


Agrivoltaics at NIPSCO

Brian Kortum - Director of Natural Resources Permitting

NiSource®

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NIPSCO's Clean Energy Transition: Key Highlights

- **Strategic Shift**
  - Aging infrastructure and rising compliance costs in the 2010s prompted a shift toward sustainable energy.
  - Began evaluating alternative technologies for improved customer economics and system reliability

- **Stakeholder-driven Integrated Resource Planning (IRP)**
  - IRPs are updated every two years and chart a 20-year strategy for meeting future energy needs.
  - Identified a diverse portfolio Wind, Solar, Battery

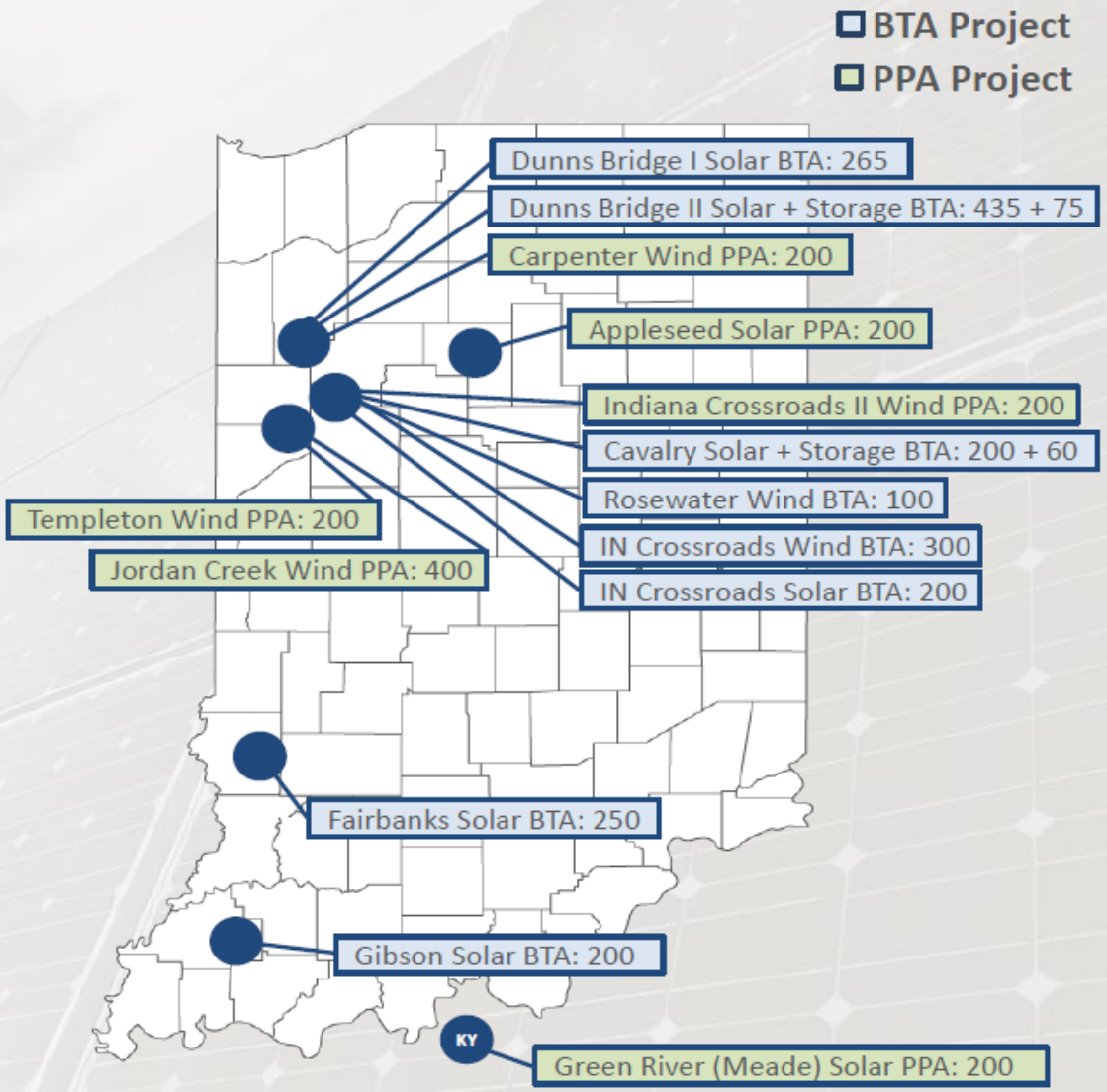
- **NIPSCO continues to prioritize a balanced transition away from coal**
  - Focus on grid reliability, affordability, and emissions reduction.
  - ongoing investments in renewables and flexible resources
  - Support peak demand and system resilience

- **Renewable Expansion**
  - Since 2018: ~15 renewable projects totaling 3,000 MW added.
  - Energy mix now includes coal, natural gas, wind, solar, hydro, and battery storage.

