

Master of Public Health
Integrative Learning Experience Report

***ENERGIZING PUBLIC HEALTH INVOLVEMENT IN THE
ENERGY SECTOR: ASSESSING WIND ENERGY IMPACTS IN
KANSAS COUNTIES***

by

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submitted in partial fulfillment of the requirements for the degree

MASTER OF PUBLIC HEALTH

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Summary

How we obtain, produce, store, and use energy profoundly influences the health of the public. Stable access to efficient, abundant, and clean energy in an increasingly electricity-dependent societal “ecosystem” is fundamental for human wellbeing; however, the traditional public health sector often remains disconnected from the energy sector. This leads to community leaders failing to advocate for this critical need; unfortunately, it leads to a missed opportunity to connect how our energy infrastructure influences community health. With some energy sources being finite, renewable alternatives such as wind and solar energy hold promise in meeting electricity demands. Despite this, wind energy continues to be a controversial issue among Kansas counties (with solar also following this trend of criticism and dispute).

Local government officials make decisions about local policies (e.g., ordinances, regulations, permits) regarding wind turbines, and ultimately decide whether a project can occur in their county. Recent federal incentives and national initiatives aim to expand upon existing renewable energy infrastructure and reach specific climate-related milestones to reduce the impacts of climate change. Achieving this goal is contingent on local governments being able to work with their communities and wind project developers to allow projects in their counties. If a county issues a moratorium on wind projects, it is not a permanent ban. That county is expected to work toward policies and provisions for future wind projects that would fit the county’s needs and mitigate negative impacts.

This project was conducted at the Kansas Health Institute (KHI) in partnership with Lawrence Berkeley National Laboratory (LBNL) and involved surveying county commissioners that has either allowed or considered allowing a wind project with at least five turbines in the past five years, *or* has a policy related to wind energy. Additionally, a policy scan was completed to identify how health impacts are considered and/or addressed in local wind policies. This integrated learning experience (ILE) report and its associated products provide understanding of county decision-making processes, local government policy development, wind projects and the expertise involved, and the impact of wind projects on communities.

Subject Keywords: wind energy, health policy, health in all policies, renewable energy transition, community impacts, health impacts, social determinants of health, commercial determinants of health

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Chapter 1 - Literature Review

Noise, Annoyance, and Visual Impact

In Kansas and elsewhere, there is skepticism and concern about how living in proximity to a wind project will impact health. This literature review did not identify findings that concluded there is a link between negative health outcomes and wind turbines (1-5) but did find that wind turbines can, in some cases, “annoy” residents. This concept of annoyance is subjective, and the level of annoyance a person experiences from wind turbine noise and appearance varies based on a person’s personality, whether they financially benefit from the wind project, their general attitudes on wind turbines, and other factors (1). People’s attitudes toward wind projects were positively correlated with whether they were being compensated, fair planning processes, and belief in wind power’s effectiveness against climate change (1,4). Negative perceptions of wind turbines can be attributed to hearing nearby turbines, poor landscape fit (aesthetics, and disruption of vistas), perceived negative property value impact, and perceived negative impact to community (1,4).

The technical phenomenon of “shadow flicker” has also been implicated as a cause for annoyance from residents near wind turbines. This occurs when wind turbine blades create a strobe effect at certain hours of the day inside a dwelling or on roads near the turbine. Flicker is a primary disturbance cited for visual disruption and annoyance, but it does not actually result in poorer health outcomes (7). Nevertheless, this strobe effect could be a legitimate concern for those with epilepsy, where seizures may be triggered by shadow flicker.

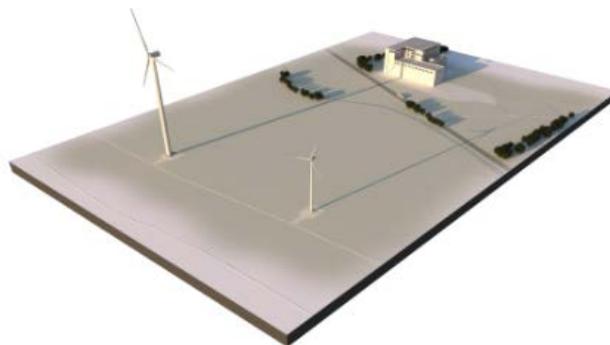


Figure 1.1 How Shadow Flicker Occurs

Image Source: Baur, Josh. National Renewable Energy Laboratory (NREL). Office of Energy Efficiency & Renewable Energy. WINDEXchange. Retrieved from <https://windexchange.energy.gov/projects/shadow-flicker>

Below are key findings identified from the literature review regarding sound, annoyance, and visual impacts.

- A clear link does not exist between wind turbine sound levels and overall sleep quality, but small changes in sound levels during the night were associated with some sleep disturbances (2).
- Wind turbine sounds below 45 decibels (dBA) did not cause significant sleep disruption (2). Keeping wind turbine noise below 45 day-night average sound level (dB Lden) for average noise exposure may mitigate health risks caused from interrupted sleep (2,5).
- The level of annoyance caused by wind turbines was not solely related to the level of sound; visual impact was also a significant factor (3).
- Strongly annoyed individuals reported health-related symptoms attributed to turbines, while somewhat annoyed individuals reported high annoyance but no symptoms, and slightly annoyed individuals reported low annoyance and no symptoms (4).
- Infrasound levels (sound waves with frequencies below 20 Hz) near wind turbines are generally low and do not reach audibility thresholds.

