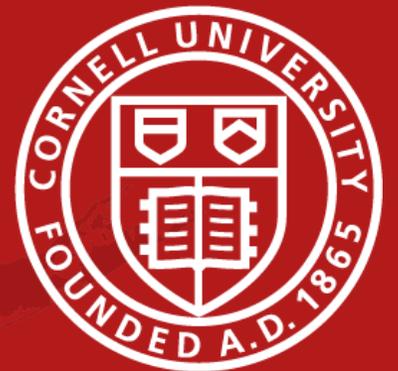


# Cornell Cooperative Extension



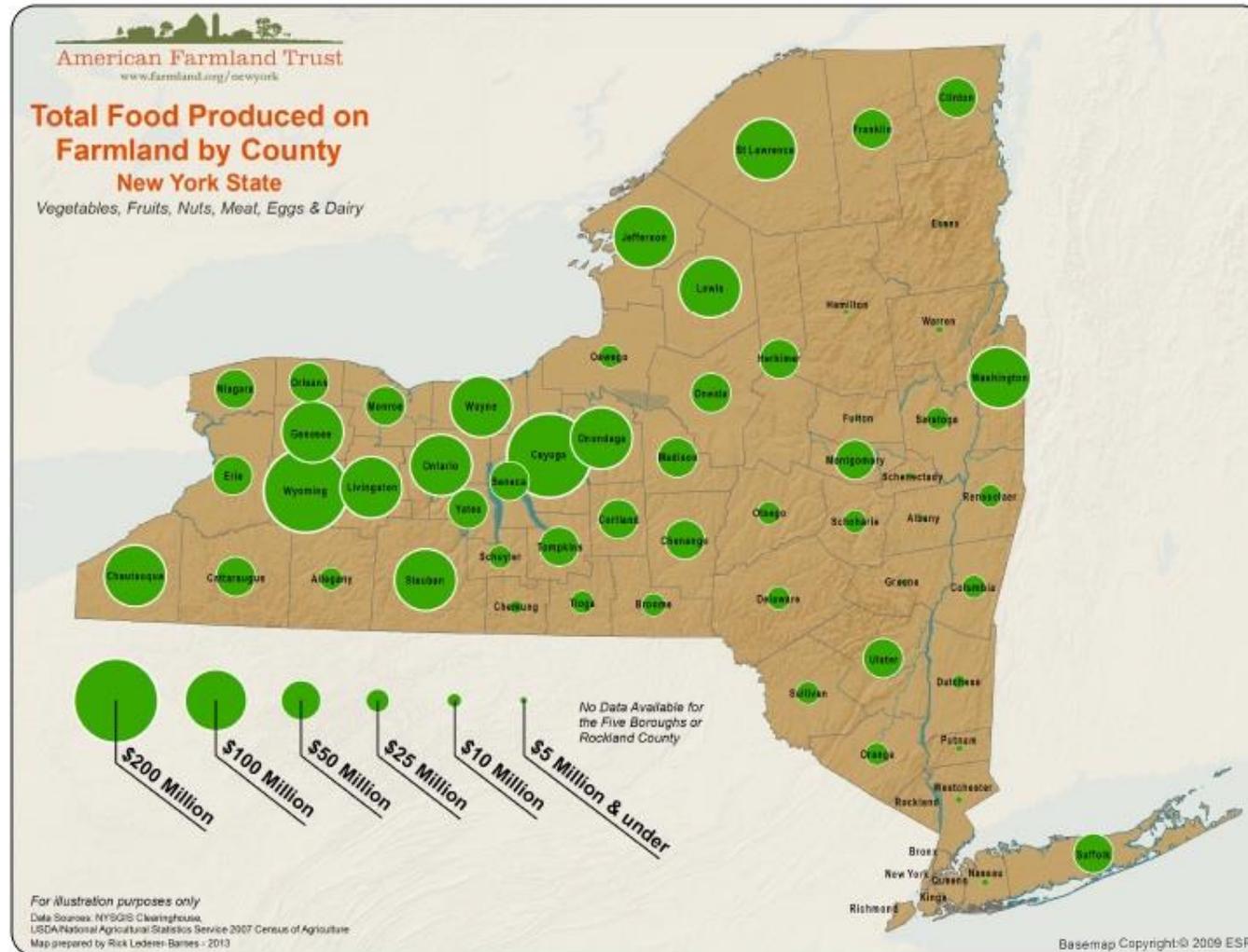
# **Agri-Voltaics:**

The Emergence of a New Form of Farming

*Garet D. Livermore*

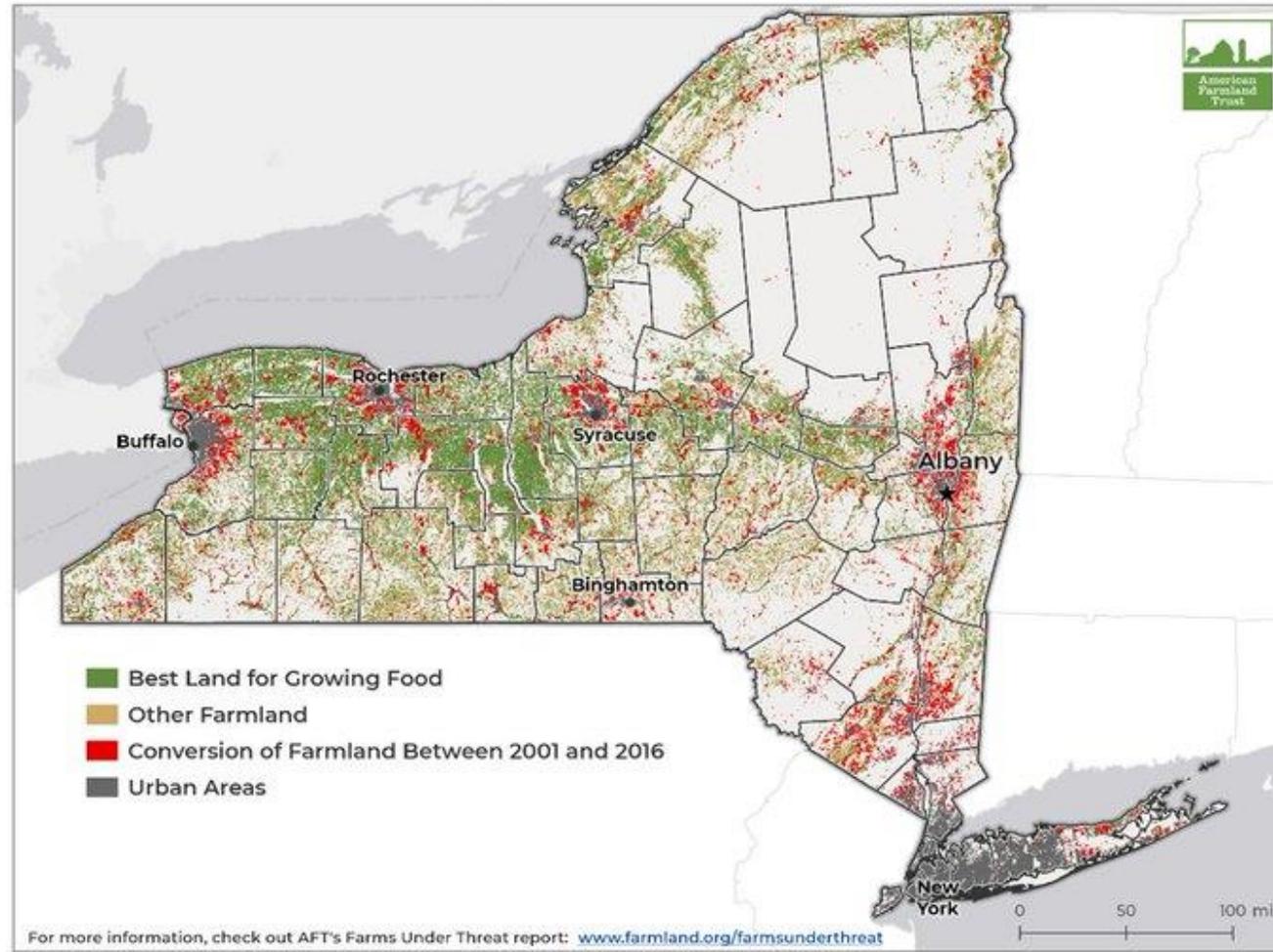
*Executive Director, CCE Herkimer County*

