Primary-Scale Solar Study and Toolkit

Report on the basics of primary-scale solar, where they are permitted in the Centre Region and the best practices for regulating the use.

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INTRODUCTION

Communities are turning to solar energy for clean, reliable, and affordable electricity to power their homes and businesses. This report was created for the Centre Region municipalities in response to the rapid growth of primary-scale solar projects being considered in Pennsylvania and wanting to improve potential large-scale solar development outcomes in the Region. The study and toolkit provide guidance for primary-scale solar facilities that distribute power onto the grid for the wholesale market; in other words, performing like a utility provider. The recommendations in this report are intended to be consistent with the Region's goals, values, and sense of identity outlined in the Centre Region Comprehensive Plan and the Centre Region Climate Action and Adaptation Plan.

Over the past decade, the decreasing cost of generating solar power coupled with tax incentives and national sustainability goals have resulted in the rapid expansion of primary-scale solar development throughout the United States. The demand for renewable energy, time-sensitive federal and state tax incentives, and limitations within the electrical grid to support primary-scale solar installations have resulted in a highly competitive landgrab scenario where primary-scale developers are acquiring leases and necessary permits to connect to the power grid in hopes of bringing projects online as quickly as possible.

In 2020, Harris Township was approached by a primary-scale solar developer about constructing a large solar facility on a 90+ acre parcel located near Shingletown Road. It is likely that similar proposals may be made in other Centre Region municipalities where solar access, available land, and electrical infrastructure are sufficient to allow for their development.

This report studies where and how primary-scale solar uses are currently permitted in the Centre Region municipalities and provides guidance on best practices to encourage a balance between solar resources and other valuable local resources (agriculture, trees, historic resources) in the development process.

Solar development can compete for land with other development options, and visual impacts and perceived safety concerns sometimes create opposition to solar installations. Utilizing the best practices identified in this toolkit can hopefully resolve conflicts and create co-benefits from solar development, such as diversifying agricultural businesses, establishing wildlife corridors and habitats, and improving surface and ground waters.

Establishing specific guidance for solar projects at the local level helps officials, residents, and investors by:

- Reducing regulatory costs through predictable permitting procedures and fees
- Building awareness among residents about the impacts/benefits of solar projects and reflecting their concern in policy
- Creating a consistent and manageable framework for officials to apply to projects despite variation across location, scale, technology, and purpose.
BASICS OF PRIMARY-SCALE SOLAR DEVELOPMENT

WHAT ARE PRIMARY-SCALE SOLAR FACILITIES?

They distribute power onto the grid for the wholesale market; basically, performing like a utility provider. They are generally large-scale solar installations on a scale of 5-100MW. The average project in the PJM* queue for Pennsylvania is 28 MW occupying 170 – 230 acres.

- There are many terms used to describe this type of use. Some commons ones are utility-scale, principle-use, grid-scale, or solar farms.

- Community Solar is currently under consideration in the Pennsylvania legislature. It is a type of primary-scale solar use. Community solar facilities would be a solar installation that would supply energy for local consumption only. It would give residents and business owners the choice to subscribe to a local solar installation and earn a credit on their electric bill for their share of the power produced (net metering). They are currently defined as a maximum of 5MW, which would be about 30 acres in size (similar in size to the University Area Joint Authority’s solar installation).

* The PJM is the name of the Regional Transmission Organization (RTO) that is responsible for managing the transportation of electricity from power plants to various utilities in its territory.

PRIMARY-SCALE SOLAR LAND REQUIREMENTS

Primary-scale solar facilities require vacant land, unimpeded solar access, and nearby electrical infrastructure to support power transmission. The land required is on average between five to eight acres per megawatt of solar energy produced. Common locations are brownfields, industrial districts, and rurally zoned areas. Due to the lack of brownfields and industrial districts in the Centre Region, our rurally zoned areas are the most likely option for where our region could see primary-scale solar facilities.

WHY SOLAR IN PENNSYLVANIA?

Over the past decade, the decreasing cost of generating solar power coupled with tax incentives and national sustainability goals have resulted in the rapid expansion of primary-scale solar development throughout the United States. Solar power in Pennsylvania currently provides less than 1% of the state’s electricity, but solar photovoltaics (PV) are the fastest growing energy source in the world due to the decreasing cost per kilowatt-hour – 70% since 2014, according to the U.S. Department of Energy1. Primary scale solar energy generation is cost competitive with conventional generation technologies as shown in the graph of unsubsidized costs and projections below.
Clean, renewable solar energy is vital to economic growth, environmental protection, and electrical grid resiliency in Pennsylvania. To help increase solar energy facilities, the Pennsylvania Department of Environmental Protection (PA DEP) assembled a statewide partnership of experts. After a year of collaboration, they identified 15 strategies, including primary-scale solar and smaller, distributed systems (such as rooftop installations), that can achieve a 10% increase in solar-powered electricity. The PA Solar Future Plan was released in November 2018 and has been a major factor in the growing developer interest to install primary-scale solar facilities in Pennsylvania².

The PA DEP compiled the two images shown with data from the PJM to demonstrate the potential growth and impact of primary-scale (also known as grid-scale) solar projects in recent years.

![Growth of Grid-Scale Solar Proposals](image1.png)

The first graph shows the increasing number of projects that are in the PJM queue from 2015 through the fall of 2021. It is expected that only about 10-20% of these will be built.

![Land Use Impact](image2.png)

The map displays the acres needed if all the projects in the PJM queue where to be built, which is unlikely. This demonstrates the regions where developers are most interested in primary-scale solar projects. The Centre Region makes up roughly 7% of the Centre County projects in the queue.
Benefits and Tradeoffs

Primary-scale solar facilities are large-scale uses that can have significant land-use impacts on communities. While solar energy aligns with the Region’s sustainability goals as a clean energy source, it is necessary to ensure that solar facilities contribute to the complete overall value of our community. The preservation of agricultural lands/industry is a central theme in the Centre Region Comprehensive Plan.

Utilizing this study and toolkit can help local governments lay the policy foundation for developing regulations and programs that enable our community to capture the benefits, while minimizing risks. Below are some benefits and tradeoffs considered during the creation of the toolkit.

Benefits

Emission Reductions: Primary-scale facilities produce electricity without generating air pollution or greenhouse gas emissions. Most of our community’s greenhouse gas (GHG) emissions, 88%, come from fossil fuel combustion for electricity, heating, transportation, and other energy-producing uses.

The Centre Region Climate Action and Adaptation Plan (CAAP) identifies renewable energy policies and programs as the largest sector to contribute to the Region’s goal to reduce greenhouse gas emissions by 45% by 2030. Supporting clean technology includes investing in new infrastructure like energy storage to provide needed grid flexibility and balance variability.

Resilience, diversification, and security: A growing solar market will help diversify the power grid. The PA DEP has identified an initial objective of increasing to 10% electricity from in-state solar energy generation by 2030. As shown in the images to the right, solar currently provides less than 1% of the state’s electricity coming from renewables.

Because most of the cost of a solar installation is up front and no additional fuel cost is needed to operate, solar plays a key role in hedging against rising fossil fuel prices.

Having a more diverse grid with a variety of fuel sources improves the ability for utilities to rebound quicker from power outages and other weather-related damage. All these factors improve the resiliency and security for our communities.

Revenue: Primary-scale solar development can provide local revenue benefits in these common ways:

- There is the potential for a net increase in tax revenue for the local municipality, particularly if taxes are assessed upon the monetary value of property lease agreements.
- Farmers or other property owners who host projects can collect guaranteed financial payments of a solar facility lease to supplement their income. In a February
22, 2019 article in the Washington Post, one farmer reported that earnings from their solar farm were three times what an average crop harvest would yield on the same amount of land.

