Siting Large-Scale Solar Photovoltaic Projects on Cape Cod

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CAPE COD COMMISSION

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INTRODUCTION

Climate change is a key challenge facing Cape Cod. It contributes to sea level rise, increased frequency and intensity of storms, and longer periods of warmer weather. Greenhouse gases (GHGs) contribute to climate change by trapping heat in the atmosphere and causing global temperatures to rise. Massachusetts has a goal to reduce GHG emissions from all sectors by at least 80% below a 1990 emissions baseline by 2050.

One way to reduce GHG emissions and slow the effects of climate change in the energy sector is to support the replacement of GHG-intensive fossil fuels with cleaner, renewable forms of energy. Solar energy is a form of renewable energy that can help governments, businesses, and individuals meet climate goals.

REGIONAL PLANNING

In 2019, updates to the Cape Cod Regional Policy Plan (RPP), Comprehensive Economic Development Strategy (CEDs), and Regional Transportation Plan (RTP) were adopted. All three of these regional plans recognize the importance of addressing climate change in the region. Renewable energy can be an effective tool when working to mitigate the impacts of climate change.

Recognizing the need to plan for context-sensitive renewable energy development, the RPP includes a planning action for the Cape Cod Commission (Commission) to conduct an analysis to identify appropriate sites for large-scale solar photovoltaic (PV) systems with an emphasis on existing developed or disturbed sites.

ABOUT SOLAR ENERGY

The primary technology by which solar energy is harnessed for electricity is solar PV. Solar PV cells, generally made from silicon, convert sunlight directly into electricity. Multiple cells are connected in a solar panel or module, encasing the cells in protective glass, metal, and/or plastic. Panels can be used individually or connected to form an array.

In addition to the solar panel or array, a PV system also includes mounting structures, an inverter to convert the direct current (DC) electricity generated into alternating current (AC) electricity used for local transmission of electricity, a meter, other electrical accessories, and wiring to connect system components.

Solar PV systems are generally considered distributed energy resources – small or medium-sized power sources that are mainly connected to the lower voltage levels of the distribution power grid near end users.

Solar PV is considered an intermittent or variable energy source because the amount of sunlight available to generate energy varies depending on location, time of day, season of the year,

and weather conditions. To compensate for this variability, solar PV systems may also include battery storage systems to store energy generated so it can be used later.

Due to their modularity, solar PV systems can vary greatly in size. In our region, small-scale solar PV systems tend to be less than or equal to 25 kilowatts (kW) and mid-scale systems are less than 500 kW. These systems are generally installed on rooftops, parking lots, or adjacent fields to serve the associated residence, business, or municipal facility.

Large-scale solar PV systems are those 500 kilowatts (kW) or larger. A 500-kW rooftop array requires approximately 50,000 square feet of suitable roof space, whereas a ground-mounted 500-kW array requires approximately 2.5 acres of land. Large solar PV systems generally provide electricity directly to the utility and are also referred to as utility-scale.

Solar PV systems also vary in who they serve. In general, small-scale systems serve an individual home, business, or municipal facility, whereas large-scale systems provide electricity to the utility. However, there are business models for multiple entities to share the benefits of solar through onsite or offsite shared solar and microgrids.

Not everyone can install or afford their own solar PV system. Shared solar PV systems allow these individuals to procure their electricity from a clean energy source located in their region. Participants typically benefit by owning or leasing a portion of a system or by purchasing kW-hour blocks of renewable energy generation.

A microgrid is a local energy grid with control capability, which means it can disconnect, or island, from the traditional grid and operate autonomously. In the event of a power outage, a microgrid continues to provide electricity to its customers. Microgrids may be designed to serve a public purpose such as providing power for critical services (e.g. hospitals, shelters, water treatment plants) in a storm. Or, microgrids may be designed to serve a neighborhood or campus.

Advantages of solar energy include reducing fossil fuel dependence, lowering GHG emissions, and improving air quality, provided overall energy demands remain constant. Disadvantages include its intermittency, the use of some potentially hazardous materials in system components, and the significant amount of land required for a large-scale, ground-mounted solar PV project.

