

# THANK YOU!

An aerial photograph of a large-scale solar farm. The solar panels are arranged in neat, parallel rows across a cleared area of land. The surrounding landscape is a mix of green fields, trees, and some residential or commercial buildings in the distance. The sky is clear and bright.

MDA would like to thank all who participated and presented during the 2023 Agri-Solar Summit.

To view the video from the Summit please click [here](#).  
(Please note the audio quality is low)

Additionally you may find slides from each presentation below.

# Solar and Agriculture in Maryland



**Kevin Atticks**  
*Secretary, Maryland Department of Agriculture*



# Agriculture is the **#1** commercial industry in Maryland

But you wouldn't see it unless you were looking. We grow food and we grow feed. We produce jams, proteins, milk, ice cream, wine, beer, spirits and all manner of deliciousness. We grow-to-make animal bedding, lumber, hemp tinctures, clothing and more.





## *Solar on Farms- But Why?*

1. Attractive and convenient option for siting generation plants and project
2. Large swaths of rural land that do not require extensive site work



## *Solar on Farms- Challenges*

1. Prime farmland with good soil health is taken out of production
2. A farm taken out of production cannot be recovered



# It's time to think out of the box

1

Consider restrictions on prime farmland

3

Examine other alternatives

2

Look to other states successfully managing solar

4

Encourage ag to be partners- not a convenient solution



# Solar in Maryland: Terms, Meanings, and Explanations

November 29, 2023

Bob Sadzinski

Director, Power Plant Research  
Program

# Presentation Overview



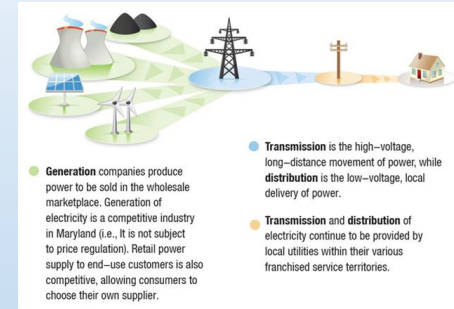
- Introduction to electricity usage and generation
- Explain utility-scale, community, and rooftop solar
- What is a MW and how many panels are needed for a MW
- Area needed for Solar - MWs/acre
- Who is PPRP?
- CPCN process and the PSC
- What does our environmental analysis look at for solar on Agricultural Lands
- Maryland's Renewable Portfolio Standard



# Maryland's Electricity Facts



- Annually uses 60,000,000 MWh of electricity
- Import 40% of our electricity from out of state.
- Instate annual electricity production:
  - Calvert Cliffs Nuclear Power Plant accounts for 41%
  - Natural Gas – 38%
  - Coal – 9%
  - Hydroelectric – 5%
  - Renewable Energy (Solar, Wind, small hydro, biomass (wood), solid waste, and landfill gas) -7%



- PJM is the Regional Transmission Organization (RTO) that oversees the flow of electricity in our region

- There are ~80,000 solar “facilities” and 10E non-solar

# Types of Solar



## Facilities in Maryland

- Rooftop Solar (Residential): Small solar projects, may be grid connected on distribution grid.
- Commercial/Community solar “Behind-the-Meter”  
<2MW behind the meter refers to anything that happens onsite, on the energy user's side of the meter.
- Commercial/Community Solar/Utility Scale - Front- of-the-Meter <2MW  
anything that happens on the grid side is deemed to be in front of the meter.
- Community Solar refers to an arrangement in which a utility customer buys a “share” of a solar power project located within the customer’s local utility service territory.
- Utility Scale Solar - Greater than 2 MWs and requires a CPCN

# Maryland Permitting



## Process

System Type	Building and Electrical Permit Required	Utility approval required	PJM Interconnection approval required	Maryland Public Services Commission Approval Required
Residential <10kW		✓		
Residential >10kW	✓	✓		
Commercial/Community Solar Behind-the-Meter <2MW	✓	✓		
Commercial/Community Solar/Utility Scale Front- of-the-Meter <2MW	✓	✓	✓	
Commercial/Community Solar/Utility Scale Front- of-the-Meter >2MW	✓	✓	✓	✓

# What is a Megawatt (MW)



- A single MW is equivalent to one million watts (1,000 KWs) of power. This is far more than the energy needed to power an average 1,500-square-foot home.
- It's estimated that 1 megawatt of solar panels can generate enough electricity to meet the annual needs of 164 homes.



# Solar Panels



- Average home needs 10 solar panels to fill their energy needs (973 KWh/month)
- If you install 400-watt solar panels, you'll need 25 panels to make a 10kW system.
- You'll need 20, 500-watt solar panels to make a 10kW system.

# Solar Facility Calculation



## 50 MW Solar Facility

- 1 MW = ~5 acres of land
- Solar panels would cover 250 acres
- Output estimate computing panel efficiency and average hours of sunlight equals 122,640 MWh per year
- This facility could power over 11,000 homes
- And receive compensation through Solar



# What is a CPCN



Certificate of Public Convenience and Necessity and is issued by Maryland's Public Service Commission.

- Provides authority for a person to construct or modify a new generating station or high-voltage transmission line
  - Generation station:  $>2\text{MW}$
  - Transmission Lines:  $\geq 69\text{kV}$



# Generation Station Permits



## What must a Generation Station do to construct and operate a Power

### Plant in MD?

- PJM - Interconnection Agreement
- Public Service Commission – CPCN
- County Permits
- Other State Permits -





# Power Plant Research Program (PPRP)



MARYLAND  
DEPARTMENT OF  
NATURAL RESOURCES

For the CPCN, PPRP:

- Conducts a comprehensive, objective assessments based on sound science of electrical generation and transmission lines
- Coordinates a consolidated State Agency review process
- Make recommended conditions to the Public Service Commission (PSC)
- The PSC has the authority to issue a CPCN

Reprinted

from

Laws of Maryland

1971

CHAPTER 31  
(Senate Bill 540)

AN ACT to add new Sections 768 through 768, inclusive, to Article 66C of the Annotated Code of Maryland, title "Natural Resources," subtitle "In General," subheading "Department of Natural Resources," to follow immediately after Section 762 thereof, and to be under the new subtitle "Power Plant Siting," to establish an Environmental Trust Fund from a surcharge on generated kilowatts ~~SECTION 768~~ of electric energy to be used to underwrite a power plant environmental research and site evaluation program and to insure long-range and timely planning for power plant site selection and acquisition; to strengthen the State of Maryland's capability to define and manage a power plant environmental research program; to provide for the exercise of eminent domain and potential power plant site ownership by the Secretary of Natural Resources, and to exempt from local zoning certain sites; to add new Section 5A to Article 66C of the Annotated Code of Maryland, title "Natural Resources," subtitle "In General," subheading "Department of Natural Resources," to assign responsibility to the Secretary of Natural Resources on applications to the Public Service Commission for certification of public convenience and necessity associated with power plant construction; to repeal and re-enact Section 705 of Article 42 of the Annotated Code of Maryland.

EXPLANATION: [Brackets] indicate matter stricken from resolution.  
[Brackets] indicate matter stricken from existing law.  
CAPITALS indicate amendments to bill.  
Strike out indicates matter stricken out of bill.

