
MARYLAND DEPARTMENT OF AGRICULTURE
50 YEARS
Agri-SOLAR SUMMIT
September 26, 2024

Solar in Maryland: Terms, Meanings, and Explanations

September 26, 2024

Bob Sadzinski

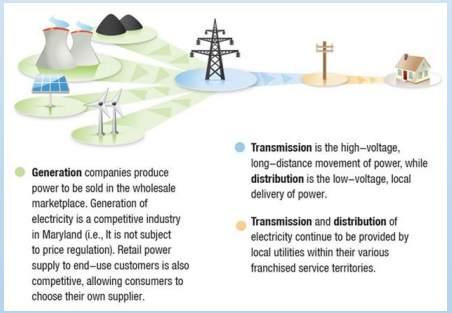
Director, Power Plant Research Program

Presentation Overview

- Introduction to electricity usage and generation
- Explain utility-scale, community, and rooftop solar
- What is a KW or MW and how many panels are needed for a home
- Area needed for Solar - MWs/acre
- Who is PPRP
- CPCN process and the PSC
- Environmental analysis used for CPCN solar cases on agricultural lands.

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:
  - Natural gas: 42.5%
  - Nuclear: 41.6%
  - Hydroelectric: 5.2%
  - Coal: 4.7%
  - Solar: 2.7%
  - Wind: 1.3%
  - Biomass: 0.9%
  - Petroleum: 0.2%
  - Other: 0.9%



- PJM is a Regional Transmission Organization (RTO) that

Types of Solar Facilities in Maryland

- Rooftop Solar (Residential): Small solar projects, may be grid connected through the distribution.
- 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.

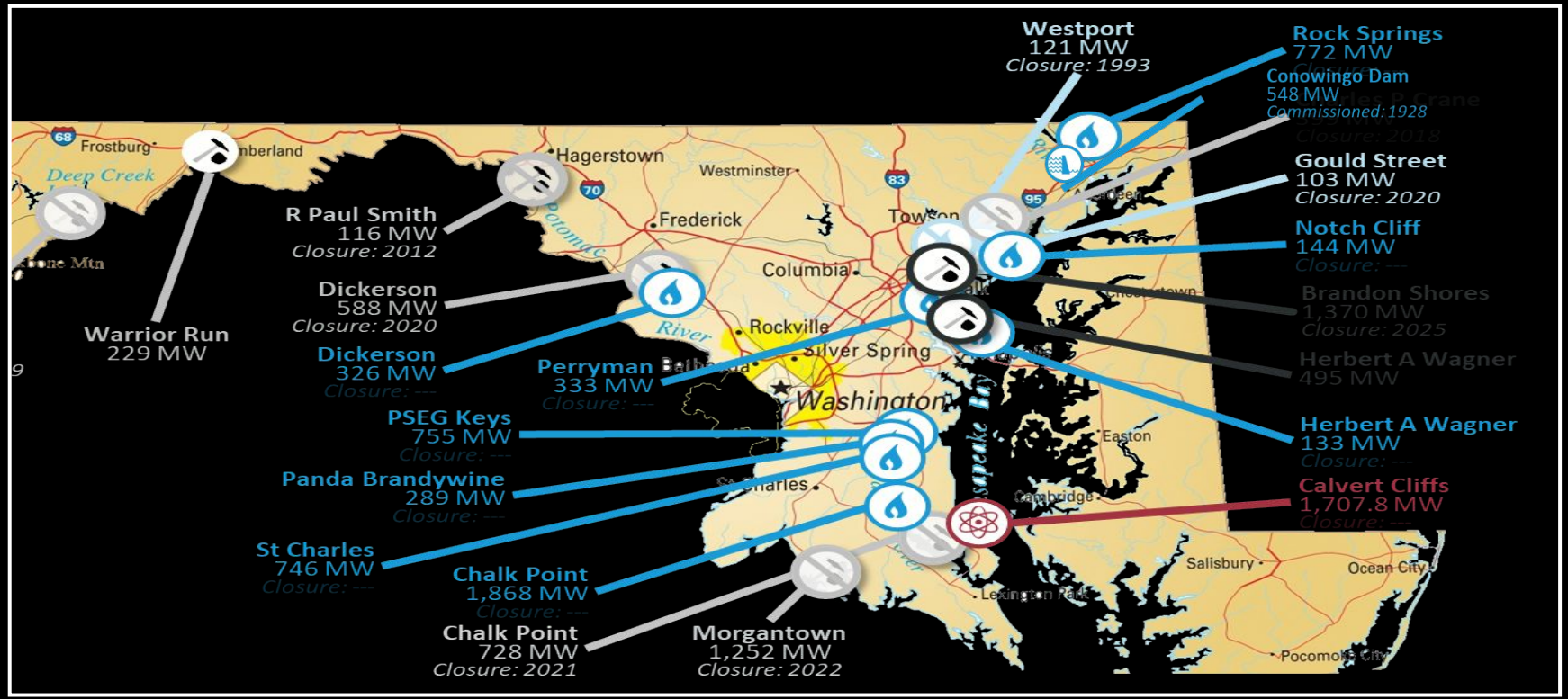
Maryland Permitting Process

Source: the Solar Incentive Task Force Meeting from 26 October 2023

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	✔	✔	✔	✔

Map of Large Power Plants in Maryland

Credit: University of Maryland Extension



Solar Sites in Maryland Currently Operational

Credit: University of Maryland Extension

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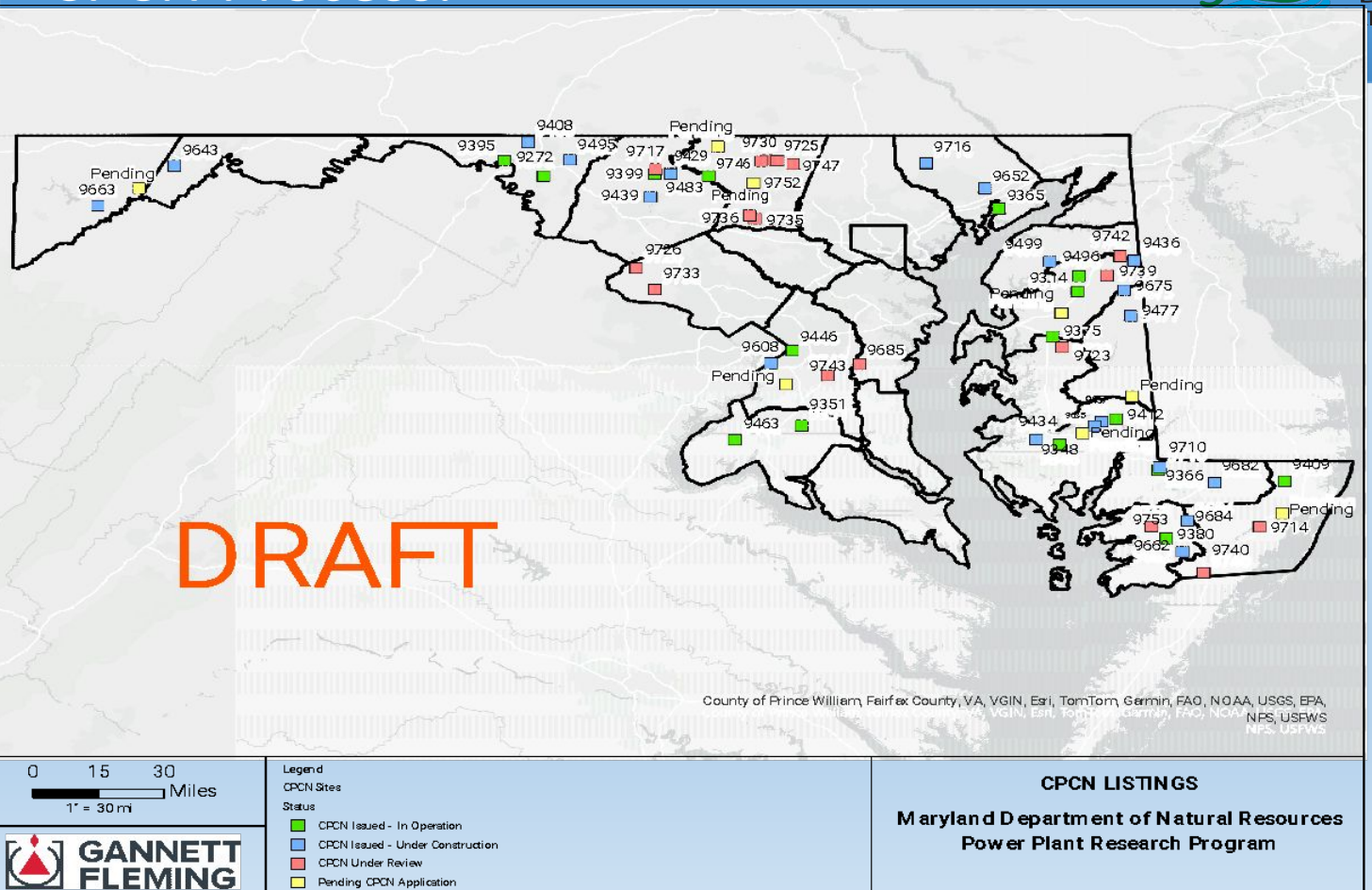
Solar Projects in Maryland in the CPCN Process.



What is a Kilowatt and a Kilowatt hour

- A kilowatt-hour (KWh) is equal to 1,000 watts of electricity used/produced for one hour
  - A 100-watt light bulb consumes 100 watts per hour – over ten hours uses 1 kilowatt-hour)
- Average home requires ~ 10,700 KWh per year
  - Or 1.2 KW per hour
- It's estimated that a 1-megawatt (1,000 kilowatt) generation facility can generate enough electricity to meet the needs of 164 homes.
- The average home in Maryland needs 12.8 kW solar

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 (122,640,000 KWh)
- This facility could power over 11,000 homes

What is a CPCN

Certificate of Public Convenience and Necessity

- Issued by Maryland Public Service Commission
- Provides authority for a person to construct or modify a new generating station or high-voltage transmission lines.
  - Generation station: >2MW
  - Transmission Lines: >69kV

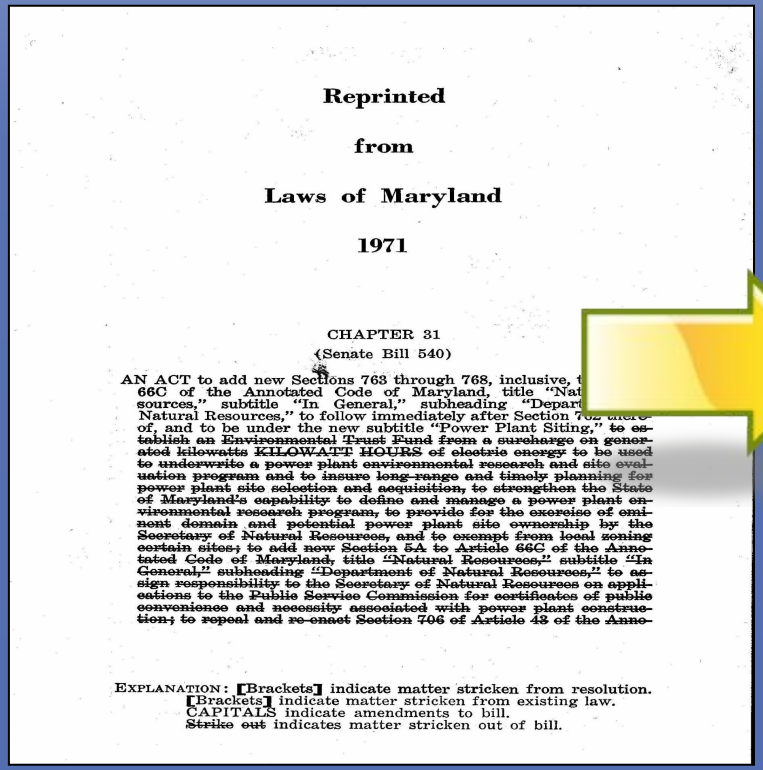
<u>Note: Solar Cases have six months to complete!</u>

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 -

The Power Plant Research Program (PPRP)



Reprinted

from

Laws of Maryland

1971

CHAPTER 31

(Senate Bill 540)

AN ACT to add new Sections 763 through 768, inclusive, t
66C of the Annotated Code of Maryland, title "Nat
sources," subtitle "In General," subheading "Depart
Natural Resources," to follow immediately after Section 76
of, and to be under the new subtitle "Power Plant Siting," ~~to es-~~
~~tablish an Environmental Trust Fund from a surcharge on gener-~~
~~ated kilowatts~~ KILOWATT HOURS ~~of electric energy; to be used~~
~~to underwrite a power plant environmental research and site eval-~~
~~uation 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 en-~~
~~vironmental research program, to provide for the exercise of emi-~~
~~nent 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 Anno-~~
~~tated Code of Maryland, title "Natural Resources," subtitle "In~~
~~General," subheading "Department of Natural Resources," to as-~~
~~sign responsibility to the Secretary of Natural Resources on appli-~~
~~cations to the Public Service Commission for certificates of public~~
~~convenience and necessity associated with power plant construc-~~
~~tion; to repeal and re-enact Section 706 of Article 48 of the Anno-~~

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.

For the CPCN, PPRP:

- Conducts a comprehensive, objective assessments based on sound science for electrical generation and transmission lines
- Coordinates an independent, consolidated State Agency review

Reviewing State Agencies

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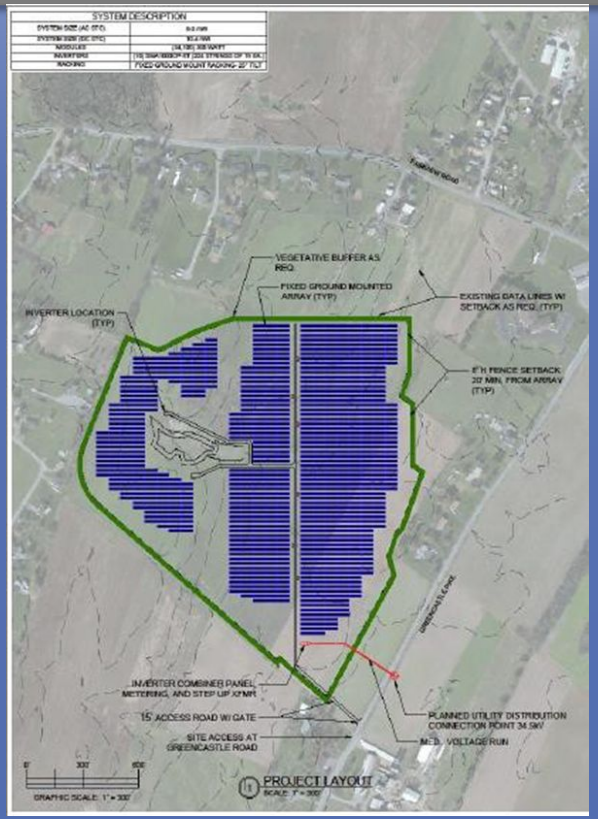
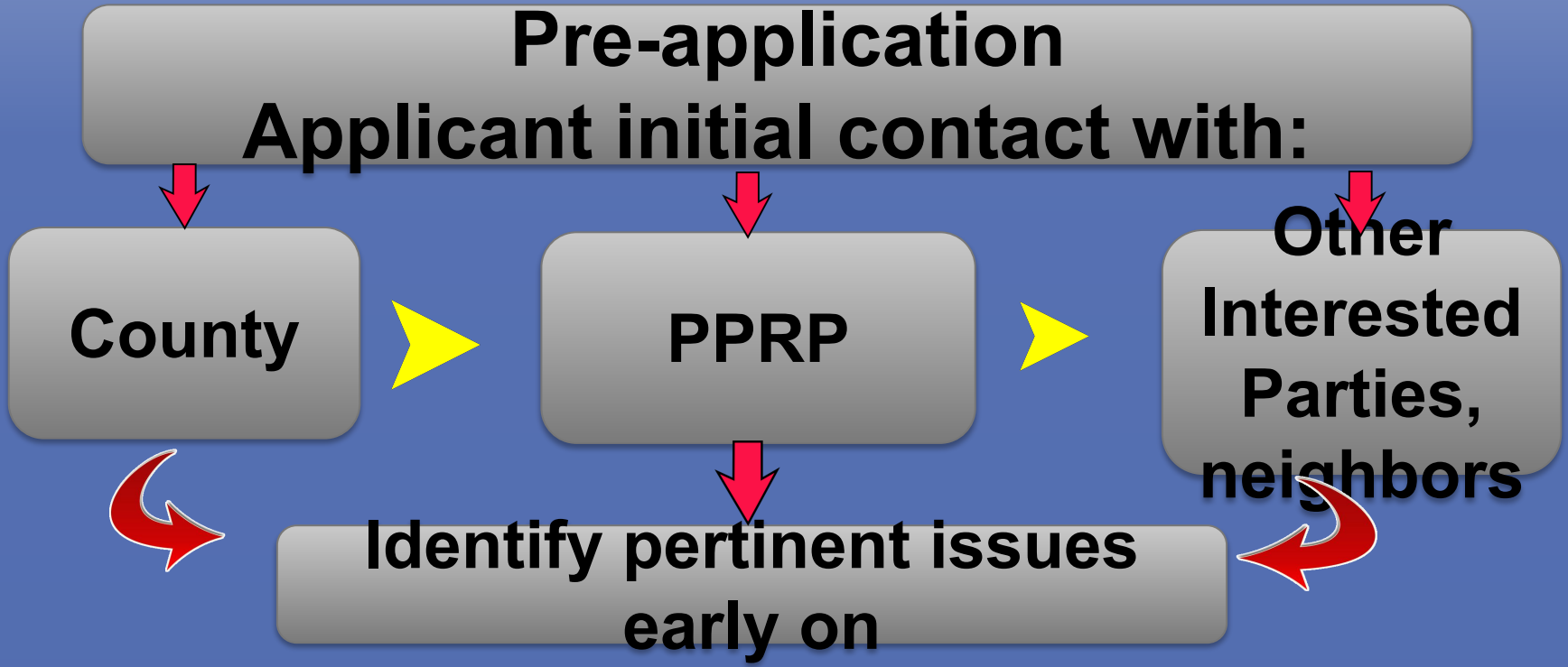
Departments of

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



Before a CPCN Application is Filed



The Power Plant Research Program (PPRP)

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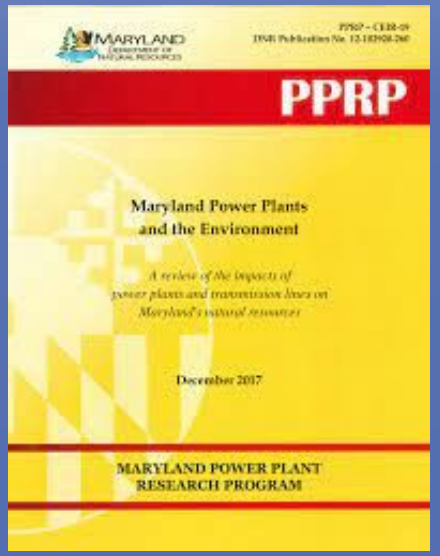
PPRP also:

- 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
- Analyze PJM queue
- Conduct energy-related studies (matting,



State Agency Contact-PPRP Interactions During a CPCN

PPRP:

- Sends out briefing email and link to company's CPCN application when CPCN is submitted
- Communicates the CPCN's procedural schedule including the estimated timeframe for final Agency review of the Secretaries' Letter, Initial Recommended Conditions and PPRP's Environmental Review Document.

