Daniel Priestley

From: Alex Delworth <alexd@cfra.org>
Sent: Thursday, September 7, 2023 5:55 PM
To: Daniel Priestley
Subject: Upcoming Solar Ordinance Meeting
Attachments: Woodbury county Zoning Comment.docx.pdf; Iowa Solar Siting Resource Guide - A Roadmap for Counties.pdf; Policy Approaches for Dual-use and AgriSolar Practices.pdf; amplifying-clean-energy-with-conservation-part-i-pollinator-friendly-solar.pdf; native-vegetation-and-solar-projects-in-iowa.pdf

Good Evening Daniel,

I am reaching out to provide a comment on behalf of the Center regarding the upcoming zoning meeting on utility-scale solar. Attached is the comment as well as some resources that you may find useful as they address many of the agricultural land-use concerns identified.

Feel free to reach out if you have any questions.

Thank you,

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CENTER *for* RURAL AFFAIRS

9/7/2023

Daniel Priestley
620 Douglas Street, 6th Floor
Sioux City, IA 51101

Re: Utility-Scale Solar Ordinance

The Center for Rural Affairs is a private non-profit organization that advocates for policies that strengthen rural communities in order to create a more vibrant future. We connect rural citizens with opportunities to engage in the decisions that affect their lives, and one of the biggest of these is the opportunity to decide how their electricity is generated. Renewable energy projects have demonstrated significant potential to bring in new tax revenue, provide additional income for landowners, and create new jobs in rural areas.

A few methods to address land-use concerns between solar and zoned agricultural land have been identified by the supervisors. We do not recommend using metrics like Corn Suitability Rating (CSR) or percentage of agricultural land as ways to regulate utility-scale solar energy. Limiting development through CSR restricts landowners with higher-valued land from taking advantage of the economic benefits of solar development and limits their right to decide what is best for their land. Implementing a CSR restriction of solar on land rated 65 or more would eliminate almost 50% of land in the county for potential development. Both of these measures are restrictive of private property rights and will limit Woodbury County landowners ability to diversify their income through solar.

Solar projects generally have minimal impact on land quality, and land can be returned to farming at the end of the project's life cycle if desired. Practices such as planting native or perennial vegetation under the panels can increase soil health and provide pollinator habitat. Site vegetation can also be managed through grazing, offering local farmers additional income opportunities and providing an avenue for the land to stay in agricultural use at the same time. Additional dual-use practices such as beekeeping and crop production under the panels offer additional opportunities to combine solar and agriculture, demonstrating that clean energy and agriculture do not require an either/or approach.

Included with this letter are a few of our solar energy siting resources we hope you will find useful during discussions. Our most recently-released report, *Policy Approaches to Dual-Use and Agrisolar Practices*, might be especially helpful given the central discussion around CSR and preserving agricultural lands. Additionally, our full clean energy siting library can be viewed at cfra.org/cleanenergysiting.

Sincerely,

Alex Delworth
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CENTER *for* RURAL AFFAIRS

Resources:

Iowa Solar Siting Guide
Policy Approaches for Dual-Use and Agrisolar Practices
Amplifying Clean Energy with Conservation
Native Vegetation and Solar Projects in Iowa

CENTER for RURAL AFFAIRS

Iowa Environmental Council

IOWA SOLAR SITING RESOURCE GUIDE: A ROADMAP FOR COUNTIES

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CENTER for RURAL AFFAIRS Iowa Environmental Council

INTRODUCTION

Solar at all scales is a growing opportunity in the state of Iowa. From immense growth in the customer-owned solar market to the emergence of utility-scale and community solar projects, Iowa appears to be at the beginning of a solar boom. For counties presented with the opportunity of large-scale solar projects, an important tool to consider is a well-drafted ordinance. A good ordinance will preserve the interests of the county and its residents while enabling developers to build workable, cost-effective projects. Under Iowa's home rule policy, counties have latitude to adopt ordinance provisions related to solar development.

A well-crafted ordinance will take into consideration the jurisdiction of the Iowa Utilities Board (IUB) to approve projects that are 25 megawatts or larger in size.

Solar in Iowa has grown from around two megawatts (MW) in 2012 to about 115 MW today.[1] The first utility-scale projects came before the Iowa Utilities Board for approval in the summer of 2019 with a 100 MW project proposed in Louisa County and a series of projects totaling 749 MW proposed for Worth, Mitchell, and Howard Counties. Multiple projects are in the works and counties around Iowa are preparing for this exciting future.

This guide focuses on siting practices for two types of large solar energy developments: Utility-Scale Solar and Community Solar. We will not focus on personal solar energy systems, such as those used at homes, farms, and businesses to produce electricity for usage on-site.

While large-scale solar development may be in its early days in Iowa, a handful of Iowa counties have already adopted solar ordinances and many of our neighbors in the Midwest have already seen utility-scale development. In addition to existing Iowa ordinances, **we have reviewed the ordinances and best practices from neighboring states and identified specific provisions that local officials can use as a road map for their own ordinances.**

> We encourage counties that are considering an ordinance, or updating an ordinance, to use this document as a reference to support the development and adoption of a well-designed ordinance rooted in existing successful practices.

As solar energy gains momentum across Iowa, community solar projects are becoming more common. Cities including Ames, Bloomfield, and Cedar Falls have adopted or are in the process of constructing community solar projects. For many Iowans, community solar projects offer an opportunity to invest in renewable energy without having to construct a system on their own. This type of project allows renters, homeowners and businesses with shaded roofs, and other community members to enjoy the benefits of solar energy while offering an opportunity for utilities to provide a clean source of energy to residents and businesses. This guide includes an addendum of resources for those considering community solar projects.

We encourage counties that are considering an ordinance, or updating an ordinance, to use this document as a reference to support the development and adoption of a well-designed ordinance rooted in existing successful practices.

This document is not legal advice and users of this guide should consult an attorney with specific legal questions.

STATE AND LOCAL BENEFITS FROM SOLAR DEVELOPMENT AND FUTURE POTENTIAL

Iowa has what it takes to be a national leader in solar energy. The state ranks 16th among U.S. states in technical potential for solar energy production, putting Iowa ahead of states such as Florida, Georgia, and South Carolina. A solar photovoltaic (PV) array located in Iowa produces a comparable amount of electricity as one located in Miami or Atlanta, and more than arrays located in Chicago.[2]

Iowa is poised for significant solar development. The rapidly improving economics of solar energy are now driving large-scale projects. A recent report found that the levelized cost of energy for utility-scale solar declined 89 percent between 2009 and 2019.[3] Using ground-mount solar systems to meet five (5) or 10 percent of Iowa's annual electricity needs would require a very small geographic footprint. Using just 21 of Iowa's 55,857 square miles of land for solar PV would provide 10 percent of Iowa's electricity needs.[4] There were 3,294 MW of potential solar projects in Iowa being studied for connection to the grid by the regional grid operator Midcontinent Independent System Operator (MISO) at the end of 2019.[5]

Counties may play a role in solar development by reviewing and approving specific solar projects. County policies that guide review and approval need to strike a balance between concerns expressed by county residents and successful, cost-effective solar development. An ordinance can be a critical part of achieving a balance and seeing maximum local benefits from solar generation.

Solar development offers a number of benefits to county residents and the county itself. These benefits include:

- **Lease or easement payments to landowners.** Payments to landowners provide long-term, stable streams of revenue.
- **Property tax revenue to counties.** Solar arrays generate property tax revenue paid to counties that can support a range of public benefits, including roads and bridges, health services, schools, debt service, and reduced need for revenue from other sources.
- **Replacement tax revenue to counties.** State law provides a defined replacement tax for electric generating facilities to ensure similar tax treatment for potential competitors within the state. The replacement tax revenue to counties may be almost as large as the property tax revenue.
- **Clean energy resources.** Unlike fossil-fuel power plants, solar arrays do not produce air pollutants such as sulfur dioxide, nitrogen oxide, greenhouse gases, particulates, or mercury, thus reducing acid rain, smog, and public health impacts such as pulmonary and heart disease and asthma. Solar arrays also do not use water or produce water pollution in the process of generating electricity or produce hazardous waste that threatens public health, unlike fossil and nuclear power plants.
- **Local economic development.** In 2018, Iowa had nearly 850 jobs supported by the solar

industry.[6] The U.S. Bureau of Labor Statistics found in 2019 that solar installers are projected to be the fastest growing job in the United States through 2026, with the position expected to grow by nearly 105 percent during that time span.[7] There are nearly 100 Iowa businesses involved in the solar energy supply chain.[8] These jobs are located across the state in a range of sectors including manufacturing, installation, and operations and maintenance.

DEFINITION OF TERMS

Like many areas of technology and regulation, solar siting terminology uses jargon that is critical for local government officials to understand and define in order to create a clear ordinance. The list of terms provided here is not exhaustive, but defines many of the terms counties should consider adding to the definitions section of a solar siting ordinance.

- **Utility-Scale Solar Energy System:** A solar energy system above a certain capacity that is intended to produce electricity to sell into the market, not to directly supply end-use customers. These systems are larger than small-scale residential or business solar installations and many community systems, often covering more land area.

  Note: *If a system is 25 MW or larger, it will need to obtain a siting certificate from the Iowa Utilities Board (IUB). The hearing for the siting certificate will be held in the county where construction is to occur and the county will be a party to the proceeding. Solar energy systems smaller than 25 MW do not require a siting certificate.*
- **Community Solar:** A solar energy system developed by a municipality, utility, or other third party that typically allows community members to subscribe to the project. In Iowa, development of community solar projects is limited to utilities at this time.
- **Easement:** A legal agreement for the use of property for a specified purpose.
- **Feeder circuits/lines:** A power line or network of lines used as a collection system that carries energy produced by a solar energy system to an interconnection point like a substation. Feeder circuits are most often placed underground.
- **Glare/glint:** Light reflected off of a surface.
- **Interconnection:** Link between a generator of electricity and the electric grid. Interconnection typically requires connection via infrastructure such as power lines and a substation, as well as a legal agreement for the project to be connected to the grid.
- **Module:** An individual unit comprised of multiple photovoltaic (PV) cells, with multiple modules used in a solar energy system.
- **Mounting:** The method of anchoring solar energy system modules to the ground or a building.
- **Non-participating landowner:** Any landowner that has not signed a lease agreement for an easement with the project owner or developer, often adjacent to or near the project.

- **Operator:** The entity or individual that operates a solar energy system.
- **Owner:** The entity or individual that has ownership over a solar energy system.
- **Participating landowner:** A landowner who has signed a lease agreement for an easement with a project owner.
- **Residential/small-scale solar energy system:** A solar energy system that is installed at a residence or business to meet the electric demand at the location. These systems are typically intended to offset electricity use for the owner and are not intended to be net generators of electricity.
- **Solar energy system:** A system that converts energy from sunlight into electricity or an additional energy source such as heat.
- **Substation:** A facility that converts electricity produced by a generator like a solar energy system to a higher voltage, allowing for interconnection to high-voltage transmission lines.
- **System height:** The height of a solar energy system, usually referring to ground mounted systems. Total system height is the measurement from the ground to the top of the mounting or modules associated with a system. Counties may also wish to include an additional height definition for ground clearance, or the measurement between the ground and the bottom of modules or mounting.
- **Transmission lines:** Power lines used to carry electricity from collection systems or substations over long distances.

BEST PRACTICES OF SOLAR SITING

SUMMARY OF BEST PRACTICE RECOMMENDATIONS

Our recommendations for solar ordinance provisions to enable responsible solar development and the benefits that come with it include:

Application and approval process. We recommend that counties establish a clear and well-defined application process with a set of known application requirements. Solar projects should be treated either as a permitted use or as a conditional use in established zoning districts. If the application and associated solar development meet the clearly identified conditions, the application and project should be approved.

Siting

- **Zoning districts.** Counties should allow for the siting of utility-scale and community solar in a variety of districts.
- **Site plan and requirements.** Part of the application and approval process may include a plan describing the project in detail as well as a number of site and structure requirements. For projects 25 MW or larger, we recommend that the county accept the Application for a Certificate, required by the Iowa Utilities Board, in lieu of a separate county application.

Setbacks. Counties should ensure that setbacks balance multiple interests and support cost-effective solar development. Counties should also provide for waivers for voluntary reduction in setbacks.

Operations & maintenance plans and land use. To address both short-term and long-term maintenance of a project area, counties may require an operations and maintenance plan and adopt land use requirements.

Infrastructure. Counties may require a pre-construction plan for handling potential impacts to roads and other infrastructure from solar project construction as well as a post-construction review to identify impacts and provide for repairs.

Decommissioning. Counties may require a decommissioning plan as part of the application and approval process to ensure restoration of land once a project is no longer operating.

MAJOR PROVISIONS FOR COUNTY SOLAR ORDINANCES

Successful solar siting ordinances will balance the interests of the county, project participants, and non-participants while allowing for cost-effective development. Ordinances can preserve these interests without imposing onerous restrictions. In order to allow for successful solar development, ordinances should rely on established best practices.

APPLICATION AND APPROVAL PROCESS

Iowa Code constrains to some extent the procedural options available to counties for consideration and approval of large-scale solar. The best practices recommended in this section apply primarily to counties that have adopted zoning and may not apply to counties without zoning.

RECOMMENDATIONS:

- **We recommend that counties adopting a solar ordinance first adopt an amendment to their comprehensive plan with a statement about their intentions for solar development in the county, the benefits of investments in solar, and the key considerations around regulating solar siting.**
- **We recommend that county officials prioritize creating a clear application and review process with well-defined steps and conditions for approval. This allows a solar developer to clearly identify the application requirements for a solar project which, if met, will result in county approval of the application. The setback provisions described below would be one of the clear application requirements, while the additional provisions discussed in this document can comprise the balance of those requirements (e.g. decommissioning, site plan, road use plan, etc.)**
- **Any application fees must not exceed the cost of processing the application, including any required inspection.[9]**

PROCESS

COMPREHENSIVE PLAN UPDATE

Iowa code specifies that zoning ordinances and decisions "shall be made in accordance with a comprehensive plan..." [10] (Iowa Code § 335.5). For this reason, we recommend a county looking to attract solar and other renewable energy development first adopt an amendment to align a county comprehensive plan with a county's intentions to attract such development.

EXAMPLE: CEDAR COUNTY

"Goal III. Encourage the creation and use of alternative and renewable energy sources. Objective 1: Increase alternative and renewable energy sources in the county.

Strategies: Review and modify the zoning ordinance and other relevant county regulations as necessary to remove barriers to the use of renewable energy systems such as solar, wind, and geothermal."

The County should promote the use of renewable and inexhaustible energy sources over non-renewable energy sources. . . ." [11]

OPTIONS FOR SITING

Counties can use various processes to govern solar siting. The two most straightforward options are to make solar systems a permitted use (also sometimes called an "allowed" or "principal" use) in specific zones or designating solar systems as a conditional use (also called a "special use" or "special exception"). In the case of a conditional use, supervisors should define the conditions that the project must meet to be approved.

Solar as a Permitted Use

If a county ordinance designates solar as a permitted use, county staff reviews projects to determine compliance with objective ordinance requirements. County staff would be able to determine objective requirements, such as whether a project meets required setbacks, but would not be able to decide on subjective requirements such as whether a particular project "fits the area." If the project complies with the ordinance, it can move forward. County staff typically issue a building or zoning permit under this approach.

Solar as a Conditional Use

The term "conditional use" in a zoning code usually means that a use may be allowed or permitted in a specified district (or districts) on the condition that certain requirements are met. Conditional use permitting decisions depend on the applicant's compliance with the standards specified in the zoning code as conditions for permit approval. These conditions may be more subjective but the decision criteria must be included in the ordinance. Conditional uses can only be permitted subject to review and approval of a county zoning board of adjustment (ZBA) after a public hearing. The ZBA should base its decision on evidence presented in the public hearing and evaluate the project based on the project's compliance with the conditions in the ordinance. If the conditions are met, the permit should be issued.

Uses permitted on this basis are generally those that a county considers not generally adverse to the public interest, but requiring some special review and precautions as well as an opportunity for public input.

Counties may wish to require the filing of items such as site plans, road use agreements, and decommissioning plans as conditions for approval. These are described in more detail below.

If a county opts for conditional use permitting through the ZBA, we recommend providing applicants with the opportunity for a preliminary review and pre-application process. Iowa law provides that appeals of a final decision of the ZBA go to court for review.[12] Allowing for preliminary review and a pre-application process helps provide applicants with a more predictable process and can minimize the potential for time-consuming or expensive judicial review.

For projects that are 25 MW or larger, the county has the opportunity to state whether the solar energy system meets the county zoning requirements, as a designated party to the Iowa Utilities Board's public hearing held in the county as a part of the single hearing siting process required under section 476A.11 of the Iowa Code.[13]

DESIGNATING ZONING DISTRICTS FOR SOLAR

Counties may allow siting of utility-scale solar in a variety of districts. An easy place to start for solar development in zoning districts would generally be designating business, commercial, industrial, and agricultural districts as eligible for utility-scale projects. After seeing development in one or more of these districts, additional districts could be considered.

Smaller-scale or community solar may be appropriate in more types of zoning districts, including those within or close to residential neighborhoods. This is especially appropriate if participants in the community solar project live in those districts.

