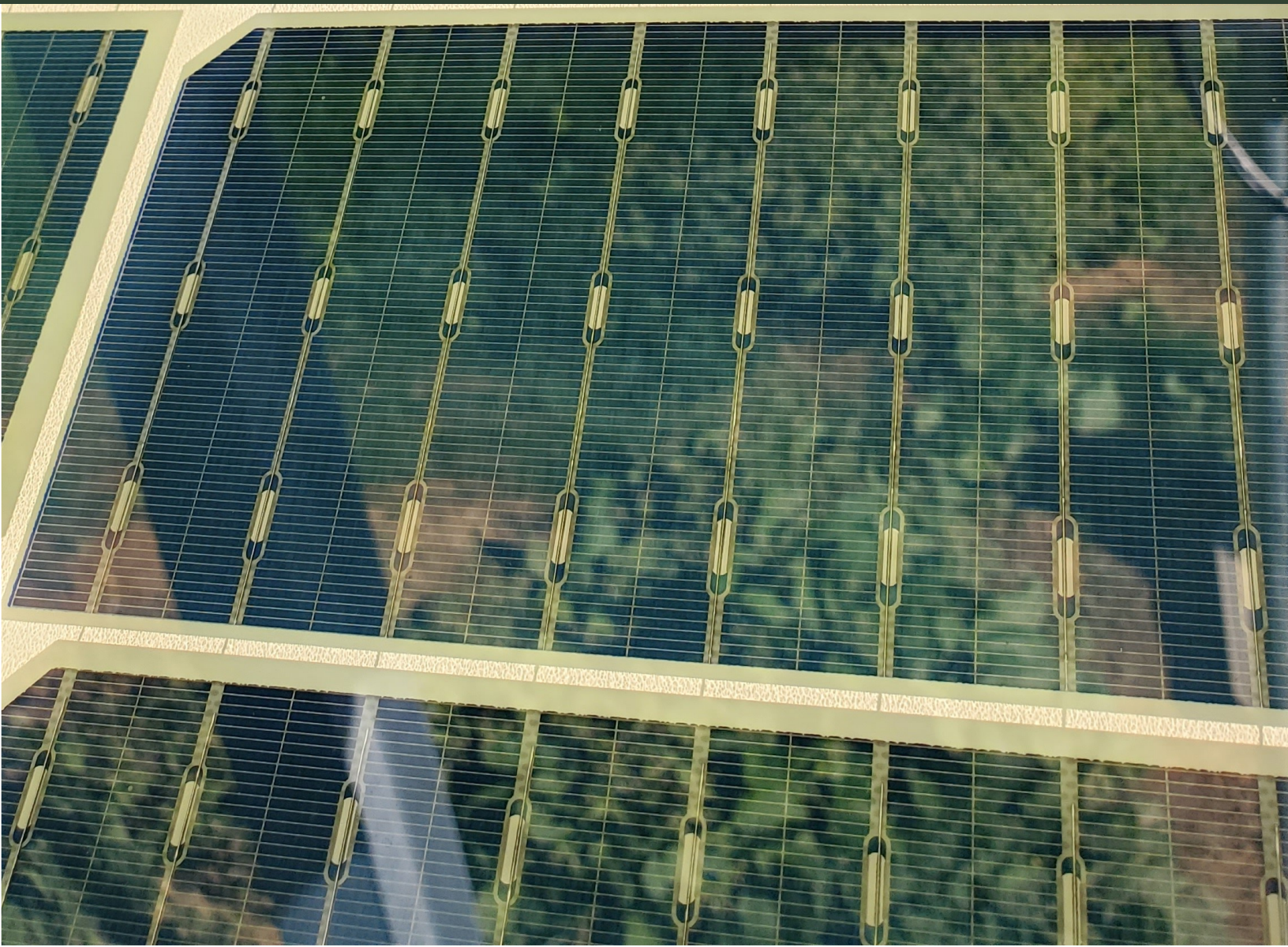




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ADVANCING AGRIVOLTAICS IN VIRGINIA



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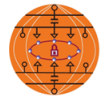
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SUMMIT MOTIVATION, BACKGROUND, AND PURPOSE