• Projects that provide power to large users or multiple utility customers (such as being considered by the 15 entities in the Solar Power Purchase Agreement Working Group) may generate net metering credits that reduce utility bills for those users.

• Large-scale solar development creates individual and collective benefits in the form of temporary construction jobs and longer-term maintenance activity.

Preserve Family Farms: According to the Farm Census, Pennsylvania lost more than 6,000 farms between 2012 and 2017, and according to the American Farmland Trust, 70% of those farms are being converted to low-density residential development. Opportunities to help sustain Pennsylvania farms are a priority in the state and solar may be able to provide supplemental income to farmers to help them maintain their agricultural operations.

In addition to local zoning regulations, some agricultural protection programs may impact the ability for farmland to be used for primary-scale solar development. Farmland preserved through a permanent Agricultural Conservation Easement may not engage in primary scale solar development. If a farm is enrolled in Clean and Green, the landowner may not engage in commercial solar development without triggering rollback taxes on the entire enrolled acreage. If a farm is enrolled in a municipal Agricultural Security Area (ASA) and no other agricultural protection programs, there are no restrictions or limitations related to commercial solar development on a property; however, they may no longer qualify to be in a designated ASA.

Tradeoffs/Risks

Drives up Land Costs: A common practice across the country, including in the Centre Region, is for rural landowners to lease their vacant land to farmers for agricultural purposes. While many farmers own farmland, they also rely on leasing land from neighbors and others in the community to support their agricultural operations. Due to the significant difference between lease rates for agricultural uses and primary-scale solar facilities, rural landowners that lease their land are presented with the opportunity to make significantly more money by leasing their property to a solar energy provider. This could ultimately reduce the amount of leasable land available to local farmers and increase the cost of remaining leasable farmland.

To emphasize this point, in 2020, a Harris Township landowner approached the municipality about permitting primary-scale solar in agricultural areas. This landowner leased approximately 80 acres of land to a local farmer but planned to discontinue that agreement to begin leasing to a solar energy provider. This landowner stated that the per acre lease amount with the solar provider was several times higher than what a local farmer was willing to pay. While primary-scale solar facilities provide significant financial benefits to landowners, the disparity in monetary value between solar leasing and farming may impact the viability of future agricultural operations. Ideally, municipalities should find a way to ensure that agriculturally viable land remain in agricultural production and that solar facilities do not supplant or degrade the local agricultural industry.

Long Term Impact to Land Use: When a primary-scale solar facility is proposed, many developers will stress that these uses are temporary in nature. Developers regularly enter a lease contract with the property owner for a period of 20 years or more. Municipalities should exercise caution in assuming that primary-scale solar uses are temporary and consider any long term impacts such facilities may have on the local agricultural industry or rural landscape.
It is disingenuous to assume that these uses are more temporary than any other use and that the previous uses will return once the lease expires. Some leases allow for automatic renewal, meaning that the use could easily be continued well beyond the originally envisioned timeframe. Similarly, aging solar panels could potentially be replaced cost effectively at the end of the original lease, especially when mounting arms and other infrastructure can be reused.

**Impact to Agricultural Soils** - Prime Agricultural Soils and Soils of Statewide Importance are those that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these land uses. In Pennsylvania, the Municipalities Planning Code requires municipal zoning ordinances to protect prime agricultural land.

A 2019 report from the American Planning Association recommends that municipalities exercise caution in permitting primary-scale solar facilities on prime agricultural soils. The report noted that initial grading and long-term vegetation management with pesticides can change the nature of the underlying soil, calling future agricultural productivity into question. Identifying and promoting primary-scale solar facilities on marginal cropland should be considered before utilizing prime farmland.

**Impact to Ecosystems** - While primary-scale solar facilities provide many positive environmental benefits by generating clean, renewable energy, these facilities can have negative impacts to the surrounding ecosystem. Since many primary-scale projects are developed in rural areas, tree removal and security fencing can disrupt natural habitats and wildlife corridors.

Utilizing the best practices identified later in this toolkit can hopefully resolve conflicts and create co-benefits from solar development, such as diversifying agricultural businesses, establishing wildlife corridors and habitats, and improving surface and ground waters.

**Agrivoltaics** refers to land that is used concurrently for solar power generation and agriculture. The agricultural component of agrivoltaic facilities can include the raising of crops between rows of solar panels, the grazing of animals such as sheep, and the keeping of bees.

A recent study by the National Renewable Energy Laboratory (NREL) concluded that agrivoltaic systems provide numerous benefits to both energy and crop production. Planting crops between rows of solar panels appeared to lower air temperatures around the panel arrays by up to nine degrees Celsius, improving the overall efficiency of the panels. While the panel efficiency appeared to benefit from the adjacent plantings, crop production (tomatoes and peppers) doubled or tripled. In addition to increased output of both power and produce, water irrigation needs were reduced significantly. The study noted that “[t]he reduction in direct sunlight exposure beneath the PV panels led to cooler air temperatures during the day and warmer temperatures at night, which allowed the plants under the solar arrays to retain more moisture than the control crops that grew in open-sky planting areas.”

Agrivoltaics appears to be a logical method of permitting solar power generation while supporting agricultural uses, however, there are limitations to its approach. Raising crops between rows of panels require these crops to grow low to the ground so that they do not create any solar obstructions. While sheep and solar panels can coexist, farmers that do not currently own and raise sheep may not be interested in doing so if a primary-scale solar facility is developed on their property.

References:

1 - DOE solar growth
2 - PA Solar Future Plan
PRIMARY-SCALE SOLAR REGULATORY STUDY

This chapter of the report reviews where primary-scale solar uses are currently permitted and an examination of current primary-scale solar regulations in the Centre Region municipalities. Each section of the study provides an overview of primary-scale solar regulations and then explores the Centre Region, including allowed locations, attributes in regulations and some example illustrations of what would be allowed with the existing regulations.

Overview of primary-scale solar regulations in the Centre Region municipalities:

**College, Ferguson, and Patton Townships:** Permit primary-scale solar facilities in their jurisdictions and each municipality has adopted regulations for establishing the use.

**Halfmoon and Harris Townships:** Do not permit these uses but have areas of their respective municipalities that meet the general land requirements for primary-scale solar facilities.

**State College Borough:** Due to a lack of open land and higher land costs, it is extremely unlikely that a primary-scale facility would be proposed in the Borough of State College, which does not identify it as a permitted use in any district.

This report solely examines primary-scale solar facilities which are defined as distributing power onto the grid for the wholesale market; basically, performing like a utility provider. They are generally developed on a scale of 5-100MW, or 30 – 800 acres.

WHERE ARE PRIMARY-SCALE SOLAR USES COMMONLY PERMITTED?

Primary-scale solar facilities are permitted in municipalities across the country, with many communities allowing the use in limited areas. While primary-scale solar facilities can theoretically be developed in any location that has regular access to sunlight, developers often seek out land that is also vacant, flat or gently sloped, and is closely located to electrical infrastructure that would support transmission of power generated onsite. While these common factors can help determine what areas of a municipality could support the use, acceptable locations for primary-scale solar facilities should be based upon the character and long-term goals of the community. This section explores primary-scale solar regulations generally, highlighting where and how these uses are being permitted in other locales as well as the Centre Region.