# Reviewing State

## Agencies

Departments of

- Planning
- Commerce
- Environment
- Natural Resources
- Transportation
- Agriculture and,
- The Maryland Energy



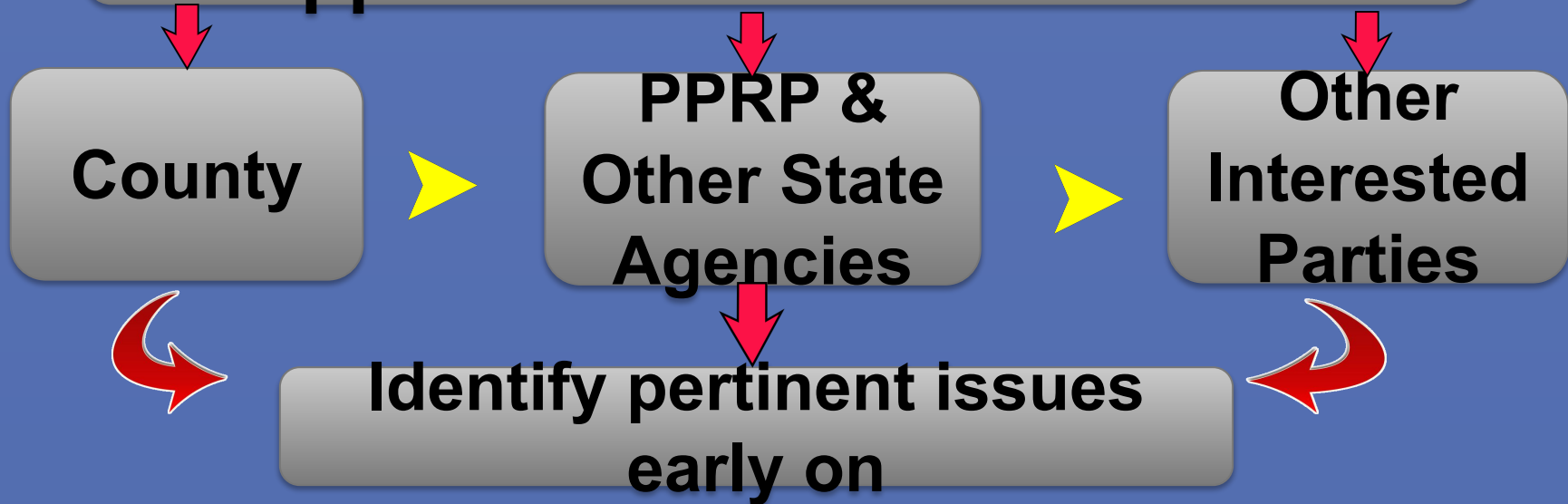
# Before a CPCN

## Application is Filed



### Pre-application

Applicant initial contact with:

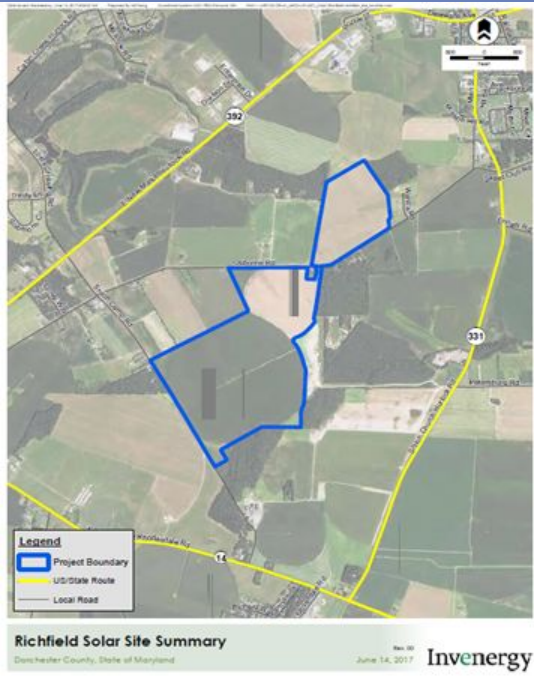


# State Agency Contact-PPRP Interactions During a CPCN



## PPRP:

- Sends out briefing email and link to company's CPCN application when CPCN is submitted, Will reach out to a particular agency if an issue is identified
- Communicates the CPCN's procedural schedule including the estimated timeframe for final Agency review of the Secretaries' Letter. Initial Recommended



# Scope of CPCN Review



PPRP investigates ~ 70 Environmental and Socioeconomic Factors on a proposed solar site including:

- Cultural and historical
- Rare Species
- Wetlands and Streams
- Environmental Justice
- Jobs
- Glare

Each Solar CPCN case has at least one unique situation and most have several.

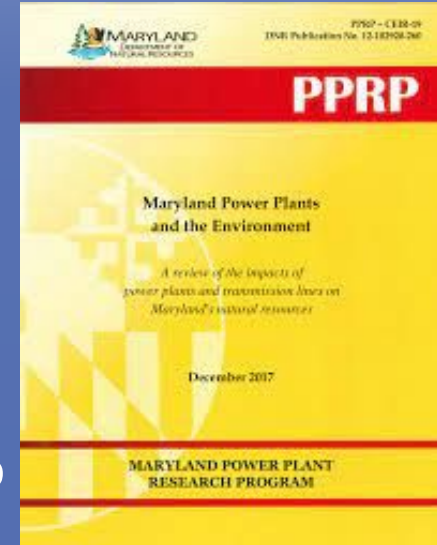
# The Power Plant Research Program (PPRP)



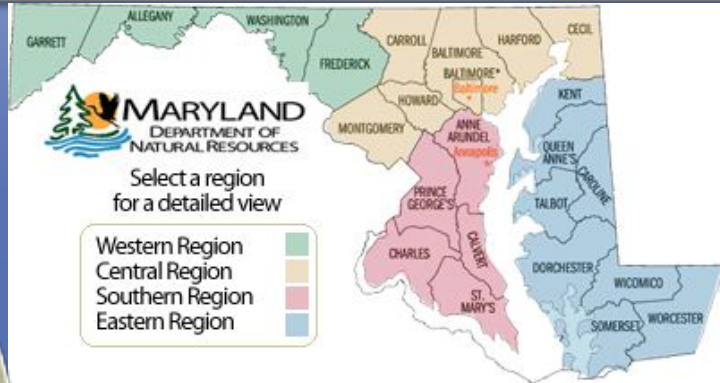
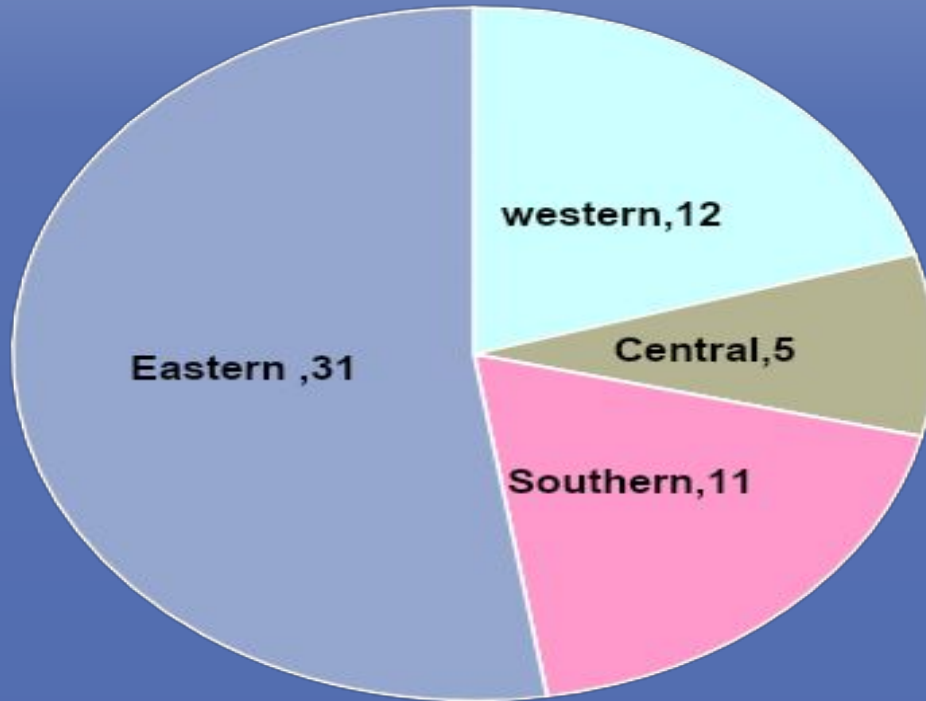
Conducts comprehensive, objective assessments based on sound science of electrical generation and transmission lines for the PSC.