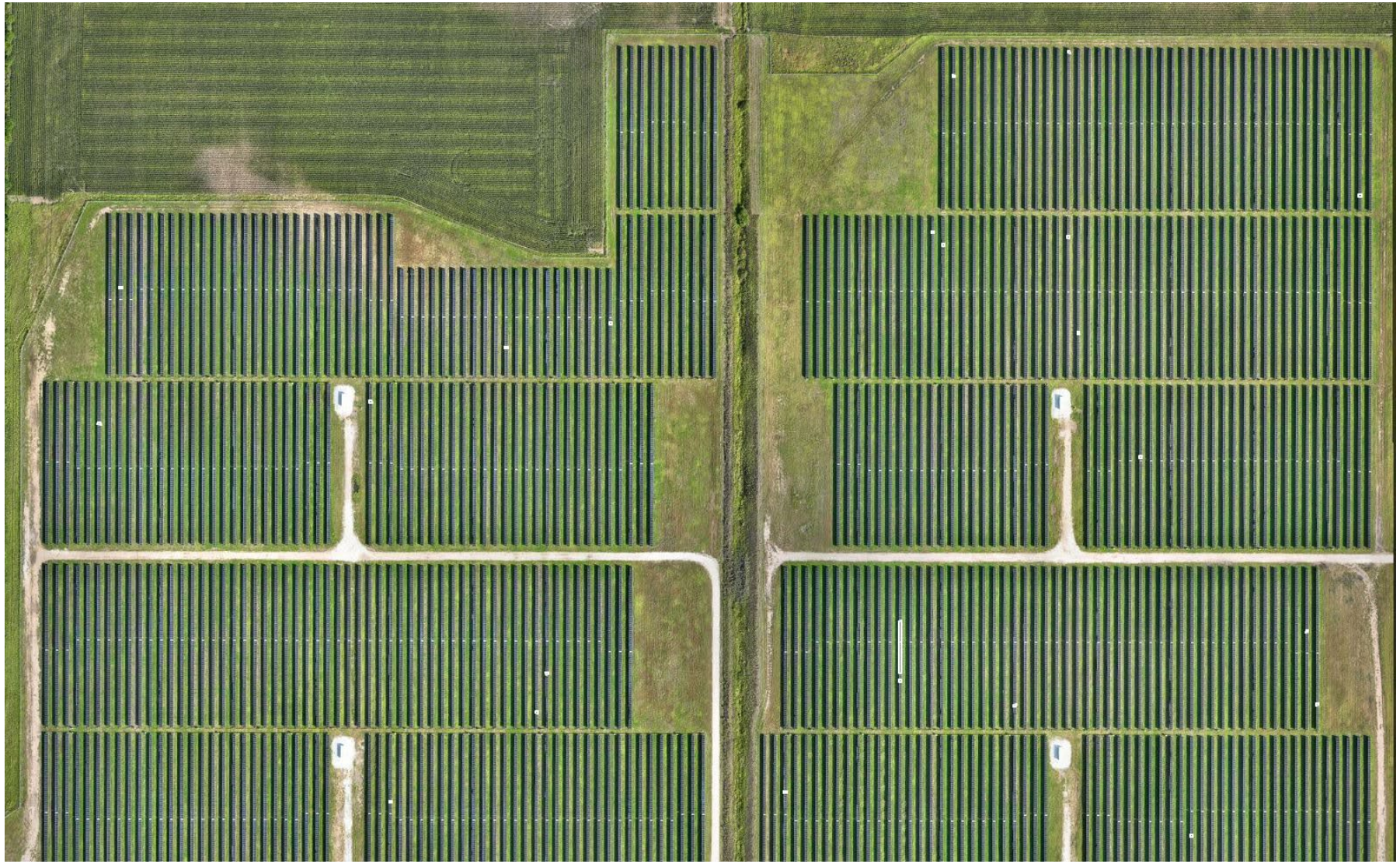
ROBUST RENEWABLE INVESTMENTS IN INDIANA

BTA Projects	Installed Capacity (MW)	Estimated In Service	Status
Rosewater Wind	100	2020	Complete
Indiana Crossroads Wind	300	2021	Complete
Dunn's Bridge I Solar	265	2Q23	Complete
Crossroads Solar	200	2Q23	Complete
Transmission Projects	---	2Q23	Complete
Cavalry Solar + Storage	200 + 60	2Q24	Construction
Dunn's Bridge II Solar + Storage	435 + 75	4Q24	Construction
Fairbanks Solar	250	2Q25	Construction
Gibson Solar	200	2025	Filed with the IURC
Total			

PPA Projects	Installed Capacity (MW)	Estimated In Service	Status
Jordan Creek Wind	400	2020	Complete
Crossroads II Wind	200	2023	Construction
Templeton Wind	200	2025	Filed with the IURC
Carpenter Wind	200	2025	Filed with the IURC
Appleseed Solar	200	2025	Filed with the IURC
Green River Solar	200	2024	Amendment Approved