**Industrial Zoning Districts**

Industrially zoned areas are a logical location for primary-scale solar uses, especially if the area contains large brownfield sites or other previously disturbed land. Industrial areas typically have adequate electrical infrastructure to support interconnections to the local grid, thereby reducing the costs for the developer. Primary-scale solar uses can help revitalize economically depressed areas, particularly those that have an abundant amount of vacant or previously developed industrial land. While industrially zoned areas seem like a logical location for primary-scale solar energy systems, many communities lack industrial districts with adequate land area to truly support the use. Unless the community has large, vacant industrially zoned parcels, these districts would be unlikely to attract primary-scale solar development.
**Centre Region Analysis:** The Centre Region lacks large brownfield sites that would be a prime candidate for primary-scale solar development and contains a very limited amount of land that is solely zoned to support industrial uses. For the purposes of this section of the report, only districts that include the title “industrial” were considered. The following table outlines the amount of industrially zoned land in each Centre Region municipality:

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>College</td>
<td>345</td>
</tr>
<tr>
<td>Ferguson</td>
<td>22.94</td>
</tr>
<tr>
<td>Halfmoon</td>
<td>60.62</td>
</tr>
<tr>
<td>Harris</td>
<td>39.59</td>
</tr>
<tr>
<td>Patton</td>
<td>87.02</td>
</tr>
<tr>
<td>State College Borough</td>
<td>5.91</td>
</tr>
</tbody>
</table>

Considering the amount of land required for primary-scale solar facilities, it would be difficult to support these uses within the Centre Region’s industrial zoning districts. College and Patton Townships both permit primary-scale solar facilities within their industrial districts. While College Township has a significantly higher amount of industrially zoned land than the other municipalities, it is important to note that this land area is divided into dozens of smaller parcels, most of which are developed.

**Agricultural/Rural Zoning Districts**

Due to their land consumptive nature, primary-scale solar facilities are often developed on land zoned for agriculture, forest, or other rural uses. Agricultural lands are desirable since they are relatively flat, have well drained soils, are cleared of vegetation, and are generally less expensive in terms of land cost.

Conflicts can arise as the preservation of agricultural land and support of the local agricultural industry is a common goal in many municipalities, including the Centre Region. Permitting primary-scale solar facilities in areas that are intended to support agricultural uses is regularly portrayed as being compatible with and beneficial to rural areas and the local agricultural industry. While agriculture and solar facilities can co-exist, it requires balancing regulations between solar resources and other valuable local resources (agriculture, trees, historic resources, etc.). Utilizing the best practices identified later in this toolkit can hopefully resolve conflicts and create co-benefits from solar development, such as diversifying agricultural businesses, establishing benefits from solar development, such as diversifying agricultural businesses, establishing wildlife corridors and habitats, and improving surface and ground waters.

**Centre Region Analysis:** Over 75% of the Centre Region’s total land area is zoned for agricultural, forestry, and open space uses. Given the amount of land zoned for low density uses and the availability of electrical infrastructure in the area, the Centre Region is a likely candidate for primary-scale solar development.

One of the primary goals of the 2013 Centre Region Comprehensive Plan is continued support of the local agricultural industry. The plan contains a variety of objectives and policies that support agricultural viability and agricultural land preservation. In 2019, the CRPA completed the Supporting the Agricultural Industry in the Centre Region study that provided a variety of regulatory recommendations intended to support the modern agricultural industry. This study recognized the potential financial benefits that can be provided by solar and wind facilities, such as capital to fund the continuation of the farm use on which the property is located. The report recommended that primary-scale solar uses not be located on Prime Agricultural Soils. To encourage farms and green infrastructure to coexist, the report also recommended that primary-scale solar uses only be permitted on parcels with active agricultural operations. This could be accomplished by permitting the solar facility to only occupy a portion of
A significant amount of the Centre Region’s agriculturally zoned land areas are comprised of Prime Agricultural Soils or Soils of Statewide Importance. Primary-scale solar facilities play an important role in providing sustainable energy and reducing pollution, but protecting agricultural resources are also important to the community’s long-term sustainability. The maps on the left side of this page illustrate the step-by-step analysis used to identify rurally zoned lands that are not protected from development and are not comprised of prime agricultural soils. These maps illustrate the following:

A. **Rurally zoned lands** are shown in orange.

B. **Rurally zoned lands that are protected from development** are shown in green. These lands include State Forest lands, Game Lands, properties within conservation easements, etc.

C. This map illustrates **rurally zoned lands that are not protected from development**. Areas shown in green are comprised of Prime Agricultural Soils or Soils of Statewide Importance.

D. This map illustrates **rurally zoned lands that are not protected from development and do not consist of farmland soils**.

This analysis reveals that most the Centre Region’s rural land areas, except for those located on steep slopes, are primarily comprised of soils that are considered ideal for agricultural production. Prohibiting the development of primary-scale solar facilities on these soil types would eliminate most of the development potential for the use.

Although this prohibition is consistent with the Comprehensive Plan’s goals for protecting agricultural uses, the CRPA recommends that other limitations be considered to allow for limited primary-scale development in rural areas. The regulatory toolkit contained within this report provides specific recommendations on how this can be accomplished.
EXISTING PRIMARY-SCALE SOLAR REGULATIONS IN THE CENTRE REGION

College, Ferguson, and Patton Townships are the three municipalities in the Centre Region that permit primary-scale solar facilities in their jurisdictions, and each municipality has adopted regulations for establishing the use. Based upon the zoning requirements in College, Ferguson, and Patton Townships, CRPA estimates that over 25,000 acres of land area could potentially be developed with primary-scale solar facilities. This area is roughly equivalent to the land area within the existing Regional Growth Boundary and Sewer Service Area, or the combined land areas of College and Halfmoon Townships.

To determine the 25,000 acres that could potentially be developed, CRPA staff first identified the 37,000 acres of land in a zoning district that permits primary-scale solar uses which includes Penn State owned parcels. Then the following properties were removed:

- State lands, conserved open space parcels, and properties in permanent agricultural easements
- Properties that did not meet the minimum acreage requirements for each zoning district

This section of the report provides an overview of where these uses are currently permitted in the Centre Region, limitations on the use, and graphical representations of how these uses could develop.

College Township

College Township permits primary-scale solar uses in its General Industrial (I1) District, which contains approximately 345 acres of land area. The district permits “Solar Energy Systems” as a primary use, which would include primary-scale solar. The majority of the existing I1 District is in the Dale Summit area, immediately south of College Avenue (SR 26) near the Nittany Mall. Several properties near Oak Hall are also zoned I1. Most of the properties in the existing district are developed to some degree, so the opportunity to establish primary-scale solar is limited to the few remaining vacant parcels, unused portions of developed lots, or through redevelopment. Primary-scale uses are also less likely to be established in this district, since most parcels are relatively small when compared to the typical size of a primary-scale system.

The I1 District does not have a minimum lot size requirement but does have setbacks as well as lot and impervious coverage limitations. Because there are no minimum lot size requirements for properties in the I1 District, a primary-scale solar facility could be developed upon any vacant parcel within the district so long as setback and other zoning limitations are met. The I1 District requires the following for solar energy systems:

<table>
<thead>
<tr>
<th>I1 District Zoning Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Lot Size</td>
</tr>
<tr>
<td>Minimum Lot Width (feet)</td>
</tr>
<tr>
<td>Maximum Building Coverage</td>
</tr>
<tr>
<td>Maximum Impervious Coverage</td>
</tr>
<tr>
<td>Front Yard (feet)</td>
</tr>
<tr>
<td>Side Yard (feet)</td>
</tr>
<tr>
<td>Rear Yard (feet)</td>
</tr>
</tbody>
</table>
In addition to the regulations found in the I1 District, the Township also has supplemental regulations for solar energy systems as follows:

**Height** – Systems can exceed the district’s designated height to the extent necessary for their safe operation.

**Setbacks** – No portion of a system can be located within the district setbacks or 1 ½ times the height of the structure, whichever is greater.