## PPRP also:

- Writes a Biannual, Cumulative Environmental Impact Report (CEIR)
- Prepare reports as required by the Maryland General Assembly such as the Renewable Portfolio Standard
- Currently responsible for the 100% clean and renewable energy analyses through CEJA.
- Analyze PJM queue and energy data mining

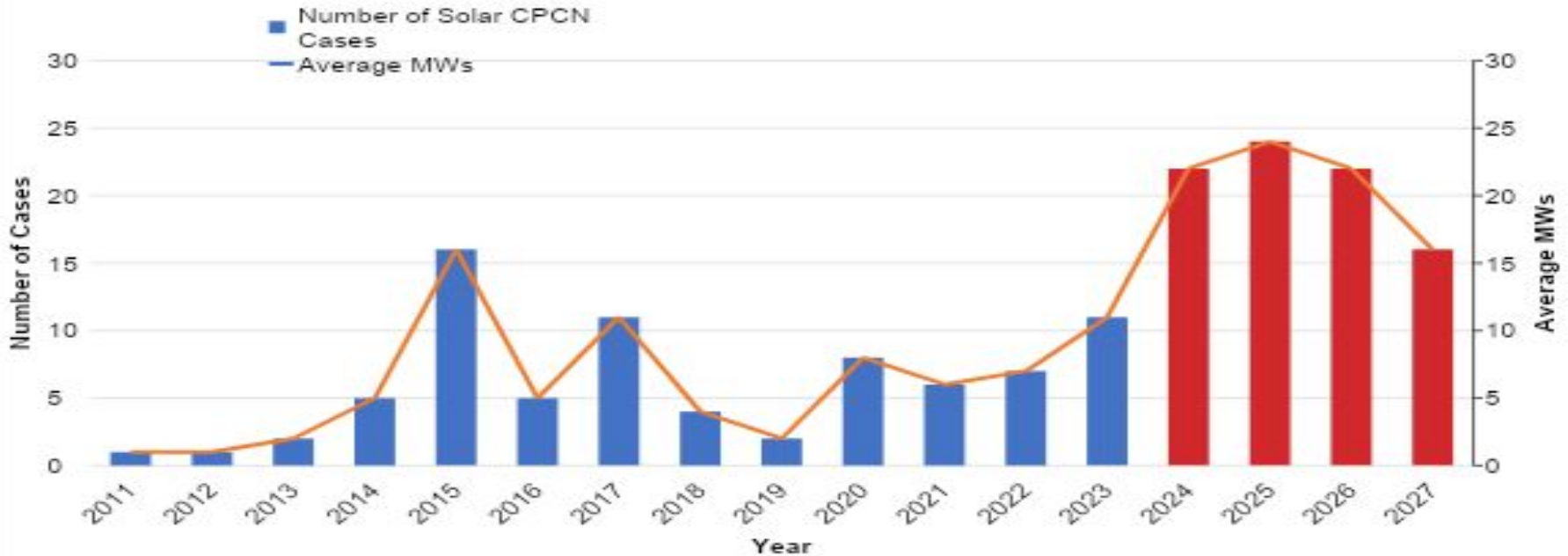


# Number of Utility-Scale Solar Cases by Region



- western
- Central
- Southern
- Eastern

# Utility-Scale Solar CPCN Cases by Year and Associated Total MWs Projected for 2024-2027.



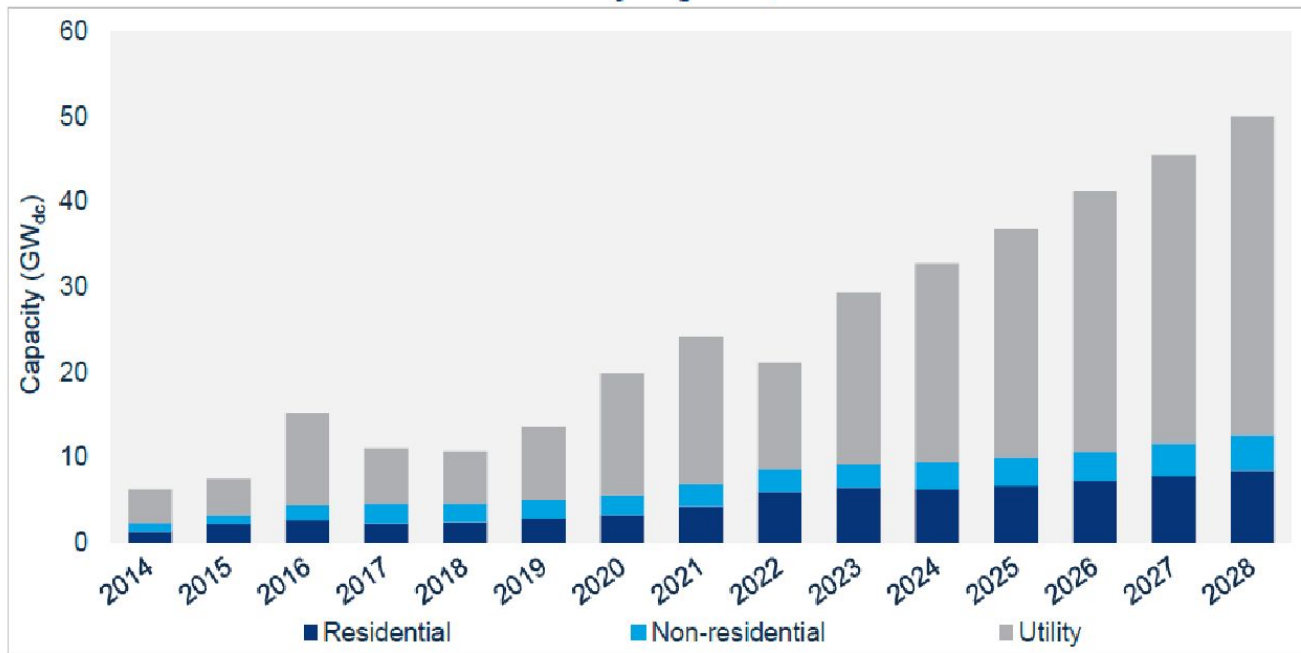
Individual Utility-Scale Solar Projects Ranged from 5-202 MW.



# US Solar Growth Projections by Wood Mackenzie and the Solar Energy Industries Association (SEIA)<sup>®</sup>



US solar PV installations and forecasts by segment, 2014-2028

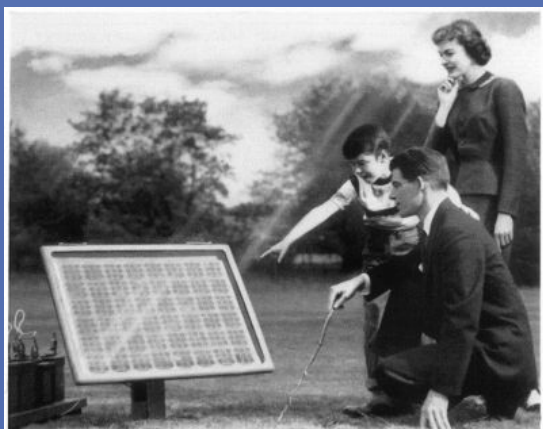
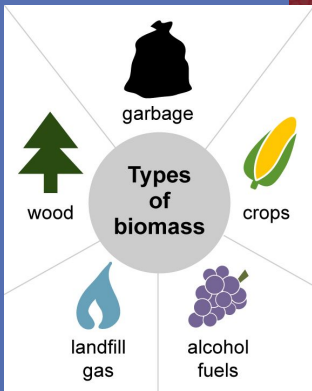
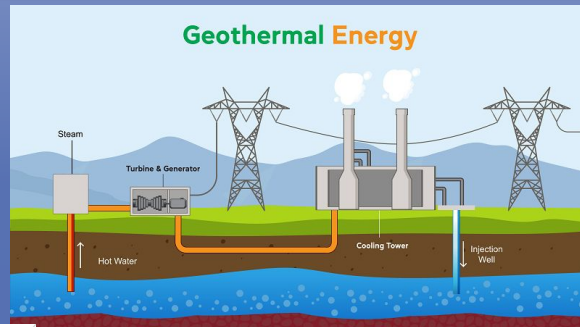
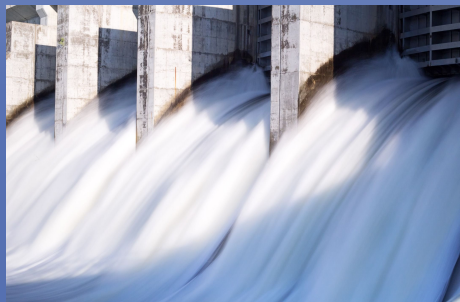


