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Farmland Solar Policy Design Toolkit

HOW TO CRAFT SOLAR REGULATIONS THAT WORK FOR YOUR STATE AND COMMUNITY

This toolkit is intended for state and municipal lawmakers, farmers, and researchers hoping to improve or better understand their community's farmland solar policies. It identifies key areas of state law affecting how much and what kind of solar development occurs on farmland, as well as farmers' access to clean energy.

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Introduction

In the absence of federal action in the United States, many state and local governments have enacted policies that are committed to drastic reductions in greenhouse gas emissions and development of clean energy alternatives to fossil fuels.[1] While photovoltaic solar[2] generation currently occupies less than two percent of the total U.S. electricity market,[3] by 2050, that percentage is likely to reach at least forty percent to meet increasingly ambitious state government goals and mandates.[4,5]

Solar energy has already seen explosive growth in recent years. By 2019, the number of solar installations had doubled to two-million Solar PV installations across the United States contributing over seventy gigawatts (GW) of generating capacity to the electric grid.[6] The U.S. Energy Information Administration expects an additional 13.5 GW of solar capacity to come online in 2020.[7] While the majority of new capacity will come from utility-scale arrays, new residential and commercial solar will experience record growth across the U.S., with 5.1 GW of added solar capacity by the end of 2020.[8]

While solar radiation potential is most favorable in the desert southwest, the eastern great plains, and the central Rocky Mountains,[9] solar installations are already contributing power to regional transmission systems and local distribution grids across the country. A "good site" for any ground-mounted solar array has a few basic requirements: decent solar radiation, a relatively flat and undeveloped parcel of land, and access to suitable power lines for interconnection. Without state policies in place to help manage solar siting, arrays are likely to be located on agricultural land and other green spaces or "greenfields" that meet the basic requirements are often less expensive to develop than other site options.

With 900 million acres of farmland in the United States, conversion of some acres of farmland to solar energy production may seem inconsequential.[10] However, farmland in the United States has already been shrinking due to residential, commercial, and industrial development. Between 1982 to 2018, the U.S. lost an estimated 39 million acres of farmland, with 15 million acres converted in the last six years.[11] With the accelerating disruptions of climate change, it is particularly concerning that farmland is being converted to other uses at a time when it is needed more than ever for food production and the environmental support it provides through ecosystem services. As climate change progresses, agricultural production is likely to face reduced output.[12] Increased flooding, heat, drought, and wildfires will take place, which adds stress to crops and livestock, while increasing soil erosion, soil degradation, and insect pests.[13] At the same time, the contribution of farmland to climate mitigation is significant, including increasing and preserving carbon storage in soil. For example, farmlands that promote no-till farming with cover crops can absorb as much as 1 to 2 metric tons of CO_2 per hectare.[14]

1 In 2015, Hawaii became the first state to commit to a 100% goal for renewable electricity, to be achieved by 2045. HI Rev. Stat. § 269-92 (2015).

2 Solar energy can be used in a variety of ways including thermal solar, often used for residential hot water tanks and photovoltaic solar, consisting of panels used to generate electricity. This report focuses exclusively on the siting of solar photovoltaic panels mounted on the ground or on a roof or other structure and connected to the distribution grid. U.S. Energy Information Administration, Solar Explained, Dec. 4, 2019, https://www.eia.gov/energyexplained/solar/ (Accessed Jan. 4, 2020).

3 U.S. Energy Information Administration, *FAQ: What is U.S. Electricity Generation by Energy Source?,* Oct. 25, 2019, https://www.eia.gov/tools/faqs/faq.php?id=427&t=3 (Accessed Jan. 4, 2020).

4 U.S. Energy Information Administration, *Annual Energy Outlook 2019 with projections to 2050,* Jan. 24, 2019, www.eia.gov/aeoe (Accessed: Jan. 30, 2020).

5 State climate goals and energy mandates are not the only driver of solar expansion. Corporate sustainability goals and individual choices to voluntarily reduce carbon footprint also contribute to the demand for new solar infrastructure. Stephen R. Estey & Lauren A. Evers, *Here Comes the Sun: the Rise of Commercial Solar Development in Michigan,* Mich. B.J., Feb. 2020, at 24.

6 Solar Energy Industries Association, *United States Surpasses 2 Million Solar Installations,* May 9, 2019, https://www.seia.org/news/united-states-surpasses-2-million-solar-installations (Accessed: Jan. 30, 2020).

7 U.S. Energy Information Administration, *New Electric Generating Capacity in 2020 will come Primarily from Wind and Solar, Today in Energy,* Jan. 14, 2020 (https://www.eia.gov/todayinenergy/detail.php?id=42495).

8 U.S. Energy Information Administration, *Short-Term Energy Outlook*, Jan. 14, 2020, https://www.eia.gov/outlooks/steo/ (Accessed: Jan. 14, 2020).

9 National Renewable Energy Laboratory, *Global Horizontal Solar Irradiance Map,* Feb. 22, 2018 (https://www.nrel.gov/gis/images/solar/solar_ghi_2018_usa_scale_01.jpg).

10 United States Dept. of Agriculture, National Agricultural Statistics Service, *2017 Census of Agriculture,* Table 9, (https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_US/st99_1_0009_0010.pdf).

11 *Id.*

12 Walthall, C.L, et. al., *Climate Change & Agriculture in the United States: Effects and Adaptation,* Feb. 2013, (https://www.usda.gov/oce/climate_change/effects_2012/CC%20and%20Agriculture%20Report%20(02-04-2013)b.pdf).

13 *Id.*

14 *Id.*

Smart Farmland Solar Policy

As solar energy is a flexible technology that may be installed in a wide variety of locations, solar siting policy should steer installations away from valuable agricultural land and toward structures, previously developed sites, previously contaminated lands, and marginal lands, where solar energy may be captured without competing with agricultural production and land preservation. Policy should strive to balance agricultural land conservation with ensuring farmer access to clean energy, as solar development can also reduce farm electric bills and improve farm viability.

State policies can require varying degrees of oversight for solar development on agricultural land based on state preference and political expediency. Simple policies include requiring enhanced review for projects proposed on farmland, while comprehensive policies can establish specific criteria and performance standards for solar arrays impacting agricultural land and uses. Categorizing solar arrays by capacity size, acreage, and relationship to on-site load provide easy ways to apply regulations to certain types of solar projects. Making basic regulatory distinctions between valuable and marginal farmland can improve both siting outcomes and farmer access to clean energy. Policies that identify and incentivize preferred sites for solar development and "dual use" or "agrivoltaic"[15] solar installations are more complicated to integrate into solar development permitting, metering, interconnection, and other land-use and energy policies, but provide the most robust strategies for farmland protection in by states today.

Benefits of Smart Farmland Solar Policy

This research analyzes state solar siting laws to identify existing policy strategies for farmland protection and options for regulatory design, as well as avenues for policy improvement. Outdated or overly general solar siting policies can threaten farmland with conversion from agricultural production to energy generation. This can reduce agricultural use and production, affect the quality of land and soils, complicate farmland transfer and access to new farmers, and affect local land use and zoning over the long-term. When sited thoughtfully, solar development invigorates rural economies, creates new sources of revenue for farmers, increases energy self-reliance on farms, and helps meet aggressive renewable energy goals. State solar siting policies can successfully balance the need for renewable energy development with protection of agricultural uses and farmer access to clean energy.

15 Dual use or agrivoltaic arrays are designed to exist alongside agricultural uses, so that the land is used for both energy generation and agricultural production concurrently.

The benefits of well-planned solar siting policies are wide-ranging:

- **Reduced competition between renewable energy generation and agricultural production.**
- **Cultivation of social and political acceptance of solar development.**
- **Protection of current and future agricultural land uses.**
- **Preservation of prime agricultural land and other important farmland.**
- **Economic growth for both the agricultural and solar sectors.**
- **Regulatory clarity for both farmers and solar developers.**
- **Improved permitting efficiency and reduced administrative costs.**
- **Accelerated deployment of renewable energy to reach clean energy goals.**

Use of this Toolkit

This toolkit is intended for state and municipal lawmakers, farmers, and researchers hoping to improve or better understand their community's farmland solar policies. It identifies key areas of state law affecting how much and what kind of solar development occurs on farmland, as well as farmers' access to clean energy. It provides examples of state laws and regulations in a variety of states that have enacted smart farmland solar policies, which can provide a useful starting point for crafting solar regulations that work for your state and community.

I. State and Local Governance

Solar development is regulated by both state and local governments. This division of labor affects both project oversight and opportunities for policy advocacy. Depending on the state, solar arrays will need to be approved by a variety of state and local land use and energy regulatory authorities.[16]

> The US electric industry comprises over 3,000 public, private, and cooperative utilities, more than 1,000 independent power generators, and over 700,000 homes and businesses with onsite solar generating systems. There are three regional synchronized power grids, eight electric reliability councils, about 140 control-area operators, and thousands of separate engineering, economic, environmental, and land-use regulatory authorities.
>
> — Lazar, J. (2016). Electricity Regulation in the US: A Guide. Second Edition. Montpelier, VT: The Regulatory Assistance Project.

A. Understanding State and Local Regulatory Authority

Differences in state government mean there is no single way that states regulate solar development or write farmland protections into state laws and regulations.

Some states have implemented comprehensive solar development rules addressing siting and land use considerations, energy metering, grid interconnection, and rate design for small, medium, and large-scale arrays in a variety of locations. Other states have made few changes to existing land use and energy permitting laws to encourage or address the rapid expansion of distributed energy resources.[17]

However, as the desire for solar generation capacity steadily increases, each state is likely to face the tension between energy development and agricultural land uses, and new farmland protection strategies addressing this tension are developing rapidly.

A variety of state agencies may have authority over agriculture, energy, land use, and economic development, all of which may play a role in solar development.

The process and criteria for approving new solar arrays, and the conditions placed on their construction and operation, vary widely from state to state. Cooperation between state and local authorities, as well as relevant state agencies and electric utilities, is required to effectively regulate solar development and steer new arrays toward less valuable lands. Lawmakers and advocates seeking to change solar policy must first understand established divisions of labor among regulatory bodies. They should carefully consider where changes are most likely to be effective, given the established structure of state and local government, and the scope of authority of the regulators involved.

State solar siting policies "live" in many different places within state law.

Solar siting policies are not found in any one state law, but include an assortment of state and local requirements, with state and local governments often sharing or dividing authority over solar project approval. Numerous state laws and administrative regulations are likely to apply the construction and operation of a new solar array. County or municipal ordinances may require additional permits. Further, individual electric utilities are likely to be involved in the interconnection process for new arrays.

State law might require a new solar array to obtain land use permits from state agencies of natural resources, environmental protection, or agriculture. Siting requirements can also be found in public utility commission regulations for solar net-metering programs, and in feed-in tariffs or procurement mandates for commercial or utility-scale solar development. Solar siting policies can even be found in state department of revenue rules for property tax assessment and agricultural "current use" taxation programs. In addition, stand-alone state laws might

16 Solar arrays interconnected to the electric transmission grid must also obtain approval from the Federal Energy Regulatory Commission. While the considerations in this Toolkit are relevant to solar infrastructure under federal jurisdiction, its focus is on state laws and state administrative regulations affecting the siting of solar energy connected to the electric distribution grid.

17 Distributed Energy Resources "are physical and virtual assets that are deployed across the distribution grid, typically close to load, and usually behind the meter, which can be used individually or in aggregate to provide value to the grid, individual customers, or both." This includes solar, wind, micro-hydro, energy storage, and biogas technologies, as well as energy efficiency and demand management strategies. Tanuj Deora, et al., Distributed Energy Resources 101: Required Reading for a Modern Grid, Advanced Energy Economy , Feb. 13, 2017 (https://blog.aee.net/distributed-energy-resources-101-required-reading-for-a-modern-grid)

establish special rules for solar development or farmland protection. Lawmakers should seek to clarify and streamline solar siting rules when opportunities arise, to swiftly approve projects that are clearly in the public interest, and to ensure oversight of large projects and those that may impact valuable resources.

The role of local government in solar development differs across states.

The Constitution of the United States does not provide for local governments. Rather, the 10th Amendment to the Constitution gives states broad authority over any non-federal matters, including the power to create and delegate authority to subdivisions of government, like municipal corporations.[18] Relationships and divisions of authority between state, county, and municipal governments are incredibly diverse across the United States.

Sometimes, state legislatures delegate broad powers to municipalities to regulate local land uses, and solar arrays will need permits from a variety of local building, planning, zoning, and conservation boards. Other states delegate power over energy infrastructure, including land use considerations, to the state public utility commission, leaving little role for municipalities in regulating solar development.

Home Rule and Dillon's Rule States

State constitutions vary in the level of power they grant to local governments. Generally, "Dillon's Rule" holds that a municipal corporation can exercise only the powers explicitly granted to it, and if there is a reasonable question as to whether a power has been conferred to a local government, then it has not.[19] In "Dillon's Rule" states, municipalities may have limited power to regulate solar arrays outside of the land use authority already delegated by the legislature. Other states have adopted "home rule" laws that confer greater authority and autonomy to local governments, including towns, villages, municipalities, and/or counties. In these "Home Rule" states, municipal governments may be able to enact ordinances regulating solar development even without express legislative direction, so long as they do not conflict with state law. These categories are not mutually exclusive. Some states are considered "hybrid" states, in which municipalities have broad home rule authority over certain subjects, like land use, but are restricted to specifically delegated authority in other areas.

B. How does State Governance Affect Farmland Solar Policy?

Different regulatory structures require different approaches to farmland solar policy development, policy advocacy, and policy change.

State review. Some states prohibit local municipalities from regulating solar development, and municipal zoning and permitting processes are preempted by a state-level siting board. Approval for a solar installation comes from one or more state agencies, not a municipality. In these states, policy change is most likely to occur through legislative advocacy and participation in relevant agency rulemaking processes.

Local review.[20] In other states, approval for a solar installation is granted by a city, town, or county through local planning, zoning, and permitting processes. State law may direct local governments as to the content of zoning ordinances applicable to solar installations or prevent the "unreasonable" regulation of solar energy, but final approval is left to municipal boards. In these states, smart farmland solar policy can be promoted through creation of model solar bylaws and ordinances that individual communities can choose to adopt or modify. State laws regulating the implementation of local planning and zoning by local governments can also be modified to improve farmland solar policy.

Hybrid authority. States may also divide authority over solar development approval between the state and local governments. For example, a state-level

18 National League of Cities, *Cities 101: Delegation of Power*, Dec. 13, 2016, https://www.nlc.org/resource/cities-101-delegation-of-power (Accessed Feb. 5, 2020).

19 *Id.*

20 Analysis of individual local government ordinances is outside the scope of this report. For excellent examples of local energy ordinances, see the Sustainable Development Code: https://sustainablecitycode.org/chapter/chapter-7/

Table 1. COMPARE: State Division of Authority over solar

VERMONT **Primarily State Authority over Solar Siting** **30 V.S.A. § 248 (2019)**	• Vermont's comprehensive energy siting statute, 30 V.S.A. § 248, rolls all land use and energy permits into a single Certificate of Public Good, issued by the Public Utility Commission (PUC), who has sole siting and approval authority for proposed solar projects in the state. • The PUC must consider impacts to prime agricultural soils for all ground-mounted solar projects over 15 kilowatts (kW). For ground-mounted solar projects 50kW or larger, the Vermont Agency of Agriculture Food and Markets receives notice of proposed projects. The Agency has the right to appear at PUC hearings for projects between 15-500 kW, and must appear if the system is greater than 500 kW and located on agricultural soils. Conditions for the protection of agricultural soils can be included in a project's Certificate of Public Good. • Municipal and regional entities provide input on preferred siting locations.
RHODE ISLAND **Mostly Municipal Authority over Solar Siting** **300-RICR-00-00-3**	• The Rhode Island Energy Facility Siting Board has authority over solar arrays greater than 40 megawatts (MW). Municipalities approve solar siting for arrays less than 40 MW, or the vast majority of solar arrays in the state. • The municipal process is directed in part by the Office of Energy Resources, which created a statewide solar permit addressing building and electrical approvals that towns must use. • Solar projects must also comply with other state land use laws and municipal zoning ordinances. • The Statewide Planning Program & Office of Energy Resources created a model solar ordinance for use by municipalities. • Special rules apply to solar sited on farmland enrolled in the current use taxation program.
CONNECTICUT **Divided Authority over Solar Siting** **C.G.S.A. §10-50i(a) and § 16-50k(a)(B)(iii)(2019).**	• The Connecticut Siting Council has jurisdiction over solar energy generation projects greater than 1 MW. • When solar arrays of at least 2 MW are proposed for prime farmland, the Department of Agriculture must represent in writing to the Siting Council that the project "will not materially affect the status of such land as prime farmland." • Municipalities make siting decisions about solar arrays less than 1 MW.

siting board may be responsible for approval of larger projects or those with expected impacts to natural resources, while smaller projects are left to local approval processes. In these states, a hybrid approach to policy advocacy may be necessary, targeting state legislation, agency regulations, and the creation of model municipal laws to advance farmland solar policy.

C. Using State Law to Improve Farmland Solar Policy

The following chapters of this report discuss specific topics in farmland solar policy development, but all states will benefit from consideration of the following basic guidelines for smart farmland solar policy design.

> Follow principles for smart farmland solar development.

While every state and community may have different priorities for solar development and farmland protection, the following principles can guide policy action:

- Identify and engage stakeholders early in the policy-making process.
- Maximize potential solar energy production while minimizing impacts to the most productive farmland.
- Guide solar development to land with the least impact on agriculture and other natural resources.
- Establish preferred sites for solar development, both generically and through use of parcel-specific data.
- Avoid the term "Solar Farm" in law and policy. It causes confusion in distinguishing land uses.
- Define important state and local farmland to protect.
- Define different administrative processes and approval criteria for different scales of solar development (for example, arrays greater and less than 1 MW in capacity).
- Define different administrative processes and approval criteria for solar development located on different site-types (for example, prime farmland, brownfields, and residential roof-tops).
- Specify an approval process and criteria for solar development intended primarily for on-farm use.
- Require developers to follow construction and decommissioning guidelines to protect soil health and active agricultural use for the future.
- Encourage dual use or agrivoltaic arrays that co-locate solar energy generation with active farming.

States can establish their own guiding principles for the siting of solar and other renewable energy generation infrastructure. Policymakers should include provisions intended to protect farmland and agricultural uses within their siting principles.

Table 2. EXAMPLE: Rhode Island Principles for Renewable Energy Siting

Rhode Island's "Principles for Renewable Energy Siting" include specific provisions for farmland protection and redevelopment of disturbed sites:

- "Encourage renewable energy development on commercial and industrial zoned land, on already developed land, and in other locations with environmental alterations such as closed landfills, brownfields, parking lots, commercial and residential rooftops, sand and gravel pits."
- "Support the economic viability of farms through appropriate renewable energy development as a complementary use in a manner which keeps farms in agricultural production while preserving agricultural soils."

> Take advantage of existing divisions of labor and expertise.

Successfully protecting farmland and promoting agricultural land uses within solar development policies requires knowledge of state agricultural land characteristics, as well as familiarity with agricultural soils and impact mitigation strategies. States can take advantage of the expertise of agencies of agriculture in developing and implementing criteria for solar development on agricultural land, and in project review and approval. At the local level, soil and water conservation districts, agricultural districts, and local boards may provide sources of authority and expertise.

Similarly, inserting farmland protection or land use requirements into net-metering programs or rules for grid interconnection requires the involvement of state public utility commissions, departments of energy, and energy utilities. State agencies play a variety of roles in solar siting and permitting processes, and lawmakers should consider how existing government structures can contribute to smart farmland solar policy development.

> Establish "preferred sites" for solar development, both by generic site-type and through use of GIS and parcel-specific data.

Some states are working to direct solar development away from farmland and other "greenfields" by providing an incentive or requirement for locating projects on other types of land or structures. These policies are generally not stand-alone laws but are located within and interact with each state's permitting, metering, and interconnection laws and regulations. Lawmakers and regulators should work to identify both site-types that are preferred for solar development, such as landfills, brownfields, or structures, and assist localities in identifying specific parcels of land where solar development is uncontroversial.

> Encourage "agrivoltaics," or the dual use of farmland for solar energy production co-located with active farming.

A dual use policy allows, incentivizes, or requires a solar array on farmland to exist alongside agricultural uses, so that the land is used both for energy generation

Table 3. Relevant State Agencies

PUBLIC UTILITY COMMISSIONS	State public utility commissions (also called public service commissions or boards) regulate how electric service is provided to customers, and the rates charged for electricity. They often develop regulations about how state energy goals are met, establish rules for net metered solar arrays and approve other utility tariffs for solar development. They may have a role in siting approval for new solar arrays
AGENCIES OF AGRICULTURE	State agencies of agriculture are usually responsible for making and implementing rules related to farming, farmland, forestry, and food. How each state defines categories of farmland within existing state agricultural laws may provide a basis for creating rules for solar development on different types of land.
AGENCIES OF NATURAL RESOURCES OR ENVIRONMENTAL PROTECTION	State natural resource agencies are often delegated broad authority over water and air quality, soil health, wildlife, and land management. Solar arrays may require one or more natural resource management permits addressing wetlands protection, erosion, land disturbance, and stormwater management. State natural resource agencies are also well-suited to identify alternate sites for solar development, including brownfields, landfills, superfund sites, and previously developed land.
AND OTHERS	Other state agencies, including the departments of energy and taxes, may also be active players in solar policy development and implementation.

and farming concurrently. For example, a solar array may be designed to permit animal grazing or vegetable production below or beside the solar panels. Dual use policies can also provide a basis for allowing solar installations on agricultural land enrolled in state "current use" taxation programs, without triggering tax penalties for land conversion.

> Consider both farmland protection and farmer access to clean energy within key areas of state law.

This Toolkit identifies different areas of state law into which smart farmland solar policies can be built. As lawmakers seek new ways to prohibit, restrict, condition, or promote solar development on certain agricultural lands, each of the key regulatory areas below should be considered as both independent and interrelated policies and programs.

SMART FARMLAND SOLAR POLICY CAN BE EASILY INTEGRATED INTO THE FOLLOWING AREAS OF STATE LAW:

- **Climate, Energy and Clean Electricity Goals**
- **Renewable Energy Procurement Mandates**
- **Siting, Land Use, and Energy Permitting**
- **Renewable Energy Compensation Mechanisms**
- **Distributed Generation Interconnection Rules**
- **Current Use Taxation Programs**

II. Regulatory Definitions for Solar & Farmland

Establishing legal definitions for "farmland"[21] and "solar development" can improve the clarity and specificity of regulations and create regulatory options for treating different projects differently. State laws may be designed to apply only to certain kinds or categories of farmland or solar development, and it is crucial to be purposeful about the lands or projects affected by new rules.

A. Defining Farmland in Federal, State, and Local Law

State and local governments will benefit from reviewing relevant legal definitions of farmland when establishing new solar development laws. This review should consider the interaction of new and existing regulatory categories for farmland with new and existing regulatory categories for solar development, as well with other applicable state and local laws governing land use and environmental permits.

When creating definitions, or regulatory categories for different types of farmland, lawmakers may begin with reference to federal definitions. Federal definitions of farmland can be incorporated by reference into new laws and regulations. Lawmakers can also design their own categories of important farmland based on a variety of land use characteristics, including the farmlands' acreage, income, crops grown, specific agricultural uses, or even suitability for solar development.

FEDERAL DEFINITIONS OF FARMLAND

1. Farmland Protection Policy Act

The Code of Federal Regulations (CFR) at 7 CFR § 657.5 defines several categories of important farmland in the United States under the Farmland Protection Policy Act (FPPA), including 1) prime farmland, 2) unique farmland, 3) additional farmland of statewide importance, and, 4) additional farmland of local importance.[22] FPPA is administered by the Natural Resources Conservation Service, and its purpose is to minimize federal contributions to farmland conversion and ensure federal programs are compatible with state, local, and private farmland protection programs and policies.[23] However, the FPPA definitions for farmland are often borrowed for other statutory purposes, including rules for solar development.

21 As discussed in more detail, the word "farmland" can be defined broadly or narrowly and by using a variety of farmland characteristics. States should also consider whether it is useful to define additional terms like "farm," "farmer," or "agricultural use."

22 Farmland Protection Policy Act (FPPA) (Public Law 97-98, December 22, 1981). The FPPA does not authorize the federal government to regulate the use of private or nonfederal land or affect the property rights of owners of such land.

23 *Id.*

Table 4. FEDERAL DEFINITIONS: Farmland Protection Policy Act, 7 CFR § 657.5

"PRIME FARMLAND"

"...land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for these uses (the land could be cropland, pastureland, rangeland, forest land, or other land, but not urban built-up land or water). It has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. They are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding. Examples of soils that qualify as prime farmland are Palouse silt loam, 0 to 7 percent slopes; Brookston silty clay loam, drained; and Tama silty clay loam, 0 to 5 percent slopes."

To qualify as "prime," farmland must also meet specific criteria relating to soil moisture and irrigation, soil temperature, pH, flooding, erosion, and permeability, as set out in 7 CFR § 657.5(a)(2).

Note: This definition does not necessarily include all land that is currently being farmed; rather, it identifies productive soils that are suitable to be farmed.

"UNIQUE FARMLAND"

"...land other than prime farmland that is used to produce specific high value food and fiber crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality and/or high yields of a specific crop when treated and managed according to acceptable farming methods. Examples of such crops are citrus, tree nuts, olives, cranberries, fruit, and vegetables." 7 CFR § 657.5(b)(1).