# Overview of New York Agriculture

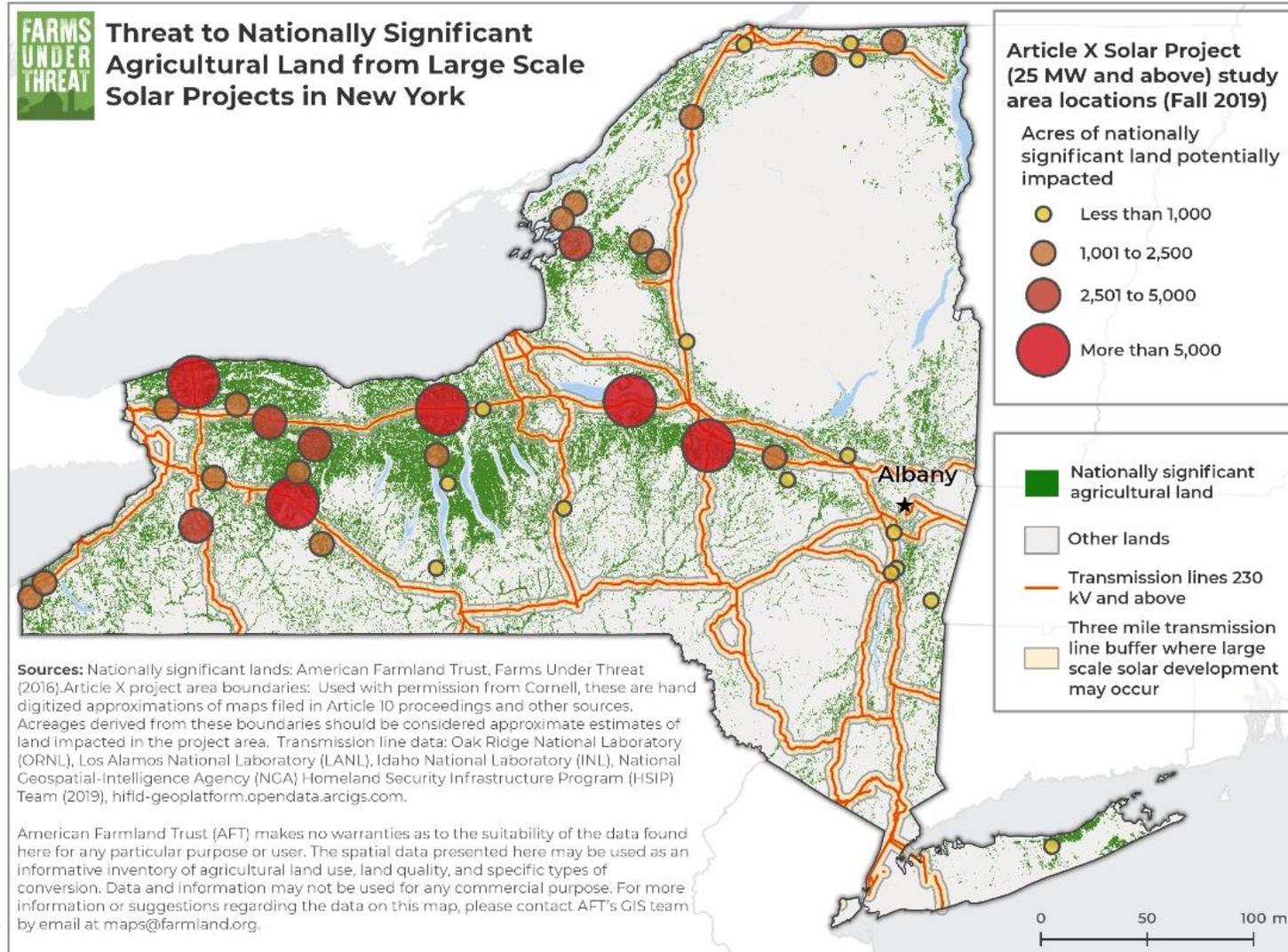


# Overview of New York Agriculture

New York's Farmland



# New York Agriculture & Solar



# How do we preserve our agricultural industry while generating clean energy?



# The Case for Dual Use in Solar Facilities

The opportunities, challenges and known adjustments needed for solar ag activities including:

- Grazing Sheep
- Grazing Cattle
- Growing Vegetables
- Apiaries and other ancillary uses



# Grazing Sheep

Opportunities:

- Established business model
- Primary focus of business is vegetation management within solar facilities
- NYS's Finger Lakes region has a growing network of farmers engaged in this business



# Grazing Sheep

## Challenges:

- Facility design
- Flock care and management
- Winter housing
- Low market value of mutton, low consumption rate of lamb
- No market or infrastructure for wool



# Grazing Sheep

Site Considerations:

- Facility Design
- Livestock care, water and shelter
- Training of shepherds
- Selection of appropriate breeds of sheep
- Winter housing at home farm



# Grazing Cattle

Opportunities:

- New York has a well established Dairy industry
- Greatest competition for land is between solar developers and various phases of dairy production
- Meat processing facilities have created demand for local cattle



# Cattle Grazing

Challenges:

- Cattle require heavier, more expensive infrastructure
- Economic model is evolving
- Grazing cattle requires larger amounts of land to be practical



# Cattle Grazing

Considerations:

- Careful economic analysis needed
- Contracts currently being developed mirror sheep grazing
- Arrays need to be built higher and heavier to accommodate cattle



# Growing Vegetables

## Opportunities:

- Vegetables are a high value crop, grown in smaller plots
- Research indicates certain crops, greens, brassicas and others do better in a partially shaded environment
- Studies have shown a high consumer interest in “solar crops”



# Growing Vegetables

## Challenges:

- Solar arrays need to be carefully designed and built to accommodate veg growing
- Some studies show less energy production in a solar facility designed for veg growing
- Ag machinery needs to be sized to fit into array



# Growing Vegetables

## Considerations:

- Optimal veg production with bifacial, tracking solar arrays
- Site design needs to incorporate path of the sun during prime growing season
- Irrigation and other crop needs
- Panel and array spacing

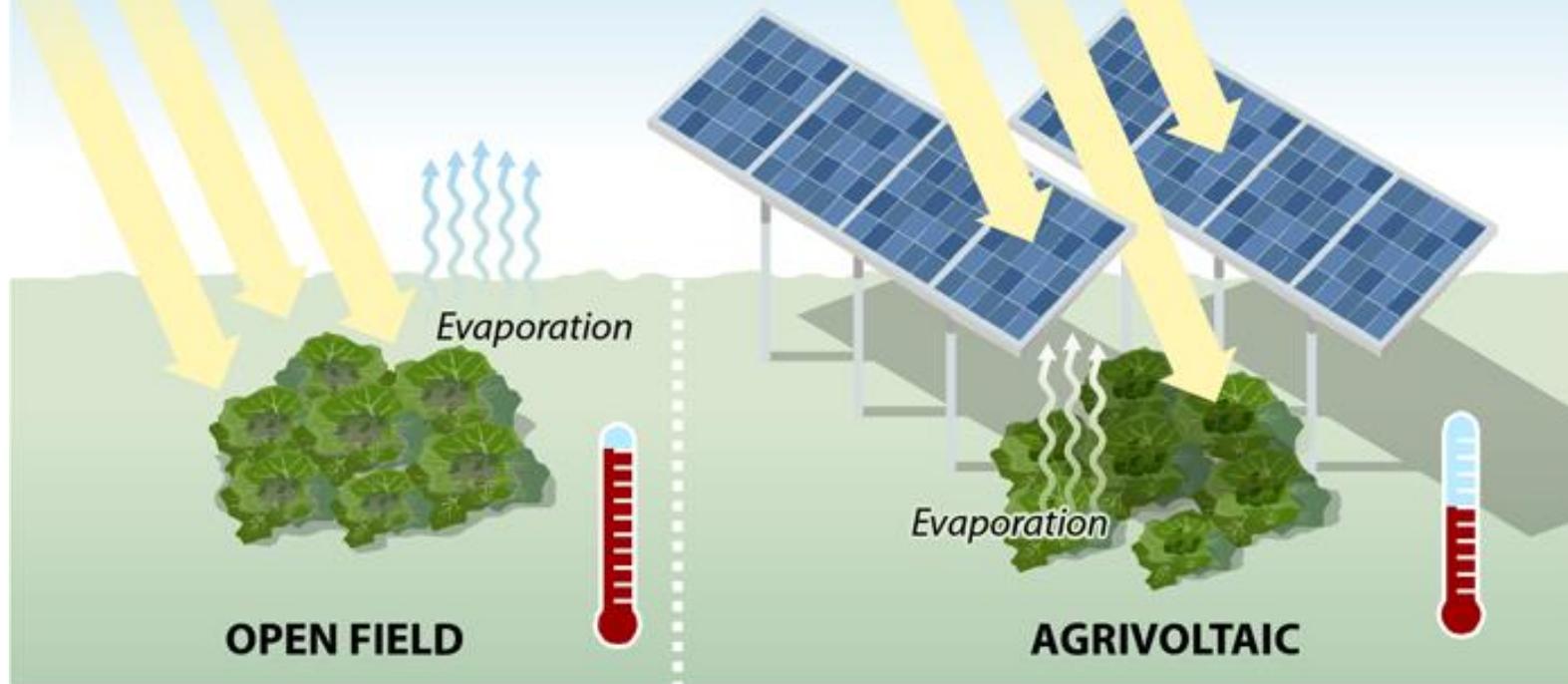


# Pairing Solar and Broccoli

Researchers in South Korea found benefits of growing broccoli beneath the shade of solar panels compared to growing the vegetable in an open field.