Source: Wood Mackenzie

# Maryland's Renewable Portfolio Standards



Renewable Energy includes



# Benefits of Maryland's Renewable Portfolio Standard



- Increases Maryland's energy independence
- Lower the cost of renewable energy to consumers
- Reduces water usage from coal and gas-fired power plants saving billions of gallons of water
- Develop clean energy businesses and workforce in Maryland.

# How an RPS Works



Each state varies its own RPS eligible resources and goals, and they are legislatively modified.

RPS is a state mandate that requires electricity utilities to purchase electricity from renewable energy suppliers.

- Each certified renewable energy generator earns renewable energy credits (RECs) for each MWh of electricity produced.
- May purchase Alternative Compliance Payments (ACPs)
- But there are mandates to purchase from certain renewable energy sources

# Maryland's Current RPS Requirements



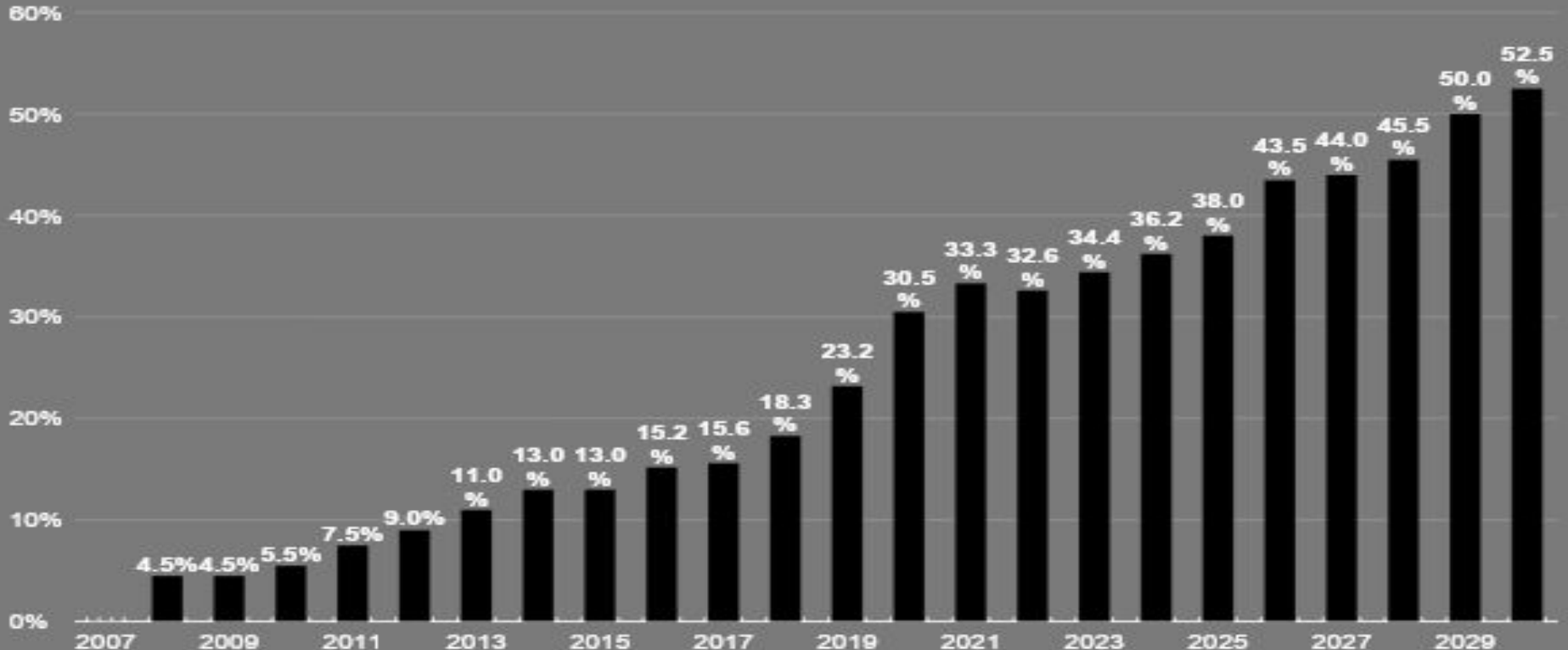
## Maryland RPS – Percentage of Renewable Energy Required

### TIER 1

#### Non- Carve out

Year		Solar	Off-shore Wind	Geo-Thermal	TIER 1 TOTAL	TIER 2 TOTAL (large Hydro)	TOTAL RPS
2021	23.3	7.5	0	0	30.8	2.5	33.3
2022	24.6	5.5	0	0	30.1	2.5	32.6
2023	25.85	6	0	0.05	31.9	2.5	34.4
2024	~25.2	6.5	~1.9	0.15	33.7	2.5	36.2
2025	~26.4	7	~1.9	0.25	35.5	2.5	38
2026	~17.3	8	~15.2	0.5	41	2.5	43.5
2027	~16.1	9.5	~15.2	0.75	41.5	2.5	44
2028	~15.8	11	~15.2	1	43	2.5	45.5
2029	~18.8	12.5	~15.2	1	47.5	2.5	50
2030	~19.3	14.5	~15.2	1	50	2.5	52.5

# Total Renewable Portfolio Standards (RPS) total by Year



# Projected Acres of Utility-Scale Solar Needed to Reach the RPS Goal.



YEAR	Utility Scale Required to Meet RPS (MWs)	Estimated Rooftop Solar (MWs)	Total Solar Capacity (MW)	Estimated Annual UPV Capacity Needed (MW)	Estimated Annual DPV Capacity Needed (MW)	Acres of Land, UPV, 5 acres/MW	Acres of Land, UPV, 8 acres/MW		
2023	758	1099	1857	52	52	3,790	6,064		
2024	833	1173	2006	75	75	4,163	6,660		
2025	902	1243	2145	70	70	4,512	7,219		
2026	1083	1288	2371	180	45	5,413	8,661		
2027	1357	1357	2714	274	69	6,785	10,855		
2028	1634	1426	3060	277	69	8,172	13,075		
2029	1906	1494	3400	272	68	9,530	15,247		
2030	2274	1586	3860	368	92	11,372	18,195		

# Conclusions

- Electricity usage in Maryland is projected to increase
- Maryland is currently 600 MWs short of its Solar goal.
- 1 MW of Solar in Maryland will generate ~ 1,800 MWhs of electricity annually.
- Technology and efficiency of solar panels is increasing significantly.
- Maryland's RPS amounts per category are set by legislation
- An additional 851 MWs of utility-scale solar will be needed by 2036