The definition further requires the land have "a moisture supply that is adequate for the specific crop," and a "combination of favorable factors" that "favor the growth of a specific food or fiber crop." 7 CFR § 657.5(b)(2).

Note: This category focuses on the land's productivity and economic potential, capturing farmland that might escape regulatory attention under the soil quality characteristics analyzed in the "prime" definition.

"ADDITIONAL FARMLAND OF STATEWIDE IMPORTANCE"

"...those that are nearly prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. Some may produce as high a yield as prime farmlands if conditions are favorable. In some States, additional farmlands of statewide importance may include tracts of land that have been designated for agriculture by State law." 7 CFR § 657.5(c). It up to relevant state agencies to develop "criteria for defining and delineating this land."

Note: When "additional farmland of statewide importance" is defined, that land is treated as important farmland under the federal definition.

"ADDITIONAL FARMLAND OF LOCAL IMPORTANCE"

"In some local areas there is concern for certain additional farmlands for the production of food, feed, fiber, forage, and oilseed crops, even though these lands are not identified as having national or statewide importance." 7 CFR § 657.5(d).

Note: Like the state-identified farmland, identification of locally-important farmland is left up to relevant local agencies and ordinances.

2. The Census of Agriculture

The Census of Agriculture collects data on all farmland and active farms in the United States, and the United States Department of Agriculture's Economic Research Service has developed extensive definitions in pursuit of accurate data collection. The categories of "land in farms" and "other farmland" may be useful to policymakers attempting to target certain types of farmland for solar development restrictions or incentives, respectively.

STATE DEFINITIONS OF FARMLAND

Lawmakers may choose to incorporate federal definitions of farmland by reference, or may define one or several meanings for the words "farm," "farmer," "farmland," "agriculture," "agricultural use," or "land in agricultural production to serve different purposes in different laws and regulations. Definitions may be based on a list of crops or specific agricultural uses, the suitability of certain lands for farming, or on the farm's acreage or income generated from farm products.

Table 5. FEDERAL DEFINITIONS: USDA, Economic Research Service

"LAND IN FARMS"

"The acreage designated as ''land in farms'' consists primarily of agricultural land used for crops, pasture, or grazing. It also includes woodland and wasteland not actually under cultivation or used for pasture or grazing, provided it was part of the farm producer's total operation. Large acreages of woodland or wasteland held for nonagricultural purposes were deleted from individual reports during the edit process. Land in farms includes CRP, WRP, FWP, and CREP acres. Land in farms is an operating unit concept and includes land owned and operated as well as land rented from others. Land used rent free was reported as land rented from others. All grazing land, except land used under government permits on a per-head basis, was included as ''land in farms'' provided it was part of a farm or ranch. Land under the exclusive use of a grazing association was reported by the grazing association and included as land in farms. All land in American Indian reservations used for growing crops, grazing livestock, or with the potential of grazing livestock was included as land in farms. Land in reservations not reported by reservation, individual American Indians, or non-Native Americans was reported in the name of the cooperative group that used the land. In a few instances, an entire American Indian reservation was reported as one farm."

"OTHER LAND"

"This category includes land in house lots, barn lots, ponds, roads, ditches, wasteland, etc. It includes those acres in the farm operation not classified as cropland, pastureland, or woodland."

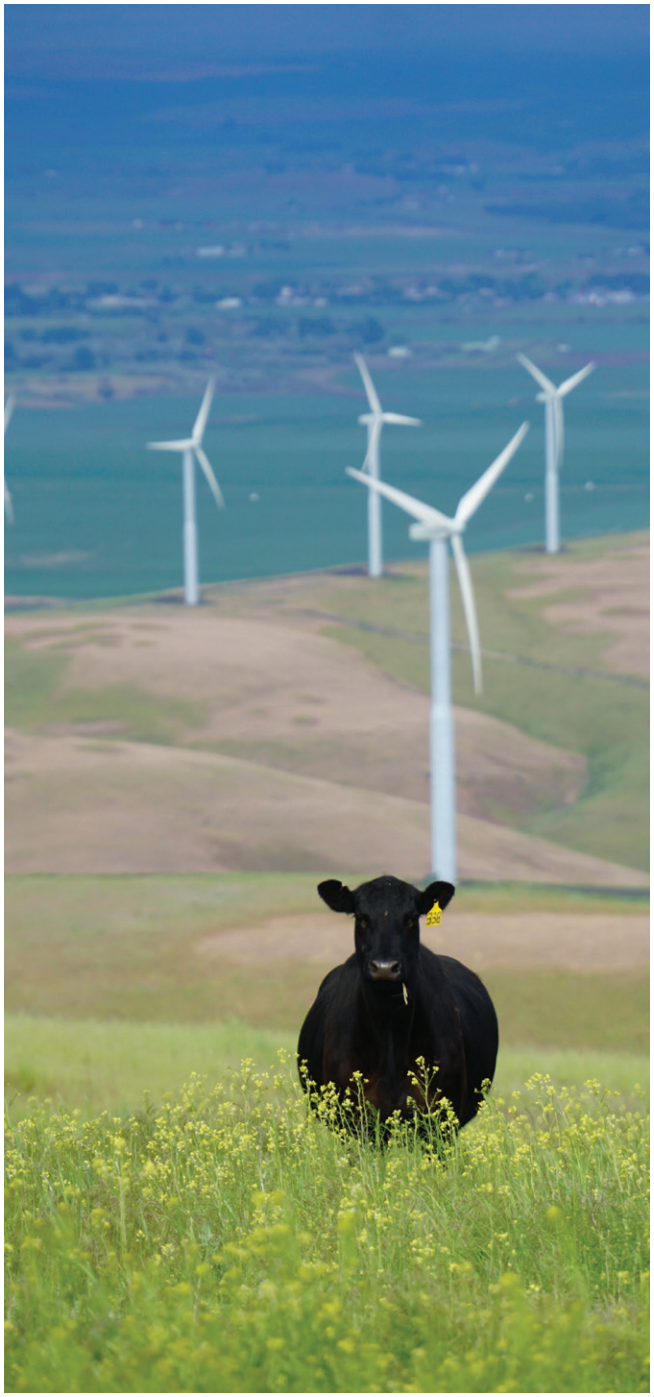

Table 6. COMPARE: Variety of State Definitions for Agricultural Use

LIST OF CROPS **Delaware** **Del. Code Ann. tit. 9 § 8330 (2019)**	"Land shall be deemed to be in agricultural use when devoted to the production for sale of plants and animals useful to man, including but not limited to: forages and sod crops; grains and feed crops; dairy animals and dairy products; poultry and poultry products; livestock, including beef cattle, sheep, swine, horses, ponies, mules or goats, including the breeding and grazing of any or all of such animals; bees and apiary products; fur animals; trees and forest products; or when devoted to and meeting the requirements and qualifications for payments or other compensation pursuant to a soil conservation program under an agreement with an agency of the federal government."
SUITABILITY FOR FARMING **Florida** **Fla. Stat. § 193.461 (2019)**	"In determining whether the use of the land for agricultural purposes is bona fide, the following factors may be taken into consideration: a. The length of time the land has been so used. b. Whether the use has been continuous. c. The purchase price paid. d. Size, as it relates to specific agricultural use, but a minimum acreage may not be required for agricultural assessment. e. Whether an indicated effort has been made to care sufficiently and adequately for the land in accordance with accepted commercial agricultural practices, including, without limitation, fertilizing, liming, tilling, mowing, reforesting, and other accepted agricultural practices. f. Whether the land is under lease and, if so, the effective length, terms, and conditions of the lease. g. Such other factors as may become applicable."
ACREAGE OR INCOME **New York** **N.Y Agric. & Mkts. Law § 301 (Consol. 2019).**	"Land used in agricultural production" means not less than seven acres of land used as a single operation in the preceding two years for the production for sale of crops, livestock or livestock products of an average gross sales value of ten thousand dollars or more; or, not less than seven acres of land used in the preceding two years to support a commercial horse boarding operation or a commercial equine operation with annual gross receipts of ten thousand dollars or more. Land used in agricultural production shall not include land or portions thereof used for processing or retail merchandising of such crops, livestock or livestock products. Land used in agricultural production shall also include: [omitted]"

ENERGY-SPECIFIC DEFINITIONS OF FARMLAND AND AGRICULTURAL USE

Lawmakers can also define types of farmland or agricultural uses within the chapter or title of state code applicable to public utilities, or within specific rate incentive programs. This provides clarity regarding definitions of farmland or agriculture within the energy development context.

B. Defining Solar Development

States often regulate solar development by defining categories of solar projects that are treated differently. Categories based on specific characteristics of a solar array are useful for drawing boundaries around solar development regardless of where in state or local law solar policies are found or which entity is charged with their implementation. Regulatory categories can help incentivize solar arrays that are low-impact, uncontroversial, and clearly in the public interest, while ensuring oversight of projects that may lead to the loss of important farmland and other natural resources, or significant community conflict.

Regulatory categories for solar systems across states can seem somewhat arbitrary, as states and utilities vary remarkably in their categorization of solar arrays as "small-scale" or "utility-scale," as well as "residential," "commercial," or "industrial." These terms do not have consistent definitions in law or policy across states and depend in part on whether an array is set up "behind the meter."[24] Fundamentally, policy-makers should consider creating regulatory categories for solar development based on the proposed the array's size, location, or design.

Table 7. COMPARE: Definitions of Agriculture Specific to Energy Regulation

VERMONT **30 V.S.A. § 248(F) (2019)**	Refers to the agency of agriculture's soil definition in the criteria for obtaining a certificate of public good: "(i) In any proceeding regarding an electric generation facility that will have a capacity greater than 500 kilowatts and will be sited on a tract containing primary agricultural soils as defined in 10 V.S.A. § 6001, the Agency shall appear as a party and provide evidence and recommendations concerning any findings to be made under subdivision (b)(5) of this section on those soils, and may provide evidence and recommendations concerning any other matters to be determined by the Commission in such a proceeding. (emphasis added)."
HAWAII **HI Rev. Stat. § 269-1 (2010 through Reg. Sess.)**	Defines "agricultural activities" within the general definitions section applicable to the Public Utilities Commission: "'Agricultural activities' means a commercial agricultural, silvicultural, or aquacultural facility or pursuit conducted, in whole or in part, including the care and production of livestock and livestock products, poultry and poultry products, apiary products, and plant and animal production for nonfood uses; the planting, cultivating, harvesting, and processing of crops; and the farming or ranching of any plant or animal species in a controlled salt, brackish, or freshwater environment."
CALIFORNIA **Cal. Pub. Util. Code § 744 (2017)**	Specially defines "agricultural producers" as eligible for time-of-use rate incentives for off-peak electricity use: "As used in this section, "agricultural producer" means any person or corporation whose principal purpose is the agrarian production of food or fiber."

24 "Behind-the-meter" resources traditionally exist "behind" the customer's electric meter, such as on-site solar panels associated with a specific electric customer. Because of advances in technology and the ability to "virtually" net meter electricity, these resources may not literally be connected behind the customer's meter, but are still counted as a reduction in load versus additional generation contributed to the electric grid. Jacob Marsh, *Behind-the-meter: What you Need to Know*, Energy Sage, September 12, 2019, https://news.energysage.com/behind-the-meter-overview/.

REGULATORY CATEGORIES BASED ON SOLAR ARRAY SIZE

State and local laws can categorize solar projects by size using characteristics like the capacity of the array, its land use footprint, or an electric load associated with the array, all of which can loosely define the "size" of a given solar project. Size-based restrictions are the most common regulatory strategy used in state solar development laws. The overall size of an array may affect nearly every aspect of project development including its land use impacts, aesthetic significance, effect on electric reliability, permitting requirements, and interconnection costs, as well as its economic potential.

Regulatory categories based on array "size" allow states and localities to offer a fast-track permitting process, lower fees, or higher rates for smaller arrays and those associated with specific electric loads, and to require additional oversight of large-scale solar development. The questions of "how small?" and "how large?" are a matter of local decision-making and have no single correct answer. Regulations based on array capacity, land use footprint, or associated electric load are relatively simple and blunt policy instruments. They draw bright lines useful for establishing basic program eligibility or the imposition of relaxed or special compliance obligations in law. They also come with a relatively low administrative burden and give regulators a simple yes-or-no answer for many development applications.

1. Array Capacity

Regulatory categories based on array capacity are the most common policy design states use to treat solar projects differently. The capacity of a solar array refers to how much power or electricity it can be expected to generate.[25] Generally, solar panels are classified by their rated output power, defined in watts. This rating is the amount of power that a single solar panel could produce in one peak hour of sunlight. A solar array consists of multiple panels put together. The installed capacity of a solar array is the wattage rating of the individual panels in the array added together, usually expressed in kilowatts.

The installed capacity of a solar array, or "nameplate capacity," represents the maximum amount of power the array could generate.[26] In reality, solar arrays only generate electricity when the sun is shining and they are free from obstruction. The capacity factor of solar compares its nameplate capacity to its actual net generation of electricity and may range from approximately 10-20%.[27] Array capacity is often used to limit the size of qualifying projects in net-metering programs, which may also include a cap on total program capacity.

2. Land Use Footprint

A solar array's land use footprint measures the acreage of land underlying the array and provides another easy way to identify projects within laws and regulations. Higher capacity arrays are likely to have a larger land use footprint. However, this generalization may be misleading as to some agrivoltaic projects. The land use footprint of smaller capacity arrays is likely to increase when designed to accommodate agricultural land uses.[28] Regulating solar arrays based on acreage may be useful when total acreage is a concern. Limitations on an array's land use footprint can also be tied to the total parcel size, restricting solar to a certain percentage of the total land area.

3. Associated Electric Load

Regulations may require solar arrays to be sized to meet the needs of a specific electric load, like an on-site or other identified business, residence, or farm. The allowed capacity might be calculated using the average electric load over a prior time period. While renewable energy resources in general are desperately needed and under-developed in the United States, putting too many distributed energy resources in one place can overload the electric grid without careful planning. Using a specific electric load as a regulatory limit on solar development allows beneficial solar arrays to be

25 A solar array's panel capacity "is often reported in direct current (DC), while operating capacity in the United States is reported as it is delivered to the grid in alternating current (AC). For economic and engineering reasons, capacity values reported in DC typically are 10% to 30% higher than those reported in AC capacity. This ratio is often referred to as the inverter loading ratio (ILR)." Energy Information Administration, *Solar plants usually install more panel capacity relative to their inverter capacity,* Mar. 16, 2018 (https://www.eia.gov/todayinenergy/detail.php?id=35372).

26 *Id.*

27 *Id.*

28 Sean Ong at el., National Renewable Energy Laboratory, *Land-Use Requirements for Solar Power Plants in the United States,* June 2013 (https://www.nrel.gov/docs/fy13osti/56290.pdf).

matched more closely with the needs of the electric grid and can reduce over-sized net-metered arrays.

4. Customer type

Solar policies may distinguish between arrays serving residential, commercial, or industrial customers. While any individual customer may differ from the average, these categories are loosely aligned with project size. In 2015, the average U.S. residential system was five kW, while the average commercial system was two-hundred kW in capacity.[29]

Regulations based on customer type identify the end-use entity consuming the electricity and how that end user is classified in a utilities' established electric rate structures for different customer classes. Regulatory categories based on customer type can align new renewable energy development rules with existing utility practices. They may be particularly useful when a utility is delegated the task of designing and implementing a net metering program.

5. Agricultural User

Some states put solar projects into a special regulatory category when the electricity will be used by a farm or other agricultural consumer. Solar arrays that meet a farm's on-site electricity needs should be encouraged so that agricultural landowners can benefit from renewable energy.

REGULATORY CATEGORIES BASED ON SOLAR ARRAY "PREFERRED SITES"

Lawmakers can categorize solar projects based on their proposed location to steer development toward or away from certain lands, or to require that projects in sensitive locations meet protective conditions for array construction and operation. Some states are working to direct solar development away from farmland and other greenfields by providing an incentive or requirement for locating projects on "preferred sites," such as roofs, landfills, carports and other alternative structures.

Table 8. COMPARE: Rhode Island's Varied Regulatory Categories for Solar[30]

Rhode Island defines a variety of regulatory categories for solar development across its renewable energy policies depending on the purpose of regulation.

Array Capacity	For residential customers and small-scale solar projects, the Renewable Energy Growth tariff applies to projects ≤ 25 kW. The Small Scale Tariff offers fixed rates for shared solar projects
Land Use Footprint	Allows solar on farmland enrolled in current use taxation when energy is sited on up to 20% of the acreage of the farm, and further allows farmers to site dual use projects on the total farmland acreage.
Customer type	Separate tariffs are established for medium and commercial scale solar, using competitive bidding under a ceiling price.
Farm User	All buildings associated with farms are eligible for net-metering credits if they meet basic "farm building" criteria.

29 Fred Mayes, U.S. EIA, *Today in Energy, More than Half of Small-scale Photovoltaic Generation comes from Residential Rooftops,* June 1, 2017 (https://www.eia.gov/todayinenergy/detail.php?id=31452).

30 RI Gen Laws §§ 44-27-10.1(a), 39-26.4-2(8), and 39-26.4-3(a)(1)(ii).

States and local governments will benefit from creating lists of "preferred sites" and "ineligible locations" for solar development that can be integrated into solar policy via siting and permitting processes and rate mechanisms. States and local governments may desire to create lists of lands falling into a variety of categories (preferred sites, eligible but not preferred, ineligible) to meet their own purposes. The advantages of creating a preferred siting policy include conservation of farmland and other greenfields, lowering of development costs by using existing infrastructure, incentivizing remediation of previously developed properties and brownfields, supporting the grid by siting solar arrays close to electric load, and increased community consensus that eases project development. Common preferred and ineligible locations for solar development are discussed below.

1. Roofs

Creating a regulatory category for roof-mounted solar arrays is low-hanging fruit for farmland solar policy. Lawmakers can make it easier for consumers to mount solar on their homes and businesses by easing land use and energy permitting requirements for roof-mounted arrays. By creating "fast-track" approval processes, lawmakers can expedite clean energy deployment while reducing development costs for solar projects sited on roofs and existing structures. These projects are usually in the public interest, and every kilowatt of solar energy placed on a roof relieves pressure on farmland, open space, and other natural resources. One of the benefits of solar energy is that it can be integrated into existing infrastructure to convert unused space to energy production. A 2018 study found eight-billion square meters of roof space in the U.S. suitable for solar development.[31]

2. Carports and Canopies

Solar canopies and solar carports describe an alternative to roof-mounted solar in which panels are not mounted on a pre-existing structure or roof, but rather are located on a new overhead canopy built to hold the arrays without interfering with the underlying land. Parking lots make up almost seven percent of urban footprint within cities. Of that, only one percent of available parking spaces are affected by shading from surrounding obstructions.[32] Coupling electric car charging stations with parking lot solar supports beneficial electrification goals by encouraging the switch to electric vehicles and increasing their convenience.[33] Further, canopy solar is a particularly useful option for building solar arrays over open space and agricultural land in ways that allow for dual land uses.

3. Landfills and Brownfields

Several states are incentivizing development of solar on closed brownfields, landfills and superfund sites. Since most landfills and previously contaminated sites remain empty and undeveloped for years, solar presents an opportunity to revitalize land and bring value to local communities surrounding these sites. Solar siting on closed landfills is occurring in diverse states, including Massachusetts, California, New York, New Jersey, Maryland, and Michigan.[34]

There are an estimated 10,000 closed landfills in the U.S., presenting thousands of acres of property with the potential for solar development.[35] Of course, landfill and brownfield sites are likely subject to a number of regulatory requirements before solar development is possible. Some landfills are subject to a five-year review process by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).[36] In addition, local or state post-closure permits may be required. Establishing financial incentives for solar projects on these sites can help defray the higher cost of project development.

31 Pieter Gagnon et al., *Rooftop Solar Photovoltaic Technical Potential in the United States: A Detailed Assessment,* Jan. 2016 (https://www.nrel.gov/docs/fy16osti/65298.pdf.)

32 Abdulsalam Alghamdi, et. al. *Assessment of Large-Scale Photovoltaic Power Generation from Carport Canopies,* Energies, May 13, 2017, at 1.

33 *Id.* at 2.

34 Cody Boteler, *Are capped landfills and solar panels a natural match?,* Waste Dive, Dec. 5, 2017 (https://www.wastedive.com/news/capped-landfills-solar-panels-energy/512115/).

35 Gabriel Sampson, *Solar Power Installation on Closed Landfills: Technical and Regulatory Considerations,* Sept. 2009 (https://clu-in.org/download/studentpapers/Solar-Power-Installations-on-Closed-Landfills-Sampson.pdf).

36 *Id.*

37 Kerry Thoubboron, Energy Sage, *Floating Solar: What you Need to Know,* Nov. 17, 2018 (https://news.energysage.com/floating-solar-what-you-need-to-know/)

4. Bodies of Water

Floating solar involves mounting panels onto rigid pontoon structures that can withstand harsh conditions on open water.[37] This idea not only saves space on land, but also reduces water evaporation from reservoirs and may increase solar efficiency.[38] As of 2017, there were over one-hundred floating solar projects around the world, with only seven located in the United States.[39] The National Renewable Energy Laboratory estimates that if floating solar were installed on bodies of water throughout the United States, as much as two million hectares of land could be saved, while meeting ten percent of the United States' electricity needs.[40]

5. Sites Designated through Municipal, Regional,or State Planning Processes

Some states and local governments establish a process through which sites not already included on a regulatory list of "preferred sites" may be added to the list and receive the same regulatory benefits. For example, Vermont's Act 174 requires local and regional planning commissions to complete energy planning and provides incentives to solar sited in locations designated in "duly adopted" municipal plans.[41] Further, specific projects may gain "preferred site" status by obtaining joint letters of support from a municipality and relevant municipal and regional planning commissions.

6.Ineligible Locations for Solar Development

In addition to identifying specific sites or site-types that states or localities prefer for solar development, lawmakers may find it useful to identify sites that are ineligible for solar development. Ineligible sites might include identified greenfields, prime farmland, land subject to conservation in perpetuity, historic sites, or other protected lands. Policy makers are encouraged to use restrictions on sensitive lands, and only establish prohibitions on solar where absolutely necessary, so as to avoid excluding residents from the benefits of clean energy.

38 Kim Trapani & Miguel Redón-Santafé, *A review of floating photovoltaic installations: 2007-2013,* Progress in Photovoltaics, at 524-532 (https://riunet.upv.es/bitstream/handle/10251/80704/FLOAT_REVIEW.pdf).

39 *Id.*

40 Robert S. Spencer, et al, *Floating Photovoltaic Systems: Assessing the Technical Potential of Photovoltaic Systems on Man-Made Water Bodies in the Continental United States,* Environmental Science & Technology 2019 53 (3), at 1680-1689 (https://pubs.acs.org/doi/abs/10.1021/acs.est.8b04735).

REGULATORY CATEGORIES BASED ON SOLAR ARRAY DESIGN

Lawmakers can regulate solar projects based on their proposed design or create specific design standards for array construction and operation. Deciding on design standards for new solar installations is "higher-level" policy creation, likely to occur after states have put basic size and location regulations in place. Policymakers should consider the regulation of array design as a tool in writing comprehensive farmland solar policy. States can regulate the design of solar arrays by establishing voluntary or mandatory design requirements for new installations, requiring that arrays are able to meet outcome-based standards, or by creating a process to develop array-specific or site-specific design requirements or performance standards.

Agrivoltaics and Dual Use Arrays

An "agrivoltaic" or "dual use" policy allows, incentivizes, or requires a solar array on farmland to exist alongside agricultural uses, so that the land is used both for energy generation and farming concurrently. For example, a solar array may be designed to permit animal grazing or vegetable production below or beside the solar panels. Layering land uses can be both efficient and profitable for an agricultural landowner, as well as good development policy. Lawmakers should consider a dual use policy to allow solar siting on agricultural land enrolled in state current use taxation programs, without triggering tax penalties for land conversion (see Section VII of this report). Dual use of land for both agriculture and solar energy may also be referred to as "multiple use" or "colocation."

Agrivoltaic systems have increased in popularity as farmers and large-scale industries try to maximize use of their land and find that solar can complement crop production or livestock grazing without overly compromising the efficiency of either land use. However, agrivoltaic systems do require compromise. It is not as simple as putting out panels and letting livestock or machinery work without

41 Vermont established a process for municipal and regional energy planning under Act 174. Once energy plans are developed through this process, sites identified by in the municipal plan are considered "preferred sites." See, VT Energy Planning Standards.

42 Adeh, E.H., Good, S.P., Calaf, M. et al., *Solar PV Power Potential is Greatest Over Croplands. Sci .Rep . 9,* 11442 (2019). (https://doi.org/10.1038/s41598-019-47803-3)

adjustment. The solar array usually must be raised at least four meters to allow space for farm machinery to safely maneuver under it compared to two meters for grazing cattle.[42] While some land area is lost to the solar array, successful systems have managed only a 10% loss of space, and the benefits realized from electricity generation support both farm viability and sustainability.[43]

Incentives for dual use or agrivoltaic projects may be structured within rates paid for energy under state net-metering or feed-in tariffs, or may be stand-alone incentives. States may also develop voluntary standards that result in solar project certification as "pollinator friendly" or "agriculture friendly." States can define a specific set of agricultural dual use practices, like sheep grazing or crop production, that are eligible for incentive programs, or they can establish flexible design standards for project qualification, like incentivizing solar arrays that achieve less than 50% shading of the underlying land.

