AGRICULTURAL LAW
Fact Sheet

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Center for Agricultural and Shale Law

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Agrivoltaics

What is Agrivoltaics?

First introduced in the early 1980s, agrivoltaics describes the combining of photovoltaic electric generation with agricultural production to optimize land use. Put more simply, it allows agricultural production to coexist with solar energy generation and can help farmers benefit from additional income by selling excess solar power to the grid or using it on-site to reduce consumption from other sources. Agrivoltaics systems are on the rise, with pilot projects in regions such as the United States.

The term “agrivoltaics” was coined in 2011 and serves as an umbrella term referring to either a combination of solar photovoltaic (PV) panels and food crops—known as agrovoltaics—or a combination of PV panels and livestock farming—known as rangevoltaics. Various terms are used interchangeably to describe agrovoltaics, such as agrophotovoltaics, or solar sharing, with preferences for specific terms varying from one region to another.

Agrivoltaics systems come in a variety of configurations. They may take the form of greenhouses with rooftop solar panels or ground-mounted solar panels positioned above agricultural fields with a choice of two layouts: either close to the ground in rows with enough spacing to accommodate agricultural machinery and/or roaming livestock or elevated on stilts to provide clear passage underneath for farming equipment and/or livestock.

This factsheet addresses the use of agrivoltaics systems for crop production. For clarity, use of the term “agrivoltaics” here will be used here to refer to “agrovoltaics.”

How do Agrivoltaics Systems Work?

Research suggests that strategically deployed agrivoltaics systems, particularly in arid and semi-arid regions, can improve both electricity generation and crop yields. The optimal density of the solar panels is essential to maximize power output while minimizing potentially harmful solar radiation for crops. Concerns exist regarding elevated panel temperatures potentially contributing to a heat island effect and impacting crop yields and nutritional value.

Additionally, researchers have agreed that integrating mobility into solar panels could significantly improve plant health. This mobility would allow for optimal panel positioning through the day based on time of day, crop type, and growth stage. Some studies have also highlighted that solar sharing can influence air and soil temperatures around crops.

Furthermore, solar panels can play an important role in reducing evapotranspiration, thus helping to maintain soil moisture levels, keeping temperatures cooler, and resulting in substantial savings in irrigation water. Evapotranspiration refers to the movement of water from the earth’s surface to the atmosphere through evaporation and plant transpiration. Researchers demonstrated that strategically applied solar shading in crop cultivation could improve water conservation and management efficiency, however, the effect of solar shading on water conservation is likely to be more significant in arid environments. Research also indicates that various factors influence the effectiveness of solar shading, including crop type and variety, crop cover rate, and sunlight intensity.

Although agrivoltaics might offer water conservation benefits, there are concerns about the impact of heavy rain on stationary solar panels. Runoff water may cause soil erosion, gully formation, and potentially promote mold growth, compromising crop health. Some researchers stressed that mobile solar panels could help prevent runoff issues and facilitate a more even water distribution around crops.

The U.S. Regulatory Landscape for Agrivoltaics

The relatively new nature of agrivoltaics in the United States, combined with the diverse range of stakeholders, site conditions, and project goals, presents a significant challenge: defining the rights, responsibilities, and relationships between involved parties and establishing appropriate legal agreements.

Agrivoltaic projects can be adapted to both small-scale initiatives, which may be carried out by farmers wanting to reach self-sufficiency, and large-scale projects. Government policies can have a significant influence on the economic feasibility of renewable energy projects. In the case of agrivoltaic projects, project development is more likely to increase after the development of a clear regulatory framework, subsidy mechanisms, and financial incentives.

Agrivoltaic commercial projects require formal lease agreements between farmland owners and solar developers. These agreements should establish a clear framework for integrating solar panels with existing farming practices, whether it involves crop or livestock production, in a mutually beneficial manner. Additionally, leasing agreements should define shared land use rights, allowing both parties to use the land simultaneously.

Given the long-term nature of agrivoltaics projects, the leasing agreements should clearly outline all potential risks, operational constraints, and cost-sharing responsibilities related to the construction, operation, and maintenance of the agrivoltaics systems.

The installation of solar panels and related onsite infrastructure, such as pads, inverters, and battery storage, may potentially disrupt existing farming operations. In that regard, the lease agreements should address land remediation responsibilities for both parties.

Solar leasing agreements can span from 20 to 50 years; therefore, it is important to negotiate and agree upon all aspects that may arise over the course of the project's lifetime.

Conclusion

There is currently no clear legal framework or regulatory approval process addressing the construction and operation of agrivoltaics systems. Therefore, solar developers must ensure that the installation of agrivoltaics projects complies with zoning regulations set by the local government where the project will be located.

However, many local ordinances do not specifically address the combination of agriculture and solar energy in dual land use, as agrivoltaics is still a relatively new concept. Consequently, the implementation of agrivoltaics systems may require changes to zoning regulations to allow the development of commercial agrivoltaics projects.

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