Community Solar Project Siting

A Framework for Producing Zero Carbon Electricity and Serving Ecosystem Enhancement & Conservation

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SEIA Whitepaper

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I. Executive Summary

To help meet aggressive state and federal clean energy goals, many more community solar projects must be built across the country. This paper proposes a siting framework for community solar projects, which can produce much needed zero-carbon electricity, while serving important ecosystem enhancement and conservation roles. Responsible siting such as we propose here can help preserve community character while protecting individual property rights. This framework builds off existing laws to balance development activity with environmental protection. In brief, siting, design and operation of community solar projects should maximize preservation of our natural capital and enhancement of ecosystem services, minimizing permanent negative impacts on land.

II. Introduction: Community Solar & Land Use

Community solar (CS) is a fast-growing sector of the United States electricity industry, with more than 3.6 gigawatts (GW) of these solar projects operating across the country at the end of third quarter of 2021, and the next five years will see the community solar market add another 4.5 GW of capacity.[1] In addition, in December, the U.S. Department of Energy announced a new community solar target of reaching 5 million American homes by 2025.[2] CS provides homeowners, renters, and businesses equal access to the economic and environmental benefits of solar energy generation regardless of the physical attributes or ownership of their home or business.

a. What is Community Solar

CS refers to local solar facilities shared by multiple community subscribers who receive credits on their electricity bills for their share of the power produced. Typically, CS facilities are less than 5 megawatts (MW) alternating current in size and are sited on less than 50 acres of land depending on the project configuration. Community solar projects are connected directly to the electric distribution system – rather than the bulk electric or transmission system – and provide power and grid benefits where they are needed most: at the local level.

With many states adopting aggressive clean energy and greenhouse gas reduction mandates, such as New York State's goal of obtaining 70 percent of its electricity from renewable energy resource by 2030 and zero carbon electricity by the year 2040, CS will play a much larger role in the national clean energy mix. Already, community solar programs have been authorized in 19 states with major markets emerging in New York, Massachusetts, Colorado, Minnesota, New Jersey, Illinois, and Maine.[3]

b. The Benefits of Community Solar

In addition to the clean energy benefits to society by avoiding the pollution that is changing our climate, CS installations produce many different monetary benefits, including lowering electricity bills for project subscribers, and in some cases producing cost savings for all electric utility ratepayers by avoiding the need for costly system upgrades on the entire electric distribution system.

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[1] See https://www.seia.org/initiatives/community-solar and "Community solar sector to beat earlier 5 year forecast by 9%", Wood Mackenzie, February 8, 2022. Available at: https://www.woodmac.com/press-releases/us_community_solar_2022/

[2] "DOE sets 2025 Community solar target to power 5 million homes", October 8, 2021. Available at: https://www.energy.gov/articles/doe-sets-2025-community-solar-target-power-5-million-homes

Community solar projects also compensate property owners for the use of their land. Lease payments to property owners can often be the difference between keeping a family farm in business or selling property off to real-estate development.[4] And they can provide important environmental benefits beyond reducing carbon emissions, such as preserving agricultural land for productive use after the life of a solar facility, co-location of certain crops, creation of habitat for a variety of helpful species including pollinators and bats, or even sheep grazing, and other benefits such as soil and runoff management. Lastly, community solar projects also typically execute Payments in Lieu of Taxes (PILOTS), or in some cases pay tax directly to municipalities, supporting the community where the solar project is located.

c. The Need for a Community Solar Siting Framework

Although smaller in scale than their utility-scale solar project cousins, which can require hundreds of acres of land, even the siting and permitting of up to 5 MW CS installations has resulted in local and sometimes statewide debates about managing solar development and protecting community character.[5]

Solar, like any kind of new development, may run into opposition from local residents. Unfortunately, this opposition has at times used false information to call into question the benefits of the new solar project by questioning the greenhouse gas reduction benefits of transitioning to solar power, to speciously arguing that some regions of the country do not have enough sunlight to make solar a reliable source of energy, to suggesting, falsely, that all materials in solar panels are hazardous and should be treated as hazardous waste. Obscured by these arguments are legitimate concerns about potential land use impacts and the need to preserve community character.

Too often opponents of community solar ignore the underlying problem: that the United States needs massive amounts of clean energy to avoid the devastating effects of climate change. Based on a Brattle Group study in New England alone, to meet state policy goals, more than 4-7 GW of clean energy installed every year would be needed to effectively decarbonize the electric grid.[6] Clean energy deployment will need to grow by more than 9% per year to meet these objectives.[7]

Likewise, some stakeholders may ignore legitimate arguments from neighbors about the ways in which a sizable solar project may impact local lands. It is understandable that neighborhoods accustomed to a particular viewshed would raise concerns about solar, or other types of land use change. And although lands for solar projects today make up a tiny fraction of the nearly 81 million acres of land across the nation dedicated to energy production, to reach an emissions free grid, the amount of land taken up by renewables projects will need to grow. [8]

In this paper, SEIA advances a process-based approach that balances the need for permitting many more community solar farms, with protecting property rights and sensitive ecosystems. Based on our experience in several jurisdictions we believe this approach has utility across the country.