Potential Impacts of Solar on Agricultural Lands

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

- Glare/Visual Impacts
- Decommissioning
- Cultural and historical
- Rare Species
- Wetlands and Streams
- Environmental Justice

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

Utility-Scale Solar Glare/Visual Impacts

Glare – reflection – temporary

Visual Impacts - Solar energy facilities have increased potential to be visible for long distances due to their:

- large size
- geometry
- highly reflective surfaces.

Vegetative buffers mitigate these potential impacts

Example of PPRP's Visual Impact Analysis

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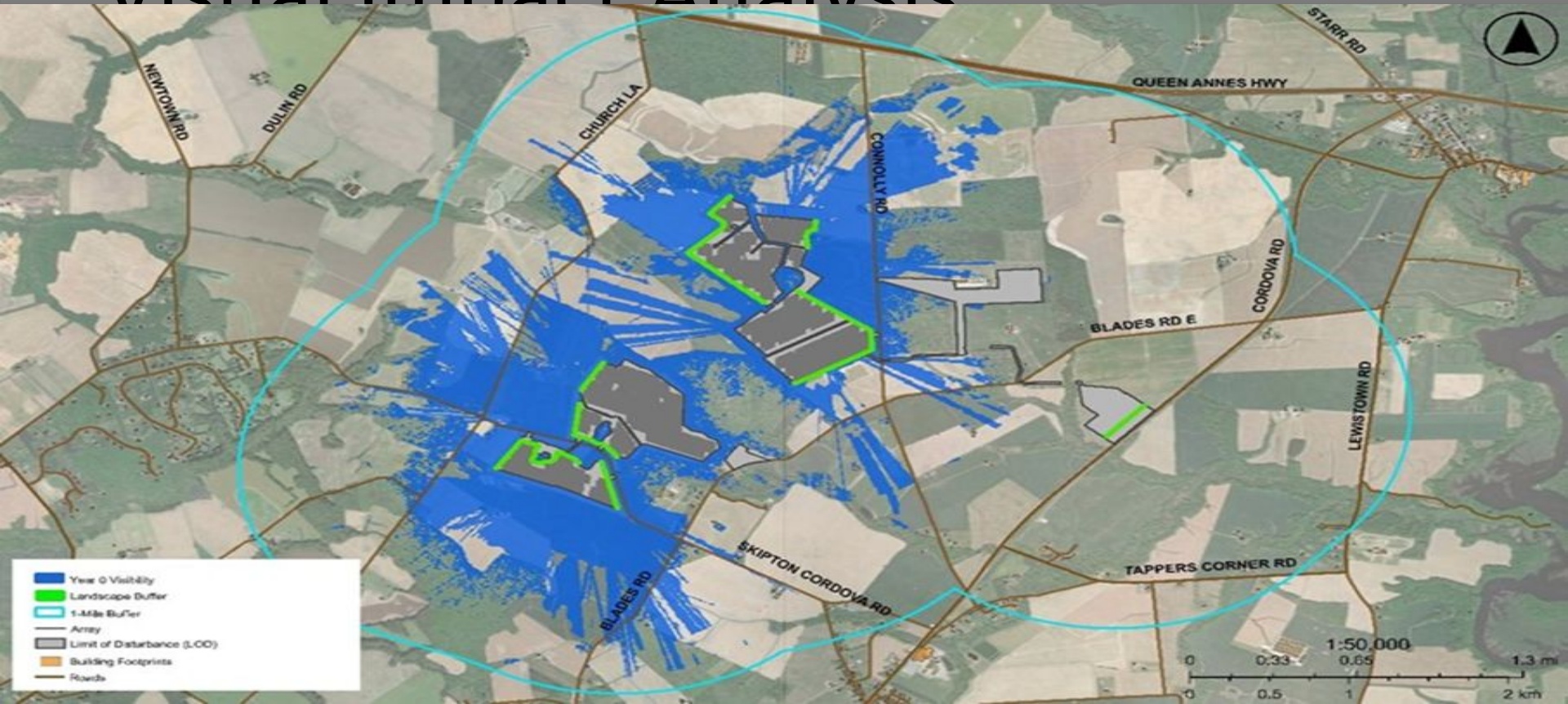

Solar Decommissioning

Decommissioning Plan must be in place to ensure that future landowners can use the parcels in a manner that is not hindered

The cost of decommissioning is not borne by the State, county, or municipality

The Public Service Commission's Decommissioning Plan

- Submitted by the Applicant as part of the CPCN process
- PPRP is generally the lead (Intervenors in the case review and comment)
- The Plan and must include:
  - A bond/ letter of credit held by the County or the PSC
  - For the life of the Project

Photo Credit: University of Maryland Extension

Decommissioning Trigger:

Solar Decommissioning -continued

The Decommissioning Plan must include:

- The responsible party(ies),
- Expected sequence of activities
- Estimated costs for decommissioning, dismantling, recycling/disposal/reuse of components
- Full restoration of the site
- Plan is updated and needs PSC approval

PPRP's Online Information for CPCN Cases

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Supplemental Environmental and Socioeconomic Information for CPCN Cases

Jump to a Section Below

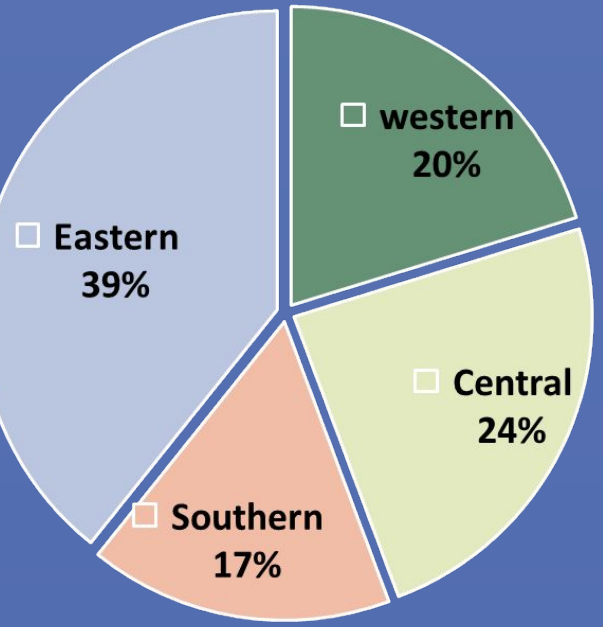
Introduction

The Public Service Commission (PSC) is the regulating entity whose jurisdiction includes licensing power generating facilities and overhead transmission lines greater than 69 kilovolts (kV) within the state of Maryland. An applicant that is planning to construct or modify a generating facility or a transmission line must receive a permit, the Certificate of Public Convenience and Necessity (CPCN), from the PSC before the start of construction. As part of the licensing process, the Maryland Department of Natural Resources (DNR) Power Plant Research Program (PPRP), in coordination with other State agencies evaluates each facility's potential impacts on environmental, socioeconomic, and cultural resources in Maryland, pursuant to Section 3-304 through 3-306 of the Natural Resources Article of the Annotated Code of Maryland (COMAR).

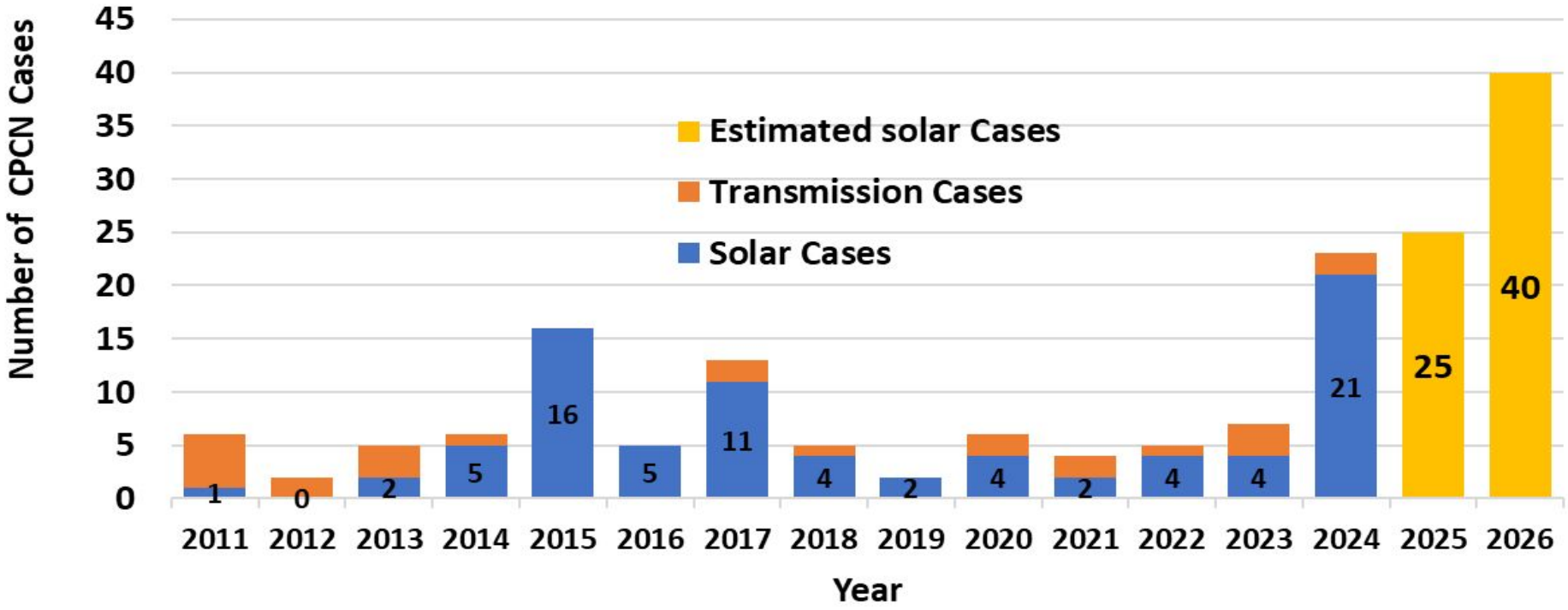
PPRP's assessment is documented within a Project Assessment Report (PAR) for each individual power generating facility or overhead transmission line project. The following information is intended to provide general background information about some of the environmental, socioeconomic, and cultural program areas within Maryland and specific topics that are evaluated as part of PPRP's assessment.

Sections below are marked as (Solar) to show content that relates specifically to solar photovoltaic (PV) power generation projects. All other content is applicable to any form of power generating facility as well as overhead transmission line projects.

Percentage by Region of Utility-Scale Solar Cases as of July 2024.



Solar CPCN Cases by Year and Associated Total MWs Projected for 2025-2026.



Individual Utility-Scale Solar Projects Ranged from 2-202 MW.

US Solar Growth Projections by Wood Mackenzie and the Solar Energy Industries Association (SEIA)®

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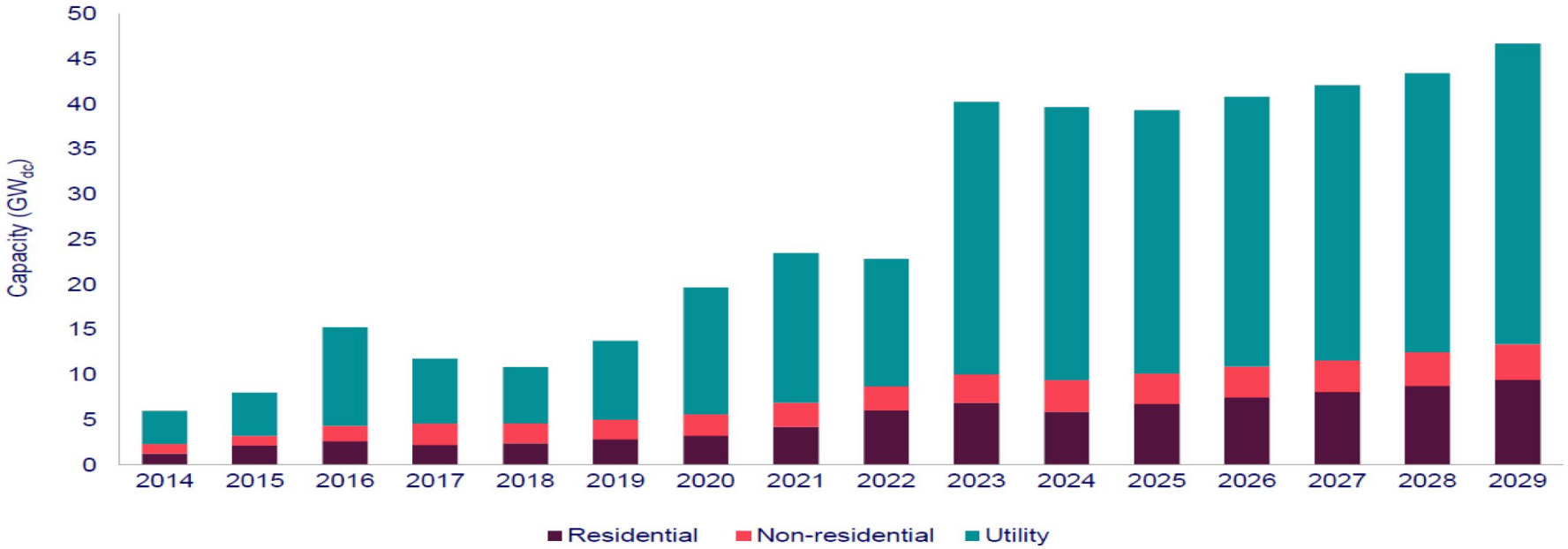
US PV installation historical data and forecast, 2014 - 2029



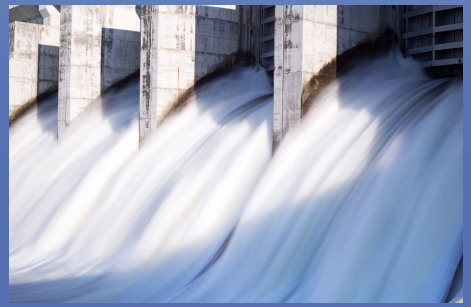
SEIA Solar Energy Industries Association®

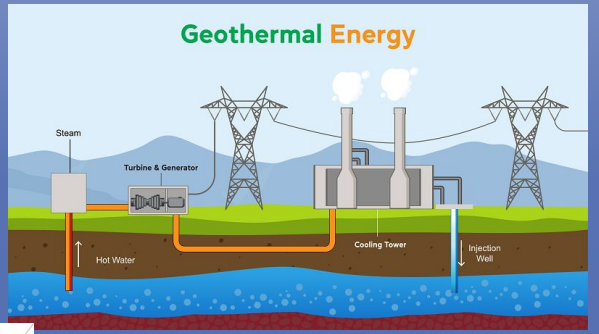
Wood Mackenzie

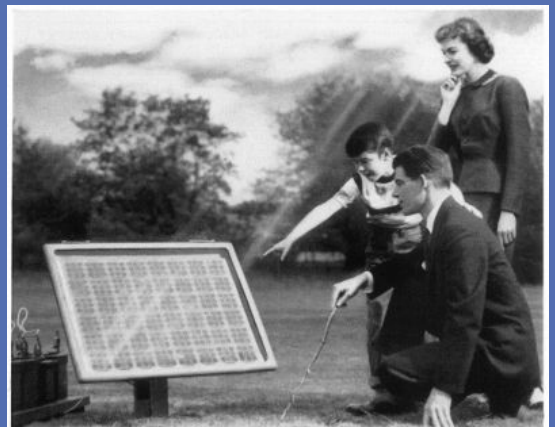
Source: SEIA/Wood Mackenzie Solar Market Insight Report Q2 2024

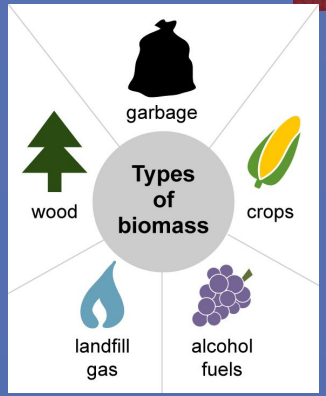
Maryland's Renewable Portfolio Standard

Renewable Energy includes









Purpose of Maryland's RPS

- **Greenhouse gas and air emission reductions**. The use of solar energy can help Maryland reduce its greenhouse gas and other air emissions from electricity generation.
  - This helps reduce health impacts from power generation and assists Maryland by contributing toward mitigating global climate change.
- **Alternative revenue for farm owners**. Utility-scale solar facilities can provide farm owners with an alternative revenue source, which can help support rural economies.
  - Can be located on farmland with less productive soils.
- **Brownfield redevelopment opportunities**. Brownfields are properties with potential hazardous substances, pollutants, or contaminants.

Benefits of Maryland's Renewable Portfolio Standard

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

Renewable Portfolio Standard (RPS)

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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

Maryland's Current RPS Requirements (Percentages)

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Maryland RPS – Percentage of Renewable Energy Required

Year	TIER 1					TIER 2 TOTAL (large Hydro)	TOTAL RPS
	Non- Carve out	Solar	Offshore Wind	Geothermal	TIER 1 TOTAL		
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

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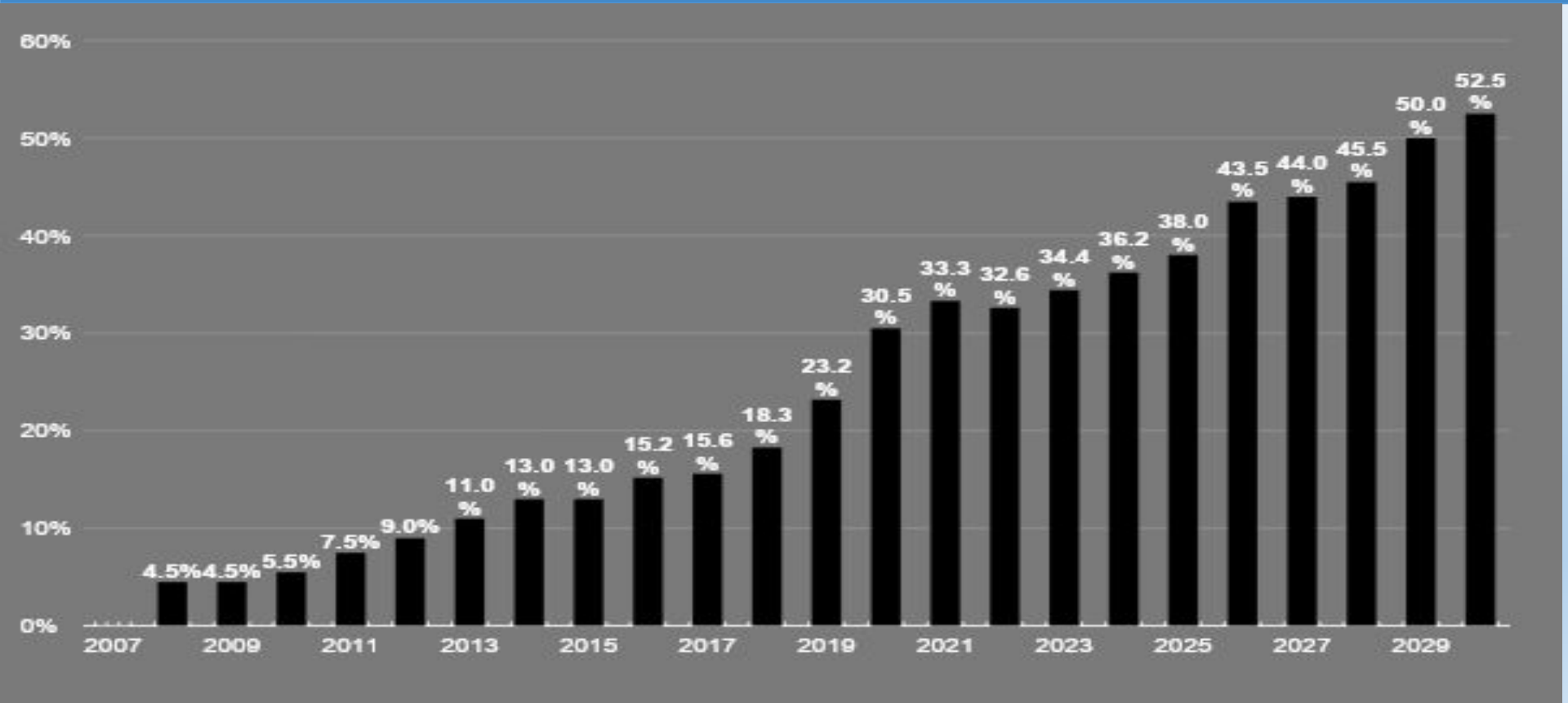

Projected Acres of Utility-Scale Solar Needed to Reach the RPS Goal.