States can use a variety of different policy types to condition the approval of agrivoltaics. For example, the Massachusetts SMART tariff establishes an "Agricultural Solar Tariff Generation Unit," or ASTGU, which receives a six-cent rate adder for solar arrays designed to coexist with agricultural production. To qualify as an AGSTU, project applicants must submit documentation about the underlying agricultural land and characteristics of the proposed solar array, including the dual-use system type (ground-mounted racking, pole towers, tracking, etc.), the total gross acres of open farmland to be integrated with the project, the type of crops to be grown and harvested, animals to be grazed with herd sizes, and design drawings. The SMART tariff AGSTU regulations include a mix of narrative standards, mandatory design parameters and performance standards, and

Table 9. EXAMPLE: Voluntary Performance Standards for Dual Use Arrays

POLICY TYPE	DESCRIPTION	VERMONT, 6 V.S.A. §§ 5101-5102 (2017).
Voluntary performance standards	Voluntary standards can incentivize performance by creating a marketable project certification.	Vermont created a voluntary standard for establishing pollinator-friendly habitat on solar sites. To be labeled "pollinator friendly," solar installers must complete and abide by a "solar site pollinator scorecard."[44] Sites can either be built to the voluntary standards or retrofitted after construction.

43 *Id.*

44 University of Vermont, Pollinator Solar Scorecard Form, https://www.uvm.edu/sites/default/files/Agriculture/Pollinator_Solar_Scorecard_FORM.pdf (Accessed: Feb. 7, 2020).

Table 10. COMPARE: Performance Standards and Design Requirements for Dual Use Arrays found in the Massachusetts SMART Program [45]

Narrative Standards Narrative standards describe the purpose or outcome intended by a regulation without mandating the method of achieving the standard.	• "The solar array must not interfere with the continued use of the land beneath the canopy for agricultural purposes; • The solar array must be designed to optimize a balance between the generation of electricity and the agricultural productive capacity of the soils beneath; and, • The solar array must be a raised structure allowing for continuous growth of crops underneath the solar photovoltaic modules, with height enough for labor and/or machinery as it relates to tilling, cultivating, soil amendments, harvesting, etc. and grazing animals."
Performance standards Mandatory performance standards may require a specific process or construction technique for solar development projects.	Specific Performance Standards for [qualifying solar arrays] Sited on Farmland: • "No removal of all field soils; • Existing leveled field areas left as is without disturbance; • Where soils need to be leveled and smoothed, such as filling potholes or leveling, this shall be done with minimal overall impact with all displaced soils returned to the areas affected; • Ballasts, screw-type, or post driven pilings and other acceptable minimal soil impact methods that do not require footings or other permanent penetration of soils for mounting are required, unless the need for such can be demonstrated; • Any soil penetrations that may be required for providing system foundations necessary for additional structural loading or for providing system trenching necessary for electrical routing shall be done with minimal soils disturbance, with any displaced soils to be temporary and recovered and returned after penetration and trenching work is completed; • No concrete or asphalt in the mounting area other than ballasts or other code required surfaces, such as transformer or electric gear pads; • Address existing soil and water resource concerns that may be impacted to ensure the installation does not disturb an existing soil and water conservation plan or to avoid creating a negative impact to soil and water conservation best management practices, such as stimulating erosion or water run-off conditions; • Limit use of geotextile fabrics; and maintain vegetative cover to prevent soil erosion." CONTINUED ON NEXT PAGE >

45 See, Massachusetts' administrative regulations and guidances: 225 CMR 20 (SMART), Agricultural Solar Tariff Generation Unit Guideline and Agricultural STGU Pre-Determination Letter Form.

Table 10. COMPARE: Performance Standards and Design Requirements for Dual Use Arrays found in the Massachusetts SMART Program [45] CONTINUED

Design Parameters Solar policies can mandate extremely specific design parameters for new solar installations, but policymakers should consider leaving room for site-specific adjustments.	• "Panel Height Requirements. For fixed tilt ASTGUs, the minimum height of the lowest panel point shall be eight (8) feet above ground. For tracking ASTGUs, the minimum height of the panel at its horizontal position shall be 10 feet above ground; • Maximum Direct Sunlight Reduction Requirements. All ASTGUs must demonstrate that the maximum sunlight reduction from the panel shading on every square foot of land directly beneath, behind and in the areas adjacent to and within the ASTGU's design shall not be more than 50% of baseline field conditions; • Growing Season/Time of Day Considerations. The typical growing season shall be considered to be March through October, with sunlight hour conditions with maximum 50% sunlight reduction to be between 10AM and 5PM for March and October, and from 9AM to 6PM from April through September; • Maximum Size. The maximum AC rated capacity of an ASTGU shall be two MW in the first two Capacity Blocks of each Distribution Company's service territory. The Department, in consultation with MDAR, will make an evaluation as to whether or not this provision shall be adjusted in subsequent Capacity Blocks."
Site-specific Analysis Solar policies can require or allow site-specific consultations, analyses, or conditions for solar project development.	"To qualify as an Agricultural Solar Tariff Generation Unit, project applicants must submit documentation about the underlying agricultural land and characteristics of the proposed solar array, including the dual-use system type (ground-mounted racking, pole towers, tracking, etc.), the total gross acres of open farmland to be integrated with the project, the type of crops to be grown and harvested, animals to be grazed with herd sizes, and design drawings." In addition, applicants must, in consultation with UMass Amherst agricultural extension services, document the crops to be grown and compatibility with the design of the agricultural solar system, and provide detailed reports annually to the Department of Energy Resources and the Department of Agricultural Resources regarding the productivity of the crops and herds after project implementation and throughout the SMART incentive period.

45 See, Massachusetts' administrative regulations and guidances: 225 CMR 20 (SMART), Agricultural Solar Tariff Generation Unit Guideline and Agricultural STGU Pre-Determination Letter Form.

site-specific requirements. Table 10 compares the requirements found in the Massachusetts SMART tariff for dual use arrays qualifying for the special six-cent rate adder.

C. Using Regulatory Categories in Smart Farmland Solar Policy

> Improve Clarity of Law and Policy.

States and local governments are seeking new ways to regulate solar development on certain agricultural lands. In specific cases, solar installations on farmland might be prohibited, restricted, subject to certain conditions, or even promoted and incentivized.

Carefully crafted legal and regulatory definitions for different types of farmland and agricultural land uses can streamline regulators' implementation of solar development laws. Regulatory categories for farmland, agricultural use, and solar development can be established by referencing existing definitions within state and municipal policy, or by creating new definitions for inclusion in solar development laws. Defining the land subject to regulation is crucial to creating clear and effective policy.

> Improve Flexibility of Law and Policy.

Establishing smart regulatory categories allows different types of farmland to be regulated differently, allowing farmers and agricultural landowners to benefit from solar development, while protecting prime and productive farmlands– both of which support important climate and energy goals. Regulatory categories can also be used to ensure additional oversight of solar arrays likely to have adverse impacts or proposed for sensitive lands.

> Promote both farmland protection and farmer access to clean energy.

- Distinguish between prime farmland, land in agricultural use, and marginal or "other" farmland in creating solar siting policy.
- Adopt different criteria for reviewing and permitting solar projects located on primary agricultural soils, land in agricultural use, and marginal farmland.
- Require applicants to submit information about potential impacts of a solar development project on farmland or existing agricultural uses.
- Require solar installations to meet specific performance standards if located on prime or important farmland.
- Require agency or third-party certification of farmland impacts or compliance with farmland protection criteria for projects in designated locations.
- Incentivize solar arrays located on marginal land or unproductive portions of established farms.
- Increase rates paid for energy from solar arrays located on marginal land or unproductive portions of established farms.
- Increase rates paid tor energy from solar arrays located on "preferred sites."
- Incentivize solar arrays sited on farmland that primarily benefit the farm, rather than other off-site entities.

> Promote Agrivoltaics and Dual Use Solar.

State and local policymakers should consider the following strategies to increase the number of solar arrays specifically designed to allow for dual land uses or a minimal impact on agriculture. Many of these strategies are described in more detail in later sections of this Toolkit.

- Create voluntary dual use standards or recommendations.
- Certify dual use projects as pollinator, agriculture, or farmland friendly.
- Engage agencies of agriculture to develop evidence-based criteria for dual use qualification.
- Establish narrative and specific performance standards for dual use projects.

- Provide rate-based incentives for dual use arrays.
- Enable farmland enrolled in current use taxation programs to install dual use solar arrays.
- Require monitoring and reporting of agricultural uses under and around solar arrays.

46 While all of the variations are not discussed here, state RPS program designs vary as to: energy versus capacity obligations; single-tier or multi-tier credit determinations; the duration of purchase obligations; incentives or requirements for resource diversity; whether all default service providers must participate; geographic eligibility for credits; whether credits can be earned only by new renewable generation units or also by pre-existing units; definitions of new or incremental generation; categorization of multi-fuel facilities; categorization of off-grid resources; and whether distributed generation on customer sides of meters is eligible. *Resource portfolio requirements,* 2 L. of Indep. Power § 10:115 (2020).

47 RPS policies may also be called Renewable Energy, Alternative Energy, or Clean Energy Standards, and, may include additional mandates for reducing energy consumption from fossil fuel sources or for transitioning other energy uses, like heat, toward carbon-free, low-carbon, or renewable energy sources. This analysis focuses on state laws that require retail suppliers of electricity to source increasing quantities of renewable electricity.

48 Many states have "unbundled" the electricity-supply functions of electric utility service from the distribution services in a process called restructuring. Distribution utilities may have divested any ownership of generating facilities, leaving the production of power to competitive suppliers. State utilities retain the "regulated natural monopoly of distribution." Lazar, J. (2016). *Electricity Regulation in the US: A Guide,* p.9. Second Edition. Montpelier, VT: The Regulatory Assistance Project (http://www.raponline.org/knowledge-center/electricityregulation-in-the-us-a-guide-2).

III. Clean Electricity Goals

States are committing to ambitious climate and energy goals. Renewable portfolio standards and other state laws that mandate the procurement of new renewable energy affect the quantity and characteristics solar sited on farmland. Land use restrictions and siting incentives can be built into state climate and energy goals to protect farmland and agricultural uses.

A. Understanding State Climate and Energy Goals

In the United States today, climate policy is virtually non-existent at the federal level. To fill this gap, many states have implemented their own goals and mandates regarding climate change, renewable energy consumption, energy efficiency, greenhouse gas emissions, and de-carbonization. This report focuses on state renewable portfolio standards, procurement mandates, and energy planning.

Renewable Portfolio Standards

State renewable portfolio standards (RPS) mandate the increased production of renewable energy by requiring retail suppliers of electricity (your local electric utility) to obtain a specific percent of their supply of electricity from renewable sources by an identified year. RPS policies incrementally increase targets for renewable electricity. For example, an RPS might require utilities to increase total renewable electricity consumption by 3% each year for the next 15 years, resulting in renewable energy constituting 45% of the utility's "portfolio" of electricity sold to customers. The specific goals, qualifying resources, and compliance requirements vary[46] from state to state.[47]

- States may set a total goal, like "100% renewable electricity by 2045," or may establish "classes" or "tiers" within their total goal for preferred energy sources.
- Classes or tiers might create different mandates for different renewable sources or for electricity generated by new sources versus existing sources of electricity.
- Electric utilities comply with RPS requirements by developing renewable generation (where permitted),[48] purchasing power from other renewable generators, or buying Renewable Energy Certificates.
- Some states may include "REC multipliers" for solar or other preferred energy characteristics.

Measuring RPS Compliance

Electric utilities (retail suppliers of electricity) are in charge of obtaining escalating percentages of energy from renewable sources. They comply with an RPS mandate by owning Renewable Energy Certificates (RECs) equal to the required percentage of renewable electricity procurement each year. The utility may obtain required RECs by generating renewable energy (and the associated RECs) or by purchasing RECs generated by others. Purchasing RECs allows utilities to comply with RPS policies flexibly without needing to build or own the renewable generation infrastructure.

The state public service or public utility commission usually administers RPS implementation and may be required to publish an annual report showing how utilities met the RPS mandate, though state reports vary in the level of detail included.[49]

49 Most RPS Annual Compliance Reports can be accessed through the Clean Energy States Alliance website: https://www.cesa.org/projects/renewable-portfolio-standards/state-rps-annual-reports-and-compliance-reports/

Renewable Energy Certificates (RECs)

RECs are digital certificates that represent the "environmental attributes" of electricity generated from renewable sources.[50] Every time one megawatt-hour of electricity is generated by a certified renewable source, two products are created:

1. the electricity, which generally flows to the grid, and

2. the benefits, or "environmental attributes," of that one megawatt-hour of renewable energy.

RECs represent the second product, and may be bought, sold, or traded, serving as a currency for environmental trading and investment incentives like RPS policies. RECs can be sold separately, or "unbundled," from the associated electricity, and only the REC owner may legally claim that their energy is renewable. When a REC is used to comply with a regulatory requirement or make public claims about renewability, it is "retired" and may not be reused or resold. The market value of a REC differs based on how many state RPS obligations it satisfies, the source of renewable energy it represents, and the age, or "vintage," of the facility generating the REC.[51]

RECs have different shelf lives for RPS compliance, and must be used before they "expire" for compliance purposes, often a few years after creation.[52] In some cases where RECs have shorter life spans, they can be banked from one year to the next to meet a certain percentage of the next year's annual requirement.[53] The percentage of RECs that may be banked for use in the future and for how long differs by state program. In addition to providing flexibility for utilities in complying with RPS obligations, RECs help to "catalyze renewable energy generation development by monetizing the environmental benefits inherent in such generation."[54] RECs provide an additional revenue stream for renewable energy developers and can help with financing renewable energy projects.[55]

Tracking and Trading RECs

There is no mandatory federal system for tracking generation or exchange of RECs, but several regional authorities have been developed to track the attributes of all the electricity contributed to the grid from all fuel sources, not just renewable generators. The regional authority issues a digital certificate recording the emissions profile, fuel source, and other attributes associated with each megawatt-hour of generation and manages the accounting of RECs used for compliance obligations or voluntary commitments. Certificates are called RECs when they are issued to a renewable generator. Electric utilities use the system's certificates to report their compliance with RPS and other fuel disclosure requirements set by states. Policymakers define required REC attributes, like project capacity size, vintage, and energy source, for each class or tier of energy established through the RPS.

The regional tracking authorities all define one REC to represent the attributes of one megawatt-hour of energy, and the tracked attributes are very similar. These tracking systems list the state RPS programs and detail the specific tiers or classes for which each registered energy generator's RECs may be eligible.[56] Tracking systems that serve a single state's RPS program may be more limited--only tracking data required by that state's RPS.[57] By tracking RECs from issuance to retirement, these systems ensure against double counting the environmental benefits of renewable energy generation.[58] Data collection requirements may be modified to track different or additional REC characteristics in response to policy changes.[59]

50 Todd Jones, et al., Center for Resource Solutions, *The legal basis for Renewable Energy Certificates,* June 15, 2017 (http://resource-solutions.org/wp-content/uploads/2015/07/The-Legal-Basis-for-RECs.pdf)

51 Lisa Koperski, *Why the Renewable Energy Credit Market Needs Standardization,* 13 Wash. J.L. Tech. & Arts 69, 97 (2017).

52 *Resource portfolio requirements,* 2 L. of Indep. Power § 10:115 (2020).

53 *Id.*

54 Joel Mack, et at., *All RECs Are Local: How In-State Generation Requirements Adversely Affect Development of a Robust REC Market,* The Electricity Journal, Vol. 24, Issue 4, May 2011.

55 *Id.*

56 Clean Energy States Alliance, *REC Definitions and Tracking Mechanisms Used by State RPS Programs,* Prepared by Jan Hamrin, June 2014 (https://www.cesa.org/wp-content/uploads/RECs-Attribute-Definitions-Hamrin-June-2014.pdf).

57 *Id.*

58 Clean Energy States Alliance, supra note 56, at 8.

59 *Id.*

Table 11. COMPARE: State and Regional REC-tracking Authorities [60]

AUTHORITY	PARTICIPATING U.S. STATES*
Western Renewable Energy Generation Information System (WREGIS)	California, Oregon, Washington, Idaho, Montana, Wyoming, Colorado, Arizona, Nevada, New Mexico, South Dakota
New England Power Pool Generation Information System (NEPOOL-GIS)	Connecticut, Rhode Island, Massachusetts, New Hampshire, Vermont, Maine
PJM EIS's Generation Attribute Tracking System (PJM-GATS)	D.C., Maryland, New Jersey, Pennsylvania, Virginia, West Virginia, Ohio, Illinois, Kentucky
Midwest Renewable Energy Tracking System (M-RETS)	Illinois, Iowa, Minnesota, Montana, North Dakota, South Dakota, Missouri, Kentucky, Arkansas, Mississippi, Louisiana, Texas, Wisconsin
Electric Reliability Council of Texas (ERCOT)	Texas
Michigan Renewable Energy Certification System (MIRECS)	Michigan
North Carolina Renewable Energy Tracking System (NC-RETS)	North Carolina
New York Generation Attribute Tracking System (NYGATS)	New York
North American Renewables Registry (NAR)	Kansas, Missouri
No tracking system formally adopted.	Nebraska, Oklahoma, Tennessee, South Carolina, Georgia, Alabama, Florida

*States are listed next to the tracking authority used for RPS compliance accounting. States may participate in more than one REC tracking system, and entities in Canada and Mexico, as well as private entities may participate in these systems.

60 National Renewable Energy Laboratory, *Renewable electricity: How do you know you are using it?*, 2015 (https://www.nrel.gov/docs/fy15osti/64558.pdf).

One limitation of the digital certificate system arises when grid-tied renewable energy is consumed on-site or "behind-the-meter." When this occurs, RECs are not issued a digital certificate, but generally still may be sold or assigned to the utility within the state's net-metering program or other power purchase program, and the utility often assumes responsibility for accounting for these RECs.

RPS Alternative Compliance

If a utility fails to generate or obtain RECs equal to the percentage of renewable electricity required by an RPS, it usually must pay an Alternative Compliance Payment, or a per-kilowatt-hour financial penalty for amount it fell short. Alternative compliance payments are often contributed to a state fund dedicated to promoting renewable energy development. The ACP rate sets a ceiling price on RPS compliance because utilities are only willing to purchase RECs at amounts lower than the ACP rate.

Renewable Energy Procurement Laws

In addition to Renewable Portfolio Standards, states may require utilities to procure a certain amount of renewable energy capacity by a target date, and offer a special rate for the purchase of energy from desired projects. Renewable energy procurement laws usually identify a desired renewable energy technology (solar, wind), eligible project characteristics ("community solar" or projects up to 1 megawatt), a term of years for contracts (usually 10-25 years), and a rate or rate calculation method for the purchase of energy generated by eligible projects. Some state energy procurement laws may allocate RECs generated by eligible projects to the connecting utility for use in meeting its renewable energy obligations under the state's RPS or may allow the utility to sell the RECs into other markets. Other state procurement laws do not address REC ownership, and by default, RECs are owned by the owner of the renewable energy generating project. Section V of this report provides additional detail about state laws offering special rates for the purchase of solar energy.

Other Climate and Energy Goals

States have designed a variety of clean energy and climate action mandates across the country, including requirements to reduce greenhouse gas emissions, reduce fossil fuel consumption, and produce or consume clean or renewable electricity. As solar energy does not emit greenhouse gases and qualifies as a renewable energy source, state climate and energy policies tend to incentivize and accelerate solar development.

GHG Reduction: State greenhouse gas reduction policies usually establish a baseline year for comparison and then require total or sector-specific in-state greenhouse gas emissions to decline by a target percentage over time. As of 2020, twenty-three states, plus D.C., have adopted greenhouse gas reduction requirements.[61] A state may also be a party to a regional cooperative agreement to reduce greenhouse gases. For example, nine states in the Regional Greenhouse Gas Initiative (RGGI) established an emissions cap and trade program specifically for the electric power sector. [62]

Fossil Fuel Reduction: States may set "total energy"[63] or fossil fuel reduction targets meant to transition energy usage across all sectors away from fossil fuels. These policies are not limited to the electricity sector, but include all sources of fossil fuel consumption, including transportation, manufacturing, and commercial activity.

Clean Peak, Energy Efficiency, and Energy Storage: Even within the electric power sector, states have begun adopting new and creative energy policies beyond the RPS. States have established requirements for increased energy efficiency[64] and energy storage.[65] They may have clean energy generation goals associated with peak times[66] of electric consumption. While these mandates may not directly affect solar siting, policymakers should be aware of the full framework of climate and energy policy that exist (or could exist!) in their state when considering changes to solar development laws.

Climate and Energy Planning

State RPS policies are usually one part of a larger energy plan in each state. States use comprehensive energy planning to create a roadmap for meeting future energy needs, and these plans may provide additional information about implementation of the state's RPS policy and other renewable energy initiatives. State Comprehensive Energy Plans usually set out state priorities for energy management and identify sector-specific and technology-specific strategies for meeting the state's energy goals. Some states identify goals for protection of agricultural land or uses within their comprehensive energy plan.

In addition to statewide planning, laws may require local and/or regional energy planning, including the identification of specific land parcels that are preferred for solar development and ineligible for solar development. Local and regional energy planning decisions are likely to receive deference within state and local permitting processes for solar development.

61 For example, California committed to economy-wide carbon neutrality by 2045, with specific emissions reduction targets: 2000 levels by 2010, 1990 levels by 2020, and 80% below 1990 levels by 2050, with an interim emissions reduction goal of 40% below 1990 levels by 2030. See, California E.O. b-55-18 (2018); California S.B. 32 (2015).

62 The RGGI states include Connecticut, Delaware, Maine, New Hampshire, New York, Vermont, Massachusetts, Rhode Island, and New Jersey. Regional Greenhouse Gas Initiative, *Program Overview and Design,* https://www.rggi.org/program-overview-and-design/design-archive (Accessed March 1, 2020).

63 For example, Vermont's 2016 Comprehensive Energy Plan sets a goal to reduce total energy consumption per capita by 15% by 2025, and by more than one third by 2050. Vermont Dept. of Public Service, *Comprehensive Energy Plan,* 2016 (https://legislature.vermont.gov/assets/Legislative-Reports/Executive-summary-for-web.pdf).

64 As of July 2017, thirty states and the District of Columbia had adopted energy efficiency policies, including mandated requirements, voluntary goals, or pilot programs, designed to reduce electricity consumption by using electricity more efficiently. Energy Information Administration, *Today in Energy, Many States have Adopted Policies to Encourage Energy Efficiency,* Aug. 3, 2017 (https://www.eia.gov/todayinenergy/detail.php?id=32332).

65 For example, Oregon requires utilities to obtain energy storage capacity of 10 MWh or up to 1% peak load by 2020. OR PUC Order No. 17-291 (July 27, 2017). Nevada established an energy storage target of 1,000 MW by 2030. S.B. 204 (Nevada 2017); See also, NV PUC Docket No. 07014.

66 For example, the Massachusetts Clean Peak Energy Standard will provide incentives to clean energy technologies that can supply electricity or reduce demand during seasonal peak demand periods. M.G.L.A. 25A § 17 (2018).

B The Impact of Climate and Energy Goals on Agricultural Land

Renewable Portfolio Standards and other clean energy goals accelerate solar development, but can also separate clean energy benefits from land use impacts.

Solar RECs

All state RPS policies include solar as a qualifying source of renewable energy, which has driven expansion of the solar industry.[67] Some states use a solar or distributed generation "carve-out" to further accelerate solar energy deployment. When an RPS policy includes a solar carve-out, or a mandate that a portion of the RPS be met using solar energy, utilities must obtain RECs specifically generated by solar energy, called SRECs. SRECs work the same way as RECs, but are more narrowly defined as RECs generated by a specific category of solar installations defined by law. SRECs have a higher market value than RECs generated by less-preferred sources of renewable energy, like hydro or biomass, because there is generally a higher demand for SRECs within regional REC markets. The value of SRECs can vary significantly depending the cost of "alternative compliance payments" utilities must pay if they fail to obtain required SRECS, the number of solar facilities producing SRECS (supply) and RPS mandates for solar development (demand).

RPS Credit Multipliers

As an alternative to carve-outs for solar or distributed renewable energy, some states have established "RPS credit multipliers"[68] to incentivize desired project characteristics. RPS credit multipliers allow eligible projects to generate an additional per-kilowatt-hour compliance credit that may be used to meet RPS obligations. An RPS might specify that for every kilowatt-hour of solar energy actually generated by solar arrays less than 1 megawatt in capacity, two kilowatt-hours will be counted for purposes of RPS compliance. While the extra credits may be referred to as "RECs," these compliance-only credits are not generally tradeable or saleable on regional exchanges. Like solar carve-outs, RPS credit multipliers for solar energy increase demand for solar development.

Regional and Out-of-state Land Use Impact

Because it is generally unconstitutional for states to "discriminate" against businesses located out-of-state,[69] RPS mandates may usually be met through purchase the of renewable electricity or RECs from either in-state or out-of-state sources. While each state has individual clean energy goals and mandates, these policies are driving renewable energy development across the nation.

Out-of-state solar projects are incentivized to sell qualifying SRECs into states with a solar carve-out, and a resulting higher SREC value, to maximize solar project profitability.

For example, a qualifying solar array in Vermont might sell its RECs to a utility in Massachusetts, which uses the SREC for compliance with its Massachusetts RPS solar carve-out obligations. Massachusetts benefits by gaining the environmental attributes of the solar energy from the array, while Vermont hosts the land-use impacts of solar array installation and operation. This is true even though the electric energy generated by the array might be physically used in Vermont, as that energy is no longer considered "solar." Because the "solar" or clean energy attributes of electricity may be claimed only once, the land use impacts of a solar array are separated from its renewable energy contributions when REC ownership is transferred.