Property Values and Prices

A home is one of the largest investments people will make in their lifetime. Factors or conditions that impact the value of a home are of prime importance to homeowners. Wind projects have been operating across the United States for decades, with scrutiny on their impact to neighboring property values. There are no adverse effects on property values or the rate of home sales in rural or urban areas due to the presence of wind turbines (8,9). Wind Farm Anticipation Stigma Theory suggests that people may anticipate a decrease in property values when a wind farm is in planning stages due to concerns about visual and noise impacts (9); however, once the wind project is built, there is no strong evidence to suggest that property values consistently decrease or increase in areas with wind farms (9). Key findings regarding wind project impacts to property values include the following:

- There is no unique impact on the rate of home sales near wind turbines (8).
- Over 21,800 property sales in Massachusetts were evaluated after turbines were built nearby. There was no strong evidence that the turbines had a significant impact on property prices (8).
- There is no strong evidence to suggest that property values are consistently lower or higher in areas with wind projects once they are built (10).

Impacts to Wildlife and Environment

Wind turbines can cause death for birds and bats by cutting off flight paths due to their height and rotor speed. Collision-caused fatalities (strikes) of birds and bats at wind power facilities create a “green versus green” conflict between wildlife conservation and renewable energy (14). Furthermore, wind turbine construction and their height disrupt vistas and the native grasslands and prairies in Kansas. To protect these lands, Governor Laura Kelly reaffirmed the Tallgrass Heartland wind moratorium in 2020 (15). The moratorium was first initiated in 2004 by a previous administration and was later expanded to cover more land in 2011. Many counties are included in this moratorium ([see table 3.2 on page 8](#)).

Evidence-based project siting and mitigation strategies can attempt to prevent wildlife mortality. Additionally, county policies can work to address strikes by reporting deaths as an extraordinary event to the Kansas Department of Wildlife and Parks. Depending on the extraordinary event, the relocation of a turbine may be warranted. Key findings regarding impacts to wildlife include the following:

- The analysis of 114 Post-Construction Monitoring (PCM) studies at wind turbine sites across the U.S. revealed that bat fatalities peaked in the fall season (12).
- Woodland bird strikes peak during spring and fall due to migration patterns. Grassland and soaring birds had more consistent fatality numbers throughout the year, likely because they inhabit regions year-round (12).
- In a study addressing ongoing bat mortality caused by wind turbine operations, adjustments were made to the operations; however, these changes did not prevent bat strikes from occurring. Landscape factors such as woodlot cover (e.g., forests or wooded vegetation) and elevation were associated with higher bat mortality. Developers and local governments can use this information to inform future site selections to avoid environmentally sensitive areas (13).
- Informed curtailment is when wind turbine operators cease or reduce operations when wildlife are at increased risk of collision. In some instances, informed curtailment can substantially reduce eagle fatalities. At one treatment site, there was an 82 percent reduction in the fatality rate compared to a control site. This reduction suggests that fatalities can be mitigated through informed curtailment (14).
- Automated wildlife monitoring systems can enhance informed curtailment, but the technology is under-tested and requires further development and research (14).

[See Appendix C](#) to see how the author organized the literature review findings cited above; this schematic tool is commonly used at KHI.

Chapter 2 - Learning Objectives and Project Description

My interest in renewable energy led me to pursue a project researching wind energy and potential impacts to Kansas communities. In May 2023, I began conceptualizing this project by attending (virtually) Douglas County Commission meetings. As someone intrigued by the inner workings of local county government, I enjoyed following Douglas County as they began revising their wind development policies. This eventually led to a collaboration between KHI and Lawrence Berkeley National Laboratory (LBNL) on a survey, completing a literature review and policy scan, and presenting at the Kansas Association of Counties (KAC) conference in Wichita, Kansas. To accomplish these project activities, the following learning objectives were established:

1. Identify potential health impacts of wind turbines on individuals, communities, and the environment.
2. Analyze the correlation between proximity to wind turbines and health outcomes.
3. Evaluate existing literature to comprehend the current understanding and gaps concerning health outcomes linked to living near wind turbines.
4. Explore how county policies regarding wind energy account for health impacts.

The learning objectives involved the creation of two portfolio products, summarized below.

Figure 2.1 Summary of Portfolio Products

Portfolio Product	Description
Wind Energy Policy Scan	<p>In Kansas, it is up to local county officials, often county commissioners, to decide to approve or deny wind turbine projects. This scan is a spreadsheet using wind energy-related databases and to give a snapshot of Kansas county policies related to wind development.</p> <p>For this product, see Appendix A.</p>
Collaboration on Lawrence Berkeley National Laboratory (LBNL) Survey	<p>The survey aims to provide insights into county commissioners' experiences and perceived impacts with wind project siting. The KHI project team contributed to survey questions, reviewed the final survey draft, and assisted with recruiting Kansas county commissioners to pilot the survey. I also attended the Kansas Association of Counties (KAC) conference in Wichita, Kansas to promote the survey.</p> <p>For this product, see Appendix B.</p>

Chapter 3 - Results

Policy Scan Results

Results from the author's policy scan utilizing two separate databases and a comprehensive search of county websites yielded the following key findings:

- In Kansas, there are currently 4,111 wind turbines in operation across 37 counties (see table 3.1).
- Out of Kansas's 105 counties, 43 counties have implemented policies pertaining to commercial wind development such as zoning ordinances, conditional use permit processes, or moratoriums.
- Among the 43 counties with policies, 22 have implemented moratoriums on wind energy development. Moratoriums temporarily halt new projects but are not designed to be permanent. (See table 3.2).

Table 3.1 Number of Wind Turbines in Kansas Counties

County Name	Turbines in County
Allen County	59
Barber County	92
Bourbon County	56
Butler County	101
Clark County	284
Cloud County	70
Coffey County	95
Crawford County	14
Doniphan County	1
Elk County	111
Ellis County	115
Ellsworth County	124
Ford County	464
Gove County	1
Grant County	61
Gray County	342
Harper County	176
Harvey County	1
Haskell County	74
Kingman County	247
Kiowa County	77

County Name	Turbines in County
Lincoln County	165
Lyon County	52
Marion County	171
Marshall County	144
Nemaha County	120
Neosho County	139
Ness County	94
Osage County	9
Pratt County	227
Republic County	100
Rush County	21
Sumner County	75
Thomas County	175
Trego County	17
Washington County	4
Wichita County	33
Total Wind Turbines in Kansas	4111

Note: The number of turbines does not include projects under construction.