**Lot Coverage** - The horizontal area projected by the solar energy system, in addition to all impervious surfaces, shall not exceed the maximum lot coverage as established by the zoning district in which it is located. For a tracking solar collector or other moveable solar energy system, the horizontal projection area shall be calculated at a thirty-three-degree tilt angle.

**Battery** – If utilized, batteries need to be in a secured and locked container.

**Screening and visibility** – Must be screened from any public right-of-way with a buffer yard “D”. A buffer yard “D” requires the following plantings per 100 linear feet or fraction thereof:

- 3 Canopy Trees
- 6 Understory Trees
- 9 Shrubs

**Warning Signage** - The manufacturer’s or installer’s identification including contact information and appropriate warning signage shall be posted at the site in a clearly visible manner.

**Fencing** – Primary-scale solar uses must be enclosed by perimeter fencing of an appropriate height to restrict unauthorized access.

**Power Lines** – To the greatest extent possible, power lines must be placed underground.

**Glare** - Systems shall be designed and installed in a manner as to not project any glare or glint onto any adjoining property or roadway.

**Removal Requirements** – If not utilized for 12 consecutive months, solar energy systems must be removed within 30 days.
Illustration of Regulations - College
College Township’s solar regulations are very similar to those found in many municipal and model solar ordinances. While the Township’s I1 District does not have an established minimum lot size, staff selected an approximately 10-acre parcel along Stewart Road to illustrate how a primary-scale solar system could theoretically be developed. These renderings are for illustration purposes only and do not indicate that the site is suitable for solar development or that development of any type should or will be proposed in the future.

Due to the I1 District's relatively high impervious coverage limits, a primary-scale solar facility could easily cover the majority of a parcel with the exception of required setback areas. The CRPA's illustration shows a minimum number of driveways and access points between panels; however, this is not uncommon. The illustrated solar facility is surrounded by a perimeter fence that would provide security to the installation, as well required plantings that provide visual screening from adjacent parcels.

*Computer rendering of some I1 limitations and additional supplemental township regulations for solar energy systems. Image: CRPA*
**Ferguson Township**

Ferguson Township permits primary-scale solar uses in several zoning districts, both as permitted and conditional uses. These districts encompass approximately 21,000 acres of land area, or 70% percent of the Township. The following table includes the districts where the use is permitted, along with several development standards:

<table>
<thead>
<tr>
<th>District</th>
<th>How Permitted</th>
<th>Minimum Area Required</th>
<th>Setbacks (Feet)</th>
<th>Coverage Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Front</td>
<td>Side</td>
</tr>
<tr>
<td>Rural Agricultural (RA)</td>
<td>Permitted</td>
<td>50 acres</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Rural Residential (RR)</td>
<td>Conditional</td>
<td>3 acres</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>Agricultural Research (AR)</td>
<td>Conditional</td>
<td>5 acres</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

Because these three districts are primarily located in rural areas that are largely comprised of agricultural uses, each of these districts have the potential of supporting a significant amount of primary-scale solar development. The minimum lot size required in the RR and AR district would allow for facilities on smaller properties; however, it is important to note that most primary-scale facilities are developed on larger parcels.
In addition to the regulations found in the individual districts, the Township also has supplemental regulations as follows:

**Height** – Ground-mounted Principal Solar Energy Systems (PSES) shall comply with the building height restrictions of the applicable zoning district.

**Setbacks** – Primary-scale systems must comply with the setbacks of the underlying zoning district. If located next to a residential district, the setback needs to be increased to 100 feet.

**Lot Coverage** – The following components of primary-scale systems are considered impervious coverage and need to be calculated as part of the impervious coverage limitations for the underlying zoning district:

- Foundation systems, typically consisting of driven piles or monopoles or helical screws with or without small concrete collars.
- All mechanical equipment of PSES including any structure for batteries or storage cells.
- Gravel of paved access roads servicing the PSES.

**Solar Access** - All solar energy systems should be designed and located to ensure solar access without reliance on and/or interference from adjacent properties.

**Stormwater** - The applicant must submit a stormwater management plan that demonstrates stormwater from the PSES will infiltrate into the ground beneath the PSES at a rate equal to that of the infiltration rate prior to the placement of the system.

**Screening and Visibility** – Ground-mounted primary-scale systems need to be screened from any adjacent property that is residentially zoned or used for residential purposes. The screen must consist of plant materials that provide a visual screen. In lieu of a planting screen, a fence that provides visual screening and meets requirements of the controlling ordinance can be used.

**Warning Signage** - A clearly visible warning sign must be placed at the base of all pad-mounted transformers and substations and on the fence surrounding the system informing individuals of potential voltage hazards.

**Fencing** – All ground-mounted primary-scale systems must be completely enclosed by fencing that consists of a minimum eight-foot-high fence with a locking gate, or as designated by the municipality.

**Power Lines** – All on-site utility transmission lines and plumbing shall be placed underground to the greatest extent feasible.

**Glare** – All primary-scale systems need to be situated to eliminate concentrated glare onto nearby structures or roadways.

**Traffic Impacts** - When the land involved qualifies as a solar energy project, traffic impact on any road upon which the solar energy project will front shall be included with the plan for the period of construction and post construction. The applicant shall state the actions they intend to take to mitigate the impact of increased traffic to the site.

**Removal Requirements** – If a ground-mounted primary-scale system is removed, any earth disturbance as a result of the removal of the ground-mounted solar energy system must be graded and reseeded.
Illustration of Regulations - Ferguson
Since primary-scale solar facilities are permitted in multiple districts that collectively apply to a large portion of the Township’s rural areas, concept facilities were modeled on two different parcels. The first parcel, located off West Whitehall Road, is approximately 80 acres in size. The second parcel is approximately 30 acres in size and is located off North Nixon Road, west of the Greenbriar subdivision. These renderings are for illustration purposes only and do not indicate that the site is suitable for solar development or that development of any type should or will be proposed in the future.

While the three rural districts that permit primary-scale facilities have impervious and lot coverage restrictions, the supplemental regulations for primary-scale facilities only require the foundation of the panels to be counted towards these limitations. Most solar panels are mounted on a small monopole structure with a minimal footprint. As a result, it would be possible for a primary-scale solar project to cover the majority of a property, with the exception of setback areas.
All facilities are required to be within a fence, which was illustrated. Vegetative buffering is only required along property lines that are adjacent to residential zones or residentially used parcels. If a property is used for agricultural or other non-residential purposes, vegetative screening would not be required, as illustrated. If a property were to be developed for residential uses after a solar facility is constructed, it is unlikely that the municipality could require the installation of vegetative screening at that time.

