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COPY

Agenda Item # 23b
Date 1-29-2020

My name is Lucas Nelsen, and I am a Policy Associate at the Center for Rural Affairs. The Center is a private, independent non-profit organization committed to strengthening rural communities. We are based in Lyons, Nebraska and Nevada, Iowa.

We know that economic development opportunities are essential to helping our communities grow and thrive. Renewable energy provides one such opportunity. These projects have the potential to bring in new tax revenue, provide additional income for landowners, and bring temporary and long-term jobs to rural areas.

As new projects are being developed across the state and region, it is important that developers and local officials work together with community members to identify and address concerns. In order for a community to fully capture the benefits of new development, projects must be built in a way that is supported by local residents. This is best achieved by soliciting community input, gathering unbiased information, and developing balanced ordinances.

Included with this letter is information that outlines common terms found in wind energy ordinances, requirements that typical counties have for the approval of projects, and recommendations for local officials. This information is meant to provide a basic understanding of the content that is typically found in ordinances and brief explanations or definitions that may be of use as you consider revising your ordinance or creating new material. Also included are fact sheets that provide additional information on studies that have reviewed subjects ranging from the potential health effects related, effects on property values, and wind turbine noise.

You may already have similar information on hand or are farther ahead in your research. If so, we thank you for your diligence. If you wish to share your experience, or have questions about the siting of wind energy systems, please feel free to contact me.

Sincerely,

Lucas Nelsen

Lucas Nelsen
Policy Associate
402-687-2103 ext. 1022
lucasn@cfra.org

INFORMATION GUIDE:
WIND ENERGY ORDINANCES

Wind turbines are multiplying across the U.S., and most are installed in rural areas overlooking crops, cattle, timber, and lakes. Rural communities have experienced several benefits from the development of wind energy, but the growth of the industry has also presented a challenge in the form of local regulations that may be insufficient or out-of-date.

Wind ordinances on the city, county, and state levels may be hard to understand, whether you are an expert or just becoming familiar with the industry. The Center for Rural Affairs has gathered some helpful items to note when reviewing ordinances.

New ordinance application and project requirements, helpful recommendations, and key definitions found inside.

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DEFINITIONS

Common terms found in wind ordinances include:

Wind Energy Conversion System (WECS) — a machine or mechanism that utilizes wind to generate electricity or mechanical energy. A WECS can be a single turbine or an entire wind farm.

Commercial/utility-scale WECS — wind systems with a total capacity of 100 kilowatts (kW) or greater.

Decibel (dB) — a unit of measurement used for the intensity of a sound.

Decibel A-weighting (dBA) — a measurement of sound using decibels that have been A-weighted. A-weighting is a frequency-dependent curve (or filter) which is applied to a sound pressure microphone to mimic the effects of human hearing. Given the same sound pressure levels, microphone recordings can be different than the levels perceived by the human ear.[1]

Feeder circuits/lines — a power line or network of power lines used as a collection system to carry energy generated by a WECS to a substation or other interconnection point. These lines may be underground or overhead.

System height — refers to the height of a WECS, either the total height or the height to a specific part of the system. Total height is most often defined as the height of a WECS from the ground to the tallest point, usually the tip of a rotor blade.

Meteorological tower — a tower placed near a proposed project site which is used to measure the wind energy resource of the area.

Non-participating landowner — any landowner that has not signed a lease agreement with the project owner or developer, often adjacent to or near the project.

Occupied building — a residence or other building used for public gatherings or that contains human occupants. This definition excludes buildings used for storage, machine shops, and other structures that do not have human occupants for a prescribed length of time.

Operator — the entity or individual that operates a WECS facility.

Owner — the entity or individual that has ownership over a WECS facility.

Participating landowner — a landowner who has signed a lease agreement with a project owner.

Rotor — the hub and blade assembly of a WECS, which is responsible for converting the kinetic energy of wind. The blades of the rotor are pushed by the wind causing this assembly to rotate on its axis.

Residential/small-scale WECS — a system that often has a capacity of less than 10 kW or up to 100 kW. Residential and small-scale WECS may be in separate locations.

Shadow flicker — flickering shadows caused by the rotation of WECS rotor blades in front of a light source, such as the sun.

Substation — a facility used to convert electricity produced by a WECS to a higher voltage allowing for interconnection to high voltage transmission lines.

Transmission line — a power line used to carry electricity from collection systems or substations over long distances.

1 Siemens Experimenter. "What is A-weighting?" July 28, 2016. https://community.plm.automation.siemens.com/t5/Testing-Knowledge-Base/What-is-A-weighting/ta-p/357894. Accessed November 2017.

APPLICATION REQUIREMENTS

County boards require applicants to submit information before they will consider a project. Boards may allow applicants to provide select information at a later date.

COMMONLY REQUIRED ITEMS	
1	Name of applicant.
2	Name of the project owner.
3	Description of the project — this should include the number of turbines, specifications for the turbines (such as height, capacity, manufacturer, model, etc.), locations for turbines and the substation, and proximity to homes and other structures.
4	Map of the project location and the surrounding area.
5	A decommissioning plan outlining the process for turbine removal and property restoration before an easement is returned to the landowner.
6	A power purchase agreement or other agreement for the sale of power generated from the facility.
7	Evidence of a transmission plan or agreement for the project.
8	Acoustical analysis of the project site. This measures sound/noise already present on the land, and provides a baseline for noise level limits that may be outlined in the ordinance.
9	A road use plan that outlines routes that will be used to transport equipment and workers. This plan should include an assessment by a county engineer of the selected roads, and a plan for repairing any potential damage caused to roads by heavy machinery or equipment. The county may also require a bond from the applicant to fix any damage that may occur.
10	Notices from relevant agencies showing the project will not be a hazard to electronic communications or air traffic.
11	Documentation of easement agreements for WECS and associated facilities, if necessary.

