Agrivoltaics Concepts and Lessons Learned in New Jersey

Rutgers Agrivoltaics Program (RAP)

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How Might Agrivoltaic Array Design and Operation Differ from Traditional Solar Installations?

Agrivoltaics refers to the practice of simultaneously combining agricultural production with solar energy generation on the same land. This co-location can allow for greater land use efficiency by generating renewable energy and a predictable source of income, while maintaining the agricultural productivity of the land.

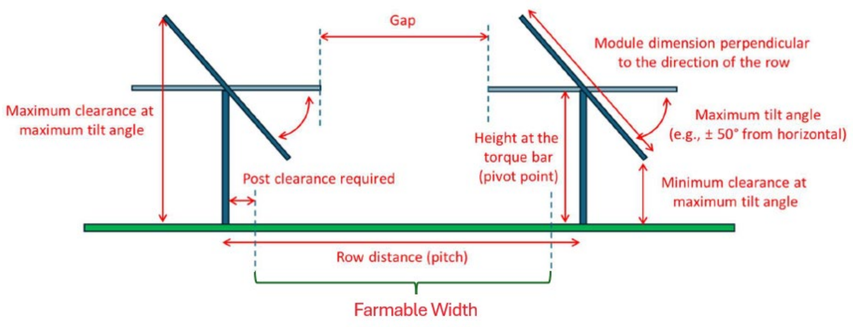
Depending on the type of agricultural production planned, the installed solar panels can be raised and the spacing between the solar panel rows widened to accommodate farm equipment and to facilitate farm management operations.

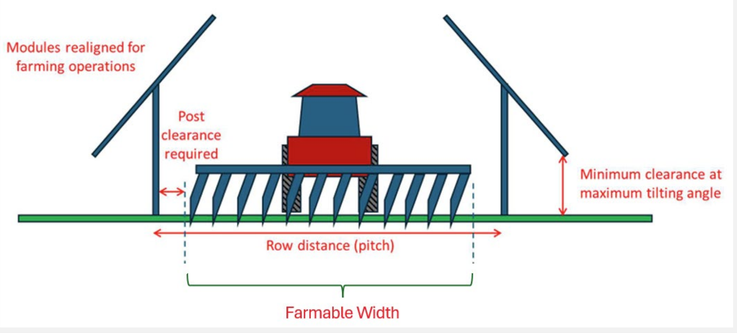
Rutgers Agrivoltaics Program, Rutgers Agricultural and Research Extension Center (RAREC) Bridgeton NJ. Vegetable trials 2024.

Key Dimensions and Calculations forAgrivoltaic Installations

Example of Key Dimensions for a Single-axis Tracker Array

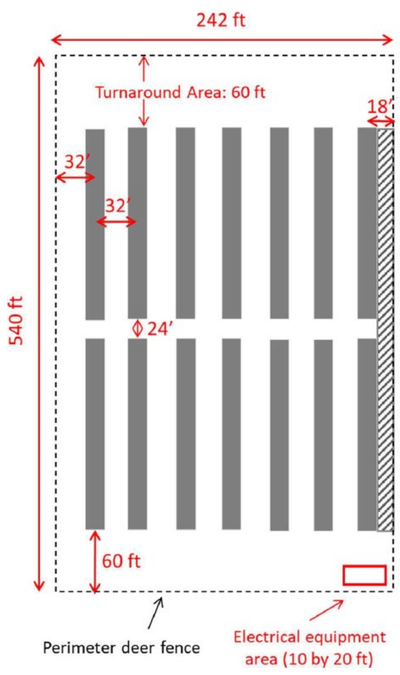
"Key Dimensions and Calculations for Agrivoltaic Installations"
Full Info Sheet Link





Counter-Tracking

Atemporary positioning of the panel rows so as to allow as much sunlight as possible to reach the ground level where it benefits plant growth and development.