Various computer rendering concepts of a Primary-Scale Solar Facility along North Nixon Road. Images: CRPA
Patton Township

Patton Township permits primary-scale solar uses in several zoning districts, both as permitted and conditional uses. These districts encompass approximately 14,000 acres of land area, or 89% percent of the Township. The following table includes the districts where the use is permitted, along with several development standards:

<table>
<thead>
<tr>
<th>District</th>
<th>How Permitted</th>
<th>Minimum Area Required</th>
<th>Setbacks (Feet)</th>
<th>Coverage Limits</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Front</td>
<td>Side</td>
</tr>
<tr>
<td>Rural (A1)</td>
<td>Conditional</td>
<td>1 acre</td>
<td>30-40</td>
<td>30</td>
</tr>
<tr>
<td>Natural Resources 1 (NR1)</td>
<td>Conditional</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Natural Resources 2 (NR2)</td>
<td>Conditional</td>
<td>40 acres</td>
<td>50-100</td>
<td>50-100</td>
</tr>
<tr>
<td>General Commercial (C1)</td>
<td>Permitted by Right</td>
<td>None</td>
<td>70</td>
<td>15</td>
</tr>
<tr>
<td>Planned Commercial (C2)</td>
<td>Permitted by Right</td>
<td>3 acres</td>
<td>25</td>
<td>Varies</td>
</tr>
<tr>
<td>Industrial (I1)</td>
<td>Conditional</td>
<td>None</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>Planned Airport District (PAD)</td>
<td>Permitted by Right</td>
<td>None*</td>
<td>50-100</td>
<td>50-100</td>
</tr>
<tr>
<td>Planned Community (PC)</td>
<td>Permitted by Right</td>
<td>Varies</td>
<td>Varies</td>
<td>Varies</td>
</tr>
<tr>
<td>University Planned District (UPD)*</td>
<td>Permitted by Right</td>
<td>Varies</td>
<td>Varies</td>
<td>Varies</td>
</tr>
</tbody>
</table>

*Ground Mounted Systems are only permitted in the subdistricts that permit utility uses, facilities, and structures.

Map of Districts that permit and Parcels that meet the minimum requirement for Solar Energy System development in Patton Township. Map: CRPA
In addition to the regulations found in the individual districts, the Township also has supplemental regulations as follows:

**Height** – Cannot exceed the maximum height permitted within the district.

**Setbacks** – Systems cannot be located within the district’s required setbacks.

**Lot Coverage** – The horizontal area projected by the solar panels as well as any other impervious surfaces must comply with the lot coverage requirements for the underlying district.

**Battery** - If the system utilizes a battery system, the battery(s) must be placed in a secure container or enclosure.

**Screening and Visibility** – Buffer requirements vary based upon the adjacent zoning districts as follows:

a. In the Industrial, General Commercial, and Planned Commercial Districts, installations must meet the requirements of § 175-44, Districts design and landscaping controls for Medium-Density Residence (R-3), Commercial (C), Office Buffer (OB) and Industrial (I) Districts.

b. In the Commercial Transitional District, installations shall adhere to the buffering requirements of § 175-17.3G(1), Screening.

c. In the Planned Community District, installations shall meet the buffering requirements of § 175-24A(4), Buffer yards and landscaping.

d. In the Planned Airport District, installations shall follow the buffering requirements of § 175-40, Design and improvement standards.

e. In the Rural, Natural Resources, Natural Resources and Recycling Districts, and the University Planned District, installations must adhere to the buffering requirements of § 175-42, Procedures and criteria for conditional uses.

f. Any installations within the I-99 Interchange Overlay District shall adhere to the additional buffering requirements of § 175-40.3, Setbacks and landscaping.

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**Warning Signage** - The identification and contact information of the owner, installer, or manufacturer of the system and warning signage shall be posted at the site in a clearly visible manner.

**Fencing** – Primary-scale solar uses must be enclosed by perimeter fencing of an appropriate height to restrict unauthorized access.

**Power Lines** – To the greatest extent possible, power lines must be placed underground.

**Glare** - Systems shall be designed and installed in a manner as to not project any glare or glint onto any adjoining property or roadway.

**Removal Requirements** – If not utilized for 12 consecutive months, solar energy systems must be removed within 30 days.
Illustration of Regulations - Patton

Patton Township permits primary-scale solar facilities in multiple zoning districts, however, very few of these districts contain parcels large enough to support primary-scale facilities. In addition, the cost of land within several of these districts would likely make development of primary-scale facilities financially unfeasible. If a facility were to be proposed in Patton Township, it would most likely be in the Rural (A1) District since it has large tracts that are minimally developed and utilized for agricultural purposes. A concept facility was modeled for one 82-acre A1-zoned parcel located off West Buffalo Run Road (SR 550). The A1 District has an impervious limitation of 20%, and while Patton Township regulations require the horizontal area of each panel to be considered impervious, most of the property could still be utilized for development. The Patton Township Zoning Ordinance would require such a facility to be surrounded by buffer yards to provide visual screening from adjacent parcels.

SHARING LAND USES THROUGH MULTI-MUNICIPAL PLANNING

While each municipality that utilizes zoning is legally required to provide for all land uses within their individual jurisdictions, the Pennsylvania Municipalities Planning Code (MPC) provides municipalities that cooperatively plan via a multi-municipal plan the flexibility to accommodate land uses throughout the entire plan area. In 2018, the CRPA completed the Centre Region Shared Land Use Study that outlines amendments to the MPC that allow municipalities that cooperatively plan to share the burden of providing for all land uses. Utilizing these sections of the MPC, the Centre Region municipalities should consider cooperatively identifying appropriate locations for primary-scale solar facilities in the Region and adjusting zoning regulations accordingly. This issue should also be addressed in the next Comprehensive Plan update, which will take place in 2023.
This chapter of the report provides primary-scale solar regulatory best practices for consideration by the Centre Region municipalities. While numerous model ordinances have been developed for these uses in other jurisdictions, the recommendations in this report have been tailored where possible to be consistent with the unique aspects of the Centre Region. The report does not provide model ordinance language, but rather focuses on general recommendations on how and where these uses should be permitted to encourage a balance between solar resources and other valuable local resources (agriculture, trees, historic resources) in the development process.

Utilizing the Toolkit

The Centre Region municipalities should consider utilizing the best practices within this toolkit whenever creating new regulations or modifying existing ordinances related to primary-scale solar uses. As a recommendatory document, the best practices within this toolkit should serve as a guide that can be exceeded or modified by each municipality as needed. Specific recommendations on utilizing this toolkit are as follows:

College, Ferguson, and Patton Townships: This toolkit should be utilized to review existing regulations and determine if changes should be made since these municipalities already permit and regulate primary-scale solar facilities in their respective jurisdictions. Since this report and toolkit are intended to establish a regional policy on how these uses should be accommodated, municipalities should consider amending existing regulations to be consistent with the findings of the study.

Halfmoon and Harris Townships: This toolkit can serve as a guide for developing regulations since these municipalities contain significant land area that meet the general requirements for primary-scale solar development.

Additional resources should be consulted, as necessary.

Regulatory Toolkit Contents

The regulatory toolkit is formatted to include a best practice for specific aspects of primary-scale solar uses along with additional information supporting the recommendations. Where possible, links to additional documentation from outside sources are also provided at the end of each best practice section.

- Height
- Glare
- Battery Storage
- Setbacks
- Screening/Visibility
- Ecosystem/Environmental Impacts
- Fencing/Security
- Lot Coverage/Impervious Restrictions
- Location/Districts
- Agrivoltaics
- Decommissioning
Height

**Best practice:** Require all primary-scale solar facilities, including panels and other structures, to comply with the maximum building height restrictions for the underlying zoning district.

If the municipality has height restrictions for accessory structures, this limitation could be applied to the panels so long as it would not be unnecessarily prohibitive.

In some cases, municipalities have chosen to adopt specific height restrictions for primary-scale solar facilities. This is often done to limit the visual impacts that could occur to neighboring properties. In many cases, panels are restricted to a maximum of 20 feet to minimize visual impacts that cannot be addressed with fencing and other screening requirements. Solar specific height restrictions are not necessary if the best practices for screening and visibility included within this toolkit are utilized.