PROJECT REQUIREMENTS

Below are several requirements for siting, construction, and operation that are commonly found in ordinances:

1. **Setback requirement** — distance of a WECS from occupied dwellings, and in some cases, property lines. The requirement most often used is 1,000 feet. Turbine height is also commonly used to determine the setback distance, such as a formula of three times the height of a turbine for a setback. County officials may choose to allow some setback requirements to be waived if residents affected by the setback voluntarily agree.

2. **Noise limits** — county officials may create requirements for limits on noise generated by WECS, sometimes dependent on the location that would experience the noise, such as an occupied residence, a nonresidential structure like a school, etc. As previously mentioned, if county officials intend to place limits on noise, the baseline noise level at a project site should be established prior to construction. Limits should be similar to noise standards for other forms of development in the county. Typically, noise standards for WECS are 50 or 45 dBA.

3. **Shadow flicker** — a limit on shadows caused by a WECS at occupied structures. Most ordinances require projects to comply with an annual limit, typically no more than 30 hours annually for each structure. Roadways may also be included as areas with shadow flicker limits.

4. **Lighting** — lights are placed on individual turbines to alert aircrafts of their presence. County officials often require that projects at least adhere to Federal Aviation Administration (FAA) regulations regarding lights on turbines. Some officials choose to prescribe lighting that is in compliance with FAA guidelines but has less visual impact by requiring the use of special lighting systems that avoid continuous lighting. Operators would instead employ tools such as radar to turn on external lighting only when aircrafts are approaching.

5. **Site restoration** — requirement that a project site is sufficiently restored post-construction and prior to any property being made available again to the landowner. This includes removal of equipment and any waste generated by the project, as well as requirements that ensure there has not been significant soil compaction or other damages affecting normal operations on the property.

6. **Signage** — requirements for signs on WECS and associated facilities providing the project name, address, emergency contact information for operator/technicians, and warnings.

7. **WECS appearance** — county officials may make certain requirements for the appearances of a WECS. These standards often require that WECS are a uniform color(s), and limit the addition of logos or signage beyond the name and logo of the project or manufacturer.

RECOMMENDATIONS

We suggest residents and local officials take the following steps when drafting new zoning regulations or ordinances, and when they are approached about a wind farm near their community.

1

Consult experts on key issue areas in a proposed ordinance. For example, specialized equipment and training are required to effectively measure the potential impacts of a wind energy system on sound/noise, frequency, etc. Anecdotal evidence should not be substituted for expert guidance, as it does not provide a sound foundation for zoning standards.

2

Communicate with officials from neighboring or similar counties who have wind development experience. Officials can provide valuable insight and give examples of what has worked in the past, as well as assist in identifying useful items to include in an ordinance.

3

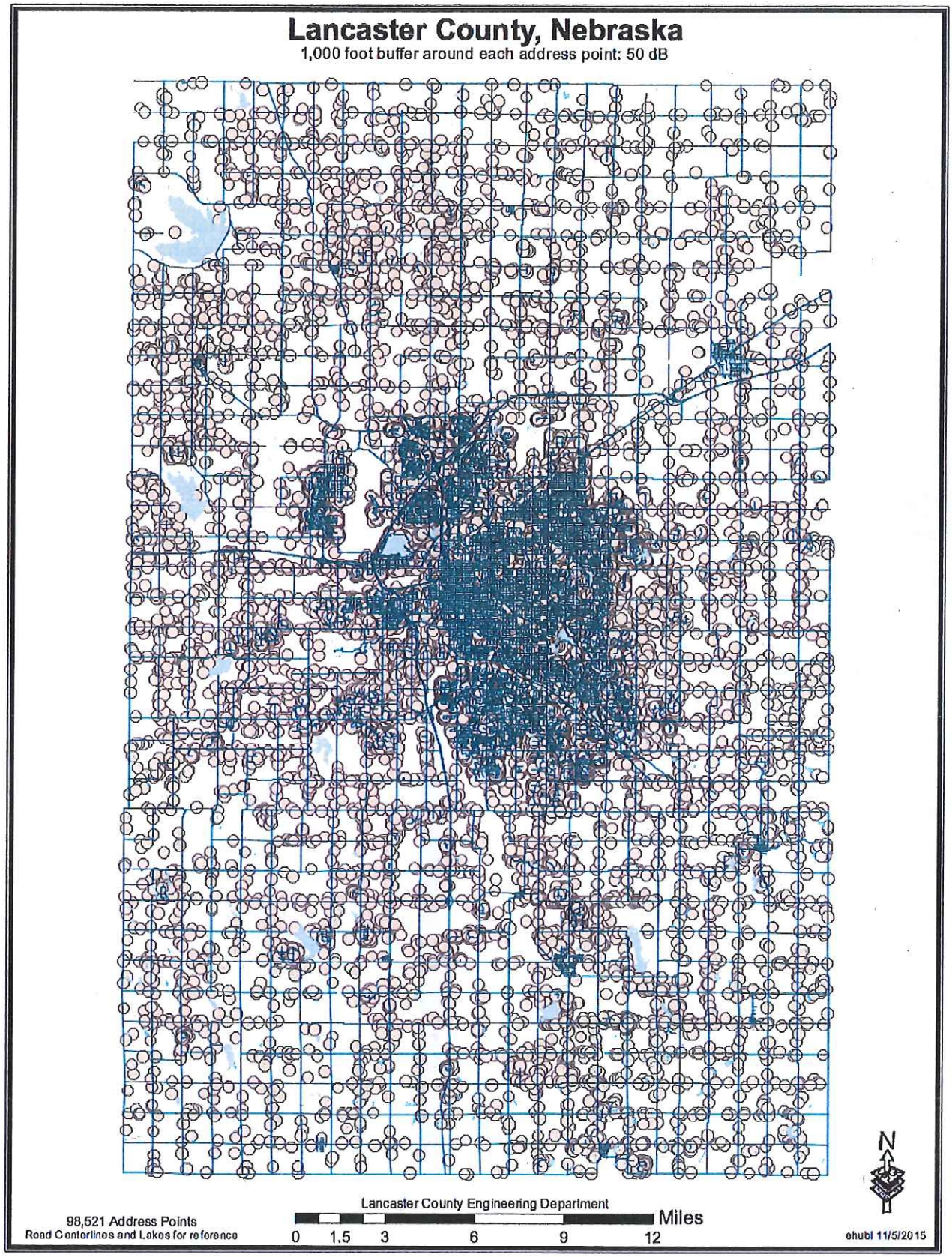
Encourage developers to hold community meetings to engage with members of the public early in the process of project development. The meetings should be an opportunity for developers to provide education on wind energy development, offer specific details about the project, and answer questions from local residents. Community members should also use the opportunity to share specific concerns.