# PPRP Website

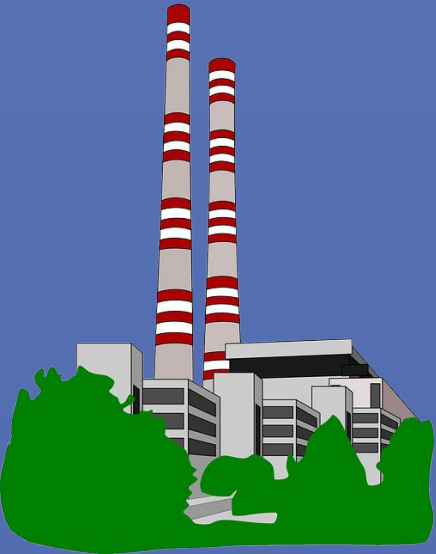


<https://dnr.maryland.gov/pprp/Pages/default.aspx>

# Thank You!



## Questions?



# Solar Decommissioning and Remediation

Paul Goeringer, Extension Specialist  
@aglawPaul



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To file a program discrimination complaint, a complainant should complete a Form AD-3027, USDA Program Discrimination Complaint Form, which can be obtained online, at <https://www.usda.gov/sites/default/files/documents/ad-3027.pdf>, from any USDA office, by calling (866) 632-9992, or by writing a letter addressed to USDA. The letter must contain the complainant's name, address, telephone number, and a written description of the alleged discriminatory action in sufficient detail to inform the Assistant Secretary for Civil Rights (ASCR) about the nature and date of an alleged civil rights violation. The completed AD-3027 form or letter must be submitted to USDA by:

**mail:**  
U.S. Department of Agriculture  
Office of the Assistant Secretary for Civil Rights  
1400 Independence Avenue, SW  
Washington, D.C. 20250-9410; or

**fax:**  
(833) 256-1665 or (202) 690-7442; or

**email:**  
[program.intake@usda.gov](mailto:program.intake@usda.gov).

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Para presentar una queja por discriminación en el programa, el reclamante debe completar un formulario AD-3027, Formulario de queja por discriminación del programa del USDA, que se puede obtener en línea, en <https://www.usda.gov/sites/default/files/documents/ad-3027s.pdf>, en cualquier oficina del USDA, llamando al (866) 632-9992, o escribiendo una carta dirigida al USDA. La carta debe contener el nombre, la dirección y el número de teléfono del reclamante, y una descripción escrita de la supuesta acción discriminatoria con suficiente detalle para informar al Subsecretario de Derechos Civiles (ASCR, por sus siglas en inglés) sobre la naturaleza y la fecha de la presunta violación de los derechos civiles. La carta o el formulario AD-3027 completado debe enviarse al USDA por medio de:

**correo postal:**  
U.S. Department of Agriculture  
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**fax:**  
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**correo electrónico:**  
[program.intake@usda.gov](mailto:program.intake@usda.gov).

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# Thank you for assistance putting this together

- Elizabeth Thilmany, Faculty Specialist, UMD
- Holiday Hull, J.D. Candidate, University of Arkansas
- Probably also Shannon Ferrell, Professor, Oklahoma State



# Thank you to USDA-NIFA

This work is supported by the Agriculture and Food Research Initiative (AFRI) program, grant no. 2020-68006-31182/project accession no. 1022637, from the U.S. Department of Agriculture, National Institute of Food and Agriculture.



National Institute of Food and Agriculture  
U.S. DEPARTMENT OF AGRICULTURE



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FORWARD**







# Introduction

# Introduction

In our research related to utility-scale solar development on ag lands, two big questions are always:

1. How much will I be paid?
2. How will the site be cleaned up?



# Introduction

I started my legal career working for a small firm in OK that only represented landowners dealing with "abandoned" oil and gas sites.



A large red arrow graphic pointing to the right, positioned on the left side of the slide. The arrow is solid red and has a white triangular cutout at its tail.

# **Solar Leasing**

# Maryland Landowner Opinions



“I just don't have a frame of reference for what a good deal would be considered. I know that they're offering more than I get from traditional farming. Is it the most that I could get? I don't know.”

Daughter of a producer who has been farming 150 acres for over 25 years



“They (the commissioners) are going to be making laws you don't like if you're not there to voice your opinion.”

Male farmer of 360 acres in MD for over 25 years



“I was not all that disappointed that [my] deal fell through because it became apparent that there was a real likelihood that the field would be left as a junkyard.”

Male farmer of ~100 acres in MD for over 25 years

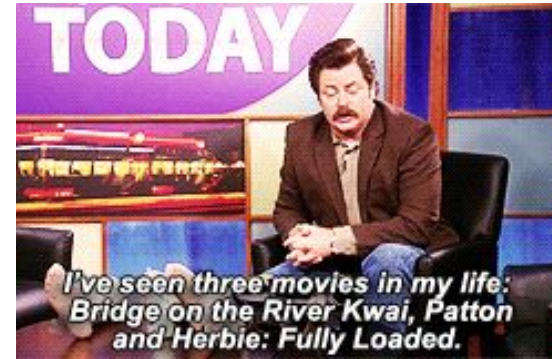


# Remediation Period

Once lease ends, company will need to remediate the site.

Currently MD requires as a part of the CPCN process for company to get bond/letter of credit to cover costs.

Still good practice for landowner to include language for how farmland will be remediated.



# Remediation Period

- PSC requires a letter of credit or bond within 30 days of construction, beginning with a decommissioning plan.
- Counties and the public can comment on the decommissioning plans.
- These plans and the costs associated with decommissioning the site will be reviewed every 5 years.