**A** In an open field, the direct sunlight leads to a lighter green color and more evaporation.

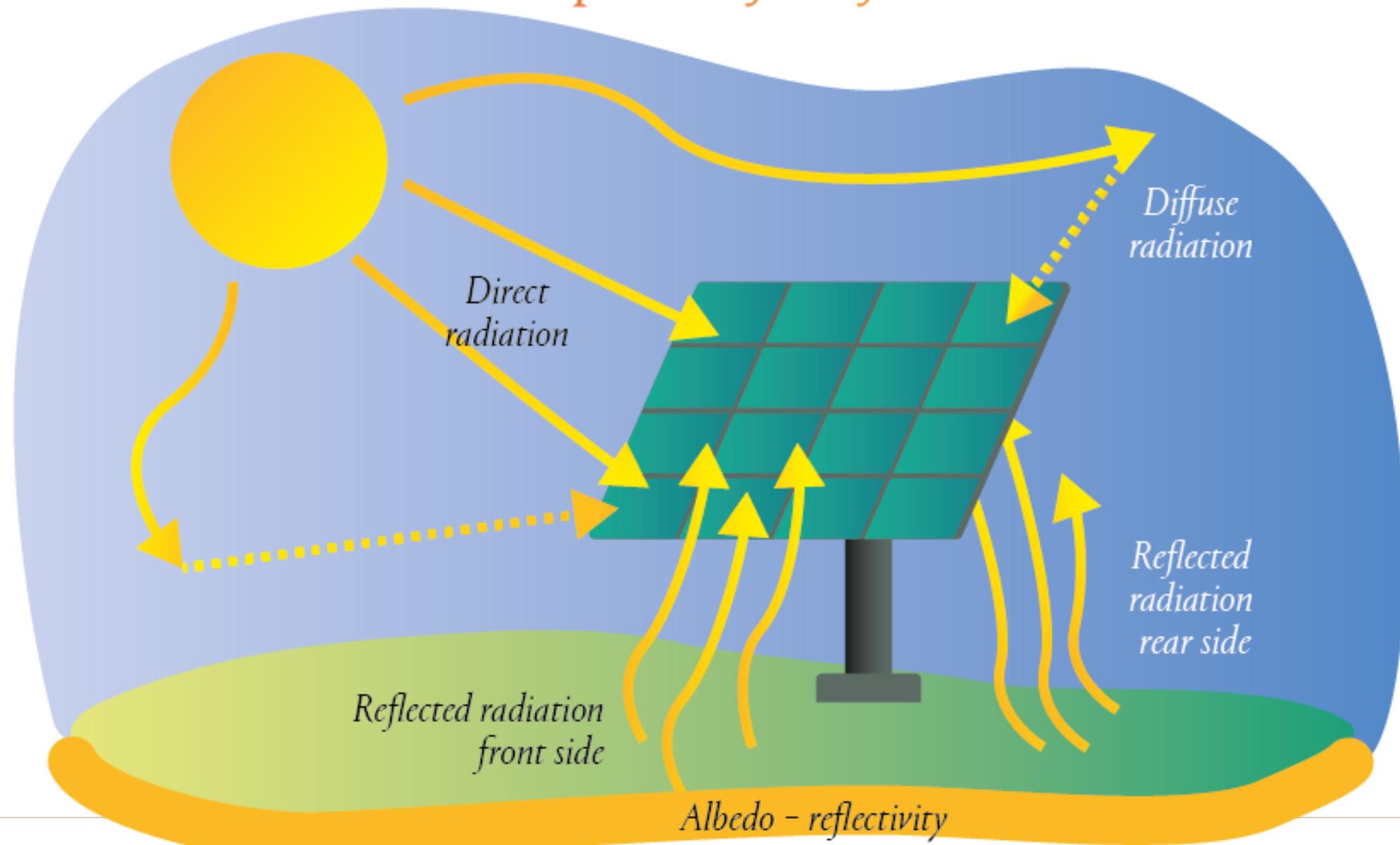
**B** Shade from solar panels leads to a deeper green color, which consumers prefer, and helps to retain moisture.



SOURCE: *Agronomy*, June 2022

PAUL HORN / Inside Climate News

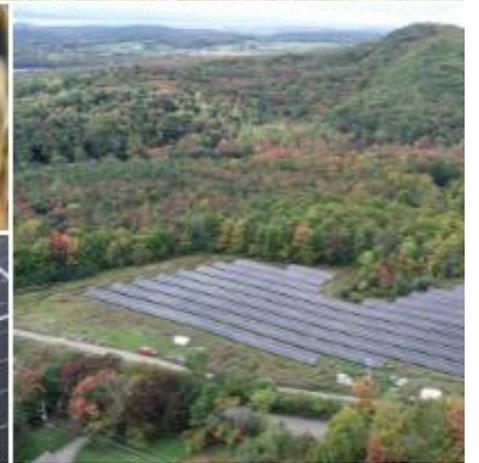
## Radiation composition for bifacial PV modules



# Other Agricultural Businesses

Opportunities :

- Great consumer interest in supporting ag and clean energy
- Jack's Solar Garden in Colorado is model for a diverse solar/ag business
- Agri-tourism is a growing business in upstate New York



# Other Solar Ag Businesses

## Challenges:

- Limited public access to solar sites
- Each business model requires its own planning



# What can public officials do to aid farmers and landowners?



# Working with Solar Developers

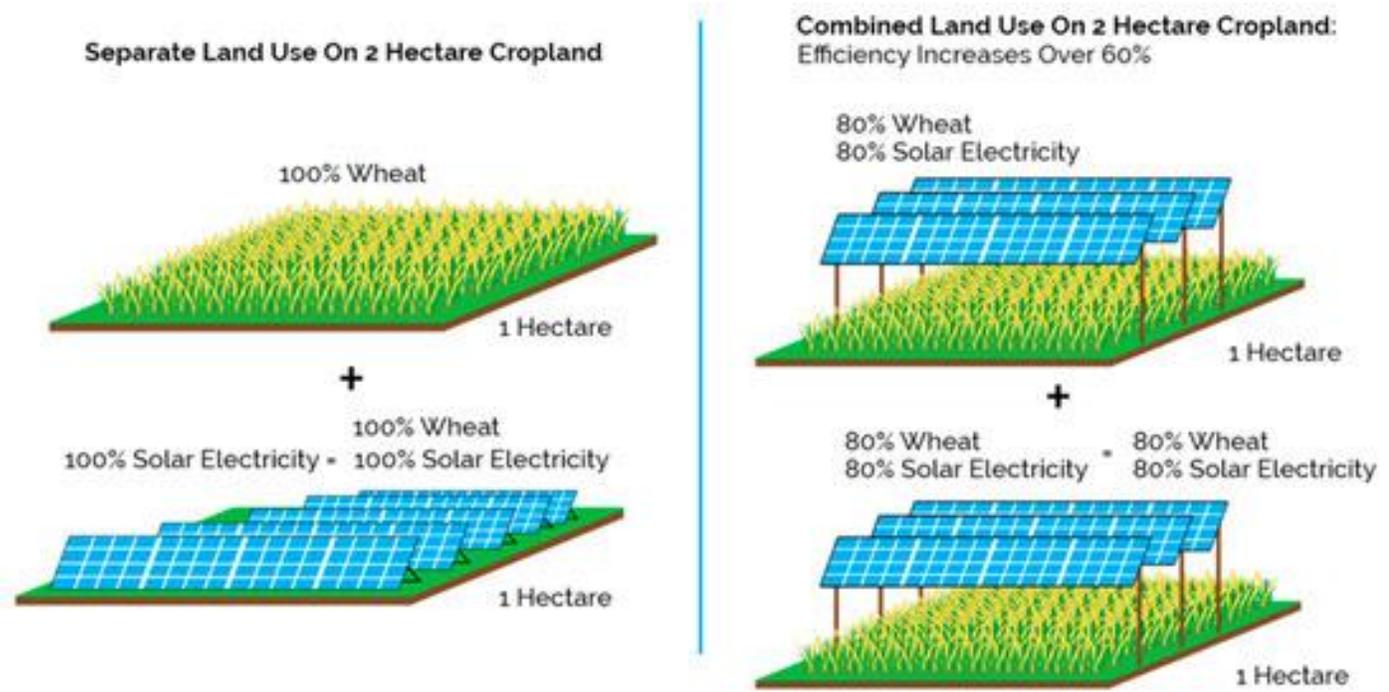
Seek commitment for specific agricultural projects within your town.

Follow the “Smart Solar Siting Scorecard” produced by NYSERDA

Contact other towns to compare benefits that they may have received



# Be aware of the economic trade-offs associated with Agri-Voltaics



# SOLAR ENERGY



Scott R. Kurkoski  
Levene Gouldin & Thompson, LLP

# Trumansburg, NY



<https://www.dcesolar.com/case-studies/community-solar-farms/>



<http://www.greenmatech.com/index.php/renewable-energy-group/solar-energy>









- ◎ 4.1 megawatt
- ◎ 15-acre solar facility
- ◎ The energy produced by the complex, along with state aid and grants, will offset all of the school district electricity costs.

# Utility-Scale Solar Projects

- Large Projects
- Typically more than 40 acres
- Often 100 + acres
- Typically 10 MW and more
- Connect to Substation

# Community Solar

- Consumers who want to obtain their power from solar energy but cannot install an array on their house
- Developers want to build 5 MW “community solar” farms.
- **20 – 40 acres**
- **Near three-phase distribution lines** alongside or across the property. Possible for properties if there is a line less than one mile away.

# Marketable Properties

- Easy interconnection – substation or 3 phase line
- Flat (slope to south might be acceptable)
- Clear of trees, structures, etc.
- Free of wetlands, ponds, streams, etc.
- Bordered by a road that will provide easy access to construction crews

# Capacity Issues

- ⦿ Substation or transmission lines near by don't guaranty interconnection. The infrastructure may not have enough capacity to handle the proposed solar farm.
- ⦿ The electrical equipment might need upgrades.
- ⦿ Interconnection study necessary before signing a lease.

# Phases of Lease

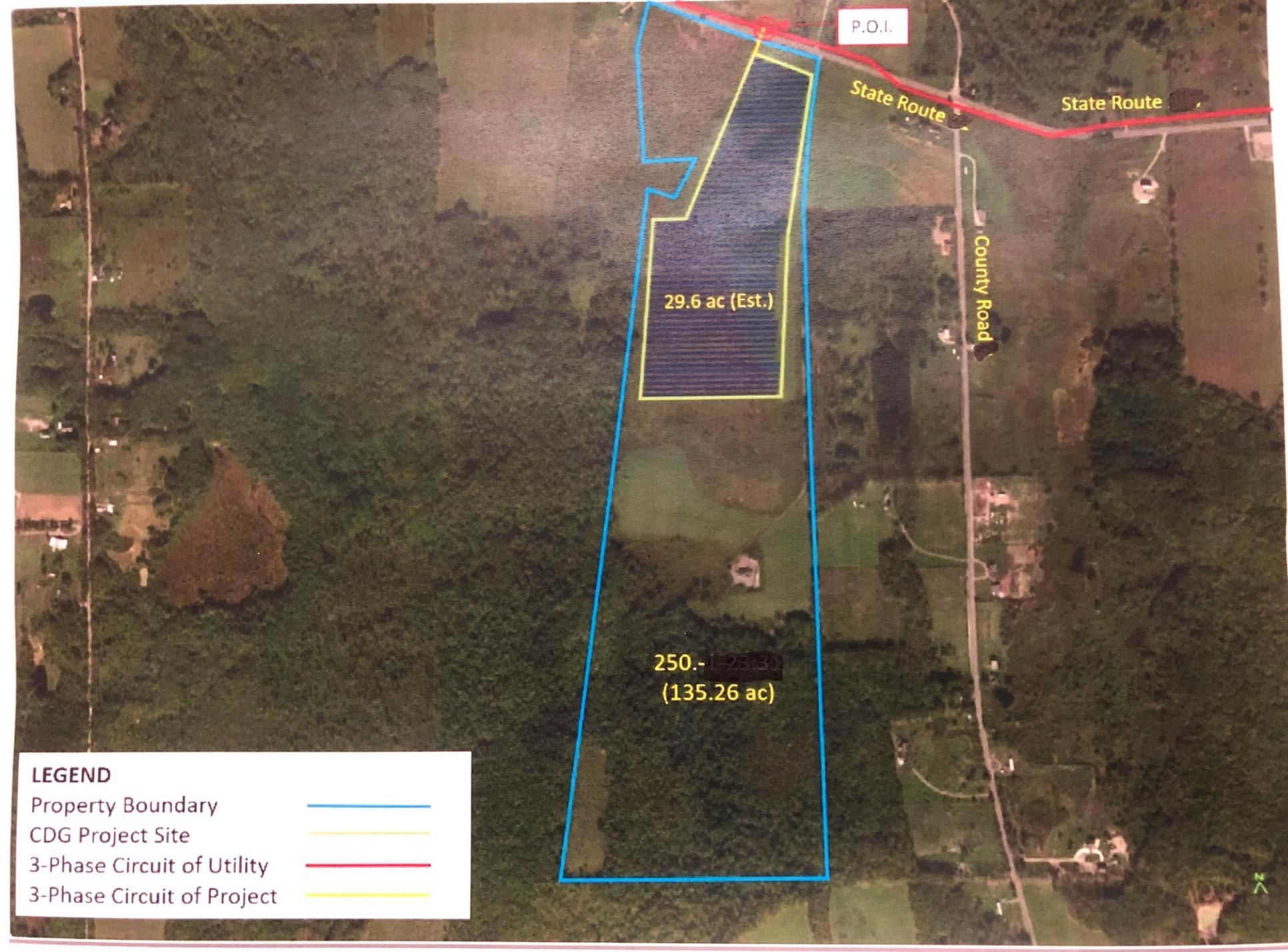
1. Option - Development Term
  - a. Inspections
  - b. Utility Study
  - c. Municipal approvals
  
2. Lease
  - a. Construction Term
  - b. Operations Term
  - c. Decommissioning

# Option

- ⦿ Option Payment and payment for each year
- ⦿ Attorneys' Fees Reimbursement
- ⦿ Minimum acres
- ⦿ Locations of all Solar Facilities and easements determined upon mutual consent
- ⦿ Minimize option years
- ⦿ Repair damages from inspections
- ⦿ Notice of inspections
- ⦿ Reserve rights during Option
  - timber, rock and gravel
  - oil and gas
  - hunting
- ⦿ Indemnification
- ⦿ Insurance
- ⦿ Right to transfer and mortgage

# Understand the Leased Area





P.O.I.

State Route

State Route

County Road

29.6 ac (Est.)

250.- [redacted]  
(135.26 ac)

**LEGEND**

Property Boundary	
CDG Project Site	
3-Phase Circuit of Utility	
3-Phase Circuit of Project	

[Redacted] Rd.

Tax Parcel # [Redacted]



Excluded from Development

Allowed Development Area

Excluded from Development

[Redacted] Rd.

Lease

The right to build the Project on the Leased Area, including but not limited to the right to construct, . . . solar panels, overhead and underground **transmission lines**, electric transformers and **substations**, **energy storage** facilities, telecommunications equipment, and **access roads** as may be necessary for the purpose of carrying on the business of a solar power generation.

# Panels to Substation Collection Units and AC Delivered to Grid





<https://www.greentechmedia.com/articles/read/how-solar-developers-can-cut-the-time-and-cost-of-installing-a-substation>

Battery system supplies 8 MW of power to the grid in upstate NY to maintain a steady frequency. Expanded to 20 MWs in 2018



[http://i.i.cbsi.com/cnwk.1d/i/tim/2011/01/11/Johnson\\_city\\_AES\\_Battery\\_Storage\\_Project\\_Aerial\\_Digitals\\_002-2.jpg](http://i.i.cbsi.com/cnwk.1d/i/tim/2011/01/11/Johnson_city_AES_Battery_Storage_Project_Aerial_Digitals_002-2.jpg)

# Rent

## Per acre

- ⦿ Depends on Location
- ⦿ Interconnection Costs
- ⦿ Leased or Usable Acres
- ⦿ Escalation Rate
- ⦿ Paid through Restoration

## ⦿ Per MW

- Is it fixed or based on production?
- Limit land Use – 6-7 acres per MW
- Repowering adjustment

# Lease Rates Per Acre

- ⦿ Higher land values - higher rent
- ⦿ Higher electricity prices - higher rent
- ⦿ \$1,100 – \$1,800

# Escalation Rate

- ① 2% per year is common, or
- ② Following the Initial Term, the annual Rent for each year of any Extension Term shall be equal to the annual Rent for the immediately preceding year plus the percentage change ("Percentage Change") between the Index published for the first calendar month of the immediately preceding year and the Index published for the first calendar month of the current lease year. For purposes of the foregoing calculations, the term "Index" shall mean the CPI for Urban Wage Earners and Clerical Workers (CPI-W), published by the United States Department of Labor, Bureau of Labor Statistics. In no event shall the Percentage Change result in an increase of more than 6 percent (6%) or a decrease of more than two percent (2%).

# Leased Acres

Survey of actual acres used

Operations rent based on final leased acres

# Title Review

- Pipeline Rights
- Utility Easements
- Rights of Way

# Lease Terms

- ⦿ Consent to all locations
- ⦿ Limit Time to commence construction
- ⦿ Rent commencement date:
  - Lease date
  - Construction Date
  - Operations Date
- ⦿ Insurance
- ⦿ Indemnification
- ⦿ Timber damages

# Reserved Rights

- oil and gas
- timber, rock and gravel
- Right to transfer

# Oil & Gas Rights

- Oil and Gas development compatible with solar
- 500' below solar farm and 250' below collection lines



# Taxes

- Lessee shall pay any property taxes attributable to the the Solar Facilities.
- Lessee pays any increase in landowner's taxes and any rollback penalties
- PILOT plans are common

# Current Property Uses

Consider any of the following on the property:

Any special uses, farming, tax abatement programs or government subsidy programs governed by the State or the Federal government, to include by way of example and not limitation,, CRP, EQIP, AG Easement, CREP or Forest Incentive Programs.

# Crop Damage

- Solar Company agrees to pay fair market value of crops destroyed during development.

# Visual Barriers



# Negotiate

- ⦿ Easements – mutual consent
- ⦿ Underground or overhead transmission lines
- ⦿ Ability to cross underground lines
- ⦿ Eliminate Right of First Refusal

# Agrivoltaics

- ⦿ The simultaneous use of land for both solar photovoltaic power generation and agriculture.
- ⦿ potatoes, squash, celery, blueberries, raspberries, strawberries, blackberries, peppers, broccoli, kale
- ⦿ Agricultural lease payments and/or a portion of revenue from the project is paid to the landowner.
- ⦿ Must reserve rights in your lease.

# Vegetation Control

- No chemicals
- Mechanical
- Contract with Landowner/Municipality
- Sheep?



[https://newsadvance.com/news/local/heres-a-bright-idea-sheep-work-to-keep-vegetation-under-control-at-solar-farm-in/article\\_ac6b2e0e-6939-11e9-8635-9b3c3f46097e.html](https://newsadvance.com/news/local/heres-a-bright-idea-sheep-work-to-keep-vegetation-under-control-at-solar-farm-in/article_ac6b2e0e-6939-11e9-8635-9b3c3f46097e.html)

# Jack's Solar Garden Boulder, Colorado



<https://www.agritecture.com/blog/2022/2/3/largest-farm-to-grow-crops-under-solar-panels-proves-to-be-a-bumper-crop-for-agrivoltaic-land-use>

# Decommissioning

- Upon termination, remove the Solar Facilities, including all improvements at and above-grade and all below-grade foundations, infrastructure, cables and
- Repair any damage caused by removal
- Restore the Premises to its condition as of the Effective Date.
- Suitable for Farming – soil decompaction

# Restoration Bond

- Bond based on cost estimate for decommissioning
- Avoid salvage value deduction
- Independent engineer
- Update every 5 years
- Don't accept Corporate Guarantee

# NYSERDA

## New York State Solar Guidebook

- ◎ <https://www.nyserda.ny.gov/All-Programs/Clean-Energy-Siting-Resources/Solar-Guidebook>
- ◎ Solar Basics
- ◎ Solar Permitting and Inspecting
- ◎ Roof Top Access and Ventilation
- ◎ State Environmental Quality Review (SEQR) for Solar
- ◎ New York State's Real Property Tax Law § 487
- ◎ Solar Payment-in-Lieu-of-Taxes (PILOT)
- ◎ Solar Installations on Agricultural Lands
- ◎ Landowner Considerations for Solar Land Leases
- ◎ Decommissioning Solar Panel Systems
- ◎ Model Solar Energy Local Law
- ◎ Municipal Solar Procurement Toolkit

# Decommissioning Costs

- The New York State Energy Research and Development Authority guide to Decommissioning Large-Scale Solar Systems estimates decommissioning costs for a ground-mounted 2 MW solar farm \$60,200;
- After 20 years, 2.5% inflation rate, the total estimated amount is \$98,900.

# Decommissioning Solar Panel Systems

## Information for local governments and landowners

### Ground-mounted 2-MW solar farm

- Remove Rack Wiring \$2,459
- Remove Panels \$2,450
- Dismantle Racks \$12,350
- Remove Electrical Equipment \$1,850
- Breakup and Remove Concrete Pads or Ballasts \$1,500
- Remove Racks \$7,800
- Remove Cable \$6,500
- Remove Ground Screws and Power Poles \$13,850
- Remove Fence \$4,950
- Grading \$4,000
- Seed Disturbed Areas \$250
- Truck to Recycling Center \$2,250
- Current Total \$60,200
- Total After 20 Years (2.5% inflation rate) \$98,900

# Purchase Options

- Purchase price is not just fair market value!
- Signing bonus
- Yearly Option Term payment
- Attorneys' fees for review of Option and final closing
- Title Fees and representations
- Identify property to be purchased – prohibit waste
- Minimum acreage
- Limit option term
- Reserve all other rights including oil/gas/mineral and right to grow/lease crops and timber
- Indemnification/Insurance
- Landowner right to transfer Property subject to Option
- Reserve Oil and Gas Rights in final deed
- Company pays all subdivision and survey costs

# SOLAR ENERGY



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# 5 Solar Law Tips From a Municipal Attorney

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Coughlin & Gerhart, LLP  
607-723-9511  
[rmckertich@cglawoffices.com](mailto:rmckertich@cglawoffices.com)

# Tip #1: Enact a Moratorium

- A moratorium preserves the status quo while the community considers and potentially adopts changes to its comprehensive plan and/or local laws.
- All moratoria must comply with these 5 standards:
  1. The moratorium must extend for a reasonable time frame
    - 6 months to 1 year have been upheld; multi-year moratoria have been overturned at times.
  2. The moratorium must have a valid public purpose
    - Must be actively engaged in updating plans and laws.
  3. The moratorium must address a situation where the burden imposed by the moratorium is being shared substantially by the public at large.
  4. The moratorium must strictly adhere to procedures for adoption of a local law
    - Including notice, public hearing, SEQR, GML §239-m, etc. Work with municipal attorney.
  5. The moratorium must have a time certain for expiration.

# TIP #2: Update Your Comprehensive Plan

- A Comprehensive Plan is a broad-based planning document, which identifies the characteristics and goals of a municipality.
- Many Comprehensive Plans do not address solar development at all and/or do not address the relationship between solar and agriculture.
- Comprehensive Plans should be updated to identify how solar development fits within the character and goals of the community, including its impact on agricultural resources.
- Any subsequent solar laws will need to be in accordance with the Comprehensive Plan.
- Municipalities must follow procedures set forth in State law, including notice, public hearing, SEQR and GML §239-m review. Work with your municipal attorney.

# TIP #3: Draft a Thorough Solar Law

## **Step 1: Closely Define What You Are Regulating.**

Consider regulating large commercial projects different from small residential projects.

NYSERDA Example: Tier 1 (up to 25 kW), Tier 2 (up to 1MW),  
Tier 3 (up to 5MW), Tier 4 (Above 5MW)

Other Example: Non-Commercial (less than 200 kW)  
Commercial (more than 200 kW)

Consider different regulations depending upon the type of solar facility proposed.

Ground-Mounted

Roof-Mounted

Building Integrated

Accessory structures and equipment

# TIP #3: Draft a Thorough Solar Law (Continued)

## **Step 2: Decide What Zoning Districts Each Solar Facility Is Allowed In.**

This may differ depending upon the size and type of facility (See Step 1)

Common zoning districts include: Residential, Commercial, Industrial, Agricultural

Example:     Small scale solar facilities are allowed in all districts  
              Large scale solar facilities are allowed in industrial district only

# TIP #3: Draft a Thorough Solar Law (Continued)

## **Step 3: Decide What The Permitting Process Looks Like.**

What approvals are required?

Special Use Permit

Site Plan Approval

Both

Just a Building Permit (small-scale projects)

Who issues the approval?

Planning Board

Zoning Board of Appeals

Code Enforcement Officer

# TIP #3: Draft a Thorough Solar Law (Continued)

## **Step 4: Establish Standards.**

An Informal Check List of standards to include in your law:

- Setbacks
- Height Limits
- Minimum Lot Size
- Visual Screening/Buffering
- Lighting
- Glare
- Noise
- Fire Suppression
- Road Frontage
- Access Road

# TIP #3: Draft a Thorough Solar Law (Continued)

- ☑ Vegetation Management Plan
- ☑ Fencing
- ☑ Utilities
- ☑ Lot Coverage
- ☑ Stormwater Management Plan
- ☑ Decommissioning Plan
- ☑ Financial Security for Decommissioning
- ☑ Insurance
- ☑ Escrow for Legal and Engineering Fees
- ☑ Enforcement

# TIP #3: Draft a Thorough Solar Law (Continued)

## **Step 5: Consider special restrictions addressing agricultural lands.**

### Example:

(1) Any commercial ground-mounted solar energy system located on areas that consist of Prime Farmland and/or Farmland of Statewide Importance shall not exceed 50% of the area of Prime Farmland and/or Farmland of Statewide Importance on the parcel.

(2) Commercial solar energy systems located on Prime Farmland and/or Farmland of Statewide Importance shall be constructed in accordance with the construction requirements of the New York State Department of Agriculture and Markets.

# TIP #3: Draft a Thorough Solar Law (Continued)

## **Step 6: Follow the Local law Approval Process Strictly.**

This includes steps such as: public notice, public hearings, SEQR, GML 239-m, etc. Work with your municipal attorney.

## Tip #4: Decide Whether to Opt-Out of the Tax Exemption

- Section 487 of the Real Property Tax Law provides a 15-year exemption from real property taxation for solar energy systems.
- Each municipality may decide whether to offer the exemption. But unlike most tax exemptions, this exemption automatically applies, unless the municipality opts-out.
- To opt-out, a town or village must adopt a local law providing that the exemption shall not be available within the municipality.
- A word of caution: Be sure to file the local law with the NYS Dept of Taxation, NYSERDA and the NYS Dept of State.
- If a municipality does not opt-out, it has the ability to require a PILOT.
- The PILOT may not exceed the taxes that would have been payable if the property were not exempt.

# Tip #5: Be Ready for a 94-c Project

- Section 94-c of the Executive law creates a streamlined permitting process for solar projects in excess of 25 MW.
- The law pre-empts local zoning laws considered “unreasonably burdensome”.
- Projects 20 MW-25MW may opt out of the local law process and into the 94-c process.
- A host municipality can be a party to the 94-c permitting process.
- Intervenor funds are available for the host municipality to help offset legal and engineering fees.

# Solar and Land Use: Striking a Balance

Ensuring solar development benefits localities where it is sited

Joe Lawrence



# Balancing Act – Ag & Rural Economy

*Is all development progress?*

- Need for Renewable Energy
  - Solar has benefits – are we siting it in the best locations?
- Economic Drivers of Economy
  - How does shift in land use affect existing economic engines in area
- Landowners Rights
  - Opportunity to generate more income per acre
  - Diversify Income

Smart Solar Siting on Farmland:

Achieving Climate Goals While Strengthening the Future for Farming in New York

***American Farmland Trust***

# Types of Solar

- Farm scale
  - Run farm operations
  - Sell excess to grid (typically very low sale price)
  - Dairy net zero
    - Rough estimate 2 panels per cow to offset dairy farms energy footprint
- Distribution Scale
  - Exclusively to sell on to grid
  - Developed & Managed by private company
    - Typically solar project is not owned by landowner
  - New York Policy & Incentive Structure
    - Community/distributed Scale (<5 MW): ~25 to 50 acres
    - Industrial Scale: 100's to 1000's of acres

# Lewis County

- Dairy is #1 industry
  - Farms *plus* Support Sector
- Significant decline in paper industry since 1990's
- Long History of Renewable Energy in County
  - Hydro
  - Wind
    - Maple Ridge Wind Farm, circa 2005
    - Additional projects added over last 15+ years
    - Total: ~250 turbines and 583 MW from 4 different projects
  - Solar
    - First project built (c. 2018) is county owned (~10 acres, ~2 MW)
    - Solar construction in County (since approx. 2019)
      - Built projects (to date): All Community Scale
      - 45 MW approved by IDA for PILOT, ~35 MW in construction or complete
      - 3-5 Utility Scale projects in planning phases
        - 15 MW approved by IDA for PILOT



# Community Perspective

- Renewable energy is important
- Future economic health is based on our natural resources
  - Prime soils are a finite resource for food production
    - Prime soils tend to be “low hanging fruit” for (solar) development
      - Proximity to electrical infrastructure
      - Access
    - Shifting food production to less productive acres has;
      - Economic Cost
      - Environmental Cost
    - We have marginal acres – need to utilize those for solar, not food
    - Prime Agricultural Land vs. Open Space
- Energy Development offers an infusion of funds
  - Need to invest these funds for the long term
    - Infrastructure to enhance tax base beyond the life of the energy projects
  - Impact (+ or -) is felt across county

# Individual Farm Impact

- Each situation is unique but experiences to date suggest some **general** differences based on project scale.

## Community Scale Project

- <5 MW *\*per project*
- <50 acres
- Often Single Landowner
- Local Jurisdictional Oversight

## Utility Scale Project

- >20 MW
- 100's to 1000's of acres
- Often Multiple Landowners
- NYS Oversight (94-c)

# Individual Farm Impact

*Tend to be.....*

## Utility Scale Project

- Rented/Leased Land
- Disrupts Ag Operation
- Loss of land = threat to farm viability
  - Economics
  - Environmental
- **IF** land **CAN** be replaced.....
  - Further travel distance from farm
  - Less productive soils
    - Rent 125 acres to replace 100
    - Increases cost of production
    - Increases environmental impact
- **More efficient use of land footprint**

Soil Type	Yield Potential for Corn Silage
Adams	15.0 tons/acre
Croghan	16.0 tons/acre
Nellis	18.5 tons/acre

Source: Cornell University

*Tend to be.....*

## Community Scale Project

- Owned Land
- Can fit within Ag Operation
- Added/diversified income for farmer
- **Less efficient land use**
  - Setbacks, etc.
- **Fragments Ag Land**
  - Rural Sprawl

# Economic Impact: County/Region

How does “that” acre contribute to economy?

- Current use
- Proposed use
  
- Dairy as an example
  - Other sectors of Ag
  - Other forms of Development



# Economic Impact: Dairy & Solar



## Dairy

- Tight margins – much (sometimes all) gross revenue spent to maintain farm
- Lewis County: \$1 change in milk price = +/- ~\$20,000 **per day** in gross milk income (Yearly swings in milk price can be large [last year: \$5 per hundred weight])
- Milk Production
- Soil Productivity
- Gross revenue from milk sales
  - Economic multiplier for gross milks sales: 1.72

\*Agriculture-Based Economic Development: Trends and Prospects for New York  
Dept of Applied Economics and Management, College of Agriculture and Life Sciences, Cornell University

***Note: not all money spent in county, most spent in region***

## Solar

- Lease to Landowner
  - Economic Multiplier for Income ??
- Payment in Lieu of Taxes (PILOT) for local municipalities
- Temporary Construction Jobs



# Economic Impact: Dairy & Solar

## Economic Activity from Dairy

### Input Values

\$ in economy from acres supporting milk production per year	
Production per cow	75 lbs milk/day
Production per cow per year	22,875 lbs/year
100 weights of milk (cwt)	229 cwt/cow/year
Milk Price	\$ 23.00 per cwt
gross milk sales	\$ 5,261.25 per cow
economic multiplier for gross milk sales	1.72
acres needed per cow (& replacement)	2 acres
\$ in economy (generated from milk sales)	\$ 9,049.35 per cow
	\$ 4,524.68 per acre

Cost of production (C.O.P.)	\$21.00 per cwt
-----------------------------	-----------------

## Economic Activity from Solar

Solar Lease for Landowner	\$1,000.00 \$/acre
Economic Multiplier of lease income	1.64 **
Acres needed to Generate 1 MW	5 acres
PILOT Payment	\$ 6,888.00 \$/MW
	\$1,377.60 \$/acre
SUM	\$3,017.60 \$/acre

## Ag land owner options

Revenue from land (Dairy) per year	
gross milk sales	\$ 5,261.25 per cow
	\$ 2,630.63 per acre
net milk sales	\$457.50 per cow
	\$228.75 per acre

Revenue from land - Rental For Crop Production	
Average	
Rental of tillable land	\$ 80.00 \$/acre

Revenue from land - Lease for Solar	
Average	
Solar Lease	\$1,000.00 \$/acre

Sell Land	\$ - \$/acre
-----------	--------------

## Model Inputs

- Interactive Spreadsheet
- Farm Specific

<https://tughill.org/agriculture-solar-calculator/>

# Economic Impact: Dairy & Solar

Soil Productivity

## Economic Activity from Dairy

### Input Values

\$ in economy from acres supporting milk production per year	
Production per cow	75 lbs milk/day
Production per cow per year	22,875 lbs/year
100 weights of milk (cwt)	229 cwt/cow/year
Milk Price	\$ 23.00 per cwt
gross milk sales	\$ 5,261.25 per cow
economic multiplier for gross milk sales	1.72
acres needed per cow (& replacement)	3.5 acres
\$ in economy (generated from milk sales)	\$ 9,049.35 per cow
	\$ 2,585.53 per acre

Cost of production (C.O.P.)	\$21.00 per cwt
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## Economic Activity from Solar

Solar Lease for Landowner	\$1,000.00 \$/acre
Economic Multiplier of lease income	1.64 **
Acres needed to Generate 1 MW	5 acres
PILOT Payment	\$ 6,888.00 \$/MW
	\$1,377.60 \$/acre
SUM	\$3,017.60 \$/acre

## Ag land owner options

Revenue from land (Dairy) per year	
gross milk sales	\$ 5,261.25 per cow
	\$ 1,503.21 per acre
net milk sales	\$457.50 per cow
	\$130.71 per acre

Revenue from land - Rental For Crop Production	
Average	
Rental of tillable land	\$ 80.00 \$/acre

Revenue from land - Lease for Solar	
Average	
Solar Lease	\$1,000.00 \$/acre

Sell Land	\$ - \$/acre
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## Model Inputs

- Interactive Spreadsheet
- Farm Specific

<https://tughill.org/agriculture-solar-calculator/>

# Project Development

## *Who, What, How*

### Developer needs

1. Lease agreement
2. Site plan approval
3. PILOT (?)
4. Interconnect agreement

### Community Mechanism

1. Individual Landowner Interest
2. Zoning
3. PILOT

### Key partners at the table

- Municipal Officials
- County Planning
- IDA / Econ. Dev.
- Landowners
- Cornell Cooperative Extension
- Soil & Water Conservation District

# Lewis County IDA

*Pre – NYS Discounted Cash Flow Appraisal Model (Part N)*

- Carrot vs. Stick
- Allow Landowner and Developer to still make ultimate decision but provide incentives to avoid prime farmland
  - highest PILOT fee for projects on prime soils and actively farmed land.
  - Offer discounts for use of marginal soils and/or idle land
  - Current Base PILOT - 100% Prime land + actively farmed = \$7500/MW
    - First iteration started at \$5,500/MW
      - Based on NY Solar PILOT Toolkit
      - Developers didn't seem to blink an eye

<https://naturallylewis.com/growing-opportunities/smart-growth-solar>

	Low (\$/MW AC)	High (\$/MW AC)
Central Hudson	\$2,600	\$7,600
Orange & Rockland	\$3,200	\$9,500
National Grid	\$1,700	\$5,100
NYSEG	\$1,700	\$5,000
Con Edison	\$3,700	\$11,100
Rochester Gas & Electric	\$1,700	\$5,000

# Lewis County IDA

## Example PILOT Calculation

- Current Base PILOT
  - 100% Prime land + actively farmed = \$7500/MW
  - Idle – not farmed in last 18 months
  - % of Prime Soils determined by county SWCD

Base PILOT:	\$7,500		
		This Array UTEP Discount	This Array Discount
Actively Farmed:	100%	0%	0.00%
Not Actively Farmed	0%	30%	0.00%
			0.00%
Prime or Prime if Drained	72.90%	0%	0.00%
Land of Statewide Importance or not categorized	27.20%	30%	8.20%
	100%		8.20%
Total Discount (cannot exceed 40%)			8.20%
<b>PILOT with discount applied:</b>	<b>\$6,888</b>		



# Managing PILOT Revenue

- PILOT (Payment in Lieu of Taxes)
  - Split between affected taxing jurisdictions (by tax rates)
    - County, Township, School
  - Initial wind project PILOT (Lewis Co.)
    - Some used funds for investment while continuing to gradually increase taxes
    - Others used funds to keep taxes artificially low
    - The PILOT “cliff”
      - With states 2% tax cap, impossible to make up difference in tax rate at end of PILOT
      - Towns scrambling – tax rate shock to residents
      - Hungry for more energy projects due to lack of other potential revenue sources to offset loss of PILOT

# The PILOT Debate

## Is the PILOT the best structure for funds

### PILOT

- Regulated as tax revenue
  - More restrictive on how it is used...fund balances
- Tax base vs. investment opportunity
  - Problematic to use it to offset taxes.....PILOT “cliff”
  - Smart investments in community will pay dividends long after PILOT ends

### Community Development Funds

- Payment to community entity....not PILOT
- More flexible uses
  - Town or County level
    - Local Development Corporations (LDC's)

# Maximizing community benefit

- Work to maximize total investment by developer
- Play hardball
  - Not our intent limit viability of renewable energy development
  - It's a negotiation, no one willingly shows their cards.....but there is money out there
- Focus on Total Spend, then figure out the best use
  - Total spend = X
  - % in PILOT + % in Community Fund = X

# Lewis County *Community Economic Development Program*

## Lewis County Development Corporation (LCDC)

- Operating at County level
- Negotiate to maximize total payment to community
- Don't put all \$\$ in PILOT
  - PILOT (15-30 years)
    - Town (road use, etc. ....minimal after construction)
    - School
    - County
  - Community Development Fund (annual payment negotiated for same length as PILOT)
    - Annual grant programs open to any entity in county
      - Small Things, Big Impact Funds
      - Building Business Funds
      - Community Connection Funds
    - Independent board of directors (appointed by LCDC) reviews grant applications and allocates funds

<https://naturallylewis.com/growing-opportunities/cedf>

# Agrivoltaics / Dual Use

“Agrivoltaics is the use of land for both agriculture and solar photovoltaic energy generation.”

<https://www.climatehubs.usda.gov/hubs/northeast/topic/agrivoltaics-coming-soon-farm-near-you>

- Related terms
  - agrisolar
  - dual use solar
  - solar grazing

## Grazing

- Sheep
  - American Solar Grazing Association
    - <https://solargrazing.org/>
  - Contract grazing solar sites
  - Ag Operations versus Vegetation Maintenance Service?
- Cattle
  - Brad Heins, U. Minnesota-Morris
  - On-farm use of solar energy
  - Shading options for pastures

# Land Use - Flexibility

- Currently some agricultural practices lend themselves better to a dual-use scenario than others.
  - This may change as technological, environmental and economic factors shift in coming decades.
- As we are still in the early stages of developing this type of land use, a priority is to utilize our current understanding to help facilitate the range of possibilities that could emerge as these projects are sited and built to allow for integrations of dual-use in the coming years.

# Project Planning and Land Use

**Communication** – *early & often* is key to a project outcome everyone can live with.

- Landowner
- Developer
- Municipal Planning/Zoning

## General Considerations

- Positioning of project on parcel of land
- Access to other parcels of land
- Visibility

## Dual-Use Considerations

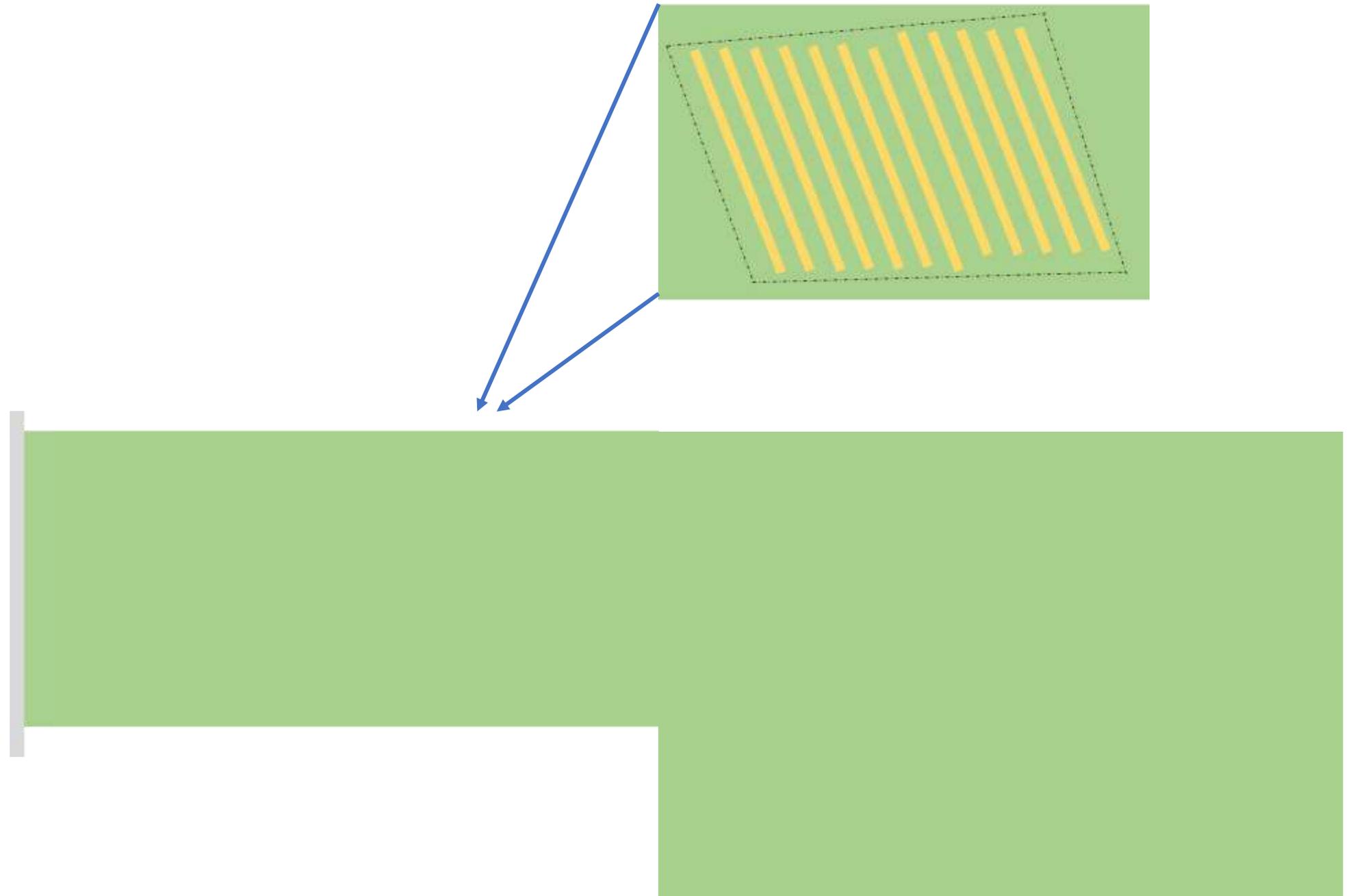
- Location of perimeter fencing
- Siting of above ground infrastructure (other than panels)
- Access to within fenced area
- Height Limits

# Zoning & Land Use Options

- Zoning *can* create a great deal of land waste
- Balancing municipalities goals with efficient land use
  - Setbacks, fencing, screening requirements, etc. can significantly increase acres “eaten up” by a project.

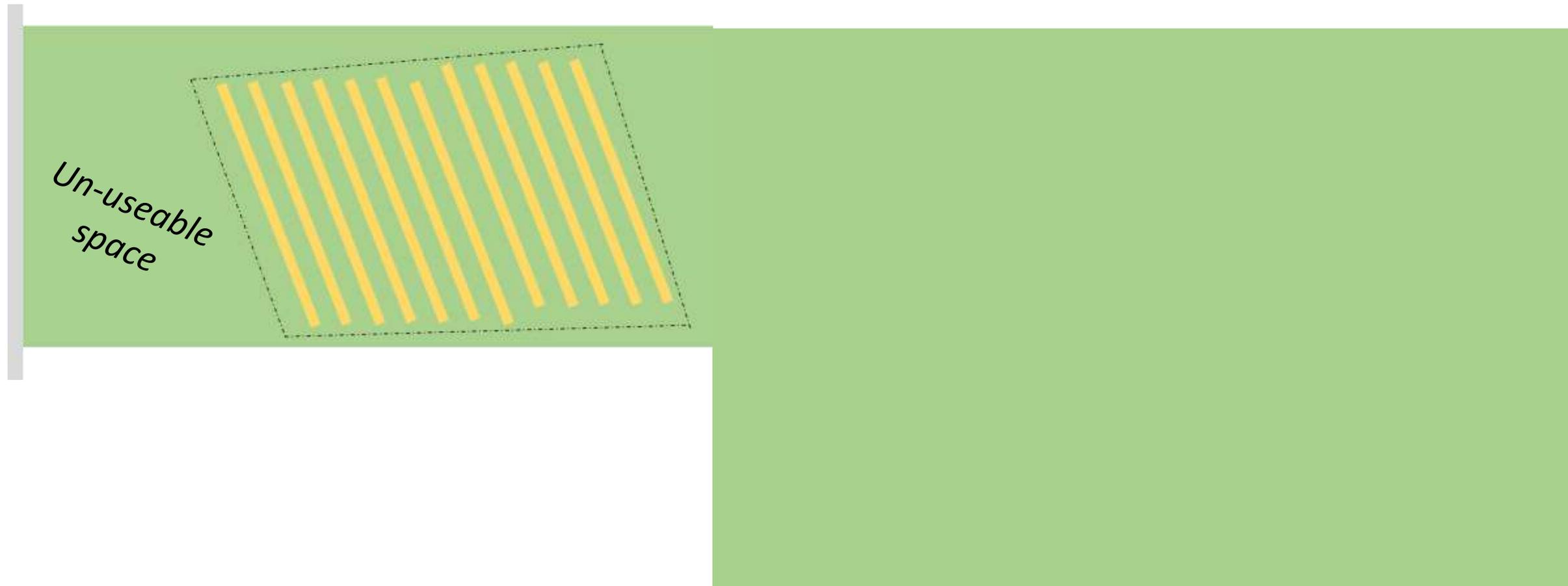


# Zoning & Land Use Options



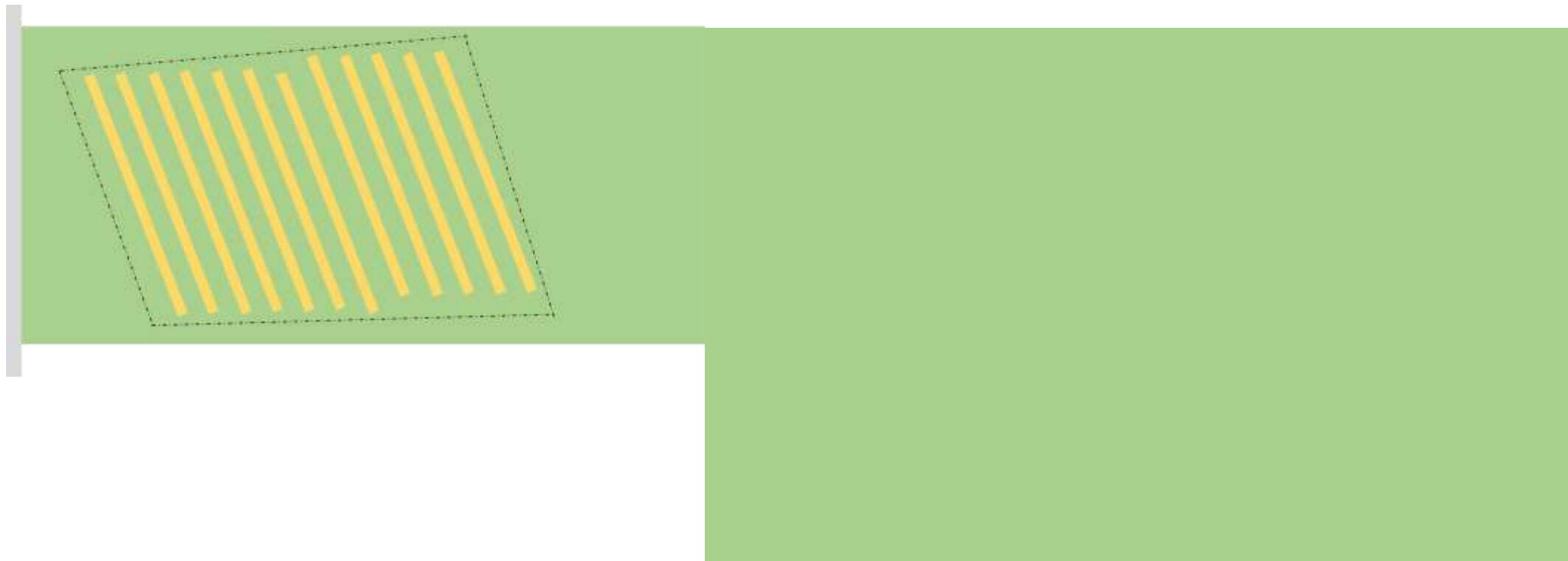
# Zoning & Land Use Options

- Unintended consequences
  - large setbacks, etc.



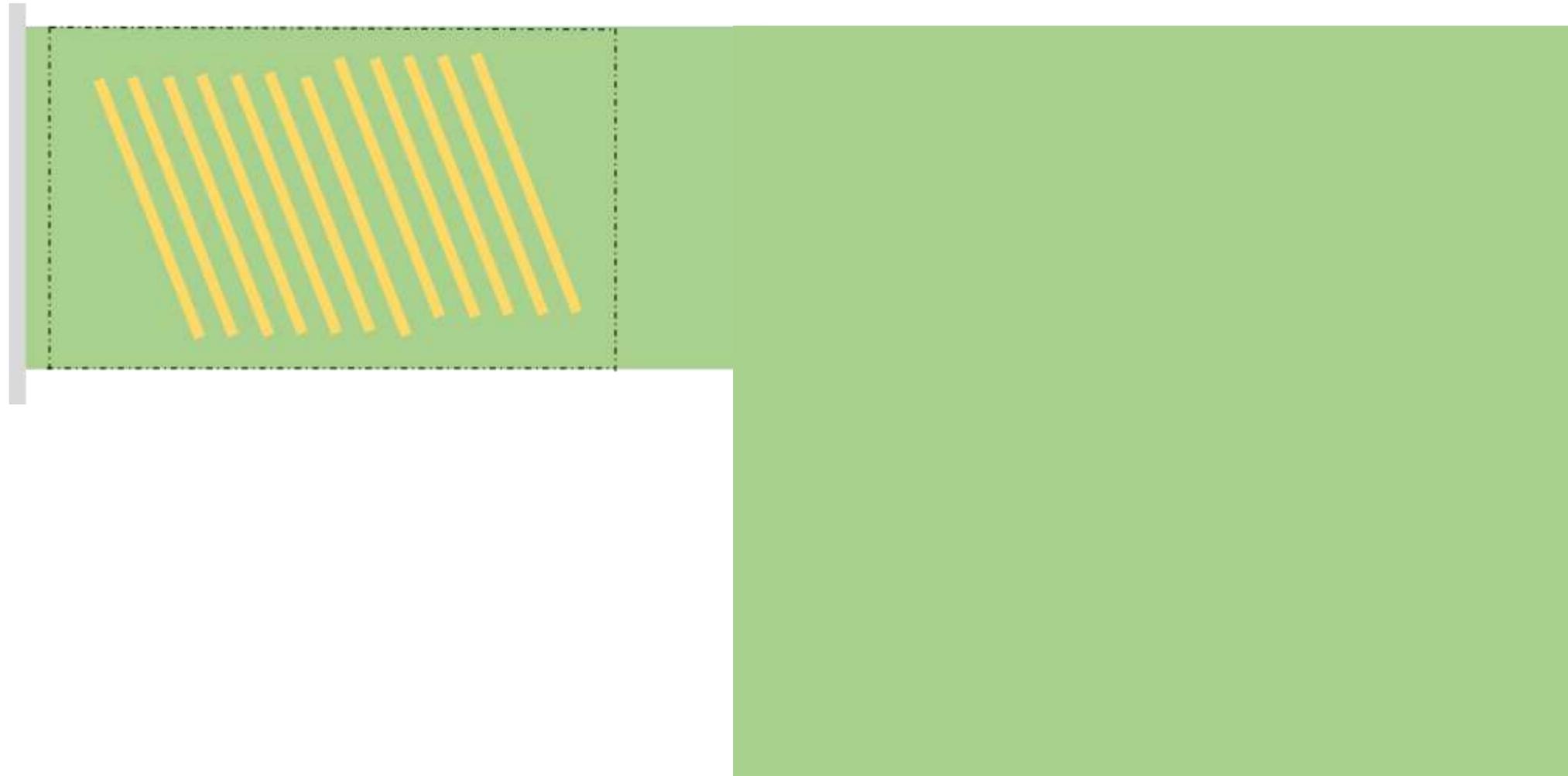
# Zoning & Land Use Options

- Goal should be to minimize awkward spaces isolated from rest of field



# Zoning & Land Use Options

- Allow fencing to follow natural field boundaries
  - Hedgerows, Waterways/drainage patterns, etc.
  - Could also promote agrivoltaics within the footprint



# Infrastructure & Possible Dual use



# Infrastructure & Possible Dual use



*Thank You!*

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# Resources

- Planning for Solar Energy Projects, Tug Hill Commission Issue Paper  
<https://tughill.org/publications/technical-issue-papers/>
- Planning and Managing Permanent Vegetation Under Solar Arrays  
<https://blogs.cornell.edu/whatscroppingup/2022/09/01/planning-and-managing-permanent-vegetation-under-solar-arrays/>
- Naturally Lewis: Smart Solar Growth in Lewis County  
<https://naturallylewis.com/growing-opportunities/smart-growth-solar>
- Smart Solar Siting in New York, American Farmland Trust  
<https://farmland.org/smart-solar-siting-in-new-york/>