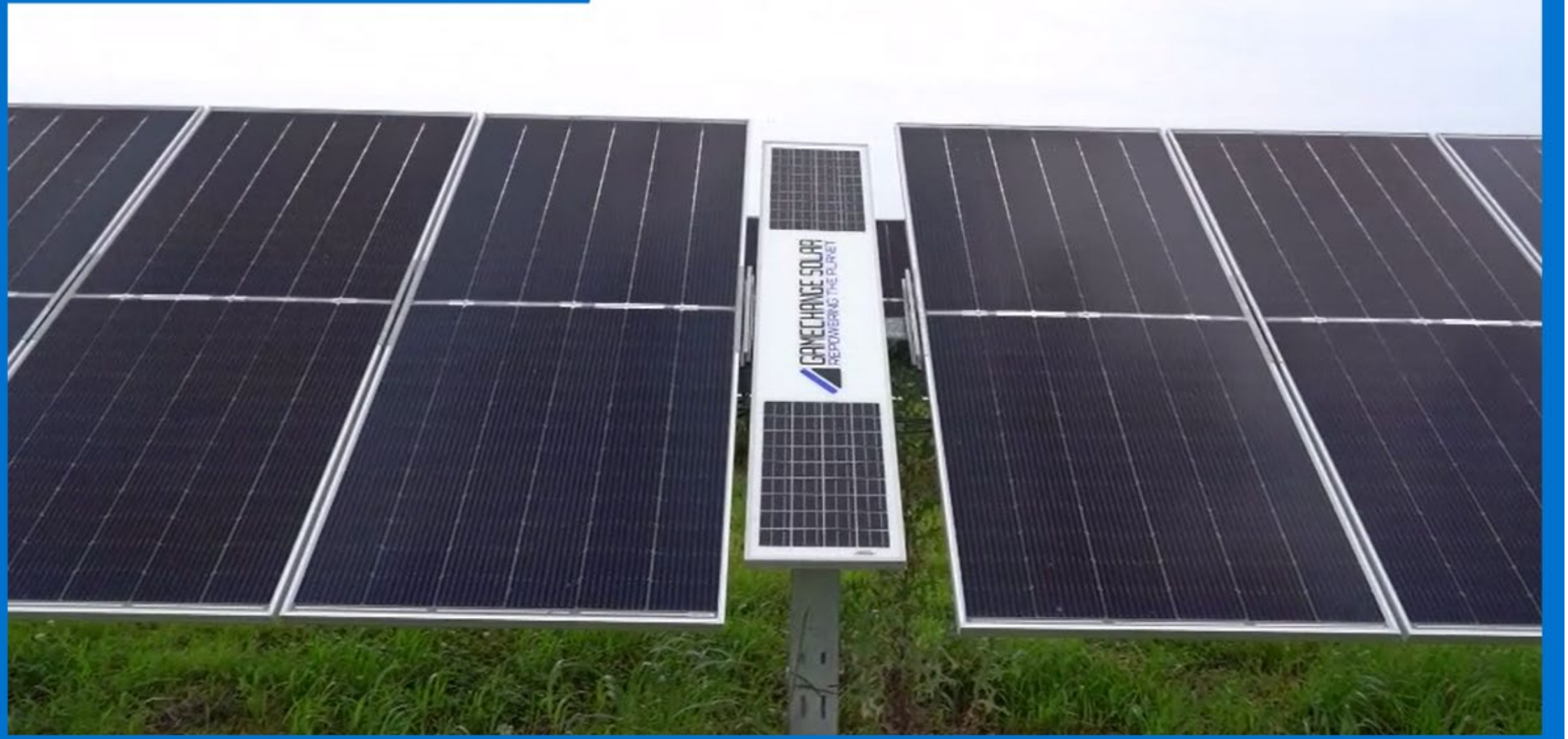


Utility Scale Solar



PV String

Tracking System

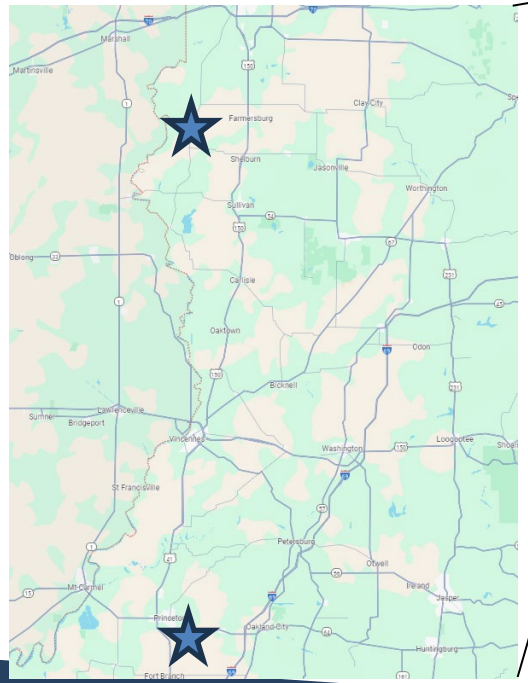


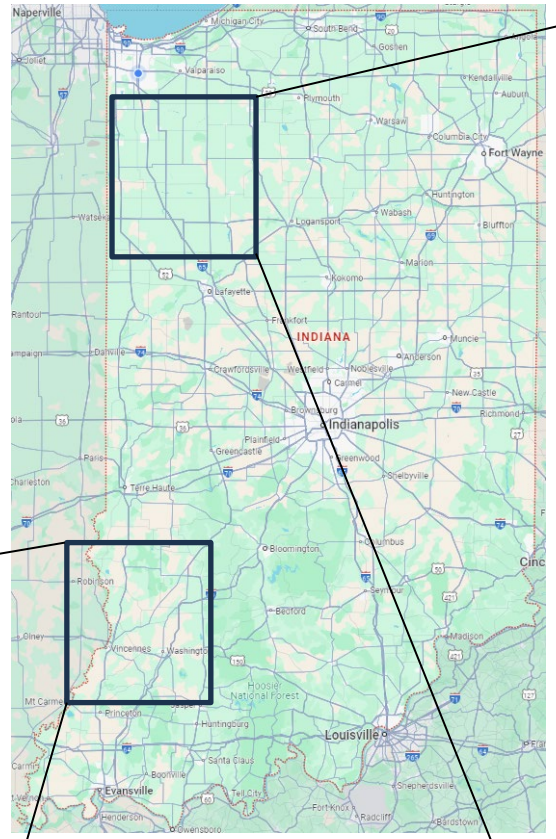
Combiner Box

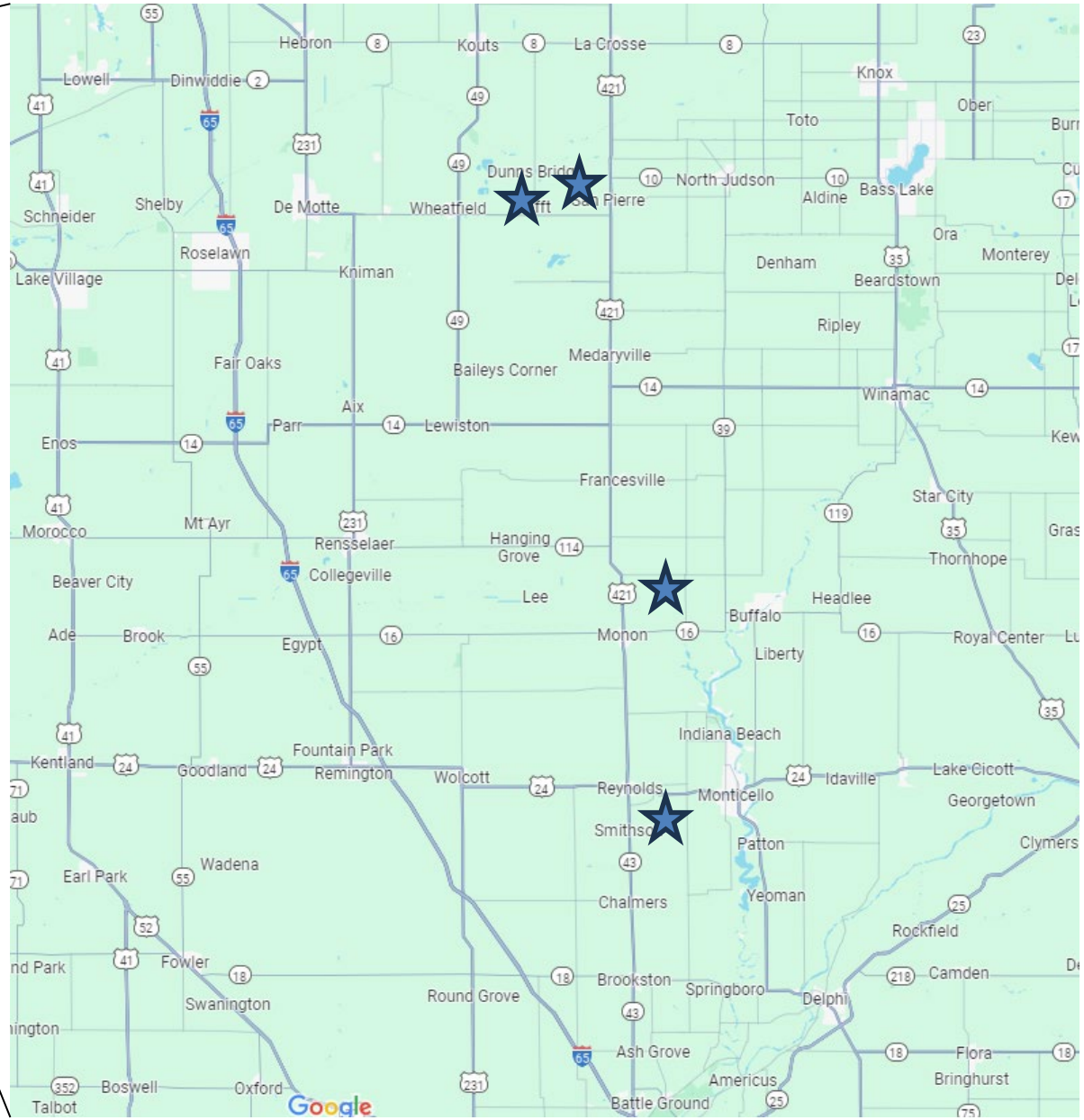