Source: Kansas Health Institute Analysis of the United States Wind Turbine Database (ver. 6.1, November 2023); U.S. Geological Survey, American Clean Power Association, and Lawrence Berkeley National Laboratory. Retrieved from <https://doi.org/10.5066/F7TX3DNO>.

Table 3.2 Select Kansas counties with wind energy ordinance

Kansas County	Ordinance Status
ALLEN	Link to Ordinance
ANDERSON	Moratorium
BARTON	Link to Ordinance
BUTLER	Moratorium due to Tallgrass Heartland Wind Moratorium
CHASE	Moratorium due to Tallgrass Heartland Wind Moratorium
CHAUTAUQUA	Moratorium due to Tallgrass Heartland Wind Moratorium
CHEROKEE	Moratorium due to Tallgrass Heartland Wind Moratorium
CLAY	Moratorium due to Tallgrass Heartland Wind Moratorium
COFFEY	Link to Ordinance
COWLEY	Moratorium due to Tallgrass Heartland Wind Moratorium
CRAWFORD	Link to Ordinance
DICKINSON	Moratorium due to Tallgrass Heartland Wind Moratorium
DONIPHAN	Link to Ordinance
DOUGLAS	Draft Ordinance
ELK	Moratorium due to Tallgrass Heartland Wind Moratorium
ELLIS	Link to Ordinance

Kansas County	Ordinance Status
ELLSWORTH	Link to Ordinance
FINNEY	Link to Ordinance
FRANKLIN	Link to Ordinance
GEARY	Moratorium due to Tallgrass Heartland Wind Moratorium
GRAY	Link to Ordinance
GREENWOOD	Moratorium due to Tallgrass Heartland Wind Moratorium
HARPER	Link to Ordinance
HARVEY	Link to Ordinance
JACKSON	Moratorium due to Tallgrass Heartland Wind Moratorium
JEFFERSON	Link to Ordinance
KEARNY	Link to Ordinance
LINN	Draft Ordinance
LYON	Moratorium due to Tallgrass Heartland Wind Moratorium
MCPHERSON	Moratorium
MARION	Moratorium due to Tallgrass Heartland Wind Moratorium
MARSHALL	Moratorium due to Tallgrass Heartland Wind Moratorium
MEADE	Link to Ordinance
MIAMI	Link to Ordinance
MORRIS	Moratorium due to Tallgrass Heartland Wind Moratorium
OSAGE	Link to Ordinance
OTTAWA	Moratorium due to Tallgrass Heartland Wind Moratorium
PAWNEE	Link to Ordinance
POTTAWATOMIE	Moratorium due to Tallgrass Heartland Wind Moratorium
PRATT	Link to Ordinance
RENO	Link to Ordinance
RILEY	Moratorium due to Tallgrass Heartland Wind Moratorium
RUSH	Link to Ordinance
SALINE	Moratorium due to Tallgrass Heartland Wind Moratorium
SEDGWICK	Moratorium
SEWARD	Link to Ordinance
SHAWNEE	Moratorium due to Tallgrass Heartland Wind Moratorium
WABAUNSEE	Moratorium due to Tallgrass Heartland Wind Moratorium

Note: Policies may have been updated, modified or are no longer in effect since the time of the policy review. Some counties with a moratorium on wind development previously had an ordinance allowing for wind projects that are still publicly available. Those policies are not included in this review. Policies were initially identified through the National Renewable Energy Laboratory (NREL) wind siting regulation and zoning database. Since the dataset has not been updated since 2022, all 105 county websites were searched for active wind ordinances.

Source: National Renewable Energy Laboratory. (2022). U.S. Wind Siting Regulation and Zoning Ordinances data set. Retrieved from <https://dx.doi.org/10.25984/1873866>. KHI Analysis of county websites containing an active wind energy ordinance.

After identifying county policies, I assessed each of them to see how potential human, wildlife, and environmental health impacts were considered. Impact areas were identified from a literature review, virtually attending a Douglas County Commission meetings where they discussed their wind energy ordinances, and conversations that took place when attending the Kansas Association of Counties (KAC) conference in Wichita, Kansas. Impact areas included noise, electromagnetic interference, annoyance, and visual disturbance. The review also considered impacts on local wildlife and plans for decommissioning.

Most Kansas county policies mandated a Conditional Use Permit (CUP) for the establishment of a wind project. These permits grant local governments authority to evaluate and approve specific land uses based on predefined provisions of the county's choosing, while also adhering to state statute and federal requirements for other parts of the development. State statutes that must be included require evaluating if the area for the proposed project is an environmentally sensitive area or an area of cultural significance.

Setbacks

Setbacks are the minimum distance required between wind turbines and other structures or features. In many jurisdictions, setback requirements for wind turbines are based on factors such as turbine height, rotor diameter, and potential impacts on neighboring properties. Setback requirements varied across counties. Setbacks from residential structures varied from 500 to 3,000 feet, with additional requirements in some counties for setbacks from public roads, property lines, and agricultural or residential accessory structures.