MARKET TRENDS AND INCENTIVES

As of 2020, over 650 gigawatts (GW) of solar capacity were installed globally. In the United States, there are almost 2.5 million solar energy systems installed with the capacity to generate over 80 GW of energy. Massachusetts has over 100,000 solar PV systems installed with the capacity to generate over 2,850 megawatts (MW) of solar energy. Regional, national, and global energy projections forecast exponential solar PV growth.

The local solar PV market has been shaped by federal and state legislation and incentives such as the federal Clean Air Act and solar Investment Tax Credit and the state's Global Warming Solutions Act and renewable energy programs.

The Solar Massachusetts Renewable Target (SMART) Program is the Massachusetts Department of Energy Resource's current incentive program established to support the development of solar in Massachusetts. As of 2020, it will support 3,200 MW of solar generating capacity in the state.

The SMART Program incorporates land use, siting criteria, and performance standards into the design of the program. To be eligible to participate in SMART, solar PV projects must take into account multiple aspects of the site, including, but not limited to: zoning; existing land use and development; site characteristics such as natural resources; and project size and design.

The SMART Program also incorporates special provisions for solar PV projects serving public entities, low-income customers, and community shared solar; projects with energy storage; dual-use projects on agricultural lands; floating projects on man-made waterbodies; and canopy projects over parking lots and other surfaces.

SOLAR PV ON CAPE COD

Solar PV systems have been appearing on Cape homes, businesses, and municipal facilities for many years. According to Massachusetts Clean Energy Center (MassCEC) data, as of 2019, there were 6,700 solar projects with a median size of 6.2 kW in Barnstable County participating in state solar energy programs – these do not include projects that do not report to MassCEC's Production Tracking System or projects participating in the SMART Program. The Cape and Vineyard Electric Cooperative has facilitated the installation of an additional 32 MW of solar with Cape towns and school districts.

There have been several large-scale solar PV developments on Cape Cod, including installations on municipal and private lands. Commission data show approximately 100 acres of ground-mounted solar installed on Cape Cod as of 2014. Most of these installations are on previously disturbed sites such as capped landfills. However, there have been several greenfield developments with potential natural and water resources impacts. Large, ground-mounted arrays, if improperly sited, have the most potential to impact the Cape's unique values.

SOLAR SCREENING TOOL

Anticipating the continued development of large-scale solar PV on Cape Cod, the Commission created an online screening tool to identify areas in Barnstable County that may be appropriate for their development. The solar screening tool is a web-application available on the Commission's website.

The tool includes built and natural features, considers relationships between these features, and provides additional context, all for use in helping to inform the siting of large-scale solar PV projects on Cape Cod. The analysis is specific to solar PV development and considers built features that may support and natural features that may be impacted by this type of development.

The solar screening tool has been developed for planning purposes. The tool considers Cape Cod's unique values and identifies areas where solar PV development is less likely to encounter conflicts with these values. Planners, developers, utilities, and others seeking to site or review solar PV projects on Cape Cod may use the tool to make an informed decision as to whether a site may be appropriate for such development. It is not intended to replace consultation with solar siting engineers and state/local authorities. Ultimately, every solar PV project will need to be assessed on a case-by-case basis.

SOLAR SCREENING TOOL CRITERIA

The solar screening tool visualizes the relationship between features of the built and natural environments at the parcel scale. These features come from various data sources including MassGIS and the Commission's 2014 planimetrics data. Planimetrics data are points, lines, and polygons representing features on the ground and is derived through 3d interpretation of aerial photography. We identified five (5) built features and ten (10) natural features to include in our analysis.

Built Features (5 in total):
The following five built environment features were chosen for inclusion in our analysis due to their presence on Cape Cod and their potential for hosting large-scale solar PV systems. Parcels with these built features would likely be considered Category 1 Non-Agricultural Land Uses in the SMART Program and may be eligible for location-based, and, depending on the community served (i.e. community shared solar, low income customers, or public entity), other incentives through that Program.