EXAMPLES OF DISTRICTS WHERE IOWA COUNTIES WITH ZONING ALLOW SOLAR DEVELOPMENT:

Linn County: Agricultural District, Highway Commercial District, General Commercial District, Industrial District, Critical Natural Resources District

Clinton County: Prime Agricultural District, Agricultural - Recreation District, Highway Commercial District, Rural Support Commercial District, Limited Industrial District, General Industrial District

Louisa County: Agricultural District, Business District, Industrial District

APPLICATION REQUIREMENTS

RECOMMENDATIONS:

- **Project applications should provide essential information to county boards and zoning officials. While some information may be required at the time of application, officials may wish to allow applicants to submit additional information at a later date.**

- **For projects 25 MW or larger, we recommend that the county accept the Application for a Certificate, required by the Iowa Utilities Board, in lieu of a separate county application.**

GENERAL REQUIREMENTS

County ordinances may include a number of site and structure requirements, many of which are discussed in further detail within this document. Some counties may ask for this information as part of a "site plan." Items required in an application for a utility-scale solar energy system may include:

1) Name of applicant.

2) Name of the project owner.

3) Description of the project — number of modules, manufacturer, mounting type, system height, system capacity, total land area covered by the system, and information about associated facilities like substations, feeder lines, battery storage, etc.

4) Legal description of the property where the solar energy system will be located.

5) Map of the project location and the surrounding area.

6) A decommissioning plan outlining the process for system removal—including individual modules and mounting—and property restoration before an easement is returned to a landowner.

7) Evidence of a power purchase agreement or interconnection application for the project.

8) Consultation with or notifications from relevant state and federal agencies showing the project will not be a hazard to wildlife, communications, air traffic, etc.

9) Documentation of easement locations acquired for solar energy systems and associated facilities.

Because the IUB requires similar types of information as part of the Generating Certificate application process, we recommend that for projects above 25 MW, counties accept the information submitted in such an application to the IUB in lieu of a separate application to avoid duplication.

SETBACKS

RECOMMENDATIONS:

- **Property line setbacks should not exceed 50 feet; setbacks from occupied residences should stay within a range of 100 to 200 feet.**
- **Counties should include waiver provisions allowing for the county to waive the mandated setback distance with the consent of the participating landowner and adjacent property owner.**
- **No setbacks should be required if a property line is shared by two participating landowners.**

Counties may choose to put into place setbacks, which specify the required distance of the project from homes, roads or existing rights-of-way, property lines, and other locations. Unlike setbacks for wind turbines, which are intended to address rare but dangerous scenarios such as turbine collapse, there are no safety concerns that point to the necessity of a specific setback requirement for solar facilities. Before putting setbacks into place, counties should consider the issues that a setback is meant to address and whether there is a separate project requirement that may better address it. While some level of setback may be appropriate, officials should carefully consider setback distances and the limits they may place on future development.

Many counties require solar installations to follow the same setback requirements (from property lines and rights of way) as other structures in the zoning district where they are located. Some counties opt for prescribed setback distances from property lines and occupied structures.

SETBACKS FROM RESIDENCES AND PROPERTY LINES

Some counties require specific setback distances between the solar system and property lines of occupied residences.

According to our research, a 50 foot property line setback is included in a number of ordinances from Iowa's neighboring states. A 100 to 200 foot setback for residential dwellings is also common, with some ordinances at 100 feet, some at 150 feet and some at 200 feet. These distances seem workable for developers, participants, and nonparticipants.

Utility-scale solar energy systems are likely to be sited in zones where residential dwellings are uncommon but may occur (agriculture, industrial, commercial). Counties can adopt an occupied structure setback that both reflects the needs and local characteristics of these zones and stays within the 100 to 200 foot range. There is no justification for larger setbacks from a safety perspective and larger setback distances would unnecessarily limit solar development in a county.

We recommend that property line setbacks do not exceed 50 feet from a property line and stay within a range of 100 to 200 feet from an occupied residence.

SETBACKS BASED ON ZONING DISTRICT

Although we recommend counties adopt specific setback distances for solar systems, counties could also choose to follow the minimum setback requirements of the zoning district where they are located, similar to Linn and Clinton Counties.

Since structures or vegetation on neighboring properties may cast shadows onto a solar system, causing a decline in solar panel efficiency, Linn County recommends greater setbacks in lieu of a "solar access agreement." These agreements are discussed in further detail later in this document.

Community solar projects may be appropriate in more types of zoning districts, including those in or closer to residential neighborhoods, especially if participants in community solar live in those districts. For this reason, counties should consider using the setback requirements of the zoning area

where the project is located to govern the solar facility. Further considerations for community solar projects are discussed later in this guide.

SHARED PROPERTY LINES

When a solar array is built across the property line of two participating landowners, no property line setback is required in Louisa County:[14]

> [Solar Farm Energy Systems] to be built on more than one parcel and parcels are abutting, a zero (0) side or rear setback shall be permitted to the property line in common with the abutting parcel(s).

In the case that a property line is shared by two participating landowners, a setback serves no purpose so we recommend this as a best practice.

RIGHTS OF WAY

A county may require a specific setback distance from a roadway. In counties with zoning, we recommend using the right of way setback standards for principal or accessory use structures specific to the zoning district where the project is located. In counties without zoning, we recommend consultation with right-of-way operators to ensure that projects do not disrupt current or planned use.

WAIVERS OR NEGOTIATED SETBACKS

Waivers are an important tool to improve flexibility and allow for the potential for additional land area to become available for solar development. However, providing a waiver is not a substitute for a setback policy that can enable cost-effective solar development.

Louisa County allows for written waiver agreements to be executed pursuant to the specific requirements set forth in the ordinance along with approval by the Zoning Board of Adjustment.

We recommend that counties allow for a waiver of the mandated setback distance with the consent of the participating landowner and adjacent property owner.

ADDITIONAL SITING STANDARDS

RECOMMENDATIONS:

- **Counties should carefully consider whether site and structure provisions are unnecessarily restrictive.**
- **Counties should allow for and encourage the project operator or owner to invest in fencing that facilitates movement of wildlife and pollinators.**
- **Solar access agreements should be facilitated by counties using Iowa Code § 564A.1 to guide their process.**

- **Counties should require appropriate safety warnings and signage at solar facilities.**

County officials should carefully consider whether site and structure provisions are unnecessarily restrictive. Well-established solar zoning guides describe the importance of avoiding inadvertent obstacles in an ordinance's major provisions:

> From the American Planning Association (APA): "Even in cases where zoning codes explicitly address solar energy systems, subtle barriers such as height restrictions, lot coverage limitations, and setback, screening, landscaping, and utility requirements may still impede solar development."[15]

> From the Great Plains Institute (GPI): "Limit regulatory barriers to developing solar resources. Ensure that access to solar resources is not unduly limited by height, setback, or coverage standards, recognizing the distinct design and function of solar technologies and land uses."[16]

FENCING

To protect the solar array and to provide for safety by preventing entry into a project area, counties may require fencing around the solar array. Both Clinton and Linn Counties use the same language to address fencing requirements:

> A security fence must be installed along all exterior sides of the utility scale solar installation and be equipped with a minimum of one gate and locking mechanism on the primary access side. Security fences, gates and warning signs must be maintained in good condition until the utility scale solar installation is dismantled and removed from the site.[17]

Project developers are required to follow the specific fencing requirements of the National Electrical Code (NEC), which is updated every three years. Currently, the NEC requires a seven foot tall fence;

therefore we do not recommend that counties set their own fence height requirements.

Specific types of fencing may be desirable for reducing impacts to wildlife or limiting aesthetic concerns related to a project. For example, deer fencing may be less visually obtrusive while also allowing for wildlife and pollinators to move through a project area. This practice could soon be deployed in Iowa, as the developers of a large solar project in Howard County have proposed to surround the project area with deer fencing.[18]

County requirements for fencing should be limited because the NEC covers this requirement. However, we do recommend that counties allow for or encourage the project operator or owner to invest in fencing that facilitates movement of wildlife and pollinators.

HEIGHT RESTRICTIONS

The height of solar arrays is typically measured by the maximum tilt of the panels.

In some counties where large-scale solar is a permitted use, the height restrictions of solar arrays match the zoning district where they are located. Counties may also choose to set specific height limitations for solar systems. Counties could consider allowing for less stringent height restrictions if coupled with longer setbacks from neighboring properties. An example is adding two feet to the setback distance for each additional foot of height.[19]

It is important that counties do not set overly restrictive height limitations given ongoing research into potential agricultural co-uses of solar project areas such as livestock grazing and planting underneath panels. There are also no compelling safety reasons for height restrictions.

SOLAR ACCESS SPACE AND AGREEMENTS

Since solar panel performance relies on the amount of sunlight collected, counties may consider how improvements or new vegetative plantings on neighboring properties could cast shadows onto solar arrays. Developers may want an assurance of continued future access to sunlight to ensure project success over the 25 to 40 year life expectancy.

There are several Iowa statutory provisions that address access to solar energy and are intended to "facilitate the orderly development and use of solar energy."[20] Iowa Code encourages voluntary solar access easements and sets out requirements for easements to protect solar access. The Code also authorizes city councils and county boards of supervisors to establish solar access regulatory boards (or authorize certain existing boards for this purpose).

These regulatory boards have the power to grant solar access easements to properties hosting solar projects in order to protect access to solar energy. The code allows public bodies to include provisions that would compensate the owner of the solar project if shade interferes with the project and/or that would compensate the owner of the easement for maintaining the easement space.[21]

Linn County's ordinance provides for a "solar access agreement" process which is defined as a

"recorded easement which provides continued access to incident sunlight necessary to operate a solar collector."[22]

We recommend counties allow for solar access agreements using Iowa Code § 564A.1 to guide their process.

SAFETY AND SIGNAGE

Projects may be required to post signs that clearly feature the name, address, emergency contact information for the operator, and warnings. Safety requirements typically include clear safety notices to the public, such as high voltage warnings. Louisa County requires the following guidance on signage in its ordinance:

> [Solar Farm Energy Systems] shall provide the following at all locked entrances:
> 1) A visible "High Voltage" warning sign;
> 2) Name(s) and phone number(s) for the electric utility provider;
> 3) Name(s) and phone number(s) for the site operator;
> 4) The facility's 911 address, GPS coordinates; and,
> 5) A lock box with keys as needed.[23]

These requirements are an appropriate best practice.

OPERATIONS AND MAINTENANCE PLANNING

RECOMMENDATIONS:

- **Counties should adopt an operations and maintenance plan designed to avoid negative impacts on the surrounding land, water, and neighbors.**
- **We encourage counties to consider requiring native vegetation to bolster wildlife, soil, and water quality benefits.**

Solar projects are expected to be in operation for at least several decades. To address both short-term and long-term maintenance of a project area, counties may require an operations and maintenance plan as part of the application process. Both Clinton County and Linn County address the same elements in the required operations and maintenance plan:

- Soil erosion and sediment control
- Stormwater management
- Ground cover and buffer areas
- Cleaning chemicals and solvents
- Maintenance, repair, or replacement of facility

In order to monitor compliance with maintenance requirements, Louisa County requires access to a project site:

> The Zoning/Building Administrator and any necessary personnel may enter any property for which a special use or building permit has been issued under this ordinance to conduct an inspection to determine whether the conditions stated in the permit have been met as specified by statute, ordinance and code. Failure to provide access shall be deemed a violation of this ordinance.[24]

NATIVE VEGETATION MANAGEMENT AND GROUND COVER

Utility-scale solar project sites often occupy multiple acres of land and are projected to cover three million acres across the nation by 2030. To produce 10 percent of Iowa's electricity from solar energy, 13,440 acres would need to be occupied by solar arrays, or 0.04 percent of all of Iowa's farmland. This offers an opportunity for project owners to demonstrate a commitment to environmental stewardship by establishing native vegetation on their solar project site(s). Investing in this practice will create habitat for a variety of at-risk pollinators, including honey bees, bumblebees, and monarch butterflies. For local officials considering the creation of a solar ordinance, this section explores a variety of considerations that can inform sound policy.

Historically, there were 28 million acres of native prairie across the state of Iowa; there is less than one-tenth of one percent of that native prairie remaining. Investments in native vegetation on solar project sites can also help restore habitat for wildlife like ring-necked pheasants, quails, and other grassland birds such as the dickcissel or the sedge wren.

Native prairie plants at the Chisago Solar Site, Chisago County, Minnesota, August 2018. Photo credit to Dennis Schroeder, National Renewable Energy Laboratory. Link: https://www.flickr.com/photos/nrel/30733119928/in/album-72157699605466033/

Meanwhile, other important environmental outcomes are also achieved through planting native perennial vegetation such as improved soil health and water quality and carbon sequestration. Importantly, the deep root systems of native vegetation can penetrate the soil surface as deep as 15 feet, allowing for increased soil structure and denitrification of water. Improving soil health and water quality also provides developers with the practical benefits of meeting stormwater drainage permit requirements and reducing erosion on project sites.

After considering the potential positive environmental outcomes, Linn County included a requirement within their solar ordinance to establish perennial vegetated ground cover:

> Ground cover and buffer areas. Ground around and under solar arrays and in project site buffer areas shall be planted and maintained in perennial vegetated ground cover, and meet the following standards:
>
> 1) Top soils shall not be removed during development, unless part of a remediation effort.
>
> 2) Soils shall be planted and maintained in perennial vegetation to prevent erosion, manage run off and build soil. Seeds should include a mix of grasses and wildflowers, ideally native to the region of the project site that will result in a short stature prairie with a diversity of forbs or flowering plants that bloom throughout the growing season. Blooming shrubs may be used in buffer areas as appropriate for visual screening.
>
> 3) Seed mixes and maintenance practices should be consistent with recommendations made by qualified natural resource professionals such as those from the department of natural resources, county soil and water conservation service, or natural resource conservation service.
>
> 4) Plant material must not have been treated with systemic insecticides, particularly neonicotinoids.[25]

The benefits of establishing even small areas of native vegetation have been proven to significantly improve pollinator and wildlife populations while helping developers maintain storm water permitting requirements, reduce erosion, and mitigate land use concerns. However, there are many important considerations for developers who wish to install native vegetation on their solar project site. While these recommendations will not typically be included in an ordinance, county officials should educate themselves on the options available to developers and the factors that influence developer implementation. We have included a short primer on those issues as an Appendix to this document.

INFRASTRUCTURE AND ROAD USE AGREEMENTS

RECOMMENDATION:

- **Counties should put a process in place for assessing and repairing infrastructure before construction begins.**

Solar construction crews will utilize roads in and out of a project site. Counties should have a lesser expectation of road impacts from solar development compared to wind development. To address potential impacts to public infrastructure, counties may adopt a road use plan.

Louisa County has adopted the following requirements for a road use agreement:

> Road Use Agreements. All routes on county roads that will be used for the construction and maintenance purposes shall be identified on the site plan. All routes for either ingress or egress shall be shown. The solar farm developer must complete and provide a preconstruction baseline survey to determine existing road conditions for assessing potential future damage due to development related traffic. The developer shall provide a road repair plan to ameliorate any and all damage, installation, or replacement of roads that might be required by the developer. The developer shall provide a letter of credit or surety bond in an amount and form approved by the appropriate highway authority(s) officials when warranted. The provision of this subsection shall be subject to the approval of the Louisa County Engineer.[26]

We recommend putting a process in place before construction begins that helps clarify for all parties what specific impacts a developer will be held responsible for and what steps must be taken to mitigate potential damage to roads and other infrastructure.

DECOMMISSIONING AND SITE RESTORATION

RECOMMENDATIONS:

- **Planning for the responsibility of decommissioning is a prudent step for a county ordinance. We recommend that counties require a decommissioning plan which defines the obligations of the project developer to remove the solar array and restore the land when the project will no longer be used.**
- **Counties should require the project developer/owner to notify the county of their intent to stop using the facility and that should be the trigger for decommissioning to begin.**

Solar ordinances often include a provision requiring the project owner to take responsibility for and bear the costs of decommissioning at the end of a solar project's life. These provisions ensure the county and landowners do not bear the cost of removing solar arrays.

Solar panels typically come with a 20 to 25 year warranty and could be useful for up to 40 years. Depending on the length of a landholder lease, or with a lease extension, projects could be refitted

with new panels once panels have reached their useful life. A county ordinance should include a notice requirement stating that once a developer/owner has determined that the facility will no longer be used, the developer/owner must notify the county of the intent to stop using the facility and to decommission the facility in accordance with the agreed-upon decommissioning plan.

We do not recommend that counties set a time limit for automatic decommissioning, such as no production for one (1) year, because as renewable penetration increases some renewable facilities may be used only as "peaker" facilities on days of extremely high electricity demand. Just because a facility is not producing electricity does not mean it is not being used as a back-up resource by the utility.

The following decommissioning example is from Linn County:

> Decommissioning and site reclamation plan.
>
> a. The application must include a decommissioning plan that describes the anticipated life of the utility scale solar installation; the anticipated manner in which the project will be decommissioned; the anticipated site restoration actions; the estimated decommissioning costs in current dollars; and the method for ensuring that funds will be available for decommissioning and restoration.
>
> b. The applicant shall provide the basis for estimates of net costs for decommissioning the site (decommissioning costs less salvage value). The cost basis shall include a mechanism for calculating adjusted costs over the life of the project.
>
> c. Restoration or reclamation activities shall include, but not be limited to, the following:
>
> 1. Restoration of the pre-construction surface grade and soil profile after removal of structures, equipment, graveled areas and access roads.
>
> 2. Re-vegetation of restored soil areas with crops, native seed mixes, plant species suitable to the area, consistent with the county's weed control plan.
>
> 3. For any part of the energy project on leased property, the plan may incorporate agreements with the landowner regarding leaving access roads, fences, gates or repurposed buildings in place or regarding restoration of agricultural crops or forest resource land. Any use of remaining structures must be in conformance with the regulations in effect at that time.