Some setbacks followed a maximum tip height (TH) multiplier, which refers to the ratio between maximum height of the blade tip and the turbine's rotor diameter. In Kansas, the multiplier ranges between 1.1 and 5. For a wind turbine with a maximum tip height (TH) of 198 meters and a multiplier of 1.1, the setback distance would be calculated as follows:

- Setback distance = Maximum tip height * Tip height multiplier
- Setback distance = 198 meters * 1.1 = 217.8 meters (or 714 feet)

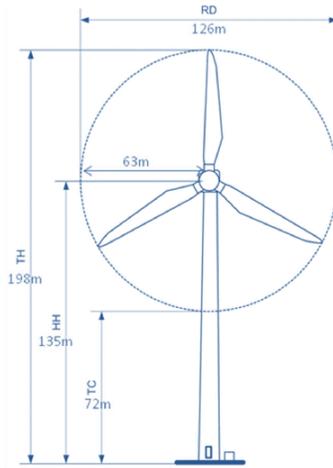


Figure 3.3 Calculating Setback Distance using Maximum Tip Height Multiplier

Source: Saffour, Hakam & Omar, A.. (2010). *Wind Turbine Wireless Communication Network % Heading Measuring System (Feasibility Study)*.

Sound

Setback distances are determined in order to mitigate the visual and noise impact from turbines. Additionally, noise limits can be implemented so that projects cannot exceed certain decibels (dBA), unless for extraordinary events or mechanical issues.

- Harvey County had the lowest identified dBA limit at 45, while Barton County had the highest at 60. Most Kansas counties do not impose a noise limit, or simply state that wind projects should conform to current county noise standards.
- To mitigate impacts to sleep, Reno County limits noise to 45 dBA during the day and 40 dBA at night at the principal building (the primary structure on the property, such as a house or commercial building).

Shadow Flicker

Some Kansas regulations addressing shadow flicker stipulate that wind projects must not generate more than 30 hours of flicker in a home annually, equivalent to about 20 minutes per day. Other policies require visual mitigation strategies, such as mandating developers to install awnings, plant trees, or offer other home modifications to residents affected by shadow flicker.

- Douglas, Harvey, and Reno County all limit shadow flicker to 30 hours annually. Meade County limits shadow flicker to 36 hours annually.

Key Issues in Development Plans

Several crucial issues can be addressed in wind project applications submitted to local government agencies. These issues may be listed as a guide for consideration and discussion among community stakeholders or must be specifically addressed with proposed mitigation strategies in the project development plan. Key issues may encompass a broad range of considerations and vary from county to county. Using Coffey County's Ordinance as an example, key issues may include the following:

- Land Use
- Electromagnetic Interference
- Visual Impact
- Reception Interference
- Noise
- Cultural Heritage
- Bird Migration / Strikes
- Native Vegetation / Weeds
- Endangered Species
- Cumulative Impact
- Soil Erosion
- Wildlife Habitat
- Water Quality
- Public Health and Safety
- Infrastructure
- Decommissioning / Restoration
- Aviation / Lighting
- Financial Surety Agreement

Chapter 4 - Discussion

Renewable energy is essential to sustain the ever-growing demands of our current energy infrastructure. These demands are representative of our standard of living, and not being able to meet these demands will likely create energy insecurity in the United States, and prompt periods of conservative energy use (17). Energy projections suggest a significant rise in global energy consumption and associated CO2 emissions by 2050, driven by factors such as population growth, manufacturing expansion, and rising living standards across the world (16). Renewable energy sources like wind and solar are expected to play a substantial role in meeting these demands; however, renewables cannot entirely replace non-renewable sources like coal and natural gas. The caveat of a delayed shift to renewable energy is not being able to meet emission reduction targets being set around the world. There is a pressing need for more renewable energy projects to offset coal and natural gas sources being decommissioned, while still meeting energy demands. If renewable energy infrastructure expands, electricity storage capability and reinforcement of the electric grid is also necessary. This will require increased mining for elements and materials used in batteries, such as lithium and cobalt.

Wind energy represents a substantial economic asset for Kansas, with Kansas having high "Front-of-the-meter" wind. This wind is so strong and consistent, that energy generated from turbines in Kansas can directly feed large amounts of electricity into the grid through power lines for distribution to consumers. Furthermore, wind energy currently supplies 47.1 percent of Kansas electricity (18). Despite this free and abundant energy resource and the advantages of wind energy, there are some perceived negative impacts being cited in moratoriums. For example, Linn County Commissioners state in their moratorium ordinance that, "WECS would create such adverse effects of intrusive development due largely to the characteristics inherent to wind farms, specifically the extreme height and constant motion of towers, turbines and blades, shadow flicker and low-frequency sounds." The appearance and operation of wind turbines may be considered unattractive by the community (19).

Local governments serve as gatekeepers to the public and private land within their jurisdiction for these projects. It is imperative that government officials understand the importance of renewable energy and the long-term impacts to their community. Developers must also consider offering adequate incentives to communities to host wind projects. ([See Appendix B](#) for a survey for county commissioners that seeks to understand impacts and experiences with wind project siting).

Chapter 5 - Competencies and Reflection on MPH Experience

To see how my ILE products met some of the required competences of the MPH program, please reference Table 5.1 below.

Table 5.1 Summary of MPH Foundational Competencies

Number and Competency		Description
4	Interpret results of data analysis for public health research, policy or practice	<p>I conducted a policy scan that included analyzing data from the national wind project and policy databases.</p> <p>I translated data obtained from different national wind ordinance and project tracking databases into Kansas-specific findings.</p>
7	Assess population needs, assets and capacities that affect communities' health	I listened to county commissioner meetings and the Kansas House Energy, Utilities and Telecommunications Committee to inform project research questions and contribute to LBNL survey.
13	Propose strategies to identify stakeholders and build coalitions and partnerships for influencing public health outcomes	I affirmed KHI's partnership with the KAC and established a new partnership with LBNL. Additionally, I contacted the University of Kansas's Just Energy Transitions and Place project team to identify areas for future partnerships and projects.
15	Evaluate policies for their impact on public health and health equity	I conducted a scan of wind development county and state policies and whether they included considerations for impacts to human and environmental health.
19	Communicate audience-appropriate public health content, both in writing and through oral presentation	<p>I recruited county commissioners for the survey at the KAC Conference in Wichita. I explained the purpose of the survey and asked if they had input on the survey.</p> <p>I create figures from policy scan to be used in a KHI issue brief.</p>

