference with aviation and weather radar systems.

The impacts of a wind energy facility on telecommunications are influenced by factors including blade composition, location of the turbine, distance from the transmitter or receiver, and antenna or receiver type. The likelihood of interference may increase with turbine size and the number of turbines.

The two types of radar interference are: (1) direct interference that can produce false images or shadow areas, and (2) doppler interference that creates false targets and can impact airborne and fixed radar.

8.2 How can these impacts be mitigated?

During wind project development, modeling methods are used to identify and mitigate potential issues. In most cases, radar interference is either not present, is not deemed significant, or is readily mitigated. There are several strategies to reduce impacts on radar including infilling radar, replacement and upgrading radar technology, or modifying operations to correct for the presence of turbines.

Occasionally, operating wind turbines may interfere with television signals or other communications. Developers are aware and often provide community solutions, such as placement of repeater antennas or offering alternatives to over-the-air television, like cable.

8.3 What is the potential impact to military bases?

Wind developers must follow federal guidelines and undergo rigorous reviews to ensure radar issues potentially affecting public safety and national security are satisfactorily resolved. Both the Department of Defense (DOD) and Federal Aviation Administration (FAA) conduct reviews of all wind turbine installations that exceed height thresholds. A range of siting, software, and hardware solutions have led to successful coexistence of wind and military bases.

The DOD and base commanders review all proposed projects near bases and if military concerns cannot be addressed, the project will not be built in that area. The DOD states that no military operations have been adversely impacted by wind facilities.

To better understand and mitigate radar impacts, the U.S. Department of Energy collaborates with DOD, FAA, and the National Oceanic and Atmospheric Administration to address potential issues on an ongoing basis. As wind energy advances, this interagency program[34] is developing hardware and software solutions to mitigate potential impacts on existing radar systems. In addition, they are developing the next generation of radar systems to be resistant to potential wind turbine interference.

Questions?

If you have any questions regarding wind energy and your community, please email questions to cleanenergyhelp@nyserda.ny.gov or request free technical assistance at https://www.nyserda.ny.gov/Siting
The NYSERDA team looks forward to partnering with communities across the State to help them meet their clean energy goals.

Section Endnotes

[1] 16 NYCRR § 1000.4(d)

[2] 16 NYCRR § 1000.4(e)

[3] Id.

[4] 16 NYCRR § 1000.5(e)

[5] Id.

[6] 16 NYCRR § 1000.10(a)(3).

[7] 16 NYCRR § 1000.10(a)(4).

[8] NY Pub Serv § 163(5).

[9] NY Pub Serv § 166(1)(j).

[10] 16 NYCRR § 1000.10(b)(3).

[11] NY Pub Serv § 165(1).

[12] NY Pub Serv § 165(4)(a).

[13] EXC § 94-C (5)(b)

[14] Id.

[15] EXC § 94-C (5)(c)(i)

[16] Id.

[17] EXC § 94-C (5)(c)(ii)

[18] EXC § 94-C (5)(d)

[19] EXC § 94-C (5)(f)

[20] EXC § 94-C (5)(g)

[21] "Bats and Wind Energy: Impacts, Mitigation, and Tradeoffs" American Wind and Wildlife Institute, November 2018. https://awwi.org/wp-content/uploads/2018/11/AWWI-Bats-and-Wind-Energy-White-Paper-FINAL.pdf

[22] "Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects" NYS Department of Environmental Conservation, June 2016. http://www.dec.ny.gov/docs/wildlife_pdf/winguide16.pdf

[23] "A synthesis of operational mitigation studies to reduce bat fatalities" National Renewable Energy Laboratory. March 2013. http://batsandwind.org/pdf/Operational%20Mitigation%20Synthesis%20FINAL%20REPORT%20UPDATED.pdf

[24] "Flying Safe: Using Technology to Protect Wildlife" American Wind Wildlife Institute. Accessed April 2019.

[25] "Operational Mitigation & Deterrents" Bats and Wind Energy Cooperative. Accessed April 2019.

[26] "National Survey of Attitudes of Wind Power Project neighbors: Summary of Results" Ben Hoen, Joseph Rand, and Ryan Wiser, Lawrence Berkeley National Laboratory (LBNL). January 2018. https://emp.lbl.gov/sites/default/files/paw_summary_results_for_web_page_v6.pdf - Larger Research Project's main page: https://emp.lbl.gov/projects/wind-neighbor-survey

[27] "Wind Turbines and Human Health" Knopper et al., June 2014. https://www.frontiersin.org/articles/10.3389/fpubh.2014.00063/full

[28] "Fundamentals of Acoustics" World Health Organization. https://www.who.int/occupational_health/publications/noise1.pdf

[29] "International Legislation for Wind Turbine Noise". Koppen, E., Fowler, K. June 2015. https://www.conforg.fr/euronoise2015/proceedings/data/articles/000225.pdf

[30] "Wind Turbine Health Impact Study: Report of the Independent Expert Panel." Massachusetts Departments of Public Health and Environmental Protection. 2012. https://www.mass.gov/files/documents/2016/08/th/turbine-impact-study.pdf

[31] Arcadis, 2017. *International Legislation and Regulations for Wind Turbine Shadow Flicker Impact*. Presented at Wind Turbine Noise Conference 2017. Erik Koppen (Netherlands), Mahesh Gunuru (Netherlands), Andy Chester (UK).

[32] "A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States" Hoen et al., Lawrence Berkley National Laboratory, August 2013. https://emp.lbl.gov/sites/all/files/lbnl-6362e.pdf

[33] Advisory Circular titled "Obstruction Marking and Lighting" US Department of Transportation, Federal Aviation Administration (FAA), August 2018. https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_70_7460-1L_-_Obstuction_Marking_and_Lighting_-_Change_2.pdf

[34] "Federal Interagency Wind Turbine Radar Interference Mitigation Strategy. 2016 US. Department of Energy https://www.energy.gov/sites/prod/files/2016/06/f32/Federal-Interagency-Wind-Turbine-Radar-Interference-Mitigation-Strategy-02092016rev.pdf.

This page intentionally left blank.