Inverter Pad

Power Block

NIPSCO Solar Site

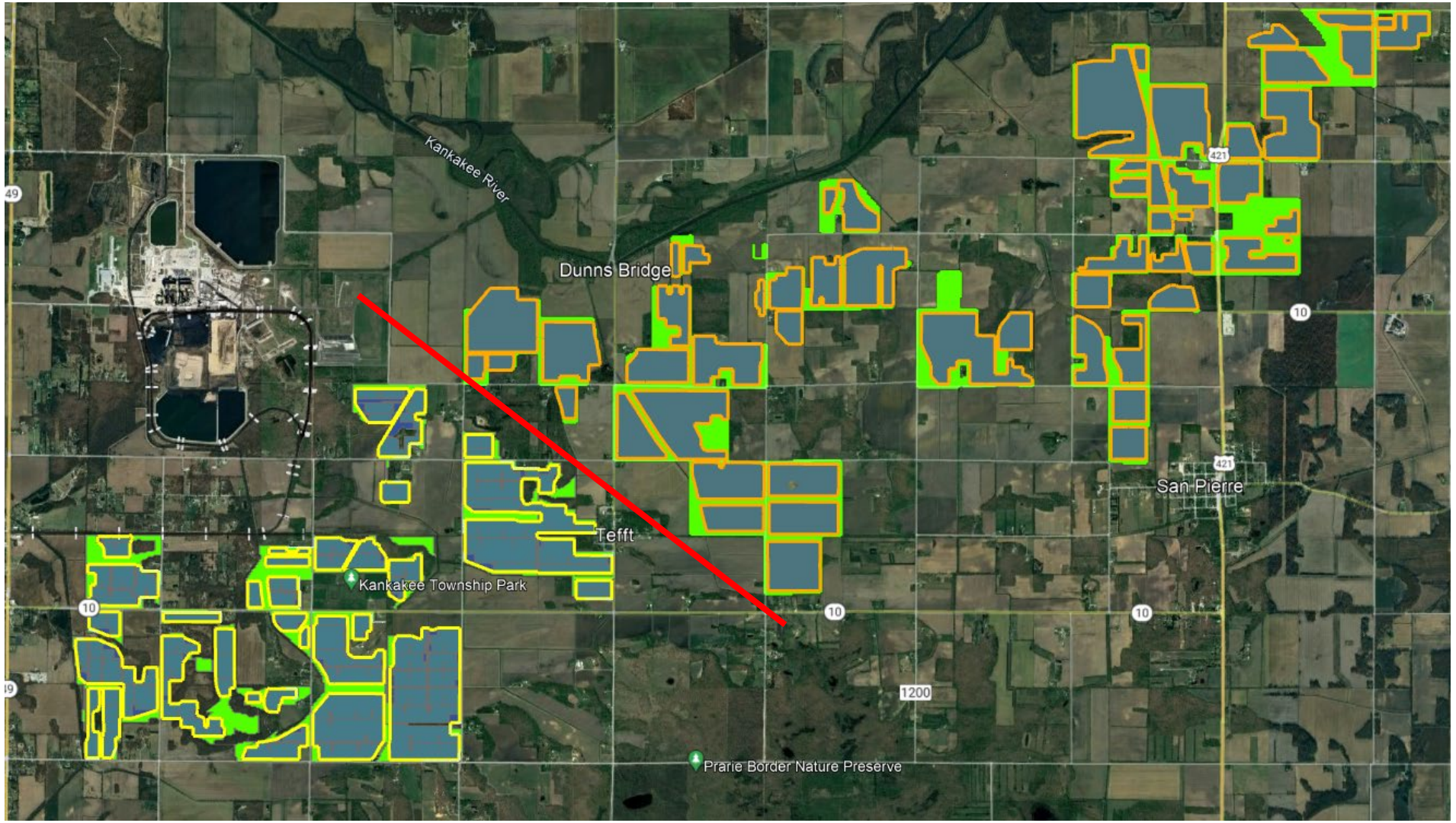






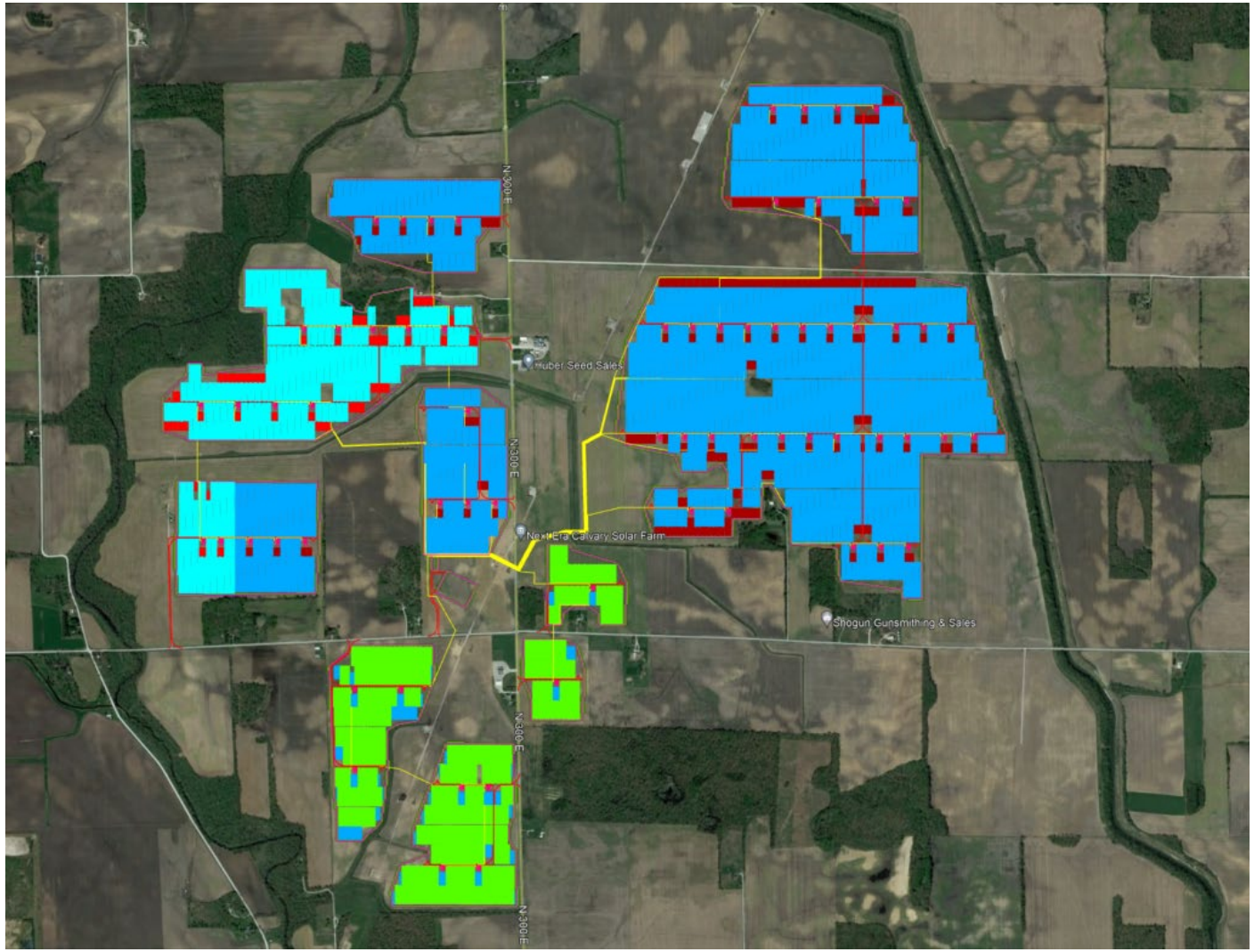
Dunns Bridge 1
Yellow fence
1486 Acres fenced
550 outside