Table 5.2 MPH Foundational Competencies and Course Taught In

22 Public Health Foundational Competencies Course Mapping	MPH 701	MPH 720	MPH 754	MPH 802	MPH 818
Evidence-based Approaches to Public Health					
1. Apply epidemiological methods to the breadth of settings and situations in public health practice	x		x		
2. Select quantitative and qualitative data collection methods appropriate for a given public health context	x	x	x		
3. Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate	x	x	x		
4. Interpret results of data analysis for public health research, policy or practice	x		x		
Public Health and Health Care Systems					
5. Compare the organization, structure and function of health care, public health and regulatory systems across national and international settings		x			
6. Discuss the means by which structural bias, social inequities and racism undermine health and create challenges to achieving health equity at organizational, community and societal levels					x
Planning and Management to Promote Health					
7. Assess population needs, assets and capacities that affect communities' health		x		x	
8. Apply awareness of cultural values and practices to the design or implementation of public health policies or programs					x

22 Public Health Foundational Competencies Course Mapping	MPH 701	MPH 720	MPH 754	MPH 802	MPH 818
9. Design a population-based policy, program, project or intervention			x		
10. Explain basic principles and tools of budget and resource management		x	x		
11. Select methods to evaluate public health programs	x	x	x		
Policy in Public Health					
12. Discuss multiple dimensions of the policy-making process, including the roles of ethics and evidence		x	x	x	
13. Propose strategies to identify stakeholders and build coalitions and partnerships for influencing public health outcomes		x		x	
14. Advocate for political, social or economic policies and programs that will improve health in diverse populations		x			x
15. Evaluate policies for their impact on public health and health equity		x		x	
Leadership					
16. Apply principles of leadership, governance and management, which include creating a vision, empowering others, fostering collaboration and guiding decision making		x			x
17. Apply negotiation and mediation skills to address organizational or community challenges		x			
Communication					
18. Select communication strategies for different audiences and sectors	DMP 815, FNDH 880 or KIN 796				

22 Public Health Foundational Competencies	MPH	MPH	MPH	MPH	MPH
Course Mapping	701	720	754	802	818
19. Communicate audience-appropriate public health content, both in writing and through oral presentation	DMP 815, FNDH 880 or KIN 796				
20. Describe the importance of cultural competence in communicating public health content		x			x
Interprofessional Practice					
21. Perform effectively on interprofessional teams		x			x
Systems Thinking					
22. Apply systems thinking tools to a public health issue			x	x	

Student Attainment of MPH Emphasis Area Competencies

The competencies listed in Table 5.3 are those which were achieved and applied through my MPH emphasis area coursework and my integrated learning experiences (ILE). MPH 802 Environmental Health initially prompted me to explore this project topic when I wrote about a state law that would require the red blinking lights atop turbines to be turned off unless an aircraft is near. While not a part of the MPH core curriculum, CDPLN 712 Sustainable Communities helped me understand how to look at solutions to issues communities face by using an asset-based approach. FDSCI 690 Principles of HACCP and HARPC helped me be concise and detail-oriented through a set process, which helped me complete the policy scan in a methodical way. FDSCI 731 Food Protection and Defense Concepts taught me about the importance of public and private collaboration when creating regulatory policies and requirements.

I started the MPH program at Kansas State University in the fall of 2021. Since then, I can confidently say that this program has shaped my knowledge foundation in a way I did not think was possible. Besides regular studies, I have been able to travel to Northern Italy for the International Mobility of Veterinary Students (iMOVES) program, and to the bay area in Northern California and Council Grove, Kansas for a Frontier Field Trip (FFT).

Kansas State University’s College of Veterinary Medicine participated in the 2022 iMOVES program, hosted by the University of Padova in Italy. The summer course covered multiple topics through different activities, field trips, and labs. These topics included food safety, animal welfare, and public health. While the content was mostly applicable to veterinary students, I thoroughly enjoyed the course content, lab to determine fraudulent buffalo mozzarella, and even dissecting a chicken.

When visiting the bay area in February 2024 we were fortunate to visit UC Berkeley’s campus for a lecture and to visit the Bancroft library. My interest and work with monitoring the Kansas Legislature at KHI led me to choose primary documents related to the state’s actions to construct the Hetch Hetchy Regional water system. The course DMP 815 Multidisciplinary Thought, Writing, and Presentation has aided me in crafting concise and clear written thoughts, both in my academic pursuits and in my current role at KHI.

During a visit to the Bancroft Library, I stumbled upon an article detailing the struggles of John Muir, a pivotal figure in the establishment of Yosemite and a fervent advocate for the preservation of the Hetch Hetchy Valley. In 1961, William E. Colby, Muir's close friend and colleague, asserted that Muir hated writing. Colby recounted that Muir deemed writing the hardest task he had ever undertaken, perpetually dissatisfied with his own work. Despite this, Muir’s written musings about his observations of the Yosemite Valley are some of the most acclaimed written media of the 19th century. According to Colby, Muir engaged in never-ending cycles of writing and revision. This revelation brought me comfort as I wrote this report.

Overall, the culmination of my time at KHI and KSU has primed me for a unique and varied career in public health where I am equipped to work across many different topic areas and practice leadership in Kansas.

The competencies within the food safety and biosecurity (FSB) emphasis were attained through required coursework. See table 5.3 below for FSB competencies.

