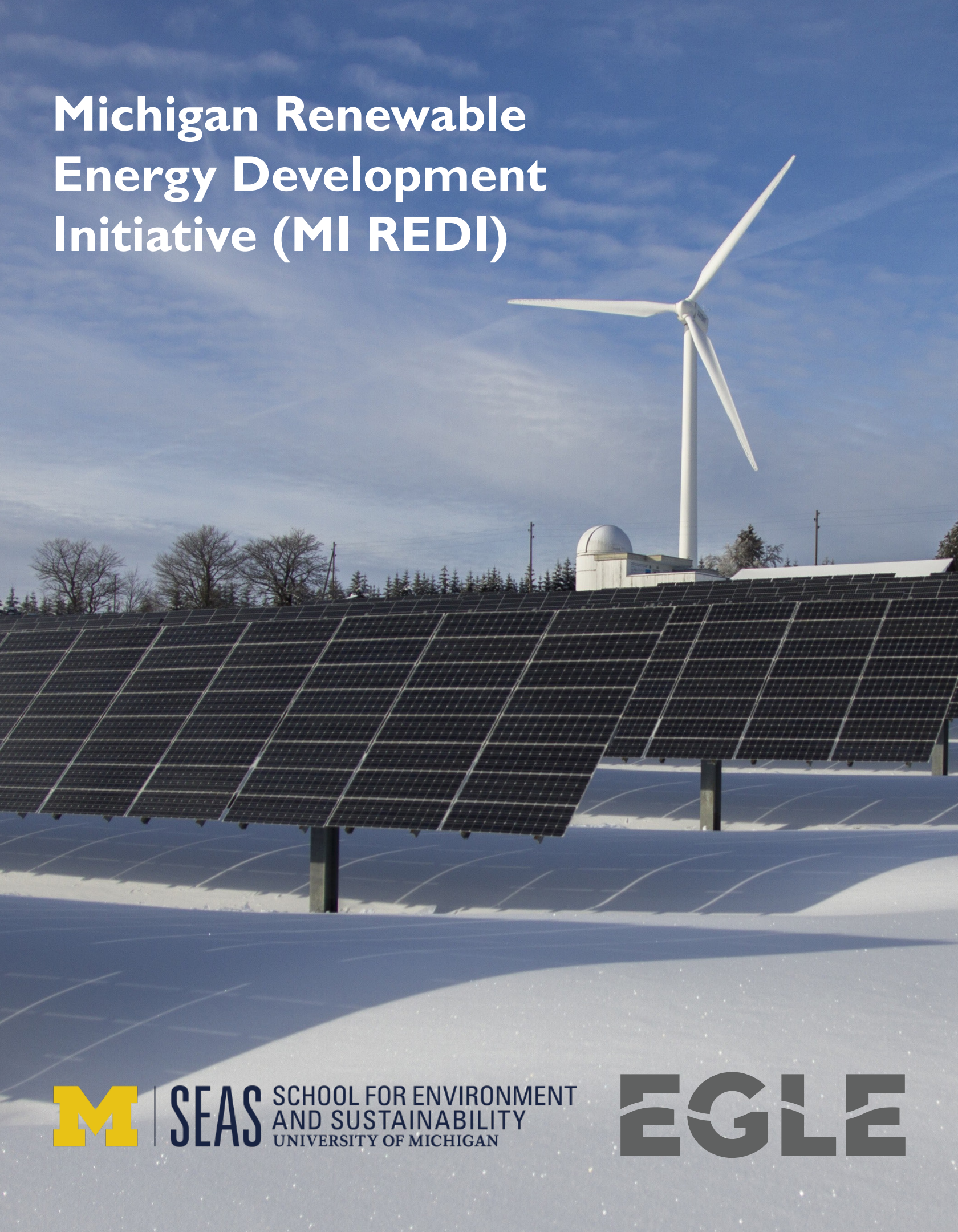
Michigan Renewable Energy Development Initiative (MI REDI)



SEAS SCHOOL FOR ENVIRONMENT AND SUSTAINABILITY
UNIVERSITY OF MICHIGAN

EGLE

Michigan Renewable Energy Development Initiative (MI REDI):

Using participatory planning, proactive zoning, and community engagement to catalyze renewable energy siting in Michigan

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On behalf of Julie Staveland (Environment, Great Lakes, and Energy) and Cory Connolly (MI Office of Climate & Energy)

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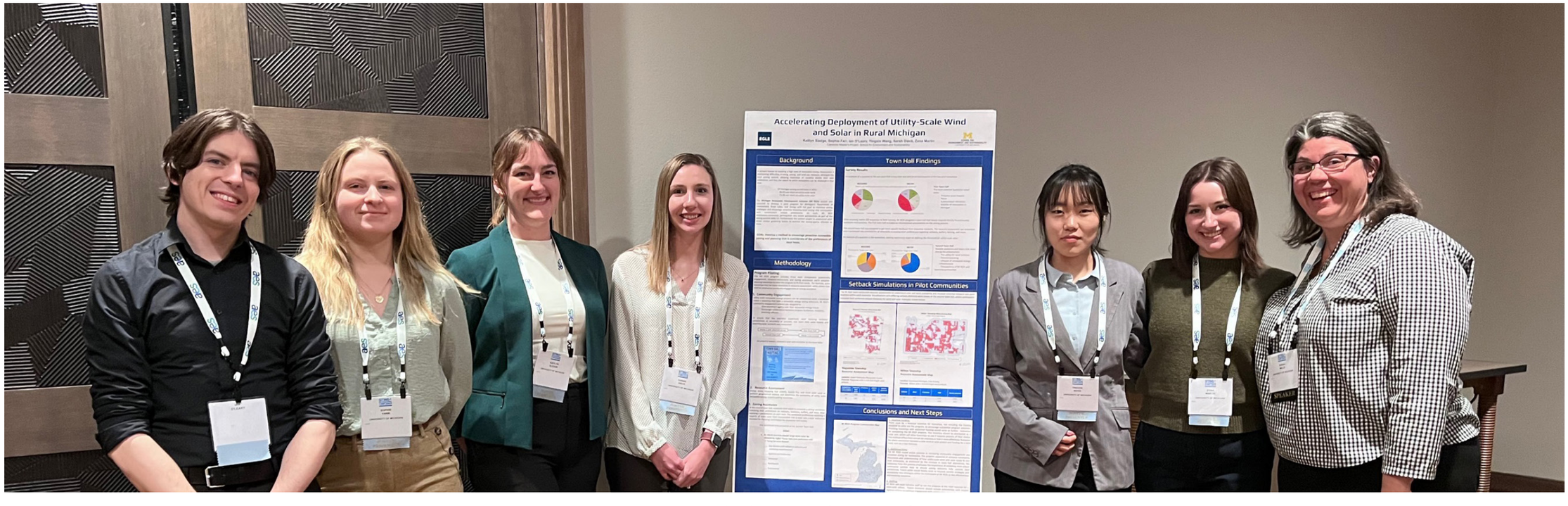

Meet the MI REDI Team

(Left to Right)

Ian O'Leary

Ian received his M.S. in Sustainable Systems and Sustainable Development, with a focus on integrating renewables into the energy system through grid planning, careful siting, and energy justice.

Sophie Farr

Sophie received her M.S. in Environmental Policy and Planning. She has a strong foundation in science, a passion for environmental stewardship, and a drive to make a positive change in the world by working with communities to achieve their sustainability goals.

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Kaitlyn received her M.S. in Environmental Policy & Planning and Sustainable Development, with a research focus on promoting an equitable clean energy transition for rural and marginalized communities.

Sarah Dieck

Sarah is a M.P.P./M.S. candidate, specializing in Behavior, Education, and Communication and Policy Analysis Methods. Her research interests include renewable energy policy, building energy management, community engagement, and clean energy workforce development.

Yingxin Wang

Yingxin received her M.S. in Geospatial Data Sciences, with a research interest in utilizing GIS skills to create analysis and visualization to help solve environmental problems.

Zona Martin

Zona received her M.S. in Environmental Policy and Planning and is passionate about working with local governments to achieve their climate goals and create healthier, happier, and more sustainable communities in the process.

Abstract

To achieve the Michigan Healthy Climate Plan's goals to acquire 60% of the state's electricity fuel mix from renewable sources by 2030 and achieve carbon neutrality by 2050, the pace of utility-scale renewable energy development across the state must increase. Currently, deployment of renewable energy is slowed in part because local governments have not set standards for this infrastructure in their zoning ordinances. Without ordinances that represent local perspectives, projects can be slowed or terminated in localities when development plans do not align with the township's priorities.

This project aimed to develop a program that streamlines renewable energy siting by providing townships with recommendations and resources needed to write zoning ordinances that reflect community perspectives. To inform the program strategy, interviews were conducted with local government officials in 24 Michigan townships to gauge current barriers to proactive zoning and identify strategies to facilitate zoning processes. The team then collaborated with two townships to pilot the program, which culminated in the delivery of customized ordinances for utility-scale wind and solar for each township. In this report we provide recommendations to our client, Michigan's Department of Environment, Great Lakes, and Energy (EGLE), for future iterations and rollout of the program. While key takeaways from this process emphasize the importance of collecting more robust community opinion data to ensure zoning decisions fully capture local preferences and further piloting is necessary to optimize programming, the Michigan Renewable Energy Development Initiative (MI REDI) model enhanced community discussions and understanding of the potential role of utility-scale renewables in local landscapes.

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Acknowledgements

This project would not have been possible without the enthusiastic support of our advisor Dr. Sarah Mills, and the trust of our clients at EGLE, Julie Staveland, Cory Connolly, and Zach Richardson. The time and expertise of the two Michigan State University Extension Educators who worked with us were invaluable to the facilitation of the four town halls; you both deserve more recognition than a cookie basket and our thanks. To every township official, developer, and planning professional who agreed to speak with us during the summer of 2022, your perspectives shaped our understanding of renewable energy in Michigan and informed many decisions throughout the development of this program. Lastly, to the friends and family of the MI REDI team who lent emotional support and stability, and to everyone who provided support, advice, editing, opinions, time, or otherwise assisted in seeing this project to completion, we thank you.

Introduction

On April 21, 2022, the Michigan Department of Environment, Great Lakes, and Energy (EGLE) released the MI Healthy Climate Plan, setting goals to reduce greenhouse gas emissions 52% by 2030 and achieve carbon neutrality by 2050.[1] To do so, 60% of the state's electricity profile will need to come from renewable sources like wind and solar by 2030. One of the most prominent barriers to reaching a high penetration of renewables, and a key strategy identified in the plan, is overcoming difficulties in siting, zoning, and land use.

For most land uses in rural Michigan, zoning decisions are made at the township (i.e., sub-county) level. utility-scale renewable energy systems fall under this purview, with "utility-scale" being defined as systems which connect to the electric grid, not those which are "distributed generation" which first offset the electricity needs of the host landowner or community. As such, building a renewable plant in Michigan requires local zoning ordinances to articulate in which areas of the community these systems are permitted, and set standards (e.g., setback distances, maximum height, etc.) for their development. However, many jurisdictions have not utilized their ability to zone for renewable energy.[2] This is undesirable for two reasons. Firstly, if a township which has not passed a zoning ordinance for renewables is approached to host a renewable project, the process of gathering community input might be hurried or incomplete, possibly evoking stronger feelings of local opposition. This can result in a temporary moratorium on development, the spread of anti-renewable discourse, or developer withdrawal. Any of these outcomes harm the statewide deployment of renewables. Secondly, a township not utilizing their ability to zone for renewables might result in projects that are unfavorable to the hosts due to community preferences not being considered and expressed via zoning. This works against the MI Healthy Climate Plan's goal for a just transition, propagating the dangerous precedent that energy generation can be built without proper consideration of the wellbeing of local hosts.

1 Michigan Department of Environment, Great Lakes, and Energy. (2022). MI Healthy Climate Plan.

2 Michigan Department of Environment, Great Lakes, and Energy, & Mills, S. (n.d.). Michigan Zoning Database. Retrieved October 4, 2022, from www.michigan.gov/egle/about/organization/materials-management/energy/communities/mi-zoning-database

Township-level zoning gives Michigan the unique opportunity to grow a decarbonized energy system around community preferences, but also presents developers with a difficult patchwork of ordinance, regulation, and community attitudes to work around. Proactive zoning prevents the delay of development at large that would occur due to failed project attempts in areas that were already opposed but did not codify their preferences in a township ordinance. Seizing the opportunity presented by local zoning without encountering these shortcomings requires townships to determine their preferences before developers approach.

Currently, there are numerous informational and financial resources available for these communities to do so. The EGLE website provides guides, webinars, and data on a variety of topics, including the planning and zoning processes for renewables, and a comprehensive list of renewable energy zoning ordinances across the state.[3] There are also many funding opportunities available through the state and EGLE, including the Community Energy Management Program, the Michigan Solar Communities Program, and the AgriEnergy and Sustainable Farming Program, many of which can be used toward renewable energy planning and zoning activities in Michigan's rural communities.[4]

Although multiple resources are available, there are still 695 communities, comprising 46.4% of the 1,499 zoning jurisdictions in Michigan, that are silent on utility-scale wind energy zoning, and 1,101 communities, comprising 73.4% of Michigan's zoning jurisdictions, that are silent on utility-scale solar energy zoning. "Utility-scale" is defined as systems which connect to the electric grid, not those which are "distributed generation" which first offset the electricity needs of the host landowner or community. There are a number of reasons that communities may not have zoned for utility-scale development. Research on community acceptance suggests that the acceptance of

3 Planning & Zoning Guidance. (n.d.). Retrieved October 4, 2022, from https://www.michigan.gov/egle/about/organization/materials-management/energy/communities/planzone

4 Climate and Energy—Funding Opportunities. (n.d.). Retrieved February 15, 2022, from https://www.michigan.gov/climateandenergy/0,4580,7-364-85453_85455_85523---,00.html

different scales of solar energy varies within communities and has regional variations.[5] This indicates that attitudes regarding utility-scale renewable development could vary depending on citizen perceptions of land use needs, community identity (i.e., historically agricultural, sustainability pioneers), and attitudes towards developers and utilities. Secondly, although abundant literature has addressed the benefits and incentives that renewables projects can provide to communities including factors considering economic impact, project details, environmental concerns, aesthetic concerns, and social influence, it is still difficult to translate information to meet local contexts.[6]

In response to this complex problem, EGLE asked our team to design and pilot a program - the Michigan Renewable Development Initiative (MI REDI) - that they could implement after the completion of the capstone project. The goal of this program is to capture the benefits of local zoning while minimizing associated challenges by encouraging proactive township-level zoning that incorporates each participating community's unique preferences. This means the MI REDI program will provide support for ordinances that are either permissive or restrictive of renewable development. While the program is ultimately designed to pursue the MI Healthy Climate Plan's renewable energy goals, assisting townships in expressing relatively more restrictive zoning still contributes to the statewide deployment of renewables by highlighting areas of optimal and suboptimal development and generally streamlining the zoning process statewide: in effect, allowing developers to not waste their time in communities that do not believe renewable energy is a good fit. This nondirectional support also reflects the project's goal of emphasizing the unique equity potential of local level zoning.

The program is intended to be tailored to the priorities of Michigan townships, and is informed by a series of interviews conducted by the student team. Key takeaways from these interviews were used when designing the program to ensure it is accessible and relevant to townships across the state. The program also includes a "MI REDI toolkit," a collection of resources, templates, and tested engagement strategies that will assist a participating township through the various components of the program.The program will accomplish this by providing three services: firstly, by advising and coordinating a community engagement process to gather public opinion and maximize transparency and inclusion; secondly, by performing a resource assessment of wind and solar resource potential and visualizing potential setbacks and plant locations within the township; and thirdly, by using the above two strategies to fill out a sample zoning ordinance that accounts for the township's unique preferences.

The general methods outlined in MI REDI, particularly related to community engagement, may serve as a useful model for other programs aimed to spur local action. and contribute to a better understanding of how proactive planning can be optimized to find win-win solutions between communities and other stakeholders. A grander outcome would be seeing this framework repurposed for functions other than zoning. A fundamental understanding of how to catalyze local action and increase local agency in land use decision making might be advanced by this footwork, especially regarding actions that fall along political fault lines like renewable energy. This ties MI REDI in with a greater mission that begins with community welfare and sustainability. Ultimately, this program may provide Michigan with the opportunity to be an exemplar in renewables-forward thinking, while still supporting and encouraging the preferences of its people.

5 Nilson, R. S., & Stedman, R. C. (2022). Are big and small solar separate things?: The importance of scale in public support for solar energy development in upstate New York. Energy Research & Social Science, 86, 102449. https://doi.org/10.1016/j.erss.2021.102449

6 Rand, J., & Hoen, B. (2017). Thirty years of North American wind energy acceptance research: What have we learned? Energy Research & Social Science, 29, 135–148. https://doi.org/10.1016/j.erss.2017.05.019

Methodology

Interviews

Before program design could begin, the MI REDI team needed to hear from local government officials and renewable energy developers about their perspectives on current barriers to renewable energy zoning in Michigan. While these two viewpoints are different in some ways, we expected to also find commonalities and points of compromise that could be addressed by the MI REDI program.

Interviews with Local Officials

Objectives

Our interviews with local townships specifically aimed to address the objectives of understanding how township representatives across Michigan perceive utility-scale renewable renewable energy to inform MI REDI program objectives and elements, identifying potential candidates for a MI REDI pilot program, and finally developing a list of interested Michigan township representatives for future MI REDI pilot or program participation opportunities. Further, the team was interested in learning about townships' community energy, sustainability, and economic development goals, existing community participatory processes and public attitudes, existing or planned utility-scale renewable energy development, obstacles to proactively zoning, and support or need for additional zoning, land assessment, and community engagement assistance.

Contact Identification

Interview candidates were identified by utilizing responses from the 2019 Michigan Local Energy Survey (MiLES) published by the University of Michigan Center for Local, State, and Urban Policy,[7] as well as the list of communities who had signed up for the Michigan Green Communities challenge.[8] Due to the scale of land typically needed to deploy renewable energy systems at the utility-scale, only townships (i.e., not cities or villages) were considered for interviews and eventual pilot selection. The data was filtered to identify contact information for Michigan township representatives that indicated they were interested in being contacted for future communications on the MiLES survey.

Townships were then further narrowed down based on zoning status for utility-scale wind and solar infrastructure, according to the Michigan Renewable Energy Zoning Database,[9] selecting only for those townships which had no zoning for either wind, solar, or both. Using this selection method, 139 township representatives were identified and contacted.

Outreach

Interview requests were sent via email to these township contacts. The outreach emails included a brief description of the objectives of the MI REDI program, purpose of the interview process, and scheduling information. If a township did not respond to the email within two weeks, they received one follow up email. If there was no response after two attempts to connect, they were not contacted again. A total of 50 emails received responses, and 24 township candidates agreed to and followed through with interviews. An interview information sheet (Appendix A-1) was sent to interviewees in accordance with The University of Michigan Institutional Review Board Health Sciences and Behavioral Sciences requirements.

Interviews were conducted via phone call and Zoom platforms depending on interviewee preferences. Two members of the MI REDI team were present at each interview, which spanned 30-60 minutes and were recorded for transcription purposes. One team member led interviews using the Interview Guide for Communities (see Appendix A-2) to guide

7 University of Michigan Center for Local, State, and Urban Policy. (n.d.). 2019 Michigan Local Energy Survey (MiLES). Retrieved January 31, 2023, from https://closup.umich.edu/research-projects/2019-michigan-local-energy-survey-miles

8 Michigan Green Communities (n.d.). Retrieved January 31, 2023, from https://migreencommunities.com/

9 Michigan Department of Environment, Great Lakes, and Energy, & Mills, S. (n.d.). Michigan Zoning Database. Retrieved October 4, 2022, from www.michigan.gov/egle/about/organization/materials-management/energy/communities/mi-zoning-database

conversations, while the other members transcribed (for phone interviews) or took notes (for zoom interviews) and performed technical support. Team members took turns alternating roles throughout the interviewing process. After the conclusion of each interview, team members completed a post-interview questionnaire regarding their personal impressions of the interview and notable findings so other team members could quickly digest interviews. These questionnaires were also useful during later pilot selection discussions for recalling important details.

Post-Interview Questionnaire, Local Officials

1. What is the role of utility scale renewable energy in this community's future?
2. What is the community's view on renewable energy development?
3. What are the community's current zoning ordinances regarding utility scale renewables?
4. What is the community's primary concern regarding utility scale development?
5. Why has the community not zoned for utility scale development?
6. What are the benefits of utility-scale renewables to this community?
7. Other than changing zoning, what does the community need?

Interviews with Developers and Utilities

In addition to the interviews with township officials, five renewables developers and utility representatives were interviewed for this project. The purpose of these interviews was to provide context for the goals and strategies of developers and understand what factors make a township more or less prepared to develop utility-scale wind and solar.

Outreach

Six representatives of utility companies and renewable development companies were reached out to, five of which provided interviews to MI REDI. These contacts were made without rigorous methodology; instead, we were advised to pursue certain connections and made others at conferences. The same methods were used for developing a question guide (See Appendix A-3), conducting developer interviews, and completing the post-interview questionnaire as for community interviews.

Post-Interview Questionnaire, Developers

1. What role does zoning play in the decision to site a utility scale renewable energy development?
2. What other factors are important in their decision to pursue a project in a community?
3. What are their preferred strategies regarding community engagement with community members and officials?
4. What are the primary challenges and frustrations that they encounter throughout the process of utility scale development?
5. Is there interest in the community profile interface that MI REDI may offer?

Interview Analysis

A codebook was created for community interviews to quantify the number of times specific topics or phrases were mentioned during interviews. No codebook was developed for developer or miscellaneous interviews because there were so few interviews in each category, so a coding process was not necessary. Transcriptions of interviews were uploaded to NVIVO, a qualitative data analysis program. Team members then assigned codes to the transcriptions using the program.

Local Officials Interview Preliminary Findings

In terms of general attitudes towards utility-scale renewable energy and whether it is suitable for their townships, a majority of local officials said that they see utility-scale renewable energy in the township's long-term plans, while some expressed concerns about renewable energy not fitting into the community identity. For communities that have been engaged in discussions regarding renewables, there is more active opposition than support for both utility-scale wind and solar. For current community engagement methods, in-person events and social media played a big role in residents taking part in township activities. When it comes to obstacles to proactive zoning, local officials in most townships reported that community members infrequently engage in public planning activities. Low staff capacity was also mentioned as a reason that more thorough zoning is not pursued proactively.

Attitude towards utility-scale renewable energy

When it comes to seeing renewable energy in the community's future plans, 40% of the respondents said they imagine renewable energy would help with community sustainability in terms of long-term plans, as it could protect the natural viewsheds and rural characteristics. Regarding specific technologies, 30% of the officials expressed support for solar while 10% expressed support for wind. In the townships where local officials perceived their residents were more welcome to utility-scale solar, township officials also mentioned that local residential solar projects (mostly small-scale or rooftop) were happening at that time, which could account for their higher support.

In terms of imagining utility-scale renewable projects in their community, a majority of the township officials said there is a physical space for wind or solar development. Among those, 50% of them envisioned agricultural land would be better for renewable energy development than residential or commercial land. This result provided the MI REDI team with ideas for related information sessions that could be offered during the project implementation, such as adding the possible solutions of combining solar panels with agricultural land, or emphasizing the farmland preservation characteristics of renewable energy (especially wind).

Figure 1. The following three images depict selected results of township interviews. Interviews followed a question guide (Appendix A-2), and responses were manually coded into data. 24 total townships were interviewed. The specific personnel interviewed in each case were based on whomever responded to the MiLES survey, usually being a township supervisor or clerk.

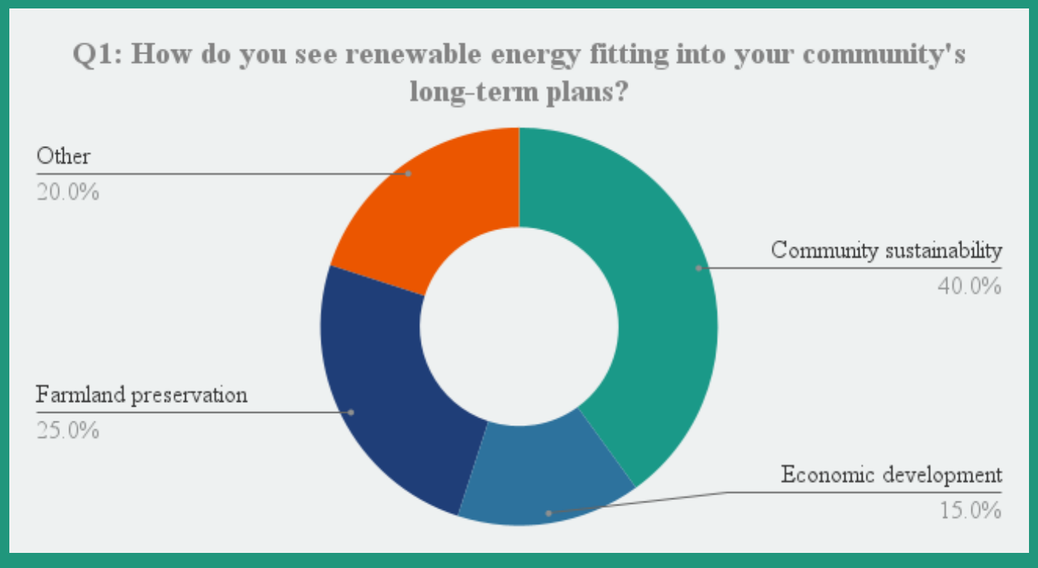
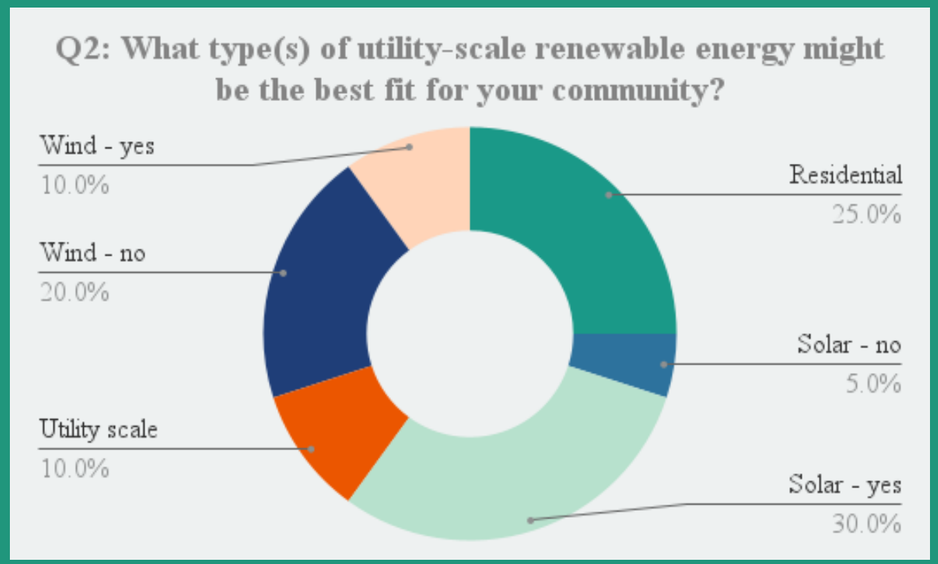
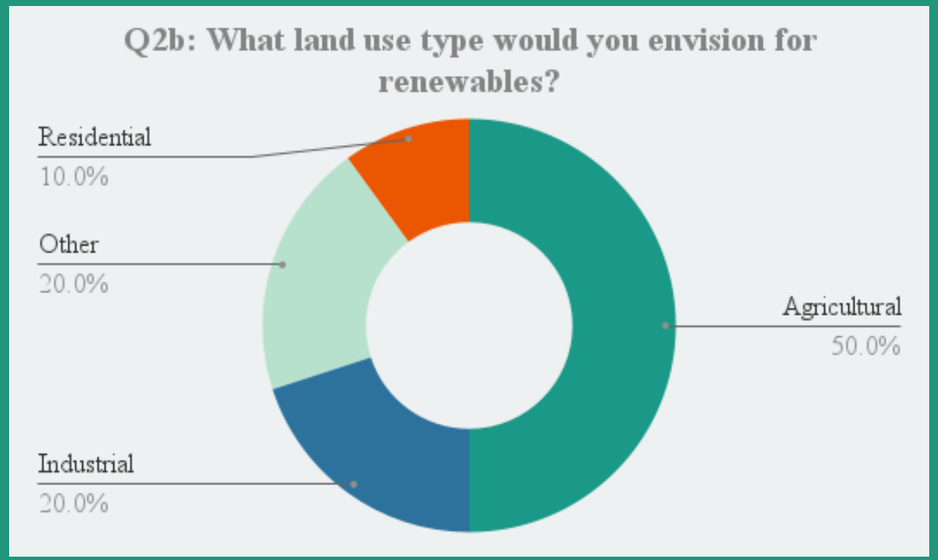


Figure 1 (cont)

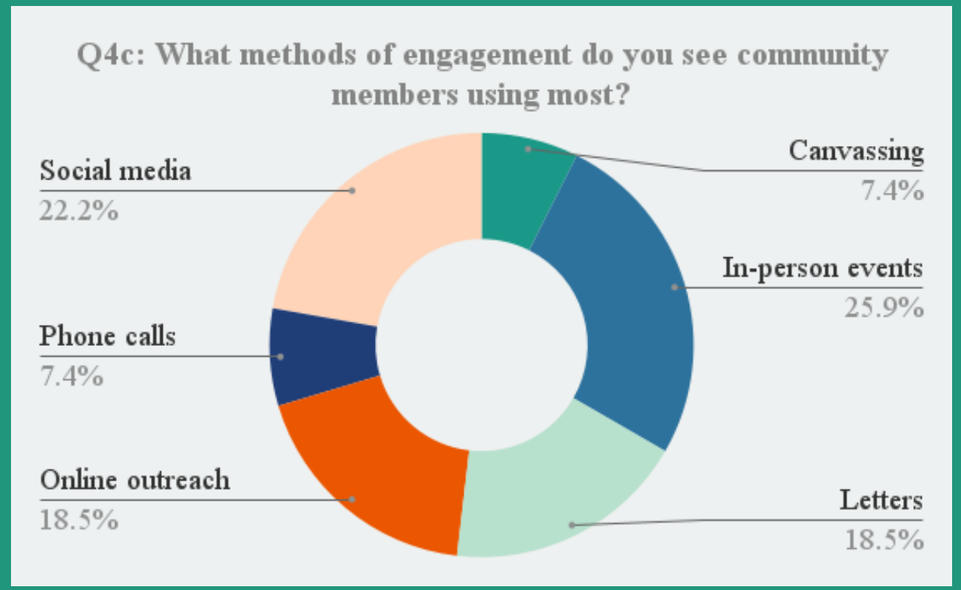




Community engagement methods

In order to better formulate the community engagement section of the MI REDI program, we asked questions about which current methods were used for residents to participate in community activities. The most common engagement methods officials used to encourage community participation were in-person events (i.e. town halls) and social media, accounting for almost half of the most commonly used methods. When the MI REDI team asked an open-ended question about public input mechanisms for local participation in the zoning process, 31% of the officials answered this was done with town hall meetings or public events and 13.8% of them mentioned sending out mailers.

Figure 2. Selected results of township interviews, continued. Interviews followed a question guide (Appendix A-2), and responses were manually coded into data. 24 total townships were interviewed. The specific personnel interviewed in each case were based on whomever responded to the MiLES survey, usually being a township supervisor or clerk.



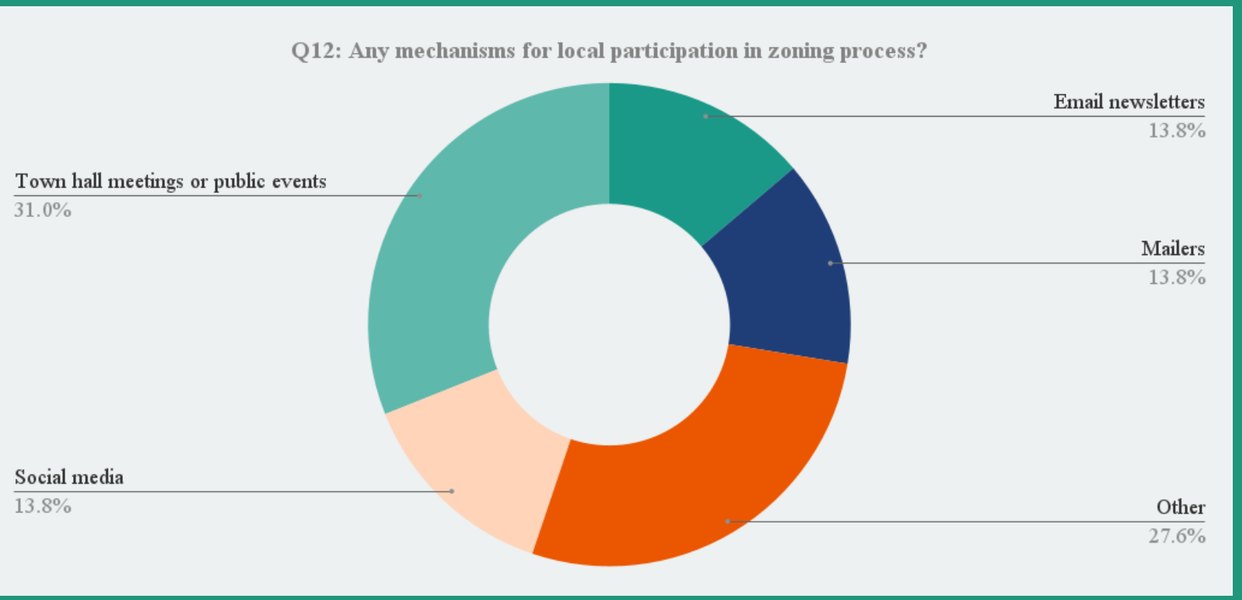
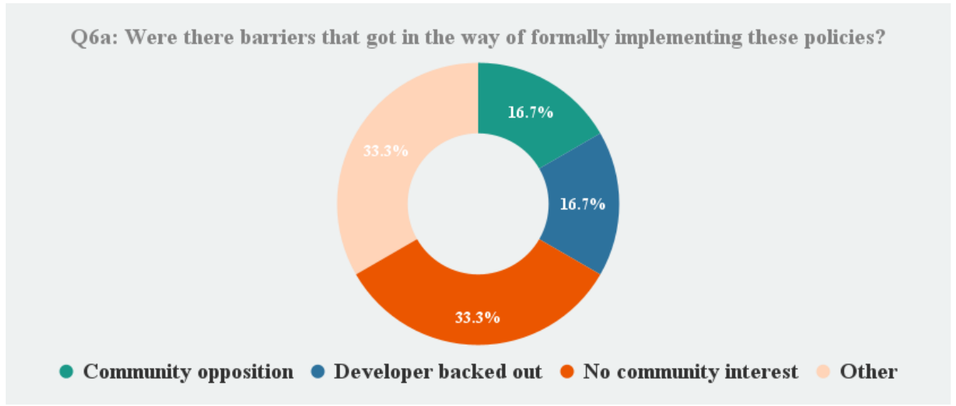


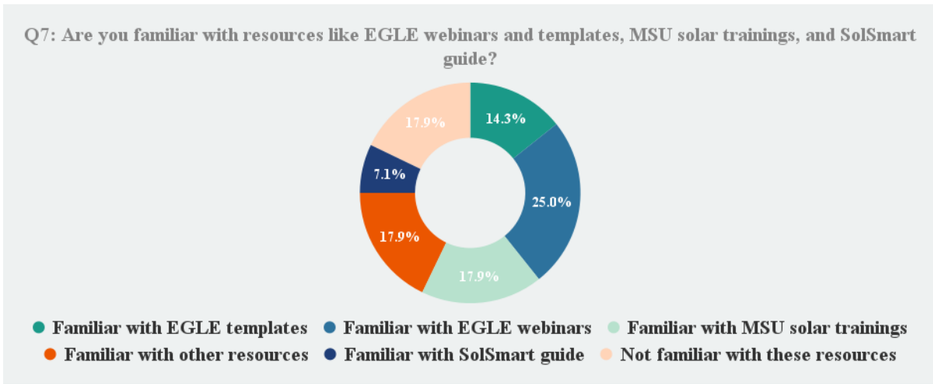
Figure 2 cont.