OTHER CONSIDERATIONS

NOISE

Inverters, the equipment that convert direct current (DC) electricity into alternating current (AC) electricity, can produce a soft sound during the daytime when the solar array is producing energy. Noticeable noise is not a common or expected impact and any noise should be imperceptible to

neighboring properties even without specific noise provisions.

We do not recommend adding standards for noise. Minimum setback requirements should sufficiently address these issues without adding specific, separate provisions for noise.

SCREENING

Some counties have chosen to adopt screening requirements in conjunction with setbacks. Counties should consider if screening requirements would be arbitrary and what, if any, other uses currently require screening. According to the National Renewable Energy Laboratory (NREL):

> While aesthetic requirements are appropriate for historic districts, requiring solar energy systems to be screened from public view adds costs, can cause shading, and may prevent many installations.[27]

We do not recommend that counties adopt screening provisions or requirements.

GLARE

The American Planning Association advises that "[s]ome residents may express concerns that glare from solar collectors will be either a public or private nuisance. However, because they are constructed of dark-colored materials and covered with anti-reflective coatings, new solar PV and thermal systems typically reflect as little as 2 percent of incoming sunlight."[28]

Similarly, a summary of research from the National Energy Research Laboratory states, "Local objections to proposed solar photovoltaic (PV) installations sometimes include concerns that the modules will cause glare that could impact neighbors or aviation. Research on this subject demonstrates that PV modules exhibit less glare than windows and water. Solar PV modules are specifically designed to reduce reflection, as any reflected light cannot be converted into electricity. PV modules have been installed without incident at many airports."[29]

Given how solar panels are constructed, glare or reflected light is not typically a major issue. Counties wishing to address this low-risk potential impact can include a provision in their ordinance, such as Clinton County and Linn County have:

> All solar panels must be constructed to minimize glare or reflection onto adjacent properties and adjacent roadways and must not interfere with traffic, including air traffic, or create a safety hazard.[30][31]

We do not recommend glare provisions in a solar ordinance. However, local or federal authorities may require a glare study that shows the potential impact to the surrounding area, particularly on infrastructure like airports and roadways. For example, the Federal Aviation Administration (FAA) required the City of Ames to conduct a glare study for its community solar project as a result of its proximity to an airport. If the study indicates that there is potential for glare, a project developer

should submit a mitigation plan for glare produced by a system. Such a study with recommended mitigation is preferable to a blanket screening requirement for solar, which adds unnecessary upfront and ongoing expense.

PRIME FARMLAND

As the development of large-scale solar generation becomes more common, land taken out of production can increase concerns over the impact to prime farmland. To produce 10 percent of Iowa's electricity from solar energy, 13,440 acres would need to be occupied by solar arrays, or just 0.04 percent of all of Iowa's farmland.

While the placement of solar panels may limit agricultural uses for prime farmland, the construction and operation of a solar energy system typically has less impact than other forms of development such as residential or commercial development. Once a system has been decommissioned and removed, farmland can be returned to an agricultural use with minimal reclamation. County officials should consider the potential for combining solar energy systems with other uses that may benefit agricultural operations, such as creating shade for livestock or habitat for pollinators and other wildlife.

We do not recommend any provisions that prohibit solar as a use on prime farmland. If a county already has a provision that prohibits certain uses on designated prime farmland, they may consider adding solar as an acceptable use, especially in conjunction with an additional use like the creation of native prairie or habitat.

CONCLUSION

For counties considering an ordinance for utility-scale solar, a well-drafted and balanced solar siting ordinance is important. Our review of county ordinances across Iowa and neighboring states shows that counties can adopt workable ordinances that enable successful solar development. We have not identified a single model ordinance in any particular county that we recommend in total. Instead, we have identified the strongest parts of different ordinances to include in this paper. Most county ordinances have additional provisions in the adopted ordinances. We have focused on the major provisions critical to the success of an ordinance.

While counties can attract solar development without adopting a specific ordinance, we believe the clarity and predictability that comes from a solar ordinance can be beneficial for the county, its residents, and solar developers.

ABOUT

The primary authors of this paper are Kerri Johannsen, Jordan Oster, and Steve Guyer of the Iowa Environmental Council and Lu Nelsen and Cody Smith of the Center for Rural Affairs. We appreciate the input and guidance provided by county officials, solar developers, colleagues and others as we researched and drafted this paper.

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A CLOSER LOOK: BEST PRACTICES FOR COMMUNITY SOLAR

Community solar is a unique model that often involves the construction of a solar array that is much larger than small-scale or residential solar. Although some states allow for independent development of community solar projects by private industry, cities, and nonprofits, such projects cannot currently be developed in Iowa. Community solar in Iowa can only be developed by or for utilities, including municipal utilities.

Typically, community solar projects incorporate methods for community members to participate in the project in some way through a mechanism such as an investment or subscription with the benefits of the project passed along to subscribers. Some considerations for community solar projects are listed below.

City of Cedar Falls community solar project. Photo courtesy of Cody Smith, Center for Rural Affairs.

Land selection is key for ground-mounted solar

- Land already owned by the project developer, owner, or off-take customer is preferable, as it eliminates the need for new easements and may mitigate several siting issues.
- Several factors contribute to cost efficiency when considering a community solar project:
  - Proximity to high intensity energy users.
  - Strong local demand for electricity, especially produced from renewable resources.
  - Access to the electric grid, allowing for interconnection without building substantial new infrastructure.

- The type of site also contributes to cost efficiency over the long-term—a square or rectangular parcel of land and in-line set-up helps streamline ongoing management like mowing and system maintenance.
- Sites should also have easy access, with limited surrounding development or vegetation that may shade a solar energy system.
- Sites should also ideally allow for expansion of a project if demand from consumers increases over time.
- Example:
  - The City of Ames will site their project on a parcel of land already owned by the City that was being leased for farmland.
  - The City of Cedar Falls community solar project currently occupies eight acres of previously undeveloped city property.

Alternatives to ground-mounted solar

- Large rooftops such as those on manufacturing facilities or big box retailers may be potential sites for community solar projects. These sites reduce land acquisition concerns associated with selecting a site for a ground-mounted solar system while providing the host with some publicity for participating.
- Siting projects in parking lots in the form of a system mounted on canopies that also offers shade is possible, but there are liability concerns around falling ice damaging vehicles during the winter months.

Community involvement in site selection is crucial

- A robust cost-benefit analysis is recommended prior to proposing a community solar project.
- Officials should be sure to engage with a wide range of stakeholders to determine if there are other plans for a selected site or the surrounding area that may impact a future solar energy system.
- Once a project has been proposed, there should be opportunities provided for community members to attend meetings or open houses that allow them to learn more about the project and ask questions.

Development and project ownership

- Leasing city land to a private developer and entering into a Power Purchase Agreement can reduce project costs by allowing the developer to take advantage of federal and state tax credits.
- If a municipal utility is seeking a private developer for a community solar project, there should

be a transparent bidding process. Information that may be required in a bid includes:

- Price and term for a power purchase agreement between the developer and the municipal utility.
- Estimate of annual electricity production.
- Performance history for the equipment that will be used in a similar environment.
- Project timeline that lays out anticipated start and completion dates for construction as well as an in-service date for the system.
- Previous experience developing similar projects.

  Example: Both Cedar Falls and Ames leased their land to a private developer at little to no cost and allowed them to construct the solar farm so the developer could take advantage of the 30% federal investment tax credit, as municipalities are ineligible. Both cities intend to buy back the project at some point.

- A competitive and transparent bidding process is important for project success.

  Example: The City of Ames included all submitted bids in their report to the city council. Their developer selection was based on the following criteria:
  - Price of a 25-year Power Purchase Agreement and estimated project buyout costs.
  - Annual production estimates.
  - Annual performance estimates.
  - Performance history and reliability of the equipment specified for this project in similar environments.

- Strength and experience of the developer's project team and proven expertise of the project team.
- System and component product warranties.
- Developer's proposed project financing capability and structure.
- Project schedule.
- Experience with building at or near an airport location.
- Notably, the federal investment tax credit began a gradual phase-out in 2020, dropping to 26 percent.

Adding consumer value

Projects may be designed to allow consumers to invest in a community project in various ways:

- Many community projects offer "shares" that residents can purchase. These typically act as a subscription in the project, paid through an additional charge on a monthly electric bill. In some cases, subscribers are credited an amount determined by the utility for energy produced by the project during the given period.
  i. The rate associated with a share should be devised in a transparent manner, clearly demonstrating the method used to determine the total cost to consumers.
  ii. **Example:** The city of Ames charges a $300 cost for a consumer subscription, or "power pack," which is a subscription to one-half of one panel for 20 years. The power packs are expected to return average monthly credits of $1 to $2 for the duration of the 20-year contract. Payback is predicted to take anywhere between 16 and 18 years.
- In other models, consumers are allowed to purchase and own panels that are part of the community solar systems.
  i. This option may allow for consumers to access available tax credits while investing in a community project, often paying a monthly maintenance fee for upkeep of the panel(s).
  ii. In some cases, consumers that choose this option may be credited for the full production of their panel(s) as though they were located behind their electric metering, as is the case with net metered residential solar.
- Community projects often feature a means of unsubscribing or selling back shares/panel(s). This often reduces anxiety associated with subscribing to a project, as residents are not tied to a subscription if they choose to move to a different area.

APPENDIX: NATIVE VEGETATION MANAGEMENT FOR SOLAR - ADDITIONAL CONSIDERATIONS

Across the U.S., the solar industry is booming. Solar project sites often occupy several acres of land and are projected to cover three million acres by 2030.[I] To produce 10 percent of Iowa's electricity from solar energy, 13,440 acres would need to be occupied by solar arrays—offering an opportunity for project owners to demonstrate their commitment to environmental stewardship.[II]

While the full detail included below may not be appropriate for inclusion in a solar ordinance, we hope it can serve to inform policymakers about the developer considerations which accompany the adoption of native vegetation on solar project sites.

INCREASING PROJECT VALUE:

In addition to providing habitat for wildlife and pollinators, investments in native vegetation on solar project sites provide ancillary benefits such as improved soil health and water quality, while also sequestering carbon.

PLANNING, COST, AND SEEDING:

Planning

Planning at least one year before the seed goes into the ground is recommended. This provides adequate time to reach out for technical assistance, review and select a site, determine the existing dominant vegetation (if any), conduct two or more herbicide applications to suppress existing vegetation if needed, and gather quotes for a native seed mix.[III]

Cost

When considering total project cost, the key variable is the number of acres that will be established. Depending on project size, different management approaches may be necessary.[IV] **Per acre in Iowa, $500-$1,000 is a reasonable range for most projects.[V]**

Best practice: Include native vegetation in the initial planning process of a project. Incorporating this desired outcome into the process will allow for a holistic consideration of all factors including soil characteristics, construction, management, establishment, and more.

Seeding

Timing is key to success—frost-seeding between November 1 and June 1 is ideal for maximum germination and ensuring stand establishment through a full growing season.[VI][VII] August and late summer plantings should be avoided as a stand won't have enough time to establish before cold temperatures. To establish the needed firm seedbed, conventional methods include discing at least twice and cultipacking, although this is dependent upon the conditions of each site.[VIII] Seeding methods include broadcast, drill, and hand-broadcast techniques. Native grass seeds need good seed-to-soil contact and should be planted no deeper than ¼" in the soil. Ideally, native prairie seeds should rest on top of the soil.

Best practice: A site may take time to establish aesthetic native vegetation. Signage that says "Pollinator habitat in progress" can mitigate public concern. Keep in mind that each seedbed is different and may not need discing or plowing—these decisions should be made in consultation with a conservation professional to review site-specific information such as existing vegetation, moisture levels, and soil type.

MANAGEMENT AND CONSTRUCTION:

Construction

Being flexible when it comes to the height of a solar energy system is important for project success. A seed mix should include plants that don't reach a peak height that could shade the low, tilted edge of ground-mounted solar energy systems unless developers plan to use strategic mowing or livestock grazing (i.e. sheep) to avoid interfering with project effi ciency.

Best practice: Although project managers may have to strip-mow to maintain project effi ciency, it is important to remember that taller native vegetation provides better habitat for wildlife and pollinators. Striking a balance between quality and height can equalize cost.

Management

Year one: Regular mowing (three to four times) during the first growing season prevents weeds from shading out seedlings and going to seed. The first mowing should be at a height of four to six inches soon after seeding; the next two mowings should be at a height no less than eight inches.

Year two: With a successful planting, years subsequent to establishment provide the opportunity for less maintenance, needing only an occasional disturbance and limited mowing to encourage desirable species.[IX]

Years three and four: Mowing and baling the plant residue approximately every three years is the preferred management option for solar project sites.[X]

Timing impacts wildlife and pollinators

After year two, avoid or minimize mowing between April 1 and August 1 to minimize impacts during the nesting season of upland birds such as pheasants and quail. Delaying mowing to late September facilitates a more welcoming habitat for migrating pollinators such as monarch butterflies, as the highest population of Monarch eggs is often found on milkweed plants in late July and early August.[XI] Spot mowing and/or herbicide application could be used during this period if necessary to control invasive plants.

Best practice: Every site is unique and all timelines should be adjusted to the needs of a project. Experts suggest evaluating the ratio of native species to weeds and invasive vegetation before making mowing and other management decisions. If native vegetation is struggling to establish a strong stand, mowing is likely necessary; if the opposite is occurring, mowing may not be in a site's best interest.

SELECTING A SEED MIX:

The height of the solar panels is a primary consideration when selecting a seed mix. Other factors include project location, soil type and moisture, the species of vegetation that are native to the area, planned management of the site, and more. Consider which desired outcomes the native vegetation is intended to achieve such as providing wildlife habitat, increasing pollinator populations, or reducing erosion. Developers should aim for a ratio of grasses to forbs when selecting a seed mix.

Best practice: Wildlife generally responds more to structure of vegetation (the ratio of grasses to forbs) than specific plant species; a seed mix closer to 30 percent grasses and 70 percent forbs is recommended for upland nesting birds.[XII] Some species of native vegetation are crucial for pollinators; monarch butterflies only lay eggs on milkweed plants. Bees, adult monarchs, and other pollinators rely on a diversity of flowering plants that provide blooms during all periods of the growing season (March to October).

Figure A shows a recommended native seed mix for a solar project site in central Iowa: [XIII]

FIGURE A

Short-grass prairie seed mix for medium-dry soils in central Iowa

Botanical Name	Common Name	Botanical Name	Common Name
Wildflowers		**Trees, Shrubs, Vines**	
Asclepias tuberosa	Butterfly Weed	Ceanothus americanus	New Jersey Tea
Baptisia alba	White Wild Indigo	Rosa arkansana	Wild Rose
Chamaecrista fasciculata	Partridge Pea	Amorpha canescens	Lead plant
Coreopsis lanceolata	Lance-leaf Coreopsis	**Grasses, Sedges, & Rushes**	
Coreopsis palmata	Prairie Coreopsis	Bouteloua curtipendula	Side-oats Grama
Dalea candida	White Prairie Clover	Carex bicknellii	Prairie Oval Sedge
Dalea purpurea	Purple Prairie Clover	Koeleria macrantha	June Grass
Drymocallis arguta	Prairie Cinquefoil	Schizachyrium scoparium	Little Bluestem
Eryngium yuccifolium	Rattlesnake Master	Sun exposure: full	
Euphorbia corollata	Flowering Spurge	Soil moisture: medium-dry	
Liatris aspera	Button Blazing Star		
Pedicularis canadensis	Wood Betony		
Penstemon digitalis	Foxglove Beardtongue		
Pseudognaphalium obtusifolium	Sweet Everlasting		
Rudbeckia hirta	Black-eyed Susan		
Ruellia humilis	Wild Petunia		
Solidago speciosa	Showy Goldenrod		
Symphyotrichum oolentangiense	Sky Blue Aster		
Tradescantia ohiensis	Ohio Spiderwort		
Verbena stricta	Hoary Vervain		
Zizia aurea	Golden Alexanders		
Asclepias syriaca	Common Milkweed		
Symphyotrichum ericoides	Heath Aster		
Symphyotrichum pilosum	Frost Aster		
Gentiana alba	Cream Gentian		
Heliopsis helianthoides	Early Sunflower		
Desmodium canadense	Showy tick trefoil		

Courtesy of Story County Conservation

When crafting local solar ordinances, we recommend that offi cials consider the intended outcomes and goals for requiring native vegetation. For example, Linn County's ordinance lists their intended goals like soil health, erosion reduction, and water quality. They also favor bee and other pollinator populations by restricting the use of potentially harmful pesticides.

Additionally, it is recommended that local offi cials weigh the factors developers are considering when contemplating the establishment of native vegetation, such as management, construction, planning, and other concerns—only some of which were listed above.

Local offi cials may also seek assistance with questions on these topics from organizations such as the Center for Rural Affairs, Audubon Society, Pheasants Forever Native Plants Program, The Iowa Monarch Consortium at Iowa State University, and the STRIPS project at Iowa State University.

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Policy Approaches for Dual-Use and Agrisolar Practices

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April 2023

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CONTENTS

INTRODUCTION

As demand for clean energy increases, solar deployment is expected to rise. Because utility-scale solar requires considerable land use, many state and local governments are prudently discussing the impact future solar development will have on agricultural lands. The practice of dual-use solar, which refers to allowing two uses to be accomplished in the same space, can address concerns about solar on agricultural land.[1]

Agrisolar, also called agrivoltaics, is the co-location of agriculture and solar within the landscape. It includes solar co-located with crops, grazing, beekeeping, pollinator habitat, aquaculture, and farm or dairy processing. In addition to photovoltaics, it also includes concentrated solar installations.[2] The practice of combining agriculture and solar energy systems can provide numerous economic and environmental benefits. This includes improving economic viability for landowners and agricultural entities, providing beneficial ecological services, and expanding siting opportunities for solar deployment.[3]

The purpose of this report is to provide decision makers and others an overview of policy approaches to combining solar with agriculture and offer considerations on how regulations can facilitate dual-use.