The motivation for the 2024 agrivoltaics summit stemmed from Virginia's growing need to balance the conservation of agricultural land with the rapid expansion of renewable energy, particularly solar power. As land-use conflicts, economic pressures on rural communities, and the need for climate resilience intensify, agrivoltaics offers a promising solution by enabling the dual-use of land for both farming and solar energy production. The agrivoltaics summit aimed to define strategies for collaboration between industry and state agencies to support agrivoltaics during the renewable energy transition, explore opportunities and challenges from diverse perspectives, and establish a network dedicated to evaluating and advancing agrivoltaics opportunities relevant to Virginia stakeholders.

KEY FINDINGS

- Farmers are open to agrivoltaics but stress the importance of balancing solar development with protecting prime agricultural land and maintaining long-term farming viability.
- Early community engagement and overcoming regulatory hurdles are key to successful solar projects, with long-term benefits expected from environmentally responsible, community-focused designs.
- Utility companies face challenges with grid connection for solar projects but see opportunities for collaboration with local communities to support renewable energy integration.
- Clear policies, financial incentives, and collaboration among stakeholders are essential to protect farmland while promoting the sustainable development of agrivoltaics in Virginia.

CALL TO ACTION

To unlock the potential of agrivoltaics in Virginia, we must act to address the challenges and realize the opportunities outlined in this white paper. Establishing a multistakeholder Agrivoltaics Innovation Network is essential for fostering collaboration among farmers, policymakers, solar developers, researchers, and communities. This network can drive the development of clear policies, financial incentives, and education initiatives, ensuring agrivoltaics systems are designed to balance agricultural sustainability with renewable energy expansion. By leveraging Virginia's strong agricultural assets and Cooperative Extension network, stakeholders can access knowledge, pilot innovative solutions, and address concerns about land use and environmental impacts. Coordinated efforts will help mitigate land-use conflicts, enhance rural economic resilience, and position Virginia as a leader in sustainable land-use practices.



INTRODUCTION

Though definitions vary, agrivoltaics—also known as agrophotovoltaics (APV), agrisolar, or dual-use solar—typically represents innovative approaches that combine agricultural production with solar energy generation on the same plot of land. By appropriately configuring solar arrays in agricultural fields, agrivoltaics systems allow farmers to continue cultivating crops or managing grazing land for livestock production while simultaneously generating renewable energy. This dual use strategy provides several key benefits both for agricultural and renewable energy producers. Agrivoltaics systems can be developed and managed to diversify land productivity and add revenue streams to support farm viability. For the energy sector, agrivoltaics opens farmland to energy projects, contributing to the expansion of renewable energy infrastructure that integrates with the farmland. As interest in sustainable practices grows, agrivoltaics has emerged as a potential solution to meet both agricultural and energy demands.

The integration of agrivoltaics in Virginia comes at a time when the state faces several critical challenges:

- **Land-use conflicts between agriculture and energy:** With growing interest in expanding solar energy infrastructure, conflicts over land use have emerged, particularly where prime agricultural land is concerned. Farmers, local communities, and developers are navigating the complex issue of how to balance the need for renewable energy growth with the conservation of vital agricultural resources.
- **Economic pressures on rural communities:** Rural areas in Virginia are experiencing mounting economic challenges. Farmers face tight profit margins, increased costs of production, and the pressures of urban sprawl. Agrivoltaics provides a potential economic lifeline by creating new income opportunities through the dual use of land for farming and energy production. This approach can help alleviate economic pressures that might otherwise lead to land conversion and other forms of development.
- **The need for climate resilience in farming:** Increasing weather variability and extremes are already affecting farming practices, with increased risks of drought, heatwaves, and floods. By offering shade and protection to crops or livestock, agrivoltaics systems can help enhance the resilience of farms, ensuring their operations remain viable in the face of increasing production uncertainty.