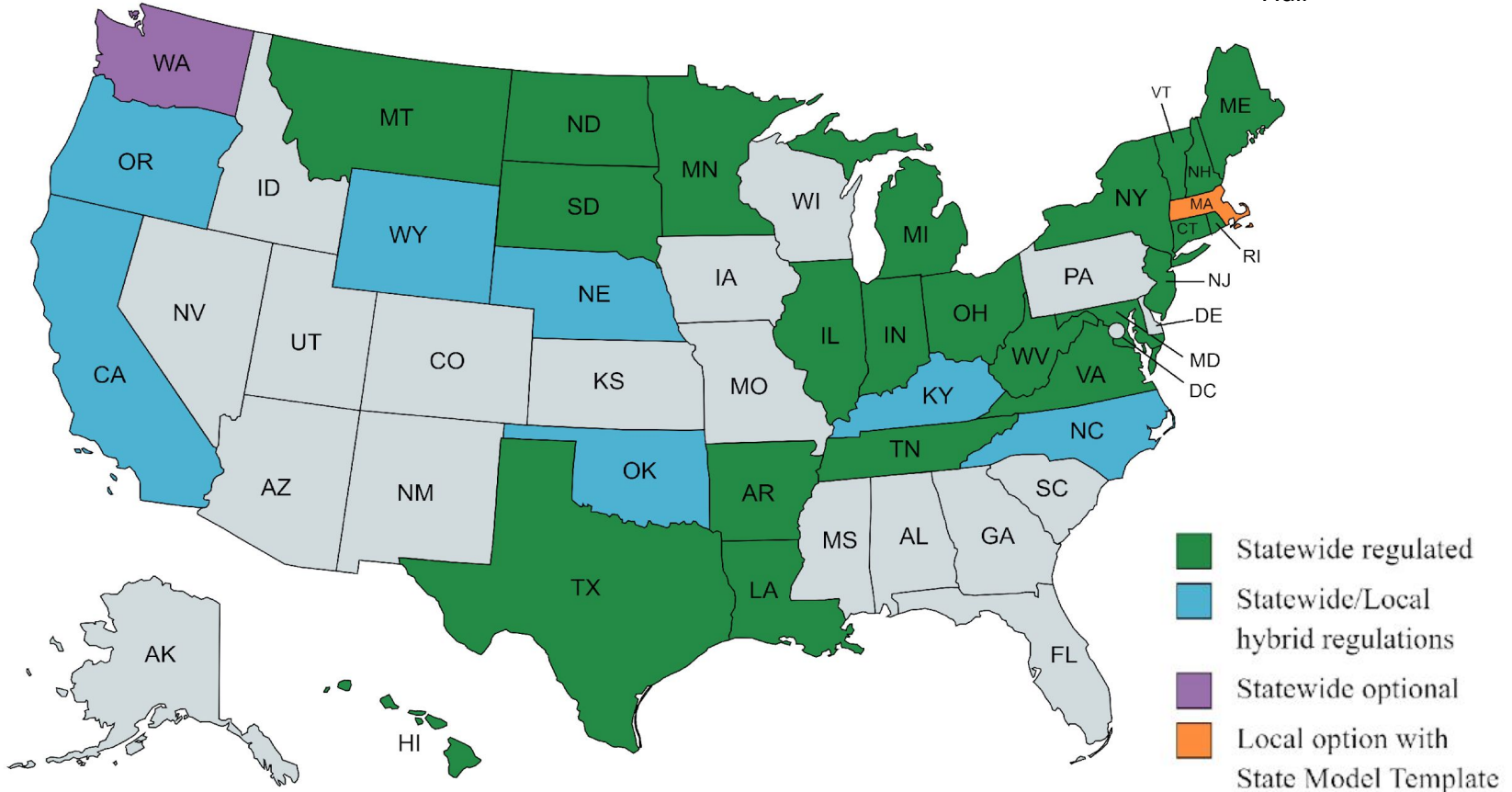


A large, bright yellow arrow graphic pointing to the right, positioned on the left side of the slide. It is composed of two overlapping triangular shapes that meet at a point on the left edge.

# **Decommissioning Costs**



Developed by Holiday  
Hull



# MD Decommissioning Plans

- First, plans are limited on PSC's site, and in a few cases, the actual costs are redacted as non-public information (head in hand emoji here).
- A couple of things to keep in mind:
  - Nationally, we have seen very few sites reach stages of decommissioning, so what happens is limited. We only have a few wind sites decommissioned, which is a very different footprint.
  - As the business model matures, this may facilitate changes in practices, such as not leasing the land but buying it to keep in solar.



Tasks	Estimated Cost (\$)
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
<b>Current Total</b>	<b>\$60,200</b>
<b>Total After 20 Years (2.5% inflation rate)</b>	<b>\$98,900</b>

**It is important to add in a provision in your contract to review inflation rates at varies time intervals and adjust the payment to reflect this change.**

**If we extend that period:**

**30 years: \$126,273**

**35 years: \$142,867**

**40 years: \$161,641**

Developed by Holiday  
Hull

\*Based on a 2MW ground mounter solar panel system in Massachusetts



# MD Decommissioning Costs

- Somerset County with two sites totaling 150MW. Estimated decommission costs were \$17,850,000. The net estimated salvage value is \$16,763,000. The total bond/letter of credit (left to the county to decide what form they wanted) was \$1,087,000.
- A Harford County site takes up 120 acres and totals 30MW. The estimated cost of removal is \$2,257,106. The estimated salvage value is \$2,948,292. Total bond/letter of credit put up: \$264,000.



# MD Decommissioning Costs

- Concerns are current financial commitments may not actually cover costs to clean up. Potentially over value salvage value.
- These plans are reviewed and updated every 5 years to take into account cost changes, will be interesting to see how these plans change over time.
- Keep in mind we may see few sites decommissioned over time.



# Southern Ag Today Blog



SOUTHERN AG  
TODAY

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[www.southernagtoday.org/e-news.aspx](http://www.southernagtoday.org/e-news.aspx)



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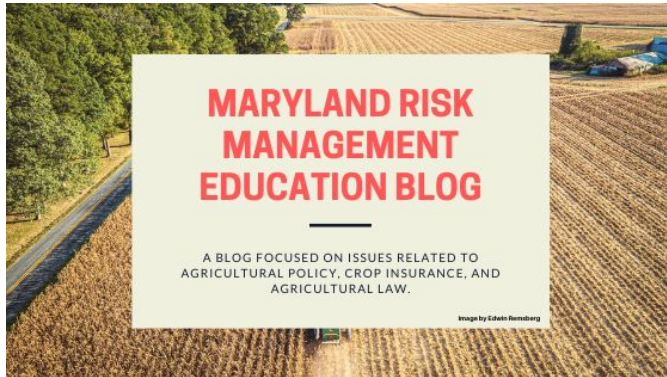
# Md. Risk Management Blog

Department of Ag and Resource Econ's blog updated periodically with timely legal, crop insurance, farm policy, and water conservation information.

[www.agrisk.umd.edu](http://www.agrisk.umd.edu)

Signup to get posts delivered to you

My podcast is also available there.



Any Questions??

Thank you!



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Paul Goeringer

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AREC: arec.umd.edu / ALEI: umaglaw.org / Blog: agrisk.umd.edu

CONSERVE: conservewaterforfood.org / Crop Insurance: arec.umd.edu/extension/crop-insurance

Podcast: marylandagpodcast.org



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A photograph of a vast field of golden wheat, with the stalks in the foreground slightly out of focus. The background shows rolling hills under a soft, hazy sky, suggesting a sunrise or sunset. The overall color palette is warm and golden.

# Solar + Farming Maryland

powered by **LIGHTSTAR**

# Kelly Buchanan, Policy Manager



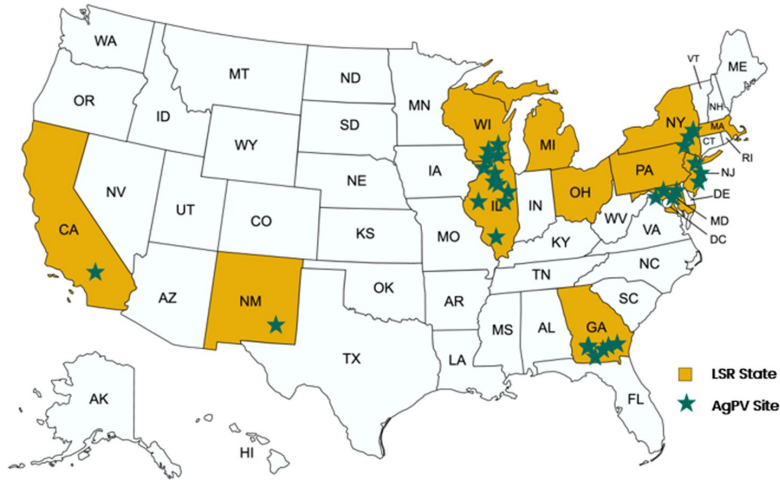
- CCSA Maryland Committee Vice Chair
- Grew up in 4-H, began my career with The Nature Conservancy & currently act as Vice Chair of the board for my local land conservation non-profit.
- Promote and support policies favorable to agrivoltaics, and community solar.

# Owen Deitcher, Development Associate



- Project developer and internal Agrivoltaic expert
- Graduated from Cornell with a Masters in Regional Planning, emphasis on rural advocacy and agricultural preservation
- Primary focus build out solar + farming best practices for Lightstar

# Lightstar - Protecting Farmland, Powering Community.



Based in Boston, Massachusetts, Lightstar Renewables (Lightstar) has over **1000MW** of solar in development across **12 states**. Of this portfolio, **300MW** are agrivoltaics projects.

Lightstar offers farmers the opportunity to use **agrivoltaics (AgPV)** – **farming under and around solar arrays** – and strives to make solar a win-win by preserving multigenerational farms and promoting energy independence.

**28 MW** in the pipeline in Maryland with **6 farmers and landowners** engaged.

# Lightstar's AgPV Definition

**Baldwin – Grassley Definition** - The term “agrivoltaic (AgPV) system” means a system under which solar energy production and agricultural production, including crop or animal production, occurs in an integrated manner on the same piece of land through the duration of a solar project.

**– Filed in the US Senate, positioned to be included in omnibus agricultural subsidy package known as the Farm Bill.**

Agricultural operation needs to produce meaningful revenue from the specific parcel – meet state specific farmland tax rules.

