Rutgers Agrivoltaics Program
New Jersey Agricultural Experiment Station

RUTGERS
New Jersey Agricultural Experiment Station

Rutgers Agrivoltaics Program Update and Lessons Learned

January 7, 2023

Project partners:

ADVANCED SOLAR PRODUCTS

RUTGERS Institutional Planning and Operations

What is Agrivoltaics?

- Combines agriculture with solar power generation (not solar farms)
- Keeps agriculture as the main focus for land use
- Can be combined with both animal and plant production
- Any yield losses are offset by income from electricity generation
- Can contribute to the viability and resiliency of farming
- Contributes to renewable energy goals (NJ: net-zero by 2050)

The Rutgers Agrivoltaic Program is focused on technologies that permit multiple uses of the farmland. We believe small animal production and native pollinator habitat should be designed into all solar installations

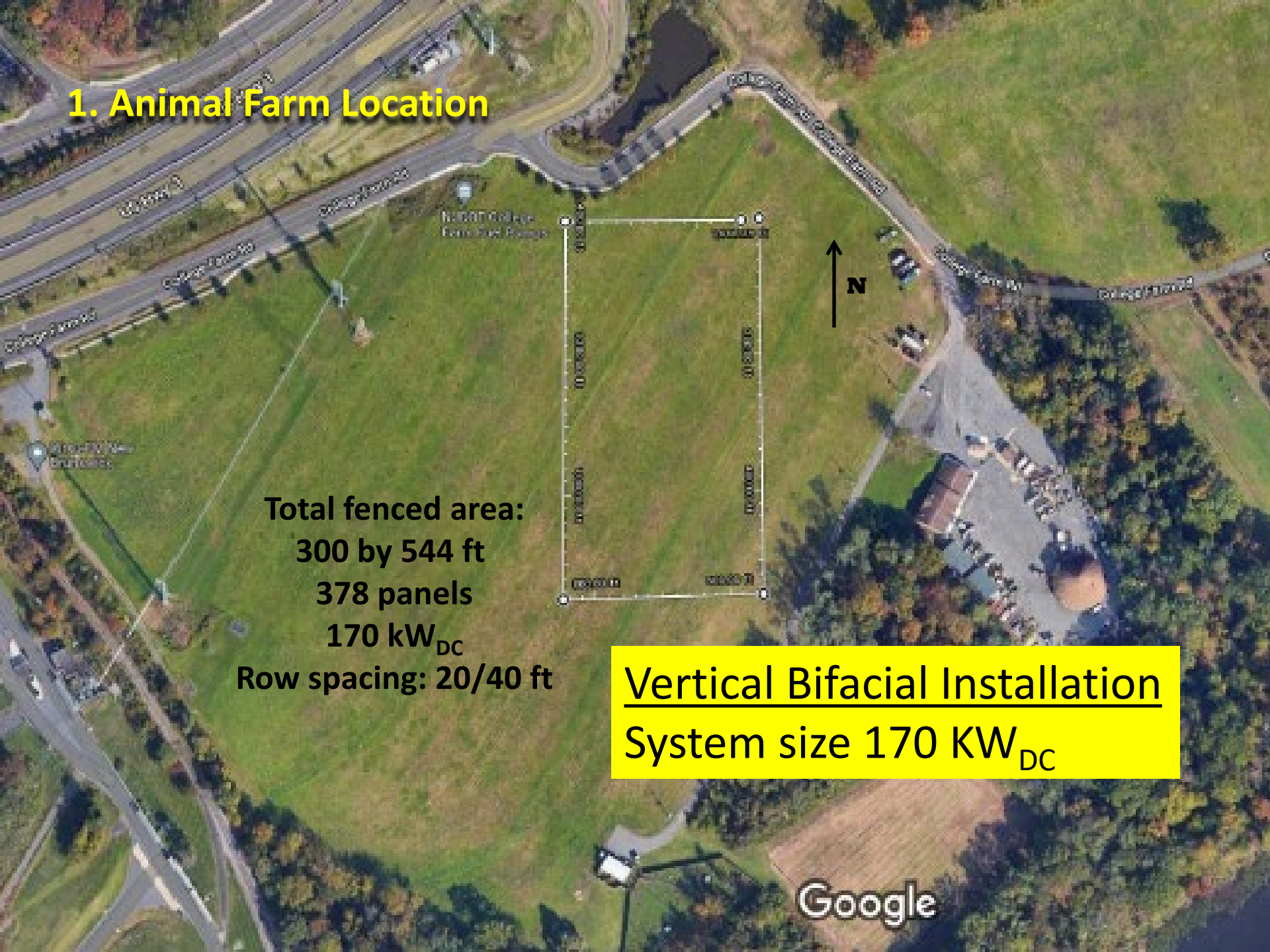
https://www.virginiamercury.com/

https://www.greenbiz.com/

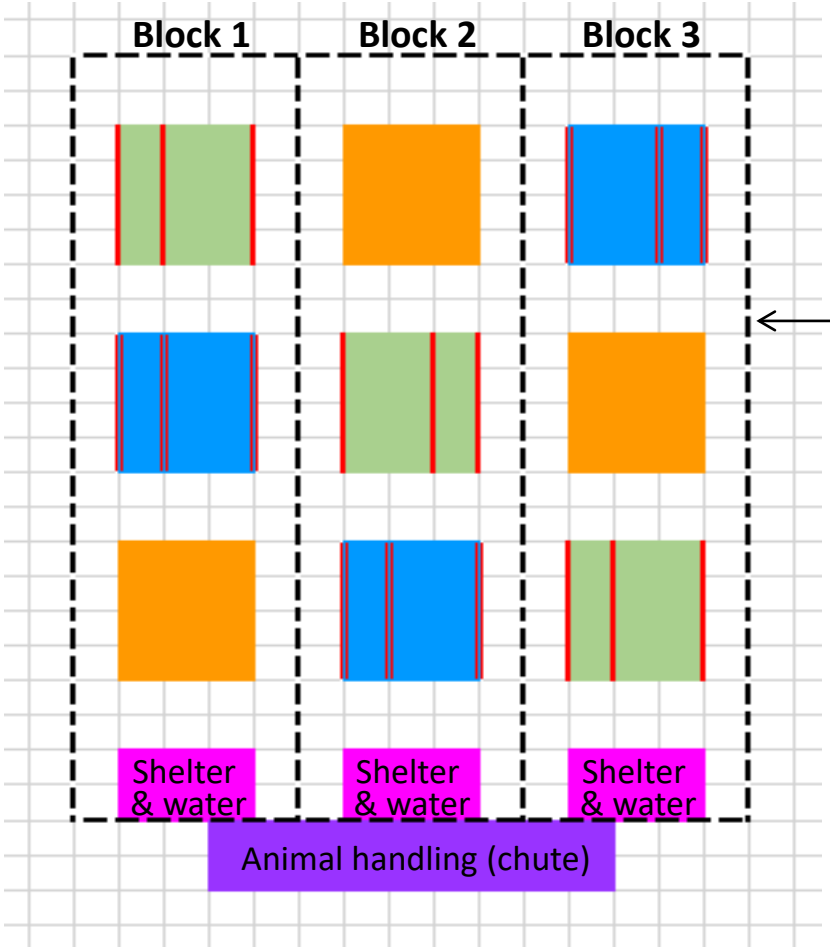
Farm Locations

1. Rutgers Animal Farm, New Brunswick, NJ
2. Rutgers Agricultural Research and Extension Center, Bridgeton, NJ
3. Clifford E. & Melda C. Snyder Research and Extension Farm, Pittstown, NJ

Proposed design for the Rutgers Animal Farm


1. Animal Farm Location
N
Total fenced area:
300 by 544 ft
378 panels
170 kW$_{DC}$
Row spacing: 20/40 ft
Vertical Bifacial Installation
System size 170 KW$_{DC}$
Google

• Design details Animal Farm



Each gray grid square measures 20 by 24.7 ft (E-W by N-S)