67 A 2016 analysis by NREL of the costs and benefits of state RPS laws found that in 2013-2014, approximately 5,600 megawatts per year of new renewable energy capacity was built to service RPS requirements. Wiser, R., G. Barbose, J. Heeter, T. Mai, L. Bird, M. Bolinger, A. Carpenter, G. Heath, D. Keyser, J. Macknick, A. Mills, and D. Millstein. 2016. *A Retrospective Analysis of the Benefits and Impacts of U.S. Renewable Portfolio Standards.* Lawrence Berkeley National Laboratory and National Renewable Energy Laboratory. NREL/TP-6A20-65005. (http://www.nrel.gov/docs/fy16osti/65005.pdf).

68 RPS Credit Multipliers may also be referred to as "REC Multipliers." Because the per-kilowatt-hour extra credit assigned by these multipliers do not represent a 1:1 ratio of energy produced to attributes counted and are not generally exchangeable in REC markets, designating these credits as "RECs" may be confusing to consumers and policymakers.

69 Some states do include in-state or in-region requirements for energy siting, generation, manufacturing, or labor in Renewable Portfolio Standards. Few of these requirements have been challenged as an unconstitutional burden on interstate commerce, but laws that facially discriminate against out-of-state actors or have the effect of favoring in-state economic interests over out-of-state interests are subject to strict scrutiny by courts. William Griffin, *Renewable Portfolio Standards and the Dormant Commerce Clause: The Case for in-Region Location Requirements,* 41 B.C. Envtl. Aff. L. Rev. 133 (2014).70 NH Rev. Stat. §362-F-3 (2017); NH PUC 2500 Rules.

Table 12. COMPARE: RPS Carve-Outs and Credit Multipliers	
Carve-out based on technology	New Hampshire's RPS requires that 25.2% of electricity come from renewable resources by 2025. Between 2020-2025, .7% of electricity must be generated from solar arrays put in operation after 2006.[70]
Carve-out with project capacity limit	Vermont's RES mandates that 75% of electricity come from renewable resources by 2032, and 10% of that electricity must come from new distributed renewable generation less than 5 MW in capacity, including new solar PV.[71]
Credit Multiplier based on technology	Virginia's RPS gives utilities "double credit toward meeting the renewable energy portfolio standard for energy derived from sunlight, from onshore wind, or from facilities in the Commonwealth fueled primarily by animal waste, and triple credit toward meeting the renewable energy portfolio standard for energy derived from offshore wind."[72]
Credit Multiplier with project capacity limit	Oregon's RPS includes a credit multiplier for solar PV systems with a capacity between 500 kW and 5 MW installed within Oregon prior to January 1, 2016. These projects receive credit for generating two kilowatt-hours for purposes of RPS compliance for every kilowatt-hour of solar energy generated.[73]

Land Use Competition

Without land use protections built into state permitting and siting processes for solar development projects, the rapid regional development of solar is likely to occur on agricultural land and other greenfields, as these generally provide ideal conditions for easy construction and operation of a solar array and are less expensive than other development options.

Policymakers should be aware that ambitious clean energy goals increase land use pressure across a region. Every state should examine its land use and siting requirements for new solar arrays to steer development toward previously developed land and structures and to ensure rules are in place to preserve our best farmland for food production and agricultural use, while promoting access to clean energy for farmers, including solar arrays that contribute to farm viability.

C. Options for Smart Farmland Solar Policy

> Use regulatory definitions to identify preferred sources of renewable energy.

State lawmakers may designate preferred or required sources of renewable energy within an RPS or other mandate for clean electricity. Using smart regulatory definitions for eligible solar projects ensures that a certain percentage of incentivized energy comes from projects of a preferred size or type. Lawmakers can define needed or wanted solar arrays by creating classes or tiers of energy based on project size or location, while ensuring that regulatory definitions comply with constitutional limitations under the Dormant Commerce Clause.

71 30 V.S.A. § 8002-8005 (2019).

72 Va. Code Ann. § 56-585.2 (C) (2016).

73 O.R.S. §§ 469A.130-469A.145 (2020).

> Include Carve-outs based on project size and preferred technology.

Rather than using a carve-out based on technology alone, which incentivizes any kind of solar development, policymakers can incentivize smaller-scale solar development by designating that a certain percentage of their RPS obligation be met by obtaining RECs from projects of a limited capacity size. RPS laws may target solar development specifically, or may incentivize smaller-scale distributed renewable energy generation without identifying a required technology.

> Include carve-outs based on project location.

States should consider writing land use requirements into RPS carve-outs for solar energy. While in-state geographic limitations on eligible projects are likely to be unconstitutional,[74] carve-outs could be established for solar arrays on rooftops, brownfields, parking lot canopies, or other preferred site-types, regardless of the geographic location of such projects.

For example, while currently applicable to in-state projects, New Jersey's SREC eligibility differs depending on the underlying land use category, or site-type:

> "A proposed grid supply facility that is not located on a brownfield, properly closed sanitary landfill facility, or area of historic fill must satisfy the requirements of this subsection for the energy it generates to serve as the basis for creation of an SREC. Applications for grid supply facilities on farmland shall be rejected."[75]

The digital information included in Renewable Energy Certificates can be tailored to record precise details about the type and location of solar projects. Requiring that projects occur on preferred site-types should increase the REC value for such projects, providing a financial incentive for this development type. This strategy helps to extend in-state land use protections, like preferred sites policies, to out-of-state projects contributing RECs used to meet state RPS mandates.

> Consider equity and transparency in REC ownership.

Even though each REC usually has its own serial number assigned by a state or regional tracking authority, it can be difficult for consumers, lawmakers, and the public to "independently audit the use of RECs or otherwise determine that a specific REC has not been placed on another registry, has not been retired, and actually exists."[76] States must be absolutely clear about REC ownership and transfer rules within renewable energy development policies,[77] including whether contracts or subsidies for renewable generation require any transfer of RECs in return for the funding.

Individuals and businesses hosting solar arrays may not clearly understand how their ability to make "green claims" about the energy they use changes depending on whether RECs are kept or sold.[78] Policymakers should ensure that RPS-defined REC attributes are clearly defined in law, and require disclosure and consumer education about REC allocation and sales in net-metering and solar development incentive programs.

> Require data collection and robust compliance reporting.

State RPS laws and other climate and energy goals are intended to achieve environmental and energy benefits, and mechanisms to evaluate whether and how intended benefits are achieved should be written into program laws and regulations. Policymakers

74 While federal courts have upheld regional RPS eligibility restrictions, requirements for in-state generation would be subject to stricter scrutiny, if challenged as an unconstitutional burden on interstate commerce. See: *Allco Finance Limited v. Klee,* 861 F.3d 82 (2017) (affirming as permissible Connecticut's program, which requires eligible renewables developers to deliver energy into Connecticut).

75 N.J.A.C. 14:8-2.4(g) (2019).

76 Lisa Koperski, *Why the Renewable Energy Credit Market Needs Standardization,* 13 Wash. J.L. Tech. & Arts 69, 101 (2017).

77 FERC has concluded that in creating RECs, states have the power to determine who owns the REC in the initial instance, and how they may be sold or traded. *American Ref-Fuel Co.,* 105 FERC ¶ 61,004, Oct. 1, 2003, at 23.

78 See, Federal Trade Commission rule s on environmental marketing claims: "If a marketer generates renewable electricity but sells renewable energy certificates for all of that electricity, it would be deceptive for the marketer to represent, directly or by implication, that it uses renewable energy." 16 C.F.R. § 260.15 (2012).

should require data collection on the size, location, and design of renewable energy sources used to meet regulatory requirements and other goals. Opportunities for stakeholder feedback and program review should also be established. Data collection and reporting are crucial for benchmarking progress toward achievement of climate and energy goals and help to identify challenges in program implementation. Such policies improve administrative transparency and help developers, utilities, consumers, and lawmakers alike understand and evaluate the costs and benefits of renewable energy development. Granular reporting requirements for farmland could include data on solar arrays sited on prime agricultural land, farmland of state or local importance, land in agricultural use, land enrolled in current use taxation programs, and/or land subject to conservation or preservation restrictions.

IV. Land Use & Energy Permitting Processes

> "Although the states are constrained by the Supremacy Clause and the Dormant Commerce Clause, it should be taken as a given that states have power to consider the environmental, economic, or other police-power-related implications of electricity generation within their borders."[79]

State and local laws regulate decisions about how and where we build electricity infrastructure, including new solar arrays. While the federal government[80] is involved in the siting of natural gas, hydroelectric plants, and certain transmission infrastructure, it has no authority over the siting of solar arrays on private land.[81] Rather, states and localities usually exercise their fundamental police powers over solar array land-use and siting decisions, in very different manners.

While some states delegate the approval of new solar arrays to local governments, a significant subset of states have established a state-level process for siting solar arrays and other energy generation infrastructure, which may override or legally preempt the exercise of traditional local land use authority.

The administrative permitting process for solar development governs the size, location, and design of solar arrays that may be constructed in any given area, including on farmland. Policymakers should consider establishing permitting requirements designed to fast-track low-impact projects, increase oversight of large-scale arrays, preserve agricultural land uses, and ensure farmer access to clean energy.

79 Emily Hammond, *The Energy in-Betweens,* 59 Jurimetrics J. 167, 175–76 (2019).

80 Solar facilities proposed for construction on federal land fall within the jurisdiction of the agency charged with the land's management, most often the U.S. Department of the Interior's Bureau of Land Management ("BLM") or the U.S. Department of Agriculture's Forest Service. Projects under Federal jurisdiction are outside the scope of this report.

81 Federal Regulatory Energy Commission, *About FERC, What FERC Does Not Do,* Updated August 14, 2018 available at http://www.ferc.gov/about/ferc-does.asp. FERC describes the limit of its own jurisdictional authority, leaving the local distribution of electricity and facility approvals as a responsibility reserved for the State Public Utility Commissions.

82 See Section VI of this report for information on the approvals needed for interconnection to the grid.

83 Amy Wilson Morris & Jessica Owley, *Mitigating the Impacts of the Renewable Energy Gold Rush,* 15 Minn. J.L. Sci. & Tech. 293, 312 (2014).

A. Understanding Land Use and Energy Permitting

State land-use and energy permitting policies include all the necessary steps required to obtain approval to install a solar array.[82] Permitting policies differ from state to state, and may require submission of a single application to a state-level siting board or separate approvals from state public utility commissions and municipal-level planning, zoning, and conservation boards.

The process usually includes submission of application materials detailing characteristics of the proposed project, including facility size, generating capacity, land-use footprint, potential impacts to neighbors, aesthetics, interconnection with the electric grid, environmental or agricultural impacts, and decommissioning plans. A state or municipal permitting authority reviews the proposed project for compliance with regulatory criteria and may place conditions on the project before issuing a land use or energy permit. Multiple permits may be required, and proposed solar arrays may need to participate in more than one permitting process in front of different authorities to obtain final approval to construct and operate the solar array. Generally speaking, larger projects with greater potential environmental impacts are likely to trigger more permitting requirements.[83]

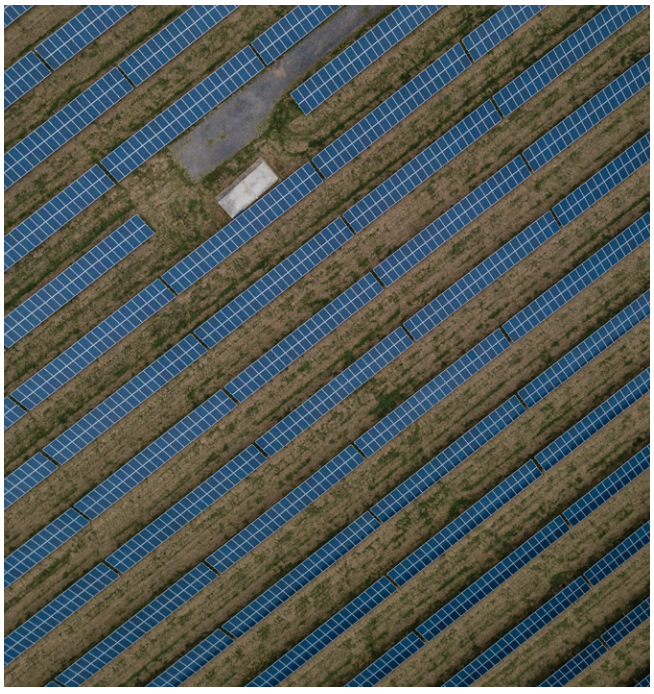

Table 13. COMPARE: Division of State and Local Authority over Solar Siting

	STATE SITING AUTHORITY	LOCAL SITING AUTHORITY
CONNECTICUT **C.G.S.A. §16-50i(a) (2014)**	The Connecticut Siting Council has jurisdiction over solar arrays greater than 1 MW in capacity.	Solar arrays less than or equal to 1 MW in capacity.
NEW HAMPSHIRE **N.H. Rev. Stat. § 162-H:2 (2017)**	The New Hampshire Site Evaluation Committee has authority over solar arrays greater than 30 MW in capacity. The SEC may review projects between 5 and 30 MW in capacity on its own motion, or the petition of the applicant or 2 petitioners.	All solar arrays less than 5 MW in capacity, and all solar arrays less than 30 MW in capacity that are not under SEC authority by petition or motion.
VERMONT **30 V.S.A. §248(a)(1)** **24 V.S.A. § 4413(b)**	The Public Utilities Commission has authority over all proposed energy generation facilities, including all solar arrays.	None. Vermont preempts municipalities from requiring local approvals for solar arrays.
MAINE **38 M.R.S. §§ 482(2) and (6)(B) (2010)** **38 M.R.S. § 483-A (2004)** **38 M.R.S. § 488(19)** **12 M.R.S. § 685A-4A**	The Maine Department of Environmental Protection, in cooperation with the Maine Land Use Planning Commission, has jurisdiction over solar "development" projects over 20 acres, solar "structures" that include areas to be stripped or graded and not to be revegetated which cause a total project to occupy a ground area in excess of 3 acres, as well as solar arrays located in unorganized territories.	Organized municipalities have jurisdiction over solar arrays outside of the DEP's authority. Municipalities may petition to administer siting approval after adopting approved land use plans and regulations. This changes the threshold for DEP review of "structures" to 7 acres for municipalities determined to have review capacity.
NEW YORK **NY Pub. Serv. Law § 162 (2016)**	The New York State Board on Electric Generation Siting and the Environment has authority over solar arrays 25 MW and greater in capacity.	Municipalities issue siting approvals for solar arrays less than 25 MW in capacity.

local land use permitting process that is not energy specific.

Public utility commissions exercise different authority over proposed solar arrays under different law in different states.[84] State authority varies as to:

- Whether states exercise any authority power generating facilities;
- Whether such authority applies only to projects over a certain minimum size;
- Whether state authority applies only to projects of regulated monopoly utilities, or whether it also includes independent power generation companies; and,
- Whether states exercise preemptive legal authority over otherwise local land-use decisions.[85]

Siting, land use, and environmental approvals might be consolidated into a single approval from the public utility commission. When a public utility commission issues a consolidated certificate of approval, the process may include trial-like regulatory hearings with submission of evidence and expert testimony on issues including land use, siting, and environmental impact. Other state agencies may lend their expertise by reviewing proposed projects and providing input to the public utility commission as to whether conditions should be set on project approval.

However, siting, land use, and environmental approvals might not be consolidated under public utility commission jurisdiction, meaning that proposed projects obtaining a certificate of approval from the commission still must obtain additional state or local land use, environmental, or siting approvals. In certain states, the public utility commission plays no role in the siting of new solar arrays.

Land Use Permitting

Traditional land use development and environmental regulations are likely to apply to new solar installations, including review for compliance with state laws regarding wetlands, endangered species, other protected natural resources, storm water run-off, land disturbance, surface and ground water quality, shoreline protection, agricultural protection, and erosion prevention. Many states require approval by a state siting authority for new energy generating facilities over a certain capacity size or acreage. State siting authorities, like public utility commissions above, may be responsible for issuing a permit that consolidates state and local land use and environmental concerns.

Additionally, local zoning restrictions and land use ordinances are likely to apply to proposed solar arrays, and may require additional analysis of impacts to historic districts, aesthetics, setbacks, and review by a local zoning authority, planning board, and/or conservation commission. It is important to understand what state and local agencies have jurisdiction over these issues before attempting to modify or improve existing permitting policies.

84 See Monast and Adair, *A triple Bottom Line for Electric Utility Regulation: Aligning State-Level Energy, Environmental, and Consumer Protection Goals*, 38 Colum. Envtl. L. 1, 11 (2013).

85 *Siting approval for power generation, transmission and distribution lines*, 2 L. of Indep. Power § 10:170, 2020.

Criteria for Project Approval

Whether at the local or the state level, new solar arrays may need to submit documentation of project characteristics to a siting authority that evaluates some or all of the following criteria:

- Grid Interconnection
- Energy system stability and reliability
- Consistency with state energy needs
- Economic impact of the facility on the economy of the local area and the effect of construction costs on the utility rate base to be borne by consumers
- Compliance with building and electrical code
- Consistency with local land use planning and zoning
- Compliance with setback requirements
- Aesthetic evaluation
- Effects on wetlands and other natural resources
- Effects on flora and fauna in the area
- Noise limitations
- Public health and safety
- Greenhouse gas impacts
- Effects on agricultural lands, soils or uses
- Decommissioning standards

Project siting and permitting processes are also likely to include requirements for public involvement including public hearings and community meetings, as well as opportunities for the public to submit comments to the permitting agency or agencies.

Application for Eligibility for Special Rates

While this section addresses permitting processes for the siting of proposed solar arrays, developers may need to apply to take advantage of special rates established by the state for the purchase of solar energy. A developer's eligibility for compensation through a state's net metering program, feed-in tariff, or other procurement program depends on the criteria and application process required by state laws establishing these rates. The application process for a given rate may be consolidated with the land use and siting process under the authority of a state public utility commission or may be a set of separate and additional criteria a proposed solar array must meet. See the following section of this report, "Compensation for Solar Energy," for additional discussion of siting criteria found in special rates for renewable energy.

State Direction of Municipal Permitting Processes

State law may establish state-wide zoning provisions or require that local governments use a particular process in implementing local planning and zoning laws that govern solar development.

For example, some states have enacted zoning preference laws that prohibit the "unreasonable regulation" of solar development or declare solar to be a «beneficial use» within the meaning of their state zoning act. This can establish a presumption in a zoning process that the zoning permit should be approved for the solar project unless the zoning authority finds that the solar project is not a beneficial use. Other states have passed "solar easement" and "solar access" laws to help preserve access to land or light for solar energy generation.[86] Some states have created standardized forms and permit applications for use by local permitting authorities.

86 Tawny L. Alvarez, *Don't Take My Sunshine Away: Right-to-Light and Solar Energy in the Twenty-First Century*, 28 Pace L. Rev. 535, 536 (2008)

Table 14. COMPARE: State Direction of Local Authority over Solar Siting	
Prohibition on Unreasonable Regulation of Solar Arrays	Nevada's Planning and Zoning Act provides, "A governing body shall not adopt an ordinance, regulation or plan or take any other action that prohibits or unreasonably restricts or has the effect of prohibiting or unreasonably restricting the owner of real property from using a system for obtaining solar energy on his or her property." NV Rev. Stat § 278.0208 (2019).
Statewide Definition of Solar as a Permitted Use	Oregon mandates that "the installation and use on a residential structure of a solar photovoltaic energy system or a solar thermal energy system is an outright permitted use in any zone in which residential structures are allowed." O.R.S. § 215.439 (2019).
Statewide Solar Permit Application for Municipal Use	Rhode Island municipalities were required to use the statewide solar energy permit application beginning on January 1, 2018. The statewide solar energy permit application is intended to "provide applicants with a predictable and universal process for obtaining a single permit from municipalities that encompasses both building and electric permits for solar photovoltaic sys-
Solar Access Enabling Act	Massachusetts provides that, "Zoning ordinances or by-laws adopted or amended pursuant to section five of this chapter may encourage the use of solar energy systems and protect solar access by regulation of the orientation of streets, lots and buildings, maximum building height limits, minimum building set back requirements, limitations on the type, height and placement
Solar Access Enabling Act Solar Easement Enabling Act	New Jersey's Solar Easements Act provides that "any easement obtained for the purpose of exposure of a solar energy device shall be created in writing and shall be subject to the same conveyancing and instrument recording requirements as other easements." N.J. Stat. Ann. § 46:3-25 (1978).

B. How do State Permitting Policies affect Farmland Solar Development?

Every kilowatt of solar capacity installed on a roof, existing structure, or next to an associated electric load takes some development pressure off of agricultural land. Incentives can be built into state land use and energy permitting laws for residential and small-scale solar installations, those installed on roofs or other structures, and other solar arrays that are clearly in the public interest. Similarly, additional oversight and criteria can be applied to larger scale projects and those located on agricultural land.

Land use and energy permitting laws can easily affect the rate, extent, and location of solar development on agricultural land, either intentionally or unintentionally.

Regulatory Incentives

First, the way administrative and regulatory processes are set up and implemented can incentivize certain types of development. State permitting policies can be complicated, expensive, and time-consuming, so easier pathways to project approval can act as a regulatory incentive for project development.

Regulatory incentives for certain types of solar energy may be explicit, like a tax credit or rebate offered to developers. Other regulatory incentives are implicit, or even accidental, when they stem from the administrative process itself. Failing to make regulatory distinctions between sizes or types of solar development projects may allow utility-scale projects to be approved at the same regulatory and permitting cost as much smaller arrays or to be sited on prime farmland without evaluating impacts to agriculture. When permitting fees, approval processes, and evidentiary requirements are the same for small and large projects, developers may be likely to pursue larger projects that offer additional income and lower installation costs per kilowatt.

Policymakers can improve permitting processes by establishing "fast track" and other graduated permitting processes that incentivize preferred projects and projects that are clearly in the public interest. Fast track and other streamlined permitting processes for renewable energy can also help to relieve the administrative burden on regulators. At the same time, requiring enhanced review of large-scale projects or those located on agricultural land can provide a disincentive for pursuing that project type, and ensures that project impacts are adequately considered.

Soft Costs

Cost is often the most significant factor for any individual solar development project, including farmland solar. While the hardware and materials costs of solar installation have decreased more than sixty percent since 2010,[87] the "soft costs" of project approval remain a deterrent to solar development, often totaling up to 64% of total project costs.[88]

Solar arrays (and other renewables) are usually smaller than conventional power plants and may present novel siting decisions. Thus, "the transaction costs of renewable energy projects—including resource assessment, siting, permitting, planning, developing project proposals, assembling financing packages, and negotiating power-purchase contracts with utilities—may be much larger on a per-kilowatt basis than for conventional power plants."[89] On the other hand, streamlined permitting processes can reduce costs and facilitate smart farmland solar development by limiting the total number of approvals required, reducing criteria for smaller projects, establishing deadlines for permit review, ensuring the evaluation of farmland impacts, and creating different pathways to approval for projects that differ in size and scope.

Overly Permissive or Restrictive Definitions

Policymakers should be careful of overly permissive or restrictive regulatory categories in the solar permitting process, as discussed in more detail in Section I of this report. For example, the existing solar siting review process may not consider whether a proposed location is valuable farmland versus marginal farmland, or may not consider whether a solar array will replace actual agricultural use, even when the proposed location is not identified as farmland.

Project Oversight and Conditions on Development

Depending on whether a solar array proposed for farmland is governed by a state or local siting review process, the agencies providing project review and oversight are likely to change. Some states require the permitting authority to evaluate and/or place conditions on solar development proposed for agricultural land. Review criteria and conditions on project development can be established both for a state-level siting board and state-wide, where local processes apply, through a state law requiring localities to implement certain criteria or conditions within the local permitting process.

Need for Predictable Standards

Criteria for permit approval may be vague or subjective, leading to project development uncertainty, delay, and additional cost. Policy makers seeking to change the permitting process for solar development should strive to require "enough information to make rational decisions based on neutral and predictable standards," including standards for farmland solar development, "while not being faced with ill-defined restrictions, such as preserving the "neighborhood character."[90] Review criteria and conditions on project development should be clear and objectively measurable, and should not represent unreasonable barriers to beneficial projects, such as solar arrays designed to serve a farm's electric load.

87 U.S. Department of Energy, *Soft Costs 101: The Key to Achieving Cheaper Solar Energy*, Feb. 25, 2016 (https://www.energy.gov/eere/articles/soft-costs-101-key-achieving-cheaper-solar-energy); Solar Energy Industries Association, Solar Soft Costs, June 2019 (https://www.seia.org/sites/default/files/2019-07/Solar-Soft-Costs-Factsheet.pdf).

88 Megan Cleveland, National Conference of State Legislature, *Tackling Solar Energy's 'Soft Costs,'* July 2017 (http://www.ncsl.org/research/energy/tackling-solar-energy-s-soft-costs.aspx).

89 Fred Beck & Eric Martinot, *Renewable Energy Policies and Barriers, Academic Press/Elsevier Science,* 2004, at 4 (http://biblioteca.cejamericas.org/bitstream/handle/2015/3308/Renewable_Energy_Policies_and_Barriers.pdf?sequence=1&isAllowed=y)

90 Anastasia Boden, et al., *The Land Use Labyrinth: Problems of Land Use Regulation and the Permitting Process,* released by the Regulatory Transparency Project of the Federalist Society, January 8, 2020, at 38 (https://regproject.org/paper/the-land-use-labyrinth-problems-of-land-use-regulation-and-the-permitting-process/).

C. Options for Smart Farmland Solar Policy Design

> Create a role for the state agency of agriculture in evaluating and conditioning solar projects located on agricultural land.