Obstacles to proactive zoning

With the goal to understand what gets in the way of proactive zoning, the team asked questions about what barriers there were to formally implement permissible utility-scale renewable energy zoning. When townships were asked why they were silent on zoning for utility-scale renewable energy, 33.3% of respondents said because there was no community interest. For example, one township official expressed concerns that even if residents were engaged throughout the policy process, there still would be opposition to the outcome.

Another related question was asked about familiarity with renewable zoning resources, such as webinars, trainings, and public documents (like zoning templates). Most of the officials were familiar with one or more resources. However, 26.7% of the officials still thought their township lacked the expertise to develop energy policies or zoning in terms of enacting new permissible zoning. This key finding helped with the MI REDI team choosing to bring zoning expertise like staff from MSU Extension to help facilitate town hall information sessions.





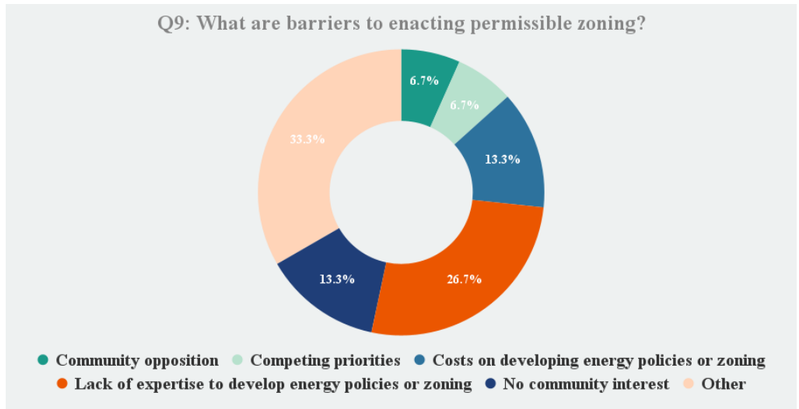


Figure 3. Selected results of township interviews, continued. Interviews followed a question guide (Appendix A-2), and responses were manually coded into data. 24 total townships were interviewed. The specific personnel interviewed in each case were based on whomever responded to the MiLES survey, usually being a township supervisor or clerk

Developer & Utility Interview Preliminary Findings

The MI REDI team interviewed five utility and renewable energy development companies to understand how zoning factors into internal siting decisions, how community engagement differs based on community opposition or acceptance, and common challenges in securing sites and building renewable projects. The team was particularly interested in how these companies navigate the complex landscape of local-level zoning that is prevalent throughout the state. The first few questions on the *Interview Guide for Developers* (See Appendix A-3) were aimed at understanding the internal process that these companies employ when first approaching a community and the degree to which zoning determines the viability of a potential project. There was general sentiment that zoning is a critical indicator of whether a potential project would be successful, although not all companies ranked it as the first step in the process, with some preferring to speak to local officials and community members first to understand general receptiveness to hosting a project.

When asked about whether there are any unique challenges to developing in Michigan compared to other states, overwhelmingly respondents indicated that local control is a unique and significant barrier when it comes to siting renewable projects. Many interviewees cited the role of social media in spreading misinformation and delaying or halting projects. Generally, while some companies indicated that hiring local workforce during construction might assist with community acceptance, this was not considered an especially strong swaying point for eliciting greater acceptance.

The MI REDI team was also interested in whether developers and utilities would find it useful for a third party to perform resource assessment and community engagement. In general, there were mixed responses to this question, with some interviewees expressing strong support for such a proposition and others positing that it would not be helpful for community relations. While responses from private sector companies were only one part of the calculus in determining the MI REDI service offerings and how the program would be structured, they were still illustrative of the broader importance of a program like MI REDI, which would serve as a third-party facilitator between communities and developers.

Pilots

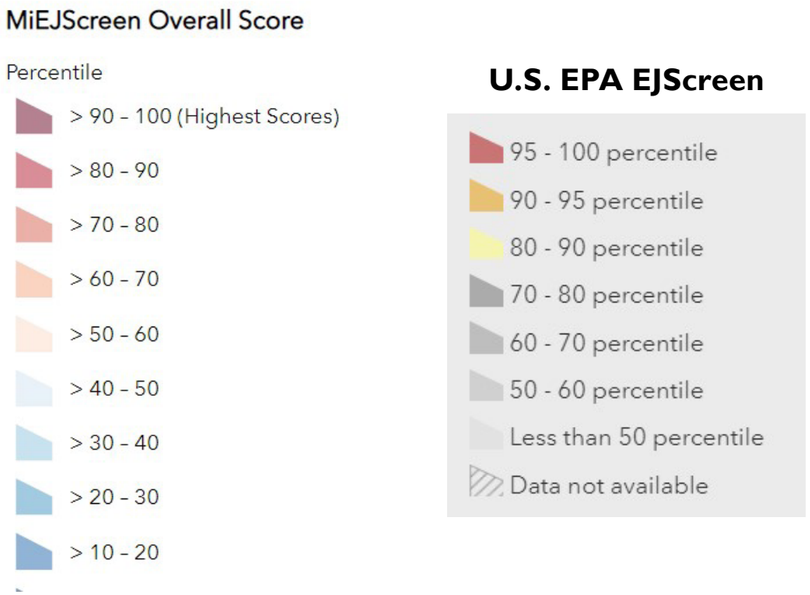
The following methodology details the uniform approach taken to piloting the first iteration of the MI REDI program. Specifics regarding each pilot township and their respective results are discussed in the Township Profiles section following the methodology. The MI REDI team provided a menu of options for the townships to choose regarding how they structure the piloting process to fit their needs with the rationale that some townships may be more interested in the resource assessment provided by the program, while others may want to emphasize community engagement or zoning assistance. Coincidentally, the two pilot townships used nearly identical methods. With only a sample size of two, it is too early to eliminate other engagement variations, so it can be assumed that future programs may vary in methodology.

Pilot Selection

Among those townships interviewed, the research team analyzed them based on their suitability for the MI REDI pilot program. Only townships whose zoning ordinances were silent on one or both of utility-scale wind or solar energy, and whose land footprint could accommodate utility-scale renewable infrastructure, were considered for pilot opportunities. Preference was given to townships that demonstrated a clear need for program service offerings pertaining to community engagement, land/resource assessment, and zoning assistance (i.e., they did not have a professional planner on staff).

Additionally, to maximize the adaptability of the MI REDI program, pilot selections aimed to identify communities representing geographic diversity and a range of "situational" factors based on the following criteria:

- Township staffing capacity and budget (High/Low)
- Community participation (e.g., town hall attendance, survey response rates) (High/Low)
- Community opinions on renewable energy (Supportive/Opposed)



- Environmental justice indicators- priority screen elements include:
  - * *U.S. EPA EJScreen*[10]: Superfund Proximity; Demographic Index; Unemployment Rate; Asthma
  - * MiEJScreen[11]: Overall Score (incorporates environmental exposure, environmental effects, sensitive populations, socioeconomic factors)

Four potential pilot candidates were selected representing the criteria and diversity preferences above. Outreach emails were sent to representatives for each township candidate briefly explaining the pilot program and requests for informational meetings to further discuss the opportunity. Two of the four townships responded to move forward with the information sessions and later accepted the pilot positions (Figure 4).

10 https://www.epa.gov/ejscreen (reported scores using upper end of percentiles (ex: 60-70 percentile --> 70)

11 MI EJScreen: Environmental Justice Screening Tool. https://www.michigan.gov/egle/maps-data/miejscreen

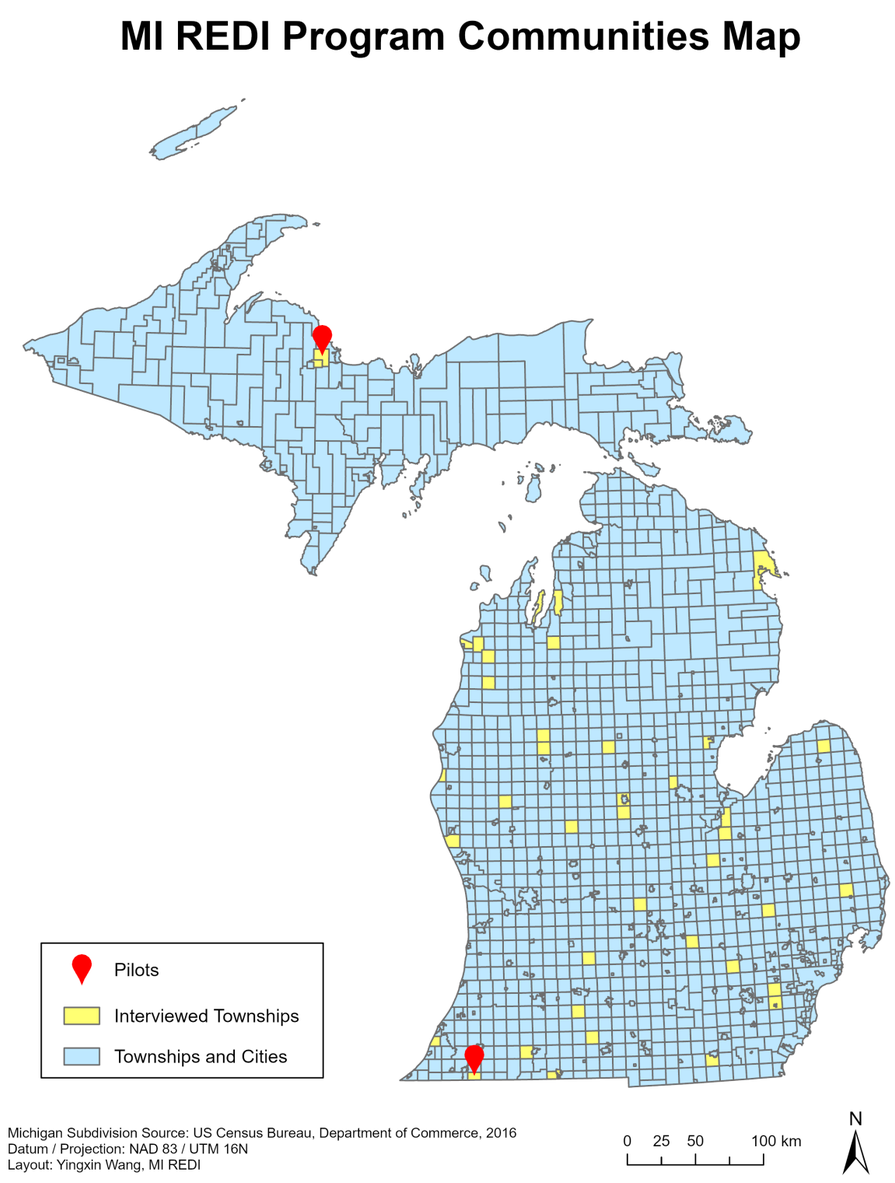


Figure 4. Interviewed townships and selected pilots from the MI REDI project. The northernmost pilot is Negaunee Township; the southernmost pilot is Milton Township.

Piloting Part One: Community Engagement

Given how contentious utility-scale renewable energy projects can become when a developer enters a township that lacks a renewable energy zoning ordinance, the MI REDI team wanted to approach the community engagement process in a way that gives the community agency and that encourages collaboration between the program facilitators, the township residents, and eventually the township planning commission and elected board. Most importantly, the MI REDI team wanted to avoid giving the township residents the sense that a team of researchers or government-affiliated consultants were entering their community and telling them what they should or should not do. Instead, the team aimed to construct an adaptive engagement strategy that was tailored to the specific interests and needs of the community, and act as a resource to assist in the township's conversations around renewables. While the township officials in the two pilot townships both decided on the same strategy, future pilots might request different engagement approaches, and MI REDI's community engagement strategy should accommodate that. The community engagement strategy was designed to be a continuous process throughout the pilot timeline, beginning in September with Postcard mailer 1, and ending with Town Hall 2 in December. The entire pilot process timeline was presented to the township official during the onboarding meeting, as seen in Figure 5. The engagement strategy that both townships chose includes, in this order: Postcard mailer 1, Town Hall 1, Postcard mailer 2, Town Hall 2.

Postcard mailer 1

The first mailer introduced the partnership between the township and the MI REDI program and advertised the Town Hall 1 meeting (Figure 6). The printed mailer included a link and QR-code to a Google Forms survey on the back of the postcard inviting residents to express their opinions about utility-scale renewable energy and to pose any questions and concerns about these projects. The survey was communicated as being the mode to guide the topics of conversation at the first town hall meeting, further encouraging residents who filled out the survey to attend. The survey provided the team with a general sentiment surrounding public attitudes towards renewables as well as willingness to participate in conversations around how or if renewable energy projects might fit in the community. The survey was mutually beneficial, serving as a valuable introduction to the community residents, allowing the town hall meeting partners time to prepare answers posed by the residents, and providing an avenue for residents to individually state their opinions on the topic on an anonymous platform. The survey questions and the survey results from each of the pilot townships can be found in Appendix B.

Figure 5. Sample Pilot Timeline

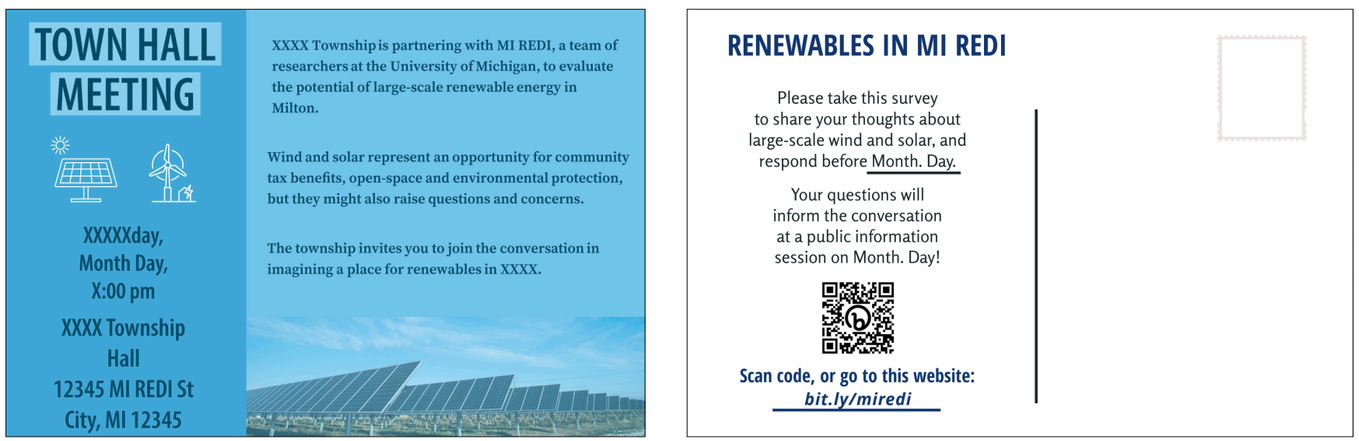


Figure 6. Postcard Mailer 1 (front and back)

Online Survey

In order to understand local opinions about large-scale wind and solar, the MI REDI team designed a Google survey, which was distributed with the help of township staff to landowners in each community based on tax records. Links to the survey were included on physical mailers, which informed recipients of the first Town Hall dates and asked whether they planned to attend. The surveys were identical for each township and included several questions, which varied from multiple choice to an open-ended format, where participants were given the option to write in notes, concerns, or anything else they wanted to share.

Survey Questions

1. What is your initial impression about a large-scale wind project in X Township?
2. What is your initial impression about a large-scale solar project in X Township?
3. What would you like to know about large-scale wind?
4. What would you like to know about large-scale solar?
5. Anything else you'd like to share regarding renewable energy?
6. What would you like to know about large-scale wind?
7. What would you like to know about large-scale solar?
8. Anything else you'd like to share regarding renewable energy?
9. Do you expect to attend the town hall on [date]?
10. If you can't attend the town hall, would you like to stay updated through another means of communication?

Town Hall 1

The first town hall meeting involved the township official and a Michigan State University (MSU) Extension staff member explaining the purpose of the partnership between MI REDI and the township and providing information through a powerpoint presentation format to address the questions residents had asked in the survey about utility-scale renewable energy. Almost every concern raised in the survey was addressed in the presentation. The MI REDI team attended the town hall meeting through Zoom and was available to answer any questions the township official or the MSU Extension staff member directed to the team.

Postcard mailer 2

The second mailer advertised the second town hall meeting and communicated to the community that the purpose of the town hall was to gather community feedback on zoning considerations for utility-scale renewable energy (Figure 7). The second town hall was designed as a continuation of the first, but the second mailer invitation was extended to everyone in the township in the interest of having as much transparency and getting as many attendees as possible.

Town Hall 2

The second town hall involved a slideshow presentation explaining the various zoning considerations for renewable energy developments. Throughout the presentation, attendees were encouraged to complete an interactive worksheet to indicate their preferences for each zoning item (see Appendix A-4). These

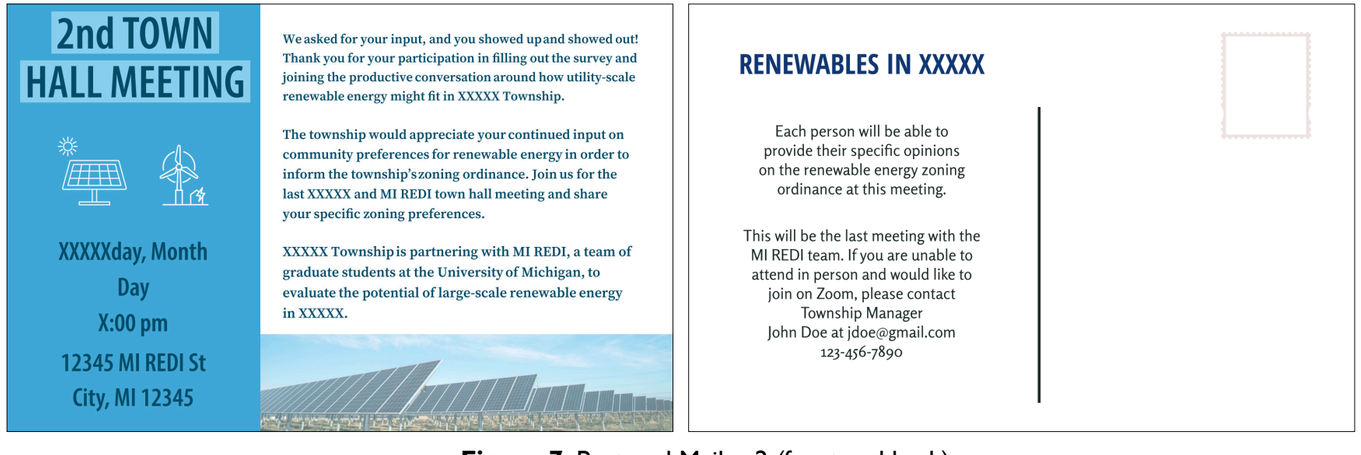


Figure 7. Postcard Mailer 2 (front and back)

worksheets were collected at the conclusion of the meeting to be coded by the MI REDI team into figures that can be used to inform zoning decisions made in the zoning assistance portion of the program, as well as by the township planning commissions during their own official zoning process. The presentation and worksheet were designed with considerable feedback from the township officials and MSU Extension staff on what they found to be most helpful in informing the recommended zoning ordinance. Because utility-scale renewable energy zoning can be a contentious topic, the final town hall highlighted some useful strategies for maintaining productive dialogue and de-escalating tensions when walking through zoning considerations. A successful strategy used by the town hall facilitators involved providing the clarification that banning renewable energy was not an option due to stipulations within Michigan's Zoning Enabling Act. Rather, the township would be adopting a renewable energy ordinance and the residents could use the town halls as a method of collectively deciding the size, placement, and method of any future renewables development.

Piloting Part Two: Resource Assessment

The MI REDI team used several pieces of software to perform a resource assessment, including the Energy Zones Mapping Tool (EZMT),[12] ArcGIS Pro, and Excel. EZMT is an online mapping tool that displays resource potential for wind and solar, including multiple weighted factors such as wind speed or sunlight availability, land cover type, distance to substations and major roads, slope, population, whether the area is protected land, and more. A shapefile data of the township's parcels was added on top of EZMT's resource potential visualization to visually identify parcels that may be impacted by nearby renewable installations. Based on that, the team used the buffer function from ArcGIS Pro to display various setback distances originating from nearby residential parcels and roads. Maps with varying setback distances and example locations of available land for each were the final product. For wind, the visualized values were a property line setback of 1.5x, 3x, and 5x a 500 foot turbine; for solar, we applied a 150, 300, and 500 foot property line setback.

12 Energy Zones Mapping Tool. (n.d.). Retrieved January 31, 2023, from https://ezmt.anl.gov/

Then, for each setback, MI REDI selected a continuous, non-excluded "patch" of potentially developable land based on access to transmission lines and substations, and resource potential and measured its acreage. For solar, the acreages of available "patches" were extremely large. As such, to estimate how large an actual installation on that plot would be, a buffer of 150, 300, and 500 feet was applied to every property line within the selected patch to visualize a percentage of a patch's total acreage that would be available and excluded.

Based on these final acreage values, the team produced an estimate of how much wind or solar could go into the respective space and how many homes this could power. This process was repeated for each setback to clearly illustrate the reduction of hypothetical generation as setbacks increased. Resource potential was not involved in the calculation; it was simply used as a selection criterion for which "patch" to measure the acreage of. An example of the final output of the resource assessment phase appeared in Figure 8 below.

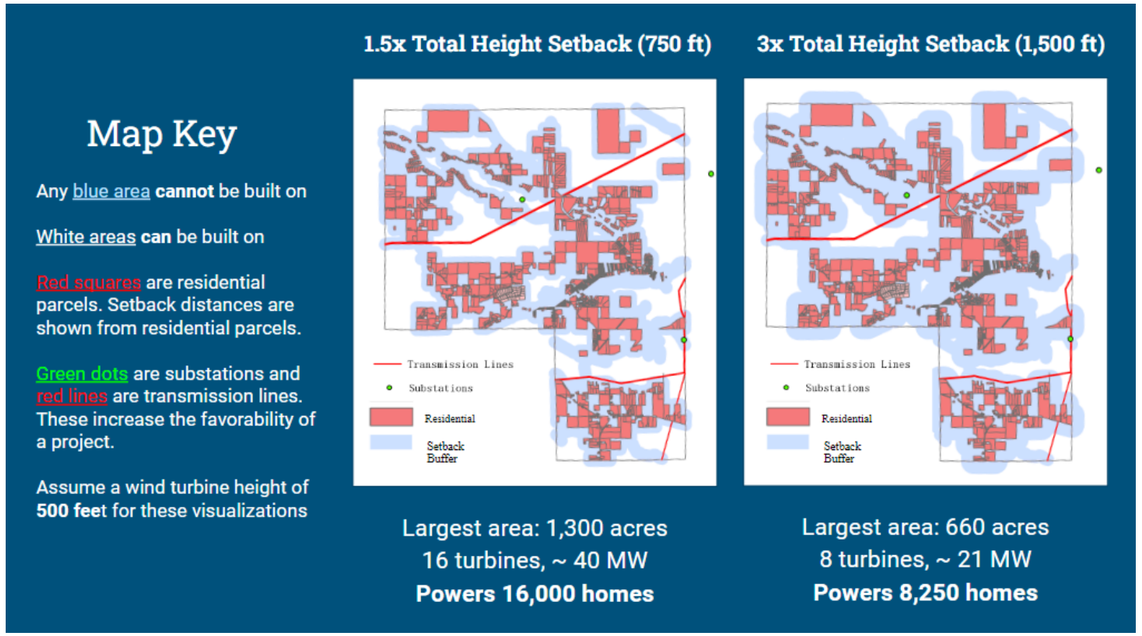


Figure 8. Final Resource Assessment product for Negaunee Township.

This visualization would not be asserting that a setback of a certain size would see a solar field installed on a certain parcel; instead, it would use a township's unique parcels to support a statement like, "reducing the setback from X to Y could potentially yield a capacity increase from X to Y." Additionally, if the trend was significant enough to report, we could show how certain areas within the township have more developable land (i.e. not excluded by the setback and high potential) than elsewhere, potentially highlighting certain zoning districts as particularly apt for renewables installations. A more detailed resource assessment methodology can be found in the Appendix C.

Part Three: Zoning Assistance

The ultimate goal of community engagement efforts was to gather local opinions on utility-scale renewables, which would then be incorporated into a draft zoning ordinance and handed off to each pilot township's respective planning commission, who could then modify or keep as much of the material as they deemed useful. The MI REDI team utilized sample zoning templates for utility-scale renewables (one for wind, one for solar) from Michigan State University and Graham Sustainability Institute,[13][14] as the starting point for the ordinance. As mentioned previously, an interactive worksheet in the second town hall meeting allowed residents to fill in their preferences on zoning items. The specific format of the worksheet questions varied from a binary 'yes' or 'no' option to a ranked choice, and for many questions participants were given the option to write in notes, concerns, or anything else they wanted to share. After these final meetings, the MI REDI team analyzed the worksheets, illustrating which items attendees felt most strongly should or should not be incorporated into a zoning ordinance. This was done by giving each option in a given question a weighted score based on how highly it ranked (for example, a first place ranking out of five options would grant that option five points, while a last place ranking would grant it one point). These points were then gathered from every worksheet to aggregate the township's ranked preferences at large.

The preferences receiving the majority of votes for each zoning item were then incorporated into the MSU sample templates, which were then provided to township officials with detailed notes explaining further context where necessary (see Figure 9). It is important to emphasize that throughout the community engagement process and during the final town hall meeting, residents were encouraged to zone either permissively or restrictively for utility-scale renewables the ultimate goal of the process was to establish some sort of zoning to ensure that the township will be ideally positioned when approached by developers in the future.

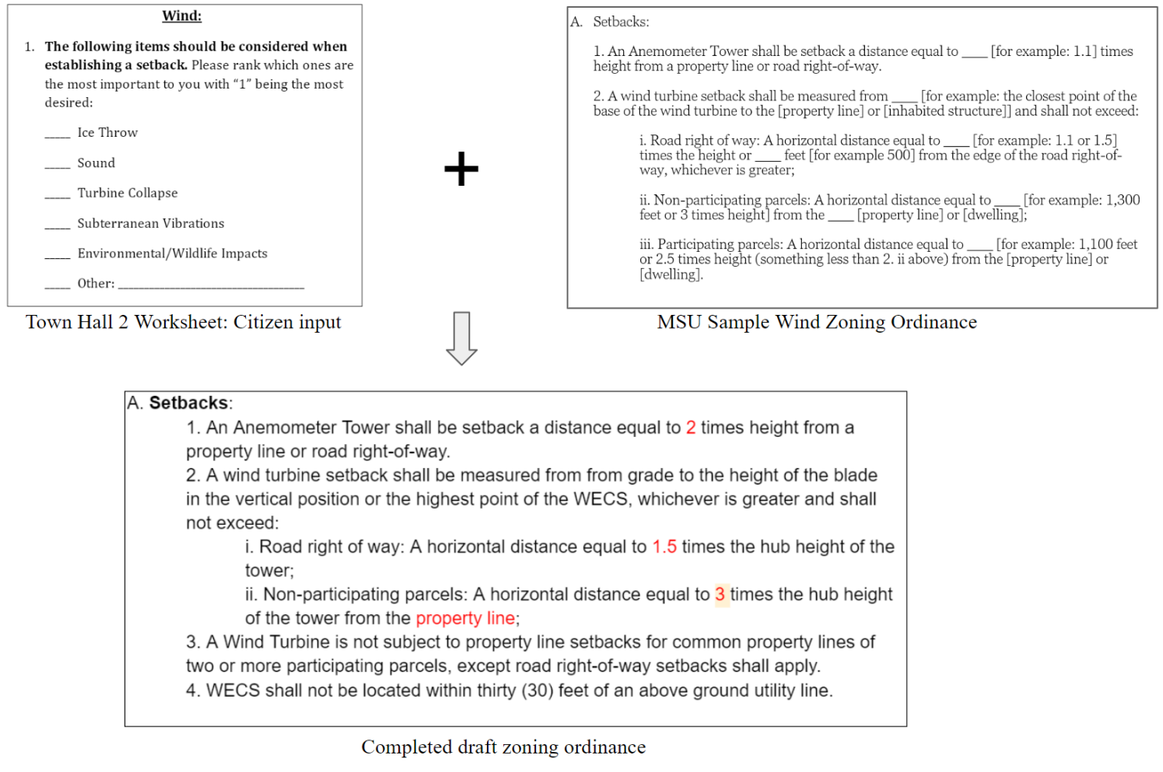


Figure 9. Illustrative description of how we produced a recommended zoning ordinance.

13 Michigan State University Extension Land Use Series "Sample Zoning for Wind Energy Systems" (2017). Retrieved from https://www.canr.msu.edu/outreach/uploads/files/wind%20sample%20zoning%2010062020_FINAL.pdf

14 Michigan State University Extension & Graham Sustainability Institute, "Planning & Zoning for Solar Energy Systems" (2021). Retrieved from https://www.canr.msu.edu/planning/uploads/files/SES-Sample-Ordinance-final-20211011-single.pdf

Results

Pilot Service Selection

Both pilot townships were presented with a series of community engagement options that allowed them to personalize the MI REDI experience to fit their own needs and interests, as well as options to receive resource assessment and zoning assistance. The MI REDI team created a toolkit of options for the townships to choose from (the toolkit was delivered to the client and is not publicly available at the time of writing). Those options included outreach strategies (e.g. social media, mailed postcard), engagement platforms (e.g. one town hall or multiple, online survey, in-person worksheet) and, should they choose to host town halls, the potential to partner with a neutral third party to facilitate those events.

As noted previously, in this pilot program, both townships chose the same set of options from the toolkit. Based on the time available and the townships' capacities, the MI REDI team did provide recommendations on which combination of tools we thought would be most effective, and in both cases, the townships accepted our recommendations. Due to time constraints of the capstone project, only the tools that were chosen were fully developed by the MI REDI team. In future iterations of the program, we recommend building out the toolkit and offering more options for future township participants, which would provide even more customization of the program.

Online Survey

In order to understand local opinions about large-scale wind and solar, the MI REDI team designed a Google survey, which was distributed with the help of township staff to landowners in each community based on tax records. Links to the survey were included on physical mailers, which informed recipients of the first Town Hall dates and asked whether they planned to attend. The surveys were identical for each township and included several questions, which varied from multiple choice to an open-ended format, where participants were given the option to write in notes, concerns, or anything else they wanted to share.

Negaunee received 94 responses, with a majority of respondents (34%) indicating that a large scale wind project "absolutely does not belong" in the township, while more than half of respondents indicated that large scale solar "absolutely does belong" or "maybe belongs". The most common questions and concerns for both wind and solar projects were land use and environmental impacts and whether the community would benefit from hosting such projects. Milton received 93 responses, with a majority of residents (47.3% and 40.9%, respectively) indicating that large scale wind and solar projects "absolutely do not belong" in the township. Like Negaunee, many community members in Milton expressed concerns about land use, environmental impacts, and community benefits. Although initial support for large-scale wind and solar was fairly low based on the first two questions, community members from both townships expressed interest in learning more and others communicated their support for such projects, citing the benefits of energy conservation, environmental protection, and economic opportunities.

Town Hall 1

In Negaunee Township, Town Hall 1 was attended by 24 residents in-person and two via Zoom. The Township Manager shared that participation in this event was higher than most town halls, and almost all attendees provided their emails to remain informed on the topic, suggesting an investment in the conversation. Participants asked questions about wind turbine effects on property values, and expressed concern over noise and subterranean vibrations. A successful facilitation strategy in Negaunee's Town Hall was the emphasis that MI REDI is a proactive program, no developer had approached the township yet, and that it is not legal in Michigan state law to outright ban solar and wind energy. In other words, the township would have to write a renewable energy ordinance no matter what, and that this conversation was an opportunity for residents to ensure their perspective contributed to the final ordinance.

In Milton Township, Town Hall 1 was attended by an estimated 19 residents and facilitated by the Township Supervisor and an MSU Extension Educator. Much like Negaunee, the Milton Township Supervisor indicated that this was a larger turnout for a public meeting than usual. Residents were inquisitive about content in the presentation

and had questions about the viability of renewables in Michigan, and expressed concerns about farmland preservation. Miton residents also had questions about the reason their township was chosen as one of the MI REDI pilot communities, and much like Negaunee's Town Hall 1, the strategy of emphasizing the proactive nature of the program helped communicate that this step was being taken before a developer arrived.

The two townships had similar questions from residents that revolved around immediate impacts on the community, such as property values and noise, and both townships expressed a strong interest in preserving the natural landscape as it currently is. Another commonality was the clear support for maintaining local control for renewable energy siting. During both events, the facilitators mentioned that this process may come with challenging questions and concerns, but that it is preferred over the alternative of state-level zoning. Residents of both townships largely agreed.

Town Hall 2

The second Town Hall gave participants a chance to share their thoughts on zoning elements related to utility-scale wind and solar. The format was similar to the first Town Hall, starting with a presentation and ending with an open Q&A session. Both sessions were designed to be led by a township staff member and an MSU Extension Educator, but in Negaunee Township there was a last-minute scheduling conflict and the session was led by a township staff member and a University of Michigan educator instead. The MI REDI team joined virtually in each session. During the presentation, participants were asked to fill out zoning worksheets, which were submitted to township staff at the end of each meeting, who then sent the results to the MI REDI team for analysis.

In Negaunee, two participants attended virtually and an estimated 13 showed up in person. Some discussion occurred about a potential brownfield parcel within the township that they considered ideal to host a large scale wind or solar project because the site's post-industrial nature makes it unsuitable for other uses. While the intention of this session was to focus on planning and zoning, many attendees had further questions about renewable energy, akin to those addressed in Town Hall 1. These included questions about the economics of wind and solar and whether these energy sources are cost-effective. There was also general interest in the life expectancy of solar panels and wind turbines. Another attendee inquired about the township's Master Plan and whether renewables fit into that plan.

