Solar Energy on the Pennsylvania Landscape – Issues and Implications

Solar session agenda:

- **Current program offerings for officials**
- **Where and why**
- **Industry drivers**
- **Key issues**
- **Siting impacts**
- **Ag/open land and solar**
- **Key solar ordinance components**

Solar Dialogue

- **In many ways, it is the Marcellus story of yesterday**
  - Same strategies used by company land agents
  - New income options for some landowners
  - New challenges, unprepared communities
  - More research initiatives vs expanding outreach
- **Biggest challenge:**
  - There needs to be a greater sense of urgency
    - Particularly related to agland utilization
  - Similar to the shale gas story
    - **Social License to Operate**
    - **Public is getting more vocal in response**

Solar Information

- **Not here to advocate for solar of any type**
  - Provide fact-based information to base decisions
- **Offering web-based and in-person programs**
  - Solar leasing for landowners
  - Solar technologies
  - Solar and farmland preservation programs
  - Financial and estate planning for landowners
  - Ongoing programs for local officials to explore solar ordinance options
  - Legal training on solar for attorneys
  - Collaboration with DEP, Cornell, OSU, Michigan, others
  - Solar guide(s) for municipal/county officials

Municipal Solar Guide

- **Print and web-based**
  - Public facing at www.marcellus.psu.edu/solar
- **Key topics:**

A. Solar "basics" including a glossary of terms
B. Technologies being used in grid scale solar
C. Physical impacts of grid scale solar deployment
D. Questions on possible environmental impacts
E. Land use implications
F. Economic impacts of solar in a community/region
G. Tax implications associated w/transitioning to solar
H. Ordinance considerations for solar development

Solar Guide

PennState

Immersive Solar Tour

Why Solar Here, Why Now?

- **An acceptable location in the U.S. for solar**
  - Ample amount of sunlight for efficient production
  - 500+ projects in PA portion of PJM queue alone
- **Abundant electrical infrastructure**
  - Major power export state
  - Significant coal plant retirements
  - Robust transmission capacity in place
- **Investor support –Est. over $20B by ‘30**
  - $1.13M/MW (approx. 6 acres/MW)
- **Central location to large metro markets**
- **New storage technology and declining costs**
  - Emerging options/greener capacity

Different Scales of Solar

Residential & Commercial

- For on-site energy use
- Rooftop or mounted adjacent to structure
- Measured in kW
- Considered accessory use system
- Mature market – available guidance

Community Solar

- For off-site energy use within community (distribution grid)
- Usually ground mounted requiring multiple acres
- Measured in 100s of kW up to 5 MW
- Considered primary use system
- Not yet allowed in PA (Senate Bill 472)

Grid-Scale Solar

- For off-site energy use distributed through transmission grid
- Ground mounted requiring significant acres to reach economies of scale
- Measured in MW
- Considered primary use system
- Emerging market – guidance in development