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		

Observations/Conclusions


Chesapeake College

- The PSC indicates a 2.1% load growth increase through 2031
- 1 MW of Solar in Maryland will generate ~ 1,800 MWh of electricity annually.
- Technology and efficiency of solar panels is increasing significantly.
- Maryland's RPS amounts per category are set by legislation.
- Significant ecological benefits result from our RPS
- PPRP is willing to meet with

PPRP Website

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

Thank You!

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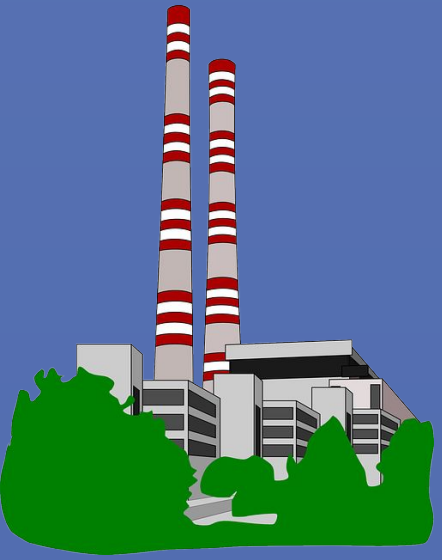
Questions?



What Research Tells Us About Solar

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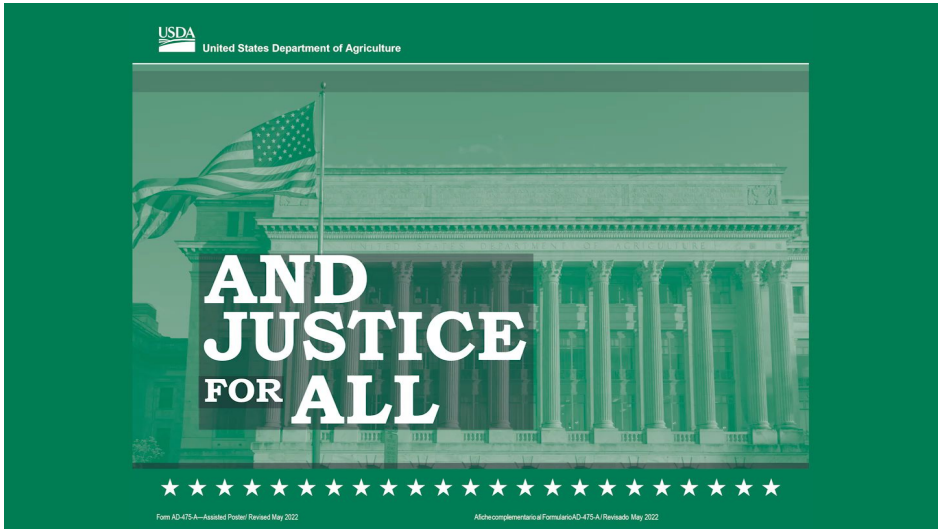
USDA
United States Department of Agriculture
AND
JUSTICE
FOR ALL
Form AD-475-A—Assisted Poster/ Revised May 2022
Afiche complementario al Formulario AD-475-A / Revisado May 2022

Agrivoltaics - Research on Barriers and Opportunities in MD

Mitchell Pavao-Zuckerman, Associate Professor
Jennifer Morash, Post-doctoral Research Associate

Environmental Science and Technology, UMD
@ecopolis

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Thanks to…

Dr. Jennifer Morash, ENST
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Garrett Fitzgerald, MoCo DEP
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Funding support from…

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Harry R. Hughes CENTER FOR AGRO-ECOLOGY

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Agrivoltaics = agriculture **+** photo**voltaics**

creating benefits across food, energy, & water systems

nature sustainability

ARTICLES

https://doi.org/10.1038/s41893-019-0364-5

Agrivoltaics provide mutual benefits across the food–energy–water nexus in drylands

Greg A. Barron-Gafford[1,2*], Mitchell A. Pavao-Zuckerman[3], Rebecca L. Minor[1,2], Leland F. Sutter[1,2], Isaiah Barnett-Moreno[1,2], Daniel T. Blackett[1,2], Moses Thompson[1,4], Kirk Dimond[5], Andrea K. Gerlak[1], Gary P. Nabhan[6] and Jordan E. Macknick[7]

***The problem**: adoption of agrivoltaics has significant barriers despite potential benefits*

lack of knowledge, conflict with traditional agricultural practices, legal and zoning obstacles, costs and markets

The 5 Cs of Agrivoltaic Success Factors in the United States: Lessons From the InSPIRE Research Study

Jordan Macknick,[1] Heidi Hartmann,[2] Greg Barron-Gafford,[3] Brenda Beatty,[4] Robin Burton,[1] Chong Seok Choi,[5] Matthew Davis,[6] Rob Davis,[7] Jorge Figueroa,[8] Amy Garrett,[9] Lexie Hain,[9] Stephen Herbert,[10] Jake Janski,[11] Austin Kinzer,[1] Alan Knapp,[12] Michael Lehan,[13] John Losey,[14] Jake Marley,[13] James MacDonald,[15] James McCall,[1] Lucas Nebert,[8] Sujith Ravi,[5] Jason Schmidt,[16] Brittany Staie,[1] Leroy Walston[2]

***Our objectives**: To explore perceptions and barriers to adoption*

1. *evaluate potential for agrivoltaics*
2. *work with ag and energy sector to identify barriers*
3. *conduct outreach and education to alleviate barriers and obstacles*

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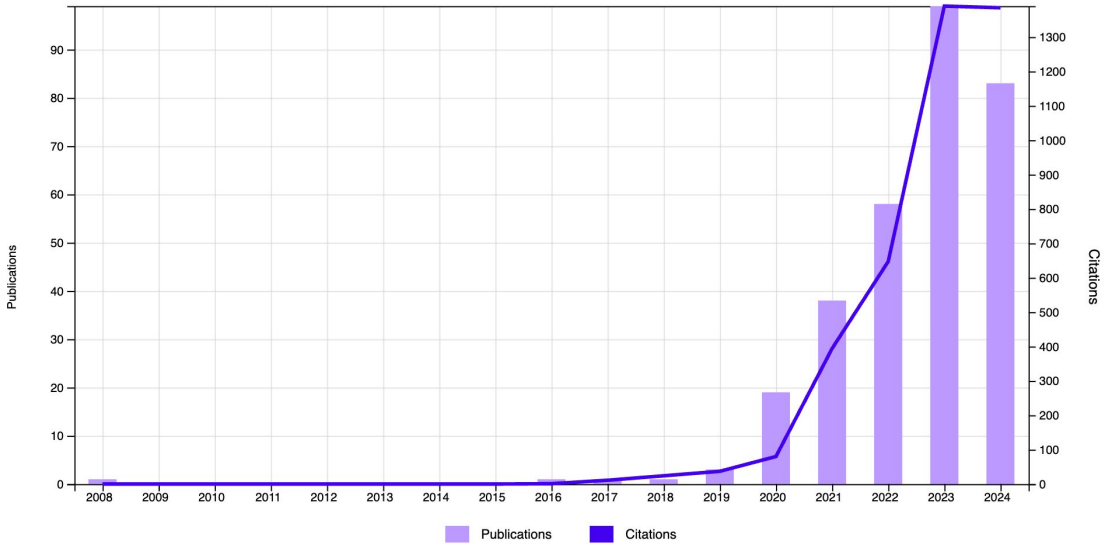
Literature Review Shows Rapid Growth Across Disciplines



Publications are increasing exponentially

Yet, many perceive that there is a lack of research

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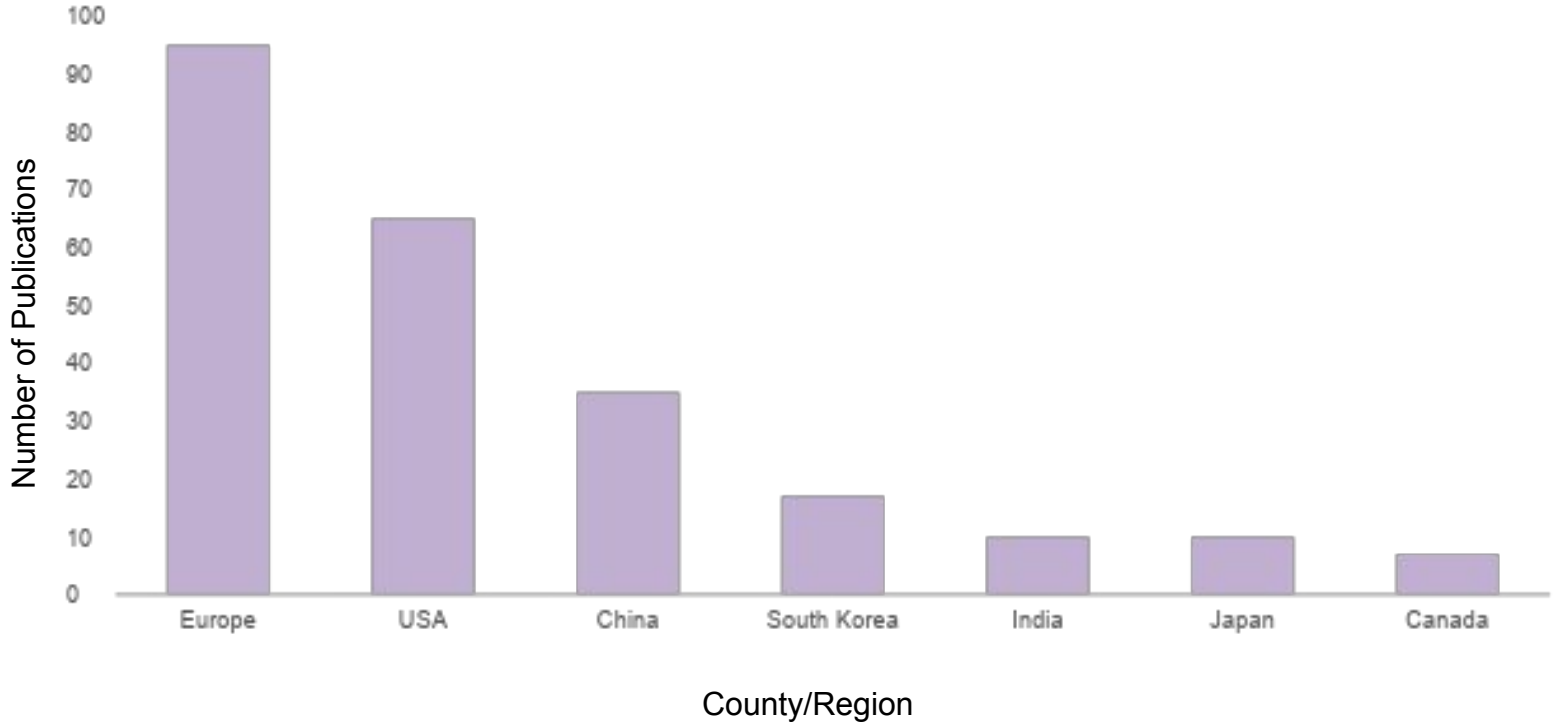
Research geographies are limited…



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interdisciplinary

agronomy, energy, design, economics, policy

Implementation of agrophotovoltaics: Techno-economic analysis of the price-performance ratio and its policy implications

Integrating solar energy with agriculture: Industry perspectives on the market, community, and socio-political dimensions of agrivoltaics

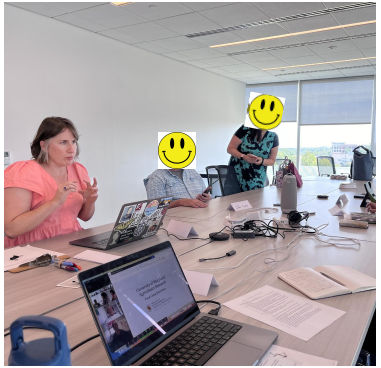
Latest Progress on Photoabsorbent Materials for Multifunctional Semitransparent Organic Solar Cells

Evaluation of solar photovoltaic systems to shade cows in a pasture-based dairy herd

Examining existing policy to inform a comprehensive legal framework for agrivoltaics in the U.S.

Participatory Research Approach
Focus Groups By Sector

Farmers
Energy Companies/Consultants
County Government
Advocates/NGOs



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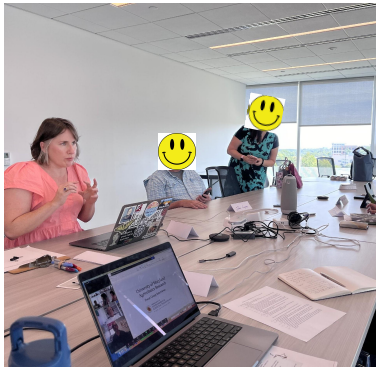
Participatory Research Approach
Focus Groups By Sector

Perceptions and definitions
Potential benefits?
How is policy/government affecting diffusion?
What impacts decision to adopt?
Sectoral implementation and logistics



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Pre-focus group surveys

97% of participants were familiar with the term ‘agrivoltaics’

68% had a positive view

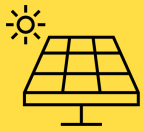
5. Does this image depict an agrivoltaic system?

- Yes
- No

Acceptance decreased if agricultural activity was not obvious. . .

Growing crops: 90%
Grazing: 89%
Pollinator habitat: 39%

Preliminary Montgomery County Agrivoltaic Opinions



We do not know enough about how agrivoltaics will impact crops in Maryland

Grazing systems seems the most accepted approach to agrivoltaics

Importance of a systems perspective

Views on policies, zoning, incentives varied – we do not know economics yet

Next Steps

Content and theme analysis from Montgomery County

Extend focus groups across the state

Synthesize findings, recommendations, roadmap

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COLLEGE OF AGRICULTURE & NATURAL RESOURCES

FEARLESSLY FORWARD

Energy Extension

UMD Agrivoltaic Initiatives

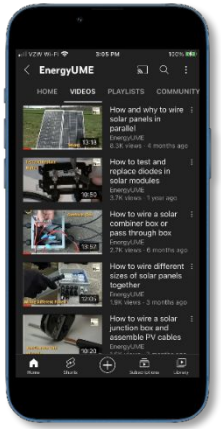
September 26, 2024
AgriSolar Summit

Drew Schiavone, PhD
Energy Specialist
University of Maryland

Maryland Energy Extension

Webpage

Video



Publications

extension.umd.edu/**Energy**

The Solar Energy Curriculum is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, through the Northeast Sustainable Agriculture Research and Education program under subaward number ENE20-165-34268

- **Module #1** Market
- **Module #2** Basics
- **Module #3** Design
- **Module #4** Regulations
- **Module #5** Installation
- **Module #6** Financial
- **Module #7** Community Solar
- **Module #8** Land Leasing
- **Module #9** Battery Backup

Maryland Energy Extension

SOLAR

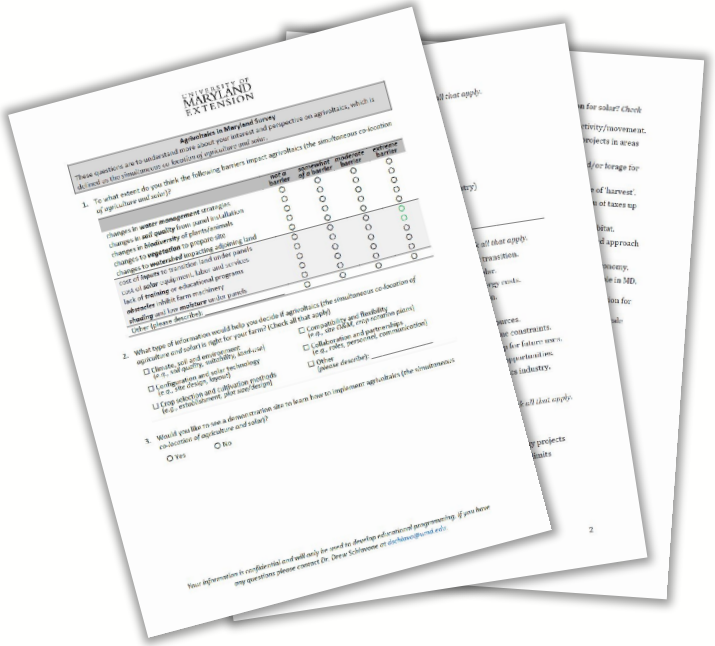
State policy calls for 14.5% solar electricity, but only 7.3% of farms have installed solar due to land-use issues and gaps in knowledge and expertise. MEE's Solar Energy initiative informs homeowners, landowners, and local government on socioeconomic and technical aspects of solar energy.

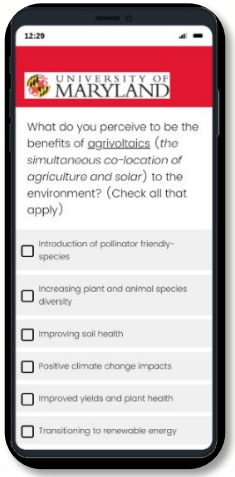
- **692** *participants*
- **6,357** *views, O/D*
- **1.02M** *video plays*
- **12,705** *pub, D/L*
- **30.2** *MW*
- **561** *GWh/yr*
- **46.5k** *homes*
- **82.3M** *energy costs*
- **155.3** *MTCO2e**
- **36k** *cars off road*

- **Curriculum** *webinar + pubs*
- **Installation** *install & maintain*
- **Solar Market** *industry overview*
- **Financing** *costs & incentives*
- **PV Basics** *components*
- **Shared Solar** *solar co-op*
- **Plan & Design** *system sizing*
- **Utility-Scale** *land leasing*
- **Regulations** *zoning & permits*
- **Battery Bank** *battery backup*

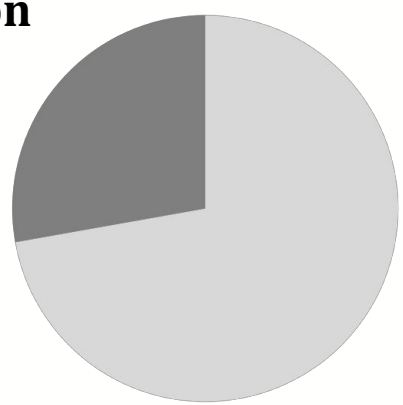
- ***Training*** *vid + pubs*
- **Wiring** *wire/fuse*
- **Ground** *earthing*
- **Panel** *output*
- **Array** *series/para*
- **Inverter** *dc/ac*
- **Design** *site/size*
- **Battery** *controller*
- **Mount** *racking*

Assessments





Interest in agrivoltaic† **demonstration**



sustainableumd

The Maryland Agrivoltaic Demonstration for Research, Education, and Outreach Project is based upon work supported by the Office of Sustainability, University of Maryland, through the Sustainability Fund.