4

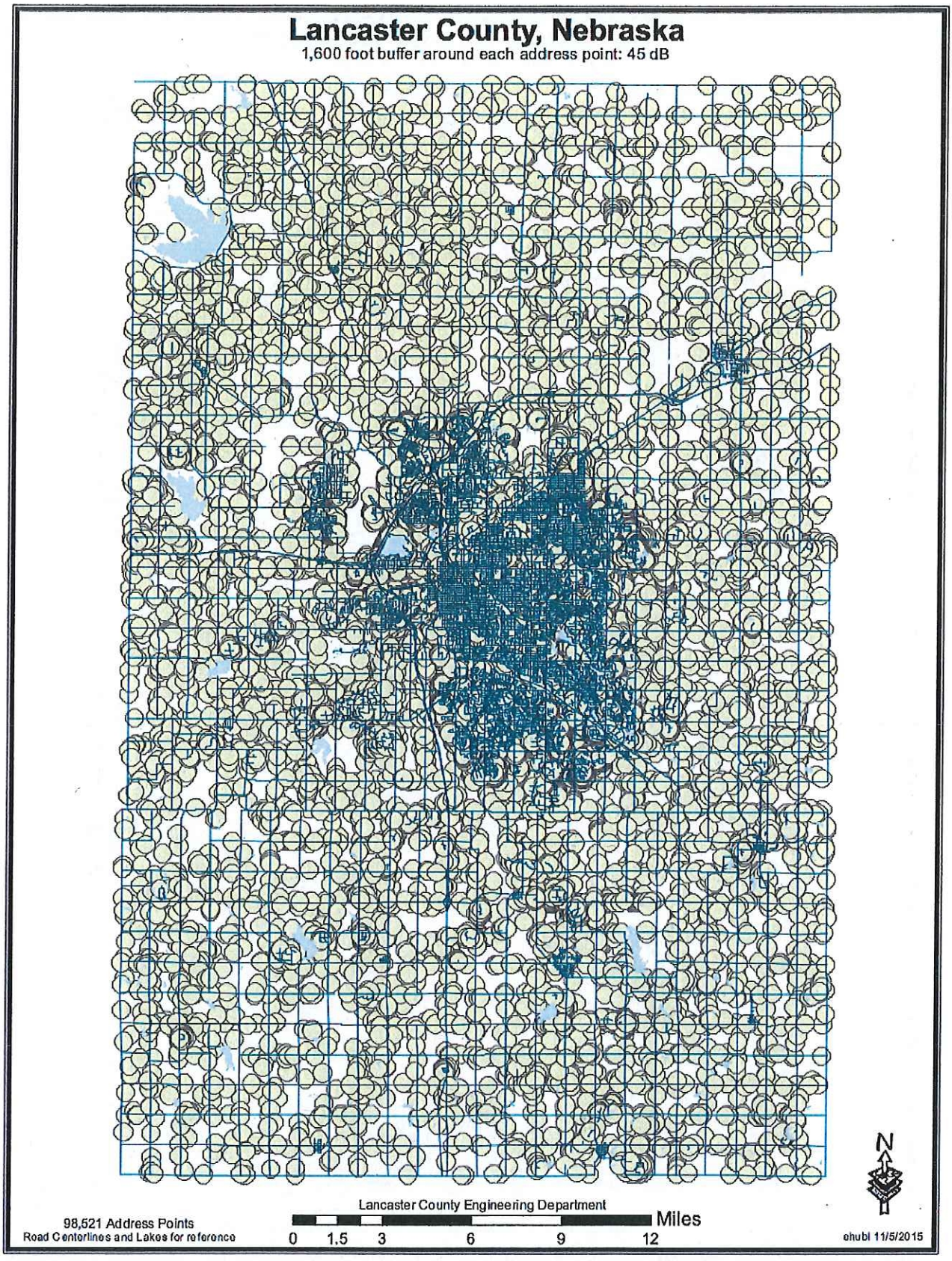
Consider potential unintended consequences of ordinances and zoning standards. Items such as setbacks and noise limits can significantly limit the ability of project developers to site projects in a county if made too restrictive. The Nebraska Farmer's Union has prepared maps showing the effects of increasingly restrictive noise standards on wind development (on the next pages). Each map marks the location of homes and examples of the buffer area that would be required with each noise limit. These maps show how low acceptable noise standards make wind energy development increasingly difficult or impossible.

5

Counties should seek out ways to ensure developers address local concerns. For instance, a common requirement is that developers submit road use plans that include two items: clear measures for mitigating impacts to the local area and steps to repair any damage incurred during the construction of a project. Officials also sometimes require bonds for infrastructure, like roads, setting aside money from a developer to repair any damages caused by construction. Forming additional agreements like these will provide county officials and developers with clear expectations for the use of local land and infrastructure, as well as outline steps a developer or operator will undertake when repairing damages that may occur.