Agrivoltaics holds significant potential to address key challenges and advance Virginia’s energy and agricultural priorities. The Commonwealth’s commitment to renewable energy, coupled with its large agricultural sector, makes agrivoltaics an attractive strategy for supporting energy goals, economic growth, and sustainable land use and food production. By adopting agrivoltaics, Virginia can potentially reduce land-use conflicts, provide rural communities with additional revenue streams, and create a more resilient agricultural sector. Additionally, by integrating agrivoltaics into the state’s energy and agricultural policies, Virginia can position itself as a leader in both sustainable farming and renewable energy innovation, while helping to meet its broader economic goals.

PANEL

The agricultural panel consisted of representatives from the Virginia State Dairywomen's Association, Virginia Cooperative Extension, and the Virginia Cattlemen's Association. While the panelists indicated their organizations did not have an official position on agrivoltaics, they expressed a willingness to explore the potential benefits of integrating solar panels with agricultural practices. Some panelists favored the concept, highlighting its potential to support sustainable farming, while others emphasized the need to carefully assess local impacts before fully endorsing such projects. The group included both advocates for innovation and those more cautious about large-scale solar developments in agricultural areas.

OPPORTUNITIES

The panel highlighted the potential benefits of agrivoltaics, particularly in terms of optimizing land use by combining energy production with agriculture. Several opportunities were identified, including the possibility of reducing land competition between solar energy and farming. Some participants believed that agrivoltaics could support farmers in generating additional income and improving the overall economic sustainability of farming operations, potentially halting the decline in the number of Virginia farms. They also saw potential for agrivoltaics to contribute to environmental goals, such as reducing carbon footprints and promoting renewable energy, while maintaining agricultural productivity.

CHALLENGES

Key challenges centered around the impact of solar energy developments on prime agricultural land and how this land can remain viable during dual use and after the decommissioning of a solar facility. Panelists expressed a specific concern about soil erosion caused by stormwater runoff, which could reduce agricultural productivity over the long term. The protection of land farmed for generations was also a significant concern, as was the need for a thorough cost-benefit analysis that considers community needs and environmental impacts. Panelists called for a balanced approach to solar projects that ensures agricultural practices are not compromised, especially across the many regions of Virginia where agriculture plays vital economic and cultural roles. Panelists also commented that large, utility-scale solar systems—with no agricultural activities—are what the majority of farmers have seen, and many conflate these systems with agrivoltaics facilities. Clearly separating these different systems is important, recognizing the need to 'right size' agrivoltaics systems to each farm. Allowing farmers to experience agrivoltaics systems and learn about the potential costs and benefits was discussed as one way to address this challenge. Finally, panelists discussed the need for clear guidance on how solar developers should partner with farmers.

KEY TAKE-HOME MESSAGES

The panel emphasized the importance of involving local communities in decision-making processes regarding solar projects. Community input, clear regulations, and further research are needed to address concerns about land use, environmental impacts, and the integration of solar energy with farming. The panelists advocated for ongoing dialogue to ensure that solar developments can coexist with agricultural practices without harming long-term farming sustainability. Overall, the need for a balanced, informed approach to agrivoltaics was a recurring theme, with an emphasis on preserving farming heritage while embracing innovation.

SOLAR INDUSTRY PERSPECTIVES

PANEL

The solar industry panel consisted of developers and experts focused on advancing solar energy projects, particularly those integrated with agriculture. Companies represented included Timmons Group, Solar Agricultural Services, BlueWave, and Strata Clean Energy. These panelists emphasized their collective experience in navigating the challenges of solar development, particularly within agricultural communities.

OPPORTUNITIES

A key opportunity identified by the panel was the potential to align solar projects with local agricultural practices through initiatives like solar grazing or growing crops beneath panels. This integration potentially offers a way to make solar energy projects more palatable to farming communities, providing additional income streams for farmers while optimizing land use. Developers highlighted that early engagement with farmers and communities can help ensure that projects are designed to fit local needs. They also believe that projects with a strong focus on environmental responsibility and community benefits have the potential for long-term economic success.