† *simultaneous co-location of agriculture and solar*

Assessments

perceived **barriers** to agrivoltaics†

ratings*	1	2	3	4	n	Avg
changes in ***water management*** strategies	6	5	2	4	17	2.24
changes in ***soil quality*** from panel installation	5	3	3	6	17	2.59
changes in ***biodiversity*** of plants/animals	4	3	2	8	17	2.82
changes to ***vegetation*** to prepare site	4	4	3	6	17	2.65
changes to ***watershed*** impacting adjoining land	5	3	3	6	17	2.59
costs of inputs to transition land under panels	2	2	5	8	17	3.12
cost of solar equipment, labor and services	1	1	6	8	16	3.31
lack of ***training*** or educational programs	2	2	8	5	17	2.94
obstacles inhibit ***farm machinery***	2	1	7	7	17	3.12
shading and ***low moisture*** under panels	3	4	3	7	17	2.82
Other (*please describe*):	0	0	0	2	2	4.00

† *the simultaneous co-location of agriculture and solar*

* ratings based on 1 = not a barrier to 4 = extreme barrier.

Costs/Benefits

- Environmental
- Economic
- Community

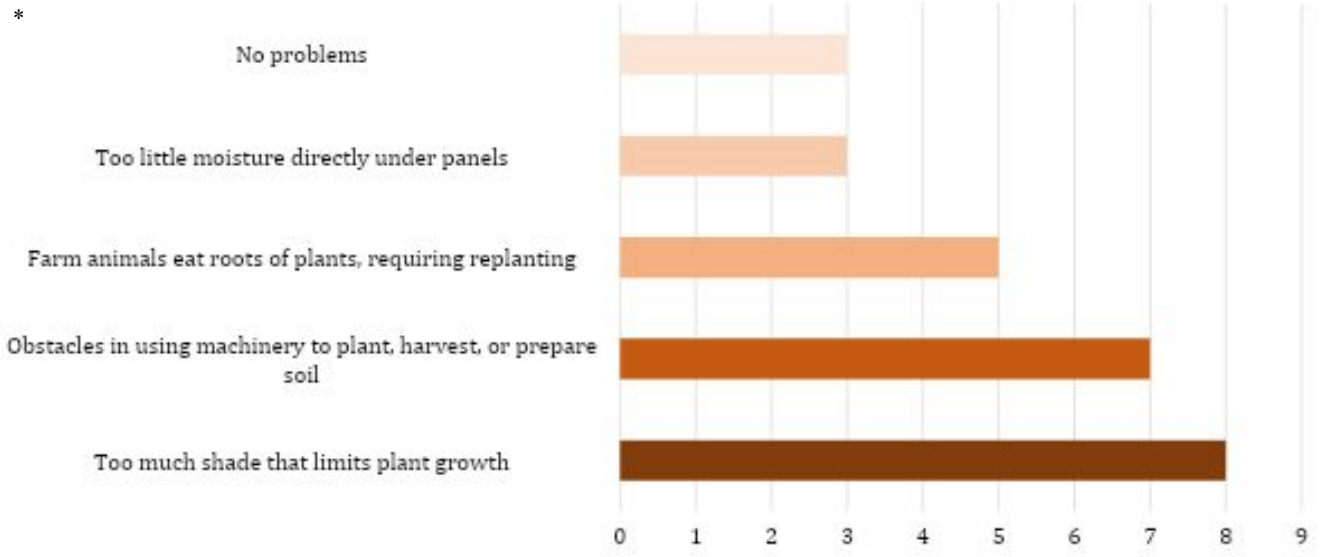
"Losing Farm Land"

"Understanding the money flow and processes of support for these projects with grants and loans"

Assessments

current **challenges** face with agisolar (n=14)

*



* Spangler, K., Buechler, S., & Lopez Olmedo, K. (2024). Understanding agrisolar in Pennsylvania.. *PennState College of Agricultural Sciences.*

Assessments

Information needed on agrivoltaics†

	n	Choice	People
Climate, soil and environment (*e.g., soil quality, suitability, land-use*)	6	13.0%	40.0%
Configuration and solar technology (*e.g., site design, layout*)	12	26.1%	80.0%
Crop selection and cultivation methods (*e.g., establishment, plot size/design*)	9	19.6%	60.0%
Compatibility and flexibility (*e.g., site O&M, crop rotation plans*)	9	19.6%	60.0%
Collaboration and partnerships (*e.g., roles, personnel, communication*)	7	15.2%	46.7%
Other (*please describe*):	7	6.5%	20.0%

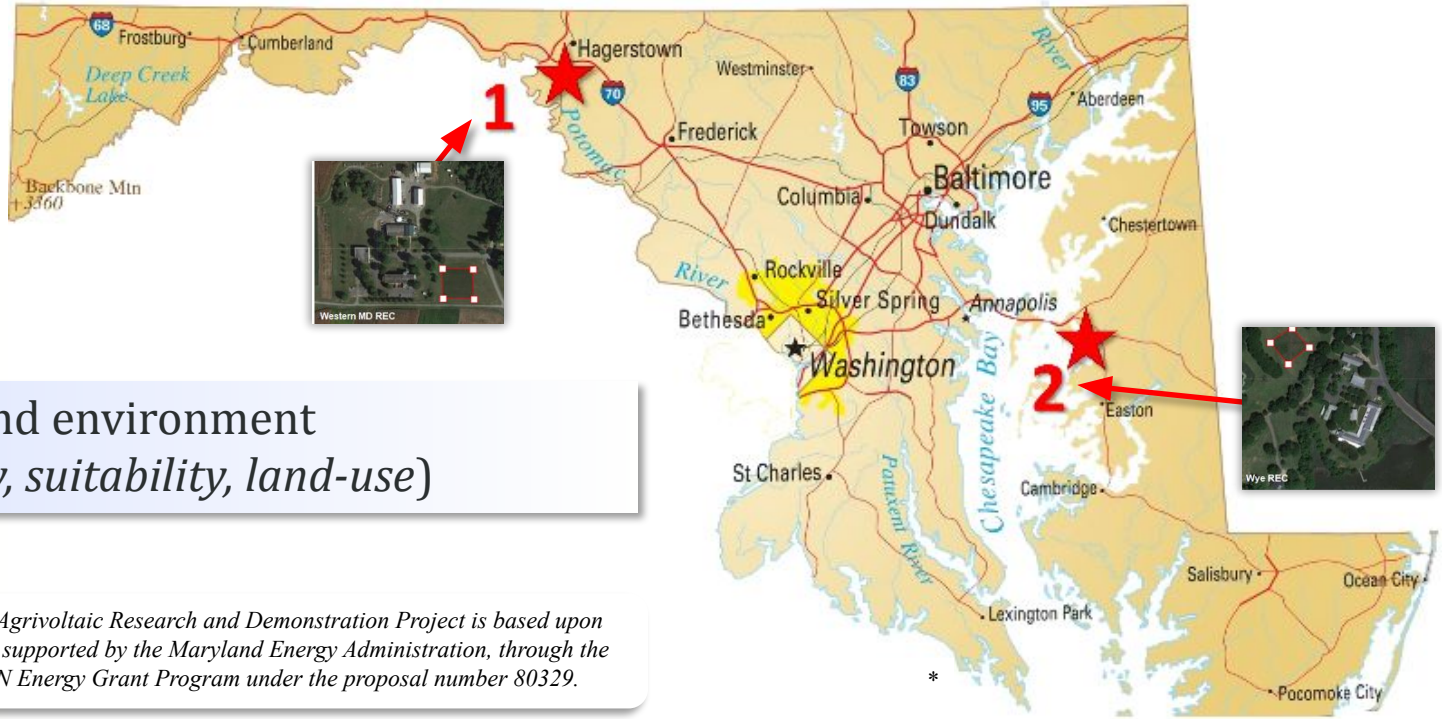
"$$$"

"Urban Solar"

"this is not agriculture"

† *the simultaneous co-location of agriculture and solar*

Agrivoltaics (ag + solar)

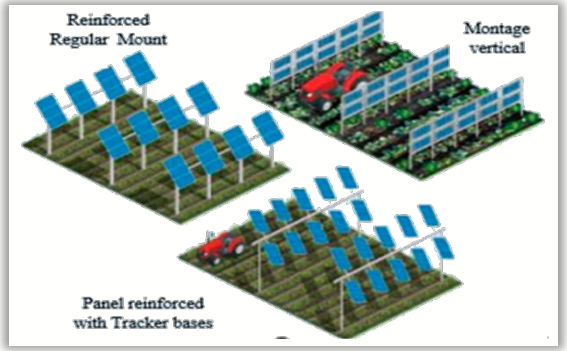


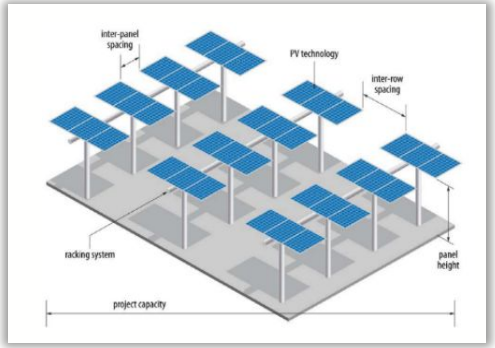
Climate, soil, and environment
(*e.g., soil quality, suitability, land-use*)

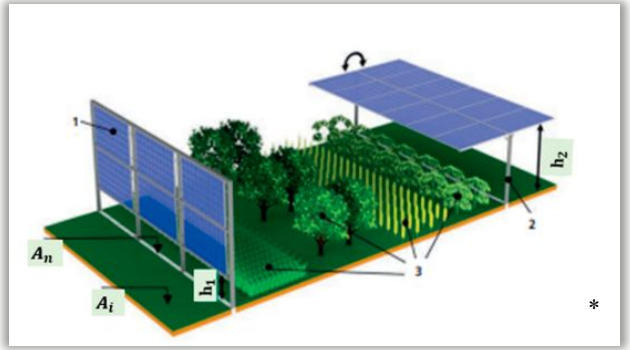
Maryland Energy Administration

This Agrivoltaic Research and Demonstration Project is based upon work supported by the Maryland Energy Administration, through the OPEN Energy Grant Program under the proposal number 80329.

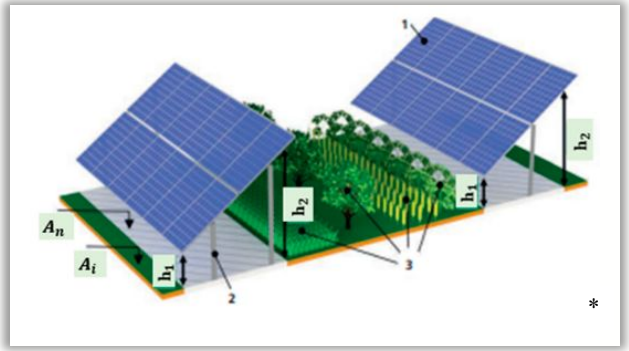
Agrivoltaics (ag + solar)







Configuration and solar technology
(*e.g., site design, layout*)



* Sarr, A., Soro, Y. M., Tossa, A. K., & Diop, L. (2023). Agrivoltaic, a synergistic co-location of agricultural and energy production in perpetual mutation: A comprehensive review. *Processes*, 11(3), 948.

Agrivoltaics (ag + solar)

Crop selection and cultivation methods (*e.g., establishment, plot size/design*)

Compatibility and flexibility (*e.g., site O&M, crop rotation plans*)

Figure 2. Agrivoltaic examples with elevated racking and optimized row spacing to accommodate farm machinery and field operations.

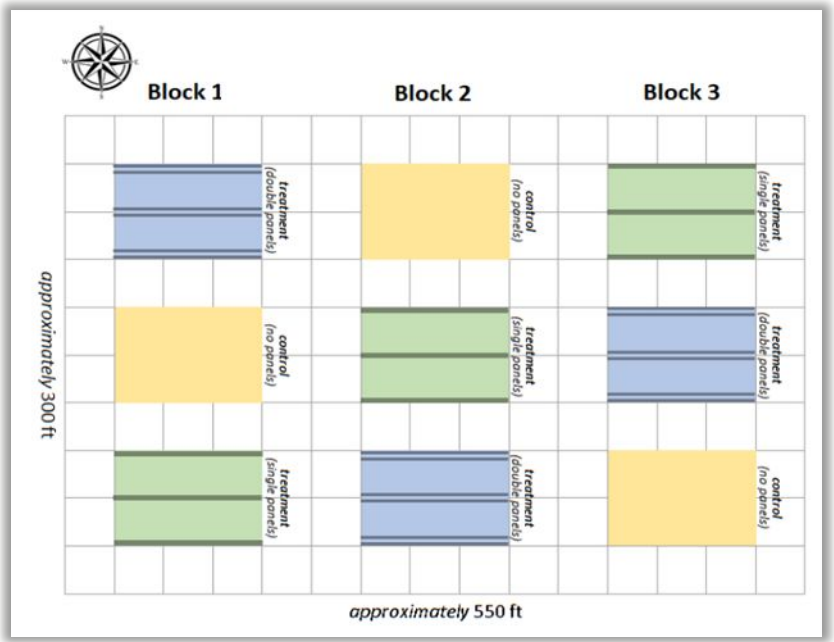


Figure 4. Potential system design and field layout at the Wye and Western Maryland RECs with possible field replications and randomized plots.

Agrivoltaics (ag + solar)

Jack's Solar Garden (Longmont, CO)
Photo by Werner Slocum, NREL

UMass Crop Animal REC Center
Photo by Dennis Schroeder, NRE

Collaboration and partnerships
(*e.g., roles, personnel, communication*)

Student Education

Institutional Research

Public Tours

Schools Tours

Farmer Education

Developer Workshops

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EXTENSION

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Leasing for Renewables

Paul Goeringer, Extension Specialist
@aglawPaul Instagram and Threads (yes Threads)

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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.

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

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UNIVERSITY OF MARYLAND

AGRICULTURE LAW EDUCATION INITIATIVE

MPOWERING THE STATE

Agriculture Law Education Initiative

The Agriculture Law Education Initiative (ALEI) is a collaboration of Francis King Carey School of Law at the University of Maryland, Baltimore (UMB), the College of Agriculture and Natural Resources at the University of Maryland (UMCP), and the School of Agriculture and Natural Sciences at the at the University of Maryland Eastern Shore (UMES).

ALEI is an initiative of the University of Maryland:
MPowering the State

Website: www.umaglaw.org

Email: umaglaw@umd.edu

Facebook: University of Maryland - Agriculture Law Education Initiative

LinkedIn: University of Maryland - Agriculture Law Education Initiative

UNIVERSITY OF MARYLAND
AGRICULTURE LAW
EDUCATION INITIATIVE
MPOWERING THE STATE

University of Maryland - MPower

The University of Maryland : *MPowering the State* brings together two universities of distinction to form a new collaborative partnership. Harnessing the resources of each, the University of Maryland, College Park and the University of Maryland, Baltimore will focus the collective expertise on critical statewide issues of public health, biomedical informatics, and bioengineering. This collaboration will drive an even greater impact on the state, its economy, the job market, and the next generation of innovators. The joint initiatives will have a profound effect on productivity, the economy, and the very fabric of higher education.

www.mpoweringmaryland.com

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.

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

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Originally developed by Elizabeth Thilmany

What to think about in leasing?

1. Resources forthcoming to assist landowners to better negotiating the leases.

2. At the same time, biggest take away from talking to landowners is keep in mind this process isn't take it or leave it.

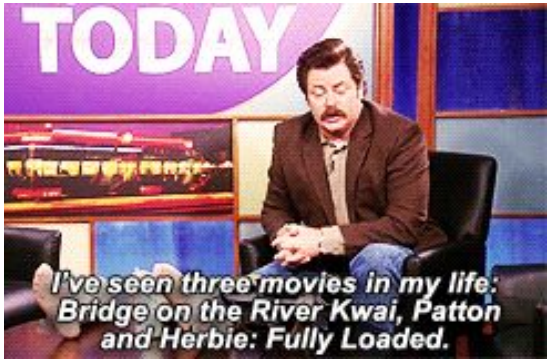
Decommissioning Costs

Decommissioning Costs

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.



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MD Decommissioning Plans

- PSC requires a decommissioning plan on file. County has option to between a bond or letter of credit to cover costs.

- As apart of the leasing process, landowners still need to think about how the restoration process will take place on their land. This would include making sure the lease includes images of the land currently and what would be expected in the restoration process.

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
Current Total	**$60,200**
Total After 20 Years (2.5% inflation rate)	**$98,900**

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

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

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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

This material is based upon work supported by USDA/NIFA under Award Number 2021-70027-34693.

NORTHEAST EXTENSION RISK MANAGEMENT EDUCATION

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

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- **Research Aim:** provide an objective analysis of current utility-scale solar projects in MD, focusing on land allocation and usage.
    - More specifically, this research seeks to answer key questions, such as: ***How much of what type of land is being developed into large, ground-mounted solar installations in Maryland?***

- **Motivation:** The 2018 report, "Benefits and Costs of Utility-Scale and Behind the Meter Solar Resources in Maryland," highlighted the importance of reassessing the Maryland Public Service Commission's (PSC) recommendations using updated data. This project addresses that gap by utilizing the Maryland Public Information Act (MD-PIA) to access and analyze critical procedural data, enabling a comprehensive geospatial analysis of solar installations.