Successfully protecting farmland and promoting agricultural use within solar development policies requires knowledge of state agricultural land characteristics and familiarity with agricultural soils and impact mitigation strategies. States can take advantage of the expertise of agencies of agriculture in developing and implementing criteria for solar development on agricultural land, and in project review and approval. A variety of roles for the state agency of agriculture can be inserted into state siting and permitting processes:

- Agency receives notice of projects.
- Agency reviews project applications, evaluates impacts, and suggests conditions.
- Agency is a statutory party to public hearings.
- Agency certification is required for project approval.

Table 15. COMPARE: Defined Role for Agency of Agriculture in Solar Permitting

CONNECTICUT	The CT Department of Agriculture reviews solar arrays over 2 MW proposed for siting on farmland, and may consult with the USDA or soil and water conservation districts. The Department must represent in writing to the Connecticut Siting Council that projects will not affect the status of prime farmland. Smaller projects are not subject to the same oversight by the Department of Agriculture.
MASSACHUSETTS **225 C.M.R. 20.**	The MA Department of Agricultural Resources receives applications and certifies agricultural net metering facilities and consults on "Agricultural Solar Tariff Generation Units" under the state's SMART solar program.
VERMONT **32 V.S.A § 248 (2019); PUC Rule 5.100.**	The VT Agency of Agriculture, Food, and Markets receives notice of ground-mounted solar projects 50 kW or larger on agricultural soils. It may appear at Public Utilities Commission hearings for projects between 15-500 kW, and must appear for systems greater than 500 kW in capacity.

> Require permitting authorities to consider impacts to agricultural land and soils, and establish performance standards for arrays located on agricultural land.

State and local energy siting authorities can adopt specific criteria for reviewing and permitting solar projects proposed for installation on agricultural land. The permitting authority can require the applicant to submit information about potential impacts to farmland and agricultural uses and can develop specific criteria or performance standards that solar arrays must meet. The permitting authority can also require third-party certification of impacts to farmland or compliance with farmland protection criteria. States integrate farmland protection criteria into permitting review processes in a variety of ways:

- Applicant submits information concerning impacts to agricultural land and uses.
- Permitting authority considers impacts to agricultural land as a criteria for permit issuance.
- Agency of agriculture certifies that projects will not "materially affect" farmland.
- Solar arrays sited on agricultural land must comply with specific performance standards.
- Professional engineer certifies that projects on agricultural land comply with specific performance standards.

Table 16. COMPARE: Criteria for Farmland Protection in Site Permit Review	
Maine	Solar arrays greater than 250 kW and located on prime farmland are only allowed by special exception and permit from the Land Use Planning Commission. Land Use Districts and Standards; 12 M.R.S.A § 685-A(10).
Massachusetts	All ground-mounted solar arrays greater than 500 kW must provide a certification from a professional engineer that the construction complied with specific standards when installed on Land in Agricultural Use, Prime Agricultural Farmland, or other pervious open space. 225 C.M.R 20.05.
Vermont	The Public Utilities Commission must consider impacts to prime agricultural soils, as defined in 10 V.S.A. § 6001, for all ground-mounted solar projects over 15 kW. 30 V.S.A. § 248(b)(5) (2019).
Oregon	Solar on high-value farmland shall not use more than 12 acres unless the "county adopts & applicant satisfies land use provisions authorizing projects subject to a dual-use development plan." O.A.R. 660-033-0130(38)(g) (2016).

> Require decommissioning plans and/or bonds for solar arrays on farmland.

Solar arrays are usually coupled with long-term contracts for the purchase of the solar energy for periods of ten to twenty-five years. Decommissioning requirements are used to ensure that the solar array infrastructure is removed from the land at the end of the energy contract, or other set time period, and that the underlying land can be returned to agricultural use. States integrate decommissioning requirements into site review processes in a variety of ways:

- The applicant must include or describe a decommissioning plan in a permit application.
- The applicant must show by "substantial evidence" that all materials will be removed upon decommissioning and soils will be capable of active agricultural production.
- The applicant must identify funds earmarked for decommissioning or post a bond to ensure decommissioning is carried out at the end of the project's life.

Table 17. COMPARE: Decommissioning Requirements for Farmland Solar Arrays	
Maine	For solar arrays greater than 250 kW on prime farmland, the applicant must show by substantial evidence that all structures and materials will be removed upon decommissioning, and soils will be capable of active agricultural production. Land Use Districts and Standards;12 M.R.S.A §685-A(10)
Vermont	Non-utility-owned generation facilities with a plant capacity equal to or greater than 150 kW and less than or equal to 500 kW must be removed once they are no longer in service, with the site restored to its condition prior to installation of the facility to the greatest extent practicable. Larger solar arrays, and those not owned by a utility, must also provide cost estimates for decommissioning and evidence of sufficient funds. The PUC incorporates this requirement as a condition of Certificates of Public Good issued pursuant to Section 248, as applicable. 32 VSA § 248 (2019); PUC Rule 5.900.

> Provide statutory protection for the status of underlying agricultural land when used for solar development.

Contracts for solar energy compensation are often designed to last ten to twenty-five years. While land may be clearly zoned or otherwise protected as farmland at the time solar arrays are installed, there are few guarantees that farmland will remain zoned or protected as farmland after solar array decommissioning. State laws can clarify the status of underlying land, protecting agricultural land regardless of its use as a site for energy generation. States can:

- Prevent subsequent redistricting of land when redistricted for energy development.
- Protect farmland classifications regardless of the use of farmland for energy generation.

For example, Vermont's siting review process protects the classification of farmland regardless of its use for energy, and the language of this requirement is included in relevant Certificates of Public Good:

> "Notwithstanding any contrary provision of law, primary agricultural soils as defined in 10 V.S.A. § 6001 located on the site of a solar electric generation facility approved under this section shall remain classified as such soils, and the review of any change in the use of the site subsequent to the construction of the facility shall treat the soils as if the facility had never been constructed."[91]

> Establish approval processes based on solar array size, location, and design with expedited permitting for small or structure-mounted projects and increased oversight of larger-scale arrays.

Policymakers should attempt to eliminate unnecessary or redundant reviews and inspections, reduce wait times and permit fees, and establish escalating levels of review based on project characteristics like solar array size, design, and location. States can take the lead in streamlining permitting processes and should develop standard technical and procedural requirements with checklists for permit applications and clear guidelines for permit review and approval.

For example, states can:

- Develop a simple application form and approval process for small and structure-mounted solar arrays.
- Reduce or cap application fees for small and structure-mounted arrays, and increase permit fees according to the administrative burden associated with permit review.
- Develop expedited review processes with reduced

91 32 V.S.A. § 248(t) (2019).

criteria and evidentiary requirements for small and structure-mounted solar arrays.

- Create a state-wide solar permit for implementation by municipal siting authorities.
- Subject large solar arrays to additional oversight and permit review criteria.

Table 18. COMPARE: Expedited and Streamlined Solar Permitting Processes

COLORADO **Reduced Application Fees**	Colorado's Fair Permit Act caps fees for residential solar permits at $500 and fees for commercial solar permits at $1000.C.R.S.A. § 30-28-113 (2017).
VERMONT **Expedited Process for Small and Roof-Mounted Arrays**	Vermont's Certificate of Public Good (CPG) process offers a ten-day fast-track registration form, including interconnection, for ground-mounted systems up to 15 kW and roof-mounted systems up to 500 kW. Rule 5.105. An expedited application process is available for ground-mounted systems between 15 and 50 kW. Rule 5.106. Expedited projects are subject to fewer criteria in permit review. The CPG consolidates siting and environmental review into a single permit approval.
CALIFORNIA **Creation of Statewide Standards for Municipal Implementation**	California's solar Permitting Efficiency Act of 2014 required all city and county governments to adopt an ordinance creating an expedited, streamlined permitting process for small residential rooftop solar arrays less than 10 kW in capacity, and must provide a simple checklist for the permit process. Cities and counties must conform their permitting processes to the recommendations in the California Solar Permitting Guidebook. CA Pub. Res. Code § 65850.5.
NEW YORK **Streamlined Oversight Of Large-Scale Arrays**	Article 10 provides for the siting review and issuance of a certificate of environmental compatibility and public need for new, repowered or modified major electric generating facilities with a nameplate capacity of 25 MW or more by the NY Board on Electric Generation Siting and the Environment in a unified proceeding instead of requiring a developer to apply for numerous state and local permits. The authority of other state agencies and municipalities is expressly preempted in Art. 10, §172. NY Pub. Serv. Art. 10 (2011).

> Establish a Special Review Process for Agrivoltaics

Agrivoltaic or dual-use solar arrays are designed to complement agricultural uses and present a special opportunity to develop smart farmland solar energy. Policymakers should ensure that permitting authorities include regulators with expertise about the integration of solar development with agricultural uses and should collaborative with agencies and entities that already preside over agricultural land management. Permitting authorities can create a specialized review and approval process for agrivoltaic solar arrays, as they do not present the same threat of land use conversion as traditional solar development and are instead likely to improve farm viability.

For example, Massachusetts defined a category for agrivoltaic solar arrays within its SMART Program, and developed a pre-application and application process that involves the University of Massachusetts Clean Energy Extension alongside the Department of Energy Resources. Projects seeking the Agricultural Solar Tariff Generation Unit (ASTGU) Adder must apply for a predetermination letter in consultation with Agricultural Extension staff.[92] Once the application is sent to the Department of Energy Resources, it is reviewed in consultation with the Massachusetts Department of Agricultural Resources.

> Consider Digital Tools to Improve Permitting Efficiency

States are beginning to use web-based tools to simplify and improve the solar permitting process. Any and all required forms and applications for solar development should be available for public download and review. State and local permitting authorities should be encouraged or required to create simple regulatory guides that describe the process and requirements applied to different solar installations, including those located on agricultural land.

GIS Mapping

Some states are working to map land use considerations using GIS technology that allows the layering of detailed information about every land parcel. Mapped characteristics might include the location of energy transmission and distribution infrastructure, electric substations, prime agricultural soils, farmland, wetlands, endangered species habitat, and other protected lands and natural resources. Detailed mapping helps to identify beneficial locations for solar development, as well as potential siting conflicts. Policymakers should encourage or require the development of GIS mapping tools to help protect agricultural lands and other natural resources.

For example, the Vermont Community Energy Dashboard identifies the location and characteristics of all existing distributed energy generators in the state. It also offers a mapping tool that can be used to evaluate potential sites for a wide variety of characteristics, including the presence of agricultural land or soils, grid connections, and other natural resources that might constrain project development.[93]

In addition, the EPA's RE-Powering America's Land website offers a range of digital tools, including decision trees for screening sites for solar potential, and interactive mapping tools, including details about grid connectivity.[94]

Online Permitting

While online permitting is not widely available at either the state or local level, it presents an opportunity to expedite small or residential solar arrays, and could facilitate a wide variety of permitting processes. The availability of online permitting can incentivize projects that are in the public interest and free up regulatory oversight for larger projects and those that may negatively impact agricultural land and natural resources.

92 225 C.M.R. 20; Solar Massachusetts Renewable Target Smart Program information, https://www.mass.gov/info-details/solar-massachusetts-renewable-target-smart-program (Accessed May 1, 2020).
93 Vermont Energy Dashboard, https://www.vtenergydashboard.org/energy-atlas (Accessed April 4, 2020).
94 U.S. Environmental Protection Agency, *Siting Renewable Energy on Potentially Contaminated Lands, Landfills, and Mine Sites* https://www.epa.gov/re-powering (Accessed May 1, 2020)

For example, the National Renewable Energy Laboratory is collaborating with lawmakers and solar developers to develop an instant online solar permitting platform for residential systems. The "SolarAPP" or "Solar Automated Permitting Process" is intended to help standardize instant permitting processes and help permitting authorities evaluate proposed solar arrays for safety and code compliance.[95]

95 National Renewable Energy Laboratory, SolarAPP, https://solarapp.nrel.gov/ (Accessed May 1, 2020).

96 Owen Zinamen, et al., *Grid-Connected Distributed Generation: Compensation Mechanism Basics*, National Renewable Energy Laboratory, Oct. 2017 (https://www.nrel.gov/docs/fy18osti/68469.pdf).

97 *Id.*

98 Douglas A. Codiga, Hot Topics in Hawaii Solar Energy, Haw. B.J., May 2013, at 4.

99 Jesse Heibel and Jocelyn Durcay, *State Policies for Power Purchase Agreements*, National Conference of State Legislators, July 10, 2015, https://www.ncsl.org/research/energy/state-policies-for-purchase-agreements.aspx.

100 Solar Energy Industries Association, Solar Power Purchase Agreements, https://www.seia.org/research-resources/solar-power-purchase-agreements (Accessed: May 3, 2020).

101 *Id.*

102 *Id.*

V. Compensation for Solar Energy

Net metering and other energy compensation programs that offer a special rate for energy from renewable sources can be used to incentivize smart land use, including smaller-scale arrays, those located on preferred sites, and agrivoltaic or dual-use arrays designed to work with agriculture. Well-designed compensation rules can minimize the negative impacts of solar development and maximize the value for all stakeholders, including utilities, solar installation owners, and other ratepayers.[96]

A. What State Policies Govern the Rates Paid for Solar Energy?

Owners of solar arrays are compensated for the energy they generate through a variety of state-law mechanisms, including net metering programs, feed-in tariffs, and performance-based incentives for solar energy generation.[97] These programs generally require that utilities distributing energy to consumers procure that energy using specific contract terms set by law, rather than negotiated by the utility.[98] Policymakers can incentivize preferred types of solar development and preferred locations for solar arrays by establishing thoughtful rate eligibility requirements and rate adjustors that modify compensation based on a project's characteristics (like solar array size, location and design) within state laws governing the purchase of and compensation for solar energy.

Power Purchase Agreements

A power purchase agreement ("PPA") is a contract between the developer of a solar array (or other source of distributed energy generation) and a customer desiring to purchase solar energy.[99] The developer is usually responsible for the design, permitting, financing, and installation of the solar array on the customer's property or off-site, at little upfront cost to the customer, and sells the generated electricity to the customer at a fixed long-term rate (often 10-25 years).[100] The developer usually takes advantage of tax credits and other incentives, while the customer benefits from lower electricity costs. [101] PPAs have been "a driving force behind the expansion of rooftop solar power in many states."[102]

However, not all states allow solar energy to be bought and sold under PPAs.[103] When lawmakers and regulators have not taken steps to specifically allow PPAs, these contracts may violate electric utility regulation rules.[104] Lawmakers should ensure that PPAs are available under state law to promote renewable energy development.

State laws governing PPAs may direct utilities to enter into PPAs with independent generators of renewable energy; they may set certain contract terms for PPAS, such as contract length; or, they may more broadly exempt certain independent generators of renewable energy from the definition of a regulated public utility.[105]

Net Metering

Net metering programs allow owners of distributed energy systems (often residential rooftop and smaller ground-mounted installations) to receive credit on their electric bill for energy contributed to the grid when their solar panels generate more electricity than can be used on site.[106] State net metering programs differ in approaches to "eligible project capacity, eligible technology, net metering credit retention, and REC ownership."[107] Net metering is essentially a retail transaction regulated by states and is not subject to FERC Regulation, as "no sale occurs under the Federal Power Act when an entity installs generation and accounts for its dealings with the utility through the practice of netting."[108] This removes the sale of net metered energy from the definition of "wholesale sales" of energy regulated by the federal government, and leaves states with significant leeway to design creative compensation incentives for specific types of solar installations.[109] This leeway also means that each state program defines its key terms differently.

Size or Type of Electric Service Provider

State laws allowing net metering do not necessarily require utilities to offer net metering to any, let alone all of their customers. Some states limit net metering obligations to investor owned utilities, while excluding municipal utilities and/or electric cooperatives from the requirement to provide net metering to eligible customers. Other states may require only large utilities to establish a net metering program.

Eligible Technology

Net metering programs define by law the sources of distributed energy eligible for enrollment. Solar energy is the most common source of net metered energy, but lawmakers may define additional eligible distributed energy generation technologies, including wind, biogas, and geothermal, among others.[110] Net metering programs have also begun to include provisions incentivizing energy storage in addition to energy generation.

Eligible Customers

Net metering may only be available to customers in a given utility's service area, and may be further limited to certain classes of customers, such as residential or commercial users. Some states have established a special category within their net metering program specifically for agricultural customers.[111]

103 See the map developed by Solar Power Rocks for a map illustrating the availability of PPAs by state: https://www.solarpowerrocks.com/solar-lease-map/.

104 For example, North Carolina allows an exclusion from the definition of "public utility" for consumers who self-finance on-site solar arrays, but prohibit PPAs between a customer and a solar developer, finding that they would function as impermissible public utilities. NC WARN, Docket No. SP-100, SUB 31, at 31, 2016 WL 1572367, at *31 (Order Issuing Declaratory Ruling).

105 Heibel, *Supra*, Note 99.

106 *State Net Metering Policies*, National Conference of State Legislators, Nov. 20, 2017 (http://www.ncsl.org/research/energy/net-metering-policy-overview-and-state-legislative-updates.aspx).

107 Id.

108 Jason Keyes, Thad Culley, *Jurisdictional Implications of New Net Metering Programs,* IREC Memo, May 22, 2012 (https://pjm.com/~/media/committees-groups/task-forces/nemstf/20120525/20120525-memorandum-from-j-keyes-and-t-culley.ashx) and 94 FERC § 61,340, 62,263 (2001)

109 The Energy Policy Act of 2005 added a federal standard for the consideration of net metering by states and utilities in PURPA section 111(d)(11). It states: "Each electric utility shall make available upon request net metering service to any electric consumer that the electric utility serves. For the purposes of this paragraph, the term 'net metering service' means service to an electric consumer under which electric energy generated by that electric consumer from an eligible on-site generating facility and delivered to the local distribution facilities may be used to offset electric energy provided by the electric utility to the electric consumer during the applicable billing period."

110 Heather Payne, *A Tale of Two Solar Installations: How Electricity Regulations Impact Distributed Generation,* 38 U. Haw. L. Rev. 135, 147 (2016).

111 See Table 19 describing Virginia's net metering program below and Section V(C) of this report.

Program and Project Capacity

States are likely to impose both eligible project capacity limits and total net metering program capacity caps.[112] Some states establish different project or program capacity limits for different eligible technologies.[113] Net metering rules may also limit individual project capacity to relatively small-scale projects (i.e. less than 10 to 50 kW in capacity), may include larger community or commercial-scale projects (i.e. 50-500 kW in capacity), or may be available to projects of more than one megawatt. Eligible project capacity may also be defined in relation to the average electric load of the enrolled customer(s), with or without an allowance for excess energy generation.[114]

Metering and Compensation for Energy

State net metering programs differ in how customers are compensated for excess electricity generation.[115] Compensation may occur at an established retail or wholesale price or at a promotional price. Consumers may or may not be charged for certain fixed costs, even if they offset their entire electric consumption with solar generation. Compensation may consist of net metering bill credits alone or a per-kilowatt-hour dollar rate paid for excess generation. Some states even change the net metering rate based on the time of day energy is used.[116] Finally, some net metering programs allow excess credits to carry forward for a defined period of time if unused, and others put strict time limits on credit expiration. Consumers may or may not be able to "cash out" unused credits for a dollar payment amount. For example, in Oregon, excess generation credits roll over to a low-income assistance program if they remain unused annually in March.[117]

It is worth noting the difference between "net metering" and "net billing," as the terms are easily confused and policymakers should understand the distinction. Net metering originated as a service provided with a single meter that rolls forward when a customer uses more power than it generates and rolls backwards when the customer generates more power than it uses, thus erasing the customer's prior usage.[118] This means the kilowatt-hours the customer consumes from the grid are valued the same as kilowatt-hours the customer contributes to the grid.[119] Net billing either uses two meters or a single sophisticated meter to separately track energy flows to and from the grid. This allows flexibility for setting different rates at which the utility and the customer exchange energy.[120]

Project Location

A few states have begun to modify the rates paid for solar energy based on the location of the solar installation. Existing structures and cleared areas, like former parking lots, industrial areas, brownfields and redevelopment sites, and former landfills or mining areas should be considered by policymakers as prime candidates for solar project incentives.[121]

REC Ownership

State net metering programs differ in how RECs generated by enrolled projects are allocated between consumer-generators and host utilities. REC ownership significantly impacts the financial implications of most solar projects and affects which parties can claim to use or consume solar energy.[122] Some states specify that RECs are to be retained by the consumer-generator, who may retain or sell the credits. Other states assign RECs generated by enrolled projects to the interconnecting utility. In this case, utilities may be required to retain the RECs for compliance with state renewable portfolio standard obligations, or may be allowed to sell the RECs into more profitable markets.

For example, New York's "Value Stack" tariff for renewable energy compensation specifies that RECs generated by participating customers are transferred to the utility by default. The utility uses the RECs for compliance with state Renewable Portfolio Standard obligations and customers are compensated for the REC value.[123] Customers may choose to retain their RECs, but then are compensated at a lower rate that excludes the environmental value of the RECs.[124]

115 *Id.* at 158-161.

116 Ariz. Admin. Code § 14-2-2301 (2014).

117 OR. Admin. R. 860-39-55(2).

118 Kenneth Rose, Karl Meeusen, *Reference Manual and Procedures for Implementation of the "PURPA Standards" in the Energy Policy Act of 2005,* Mar. 22, 2006, at 37.

119 *Id.*

120 *Id.*

121 Richard M. Hluchan, *Here Comes the Sun Land Use Laws Affecting the Development of Solar Energy Facilities in New Jersey,* N.J. Law., June 2011, at 31, 32.

122 Payne, *Supra* Note 110, at 152-153.

123 NY Public Service Commission, Case 15-E-0751, In the Matter of the Value of Distributed Energy Resources, *Order Regarding Value Stack Compensation,* April 18, 2019 (https://www.nyserda.ny.gov/All-Programs/Programs/NY-Sun/Contractors/Value-of-Distributed-Energy-Resources/Value-Stack-Resources)

124 NY Public Service Commission, Cases 15-E-0751 and 15-E-0082, In the Matter of the Value of Distributed Energy Resources, Order Regarding Value Stack Compensation, *Order on Net Energy Metering Transition, Phase One of Value of Distributed Energy Resources, and Related Matters,* March 9, 2017.

Community Solar and Group or "Virtual" Net Metering

Group or virtual net metering allows a group of customers to share the net-metering credits generated from a single, larger solar array. Group members do not have to be connected to the generation source, which may be located on a host customer's property or on another site. Group members can share credits with others in the same electric service territory. Group net metering allows expanded participation in renewable energy, as it makes economies of scale available to save on regulatory compliance and system installation costs.

Table 19. EXAMPLE: Virginia's Net Metering Program [125]

Definition of Net Metering	"Net energy metering means measuring the difference, over the net metering period, between (i) electricity supplied to an eligible customer-generator or eligible agricultural customer-generator from the electric grid and (ii) the electricity generated and fed back to the electric grid by the eligible customer-generator or eligible agricultural customer-generator."
Obligated Utilities	The state's investor-owned utilities (Dominion and Appalachian power) and electric cooperatives are obligated to follow the rules set out in §56-594 while participation is optional for smaller municipal utilities
Eligible Technology	Solar power, wind power, and aerobic or anaerobic digester gas.
Eligible Customers	Residential and commercial customers are both eligible to enroll.
Eligible Project Capacity	Residential systems are limited to 20 kW in capacity, while non-residential systems may be as large as one megawatt. Systems are sized to not exceed a customer's annual electricity consumption. Virginia created a special net metering category for Agricultural Customers, who are limited to 500 kW of aggregated project capacity. While other customers are limited to enrolling a single meter associated with their individual customer account, agricultural customers may "aggregate" meters, or use multiple meters that are located at separate but contiguous sites.
Program Capacity Cap	Each utility is obligated to net meter up to one percent of the utility's peak-load from previous year.
Compensation for Energy	Customers are compensated at a one-to-one retail rate for the excess solar energy they contribute to the electric grid. However, if a customer generates too much solar over the course of a 12-month period, the customer can roll over the credit or receive a payment at the avoided cost rate.
Fixed Charges	Residential customers with systems larger than 10 kW must pay standby charges, even if they consumed no net energy from the electric grid.
Renewable Energy Certificate Ownership	Customer-generators own any renewable energy certificates associated with their solar array. When customers enroll in net metering, they have a one-time option to sell RECs associated with their solar array to its energy supplier and be compensated at regulated rate that reflects the value of the RECs.such renewable energy certificates. Customers are not prevented from
Group/Virtual Net Metering	Virtual net metering is not allowed in Virginia.

125 VA Code Ann. § 56-594 (2019).

Feed-in Tariffs

Feed-in tariffs are similar to net metering programs, except that the power generated by the solar array is contributed to the grid and not used to offset a customer-generator's electricity consumption. A feed-in tariff establishes long-term standard contracts for generators of renewable energy, typically offering a specified rate set by law for every kilowatt-hour of electricity produced under a contract lasting 10-25 years. This provides financial certainty to renewable energy developers and investors, stimulating solar energy development.[126]

State lawmakers can vary feed-in tariff rates to promote a preferred technology, project size, location, or other resource quality to align with specific policy goals. Feed-in tariffs are also similar to net metering programs in that the program details are likely to differ among states, including program definitions, eligible projects and technology, total program capacity, compensation for energy, and REC ownership.[127] Some feed-in tariffs may provide a set dollar amount for per-kilowatt-hour compensation, while others request bids from potential developers, and others may establish a series of rate adjustors that change based on project characteristics, like solar array size, location, or design.