First, we will look at land use and solar, examining the impact expected by the rapid increase of solar development in the near future, and the varying level of responses occurring around clean energy siting regulations and guidance. Next, we will explore the types of dual-use applications and the benefits associated with them, and then move into an overview of policy mechanisms at the federal, state, and local levels that facilitate dual-use. Lastly, we will take a closer look at how local governments have the most impact on solar development, and offer considerations for decision-makers who are interested in creating ordinances or incentives around dual-use.

1 Marieb, Dugan. "Dual-use Solar in the Pacific Northwest: A Way Forward." Renewable Northwest. 2019. Accessed March 2023.
2 Personal communication, Stacie Peterson, Energy Program Director, National Center for Appropriate Technology. March 2023.
3 Macknick, Jordan, et al. "The 5 Cs of Agrivoltaic Success Factors in the United States: Lessons From the InSPIRE Research Study." National Renewable Energy Laboratory. 2022. Accessed March 2023.

LAND USE AND SOLAR

How Much Land Will Be Needed?

As the U.S. moves toward setting ambitious decarbonization goals, solar energy is forecasted to grow considerably. Based on solar deployment scenarios by the U.S. Department of Energy (DOE), ground-based solar technologies may require a land area equivalent to 0.5% of the contiguous U.S. However, it is estimated that this requirement could be met using less than 10% of already disturbed or contaminated lands.[4]

By county, it does not appear that current or planned solar projects would require significant land allocation as a proportion of local area. In an analysis of all counties in the contiguous U.S., the Great Plains Institute found that existing solar development comprises on average 0.04% of land per county and that if all proposed solar projects were built, development would average 0.22% of land per county. As of 2021, no county in the U.S. had more than 4% of total county area in solar development. In contrast, cultivated lands comprise up to 75% of the total county area in much of the central Midwest.[5]

Some state and local governments have created restrictions around using farmland for solar development. However, clean energy development does not appear to pose an immediate threat to the availability of farmland. As of 2022, Iowa had 30.6 million acres of farmland, about 17.5 million of which meets the U.S. Department of Agriculture's (USDA) definition of "prime."[6,7] If all of the 2,290 MW of proposed solar projects in Iowa were sited on prime farmland, it would use only 0.11% of prime farmland in the state.[8]
According to Minnesota Solar Pathways, powering 70% of Minnesota's electrical load by 2050 would require adding 22 gigawatts of solar,

4 "Solar Futures Study Fact Sheet." U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy. September 2021. Accessed March 2023.
5 Wyatt, Jessi, and Maggie Kristian. "The True Land Footprint of Solar Energy." Great Plains Institute for Sustainable Development. Sept. 14, 2021. Accessed March 2023.
6 "Prime Farmland Definition." Natural Resources Conservation Service. March 2015. Accessed March 2023.
7 "Iowa Solar and Agriculture Fact Sheet." Clean Grid Alliance. Accessed March 2023.
8 Ibid.

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which would use 220,000 acres of land. Even if all of this solar were to be sited exclusively on prime farmland, it would still only use 1.32% of prime farmland in the state.[9]

Alternatives to Land-use Restrictions

Even though the land needed for solar development is proportionally low, many state and local governments have enacted or are considering enacting restrictions on clean energy development on farmland. In Iowa, some counties have considered using Corn Suitability Ratings (CSR) to restrict development,[10,11] and state legislators have introduced bills prohibiting solar development on farmland.[12,13,14]

In Minnesota, the Public Utilities Commission's administrative rules restrict large electric generation plants from being located on prime farmland.[15] In Midwest states where a large percentage of the land qualifies as farmland, blanket restrictions such as these can severely impact opportunities for clean energy development.

However, some organizations concerned about the land use impacts of clean energy development have developed siting guidance that mitigates impacts to sensitive areas. For example, the American Farmland Trust, an organization dedicated to the preservation of farmland, has created a series of Smart Solar principles, which they believe meet three goals: accelerate solar energy development, strengthen farm viability, and safeguard land well-suited for farming and ranching.[16]

These principles include:[17]

Prioritize solar siting on buildings and land not well suited for farming
Including buildings, irrigation ditches, brownfields or other marginal lands.

Safeguard the ability for land to be used for agriculture
If developed on farm or ranch land, policies and practices should protect soil health, especially during construction and decommissioning.

Grow agrivoltaics for agricultural production and solar energy
Agrivoltaics sustain agricultural production under/between the solar panels.

Promote equity and farm viability
Farmers and underserved communities should benefit from solar development and should be included in stakeholder engagement processes.

This type of siting guidance offers a more nuanced approach to clean energy development. By taking a wider array of factors into consideration, including economic impacts and dual usage, this approach demonstrates that clean energy siting does not require an either/or mindset.

Through thoughtful planning, local decision makers can craft policies that respect the property rights of local landowners and allow them to take advantage of opportunities to diversify their income, while at the same time encouraging dual-use practices that preserve the agricultural values of the local community.

9 "Minnesota Solar and Agriculture." Clean Grid Alliance. Accessed March 2023.
10 Whiskeyman, Danny. "Scott County Board of Supervisors approves new solar ordinance." KWQC. Sept. 20, 2022. Accessed March 2023.
11 Klotzbach, John. "County Considering Wind Turbine Ordinance Changes." Independence Bulletin Journal. Sept. 6, 2022. Accessed March 2023.
12 "Senate Study Bill 1027." Iowa Legislature. Jan. 24, 2023. Accessed March 2023.
13 "Senate File 2127." Iowa Legislature. Jan. 26, 2022. Accessed March 2023.
14 "Senate File 2321." Iowa Legislature. Feb. 17, 2022. Accessed March 2023.
15 "Minnesota Administrative Rules." Minnesota Legislature. Sept. 18, 2009. Accessed March 2023.
16 Sallet, Lori. "Growing Renewable Energy While Strengthening Farm Viability and Safeguarding Healthy Soil." American Farmland Trust. Sept. 22, 2022. Accessed March 2023.
17 Ibid.

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TYPES OF DUAL-USE

There are several types of dual-use practices that can be combined with solar energy sites including cultivating different types of crops such as vegetables and berries, utilizing livestock grazing for managing vegetation, beekeeping, and planting native vegetation and pollinator habitat. These practices can create environmental and economic benefits such as new revenue streams for local farmers, increased pollinators, wildlife habitat, enhanced soil health, reduced erosion, and carbon storage. These projects are not mutually exclusive, however, and multiple activities can occur simultaneously, or at different times of the year.[18]

Crops

A variety of agricultural crops can be grown in co-location with solar installations, including fruit, vegetables, and berries. Any crops that are successful in a region are likely to be suitable for co-location with solar projects. Crops can be grown under the panels, between rows, or outside the perimeter of the installation. Panel height, spacing, water access, equipment needs, and whether the system is fixed or tracking, all will play a role in the success of integrating specific types of crop production into a solar installation. Research is ongoing to better understand the performance and feasibility of co-locating crops with solar energy systems.[19,20]

Iowa State University recently announced it will kick off a $1.8 million, four-year research project on dual-use and food crop production.[21] Similar food crop-focused research is ongoing through the Sustainably Colocating Agricultural and Photovoltaic Electricity Systems (SCAPES) projects at University of Illinois Urbana-Champaign, University of Arizona, Colorado State University, Auburn University, and

18 Macknick, Jordan, et al. "The 5 Cs of Agrivoltaic Success Factors in the United States: Lessons From the InSPIRE Research Study." National Renewable Energy Laboratory. 2022. Accessed March 2023.
19 "Suitable Agricultural Activities for Low-Impact Solar Development." InSPIRE. Aug. 11, 2022. Accessed March 2023.
20 Macknick, Jordan, et al. "The 5 Cs of Agrivoltaic Success Factors in the United States: Lessons From the InSPIRE Research Study." National Renewable Energy Laboratory. 2022. Accessed March 2023.
21 "ISU researchers to study growing crops in solar farm's footprint." Iowa State University. Feb. 15, 2023. Accessed March 2023.

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University of Chicago.[22]

Outside of food crops, researchers are also looking into whether more traditional row crops can be co-located with solar installations. For example, Purdue University is conducting field trials combining traditional crops like corn and soy with raised solar panels.[23]

Grazing

Solar grazing is the utilization of livestock, usually sheep, to manage vegetation at solar sites. It takes the place of traditional mowing and offers both environmental and financial benefits. For project developers, contracting with local farmers to use solar grazing as a management tool can reduce operations and maintenance costs. Solar grazing can offer local livestock owners additional pasture opportunities and the opportunity to be paid for a valuable service, increasing income to their business and adding to the economy of the rural communities where these projects are usually located.[24]

Beekeeping

Solar beekeeping is the practice of placing beehives on or near solar sites that have been planted in native vegetation or other pollinator habitats. Solar beekeeping can offer new revenue streams for local beekeepers, as well as the opportunity to gain resiliency from a diverse source of pollen for honey production.

Additionally, the landowner sees a positive impact from improved soil health, and nearby farmers profit from pollination services.[25] Pollinators are critical to crop production, with the USDA estimating that wild and managed bees together add $15 billion in crop value each year.[26] An Argonne National Laboratory case study found that the value of pollinator habitat on U.S. lands designated as proposed or potential solar sites is between $1.5 billion and $3.2 billion.[27]

Native Vegetation and Pollinator-Friendly Solar

Sites with native or naturalized, non-invasive, flowering vegetation are commonly referred to as "pollinator-friendly solar sites." Pollinator-friendly solar project sites offer habitat for honey bees, native bees, and other species of pollinators, all of which can positively benefit local agricultural production. Using native or pollinator-friendly vegetation provides numerous benefits, including reduced erosion, improved water quality and soil health, and increased habitat for wildlife. It can also reduce long-term operation and maintenance costs for project developers and site managers.[28]

Determining the appropriate types of dual-use projects most likely to be successful at a specific site can be daunting. However, research is ongoing to understand the components needed for successful deployment and operation of agrisolar projects. From 2015 to 2021, the Innovative Solar Practices Integrated with Rural Economies and Ecosystems (InSPIRE) project studied field research sites and identified five key elements that enable success. These elements were explored in the report *"The 5 C's of Agrivoltaic Success Factors in the United States: Lessons from the InSPIRE Research Study."* They include:[29]

Climate, soil, and environmental conditions
The ambient conditions and factors of the specific location that are beyond the control of the solar owners, solar operators, agrivoltaic practitioners, and researchers.

Configurations, solar technologies, and designs
The choice of solar technology, the site layout, and other infrastructure that can affect light availability and solar generation.

Crop selection and cultivation methods, seed and vegetation designs, and management approaches
The methods, vegetation, and agricultural approaches used for agrivoltaic activities and research.

Compatibility and flexibility
The compatibility of the solar technology design and configuration with the competing needs of the solar owners, solar operators, agricultural practitioners, and researchers.

Collaboration and partnerships
Understandings and agreements made across stakeholders and sectors to support agrivoltaic installations and research, including community engagement, permitting, and legal agreements.

POLICY APPROACHES TO DUAL-USE

Policies at the federal, state, and local levels of government can influence the implementation of dual-use solar. These policies interact, but overall, local land-use policies have been shown to be the most significant catalyst or inhibitor of agrisolar development.[30]

We will be looking at a variety of policy approaches at each level of government, including tax incentives, land use laws, renewable portfolio standards, and others.

22 Harwood, Lori. "UArizona Partners on $10M USDA Grant to Expand Research on Growing Crops Under Solar Panels." University of Arizona, Oct. 6, 2021. Accessed March 2023.
23 Bowman, Sarah, et al. "Can solar panels and row crops coexist on farmland across the skeptical Corn Belt?" Indy Star, Sept. 13, 2022. Accessed March 2023.
24 "Fact Sheet: Making the Case for Solar Grazing." Center for Rural Affairs, Dec. 20, 2021. Accessed March 2023.
25 "Fact Sheet: Making the Case for Solar Beekeeping." Center for Rural Affairs, Dec. 22, 2022. Accessed March 2023.
26 Marieb, Dugan. "Dual-use Solar in the Pacific Northwest: A Way Forward." Renewable Northwest, 2019. Accessed March 2023.
27 "Case Study: Economics of Pollinator Habitats at Solar Facilities." Argonne National Laboratory. Accessed March 2023.
28 Smith, Cody. "Amplifying Clean Energy with Conservation, Part One: Pollinator-Friendly Solar." Center for Rural Affairs, October 2020. Accessed March 2023.
29 Macknick, Jordan, et al. "The 5 Cs of Agrivoltaic Success Factors in the United States: Lessons from the InSPIRE Research Study." National Renewable Energy Laboratory, 2022. Accessed March 2023.
30 Pascaris, Alexis S. "Examining existing policy to inform a comprehensive legal framework for agrivoltaics in the U.S." Energy Policy, December 2021. Accessed March 2023.

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Federal

Because land use decisions are typically made at the local level, the role of federal policy in encouraging or discouraging dual-use applications is limited. However, two primary incentives exist for solar development—the Business Energy Investment Tax Credit (ITC) and USDA's Rural Energy for America Program (REAP). Additionally, federal investments in dual-use can help bolster the practice.

Tax incentives

The ITC is the sole corporate tax credit available for solar. The tax credit does not include any restrictions that would disallow solar on specific locations, making it acceptable for combination with dual-use.[31]

Land-use laws

Authority over land use in the U.S. is held by state and local governments.[32]

Portfolio standards

Renewable portfolio standards are policies that require electricity suppliers to provide customers with a stated amount of electricity from renewable sources. Although the idea of a federal renewable portfolio standard has been proposed, no such policy currently exists.[33]

Other

REAP grants and loan guarantees offer financial assistance to agricultural producers and small businesses for energy improvements or investments. This can include construction of solar energy systems and does not present conflicts with dual-use integration.[34]

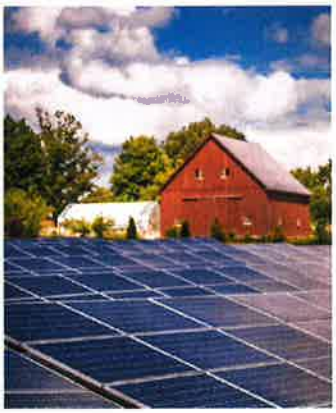
In 2022, DOE announced an $8 million investment in agrivoltaic research projects. The Foundational Agrivoltaic Research for Megawatt Scale-funding program is aimed at developing best practices, seeking replicable models, providing new economic opportunities, and reducing land-use conflicts.[35] In 2022, USDA's Partnerships for Climate Smart Commodities awarded the University of Arizona $4.7 million[36] and the University of Texas Rio Grande Valley $2.2 million[37] for agrivoltaic research projects.

State

State policy approaches to dual-use include tax and other financial incentives, state-level land-use laws, renewable portfolio standards, and pollinator scorecards. State-level policies interact with local decision making in ways that can either enable or restrict local governments from enacting certain practices or policies.

Tax incentives

States can incentivize solar dual-use practices through land use taxes. If landowners are able to integrate solar development into their farming operation without a land-use tax change, they may be more receptive to the development. For example, Rhode Island has amended its Farm, Forest, and Open Space Land law to exempt landowners from a land-use change tax if they are integrating a dual-use renewable energy generation system, which is defined as a wind or solar system that allows agricultural practices to continue around it under normal practices.[38] [39]



Similarly, in 2021, New Jersey enacted a Dual-Use Solar Law, which provides an incentive for keeping land at solar sites in agricultural production. The law established a pilot program allowing unpreserved farmland used for dual-use solar projects to be eligible for farmland assessment under certain conditions.[40]

The AgriSolar Clearinghouse maintains an interactive map detailing dual-use financial incentives throughout the United States, including potential funding sources, assistance programs, utility incentives, and tax breaks. It can be found at: agrisolarclearinghouse.org/financial-information-map.

Land-use laws

State-level land use laws can significantly impact where solar development can happen. For example, Illinois' Agricultural Areas Conservation & Protection Act creates land areas where only agricultural production is allowed.[41]

As dual-use has evolved, debates about whether implementation of these practices at solar sites should qualify as agricultural land use are ongoing. One practice states can employ to help facilitate dual-use at solar sites is to review land use planning goals and definitions of solar generation, farmland, and farm uses to ensure they do not preclude dual-use solar.[42]

Some states have created statewide siting standards to regulate clean energy development. For example, in early 2023, lawmakers in Illinois passed House Bill 4412, which dictates statewide setbacks for wind and solar development.[43] Alternative approaches, such as the creation of state-specific best practices, model ordinances, or voluntary siting matrices offer ways to preserve local control while also providing helpful guidelines for local decision makers.[44] [45]

31 Ibid.
32 Ibid.
33 "Renewable energy explained: Portfolio standards." U.S. Energy Information Administration, November 30, 2022. Accessed March 2023.
34 Pascaris, Alexis S. "Examining existing policy to inform a comprehensive legal framework for agrivoltaics in the U.S." Energy Policy, December 2021. Accessed March 2023.
35 "DOE Announces $8 Million to Integrate Solar Energy Production with Farming." U.S. Department of Energy, Dec. 8, 2022. Accessed March 2023.
36 "Media Advisory: USDA awards over $4.7M to support and promote 'climate smart' food production." University of Arizona, Dec. 19, 2022. Accessed March 2023.
37 Gonzalez, Maria. "UTRGV receives $2.2M grant for 'Climate-Smart Commodities project.'" University of Texas Rio Grande Valley, Dec. 12, 2022. Accessed March 2023.
38 "Rules and Regulations for Enforcement of the Farm, Forest, and Open Space Act." Rhode Island Department of State. Accessed March 2023.
39 Marieb, Dugan. "Dual-use Solar in the Pacific Northwest: A Way Forward." Renewable Northwest, 2019. Accessed March 2023.
40 "Chapter 170." New Jersey Legislature, 2021. Accessed March 2023.
41 Guarino, Jessica, and Tyler Swanson. "The Illinois Agrivoltaics Regulatory and Policy Guide Analyzes State and Local Laws." AgriSolar Clearinghouse, Feb. 1, 2023. Accessed March 2023.
42 Marieb, Dugan. "Dual-use Solar in the Pacific Northwest: A Way Forward." Renewable Northwest, 2019. Accessed March 2023.
43 Moore, Brenden. "New Illinois state energy project standards welcomed by some, resisted by others." The Pantagraph, February 13, 2023. Accessed March 2023.
44 Marieb, Dugan. "Dual-use Solar in the Pacific Northwest: A Way Forward." Renewable Northwest, 2019. Accessed March 2023.
45 Mouw, Lindsay. "Exploring Siting Guidance: Agriculture Siting Matrices Inform Renewable Energy Siting." Center for Rural Affairs, July 2022. Accessed March 2023.