Image generated by OpenAI's DALL·E, accessed on May 6, 2024

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The “array” of photovoltaic solar systems

- Roof-mounted systems:
  - Residential rooftop solar panels
  - Industrial (College Park Ikea Parking Lot)
- Ground-mounted systems:
  - Co-location (agrivoltaics)
  - Community solar
  - Utility-scale solar

Workflow for Extracting & Organizing Data from the CPCN Permitting Process

MARYLAND
PUBLIC SERVICE COMMISSION

Electricity

- About Us +
- Newsroom+
- Agendas & Calendars +
- Online Services +
- Related Agencies and Organizations

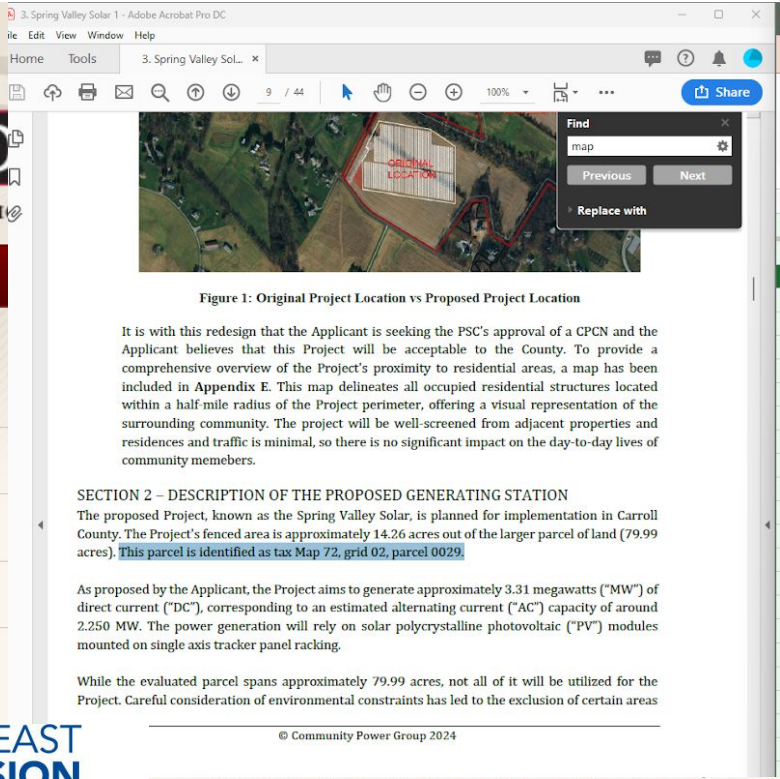


Figure 1: Original Project Location vs Proposed Project Location

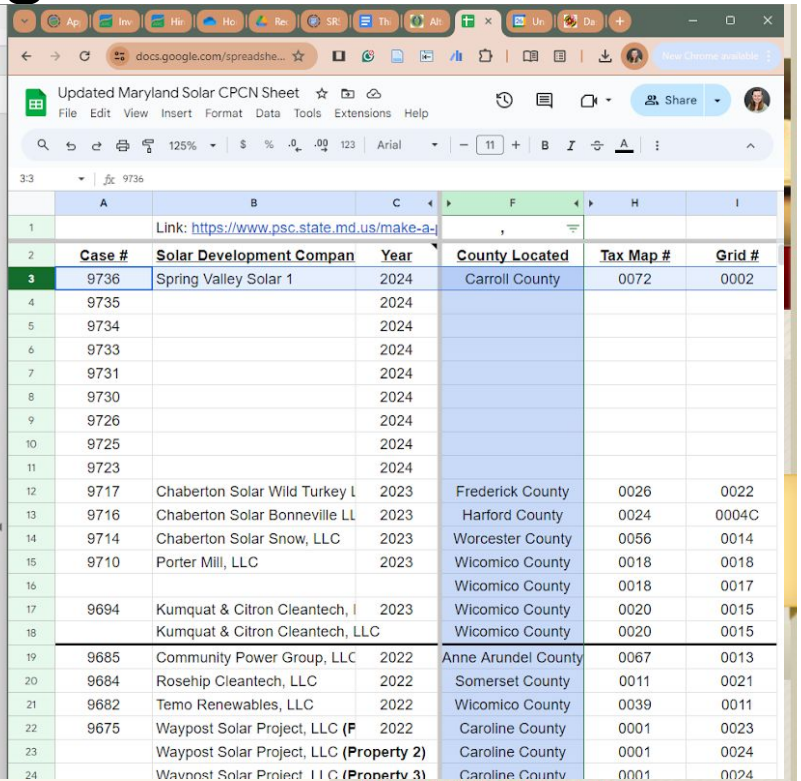
It is with this redesign that the Applicant is seeking the PSC's approval of a CPCN and the Applicant believes that this Project will be acceptable to the County. To provide a comprehensive overview of the Project's proximity to residential areas, a map has been included in **Appendix E**. This map delineates all occupied residential structures located within a half-mile radius of the Project perimeter, offering a visual representation of the surrounding community. The project will be well-screened from adjacent properties and residences and traffic is minimal, so there is no significant impact on the day-to-day lives of community memebers.

SECTION 2 – DESCRIPTION OF THE PROPOSED GENERATING STATION

The proposed Project, known as the Spring Valley Solar, is planned for implementation in Carroll County. The Project's fenced area is approximately 14.26 acres out of the larger parcel of land (79.99 acres). This parcel is identified as tax Map 72, grid 02, parcel 0029.

As proposed by the Applicant, the Project aims to generate approximately 3.31 megawatts ("MW") of direct current ("DC"), corresponding to an estimated alternating current ("AC") capacity of around 2.250 MW. The power generation will rely on solar polycrystalline photovoltaic ("PV") modules mounted on single axis tracker panel racking.

While the evaluated parcel spans approximately 79.99 acres, not all of it will be utilized for the Project. Careful consideration of environmental constraints has led to the exclusion of certain areas



	Case #	Solar Development Compan	Year	County Located	Tax Map #	Grid #
3	9736	Spring Valley Solar 1	2024	Carroll County	0072	0002
4	9735		2024			
5	9734		2024			
6	9733		2024			
7	9731		2024			
8	9730		2024			
9	9726		2024			
10	9725		2024			
11	9723		2024			
12	9717	Chaberton Solar Wild Turkey L	2023	Frederick County	0026	0022
13	9716	Chaberton Solar Bonneville LL	2023	Harford County	0024	0004C
14	9714	Chaberton Solar Snow, LLC	2023	Worcester County	0056	0014
15	9710	Porter Mill, LLC	2023	Wicomico County	0018	0018
16				Wicomico County	0018	0017
17	9694	Kumquat & Citron Cleantech, I	2023	Wicomico County	0020	0015
18		Kumquat & Citron Cleantech, LLC		Wicomico County	0020	0015
19	9685	Community Power Group, LLC	2022	Anne Arundel County	0067	0013
20	9684	Rosehip Cleantech, LLC	2022	Somerset County	0011	0021
21	9682	Temo Renewables, LLC	2022	Wicomico County	0039	0011
22	9675	Waypost Solar Project, LLC (F	2022	Caroline County	0001	0023
23		Waypost Solar Project, LLC **(Property 2)**		Caroline County	0001	0024
24		Waypost Solar Project, LLC **(Property 3)**		Caroline County	0001	0024

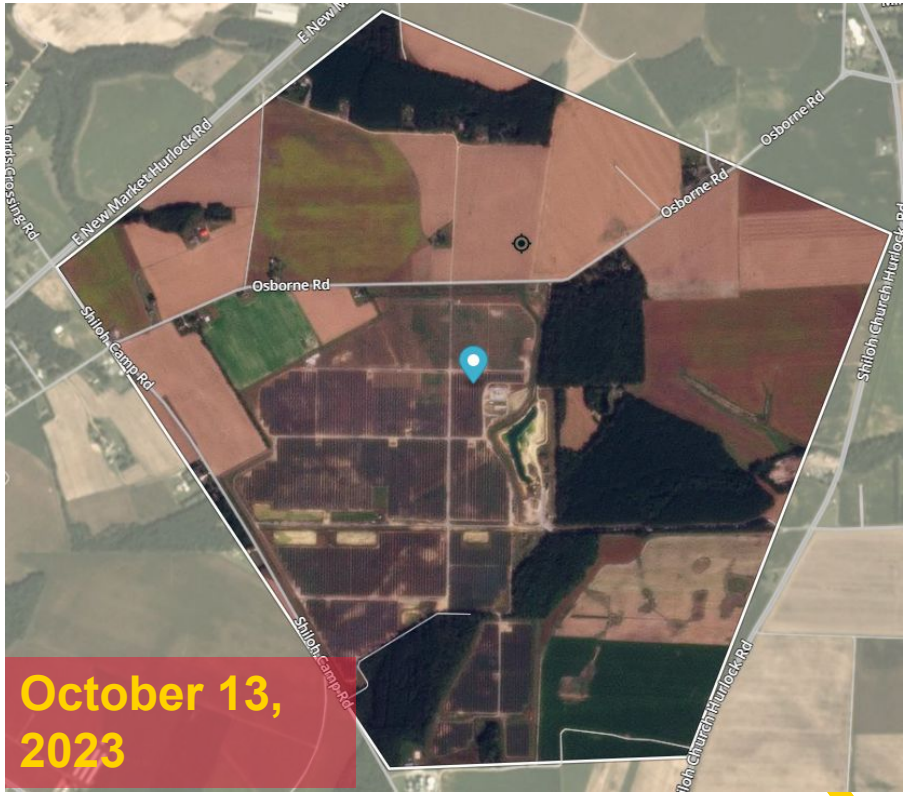
NORTHEAST EXTENSION RISK MANAGEMENT EDUCATION

3.0 MW solar facility (Carroll County)

- **Case No. 9723** – Crockett Solar I, LLC
  61.2 MW solar facility (Talbot County)

File a Public Comment
Supplier/Utility Complaint Data
Transforming the Grid (PC44)

Getting the Spatial Imagery from Planet Labs



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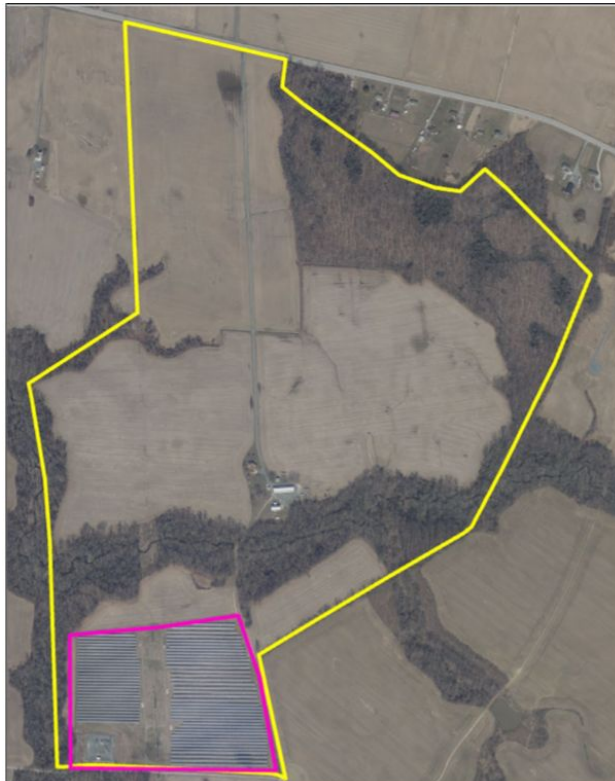
CPCN = 9457 – 50 MW in Dorchester County (Hurlock, MD)

Example of data creation in ArcGIS Pro of tracing the maximum extent, perimeter, of USS installations (pink) within implicated tax parcel(s) (yellow)

- Creating two geodatabases for Maryland:
  - 1 = All properties in MD impacted by USS projects at any stage of the approval process
  - 2 = For all built USS projects in MD, the traced perimeter of the area with installed panels



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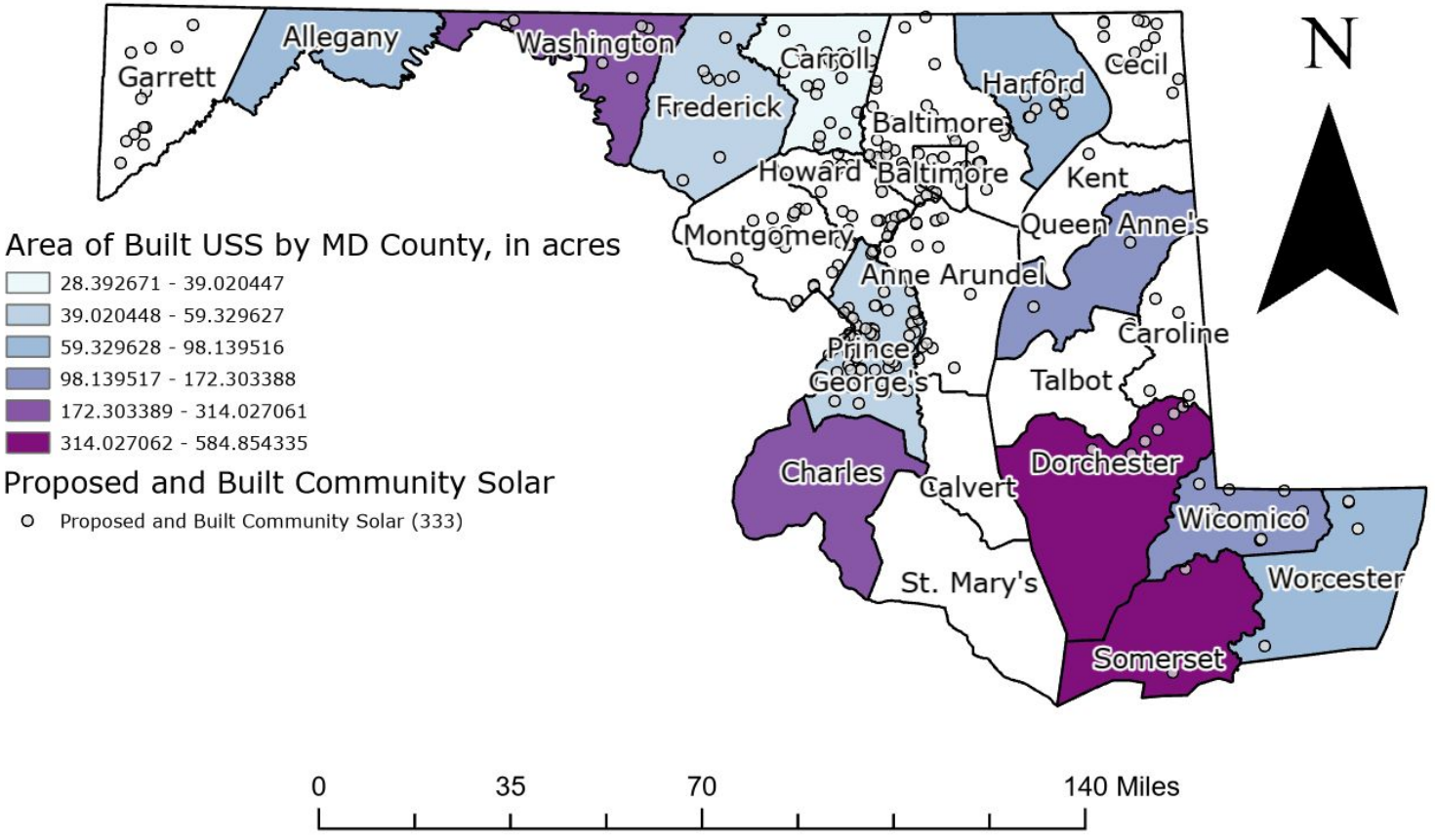
Leading to static map and tool development

- built utility-scale solar and community-scale solar developments



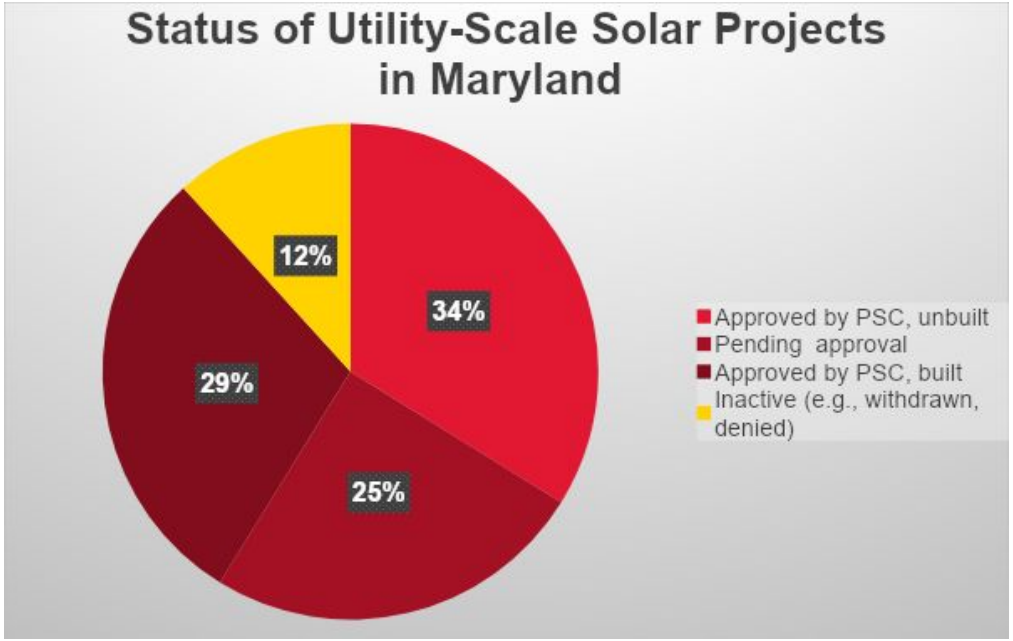
Most recent analysis results (May 2024)

- *of only utility-scale solar projects in Maryland*

Analysis from data mining, pre-processing, and analysis

As of May 2024, 68 USS projects are involved in MD's CPCN process, 60 of which are still active:

- Approved but Not Built: As of February 2024, 34% (n=23) have PSC approval, but construction has yet to commence.
- Pending PSC Approval: 25% (n=17) are awaiting PSC approval
- Built: 29% (n=20) have been approved by PSC and constructed as of February 2024.
- Withdrawn or Canceled: 12% (n=8) were withdrawn or canceled as of April 2024.



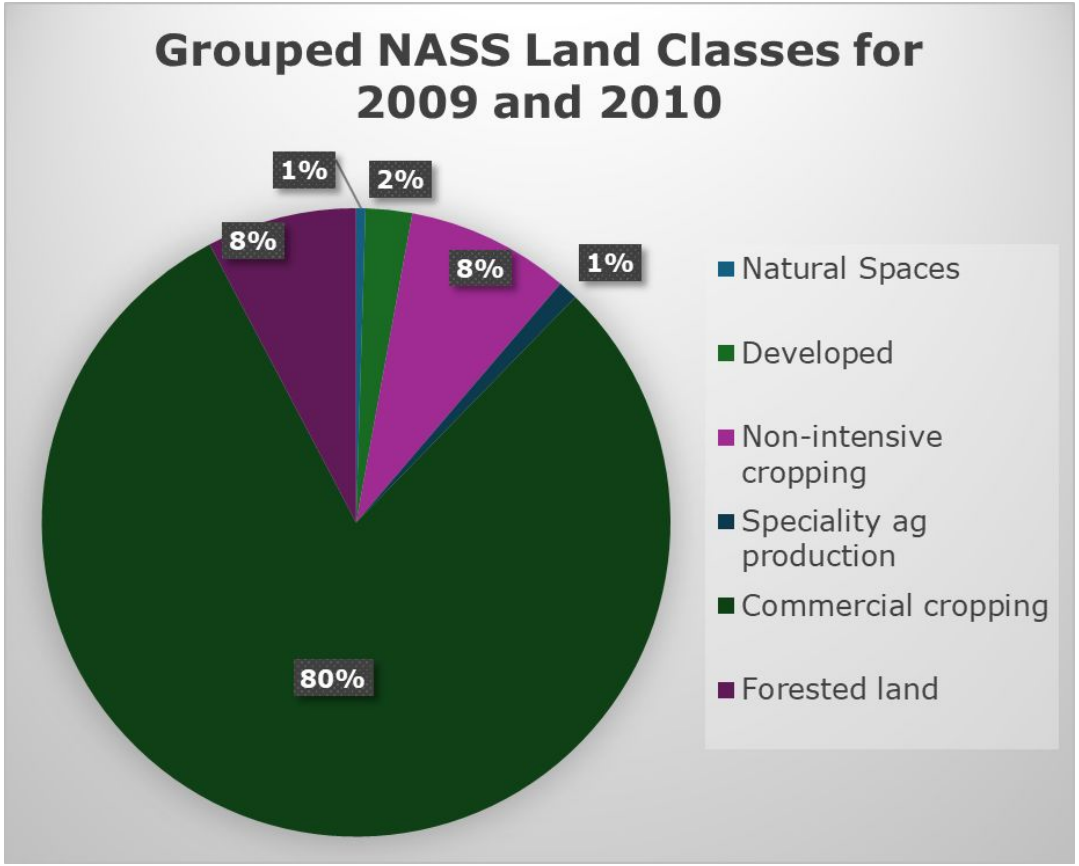
Breakdown of the Statuses of MD's Current USS Projects in the CPCN Process – as of May 1, 2024

The MD Land Under Utility-Scale Solar Panels

as of May 2024

~1,965 acres of land are under utility-scale solar panel projects:

- Commercial cropping acres displaced ~ 1,572
- Non-intensive cropping acres displaced ~ 157
- Forested land acres displaced ~ 157
- Developed acres displaced ~ 31.5
- Specialty ag production acres displaced ~ 15.7
- Natural spaces acres displaced ~ 15.7



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Common Land Characteristics for Large Scale Solar

Flat land: Gently sloping, south-facing slopes are still considered

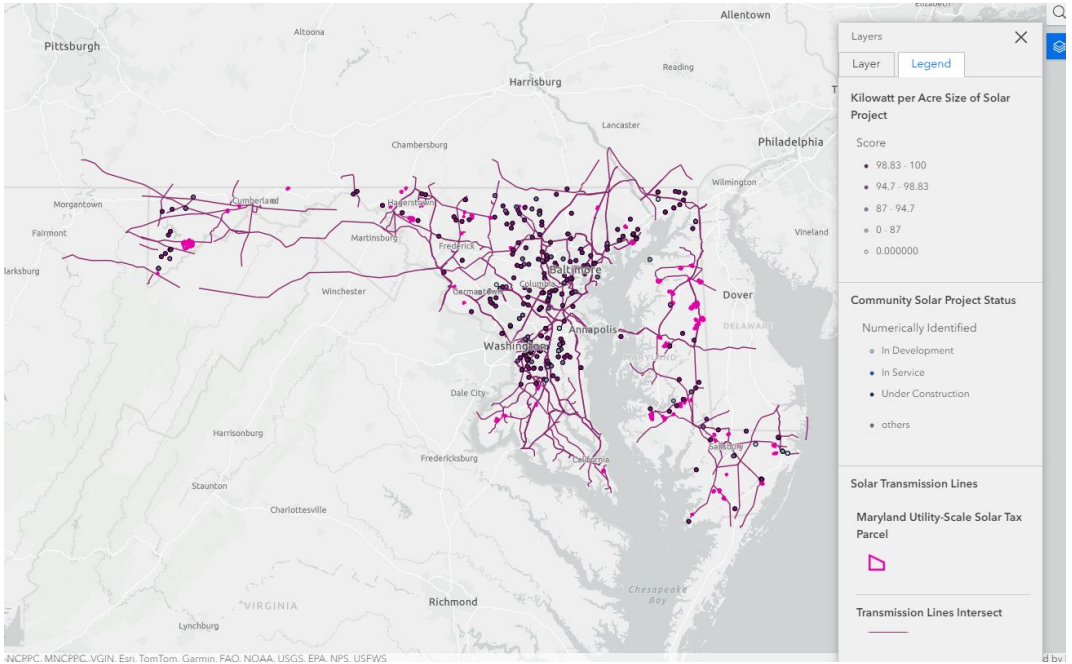
Minimal obstructions: Avoids additional clearing costs.