**Pollinator friendly plantings/Small Apiaries/Sheep 2x a year = Ecovoltaics NOT Agrivoltaics**

# Strategic Partnership

Lightstar is a proud partner of American Farmland Trust. AFT launched the conservation agriculture movement and has been bringing agriculture and the environment together since 1980. AFT's mission is to save the land that sustains us by protecting farmland, promoting environmentally sound farming practices, and keeping farmers on the land. At Lightstar, we share in this vision and join AFT in their holistic approach to forward-looking farming practices with objective research and advocacy.



**American Farmland Trust**

# U.S. Agrivoltaics Landscape

Lightstar has worked closely with national and local farming organizations, advocacy groups, and policymakers to shape implementation of agrivoltaics policy across the country.





# Agrivoltaics in Maryland



- In Maryland, **community solar projects are less than or equal to 5 megawatts**. Agrivoltaics can co-locate up to 10MW.
- Permitting occurs through the Public Service Commission (PSC) for projects above 2MWs to obtain a **Certificate of Public Convenience and Necessity (CPCN)**.
- **Below 2 MWs may permit locally** or elect to permit via the PSC if project does not conform to local law.
- County-level permitting is extremely restrictive in some areas. **Many developers are now exclusively using the PSC process.**
- **Currently no process for expediting Agrivoltaics or other preferred siting projects.**

# Maryland Incentives for Agrivoltaics

- Definition established in 2023 codified in COMAR, supported by MD Farm Bureau and Lightstar
- Projects that serve 50% LMI and provide a 20% discount and meet the COMAR AgPV definition and are under 2MW are eligible for personal property tax exemption on solar equipment.
- AgPV projects may retain farmland tax assessment and are expected to continue to remain enrolled for the life of the project (20-25 years).

**Legislature action needed** to extend the personal property tax exemption.

Sunset is 2025, but it is unlikely any projects will be ready in time to meet that deadline. Both AgPV and Standard CSEGs projects take **28 months from application to start of construction. AgPV projects may take longer because additional agricultural component.**



# What do projects look like?

# Landowners & Tenant Farmers



- Landowners receive **monthly lease payments** from Lightstar.
- **Lightstar pays for all costs** associated with development, construction, and operation of the agrivoltaics project.
- **A stipend is paid to the tenant farmer** for the life of the project to ensure agricultural activity.
- AgPV systems financially support farming families, keeping them on the land and producing.
- Lightstar & farmer establish a **detailed, flexible farm plan**.
- **Farm viability tool for both landowners and tenant farmers.**

# Typical Project Specs for Agrivoltaics

Height w/ Horizontal Panels: 6-9 ft

Row spacing: 30-40 ft

Min. Acreage:

32 acres Commodity

38 acres Specialty Crop

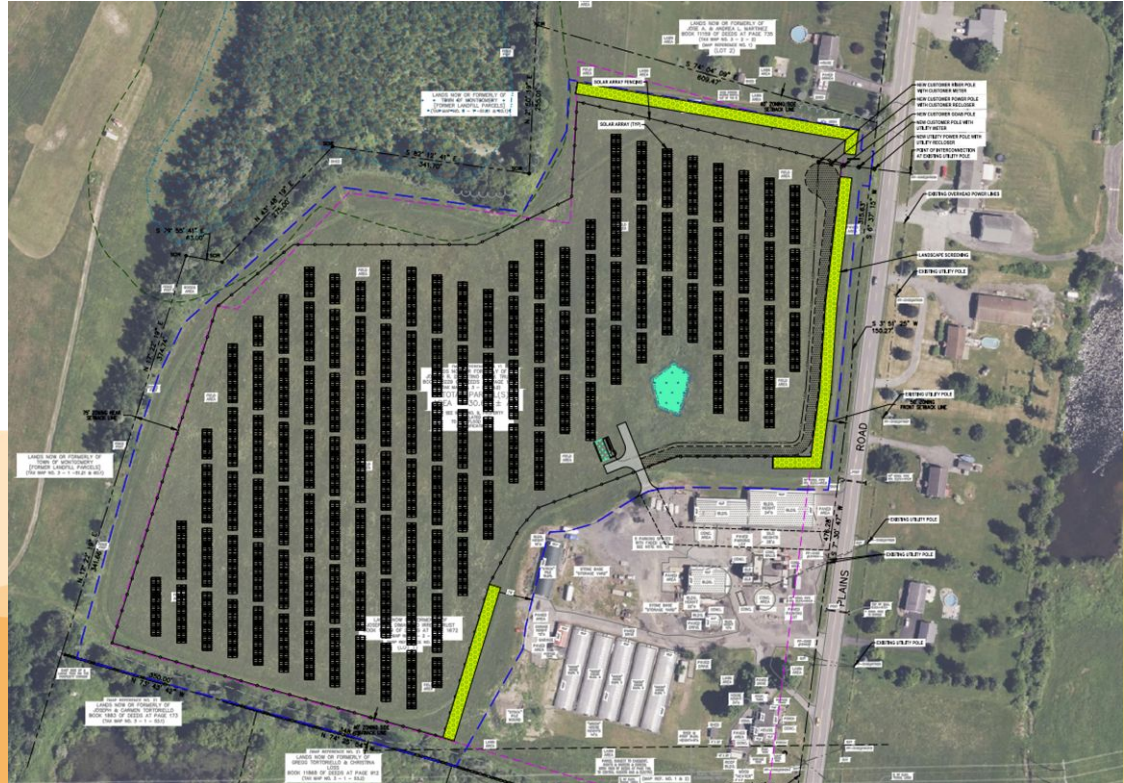
35 acres Grazing

Crops: Soy, hay, tomatoes, strawberries, blueberries, peppers, lavender, and others.

Livestock: sheep, pigs, cattle, chickens

Agricultural fencing can protect crops from wildlife visitors.

Accessible for farm equipment during planting and harvest.



# Supporting Crop Yields

**Panels provide shade to workers and crops, reducing water usage and potentially increase yields of specialty crops. Microclimate of panels provide frost protection.**

## Northern Europe Crop Trials – Laub et al 2022

- Fruits, berries, and fruity vegetables **increased yields** in shadier conditions
- Forages, leafy vegetables and tubers/root crops start with a less than proportional loss of yield at low levels of shade.

## Arizona – Hardiness zone 8a

- Tomatoes fruited more, and peppers **fruited 3x more** than in an open field
- AgPV grown crops were **less water stressed** than in open fields
- When water was decreased by 50% in the dual-use crops – there was **no reduction in food production**.

## Illinois – Hardiness zone 5a–7b

- AgPV systems could **protect plants** during heavy precipitation periods

## Colorado – Hardiness zone 3a–7a

- First commercial growing season: 8,600 lbs in half a season on 24 acres, less water usage, and a profiting CSA.
- Found berry crops were extended because of early and late frost protection.

## Massachusetts – Hardiness zone 5a–7a

- Peppers, broccoli, kale, and swiss chard all **saw the same or greater yield** despite a record dry and hot summer in 2017.



**Jack's Solar Garden**  
**with Sprout City Farm Workers**



 **Cattle + Solar –  
University of Minnesota**

## Benefits

- + Reduced heat stress in cattle, lowered body temperatures
- + Increased well-being of livestock
- + Study by the University of Minnesota



# **Lightstar's AgPV Project Examples**

# Thompson Family Farms – Old Myers Road

*2.6 MWDC – 15 acres – Wappingers Falls, New York*

- Historically a hay field farmed by the Thompson brothers. Thompsons are planning on leveraging the financial stability of the AgPV array to purchase more farmland.
- Plan to produce strawberries, blueberries, tomatoes, peppers, lavender, other produce under AgPV.
- Direct to consumer sales & other local channels.
- 8 foot tall racking, rows are 28 foot spacing, 16 foot between panel edges. Room for tractors to traverse and beneficial for farm workers.
- Farmers are most excited about frost protection from arrays.