Table 5.3 Summary of MPH Emphasis Area Competencies

MPH Emphasis Area: Food Safety and Biosecurity (FSB)			
FSB Competency		Description of Competency	Required Course
1	Food safety and biosecurity	Evaluate solutions appropriate for different food safety, biosecurity, and defense issues in the food production continuum.	FDSCI 730 and FDSCI 731

2	Threats to the food system	Examine specific threats to the food system and scientifically investigate how each can be prevented, controlled, and/or mitigated in the food production system.	FDSCI 730 and FDSCI 731
3	Food safety laws and regulations	Differentiate key U.S. food safety regulatory bodies and their unique legislative authorities, missions, and jurisdictions.	DMP 816
4	Food safety policy and the global food system	Analyze and distinguish how food safety and governmental biosecurity policies, globalization, and international trade cooperation influence public health.	DMP 888
5	Multidisciplinary leadership	Contrast the food safety and biosecurity technical needs of different stakeholders and make judgements as to the appropriate methods of collaboration.	DMP 815

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Appendix A - Wind Energy Policy Scan

The policy review aimed to identify counties with policies governing wind turbine development and to assess how these policies incorporate considerations for human and environmental health impacts. Policies were obtained from publicly available sources, including county websites and two national databases. The review included policies that were up to date to the best of the reviewer's knowledge.

Initially, a list of counties with wind projects was compiled using the Wind EXCHANGE database from the U.S. Department of Energy. Next, the 2022 National Renewable Energy Laboratory (NREL) Wind Siting Regulation and Zoning Ordinances database was used. This database provides information on wind energy-related policies and regulations at the state and local levels across the United States. Since the NREL dataset is two years old, county websites were searched for ordinances regarding wind development to fill in any gaps. The policy review consisted of the following specific steps:

- Identifying counties with wind turbine policies based on the status of wind projects (active, denied, or under consideration).
- Assessing how human and environmental health impacts are addressed in local policies.
- Applying inclusion criteria for county policies based on geographical location and policy status (including proposals and drafts).

Below is a snapshot of the counties with a publicly available ordinance, evaluated for health impact areas. Setback-structures can be any structure, or the home of the landowner where the wind project is located.

Kansas County	Turbines in County	Ordinance Status	Noise Limit	Shadow Flicker Limit	Visual Impact Mitigation	Setback - Non-Participating Landowners	Setback - Structures	Electromagnetic Interference (EMI) Mitigation	Bird Strike Monitoring	Decommissioning Plan	Key Issues List to be Addressed in Development Plan
Allen	59	Link to Ordinance	50 dBA	No	Yes	Max tip-height Multiplier 2; 1400 ft	Max tip-height Multiplier 1.1; 1000 ft	Yes	Yes	Yes	Yes
Barton	0	Link to Ordinance	65 dBA	No	Yes	Max tip-height Multiplier 1.1=	Max tip-height Multiplier 1.1	Yes	Yes	No	No
Coffey	95	Link to Ordinance	60 dBA	No	Yes	1,000 ft	Max tip-height Multiplier + 10% total height; or 500 ft	Yes	Yes	Yes	Yes
Crawford	14	Link to Ordinance	No	No	No	Max tip-height Multiplier 2	No	No	No	No	No
Doniphan	1	Link to Ordinance	55 dBA	No	Yes	1,320	Total height + 50 ft	Yes	Yes	Yes	Yes

Kansas County	Turbines in County	Ordinance Status	Noise Limit	Shadow Flicker Limit	Visual Impact Mitigation	Setback - Non-Participating Landowners	Setback - Structures	Electromagnetic Interference (EMI) Mitigation	Bird Strike Monitoring	Decommissioning Plan	Key Issues List to be Addressed in Development Plan
Douglas	0	Draft Ordinance		30 hrs	Yes	2,500 ft	1,500	Yes	Yes	Yes	Yes
Ellis	115	Link to Ordinance	60 dBA	No	Yes	2,640 ft	1.1 times the total height	Yes	No	Yes	No
Ellsworth	124	Link to Ordinance	60 dBA	No	No	Between 100-385 ft, dependent on rotor diameter	Between 100-385 ft, dependent on rotor diameter	Yes	No	No	No
Finney	0	Link to Ordinance	60 dBA	No	No	Max tip-height Multiplier 1	Max tip-height Multiplier 1	No	No	No	No
Franklin	0	Link to Ordinance	50 dBA	No	Yes		Max tip-height Multiplier 1.5	Yes	Yes	Yes	Yes
Gray	342	Link to Ordinance	No	No	No	No	No	No	No	No	No
Harper	176	Link to Ordinance	60 dBA	No	No	500 ft	No	No	No	Yes	No
Harvey	1	Link to Ordinance	45 dBA	30 hrs	Yes	2,000 ft	1,500 ft	Yes	Yes	Yes	Yes
Jefferson	0	Link to Ordinance	No	No	No	Max tip-height Multiplier 2	No	No	No	No	No
Kearny	0	Link to Ordinance	No	No	Yes	2,000 ft	Max tip-height Multiplier 2	Yes	Yes	Yes	Yes
Meade	0	Link to Ordinance	55 dBA	36 hrs	Yes	Max tip-height Multiplier 5; or 1,000 ft	No	No	No	Yes	No
Miami	0	Link to Ordinance	60 dBA	No	Yes	Max tip-height Multiplier 1.1	No	No	No	Yes	No
Osage	9	Link to Ordinance	No	No	Yes	Max tip-height Multiplier 2		No	Yes	Yes	Yes
Pawnee	0	Link to Ordinance	No	No	Yes	1,000	-	Yes	Yes	Yes	Yes
Pratt	227	Link to Ordinance	50 dBA	No	Yes	2,500 ft	2,500 ft	Yes	Yes	Yes	Yes
Reno	0	Link to Ordinance	45 dBA during the day;	30 hrs	Yes	3,000 ft	Total height plus 50 ft	No	Yes	Yes	Yes