Dunns Bridge 2
Orange Fence
2500 Acres fenced
770 outside

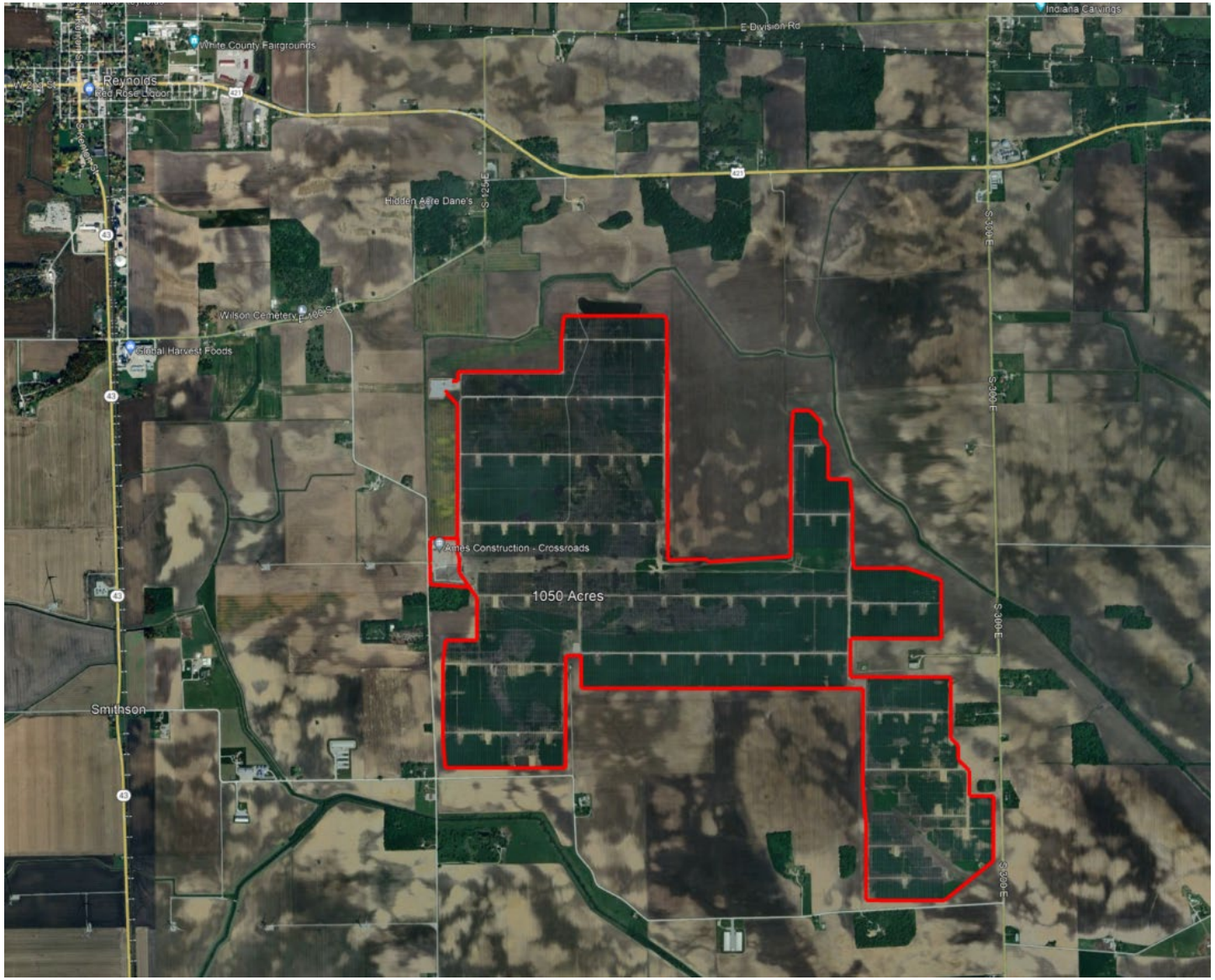


Cavalry Solar
200MW
1048 Acres