Ground mounted solar panels are typically no higher than 10 to 15 feet to allow for ease of maintenance and also to provide adequate solar access to adjacent solar arrays.
Glare

Best practice: Glare studies or analysis should only be required for installations near airports as required by the FAA.

In order to generate electricity, solar panels are engineered to absorb sunlight. To do this, solar panels utilize non-reflective glass resulting in very little sunlight being reflected from their surface. Household and automobile windows, metal roofs, and agricultural crops generally reflect significantly more sunlight than a solar panel. In addition, solar panels are oriented towards the south and facing the sun, resulting in angles that would reflect any residual sunlight above nearby homes and roadways.

Municipal ordinances should require panels associated with primary-scale solar facilities to utilize anti-reflective coatings to minimize any potential glare. Developers should also inform/demonstrate that panels will be oriented to avoid potential glare on adjacent properties or roadways. Utilizing the recommended screening and visibility best practices within this toolkit will also help ensure that panels will be screened from view of adjacent properties and roadways, significantly reducing any potential reflection of sunlight.

Additional Resources:

NREL Research and Analysis Demonstrate the Lack of Impacts of Glare from Photovoltaic Modules
FAA-Airport Solar Guide 2018

Anti-reflective coatings not only minimize potential glare and glint but also improve solar panel performance. These coatings have provided opportunities for solar arrays to be safely located next to roadways and airports without creating visual hazards.
Battery Storage

Best practice: If a primary-scale solar facility utilizes batteries for storage or for any other purpose, municipalities should require these batteries to be located in a secured container or locked enclosure.

Municipalities should also require containers or enclosures that contain battery systems to be designed and constructed in a manner that prohibits the leakage of hazardous chemicals onto the ground. Emergency management services should be consulted during the development phase.

Proper battery storage is critical to reduce risk of fire and leakage of hazardous chemicals.
Setbacks

Best practice: Setbacks for primary-scale solar facilities, including panels and other structures, should be generally consistent with regularly established uses in the underlying zoning district.

Municipalities should require primary-scale solar facilities to meet reasonable setbacks that will protect the health, safety, and general welfare of the community. Reduced setbacks can be considered for structures related to the solar facility but should be generally consistent with the requirements for other uses in the same district.

Setback areas not only provide adequate separation from uses on adjacent parcels, but also provide a location for screening and other buffering requirements that will reduce visual impacts.
**Screening & Visibility**

**Best practice:** To help reduce potential visual impacts, primary-scale solar facilities should be screened from all adjacent properties and roadways with vegetative screening buffers. Screening requirements must be clearly defined and should include replacement standards for vegetation that does not survive. This vegetative screening should consist of native canopy and understory trees, as well as shrubs. Native grasses or other groundcover should also be required within the setback areas.

Despite increasing demand for green infrastructure and clean energy, proposals for primary-scale solar facilities are often met with a “not in my backyard” resistance from nearby property owners. This resistance is common in rural areas where solar facilities may be viewed as incompatible and intrusive. In many cases, nearby property owners are concerned about how these facilities will visually impact their neighborhood, cause decline in the rural character of the area, and affect property values. Screening requirements can help assure neighboring property owners and residents that primary-scale facilities will blend into the surrounding landscape and that the physical panels and arrays will not dominate viewsheds.

To avoid or minimize the impacts on scenic viewpoints, site design should include appropriate setbacks and vegetative screening to minimize and mitigate visual impacts. Such plantings should:

- Be large enough to screen the facility within five years of construction
- Be selected to provide year-round screening
- Enhance/preserve the area’s existing beauty
- Provide a long-lived, resilient and dense bank of vegetation
- Be a native species readily available in the area.

**Trees used as buffer zone for solar farm in North Carolina**

Vegetative screening can minimize the visual impact to adjacent neighbors and provide ecosystem benefits.
Ecosystem / Environmental Impacts

Best practice: To help promote biodiversity in and around the property, primary-scale solar facilities should be vegetated/revegetated with native plants and grasses. Setback areas should be planted with native grasses and/or pollinator plantings, as well as native trees and shrubs that can provide habitat and visual screening. To protect wildlife corridors and retain habitat for small mammals, security fencing should consist of wildlife-permeable materials.

While primary-scale solar facilities provide many positive environmental benefits by generating clean, renewable energy, these facilities can have negative impacts to the surrounding ecosystem. Since many primary-scale projects are developed in rural areas, tree removal and security fencing can disrupt natural habitats and wildlife corridors. Municipalities should prohibit primary-scale solar facilities from being located on lands that have significant native biodiversity.

Planting a diverse, native vegetative mix that attracts pollinators and other wildlife can be beneficial to adjoining farms and properties. Native plants may also support long-term operational cost savings by reducing the frequency of on-site mowing, weed control and fertilizer application.

Wildlife permeable fencing: While the CRPA recommends the use of security fencing around all primary-scale solar facilities, security can be accomplished with the use of wildlife permeable fencing. This fencing material can be utilized for the entire facility or at periodic intervals. Where sight obscuring materials are being used, wildlife permeable panels can be installed in limited areas. Agrivoltaic uses that propose the grazing of animals should be exempt from wildlife permeable fencing requirements to ensure the safety of livestock.

Additional Resources:

- PA Department of Conservation & Natural Resources - Landscaping with Native Plants
- Ernst Conservation Seed, Meadville PA – solar native seed mixes
- Ohio Prairie Nursery Solar field grass mix

Wildlife permeable fencing provides necessary security protection while allowing smaller mammals such as fox, raccoon, rabbits, etc. to penetrate the fence and access areas within the facility.
Fencing / Security

Best practice: Primary-scale solar facilities should be surrounded by a security fence in order to limit access by unauthorized persons and deter vandalism. Fences should be a minimum of six (6) feet in height, be equipped with a self-locking gate, and contain signage informing individuals of potential voltage hazards. All fences should be located at the edge of the required setback, not the property line. This ensures that the setback areas are available for buffer plantings.

Additional fencing recommendations are provided in the Ecosystem/Environmental subsection.

Lot Coverage / Impervious Restrictions

Best practice: Exempt ground-mounted systems from lot coverage/impervious surface calculations as long as the ground beneath the system is pervious (e.g., vegetation) and the facility meets other stormwater minimization recommendations of the Pennsylvania Department of Environmental Protection.

Lot Coverage

If a municipality wants to limit the overall size of primary-scale facilities, considering the horizontal areas of panels as impervious coverage will likely be ineffective. Municipalities wanting to limit the overall size of a facility should consider limitations for the percentage of a property that can be used for solar power generation, which would include the panels, roadways, space between rows, etc. Such a limitation is more straightforward at achieving the desired outcome and providing predictability to residents and developers.
In the Centre Region, College and Patton Township both consider the horizontal area of a panel to be impervious while Ferguson Township only considers the portion of the mounting system that touches the ground as impervious. In College Township, this regulation would have little impact to a facility's size since the impervious limitation in the Industrial District is very high. Despite Patton Township’s more restrictive impervious coverage requirements, it is unlikely that the overall size of a primary-scale facility would be impacted due to the amount of open space typically provided between and around panel arrays. Facilities in Ferguson Township would be virtually unaffected by the impervious limits since the vertical supports for solar panels cover very little ground area.

### Impervious and Stormwater Impacts

Solar panels should not be included in any calculation of impervious surface or impervious cover. Vegetation beneath the PV arrays is pervious and aids in storm water absorption, reduces erosion, and improves the visual appearance of the property. The racking, all mechanical equipment and gravel or paved access roads would be considered impervious.