In Milton, an estimated 17 participants attended in person with no online attendees. Many attendees asked clarifying questions about the boundaries and characteristics of zoning districts within the township that could potentially host utility-scale wind or solar projects. They also inquired about the decommissioning process and whether developers are required to contribute to a decommissioning fund before a project is built. Moreover, it seemed that there was a lot of interest in determining the threshold for the size (in acres) of large scale projects, where anything above that threshold would be classified as large scale and subject to additional regulations.

Coincidentally, thirteen worksheets were submitted from each township. Prior to discussing the data and interpretation of the worksheets themselves (see the next section), there are several interesting takeaways regarding how this activity was responded to by the Town Hall attendees. First, many attendees did not follow worksheet instructions, for example, a ranked preference item being filled out with X's on any item that concerned a citizen. Additionally, many attendees left several questions on the worksheet incomplete, instead referring to comments the participant had made elsewhere on the worksheet which suggested a preference for rejecting wind or solar altogether (for example, the question asking which zoning district was preferable to host solar was answered in 6 out of 13 of Milton's worksheets with the word "None.") In both of these examples, any deviation from instructions would impact that worksheet's ability to contribute to our eventual data collection and preference coding. We discuss later how this was largely a methodological oversight on our part with several suggested improvements for future iterations of the program. Despite these limitations, the overall sense in both townships was that citizens took advantage of their allotted time during Town Hall 2 to fill out their preferences, confer among each other, and write thoughtful comments and questions in the notes column. As such, despite the errors mentioned above, the worksheets seemed to be responded to favorably and in good faith.

Worksheet Interpretation & Zoning Results

After Town Hall 2 in each township, the MI REDI team compiled the results of the

zoning worksheets into quantitative data and created charts to visualize the results (See Appendix E for item-by-item results). As described in Methodology, this data was then used to populate the template ordinances found in Michigan State University's "Sample Zoning for Wind Energy Systems" and "Planning & Zoning for Solar Energy Systems." This process was largely similar between townships. For both Milton and Negaunee Townships, a utility-scale wind ordinance was in place prior to engaging as a MI REDI pilot. As such, the wind language used in the recommended ordinance was composed of both Michigan State University's template and the township's own language. In general, we deferred to the township's pre-existing language and simply altered specific values or imported full clauses when necessary to ensure that each item covered in the zoning template was represented in the final product. For solar, however, neither township had pre-existing language. As such, we imported the full MSU template and populated it with values based on citizen input from the worksheets. These Recommended Ordinances can be found in Appendix F, with color coding that indicates whether the language was imported from a township's ordinance or from the MSU templates.

This process ensured that a given township's zoning ordinance contained language on every item included in the MSU template. Certain items were left blank as our proceedings did not produce clear data. In these cases, we included recommendations and comments such that future zoning officials could make decisions on these items. Overall, it was difficult to make a judgment on certain zoning points due to non-revelatory data from the Town Hall 2 worksheet (see Limitations for more on this). A major example of this is wind setback. For Negaunee, we left the recommended ordinance for this item blank as we had received feedback from our partners in Negaunee that more research was necessary before leaning one way or another on such a significant zoning item (See Limitations). For Milton, however, despite producing a similar consolidated worksheet answer (see Figure 4 below), we were able to recommend a specific setback based on worksheet results and in part our intuition of the township's sentiment, which was strongly oppositional.

Three of the eleven worksheet items differed significantly between Negaunee and Milton: Item 6: "In which districts should large-scale solar be allowed?"; Item 8: "Is X Township's current screening ordinance [provided on presentation] sufficient for solar?"; and Item 11: "Principal-Use Acreage: At what acreage value should a solar installation be considered "large scale" and thereby be subject to this ordinance?" Otherwise, eight of eleven worksheet items were highly similar across townships. This produced two Recommended Ordinances with some unique inflection points based on township preference, but documents that were generally similar that served as significant organizational and language updates to the townships' prior ordinances. We communicated clearly with each respective township official that these Recommended Ordinances could be completed

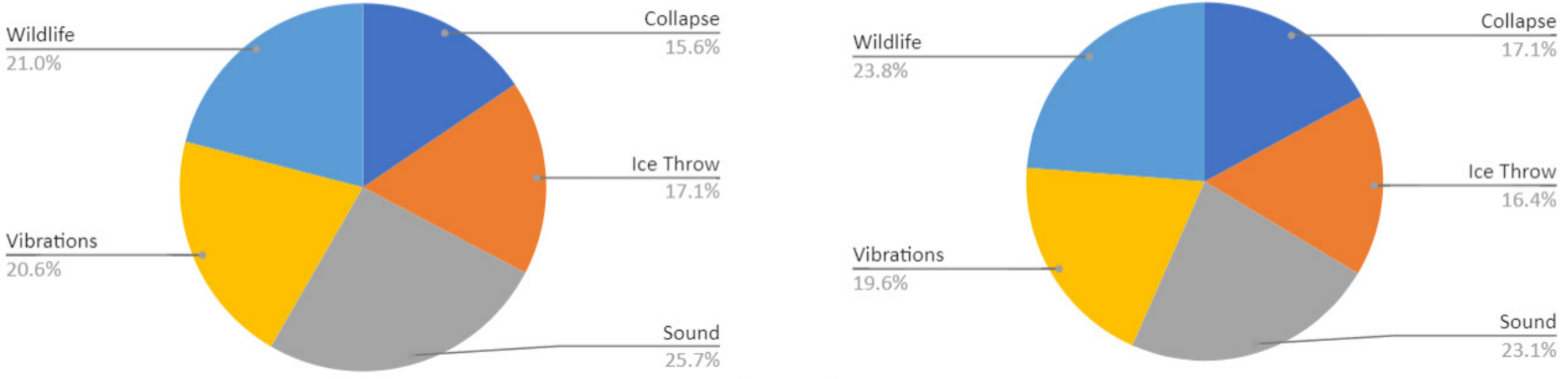


Figure 10. Comparison of the worksheet item "Setback Considerations for Wind" across Negaunee (left) and Milton (right). Results are largely consistent with one another, with sound and wildlife representing the top two concerns.

and altered in the future when it came time to refine specific zoning points (such as for Negaunee's blank wind setback.)

Resource Assessment

The results of the resource assessment process (as detailed earlier in Methodology) differed between each township. Generally, the wind and solar resources in Negaunee and Milton had minimal notable differentiation. However, when only factors such as slope, land cover, transmission, road proximity, and others were considered, each township had areas with greater wind or solar potential than elsewhere in the township. This was further limited by excluding certain zoning districts. Notably, Milton had less industrial space and smaller contiguous patches of agricultural space, while Negaunee had larger patches of agricultural space not excluded by setbacks. Overall, this suggested that Negaunee had higher hypothetical wind development potential than Milton, which can be confirmed by the power plant estimate calculations (40.6 MW of wind on the "best patch" for Negaunee vs. 17.8 MW of wind on the "best patch" for Milton, for a 1.5x hub height setback).

For solar, our analysis applied a given setback to every parcel boundary in a selected patch, not just residential parcels. As such, Negaunee was less fit for solar than Milton due to the size and distribution of its parcels, which would impact the continuity of a single solar patch. This was confirmed by the power plant estimate based on the best selected patch (51.7 MW for Negaunee vs. 76.4 MW for Milton, for a 500ft property line setback). For further detail, Appendix D includes all map visualizations and power plant estimates.

Limitations

Several ways in which the MI REDI program could be improved before launching a larger, statewide program were illuminated during the piloting process. Most of the limitations of the program surround the lack of conclusivity from only having two pilots. Thus, the extent to which these limitations can be understood and improved upon can only increase from the piloting of more townships in order to collect additional data and experiences to reflect upon. There are several overall categories in which limitations can be described: scoping & pilot selection, community engagement, methodologies, and allowance of restrictivity.

Scoping & Pilot Selection

As mentioned previously, the MI REDI project piloted two townships. As such, the character and demographics of each township contributed significantly to our final design. The pilot selection process was limited by time constraints and the capacity of the team to conduct interviews over the summer. Additionally, the selection process was biased toward townships that had previously shown interest in sustainability through our utilization of the MiLES survey as our contact list: communities which did not take the survey or took the survey but suggested they did not want to be contacted were not even considered for interviews, let alone piloting. As a result, our chosen pilots had both shown some degree of proactive zoning in that they already had utility-scale wind zoning in place. The program, however, hopes to appeal to a wide range of townships and would, in fact, have the greatest net effect on townships that are fully silent on renewable zoning. Therefore, future piloting should be conducted on townships which might otherwise not be interested in proactively zoning for renewable energy development. To accomplish this, the initial outreach net could be widened beyond the MiLES survey, which could be easily addressed by greater time or staffing capacity, or by working with the Michigan Townships Association or Michigan Association of Planning.

Community Engagement

The limitations of the community engagement strategy of the pilot are not unlike the common struggles surrounding participatory planning: low overall turnout to community meetings, voluntary response bias of community meeting attendees skewing toward negative, oppositional opinions, and designing effective modes of participation to collect public feedback. As previously mentioned in the community engagement methodology and township reports sections, the first round of community outreach included a mailer with an attached online survey. The survey received around 90 responses in each township. While we do not have an exact headcount at the Town Hall 1 meetings in either township, both of the pilot township officials claimed this was the best turnout to a township meeting they'd ever seen.

However, the participation at the second town hall decreased, with at least 13 people attending, determined by the number of completed worksheets. There could be many explanations for this decrease in public participation:

- It could be due to the lack of an engaging activity, like the survey, on the second mailer to peak public interest.
- The public could have felt as if their concerns were heard at the first meeting and that there was little need to attend a second town hall.
- The importance of the publics' attendance at Town Hall 2 and the content that would be covered might not have been effectively communicated.
- The timing of the meetings were perhaps not convenient, as they were built around the team's academic schedules.
- The mailers were inadequate in communicating the purpose of the town hall, garnering interest, and motivating the public to attend.

The feedback from the attendees of the town hall could indicate that opposition to these projects motivated people to attend and also points to a voluntary response bias. These are all possibilities, and only deploying more pilots will clarify the root of the participation problem.

Furthermore, designing different community engagement strategies or adding more methods of outreach to the current strategy should be considered. This might include drafting social media posts and graphics for the townships to post on their social media pages, or at the very least, on their website; finding ways to reach all members of the community, not just homeowners, with the mailers and surveys; and rethinking the format of the town hall meetings. The *Additional Pilots* section in Discussion covers these recommendations in greater detail.

Methodologies

Beyond the high-level limitations detailed above, several elements of the MI REDI methodology could be improved. Firstly, both mailers were sent only to property tax addresses, since those were the mailing lists the township officials had available to them. This means that the introductory survey (which was used to proxy the township's opinions on renewables) as well as announcements of the town hall events did not reach renters, including apartments, condominiums, or any other multi-unit housing. Future pilots may work through the post office to go to postal addresses, not just tax addresses.

Next, a second session of Town Hall 1 could be beneficial. As a reminder, Town Hall 1 was educational on the general topic of renewables, utility-scale energy, and zoning. It ended with an open floor Q&A that allowed for rich and productive discussion. However, some attendees of the second town hall did not attend this initial Town Hall, and thus were less equipped to understand this background information. This led to significant time at the second town hall being used to "catch up" those who hadn't attended the first gathering, such as defining utility-scale, detailing the significance of zoning, or describing the fundamental goal of *zoning proactively*, not *permissively*. This could be addressed by running a second session of Town Hall 1 at a different time slot than the first in order to accommodate more residents and create additional opportunities for them to become familiar with general information related to MI REDI.

Similarly, piloting revealed that several principles should be established clearly at the beginning of any town hall proceedings to keep conversation focused:

- MI REDI is *not* affiliated with any developers or utilities, instead representing a neutral interest. Zoning restrictively is a viable choice for a township that the team is fully willing to assist with.
- MI REDI is a proactive initiative. This program is taking place before any developers approach the township.
- Though comparatively less than other U.S. regions such as the Great Plains or Southwest, wind and solar energy are still viable renewable energy sources throughout the state of Michigan. Therefore, townships should zone proactively to prepare for potential development in the future.
- Energy generated from utility-scale wind or solar powers the wider electricity grid, and does not necessarily go to the local electric lines within host townships. This means that any unreliability associated with these developments will not directly affect the host township.

Next, and following the spirit of many of the above statements, the worksheet instructions for the second town hall should be more explicit. Milton Township in particular lost statistical validity in certain items due to respondents rejecting questions

in favor of writing blanket statements of opposition to renewables. These are welcomed comments, but by not participating in a given question, those who did vote on a certain item had more sway in the final ordinance. It should be made clear that every question should be filled out if a participant has an opinion on the matter. However, it may be a further limitation that certain worksheet items did not properly signal restrictive options to a layman audience. An example of this would be Milton's response to which zoning district solar belongs in. "None" was not an option; thus, 6 of 13 respondents abstained, instead writing in a statement of general opposition. In the team's perspective, voting "Industrial only" represented a restrictive option (one which did not enter the territory of "exclusionary zoning"), but this understanding was not necessarily shared with our audience. This limitation is discussed more below in "*Allowance of Restrictivity*." On a related note, the ranking instructions should be clear in order to have consistency across worksheets (such as in "Required Permits and Analyses," which only intended for 4 of the 9 possible items to be ranked 1-4).

One possible alternative or supplementary activity to the zoning worksheets could be to provide Town Hall 2 attendees with opportunities to directly engage with potential zoning decisions related to utility-scale renewable infrastructure placement and setback options within their community through interactive map-based activities that could simulate possible developments within their own township. This could be similar in style to the American Planning Association's Solar Powering Sunnyside activity, which is a participatory planning exercise that engages community residents in renewable energy zoning decision-making from a land-use planning lens for a fictional community.[15] Modeling a community engagement opportunity after this activity could actively involve community members in the planning process by allowing them to visually understand how renewable energy developments may fit into their community and support (or get in the way of) other township priorities such as farmland preservation or urban redevelopment. Such activities could more directly reflect residents' preferences related to zoning elements such as allowed zoning districts and setback distances by prompting collaborative discussions to determine where utility-scale infrastructure could be allowed in the community and what different setback distances might look like. Overlay districts could be considered in the participatory mapping process as well. This could provide town hall participants with a stronger understanding of what utility-scale renewable energy infrastructure may look like in their communities, and provide township supervisors, planning commission members, and MI REDI staff with more specific guidance for proposed zoning districts and setback distances that reflect community values and priorities.

Finally, the resource assessment process could be improved in many ways. However, this is only necessary if a given township requested more thorough resource assessment services. In the case of Negaunee and Milton, the township officials ended up requesting less than what we had produced, such as removing the 5x setback visualization from township-facing materials. An example improvement could be "parcel pre-selection," in which specific parcels could be highlighted as potential renewable host candidates for early attempts at landowner-level outreach. Additionally, visualizations could be produced to provide residents with more context as to where existing utility-scale developments are operating in Michigan and the associated resource potential of those areas. This could provide residents with a baseline for how such infrastructure could function in their own township through comparisons with other townships. Overall, the Resource Assessment branch of the MI REDI programming gave the least benefit to our pilot townships, as it provided a single graphic for two wind setback options as a point of education and reference.

Allowance of Restrictivity

Beyond the methodological limitations detailed above, a significant modification to the project's initial approach of Town Hall 2 illuminated another potential limitation. Initially, a MI REDI Town Hall 2 worksheet was intended to mirror the sample zoning "fill-in-the-blanks" directly, allowing each individual worksheet to hypothetically fill out the sample zoning on its own. This would mean inclusion of explicitly restrictive choices in many of the items in order to properly reflect an attendee's potential opposition. This would also open the possibility for the township to zone with exclusion of renewables in mind, which could cause legal issues with the planning commission later on. However, following the suggestion of township officials and several professional advisors, a rescoping was decided upon which softened the explicit restrictive options (and thereby

15 Solar Powering Sunnyside. (n.d.). American Planning Association. Retrieved March 30, 2023, from https://www.planning.org/research/solar/sunnyside.htm

the 1:1 mapping to the sample zoning blanks) in favor of items that could capture the general preferences of the Town Hall 2 attendees while also preventing the potential of only gathering feedback that was not legally actionable due to clear exclusionary zoning. The intention was that specific zoning items could be synthesized by the zoning administration and/or professionals based on the Town Hall 2 worksheets after the fact, and that exclusionary options would hinder this process more than help it. Furthermore, there were concerns that a zoning ordinance crafted only by Town Hall 2 attendees would be biased, unrealistic, and unrepresentative of the township's best interests. This concern could be mitigated in the future by increased outreach or other efforts to encourage more participation, expanding the zoning-focused activities within MI REDI, or having the planning commission hold more public meetings to attempt to further gauge the public sentiment on the issue.

A significant example of this rescoping is the worksheet's wind setback decision. Initially, the team drafted the worksheet to include choices based on height multipliers: 1.5x, 3x, and 5x total height informed by graphics produced during the resource assessment phase. This item—once aggregated from all Town Hall 2 worksheets for a given township—would map directly into the sample zoning ordinance's blank spot for utility-scale wind setback. Notably, the latter of these options (5x total height) could be considered more restrictive of wind development, following the resource assessment of Negaunee Township. It was advised, however, that generating documented requests for a fully restrictive option would leave the community in a more difficult place zoning-wise than it had been before MI REDI arrived. As such, this decision-point was changed on the final interactive worksheet to a ranked preference of several items such as sound, ice throw, and shadow flicker, the setback implications of which could be professionally determined later on.

The MI REDI team agreed with and implemented these changes. However, this made it more difficult than anticipated to fill out a recommended zoning ordinance based on Town Hall 2 worksheet input, as the ranked preferences did not translate directly into zoning items. Regardless, it is possible that this rescoping was optimal, and that the best service MI REDI could have provided to a pilot township was not necessarily a direct translation of worksheets to ordinance, but a catalyzed opportunity for constructive community input. Further piloting should weigh this trade-off for each unique township, however, as some communities may benefit from an outlet for clear renewable opposition, or because some communities may desire a very thorough and specific zoning ordinance (something that our pilots, due to scoping limitations as described above, had less need for).

Discussion

At the start of this project, the MI REDI team took on a big task: find out what it is that holds communities back from proactively zoning for renewables and design a program that reduces those barriers or provides those necessary incentives. The team dove into literature on the relevant topics, spoke directly to township officials and renewables developers, and eventually partnered with two townships with the goal of sorting out these major questions and hopefully landing on two feet with a program that served the township and achieved our goals of proactive zoning. The two pilots of the MI REDI program provided the team with valuable insight on what works, what remains unanswered, and what should be attempted in further iterations. The piloting process facilitated more public participation with the township officials than they have ever seen before (according to their reports), leaving both townships on the path to no longer be silent in their utility-scale wind and solar ordinances. Furthermore, each township was left with an updated zoning language framework that reflects professionally determined best practices. The program provided people in each township the opportunity to engage with the community and voice their thoughts and concerns through various mediums, and the participating townships were able to utilize these various tools of engagement at no cost of their own. While we might have left the piloting process with more questions than answers, these small achievements in these townships are reason enough to continue refining the program. The following subsections provide further explanation of considerations for the future of the MI REDI program.

Additional Pilots

According to an interview with a professional planner who has experience in designing and launching state programs, it is their opinion that around ten pilots need to be completed before the majority of townships will be comfortable with going through the

program themselves. Further piloting would allow for the refinement of the program through the testing of more variables in every component of the process. Ideally, future piloting would achieve the following goals:

- Ensure that pilot townships exhibit more varied characteristics (such as land availability, personnel & capacity, perceived renewable opposition, etc.) than were present in the initial two pilots.
- Improve the suite of MI REDI community engagement methodologies by testing new public participatory activities and outreach strategies, and ensuring they address the shortcomings described in Limitations.
- Improve the data gathered throughout piloting such that a recommended zoning ordinance is more robust and indicative of community views.
- Assemble a network of professional contacts in the field of zoning, planning, and renewable energy, both for use in MI REDI services and for communities not interested in the full suite of MI REDI services to be able to contact (i.,e, a renewable energy experts bureau).
- Test new services such as a *developer interfacing pathway*, in which program staff contact developers to help a jurisdiction from the start to finish of development; zoning guidance, in which the program staff assists in longer a secondary zoning-focused engagement campaign such that a renewable zoning ordinance is actually passed; and *reward visualization*, in which financial rewards (from property tax, developer payments, or a state-level incentive) to the township are tangibly explored, such as a solar farm potentially resulting in a new park, ambulance, broadband installation, etc. as a direct result of hosting renewables.
- Improve resource assessment methodology and further ways to apply this service, such as an automated and publicly available mapping tool that could perform resource assessment and determine a township's suitability and potential benefit from renewables, for the purpose of encouraging more jurisdictions to zone proactively even without using all MI REDI tools.
- Assess the need for a website to host the aforementioned tool, with intent to recruit new townships and advertise certified townships to renewables developers. This could serve as a place for interested townships to learn about the program, read about other success stories, and see a list of knowledgeable experts on specific subjects.

In summary, hosting additional pilots would provide the opportunity to test the program's adaptability or capability to tailor the methods to a diverse range of communities (as determined by the metrics in the Methodology section) and their specific preferences. While the first two pilots requested the same community engagement methods, alternative methods or tools of engagement could be employed to diversify the suite of options accessible through the MI REDI program. Due to the limited timeline of a Capstone Master's Project, the MI REDI team delivered the recommended zoning ordinance to each pilot township and left them to carry out the zoning process on their own, missing arguably the most important step in the proactive zoning process. Ideally, with additional piloting, the team would have the opportunity to continue providing community engagement, zoning, and resource assessment assistance until the zoning ordinance is passed.

Incentive Funding

Our research has found there must be greater financial incentive for townships who ultimately host large renewable energy projects; the standard property tax and land lease payments are not enough to induce many communities to set permissive zoning policies. This incentive, to be clear, would be separate from the funding provided to carry out the MI REDI program (i.e., paying for community engagement and staff support through the planning and zoning process). While a state-wide incentive program for renewable energy hosts does not need to be contingent on participation in MI REDI, knowing this incentive exists could serve as additional motivation for performing some of the participatory planning best practices as laid out in the MI REDI programming. Additionally, since this incentive would be disbursed based on megawatts developed, more townships would be encouraged to zone permissively more often than restrictively.

While it was beyond the scope of this project to design that incentive, our experience suggests that, unlike tax revenues that will be received annually, this additional incentive should be distributed as a lump sum once the project is approved and "vested", and townships should have flexibility to use it towards projects of their choice. This will allow the community to experience a tangible community-wide benefit to hosting renewables. Interviews conducted by the MI REDI team indicated that townships are likely to prioritize projects such as road improvements, installation or maintenance

of community infrastructure (e.g. parks, community centers, trails, and playgrounds), broadband access, local economic development, and addressing housing or grocery store shortages. If this incentive pot materializes, the MI REDI program should be edited to incorporate it. Discussion of community-wide needs that might be furthered by the incentive could be included throughout the community engagement campaign, similar to the "reward visualization" service as described in Additional Pilots.

Additionally, a second round of piloting would allow certain elements of a financial incentive to be considered. For example, equipped with data from more pilots, a team could produce recommendations on whether the financial incentive should be tied to MI REDI certification, and produce recommendations on how the financial incentive should be disbursed—for example, $/MW installed, or "$/MW/% of available land" (meaning a smaller township would not automatically receive less money than a larger township due to limits of available acreage). In either case, it remains our position that completion of MI REDI programming should not be necessary to receive an incentive—instead, the program would stand as an encouragement for townships to undergo participatory best-practices, leaving participants with an increased sense of community involvement and transparency, which in turn would reduce a township's chance of withdrawing from proposed projects, enacting moratoriums, or engaging in intertownship anti-renewable discourse, all of which support the greater endeavor of the MI Healthy Climate Plan.

Personnel

Our research suggests there are two types of personnel needed to ultimately attain the goals of the MI REDI program: Program staff and a network of subject matter experts and professionals ready to aid townships to reach their renewable energy goals.

Initially, this University of Michigan team played the role of program staff. However, if this project is to continue piloting with eventual implementation as a legitimate program, it will need permanent staffing housed either at the State or contracted to an external group. Likely candidates for this second option include the Michigan Townships Association (who, according to the MPPS data, local officials trust most as a source of information on energy), a planning/consulting firm with state-wide reach, or an academic or research institution. From our research and experience, we would recommend that the final iteration of the program be housed with a trusted nonprofit organization with minimal ties to government or profit, such as the Michigan Townships Association. In the short term, continued work with a university (e.g., either with MSU Extension or University of Michigan's Graham Sustainability Institute) may allow for better inclusion of student researchers, and also help build a pipeline of talent to ultimately carry out this work.

In addition to the program staff, the MI REDI project required and should continue to emphasize the need for a network of local/regional facilitators. The MI REDI team observed through interviews and town halls that planning experts from the local area were more likely to be a trusted source of information than a group of students or someone working for a state agency. During the piloting program, MI REDI partnered with planning professionals through MSU Extension and University of Michigan to be town hall facilitators, and future iterations of the project should solidify and expand such partnerships. Further, based on related experience in EGLE's Renewable Energy Academy, the future iterations should explore partnerships with the regional planning associations and/or the Michigan Association of Planning to further identify trusted regional partners who might also be part of a broader network of MI REDI facilitators.

Conclusion

Overall, we feel that the MI REDI draft program contributed to our objective to support the MI Healthy Climate Plan while simultaneously empowering participatory planning at the township level, though there is significant room for further development. On the precipice of a global energy transition, it is imperative that precedents of transparency, justice, and proactivity are established clearly, and we believe that further work on initiatives like MI REDI will see this goal realized.

This is especially pertinent as entities throughout the state—including some of our developer interviewees—insist that township-level zoning is a detriment to expedited renewable siting and should therefore be discarded; a possibility which citizens in our Town Halls spoke of with sincere concern. From our research and experience, we believe strongly that community level goals can synergize with state level goals such

as the MI Healthy Climate Plan. Michigan's standing as a state where any jurisdiction can manifest its unique vision of home does not need to be undone for us to establish a future with sustainable energy. On the contrary, the two goals can work in tandem, allowing townships who align strongly with the goals of renewable energy to stand as hosts and be assisted to realize that desire and the rewards it brings. Meanwhile, those communities who do not align with the goals of renewable energy may zone accordingly and slow the campaign of opposition that originates from discontented host communities who had little to no say on their place in the energy transition. Synergizing community empowerment with rapid renewable deployment will require more work—from dedicated program staff, to an inventory of experts ready to assist in our mutual goals, to the potential need for incentive funding—but if such a framework can be established, Michigan can stand as a model for energy justice and participatory planning nationwide.

Team MI REDI: Sarah Dieck, Sophie Farr, Zona Martin, Ian O'Leary, Kaitlyn Sledge, and Yingxin Wang

MI REDI Appendix
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Appendices

Appendix A. Blank Community Engagement Templates

A-1. MI REDI Interview Information Sheet Template

INFORMATION SHEET
DEVELOPING A UTILITY-SCALE RENEWABLES-READY PROGRAM FOR LOCAL GOVERNMENTS
HUM# 00218285

Principal Investigator:
Co-investigators:
Faculty Advisor:

You are invited to participate in a research study about utility-scale renewable energy in the state of Michigan. This research intends to measure communities' interests in renewable energy, as well as the feasibility of development in relation to current zoning ordinances. Specifically, we are interested in knowing about your concerns, potential advantages of renewable energy in your community, and any factors you can identify that have prevented renewable energy development to date.

If you agree to be part of the research study, you will be asked to share your experiences related to renewable energy perceptions in your community. You will be asked to meet with the research over the phone, virtually via zoom, or in person. The researcher will ask you a series of loosely structured questions. You can answer the questions based on your discretion and comfort level. You will be asked for your verbal consent for the interviewer to audio record the interview. If you prefer that the interview take notes by hand, the interview will not be recorded.

Benefits of the research
You may not directly benefit from participating in this study. However your involvement will aid in the understanding of rural Michigan's community interest in renewable energy development, specifically to help local governments in Michigan create zoning ordinances that allow for development of utility-scale renewable energy projects.

Risks and discomforts
There are very few foreseeable potential risks to you from partaking in this study.
If you are uncomfortable with any questions, you may choose to skip the question or terminate the interview at any time.

Compensation
You will not receive money or any other form of compensation for participating in this study.

Participating in this study is completely voluntary. Even if you decide to participate now, you may change your mind and stop at any time.

We will protect the confidentiality of your research records by
- Remove any and all identifying information from transcripts.
- Report findings in summary and/or anonymized, i.e., in a way that will not give away your identity. If we use a direct quote, it will be anonymized and you will never be directly identified.
- Keep all electronic data files, including audio recordings, on a password-protected server and/or password-protected phone, recorder, or university-owned laptop.

Information collected in this project may be shared with other researchers on the research team, but we will not share any information that could identify you.

If you have questions about this research study, please contact **XXX XXX at XXXXX@umich.edu.**

The University of Michigan Institutional Review Board Health Sciences and Behavioral Sciences has determined that this study is exempt from IRB oversight

A-2. Interview Guide for Communities

1. How do you see renewable energy fitting into your community's long-term plans?
    a. *Do you have community sustainability, economic development, or farmland preservation goals?
    b. *Why not? What are the barriers to incorporating renewable energy into your community plans?
        i. *Can these barriers be overcome?

2. What type(s) of utility-scale renewable energy might be the best fit for your community (wind, solar) and why? If you don't think you're a good fit for a wind or solar project, why not?
    a. Do you see a *physical* space for wind or solar in your community?
    b. What land-use type would you envision (industrial, agricultural, residential, other)?
    c. What are the barriers to securing these sites?

3. How would residents describe your community? Does renewable energy fit into your community's identity?

4. Has your community been engaged with discussions regarding renewables?
    a. Is there active opposition or support for implementation of utility-scale renewables in your community, either from local residents or developers?
    b. What are the primary concerns among or benefits for stakeholders?
    c. What methods of engagement do you see community members using the most? (e.g. social media, in-person events, letters or phone calls, etc)

5. Do your current zoning ordinances mention utility-scale renewable energy, whether that be permissive or prohibitive of development?
    a. Are there plans to change that?

6. Has your jurisdiction taken steps to implement plans and policies related to hosting utility-scale renewables?
    a. *Were there barriers that got in the way of formally implementing these policies?

7. Are you familiar with resources like EGLE webinars and templates, MSU solar trainings, and SolSmart guide?
    a. Which resources have been helpful and why?
    b. Which resources have not been helpful and why?
    c. What additional resources do you need to help with future planning? (e.g., GIS support, resource assessment)
        i. *Would your jurisdiction be likely to take advantage of any of the following resources?
            1. Templates/examples for addressing utility-scale renewables in your Master Plan
            2. Sample zoning ordinances for utility-scale renewables

3. Workshops or training sessions on utility-scale renewable energy planning or zoning
4. A "help desk" to call for help with utility-scale planning or zoning issues
    a. *How do we answer questions from the community?*
5. Matching funding for hiring consultants or staff

8. What financial barriers might your community encounter in changing your zoning ordinances?
    a. From your perspective, are there enough external financial resources available to support your work?
    b. What financial resources has your community applied for or considered in order to support future utility-scale renewable energy development? (e.g., EGLE Community Energy Management Program grants)

9. Barriers to zoning process: What are the greatest challenges in the way of enacting new permissible zoning for utility-scale renewables? (e.g. lack of interest/opposition amongst residents or local officials; development costs; lack of technical expertise; etc)
    a. What do you think it would take for local residents to support utility-scale zoning changes?
    b. If there were a pot of money that accompanies the development, that you could allocate as you want outside of tax benefits, what do you think your residents would want to spend it on?
    c. *Only if they express frustration with the current structure of local-control zoning:* Would it be helpful or detrimental to have the state determine renewable energy ordinances for you?

10. Renewable energy provides potential community wide benefits from tax revenue. To what extent is that considered in the planning process? (e.g. additional funding for road improvement, trash pickup, etc.)
    a. *For permissive communities: How are you communicating the tax benefits to the community?

11. Not necessarily related to energy, what are the major issues on the minds of residents in the township/county? Some examples include shortage of housing, lack of broadband access, need for community centers, etc.

12. Does your community employ mechanisms for local citizens to participate in the zoning process or allow for public input (i.e., town hall meetings/public events, mailers, email newsletters, social media, polls, etc.)?
    a. *How often are these mechanisms employed?
    b. How have you incorporated community feedback into your zoning process? Overall, do you consider community input to be a valuable contribution to the process?

c. What strategies have been successful in limiting opposition to zoning decisions down the road? (or: How effective do you think these interactions with community residents have been?)
d. What resources do you think would be most valuable to assist with community engagement efforts?
   i. Ex: *Newsletter article templates, sample neighborhood meeting materials, social media posts, funds or grants for community engagement efforts, training for staff, etc.

13. If your township were hypothetically undergoing the proactive renewable steps of early community engagement, resource/land assessment, and rezoning, what obstacles would you encounter? For example, staff shortage, low financial resources for community outreach mechanisms?

Closing statement: "Our next step is to select a single 'pilot' community around whom we'll design the first major draft of our program. Would you be interested in future outreach from the Renewables Ready team for further interviews and potential 'pilot community' selection?"

a. *If yes:* We'll describe the pilot opportunity in more detail with a forthcoming email.

A-3. Interview Guide for Developers

1. How does zoning factor into the decision to site a project?

2. What factors other than zoning make certain locations good candidates for utility-scale renewable energy? (e.g., near existing substations/transmission lines, existing community support for renewables)
    a. What non-zoning factors suggest that a location is *not* a good host site?

3. Of all the previous points, which ones are the "must-haves" for a community to be considered attractive for utility-scale renewable development?
    a. Similarly, which factors are guaranteed deal-breakers?

4. How would a developer approach the hypothetical that a community has strong resource and siting prospects, but is either *silently* or *restrictively* zoned for renewable energy?

5. What unique challenges does developing in Michigan bring, especially compared to other states?
    a. Are there any unique advantages?

6. How do you communicate project expectations with landowners, officials, and the community members in areas of potential development?

7. When considering a location for a new development site, do you consider the available workforce in that area?
    a. Do you prefer to hire locals or bring company employees?
    b. How does this decision influence local favorability?

8. What challenges have you encountered regarding land acquisition for utility-scale projects?
    a. What strategies were successful in securing these sites?
    b. Would a community sorting out potential participants ahead of time be beneficial, or do developers want to have a hand in that process?
    c. What land-use types are you prioritizing for utility-scale renewable development?

9. Within a community, who do you primarily work with when developing a project, and to what degree do you interact with the citizens?
    a. From your perspective, is more or less community engagement beneficial to the successful implementation of a project?
    b. When working with communities who have concerns related to renewables, are there certain strategies or persuasive elements you believe are more successful in getting community members on board? For example, tax revenue, farmland preservation, or adopting a unique green identity?

    c. What criteria would go into customizing a project to more appropriately fit a community's needs?

10. There are instances in which extensive community engagement still results in restrictive zoning and no project. What factors contribute to these situations?
    a. What steps can be taken in the future to avoid these situations?

11. Similar to the previous question, there are situations in which projects have begun on seemingly stable footing, then the community withdrew support. What strategies would you recommend to ensure long-term favorability?
    a. In your experience, does the hand-off of a project from developer to local utility, such as DTE, increase or decrease public favorability?