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Portfolio standards

As of 2021, 31 states and the District of Columbia had adopted renewable portfolio standards or clean energy goals.[46] Within these standards, "carve out" provisions can be used to encourage the adoption of certain technologies, such as solar and dual-use. As of 2021, 21 states had solar carve-out provisions in their renewable portfolio standards. Massachusetts' SMART program is one example of such a renewable portfolio standard that also incorporates incentives for dual-use.[47]

Other

Under the Massachusetts Department of Energy's Solar Massachusetts Renewable Target (SMART) program, specific kinds of dual-use solar systems, known as Agricultural Solar Tariff Generation Units (ASTGU), can qualify for financial incentives. To qualify, the land under the solar system must be in continuous agricultural production. The SMART program offers a base cents-per-kilowatt-hour compensation rate for new solar arrays. Systems using these practices that qualify as an ASTGU receive an additional 6 cents per kilowatt-hour to the base rate.[48] [49] [50]

Many states across the U.S. have created policies or programs to encourage or require implementation of pollinator habitat at solar

sites. These initiatives can vary widely in their structure and implementation. One tool is a pollinator scorecard, which provides a model to score pollinator-friendly practices. This score can be used to gauge if a site meets state or local requirements, to designate a site as pollinator-friendly, or to determine if a site qualifies for other types of incentives.[51]

For example, Minnesota state code (§216B.1642)[52] authorizes the Board of Soil and Water Resources to establish statewide guidance for solar project developers aiming for recognition under the Habitat Friendly Solar Program. The statute reads, "...an owner of a solar site implementing solar site management practices may claim that the site provides benefits to gamebirds, songbirds, and pollinators only if the site adheres to guidance set forth by the pollinator plan provided by the Board of Water and Soil Resources."[53] [54]

Local

Local land-use policy is the key leverage point

46 Bowers, Richard. "Five states updated or adopted new clean energy standards in 2021." U.S. Energy Information Administration, February 1, 2022. Accessed March 2023.
47 Pascaris, Alexis S. "Examining existing policy to inform a comprehensive legal framework for agrivoltaics in the U.S." Energy Policy, December 2021. Accessed March 2023.
48 "Dual-use, Agriculture and Solar Photovoltaics." University of Massachusetts Amherst. Accessed March 2023.
49 "Guideline Regarding the Definition of Agricultural Solar Tariff Generation Units." Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs, Department of Energy Resources, Department of Agricultural Resources, April 26, 2018. Accessed March 2023.
50 "SMART Program Incentives for Solar Arrays." University of Massachusetts Amherst. Accessed March 2023.
51 "Pollinator-Friendly Solar Scorecards." Fresh Energy. Accessed March 2023.
52 "2019 Minnesota Statutes." Office of the Revisor of Statutes, Minnesota Legislature. Accessed March 2023.
53 "Minnesota Habitat Friendly Solar Program." Minnesota Board of Water and Soil Resources, 2019. Accessed March 2023.
54 Smith, Cody. "Amplifying Clean Energy with Conservation, Part One: Pollinator Friendly Solar." October 2020. Accessed March 2023.

Policy Approaches for Dual-use and AgriSolar Practices

for enabling development on land suitable for combining agriculture and solar energy production.[55] This is because local governments usually have the most influence over land use, including the ability to regulate zoning and develop siting ordinances that dictate how and where development can occur. Tax incentives and renewable portfolio standards are seen more in state-level policy.

Tax incentives

Local governments have the ability to create tax incentives, though these are more common in state-level policy.

Land-use laws

Land-use laws are the primary lever for local governments to facilitate dual-use. However, despite rapid expansion of solar energy development, many local governments have not addressed siting in their ordinances. In a review of local-level policies in Illinois, researchers found that many counties had no solar siting ordinance on the books, and the counties that did represented drastically different approaches to zoning and land-use policy.[56] As of 2020, only 19% of zoning ordinances in Michigan addressed utility-scale solar siting.[57] When counties lack an ordinance, it can create uncertainty for decision makers and developers, who won't know if the land use is permitted or prohibited.[58]

Solar siting often depends on the county's comprehensive land-use plans and resulting zoning and siting ordinances. When developing ordinances, local decision makers often use the county's land-use planning goals to help guide the process. For example, in Buchanan County, Iowa, county supervisors cited language in their comprehensive land-use plan about preserving agricultural lands with highly productive soils to propose a restriction on clean energy development on lands with high CSR.[59] Expressing similar concern, Scott County, Iowa passed an ordinance restricting solar development on lands with high CSR.[60] [61]

Conversely, some counties have identified renewable energy development as a priority within their comprehensive land-use plan. Linn County, Iowa's comprehensive plan contains a section on renewable energy, which identifies an objective to "encourage development of local alternative and renewable energy resources through identification and removal of regulatory

55 Pascaris, Alexis S. "Examining existing policy to inform a comprehensive legal framework for agrivoltaics in the U.S." Energy Policy, December 2021. Accessed March 2023.
56 Guarino, Jessica, and Tyler Swanson. "The Illinois Agrivoltaics Regulatory and Policy Guide Analyzes State and Local Laws." AgriSolar Clearinghouse, Feb. 1, 2023. Accessed March 2023.
57 Pascaris, Alexis S. "Examining existing policy to inform a comprehensive legal framework for agrivoltaics in the U.S." Energy Policy, December 2021. Accessed March 2023.
58 Ibid.
59 Klotzbach, John. "County Considering Wind Turbine Ordinance Changes." Independence Bulletin Journal, Sept. 6, 2022. Accessed March 2023.
60 "Scott County Ordinance NO. 22-04." Scott County, Iowa, Sept. 15, 2022. Accessed March 2023.
61 Whiskeyman, Danny. "Scott County Board of Supervisors approves new solar ordinance." KWQC, Sept. 20, 2022. Accessed March 2023.

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barriers."[62]

Additionally, local governments can adopt siting ordinances that dictate specific dual-use management practices at solar sites. For example, ordinances can require sites to be planted in native vegetation or pollinator habitat, or to be maintained by livestock grazing.

Portfolio standards

Both municipalities and utilities have the ability to set their own renewable electricity goals.

Other

Community agrisolar projects can improve local buy-in by providing an opportunity for community members to become shareholders.[63]

CONSIDERATIONS FOR LOCAL DECISION MAKERS: HOW ORDINANCES CAN FACILITATE DUAL-USE

Decision makers who want to facilitate the combination of clean energy development and agriculture should consider the following topics when engaging in the ordinance development or amendment process:

Land-use Planning

Comprehensive land-use plans are commonly used by counties to help guide development. These plans reflect the values and vision of the community and, in rural areas, they often contain language relating to the preservation of agricultural heritage and farmland. The way this language is interpreted varies widely between counties, and some decision makers may have difficulty interpreting how language around agricultural resource protection relates to dual-use.[64]

Implementation of dual-use practices can provide an alternative to an either/or mindset relating to agriculture and clean energy development, as they allow land to stay in agricultural use. Combining livestock grazing, crop production, and other endeavors with solar sites preserves the agricultural roots of rural communities while also allowing landowners and counties to take advantage of the environmental and economic benefits of clean energy development.

Including renewable-energy development within the county's comprehensive plan can ensure the economic benefits of this development are taken into consideration when ordinances are created or amended in the future. Clean energy can benefit counties in the form of increased tax revenues, lease payments to local landowners, and job creation. Combining this development with dual-use can offer increased environmental benefits and provide new revenue streams for local farmers.

Zoning and Siting Regulations

Local decision makers can ensure that development is done in a way that meets the needs of the community by engaging in a proactive ordinance development process. By taking the time to create an ordinance before development has been proposed, decision makers can ensure there is time to receive

62 "Linn County Comprehensive Plan: Volume 1." Linn County, Iowa, July 19, 2013. Accessed March 2023.
63 Brunswick, Sarah, and Danika Marzillier. "The New Solar Farms: Growing a Fertile Policy Environment for Agrivoltaics." Minnesota Journal of Law, Science & Technology, March 4, 2023. Accessed March 2023.
64 Marieb, Dugan. "Dual-use Solar in the Pacific Northwest: A Way Forward." Renewable Northwest, 2019. Accessed March 2023.

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community input and feedback on proposed language. Additionally, considerations can be made about setting additional land use expectations, such as dual use.

Counties wanting to enable dual-use integration should consider zoning schemes that allow for mixed land usage. This could include overlay districts, which would allow a special permit for solar in certain zones, or allowing development when certain land use standards are met, such placing a certain percentage of land into pollinator habitat.[65]

Siting regulations should be carefully crafted to ensure they don't restrict dual-use. For example, setting restrictions on panel height or developing overly prescriptive vegetation management requirements can limit dual-use opportunities.

Definitions

When creating definitions within zoning and siting regulations, local governments can ensure they do not preclude dual-use solar. This could include refining definitions for solar generation, farmland, and farm uses to ensure compatibility with desired dual-use practices.[66]

It is also important to determine wich applications and practices will be considered dual-use. For example, in Oregon, a rule was adopted allowing for dual-use practices on high-value soils. However, the rule only specifies agrivoltaics and grazing, meaning pollinator habitats or other conservation dual-use do not qualify.[67]

Interaction of Dual-use Goals

When creating policies, it is especially important to carefully consider how the dual-usage goals interact. Certain requirements may unintentionally restrict beneficial practices. For example, native vegetation or pollinator-friendly habitat requirements may unintentionally limit grazing opportunities if plants on the site are not suitable. In the same vein, to meet pollinator requirements vegetation must be allowed to bloom to ensure it is actually benefiting pollinators, requiring grazing schedules be modified to accommodate bloom times.[68]

It is wise to consider that 100% of land may not be able to be integrated into dual-use. Setting overly strict guidance could deter development if prescriptions are not feasible. Instead, requiring a percentage of land to be used for dual-use purposes introduces a level of flexibility while ensuring that the original intent of the usage policy is preserved.

Site Construction, Decommissioning, and Restoration

Although not directly related to dual-use, local governments can use ordinances to minimize land impacts during the construction and decommissioning of solar systems.

Solar projects generally have minimal impact on land quality, and land can be returned to farming at the end of the project's life cycle, if desired. However, being clear about how land will be

65 Pascaris, Alexis S. "Examining existing policy to inform a comprehensive legal framework for agrivoltaics in the U.S." Energy Policy, December 2021. Accessed March 2023.
66 Marieb, Dugan. "Dual-use Solar in the Pacific Northwest: A Way Forward." Renewable Northwest, 2019. Accessed March 2023.
67 Ibid.
68 "Fact Sheet: Making the Case for Solar Grazing." Center for Rural Affairs, Dec. 20, 2021. Accessed March 2023.

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managed during construction as well as once a project is decommissioned can help protect land quality. Local governments can set requirements for construction, vegetation management, and decommissioning that spell out the expectations and obligations. This can also include requiring financial guarantees to ensure funds are available for decommissioning purposes and that local governments are not responsible for costs.[69]

KEY TAKE-AWAYS

Solar development is expected to rise significantly in the coming years. Although deployment models reflect that will require a large amount of land, it is expected it will require 0.5% of land in the contiguous U.S. and, in many cases, can be placed on already disturbed or marginal lands. Even if all proposed projects in Minnesota and Iowa were sited on prime farmland, it would only represent 1.32% and 0.11% of all prime land in those states, respectively.

Clean energy and agriculture do not require an either/or approach. Through thoughtful planning, local decision makers can craft policies that respect the property rights of local landowners and allow them to take advantage of opportunities to diversify their income, while at the same time encouraging dual-use and agrisolar practices that preserve the agricultural values of the local community.

Dual-use and agrisolar practices can include cultivating crops, utilizing livestock grazing, beekeeping, and planting native vegetation and pollinator habitat. These practices can create a variety of environmental and economic benefits, such as new revenue streams for local farmers, increased

pollinators, wildlife habitat, and soil health, reduced erosion, and carbon storage.

Policies exist at the federal, state, and local levels of government that can influence the implementation of dual-use solar and agrivoltiacs. These policies interact but overall, local land-use policies have the most significant role in impacting solar and agrivoltaic development.

By engaging in a proactive ordinance development process, local decision makers can ensure that development is done in a way that meets the needs of their community. Creating an ordinance in advance of development ensures there is time to receive community input and feedback on the proposed language.

69 Kolbeck-Urlacher, Heidi. "Decommissioning Solar Energy Systems Resource Guide." Center for Rural Affairs, June 2022. Accessed March 2023.

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AMPLIFYING CLEAN ENERGY WITH CONSERVATION
PART ONE: POLLINATOR-FRIENDLY SOLAR

A REPORT BY CODY SMITH,
CENTER FOR RURAL AFFAIRS

CENTER *for* RURAL AFFAIRS

Amplifying Clean Energy with Conservation
Part One: Pollinator-Friendly Solar

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AMPLIFYING CLEAN ENERGY WITH CONSERVATION
PART ONE: POLLINATOR-FRIENDLY SOLAR

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October 2020

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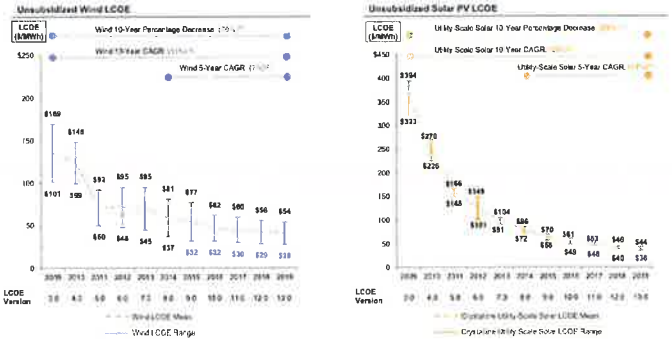
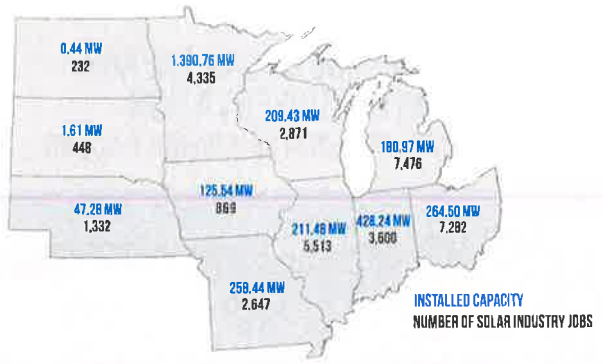


FIGURE 2. MIDWEST SOLAR ENERGY INDUSTRY GROWTH BY THE NUMBERS



I. INTRODUCTION

A. MIDWEST EMBRACES SOLAR ENERGY BOOM

Throughout the Midwest region of the U.S., farmers, schools, and small businesses have been on the frontline of solar energy adoption. Collectively, states in the Midwest employ approximately 36,605 workers in the solar industry with 3,118.67 megawatts (MW) of installed solar capacity.[1] These jobs include workers in the installation, manufacturing, and sale of solar energy systems of all sizes. These economic windfalls come as many cities, counties, and states across the U.S. are taking advantage of affordable renewable energy sources, including solar energy.

Over the past nine years, the price of installing solar energy projects has decreased by 70 percent.[2] This rapid decline in cost has empowered Americans to embrace affordable, clean, and renewable energy. Meanwhile, several jurisdictions are setting ambitious clean energy goals aimed at reducing their carbon footprint in the face of a changing climate. Across the U.S., more than 150 cities, 10 counties, and 7 states, have adopted goals and policies to reach 100 percent clean energy.[3] See Figure 1.[4]

As the renewable energy economy continues to expand, projects bring jobs and tax revenue with them—stimulating local economies in a way which may have been previously unattainable, especially in rural communities. The solar energy industry is in the midst of an unprecedented boom. Supportive public policies, such as the federal Investment Tax Credit, have continued to spur development of this renewable energy source. The industry has expanded by 52 percent since the enactment of the Investment Tax Credit in 2006, empowering the solar energy workforce to employ more than 250,000 people across the U.S. and generate more than 2.5 percent of the nation's electricity as of the first quarter of 2020.[5][6] In addition to jobs and tax payments to states and counties, the solar industry generated $18 billion in investments to the U.S. economy in 2019 alone.[7] This rapid growth, paired with expectations that installed solar generation capacity will potentially double over the next five years, are leading many farmers, small business owners, municipalities, utilities, and corporations to expand their investments in solar energy.[8] See Figure 2.[9]

As the nation continues to embrace a clean energy future, fueled by renewable sources like solar, many Americans will be searching for ways to make sure these investments benefit everyone in their communities.