Source: Nebraska Farmer's Union



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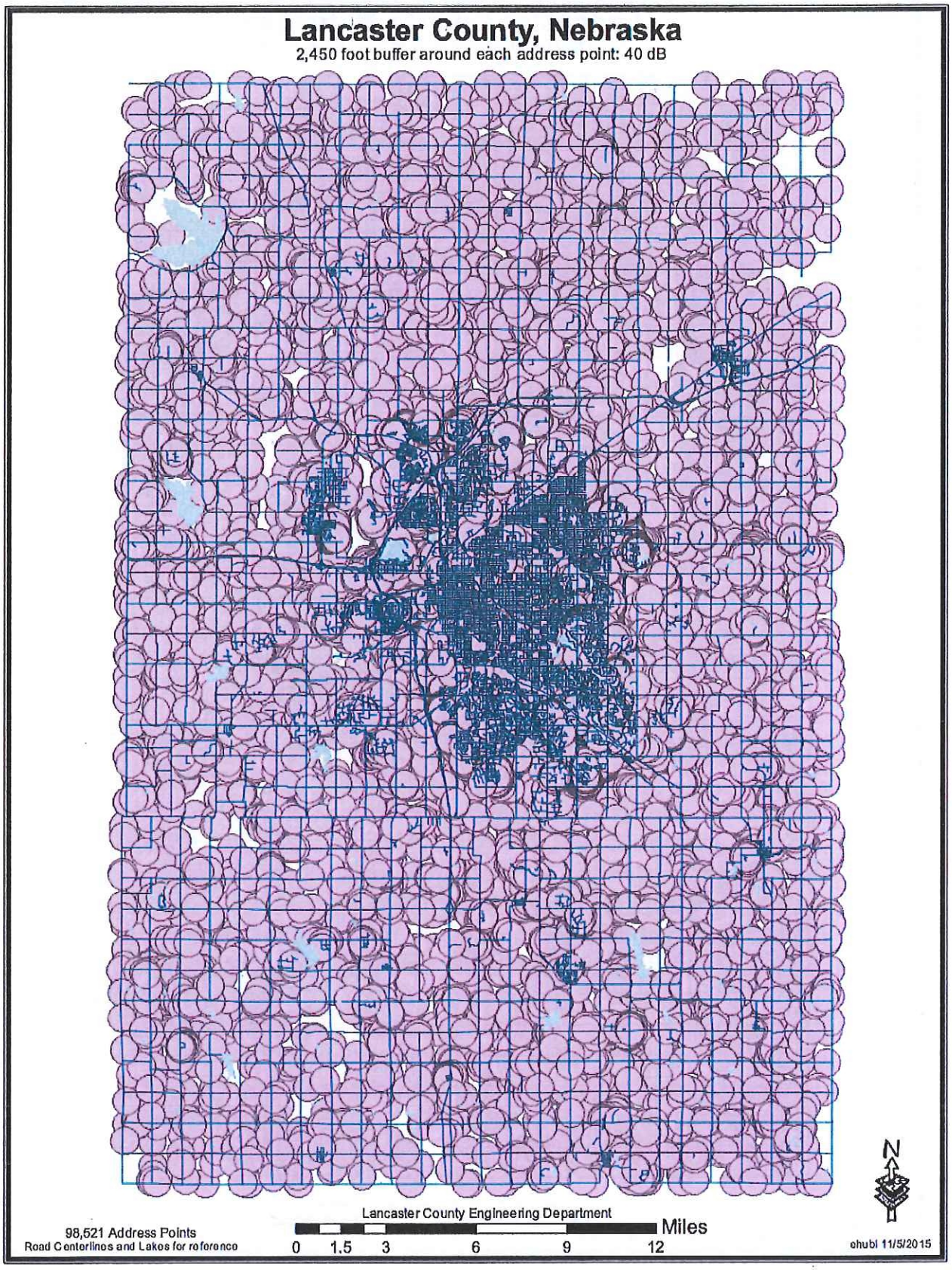
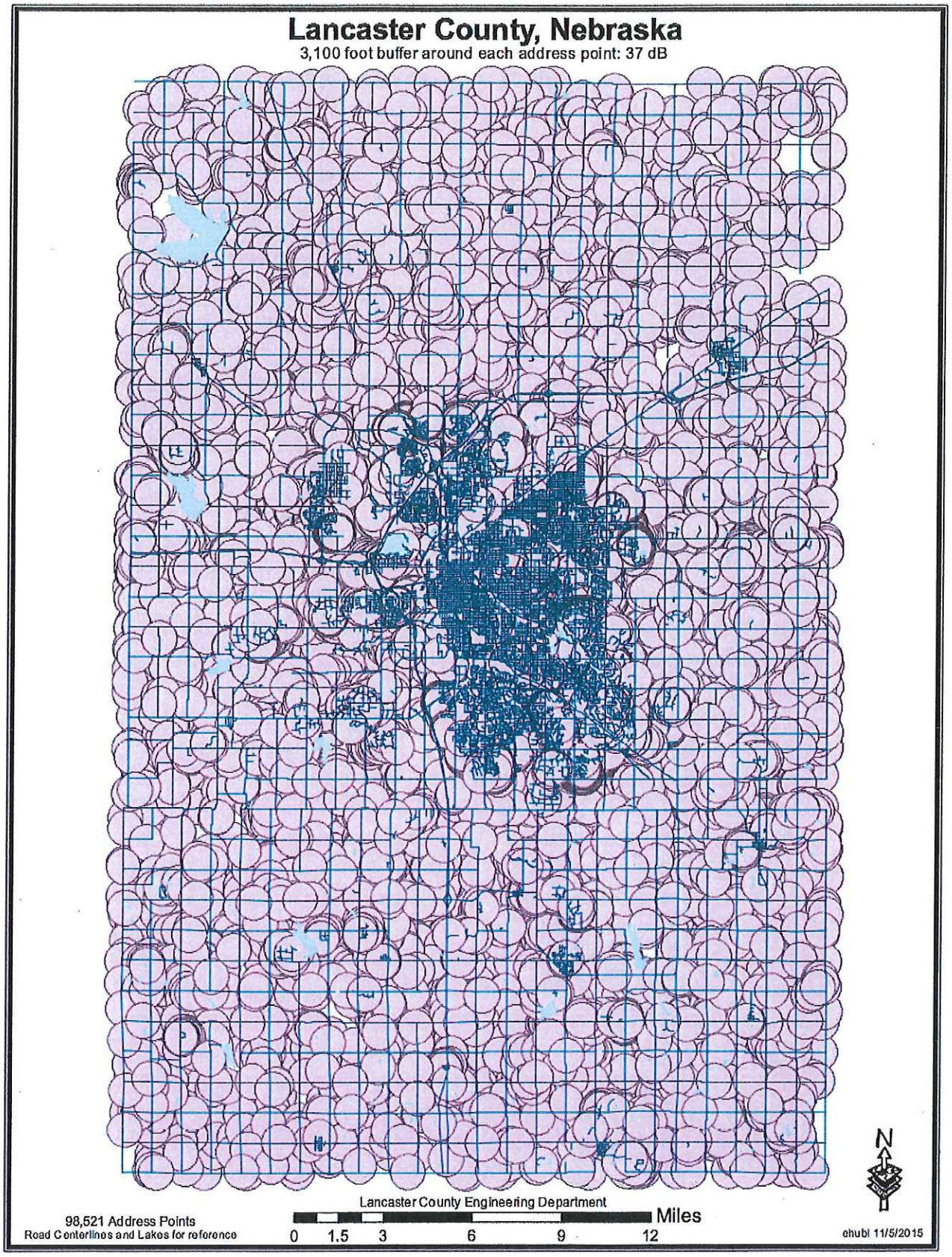