12. We've heard concerns about congested transmission or small corners of the grid that couldn't handle renewable development. What's the schedule/cost benefit analysis of upgrading T&D so that development can start taking off in these areas?

13. As stated before, we're designing a program that will support interested hosts with zoning, land assessment, and community engagement to become "Renewables Ready." We expect the online interface of this program will be useful for both localities and developers, in that developers will be able to easily identify which Renewables Ready criteria a given jurisdiction meets. In short, each community that undergoes the process will have a profile that describes which proactive steps have been taken.
    a. With this in mind, what information would you find useful in a community's "Renewables Ready" profile that isn't easily accessible to you?
    b. Are there any steps in the development process that would be convenient if performed in advance by an external entity? Essentially, what services could our program provide to help streamline development? As an example, our program intends to perform hypothetical setback visualization to advise officials on their options and pre-select parcels for potential development.

A-4. Template Worksheet

Zoning Preferences Worksheet for Large-Scale Wind and Solar in XXXXX Township

1. Throughout the presentation, we will describe each zoning item and provide examples where relevant. After each item, there will be dedicated time to fill out your preference on the zoning worksheet.
2. After the presentation you'll have time to ask questions or brainstorm with neighbors during a cider and donuts break.

Wind:	**Notes:**
1. **The following items should be considered when establishing a setback.** Please rank which ones are the most important to you with "1" being the most desired: _____ Ice Throw _____ Sound _____ Turbine Collapse _____ Subterranean Vibrations _____ Environmental/Wildlife Impacts _____ Other: _____ 2. **Do you think the ordinance should require ADLS (aircraft detection lighting system) or not?** Blinking lights are required by the Federal Aviation Administration. Installing ADLS additionally could be slightly more costly. (Circle one) Yes No 3. **Other wind zoning items:** The following items may also be accounted for in the zoning ordinance.	

Please rank each item by importance with "1" being the most desirable.

_____ Damaged road repair

_____ Turbine paint/finish

_____ Signage

_____ Access Points

_____ Wiring

4. **Do you have any other comments to share regarding wind?** If so, please fill them in below/in "Notes."

Notes:

Applies to Both Wind and Solar:

5. **Desired permits/analyses:** Please check all items that would be *most important* to you, keeping in mind that most of these are typically asked of developers anyway. Please rank your top four preferences, with "1" being the most desired.

_____ Transportation plan: Access roads for installation and maintenance.

_____ Visual simulations: Modeling how the project will look.

_____ Sound modeling study: Predictive sound levels at various distances.

_____ Environmental analysis: Third party qualified consultant conducts analysis on how the

development will impact the surrounding natural environment.

_____ Wildlife impact analysis: Third party qualified consultant conducts analysis on how the development will impact the habitats of local wildlife.

_____ Shadow flicker study (wind specific): Amount of time that turbine shadows hit nearby homes

_____ Glare study (solar specific): Will glare from panels be visible to nearby homes?

_____ Stormwater study (solar specific): How will solar panels affect stormwater infiltration?

_____ Property value assessment: Estimation of a property's financial value.

Solar:

6. **In which districts should large-scale solar be allowed by right?** Please rank your preference with "1" being the most desired.

   _____ Any district (still subject to setbacks and screening requirements)

   _____ Forestry

   _____ Industrial

   _____ Residential

   _____ Business

7. **The following items should be considered when establishing a setback.** Please rank which ones are the most important to you with "1" being the most desired:

Notes:

_____ Sound _____ Visual impacts _____ Lighting (glare visibility) _____ Traffic safety _____ Access to natural light (shading) _____ Other: _____	
8. **Screening:** Is **<u>XXXXX</u>**'s current screening ordinance sufficient for solar? (Choose one) *"All planting screens shall consist of plants… pruned to provide maximum opacity from the ground to a height of 6 feet."* 32 species of evergreen, deciduous, and tree-like shrubs are allowed in the ordinance for plant screening. ● Current screening is sufficient for solar ● Should be more thorough for solar ● Should be less thorough for solar	**<u>Notes:</u>**
9. **Fencing**: Rank which type you prefer with "1" being the most desired. _____ Chain link _____ Wildlife fencing _____ Opaque privacy fencing	
10. **Ground coverage**: Rank which type you prefer with "1" being the most desired. _____ Vegetative cover- no specificity	

_____ Conservation cover

_____ Pollinator Habitat

_____ Forage for grazing

_____ Agrivoltaics

11. **Principal-Use Acreage**: What is “large scale” solar? Anything under the threshold you choose would be considered "small scale" and anything at or above would be considered "large scale." (Circle one)

    1 acre 20 acres

    10 acres 40 acres

12. **Other solar zoning items:** The following items may also be accounted for in the zoning ordinance. Please rank each item by importance with “1” being the most desirable.

    _____ Signage

    _____ Wiring

    _____ Land clearing

13. **Do you have any other comments to share regarding solar?** If so, please fill them in below/in “Notes.”

Notes:

14. **Do you want to be contacted about <u>XXXXX</u>'s small-scale renewable zoning in the future?** If yes, please provide your email address below.	

Appendix B. Pilot Township Survey
B-1. Survey Template

XXXXX & MI REDI Survey

XXXXX Township is partnering with the Michigan Renewable Energy Development Initiative (MI REDI) pilot program to understand your perspectives and questions about large-scale wind and solar energy projects.

Your responses will inform the topics discussed at the XXXXX Township town hall meeting on DATE. Responses are due by DATE and **will be anonymous.**

1. What is your initial impression about a large scale **wind** project in XXXXX Township?

   Mark only one oval.

   - ◯ Absolutely does not belong
   - ◯ Maybe does not belong
   - ◯ Maybe belongs
   - ◯ Absolutely does belong
   - ◯ I need more information
   - ◯ Other: _____

2. What is your initial impression about a large scale **solar** project in XXXXX Township?

   Mark only one oval.

   - ◯ Absolutely does not belong
   - ◯ Maybe does not belong
   - ◯ Maybe belongs
   - ◯ Absolutely does belong
   - ◯ I need more information
   - ◯ Other: _____

3. What would you like to know about large scale **wind**? Check all that apply and/or write your own question.

Check all that apply.

- [ ] How much land is needed to host a wind project?
- [ ] Visual/Noise/Environmental Impacts
- [ ] Land/forest preservation
- [ ] Long-term impacts at the end of life
- [ ] Would the community benefit from a wind project?
- [ ] Other: _____

4. What would you like to know about large scale **solar**? Check all that apply and/or write your own question.

Check all that apply.

- [ ] How much land is needed to host a solar project?
- [ ] Visual/Noise/Environmental Impacts
- [ ] Land/forest preservation
- [ ] Long-term impacts at the end of life
- [ ] Would the community benefit from a solar project?
- [ ] Other: _____

5. Anything else you'd like to share regarding renewable energy?

_____

_____

_____

_____

_____

6. Do you expect to attend the town hall on **DATE**?

   Mark only one oval.

   - ◯ Yes
   - ◯ No
   - ◯ Maybe

7. If you can't attend the DATE town hall, would you like to stay updated through another means of communication? If yes, provide your preferred email below. (This response is optional. By providing your information, your survey will no longer be anonymous, but it will be held confidential.)

B-2. Negaunee Township Survey Analytics

Negaunee & MI REDI Survey

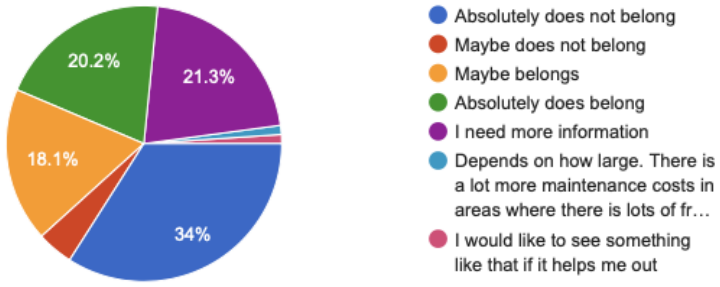
94 responses

Publish analytics

What is your initial impression about a large scale **wind** project in Negaunee Township?

Copy

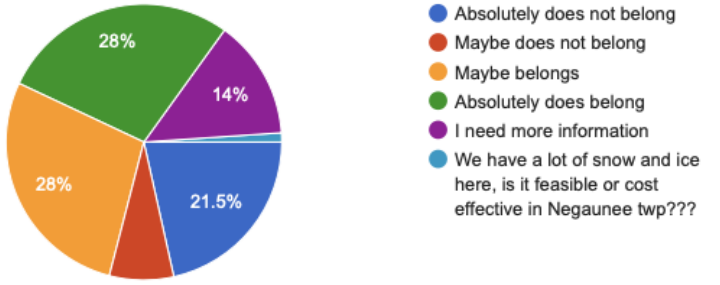
94 responses



What is your initial impression about a large scale **solar** project in Negaunee Township?

Copy

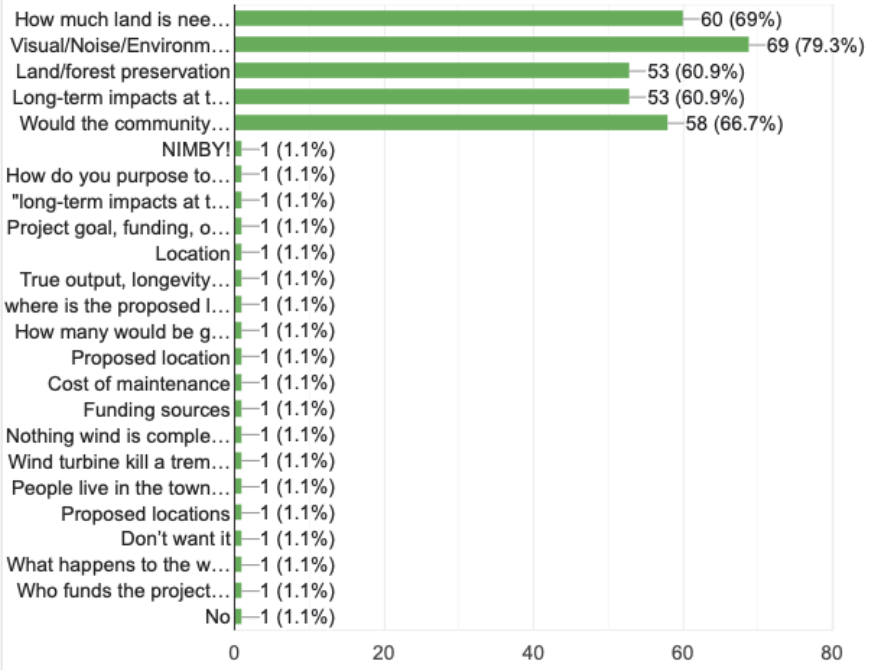
93 responses



What would you like to know about large scale **wind**? Check all that apply and/or write your own question.

Copy

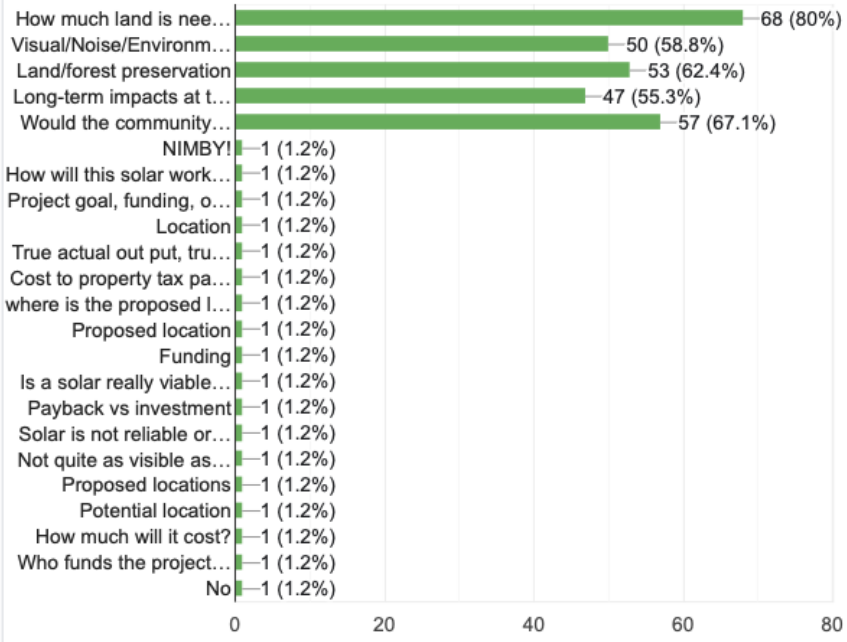
87 responses



What would you like to know about large scale **solar**? Check all that apply and/or write your own question.

Copy

85 responses



Anything else you'd like to share regarding renewable energy?

40 responses

No

The blades from the windmills cannot be disposed of. The solar and wind left residents of Texas without energy during the winter. California has rolling blackouts due to its reliance on solar and wind. California is a leader in wind and solar and cannot produce enough electricity to power homes AND electric vehicles. Look at the replacement costs of EV batteries and you should realize what a sham the effort to introduce wind and solar is.

My only concern would be the impact on atv trails.

Not sustainable, or economical for our region. It's a waste of resources

Renewable energy already assists our township to conserve energy and save money. Let's keep innovating, moving forward, and become a leader in the establishment of renewal energy usage in our township. Negaunee Township could become a model for other townships and municipalities.

Township leaders have done an amazing job in this area! I think establishing renewable energy will be beneficial and open up opportunities.

Having non polluting and tax generating areas of energy production in our township helps to fund services for all residents. I am in favor.

Could there be incentives, subsidies, and/or partnerships with individual homeowners to install small renewable energy sources on our land, so that the "energy eggs would not all be in one basket" in the township?

Forget it, there's lots of fossil available

Clear, concise goals with measurable results. Township office solar array and ability to monitor performance are great model to demonstrate value. While I support efforts in this direction I would be cautious with taxpayer dollars regarding studies and return on investment.

Very excited to hear more about wind and solar options in the Township.

It's a farce. Take away the subsidies and there to expensive. Not reliable especially in northern Michigan.

It can cost way more than it benefits a community sometimes. It should be evaluated properly or we will wind up with an expensive eyesore like the city of Ishpeming has at the senior center

Is the local electrical grid capable of supporting either renewable idea?

Method of financing the project.

I am grateful that Negaunee Township is looking into renewable energy, whether it is agreed upon as a whole or not. Disagreement behind it typically has to do with lack of knowledge and fear of being "replaced". I think showing a comparison between how our current resources hurt the environment, and how they will continue to be more costly vs. how renewable energy will help in the end would be beneficial. Along with a comparison on jobs that might be "lost" or people who might need to be repurposed due to the energy source changing. People fear what they do not know and it's a heck of a lot easier for many to be ignorant so the more truth about the impacts you can share through kindness and with the understanding that people are just afraid of a change, the better!

Necessary as demand for electricity will only increase with electric vehicles and needs due to climate change.

I oversaw the analysis of impacts to wildlife of many large-scale wind projects as a federal regulator. The impacts of any particular project are dependent on the siting and operation. Society needs more renewable energy projects, but they must be sited in areas where impacts are minimized.

I am 100% for small scale renewable enery that does NOT impact local wildlife or environment. I do NOT support large scale solar or wind energy in our township.

Is this a supplemental energy source or intended to replace the primary sources?

Save it for the city folks with EV's.

I believe in it and support it but would want to know how the environment would be impacted where the installation would be built.

Cost benefit analysis is the key to be sustainable

Not related to renewable energy but wanted to comment I think better use if funds would be to help the neighborhoods become more walker/kid/family friendly by building sidewalks/paths along busy roads (north road, Kivela road, etc) as it's currently unsafe and someone is going to get hurt. A lot of people are trying to be healthier but this is a roadblock. Too many close calls have already happened

Is it safe for animal habits and the birding community

We totally support wind & solar answers to help our environment .

Current technology impacts the environment in a negative way due to the amount of energy it takes to produce it and the lack of proper disposal. The parts don't decompose in a timely fashion or in a soul friendly way.

We're especially concerned about bird deaths from wind turbines.

Who pays for the installation and materials?

It is not reliable hurts the environment and is expensive

It's extremely important but should be located in already disrupted and/or vacant (ie. Abandoned by industry) environments

Neither of these create very many jobs. It seriously impacts the quiet and peaceful nature of the township where we live with nature. That is why people move here. Don't turn the township into an industrial site.

The people that live near these windmills do not like having them

It's very exciting, absolutely eager to learn more!

I don't like large scale projects as in acres of solar panels. Very disturbing. But as a home owner I am interested in small projects with a direct benefit to township citizens

If the township population gets it's electricity from We energies or BLP, where do we benefit from producing our own?

Consider rooftop solar, solar-topped parking structures.

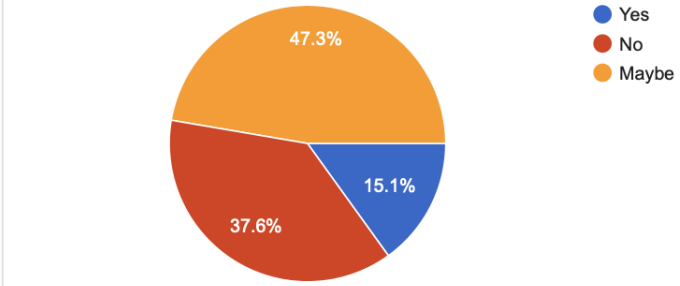
I am very in favor of renewable energy projects, but forest preservation is also very important.

No

Do you expect to attend the town hall on **Wednesday, October 19th**?

Copy

93 responses



B-3. Milton Township Survey Analytics

Milton & MI REDI Survey

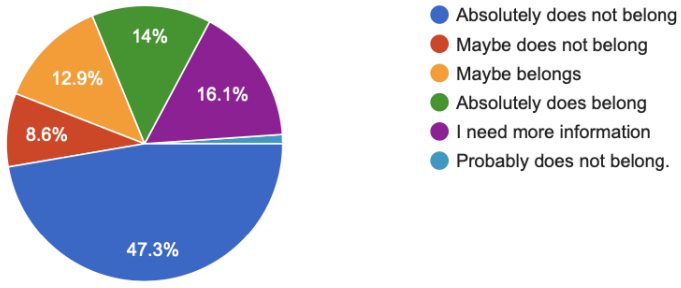
93 responses

Publish analytics

What is your initial impression about a large scale **wind** project in Milton Township?

Copy

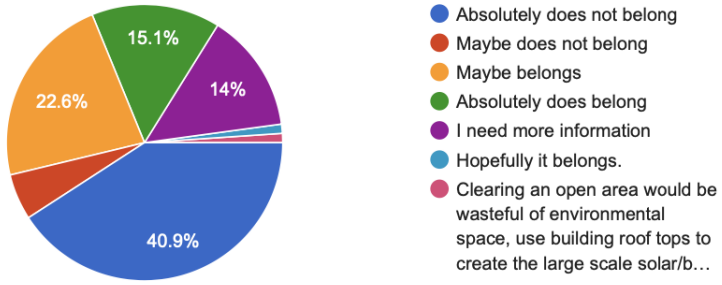
93 responses



What is your initial impression about a large scale **solar** project in Milton Township?

Copy

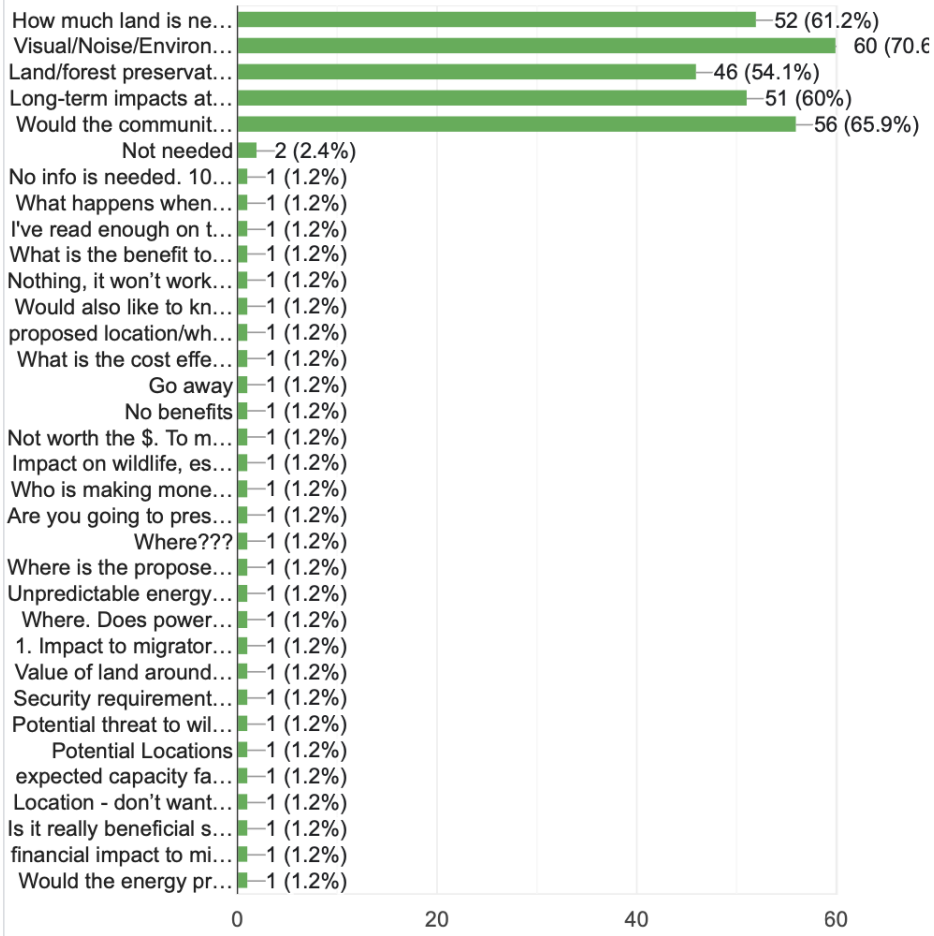
93 responses



What would you like to know about large scale **wind**? Check all that apply and/or write your own question.

Copy

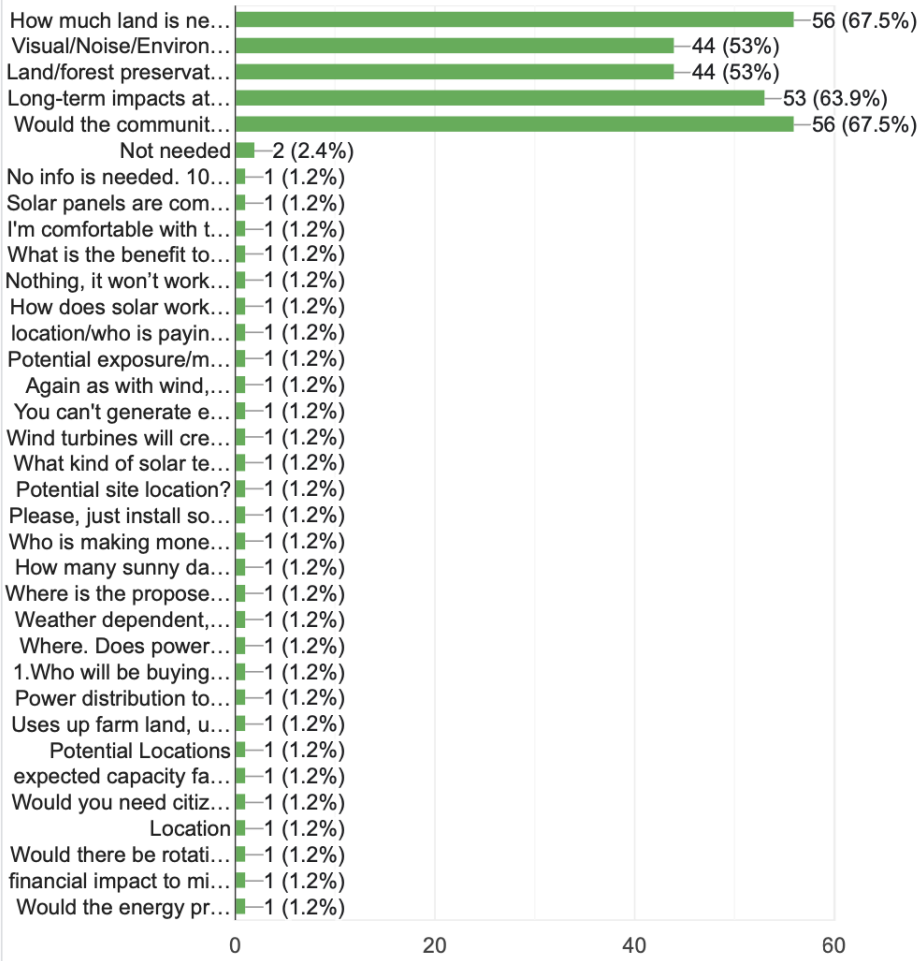
85 responses



What would you like to know about large scale **solar**? Check all that apply and/or write your own question.

Copy

83 responses



Anything else you'd like to share regarding renewable energy?

47 responses

Please pass rules that HOA cannot block residential solar in Milton Twsp. We need to ensure all residents have the right to have solar.

Please watch the documentary titled Windfall. Also, please review the statistics on how many bats, birds of prey, and other birds have been killed and/or negatively affected by the use of renewable energy sources.

wind and solar is good but needs to be dual usage. If you put in solar and allow vegetables grow underneath it or allow sheep to graze under it. We don't want to loose our farmlands. That is the only way this would work for Milton Township.

If someone can guarantee no blackouts and lower energy costs under penalty of perjury then I'll sign on, but if not then no way.

Do we get incentives? Tax breaks?

I have heard that our area has one of the Lowest number of sunny days in the country (actually heard lowest.) Even if this is remotely accurate, it seems to preclude the value of solar energy in our community. I would hate to see Any investment in land or tax money if this is the case. Has this been assessed? I would hate to see us jump on a bandwagon without substantial evidence of ROI in dollars, time, and resources. I know Very Little about wind, so don't have enough information to even have an opinion…unless it was in my backyard…

Personally, I like the look's of farmland, more than solar panels in our township

Everyone I know has absolutely regretted allowing solar and wind on their land/in their community !!!

Yes mirror array systems are my choice they work all year long and during the daylight hours. The energy they produce is equivalent to hydroelectric dams. However a battery system is still needed to collect the energy for nightime hours. An old estimate from modernmarvels was each unit would cost $250,000 vs solar $3,000,000 per unit.

We need it!

If farm ground is taken out of production for energy, where are we going to get our food?

I think it's stupid. Southwest Michigan is one of the least sunniest places in the world!

Why not more nuclear power, it is the most cost effective and efficient?

We can set a great example for Michiana doing this.

What are the potential pluses for Milton; is township receiving kickback; would it be optional to have to pay taxes for it? Will this go to referendum? How long and much has Milton township been looking into this?

Was township approached or did hyou approach someone? What are benefits/concerns so close to houses.Meicall

Renewable energy is essential for a better future, even if some sacrifices have to be made. We are considering installing solar panels in our home.

Climate change is a shame. 6,000 year old earth is not going away

Gas and coal are also renewal

What prompted the partnership?

The country needs every renewable energy project that we can provide. The township is in a great position to provide energy with its high transmission lines.

Can I get a small unit in my yard ?

Is the juice worth the squeeze

Both are a waste of time and $. Not much danger to the environment and not worth the cost

I generally think it's a good idea but would like to understand it better

Nuclear has the least environmental impact and is the most efficient.

How much my property value will decrease? What are the health effects it has on me and my children?

How much "non-green" energy does it take to make the equipment to produce green energy? What is the initial cost and how much time will it take to pay that back and see a benefit? And what is the plan to dispose of equipment that can no longer be used since I understand a lot of it cannot be recycled?

Financials - where does the initial investment come from? What is the return on investment? Where does the generated electricity money go? Do the current local wires / connection to the grid need to be upgraded?

Please consider the entire system "costs" (mining for materials, environment, pollution, cost) associated with obtaining the materials needed for solar and wind systems, their

environmental impact (would you want them in your backyard), the maintenance costs and the environmental impacts associated when they must be discarded (would you want them discarded in your backyard?). Simply looking at these technologies exclusively when they are installed does not provide a fair assessment of issues associated with these technologies. We demand a wholistic analysis of these technologies from the initial stage of obtaining materials needed for manufacturing to the point of discarding the systems/subsystems once they no longer function.

Europe.

All for it

If a home owner wants to invest for their own use, fine. Do not want large scale solar or wind farms in Milton!!

No

Don't fully understand how using up all that land for solar is better than just using nuclear power. Much smaller footprint and safe on nuclear.

Why can't we make it more accessible to private people

Individual wind and solar opportunity, support

See reasons against above

Renewable energy is the future whether one likes it or not. We need to embrace advances in green/sustainable technology for our growing energy needs and step up to act in the responsible way for benefitting future generations and our planet.

Need long term plan, versus quick implementation. When and how will I get my questions answered per above. Milton Township lead / contact person and contact info.

Encourage homeowners in some fashion to do something on their own property

plans for energy storage (battery, hydrogen cells, pumped storage)

This is not wise for our small township. Wasting time. Fix the roads first!

Will the community really have say or has it already been decided to move forward?

where is this project anticipated to be installed

I am concerned how these renewable energy projects affect the rural character of our township. Would these type of projects be allowed to clear land that is host to native plants

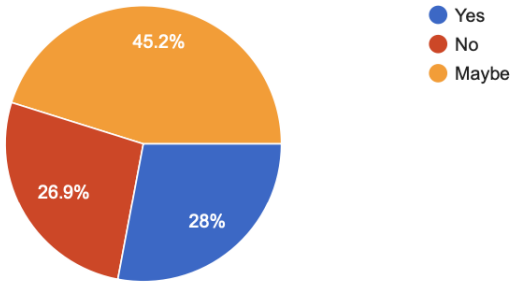
and wildlife? Who would hold these companies responsible for the decommissioning of these projects? Could we mandate that the power that is created through these sources be used locally so that we could enjoy its benefits rather than be sold to others while we experience the loss of the open spaces that they occupy? What kind of revenue, jobs, etc. could we expect them to bring? What about the impact on local traffic during the construction and afterwards?

I'm concerned about the noise and light pollution as well as the loss of farmand and woodlands created by these type of projects.

Do you expect to attend the town hall on 10-26?

Copy

93 responses



Appendix C. Resource Assessment Methodology

The MI REDI team used several pieces of software to perform a resource assessment, including the Energy Zones Mapping Tool (EZMT), ArcGIS Pro, and Excel. EZMT is an online mapping tool that displays resource potential for wind and solar, including multiple weighted factors such as wind speed, sunlight availability, land cover type, distance to substations and major roads, slope, population, whether the area is a habitat or protected land, and more. A shapefile data of the township's parcels were added on top of EZMT's resource potential visualization to visually identify parcels that may be suitable for renewable installations. Based on that, the team used the buffer function from ArcGIS Pro to display various setback distances originating from nearby residential parcels and roads. Maps with varying setback distances and example locations of available land for each were the final product. For wind, the visualized values were a property line setback of 1.5x, 3x, and 5x a 500-hub height turbine; for solar, we applied a 150, 300, and 500-foot property line setback.

Then, for each setback, MI REDI selected a continuous, non-excluded "patch" based on transmission lines, substations, and resource potential and measured its acreage. This step was arbitrary but largely intuitive—for example, Negaunee's optimal patch was the only continuous space not excluded by the setback, proximal to transmission and substations, and of at least average relative resource potential. For solar, the acreages of available "patches" were extremely large. As such, to estimate how large an actual installation on that plot would be, buffers of 150, 300, and 500 feet were applied to every property line *within* the selected patch to visualize a percentage of a patch's total acreage that would be available and excluded.

Based on these final acreage values, the team produced an estimate of how much wind or solar could go into the respective space and how many homes this could power. This process was repeated for each setback to clearly illuminate the reduction of hypothetical generation as setbacks increased. Resource potential was not involved in the calculation; it was simply used as a selection criterion for which "patch" to measure the acreage of. The following is a step-by-step description of the process described above.

In-depth process:

EZMT

1. **Add township as new analysis area:** EZMT > Main Menu > New Analysis Area > Upload. Then select the township geographical data in a Shapefile format, containing polygon or multipolygon features, in a ZIP archive; or a GeoJSON file, containing polygon or multipolygon features.
2. **Add utility-scale wind suitability analysis model:** EZMT > Main Menu > Analyze. In the Models, choose Land-Based Wind Turbine (100m) and click Actions. There are models at different heights, choose one based on the need. Adjust the Weight for different factors as needed.

3. **Add utility-scale solar suitability analysis model:** EZMT > Main Menu > Analyze. In the Models, choose Utility-scale Photovoltaic Solar (PV) and click Actions. Adjust the Weight for different factors as needed.
4. **Visually check the suitability for utility-scale renewables of the township:** EZMT > Map Contents. Right-click My Analysis Areas and select Zoom to layer extent. Uncheck different layers for comparison.
5. **Optional:** Due to uniform solar resources across most of Michigan, removing the solar radiation from EZMT's model visually emphasizes other factors like slope, clearer land, road proximity, etc. We found this useful in preparing visualizations for the township.

ArcGIS Pro

1. **Create a new project:** Once logged into ArcGIS Pro, create a new project in a desired folder and name the project.
2. **Connect the data folder and add needed data:** Insert > Project > Add Folder. Add the folder where the needed data is located. Once the folder is added, it will appear in Catalog on the right. Add the following shapefiles: township parcel map and zoning map (available from township: Negaunee Township, Milton Township), transmission lines (available from Homeland Infrastructure Foundation Level Database (HIFLD)), substations (available from Homeland Infrastructure Foundation Level Database (HIFLD)), and primary roads (available from U.S. Census Bureau, Department of Commerce). Arrange the layers for better visualization in Contents on the left.
3. **Clip nationwide data to the needed size:** Analysis > Geoprocessing > Tools. In the Find Tools search box, type Clip and select Clip (Analysis Tools). Choose Roads as the Input Features or Dataset and township as the Clip Features. Give the Output Features a proper name then click Run. Repeat this process for transmission lines as the Input Features or Dataset.
4. **Select residential area:** Map > Selection > Select By Attributes. Select the township as Input Rows and New selection as Selection Type. Click Add Clause, then select the field that represents land cover type. Leave the second column default as "is equal to". And in the last column choose whichever represents the residential area. Add more clauses if needed. As the selected areas are highlighted, move on to the next step.
5. **Create a layer for residential areas:** Date > Selection > Layer From Selection. Make sure the township layer is selected in the Contents. Rename the new layer as needed.
6. **Create setbacks from property lines and major roads:** Analysis > Geoprocessing > Tools. In the Find Tools search box, type Buffer and select Buffer (Analysis Tools). Choose residential areas as Input Features. Name the Output Feature Class in a proper way. For Distance, choose the needed unit (e.g. US Survey Feet) and type the value (e.g. 750). Leave the Side Type, End Type, and Method as default. Select Dissolve all output features into a single feature as the Dissolve type, then click Run. Repeat this process multiple times for different property lines and road setback distances. MI REDI used 1.5x, 3x, and 5x from a hypothetical 500-foot turbine.