For example, Vermont's Standard Offer Program is a feed-in tariff open to renewable energy projects up to 2.2 MW in capacity, with a cumulative program cap of 127.5 MW through 2022.[128] New projects are solicited annually through Requests for Proposals, with generators bidding for a contract, subject to a price cap.[129] In 2019, the price cap for solar projects was $0.13 per kilowatt-hour.[130] RECs generated by standard offer projects are transferred to the interconnecting utility, and may be sold out-of-state in REC markets.

As the cost of solar infrastructure has decreased significantly,[131] some states and even local governments have found that rates established through feed-in tariffs are overly generous, burdening utilities locked into long-term contracts.[132] Policymakers can estab-

126 Codiga, *Supra* Note 98, at 4.

127 Energy Information Administration, *Feed-in Tariff: A Policy Tool Encouraging Deployment of Renewable Energy Technologies,* May 20, 2013 (https://www.eia.gov/todayinenergy/detail.php?id=11471) (Accessed March 1, 2020).

128 30 V.S.A. § 8005a (2019)

129 The Standard Offer Program is implemented through Public Utility Commission Orders in Dockets 7523, 7533, 7780, 7873, and 7874.

130 PUC Case No. 19-4466-INV, Order Re: 2020 Standard Offer Program, Mar. 4, 2020 (https://vermontstandardoffer.com/wp-content/uploads/2020/03/2020-RFP-FINAL-ORDER-3-4-20.pdf).

131 A recent analysis concluded "the solar electricity price falls 30-40% for every doubling in deployment of solar generation capacity." Jean Haggerty, *Sunny Regions Could See One Cent Solar within a Decade,* PV Magazine, May 19, 2020 (https://www.pv-magazine.com/2020/05/19/sunny-regions-could-see-one-cent-solar-within-a-decade/)

132 For example, the city of Gainesville, Florida offered a feed-in tariff for solar PV systems. "The aggressively high tariff drove installation of 18.5 MW of solar capacity at 259 sites. The Gainesville City Commission approved its suspension in 2014 'to help control upward rate pressures.'" Herman Trabish, RIP FITS: *As US Feed-in Tariffs Fade, Adopting Elements Could Spur Solar Growth,* Utility Dive, July 18, 2016 (https://www.utilitydive.com/news/rip-fits-as-us-feed-in-tariffs-fade-adopting-elements-could-spur-solar-gr/422727/)

lish periodic reviews for feed-in-tariff contracts or set pre-established declines in feed-in tariff contract rates.[133] This helps to provide a predictable regulatory framework, while leaving room for policy flexibility.

Value of Solar

A Value of Solar rate is not by itself a compensation mechanism for solar or renewable energy. Rather, it is a method of calculating compensation for renewable energy contributed to the grid by renewable generators, designed to capture the value of the renewable energy to both utilities and larger public policy goals, [134] like ensuring that costs of renewable energy development are spread fairly among ratepayers.[135] Net metering or other solar compensation mechanisms may consider the value of solar to the distribution grid and to public policy goals in setting energy compensation rates.

A Value of Solar rate is calculated by studying, analyzing, and accounting for the benefits and costs of the solar system to the grid.[136] Rates may be locked in for a fixed contract length or can be open to revision based on changes in solar energy value over time or modifications based on market conditions at specific times and locations.[137] Value of Solar rates may decrease the burden of solar development costs on rate payers, but do not expand solar growth as much as the above-market rates generally used in state net metering programs and feed-in tariffs.[138]

For example, Minnesota established a Value of Solar tariff that is the mandatory rate for energy generated by community solar projects up to one MW in capacity. [139] The tariff is calculated based on the following factors: avoided generation capacity costs, avoided transmission capacity costs, avoided fuel costs, avoided environmental costs, avoided distributed capacity costs, avoided plant operation and maintenance costs, and avoided reserve capacity costs.[140] Customers are billed for all electricity consumed from the grid at their existing rate, and credited for the solar electricity contributed to the grid under the Value of Solar tariff.

Rate Adders, Subtractors, and Adjustors

Some states have established rate "adders" and "subtractors" within their compensation mechanisms for solar energy to encourage preferred project size, location, or design.[141] For example, an additional $0.01-$0.06 per-kilowatt-hour might be provided to small-scale solar arrays, low-income projects, community solar installations, projects located on structures or previously disturbed land, or those using solar tracker technology or incorporating battery storage. Policymakers might subtract a per-kilowatt-hour amount from large-scale arrays or for projects located on greenfields. See the "Options for Smart Farmland Solar Policy" section of this chapter for information about using rate adders and subtractors to protect agricultural land and encourage farmer access to clean energy.

Other Per-kilowatt-hour Rate Incentives

States have established a variety of additional "performance-based incentives" for solar energy. Performance-based incentive payments depend on the energy output of a solar installation.[142] Because these per-kilowatt-hour incentives are paid as energy is generated, they can provide an additional revenue stream to support solar projects over the long-term.[143]

133 Clean Energy Solutions Center, *Policy Briefs: Feed-in Tariffs*, https://cleanenergysolutions.org/instruments/feed-tariffs (Accessed April 15, 2020).

134 Zinaman, *Supra* Note 96.

135 When solar arrays are compensated at above retail or full retail rates for energy contributed to the grid, it reduces utility revenues and may lead to general rate increases, which can shift costs to customers that aren't using or directly benefitting from the solar energy. However, cost-shifting may not significantly affect non-participating customers until the percentage of electricity coming from solar, or solar penetration, reaches 4%-9%. Jackson Salovaara, *Just and Reasonable Rooftop Solar: A Proposal for Net Metering Reform,* 7 Ariz. J. Envtl. L. & Pol'y 56, 2017 at 83-84 (https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3363011).

136 Zinaman, *Supra* Note 96 at 8.

137 *Id.*

138 Trabish, *Supra* Note 132.

139 M.S.A. § 216B.164 (2017). See also: Catherine Lane, *Is Minnesota's Value of Solar Tariff the Future of Solar,* SolarReviews.com, Updated May 15, 2020 (https://www.solarreviews.com/blog/minnesotas-value-of-solar-tariff)

140 *Id.*

141 Mike Taylor, et al., *Value of Solar: Program Design and Implementation Considerations,* National Renewable Energy Laboratory, March 2015, at 43 (https://www.nrel.gov/docs/fy15osti/62361.pdf).

142 Tian Tian, et al., *Midmarket Solar Policies in the United States: A Guide for Midsized Solar Customers,* National Renewable Energy Laboratory, Sept. 2016, at 20 (https://www.nrel.gov/docs/fy16osti/66905.pdf).

143 *Id.*

For example, Connecticut requires utilities to solicit Zero-emissions Renewable Energy Credits (ZRECs) under 15-year contracts from customer-generators up to one MW in capacity that emit no greenhouse gases, including solar installations. Generators earn one ZREC for each megawatt-hour of energy produced, with different payment rates for small (< 100 kW) Medium (100 – 250 kW) and large (250 kW – 1 MW) ZREC projects.[144]

PURPA Qualifying Facilities

The federal Public Utility Regulatory Policy Act (PURPA) of 1978 required utilities to purchase the renewable energy generated by "qualifying facility" (QF) projects up to 80 MW in capacity at an "avoided cost" rate and to facilitate the interconnection of these projects to the grid.[145] PURPA rates may be available for projects that do not otherwise qualify for other state energy procurement programs.[146] The Energy Policy Act of 2005 amended PURPA to remove the mandatory purchase obligation on certain utilities for most QFs greater than 20 MW, but the obligation remains to purchase power from generators less than 20 MW.[147]

If a solar array is a QF, it generally has the option of selling energy to a utility either at the utility's avoided cost or at a negotiated rate. An "avoided cost" rate is the "incremental cost to an electric utility of electric energy or capacity which, but for the purchase from the QF, such utility would generate itself or purchase from another source."[148] PURPA has been a significant driver of utility-scale solar projects,[149] and "faithful implementation of PURPA is essential to the continued growth of solar."[150]

For example, National Grid, the largest electric distribution utility in Rhode Island, notes on its website, "Distributed generation facilities, which are not eligible for Net Metering Services, may alternatively register as Qualifying Facilities in order to sell excess power to National Grid at wholesale rates."[151] It directs interested customers to a separate tariff establishing a power purchase rate for QFs.[152]

144 C.G.S.A. § 16-244r (2019).

145 Public Utility Regulatory Policy Act (PURPA), P.L. 95-617 (1978) codified at 16 U.S.C. § 796(17) - (22) and § 824a-3 (2005); 18 C.F.R. § 131.80; 18 C.F.R. Part 292; Federal Energy Regulatory Commission Order No. 732, 2010.

146 In fact, net metering was initially invented as a way for utilities to fulfill PURPAS purchase obligations. Kenneth Rose, Karl Meeusen, *Reference Manual and Procedures for Implementation of the "PURPA Standards" in the Energy Policy Act of 2005,* Mar. 22, 2006, at FN 31.

147 It established a rebuttable presumption that generators larger than 20 MW in regions with wholesale markets have nondiscriminatory access to those markets and no longer need the protection of PURPA's mandatory purchase requirement. QF generators with a net capacity of 20 MW or less are not considered to have such access, so utilities must still buy power from those facilities. Solar Energy Industries Association, *The Public utility Regulatory Policy Act of 1978: PURPA 101,* Oct. 18, 2017 (https://www.seia.org/sites/default/files/2018-02/PURPA%202017.10.10.pdf).

148 18 C.F.R. § 292.101(b)(6); *PURPA Qualifying Facilities,* Federal Energy Regulatory Commission, https://www.ferc.gov/industries/electric/gen-info/qual-fac.asp (Accessed March 10, 2020).

149 Colin Smith, *What Drives Utility Solar Growth in a Post-ITC-Extension World?* GreenTech Media, Mar. 24, 2016 (https://www.greentechmedia.com/articles/read/What-Drives-Utility-Solar-Growth-in-a-Post-ITC-Extension-World).

150 Solar Energy Industries Association, *The Public utility Regulatory Policy Act of 1978: PURPA 101,* Oct. 18, 2017 (https://www.seia.org/sites/default/files/2018-02/PURPA%202017.10.10.pdf).

151 National Grid, Distributed Generation, *Net Metering in Rhode Island,* https://ngus.force.com/s/article/Net-Metering-in-Rhode-Island (accessed March 15, 2020).

152 Rhode Island Public Utilities Commission, RIPUC No. 2221, *The Naragansett Electric Company Qualifying Facilities Power Purchase Rate,* April 3, 2020 (effective May 1, 2020)(https://www.nationalgridus.com/media/pdfs/billing-payments/tariffs/ri/qf-rate-052020.pdf)

B. How do solar energy compensation rules affect farmers and farmland?

Integrating renewable energy into agriculture supports farm viability, among other benefits. Farmers and agricultural landowners can create additional income streams by leasing land to solar developers or participating directly in net metering programs and other compensation mechanisms for solar development. Solar energy can also support farm viability by significantly reducing the burden of a farm's electric bills. When rules are established to incentivize agrivoltaic or dual-use projects, farmers can create dual income streams from a single parcel of land that remains in agricultural production while generating solar electricity. However, farmers and agricultural landowners may be excluded from participation in net metering and other special energy compensation programs when the rules fail to consider the specific needs of agricultural electric customers.

Demand for solar development

Like state Renewable Portfolio Standards, state compensation mechanisms for solar energy that provide an above-market rate incentive are likely to significantly increase the sheer amount of solar development occurring in a given area, increasing the risks to agricultural land and uses. Farmers and agricultural landowners may experience increased pressure to lease land for large-scale solar development.[153] To address this pressure, lawmakers can include project siting conditions in solar compensation rate eligibility requirements or provide rate incentives to steer solar arrays away from farms and other greenfields.

Opportunities for Reduced Electricity Costs

While farms of any size can benefit financially from solar energy, "farm businesses" are poised to drastically reduce electricity costs if a beneficial compensation mechanism for solar energy is available. The U.S. Department of Agriculture defines a "farm business" as a farm where the primary operator spends the majority of time on agricultural production, or, if the operator is largely employed off-farm, the farm operation has over $350,000 in annual gross-cash income. While only 41% of U.S. farms are "farm businesses," they account for 93% of the country's agricultural production value and 90% of fuel and electricity consumption.[154] Electricity costs average about 1-6% of total expenses for farm businesses,[155] which also represents the farm's potential savings if a solar array meeting or exceeding this electric demand were installed. Solar development policies should leave room for farms of all sizes to benefit from the electricity cost savings and potential income realized from solar energy.

Customer Class Exclusions

The scale of farms and types agricultural production differ widely across the country.[156] Depending on the distribution utility or electric service provider serving the farm, the utility's available rate schedules and the farmer's electricity uses, the farmer might pay farm, residential, commercial, or industrial retail prices.[157] Unless policymakers have considered agricultural customers, they may be excluded from participating in state net metering programs.

For example, when California established its net metering program back in 1996, it only permitted residential customers with solar facilities under 10 kilowatts on their property to offset their electricity needs through net metering.[158] Later, small commercial customers and wind generators were allowed to participate, followed by agricultural, commercial, and industrial customers with solar or wind systems under one megawatt in capacity.[159] Finally, the program opened to any customer meeting project eligibility requirements.[160]

153 Claudia Hitaj and Shellye Suttles ,*Trends in U.S. Agriculture Production and Consumption of Energy: Renewable Power, Shale Gas, and Cellulosic Biomass,* EIB-159 Economic Research Service/USDA, Aug. 2016, at 2 (https://www.ers.usda.gov/webdocs/publications/74658/60128_eib159.pdf?v=0).

154 *Id.*

155 *Id.* at 37.

156 Farms 10-49 acres in size make up 28% of total farms, while 13% are small farms 1-9 acres in size and 8% are farms over 1,000 acres. USDA National Agricultural Statistics Service, 2017 Census of Agriculture. Complete data available at www.nass.usda.gov/AgCensus

157 Irene Xiarchos and Brian Vick, *Solar Energy Use in U.S. Agriculture: Overview and Policy Issues,* USDA, Office of Energy Policy and New Uses, April 2011 (https://www.usda.gov/oce/reports/energy/Web_SolarEnergy_combined.pdf).

158 S.B. 656 § 1 (b), 1995-96 Leg., Reg. Sess. (Cal. 1996); Mark James et. al., *Planning for the Sun to Come Up: How Nevada and California Explain the Future of Net Metering,* 8 San Diego J. Climate & Energy L. 1, 2017, at 27.

159 A.B. 1755 § 1(b)(2), 1997-98 Leg., Reg. Sess. (Cal. 1998); A.B. 58 § 2 (b)(2), 2001-02 Leg., Reg. Sess. (Cal. 2002); Id.

160 S.B. 489 § 1 (b)(4)-(5), 2011-12 Leg., Reg. Sess. (Cal. 2011); Id.

Electric Service Provider Exemptions

Many states only require large or investor-owned utilities to establish net metering programs and other per-kilowatt-hour compensation rates for solar energy.[161] Many farmers and agricultural landowners are served by Rural Electric Cooperatives, which are likely to be excluded from the obligation to offer net metering to their customers or to establish other standard contracts for purchasing solar energy.[162]

The Rural Electrification Act of 1936 promoted Rural Electric Cooperatives with the goal of bringing affordable electrical power to rural areas across the country.[163] Cooperatives are controlled by a board of directors elected by their customer-members, rather than beholden to shareholders like traditional investor-owned utilities.[164] While the democratic process in these cooperatives may allow interested members to advocate for smart solar incentives, their exemption from state requirements for solar energy compensation can leave farmers excluded from participation.[165]

Project Capacity and Siting Limitations

Project capacity size limitations and locational siting restrictions found within state energy compensation rules can exclude agricultural landowners from installing even solar arrays intended to serve an on-site electric load. Lawmakers should be careful not to create barriers to solar arrays that support farm sustainability and viability. For example, a broad prohibition on eligibility for projects sited on agricultural land can deny farmers access to clean energy.

Group or Virtual Net Metering

Group net metering, also known as community solar, allows multiple customers to benefit from a single, larger solar array and divide the net metering benefits among the group participants. Similarly, virtual net metering allows a customer or customers to benefit from a remote solar array not physically connected to the customer's electric meter. Such policies are beneficial both for the protection of agricultural land and for increasing farmer access to clean energy. Becoming a group member allows an agricultural landowner to participate in solar energy generation without siting an array on the farm property. Alternatively, it could allow a designated parcel of marginal farmland to host a solar array serving several farms in the area, while preserving the most productive farmland.

For example, Connecticut created a category within its virtual net metering program for "agricultural hosts," allowing farmers with net-metered solar arrays to share the benefits with up to 10 other farms, towns, cities, and other specified electric customers.[166]

Meter Aggregation

Traditional net metering generally applies to a single solar array associated with a single customer meter, while group net metering generally applies to a single solar array serving multiple customers all with separate accounts and meters. While farms may benefit from either policy, they are often limited by a "one customer, one meter" rule. This means a farm often cannot offset electricity consumed from more than one meter, even if all of the electricity is associated with the same farm business.

161 "Even for states with net metering policies, there are often exemptions. In Alaska, utilities with retail sales of less than 5 million kilowatt hours/year or utilities that generate 100% of their electricity from certain approved sources with a low environmental impact need not offer net metering. In Arizona, the Salt River Project and municipal utilities are not required to provide net metering. Likewise, municipal utilities are exempt in Arkansas, Massachusetts, and Virginia. In California, publicly-owned electric utilities with more than 750,000 customers which also provide water are exempt (e.g., the Los Angeles Department of Water and Power). Colorado exempts municipal utilities with fewer than 5,000 customers. Florida's rules exempt cooperatives or municipal utilities, as do Illinois'. Michigan exempts utilities with fewer than a million customers. In Pennsylvania, electric generation suppliers are permitted but not required to offer net metering, so customers who choose a retailer other than their traditional regulated utility may not have net metering available. Wisconsin exempts electric cooperatives. These exemptions mean that consumers may not have access to net metering even where there is a state-level policy in place." Heather Payne,Supra Note 110, at 145–46.

162 Zachary Brecheisen, *Green Acres: How Bringing Pennsylvania Rural Electric Cooperatives Under the Full Provisions of the Alternative Energy Portfolio Standard Can Boost Renewable Energy Growth in Pennsylvania,* 19 Penn St. Envtl. L. Rev. 333, 2011, at 338.

163 Rural Electrification Act of 1936, ch. 432, §1, 49 Stat. 1363.

164 National Rural Electric Cooperative Association, *A Solar Revolution in America,* July 2018 (https://www.cooperative.com/programs-services/bts/sunda-solar/Documents/Solar-Revolution.pdf).

165 "Currently, Rural Electric Cooperatives account for approximately ten percent of the total kilowatt-hours of electric power sold annually in the United States and approximately five percent of kWh generated. Cooperatives also control and operate approximately forty-three percent of all electrical distribution lines in the country, serving over 17 million consumers in rural and suburban areas." Zachary Brecheisen, *Supra* Note 162 at 338.

166 C.G.S.A. § 16-244u (2019).

"Meter aggregation" policies are important for accommodating agricultural businesses that may meter electricity at multiple locations on the same farm. These policies allow a single customer to offset electrical use from multiple meters, without needing additional "group" members. For example, a farmer could use net metering credits generated from a single renewable energy system to offset the load from multiple meters on the farmer's property or adjacent farm properties.

C. Options for Smart Farmland Policy Design

Solar arrays are compensated for the energy they generate through a variety of state-law mechanisms, including net metering programs, feed-in tariffs, value of solar tariffs, and other per-kilowatt-hour payments designed by regulators.[167] Lawmakers can identify preferred categories of solar development and preferred sites for solar arrays within program eligibility requirements and can change the rates paid for energy based on project characteristics that minimize impacts to agriculture.

> Create solar rate incentives that specifically include agricultural customers.

States should create a special category within energy compensation incentive programs for agricultural customers to ensure they are not precluded from participation.

For example, Virginia defines "eligible agricultural customer-generator" in its net metering law, and designates that the consumption and generation of multiple farm electric meters may be aggregated into a single account:

> "a customer that operates a renewable energy generating facility as part of an agricultural business, which generating facility (i) uses as its sole energy source solar power, wind power, or aerobic or anaerobic digester gas, (ii) does not have an aggregate generation capacity of more than 500 kilowatts, (iii) is located on land owned or controlled by the agricultural business, (iv) is connected to the customer's wiring on the customer's side of its interconnection with the distributor; (v) is interconnected and operated in parallel with an electric company's transmission and distribution facilities, and (vi) is used primarily to provide energy to metered accounts of the agricultural business. An eligible agricultural customer-generator may be served by multiple meters that are located at separate but contiguous sites, such that the eligible agricultural customer-generator may aggregate in a single account the electricity consumption and generation measured by the meters, provided that the same utility serves all such meters. The aggregated load shall be served under the appropriate tariff."[168]

> Allow agricultural net metering customers to aggregate meters.

States should designate by law that the consumption and generation of multiple agricultural electric meters associated with the same farm business may be aggregated into a single customer account. This allows farms to offset more electricity consumption with solar energy generation. Further, when eligible project capacity size is determined by the average annual electric load of the customer, this calculation should use an average from aggregated meters associated with the farm business to more accurately represent a farm's electricity needs, rather than forcing a farm customer to choose a single meter.

167 While this analysis focuses on notable state-law solar energy compensation programs, other important options for payment for solar energy are available, including participation in wholesale energy and capacity markets for utility scale systems. These policies are excluded from the scope of this analysis.

168 VA Code Ann. § 56-594(B)(2019)

Table 20. COMPARE: State Agricultural Meter Aggregation Policies

RHODE ISLAND **RI Gen. Laws § 39-26.4-2(8) (2017)**	"'Farm' shall be defined in accordance with § 44-27-2, except that all buildings associated with the farm shall be eligible for net-metering credits as long as: (i) The buildings are owned by the same entity operating the farm or persons associated with operating the farm; and (ii) The buildings are on the same farmland as the project on either a tract of land contiguous with, or reasonably proximate to, such farmland or across a public way from such farmland."
WASHINGTON **RCWA 80.60.030(4) (2019)**	"If a customer-generator requests, an electric utility shall provide such a customer-generator meter aggregation. (a) For a customer-generator participating in meter aggregation, credits for kilowatt-hours earned by the customer-generator's net metering system during the billing period first shall be used to offset electricity supplied by the electric utility at the location of the customer-generator's designated meter. (b) A customer-generator may aggregate a designated meter with one additional aggregated meter located on the same parcel as the designated meter or a parcel that is contiguous with the parcel where the designated meter is located. (c) For the purposes of (b) of this subsection, a parcel is considered contiguous if they share a common property boundary, but may be separated only by a road or rail corridor. (d) A retail electric customer who is a customer-generator and receives retail electric service from an electric utility at an aggregated meter must be the same retail electric customer who receives retail electric service from such an electric utility at the designated meter that is located on the premises where such a customer-generators net metering system is located."
MARYLAND **COMAR 20.50.10.07 (2016)**	A. When requested in writing by a qualified eligible customer-generator under §B of this regulation, an electric utility shall provide meter aggregation. B. Customers Qualifying for Aggregation. The following electric utility eligible customer-generators are qualified to request meter aggregation under §A of this regulation: (1) An eligible customer-generator using electrical service for agriculture; (2) An eligible customer-generator who is a not-for-profit organization or a not-for-profit business; or (3) An eligible customer-generator who is a municipal or county government or its affiliated organizations. C. An electric company shall require that an eligible customer-generator requesting meter aggregation under this regulation provide written allocation instructions detailing how to distribute its excess generation credits to each account prior to the commencement of any meter aggregation."

> Provide for group or virtual net metering for agricultural customers.

Lawmakers should ensure that agricultural customers can participate in group or virtual net metering so that farmers can benefit from solar energy sited remotely rather than sited on productive agricultural land.

Table 21. COMPARE: Solar Energy Compensation Rate Eligibility Requirements

CONNECTICUT **C.G.S.A. § 16-244u(a)(7)(B) and (d) (2019)**	"Agricultural virtual net metering facility" means a Class I renewable energy source that is operated as part of a business for the purpose of agriculture, as defined in subsection (q) of section 1-1 that: (i) Is served by an electric distribution company on land owned or controlled by an agricultural customer host and serves the electricity needs of the agricultural customer host and its beneficial accounts; (ii) is within the same electric distribution company service territory as the agricultural customer host and its beneficial accounts; and (iii) has a name-plate capacity rating of three megawatts or less." "The agricultural customer host shall not designate more than ten beneficial accounts each of which shall (1) use electricity for the purpose of agriculture, as defined in subsection (q) of section 1-1, (2) be a municipality, or (3) be a noncommercial critical facility..."

> Establish rate eligibility requirements based on project size and location.

Lawmakers should consider limiting the eligibility for solar compensation programs to smaller-scale projects and those in preferred locations. They can also establish different eligibility requirements for small and large-scale projects. Lawmakers should consider the following policy options:

- Set aside a portion of total program capacity for residential-scale arrays and those sited on structures, or exempt these arrays from program capacity caps.
- Establish energy compensation programs that are available to residential and small-scale solar projects, community or shared solar projects, and specifically available to agricultural customers.
- Increase eligible project capacity limits for agricultural customers to accommodate the farm's electric load.
- Establish separate tariffs and energy compensation rules for small and large-scale solar arrays.
- Limit program eligibility to projects located on preferred site-types.
- Tie eligible project capacity for net metering enrollment to customers' associated electric load, instead of or in addition to a flat project capacity limit.
- Where possible, streamline and combine the project permitting and siting approval process with the energy compensation program application and enrollment process.