> While the industry continues to plan, site, construct, and maintain an ever-growing amount of solar energy projects, working with local stakeholders can ensure the value of these renewable energy projects are amplified by investments in the conservation of our shared natural resources.

The solar industry generated $18 billion in investments to the U.S. economy in 2019. This growth is poised to double over the next five years.

1 "Solar State By State." Solar Energy Industries Association, 2020, seia.org/states-map. Accessed August 2020.

2 "Growth in Solar is Led by Falling Prices." Solar Energy Industries Association, 2020, seia.org/solar-industry-research-data. Accessed August 2020.

3 "Committed." Sierra Club, 2020, sierraclub.org/ready-for-100/commitments. Accessed August 2020.

4 "Lazard's Levelized Cost of Energy Analysis—Version 12.0." Lazard, November 2018, lazard.com/media/450784/lazards-levelized-cost-of-energyversion-120-vfinal.pdf. Accessed September 2020.

5 "Solar Investment Tax Credit (ITC)." Solar Energy Industries Association, 2020, seia.org/initiatives/solar-investment-tax-credit-itc. Accessed August 2020.

6 "Solar State By State." Solar Energy Industries Association, 2020, seia.org/states-map. Accessed August 2020.

7 "Solar Industry Research Data." Solar Energy Industries Association, 2020, seia.org/solar-industry-research-data. Accessed August 2020.

8 Ibid.

9 "Solar State By State." Solar Energy Industries Association, 2020, seia.org/states-map. Accessed August 2020.

In general, there are three types of solar projects to be considered: residential (small-scale), community (medium-scale), and utility-scale (large-scale).

Utility-scale solar systems are installations above a certain capacity intended to produce electricity to sell into the market, not to directly supply end-use customers. These systems are larger than small-scale residential or business solar installations and many community systems, often covering more land area. Community solar systems are developed by a municipality, utility, or third party that typically allows community members to subscribe to the project. In Iowa, development of community solar projects is limited to utilities at this time. Residential or small-scale solar energy systems are installed at a residence or business to meet the electric demand at the location. These systems are typically intended to offset electricity use for the owner and are not intended to be net generators of electricity.

The opportunity for the combination of native and naturalized, non-invasive vegetation on project sites is greatest when solar farms cover several contiguous acres of land. With this in mind, potential for the conservation of natural resources and the restoration of pollinator and wildlife habitat is greatest on community- and utility-scale solar sites given their size.

A recent analysis found that nationwide, solar projects occupied 258,000 acres of land in 2018, while the National Renewable Energy Laboratory (NREL) at the U.S. Department of Energy estimates that solar panels will occupy 3 million acres by 2030.[10] This offers a unique opportunity for the practical co-usage of solar project land for the restoration of native and naturalized, non-invasive vegetation, helping achieve ecosystem services for everyone, and reducing financial obligations for project developers. In a display of the scale, using the average of 7 to 8 acres per megawatt, producing 10 percent of Iowa's electricity from solar energy would require 13,440 acres of land to be occupied by solar arrays. Though just .05 percent of Iowa's more than 26 million acres of farmland, this is an opportunity for project developers and site managers to demonstrate their commitment to environmental stewardship. Furthermore, even a small 50 megawatt project could offer more than 360 acres for the restoration of native vegetation.

10 Maltais, Kirk. "Struggling Farmers See Bright Spot in Solar." The Wall Street Journal, Sept. 23, 2019, wsj.com/articles/struggling-farmers-see-bright-spot-in-solar-11569242733. Accessed August 2020.

II. SOLAR SHINES SPOTLIGHT ON STEWARDSHIP

A. ILLUMINATING AN OPPORTUNITY FOR CONSERVATION

Solar presents an opportunity for substantial investments in the conservation of our natural resources as utility-scale projects can occupy hundreds of acres of land. According to the NREL, for every 1 megawatt of energy produced by a solar energy system, on average, 7.3 acres of land will need to be occupied by solar arrays.[11] Project developers, site managers, utilities, and other industry professionals can work together with local communities and natural resources professionals to ensure new electric generation projects provide value for both the landowner hosting the project and their neighbors.

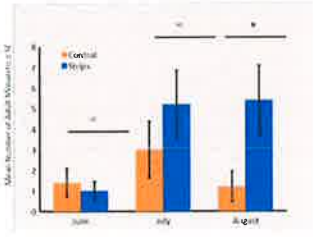
By combining native and naturalized, non-invasive species of vegetation with solar projects, new renewable energy generation can provide habitat for honey bees, native bees, and other critical species of pollinators, such as monarch butterflies. Wildlife, including upland nesting birds such as ring-necked pheasants and quail and at-risk birds such as the sedge wren, also benefit from these new investments. Furthermore, native vegetation, which is perennial, can improve water quality and build soil health with deep, complex root systems that filter out nutrients (i.e. nitrogen and phosphorus) before they leech to lakes, rivers, and streams. Perennial vegetation has also been shown to reduce peak stream-flows by up to 40 percent during flood events, building resiliency in times of stress.[12]

Designing projects to achieve these key environmental outcomes ensures ratepayers, including surrounding farms and communities, receive the greatest possible value for renewable energy generation investments. Local agricultural producers benefit from an increase in pollinators while the practice also reduces long-term operation and maintenance costs for project developers and site managers.

11 Ong, Sean, et al. "Land-Use Requirements for Solar Power Plants in the United States." National Renewable Energy Laboratory, U.S. Department of Energy, June 2013, nrel.gov/docs/fy13osti/56290.pdf. Accessed August 2020.

12 "Iowa Watershed Approach." Iowa Flood Center, The University of Iowa, iowafloodcenter.org/projects/iowa-watershed-approach-hydrologic-network-4/. Accessed August 2020.

FIGURE 3. NUMBER OF ADULT MONARCHS FOUND ON-SITE



B. POWERING ECOSYSTEM SERVICES

While all investments in conservation promote environmental improvement, developers can follow a few best practices to ensure project success. For example, native seed mixes undoubtedly offer the greatest return on investment when it comes to providing ecosystem services, such as habitat for pollinators and wildlife, as well as improved water quality and soil health. If possible, project developers should prioritize native seed selections over naturalized, non-invasive species of vegetation. However, equipment, cost, and on-site limitations may make the selection of naturalized, non-invasive species, such as clover, a more practical or cost effective option. "Naturalized, non-invasive species" refers to vegetation which is not native to the region, but still offers value for achieving environmental outcomes. For example, clover is not native to the region but is a valuable source of pollen for honey bees in central Iowa.

If the decision is made to seed naturalized, non-invasive species on a site, developers should note these plants will move to other areas of the project and compete with native species, regardless of where they were planted. Additionally, if these species are included in a mix, they will likely not provide the same level of environmental benefits and the cost of the mix should be lower. Setting goals for the project and a holistic evaluation of all factors will help equalize costs for a project while balancing ecological outcomes.

In all, pairing native and naturalized, non-invasive vegetation with new solar energy projects saves developers money, conserves natural resources, and provides ratepayers with the greatest return on investment—ultimately, amplifying the value of a quickly-approaching renewable energy future. Sites with native vegetation are more commonly referred to as "pollinator-friendly solar sites." Pollinator-friendly solar project sites offer a prime opportunity to jumpstart populations of at-risk pollinators and wildlife while improving water quality and building soil health. Even with modest investments in habitat creation, honey bees, native bees, monarch butterflies, ring-necked pheasants, and quail can experience vibrant and measurable expansions in overall population.

Pollinators play a critical role in the robust food, fuel, and fiber production economy of the Midwest. By pollinating agricultural crops, this group of insects is crucial to ensuring economic and food security. Research shows pollinator-friendly solar sites lead to significant increases in the populations of butterflies and bees.[13] In fact, the populations of all pollinators, including honey bees, native bees, and monarch butterflies, were three and a half times

13 Montag, Hannah, et al. "The Effects of Solar Farms on Local Biodiversity: A Comparative Study." Clarkson and Woods, Wychwood Biodiversity, April 2016, solar-trade.org.uk/wp-content/uploads/2016/04/The-effects-of-solar-farms-on-local-biodiversity-study.pdf. Accessed August 2020.

greater on sites with investments in the reestablishment of native and naturalized, non-invasive vegetation in central Iowa when compared to control sites.[14] Meanwhile, the same team at Iowa State University found a significant increase in the number of adult monarchs in late August on sites with native vegetation, due in part to a greater abundance of flowering resources at that point in the growing season.[15] See Figure 3 on page 4.[16]

In addition to facilitating notable expansions in pollinator and other desirable insect populations, investments in native and naturalized, non-invasive vegetation create habitat for a variety of upland nesting birds. Ring-necked pheasants and quail, as well as other grassland birds like the sedge wren and dickissel, each benefit from these efforts. Investments in habitat are critical to species success given the loss of habitat in recent years for these wildlife species. Between 1990 and 2018, upland wildlife (i.e. ring-necked pheasants) lost more than 1.8 million acres of habitat in Iowa alone.[17] Expressed as square miles, this group of wildlife species lost nearly 3,000 square miles of habitat during that period, an area nearly 400 square miles larger than the entire state of Delaware.[18] Pollinator-friendly solar projects offer previously unavailable opportunities to invest in this critical wildlife habitat.

Site managers of pollinator-friendly solar projects can improve water quality and build soil health with investments in native and naturalized, non-invasive vegetation. Beyond clearly-visible impacts such as reducing on-site erosion, these investments offer a multitude of benefits for soil and water quality. For example, this practice has been proven to significantly reduce surface water runoff, helping retain toxic nutrients, such as nitrogen and phosphorus on the landscape and preventing them from leaching to lakes, rivers, and streams. Excess nutrients in water bodies lead to hypoxia, or a lack of oxygen caused by the bloom and decay of algae and other aquatic plant life.[19] Strips of perennial native vegetation have been shown to reduce nitrogen loss by 60 percent and phosphorus loss by 90 percent.[20] The deep root systems of native plant species can absorb and filter more water, making it an effective flood reduction practice as well. In fact, perennial vegetation has been shown to reduce peak stream-flows by up to 40 percent during flood events.[21]

With investments in native and naturalized, non-invasive vegetation, site managers of renewable energy projects can help power a variety of ecosystem services. These services include the creation of habitat for at-risk pollinators and vulnerable wildlife species, as well as helping promote cleaner water and healthier soils in the surrounding areas. Holistically, these investments help ensure that surrounding local stakeholders, project developers, and landowners hosting projects each see a return on investment for renewable energy projects.

C. POLLINATOR-FRIENDLY SOLAR ADDS VALUE

By implementing this practice, project developers can slash their operations and maintenance costs by up to three times over 20 years when compared to mowing and maintaining turf grass. See Figure 4 on page 6.[22] This illustrates the mutually-beneficial outcomes for developers, site managers, pollinators and wildlife, and surrounding communities.

1. PLANNING, COST, AND SEEDING

Planning — At least one year before the seed goes into the ground, planning is recommended to allow for a holistic consideration of all factors. With adequate time to plan, site managers can reach out for technical assistance, review and select a site location, determine the existing dominant vegetation (if any), and conduct the appropriate herbicide applications to remove it. Two or more herbicide applications are recommended to suppress existing vegetation, but site managers should make these decisions after evaluating the conditions and needs of each site. Additionally, this planning window allows site managers to consult with natural resources professionals, retailers, and others to formulate and gather quotes for a native seed mix.[23] For developers constructing and managing projects in and immediately around Iowa, the Tallgrass Prairie Center at the University of Northern Iowa has compiled the 2020 Iowa Seed and Service Provider List which contains resources in the region.[24]

Cost — As with any new investment, the uncertainty presented can often be discouraging, or even a deterrent, for project developers and site managers. However, a fair evaluation of all costs and beneficial outcomes will help ensure a smooth process. When considering total project cost, a primary variable is the number of acres of native and naturalized, non-invasive vegetation that will be established. Determining the number of acres to be established will allow site managers to identify the quality and price of the seed mix for a project, as well as full consideration of the management options for the site. For example, seeding expenses may be different if a site manager is hand-broadcasting a 2-acre community solar project as compared to drilling a 850-acre utility-scale solar project site. Depending on the project size, different management approaches may be necessary, as well as additional equipment like mowers or other machinery.

> Per acre in Iowa, $500 to $1,000 for a seed mix is a reasonable range for most projects.[25] To assist with planning purposes, a site manager should budget $700 per acre for the seed mix and $100 per acre for seedbed preparations. These numbers are expected to fluctuate based on the needs of different project sites.[26]

Site managers should include native vegetation in the initial planning of a project. Incorporating this desired outcome into the process will allow for a holistic consideration of all factors including construction, management, establishment, and more.

14 Schulte, Lisa A., et al. "Prairie strips improve corn-soybean croplands." Proceedings of the National Academy of Sciences of the United States of America, October 2017, 114 (42) 11247-11252; DOI: 10.1073/pnas.1620229114.

15 "Research Highlight: Prairie strips help honey bees and wild pollinators." Iowa State University, February 2020, nrem.iastate.edu/research/STRIPS/files/publication/strips_flar_infosheet_20200203.pdf. Accessed August 2020.

16 Ibid.

17 Bogenschutz, Todd, et al. "2019 Iowa August Roadside Survey." Iowa Department Of Natural Resources. September 2019.

18 Ibid.

19 Schulte, Lisa A., et al. "Prairie strips improve corn-soybean croplands." Proceedings of the National Academy of Sciences of the United States of America, October 2017, 114 (42) 11247-11252; DOI: 10.1073/pnas.1620229114.

20 "A Landowner's Guide to Prairie Conservation Strips." Iowa State University, extension.iastate.edu/alternativeag/info/Landowners%20Guide%20to%20Prairie%20Conservation%20Strips.pdf. Accessed August 2020.

21 "Flood Resilience Program." Iowa Watershed Approach, Iowa Department of Homeland Security and Emergency Management, 2017, iowawatershedapproach.org/programs/resilience/. Accessed August 2020.

22 Argonne National Laboratory, produced for the U.S. Department of Energy's InSPIRE Study. Obtained via personal communication with Fresh Energy, April 2020.

23 "Iowa Monarch Conservation Consortium." Iowa State University, monarch.ent.iastate.edu/. Accessed December 2019.

24 "Iowa Prairie Seed And Service Providers." Tallgrass Prairie Center, University of Northern Iowa, 2020, tallgrassprairiecenter.org/seed-service-providers. Accessed May 2020.

25 Ibid.

26 Personal communications with Amy Yoakum of Conservation Corps Iowa & Minnesota, and Tim Youngquist, Iowa State University STRIPS Project, March 2020.

FIGURE 4. COST REDUCTIONS FOR SOLAR PROJECT DEVELOPERS

Preliminary Cost Benefit Analysis - Native Vegetation vs. Grass, 100-acre facility operation and maintenance over 20 years, Midwest

Pollinator habitat assumptions:
- Seed: $600-$1,200/acre; $150 more/acre for planting
- Mowing/maintaining: $120/acre; $12,000 mow 3-4x/year first four years, then 1x/year

Pollinator habitat 20-year seed and mow costs:
- Low $435,000; high $519,000

Low-growth grass assumptions:
- Seed: $300-$500/acre; $150 more/acre for planting
- Mowing/maintaining: $670/acre/year (includes weekly or biweekly mowing)

Grass 20-year seed and mow costs:
- ~$1.4 mil

Seed/mow total cost of pollinator habitat up to 3x less than grass

Seeding — When considering the seeding of a project site, timing is key to success. Frost-seeding between Nov. 1 and June 1 is ideal for maximum germination and ensuring a strong stand establishment through a full growing season.[27] Native plants need time to establish their deep, complex root systems which enable their effectiveness at water filtration and nutrient cycling. August and late summer should be avoided as a stand won't have enough time to establish before cold temperatures arrive. Remember, establishing this practice on solar project sites takes time and requires a great deal of patience.

> "In year one prairie sleeps, in year two prairie creeps, and in year three prairie leaps."[28]

To establish the needed firm seedbed, conventional methods include discing at least twice, and cultipacking, although these decisions should be made based upon the conditions of each site. As site managers work to identify seeding methods, broadcast, drill, and hand-broadcast are each techniques that can be considered. Important to remember in this process is that native grass seeds need good seed-to-soil contact and should never be planted deeper than one-fourth of an inch in the soil. Ideally, newly-cast native prairie seeds should rest on top of the soil.[29]

Best practice: A site may take time to establish aesthetic native vegetation. Signage that says, "Pollinator habitat in progress" can mitigate public concern during the one to three year establishment period. Site managers should keep in mind each seedbed is different and may not need discing or other disturbance—these decisions should be made with a natural resources professional while reviewing site specific information such as existing vegetation, moisture levels, and soil type. For site managers trying to reduce erosion through the construction phase, cover crops like cereal rye can be used prior to seeding, but should be terminated before the final mix is distributed on the site.

2. CONSTRUCTION, DESIGN, AND MANAGEMENT

Construction and design — Site managers should be flexible when it comes to the height of a solar energy system; this will help ensure project success. Across the energy industry, 3 to 4 feet of ground clearance between the lowest, tilted edge of a ground-mounted solar energy system and the ground is widely viewed as the maximum clearance without substantially increasing material costs and/or creating the need for elevation of workers for operations and maintenance.[30] Workers who need to be elevated for project upgrades and maintenance often require more safety equipment and work longer hours.

> Total project height refers to the overall height of the solar array and is different than the clearance between the lowest edge of the solar panel and the ground; oftentimes, total project height is regulated by city, county, or state codes.