7. **Calculate a patch size:** Map > Inquiry > Measure > Measure Area. For each setback, MI REDI selected a continuous, non-excluded "patch" based on transmission lines, substations, and resource potential. This was done arbitrarily, but was quite intuitive (for example, Negaunee had a large, non-excluded, transmission and substation adjacent patch in the center of the township.) In ArcGIS Pro, use the Measure Area function to draw the outline of the wanted patch and determine its acreage.
8. **Change symbology for each layer:** In the Contents on the left, and right click on the layer that needs symbology change and select Symbology. Change the color, outline, size, and other properties as needed.
9. **Create map layout:** Insert > Project > New Layout. Choose a desired layout according to the wanted map product. Add map into the layout by selecting Map Frame. Adjust the scale as needed. Add Legend, North Arrow, Scale Bar, Title, and other map elements in the Map Surrounds and Graphics and Text. Adjust the layout for better visualization.
10. **Optional:** Utilizing external software, the resource assessment map from EZMT can be overlaid with the setback map from ArcGIS to assist in patch selection and as a visual aid to the township.
11. **Optional:** As described above, for solar, the acreages of available patches were both extremely large *and* virtually unimpacted by an increase of property line setback (manual acreage measurement as detailed in Step 7 yielded nearly the same patch acreage). As such, to estimate how large a "real" installation on that plot would be, a buffer of 150, 300, and 500 feet was applied to every property line *within* the selected patch to visualize a percentage of a patch's total acreage that would be available and excluded. This percentage would then reduce the total acreage of the patch to yield our "real" acreage.

Excel: Each hypothetical setback yields not only a visual aid, but based on the best patch selected (again, arbitrarily), a quick calculation on the capacity, number of turbines/panels, and homes powered from theoretical development on that patch could be performed. The following assumptions were used to perform this calculation based on a single initial value: the acreage of the "best" patch.

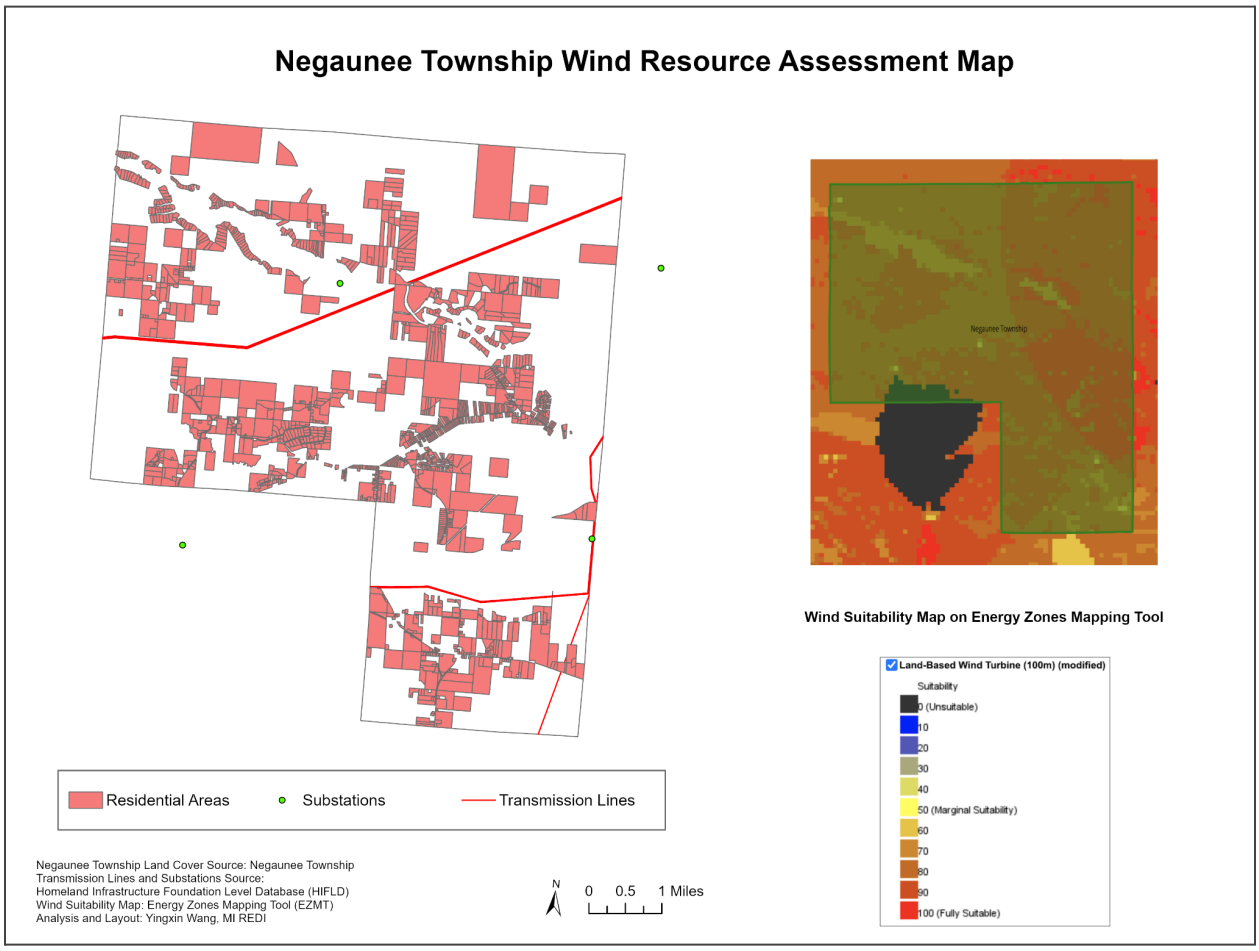
Acres per turbine	MW per turbine	Homes per turbine	PV panels per acre	Acres per MW	Homes per acre of PV
80	2.5	1,000	2,000	10	20

Final visualizations and calculations can be seen in the Appendix D. "Resource Assessment Maps."

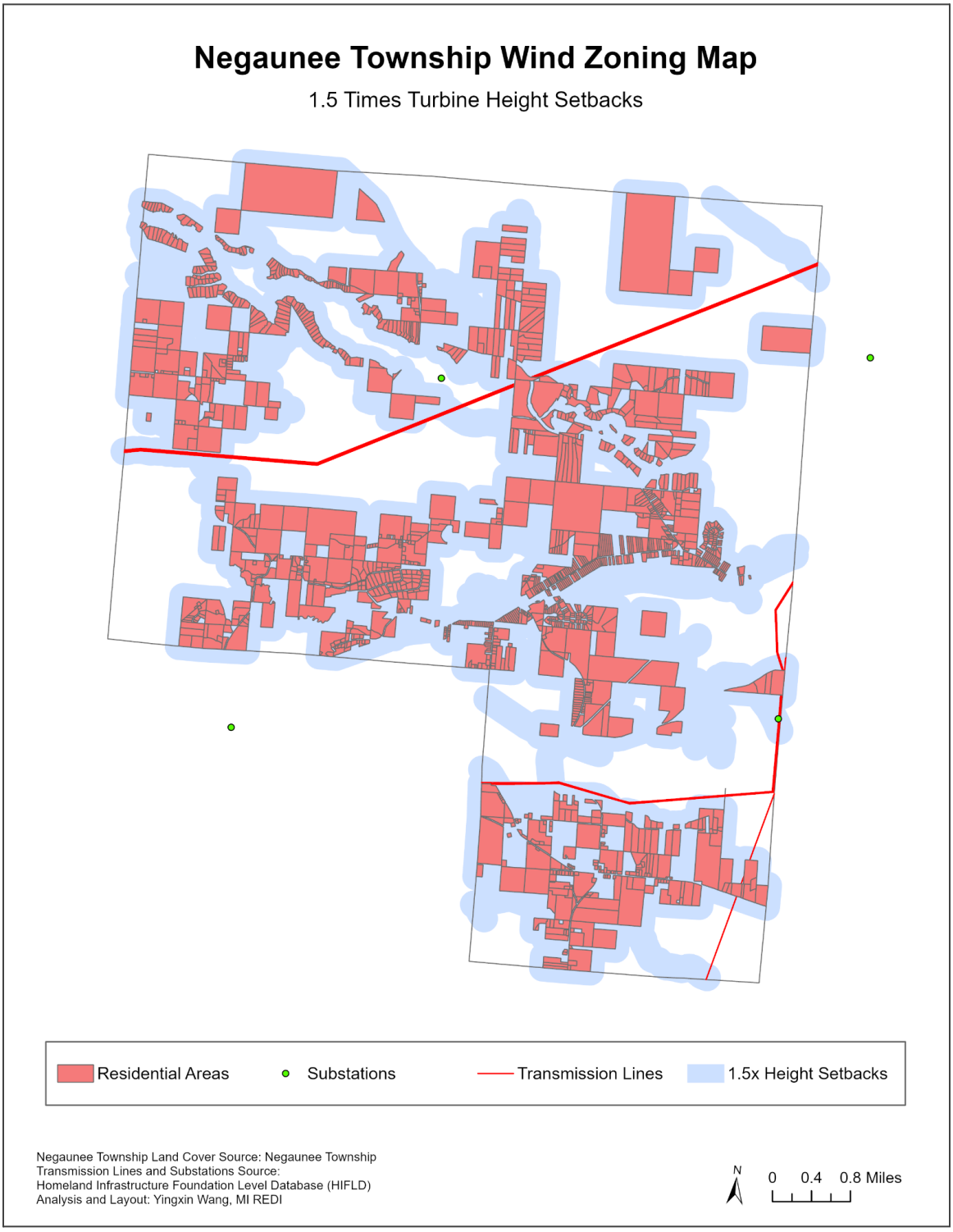
Appendix D. Resource Assessment Results

Negaunee Township:

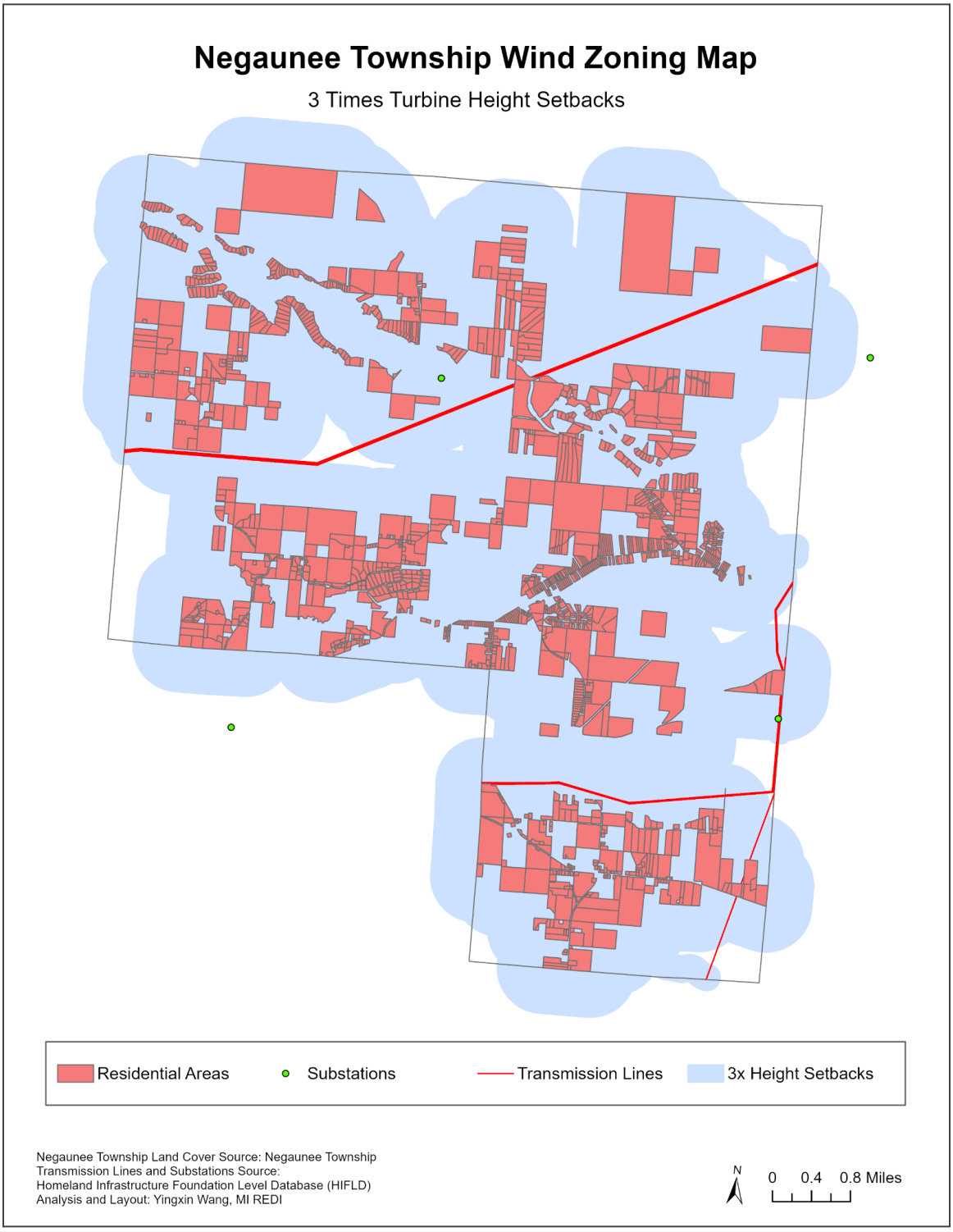
Negaunee Township's residential parcels and transmission infrastructure are shown in red on the figure to the left. Wind resource assessment map with Negaunee Township land cover map and wind suitability model on Energy Zones Mapping Tool (EZMT) is included on the right.



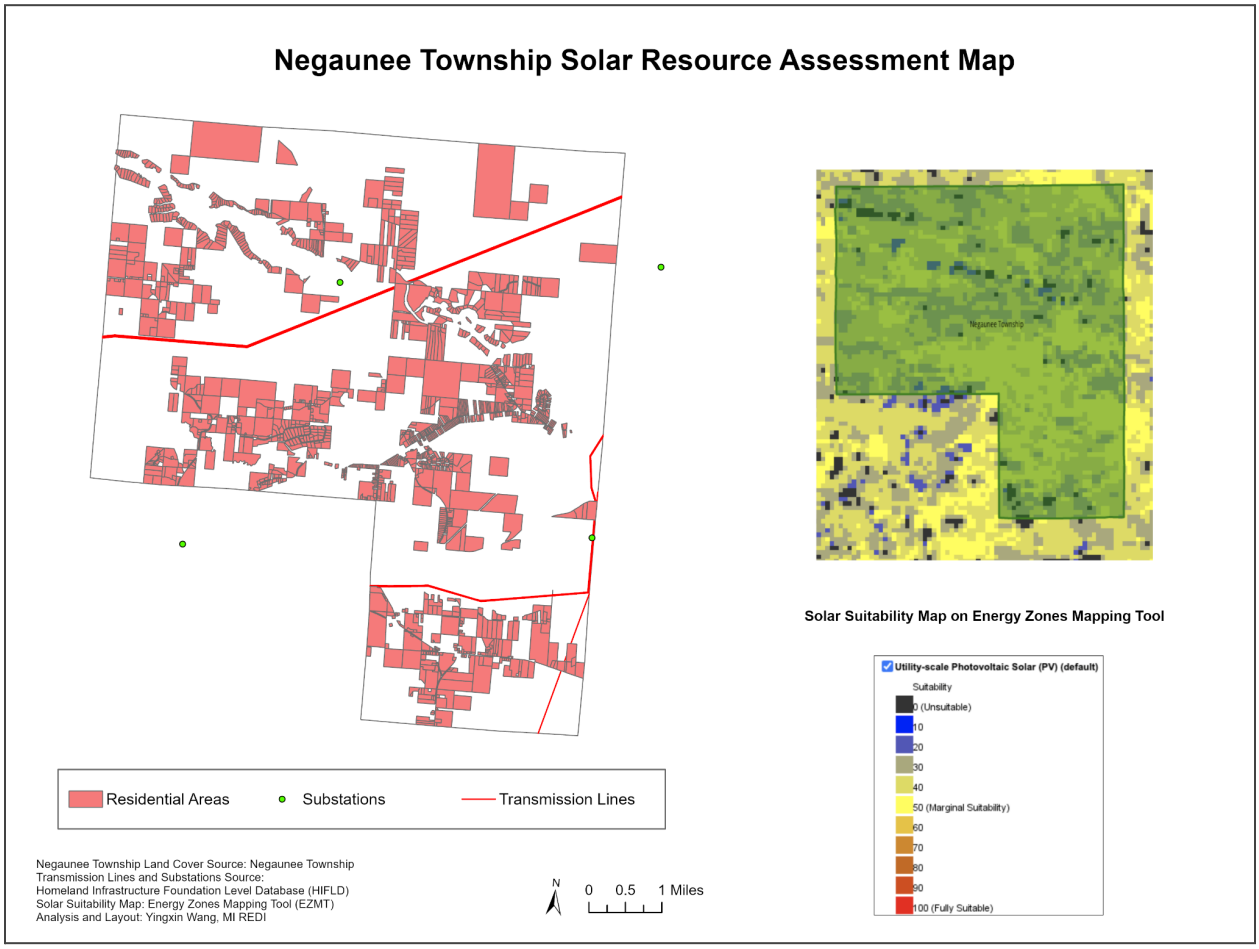
Wind Zoning Map with 1.5 times turbine height setbacks (750 feet) from property lines



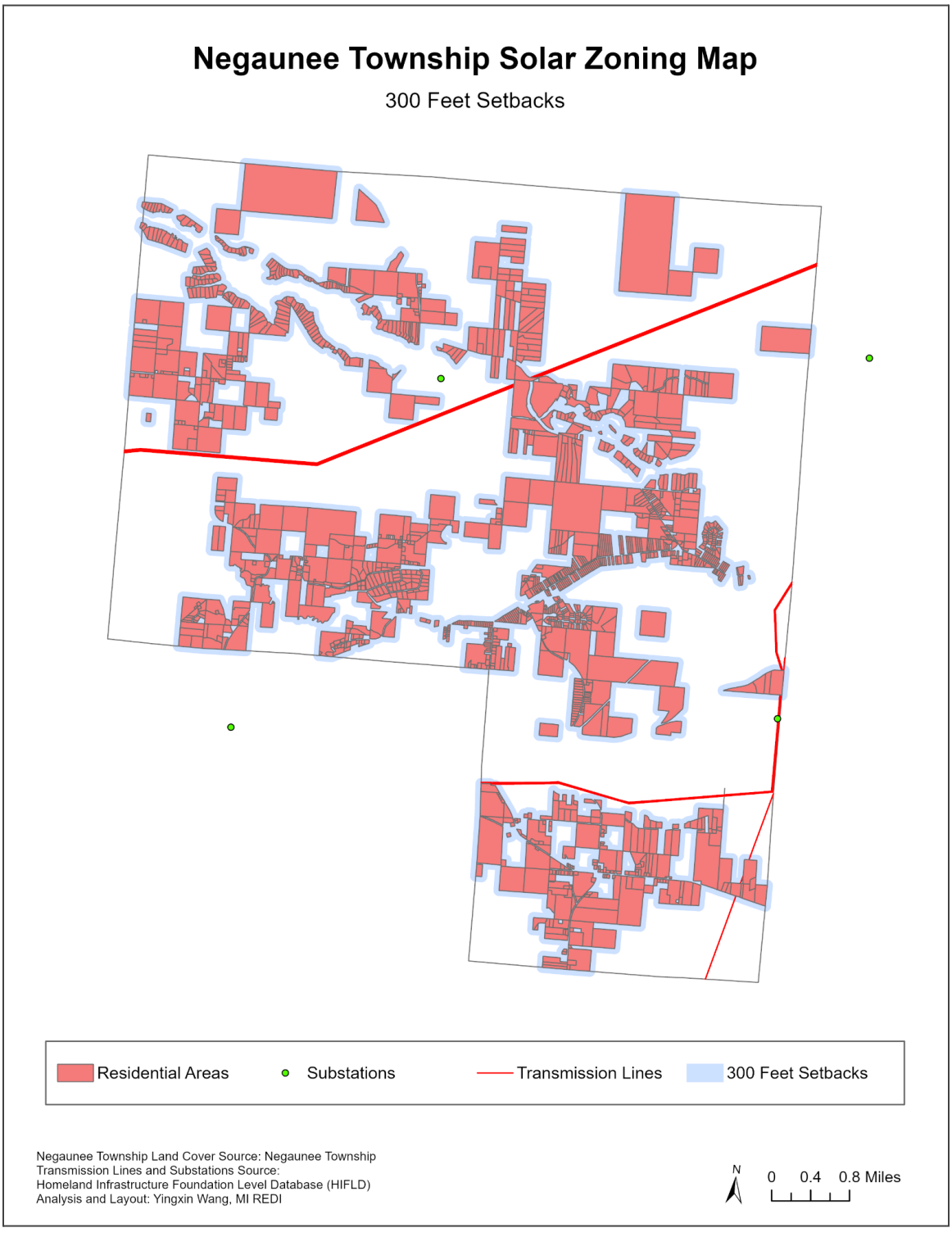
Wind Zoning Map with 3 times turbine height setbacks (1,500 feet) from property lines



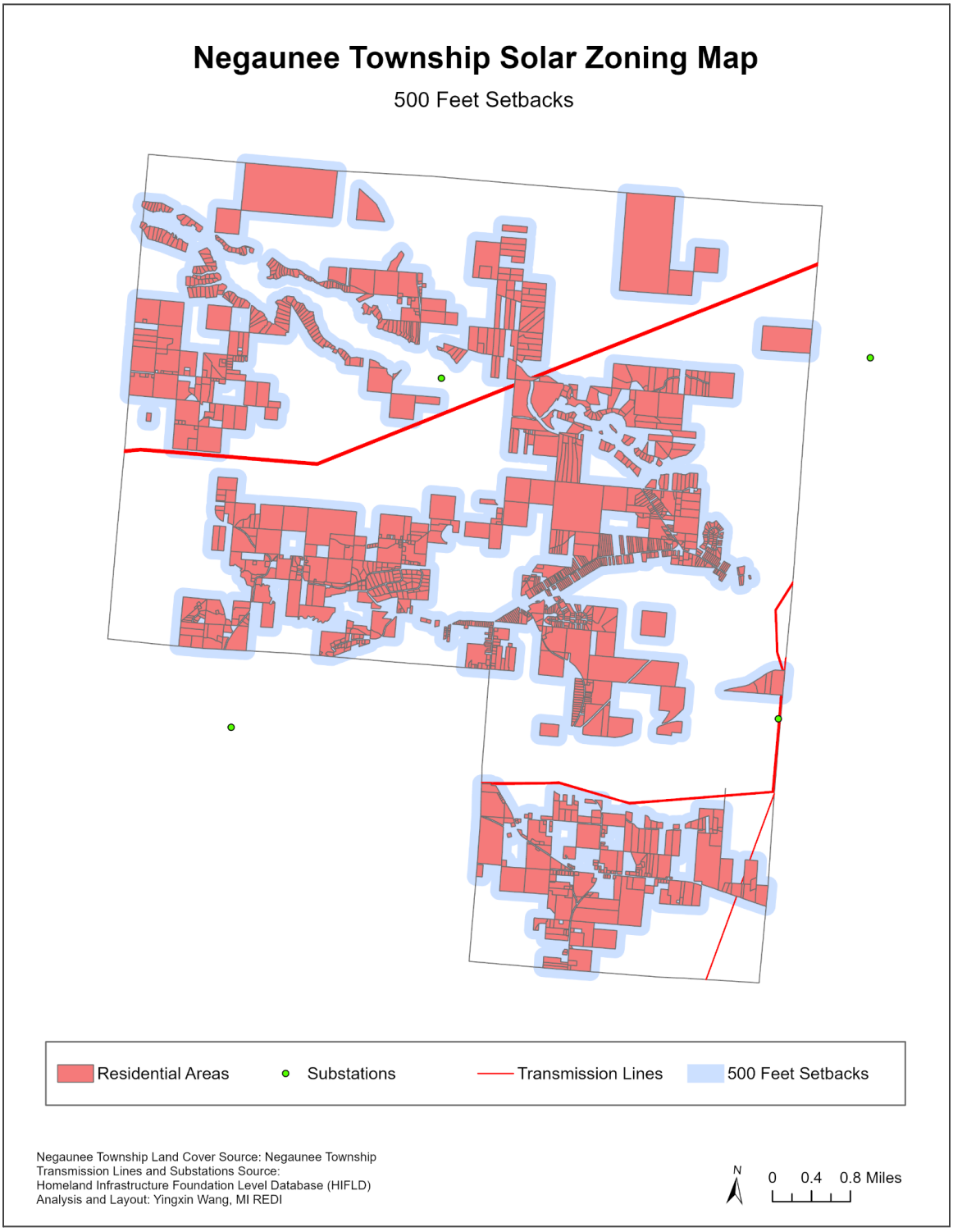
Negaunee Township's residential parcels and transmission infrastructure are shown in red on the figure to the left. Solar resource assessment map with Negaunee Township land cover map and solar suitability model on Energy Zones Mapping Tool (EZMT) is included on the right.



Solar Zoning Map with 300 feet setbacks from property lines

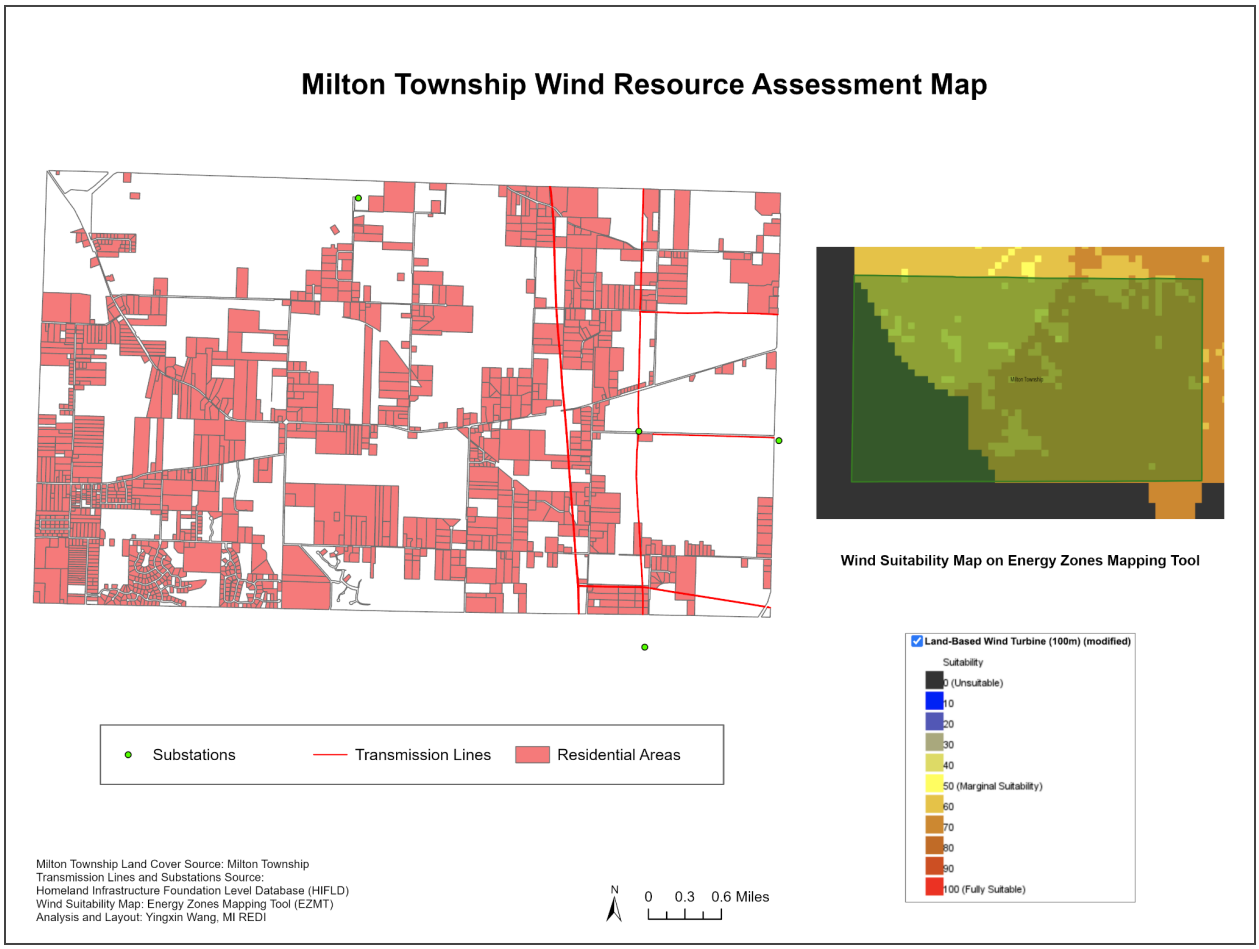


Solar Zoning Map with 500 feet setbacks from property lines

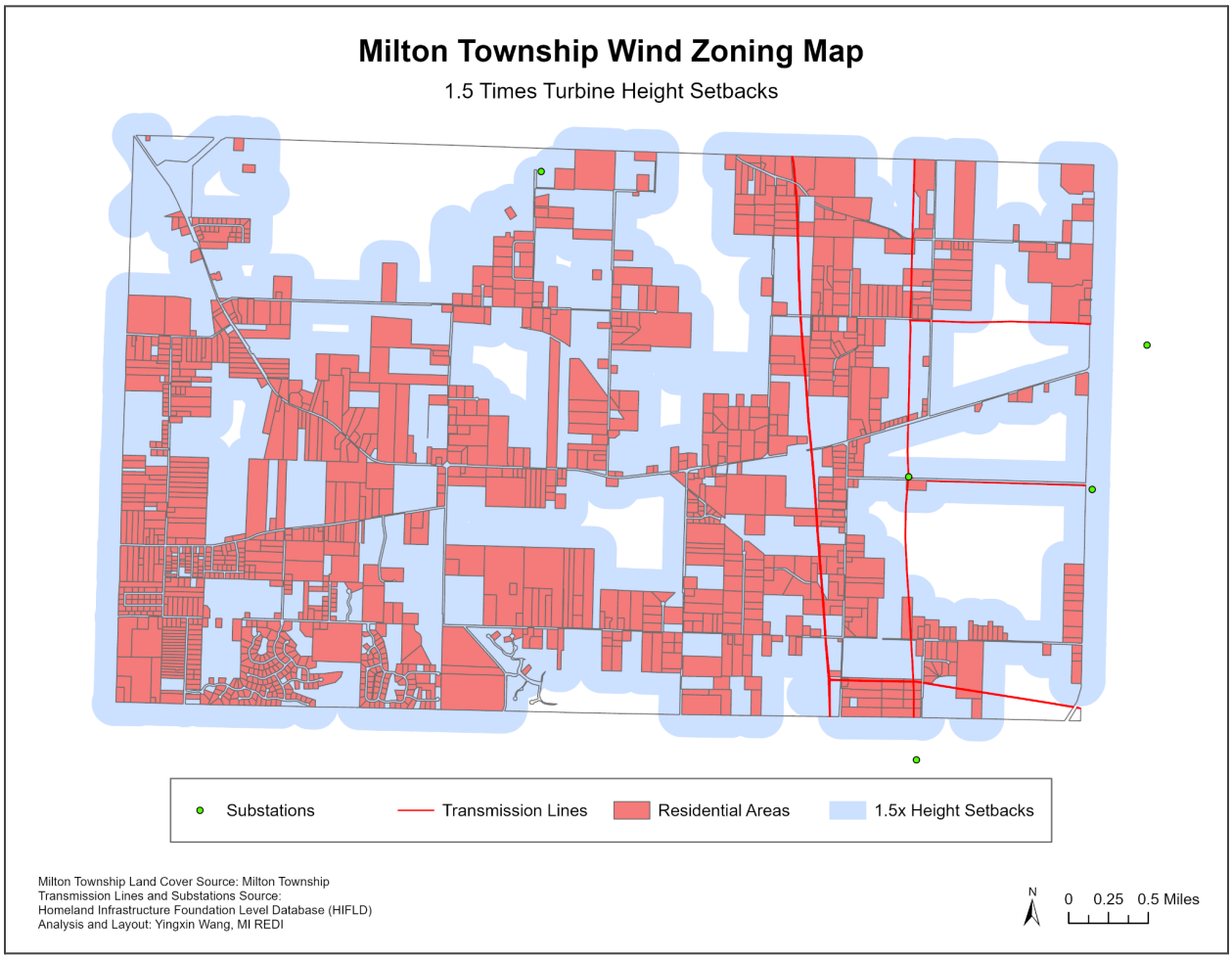


Milton Township:

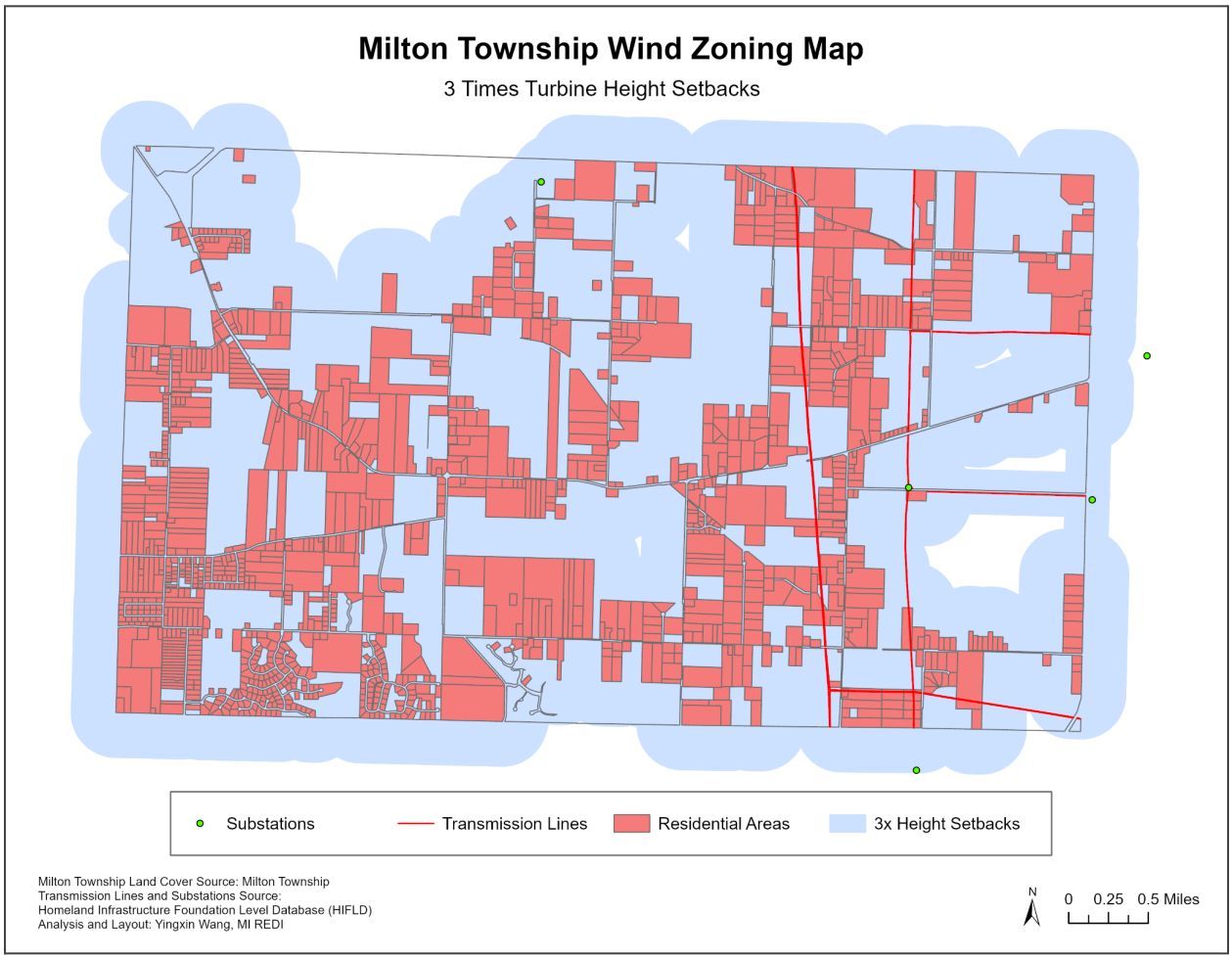
Wind resource assessment map with Milton Township land cover map and wind suitability model on Energy Zones Mapping Tool (EZMT)