Table 22. COMPARE: Solar Energy Compensation Rate Eligibility Requirements

DELAWARE **26 Del. C. § 1014(d) (2019)** **• Project Size Eligibility Changes by Customer Type** **• Established Regulatory Category for Farm Customers** **• Increased Eligible Project Capacity Limit for Farm Customers**	Delaware's net metering law establishes different eligibility requirements based on customer type, project capacity size, and interconnecting utility, including: "a. For residential customers of DP&L, DEC, and municipal electric companies, has a capacity of not more than 25 kW; b. For farm customers as described in § 902(3) of Title 3[169] who are customers of DP&L, DEC, or municipal electric companies that receive distribution service under a residential tariff or service offering, does not exceed more than 100 kW. On a case by case basis the Delaware Energy Office shall review a farm's application for a system above 100 kW by comparing the output of the system to the energy requirements of the farm and may grant a waiver to increase the size of the system above the 100 kW limit.... c. For nonresidential customers, is not more than 2 MW per DP&L meter, and 500 kW per DEC or municipal electric company meter. DEC and municipal electric companies are encouraged to provide for net metering up to a capacity of not more than 2 MW for nonresidential customers."
VERMONT **30 V.S.A §§ 8002 and 8005a (2019).** **• Separate Tariffs based on Project Size** **• Combined Permitting and Energy Compensation Eligibility Approval**	Net metering in Vermont is available for projects up to 500 kW in capacity, with project requirements for rate eligibility set out in the rules for obtaining a Certificate of Public Good (CPG) from the Public Utility Commission (PUC), which also serves as a siting and environmental approval. Vermont's CPG process offers a ten-day fast-track registration form, including interconnection, for ground-mounted systems up to 15 kW and roof-mounted systems up to 500 kW. Rule 5.105. An expedited application process is available for ground-mounted systems between 15 and 50 kW. Rule 5.106. Larger projects submit a CPG petition to the PUC and participate in evidentiary hearing process. The Standard Offer Program is a feed-in tariff offering long-term contracts to projects up to 2.2 MW in capacity through a competitive bidding process under a price cap. The 2019 Solar Standard Offer Price Cap was $0.130 per kWh. Standard Offer applicants are required to submit a petition for a CPG to the PUC and participate in an evidentiary hearing process for siting and environmental review in addition to the bidding process for energy compensation. *Also, see Table 23(a) below for rate modifications based on project size and location. CONTINUED ON NEXT PAGE >

169 § 902(3) of Delaware's Title 3 defines "Agricultural use" to mean "all forms of farming, including agriculture, horticulture, aquaculture, silviculture and activities devoted to the production for sale of food and other products useful to humans which are grown, raised or harvested on lands and waters."

Table 22. COMPARE: Solar Energy Compensation Rate Eligibility Requirements
(continued)

RHODE ISLAND

RI ST. § 39-26.6-1:27 (2016)

Separate Tariffs based on Project Size and Customer Class

And

Program Capacity Set Aside for Small Scale Solar

And

Includes Program Capacity Carve-outs based on Project Size and Location (carports)

And

Rates Change based on Project Size and Location (carports)

Rhode Island's Renewable Energy Growth Program[170] is a feed-in tariff allowing customers to sell renewable energy to utilities [171] for terms of 15 or 20 years at a fixed rate. It is separate from Rhode Island's net metering program and defines four different categories for solar projects based on nameplate capacity, as well as "shared solar" and "community remote" projects.[172]

- A "Small-scale solar project" has a nameplate capacity of 25 kW or less.
- A "Medium-scale solar project" has a nameplate capacity of greater than 25 kW up to and including 250 kW.
- A "Commercial-scale solar project" has a nameplate capacity of solar projects greater than 250 kW but less than one MW.
- A "Large-scale solar project" has a nameplate capacity of one to five MW in capacity.
- A "Shared Solar Facility" is a single Small-Scale or Medium-Scale Solar Project that allocates Bill Credits to at least two and no more than fifty accounts in the same customer class.
- A "Community Remote Distributed Generation System" is a distributed generation facility with a nameplate capacity greater than 250 kW and which allocates Bill Credits for each kilowatt-hour generated to a minimum of three eligible recipient customer accounts pursuant to the program rules.

Residential and small commercial customers (different from commercial scale solar) developing solar projects with a nameplate capacity of 25 kW or less apply by submitting completing an interconnection application and other required forms in an expedited process. Eligible projects are offered a standard rate, or "performance-based incentive." Projects 1-10 kW in capacity are compensated 29.65 cents per kilowatt-hour in 2020 under a 15-year tariff. Projects 11-25 kilowatts in capacity are offered 23.45 cents per kilowatt-hour under a 20-year tariff.[173] Applications are accepted on a rolling basis until the annual program capacity target of 6.95 MW is reached.

Projects larger than 25 kW must apply during a two-week open enrollment period, in which applicants submit bids that are at or below a ceiling price set by the Rhode Island Distributed Generation Board, which also sets annual targets for program capacity for different solar project categories. In 2020, annual enrollment targets are as follows: Medium-scale solar, 3 MW; Commercial-scale solar, 8.244 MW; large-scale solar, 18.294 MW. There is a further carve out for solar carport capacity targets of 2 MW of the commercial-scale target and 4 MW of the large-scale solar target. Projects are selected beginning with the lowest bid price until the enrollment target for the applicable class is met. If selected, the price each project bids into the solicitation will become its energy compensation rate, effective for 20 years.

An adder of six cents per kilowatt-hour is available for qualifying solar capacity installed on permanent carport structures. The Solar Carport Incentive is added to the competitively bid of the specific project upon acceptance.

An adder could be developed for projects to be located in designated areas where there is an identifiable grid system benefit, reliability benefit, or cost savings to the distribution system if the utility proposes to include an incentive-payment adder and the adder is approved.

Further, Rhode Island's Renewable Energy Fund provides additional per-kilowatt-hour subsidies for solar development, with different programs for small scale, commercial scale, community solar, and brownfield redevelopment solar projects.[174]

170 RI PUC, Docket No. 4892, Order RE: Renewable Energy Growth, May 7, 2020 (http://www.ripuc.ri.gov/eventsactions/docket/4892-DGBoard-NGrid-2019REG-Ord23827%205-7-2020.pdf).

171 National Grid is the only utility operating in Rhode Island that is obligated by the Renewable Energy Growth Program.

172 RI Office of Energy Resources, Renewable energy Growth Program, http://www.energy.ri.gov/policies-programs/programs-incentives/reg-program.php (Accessed March 1, 2020).

173 National Grid, Distributed Generation, *Rhode Island Renewable Energy Growth Program,* https://ngus.force.com/s/article/Rhode-Island-Renewable-Energy-Growth-Program (accessed March 1, 2020).

174 Commerce Rhode Island, Renewable Energy Fund, https://commerceri.com/financing/renewable-energy-fund/ (Accessed March 1, 2020).

Table 23a. COMPARE: VT Solar Rates Based on Size, Location and Design [175]

Vermont's "preferred siting" policy applies to net-metered solar arrays up to 500 kW in capacity. The state's net-metering regulation, Public Utilities Commission Rule 5.100, defines the following preferred sites:

(1) new or existing structures;

(2) parking lot canopies;

(3) previously developed tracts, excluding prime agricultural land and certain other resources;

(4) brownfields;

(5) suitable sanitary landfills;

(6) disturbed portions of gravel pits and quarries;

(7) locations designated in "duly adopted" municipal plans or joint letters of support from a municipality and relevant municipal and regional planning commissions;

(8) suitable Superfund sites;

(9) on the same or adjacent parcel as a customer using more than 50% of the system output.

Rate Modifiers

The RATE earned by net metered projects, including solar arrays, changes based both on project size and on project location:

- Category I: a net-metering system that is not a hydroelectric facility and that has a capacity of 15 kW or less.
- Category I Adder:[176] $0.01 per kilowatt-hour
- Category II: a net-metering system that is not a hydroelectric facility that has a capacity of more than 15 kW and less than or equal to 150 kW, and that is sited on a preferred site.
- Category II Adder: $0.01 per kilowatt-hour
- Category III: a net-metering system that is not a hydroelectric facility, that has a capacity of greater than 150 kW and less than or equal to 500 kW, and that is sited on a preferred site.
- Category III Subtractor: negative $0.02 per kilowatt-hour
- Category IV: means a net-metering system that is not a hydroelectric facility, that has a capacity of greater than 15 kW and less than or equal to 150 kW, and that is not located on a preferred site
- Category IV Subtractor: negative $0.03 per kilowatt-hour

In addition, net metering rates change based on whether customers choose to retain the Renewable Energy Certificates generated by their solar array or transfer them to the interconnecting utility:

- REC Transfer Adder = $0.01 per kilowatt-hour
- REC Retention Subtractor = negative $0.03 per kilowatt-hour

For both the siting and the REC adjustors, rate adders last for ten years, while rate subtractors stay in effect for the life of the solar project.

175 30 V.S.A. § 8010; PUC Rule 5.100.

176 Adjustors were updated in the Vermont Public Utility Commission's net metering biennial review. Case No. 18-0086-INV, Order: In re: biennial update of the net-metering program, Issued May 1, 2018.

Table 23b. COMPARE: MA Solar Rates Based on Size, Location and Design

MASSACHUSETTS: SMART Tariff

The Solar Massachusetts Renewable Target (SMART) Tariff is a feed-in tariff with a declining rate offered for each "block" of solar generation capacity deployed through the program. Small projects up to 25 kW in capacity receive a 10-year fixed price term and larger projects receive a 20-year fixed price term. The maximum eligible project size is 5 MW. It defines eligible projects by creating categories of "Solar Tariff Generation Units" subject to different eligibility requirements and compensation mechanisms. Projects must obtain a Certificate of Qualification for program eligibility approval. The SMART program recently underwent a regulatory review after filling the first 400 MW of program capacity, and modified program requirements based on stakeholder feedback.[177]

The SMART incentive levels decline by prescribed amounts over up to eight blocks per utility territory, with set-aside amounts in each block for projects up to 25 kW in capacity, projects between 25 and 500 kW, and low-income or community shared solar. After establishing a project's "base compensation rate," the Massachusetts SMART Tariff uses a variety of rate "adders" and "subtractors" to change the per kilowatt-hour rate paid for solar energy based on the arrays size, location, design, as well as characteristics of the off-takers, or users of the solar electricity. M.G.L. c. 25A, § 6, 225 C.M.R. 20.

BASE COMPENSATION RATE FACTOR **First, a multiplier applies to the base rate for projects less than 500 kW.**	**Percentage of Block 1 Base Compensation Rate received:** • Low Income Solar Tariff Generation Units ≤ 25 kW: 230% • ≤ 25 kW: 200% • > 25 kW AC to 250 kW: 150% • > 250 kW AC to 500 kW: 125% • > 500 kW AC to 1,000 kW: 110%
LAND USE CATEGORY **Second, projects are placed into a land use category based on project location, size, and design.**	**Category 1 Agricultural** Solar Tariff Generation Units located on Land in Agricultural Use or Important Agricultural Farmland that meet one or more of the following criteria: • Agricultural Solar Tariff Generation Units; • Building Mounted Solar Tariff Generation Units; • Floating Solar Tariff Generation Units; • Canopy Solar Tariff Generation Units; • Solar Tariff Generation Units sized to meet no greater than 200% of annual operation load of an agricultural facility. CONTINUED ON NEXT PAGE >

177 225 C.M.R. 20, Emergency Regulations, filed April 14, 2020 (https://www.mass.gov/doc/225-cmr-2000-smart-clean-0).

Table 23b. COMPARE: Solar Rates Based on Size, Location and Design
(continued)

LAND USE CATEGORY	
Second, projects are placed into a land use category based on project location, size, and design.	**Category 1 Non-Agricultural** Solar Tariff Generation Units not located on Land in Agricultural Use or Important Agricultural Farmland that meet one or more of the following criteria: • Ground-mounted Solar Tariff Generation Units with a capacity less than or equal to 500 kW; • Building Mounted Solar Tariff Generation Units; • Solar Tariff Generation Units sited on Brownfields; • Solar Tariff Generation Units sited on Eligible Landfills; • Floating Solar Tariff Generation Units; • Canopy Solar Tariff Generation Units; • Solar Tariff Generation Units that are ground-mounted with a capacity greater than 500 kW and less than or equal to 5,000 kW that are on land that has been previously developed; and • Solar Tariff Generation Units that are ground-mounted with a capacity greater than 500 kW and less than or equal to 5,000 kW that are sited within a solar overlay district or that comply with established local zoning that explicitly addresses solar or power generation. **Category 2 Land Use** Solar Tariff Generation Units not otherwise designated Category 1 that are ground-mounted with a capacity between 500 kW and 5 MW, sited on land that: • has not been previously developed and • is zoned for commercial or industrial use. **Category 3 Land Use.** Solar Tariff Generation Units not otherwise designated Category 1 or Category 2 that are ground-mounted. Ineligible Land Use. Solar photovoltaic Generation Units that meet one or more of following criteria shall not be eligible to qualify as Solar Tariff Generation Units under 225 CMR 20.00: • Projects on protected open space, as established under Article XCVII of the Amendments to the Constitution, that do not meet the criteria of Category 1 Land Use; • Projects sited in a wetland Resource Area (not including Buffer Zones), except as authorized by all necessary regulatory bodies; and • Projects sited on properties included the State Register, as defined in 950 CMR 71.03: Definitions, except as authorized by regulatory bodies CONTINUED ON NEXT PAGE >

Table 23b. COMPARE: Solar Rates Based on Size, Location and Design
(continued)

GREENFIELD SUBTRACTOR **Third, a rate subtractor is applied to certain land use categories.**	Greenfield Subtractor based on land use category: • Category 1: No greenfield subtractor • Category 2: (-)$0.00125/kWh per acre impacted
PREFERRED SITE AND DESIGN ADDERS **Fourth, rates are adjusted based on specific project characteristics.**	Adders based on Solar Tariff Generation Unit site location and array design: • Building Mounted: $0.02/kWh • Floating Solar: $0.03/kWh • Brownfield: $0.03/kWh • Eligible Landfill: $0.04/kWh • Canopy: $0.06/kWh • Agricultural Solar Tariff Generation Unit: $0.06/kWh • Solar Tracker Adder: $0.01/kWh • Energy Storage Adder: by formula • Pollinator Adder: $0.0025/kWh (see details below)
OFF TAKER ADDERS **Finally, rates are adjusted based on project offtakers.**	Adders based on specific off-takers, or participants the project: • Community Shared Solar Tariff Generation Unit $0.05 • Low Income Property Solar Tariff Generation Unit $0.03 • Low Income Community Shared Solar Tariff Generation Unit $0.06 • Public Entity Solar Tariff Generation Unit $0.02 CONTINUED ON NEXT PAGE >

Table 23b. COMPARE: Solar Rates Based on Size, Location and Design
(continued)

ENERGY STORAGE REQUIREMENT **This requirement was added during the 400 MW program review.**	Projects greater than 500 kW applying for a Statement of Qualification for any available capacity in any capacity block available after April 14, 2020 must be co-located with an Energy Storage System that meets the eligibility requirements for an Energy Storage Adder pursuant to 225 CMR 20.06(1)(e) unless it can demonstrate it should be granted an exception to the provisions of 225 CMR 20.05(5)(k) for good cause.
POLLINATOR ADDER **This option was added during the 400 MW program review.**	To be eligible for the Pollinator Adder, projects must "obtain and maintain at least a silver certification from the University of Massachusetts Clean Energy Extension Pollinator-Friendly Certification Program, or other equivalent certification as determined by the Department."

> Adjust rates based on project size, location or design.

Lawmakers should consider varying the compensation offered to different solar generators based on project characteristics. Lawmakers should consider the following policy options:

- Establish different solar compensation rates for small and large-scale projects.
- Establish special rates based on project location or site-type.
- Use rate adders and subtractors based on system size, location, and design within net metering programs, feed-in tariffs, and other per-kilowatt-hour compensation programs.
- Create a rate incentive specifically for agrivoltaic or dual use solar arrays.
- Create rate incentives for solar project characteristics like solar tracker hardware, energy storage components, or maintenance of pollinator habitat.

> Use digital tools to facilitate tariff implementation and consumer understanding.

As state rules for solar energy compensation take into account more and more factors that may affect the ultimate per-kilowatt-hour rate, tariff formulas for rate calculation become increasingly complicated. To support transparency and improve stakeholder understanding of compensation programs, lawmakers should encourage or require the use of digital tools and explanatory resources.

For example, NY-Sun developed a Microsoft Excel "Solar Value Stack Calculator" that estimates compensation for specific solar projects under the state's Value of Distributed Energy Resources tariff. The calculator "combines the wholesale price of energy with the distinct elements of DER that benefit the grid: the avoided carbon emissions, the cost savings to customers and utilities, and other savings from avoiding expensive capital investments."[178]

VI. Interconnection

Utility interconnection refers to the process of connecting a new solar array to the existing electric grid. Grid interconnection rules are essential for ensuring electric reliability, but can be costly and complicated. Depending on whether a new solar array connects to the transmission grid or the distribution grid, federal, regional, state, and utility-specific rules and fees may apply to the interconnection process. The interconnection of solar arrays remains a significant regulatory issue because of the technical and procedural requirements needed to safely, reliably and efficiently interconnect a new solar array.

A. Understanding Interconnection Policies

Federal Authority over Interconnection

At the federal level, the Federal Energy Regulatory Commission (FERC) has broad authority over all wholesale sales of electricity and over interconnection of new energy generators to the transmission grid. FERC has issued several orders governing interconnection procedures for new electricity generators under its jurisdiction. FERC Order 2003 established a procedure to standardize the interconnection process for large electric generators, greater than 20 MW.[179] The standardized interconnection procedures and agreements for large generators include studies conducted by the transmission provider, which FERC uses to evaluate the request to interconnect, and standardized requirements covering frequency, voltage, and other power standards.[180]

FERC has also addressed interconnection procedures for "small" generators under 20 MW, initially in Order 2006, which also included a streamlined process for

178 NYSERDA, Value of Distributed Energy Resources, Solar Value Stack Calculator, https://www.nyserda.ny.gov/All-Programs/Programs/NY-Sun/Contractors/Value-of-Distributed-Energy-Resources/Solar-Value-Stack-Calculator (Accessed March 1, 2020).

179 FERC Order No. 2003, Standardization of Generator Interconnection Agreements and Procedures, 68 Fed. Reg. 49,846 (Aug. 19, 2003) (codified at 18 C.F.R. pt. 35). Since issuing Order 2003, FERC has revised the large generator interconnection procedures several times. The history of revisions and current rules can be found at https://www.ferc.gov/industries/electric/indus-act/gi/stnd-gen/LGIP-procedures.pdf

180 FERC recently reformed these procedures in Order 845. FERC Order No. 845, 163 FERC ¶ 61,043, Reform of Generator Interconnection Procedures and Agreements (April 19, 2018) (codified at 18 C.F.R. pt. 37).

generating facilities with capacity less than 2 MW.[181] In 2013, FERC responded to a rapid increase in small-scale, distributed solar deployment with Order 792, allowing certain inverter-based interconnections up to 5 MW to qualify for a streamlined "fast-track."[182] Eligibility to apply "for the fast-track interconnection process is based on the generator type and size, and the line voltage and type at the point of interconnection."[183]

While the interconnection rules developed by FERC legally only apply to projects under FERC jurisdiction, several states have used the FERC rules as a model in designing rules governing interconnection to the distribution grid, and these rules have influenced the creation of other regulatory categories for energy development.

The North American Electric Reliability Corporation (NERC) is designated by FERC as the nation's Electric Reliability Organization (ERO), meaning that NERC establishes nationwide grid maintenance and testing standards for transmission, generation, load shedding, and other technical requirements. FERC directs NERC to develop "modifications to reliability standards in an ongoing process that is designed to respond to changing market conditions and transmission system properties."[184] Ultimately, NERC ensures the reliability of the North American bulk electric system.[185]

While FERC and NERC set national interconnection and reliability standards, the United States has not developed a single, unified set of interconnection requirements for connection to the distribution grid. It is important to distinguish between state and federal jurisdiction for solar array interconnections. If a solar array interconnects to the distribution grid with an electric utility exclusively making retail sales, it does not fall under FERC jurisdiction and is subject to state interconnection rules.

State Authority over Interconnection

States have the authority to create and implement interconnection policies for generation facilities that fall under state jurisdiction, including solar arrays connecting to the distribution grid.[186] Public utility commissions are often tasked with establishing rules for interconnection of new solar arrays to the distribution grid, but specific requirements are often left up to the individual interconnecting utility. Some states allow smaller projects to qualify for an expedited interconnection process, while requiring larger projects to go through more comprehensive review, which often includes paying for an interconnection study. Some state interconnection rules only apply to net-metered systems or interconnection by investor-owned utilities—not to municipal utilities or electric cooperatives. Where rules have not been established, the interconnecting utility is in charge of the interconnection process.

Interconnection Agreements

Any generator that proposes to connect to a local electric utility's distribution or transmission system must comply with the utility's tariff for interconnections and enter into an interconnection agreement.[187] Utilities may use the same interconnection agreement and procedures for small systems and large power generators, and may charge for system studies, upgrades, and miscellaneous i nterconnection fees that greatly reduce the financial feasibility of smaller-scale solar arrays.[188] In the process of developing standard interconnection

181 FERC Order No. 2006, *Standardization of Small Generator Interconnection Agreements and Procedures,* 68 Fed. Reg. 49,846 (May 12, 2005) (codified at 18 C.F.R. pt. 35).

182 FERC Order No. 792, Small Generator Interconnection Agreements and Procedures (Nov. 22, 2013) (codified at 18 C.F.R. pt. 35). The small generator procedures were revised in several subsequent orders. This history of revisions and current rules can be found at https://www.ferc.gov/industries/electric/indus-act/gi/small-gen/sm-gen-procedures.pdf.

183 Ilya Chernyakhovskiy, et al., *U.S. Laws and Regulations for Renewable Energy Grid Interconnection*, National Renewable Energy Laboratory, 2016, at 14 (https://www.nrel.gov/docs/fy16osti/66724.pdf).

184 *Id.* at 2.

185 This includes three major independent interconnections: Eastern Interconnection, Western Interconnection, and Electricity Reliability Council of Texas (ERCOT) Interconnection. It also includes multiple regional transmission grids operated by Regional Transmission Organizations or Independent System Operators.

186 Chernyakhovskiy, *Supra* Note 183, at 2.

187 If the solar array is a wholesale power generation facility intended to be interconnected electrically to the transmission or distribution system operated by a local electric utility on behalf of the power region, the facility must enter into an interconnectionagreement that has been approved by the Federal Energy Regulatory Commission (FERC) as part of a tariff filing of the utility or as part of the overall tariff documents approved by a regional transmission organization (RTO) or an independent system operator. These projects are outside the scope of this report.

188 Fred Beck & Eric Martinot, *Renewable Energy Policies and Barriers,* Academic Press/Elsevier (2004), Science (http://biblioteca.cejamericas.org/bitstream/handle/2015/3308/Renewable_Energy_Policies_and_Barriers.pdf?sequence=1&isAllowed=y).

procedures, state lawmakers may choose to establish standard interconnection agreements as well, in order to assure equal legal treatment of solar and other distributed renewable energy installations across different utility service territories in the same state.

Hosting Capacity

A utility must ensure that interconnecting a new solar array to a distribution system does not negatively impact electric power quality or reliability for customers, like voltage deviations or violations of electrical safety limits.[189] Hosting capacity refers to the aggregate solar capacity (and other distributed energy resource capacity) that can be interconnected to a distribution system without requiring system-infrastructure upgrades. When upgrades are required, the costs may be added onto the cost of the proposed solar development.

B How do Interconnection Policies affect Farmland?

While many concerns about grid interconnection are not limited to farmland solar arrays, policymakers hoping to establish smart farmland solar policy should seek to streamline and improve interconnection rules. Current rules create project approval delays and increase project costs, particularly for rural solar development.

Project Delays

One issue with interconnection is the delay between submission of an interconnection application to a utility and receipt of the utility's permission to operate. It can take a long time to complete required electrical interconnection studies and analyses on system impacts for proposed solar arrays.[190] Using data from more than 30,000 solar arrays installed between 2012 and 2014, the National Renewable Energy Laboratory found that the median interconnection approval time for residential arrays (up to 10 kW) was 52 days, and small commercial arrays (between 10 and 50 kW) took 63 days to obtain approval.[191] Policymakers should strive to ensure that needed renewable energy resources and those that support farm viability are not unreasonably delayed in obtaining interconnection approval.

Increased Costs and Fees

In addition to time delays, solar arrays sited on farmland, like other solar arrays, may face substantial fees and compliance costs for interconnection. Charges include application fees, engineering fees, and inspection fees for reviewing, for example, the stress a new solar array will add to a neighborhood transformer.[192]

> "Individual home or commercial systems connected to utility grids can face burdensome, inconsistent, or unclear utility interconnection requirements. Lack of uniform requirements can add to transaction costs. Safety and power-quality risk from non-utility generation is a legitimate concern of utilities, but a utility may tend to set interconnection requirements that go beyond what is necessary or practical for small producers, in the absence of any incentive to set more reasonable but still technically sound requirements. In turn, the transaction costs of hiring legal and technical experts to understand and comply with interconnection requirements may be significant. Policies that create sound and uniform interconnection standards can reduce interconnection hurdles and costs."
> — Fred Beck & Eric Martinot, Renewable Energy Policies and Barriers [193]

189 McAllister, Richard, David Manning, Lori Bird, Michael Coddington, and Christina Volpi. 2019. *New Approaches to Distributed PV Interconnection: Implementation Considerations for Addressing Emerging Issues.* Golden, CO: National Renewable Energy Laboratory (https://www.nrel.gov/docs/fy19osti/72038.pdf).