CHALLENGES

Developers face significant challenges in navigating local permitting and regulatory frameworks, particularly in Virginia. Many local governments have established strict rules in response to past negative experiences with solar projects, leading to cautious approaches that can slow down or block new developments. The panelists also discussed the higher costs associated with integrating solar energy and agriculture. While solar grazing or crop production under panels offers promising synergies, they come with added financial and logistical complexities. Effective communication with local governments was deemed essential to overcoming these regulatory hurdles and ensuring smoother project approvals. Panelists also discussed the need for clear agreements between solar facility operators and farmers with regards to permitted operation and maintenance and farming practices within an agrivoltaics facility. The panel reaffirmed the observation that agrivoltaics tends to be considered as equivalent to large, utility-scale solar systems—with no agricultural activities—and noted that clearly distinguishing the two types of systems for farmers and communities is important.

KEY TAKE-HOME MESSAGES

The panel underscored the importance of early and ongoing community engagement to gain support for agrivoltaics projects. Developers agreed that working closely with farmers and residents is essential for aligning projects with local needs, mitigating concerns, and increasing the likelihood of project approval. Additionally, the need for clearer policies and more research to guide the integration of solar energy with agriculture was emphasized. Although the upfront costs may be higher, panelists believed that investing in projects that are community-friendly and environmentally sound will yield long-term benefits for both the solar industry and agricultural stakeholders.

PERSPECTIVES

PANEL

The utility company panel featured representatives from Dominion Energy, Appalachian Power Company, and Rappahannock Electric Cooperative, who discussed their experiences managing utility-scale solar projects. These panelists provided insights into the technical and logistical processes of connecting solar energy to the grid, as well as the role of utilities in supporting solar adoption. Their perspectives were grounded in operational expertise and their roles in ensuring grid reliability while advancing renewable energy integration.

OPPORTUNITIES

The panelists highlighted several opportunities for expanding solar energy in Virginia, particularly through utility-scale projects. They discussed how utilities can leverage economies of scale to deploy solar efficiently and cost-effectively. Additionally, the companies have developed various programs and services designed to incentivize solar adoption, both for utility-scale developments and smaller community or residential projects. These include offering customers options to participate in solar energy programs, making renewable energy more accessible. The panel also acknowledged the potential for collaboration with agriculture through initiatives like agrivoltaics, which could open new opportunities for utility involvement in dual-use land projects.

CHALLENGES

One of the primary challenges identified by the utility representatives was the complexity of connecting solar projects to the grid. Panelists detailed the extensive planning and permitting processes involved in grid connection, which often require coordination between multiple stakeholders. Another significant challenge discussed was balancing the demand for renewable energy with the need to maintain grid stability. As more solar projects come online, ensuring the grid can handle intermittent energy sources like solar becomes a growing concern. The panelists also pointed to regulatory hurdles, including state and federal policies, that can slow down the development of new solar projects and make it difficult to scale rapidly. For example, solar project proposals submitted to the State Corporation Commission are reviewed in relation to the need for electric generation, impacts on service reliability, the potential environmental impact, whether the project is in the public interest, and whether it advances economic development within the Commonwealth. Navigating this review process can be time consuming and require specialist support.

KEY TAKE-HOME MESSAGES

Utility companies emphasized the importance of a well-coordinated approach to solar energy integration, both in terms of technical grid management and community engagement. They stressed that solar energy is a crucial part of the future energy mix but noted that the success of these projects depends on effective collaboration with local stakeholders and regulatory bodies. The panelists also called for continued investment in grid infrastructure and the development of clearer regulatory frameworks to support the expansion of solar. Ultimately, the message was that utilities are committed to growing their solar portfolios but need policy support and technological innovations to do so sustainably and cost effectively.

POLICY/REGULATORY PERSPECTIVES

PANEL

The policy and regulatory agency panel featured representatives from regulatory and policy-focused agencies, including USDA-NRCS, Virginia Department of Energy, American Farmland Trust, and the Virginia Commission on Electric Utility Regulation. These panelists shared their insights on how policies can be designed to support the integration of solar energy with agriculture while ensuring the protection of valuable farmland. Their perspectives were informed by experiences in crafting and implementing regulations for renewable energy projects and balancing competing interests.