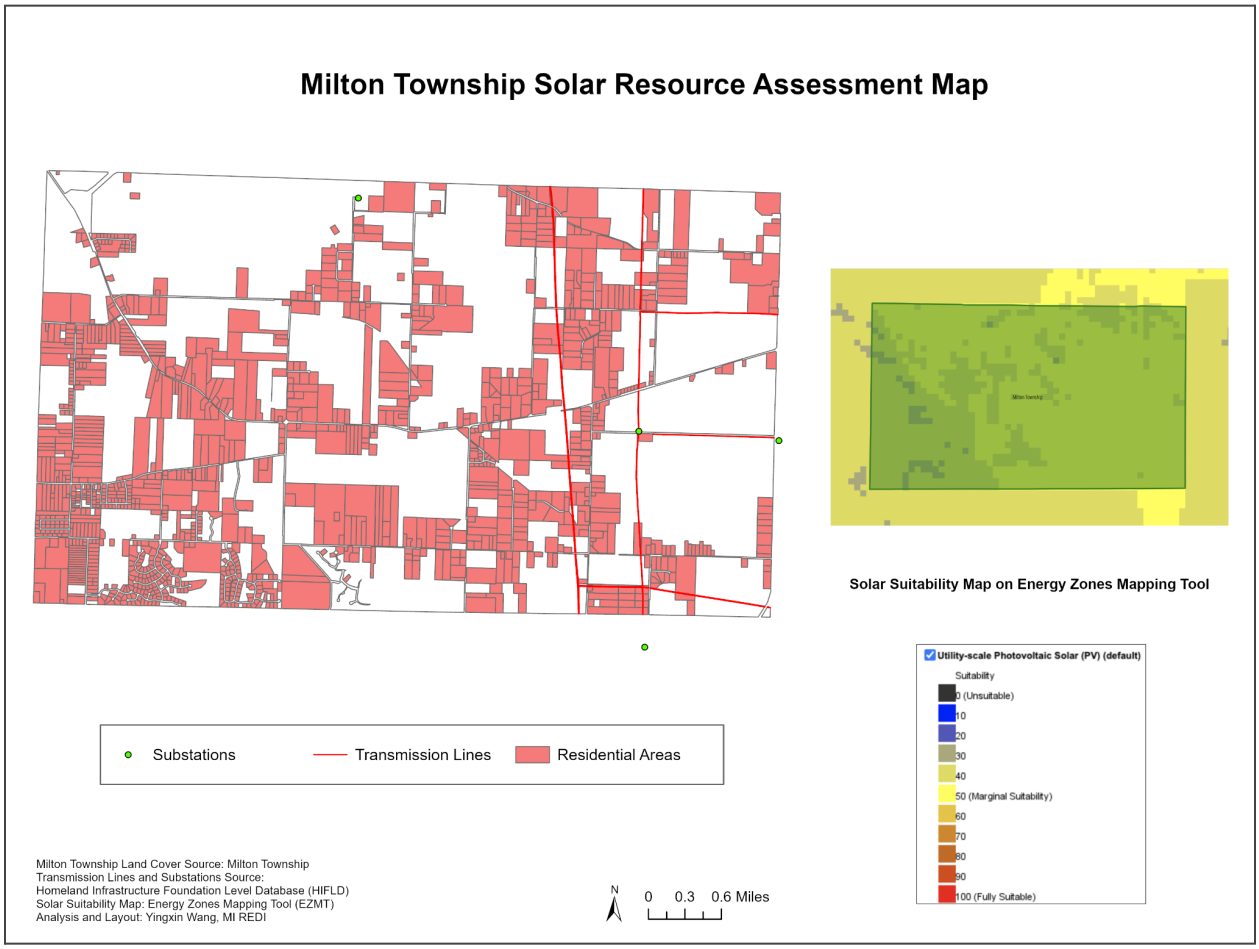
Wind Zoning Map with 1.5 times turbine height setbacks(750 feet) from property lines



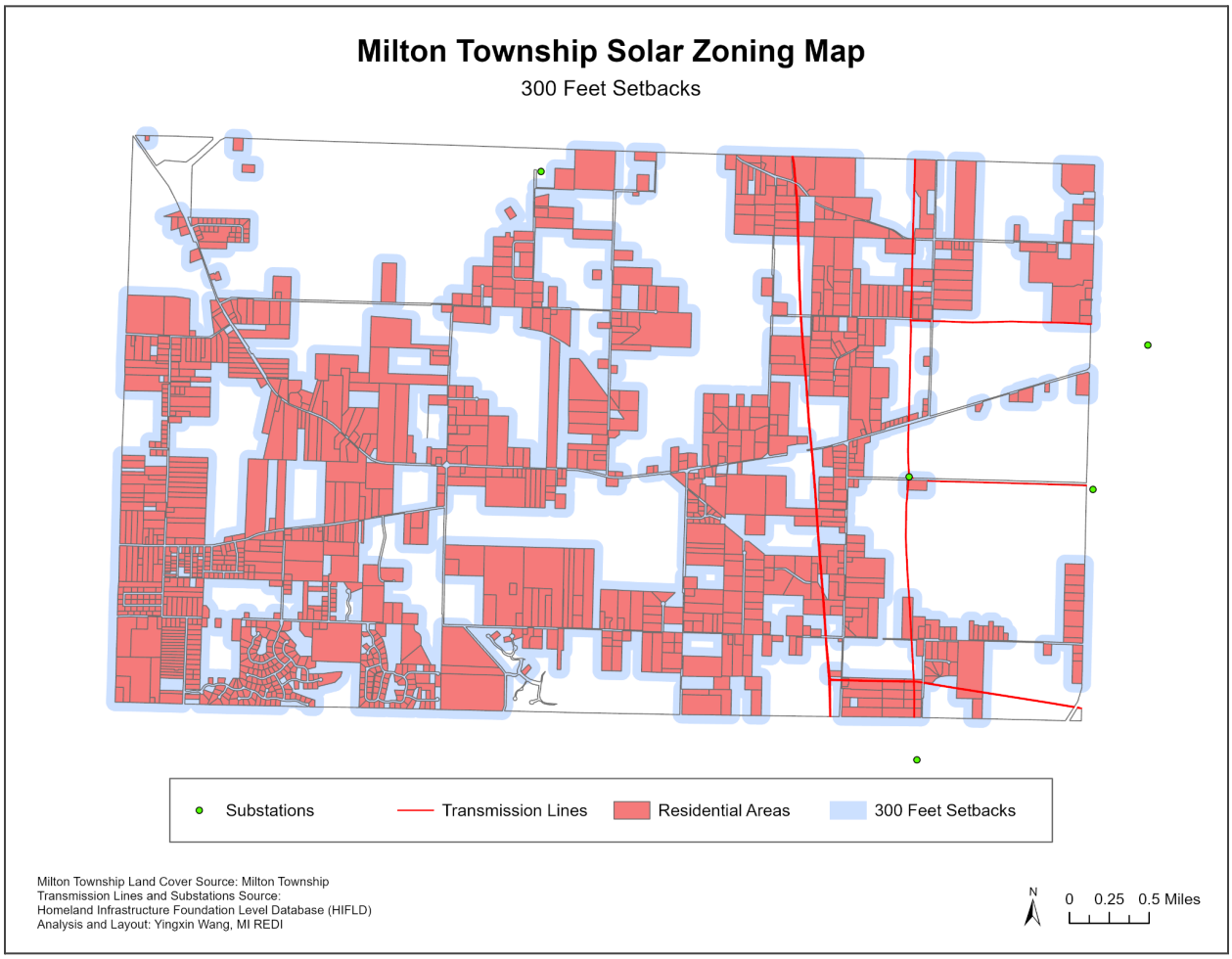
Wind Zoning Map with 3 times turbine height setbacks (1,500 feet) from property lines



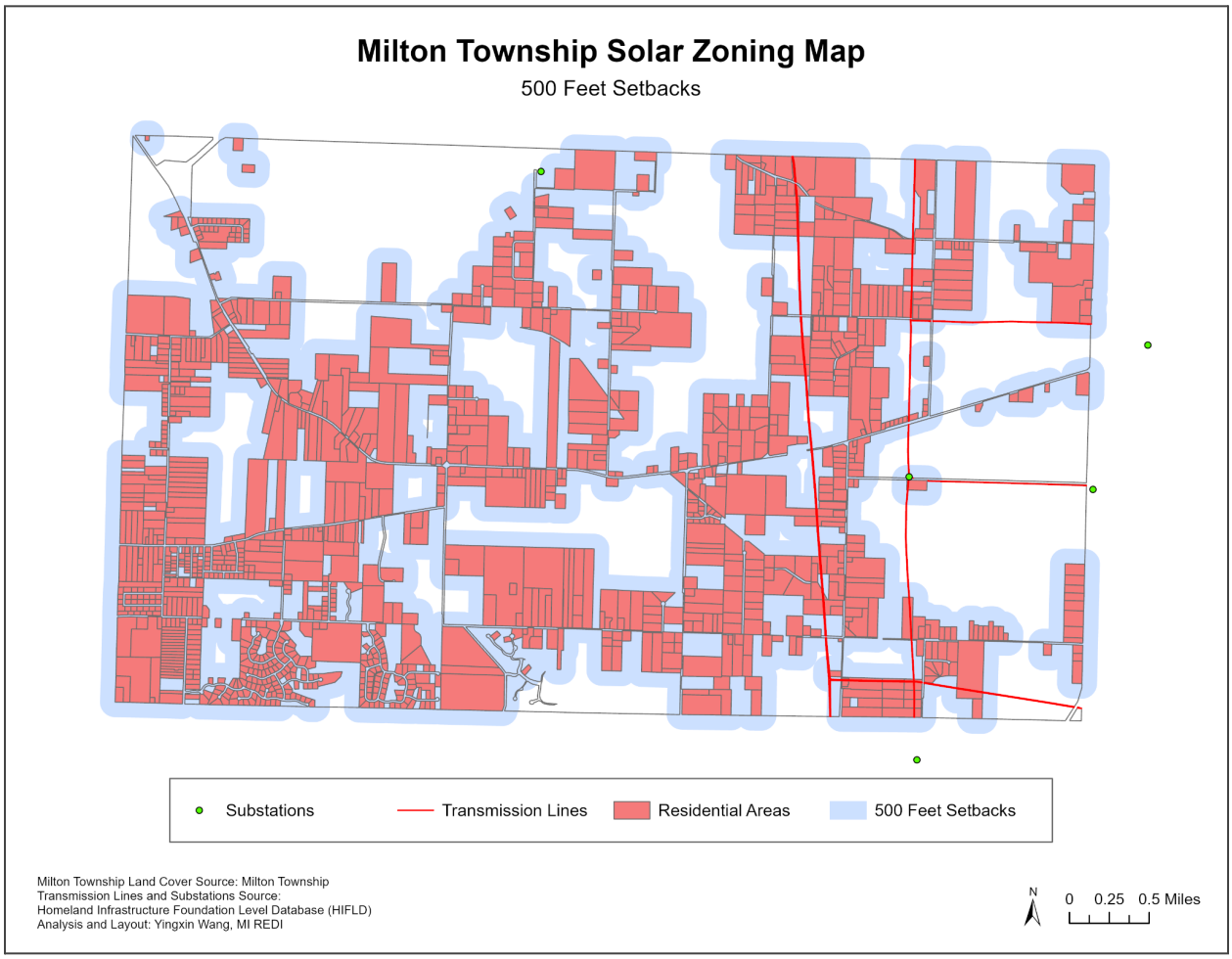
Solar resource assessment map with Milton Township land cover map and solar suitability model on Energy Zones Mapping Tool (EZMT)



Solar Zoning Map with 300 feet setbacks from property lines



Solar Zoning Map with 500 feet setbacks from property lines



The following tables present the results of the methodology detailed in Appendix C that sought to estimate the actual size of a wind or solar installation, based on setback, residential parcel distribution, and resource potential, for each township and setback amount.

The calculations for wind in Negaunee Township are as follows:

Setback (hub height multiplier, assuming 500 ft)	Acres of best patch	# Turbines	MW of farm	Homes powered
1.5x	1300	16.25	40.6	16,250
3x	660	8.25	20.6	8,250
5x	110	1.375	3.4	1,375

The calculations for solar in Negaunee Township are as follows:

Property line setback	Acres of best patch	Acres of best patch with internal property line buffers applied	# Panels	MW	Homes powered
150 ft	~1050	870	1,740,000	87.0	17400
300 ft	~1050	703	1,406,000	70.3	14060
500 ft	~1050	517	1,034,000	51.7	10340

The calculations for wind in Milton Township are as follows:

Setback (hub height multiplier, assuming 500 ft)	Acres of best patch	# Turbines	MW	Homes powered
1.5x	570	7.125	17.8	7125
3x	370	4.625	11.6	4625
5x	140	1.75	4.4	1750

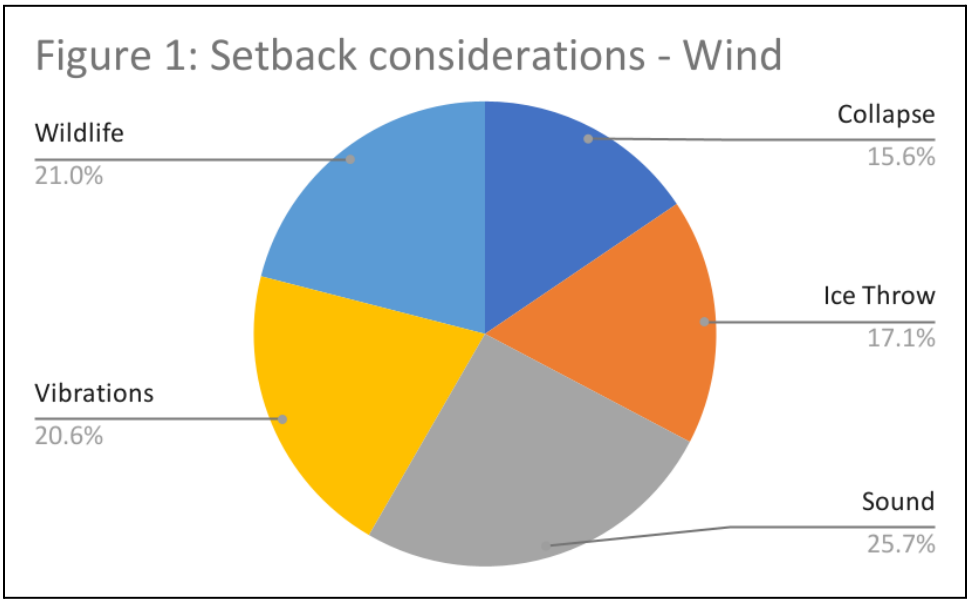
The calculations for solar in Milton Township are as follows:

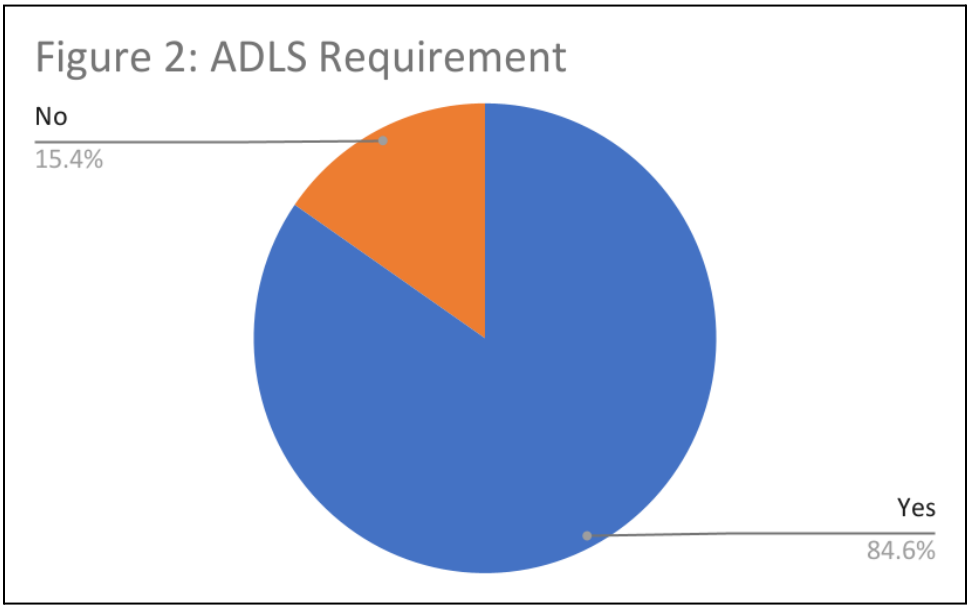
Property line setback	Acres of best patch	Acres of best patch with internal property line buffers applied	# Panels	MW	Homes powered
150ft	~1115	998	1,996,000	99.8	19960
300ft	~1115	894	1,788,000	89.4	17880
500ft	~1115	764	1,528,000	76.4	15280

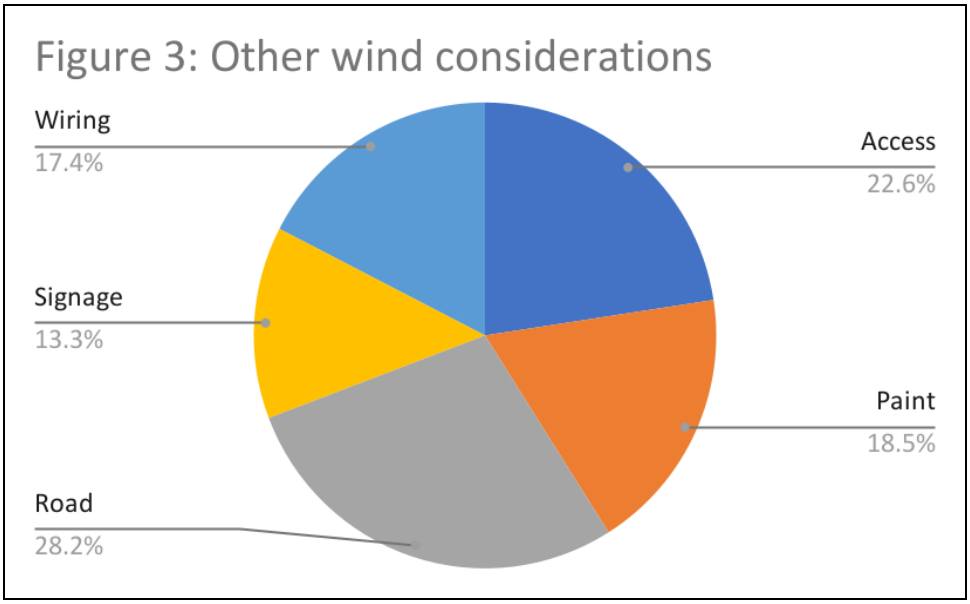
Appendix E. Worksheet result figures

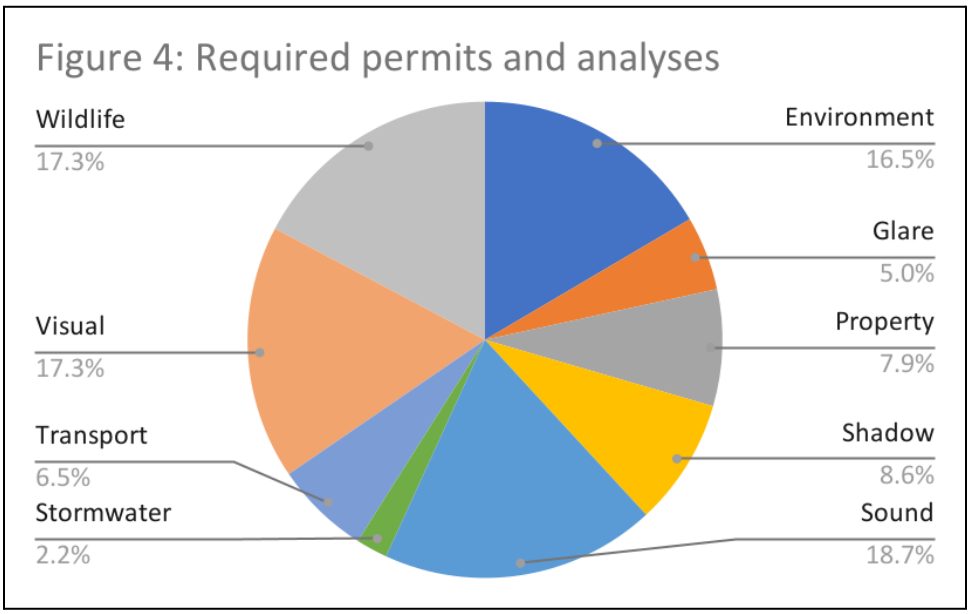
These figures were compiled from Town Hall 2's worksheets. Since each item asked for preferences to be ranked, these figures were produced by allocating points toward an item based on its ranking. For example, a first place ranking for Wildlife would give it 5 points, while a fifth place ranking for Collapse would give it 1 point. Percentages were then taken from the total points. 13 worksheets were submitted for both Negaunee and Milton. Please refer to the Template Worksheet in Appendix A to see the questions as phrased.

NEGAUNEE









Solar Figures

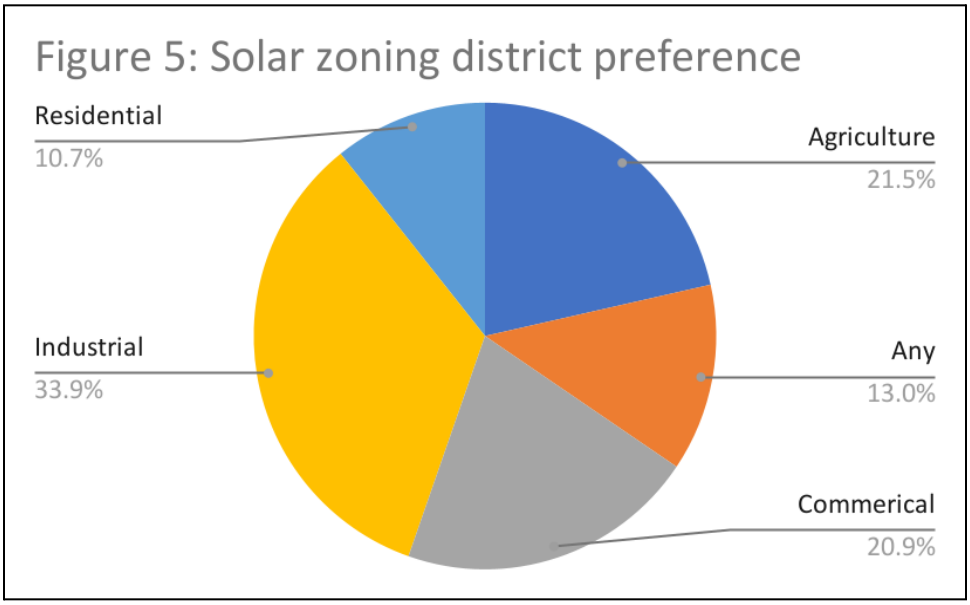


Figure 5: Solar zoning district preference
Residential
10.7%
Agriculture
21.5%
Industrial
33.9%
Any
13.0%
Commerical
20.9%

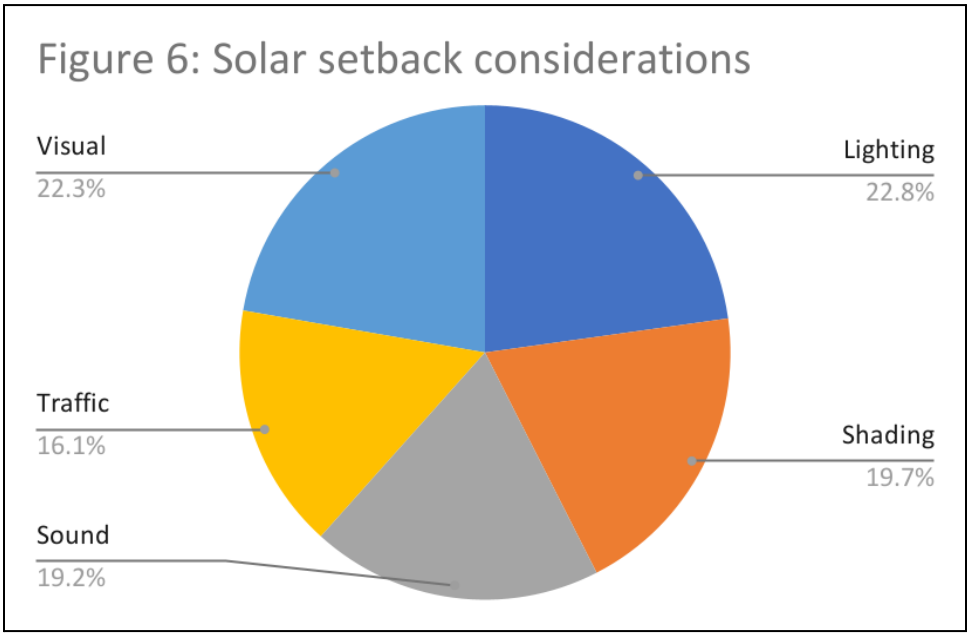


Figure 6: Solar setback considerations
Visual
22.3%
Lighting
22.8%
Traffic
16.1%
Shading
19.7%
Sound
19.2%

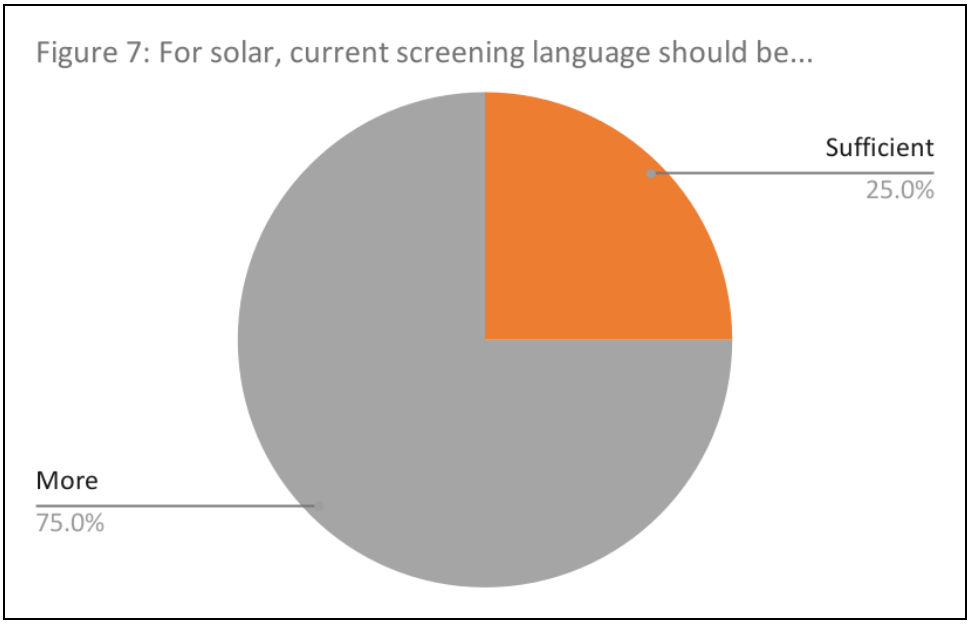


Figure 7: For solar, current screening language should be...
Sufficient
25.0%
More
75.0%

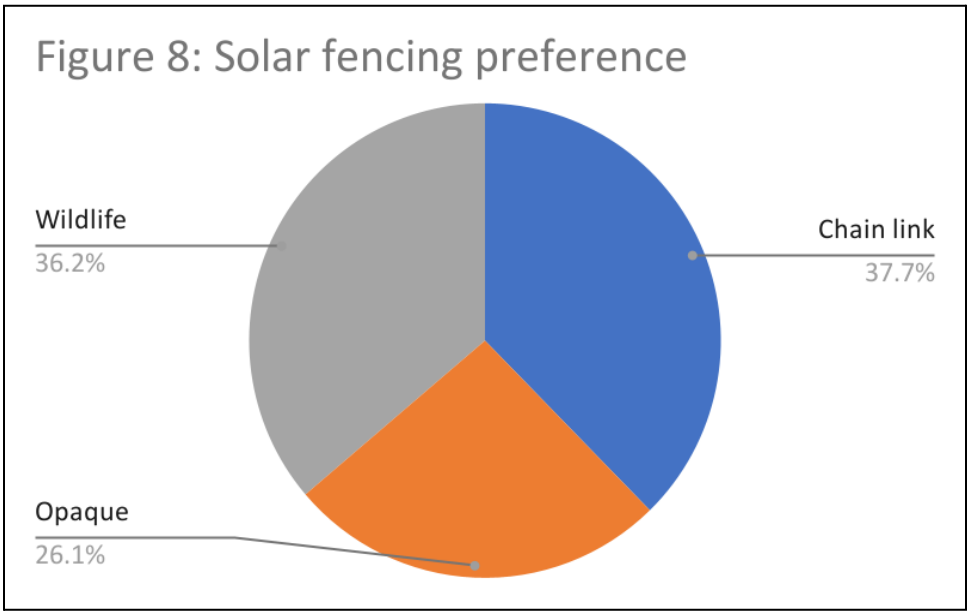


Figure 8: Solar fencing preference
Wildlife
36.2%
Chain link
37.7%
Opaque
26.1%

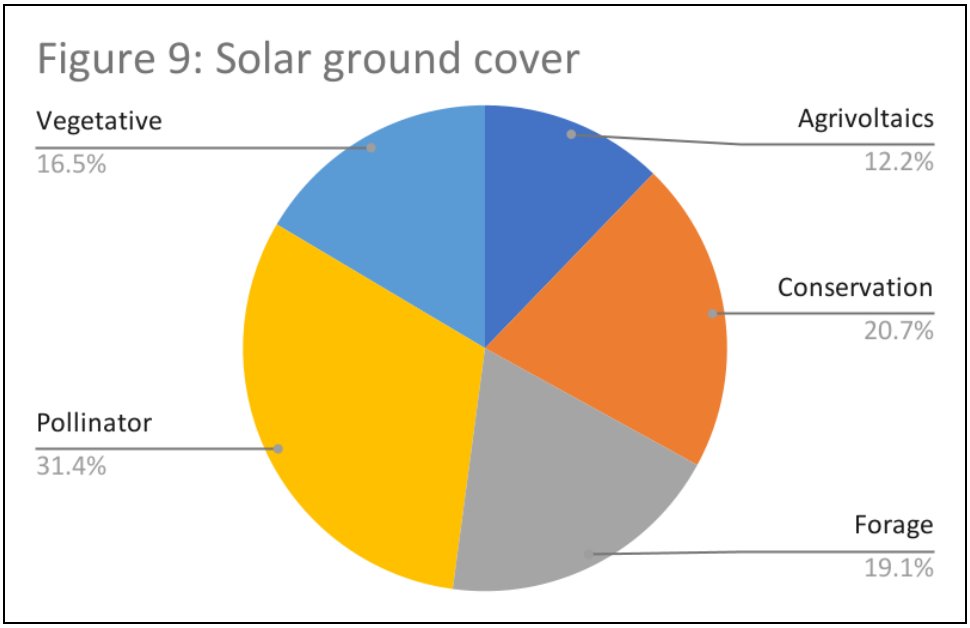


Figure 9: Solar ground cover
Vegetative
16.5%
Agrivoltaics
12.2%
Conservation
20.7%
Pollinator
31.4%
Forage
19.1%

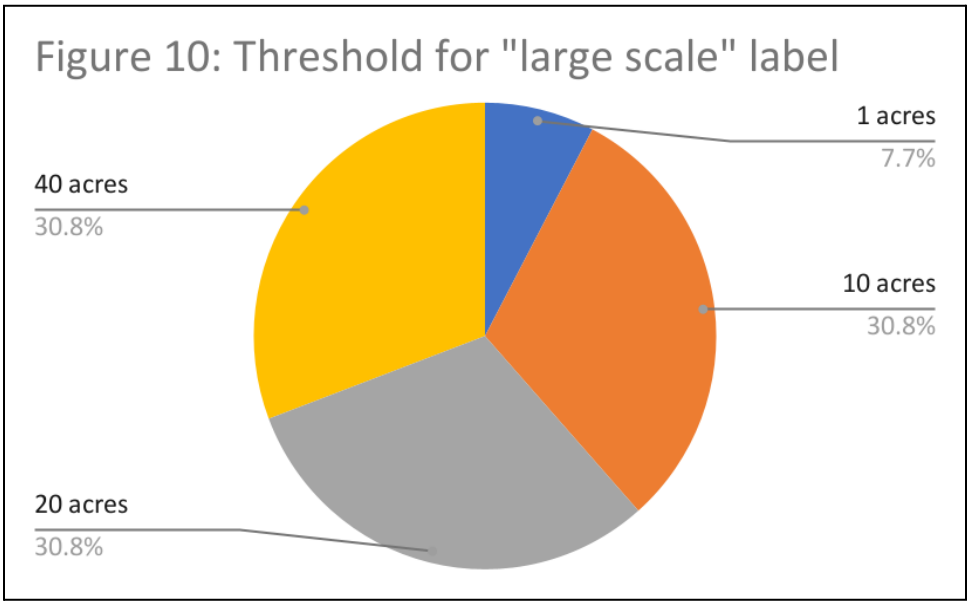


Figure 10: Threshold for "large scale" label
1 acres
7.7%
40 acres
30.8%
10 acres
30.8%
20 acres
30.8%