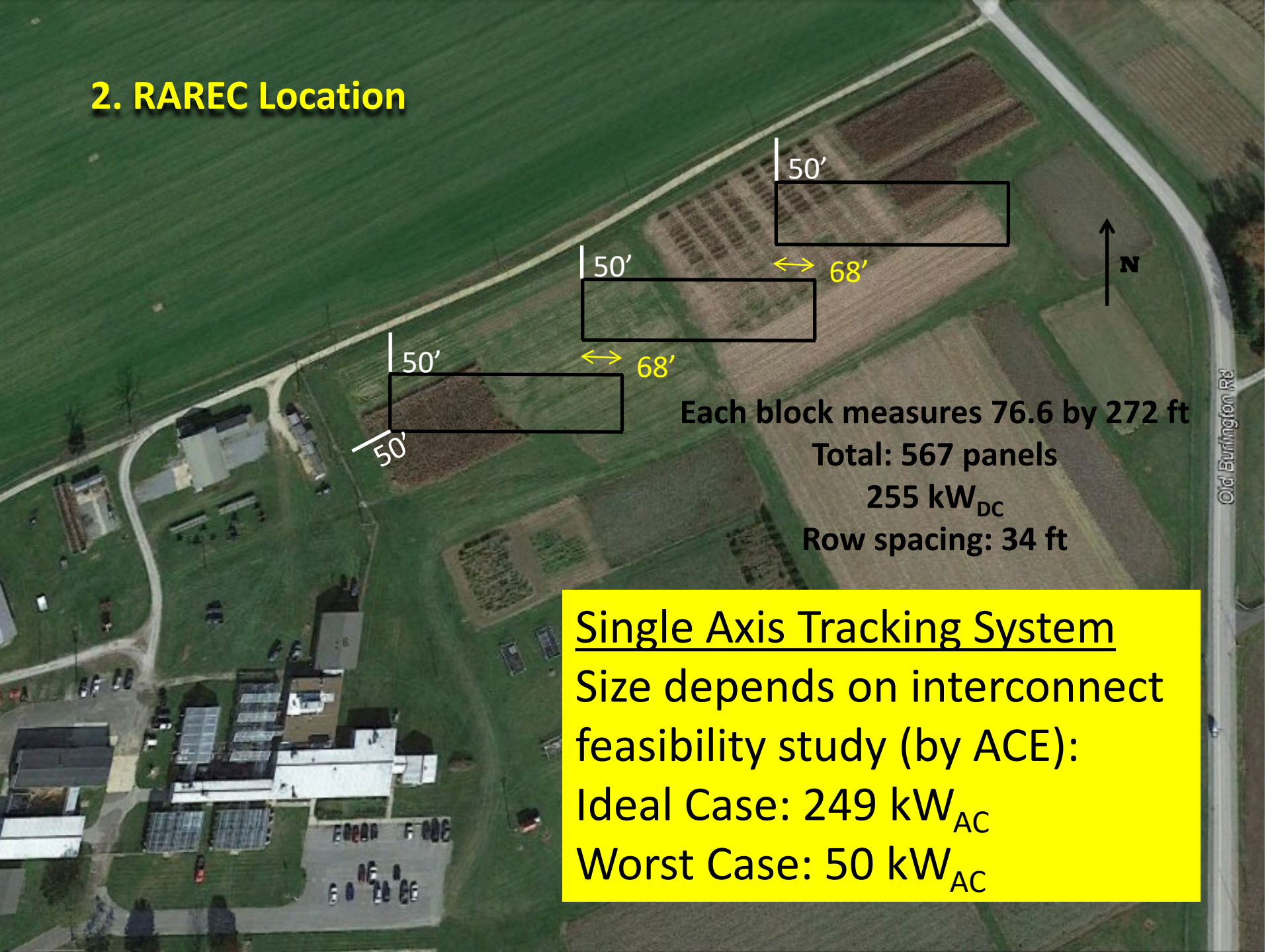
Total fenced area: 300 by 544 ft

- Green = Three rows of single panels
- Blue = Three rows of double panels
- Orange = control treatment (no panels)
- Total number of panels (all three blocks): 378 (170 kW_{DC})
- Panels: ZnShine (450 W; bifaciality: 70%)
- Racking: Next2Sun or ASP

