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Energy Generation Data for Three Agrivoltaics Sites in New Jersey

This information sheet compares actual energy generation data for three agrivoltaics arrays after more than a year of operation at research farms operated by Rutgers University. The annual energy generated is compared with predictions that are available through open-source software provided by the U.S. Department of Energy's National Renewable Energy Laboratory (NREL).

Additional details about the three arrays are described at our website: https://agrivoltaics.rutgers.edu/. The three arrays consist of two specific types: 1) single-axis trackers (SATs), and 2) vertical-bifacial (VBF). These array types provide relatively good accessibility for farming, as well as nearly uniform light distribution at ground level, favoring more uniform plant growth within the array. Figure 1 shows the locations for each array. **Location 1** is at the Cook Campus Animal Farm, in New Brunswick, NJ (40.47° N, 74.43° W) – which has a VBF array; **Location 2** is at the Rutgers Agricultural Research and Extension Center (RAREC), near Bridgeton, NJ (39.52° N, 75.21° W) – which has single-axis-trackers with both one-in-portrait and two-in-portrait configurations; and, **Location 3** is at the Clifford E. & Melda C. Snyder Research and Extension Farm, in Pittstown, NJ (40.56° N, 74.96° W) – which has a one-in-portrait SAT array. All three arrays were constructed with ZnShine 450W bifacial modules with 70% bifaciality based on the manufacturer's specification sheet.

Figure 1: Locations of the three agrivoltaics research arrays at Rutgers University.

For this analysis, we note that the SAT at Snyder Farm **(#3)** and the VBF at Cook Campus **(#1)** have very similar latitude and therefore similar expected sunlight exposure day-by-day. Figure 2 shows the Snyder Farm array consisting of 10 rows of 21 panels mounted one-in-portrait (1P). Figure 3 (next page) shows the VBF array with 18 rows of 21 vertically mounted panels, with some rows having the front side of the panels facing East and other rows with the front side of their panels facing West. The rows are aligned North-South so that the morning direct sunlight hits one side of the panels and the afternoon direct sunlight hits the opposite side. The panels are bifacial – meaning that both front and back sides can collect sunlight, but according to the manufacturer's specifications, the back side produces only 70% of the energy compared to the front side under standard test conditions.

Figure 2: Single-axis trackers at Snyder Farm in Pittstown, NJ.
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Data Collection and Comparison:

Each of the three Rutgers arrays is connected using SolarEdge brand inverters that track energy production in 15-minute intervals. Energy production is reported here in annual kWh_{AC}/kW_{DC} as shown in Table 1.

As noted above, Snyder Farm and Cook Campus are at nearly the same latitude and should be experiencing nearly the same sunlight exposure. Comparing the annual electricity production at the three sites, it is observed that the VBF array in New Brunswick has generated approximately 71% of the energy production by the SAT in Pittstown.

It is interesting to compare these actual output values with numbers predicted by PVWATTS, an online solar energy production estimation tool provided by NREL[1]. The PVWATTS outputs were calculated for the specific latitude and longitude values for each site, as well as selecting each array's mode of operation, alignment, and average ground-coverage-ratio. Within PVWATTS, our sites were modeled with premium bifacial modules with a bifaciality of 70% and other parameters to match each specific installation's construction[2]. Comparing the RAREC and Snyder Farm sites, both having SAT arrays, we see that RAREC, located further South, generated approximately 8% more energy per unit of installed capacity during the first year of production than Snyder Farm.

Figure 3: Vertical bifacial array, looking South, at the Rutgers University Animal Farm on Cook Campus, New Brunswick, NJ.
Image © Rutgers Agrivoltaics Program.

Energy production projections, such as the ones reported here, should be considered when planning agrivoltaics installations for future energy generation in New Jersey. All three sites generated slightly more energy than predicted by PVWATTS, though the variations shown here are within the range of year-to-year typical sunlight variations.

Table 1. Full year total energy production per unit of installed capacity (May 1, 2024 – April 30, 2025) for the three agrivoltaic sites at Rutgers University.

	Cook Animal Farm	RAREC	Snyder Farm
Array Type	Vertical bifacial	Single-axis tracker (1P and 2P)	Single-axis tracker (1P)
Recorded annual energy production (kWh_{AC}/kW_{DC})	1,116	1,700	1,573
Predicted annual energy production using PVWATTS (kWh_{AC}/kW_{DC})	1,086	1,624	1,564
Ratio	1.027	1.046	1.006

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Additional agrivoltaics information can be found at: https://agrivoltaics.rutgers.edu

[1] https://pvwatts.nrel.gov/pvwatts.php

[2] Ground-coverage-ratios (GCRs; panel dimension perpendicular to the row direction divided by the row pitch) were set to match with the average value for the array areas (ignoring edge effects). The GCRs are: Animal Farm = 0.258; RAREC = 0.303; Snyder Farm = 0.215. Applicable DC/AC inverter sizes were also applied for each site. **Animal Farm** has 170.1 kW_{DC} feeding into 120 kW_{AC}; **RAREC** has 48.6 kW_{DC} feeding into 40 kW_{AC}; **Snyder Farm** has two zones, one with 56.7 kW_{DC} feeding into 50 kW_{AC} and the second with 25.65 kW_{DC} feeding into 17.3 kW_{AC}.