1. Industrial Activity Centers
    a. As identified in the Commission's 2018 RPP, these are lands containing industrial uses that are suitable for future industrial activity as well as emerging industries.
    b. These are lands without significant resource constraints and are of an adequate size to support industrial uses and therefore may be suitable for solar PV development.

2. Commercial and Industrial Structures over 10,000 square feet
    a. Structures were identified from the 2014 planimetrics data.
    b. Area was calculated and only structures with an area greater than 10,000 square feet were included in our analysis.

3. Parking Lots over 10,000 square feet
    a. Parking lots were identified from the 2014 planimetrics data.
    b. Area was calculated and only parking lots with an area greater than 10,000 square feet were included in our analysis.

4. Transfer Stations
    a. Using a combination of Massachusetts assessors land use codes and the 2014 planimetrics feature class "Transfer Stations", parcels were identified as Transfer Stations.
    b. Entire parcels may be identified as Transfer Stations; however, disturbed lands associated with transfer station operations may only exist on portions of these parcels.

5. Sand and Gravel
    a. Using a combination of Massachusetts assessors land use codes compiled by MassGIS, the 2014 planimetrics feature class "Borrow Pits", a review of satellite data, and conversations with the towns, parcels were identified as Sand and Gravel.
    b. Entire parcels may be identified as Sand and Gravel; however, disturbed lands associated with sand and gravel extraction operations may only exist on portions of these parcels.

Natural Features (10 in total):
The following ten natural environment features were chosen for inclusion in our analysis due to their presence on Cape Cod, the potential environmental constraints they present to solar PV development, and the potential impacts, including the loss of carbon sequestration potential, that large-scale solar PV development may have on the region's natural resources. Parcels with these natural features may be ineligible for SMART Program location-based incentives and may be subject to a greenfield disincentive or, may be ineligible to participate in the SMART Program.

1. Undeveloped Unprotected Forest and Shrubland
    a. This feature includes the following land cover categories from the MassGIS 2016 Land Cover Land Use layer: Evergreen forest, Deciduous forest, Scrub/shrub, Estuarine forest/wetland, Estuarine scrub/shrub wetland, Palustrine forest, and Palustrine scrub/shrub wetland.
    b. The undeveloped unprotected layer combines above categories and removes any Protected Open Space (all levels of protection), leaving only undeveloped and unprotected areas.
    c. Given their unprotected status, these undeveloped areas may be sought after for development, solar or otherwise; however, these vegetated areas may provide valuable ecosystem services such as carbon storage and sequestration, and filtering and cleaning air and water and, therefore, should be carefully investigated prior to any development.

2. Wellhead Protection Area
    a. Wellhead Protection Areas are important for protecting the recharge area around public water supply groundwater sources.
    b. Undisturbed trees and soils in these areas filter and clean our drinking water; a priority for these areas is protection from disturbance and sources of potential contamination.

3. BioMap2 Core Habitat
    a. Core Habitat identifies key areas to ensure the long-term persistence of species of conservation concern, exemplary natural communities, and intact ecosystems across the Commonwealth.
    b. SMART Program note – solar projects sited on land designated as Core Habitat or on a parcel with 50% or more of its area designated as Priority Habitat and/or Core Habitat that do not meet the criteria of Category 1 Land Use are ineligible to participate in the SMART Program.

4. BioMap2 Critical Natural Landscape
    a. Critical Natural Landscape identifies larger landscape areas that are better able to support ecological processes, disturbances, and wide-ranging species.

5. Open Space
    a. The protected and recreational open space datalayer contains the boundaries of conservation lands and outdoor recreational facilities.
    b. Newly protected open space changes continually and this data layer is therefore considered to be under development. Users should check with local agencies and land trusts regarding any open space not shown in the MassGIS data.
    c. The open space layer includes five categories of protection: in perpetuity (including land protected under Article 97 of the Massachusetts Constitution), limited, temporary, none, and unknown. For our analysis, we included open space with levels of protection of in perpetuity, limited, and temporary. The categories of unknown and none were not included in our analysis.
    d. Land protected by Article 97 would require a 2/3 vote of town meeting and the state Legislature before it could be converted to another use. The Massachusetts Executive Office of Energy and Environmental Affairs (EEA) has a "no net loss" policy with regards to the disposition of any Article 97 protected open space.
    e. SMART Program note – Solar PV projects on open space protected under Article 97 are not eligible for SMART unless they meet that program's Category 1 Land Use criteria.