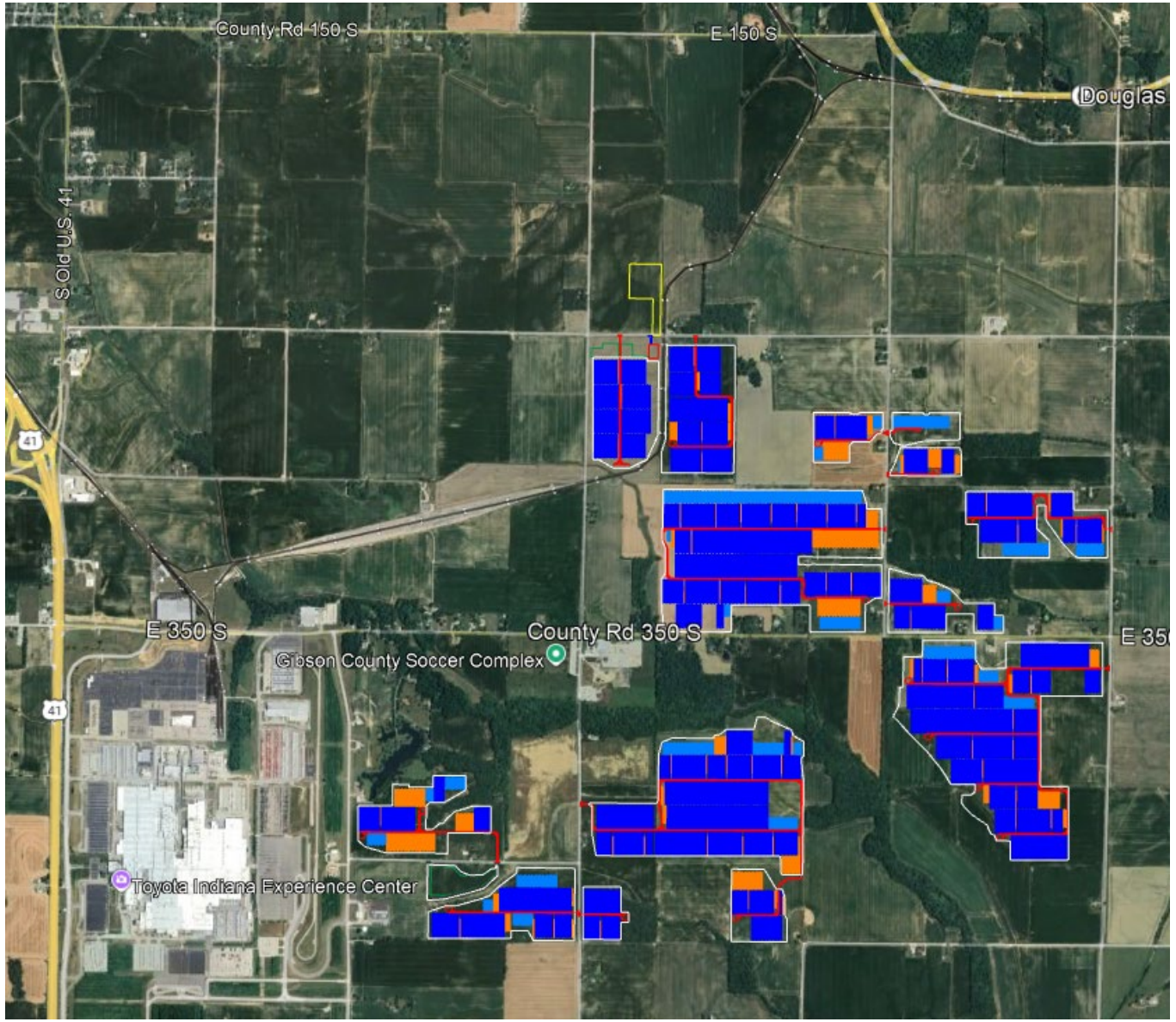
possibly 400 acres outside the fence



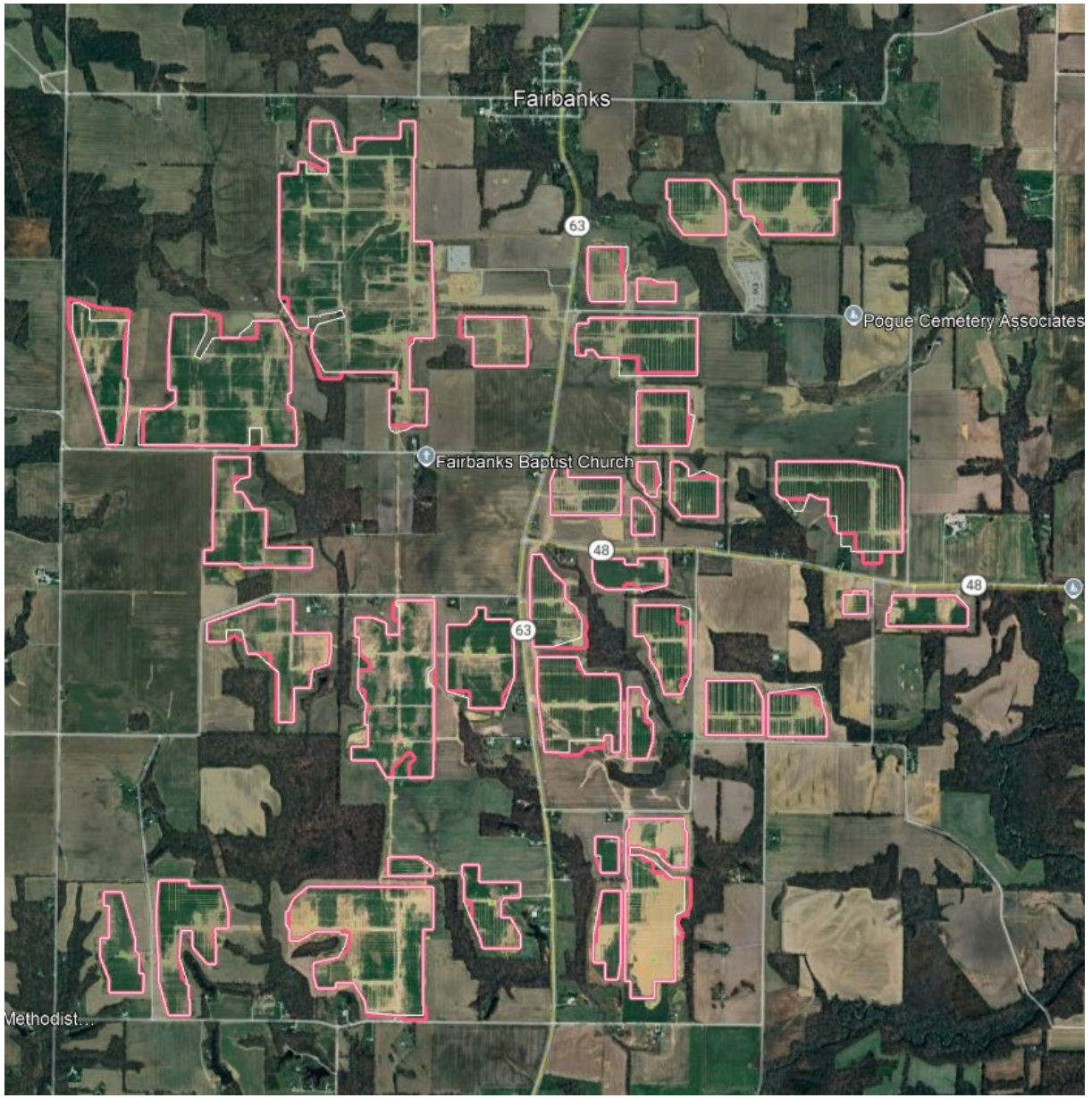
Indiana
Crossroads Solar
200MW
1050 Acres