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[4] See https://www.seia.org/blog/how-community-solar-supports-rural-communities-and-farmers
[5] https://www.brookings.edu/research/renewables-land-use-and-local-opposition-in-the-united-states/
[6] https://www.brattle.com/news-and-knowledge/news/brattle-study-achieving-new-englands-ambitious-2050-greenhouse-gas-reduction-goals-will-require-keeping-the-foot-on-the-clean-energy-deployment-accelerator
[7] Ibid
[8] See: https://www.bloomberg.com/graphics/2021-energy-land-use-economy/. In Massachusetts, a 2019 analysis by SEIA showed solar installations take up far less acreage than golf courses across the Commonwealth.

Community Solar as Land Preservation Resource

Community solar project development is unlike many other building projects. CS installations do not interfere with the natural habitat to the same extent as other types of development and may be more temporary in nature. Building a commercial shopping center or residential housing development on farmland, for example, essentially changes the character of that land forever. With community solar, however, panels, posts and racking may be removed at the end of a project lease term. In this way, community solar can be seen as a tool for preserving land, encouraging long-term sustainable farming, and in some cases even increasing the value of a piece of property over time.

In the agricultural context, for example, allowing the underlying land the ability to regenerate by lying uncultivated for many years increases the productivity of that land.[9] Similarly, there are land use benefits, and benefits to ecosystems brought about by building solar farms that should be considered when making siting decisions. Planting native grasses at community solar farms, or including pollinator friendly seed mixes, can reverse decades of habitat loss for many threatened species and result in significant environmental gains.

Analysis in the United Kingdom indicates that well-designed solar arrays can not only help achieve needed decarbonization targets but also contribute to maintaining biodiversity and achieving other environmental goals. [10] Additional research should be undertaken in the United States to better understand and help quantify the ecosystem benefits provided by community solar projects.

d. Three Foundational Principles

Before outlining our approach in detail, it is important to share our underlying assumptions. We assume that most community solar projects are ground-mounted on semi-open land. These projects tend to be the most economical to build, although increasingly policy makers are attempting to encourage development of community solar projects on existing buildings and warehouses, especially in urban areas. Though building-mounted community solar arrays are not the subject of this paper, those projects should continue to be encouraged by state legislative and regulatory policy. [6]

Furthermore, it is helpful to keep in mind three foundational principles about solar development. These three underlying concepts inform our entire framework.

1. There is an extensive body of existing federal and state law that already protects and prohibits development on sensitive ecosystems such as wetlands, protects habitat and species of concern, encourages community outreach, and requires developers to consider a project's impact on native sites, and other historical resources. In short, decision-makers should not "reinvent the wheel" or layer on new restrictions based on the existence of this already robust set of protections. For decades, project developers seeking federal, and in some cases state approvals, have been required to assess the environmental impact of their proposed projects, consider alternatives that address environmental concerns, and avoid, minimize and/or mitigate those impacts through various mechanisms.

[9] https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/
[10] Solar Trade Association (2019) Natural Capital Value of Solar, Eds N. Gall and E. Rosewarne. Available at: https://solarenergyuk.org/resource/natural-capital/

2. State regulators should develop frameworks and tools for use by local governments in making permitting decisions. Although "home rule," or the idea that a county, municipality or town has the right and authority to make its own policies regarding land use and zoning is not in question, local governments are often understaffed and could benefit from having tools developed by expert state regulators to aid them in making decisions. Policy makers should have up-to-date, publicly accessible, land use mapping tools available to help drive responsible siting decisions. [11]
3. Finally, solar development can be compatible with conservation and preservation of community character provided that the recommendations of this framework are followed.

III. Community Solar Siting Framework: Design for Ecosystem Services, Avoid, Minimize, and Mitigate Potential Negative Impacts

This approach starts with a careful, science-based assessment of the land on which the project will be built. This assessment involves analysis of available GIS data, on-the-ground review of the conditions of the property in part to ensure the accuracy of the mapping data, and an analysis of any special project circumstances.

Although the GIS data should be part of the analysis, GIS data should not be determinative. In other words, GIS data that was collected for different environmental objectives, such as habitat and species mapping, shouldn't be used to drive regulatory decisions. Furthermore, despite regulators' best efforts, GIS data is often incomplete or out of date, and therefore must be accompanied by on-the ground verification of its accuracy to be used in case-by-case siting decisions.