6. Natural Heritage and Endangered Species Priority Habitat

a. Priority Habitat maps are used for determining whether a proposed project must be reviewed by the NHESP for Massachusetts Endangered Species Act compliance.
b. Priority Habitat is based on the known geographical extent of habitat for all state-listed rare species, both plants and animals. Habitat alteration within Priority Habitats may result in a take of a state-listed species and is subject to regulatory review by NHESP.
c. SMART Program note – solar projects sited on land designated as Priority Habitat or on a parcel with 50% or more of its area designated as Priority Habitat and/or Core Habitat that do not meet the criteria of Category 1 Land Use are ineligible to participate in the SMART Program.

7. MassDEP Wetland and/or Vernal Pool
    a. The 2019 MassDEP Wetlands layer provides a medium-scale representation of wetland areas. The wetlands information is for planning purposes only. They do not represent, and should not be used as, wetlands delineations under the Wetlands Protection Act.
    b. Vernal pools are temporary pools of water that provide habitat for distinctive plants and animals that rely on this habitat for critical life cycle processes.
        i. Certified vernal pools are those that have been certified by the NHESP according to the Guidelines for the Certification of Vernal Pool Habitat.
        ii. Potential vernal pools are those that were visible to NHESP staff on aerial photographs and interpreted to be vernal pools.
    c. For our analysis, we merged the wetlands (including a 100-foot buffer to wetland edge) and vernal pools (delineated as a 350-foot buffer to vernal pool center point) layers. The 350-foot vernal pool buffer was chosen as it relates to Commission wildlife and plant habitat goals and objectives.
    d. MassDEP has a Wetlands Program Policy (17-1) describing how MassDEP reviews solar PV projects that may impact wetland areas.
    e. SMART Program note – solar projects sited in wetland Resource Areas may not be eligible to participate in the SMART Program.

8. Important Bird Areas
    a. The National Audubon Society identifies Important Bird Areas.
    b. Important Bird Areas are sites providing essential habitat to one or more species of breeding, wintering, and/or migrating birds.

9. Area of Critical Environmental Concern
    a. ACECs are places that receive special recognition, and may be subject to increased regulatory requirements, because of the quality, uniqueness, and significance of their natural and cultural resources.

10. Flood Hazard and/or Sea, Lake and Overland Surges from Hurricanes
    a. The National Flood Hazard dataset represents the current effective flood risk data for those parts of the country where maps have been modernized by the Federal Emergency Management Agency. This layer is a compilation of effective Flood Insurance Rate Map databases and any Letters of Map Revision that have been issued against those databases since their publication date.
    b. The SLOSH model is a computerized numerical model developed by the National Weather Service to estimate storm surge heights resulting from historical, hypothetical, or predicted hurricanes by considering the atmospheric pressure, size, forward speed, and track data.

Contextual Features:
The screening tool includes additional contextual features for visualization and consideration in the solar siting process. These include:

1. Parcels
    a. Two categories of parcels are delineated: those > 2.5 acres and those < 2.5 acres.
    b. 2.5 acres was chosen because, in general, a large-scale solar PV system is at minimum 500 kW and a 500 kW ground-mounted array requires approximately 2.5 acres of land.

2. Eversource Hosting Capacity
    a. "Hosting Capacity" refers to an estimated maximum amount of distributed generation that can be accommodated on the distribution system at a given location under existing grid conditions and operations, without adversely impacting safety, power quality, reliability or other operational criteria, and without requiring significant infrastructure upgrades.
    b. This map layer provides some guidance on an approximate value of Hosting Capacity measured in megawatts that may be accommodated onto a point on the distribution system.
    c. Hosting capacity is dynamic and therefore planning for preferred solar PV development locations based on proximity to distribution is difficult because locations with capacity on electrical lines, reasonable costs to interconnect, and market demand change over time.