OPPORTUNITIES

The panel emphasized the potential for collaboration between farmers, solar developers, and policymakers as a key opportunity for advancing agrivoltaics. By working together, stakeholders can create solutions that promote both agricultural sustainability and renewable energy production. Additionally, panelists pointed to the possibility of using financial incentives, such as tax breaks or subsidies, to encourage the adoption of agrivoltaics. They also mentioned that Virginia can draw valuable lessons from other regions which have developed agrivoltaics strategies that balance solar energy growth with maintaining prime farmland.

CHALLENGES

One of the central challenges discussed was the need for clear, consistent policies, design standards, and guidelines for agrivoltaics that protect farmland while promoting solar development. Without well-defined regulations, there is a risk of either stifling solar innovation or causing unintended harm to agricultural areas. The panel also acknowledged that agrivoltaics can be more expensive to implement than traditional solar or farming practices, particularly in the initial stages. As such, financial barriers may prevent widespread adoption unless appropriate incentives are introduced. Another challenge identified was the lack of research and pilot projects to determine the most effective ways to integrate solar energy with farming in diverse agricultural environments.

KEY TAKE-HOME MESSAGES

The panelists underscored the importance of developing clear policies that balance the need for renewable energy expansion with the protection of prime agricultural land. They stressed that collaboration between farmers, developers, and policymakers is essential for crafting solutions that benefit all parties. Additionally, while agrivoltaics can come with higher upfront costs, the long-term environmental and economic benefits may justify the investment. The panel called for more research and pilot projects to explore the best methods for integrating solar with agriculture and recommended looking to other states for models of success. Carefully designed financial incentives will likely play a key role in accelerating the adoption of agrivoltaics in Virginia.

PANEL

The academic panel brought together faculty from Radford University and Virginia Tech, whose research spans topics including solar energy siting, the sociology of energy, and rural sociology. These experts provided insights into the human, social, and geographical dimensions of agrivoltaics from diverse academic backgrounds. The panelists discussed the need for evidence-based perspectives on how to integrate renewable energy with agricultural practices in ways that align with societal values and local needs.

OPPORTUNITIES

The panel highlighted the opportunity to learn from both the successes and failures of prior agrivoltaics projects, emphasizing that historical insights can inform more effective implementation strategies. A critical theme was the importance of community support, which panelists identified as foundational to the success of any agrivoltaics initiative. They stressed the need to study community attitudes before, during, and after project installation to better understand how perceptions evolve and why. Additionally, the Virginia Cooperative Extension system, with agents present in every county across the state, was identified as a valuable resource. Panelists noted that extension agents serve as trusted advisors to farmers and can play a pivotal role in disseminating information, providing guidance, and facilitating agrivoltaics adoption. Leveraging this network offers a unique opportunity to bridge the gap between research findings and on-the-ground application.

CHALLENGES

Panelists recognized the inherent complexity of agrivoltaics, noting that its success demands 360-degree collaboration across multiple sectors, including farmers, developers, academics, and policymakers. Reaching vulnerable stakeholders and organizations was cited as a particular challenge, with panelists emphasizing the need for targeted outreach strategies to ensure equitable access to the benefits of agrivoltaics. Another challenge discussed was fostering meaningful engagement with farmers, especially when they express concerns about solar energy projects. Panelists acknowledged the importance of making farmers feel heard and validated, recognizing that their perspectives and experiences are crucial to designing solutions that are both practical and respectful of agricultural traditions.

KEY TAKE-HOME MESSAGES

The panel underscored the critical role of community engagement and trust-building in advancing agrivoltaics initiatives. They emphasized that a deeper understanding of community attitudes and needs should guide project planning and implementation. The Virginia Cooperative Extension system was considered an essential resource for achieving this goal, with extension agents serving as trusted intermediaries between researchers, developers, and farmers. Panelists also stressed the need for inclusive collaboration among all stakeholders, particularly vulnerable groups, to ensure equitable access to the benefits of agrivoltaics. They called for proactive efforts to address farmers' concerns and ensure their voices are central to decision-making processes. Finally, the panelists urged stakeholders to learn from past agrivoltaics projects—both successes and setbacks—and to adapt strategies based on these lessons.