Gibson Solar
200MW
1000 Acres



Fairbanks Solar
250MW
1420 Acres

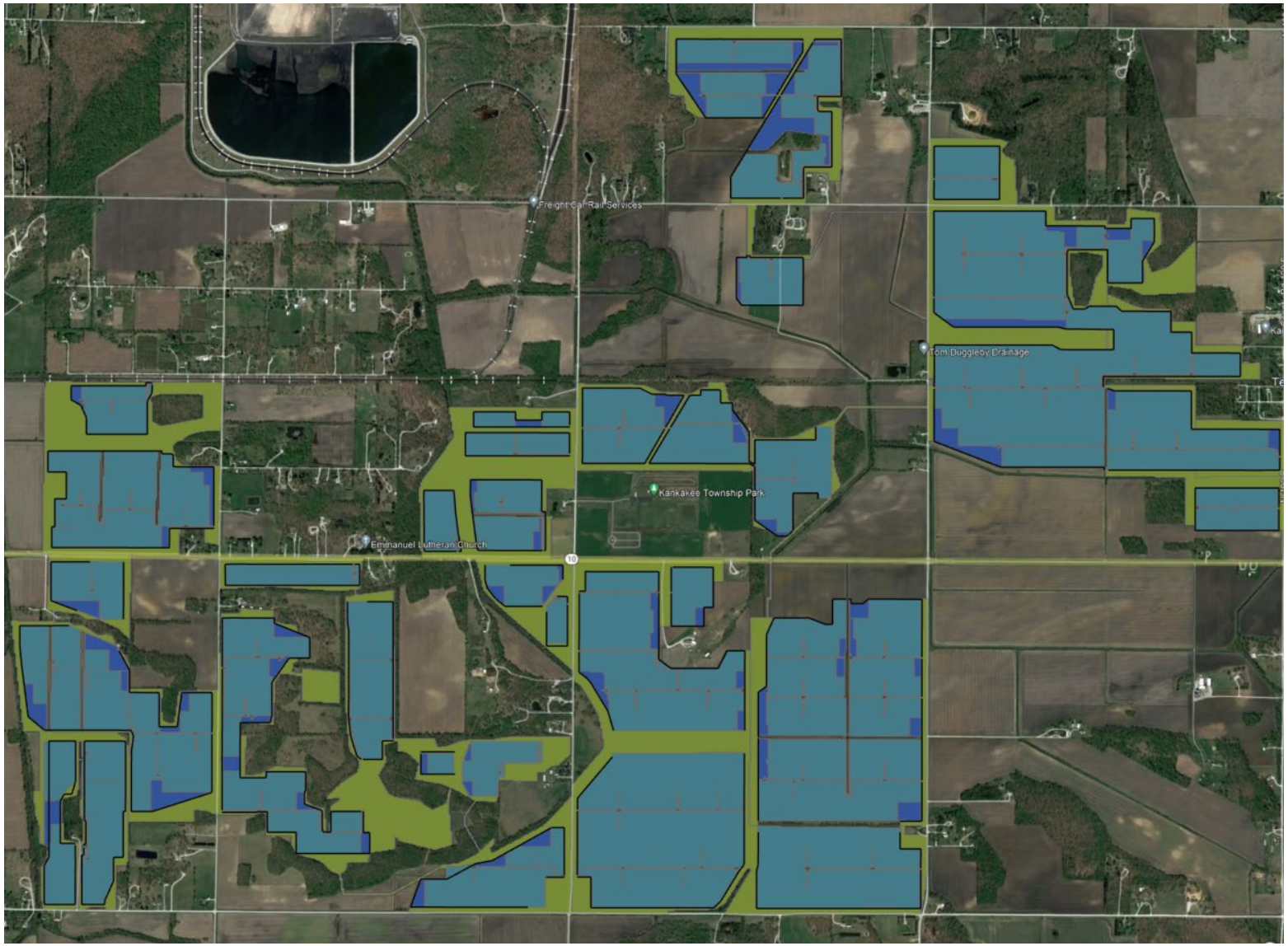


Vegetation Management Plan

- **3 Primary Vegetation zones**
  - Array – less than 18 inches
  - Buffer – up to 48 inches
  - Conservation areas – can include native trees depending upon location
- **Conservation Project**

  Partnership
  - Pheasants Forever
  - USFWS
  - Bee and Butterfly Habitat Fund
  - Next Era
  - Local Farmer

Dunn's Bridge 1 Solar 200 MW 1486 Acres with an additional 500+ acres outside of the fence



Vegetation Management Plan

- **Seed mix**
  - Includes Pollinator areas
  - Array mix is fescue, clover, small forms – sheep friendly
- **Evaluating Various maintenance strategies**
  - Company Mowing Crews
  - Contracted Mowing Crews
  - Autonomous Mowers
  - Sheep Grazing

Prices range from $250 to over $600 per acre

BTA Project	Installed Capacity (MW)	Fenced Acres
Dunns Bridge Solar 1	265	1486
Dunns Bridge Solar 2	435	2500
Indiana Crossroads Solar	200	1050
Cavalry Solar	200	1048
Faribanks Solar	250	1420
Gibson Solar	200	1000
	1550	**8504**
PPA Projects		
Appleseed Solar	200	1000
Green River Solar	200	1000
		2000
Total		10,500

$2.6 – $6.3 Million/year for Vegetation Management

Evaluating vegetation management options for solar

- **Traditional Mowing**

Pros

- Vegetation Control
- Aesthetic Appeal
- Immediate Results

Cons

- Safety Risks
- Equipment Damage
- Environmental Impact
- Fire Hazard
- Higher and variable costs
- Operational Interruptions

- **Autonomous Mowing**

Pros

- Efficient
- Cost savings
- Precision and Safety
- Environmental Benefits
- Reduced safety risk

Cons

- Initial investment
- Technical issues
- Limited adaptability
- Dependance on new technology

- **Sheep Grazing**

Pros

- Efficient Land use
- Cost savings
- Natural vegetation management
- Eco-friendly solution
- Improved soil health
- Reduced carbon footprint
- Increases agricultural outputs