When designing a pollinator-friendly solar project, a seed mix should include plants that do not reach a peak height that could shade the lowest, tilted edge of ground-mounted solar energy systems unless site managers plan to use strategic mowing or livestock grazing (i.e. sheep) to avoid interfering with project efficiency.

Best practice: Although site managers may have to strip-mow to maintain project efficiency, they should remember that taller, more diverse native and naturalized, non-invasive vegetation will provide better habitat for wildlife and pollinators.[31] Striking a balance between vegetative quality and diversity and ground clearance height can equalize overall project costs.

Management — While it is helpful to have robust management timelines which can help with planning, every site is unique and all timelines should be adjusted to fit the needs of each site. Evaluating the ratio of native and desirable species to invasives and weeds before making mowing and other management decisions will facilitate greater progress in a site's establishment. Pollinator-friendly solar projects will require more up-front management, particularly during the establishment period between years one and three. However, as noted in Figure 5 on page 6, major cost reductions can be realized after this period.

> Contrary to typical management of native prairies in the Midwest, the preferred management option for pollinator-friendly solar project sites is mowing—this reduces concerns of fire damage to on-site equipment.

- Year one: Site managers should expect to conduct regular mowings (three to four times) during the first growing season. This prevents weeds from shading out seedlings and going to seed which facilitates greater spread. The first mowing should be at a height of 4 to 6 inches soon after seeding, and the next two mowings should be at a height no less than 8 inches.[32]
- Year two: With a successful planting, years subsequent to establishment provide the opportunity for site managers to enjoy less overall maintenance. During year two, sites need only an occasional disturbance to encourage desirable species.[33] At this point, mowing based on the needs of a site is appropriate, but these decisions should be made in conjunction with a natural resources professional and should consider the ratio of desirable to undesirable species.
- Years three and four: Site managers can expect to begin realizing substantially less maintenance needs during this period. At this time, mowing and baling approximately every three years is the preferred management option for pollinator-friendly solar project sites.[34]

> Some sites have seen success with rotational grazing of sheep as a management option; however, waiting until after the establishment period of one to three years before using this practice will help avoid risks of overgrazing and failed establishment.

3. TIMING IMPACTS FOR WILDLIFE AND POLLINATORS

Management actions on pollinator-friendly solar sites should consider timing to avoid negatively impacting populations of wildlife and pollinators and reducing overall project value. After year two, site managers should avoid or minimize mowing between April 1 and Aug. 1 to reduce disturbances during the nesting season of upland birds, such as ring-necked pheasants and quail.[35] Delaying mowing even further to late September facilitates a more welcoming habitat for migrating pollinators, such as monarch butterflies. This date is preferred because the highest population of monarch eggs is often found on milkweed plants in late July and early August.[36] However, site managers could use spot mowing and/or herbicide application during this period if site conditions deem it necessary.

Best practice: Every site is unique and all timelines should be adjusted to the needs of a project rather than arbitrary timelines. Evaluating the ratio of native and desirable species to weeds and invasive vegetation before making mowing and other management decisions will help site managers reach their goals more quickly. If native and desirable species of vegetation are struggling to establish a strong stand, mowing is likely necessary; if the opposite is occuring, mowing may not be in a site's best interest.

27 "Habitat How-To." Iowa Monarch Conservation Consortium, Iowa State University, 2019, monarch.ent.iastate.edu/habitat-how. Accessed December 2019.

28 Personal communication, Matt O'Neal, entomologist at Iowa State University, March 2020.

29 "Management Overview, Science-Based Trials of Row Crops Integrated with Prairie Strips." Iowa State University, 2019, nrem.iastate.edu/research/STRIPS/content/management-overview. Accessed December 2019.

30 Personal communications, City of Cedar Falls, Oct. 26, 2019; and Kertech, LLC, Oct. 30, 2019.

31 "Native Seed Program." Iowa Pheasants Forever, 2019, iowapf.net/native-seed-program. Accessed December 2019.

32 "Habitat How-To." Iowa Monarch Conservation Consortium, Iowa State University, 2019, monarch.ent.iastate.edu/habitat-how. Accessed December 2019.

33 Ibid.

34 "Iowa Monarch Conservation Consortium." Iowa State University, monarch.ent.iastate.edu/. Accessed December 2019.

35 "Native Seed Program." Iowa Pheasants Forever, 2019, iowapf.net/native-seed-program. Accessed December 2019.

36 "Habitat How-To." Iowa Monarch Conservation Consortium, Iowa State University, 2019, monarch.ent.iastate.edu/habitat-how. Accessed December 2019.

TABLE 1. SPECIES CONSIDERATIONS FOR SEED MIX SELECTIONS

Latin name	Common name	Height	Bloom time and color: April	May	June	July	Aug	Sept.	Oct.	Insect attractiveness rating
Zizia aurea	Golden Alexanders	3'								HA, PP
Tradescantia ohiensis	Ohio Spiderwort (common spiderwort)	3'								PP
Baptisia alba	Wild White Indigo	4'								
Penstemon digitalis (Penstemon hirsutus)	Foxglove beardtongue	3'								MA, PP
Asclepias tuberosa	Butterfly Milkweed	2'								MA, LH, N
Coreopsis palmata (Coreopsis lanceolata)	Prairie Coreopsis	2								HA, PP
Euphorbia corollata	Flowering Spurge	3								
Ruellia humilis	Wild Petunia	1'								
Ceanothus americanus	New Jersey Tea	3'								LNA, PP
Rosa arkansana (Rosa setigera)	Wild Rose	2'								MA, PP
Amorpha canescens	Lead Plant	3'								LNA, PP
Asclepias syriaca	Common Milkweed	3'								
Dalea candida	White Prairie Clover	2'								
Drymocallis arguta	Prairie Cinquefoil	2								
Liatris aspera	Rough Blazing Star	3'								MA, N
Pseudognaphalium obtusifolium	Sweet Everlasting	2'								
Verbena stricta	Hoary Vervain	2								MA, PP
Heliopsis helianthoides	Early Sunflower	5'								PP
Rudbeckia hirta	Black-eyed Susan	2								LH, N
Desmodium canadense	Showy Tick Trefoil	5'								L, NA
Chamaecrista fasciculata	Partridge Pea	2'								PP
Dalea purpurea	Purple Prairie Clover	2'								PP
Eryngium yuccifolium	Rattlesnake Master	4'								PP
Gentiana alba	Cream Gentian	3								
Pedicularis lanceolata	Marsh Betony	3'								
Solidago speciosa	Showy Goldenrod	5'								MA, N, PP
Symphyotrichum oolentangiense	Sky Blue Aster	3'								
Symphyotrichum ericoides	Heath Aster	2'								PP
Symphyotrichum pilosum	Frost Aster	3'								
Bouteloua curtipendula	Side-oats Grama	2'								
Carex brevior	Plains Oval Sedge	1'								
Koeleria macrantha	June Grass	2'								
Schizachyrium scoparium	Little Bluestem	3'								
Alternatives										
Symphyotrichum novae angliae (formerly Aster novae angliae)	New England Aster									HA
Asclepias tuberosa	Butterfly Weed									MA

KEY

HA = Highly Attractive
MA = Moderately Attractive
LNA = Low/No Attractiveness
PP = Attracts Pollinators and Predatory Insects
LH = Larval Host
N = Provides Nectar for Butterflies

= Value added to pollinators
= Value added to monarchs
= Value added to grazing livestock

4. SELECTING A SEED MIX FOR POLLINATOR-FRIENDLY SOLAR SITES

When planning for a solar project site with native and naturalized, non-invasive vegetation, site managers should carefully consider several variables. While the ground clearance between the lowest, tilted edge of a solar panel and the ground is a primary consideration when crafting a mix of seeds for the site, there are other factors site managers should evaluate when designing, constructing, and planning their pollinator-friendly solar sites.

To aid in the identification of valuable native and naturalized, non-invasive species of vegetation for a pollinator-friendly solar project, site managers are encouraged to use the following steps as a resource.

Step one: Consult with natural resources professionals to evaluate the following site-specific information:

- Project location (i.e. floodplain, steep slopes).
- Soil type and moisture (i.e. wet, wet-dry, dry, etc.).
- Site history (past vegetation, previous uses).
- The species of vegetation native to the area (local ecotype varies by region).
- Planned management methods for the site (mowing, grazing, equipment).

Step two: Set goals to help guide decision making

Managing a site to provide value for certain insect and wildlife species can require special considerations. Setting goals for the vegetation placed on a solar project site can help guide management decisions. Site managers should work with local stakeholders to help identify goals that will add the most value to a solar project site.

Wildlife generally responds more to the structure of vegetation instead of specific plant species. For example, seed mixes which contain too many grasses could restrict the navigability of the site for upland nesting birds, such as ring-necked pheasants and quail, negating the value of the site to these birds. When formulating a seed mix, site managers should evaluate the ratio of grasses to forbs to inform their seed selection process. A desired seed mix for upland nesting birds would be closer to 30 percent grasses and 70 percent forbs.

When managing a site to achieve value for a variety of pollinators, including native bees, honey bees, and monarch butterflies, a diversity of flowering plants that bloom during the entire growing season is crucial to provide ample pollen and nectar resources. This can help improve overall honey production in beehives placed on a project site as well as provide crucial resources for migrating monarch butterflies. Additionally, monarch butterflies only lay eggs on milkweed plants, making this species of vegetation a crucial component of a seed mix intended to maximize project value for this flagship species.

Importantly, wild bees benefit significantly from vegetation native to the location. However, naturalized, non-invasive species (i.e. clover) could offer similar or enhanced value. Honey bees have been proven to benefit from both native and naturalized, non-invasive species. Table 1 on page 9 displays some species which offer valuable nectar and pollen resources for this species.

Many pollinator-friendly solar site developers may want to consider species of vegetation which could make the site more valuable for the grazing of livestock. Given the significant cost of the equipment installed at a solar farm, sheep offer the lowest amount of risk for grazing. Other livestock, such as goats, may jump up on the panels and/or chew crucial wiring. Meanwhile, cattle would be expected to utilize the solar array as a scratching post, posing potential risks of equipment damage. Sheep are flexible grazers and Table 1 on page 9 highlights species which could help enable grazing value at the site. However, site managers are encouraged to avoid the introduction of sheep grazing until after the vegetation establishment period of one to three years. Delaying the introduction of grazing ensures the site does not encounter emergence issues and reductions in pollinator value. Once sheep grazing is introduced, site managers should consult with natural resources professionals and livestock managers to formulate a robust rotational grazing plan.

Other pollinator considerations:

- Grasses, such as Little Bluestem, have limited value for pollinators.
- Clovers are very valuable for honey bees, recognized as a source of nectar for honey production and have been identified as the most common source of pollen for honey bees in central Iowa.
- Goldenrods (Solidigos) and Birdsfoot Trefoil (Lotus corniculatus) have been proven to be used as a source of pollen for honey bees.

FIGURE 5. PROJECT SITE PLACEMENT OPPORTUNITIES FOR NATIVE AND NATURALIZED, NON-INVASIVE VEGETATION

Step three: Determine site placement and workability

Once the plants have been identified to meet the goals of the project, their practicality for solar operations is a key consideration. Placement of certain species may be better suited for specific areas of the project, including around the border of the solar farm, between the solar arrays, underneath the panels, and in screening/buffer areas which surround the solar project. See Figure 5. Some of the plants listed in Table 1 on page 9 may be too tall to plant between the panels and should be limited to the border around the solar farm to avoid shading concerns—this should be determined in conjunction with site managers and natural resources professionals using site-specific information.

Step four: Determine seed source and suitability

Once the plant species have been identified, selecting a retailer who can source the seeds is a key project need. Retailers who offer local ecotype seeds, meaning they're best suited for establishment within the site's conditions and native to the region, are recommended to ensure maximum project value. When consulting with retailers about a seed mix, the following factors should be considered:

- Is the seed locally-sourced?
- Given my site history, do you have suggestions for how I can ensure desirable species?
- What is your recommended seeding rate?
- What is the total cost per acre for this seed mix?

Table 1 on page 9 contains species of native vegetation which provide value to pollinators, monarchs, and grazing while also detailing considerations, such as projected height for solar site operators. This seed mix recommendation was compiled after consultation with a local county conservation board, researchers at Iowa State University, and technical staff at a nonprofit conservation organization. Bloom times are also listed so site managers can take action to identify a replacement species if they must remove a species due to height or other considerations—this ensures ample pollen and nectar resources for pollinators throughout the blooming season. For site managers working to identify sources of natural resource expertise, the following list may prove useful:

- County conservation boards, natural resource districts, etc.
- Soil and water conservation districts
- State agriculture and natural resources agencies (Iowa Department of Agriculture and Land Stewardship, Iowa Department of Natural Resources, etc.)
- Natural Resources Conservation Service (NRCS)
- University extension and outreach professionals

D. POLICY CONSIDERATIONS FOR PUBLIC AND PRIVATE STAKEHOLDERS

1. POLLINATOR-FRIENDLY SOLAR PROGRAMS

Across the U.S., many states have recognized the value of pollinator-friendly solar projects and passed policies to ensure this practical co-usage of land is implemented. Several states, including Illinois, Maryland, Minnesota, and Virginia, have statewide pollinator-friendly solar programs.

In Minnesota, state code (§216B.1642)[37] authorizes the Board of Soil and Water Resources to establish statewide guidance for solar project developers aiming for recognition under the Habitat Friendly Solar Program. The statute reads, "...an owner of a solar site implementing solar site management practices may claim that the site provides benefits to gamebirds, songbirds, and pollinators only if the site adheres to guidance set forth by the pollinator plan provided by the Board of Water and Soil Resources."[38]

This guidance is based in part on the Minnesota Solar Site Pollinator Habitat Assessment Form for Project Planning, also known as a pollinator-friendly solar scorecard.[39] This form helps solar project developers and site managers implement pollinator-friendly solar projects by setting goals for percentage of the site coverage by wildflowers, native species, blooming species, and evaluating habitat resources, among other guidance. This guidance is then incorporated into local ordinances at the county and municipal levels, setting clear rules solar project developers must follow to be recognized on a publicly-available statewide listing of pollinator-friendly solar projects.

As solar energy continues to grow, states can work with stakeholders, including pollinator and natural resources professionals, solar project developers, and local government officials, to establish their own statewide pollinator-friendly solar programs. In addition to meeting on-site practical goals for project developers, such as reducing erosion, these programs ensure that all local stakeholders benefit from renewable solar energy. States with pollinator-friendly solar projects are facilitating investments in natural resources, pollinators, and rural communities with one common sense action.

Apart from statewide programs, local government officials with authority to regulate zoning within their jurisdiction can write requirements for pollinator-friendly solar projects into their solar energy ordinances. In Iowa, several counties have led the way on this innovative approach of requiring pollinator-friendly solar. Linn County, Iowa, for example, included the following language in its solar energy ordinance:

"...2) Soils shall be planted and maintained in perennial vegetation to prevent erosion, manage runoff, and build soil. Seeds should include a mix of grasses and wildflowers, ideally native to the region of the project site that will result in a short stature

37 "2019 Minnesota Statutes." Office of the Revisor of Statutes, Minnesota Legislature, revisor.mn.gov/statutes/cite/216B.1642. Accessed May 2020.

38 "Minnesota Habitat Friendly Solar Program." Minnesota Board of Water and Soil Resources, 2019, bwsr.state.mn.us/bwsr-habitat-friendly-solar-program. Accessed May 2020.

39 "Solar Site Pollinator Habitat Assessment Form For Project Planning." Minnesota Board of Water and Soil Resources, 2lwej14565m2mnjlk31pmwq-wpengine.netdna-ssl.com/wp-content/uploads/2019/08/Minnesota-pollinator-scorecard.pdf. Accessed May 2020.

prairie with a diversity of forbs or flowering plants that bloom throughout the growing season. Blooming shrubs may be used in buffer areas as appropriate for visual screening. 3) Seed mixes and maintenance practices should be consistent with recommendations made by qualified natural resource professionals such as those from the department of natural resources, county soil and water conservation service, or natural resource conservation service. 4) Plant material must not have been treated with systemic insecticides, particularly neonicotinoids."[40]

Other counties and cities across the region could consider the inclusion of pollinator-friendly solar language in their renewable energy ordinances to ensure all local stakeholders benefit from expanded solar energy development. This allows all residents of the county, not just the landowner hosting the lease, to see a return on investments in solar projects.

V. CONCLUSION

The clean energy economy is growing rapidly and is fueled in large part by widespread adoption of solar energy. As the industry continues to create hundreds of thousands of jobs, stimulate local and state tax revenue, and help reduce greenhouse gas emissions, more stakeholders will continue to explore ways to add more value to solar energy for all stakeholders. By developing resources for site managers of pollinator-friendly solar projects, public officials at all levels are well positioned to add value to these projects for every ratepayer. Investments in native and naturalized, non-invasive vegetation ensure habitat for at-risk pollinators, including the monarch butterfly, while creating habitat for vulnerable wildlife species. These species are crucial for economic and food security in the Midwest and underwriting solar energy projects with native perennial vegetation improves quality of life for all.

Combining conservation with renewable energy projects and saving money are not mutually exclusive. The research has clearly demonstrated these investments can save project developers up to three times the cost of managing traditional turfgrass sites.[41] Simultaneously, pairing this practice combination with community- and utility-scale energy projects opens the door to numerous, scarcely-explored economic development opportunities, particularly in the rural Midwest. Developers and communities can work together to leverage these projects to generate more than just renewable energy. Looking forward, opening up project sites for beekeeping, investing in the local native seed supply chain by supporting local retailers and service providers, offers a way to further leverage solar energy to stimulate rural economies.