Stormwater management may still be required depending upon the construction and layout of a facility. A National Pollutant Discharge Elimination System (NPDES) permit may also be required depending upon the amount of land disturbance associated with a development.

In January 2019, the Pennsylvania Department of Environmental Protection (DEP) published a frequently asked questions paper titled “Chapter 102 Permitting for Solar Panel Farms FAQs” which provides additional information on when an NPDES permit would be required and means of minimizing stormwater impacts. The FAQ also provides information on the use of agrivoltaics to minimize impacts to groundwater and stormwater runoff.

Several of the DEP’s stormwater minimization recommendations include but are not limited to:

- Post-construction condition should be 90% perennial vegetative cover.
- A meadow condition is preferable with native, deep-rooted perennial vegetation.
- Existing slopes on the project site should be 10% or less.
- Panels should be configured that they disconnect surfaces to promote sheet flow and natural infiltration into the ground beneath the panels.
- Vegetated areas beneath panels should not be cut to less than 4 inches in height. Vegetation will not be subject to fertilization or herbicide/pesticide application except as needed to support crop production or erosion and sedimentation planning.
- Compaction of the subsoil will be avoided, and vehicular traffic minimized.
- The site should be designed to maintain applicable buffer distances from the delineated watercourse or wetland limits.
- Individual panels should be arranged to:
  - Allow for passage of sheet flow between each panel to minimize runoff concentration
  - Allow for the growth of vegetation beneath and around the arrays, with shade tolerant vegetation being preferred.
  - The distance between arrays is sufficient to infiltrate runoff from the upslope array.
  - Minimize the lowest vertical clearance of the array to minimize accelerate erosion.
The DEP also provides recommendations for agrivoltaics, which can be utilized to help manage stormwater runoff generated by solar panels. These recommendations include but are not limited to:

- Shade tolerant crops should be used beneath panels.
- Crops should be planted using no till practices.
- Hand harvested or small machine-harvested crops are recommended.
- Sustainable grazing practices should be employed to help maintain a healthy vegetative cover.
- Application of chemical fertilization or herbicides/pesticides is limited to the needs of the crops.

Zoning ordinances and stormwater regulations are typically addressed in separate chapters; however, zoning requirements can be structured in such a way to help minimize stormwater impacts. To minimize stormwater impacts, municipal zoning regulations should require areas between arrays and around the facility to consist of native vegetation or be used for agrivoltaics (if permitted in rural zoned area).

Additional Resources:

DEP Chapter 102 Permitting for Solar Panel Farms FAQs
DEP Solar Developer Resources

**Location / Districts**

Best practice: Primary-scale solar facilities should be permitted by-right in industrially zoned areas. In rurally zoned areas, development of farmland soils for primary-scale solar uses should be minimized. Municipalities should restrict development of primary-scale solar facilities on Prime Agricultural soils and Soils of Statewide Importance, unless one of the following conditions are met:

a. The facility incorporates the co-location of agricultural uses (agrivoltaics) on the project site.

b. The facility is located in a wellhead protection area for the purpose of removing agricultural uses from high-risk recharge areas

c. A perpetual agricultural conservation easement is established on an equivalent number of farmland soil acres adjacent to or surrounding the project site.

Primary-scale solar facilities are typically developed in areas with ample vacant land, unimpeded solar access, and nearby electrical infrastructure to support power transmission. The Centre Region lacks large brownfield sites, disturbed lands, or industrially zoned areas that would be prime locations for primary-scale solar development. However, rural areas of the Region contain large amounts of land area capable of supporting primary-scale solar development. Most of these solar suitable areas are in districts that are intended for agricultural uses.

To minimize impacts to agricultural areas, municipalities should consider limiting development of primary-scale solar facilities on Prime Agricultural soils and Soils of Statewide Importance. Due to the prevalence of these soil types in the Region's rural areas, a complete prohibition of development on these soil types would nearly eliminate all development potential.

While rural zoning districts contain the necessary characteristics to permit development of these uses, the CRPA recommends that municipalities carefully consider how these uses might impact the overall
The agricultural industry both in terms of loss of active farm operations as well as impacts to ancillary industries that rely on agriculture. To balance the preservation of agricultural soils and family farms with primary-scale solar, CRPA staff recommends ensuring farm protection while allowing for solar facilities in its best practice.

Development of solar facilities should be prohibited from occurring on steep slopes and nearby ridges to minimize deforestation and disturbance of limited soils.

Other methods exist for balancing farmland preservation with solar facilities. Some jurisdictions have required that a certain percentage of farmland soils must remain outside of the development area.

Montour County proposed solar regulations that state “Solar Arrays may be located only on 75% of the total Class I and II agricultural soils”. This requirement did not apply if agrivoltaic uses were proposed. Regulations in Delaware Township, Northumberland County state that “no more than 20 percent of the entire area for development shall consist of Class I and Class II prime agricultural soils.”

Looking beyond the boundaries of the Region, other locations on marginal, less productive land in Centre County are likely better suited to support primary-scale solar development and would have fewer impacts to agricultural soils and operations. Brownfield sites in former mining areas, for example, could be excellent candidates for primary-scale solar uses.

**Agrivoltaics**

**Best practices: Require in rurally zoned areas where Prime Agricultural Soils and Soils of Statewide Importance are being utilized. Regulations should provide clear definitions, require an Agrivoltaics Plan and define minimum requirements.**

Agrivoltaics is the concurrent use of land for agricultural production and solar energy generation. As stated throughout this report, agrivoltaics can provide numerous benefits to the operation of the solar facility and to the community. Agrivoltaics can include but is not limited to crops planted between and underneath solar panel arrays, apiaries (bees), the grazing of animals such as sheep, and the planting of pollinators.

One of the core themes of the Centre Region Comprehensive Plan is supporting the local agricultural industry. Loss of farmland and agricultural operations, primarily to development for other uses, has lasting impacts on the local agricultural industry. If Centre Region municipalities determine that primary-scale solar should be permitted in areas that have been traditionally used and zoned for agricultural uses, the use of agrivoltaics is the most effective means of simultaneously allowing for clean power generation and supporting local agriculture. Agrivoltaics can help achieve the Comprehensive Plan’s goals and objectives related to supporting a viable agricultural industry. The CRPA recommends that municipal ordinances require the use of agrivoltaics on any agriculturally or rurally zoned property that is developed with a primary-scale solar facility, unless:

a. The facility will not be constructed on Prime Agricultural Soils or Soils of Statewide Importance;
b. The facility will be located in a wellhead protection area; or
c. A perpetual conservation easement has been established on an equivalent number of farmland soil acres adjacent to or surrounding the site.
Because agrivoltaics are a relatively new concept, there are limited examples of local or state governments requiring their use in conjunction with primary-scale solar. The CRPA studied the issue and recommends the following regulatory approach:

1. **Permitting the Use** – Rather than listing primary-scale solar as a permitted use, municipalities can permit “Agrivoltaics Facilities” in rurally zoned areas. Municipal regulations would need to include a definition for agrivoltaics facilities, emphasizing that solar power generation for commercial distribution is only permitted on properties that contain an active agricultural operation. The definition should also emphasize that the agricultural use must be present in the same area as the primary-scale facility. As noted earlier in this toolkit, the ordinance can also include exceptions to the agrivoltaics component for facilities in wellhead protection areas or in exchange for a perpetual agricultural easement.

2. **Require an Agrivoltaics Plan** – A plan for how agrivoltaics will be accomplished should be required with every land development plan that proposes a primary-scale solar facility. This plan should identify how the site will be used for agricultural purposes and how the site will be managed. In addition, the ordinance should require an update to the plan if changes to agrivoltaic uses are proposed (ex. grazing sheep to raising vegetables).