3. 3D Buildings
    a. As identified in the 2014 planimetrics data, 3D buildings provide the user with an indication of structure/rooftop form and elevation and may be used to help determine whether a structure can accommodate a solar installation or potential shading.

4. Street Trees
    a. As identified in the 2014 planimetrics data, street trees provide the user with an indication of shading or buffering.

5. Solar Arrays 2014
    a. The 2014 planimetrics data identified ground-mounted solar arrays.

6. Town Industrial and Commercial Zoning
    a. These may be appropriate areas for solar PV development; however, natural features present within these zones must also be considered.
    b. Users should check with the municipality regarding the siting and regulations of solar PV systems in these zones and any solar overlays.

7. Community Activity Centers
    a. As identified in the 2018 RPP, these are areas with a concentration of business activity, community activity, and a compact built environment. These areas are more densely developed and often contain concentrations of historic buildings.

8. Green Communities
    a. Designated Green Communities are those municipalities that pledge to cut municipal energy use by 20 percent over 5 years and meet other criteria established in the Green Communities Act.
    b. One criterion is met by a municipality passing zoning in designated locations for the as-of-right siting of renewable or alternative energy generating facilities, research and development facilities, or manufacturing facilities.
    c. Users should check with the municipality regarding any local solar overlay zoning.

9. Agricultural Lands
    a. Active Cranberry Bogs
        i. Detailed active cranberry bogs were created using 2011 aerial photography to inform a wide variety of Commission clean water initiatives. This layer represents the actual site of the bog, not the surrounding operations, and may capture greater detail than other wetland layers.
        ii. MassDEP has guidance regarding the installation of solar panels at cranberry bogs in relation to the Wetlands Protection Act.

    b. Cape Cod Farms
        i. Using land use codes and local knowledge Commission staff identified local farms for the RPP in 2009.

    c. Prime Farmland Soils
        i. This layer is comprised of three important farmland categories: Prime Farmland, Farmland of Unique Importance, and Farmland of Statewide Importance. Urban built-up land and water are excluded from all three categories, but forested lands are included in all three categories if they meet the appropriate criteria.

ii. SMART Program note – solar projects on certain Land in Agricultural Use or Important Farmland that allow for the continued use of the land for agriculture and meet certain criteria may be considered Category 1 Agricultural Land Use and may be eligible for certain location-based incentives.

10. Massachusetts Historical Commission (MHC) information:
    a. Historic Places
        i. Denotes all properties where an historic resource has been inventoried.
    b. Historic Areas
        i. Denotes the Old Kings Highway Regional Historic District and areas where neighborhood-scale historic inventories have been completed.
        ii. Historic inventories may contain information and locations of local scenic landscapes.
    c. Historic Districts
        i. Denotes both Local and National Register Historic Districts.
    d. Solar PV projects in these areas may require additional regulatory review by authorized regulatory bodies including, but not limited to, MHC review for archaeological resources.
    e. SMART Program note – solar projects that are located on properties that are on the State Register of Historic Places are ineligible to participate in the SMART Program, except as authorized by regulatory bodies.

11. NHESP Natural Communities
    a. NHESP Natural Communities represents the extent of various natural communities of biodiversity conservation interest in Massachusetts.

SOLAR SCREENING METHODS

The solar screening tool includes the above built and natural features and evaluates relationships between these at the parcel scale. Information on parcel land uses, protections, and other data are presented in the tool so the user can easily explore the potential opportunities and constraints to developing large-scale solar PV at a location.

Each of the built and natural features present within a parcel were given a point then categorized as high, moderate, low, or no presence in relation to one another on a Solar Screening scale. Where a parcel falls on the scale demonstrates its relative built and natural features.

A parcel in the "More Appropriate" area of the scale has high built features and no or low natural features present and may be more suitable for large-scale solar PV installations, especially on already developed or disturbed portions of the parcel.