In all, when conservation is made a priority on solar energy sites, the value of these projects are amplified. Value for ratepayers, vulnerable pollinators and wildlife, soil and water quality, and economic stimulation rarely come in such a clear and practical package. As the Midwest looks forward to a future powered by a clean energy economy, this innovative and pragmatic approach to solar energy may offer the brightest path forward.

About the Center for Rural Affairs

Established in 1973, the Center for Rural Affairs is a private, nonprofit organization with a mission to establish strong rural communities, social and economic justice, environmental stewardship, and genuine opportunity for all while engaging people in decisions that affect the quality of their lives and the future of their communities.

40 Smith, Cody, et al. "Iowa Solar Siting Resource Guide: A Roadmap For Counties." Center for Rural Affairs, Iowa Environmental Council, cfra.org/publications/iowa-solar-siting-resource-guide. Accessed August 2020.

41 Argonne National Laboratory, produced for the U.S. Department of Energy's InSPIRE Study. Obtained via personal communication with Fresh Energy, April 2020.

FACT SHEET:

NATIVE VEGETATION AND SOLAR PROJECTS IN IOWA

Across the U.S., the solar industry is booming. Solar project sites often occupy several acres of land and are projected to cover 3 million acres by 2030.[1] To produce 10 percent of Iowa's electricity from solar energy, 13,440 acres would need to be occupied by solar arrays—offering an opportunity for project owners to demonstrate their commitment to environmental stewardship.[2]

ADDING PROJECT VALUE

In addition to providing habitat for wildlife and pollinators, investments in native vegetation (including non-invasive, naturalized species) on solar project sites provide ancillary benefits, such as improved soil health and water quality, while also sequestering carbon.

PLANNING, COST, AND SEEDING

Planning

- Planning at least one year before the seed goes into the ground is recommended; this provides adequate time to reach out for technical assistance, review and select a site, determine the existing dominant vegetation (if any), conduct two or more herbicide applications to suppress existing vegetation (if needed), and gather quotes for a native seed mix.[3]

Cost

- When considering total project cost, the key variable is the number of acres that will be established. Depending on project size, different management approaches may be necessary. **Per acre in Iowa, $500 to $1,000 is a reasonable range for most projects.**[4,5]

Best practice: Include native vegetation in the initial planning of a project. Incorporating this desired outcome into the process will allow for a holistic consideration of all factors including construction, management, establishment, and more.

Seeding

- Timing is key to success—frost-seeding between Nov. 1 and June 1 is ideal for maximum germination and ensuring stand establishment through a full growing season.[6] August and late summer should be avoided as a stand won't have enough time to establish before cold temperatures. To establish the needed firm seedbed, conventional methods include discing at least twice, and cultipacking, although this is dependent upon the conditions of each site. Seeding methods include broadcast, drill, and hand-broadcast techniques. Native grass seeds need good seed-to-soil contact and should be planted no deeper than one-fourth of an inch in the soil. Ideally, native prairie seeds should rest on top of the soil.[7]

Best practice: A site may take time to establish aesthetic native vegetation. Signage that says, "Pollinator habitat in progress" can mitigate public concern. Keep in mind each seedbed is different and may not need discing—these decisions should be made with a professional to review site-specific information such as existing vegetation, moisture levels, and soil type.

Sources

1. [illegible] "Struggling Farmers [illegible] Solar." The Wall Street Journal, [illegible] Accessed December 2019.
2. "[illegible] Solar energy in Iowa." Iowa Environmental Council, [illegible] Accessed December 2019.
3. "Iowa Monarch Conservation Consortium." Iowa State University. monarch.iastate.edu. Accessed December 2019.
4. Ibid.
5. "Native Seed Program." Iowa Pheasants Forever, 2019. iowapf.net/native-seed-program. Accessed December 2019.
6. "Habitat How To." Iowa Monarch Conservation Consortium, Iowa State University, 2019. monarch.ent.iastate.edu/habitat-how. Accessed December 2019.
7. "Management Overview. Science-Based Trials of Row Crops Integrated with Prairie Strips." Iowa State University, 2019. nrem.iastate.edu/research/STRIPS/content/management-overview. Accessed December 2019.

MANAGEMENT AND CONSTRUCTION

Construction and design

- Being flexible when it comes to the height of a solar energy system is important for project success. 3 to 4 feet tall is widely viewed as the maximum clearance between the lowest edge of the solar panel and the ground without substantially increasing material costs and creating the need for elevation of workers for operations and maintenance.[8] A seed mix should include plants that don't reach a peak height that could shade the low, tilted edge of ground-mounted solar energy systems unless developers plan to use strategic mowing or livestock grazing (i.e. sheep) to avoid interfering with project efficiency.

Best practice: Although project managers may have to strip-mow to maintain project efficiency, remember that taller native vegetation provides better habitat for wildlife and pollinators.[9] Striking a balance between quality and height can equalize cost.

Management

- **Year one:** Regular mowing (three to four times) during the first growing season prevents weeds from shading out seedlings and going to seed. The first mowing should be at a height of 4 to 6 inches soon after seeding, the next two mowings should be at a height no less than 8 inches.[10]
- **Year two:** With a successful planting, years subsequent to establishment provide the opportunity for less maintenance, needing only an occasional disturbance to encourage desirable species.[11]
- **Years three and four:** Mowing and baling approximately every three years is the preferred management option for solar project sites.[12]

Timing impacts wildlife and pollinators

- After year two, avoid or minimize mowing between April 1 and Aug. 1 to reduce impacts during the nesting season of upland birds such as pheasants and quail.[13] Delaying mowing to late September facilitates a more welcoming habitat for migrating pollinators such as monarch butterflies, as the highest population of monarch eggs is often found on milkweed plants in late July and early August.[14] Spot mowing and/or herbicide application could be used during this period if necessary.

Best practice: Every site is unique and all timelines should be adjusted to the needs of a project. Experts suggest evaluating the ratio of native species to weeds and invasive vegetation before making mowing and other management decisions. If native vegetation is struggling to establish a strong stand, mowing is likely necessary; if the opposite is occuring, mowing may not be in a site's best interest.

Selecting a seed mix

- The height of the solar panels is a primary consideration when selecting a seed mix. Other factors include project location, soil type and moisture, the species of vegetation native to the area, planned management of the site, and more. Consider desired outcomes of the native vegetation, such as providing wildlife habitat, increasing pollinator populations, or reducing erosion. Developers should aim for a ratio of grasses to forbs when selecting a seed mix.

Best practice: Wildlife generally responds more to structure of vegetation (the ratio of grasses to forbs) than specific plant species; a seed mix closer to 30 percent grasses and 70 percent forbs is recommended for upland nesting birds. Some species of native vegetation are crucial for pollinators; monarch butterflies only lay eggs on milkweed plants.[15] Bees, adult monarchs, and other pollinators rely on a diversity of flowering plants that have blooms during all periods of the growing season (March to October). See Figure 1 on the following page for recommended seed mix.

Sources

8. Personal communications, City of Cedar Falls, Oct. 26, 2019; Kertech, LLC, Oct. 30, 2019.
9. "Native Seed Program." Iowa Pheasants Forever, 2019. iowapf.net/native-seed-program. Accessed December 2019.
10. "Habitat How To." Iowa Monarch Conservation Consortium, Iowa State University, 2019. monarch.ent.iastate.edu/habitat-how. Accessed December 2019.
11. Ibid.
12. "Iowa Monarch Conservation Consortium." Iowa [illegible] Accessed December 2019.
13. "Native Seed Program." Iowa Pheasants Forever, 2019. [illegible] Accessed December 2019.
14. "Habitat How To." Iowa Monarch Conservation Consortium, Iowa State University, 2019. [illegible] Accessed December 2019.
15. Personal communications, [illegible] Iowa State University, Oct. [illegible], 2019.

FIGURE 1: RECOMMENDED NATIVE SEED MIX FOR A SOLAR PROJECT SITE IN CENTRAL IOWA[16]

Short species prairie seed mix for medium-dry soils in central Iowa			
Botanical name	**Common name**	**Botanical name**	**Common name**
Wildflowers (forbs)		**Trees, shrubs, vines**	
Asclepias tuberosa	Butterfly Weed	Ceanthus americanus	New Jersey Tea
Baptisia alba	White Wild Indigo	Rosa arkansana	Wild Rose
Chamaecrista fasciculata	Partridge Pea	Amorpha canescens	Lead Plant
Coreopsis lanceolata	Lance-leaf Coreopsis	**Grasses, sedges, rushes**	
Coreopsis palmata	Prairie Coreopsis	Bouteloua curt pendula	Side-oats Grama
Dalea candida	White Prairie Clover	Carex brevior	Plains Oval Sedge
Dalea purpurea	Purple Prairie Clover	Koeleria marcantha	June Grass
Drymocallis arguta	Prairie Cinquefoil	Schyzachyrium scoparium	Little Bluestem
Eryngium yuccifolium	Rattlesnake Master	**Sun exposure: full**	
Euphorbia corollata	Flowering Spurge	**Soil moisture: medium-dry**	
Liatris aspera	Button Blazing Star		
Pedicularis canadensis	Wood Betony		
Penstemon digitalis	Foxglove Beardtongue		
Pseudognaphalium obtusifolium	Sweet Everlasting		
Rudbeckia hirta	Black-eyed Susan		
Ruellia humilis	Wild Petunia		
Solidago speciosa	Showy Goldenrod		
Symphyotrichum oolentangiense	Sky Blue Aster		
Tradescantia ohiensis	Ohio Spiderwort		
Verbena stricta	Hoary Vervain		
Zizia aurea	Golden Alexanders		
Asclepias syriaca	Common Milkweed		
Symphyotrichum ericoides	Heath Aster		
Symphyotrichum pilosum	Frost Aster		
Gentiana alba	Cream Gentian		
Heliopsis helianthoides	Early Sunflower		
Desmodium canadense	Showy Tick Trefoil		

Sources

16. Personal communications, Amy Yoakum, Natural Resources Specialist, Story County Conservation, Oct. 23, 2019.

Daniel Priestley

From: Jayme Huber <jhuber@nipco.coop>
Sent: Friday, September 8, 2023 1:33 PM
To: Daniel Priestley
Subject: RE: Solar Public Hearing Postponed to September 11 in Moville at 5 PM (Comments Requested)

Follow Up Flag: Follow up
Flag Status: Flagged

Daniel,

Missed the 10AM deadline for response on this. If possible would like to respond with the following as a response from Northwest Iowa Power Cooperative (NIPCO):

Woodbury County Zoning Solar Ordinances should include and/or require the following data:

1. Location and footprint (Acres) of solar array(s)?
2. Have they started the generation interconnection agreement with the appropriate RTO (SPP or MISO)?
3. What utility have or are they going to partner with on this?
4. What is the size (MW) and voltage (kV) they are considering?
5. What transmission and substation facilities will they need to build and or use that are existing?
6. Do they understand the service territories between MEC, REC's & Muni's?
7. Solar ordinances should match all the ordinances Woodbury County Zoning currently has in place for wind generation facilities.

Regards

Jayme Huber

Jayme Huber
V.P Engineering & Operations
==========
NIPCO
Northwest Iowa Power Cooperative
PO Box 240
31002 County Road C38
Le Mars, IA 51031
==========
jhuber@nipco.coop
Office - 712-546-3509
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Daniel Priestley

From: Kent Amundson <kamundson@woodburyrec.com>
Sent: Friday, September 8, 2023 4:04 PM
To: Daniel Priestley
Subject: RE: Solar Public Hearing Postponed to September 11 in Moville at 5 PM (Comments Requested)

Mr. Priestley,

Thank you for asking the Woodbury County REC to comment on the proposed Utility-Scale Solar Ordinance.

Woodbury County Rural Electric Cooperative provides electric distribution services to our member-consumer in Woodbury County. We contract with other organizations to provide or negotiate for the power used by our member-consumers, and we do not directly install or arrange for utility generation. Generally, demand for electricity across the country is increasing. The country needs to use all available resources to generate electricity, to provide safe and reliable power that our citizens demand.

With respect to a local utility scale solar ordinance, we feel an ordinance should be similar to the current wind ordinance. However, because the technologies are different with respect to shape, sound, and coverage, minor changes could be made to modify distances, etc. reasonable distances should be determined with inputs from all interested parties including landowners of the sites and landowners of surrounding properties. With respect to the definition of "utility scale", we would suggest it be based on system connected to the utility grid, however, larger individual or company owned systems may be a concern for surrounding residence so size considerations may be needed. With respect to other topics being considered like percentages of acres in the county, suitability ratings, etc. these topics should be thoughtfully discussed as they may limit a landowners property rights.

Respectfully submitted,
Kent Amundson
CEO and General Manager
Woodbury County REC
Moville, Iowa

Daniel Priestley

From: Thomas Bean <tbean@landandlibertycoalition.com>
Sent: Monday, September 11, 2023 1:23 PM
To: Daniel Priestley
Subject: Iowa Land and Liberty Coalition Solar Ordinance Guide
Attachments: Iowa Solar Ordinance Guidebook.pdf

Hello Dan,

My name is Thomas Bean with the Iowa Land & Liberty Coalition. Our group wanted to send over our solar ordinance guide we share with counties who undergo ordinance changes. If you would please provide the commission members with the document that would be great.

Please let me know if you have any questions!

Thank you,

LAND & LIBERTY COALITION

Thomas Bean

Field Representative
m: (319) 899 4451

IA L&LC is a project of the Iowa Conservative Energy Forum

IOWA SOLAR ORDINANCE GUIDE

www.landandlibertycoalition.com/iowa @IowaLLC

ORDINANCE GUIDE SUMMARY

This guide aligns with our mission to collaborate with county officials and develop common-ground solar ordinances that consider the landowner's freedom to develop their private land while respecting the rights of their neighbors and citizens in their county.

WHAT'S INCLUDED:

- Recommendations on the key criteria for a balanced and effective solar energy ordinance.
- A subset of successful county ordinances across the state that preserves landowner rights and brings economic benefits to their communities.

APPLICATION & APPROVAL PROCESS:

We recommend that county officials prioritize creating a clear application and review process with well-defined steps and conditions for approval. This allows a solar developer to clearly identify the application requirements for a solar project which, if met, will result in county approval of the application.

APPLICATION REQUIREMENTS

Project applications should provide essential information to county boards and zoning officials. While some information may be required at the time of application, officials may wish to allow applicants to submit additional information later.

IOWA LAND AND LIBERTY COALITION

Solar Ordinance Guide

WHO WE ARE

The Iowa Land & Liberty Coalition is made up of farmers, landowners, and stakeholders who are concerned about protecting their property rights, building their communities through job creation and economic opportunity, and being good stewards of the land.

SOLAR WORKS IN IOWA

Presently, Iowa is experiencing a boom in the field of Solar Energy Production. The state is seeing unprecedented growth in the customer-owned solar market. Additionally, utility-scale and community solar projects have begun popping up around the state. Here are some statistics and motivations to consider solar:

- **Iowa ranks 16th in the nation in technical potential for solar energy production.** Due to its geography and climate, Iowa can harness more sunshine than Georgia, South Carolina, and even the sunshine state itself, Florida!
- **Large-scale projects are cost-effective.** A recent report found that the cost of energy for utility-scale solar declined 89% between 2009 and 2019. The cost to put up a solar array is cheaper than ever, which means the proceeds can go right back to the landowner and the county.
- **Lease or easement payments provide steady streams of income.** Landowners who are looking to diversify their revenue streams can look to solar to accomplish this goal.
- **Property tax benefits go directly to counties.** Solar arrays must pay properly taxes, which creates a revenue stream that can be directed to a variety of different public works, like county infrastructure, schools, health services, and debt services.
- **Solar arrays produce clean energy with no environmental impact.** Solar arrays do not add harmful emissions into the environment like fossil-fuel power plants. They produce clean energy and after their lifespan is up, they can be recycled, and their components can be repurposed for other manufacturing uses.
- **The job market for solar is growing rapidly.** In 2019, the U.S. Bureau of Labor Statistics projected that Solar Installers will be the fastest growing job market in the United States through 2026, with positions expected to grow by 105% during the time span.

www.landandlibertycoalition.com/iowa @IowaLLC

This guide does not represent legal advice. Recipients of this document should discuss all legal inquiries with an attorney.

COMMON-GROUND SOLAR ORDINANCE CRITERIA

Safe, Proven and Workable for Utility Scale Solar Projects

Category	Standard
Setbacks	• Non-participating property line: 50 ft. • Non-participating dwelling: 250 ft. • Non-participating neighbors can waive the 250 ft. setback by way of a written agreement.
Height Limit	25 ft. at full tilt.
Vegetation Management	25 ft. at full tilt.
Landowner Complaints	Project owner/developer shall establish a complaint resolution system and make a good faith effort to resolve complaints within 45 days.
Decommissioning	• Project owner/developer is required to provide financial assurance for the full cost of decommissioning of the project in a form acceptable to county. This estimated cost is updated every 5 years of operation. • Project owner/developer is required to notify the county of their intent to stop using the facility, and that should be the trigger for decommissioning to begin.

While each county across the state is unique, all counties can utilize these common ground recommendations to preserve property rights for all citizens and invite economic development opportunities to their communities.

View common-ground solar ordinances across the state by checking out some of Iowa's most successful examples below:

Louisa County	Webster County	Johnson County	Muscatine County	Winneshiek County

www.landandlibertycoalition.com/iowa @IowaLLC

This guide does not represent legal advice. Recipients of this document should discuss all legal inquiries with an attorney.

FIND YOUR COMMON GROUND

PRESERVE LANDOWNER RIGHTS

PROTECT CONCERNED CITIZENS

PAVE THE WAY FOR ECONOMIC DEVELOPMENT & TAX BASE GROWTH

CONTACT US TODAY

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