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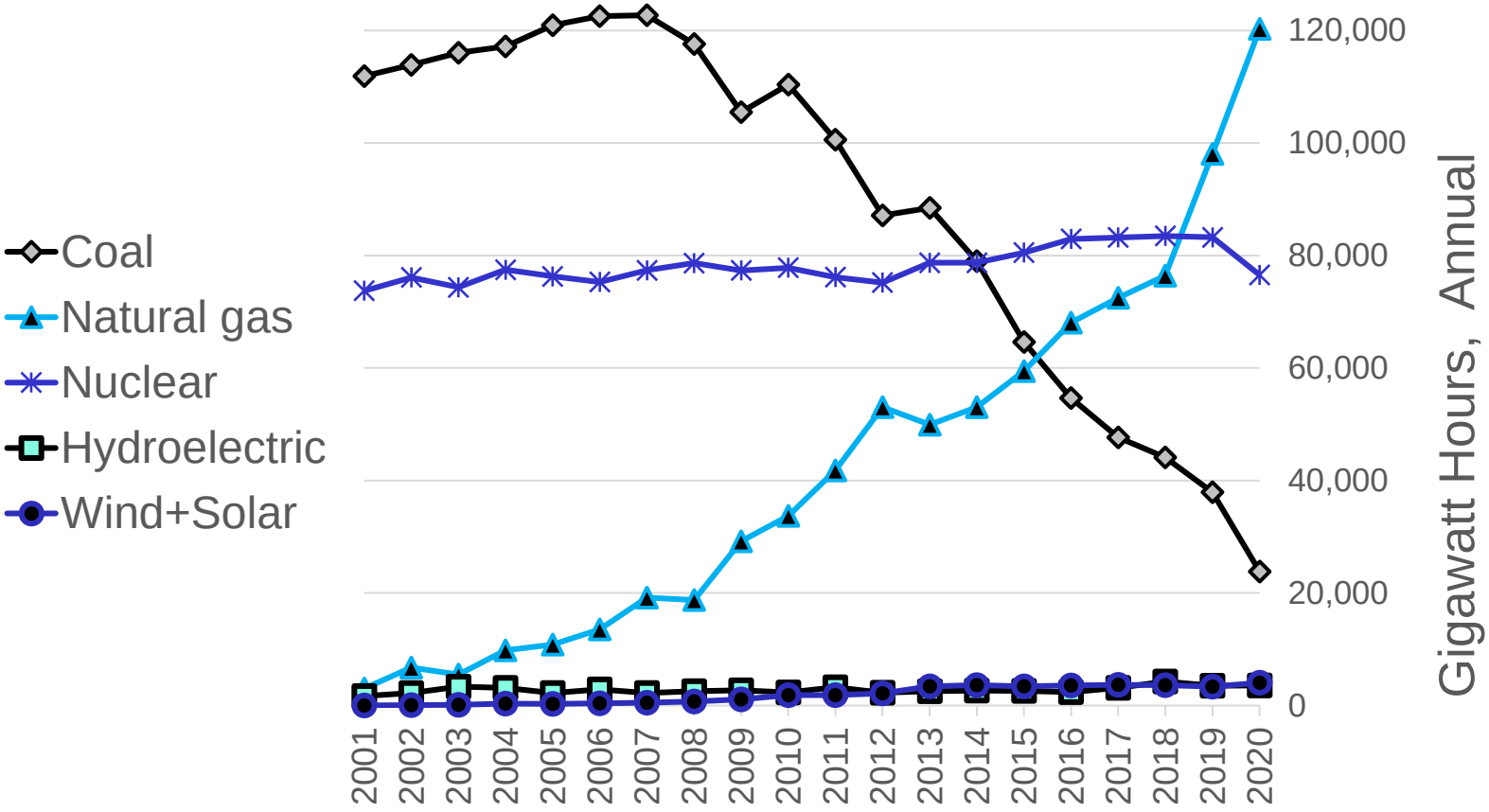
Source: DEP