NEXT STEPS

Virginia stands at a critical juncture where its dual priorities of maintaining agricultural land and renewable energy expansion intersect. Agrivoltaics offers a promising pathway to address these needs by enabling the simultaneous use of land for farming and solar energy generation. However, the successful adoption of agrivoltaics in Virginia requires a coordinated and collaborative effort among stakeholders. Establishing a dedicated Agrivoltaics Innovation Network in the Commonwealth is essential to effectively explore the opportunities and challenges identified in this white paper.

An Agrivoltaics Innovation Network would serve as a platform for bringing together diverse stakeholders, including farmers, policymakers, solar developers, utility companies, researchers, and community representatives. Such a coalition is vital to addressing the multifaceted challenges identified, including land-use conflicts, financial barriers, and the need for clear regulatory frameworks. By fostering dialogue and collaboration, the innovation network can develop best practices, share resources, and create unified strategies that balance agricultural and energy priorities.

One of the most significant opportunities highlighted in this white paper is the ability to leverage Virginia's unique assets, such as its strong agricultural sector and the Virginia Cooperative Extension system. The extension system, with agents in every county, could play a pivotal role in disseminating agrivoltaics-related knowledge and connecting farmers with technical and financial resources. An Agrivoltaics Innovation Network could formalize partnerships with these agents to ensure consistent, state-wide outreach and education, thereby empowering farmers and communities to make informed decisions about agrivoltaics adoption.

The network could also address key challenges by prioritizing research and pilot projects tailored to Virginia's agricultural and climatic conditions and work to help establish clear, consistent agrivoltaics policies, standards, and guidelines that align with Virginia's renewable energy and agricultural goals. By coordinating efforts across sectors, the network would position Virginia as a leader in innovative, sustainable land use practices.

The following section outlines several potential key action areas that can be considered by a multistakeholder Virginia Agrivoltaics Innovation Network.



SUPPORT THE DEVELOPMENT OF CLEAR AND CONSISTENT AGRIVOLTAICS POLICIES. Support the creation of statewide guidelines that define agrivoltaics standards, addressing land use, environmental impact, and system design considerations. These policies should balance solar expansion with the protection of prime agricultural land.

SUPPORT THE DESIGN OF AGRIVOLTAICS FINANCIAL INCENTIVES. Support the design of science-informed financial incentives to offset the higher initial costs of agrivoltaics systems. Financial support should target both farmers and developers to encourage collaboration and investment in agrivoltaics projects.

CRAFT GUIDELINES FOR DEVELOPER-FARMER PARTNERSHIPS. Develop standardized agreements that outline roles, responsibilities, and benefits for both farmers and developers. These guidelines should ensure fair compensation and address operational concerns.

SUPPORT THE AGRIVOLTAICS PERMITTING PROCESS. Develop guidance for farmers, landowners, and communities navigating the agrivoltaics permitting process.

PROVIDE SUPPORT TO FARMERS PLANNING TO LEASE LAND FOR AGRIVOLTAICS. Provide informational resources to farmers who are planning to lease prime farmland for agrivoltaics.

PROMOTE COMMUNITY ENGAGEMENT AND EDUCATION. Create platforms for early and continuous dialogue between farmers, developers, and local communities. Education campaigns should provide data-driven definitions of farm-appropriate agrivoltaics systems, clarify the difference between agrivoltaics and utility-scale solar projects without agricultural activities, highlight the benefits of agrivoltaics, address common concerns, and showcase successful case studies.

SUPPORT RESEARCH AND PILOT PROJECTS. Fund pilot programs and research to assess the effectiveness of agrivoltaics in Virginia's diverse agricultural settings. These efforts should explore optimal designs, crop compatibility, and long-term impacts on land productivity and farm viability.

LEVERAGE LESSONS FROM OTHER STATES. Study successful agrivoltaics policies and approaches in other states to adapt proven strategies to Virginia's unique agricultural and regulatory environment.

RESEARCH THE IMPACT OF AGRIVOLTAICS PROJECTS ON FARMLAND. Study the impacts of agrivoltaics projects on farmland with a focus on the construction, operation, and decommissioning phases of a project.



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