3. **Define Minimum Requirements** – Municipal ordinances should provide clear standards and requirements for agrivoltaic uses. Due to the differing types of agriculture that can be conducted around primary-scale solar facilities, regulations should provide different options depending upon the type of agrivoltaic use that is proposed. Examples of agrivoltaic minimum requirements could include but are not limited to:

   a. **Horticultural Uses** – If crops are to be grown in conjunction with a primary-scale solar use, municipal ordinances should require a minimum percentage of the open space on the parcel to be utilized for crop production. This percentage should be calculated based upon the land area that is not covered by solar panels and any related structures. Required buffer yards should also be excluded from this calculation. The percentage should not be so restrictive as to limit access to the solar panel infrastructure.

   b. **Livestock** – Primary-scale solar facilities that will be utilized to graze livestock should, in their agrivoltaics plan, identify the number, type, and seasons when livestock will be present. Municipalities may wish to require a minimum percentage of the land area be open and available for animals to graze, notwithstanding necessary safeguards and fencing to protect livestock and solar facility-related equipment.

   c. **Apiaries/Pollinators** – Rather than requiring the production of crops or keeping of livestock, municipalities can choose to require the planting of pollinator friendly vegetation. Pollinators are beneficial to surrounding farms, support biodiversity, and can also help support onsite beekeeping to produce honey. At a minimum, municipalities should consider requiring all open spaces between and around solar panel arrays to be planted with native pollinators to help support local bee populations. There are numerous companies that produce pollinator friendly seed mixes specifically for use around solar facilities. Limitations should also be considered for the application of pesticides and herbicides as well as mowing of vegetation.
Additional Resources:

NREL Beneath Solar Panels, the Seeds of Opportunity Sprout
American Solar Grazing Association
Ernst Conservation Seed, Meadville PA – solar native seed mixes
Ohio Prairie Nursery Solar field grass mix

Agrivoltaics could help offset the impacts of extreme weather by reducing water use, increasing food yields, and limiting the negative effects of heat on solar panels - www.nrel.gov
Decommissioning

Best practices: Whenever a primary-scale solar facility is proposed, municipal ordinances should require the submission of a decommissioning plan. The decommissioning plan should include:

- A description of the activities and the responsible party for complete physical removal of all solar system structures, components, equipment, fencing, and transmission lines.
- The anticipate life of the solar energy system and a timeline for decommissioning
- Information on how the materials on the site will be disposed of or recycled
- A description of how the land will be restored when it is decommissioned
- The estimated decommissioning costs and how the estimate was determined
- The method for ensuring that funds will be available for decommissioning and restoration
- The method by which the decommissioning cost will be kept current

In most cases, primary-scale solar facilities are developed on leased land for a limited period. Even in cases where the developer owns the land, there is no guarantee that the use will remain operational beyond the usable life of the solar panels. If leases are not renewed upon expiration or if the operator were to discontinue use of the site, the solar facility should be dismantled appropriately. A facility is typically considered discontinued or abandoned if it has not generated electricity for distribution at any time over the last 12 months.

Once a facility has been abandoned or operations have ceased, operators should be required to completely dismantle and remove the facility, including all related buildings, cables, roads, etc. The cost to decommission a solar facility is steep and the burden of that cost should not be borne by the landowner (in the case of a lease) or the municipality. The cost of decommissioning can range from thousands to millions of dollars depending upon the size of the facility. There are numerous guides and estimate tools available to calculate the cost of decommissioning.

Municipal regulations should also require developers to post a bond or other financial security to ensure that decommissioning occurs in a timely manner following cessation or abandonment of the operation. The chosen financial security amount should be calculated based on current estimates and then adjusted for inflation over the period of the lease or for a set amount of time. The security amount should be updated if the facility continues operation beyond the original anticipated operational timeframe. If removal is not completed by responsible party within a reasonable period of time after cessation or abandonment (typically 12 months), the municipality can utilize the financial security to complete the decommissioning process.

Additional Resources:

- NREL Best Practices at the End of the PV System Performance Period
- Athol MA Solar Decommissioning Template
- SEIA National PV Recycling Program
- York County Model Ordinance – Wind Energy, Section 3.B.14 – example decommissioning language
- PA House Bill 2104 – Responsible Decommissioning of Solar/Wind Energy Facilities
Agrivoltaics – Land that is used concurrently for solar power generation and agriculture.

Community Solar – A solar energy system that generates electricity with subscribers who receive a bill credit for the electricity generated based on the size of the subscriptions.

Farmland of Statewide Importance – Class III soils that do not meet the criteria for prime agricultural soils but is considered to be farmland of statewide importance for the production of food, feed, fiber, forage, and oilseed crops.

Glare – The effect produced by light with an intensity sufficient to cause annoyance, discomfort, or loss in visual performance and visibility.

Impervious Surface – A surface area that prevents or slows the infiltration of water into the soil and/or a hard surface area that causes water to run off the surface of the ground in greater quantities or at an increased rate of flow from the conditions prior to development, construction, building or installation.

Interconnection – The technical and practical link between the solar generator and the grid providing electricity to the greater community.

Kilowatt – A unit of electrical power equal to 1,000Watts, which constitutes the basic unit of electrical demand. A watt is a metric measurement of power (not energy) and is the rate (not the duration) at which electricity is used. 1,000 kW is equal to 1 megawatt (MW).

Mechanical Equipment – All items not listed in these definitions that are directly related to construction and operation of a solar energy system including, but not limited to, on-site transmission lines, pumps, batteries, inverters, mounting brackets, framing, foundations or other structures, etc.

PJM – A regional transmission organization that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia.

Prime Agricultural Soil – Class I and II soils, as defined by the U.S. Department of Agriculture, that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses.

Solar Access – Space open to the sun and clear of overhangs or shade including the orientation of streets and lots to the sun so as to permit the use of active and/or passive solar energy systems on individual properties.
**Solar Access Easement** – A recorded easement, the purpose of which is to secure the right to receive sunlight across real property of another for continued access to sunlight necessary to operate a solar energy system.

**Solar Array** – A number of photovoltaic modules or panels that generate solar electricity, assembled or connected together to provide a single electrical output.

**Solar Array, Tracking** – A solar array that follows the path of the sun to optimize the amount of solar radiation received by the device. A tracking solar array may be ground mounted or building mounted.

**Solar Collector** - A solar photovoltaic cell, panel, or array, or solar hot air or water collector device, which relies upon solar radiation as an energy source for the generation of electricity or transfer of stored heat.

**Solar Energy** – Radiant energy received from the sun that can be collected in the form of heat or light by a solar collector or solar energy system.

**Solar Energy System** – A system that produces electricity by the use of semiconductor devices, called photovoltaic cells, which generate electricity whenever light strikes them. Included in a solar energy system are the solar energy generation mechanisms (e.g., panels or other assemblies of solar electric cells), inverters (devices that convert Direct Current electricity produced by the system to usable Alternating Current), batteries and battery systems that store electrical energy from the PV system for future use, meters and electric transmission wires and conduits that facilitate connections with users and/or the local power grid.

**Solar Energy System, Community** – A solar energy system that generates electricity with subscribers who receive a bill credit for the electricity generated based on the size of the subscriptions.

**Solar Energy System, Primary-Scale** – A facility of solar collectors with the primary purpose of wholesale or retail sales of generated electricity. Commonly referred to as solar farms.

**Solar Panel** – A device for the direct conversion of solar energy into electricity.