In designing the facility, the project developer, to the best of their ability, would first work to identify ways in which the project could be designed to provide ecosystem service benefits over the term of its operation. They would then work to determine how the project's design and operation could avoid environmental impacts such as unnecessary soil disturbance, tree cutting, and sedimentation and water runoff. To the extent that these impacts cannot be avoided, the project designers would do their best to minimize impacts, such as installing erosion control barriers, selectively cutting trees where possible, or adding setbacks and buffers to appropriately manage the neighboring community's view and minimize changes in community character.

In the event that certain impacts cannot be avoided, mitigation steps could include executing a protection agreement for an equivalent resource, such as agreeing to fund an agricultural easement on certain lands, paying into a fund for preservation work, or integrating, for example, a dual use agriculture/solar protocol to preserve the resource.

The following table explains this simplified approach, and each term and response is laid out in more detail below.

[11] What data you use matters. Publicly available GIS data such as Massachusetts is preferred. Data layers and exercises developed by private parties and interest groups should be avoided.

Table 1. Framework for Community Solar Siting

Category	Required Actions
Design:	Design the solar project operation to encourage habitat/biodiversity, dual-use and add elements that can provide additional ecosystem services.
Avoid	Select the least damaging alternative for the resource, involves consideration of multiple alternatives and project configurations with the goal of avoiding environmental impacts.
Minimize:	For impacts that cannot be avoided, projects should employ measures to minimize the environmental impact on such as installing erosion control barriers, buffers or setbacks from sensitive resources.
Mitigate:	For unavoidable negative environmental impacts, provide mitigation, such as, a) engaging in agreements for protection of an equivalent resource, or b) integrate dual use agriculture protocols or other compatibility measures or c) where established, pay into a fund or fee for restoration or preservation work.

a. Design for Ecosystem Service Benefits

Land use change for solar is increasingly being recognized as distinct from other forms of development given its temporary, reversable nature, the minimal human disturbance of the ground and small infrastructure footprint. Incremental design and operation in the form of habitat/biodiversity, dual-use or other elements can provide additional ecosystem services and should be explored. State regulators should also encourage design that results in ecosystem services or increased agricultural output by initially deploying incentives to encourage their development, and then taking these benefits into account when considering long-term solar project compensation.

b. Avoid

Avoiding adverse environmental impacts when considering a proposed project is already a bedrock principle in environmental law. Flowing from this category of actions is analyzing alternatives in the community solar project configuration to select the least damaging alternative. For example, CS projects should be carefully designed to avoid Native American sites of significance, and other resources that may have special meaning to the host community.

c. Minimize

To the extent that these impacts cannot be avoided, the project designers do their best to minimize impacts, such as installing erosion control barriers, selectively cutting trees where possible, or adding setbacks and buffers to appropriately manage view sheds and changes in community character.

d. Mitigate

In the event that avoiding certain negative environmental impacts are impossible, the federal government and most states allow for mitigation payments to offset those impacts. For example, to offset impacts a firm could execute an agreement to protect another parcel of nearby land that has conservation value, or make payments to an established trust fund or state-run program to encourage the protection of agricultural of forested land. By entering into mitigation agreements, a state or region can continue to make progress toward its long-tern conservation objectives as well as make progress toward its clean energy goals.

IV. A Planned Development Approach

In addition to the process-based approach described above, one concept that should be considered more broadly is included in pending Massachusetts legislation that envisions the creation of "solar opportunity zones." [12] The goal in creating these zones is to identify areas of the state that would be suitable for ground mount solar development and consider such factors as a) the availability of land b) the state of distribution and transmission infrastructure and its ability to connect new projects c) receptiveness of local communities and d) the overall need to build more clean energy projects, among others. In other words, the legislation would create a comprehensive planning process that includes stakeholders and would encourage the development of community solar projects.

Solar development in these pre-determined zones would be supported by additional incentives or other supportive policies such as favorable tax treatment and would be aligned with grid infrastructure planning and investment. Furthermore, these incentives should be shared by the project developer, the host community and the utility.

V. ADDITIONAL CONSIDERATIONS

This section of the paper describes a few additional considerations that should be taken into account when making siting decisions. These are broken down between agricultural, forest, and wildlife resources.

a. Agricultural Resources

As state regulators work to put together guidance for local governments, it is essential that state departments of agriculture and the energy regulatory agencies work together to ensure consistent policy implementation. Although these regulatory agencies generally have very different missions and statutory authority, the agencies must be on the same page with respect to project siting.

One way to encourage cooperation is the development of dual use agriculture and solar guidelines. Beyond having sheep keep vegetation at bay at a community solar project, solar projects can often be designed to allow for both crop and clean energy production. Dual use solar projects can be designed to maximize crop production from the farm, or the total value of the agricultural goods, as well as for clean energy production. Increasing the height of panels, increasing spacing between panel rows and other techniques, where feasible, could be used more effectively in designing a dual use program.

Furthermore, dual use agriculture and solar could be integrated on projects where a certain percentage of prime farmland is affected by the construction of a solar farm. Any solar incentive program should be designed to cover any additional cost associated with configuring a project to accommodate dual use.

b. Solar & Forested Land

Another important consideration is recognizing that not all forested lands are created equal. In part, this recognition informs our approach by requiring mitigation on the forest lands of

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[12] H.4040 – Rep. C. Dykema et al.

significant value. However, solar projects may need to cut trees to accommodate the installation. Some tree cutting, in the Northeast for example, is unavoidable.

An MIT analysis has shown that the carbon benefits of building solar projects far outweighs the carbon sequestration benefits of an equivalent amount of less valuable woodland resources. [13]

Furthermore, woodland conversion, especially on agricultural land, is common, and some tree cutting is involved in almost any building or construction project.

That said, an important element of preserving community character is continuity. Often community solar siting tends to be more visible because of its need for road access and connection to electricity infrastructure. Although this increased visibility may exacerbate neighbor complaints, it is important to keep in mind that CS's proximity to infrastructure means more sensitive and remote lands remain untouched But changing the way a landscape looks from the road can often affect people's perceptions of a project. Therefore, we recommend that all projects on forested property should be designed with setbacks to help preserve community character. Even setbacks of 50 feet in most instances will make the solar installation harder to spot, without creating shading problems that could affect the amount of energy produced by the facility.

c. Protection of Wildlife

A robust suite of federal and state laws protect wildlife, including threatened and endangered species, from the potential impacts of solar development. At the federal level, the Endangered Species Act prohibits the taking of over 2,000 individual threatened and endangered species and encourages the conservation of species that may potentially be designated as threatened or endangered in the future and critical species habitats across the country. Other federal laws provide specific protections for marine mammals, migratory birds, and certain species of eagles. And many states have enacted their own versions of these laws to protect local species of concern.

While the best available science regarding potential impacts of solar development on wildlife continues to evolve, the industry also employs best management practices to create habitat as well as avoid or minimize potential impacts. For example, many developers conduct pre- and post-construction wildlife surveys, often in coordination with state or federal agencies; deploy measures such as downward-facing lights and anti-perch equipment to protect birds and bats; and install special fencing that allows wildlife to safely cross solar facility footprints. Industry also works closely with government and private research institutions to advance understanding of potential impacts and effective mitigation measures.

d. Innovation

As regulators wrestle with the land use impacts of community solar siting, they should also keep in mind that tomorrow's community solar projects may look significantly different than today.

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[13] MIT's program on the science and policy of climate change estimated a solar farm's zero emission electricity output makes up all the carbon stored in a forested area in 23-46 days based on the fossil fuel type being displaced by clean energy generation. Also, the community solar farm would operate for at least 20 years. https://globalchange.mit.edu/news-media/in-the-news/some-massachusetts-forestland-being-clear-cut-put-solar-farms.See also: https://blog.ucsusa.org/kate-cell/when-slowing-global-warming-means-cutting-down-trees-hard-choices-in-the-climate-crisis/
It is also worth noting that a significant amount of carbon is stored in soils, which are largely undisturbed by the installation of a solar project.

Panel efficiency continues to improve. Increasingly, trackers are allowing solar to pivot with the angle of the sun further increasing efficiency and electricity project output.

As improvements to solar technology continue, the acreage needed to build community solar projects is likely to decrease. This is not to say that states should delay siting facilities until a later date. With the impacts of the climate crisis manifesting themselves in new more dangerous ways every day, the transition to renewable energy must take place as soon as possible. The point is simple: tomorrow's siting framework may be different than today's, and regulators should keep in mind that land use solutions appropriate now may need a second look based on the pace of technical innovation.

VI. Recap/Conclusions

A vast amount of additional renewable energy must be developed in order to enable decarbonization. While many land use concerns are legitimate, solutions are needed to find an appropriate balance that enables a sufficient pace of renewable energy deployment to avoid the worst consequences of climate change. To find that appropriate balance, policy makers should avoid the temptation to reinvent the wheel when making decisions about solar and land use.

A well-established body of law can be used to help guide the sensible development of renewable energy projects. A fact-based approach should consider the overall need for renewable energy and the ecosystem benefits of solar installations alongside the potential impacts and aesthetic concerns.