Single-axis tracking systems (Rotate E-W)

- Single or double rows of solar panels
- Panels in portrait orientation

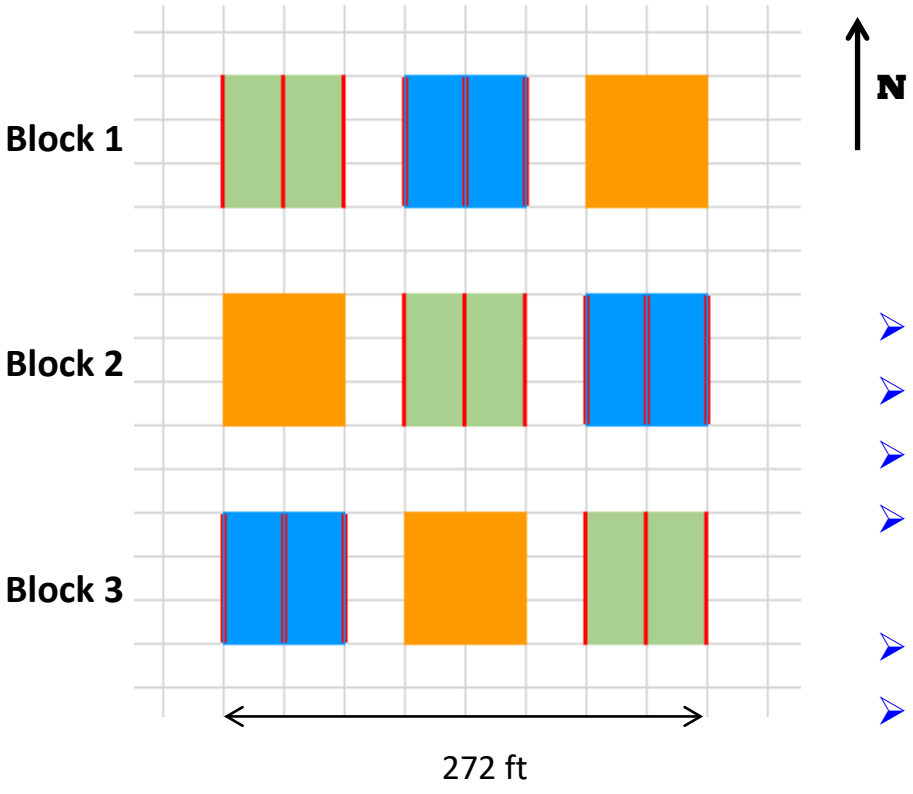
2. RAREC Location



Each block measures 76.6 by 272 ft
Total: 567 panels
255 kW_{DC}
Row spacing: 34 ft