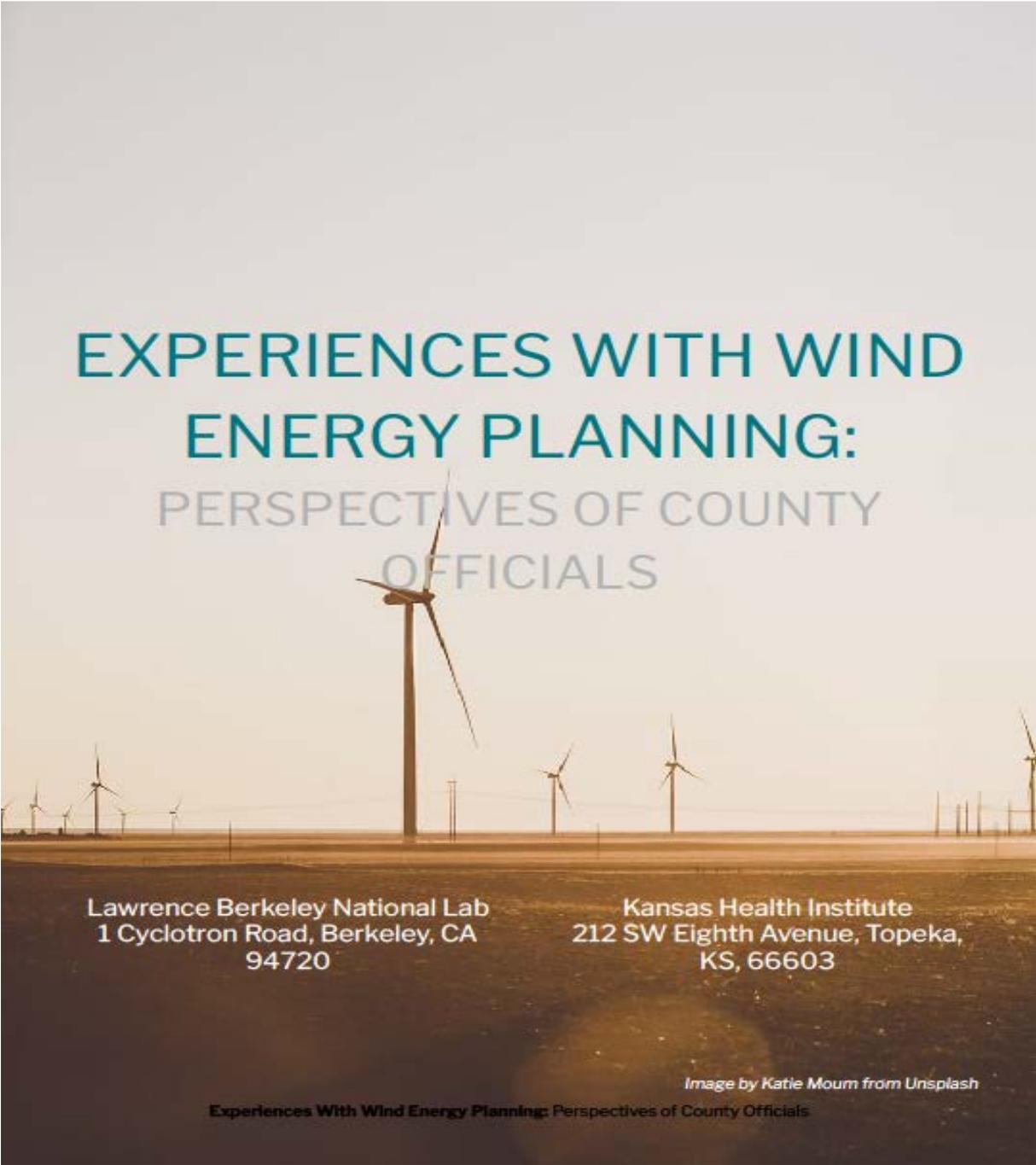
Kansas County	Turbines in County	Ordinance Status	Noise Limit	Shadow Flicker Limit	Visual Impact Mitigation	Setback - Non-Participating Landowners	Setback - Structures	Electromagnetic Interference (EMI) Mitigation	Bird Strike Monitoring	Decommissioning Plan	Key Issues List to be Addressed in Development Plan
			40 dBA at night at principal buildings .								
Rush	21	Link to Ordinance	No	No	Yes	Max tip-height Multiplier 2	No	No	No	Yes	Yes
Seward	0	Link to Ordinance	No	No	No	1,000	No	No	No	Yes	No

Appendix B - Survey

I collaborated with Lawrence Berkeley National Laboratory (LBNL) and other members of the KHI project team to review and contribute to a survey for county commissioners regarding their experiences with wind project siting. The survey, which included a sample size of 62 counties in Kansas, was conducted from mid-January to late March 2024. The survey's aim was to reach a representative group of commissioners across Kansas and in seven other states. The survey covered various topics, enabling commissioners to share their experiences and perspectives on wind project siting and how projects may impact their community. Additionally, selected individuals were offered the opportunity to participate in key informant interviews for deeper insights.

The survey was distributed to commissioners via email or mailing address, utilizing the Kansas County Commissioners Directory for contact information. In cases where email listings were unavailable, LBNL mailed physical copies of the survey to the provided addresses. The survey content was developed collaboratively with LBNL to align with KHI focused areas regarding potential health impacts. My role involved reviewing and proposing health impact areas to be added, facilitating the distribution of the survey, engaging with county commissioners to encourage participation, and providing support to LBNL on recruitment. Furthermore, my attendance and presentation at the Kansas Association of Counties (KAC) conference in Wichita assisted with recruitment.

This project and the collaboration with LBNL were valuable to my education and my work at KHI. At KHI, we often work within different areas in healthcare and public health. KHI has not worked on a project pertaining to renewable energy before. This project introduced me to LBNL, a national research institute working on renewable energy research. These connections could be valuable for future work in this area. Double click the survey image on the next page to view the entire survey.