Source: Nebraska Farmer's Union



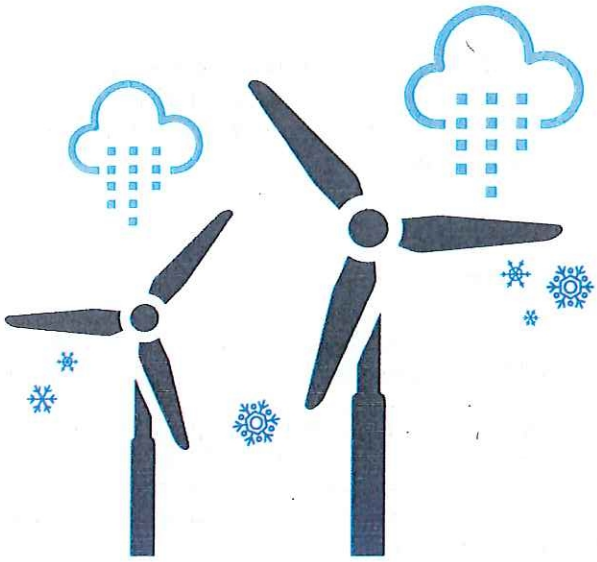
Source: Nebraska Farmer's Union

FACT SHEET:
ICING AND WIND ENERGY SYSTEMS

Every day, rural communities benefit from wind energy. Wind development provides new income for landowners, new tax revenue to fund schools and services, and creates local career and job opportunities. County officials are responsible for enacting siting or zoning standards that help ensure wind development is supported by local residents. Many seek to address the issue of **icing**.

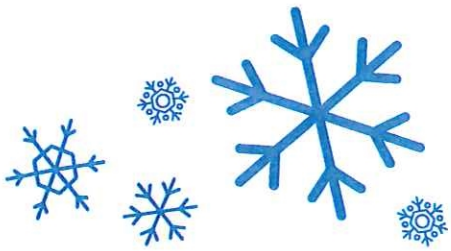
Icing on wind energy systems

- Like most structures, the accumulation of ice on wind turbines occurs due to localized temperature and other weather conditions, such as humidity and precipitation.
- While accumulation itself may not pose a particular threat to a wind system or the surrounding area, the shedding of ice can be hazardous to the area directly underneath a system or to nearby locations due to ice throw.[1]
  - Ice throw is a term applied to the shedding of ice from a turbine blade while a turbine is in operation, with the motion of the blades potentially propelling ice over a greater distance.
  - The distance that ice can travel when thrown varies, depending on factors such as blade speed, weight and size of the ice, the position of the blade when the ice is dislodged, etc.
- When ice formation is detected—either by personnel or automated systems—wind farm operators may shut down turbines until the ice has been shed.



Recommendations

- If ice accumulation is likely in a project area, local officials may request developers to provide data on potential ice throw from the wind energy systems that will be used, as well as maps for the affected area around each turbine.
  - Officials should also request information about the procedures that a wind farm operator will use during periods of icing and methods that will be used to detect ice formation on systems.
- While the overall risk of ice throw may be small due to the amount of variables that affect the formation and shedding of ice, officials should consider the possibility when determining appropriate setback distances for wind energy systems.
  - One study suggests that a buffer zone of 1.5 (hub height + rotor diameter) may be sufficient to reduce risk to the nearby area in locations with a high probability for ice formation.[2]
  - Officials may also require signage placed near this buffer zone to alert people to the risk of ice throw under certain weather conditions.
- Wind farm operators can employ passive or active measures that reduce the potential for icing or address the accumulation of ice. Officials should consider the overall effectiveness of these measures as well as the associated costs before requiring their use.
  - An example of a passive mitigation measure is the application of a hydrophobic coating to the surface of a wind turbine which can limit icing. Although this may be a low-cost option for addressing ice build up, wind farm operators will likely have to reapply this coating to maintain its effectiveness.
  - Heating systems integrated into a turbine are an active measure for preventing ice formation. The effectiveness of these systems depends upon the ability of personnel to identify icing conditions and activate the systems to address icing.[3]



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1 Wahl, David, and Philppe Giguere. "Ice Shedding and Ice Throw - Risk and Mitigation." GE Energy, 2006, ge.com/content/dam/gepower-pgdp/global/en_US/documents/technical/ger/ger-4262-ice-shedding-ice-throw-risk-mitigation.pdf. Accessed July 2019.

2 Tammelin, B., et al. "Wind energy production in cold climate (WECO)." Finnish Meteorological Institute, 2000, orbit.dtu.dk/files/167477321/26134.pdf. Accessed July 2019.