PA Electricity Generation by Source

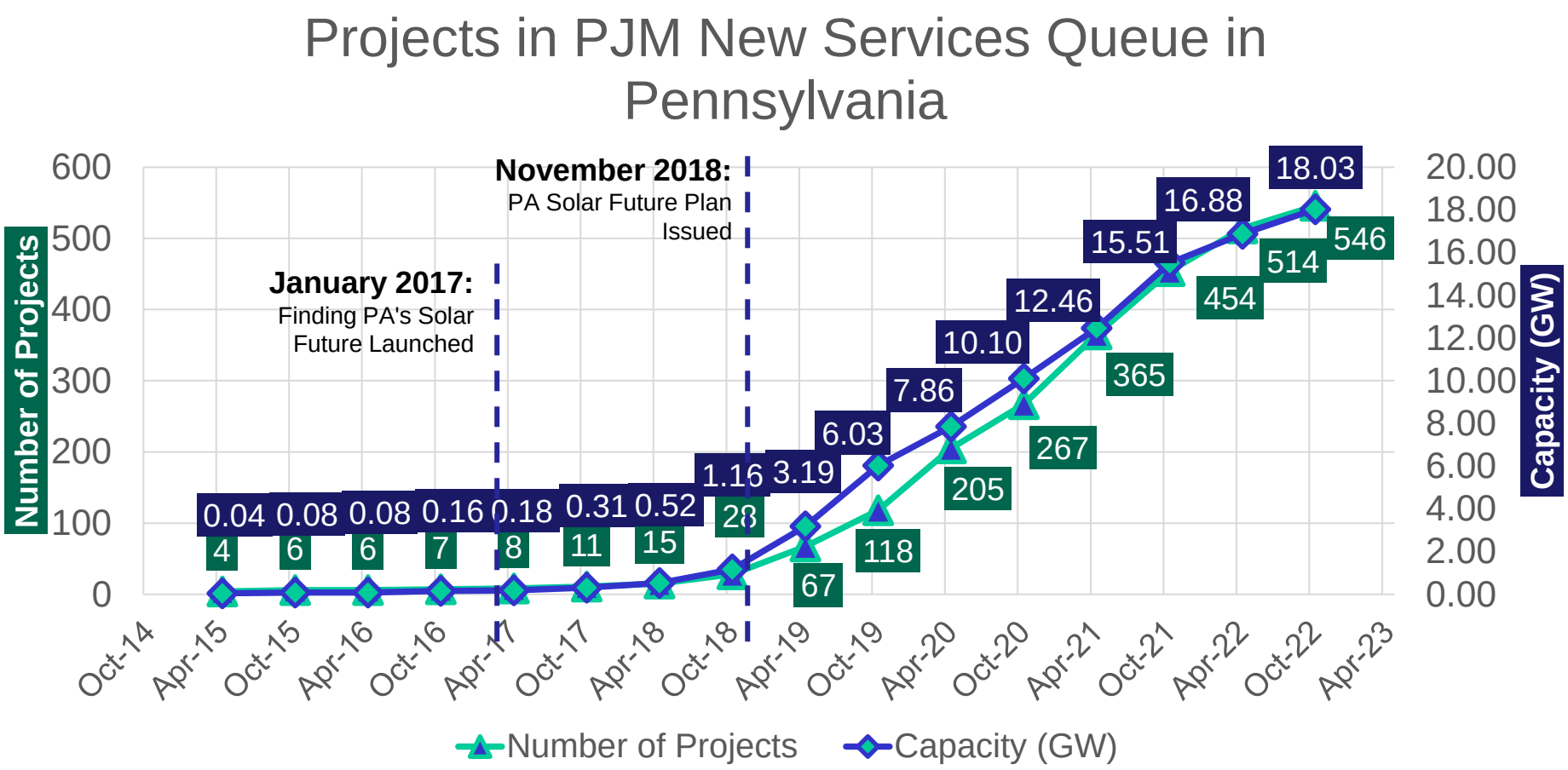


Data from U.S. Energy Information Administration (EIA): https://www.eia.gov/electricity/

Solar Drivers in PA

- **Tax and policy incentives**
- **Societal and business demands for new energy sourcing --<u>decarbonization of the PJM grid</u>**
- **Large utility moves to diversify technologies**
- **Reduced long term costs for solar components**
  - Fair trade issues
  - Increasing costs to permit sites at local level
- **Availability of open land resources**