EXPERIENCES WITH WIND ENERGY PLANNING: PERSPECTIVES OF COUNTY OFFICIALS

Lawrence Berkeley National Lab
1 Cyclotron Road, Berkeley, CA
94720

Kansas Health Institute
212 SW Eighth Avenue, Topeka,
KS, 66603

Image by Katie Mourm from Unsplash

Experiences With Wind Energy Planning: Perspectives of County Officials

Survey Recruitment Distribution

Emma Uridge

From: Kansas Health Institute <info@khi.org>
Sent: Thursday, March 14, 2024 7:46 AM
To: Emma Uridge
Subject: ET: Invitation to Participate in Wind Energy Survey for KS Local Elected Officials

EXTERNAL Email Warning!

"This message originated outside of KHI. Use caution when opening attachments, clicking links or responding to requests for information."



Good afternoon, Emma!

As a local elected official, the Kansas Health Institute and Lawrence Berkeley National Laboratory invite you to participate in a survey about your experiences with new wind energy projects, including siting. The deadline to take the survey is March 31, 2024.

Link to Survey:

About the Survey: The purpose of this survey is to learn how local government officials navigate the planning process for wind projects and, specifically, if local governments have the resources they need to do this planning. The survey will ask questions about your experiences and perspectives on proactively planning for wind projects, negotiating with developers, determining potential community impacts, and facilitating community engagement and participation when projects are proposed in your county. There also will be an opportunity in the survey to apply for participation in key informant interviews, which will allow those selected to delve deeper into their experiences with wind project siting.

Your input is valuable: The findings of the survey, once published, will provide decision-makers and stakeholders with insights into the local impacts of wind development in Kansas and seven other participating states. Sharing your experiences can lead to more opportunities to contribute to the creation of responsive policies that can effectively address local needs. Your contributions will aid in shaping recommendations for supporting local officials tasked with wind project siting and will also inform future research initiatives by the U.S Department of Energy.

Note: We contacted you because records indicate you're an official in a county that has either allowed or considered allowing a wind project with at least five turbines in the past five years, OR

Appendix C - Literature Review Evidence Table

Below is a table of how I compiled information from the literature review findings. Bolded relevant findings for each study were included as key findings in the Results section of this report.

Source Title, Date, Authors	Focus Area(s)	Affiliations	Research Method/Description	Limitations	Relevant Findings
<p>Wind Turbines and Health: A Critical Review of the Scientific Literature. Journal of Occupational and Environmental Medicine (2014) McCunney, Robert J. MD, MPH; Mundt, Kenneth A. PhD; Colby, W. David MD; Dobie, Robert MD; Kaliski, Kenneth BE, PE; Blais, Mark PsyD. 56(11):p e108-e130, November 2014. DOI: 10.1097/JOM.0000000000000313</p>	<p>Human Health</p> <p>Annoyance</p> <p>Noise Measurement</p> <p>Epidemiological studies</p> <p>Otolaryngology issues</p> <p>Government and non-governmental reports that address turbine operations</p>	<p>Funding: Canadian Wind Energy Association (CanWEA)</p> <p>Affiliations: Department of Biological Engineering, MIT</p> <p>Department of Epidemiology, Environ International Travel Immunization Clinic, Middlesex-London Health Unit</p> <p>Dobie Associates, Texas</p> <p>Environment, Energy, and Acoustics, Resource Systems Group, Vermont</p> <p>Psychological Evaluation and</p>	<p>Out of approximately 80 articles initially found, only 20 (14 observational and six controlled human exposure studies) met the screening criteria. These articles were thoroughly reviewed to evaluate their quality and validity. Other documents, such as reviews, commentaries, case reports, surveys, and non-peer-reviewed sources, were also considered. The 14 observational epidemiological studies underwent critical assessment based on study design and the ability to address selection, information and confounding bias.</p> <p>The authors exclusively considered peer-reviewed studies and exposure-related assessments. They did not include non-peer-reviewed reports or commentaries due to</p>	<p>This study is 10 years old. Reviewing complaints near wind farms can help assess annoyance due to turbine noise, but complaints can vary in intensity, and factors like personality, attitudes toward turbines and wind energy, and economic benefits can influence whether someone complains about noise.</p>	<p>This source is an authoritative peer-reviewed, critical review of the available research. Out of all studies found, the review did not find a link between health outcomes and wind turbines. There is sufficient evidence that wind turbines cause annoyance in some cases. However, the studies reviewed did not measure sound levels independent of other factors, such as personal feelings about the turbines and the change in viewsheds.</p> <p>Low-frequency sound refers to sound between 20 and 200 Hz, while infrasound is sound below 20 Hz. Measurements taken close to wind turbines (within 500 meters) typically detect infrasound from wind farms, but it usually doesn't reach audibility thresholds. One study found sound levels of 61-63 dBG at distances of 360 m and 200 m from a wind</p>

Source Title, Date, Authors	Focus Area(s)	Affiliations	Research Method/Description	Limitations	Relevant Findings
		Research Laboratory, Massachusetts	difficulties in evaluating their quality, aligning with practices followed by organizations like the World Health Organization (WHO) and the USA National Toxicology Program. These non-peer-reviewed reports raise concerns about potential health effects related to wind turbines, focusing on general symptoms like headaches, tinnitus, and sleep disturbances.		farm, well below the 85 dBG audibility threshold. Infrasound levels at distances less than 450 feet were 80 dBG or lower, and at greater distances (over 300 m), they were 72 dBG or lower, corresponding to A-weighted sound levels above most regulatory noise limits. ANSI/ASA S12.9 Part 7 standards currently in place for the measurement of wind turbine noise that includes the infrasonic range