3 Froese, Michelle. "Cracking the icing problem on turbine blades." Windpower Engineering and Development, March 28, 2017, windpowerengineering.com/business-news-projects/cracking-icing-problem-turbine-blades/. Accessed July 2019.

FACT SHEET:
WIND ENERGY AND NOISE

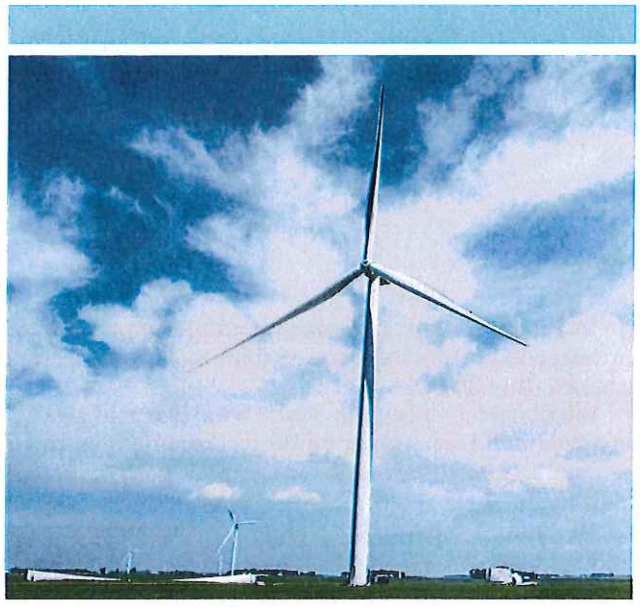
Every day, rural communities benefit from wind energy. Wind development provides new income for landowners, new tax revenue to fund schools and services, and creates local career and job opportunities. County officials are responsible for enacting siting or zoning standards that help ensure wind development is supported by local residents. Many seek to address the issue of **noise**.

Noise produced by wind energy systems

- An operating wind turbine can create noise—or unwanted sound—due to vibration and the rotating blades.
- The amount of noise generated by wind turbines is influenced by multiple factors: atmospheric conditions, whether the turbine is upwind or downwind from the person perceiving the sound, the model and design of the turbine, the local terrain, distance from the turbine, and ambient sound.
- Sound decreases as it travels from the source, meaning any noise produced by a turbine will be more intense next to the system.

> Noise is measured in decibels, commonly using an A-weighted or C-weighted filter. A-weighted decibels (dBA) measure sound based on the loudness and the response to that sound, while C-weighted decibels (dBC) include measurement of lower or higher frequencies that people cannot hear.[1]

- Modern turbines produce a sound pressure level of just over 100 dBA. At 400 meters from the turbine, this sound pressure level typically drops to 40 dBA or less—a level consistent with sound produced by household appliances, such as a refrigerator.[2]
- Wind energy systems also produce infrasound, or vibrations measuring under 20 Hertz. Infrasound measured from wind turbines has been below the threshold for human perception.[3]
- While some have raised concerns about health impacts related to noise from wind turbines, there have been no studies that show a direct connection between specific health conditions and exposure to wind turbine noise.[4]
- However, wind turbine noise may be a cause of annoyance for nearby residents. Studies have shown that self-reported annoyance from wind turbine noise increases as sound levels surpass 35 dBA.
  - Notably, other factors may contribute to self-reported annoyance—perceived sensitivity to noise, personal benefit or lack thereof, and aesthetic issues related to wind turbines.
- Annoyance itself has been shown to have an effect on health, although the link between a particular noise level and annoyance has not been identified.[5]



Recommendations

- Local officials may wish to enact noise limits on wind energy systems to reduce exposure to nearby residents. Before putting a noise limit into place, however, officials should develop an understanding between noise level and distance—more restrictive noise standards significantly limit viable turbine locations.
  - If a county wishes to enact a noise standard, it should also create requirements for measuring sound levels, typically pre- and post-construction. Officials can also request sound modeling information from developers, providing decision makers with more information on the potential sound impacts of a project.
  - Counties should seek out certified professionals if they wish to do their own independent sound modeling.
- Rather than putting into place noise limits, counties can use distance setbacks to limit potential impacts of noise produced by wind turbines.
  - In this case, the aforementioned sound modeling data can offer insight into the optimal distance to limit potential impacts.
- Developers can limit potential for high level noise exposure to residents by using the nearby landscape and their own setback distances to reduce noise levels when possible.
- Because annoyance may be derived from actual wind turbine noise as well as perceptions of a given project, developers must work to include stakeholders early in the development process. Addressing myriad concerns and integrating insight from nearby residents may assist in reducing annoyance and improve the final design of a project.

Sources

1 "A Primer on Noise." Government of Canada, Oct. 28, 2014, canada.ca/en/health-canada/services/environmental-workplace-health/noise/wind-turbine-noise/primer-noise-environmental-workplace-health.html. Accessed July 2019.

2 Ellenbogen, Jeffrey M., et al. "Wind Turbine Health Impact Study: Report of Independent Expert Panel." Massachusetts Department of Environmental Protection and Massachusetts Department of Public Health, January 2012, mass.gov/files/documents/2016/08/th/turbine-impact-study.pdf. Accessed July 2019.

3 Ibid.

4 Michaud, DS, et al. "Exposure to wind turbine noise: Perceptual responses and reported health effects." Journal of the Acoustical Society of America, 139(3): 1467-1479, March 2016.

5 Ibid.

FACT SHEET:
WIND ENERGY AND PROPERTY VALUES

Wind energy continues to create new economic prospects in rural areas. However, this new development can come with concerns from local communities and landowners. Often mentioned is the possible effect on nearby property values. While there are many anecdotes about potential effects, there are several studies examining property values near wind farms. This fact sheet outlines considerations, findings, and recommendations drawn from those studies.