Dry and accessible: Reduces construction challenges and costs.

There's a power line or substation nearby The grid can handle the amount of electricity your solar farm would produce.

demonstration

go.umd.edu/solar_tool



Explore Large-Scale Solar Developments in Maryland

What Can I Do With This Web App?

This Web App has three pages, the Landing Page (you're here now), a Utility Scale Solar Dashboard, a Community Solar Dashboard, information on engaging with large-scale solar-siting, and additional information.

You can navigate between those pages by clicking on each tabs title above. Dashboards give a broad view of the solar landscape. Individual Pages allow you to search information.

To understand what the map means, use the bullet list legend button.

Each map is made of different layers of data, see all of the different data layers on the page and switch them on and off, use the three layer button.

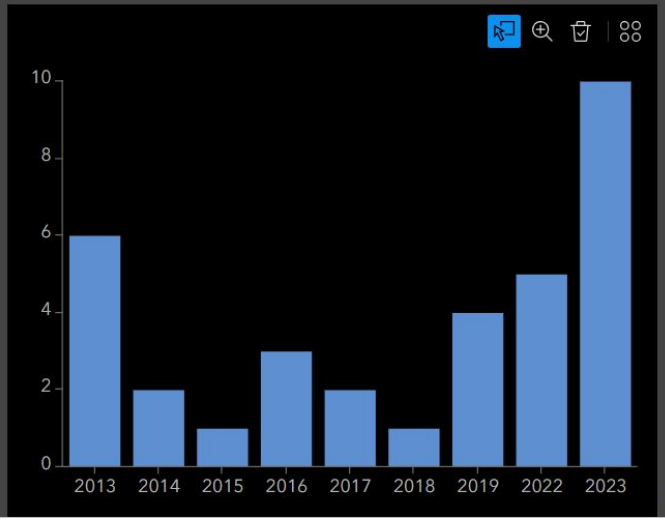
Total Installed Acres of Utility Scale Solar

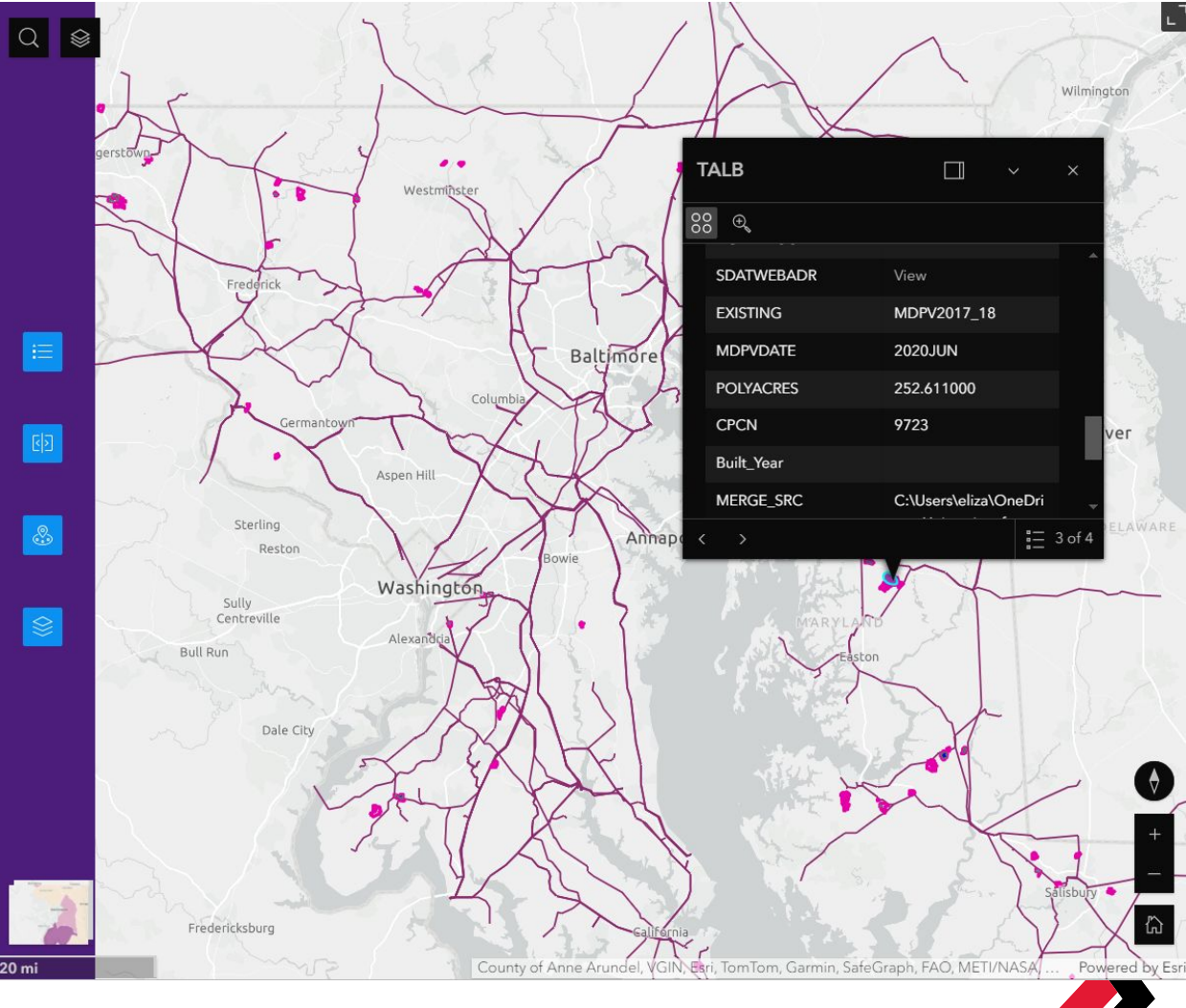
1,965

As of 6/1/24

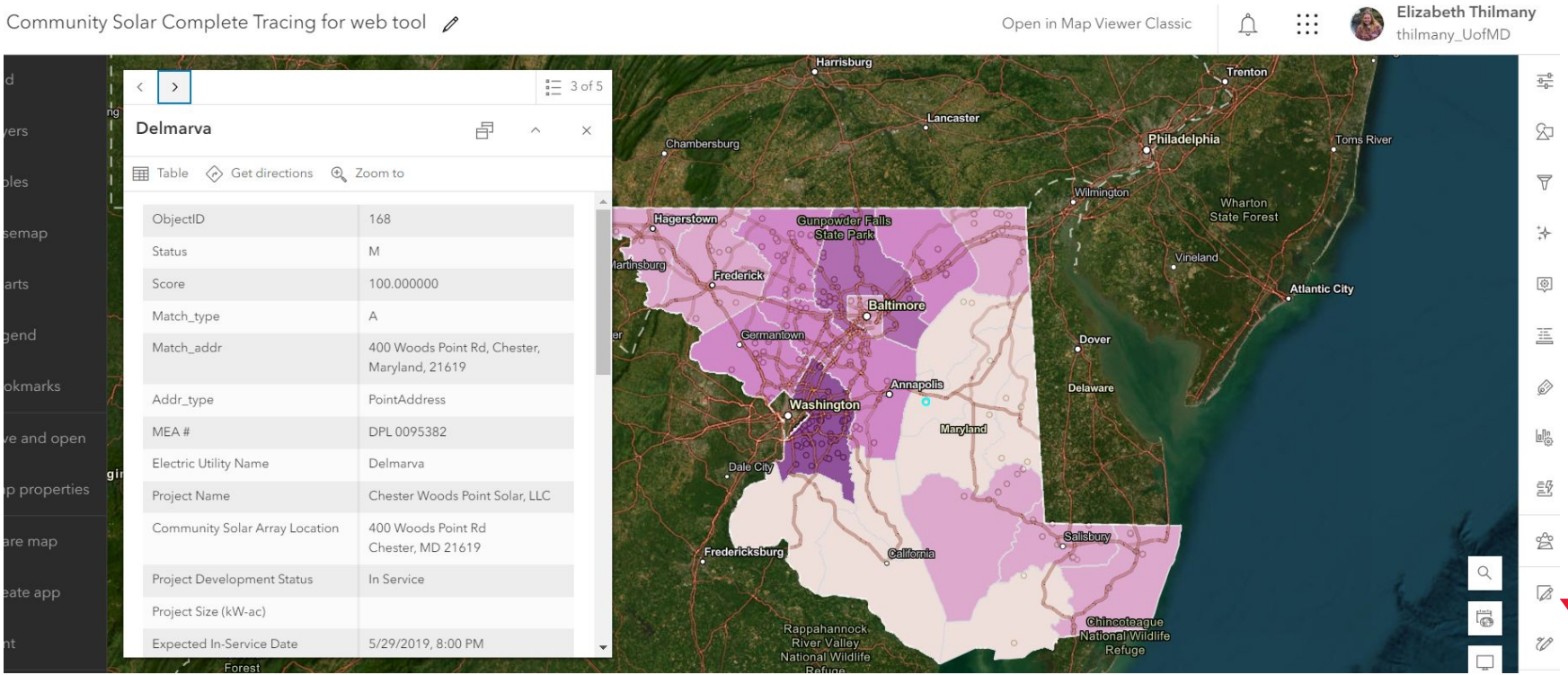
"In Maryland (MD), the Renewable Energy Portfolio Standard requires renewable energy (RE) to account for 50% of the state's energy production by 2030, with solar comprising 14.5 % (Renewable Energy Portfolio Standard, § 7-703)."

E. Thilmany, P. Goeringer, D. Kay, and A. Chatrchyan (2024). Aligning Renewable

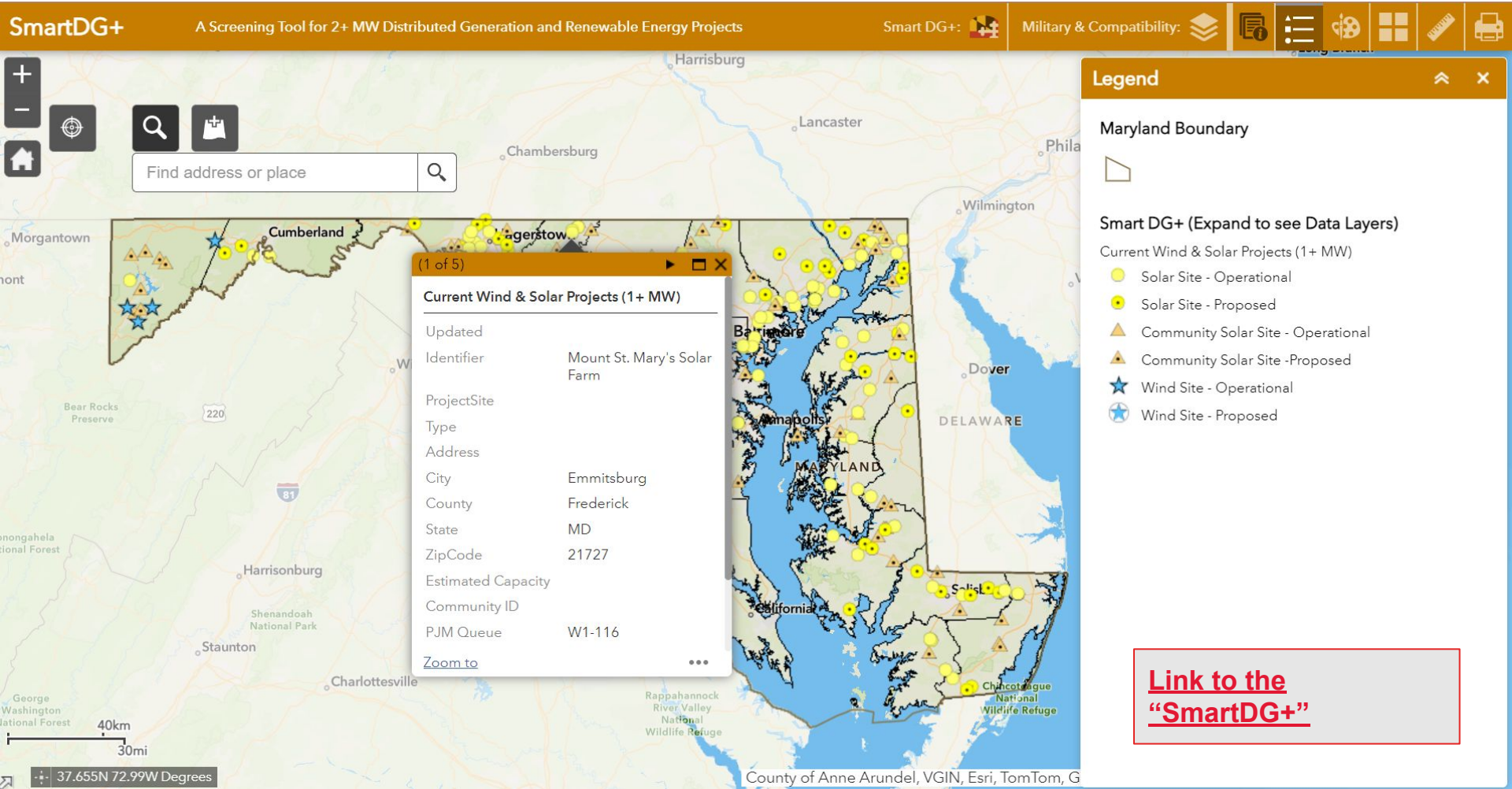




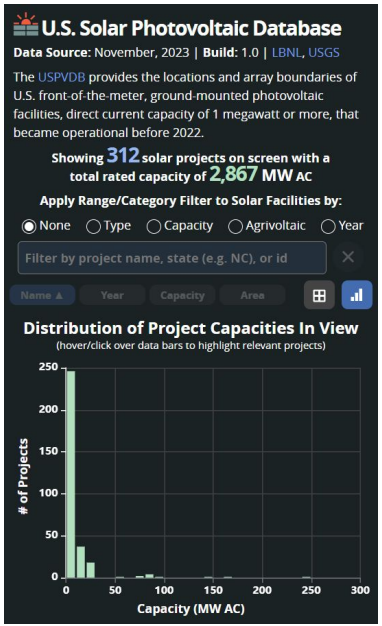
Adding in Community-Scale Solar

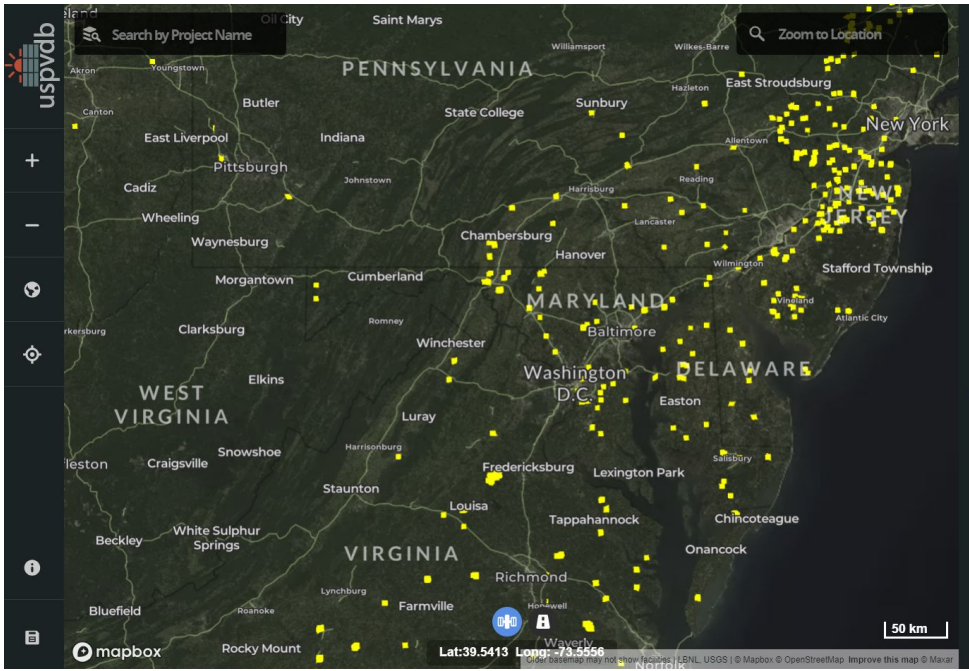


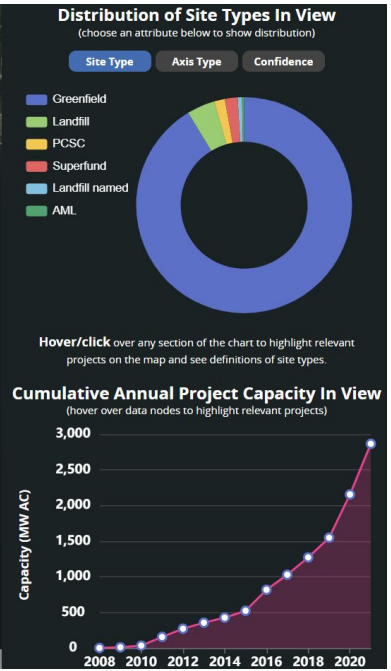
Additional Resources & Tools


SmartDG+
A Screening Tool for 2+ MW Distributed Generation and Renewable Energy Projects
Smart DG+:
Military & Compatibility:
Find address or place
Harrisburg
Lancaster
Chambersburg
Wilmington
Morgantown
Cumberland
Dover
DELAWARE
MARYLAND
Annapolis
Harrisonburg
Staunton
Charlottesville
Bear Rocks Preserve
Shenandoah National Park
Chincoteague National Wildlife Refuge
(1 of 5)
Current Wind & Solar Projects (1+ MW)
Updated
Identifier
Mount St. Mary's Solar Farm
ProjectSite
Type
Address
City
Emmitsburg
County
Frederick
State
MD
ZipCode
21727
Estimated Capacity
Community ID
PJM Queue
W1-116
Zoom to
Legend
Maryland Boundary
Smart DG+ (Expand to see Data Layers)
Current Wind & Solar Projects (1+ MW)
Solar Site - Operational
Solar Site - Proposed
Community Solar Site - Operational
Community Solar Site -Proposed
Wind Site - Operational
Wind Site - Proposed
Link to the "SmartDG+"
40km
30mi
37.655N 72.99W Degrees
County of Anne Arundel, VGIN, Esri, TomTom, G