Ground Cover Ratio and Farmable Area

Given Measurements:

Module Dimensions: 1x2 meters, single file in portrait (1P)
Row Spacing(pitch): 32-feet
GAP:25.4-feet
Farmable Area Between Rows28-feet

Key Calculations:

Ground Cover Ratio (GCR)

$GCR_A = 13.8\%$
$GCR_I = 20.5\%$

Percent Farmable Area(%FA) = 85%

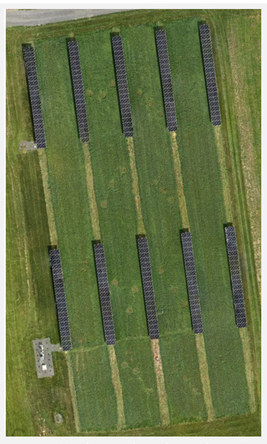
GCR_A – total panel surface area/land area
GCR_I – panel length/row pitch
%FA– turnaround area plus 7 strips of 28 feet minus electrical equipment area

Azimuth Shift and Field Orientation

"Impact of Azimuth Angle on Energy Production of an Agrivoltaic Array"
Full Info Sheet Link

Farming constraints like the geometry of a parcel or terrain contours that impact water drainage may require solar panel row orientations that are not aligned to true North-South (for single-axis trackers).

Azimuth angle deviations of -30 to +30 degrees impact energy reduction by less than 2%. Deviations of -20 to +20 degrees by less than 1%.
*PVWATTS was used for modeling

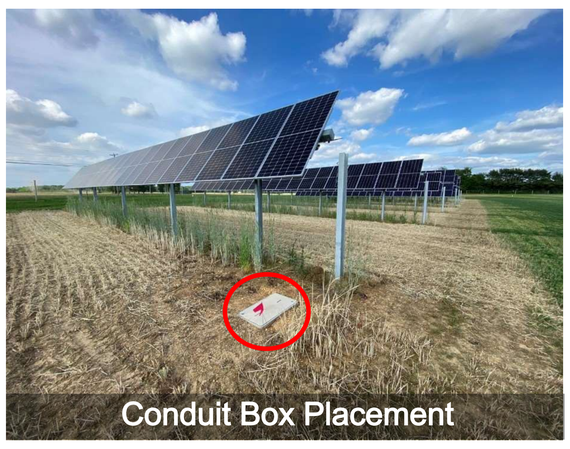


Rutgers University Snyder Farm
-7° azimuth adjustment
< 0.2% Energy loss

Challenges and Lessons Learned from New Jersey

Farmer | Solar Developer– Good Communication is Key

"Agrivoltaics 101"
Full Presentation Link



Solar developers may have limited understanding of agricultural needs.

Regular input from the farmer during design and installation will more likely lead to a successful project.

General Considerations

"Lessons learned from three agrivoltaics installations in New Jersey"
Full Publication Link

Interconnection

- Electric utility companies have their own timelines
- Grid capacity info may be difficult to obtain
- Grid upgrades are expensive and time consuming

Permitting

- Local, County, and State Officials may be unfamiliar with agrivoltaics
- Proactive approach for State and local support

Design and Construction

- Raised solar panel racking and wide spacing between rows
- Individually controlled tracker rows
- Buried cables below the depth of tillage equipment
- End of system life conversion back to farmland – no concrete
- Cover crop pre-installation to reduce impact of heavy equipment

Operations

- Cover crop post installation to visually assess impact of installation
- Control area with no panels to assess impact of panel shade on crops
- Use of agricultural equipment near panels requires extra attention
- Secure detailed warranties and maintenance contracts to cover parts/labor/travel

The Rutgers Agrivoltaics Program

The Rutgers Agrivoltaics Program (RAP) consists of a multidisciplinary group of faculty and staff committed to conducting applied agrivoltaics research and outreach. RAP is part of the New Jersey Agricultural Experiment Station and Rutgers Cooperative Extension, which provide research, outreach and education resources to residents, communities, and businesses in New Jersey and beyond.

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agrivoltaics.rutgers.edu