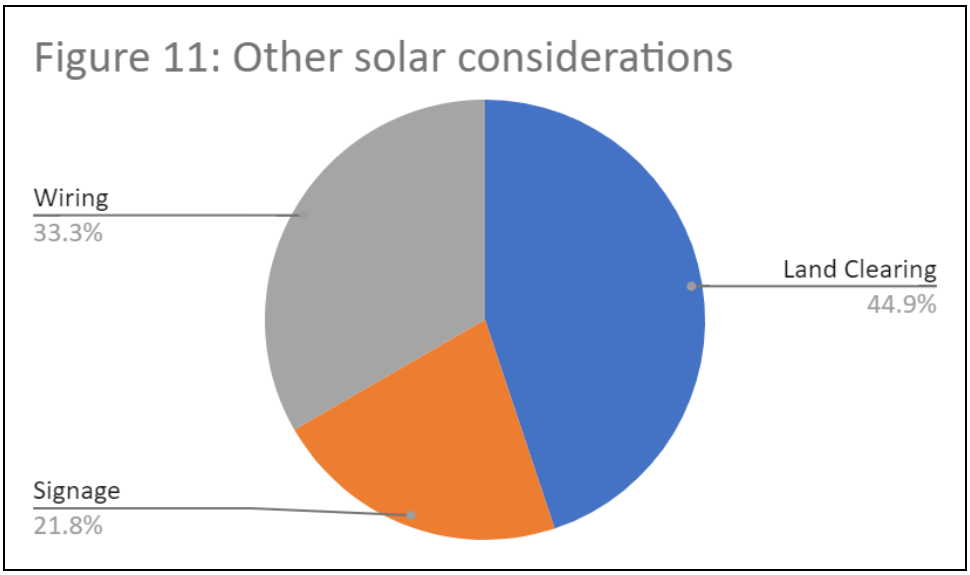


Figure 11: Other solar considerations
Wiring
33.3%
Land Clearing
44.9%
Signage
21.8%

MILTON

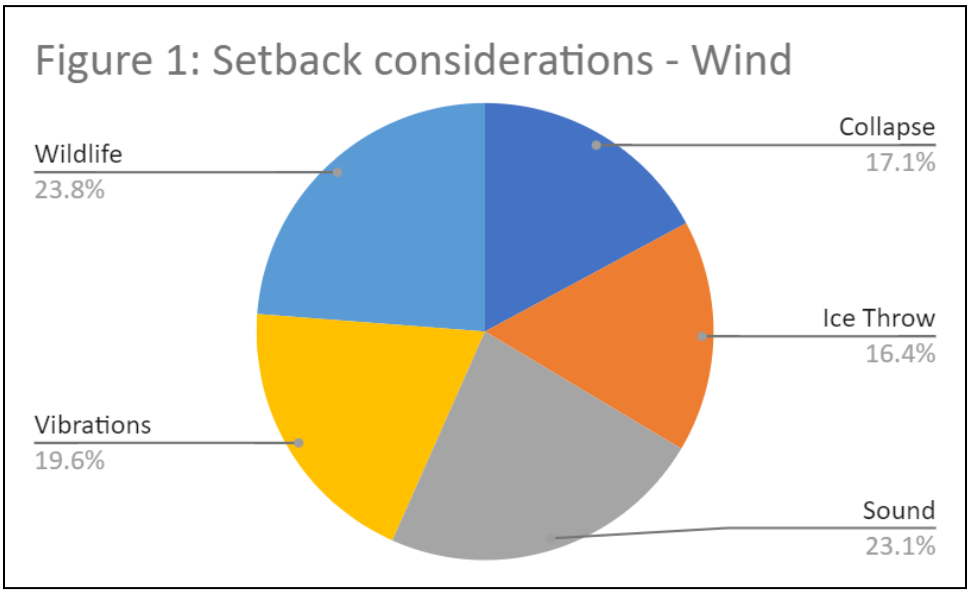


Figure 1: Setback considerations - Wind
Collapse
17.1%
Ice Throw
16.4%
Sound
23.1%
Vibrations
19.6%
Wildlife
23.8%

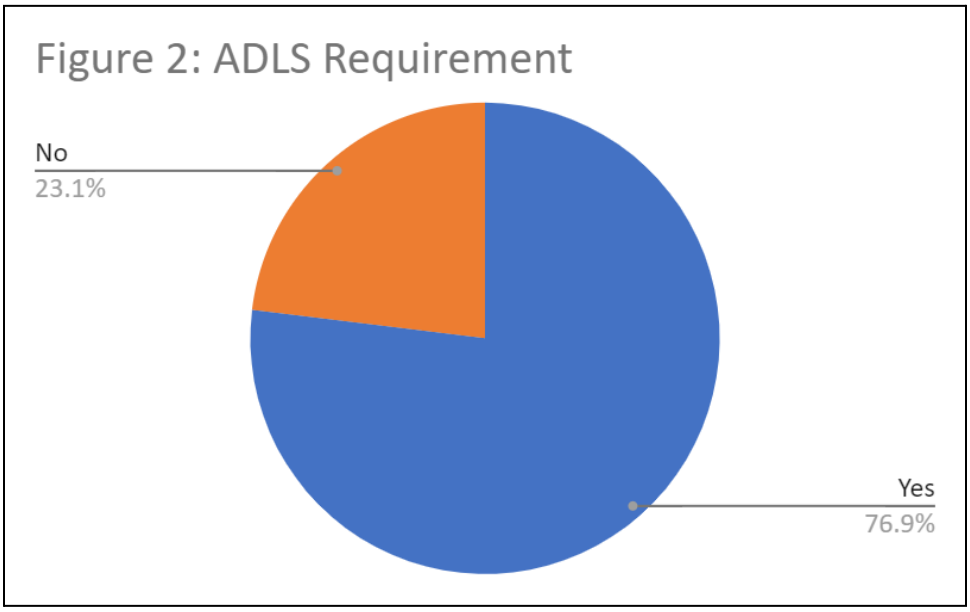


Figure 2: ADLS Requirement
No
23.1%
Yes
76.9%

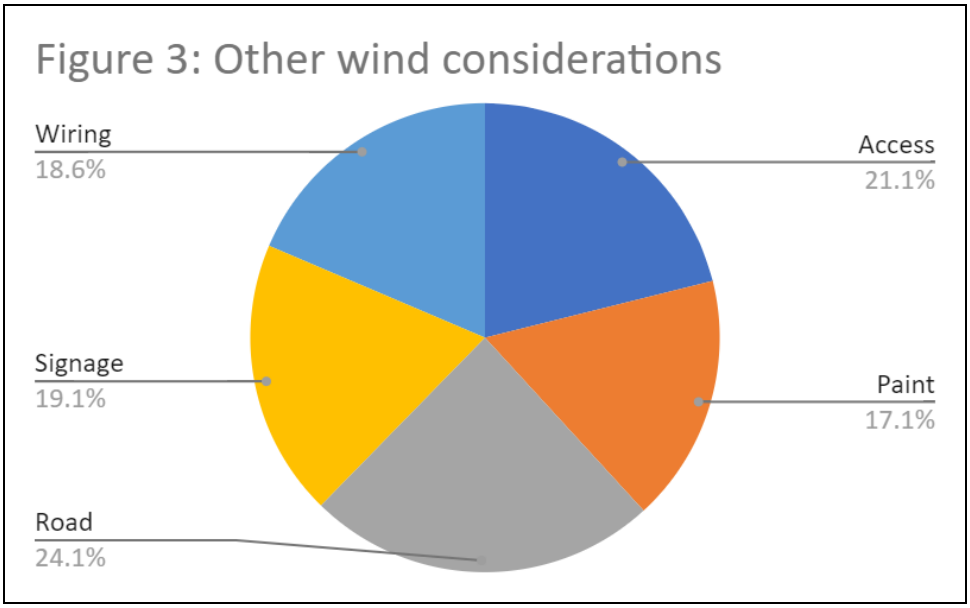


Figure 3: Other wind considerations
Wiring
18.6%
Access
21.1%
Signage
19.1%
Paint
17.1%
Road
24.1%

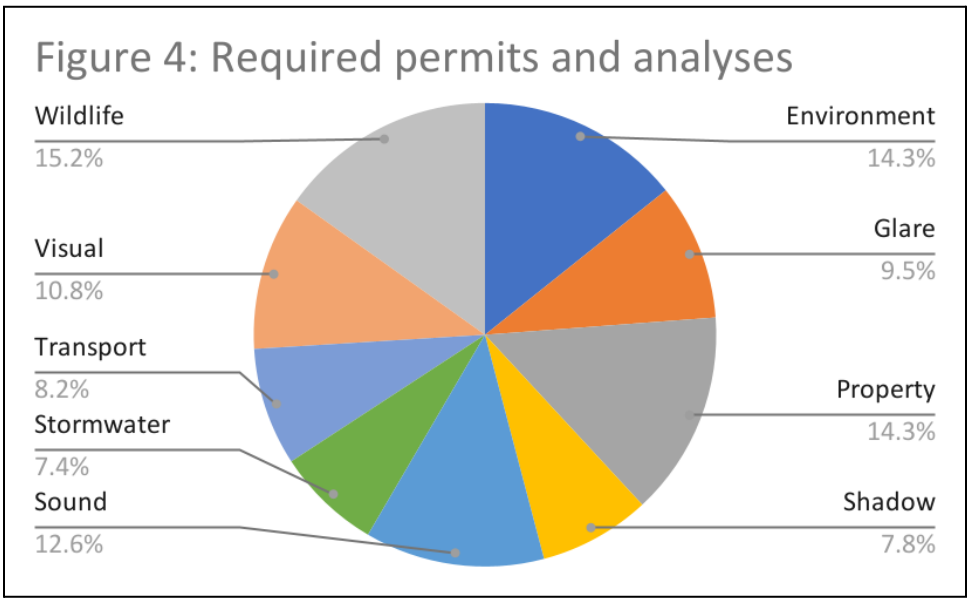


Figure 4: Required permits and analyses
Wildlife
15.2%
Environment
14.3%
Visual
10.8%
Glare
9.5%
Transport
8.2%
Property
14.3%
Stormwater
7.4%
Sound
12.6%
Shadow
7.8%

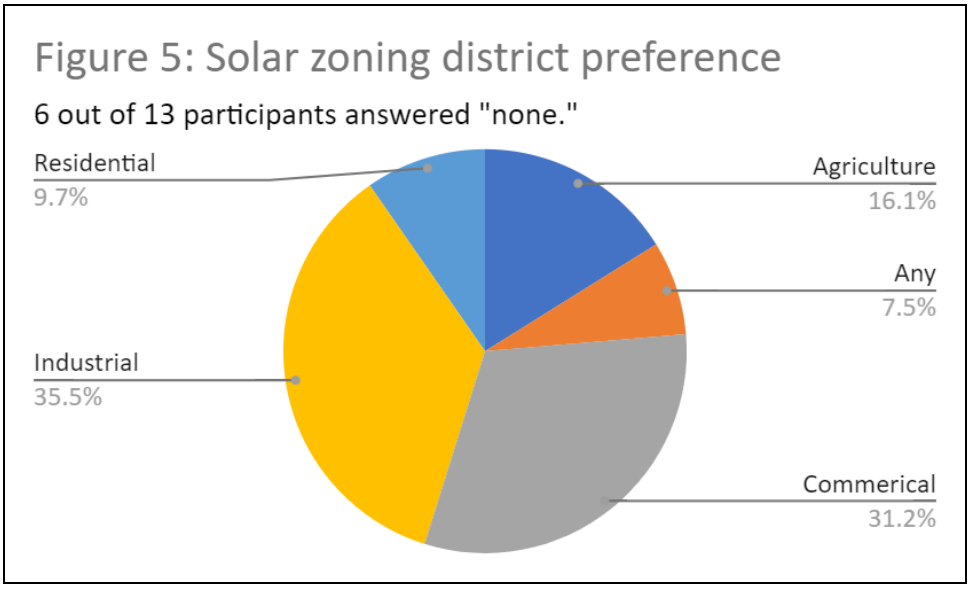


Figure 5: Solar zoning district preference
6 out of 13 participants answered "none."
Residential
9.7%
Agriculture
16.1%
Any
7.5%
Industrial
35.5%
Commerical
31.2%

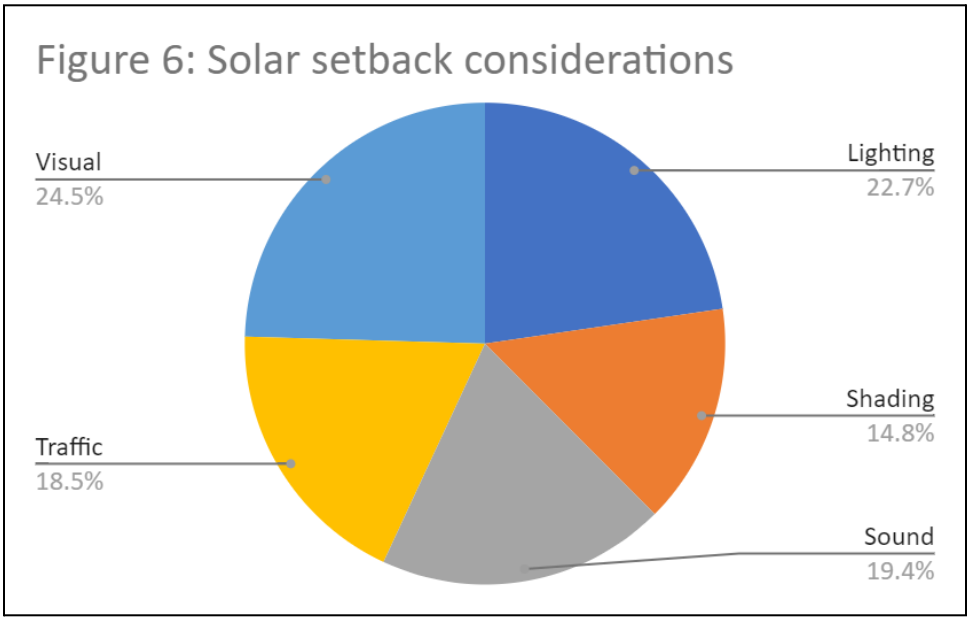
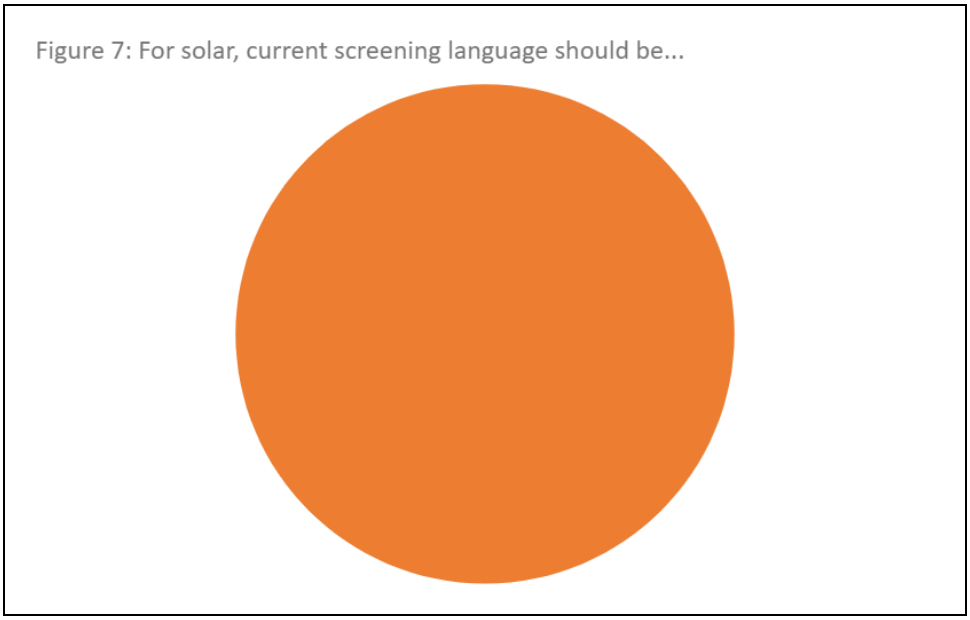
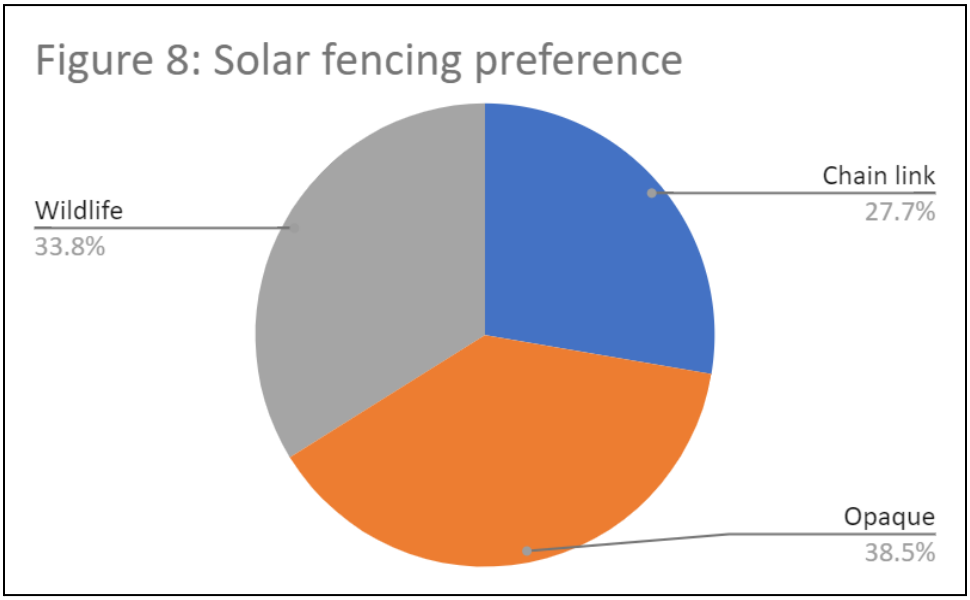


Figure 6: Solar setback considerations
Visual
24.5%
Lighting
22.7%
Shading
14.8%
Traffic
18.5%
Sound
19.4%



(100% of respondents wanted "more thorough" screening than the provided MSU example with average values)



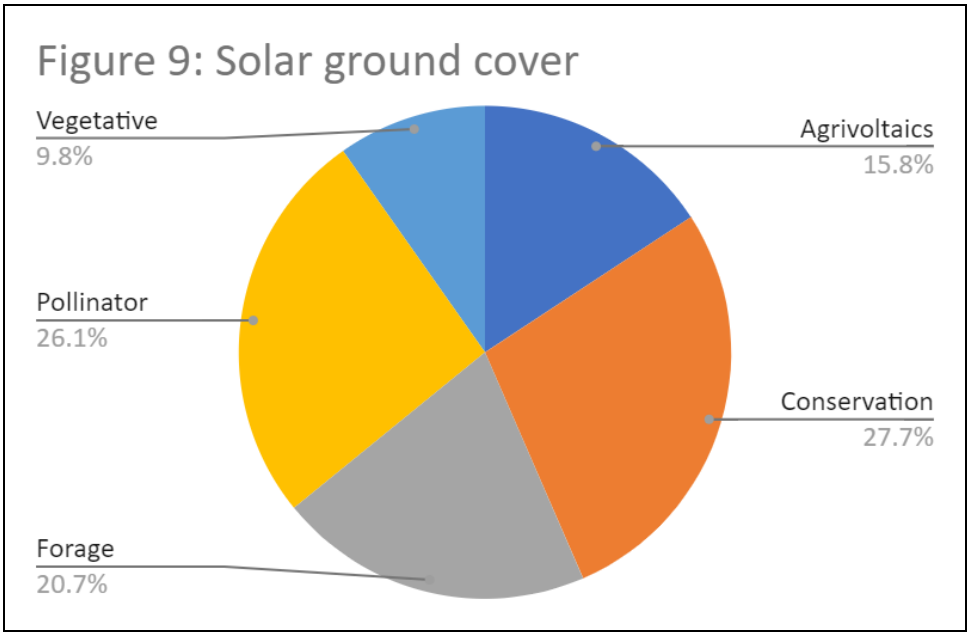


Figure 9: Solar ground cover
Vegetative
9.8%
Agrivoltaics
15.8%
Pollinator
26.1%
Conservation
27.7%
Forage
20.7%

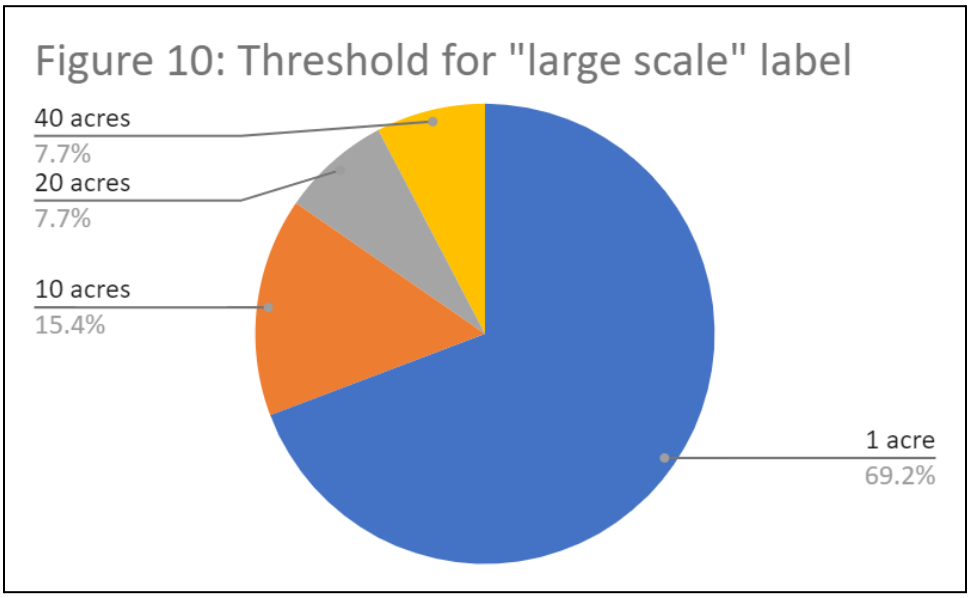


Figure 10: Threshold for "large scale" label
40 acres
7.7%
20 acres
7.7%
10 acres
15.4%
1 acre
69.2%

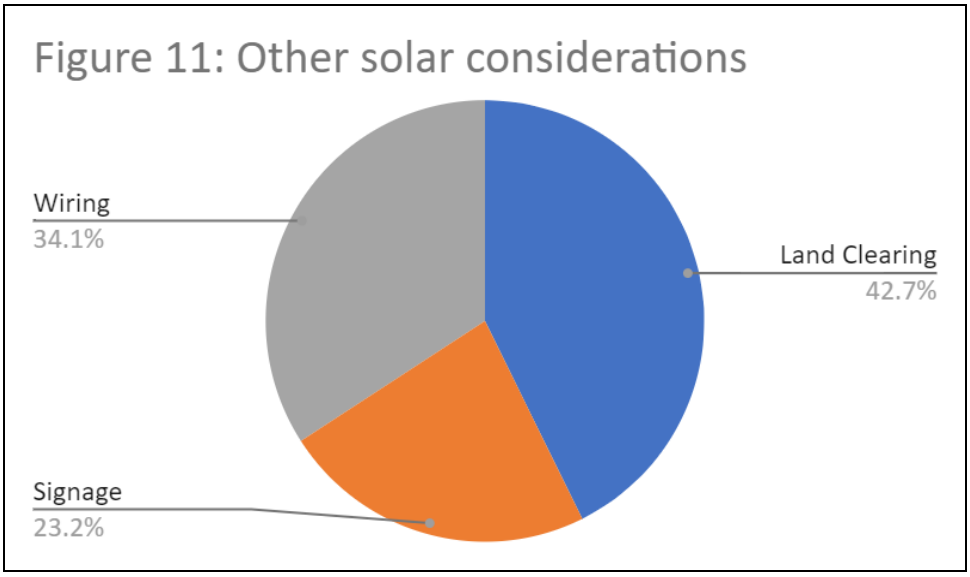


Figure 11: Other solar considerations
Wiring
34.1%
Land Clearing
42.7%
Signage
23.2%

Appendix F. Recommended zoning ordinances
F-1. Negaunee Wind and Solar Recommended Ordinance

Code:
No color: Language from MSU Sample Ordinance
In pink: Language currently in Milton's ordinance
~~Strike through~~: Language from MSU Sample Ordinance, but MI REDI recommends not including
Red text: Recommendation from MI REDI

Notes for Negaunee:

- Most important setback considerations for solar, as determined by the township: Visual, Lighting, Shading, Sound. Traffic was the least important, but still relevant. Many of these concerns are addressed through separate sections of a solar ordinance (i.e., a specific sound ordinance, see section 12 of the solar part)
- This ordinance covers utility-scale solar and wind only. We recommend adopting an accessory-use/small solar ordinance as well.
- Most important setback considerations for wind, as determined by the township: Sound, Wildlife, Vibrations. Ice Throw and Collapse were less important, but still relevant. Many of these concerns are addressed through pre-application permits or separate sections of a wind ordinance (i.e., a specific sound ordinance, see section E of the wind part; required avian and wildlife impact analysis, see section H.4 of the wind part)
- Blanks refer to items in which not enough information was present from worksheet input to make a decision, though recommended standard values are included in parentheses.

DEFINITIONS

Aircraft Detection Lighting System (ADLS): Radar-activated aircraft detection system on wind turbines that activates wind turbine obstruction lights only when an aircraft is within three nautical miles of a wind farm. Allows for blinking lights on turbines to be turned off most of the time, while still complying with Federal Aviation Administration requirements.

Anemometer Tower: means a freestanding tower containing instrumentation such as anemometers that is designed to provide present moment wind data for use by the supervisory control and data acquisition (SCADA) system which is an accessory land use to a utility-scale wind energy system. Also includes the same equipment for evaluating wind characteristics in preparation of or evaluation of construction of on-site wind energy system and utility-scale WES.

Decibel: Means a unit used to measure the intensity of a sound or the power level of an electric signal by comparing it with a given level on a logarithmic scale.

Decommissioning: Deconstruction and removal of wind or solar equipment, site office, and other ancillary infrastructure from the site.

Laydown Area: Area cleared for the temporary storage of supplies and equipment during construction.

Sound Pressure: Measured in decibels, indicator of sound intensity emanating from a wind or solar project.

Dual Use: A solar energy system that employs one or more of the following land management and conservation practices throughout the project site:

- Pollinator Habitat: Solar sites designed to meet a score of 76 or more on the Michigan Pollinator Habitat Planning Scorecard for Solar Sites.62
- Conservation Cover: Solar sites designed in consultation with conservation organizations that focus on restoring native plants, grasses, and prairie with the aim of protecting specific species (e.g., bird habitat) or providing specific ecosystem services (e.g., carbon sequestration, soil health).
- Forage: Solar sites that incorporate rotational livestock grazing and forage production as part of an overall vegetative maintenance plan.
- Agrivoltaics: Solar sites that combine raising crops for food, fiber, or fuel, and generating electricity within the project area to maximize land use.

Maximum Tilt: The maximum angle of a solar array (i.e., most vertical position) for capturing solar radiation as compared to the horizon line.

Non-Participating Lot(s): One or more lots for which there is not a signed lease or easement for development of a principal-use SES or wind associated with the applicant project.

Participating Lot(s): One or more lots under a signed lease or easement for development of a principal-use SES or wind associated with the applicant project.

Principal-Use (Large) Solar Energy System: A Principal-Use SES occupying 20 acres or more for the primary purpose of off-site use through the electrical grid or export to the wholesale market [see discussion in “Land-Use Considerations” on why this number is suggested, and why it might warrant tailoring to your community’s land-use typologies].

Repowering: Reconfiguring, renovating, or replacing an SES to maintain or increase the power rating of the SES within the existing project footprint.

Solar Energy System (SES): A photovoltaic system or solar thermal system for generating and/or storing electricity or heat, including all above and below ground equipment or components required for the system to operate properly and to be secured to a roof surface or the ground. This includes any necessary operations and maintenance building(s), but does not include any temporary construction offices, substation(s) or other transmission facilities between the SES and the point of interconnection to the electric grid.

Utility-scale Wind Energy System (WES): Means a land use for generating power by use of wind at multiple tower locations in a community and includes accessory uses such as but not limited to a SCADA Tower, electric substation. A utility-scale WES is designed and built to provide electricity to the electric utility.

Wildlife-Friendly Fencing: A fencing system with openings that allow wildlife to traverse over or through a fenced area.

Wind Turbine: Means a group of component parts used to convert wind energy into electricity and includes the tower, base, rotor, nacelle, and blades.

SOLAR

LARGE PRINCIPAL-USE SES: A large principal-use SES is a special land use in the zoning districts specified and shall meet the following requirements:

1. **Height:** Total height for a large principal-use SES shall not exceed the maximum allowed height in the district in which the system is located.

2. **Setbacks:** Setback distance shall be measured from the property line or road right-of-way to the closest point of the solar array at minimum tilt or any SES components and as follows:

a. In accordance with the setbacks for principal buildings or structures for the zoning district of the project site [or __ [e.g. 50] feet from the property line of a non-participating lot].

b. __ [e.g., 100] feet from any existing dwelling unit on a non-participating lot.

c. A Ground-Mounted SES is not subject to property line setbacks for common property lines of two or more participating lots, except road right-of-way setbacks shall apply.

3. **Fencing:** A large principal-use SES shall be secured with perimeter fencing to restrict unauthorized access. If installed, perimeter fencing shall be a maximum of __ [e.g. something greater than or equal to 7] feet in height. [Barbed wire is prohibited.] Fencing is not subject to setbacks.

4. **Screening/Landscaping:** ~~A large principal-use SES shall follow the screening and/or landscaping standards for the zoning district of the project site. Any required screening and landscaping shall be placed outside the perimeter fencing.~~

a. When current zoning district screening and landscaping standards are determined to be inadequate based on a legitimate community purpose consistent with local government planning documents, the Planning Commission may require substitute screening consisting of native deciduous trees planted __ [e.g. 30] feet on center, and native evergreen trees planted __ [e.g. 15] feet on center along existing non-participating residential uses.

b. The Planning Commission may reduce or waive screening requirements provided that any such adjustment is in keeping with the intent of the Ordinance.

c. Screening/landscaping detail shall be submitted as part of the site plan that identifies the type and extent of screening for a large principal-use SES, which may include plantings, strategic use of berms, and/or fencing.

5. **Ground Cover**: A large principal-use SES shall include the installation of ground cover vegetation maintained for the duration of operation until the site is decommissioned. The applicant shall include a ground cover vegetation establishment and management plan as part of the site plan. Vegetation establishment must include invasive plant species [and noxious weed, if local regulation applies] control. The following standards apply:

a. Sites bound by a Farmland Development Rights (PA 116) Agreement must follow the Michigan Department of Agriculture and Rural Development's Policy for Allowing Commercial Solar Panel Development on PA 116 Lands.

b. Ground cover at sites not enrolled in PA 116 must meet one or more of the four types of Dual Use defined in this ordinance.

i. *Pollinator Habitat*: Solar sites designed to meet a score of 76 or more on the Michigan Pollinator Habitat Planning Scorecard for Solar Sites.

ii. *Conservation Cover*: Solar sites designed in consultation with conservation organizations that focus on restoring native plants, grasses, and prairie with the aim of protecting specific species (e.g., bird habitat) or providing specific ecosystem services (e.g., carbon sequestration, soil health).

iii. *Forage*: Solar sites that incorporate rotational livestock grazing and forage production as part of an overall vegetative maintenance plan.

~~iv. *Agrivoltaics*: Solar sites that combine raising crops for food, fiber, or fuel, and generating electricity within the project area to maximize land use.Project sites that are included in a brownfield plan adopted under the Brownfield Redevelopment Financing Act, PA 381 of 1996, as amended, that contain impervious surface at the time of construction or soils that cannot be disturbed, are exempt from ground cover requirements~~

c. Project sites that are included in a brownfield plan adopted under the Brownfield Redevelopment Financing Act, PA 381 of 1996, as amended, that contain impervious surface at the time of construction or soils that cannot be disturbed, are exempt from ground cover requirements.

6. **Lot Coverage**: A large principal-use SES shall not count towards the maximum lot coverage or impervious surface standards for the district.

7. **Land Clearing**: Land disturbance or clearing shall be limited to what is minimally necessary for the installation and operation of the system and to ensure sufficient all-season access to the solar resource given the topography of the land. Topsoil distributed during site preparation (grading) on the property shall be retained on site.

8. **Access Drives**: New access drives within the SES shall be designed to minimize the extent of soil disturbance, water runoff, and soil compaction on the premises. The use of geotextile fabrics and gravel placed on the surface of the existing soil for the construction of temporary drives during the construction of the SES is permitted, provided that the geotextile fabrics and gravel are removed once the SES is in operation.

9. **Wiring**: SES wiring (including communication lines) may be buried underground. Any above-ground wiring within the footprint of the SES shall not exceed the height of the solar array at maximum tilt.

10. **Lighting**: Large principal-use SES lighting shall be limited to inverter and/or substation locations only. Light fixtures shall have downlit shielding and be placed to keep light on-site and glare away from adjacent properties, bodies of water, and adjacent roadways. Flashing or intermittent lights are prohibited.

11. **Signage**: Area consistent with the district or sign type standard may be used for signage at the project site. Any signage shall meet the setback, illumination, and materials or construction requirements of the zoning district for the project site.

12. **Sound**: The sound pressure level of a large principal-use SES and all ancillary solar equipment shall not exceed 45 dBA Leq at the property line of an adjoining non-participating lot. The site plan shall include modeled sound isolines extending from the sound source to the property lines to demonstrate compliance with this standard.

13. **Repowering**: In addition to repairing or replacing SES components to maintain the system, a large principal-use SES may at any time be repowered, without the need to apply for a new special land use permit, by reconfiguring, renovating, or replacing the SES to increase the power rating within the existing project footprint.

a. A proposal to change the project footprint of an existing SES shall be considered a new application, subject to the ordinance standards at the time of the request.
[Expenses for legal services and other studies resulting from an application to modify an SES will be reimbursed to the township by the SES owner in compliance with established escrow policy.]

14. **Decommissioning**: A decommissioning plan is required at the time of application.

a. The decommission plan shall include:

i. The anticipated manner in which the project will be decommissioned, including a description of which above-grade and below-grade improvements will be removed, retained (e.g. access drive, fencing), or restored for viable reuse of the property consistent with the zoning district,

ii. The projected decommissioning costs for removal of the SES (net of salvage value in current dollars) and soil stabilization, less the amount of the surety bond posted with the State of Michigan for decommissioning of panels installed on PA 116 lands,

iii. The method of ensuring that funds will be available for site decommissioning and stabilization (in the form of surety bond, irrevocable letter of credit, or cash deposit), and:

b. A review of the amount of the performance guarantee based on inflation, salvage value, and current removal costs shall be completed every 3 years, for the life of the project, and approved by the Negaunee Township Board. An SES owner may at any time:

i. Proceed with the decommissioning plan approved by the Planning Commission and remove the system as indicated in the most recent approved plan; or
ii. Amend the decommissioning plan with Zoning Administrator [or Planning Commission] approval and proceed according to the revised plan.

c. Decommissioning an SES must commence when the soil is dry to prevent soil compaction and must be complete within 18 after abandonment. An SES that has not produced electrical energy for 12 consecutive months shall prompt an abandonment hearing.