CONSIDERATIONS

- A key feature of many wind energy ordinances is turbine setback distances from homes and other properties. Because these distances vary by county, there are questions about the effect on property values.
- There may be different results based on the development time frame – the announcement of a wind farm, for example, could have some effect, while impact on property values may dissipate with a completed wind farm.
- Housing and land markets may change year to year, meaning any particular single year is likely not enough to gauge whether there is a clear effect on property values from nearby wind farms.
- Other factors like "disamenities" may affect property values. These can be related to wind farms, in the case of access roads to service turbines or substations, although there are more common disamenities such as concentrated animal feeding operations, wastewater treatment plants, landfills, and heavily developed areas.

FINDINGS

A recent study found no evidence of an effect on home prices in proximity to wind turbines.

The 2013 study, conducted by the Lawrence Berkeley National Laboratory, used data collected from the sale of more than **50,000 homes** in **27 counties**, located in **nine different states.**[1]

The homes were within 10 miles of wind projects, with **1,198 sales within one mile**, and **331 within half of a mile.** This study also used data from before the announcement of a project; the post-announcement, pre-construction period; and the eventual operation of the project.

Results were affirmed by similar studies done by the University of Rhode Island and the University of Connecticut in conjunction with the Lawrence Berkeley National Laboratory.[2] [3]

RECOMMENDATIONS

While wind farms appear to have no notable effect on property values, siting remains an important piece of wind energy development. Counties and local communities must identify ways to address concerns and mitigate impacts from new development, while allowing landowners to host wind turbines if they choose to.

Recommendations include:

- Host public meetings at the county or community level to discuss local concerns and to present information such as the findings cited in this fact sheet.
- Use informed feedback when creating new ordinances or making changes to current wind energy ordinances.
- Developers should meet with host landowners and neighbors to determine how to avoid unnecessary impacts to subjective value of property these studies may not capture.
- When possible, developers should attempt to avoid additional disamenities. For example, if existing access to an area is present, and can be used as a service road, a developer should avoid creating a new access road.
- Address post-construction damages that may have occurred to a property to avoid potential property value loss. Developers and landowners should have a clear process for dealing with any damages that have occurred.
- Counties should look for opportunities to work with developers to improve local amenities. In some cases, project developers will make improvements to roads in an area during the construction phase, leaving the county with better roads after a project is completed.

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1 Hoen, Ben, Jason P. Brown, Thomas Jackson, Ryan Wiser, Mark Thayer, and Peter Cappers. "A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States." Ernest Orlando Lawrence Berkeley National Laboratory, Environmental Energy Technologies Division, August 2013, emp.lbl.gov/sites/all/files/lbnl-6362e.pdf. Accessed May 2018.

2 Lang, Corey and James Opaluch. "Effects of Wind Turbines on Property Values in Rhode Island." University of Rhode Island, Environmental and Natural Resource Economics, Oct.18, 2013, energy.ri.gov/documents/Onshore%20Wind/Final%20Property%20Values%20Report.pdf. Accessed May 2018.

3 Atkinson-Palombo, Carol and Ben Hoen. "Relationship Between Wind Turbines and Residential Property Values in Massachusetts." University of Connecticut, Lawrence Berkeley National Laboratory, Jan. 9, 2014, files.masscec.com/research/RelationshipWindTurbinesandResidentialPropertyValuesinMassachusetts.pdf. Accessed May 2018.

Recommendations

- County officials may choose to require data on the number of properties impacted by shadow flicker from turbines, as well as the total annual hours that shadow flicker will likely occur.
- While annual limits on hours of shadow flicker are found in wind energy ordinances, it is important that planning and zoning officials consider the impact limits may have on the ability of wind energy facilities to operate without curtailment.
  - For example, a county may implement a limit of 30 hours annually for a wind turbine, requiring developers to demonstrate the amount of shadow cast on homes from a turbine will not exceed that limit in a given year.
  - Additionally, officials may set similar limits for shadow flicker on other areas such as roads or recreation areas.
- Developers should use early public engagement as an opportunity to identify homes, businesses, and other properties that may fall within the area around a turbine where shadow flicker can occur. These locations and the configurations of these properties will assist developers in forming mitigation measures or reducing shadow flicker.
  - Mitigation may include siting a turbine in such a way so that shadows are blocked by existing vegetation or the placement of new vegetation. During certain times of year, it may be necessary for projects to be curtailed—a forced stop for the wind energy system—during times of day to reduce the annual total shadow flicker from systems.

Sources

1 Priestly, Thomas. "An Introduction to Shadow Flicker and its Analysis." CH2M Hill, Feb. 10, 2011. windharvest.com/wp-content/uploads/2017/03/Shadow-Flicker.pdf. Accessed June 2019.

2 Ibid.

3 Rynne, Suzanne, et al. "Planning for Wind Energy." American Planning Association, 2011, planning-org-uploaded-media.s3.amazonaws.com/publication/online/PAS-Report-566.pdf. Accessed June 2019.