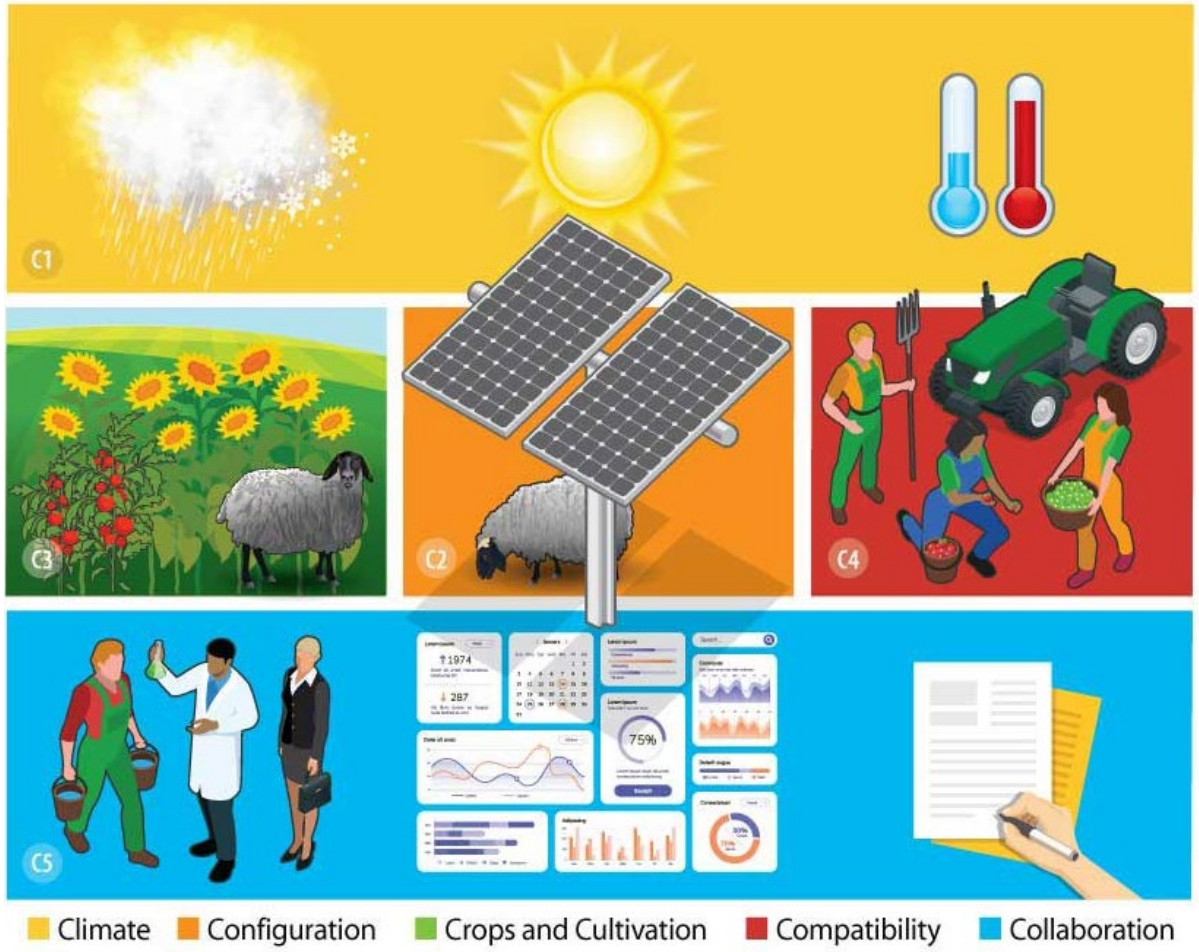
Cons

- Predation
- Manure management
- Health Risks to sheep
- Initial investment

Deploying Agrivoltaics at NIPSCO

- **Goal: Find an Agricultural Integration strategy that results in a near $0 annual vegetation management solution.**

- **Considerations**
  - Land under and around solar arrays is a valuable resource – Free access
  - Sentiment that solar is taking farm ground out of production – demonstrate dual use
  - Minimal alterations to site design – low-cost construction
  - Considerations for future return to row crop agriculture – restore soil fertility
  - Minimize conflicts between primary and secondary uses. - Electric production is primary.



Agrivoltaic options explored

- **Specialty Crops**
  - Pumpkins
  - Herbs
  - Garlic
  - Mint
  - Local CSA partnership
- **Chickens**
  - Broilers
  - layers
- **Turkeys**
- **Pasture pigs**
- **Sheep**

100 Acre pilot project Summer 2024

- Started in August
- No mowing done previously
- 2 different groups of 250 Sheep
- Rotationally Grazed
- 10 -15 temporary Paddocks
- External fencing was inadequate
- Hot wire fences used for predator control
- No livestock guardian dogs used for 1st flock
  - Predator losses
- 1 livestock guardian dog used second flock
  - No predator losses
- Water hauled into site

Grazing pilot lessons learned

- **Need to improve manure management**
  - Must have fencing around inverters for manure management
  - Water and minerals need to be away from inverter or solar tech areas
  - Rotational grazing is ideal to reduce solar tech / sheep conflicts
- **Predator management is required**
  - Must have livestock guardian dogs for predator control
- **Community engagement**
  - Site must be visited by farmer more frequently (daily)
  - Educate community for awareness (sheep are out there without food!)
  - Dead animals need to be removed within 24 hours
- **Vegetation management**
  - Sheep need to be on site for VM control at the beginning of the season.
- **Site Impacts**
  - Cab lines need to be better secured
  - Permanent paddock fencing would be ideal for rotational grazing units
  - Training for solar techs
  - Established relationship between farmer and solar techs
  - Farmer is additional set of eyes on the site - Presence may prevent vandalism
  - Fencing outside areas will increase security permitter.

NIPSCO sheep grazing partnership on 1000 acres at Cavalry Solar

NIPSCO

- Purchases and owns sheep (starter flock) 1500 ewes
- Purchase sheep handling equipment
- Provide access to water
- Provide access to leased lands at solar
- Provide infrastructure for year long flock residence.

Farmer's responsibilities

- Maintain healthy flock of sheep at established number
- Implement replacement strategy
- Establish grazing plan that meets objectives of the vegetation management plan
- Management of sheep transportation, breeding, lambing minerals, veterinary services, supplemental feed
- Provide livestock guardian dogs
- Manages leased lands outside of the fenced arrays
  - Coordinating with landowners/farmers for winter forage crops
- Ownership of all lambs produced by NIPSCO ewe flock

Water and sheep management

Water and sheep management

Challenges

Challenges

Challenges

Happy Sheep pics

Results

Before

After 3 days mob grazing

Sheep Grazing and Circularity

1. **Resource Optimization**: Optimizes the use of land by combining two functions—energy generation and agriculture—on the same plot of land, reducing the need for additional resources.
2. **Natural Vegetation Management**: Sheep grazing naturally manages vegetation under solar panels, eliminating the need for mechanical mowing or herbicides. This reduces waste and promotes a healthier ecosystem.
3. **Soil Health**: Sheep contribute to soil health by depositing organic matter (manure), which enriches the soil and supports current and future plant growth. This regenerative practice aligns with circular principles by enhancing the natural ecosystem.
4. **Reduction of Carbon Footprint**: By reducing the need for gas-powered mowing equipment, sheep grazing lowers carbon emissions. Additionally, solar energy production itself reduces reliance on fossil fuels, contributing to a more sustainable and circular energy system.
5. **Economic Synergy**: The combination of sheep farming and solar energy creates additional revenue streams for farmers and landowners, promoting local economic sustainability and resilience.
6. **Waste Reduction and Protein creation:** Grass is eaten by sheep rather than cut and decomposed.