A parcel in the "Less Appropriate" area of the scale has no or low built features and high natural features present and may not be suitable for large-scale, ground-mounted solar PV development.

A parcel in the middle area of the scale has a more complex mix of built and natural features. Already developed or disturbed portions of these parcels may be appropriate for large-scale solar PV installations whereas, portions of these parcels containing sensitive natural features may not be appropriate.

With the Solar Screening scale activated, clicking on a parcel opens a pop-up box containing parcel-scale information on the built and natural features present and the relative categorization of these. Pop-up boxes also include other useful parcel statistics including size, square footage of structures, land use, presence of prime farmland soils, area of forest/shrub, and whether the parcel is within an Historic District.

The Solar Screening scale is included for illustrative purposes and is not intended to replace consultation with solar siting engineers and state/local authorities. Individual solar PV projects will require more detailed site assessments and review.

OTHER SOLAR PV CONSIDERATIONS

Markets and Permitting

Solar PV projects involve complex engineering, financial, and legal processes. Preferable sites for large-scale projects such as landfills, brownfields, and commercial and industrial rooftops and parking lots may be more expensive to develop than greenfields due to increased engineering, site assessment, material, and labor costs, complicated contracts, and high lease rates. Government programs and regulations that incentivize and streamline the financing, permitting, building, and inspection of such projects need to be developed to make previously developed sites more attractive to solar PV developers.

Communities Served

Access to solar energy may be challenging for low-income communities. While the SMART Program includes set-asides and incentives for projects that serve low-income customers, shared solar models, assistance programs, and policies need to be further developed and implemented to ensure access to solar energy is equitably distributed and affordable for all electricity consumers.

Interconnection

Solar PV projects require a three-phase distribution line to interconnect to the grid and developers must apply for and obtain an interconnection service agreement with the utility. Interconnection to the grid can be complicated where there is limited hosting capacity. To help solar PV developers select

locations for interconnections, Eversource has developed a Hosting Capacity Map and has answers to frequently asked questions about hosting capacity on its website.

Places where the distribution grid has reached, or is likely to reach, its maximum interconnection capacity may not have the ability to accommodate additional solar PV projects without impact studies and infrastructure upgrades. Therefore, project proponents should contact the utility early to review the proposal and determine whether a study or upgrade may be required.

Energy Storage

Solar PV systems may produce more electricity than is needed during the day and do not produce electricity at night. Energy storage is a potential solution to smooth the production and integration of solar energy into the grid.

Energy storage systems co-located with solar PV systems are becoming more common. Indeed, the SMART program includes requirements and incentives for solar PV systems co-located with energy storage systems.

Sites identified as more appropriate for solar PV systems may also be appropriate for co-located or stand-alone energy storage systems, provided siting, construction, operations and management, and decommissioning best practices are followed.

Considerations specific to battery energy storage systems include potential noise impacts from heating and cooling systems; hazardous materials transportation, use, and disposal; fire and explosion risk; containment; and screening.

Best Management Practices

Solar PV projects on existing structures (e.g. rooftops and parking lots) should follow standard construction best practices. In addition, these projects require additional structural analyses to ensure the structure can safely accommodate the solar PV system. Other considerations for these types of systems include fire prevention, preventing water penetration, stormwater management, weather-related hazards (e.g. due to snow and wind loads), and safe access for maintenance personnel and first responders in the event of an emergency.

A large-scale, ground-mounted solar PV project involves multiple activities, including, but not limited to, the solar PV system, cleared buffers, access and maintenance roads, and utility interconnection. All activities should be considered in project planning and review and these developments should follow greenfield best management practices. Such practices include minimizing grading, protecting and stabilizing soils, managing stormwater, raising fences to allow for wildlife movement, avoiding the use of fertilizers, herbicides and pesticides, retaining or planting vegetated buffers, removing invasive plants, and seeding beneath the array with native and pollinator-friendly plant mixes.

The University of Massachusetts Clean Energy Extension has developed a useful set of solar PV Best Management Practices associated with its pollinator-friendly solar certification program. Projects

obtaining and maintaining at least a silver certification or equivalent may be eligible for a pollinator incentive through the SMART Program.