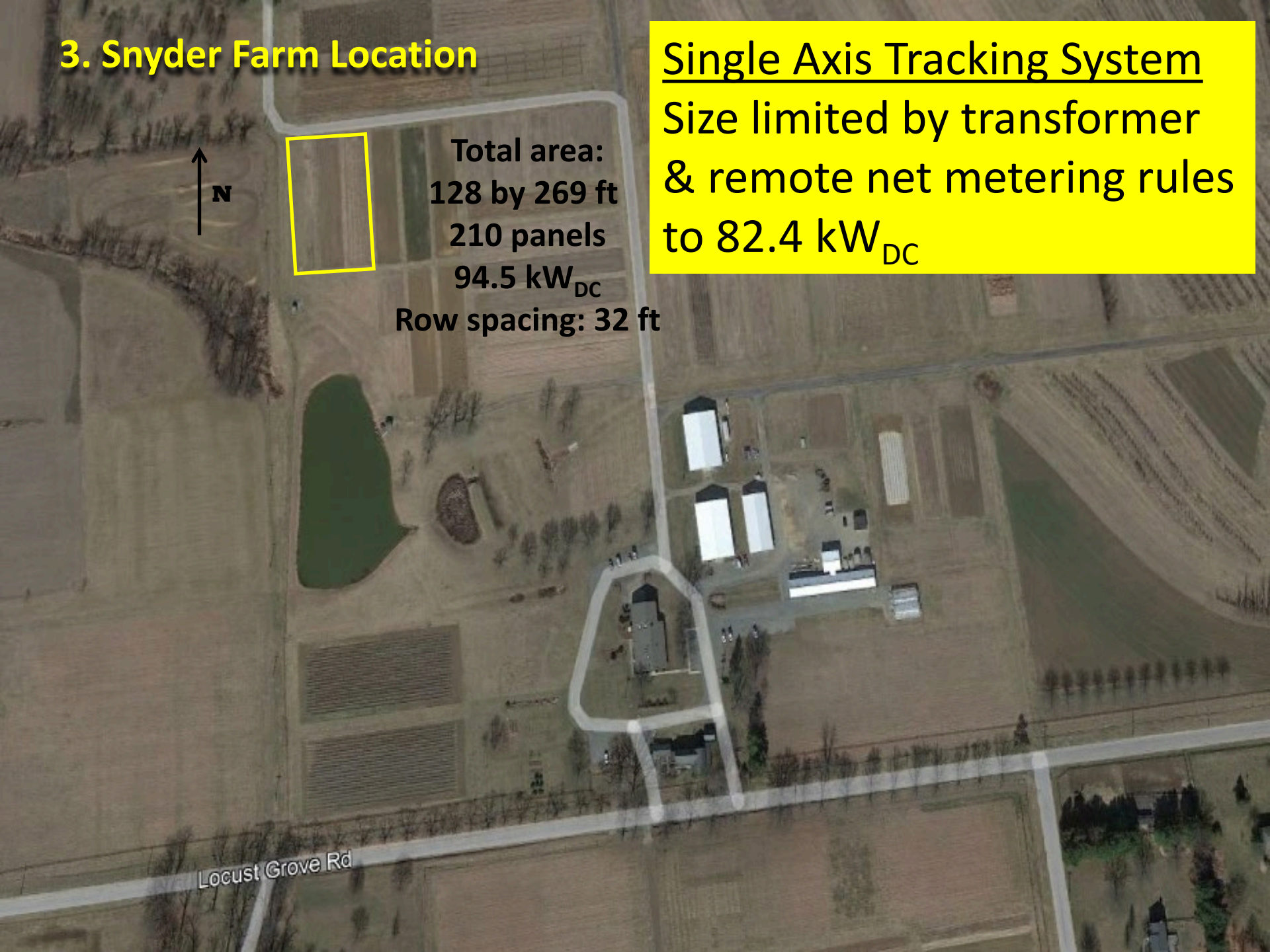
<u>Single Axis Tracking System</u>
Size depends on interconnect feasibility study (by ACE):
Ideal Case: 249 kW_{AC}
Worst Case: 50 kW_{AC}

• Design details RAREC



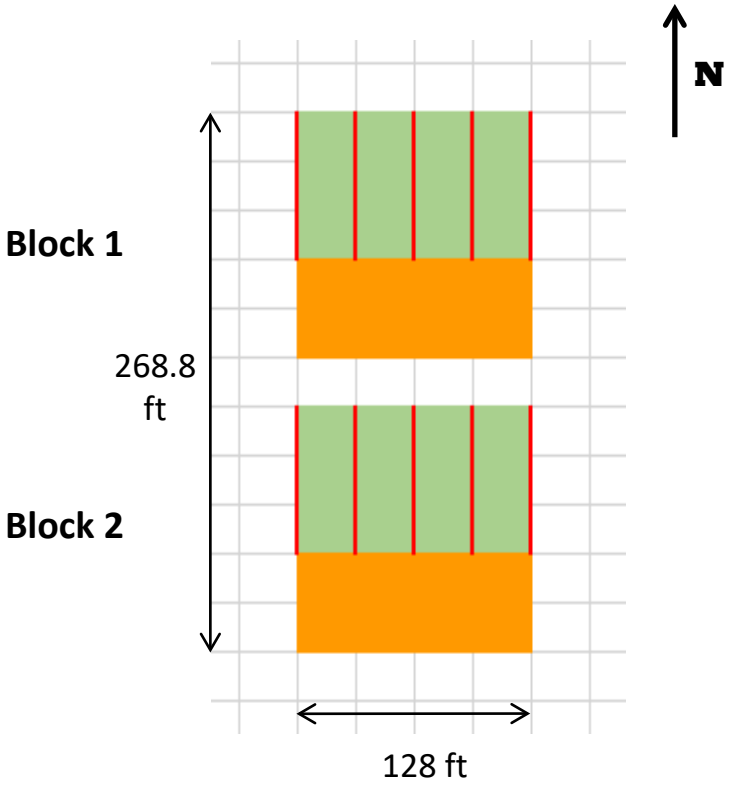
Each gray grid square measures 34 by 24.4 ft (E-W by N-S)