WIND

A. **Setbacks**:

1. An Anemometer Tower shall be setback a distance equal to the height of the tower from a property line or from the lease unit boundary, whichever is less.
2. A wind turbine setback shall be measured from: the closest point of the base of the wind turbine to the property line or inhabited structure and shall not exceed:
   i. Road right of way: A horizontal distance equal to 1.5 times the height of the tower or from the edge of the road right-of-way as defined by the district, whichever is greater;
   ii. Non-participating parcels: A horizontal distance equal to ___ [for example: 1,300 feet or 3 times height] from the ___ [property line] or [dwelling];
3. A Wind Turbine is not subject to property line setbacks for common property lines of two or more participating parcels, except road right-of-way setbacks shall apply.

B. **Height**: WES are not subject to height limitations found in Section 411.

C. **Accessory Uses**: An Operations and Maintenance Office building, a substation, or ancillary equipment shall comply with property setback requirements of the respective zoning district. Overhead transmission lines and power poles shall comply with the setback and placement requirements applicable to public utilities.

D. **Laydown Area**: A centralized temporary laydown area for wind turbine component parts and other related equipment shall comply with property-setback requirements of the district and be detailed in the application.

E. **Sound Pressure Level**: The sound pressure level shall not exceed the following:

1. Sound from a WES shall not exceed 45 dBA for 3 minutes for any hour of the day, measured at the property lines or the lease unit boundary___ [dwelling] or [property line] of a non-participating property, whichever is farther from the source of the noise. If the average background sound pressure level exceeds 45 dBA L (3-minute) the standard shall be background sound dBA plus 5 dBA.
2. *Sound measurement methodology*: Sound pressure level measurements shall be performed by a third party, qualified professional selected by the developer and approved by the Planning Commission. Testing shall be performed according to the procedures in the most current version of ANSI S12.18 and ANSI S12.9 Part 3. All sound pressure levels shall be measured with a sound meter that meets or exceeds the most current version of ANSI S1.4 specifications for a Type II sound meter.
3. *Post-construction sound survey*: A post-construction sound survey shall commence within the first year of operation to document levels of sound emitted from wind turbines. The study will be designed to verify compliance with sound standards applicable to this ordinance. The WES owner shall provide SCADA data during the testing period to the sound consultant completing the study.

F. **Safety**: Utility-scale WES shall be designed to prevent unauthorized access to electrical and mechanical components and shall have access doors that are kept securely locked at all times when service personnel are not present. All spent lubricants and cooling fluids shall be properly and safely removed in a timely manner from the site of the WES. A sign shall be posted near the tower or Operations and Maintenance Office building that will contain emergency contact information. A sign shall be placed at the road access to a wind turbine to warn visitors about the potential danger of falling ice. The minimum vertical blade tip clearance from grade shall be 20 feet for a WES employing a horizontal axis rotor.

G. **Construction Codes, Towers, and Interconnection Standards**: Utility-scale WES shall comply with all applicable state construction and electrical codes and local building permit requirements.

H. **Pre-Application Permits**: Utility-scale WES shall comply with applicable utility, Michigan Public Service Commission, Federal Energy Regulatory Commission interconnection standards, FAA requirements, and tall structures requirements, including but not limited to:

1. Utility Infrastructure

i. Shall comply with Federal Aviation Administration (FAA) requirements, the Michigan Airport Zoning Act (PA 23 of 1950 as amended), the Sawyer International Zoning Ordinance, the Michigan Tall Structures Act (PA 259 of 1959 as amended) and local jurisdiction airport overlay zone regulations. The minimum FAA lighting standards shall not be exceeded. All tower lighting required by the FAA shall be shielded to the extent possible to reduce glare and visibility from the ground. The tower shaft shall not be illuminated unless required by the FAA. Utility Grid wind

energy systems shall comply with applicable utility, Michigan Public Service Commission and Federal Energy Regulatory Commission interconnection standards.

2. Aviation and Airport:

i. Federal Aviation Administration (FAA) requirements. The minimum FAA lighting standards shall not be exceeded. The lighting plan submitted to the FAA shall include an Aircraft Detection Lighting System (ADLS) for the utility-scale WES. The tower shaft shall not be illuminated unless required by the FAA.

ii. Michigan Airport Zoning Act (Public Act 23 of 1950 as amended, MCL 259.431 et seq.).

iii. Michigan Tall Structures Act (Public Act 259 of 1959 as amended, MCL 259.481 et seq.).

iv. Local jurisdiction airport overlay zone regulations.

3. *Environment:*

i. The site plan and other documents and drawings shall show mitigation measures to minimize potential impacts on the natural environment including, but not limited to:

- Wetlands and other fragile ecosystems;
- Historical and cultural sites; and
- Antiquities, as identified in the Environmental Analysis.

ii. The applicant shall comply with applicable parts of the Michigan Natural Resources and Environmental Protection Act (PA 451 of 1994), including, but not limited to:

- Part 31 Water Resources Protection (MCL 324.3101 et seq.)
- Part 91 Soil Erosion and Sedimentation Control (MCL 324.9101 et seq.)
- Part 301 Inland Lakes and Streams (MCL 324.30101 et seq.)
- Part 303 Wetlands (MCL 324.30301 et seq.)
- Part 323 Shoreland Protection and Management (MCL 324.32301 et seq.)
- Part 325 Great Lakes Submerged Lands (MCL 324.32501 et seq.)
- Part 353 Sand Dunes Protection and Management as shown by having obtained each respective permit with requirements and limitations of those permits reflected on the site plan. (MCL 324.35301 et seq.)

4. *Avian and Wildlife Impact*: Site plan and other documents and drawings shall provide mitigation measures to minimize potential impacts on avians and wildlife, as identified in the Avian and Wildlife Impact analysis.

i. The application shall demonstrate consultation with the U.S. Fish and Wildlife Service's Land-Based Wind Energy Guidelines.

ii. Applicants must comply with applicable sections of the Federal Endangered Species Act and Michigan's endangered species protection laws (NREPA, Act 451 of 1994, Part 365).

iii. The applicant or the applicant's impact assessment must show consultation with the U.S. Fish and Wildlife Service regarding federally listed species and the Michigan Department of Natural Resources for state listed species. Early coordination with state and federal agencies is recommended

I. **Performance Security**: Performance security, pursuant to Section 423 of this Ordinance, shall be provided for the applicant to make repairs to public roads damaged by the construction of the WES. In lieu of a performance security agreement with Negaunee Township, the applicant may enter into a road use agreement with the Marquette County Road Commission to cover the costs of all road damage resulting from the construction of the WES.

J. **Utilities**: Power lines should be placed underground, when feasible, to prevent avian collisions and electrocutions. All above-ground lines, transformers or conductors should comply with Avian Power Line Interaction Committee (APLIC) published standards to prevent avian mortality.

K. **Visual Impact**: A *Visual Impact Simulation* showing the completed site as proposed on the submitted site plan. Utility-scale WES projects shall use tubular towers and all utility-scale WES in a project shall be finished in a single, non-reflective, matte finish, color approved by the Planning Commission. A project shall be constructed using WES components (tower, nacelle, blade) of similar design, size, operation, and appearance throughout the project. An area of ___ square feet or ___ [for example: 5] percent of the nacelle [on one or two sides] may be used for a sign, such as for turbine identification or other insignia. The applicant shall avoid state or federal scenic areas and significant visual resources listed in the local unit of government's Master Plan.

L. **Shadow Flicker**: Shadow flicker shall not exceed 30 hours per year and/or 30 minutes per day measured to the exterior wall of a dwelling or other occupied building on a non-participating parcel. Mitigation measures to minimize or eliminate potential impacts from shadow flicker, as identified in the Shadow Flicker Impact Analysis for human-occupied structures, shall include, but not be limited to:

1. Change the proposed location of the wind energy tower; or
2. The utility-scale WES shall be turned off by manufacturer approved automated system during the period of time an inhabited structure receives shadow flicker; or
3. The utility-scale WES shall be turned off during flicker events after 30 hours/year of shadow flicker on an inhabited structure; or
4. There is screening (forest, other building(s), topography, window treatments/blinds) which shields the inhabited structure from a direct line of sight to the rotors causing shadow flicker.

M. **Signal Interference**: No utility-scale WES shall be installed in any location where its proximity to existing fixed broadcast, retransmission, or reception antennae for radio, television, or wireless phone or other personal communication systems would produce interference with signal transmission or reception unless the applicant provides a replacement signal to the affected party that will restore reception to at least the level present before operation of the WES. No utility-scale WES shall be installed in any location within the line of sight of an existing microwave

communications link where operation of the WES is likely to produce electromagnetic interference in the link's operation unless the interference is insignificant.

N. **Decommissioning**: A planning commission approved decommissioning plan, with the requirements set forth in Section 422 of this Ordinance, indicating:

1) the anticipated life of the project,
2) the estimated decommissioning costs net of salvage value in current dollars,
3) the method of ensuring that funds will be available for decommissioning and restoration,
4) the anticipated manner in which the project will be decommissioned and the site restored, and
5) the review of the amount of the performance guarantee based on inflation and current removal costs to be completed every 3 years, for the life of the project, and approved by the planning commission board.

O. **Complaint Resolution**: A complaint resolution plan shall be presented to the planning commission and approved prior to approval of a special land use permit. The complaint resolution program will describe how the developer receives, responds, and resolves complaints that may arise from the operation of the WES. The complaint resolution plan shall include appropriate timelines for response and other detailed information (such as forms, and contact information). As a condition of filing a complaint, a landowner must allow the Negaunee Township staff or designated agents and WES owner or agents on the subject property for further investigation.

P. **Annual Maintenance Review**: The WES shall be maintained and kept in a safe working condition. The WES owner shall certify on an annual basis that all turbines are operating under normal conditions. Non-operational turbines at the time of the annual review, shall be identified and provided an expected date to resolve the maintenance issue. A wind turbine generator that has not been operational for over 12 months shall be considered abandoned and a violation of the special land use permit.

Q. **End of Useful Life**: At the end of the useful life of the WES, the system owner:

1. Shall follow the decommissioning plan approved by the Planning Commission under Section 422 and remove the system as indicated in the most recent approved plan; or,
2. Amend the decommissioning plan with Planning Commission approval and proceed with P.1 above; or,
3.The township board reserves the right to approve, deny, or modify an application to modify an existing WES at the end of useful life, in whole or in part, based on ordinance standards at the time of the request. Expenses for legal services and other studies resulting from application to modify or repower a WES will be reimbursed to the township board by the WES owner in compliance with established escrow policy.

F-2. Milton Wind and Solar Recommended Ordinance

Code:
No color: Language from MSU Sample Ordinance
In pink: Language currently in Milton's ordinance
~~Strike through~~: Language from MSU Sample Ordinance, but MI REDI recommends not including
Red text: Recommendation from MI REDI

Notes for Milton:

- Most important setback considerations for solar, as determined by the township: Visual, Lighting, Sound, Traffic. Shading was the least important, but still relevant. Many of these concerns are addressed through separate sections of a solar ordinance (i.e., a specific sound ordinance, see section 12 of the solar part)
- This ordinance covers utility-scale solar and wind only. We recommend adopting an accessory-use/small solar ordinance as well.
- Most important setback considerations for wind, as determined by the township: Wildlife, Sound, Vibrations. Ice Throw and Collapse were less important, but still relevant. Many of these concerns are addressed through pre-application permits or separate sections of a wind ordinance (i.e., a specific sound ordinance, see section F of the wind part; required avian and wildlife impact analysis, see section I.3 of the wind part)
- Blanks refer to items in which not enough information was present from worksheet input to make a decision, though recommended standard values are included in parentheses.

DEFINITIONS

Aircraft Detection Lighting System (ADLS): Radar-activated aircraft detection system on wind turbines that activates wind turbine obstruction lights only when an aircraft is within three nautical miles of a wind farm. Allows for blinking lights on turbines to be turned off most of the time, while still complying with Federal Aviation Administration requirements.

Anemometer Tower: means a freestanding tower containing instrumentation such as anemometers that is designed to provide present moment wind data for use by the supervisory control and data acquisition (SCADA) system which is an accessory land use to a utility-scale wind energy system. Also includes the same equipment for evaluating wind characteristics in preparation of or evaluation of construction of on-site wind energy system and utility-scale WES.

Decibel: Means a unit used to measure the intensity of a sound or the power level of an electric signal by comparing it with a given level on a logarithmic scale.

Decommissioning: Deconstruction and removal of wind or solar equipment, site office, and other ancillary infrastructure from the site.

Laydown Area: Area cleared for the temporary storage of supplies and equipment during construction.

Sound Pressure: Measured in decibels, indicator of sound intensity emanating from a wind or solar project.

Dual Use: A solar energy system that employs one or more of the following land management and conservation practices throughout the project site:

- Pollinator Habitat: Solar sites designed to meet a score of 76 or more on the Michigan Pollinator Habitat Planning Scorecard for Solar Sites.62
- Conservation Cover: Solar sites designed in consultation with conservation organizations that focus on restoring native plants, grasses, and prairie with the aim of protecting specific species (e.g., bird habitat) or providing specific ecosystem services (e.g., carbon sequestration, soil health).
- Forage: Solar sites that incorporate rotational livestock grazing and forage production as part of an overall vegetative maintenance plan.
- Agrivoltaics: Solar sites that combine raising crops for food, fiber, or fuel, and generating electricity within the project area to maximize land use.

Maximum Tilt: The maximum angle of a solar array (i.e., most vertical position) for capturing solar radiation as compared to the horizon line.

Non-Participating Lot(s): One or more lots for which there is not a signed lease or easement for development of a principal-use SES or wind associated with the applicant project.

Participating Lot(s): One or more lots under a signed lease or easement for development of a principal-use SES or wind associated with the applicant project.

Principal-Use (Large) Solar Energy System: A Principal-Use SES occupying 1 acre or more for the primary purpose of off-site use through the electrical grid or export to the wholesale market [see discussion in “Land-Use Considerations” on why this number is suggested, and why it might warrant tailoring to your community’s land-use typologies].

Repowering: Reconfiguring, renovating, or replacing an SES to maintain or increase the power rating of the SES within the existing project footprint.

Solar Energy System (SES): A photovoltaic system or solar thermal system for generating and/or storing electricity or heat, including all above and below ground equipment or components required for the system to operate properly and to be secured to a roof surface or the ground. This includes any necessary operations and maintenance building(s), but does not include any temporary construction offices, substation(s) or other transmission facilities between the SES and the point of interconnection to the electric grid.

Utility-scale Wind Energy System (WES): Means a land use for generating power by use of wind at multiple tower locations in a community and includes accessory uses such as but not limited to a SCADA Tower, electric substation. A utility-scale WES is designed and built to provide electricity to the electric utility.

Wildlife-Friendly Fencing: A fencing system with openings that allow wildlife to traverse over or through a fenced area.

Wind Turbine: Means a group of component parts used to convert wind energy into electricity and includes the tower, base, rotor, nacelle, and blades.

WIND

A. **Setbacks**:

1. An Anemometer Tower shall be setback a distance equal to 2 times height from a property line or road right-of-way.
2. A wind turbine setback shall be measured from from grade to the height of the blade in the vertical position or the highest point of the WECS, whichever is greater and shall not exceed:
    i. Road right of way: A horizontal distance equal to 1.5 times the hub height of the tower;
    ii. Non-participating parcels: A horizontal distance equal to 3 times the hub height of the tower from the property line;
3. A Wind Turbine is not subject to property line setbacks for common property lines of two or more participating parcels, except road right-of-way setbacks shall apply.
4. WECS shall not be located within thirty (30) feet of an above ground utility line.

B. **Minimum Lot Size**: Minimum lot size for a commercial WECS shall be twenty (20) acres, but a minimum of five (5) acres of site area is required for each WECS proposed within an eligible property.

C. **Height**: WES are not subject to height limitations.

1. Blade-arcs created by the WECS shall have a minimum of thirty (30) feet of clearance over any structure, land or tree within a two hundred (200) foot radius of the tower.

D. **Accessory Uses**: An Operations and Maintenance Office building, a substation, or ancillary equipment shall comply with property setback requirements of the respective zoning district. Overhead transmission lines and power poles shall comply with the setback and placement requirements applicable to public utilities.

1. A minimum of a six (6) foot tall fence shall be provided around the perimeter of the WECS, or in the case of several WECS, around the perimeter of the site.

E. **Laydown Area**: A centralized temporary laydown area for wind turbine component parts and other related equipment shall comply with property-setback requirements of the district and be detailed in the application.

F. **Sound Pressure Level**: The sound pressure level shall not exceed the following:

1. *Non-participating property*: Sound from a WES shall not exceed 65 dBA Leq measured at the property line [dwelling] or [property line] of a non-participating property. If the average background sound pressure level exceeds 65 dBA Leq the standard shall be background sound dBA plus 10 [for example: 5 or 10] dBA.
2. *Participating property*: Sound from a WES shall not exceed 65 dBA Leq measured at the property line [dwelling] or [property line] of a participating property. If the average background sound pressure level exceeds 65 dBA Leq the standard shall be background sound dBA plus 5 [for example: 5 or 10] dBA.
3. *Sound measurement methodology*: Sound pressure level measurements shall be performed by a third party, qualified professional selected by the developer and approved by the Planning Commission. Testing shall be performed according to the procedures in the most current version of ANSI S12.18 and ANSI S12.9 Part 3. All sound pressure levels shall be measured with a sound meter that meets or exceeds the most current version of ANSI S1.4 specifications for a Type II sound meter.
4. *Post-construction sound survey*: A post-construction sound survey shall commence within the first year of operation to document levels of sound emitted from wind turbines. The study will be designed to verify compliance with sound standards applicable to this ordinance. The WES owner shall provide SCADA data during the testing period to the sound consultant completing the study.
5. Any proposed WECS shall not produce vibrations humanly perceptible beyond the property on which it is located.

G. **Safety**: Utility-scale WES shall be designed to prevent unauthorized access to electrical and mechanical components and shall have access doors that are kept securely locked at all times when service personnel are not present. All spent lubricants and cooling fluids shall be properly and safely removed in a timely manner from the site of the WES. A sign shall be posted near the tower or Operations and Maintenance Office building that will contain emergency contact information. A sign shall be placed at the road access to a wind turbine to warn visitors about the potential danger of falling ice. The minimum vertical blade tip clearance from grade shall be 20 feet for a WES employing a horizontal axis rotor.

1. To prevent unauthorized climbing, WECS towers must comply with one of the following provisions:
    i. Tower climbing apparatus shall not be located within twelve (12) feet of the ground.
    ii. A locked anti-climb device shall be installed on the tower.
    iii. Tower capable of being climbed shall be enclosed by a locked, protective fence at least six (6) feet high.

H. **Construction Codes, Towers, and Interconnection Standards**: Utility-scale WES shall comply with all applicable state construction and electrical codes and local building permit requirements.

1. Each WECS shall be grounded to protect against natural lightning strikes in conformance with the National Electrical Code. Additionally, WECS electrical equipment and connections shall be designed and installed in adherence to the National Electrical Code as adopted by the Community.
2. A copy of the manufacturer's installation instruction shall be provided. Included as part of or as an attachment to the installation instructions shall be standard drawings of the structural components of the wind energy conversion system and support structures, including base and footings provided along with engineering data and calculations to demonstrate compliance with the structural design provisions of the Building Code; drawings and engineering calculations shall be certified by a registered engineer licensed to practice in the State of Michigan.
3. WECS shall be of monopole design and shall not have guy wires.

I. **Pre-Application Permits**: Utility-scale WES shall comply with applicable utility, Michigan Public Service Commission, Federal Energy Regulatory Commission interconnection standards, FAA requirements, and tall structures requirements, including but not limited to:

1. *Aviation and Airport*:
    i. Federal Aviation Administration (FAA) requirements. The minimum FAA lighting standards shall not be exceeded. The lighting plan submitted to the FAA shall include an Aircraft Detection Lighting System (ADLS) for the utility-scale WES. The tower shaft shall not be illuminated unless required by the FAA.
    ii. Michigan Airport Zoning Act (Public Act 23 of 1950 as amended, MCL 259.431 et seq.).
    iii. Michigan Tall Structures Act (Public Act 259 of 1959 as amended, MCL 259.481 et seq.).
    iv. Local jurisdiction airport overlay zone regulations.

2. *Environment*: The application will demonstrate mitigation measures to minimize potential impacts on the natural environment including, but not limited to wetlands and other fragile ecosystems, historical and cultural sites, and antiquities, as identified in the Environmental Analysis. The application shall demonstrate compliance with:
    i. Michigan Natural Resources and Environmental Protection Act (Act 451 of 1994, MCL 324.101 et seq.) (including but not limited to: Part 31 Water Resources Protection (MCL 324.3101 et seq.),
    ii. Part 91 Soil Erosion and Sedimentation Control (MCL 324.9101 et seq.)
    iii. Part 301 Inland Lakes and Streams (MCL 324.30101 et seq.)
    iv. Part 303 Wetlands (MCL 324.30301 et seq.)
    v. Part 323 Shoreland Protection and Management (MCL 324.32301 et seq.)
    vi. Part 325 Great Lakes Submerged Lands (MCL 324.32501 et seq.)
    vii. Part 353 Sand Dunes Protection and Management (MCL 324.35301 et seq.)

3. *Avian and Wildlife Impact*: Site plan and other documents and drawings shall provide mitigation measures to minimize potential impacts on avians and wildlife, as identified in the Avian and Wildlife Impact analysis.

i. The application shall demonstrate consultation with the U.S. Fish and Wildlife Service's Land-Based Wind Energy Guidelines.

ii. Applicants must comply with applicable sections of the Federal Endangered Species Act and Michigan's endangered species protection laws (NREPA, Act 451 of 1994, Part 365).

iii. The applicant or the applicant's impact assessment must show consultation with the U.S. Fish and Wildlife Service regarding federally listed species and the Michigan Department of Natural Resources for state listed species. Early coordination with state and federal agencies is recommended.

4. In addition to the requirements for site plan application and review outlined in Chapter 13, the following information shall be included with any application of a Special Land Use for a WECS:

i. Location of overhead electrical transmission or distribution lines.

ii. Location and height of all buildings, structures, towers, guy wires, guy wire anchors, security fencing, and other above ground structures associated with the WECS.

iii. Locations and height of all adjacent buildings, structures, and above ground utilities located within three hundred (300) feet of the exterior boundaries of the site housing the WECS. The boundaries include the outermost locations upon which towers, structures, fencing, facilities,and other items associated with a WECS are placed. Specific distances to other on-site buildings, structures, and utilities shall be provided.

iv. A description of a proper buffer or greenbelt to screen the use from any adjacent Residential District or use and the public road.

v. Existing and proposed setbacks of all structures located on the property in question.

vi. Sketch elevation of the premises accurately depicting the proposed WECS and its relationship to all structures within three hundred (300) feet. For wind farms in which case numerous towers of similar height are planned, sketches are necessary only at borders of proposed projects and when adjacent to other established structures within three hundred (300) feet.

vii. Access road to the WECS facility with detail on dimensions, composition, and maintenance.

viii. Planned security measures to prevent unauthorized trespass and access.

ix. WECS maintenance programs shall be provided that describe the maintenance program used to maintain the WECS, including removal when determined to be obsolete.

5. Property Value Assessment: Comparing property values before and after project development within a similar area

J. **Performance Security**: Performance security, pursuant to Section 19.05 of this Ordinance, shall be provided for the applicant to make repairs to public roads damaged by the construction of the WES. In lieu of a performance security agreement with Milton Township [County or Township], the applicant may enter into a road use agreement with the Cass County Road Commission to cover the costs of all road damage resulting from the construction of the WES.

K. **Utilities**: Electric transmission lines extending from a wind turbine to a substation should be placed underground to allow for continued farming and existing land use operations in the vicinity of the WES, and to prevent avian collisions and electrocutions. All other above-ground lines, transformers, or conductors should comply with the Avian Power Line Interaction Committee (APLIC) published guidelines to reduce avian mortality.

1. No WECS shall be interconnected with a local electrical utility company until the utility company has reviewed and commented upon it. The interconnection of the WECS with the utility company shall adhere to the National Electrical Code as adopted by the Community.
2. The on-site electrical transmission lines connecting the WECS to the public utility electricity distribution system shall be located underground.

L. **Visual Impact**: A project shall be constructed using WES components (tower, nacelle, blade) of similar design, size, operation, and appearance throughout the project. Each WECS shall have one (1) sign, not to exceed two (2) square feet in area posted at the base of the tower. The sign shall contain the following information: warning high voltage, manufacturer's name, emergency phone number, and emergency shutdown procedures. The applicant shall avoid state or federal scenic areas and significant visual resources listed in the local unit of government's Master Plan. WECS shall not have affixed or attached any lights, reflectors, flashers or any other illumination, except for illumination devices required by Federal regulations. Colors and surface treatment of the WECS and supporting structures shall minimize disruption of the natural characteristics of the site. No part of the structure shall be used for signs or advertising. Utility-scale WES projects shall use tubular towers and all utility-scale WES in a project shall be finished in a single, non-reflective, matte finish, color approved by the Planning Commission.

M. **Shadow Flicker**: Shadow flicker shall not exceed 30 hours per year and/or 30 minutes per day measured to the exterior wall of a dwelling or other occupied building on a non-participating parcel. Mitigation measures to minimize or eliminate potential impacts from shadow flicker, as identified in the Shadow Flicker Impact Analysis for human-occupied structures, shall include, but not be limited to:

1. Change the proposed location of the wind energy tower; or
2. The utility-scale WES shall be turned off by manufacturer approved automated system during the period of time an inhabited structure receives shadow flicker; or

3. The utility-scale WES shall be turned off during flicker events after 30 hours/year of shadow flicker on an inhabited structure; or
4. There is screening (forest, other building(s), topography, window treatments/blinds) which shields the inhabited structure from a direct line of sight to the rotors causing shadow flicker.

N. **Signal Interference**: No utility-scale WES shall be installed in any location where its proximity to existing fixed broadcast, retransmission, or reception antennae for radio, television, or wireless phone or other personal communication systems would produce interference with signal transmission or reception unless the applicant provides a replacement signal to the affected party that will restore reception to at least the level present before operation of the WES. No utility-scale WES shall be installed in any location within the line of sight of an existing microwave communications link where operation of the WES is likely to produce electromagnetic interference in the link's operation.

O. **Decommissioning**: A planning commission approved decommissioning plan indicating:
1. the anticipated life of the project,
2. the estimated decommissioning costs net of salvage value in current dollars,
3. the method of ensuring that funds will be available for decommissioning and restoration,
4. the anticipated manner in which the project will be decommissioned and the site restored, and
5. the review of the amount of the performance guarantee based on inflation and current removal costs to be completed every 3 years, for the life of the project, and approved by the planning commission board.
6. Any WECS which are not used for six (6) successive months shall be deemed abandoned and shall be dismantled and removed from the property at the expense of the property owner.

P. **Permission to Inspect:** The Community hereby reserves the right upon issuing any WECS special land use permit to inspect the premises on which the WECS is located. If a WECS is not maintained in operational condition and poses a potential safety hazard, the owner shall take expeditious action to correct the situation.

Q. **Complaint Resolution**: A complaint resolution plan shall be presented to the planning commission and approved prior to approval of a special land use permit. The complaint resolution program will describe how the developer receives, responds, and resolves complaints that may arise from the operation of the WES. The complaint resolution plan shall include appropriate timelines for response and other detailed information (such as forms, and contact information). As a condition of filing a complaint, a landowner must allow the staff or designated agents and WES owner or agents on the subject property for further investigation.

R. **Annual Maintenance Review**: The WES shall be maintained and kept in a safe working condition. The WES owner shall certify on an annual basis that all turbines are operating under

normal conditions. Non-operational turbines at the time of the annual review, shall be identified and provided an expected date to resolve the maintenance issue. A wind turbine generator that has not been operational for over 12 months shall be considered abandoned and a violation of the special land use permit.

S. **End of Useful Life**: At the end of the useful life of the WES, the system owner:

1. Shall follow the decommissioning plan approved by the Planning Commission under Section O [from local government ordinance] and remove the system as indicated in the most recent approved plan; or,
2. Amend the decommissioning plan with Planning Commission approval and proceed with P.1 above; or,
3.The planning commission [local unit of government] reserves the right to approve, deny, or modify an application to modify an existing WES at the end of useful life, in whole or in part, based on ordinance standards at the time of the request. Expenses for legal services and other studies resulting from application to modify or repower a WES will be reimbursed to the township by the WES owner in compliance with established escrow policy.

SOLAR

A. LARGE PRINCIPAL-USE SES: A large principal-use SES is a special land use in the zoning districts specified and shall meet the following requirements:

1. Height: Total height for a large principal-use SES shall not exceed the maximum allowed height in the district in which the system is located.

2. Setbacks: Setback distance shall be measured from the property line or road right-of-way to the closest point of the solar array at minimum tilt or any SES components and as follows:

a. In accordance with the setbacks for principal buildings or structures for the zoning district of the project site 100 feet from the property line of a non-participating lot.
b 150 feet from any existing dwelling unit on a non-participating lot.
c. A Ground-Mounted SES is not subject to property line setbacks for common property lines of two or more participating lots, except road right-of-way setbacks shall apply.

3. Fencing: A large principal-use SES may [shall] be secured with perimeter fencing to restrict unauthorized access. If installed, perimeter fencing shall be a maximum of __ [e.g. something greater than or equal to 7] feet in height. [Barbed wire and chain link fencing is prohibited.] Fencing is not subject to setbacks.

4. Screening/Landscaping: A large principal-use SES shall follow the screening and/or landscaping standards for the zoning district of the project site. Any required screening and landscaping shall be placed outside the perimeter fencing.

a. In districts that call for screening or landscaping along rear or side property lines, these shall only be required where an adjoining non-participating lot has an existing residential or public use.

b. When current zoning district screening and landscaping standards are determined to be inadequate based on a legitimate community purpose consistent with local government planning documents, the Planning Commission may require substitute screening consisting of native deciduous trees planted 50 feet on center, and native evergreen trees planted 30 feet on center along existing non-participating residential uses.

c. The Planning Commission may reduce or waive screening requirements provided that any such adjustment is in keeping with the intent of the Ordinance.

d. Screening/landscaping detail shall be submitted as part of the site plan that identifies the type and extent of screening for a large principal-use SES, which may include plantings, strategic use of berms, and/or fencing.

5. **Ground Cover**: A large principal-use SES shall include the installation of ground cover vegetation maintained for the duration of operation until the site is decommissioned. The applicant shall include a ground cover vegetation establishment and management plan as part of the site plan. Vegetation establishment must include invasive plant species [and noxious weed, if local regulation applies] control. The following standards apply:

a. Sites bound by a Farmland Development Rights (PA 116) Agreement must follow the Michigan Department of Agriculture and Rural Development's Policy for Allowing Commercial Solar Panel Development on PA 116 Lands.

b. Ground cover at sites not enrolled in PA 116 must meet one or more of the four types of Dual Use defined in this ordinance.

i. *Pollinator Habitat*: Solar sites designed to meet a score of 76 or more on the Michigan Pollinator Habitat Planning Scorecard for Solar Sites.

ii. *Conservation Cover*: Solar sites designed in consultation with conservation organizations that focus on restoring native plants, grasses, and prairie with the aim of protecting specific species (e.g., bird habitat) or providing specific ecosystem services (e.g., carbon sequestration, soil health).

iii. *Forage*: Solar sites that incorporate rotational livestock grazing and forage production as part of an overall vegetative maintenance plan.

~~iv. *Agrivoltaics*: Solar sites that combine raising crops for food, fiber, or fuel, and generating electricity within the project area to maximize land use.Project sites that are included in a brownfield plan adopted under the Brownfield Redevelopment Financing Act, PA 381 of 1996, as amended, that contain impervious surface at the time of construction or soils that cannot be disturbed, are exempt from ground cover requirements~~

c. Project sites that are included in a brownfield plan adopted under the Brownfield Redevelopment Financing Act, PA 381 of 1996, as amended, that contain impervious surface at the time of construction or soils that cannot be disturbed, are exempt from ground cover requirements.

6. **Lot Coverage**: A large principal-use SES shall not count towards the maximum lot coverage or impervious surface standards for the district.

7. **Land Clearing**: Land disturbance or clearing shall be limited to what is minimally necessary for the installation and operation of the system and to ensure sufficient all-season access to the solar resource given the topography of the land. Topsoil distributed during site preparation (grading) on the property shall be retained on site.

8. **Access Drives**: New access drives within the SES shall be designed to minimize the extent of soil disturbance, water runoff, and soil compaction on the premises. The use of geotextile fabrics and gravel placed on the surface of the existing soil for the construction of temporary drives during the construction of the SES is permitted, provided that the geotextile fabrics and gravel are removed once the SES is in operation.

9. **Wiring**: SES wiring (including communication lines) may be buried underground. Any above-ground wiring within the footprint of the SES shall not exceed the height of the solar array at maximum tilt.

10. **Lighting**: Large principal-use SES lighting shall be limited to inverter and/or substation locations only. Light fixtures shall have downlit shielding and be placed to keep light on-site and glare away from adjacent properties, bodies of water, and adjacent roadways. Flashing or intermittent lights are prohibited.

11. **Signage**: Area consistent with the district or sign type standard may be used for signage at the project site. Any signage shall meet the setback, illumination, and materials or construction requirements of the zoning district for the project site.

12. **Sound**: The sound pressure level of a large principal-use SES and all ancillary solar equipment shall not exceed 45 dBA (Leq (1-hour)) at the property line of an adjoining non-participating lot. The site plan shall include modeled sound isolines extending from the sound source to the property lines to demonstrate compliance with this standard.

13. **Repowering**: In addition to repairing or replacing SES components to maintain the system, a large principal-use SES may at any time be repowered, without the need to apply for a new special land use permit, by reconfiguring, renovating, or replacing the SES to increase the power rating within the existing project footprint.

a. A proposal to change the project footprint of an existing SES shall be considered a new application, subject to the ordinance standards at the time of the request.

[Expenses for legal services and other studies resulting from an application to modify an SES will be reimbursed to the township by the SES owner in compliance with established escrow policy.]

14. **Decommissioning**: A decommissioning plan is required at the time of application.
    a. The decommission plan shall include:
        i. The anticipated manner in which the project will be decommissioned, including a description of which above-grade and below-grade improvements will be removed, retained (e.g. access drive, fencing), or restored for viable reuse of the property consistent with the zoning district,
        ii. The projected decommissioning costs for removal of the SES (net of salvage value in current dollars) and soil stabilization, less the amount of the surety bond posted with the State of Michigan for decommissioning of panels installed on PA 116 lands,
        iii. The method of ensuring that funds will be available for site decommissioning and stabilization (in the form of surety bond, irrevocable letter of credit, or cash deposit), and:

    b. A review of the amount of the performance guarantee based on inflation, salvage value, and current removal costs shall be completed every 3 years, for the life of the project, and approved by the planning commission board. An SES owner may at any time:

        i. Proceed with the decommissioning plan approved by the Planning Commission and remove the system as indicated in the most recent approved plan; or
        ii. Amend the decommissioning plan with Planning Commission approval and proceed according to the revised plan.

    c. Decommissioning an SES must commence when the soil is dry to prevent soil compaction and must be complete within 18 months after abandonment. An SES that has not produced electrical energy for 12 consecutive months shall prompt an abandonment hearing.