Operations & Management

An operation and management (O&M) plan is a key component of a large-scale solar PV system as it ensures that the system will operate at high levels of performance over the project's lifetime. The O&M phase is the longest in the lifecycle of a PV project, as it typically lasts 20+ years.

An O&M plan should include provisions for on-going management of the system components, the land or structure it is installed on, stormwater, and waste, including a plan to properly dispose of damaged or mal-functioning panels and other system components. The plan should also include a schedule for regular inspections of the system. Solar PV projects with storage should incorporate remote monitoring of batteries and an emergency operations plan developed in coordination with the local fire department.

Natural events can cause damage to panels; therefore, systems should be designed to withstand these events and be inspected after high wind, fire, or storm events. A contingency plan should also be included for other unforeseen issues.

Decommissioning

Solar panels have projected lifespans of 20+ years and solar PV projects have matching contract terms. Although panels can be replaced and contracts extended, solar projects may be temporary fixtures on the landscape, and it is expected that a solar PV system will be decommissioned at some future date. Therefore, a decommissioning plan is another key component of a large-scale solar PV project as it ensures the system will be removed and structure or land restored or put into another productive use. A decommissioning plan should include financial assurances, stipulations to remove all system components, and, at a minimum, a requirement to restore the structure or land to its previous condition.

As the solar PV market increases, so will the need to manage the volume of decommissioned panels and other PV system components. Circular economy principles should be applied, and components reduced, reused, or recycled. Solar PV end-of-life industries will be needed to manage anticipated solar PV waste.

RESOURCES

Solar Energy Information:

- National Renewable Energy Lab: Solar Energy Basics
- Department of Energy: Solar
- International Renewable Energy Agency: Solar Energy
- International Energy Agency: Solar
- Solar Energy Industries Association: Solar State By State
- Project Drawdown: Utility-Scale Solar Photovoltaics

- Project Drawdown: Distributed Solar Photovoltaics

Federal and State Legislation and Incentive Programs:

- Department of Energy: Residential and Commercial ITC Factsheets
- Solar Energy Industries Association: Solar Investment Tax Credit (ITC)
- Massachusetts Climate Change Legislation: Global Warming Solutions Act
- Massachusetts Department of Energy Resources: SMART Program
- Massachusetts Department of Energy Resources: Renewable Energy Programs
- Massachusetts Department of Energy Resources: Green Communities Division

State and Regional Solar Energy Resources:

- Massachusetts Department of Energy Resources: Renewable Energy Snapshot
- Massachusetts Clean Energy Center: Solar Electricity
- University of Massachusetts Clean Energy Extension: Solar Resources for Municipalities
- Massachusetts Audubon: Losing Ground 2020 Report
- ISO New England: Regional Electricity Outlook
- Eversource: Learn About Solar Energy
- Eversource: Hosting Capacity Map
- Cape and Vineyard Electric Compact: Photovoltaics (PV) Initiatives
- Cape Light Compact: Save with Solar
- New York State Energy Research and Development Authority: Solar Guidebook
- Scenic Hudson: A Guide to Siting Renewable Energy in the Hudson Valley
- New Jersey Department of Environmental Protection: Solar Siting Analysis
- Rhode Island Office of Energy Resources: Solar Guidance and Model Ordinance Development
- Rhode Island Office of Energy Resources: Solar Siting Opportunities for Rhode Island
- Maine Audubon: Thoughtfully Sited Solar

Solar Energy and Wetland, Agricultural, and Historical Resources:

- Massachusetts Department of Environmental Protection: Wetlands Program Policy 17-1
- University of Massachusetts Clean Energy Extension: Solar PV and Agriculture
- University of Massachusetts Clean Energy Extension: Solar PV and Cranberry Production
- Massachusetts Department of Environmental Protection: Guidance on Agriculture and Solar
- American Farmland Trust: Smart Solar Siting for New England
- National Park Service: New Technology and Historic Properties
- Preservation League of New York State: Solar Power and Historic Preservation

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