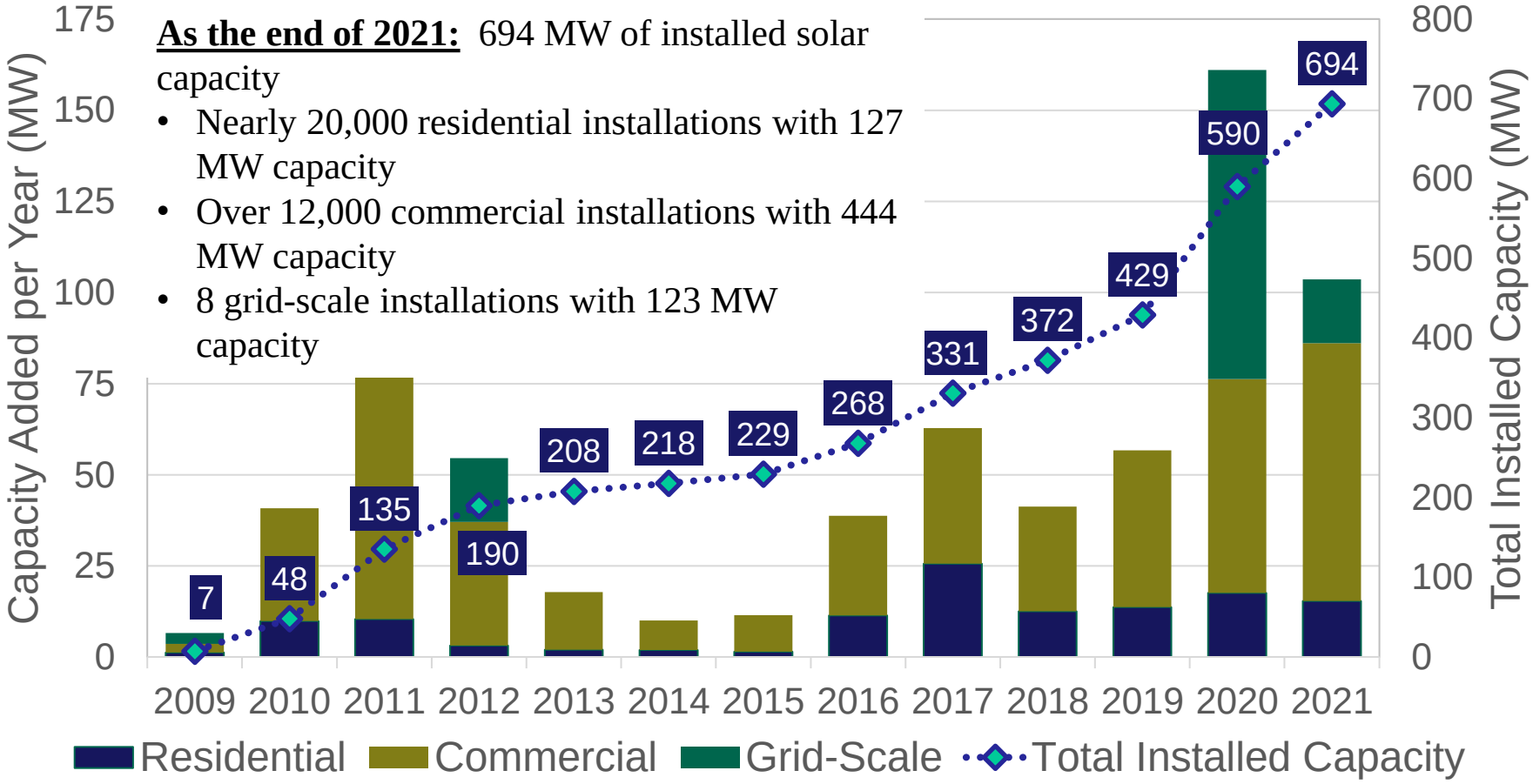
Growth of Grid-Scale Solar Proposals



Pennsylvania Annual Solar Installations and Cumulative Capacity (MW) 2009 - 2021

<u>As the end of 2021:</u> 694 MW of installed solar capacity

- Nearly 20,000 residential installations with 127 MW capacity
- Over 12,000 commercial installations with 444 MW capacity
- 8 grid-scale installations with 123 MW capacity