# Potential Crop Layout

LANDS NOW OR FORMERLY OF  
DIESING FAMILY LIMITED PARTNERSHIP  
INSTRUMENT DOC. NO. 02 2010 4806  
LANDS NOW OR FORMERLY OF  
SEAN THOMPSON  
INSTRUMENT DOC. NO. 02 2019 4461  
(T.M. NO. 135669-6258-03-376432)

"NORTH & SOUTH OF"  
MYERS CORNERS ROAD

PROPOSED CLEARING LIMITS  
MINIMUM 10' FROM FENCE (TYP.)

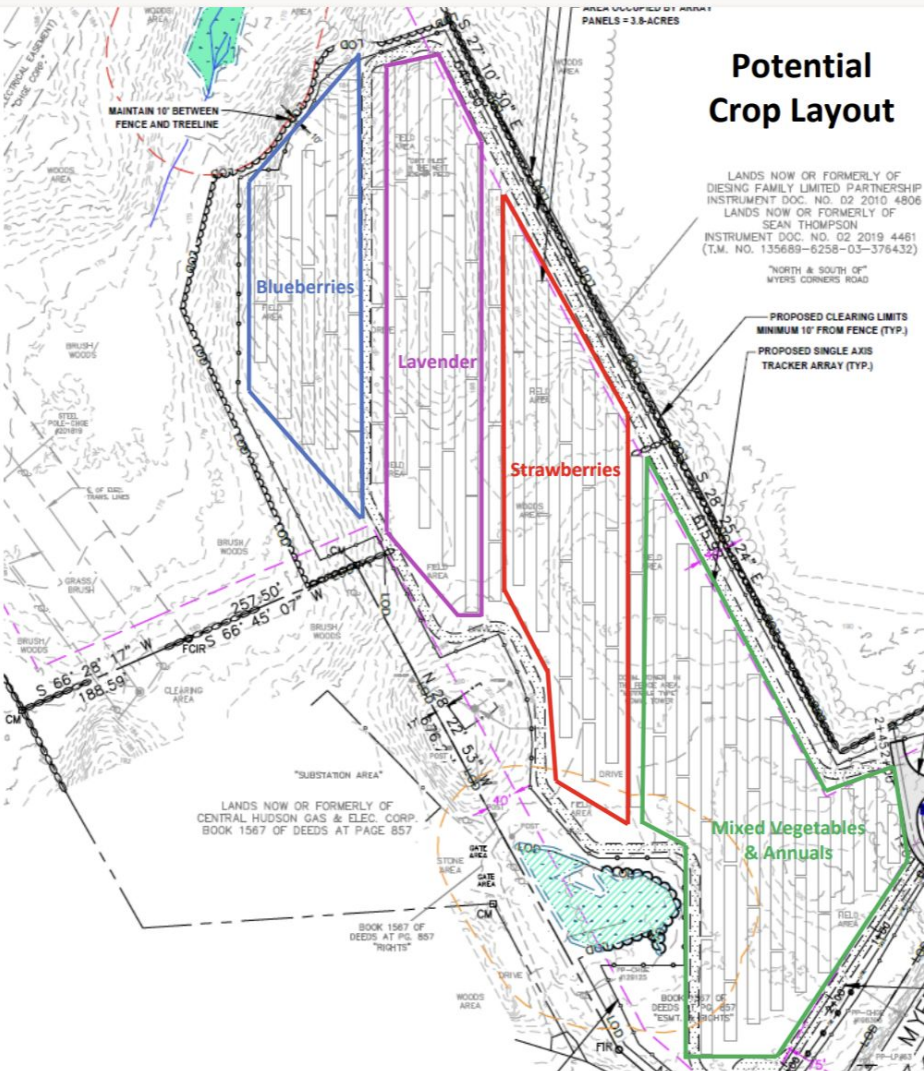
PROPOSED SINGLE AXIS  
TRACKER ARRAY (TYP.)

Blueberries

Lavender

Strawberries

Mixed Vegetables  
& Annuals



# Phillips Farm – York Road

*3 MWDC – 16 acres – Baltimore County, Maryland*

- Phillips Family – Landowner. Currently being farmed and in the family since 1880. Same tenant farming family since the beginning.
- Tenant Farming Family is looking to pivot to market row crops and exit soybean market.
- Array is 7.5 feet tall, 32-34 feet between rows. ~16 feet between panel edges. Farm equipment can navigate in panel override and between edges.
- Aiming to work with researchers in Maryland and other states to evaluate commodity crop viability within Lightstar's design.
- Site is currently constrained by interconnection capacity at local substation. Will likely have to be downsized.
- Finding an engaged agrivoltaic farmer with nearby interconnection viability takes effort that many developers aren't willing to take on without incentive.



# Additional Information: What is needed for responsible AgPV?

**Definition of AgPV** The technical definition of Agrivoltaics should follow the Fraunhofer ISE's guidance. Municipalities can use the state definition for acceptable agricultural use in each state. Although apiaries and pollinators can be considered dual-use, LSR does not consider it agrivoltaics or "solar farming."

## **Ensuring a project remains in production**

Developers should pay a meaningful stipend to the farmer for keeping the land in production. Utilize the tax assessment or similar for compliance. Cure periods, similar to other agricultural programs, should be allowed for projects that have fallen out of compliance due to extreme weather, crop failure, drought, and other typical agricultural challenges. Site plan approval can be revoked if project is not farmed.

**Farm Logistics Plan** should be completed in direct consultation with the farmer or farm manager, and an agricultural extension agent and/or equipped third parties (NRCS conservation planner). Should be required for site plan approval.

**Clear Construction Guidelines** these may include soils being tested for Ph levels, nutrients, etc. before and after construction. Engineering, procurement and contracting firms (EPCs) must have proper soil compaction practices outlined in the specs of each project. (NY State has excellent ones)

**Decommissioning of Projects** includes soil testing, top soil treatment, and removal of all solar system materials, unless determined that some materials would be beneficial to the farming operation.

**Agricultural Fencing** should be an acceptable option for all zoning purposes and is in line with federal electric code, as it preserves the rural character of the farm and lends an added benefit to farmers by keeping wildlife away from crops.

**Setbacks for Operation** towns should consider the total farming operation and adjusting setbacks to allow for maneuvering of necessary farm equipment while

# Additional Information: Resources for AgPV

[Arenas-Corraliza et al., 2019. \*Wheat and barely can increase grain yield in shade through acclimation of physiological and morphological traits in Mediterranean conditions\*](#)

[Tazawa, 1999. \*Effects of Various Radiant Sources on Plant Growth\*](#)

[UMass Extension, 2019. \*Expectations for Cranberry Growth and Productivity under Photovoltaic Panels\*](#)

[Fraunhofer Institute for Solar Energy Systems, 2018. \*Agrophotovoltaics: High Harvesting Yield in Hot Summer of 2018\*](#)

[Adeh, Selker, & Higgins, 2018. \*Remarkable agrivoltaic influence on soil moisture, micrometeorology, and water-use efficiency.\*](#)

[Barron-Gafford et. al., Nature 2019 \*Agrivoltaics provide mutual benefits across the food-energy-water nexus in drylands\*](#)

[Outline of 2020-2021 Research Findings By Professor Greg Barron-Gafford, Arizona State University](#)

[Laub et. al. Agronomy for Sustainable Development 2022, \*Contrasting yield responses at varying levels of shade suggest different suitability of crops for dual land-use systems: a meta-analysis\*](#)

[Potenza et. al. Agrivoltaic System and Modelling Simulation: A Case Study of Soybean \(Glycine max L.\) in Italy](#)

[Growing Crops Under Solar Panels? Now There's a Bright Idea](#)

[American Farmland Trust Dual-Use Resources](#)

[Agrivoltaic Research and Resource Clearinghouse](#)

[NREL 5 C's of Agrivoltaic Development](#)

A photograph of a vast, golden wheat field under a soft, hazy sky. The wheat stalks are in focus in the foreground, with some showing their heads. The background is a blurred expanse of the same field stretching to a low horizon line. The overall color palette is warm, dominated by golden yellows and soft oranges.

**Thank  
you**

powered by **LIGHTSTAR**