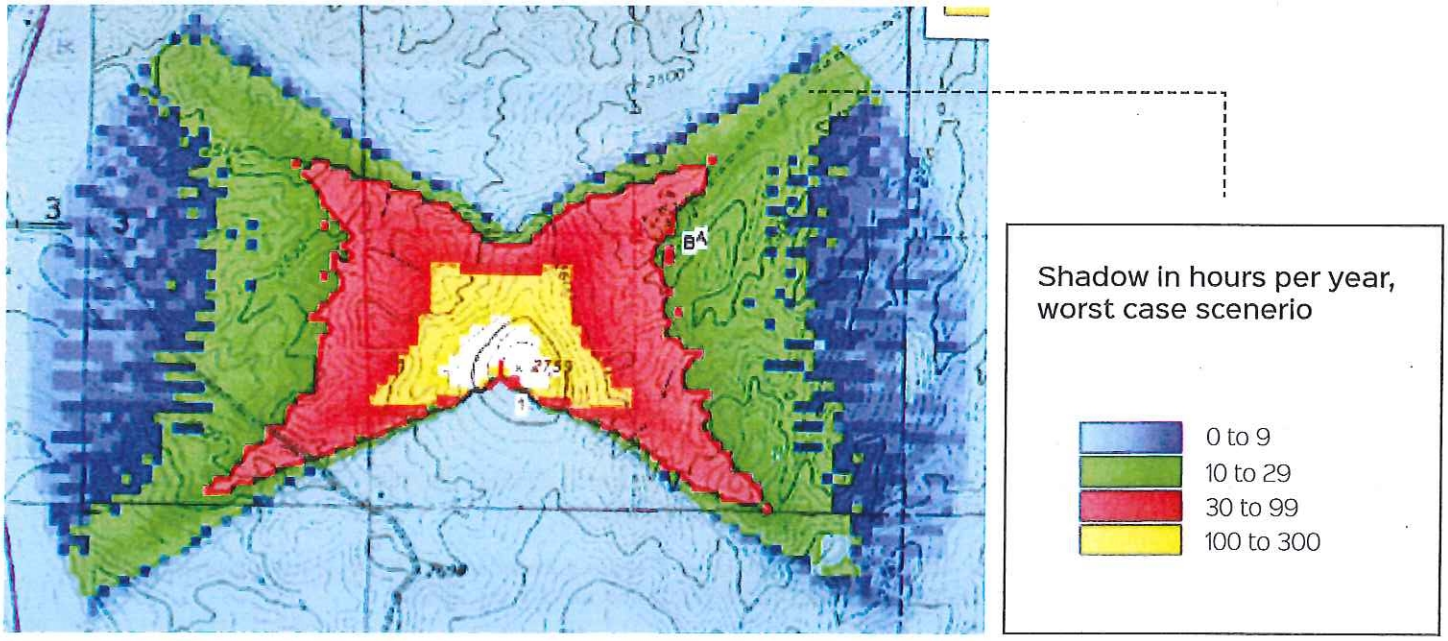
FACT SHEET:
WIND ENERGY AND SHADOW FLICKER

Every day, rural communities benefit from wind energy. Wind development provides new income for landowners, new tax revenue to fund schools and services, and creates local career and job opportunities. County officials are responsible for enacting siting or zoning standards that help ensure wind development is supported by local residents. Many seek to address the incidence of shadow flicker.

What is shadow flicker?

- Shadow flicker is the effect of turbines casting shadows that flicker due to the turning of the blades.
- As shadow flicker is dependent upon several factors—time of day, seasonal consideration, light source, turning of turbine blades, etc.—the effect typically occurs over a short window, and exposure is often measured in annual hours.
- Particular concerns about shadow flicker relate to shadows cast across nearby homes, and the flickering or strobe effect that may be experienced by occupants.
- While shadow flicker may be perceived as an annoyance, it is unlikely to contribute to or trigger health conditions like photosensitive epilepsy.
  - Flashing lights that typically contribute to epileptic seizures fall in the 5 to 30 Hertz range, while most modern turbines would cause a shadow flicker in the range of 0.6 to 1 Hertz.[1]
- Developers are able to calculate and map areas affected by shadow flicker from turbines prior to construction, creating the opportunity to reduce or avoid shadow flicker during the planning phase. See Figure 1.[2]

FIGURE 1. SHADOW FLICKER MAP



FACT SHEET:
WIND ENERGY AND LIGHTING

Every day, rural communities benefit from wind energy. Wind development provides new income for landowners, new tax revenue to fund schools and services, and creates local career and job opportunities. County officials are responsible for enacting siting or zoning standards that help ensure wind development is supported by local residents. Many seek to address the issue of lighting.

Requirements for lighting

- The Federal Aviation Administration (FAA) provides wind turbine lighting standards to increase the visibility of systems for pilots. See Figure 1 on reverse side.[1]
- Systems must consist of aviation red (FAA L-864) obstruction lights that are either flashing, strobe, or pulsed. This lighting must be synchronized to flash with nearby systems.
- In some cases, the FAA will not require that every turbine in a wind farm feature this lighting.
  - Lighting may be placed on turbines at the perimeter of the wind farm, although unlit sections of the perimeter cannot exceed 804 meters or .5 statute mile.
  - Within the perimeter of a cluster of wind turbines, there can be no unlit section larger than 1.6 kilometers or 1 statute mile.[2]
- Turbines with a rotor tip height above 499 feet must be lit no matter the configuration of a wind farm or nearby turbines.
  - Wind energy systems above 699 feet must feature lighting on the nacelle—the housing for the generator at the top of a turbine that is connected to the rotor—as well as at a midpoint on the turbine's mast, placed between the nacelle at the top of the turbine and the ground.

Recommendations

- While zoning standards must comply with FAA regulations, local officials may include provisions that limit the amount of obstruction lighting used if possible, or require alternative approved lighting systems.[3]
  - Alternative lighting systems that have been approved by the FAA are Aircraft Detection Lighting Systems for wind turbines. These reduce persistent lighting for wind turbines by using obstruction lights that only activate when radar systems detect an approaching aircraft.
- Developers should meet with stakeholders to determine ways to minimize this visual impact from ground level while considering site configuration for a project or a lighting plan.
  - Mitigating the visual impact of turbine obstruction lighting can be difficult due to lighting requirements and the unique nature of these lights in areas where wind projects are built. Minimizing impacts from homes may be possible by avoiding direct viewsheds from residences, or using existing tree cover or other vegetation to block lighting.

Turn over for Figure 1.

Sources

1 "Advisory Circular 70/7460-1 L." Federal Aviation Administration, U.S. Department of Transportation, Aug. 17, 2018, faa.gov/documentLibrary/media/Advisory_Circular/AC_70_7460-1L_-_Obstuction_Marking_and_Lighting_-_Change_2.pdf. Accessed June 2019.

2 Ibid.

3 Rynne, Suzanne, et al. "Planning for Wind Energy." American Planning Association, 2011, planning-org-uploaded-media.s3.amazonaws.com/publication/online/PAS-Report-566.pdf. Accessed June 2019.

FIGURE 1. WIND TURBINE LIGHTING