190 K. Ardani & C. Davidson & R. Margolis & E. Nobler, NREL, *A State-Level Comparison of Processes and Timelines for Distributed Photovoltaic Interconnection in the United States,* Jan. 2015 (https://www.nrel.gov/docs/fy15osti/63556.pdf).

191 *Id.*

192 *Id.*

193 Fred Beck & Eric Martinot, *Renewable Energy Policies and Barriers,* Academic Press/Elsevier (2004), Science http://biblioteca.cejamericas.org/bitstream/handle/2015/3308/Renewable_Energy_Policies_and_Barriers.pdf?sequence=1&isAllowed=y

Standardized interconnection agreements can expedite this process, removing a barrier to the smaller-scale solar development that is more consistent with farmland protection.[194] States may also choose to adopt a standard interconnection agreement, particularly for small-scale arrays that are less likely to burden the distribution grid.

Rural Interconnection Barriers

Agricultural businesses are likely to be located in more rural areas that may be served by radial distribution network.[195] A "radial network passes from the substation through the network area with no connection to any other transmission or distribution lines."[196] This is common for rural lines with isolated electric loads, like farms, and may limit the hosting capacity of the grid or the capacity size of proposed projects. Additionally, farmers and ranchers are often served by Rural Electric Cooperatives that are usually not subject to standardized state interconnection policies.[197] This means lawmakers must specifically address improvements in interconnection procedures for rural generators electric cooperatives when considering changes to farmland solar interconnection policies.

C. Options for Smart Farmland Policy Design

> Specify time limits for interconnection application review.

Effective interconnection rules should specify both the procedural steps that must be taken and also the amount of time allowed for each phase of the process. Timing can be critical to project development success, and delays are likely to arise if procedures do not include specific, reasonable time limits for each step.

For example, Virginia's net metering law provides, "The electric distribution company shall have 30 days from the date of notification for residential facilities, and 60 days from the date of notification for nonresidential facilities, to determine whether the interconnection requirements have been met."[198]

> Expedite applications for smaller-scale solar arrays.

States should create simple, transparent interconnection applications for small generators. If possible, the interconnection application should be combined with a simplified interconnection agreement.

For example, Oregon has established four tiers of interconnection requirements applicable to solar arrays:

- Tier 1 application process is generally used for arrays 25 kW or less.
- Tier 2 application process is generally used for arrays from 25 kw to 2 MW.
- Tier 3 application process is generally used for arrays between 2 and 10 MW.
- Tier 4 application process is for projects 10 MW or less in capacity, but which do not meet other requirements of the lower tiers.
- The public utility must provide separate application form for Tier 1 review and for review under Tiers 2,3 & 4. Further, application fees are capped at $100 for Tier 1 review, $500 for Tier 2 review, and $1000 for review under Tiers 3 and 4.[199]

194 *Id.*

195 Ecofys US, Energy Trust of Oregon, Interconnection Guidebook for Developers of Small Scale Renewable Energy Generation Systems, at 42 (2016). Available at: https://www.energytrust.org/wp-content/uploads/2016/10/100908_Interconnection_Guidebook.pdf

196 *Id.*

197 They were created by the New Deal to bring electric power and telephone service to rural areas. Irene Xiarchos and Brian Vick, *Solar Energy Use in U.S. Agriculture – Overview and Policy Issues*, United States Department of Agriculture, 2011, at 59.

198 VA Code Ann. § 56-594(C) (2019).

199 OAR 860-082-(0045-0060) (2017).

> Limit fees and reduce interconnection costs for smaller-scale solar arrays.

States should limit application and processing fees for interconnection of smaller-scale projects. This includes limiting overly burdensome administrative requirements, such as obtaining signatures from local code officials, unless necessary.

For example, California's Rule 21 Tariff, governing interconnection, mandates that customer-generators with solar arrays up to 1 MW must pay a pre-approved one-time interconnection fee based on each investor owned utility's historic interconnection costs. This fee is between $75-$145. Customer-generators with systems greater than 1 MW must pay an $800 interconnection fee and must pay for any necessary transmission or distribution system upgrades.

> Consider Use of a Cost Envelope.

A cost envelope limits a developer's cost responsibility for upgrades (or modifications) to a certain threshold above a utility's estimate. Typically, costs are estimated before a developer signs an interconnection agreement, and these estimates generally are made based on a preliminary assessment of the project without a site visit.[200]

For example, in Massachusetts, once a utility has conducted an impact study that includes a cost estimate, a developer can sign an Early Interconnection Service Agreement to limit its liability to 25% above the impact study cost estimate.[201] After the utility produces another cost estimate based on a detailed study, developers only are liable for actual upgrade costs up to 10% more than the detailed study estimate.[202]

> Develop Model Interconnection Standards for Rural Electric Cooperatives.

Policymakers should consider developing rules or models for interconnection with rural electric cooperatives to facilitate farmland solar arrays.

For example, the Montana Electric Cooperatives' Association (MECA) developed and adopted a model Interconnection of Small Customer Generation Facilities policy in 2001, which has been adopted in whole or part by most of the 26 electric cooperatives in Montana, although individual cooperatives may choose to modify the policy.

200 McAllister, Richard, David Manning, Lori Bird, Michael Coddington, and Christina Volpi. 2019. *New Approaches to Distributed PV Interconnection: Implementation Considerations for Addressing Emerging Issues.* Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-72038. https://www.nrel.gov/docs/fy19osti/72038.pdf.

201 *Id.*, citing MDPU 2009, 14; MDPU 2015, 115.

202 *Id.* citing MDPU 2009, 76.

VII. Current Use Taxation

Agricultural land enrolled in beneficial taxation programs are often barred from installing solar arrays. States are starting to change their policies to allow limited solar development on enrolled land to avoid farmers and agricultural landowners facing penalties for using renewable energy on-farm.

A. What is Current Use Taxation?

Current Use Taxation policies are beneficial taxation programs in which agricultural land is assessed and taxed at its agricultural value, rather than market value, so long as the land continues to be used or available for agricultural purposes.[203] These programs may also be open to forestry or other specific land uses. They create an incentive for private landowners to keep their land undeveloped by providing some relief from market pressure to convert agricultural, open space, and forest land to economically "best uses" through development.[204]

Landowners reduce their property tax obligations by limiting the use of their land to a beneficial purpose, like agriculture or forestry, and are subject to tax penalties if the land use is changed. Agricultural current use taxation programs provide a public benefit by sustaining the variety of services provided by agricultural lands, including greenspace preservation, food production, and ecosystem services like flood control, air quality, biological controls, pollination habitat, and carbon sequestration. States should carefully consider the types of solar infrastructure to allow on enrolled land to ensure arrays support the underlying beneficial use.

Land Use Conversion

State programs vary on the activities permitted on enrolled land. When a landowner commences a land use not permitted by the state's current use program, this may constitute "land use conversion," disqualifying the land from beneficial taxation. Some states have addressed the addition of renewable energy infrastructure on enrolled land, setting out conditions for renewable energy use and development that are consistent with current use enrollment. Other states have not yet addressed this issue, making it likely that the addition of solar infrastructure to enrolled land would be considered land use conversion, subjecting the landowner to a conversion penalty or land use change tax.

Land Use Change Tax

If land enrolled in a current use program no longer meets the criteria for beneficial taxation, the landowner is likely to be assessed a tax penalty. This penalty may simply require the landowner to pay the tax rate that would have been applied to the land if it were never enrolled in current use, but could impose additional penalties like "roll-back taxes" requiring the payment of taxes for prior years adjusted to a "fair market value" tax rate.

B The Role of Current Use Programs in Farmland Solar Development

Current use policies are protective of farmland, as they support farm viability and long-term agricultural use. However, they can pose a significant barrier to farmers who wish to install a solar array. If a state has not addressed the addition of renewable energy infrastructure to land enrolled in current use taxation, the new infrastructure may be considered "development" or "land conversion," disqualifying the underlying land for beneficial taxation and potentially subjecting the landowner to conversion tax penalties.

Current Use Program Rules May Prohibit Solar Development

Existing current use program rules may not leave any flexibility for solar development, even when the array specifically benefits a farm or powers an agricultural use on enrolled land. Agricultural landowners must be very careful to ensure that a solar project is consistent with current use program rules and will not subject the landowner to a hefty tax penalty. When specific rules have not been established for solar development on enrolled land, a proposed array will be judged according to existing program definitions and allowed uses.[205]

203 John Bordeau, et al, *Rural or Agricultural Lands*, 84 C.J.S. Taxation § 596.

204 Justin Barnes & Chad Laurent & Jayson Uppal & Chelsea Barnes & Amy Heinemann, *Property Taxes and Solar PV Systems: Policies, Practices, and Issues*, at 45, July 2013 (https://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2015/06/Property-Taxes-and-Solar-PV-Systems-Policies-Practices-and-Issues.pdf).

Definition of ''Farmer''

Some state current use programs define the word "farmer" as a person receiving a certain percentage of their income from agricultural activity or the practice of farming. If income from a solar array changes the farmer's income percentage, this could disqualify them from current use enrollment.

Definition of ''Farm'' or ''Agricultural Use''

The definition of "farm," "farming," or "agricultural use" in a state current use program helps to establish the activities or land uses that qualify for a beneficial tax rate. If renewable or solar energy infrastructure is not addressed within the current use program rules, this land use may disqualify the land and potentially subject the landowner to conversion tax penalties.

Acreage required for enrollment in Current Use

Many state programs have minimum acreage requirements for enrollment in current use taxation. If a solar installation does not qualify as an agricultural use and reduces the total agricultural land acreage of a property, this could disqualify the entire property from beneficial taxation due to failure to meet minimum acreage requirements.

Land income requirement

Some states require that land produce a certain quantity of products for sale or the actual sale of agricultural goods to qualify for current use enrollment, regardless of what percentage of the landowner's total income comes from those agricultural sales. If a solar installation prevents the production of agricultural goods needed to maintain enrollment, the property could be disqualified from the current use taxation program.

Building Envelopes, Farm Buildings and Dwellings

Farms often have outbuildings, barns, and residences on the property. Many current use programs define certain structures as "farm buildings," meaning that underlying land still qualifies for beneficial taxation. Other programs may carve out space around existing buildings or dwellings to be included in a "development envelope," where certain land use changes are permitted to occur. Renewable energy infrastructure sited on farm buildings or within an established development envelope are much less likely to affect a property's enrollment in current use taxation, even if a state has not modified its current use rules to address solar development.

C. Policy Options for Addressing Solar Development on Enrolled Farmland.

States have begun to develop rules for their current use programs, governing when solar development is consistent with enrollment and when it will subject the landowner to a tax penalty. These rules might clearly establish that solar development is not permitted on enrolled land or may allow limited solar development based on the system's size, land use footprint, the percentage of energy used by the farm, or on a case by case basis.

205 Doug Stienbarger & Penny Ramey & Eric Lambert, Small Acreage Program & Washington State University: Clark County Extension, *Do You Qualify For Reduced Property Taxes? Current Use Taxation* (2014) (https://s3.wp.wsu.edu/uploads/sites/2079/2014/04/current-use-15.pdf.)

Table 24. COMPARE: Current Use Rules for Solar Development Serving the Farm

PENNSYLVANIA **7 Pa. Code Ch. 137b(12) (2015)**	"Tier 1 alternative energy systems" as defined under Pennsylvania's Alternative Energy Portfolio Standard, including solar energy, are permitted on enrolled land when meeting the following requirements: "Land that is in agricultural use is eligible for preferential assessment under the act if it has been producing an agricultural commodity or has been devoted to a soil conservation program under an agreement with the Federal Government for at least 3 years preceding the application for preferential assessment, and is one of the following: (1) Comprised of 10 or more contiguous acres (including any farmstead land and woodlot). (2) Has an anticipated yearly gross income of at least $2,000 from the production of an agricultural commodity. (3) Devoted to the development and operation of an alternative energy system, if a majority of the energy generated annually is utilized on the tract."
NEW JERSEY **N.J.S.A. 4:1C-32.4 (2010)**	"a. Notwithstanding any law, rule or regulation to the contrary, a person who owns preserved farmland may construct, install, and operate biomass, solar, or wind energy generation facilities, structures, and equipment on the farm, whether on the preserved portion of the farm or on any portion excluded from preservation, for the purpose of generating power or heat, and may make improvements to any agricultural, horticultural, residential, or other building or structure on the land for that purpose, provided that the biomass, solar, or wind energy generation facilities, structures, and equipment: (1) do not interfere significantly with the use of the land for agricultural or horticultural production, as determined by the committee; (2) are owned by the landowner, or will be owned by the landowner upon the conclusion of the term of an agreement with the installer of the biomass, solar, or wind energy generation facilities... (3) are used to provide power or heat to the farm, either directly or indirectly, or to reduce, through net metering or similar programs and systems, energy costs on the farm; and (4) are limited (a) in annual energy generation capacity to the previous calendar year's energy demand plus 10 percent, in addition to what is allowed under subsection b. of this section, or alternatively at the option of the landowner (b) to occupying no more than one percent of the area of the entire farm including both the preserved portion and any portion excluded from preservation. The person who owns the farm and the energy generation facilities, structures, and equipment may only sell energy through net metering or as otherwise permitted under an agreement allowed pursuant to paragraph (2) of this subsection. b. The limit on the annual energy generation capacity established pursuant to subparagraph (a) of paragraph (4) of subsection a. of this section shall not include energy generated from facilities, structures, or equipment existing on the roofs of buildings or other structures on the farm as of the date of enactment of P.L. 2009, c. 213." CONTINUED ON NEXT PAGE >

Table 24. COMPARE: Current Use Rules for Solar Development Serving the Farm (continued)

VERMONT **32 V.S.A. §§ 3752, 3755, 3757, 3802, and 8701 (2019)**	"Land with a solar generating facility may qualify for enrollment in the Current Use Program if the facility qualifies as a farm improvement. In that circumstance, the land and facility may both be enrolled in the Current Use Program. One of the statutory criteria that must be met in order to qualify as a farm improvement is that the improvement must be part of a farming operation. The Department of Taxes will presume that a facility is part of a farming operation in cases where 50% or more of the electricity generated is used by enrolled farm buildings. Some surplus electricity may be shared with non-farm buildings, or sold, as long as 50% or more of the electricity generated is used by enrolled farm buildings. Generally, a facility that shares or sells more than 50% of the electricity generated is not eligible for enrollment in the Current Use Program. However, an applicant may provide further evidence that a facility is part of a farming operation even though 50% or more of the electricity generated is used by non-farm buildings or is sold. Enrollment decisions are ultimately made by applying the statutory criteria for Current Use eligibility and the applicable statutory definitions."[207]

> Agrivoltaic or Dual Use Solar Arrays may be Sited on Enrolled Land

Some states only allow agrivoltaic or dual use solar arrays to be sited on enrolled land without triggering tax penalties. Such projects are valued as they support farm viability, maintain agricultural land uses, and provide farmers with a dual income stream from renewable energy generation.

For example, Rhode Island allows solar development on up to 20% of enrolled farmland acreage, but requires a dual use design for any solar array sited on more than 20% of farmland acreage.

Table 25. EXAMPLE: Requirements for Rhode Island's Dual Use Generation Unit

Pursuant to R.I. Gen. Laws § 44-27-10.1, farmland hosting a solar array continues to be taxed according to agricultural use if the solar array qualifies as a "dual use generation unit."

- Array will not interfere with the continued use of the land beneath the unit or around the structure for agricultural purposes;
- Array is designed to optimize a balance between the generation of electricity and the agricultural productive capacity of the soils;
- Array is a raised or freestanding structure allowing for continuous growth of crops underneath the solar photovoltaic modules or around the turbine, with height enough for labor and/or machinery as it relates to tilling, cultivating, soil amendments, harvesting, etc. and grazing animals; and,
- Array complies with applicable Fire Safety, Building Code, and other applicable regulations.
- Applicant reports annually to the Division of Agriculture of the regarding agricultural productivity, including identification of dual uses, acres of farmland integrated with the project, planned crops and expected harvests, and planned animals and herd sizes;
- Applicant develops a vegetative management plan (annual landscaping, mowing, etc. surrounding the Dual Use Generation Unit) with the local fire official for a fire permit to be issued; and,
- Applicant submits a current conservation plan to the Department that ensures continued viability of the farmland during and after the prescribed life of the renewable energy project.

207 Vermont Department of Taxes, Technical Bulletin 69, *Solar Generating Facilities Constructed on Land Enrolled in the Current Use Program,* July 13, 2015.

> Solar May Never be Sited on Enrolled Land.

Some states refuse to accept solar energy generation as an agricultural use on land enrolled in current use taxation programs. In these states, installation of a solar generating facility on land enrolled in the current use program would result in a revocation of current use enrollment and assessment of land use change penalties. Policymakers may view solar development as an improper use of agricultural land receiving current use benefits, and should be clear in law and regulation if solar development is prohibited under program rules.

> Solar Arrays are Not Permitted on Quality Soils

States can limit prohibitions on solar development to enrolled land designated as "prime farmland," "unique farmland," "land of statewide importance," or even "land in agricultural use.[206] This would preserve high-quality soils and productive farmland while leaving room for solar development on enrolled land consisting of marginal farmland and poorer-quality soils.

>Solar Arrays may be Sited on a Case-by-Case Basis.

Some states allow landowners to show that the solar array is being used for agricultural purposes on a case-by-case basis. If the solar array does not violate program rules, the tax assessor will allow the hosting land to retain its tax benefits. This policy is likely the most difficult to implement of all policy options, and leads to confusion among participants and regulators alike.

For example, in Connecticut, tax assessors make decisions about agricultural use on a case-by-case basis based on different farm characteristics. Tax assessors take into account "the acreage of such land, the portion thereof in actual use for farming or agricultural operations, the productivity of such land, the gross income derived therefrom, the nature and value of the equipment used in connection therewith, and the extent to which the tracts comprising such land are contiguous." While it is not clear that solar arrays are permitted on enrolled land, the program rules leave room for such a determination.

> Solar Arrays of Limited Size may be Sited on Enrolled Land.

Some states allow landowners to site solar arrays of limited capacity on enrolled land, as small-scale arrays are likely to have a minimal impact on agricultural use.

For example, in Vermont, any solar generating facility that is less than fifty kilowatts and is net metered may be located on land enrolled in Vermont's current use program without triggering tax penalties. In addition, solar arrays are generally considered as allowed "farmland improvements" when fifty percent or more of the electricity generated from the solar array is consumed on-site. See Table 24, below.

>Solar Arrays Serving the Farm may be Sited on Enrolled Land.

Some states allow landowners to site solar arrays on enrolled farmland when the array is designed to meet the farm's on-site electricity load.

> Solar Defers or Cancels Current Use Enrollment without Penalty

Some states have established provisions for the deferment or cancellation of current use enrollment, in lieu of penalties, to accommodate solar development.

For example, California's Williamson Act[208] allows landowners to restrict their land to agricultural and compatible uses in exchange for lower property taxes.[209] As solar development has increased on California's agricultural lands, the rules governing solar development on Williamson Act lands have evolved.[210]

206 Amy Odens, *A New Crop for Agricultural Land: The Renewable Energy Mandate and Its Potential to Turn Farm Lands into Energy Fields,* 44 McGeorge L. Rev. 1037, 1064 (2013).

208 California Land Conservation Act of 1965, codified at Cal. Gov. Code §§ 51200-51297.5 (2000).

209 David H. Blackwell & Michael Patrick Durkee, *The Williamson Act: Siting Implications For California Projects,* SOLAR INDUSTRY, June 2010.

210 Rajinder Singh Sungu, *Growing Energy: Amending the Williamson Act to Protect Prime Farmland and Support California's Solar Energy Future*, 21 San Joaquin Agric. L. Rev. 321 (2012).

Currently, nearly every local jurisdiction in California requires that a Williamson Act contract be canceled to accommodate solar development. The cancellation process can be controversial and requires the local jurisdiction to make specific findings, but the California courts have confirmed that cancellation of a Williamson Act contract in favor of solar development is permissible under certain factual circumstances.

VII. Other Considerations

This toolkit views solar development policy through the lens of agricultural use protection and farmer access to clean energy. The policy considerations applicable to farmland solar siting are more widely applicable to renewable energy development on any valuable lands, and lawmakers should evaluate the options for smart farmland solar policy identified here for application to other lands and renewable energy technologies. At the same time, the policy options identified here may not be appropriate for all farmland, particularly land enrolled in strict conservation programs. This toolkit does not address every single state law promoting or regulating solar development, and excludes discussion of solar arrays on federal land or under federal jurisdiction. Policymakers should use this toolkit as a jumping off point for exploring solar development laws in these other contexts.

A. Other Lands and Renewable Technologies

Open Space, Forestland, and other Valuable Natural Resources

Forestland and non-agricultural open space land are frequently targeted as sites for solar development. Lawmakers should address the impact of solar development not only on farmland, but on forestland and other valuable natural resources. The options for policy design identified in this Toolkit can be modified for application to other land types.

Other Renewable Energy Technologies

Solar energy is not the only renewable energy technology that developers or landowners seek to site on agricultural land. Wind, micro-hydro, and biogas generation facilities are also likely to be sited on farms. Lawmakers should evaluate all state renewable energy siting policies for adverse impacts on agricultural land and for barriers to renewable energy development that improve farm viability. The options for policy design identified in this Toolkit can be modified for application to other renewable energy technologies.

Other Renewable Energy Incentives

Incentives for solar development, including special financing, grant and loan programs, and sales or property tax exemptions may be available for new solar arrays in certain states. Federal incentives for renewable energy development are also available. These programs, which are not discussed in any detail in this report, are likely to accelerate in-state solar development, which increases pressure on agricultural lands. When special incentives are made available to farmers and agricultural landowners, it expands access to renewable energy and can support farm viability.

Similarly, policymakers should be aware of incentives and programs that may accelerate the development of other renewable energy technologies on agricultural land including wind, micro-hydro, and biogas.

B. Protected and Conserved Farmland

Rules for solar development on farmland subject to agricultural or other conservation easements or enrolled in state, federal, or land trust conservation programs vary widely. Solar arrays on conserved or protected land may be prohibited or subject to program-specific or land trust-specific restrictions. Usually, the right to develop protected or conserved farmland has been separated from the underlying estate and is held by a third-party, usually a state agency or land trust. Because conservation restrictions are often enforceable deed restrictions meant to apply to the property in perpetuity, rules about allowing solar development on such lands are likely to be very strict.

Land Trust-Owned Land

Land trusts that either own land outright or hold the development rights to land may be able to establish rules for solar development on lands they administer. The smart farmland solar policy options identified in the Current Use Taxation section of this report may be useful for land trusts evaluating when solar development might be allowed.

For example, the Pennsylvania Land Trust Association identified land trust-owned land that may be compatible with renewable energy development, including marginal land with poor soil and poor wildlife habitat, rooftops of existing and future structures, and parking lots.[211] They promote a model in which solar arrays could be allowed under a conservation easement depending on the level of protection of the underlying land. Solar infrastructure would be prohibited in areas designated for the protection of biodiversity and natural habitat and are allowed at the approval of the easement holder in areas designated as needing minimal protection.

New and Existing Conservation Easements

Existing conservation easements agreements may leave no room for solar development, as the terms may restrict any new development on the protected land. It is much easier for land trusts and other easement holders to consider building opportunities for smart renewable energy development projects into new conservation easement agreements.

For example, farm easements funded under the Natural Resource Conservation Service's ACEP/ALE program allow renewable energy production as a permitted use when it serves the electric needs of the protected property: [212]

> "On-Farm Energy Production: Renewable energy production is allowed for the purpose of generating energy for the agricultural and residential needs of the Protected Property. Renewable energy sources on the Protected Property must be built and maintained in accordance with any local zoning ordinance and applicable State and Federal laws. Renewable energy sources must be approved by Grantees', in their sole discretion, and at a minimum shall be built and maintained within impervious surface limits, with minimal impact on the conservation values of the Protected Property and consistent with the Purposes of this Grant as determined by Grantees'."

211 Andrew M. Loza, Pennsylvania Land Trust Association, *Solar Energy Development and Land Conservation* (2019).

212 U.S.D.A., N.R.C.S., *Minimum Deed Terms for the Protection of Agricultural Use,* April 29, 2016 (https://www.nrcs.usda.gov/wps/portal/nrcs/detail/null/?cid=stelprdb1248212).

C. Additional Resources

The following organizations and websites are useful to researchers seeking to understand more about farmland solar siting policy:

Solar and Renewable Energy Policy Resources

National Renewable Energy Laboratory
https://www.nrel.gov/analysis/energy-systems-tools.html

Energy Information Administration
https://www.eia.gov/electricity/state/

Solar Energy Industries Association
https://www.seia.org/states-map

Clean Energy States Alliance
https://cesa.org/projects/renewable-portfolio-standards/state-rps-annual-reports-and-compliance-reports/

Solar Power Rocks
https://www.solarpowerrocks.com

Database of State Incentives for Renewable Energy
http://programs.dsireusa.org/system/program

Department of Energy
https://www.energy.gov/eere/femp/renewable-energy-maps-and-tools

Acadia Center
https://acadiacenter.org/knowledge-center/

Conservation Law Foundation
https://www.clf.org/making-an-impact/solar-power/

Vote Solar
https://votesolar.org/usa/

Farmland and Agricultural Policy Resources

USDA Economic Research Service
https://www.ers.usda.gov/

2017 Census of Agriculture
https://www.nass.usda.gov/Publications/AgCensus/2017/

Farmland Information Center
https://farmlandinfo.org/

American Farmland Trust
https://farmland.org/project/smart-solar-siting-partnership-project-for-new-england/