- Green = 3 rows of single panels
- Blue = 3 rows of double panels
- Orange = control (no panels)
- Total number of panels (all three blocks): 567 (255.2 kW_{DC})
- Panels: ZnShine (450 W; bifaciality: 70%)
- Racking system: Arctech Solar


3. Snyder Farm Location
N
Total area:
128 by 269 ft
210 panels
94.5 kW$_{DC}$
Row spacing: 32 ft
Single Axis Tracking System
Size limited by transformer & remote net metering rules to 82.4 kW$_{DC}$
Locust Grove Rd

• Design details Snyder Farm

Jersey Central Power & Light
A FirstEnergy Company



Each gray grid square measures 32 by 24.4 ft (E-W by N-S)

- Green = 5 rows of single panels
- Orange = control (no panels)
- Total number of panels: 210 (94.5 kW_{DC})
- Maximum interconnect capacity: 82.4 kW_{DC}
- Panels: ZnShine (450 W; bifaciality: 70%)
- Racking system: Arctech Solar

Lessons Learned to Date

- Location, location, location! Branch lines on power grids in rural areas are not always designed to accommodate additional generating capacity, especially when considering larger systems (> 1 MW)
- Getting interconnect approvals from local utilities varies greatly from one provider to another and may incur engineering fees
- Most solar developers have limited knowledge of farming practices and how to properly design agrivoltaic systems
- Some key agrivoltaic equipment is manufactured outside the US, causing longer delivery times and additional costs
- Large-scale (grid-scale) projects have a long wait time, over two years, to get regional interconnect approvals (PJM in our case)

- Capacity of local utility grids

Atlantic City Electric (ACE) map:

- https://pepco.maps.arcgis.com/apps/dashboards/940e65bff6294b589f5832ab1521c93f

PSEG map:

- https://nj.pseg.com/saveenergyandmoney/solarandrenewablеenergy/solarpowersustanibility
  (You have to use the +/- button on the map to zoom in)

JCP&L map:

- https://firstenergycorp.maps.arcgis.com/apps/webappviewer/index.html?id=d43cf2482a344e469eae6ca569403c24
  (again, you have to zoom in to see stuff)

There are other electric suppliers in NJ but they may not have the online mapping available

Dual-Use Solar Energy Pilot Program

Highlights

- Rules and regulation to be established by the NJ Board of Public Utilities in Consultation with Secretary of Agriculture
- Up to 300 MW of Dual-use Solar Installations in NJ over the next 3-5 years (except for preserved farms, Highlands and Pinelands)
- Maximum of 10 MW per each installation (equals approximately 100 acres @ 50% solar density)
- Must continue to be actively devoted to agricultural or horticultural use
- Competitive application to BPU in consultation with Secretary of Agriculture for ranking and approval
- If located in an Ag Development Area (ADA), project must be in association with a research study undertaken in coordination with a NJ institution of higher education

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In summary

- We anticipate construction of NJAES agrivoltaic systems to be completed by April 2023
- Crop trials to begin immediately afterwards
- Policymakers need to consider limitations of grid interconnection when designing AV/solar programs.
- Multidisciplinary approach is key
- Farmer and community acceptance to be determined
- Push-back anticipated (already encountered)
- Agrivoltaics could be a real boon for agriculture, but sound research is needed