Source: AEPS Qualified Facilities Report

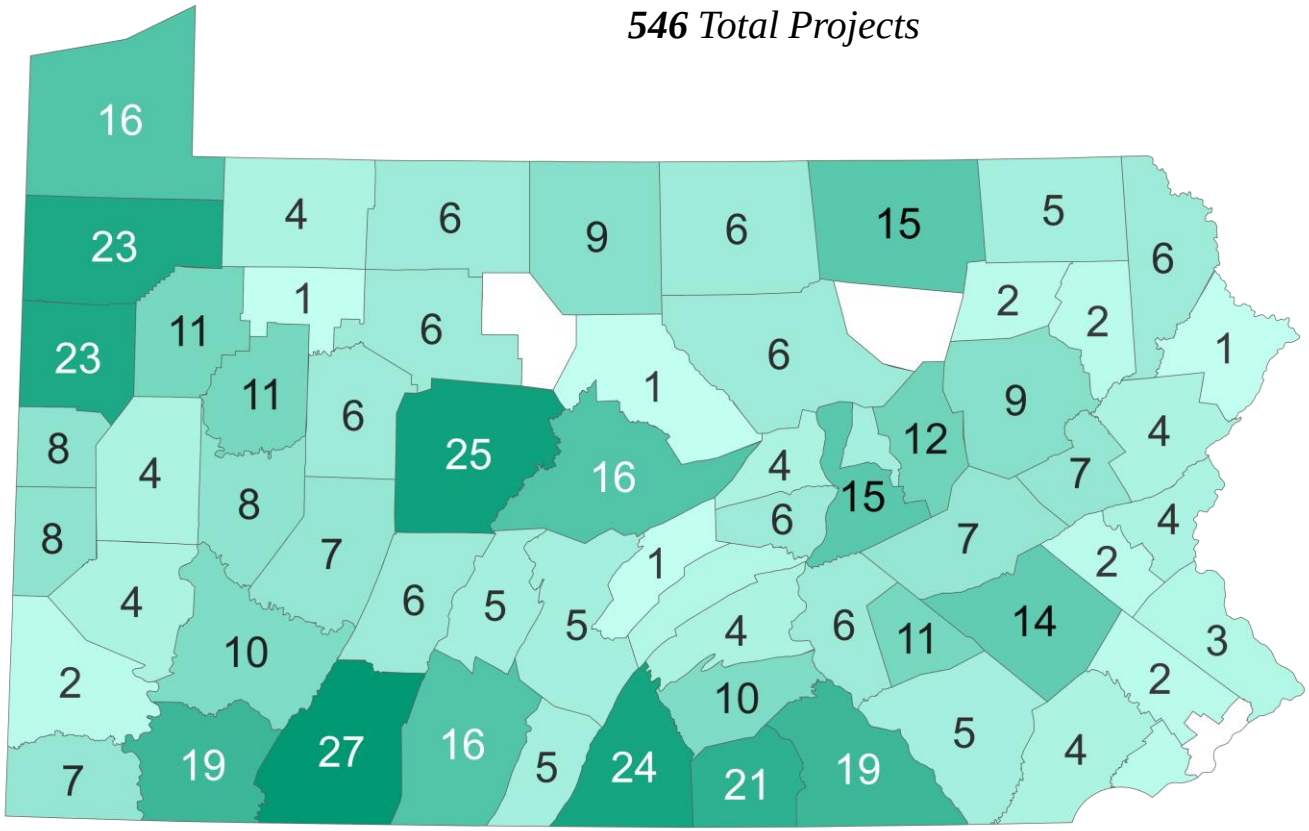
Development Potential (# of Projects)

Review Phase:

303	Initial Review
123	Advanced Review
112	Interconnection Agreement
8	Operations

Total Number of Projects in PJM New Services Queue

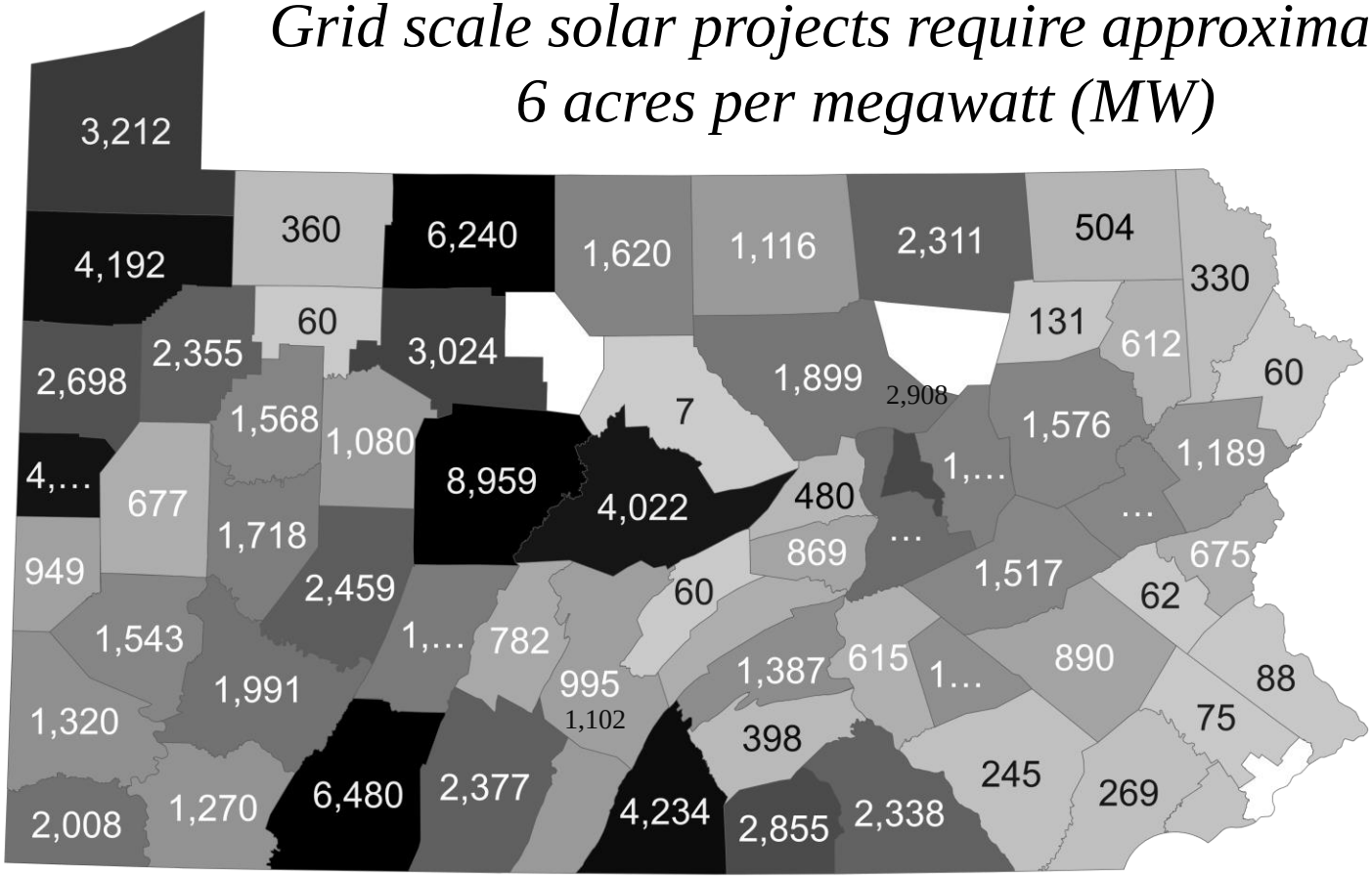
***546** Total Projects*



Land Use Impact

Acres Needed for Project Development

Grid scale solar projects require approximately 6 acres per megawatt (MW)



Where is Most Solar Proposed?

- **82% on “open” land**
  - Mostly agland
- **5% on forested land**
- **4% on brownfields locations**
  - Increasing interest in former mined land
- **9% misc**

Site Selection Criteria

- Total amount of land available
- Slope: southerly exposure on gently sloping (slope less than 7%)
- Avoiding wetlands and floodplains
- Avoiding surface restriction clauses
- Well-drained soils
- Brownfield versus greenfield project
- Avoiding extremely rocky sites
- Private vs. public owned

Site Selection Criteria

If high-voltage power lines are not nearby, utility-scale solar developers are probably not interested at this time.

Ag Issues

- **Impacts to prime farmland**
  - Where to place
    - Rooftop vs. ground mount
    - Agland vs. industrial zones
  - What to preserve
    - Bigger view of development
  - Dual use options
- **Agrivoltaics**
  - Contractual language in lease
    - **Preserve the right of first refusal**
  - Vegetation management
  - Grazing is common answer
  - Emerging options with newer technologies

Ag Issues

- **Benefits to landowner**
  - Long term steady rental income
  - Multi-year maintenance contracts
  - Option to continue farming
- **Issues**
  - Rental land inflation
  - