Fact sheet:
Making the Case for Crops + Solar

Introduction

Solar energy is on the rise, with an estimated 10.3 million acres projected to be used for solar energy production by 2050, according to the U.S. Department of Energy.[1] An expected 90% of solar siting will occur in rural communities.[2] Agrisolar, also referred to as agrivoltaics, is the co-location of agriculture and solar within the landscape. It includes solar co-located with crops, grazing, beekeeping, pollinator habitat, aquaculture, or farm or dairy processing.[3] Agrisolar practices offer an opportunity for solar and agriculture to co-exist, meeting demands for clean energy while keeping land in agricultural use.

Large-scale solar energy production requires considerable amounts of land. Farmland is particularly appealing to solar developers because it is typically free of trees and rocks and requires less alteration before construction. Agrisolar practices offer an opportunity to prevent farmland loss by integrating existing agricultural lands with solar production while conserving forests and maintaining food production.

One practice gaining popularity is the combination of crop production and solar. New research continues to broaden agrisolar crop options by testing new techniques and approaches that make the most of this pairing.

Crops

Producers successfully grow a variety of crops, including traditional row crops and cooler-season varieties, alongside solar panels. Solar energy production and agriculture can mutually benefit each other and bring in new income for producers while allowing them to provide both food and electricity to their communities.

Certain crops perform especially well growing in the shade of solar panels. When grown on test farms, herbs, lettuces, and cruciferous and root vegetables planted under the panels grew larger and had better taste than the same varieties grown in full sun.[4]

The shade created by solar arrays can lengthen the growing season for certain plants. Test farms grew traditional spring crops such as lettuces and chard well into the summer and continued producing kale into the winter.[5]

Traditional row crops such as corn and soybeans have also started to see success in agrisolar systems. The process needs a more individualized approach, however, with panels built at greater heights to accommodate farm equipment. Given the amount of agricultural land dedicated to traditional row crops, finding ways to combine them with solar production will go a long way toward meeting the demand for solar energy.[6]

Sources

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2 "Renewable Energy in Rural America: Frequently Asked Questions." U.S. Department of Agriculture, Rural Development, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Feb. 6, 2024, agrisolarclearinghouse.org/renewable-energy-in-rural-america-frequently-asked-questions. Accessed March 2024.

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4 Ibid.

5 Ibid.

6 Bowman, Sarah, et al. "Can solar panels and row crops coexist on farmland across the skeptical Corn Belt?" The Indianapolis Star, Sept. 13, 2022, indystar.com/story/news/environment/2022/09/13/purdue-leading-research-to-grow-solar-and-crops-together-in-corn-belt/66843196007. Accessed March 2024.

Environmental benefits

Solar arrays can have a positive impact on the environment around them. Solar panels and plants benefit each other, with the plants cooling the panels and improving their efficiency. Additionally, the panels offer shade and protection to the crops. This shade can keep the ground several degrees cooler and help maintain soil moisture.[7] Shade and increased moisture can be particularly helpful in dry, hot years, which have become more common as many areas of the country continue to face years-long droughts.[8]

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During high-heat periods, panels soak up the energy from the sun and protect the crops below. This protection can help crop yields and quality, maintaining or even increasing a producer's income. Combining solar arrays with crop production is also beneficial for the solar panels. Today's solar technology works best when panels are kept at a moderate temperature.[9] By maintaining crops under the panels, the ground cover and natural evaporation of moisture from the plants help keep the panels cooler and working more efficiently.[10]

Economics

Agrisolar offers producers and landowners who lease their land for agriculture production the opportunity to diversify their operations and their income. While still using their land to produce crops, landowners can own and install solar panels or lease their land to solar developers. Leases can bring in up to $1,000 per acre each year.[11] The new source of revenue can provide added financial stability for an operation.

In addition, agrisolar can offset the cost of running a farm if the system is designed for on-farm usage, as the energy produced can be used directly for the operation. Landowners may qualify for federal funding, such as grants through the U.S. Department of Agriculture Rural Energy for America Program or utility or tax incentives to install and maintain solar panels.

Depending on the local tax code, producers may continue to classify their land as farmland and benefit from tax incentives, even after adding solar to their production. In areas where farmland is wholly converted to utility-scale solar production, the producer may be subject to rezoning and higher taxes.[12]

Local communities and governments also benefit from the addition of agrisolar in their counties through increased solar tax revenue as well as continued production of local food or agricultural products.

Sources, continued

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Planning considerations

Location

Careful planning is needed for success in implementing agrisolar. Farmland is often a good choice for installing arrays as it usually is flat, has high sun exposure, and is near roadways. Solar projects must be near transmission lines and substations to be profitable; the further the panels are from a substation, the more energy is lost during transmission.[13]

Water access for irrigation benefits agrisolar projects to support crop production.[14] In turn, irrigation systems can be powered by solar arrays. Additional considerations should be made for areas with frequent flooding, as it may be necessary for electrical components to be installed at a greater height.[15]

Crop selection

Crop selection should be carefully considered when planning an agrisolar project. Solar panels should be adequately spaced for planting, tending to, and harvesting crops, including allowing room for carts, trolleys, or other equipment to fit between the rows.[16]

When considering the human needs of an operation, protection from the sun and heat can be particularly advantageous.[17] For crops harvested by hand, the shade and microclimates from solar panels benefit farm workers.

As with all crop production, weather has a significant impact on the success of agrisolar. Solar productivity can decrease during cold and damp years. Expected climate should be considered when selecting which crops to produce alongside solar panels.[18]

Sources, continued

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17 Ibid.
18 Ibid.

Policy considerations

States lawmakers can incentivize agrisolar through beneficial land use taxes that allow participating producers to receive agricultural tax benefits on their operations. Large-scale solar projects are normally subject to a commercial tax rate, but local policies can allow agrisolar systems to still be treated as farms.[19] For example, through a dual-use solar law adopted in 2021, New Jersey began providing an incentive to continue agricultural production at solar sites. The pilot program made dual-use solar and agriculture operations eligible for farmland assessment, a financial benefit for landowners.

Additionally, land use laws at the state level can limit solar development. For example, in Illinois, the Agricultural Areas Conservation and Protection Act establishes areas where only agricultural production is allowed, limiting the use of agrisolar.[20] Similar laws have been proposed in other states. To prevent such legislation from impeding dual-use operations, agrisolar must be defined as agriculture production in those states.

Other U.S. states have set clean energy goals to encourage the adoption of both solar and agrisolar. For example, the Solar Massachusetts Renewable Target program allows producers who introduce solar and maintain their agriculture production to qualify for special financial incentives.[21]

Local land use policies have a further significant impact on agrisolar development. Policymakers can help increase adoption by prioritizing renewable energy development in their county's comprehensive plan and by adopting ordinances, without excessive restrictions, that encourage solar development.[22] Local governments can also consider tax incentives and pass ordinances and siting regulations that are permissive of agrisolar, further supporting its adoption.

Sources, continued

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