U.S Solar Photovoltaic Database (NREL, 2021)







Ongoing Work – Tool Development and Outreach

- Continue digesting Focus Group data with New York and Maryland ***landowners.***
- Publish online curriculum
- Finalize tool
- Interested in being notified?
  - Fill out the form at **go.umd.edu/solar_info**
  - Or give me your email

go.umd.edu/solar_tool

COLLEGE OF AGRICULTURE & NATURAL RESOURCES

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Home
About
Research
Extension
Project Team
Contact
Solar Energy Production on Agricultural Lands
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www.solarleasing.umd.edu

Thank you

COLLEGE OF AGRICULTURE & NATURAL RESOURCES

FEARLESSLY FORWARD

AGRISOLAR SUMMIT

SEPTEMBER 26, 2024

John Miller, Vice President, Development

Lauren Barchi, Manager, Community Impact

chaberton ENERGY

chaberton ENERGY

- Founded in 2020
- Headquartered in Maryland
- 50 employees
- 300+ combined years of solar experience

Inc. 5000

#34

FASTEST-GROWING PRIVATE COMPANY

#1

FASTEST-GROWING COMMUNITY SOLAR COMPANY

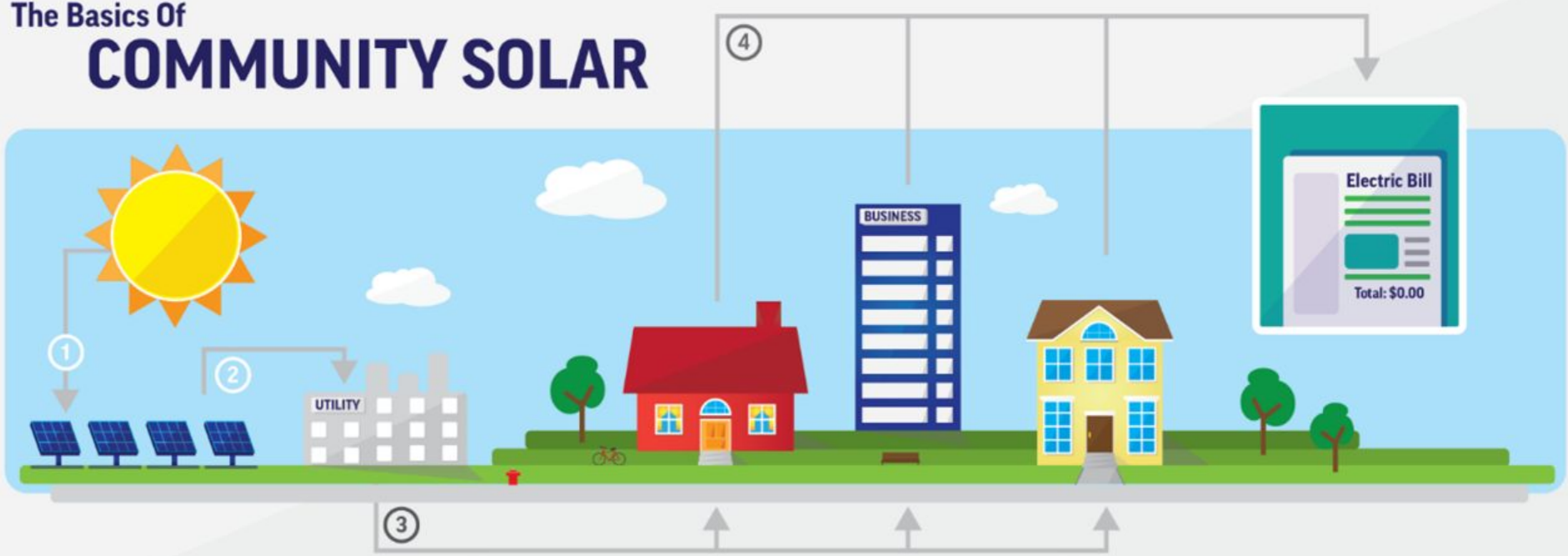
ON THE 2024 INC. 5000 LIST

COMMUNITY SOLAR SUPPORTS LAND PRESERVATION

- Responsibly developed, constructed, and maintained solar projects preserve land for future uses
- Solar projects are a temporary use; flexibility for future use as land returned to original state
- Often utilize only a portion of a property, diversifying landowner revenue and enabling other uses, such as agriculture, to continue and/or expand on site (e.g., grazing, dual harvest)
- With a properly designed and maintained ground cover, including pollinators & native meadow grasses, can increase soil quality while land lay ‘fallow’
- With the shift to livestock grazing as a standard for vegetation management, industry is implementing sustainable practices that support local businesses & mitigate mowing
- Introduces fewer herbicides and other chemicals to the soil for the lifetime of the project.
- Provide an option for landowners & farmers who are interested in dedicating a portion of their field for another use, but want to maintain ownership long term (revenue diversification)
- There is more to be done via close partnership between solar and agricultural communities to deploy meaningful and commercially viable dual harvest options

chaberton ENERGY

The Basics Of COMMUNITY SOLAR



1 The sun hits the panels and generates electricity.

2 Electricity flows through the on-site meter to the electrical utility grid.

3 Utility measures the generated electricity and calculates the dollar amount for the power.

4 Utility distributes the dollar amount as a credit to subscribers on their bills.

COMMUNITY SOLAR FITS WELL WITH AGRICULTURE

- Typically, less than 40 acres.
- Often utilizes only a portion of the site, allowing remaining land to be used for agriculture or other uses.
- Supports the local community by providing direct cost savings on utility bills.
- Offers long-term, stable revenue to landowners, who can reinvest these funds to support agricultural or other uses on the property.
- Proper planting and maintenance of a native or pollinator-friendly can improve soil quality over time.
- Creating pollinator habitats attracts pollinators, which can boost agricultural yields.
- Solar is a temporary use which returns the land to a natural state

COMMUNITY SOLAR IS NATURALLY LIMITED

We need to meet many criteria to find a property that works for solar.

Close proximity to 3-phase powerlines with available capacity

Moderate, gentle slope for optimal installation

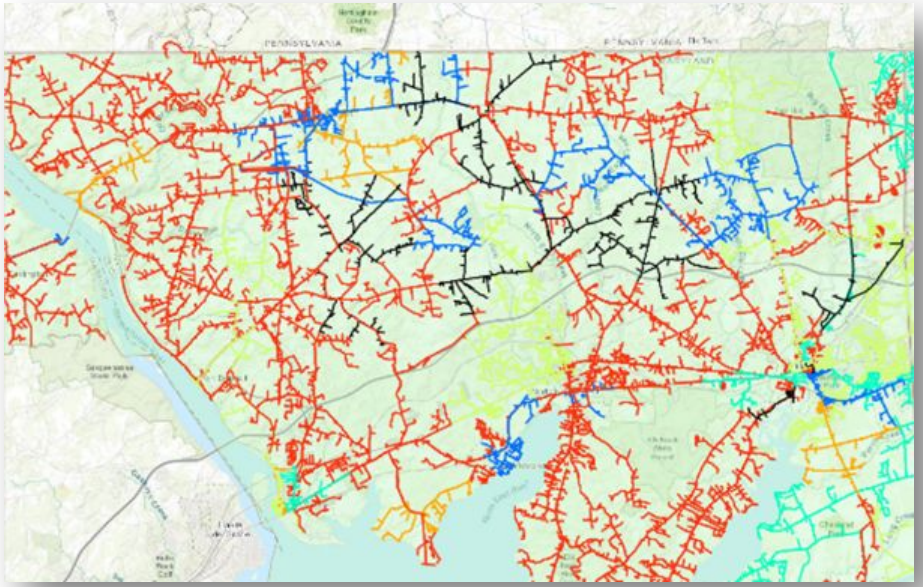
Minimal or neutral environmental impact

Cooperative and willing property owner

- Viable existing three-phase lines are the most limiting factor.
- Current interconnection rules restrict the capacity available on each existing three-phase circuit.
- Typically, each three-phase circuit is limited to supporting three or fewer projects.

SOLAR HOSTING CAPACITY IS RESTRICTED

- Many circuits (black and red) are already too constrained to accommodate additional capacity.
- Addition of a single project (teal and blue) is likely to fully utilize circuits with any available capacity.
- The most robust and available circuits are often located in densely populated areas, where solar development is limited or not feasible.



Delmarva Hosting Capacity- Cecil County Area

SOLAR BEST PRACTICES ARE EVOLVING

Native or Pollinator Vegetation

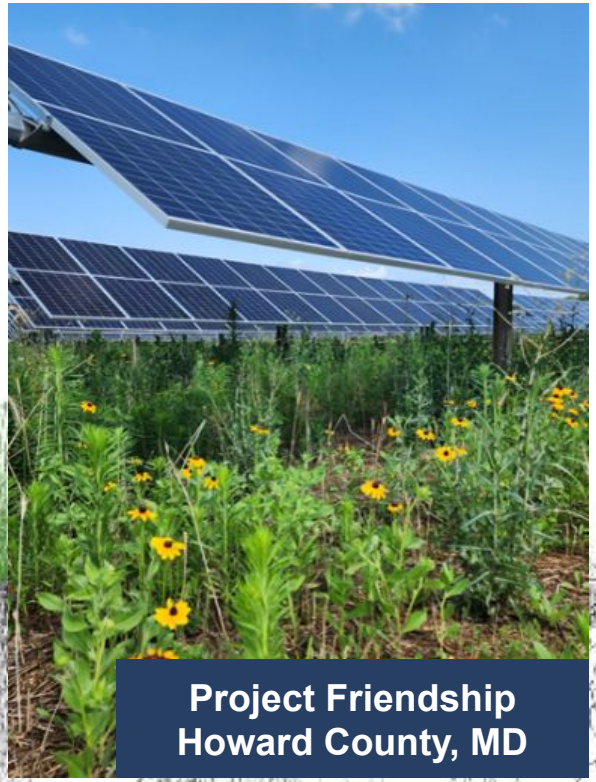
Livestock Grazing

Dual Harvest

We are actively planning for Dual Harvest opportunities on our sites, but are looking for support and partnerships from local experts on the best way to design & implement

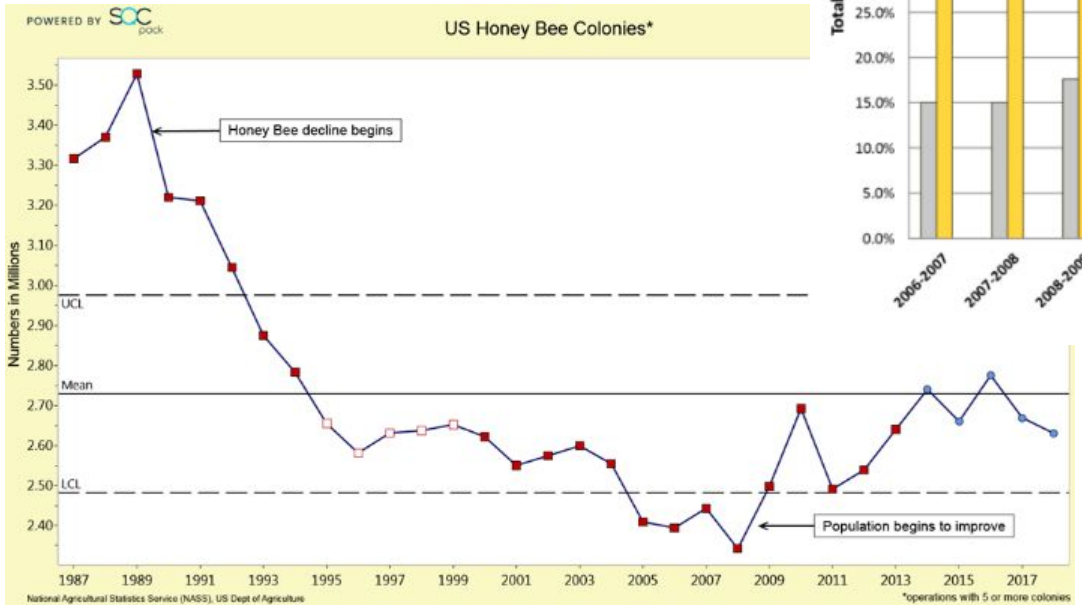
VEGETATION MANAGEMENT IS A STANDARD PRACTICE

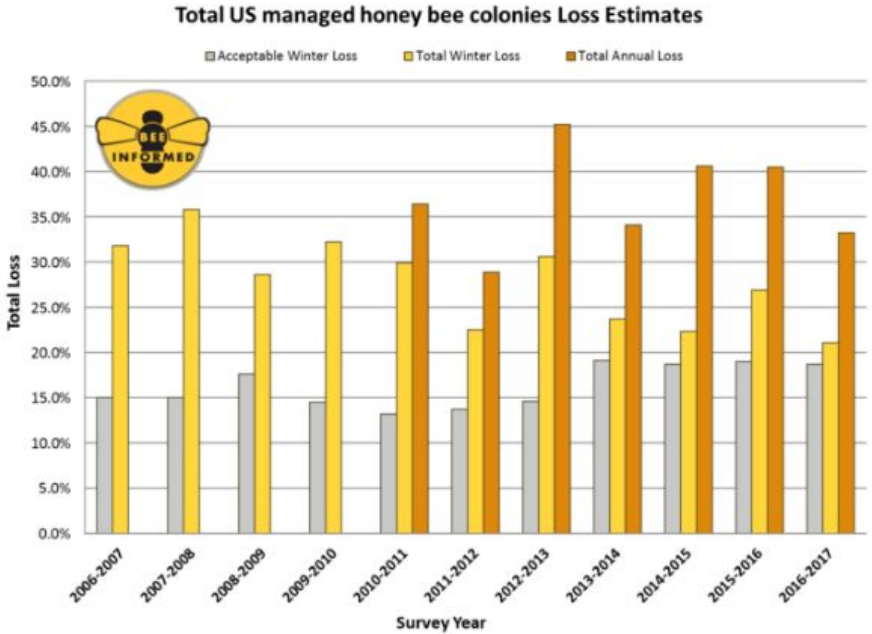
- Each site is evaluated based on its unique characteristics & location, with a qualifying native or pollinator seed mix selected to create a “meadowscape” beneath the solar array.
- Native vegetation develops deep root systems that require less water and help restore nutrients to the soil.
- Planting & maintaining a robust pollinator habitat reduces long-term maintenance costs.
- Promotes ecological diversity.
- Limits use of herbicides and pesticides:
  - No mass spraying or runoff.
  - Targeted spraying focused on small pockets of invasive species.



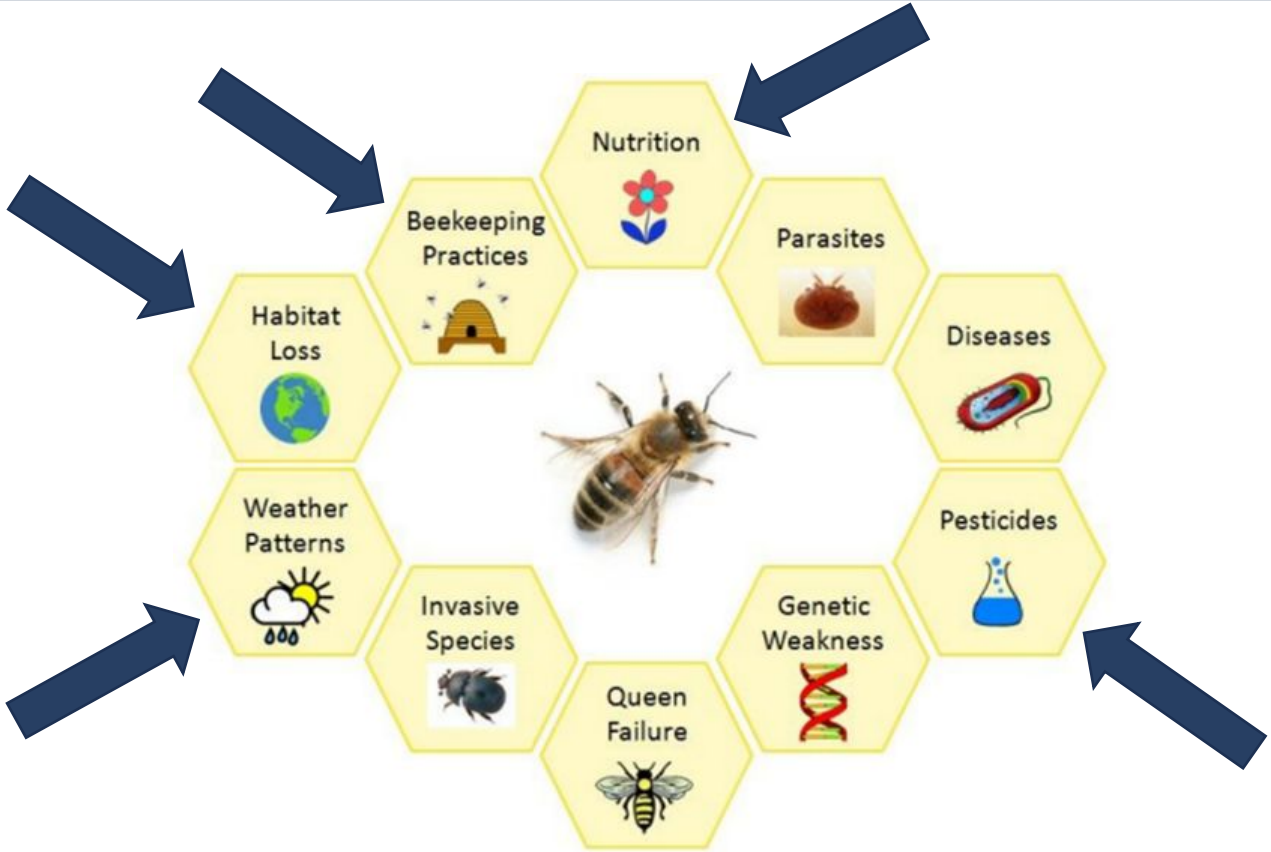
Project Friendship
Howard County, MD

POLLINATORS ARE DECLINING





SUSTAINABLE AND RESPONSIBLE SOLAR CAN HELP



DECOMMISSIONING: LAND RETURNED TO ORIGINAL STATE

- Goal of decommissioning is to return the land to its original state
- Decommissioning plans are approved by local jurisdictions and include bonding as backstop in case project fails to uphold obligations
- Panel recycling
  - Burgeoning reuse and recycle industry
- Nothing stays in the ground
  - Steel pilings
  - Conduits
- Soil benefits

Project Greyrock
Wicomico County, MD

MARYLAND STATE GOALS- FINDING THE BALANCE

- Maryland is balancing multiple state goals, including renewable energy development and land preservation.
- The current target is for 52.5% of the state's energy to come from renewable sources by 2030, with a specific carve-out with a goal of 14.5% for solar.
- In 2020, Governor Hogan convened a Task Force of Renewable Energy Development and Siting, which found that achieving this goal would require using only **1.7% of available farmland**.
- Maryland currently imports 40% of its electricity from neighboring states, and its electricity demand is expected to grow at a higher rate than in the past.
- Maryland has the 39th highest average electricity costs in the United States.
- Maryland's limited capacity is affecting customers: A recent capacity auction in PJM is expected to result in electricity cost increases of up to 24% for Maryland residents.

DUAL HARVEST & LAND CONSERVATION- SETTING THE STANDARD

Continue to evolve vegetation practices

Implement livestock grazing as standard management

Work with the local experts to define the next evolution

THANK YOU

John Miller, VP Development

Lauren Barchi, Manager Community Impact

chaberton ENERGY

OUR WORK IN MARYLAND

Deep Experience in the Free State

Project Friendship
West Friendship, Howard County
6.25 MWdc
Operational as of early 2023

Project Lime Kiln
Fulton, Howard County
3.2 MWdc
Construction began June 2024

Project Catherine
Cooksville, Howard County
4.32 MWdc
Operational as of early 2023

Project Santa Rosa
Potomac, Montgomery County
2.47 MWdc
Construction projected to begin fall 2024

Project Greyrock
Pittsville, Wicomico County
3.31 MWdc
Construction complete, awaiting power up

In Maryland, Chaberton also has

190 MWdc

under site control, which is equivalent to powering 32,000+ homes. This not only supports clean energy but also promotes thriving pollinator habitats, benefiting local farmers and the community.


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.

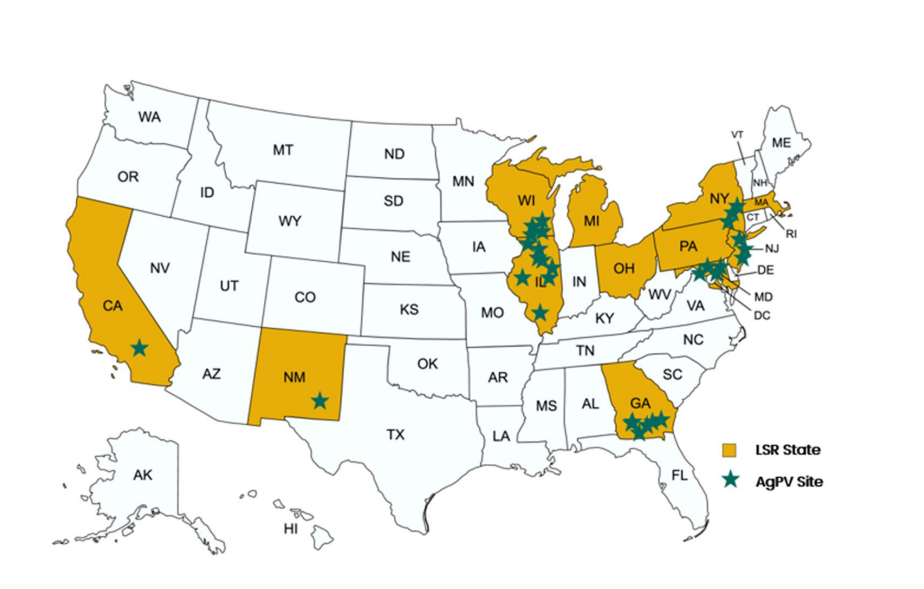
LIGHTSTAR

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

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

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.

"Protecting Future Farmland Act 2023" – 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.

California
Partnered with AFT to support SB688 to provide grants to AgPV projects and allow Williamson Land to be used for AgPV

Illinois
Illinois' community solar program includes a points preference for agrivoltaic projects

New York
Lightstar worked with the town of Montgomery, NY to change their bylaws to allow for commercial agrivoltaic systems

Massachusetts
MA's SMART program provides $.06/kWh for agrivoltaic systems

Colorado
AgPV tax exemption passed in 2023. Also provides for research grants

New Jersey
NJ signed into law a 200 MW pilot program for dual-use systems, the largest in the country

Georgia
The GA Farm Bureau and GA Agribusiness Council are supportive of agrivoltaics as an alternative to standard utility scale

Maryland
Maryland incentivizes agrivoltaics through tax exemptions and co-location preferences

American Farmland Trust · New Jersey Farm Bureau · GAC Georgia Agribusiness Council · Farm Bureau New York · The Nature Conservancy Colorado · Maryland Farm Bureau · Farm Bureau Georgia

National Renewable Energy Lab (NREL) confirms that nearly **6,000MW** of Agrivoltaics already exist in the US.

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.

LIGHTSTAR

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.**

LIGHTSTAR

What do projects look like?

LIGHTSTAR

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.

LIGHTSTAR

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

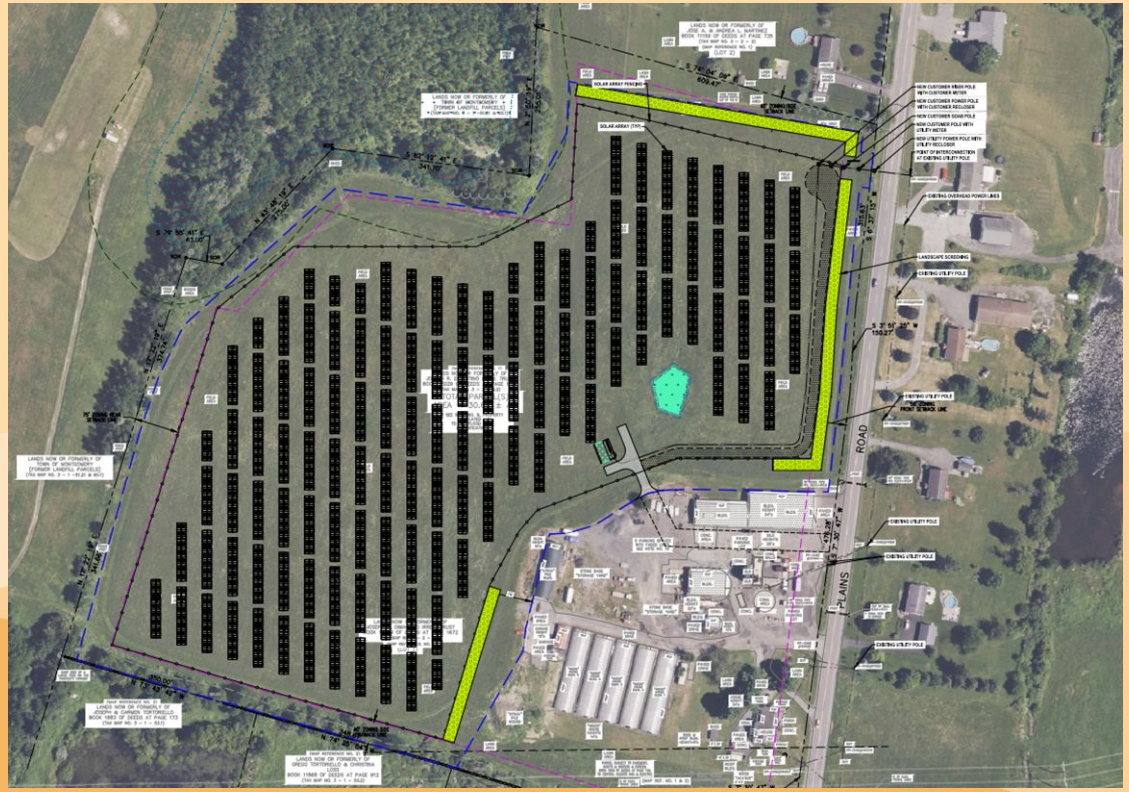
35 acres Grazing

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.



LIGHTSTAR

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.

LIGHTSTAR


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

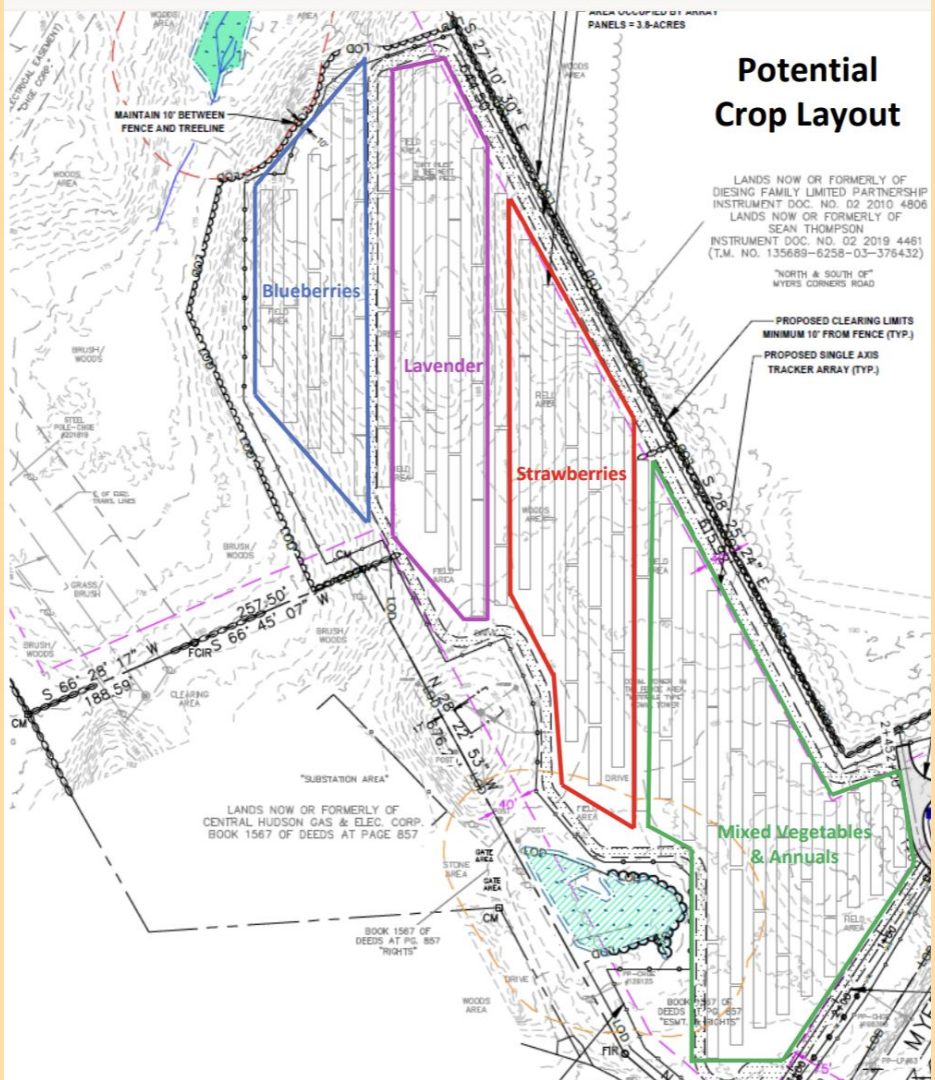
Lightstar's AgPV Project Examples

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.

LIGHTSTAR


Potential
Crop Layout
Blueberries
Lavender
Strawberries
Mixed Vegetables
& Annuals
MAINTAIN 10' BETWEEN
FENCE AND TREELINE
PROPOSED CLEARING LIMITS
MINIMUM 10' FROM FENCE (TYP.)
PROPOSED SINGLE AXIS
TRACKER ARRAY (TYP.)
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. 135689-6258-03-376432)
"NORTH & SOUTH OF"
MYERS CORNERS ROAD
LANDS NOW OR FORMERLY OF
CENTRAL HUDSON GAS & ELEC. CORP.
BOOK 1567 OF DEEDS AT PAGE 857
"SUBSTATION AREA"
BOOK 1567 OF
DEEDS AT PG. 857
"RIGHTS"
S 66° 28' 17" W
188.59'
S 66° 45' 07" W
257.50'
S 27° 10' 30" E
S 28° 25' 24" E
N 28° 22' 53" W
676.71'
PANELS = 3.8-ACRES

LIGHTSTAR

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

LIGHTSTAR


Thank
you
powered by LIGHTSTAR

Maryland utility-scale solar development overview

James McCulla (RWE) &
Evan Vaughan (MAREC)

September 26, 2024

Working with top-tier developers has benefits

- Solar leases offer stable income and reduced risk
  - 20-40 years of income shielded from commodity price volatility
- Active land management can improve soil health through project life
  - Regionally-tailored BMPs maintain soil cover and increase water retention
- Upon decommissioning, the property stays in the family
  - Developer-financed bonds cover the costs of returning the land to its current state

How do developers identify project locations?

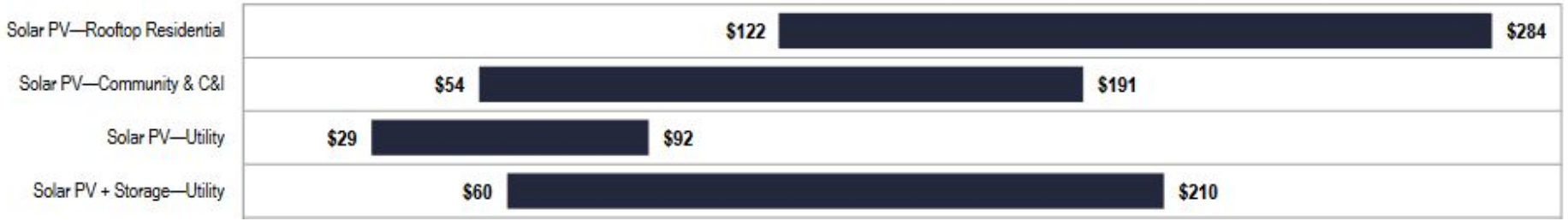
- Flat, dry land close to utility transmission lines
  - Shorter distances to transmission lines and substations have lower costs and are less complicated
- Proximity to fossil-fuel plants prepares the grid for the future
  - As old generators retire, renewables can quickly replace them
- Large projects take advantage of economies of scale
  - Utility-scale projects help the state meet renewable energy goals faster

How do developers work with the community?

- Building trust with counties through transparency
  - Engaging early and often with County Council and Board of County Commissioners
- Going above and beyond local ordinances
  - Well-maintained vegetative buffers are in the interest of the project and the community
- Becoming active members of the community
  - Developers employ community members to serve as points of contact for the project and to operate and maintain the project

Utility-scale solar = least-cost energy

National ranges for levelized cost of energy measured in $/MWh
(without incentives, for NEW energy facilities)



Source: Lazard 2024 Levelized Cost of Energy+ report

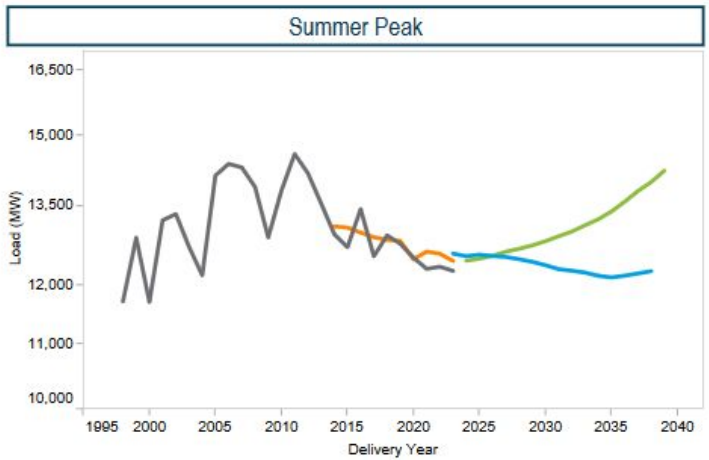
Other sources for comparison (ranked least to most expensive for new build, without incentives).

- Wind (onshore) $27-73
- Gas Combined Cycle, $45-108
- Wind (offshore) $74-139
- Nuclear, $142-222

Electricity demand growth

Electricity demand had been flat for many years, but that's rapidly changing due to factors ranging from data center growth to electrification and onshoring of manufacturing.

Central Maryland (S-MAAC) Summer Peak Forecast



Source: PJM Jan. 2024 Load Forecast Report

The chart shows the upward adjustment of forecasted load growth by the regional grid operator (PJM) from 2023 to 2024.

In green, PJM's 2024 forecast.

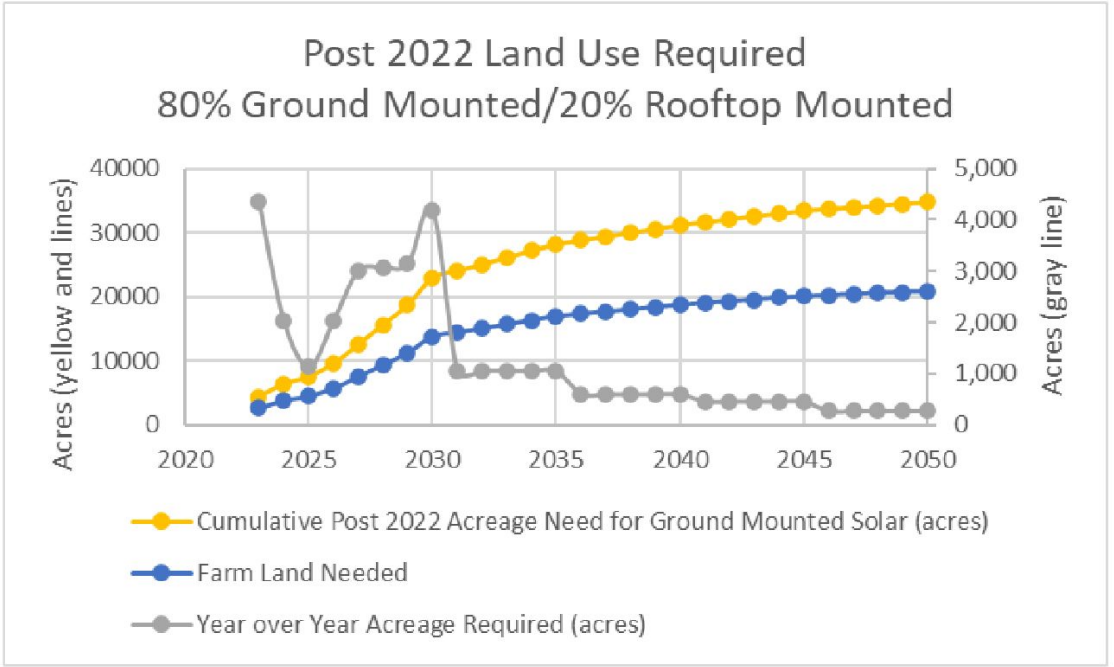
In blue, PJM's 2023 forecast.

The growth represents roughly 1,500 megawatts of new load. PJM's winter peak forecast, and forecast for other parts of Maryland, are similar.

How the growth of solar impacts land use

- Key facts about land use:
  - Every solar project developed in Maryland has landowner support.
  - Projected solar that would be built on farm lands through 2050 = ~20,000 acres.

- What's in it for landowners?
  - Solar enables farmers to participate in the clean energy economy.
  - Dramatically higher profit per acre.
  - Drought and pest-proof.
  - Support for local govt services.
  - Retain rural character, avoid subdivision of farmland.



Source: Maryland Energy Administration (Nov. 2023)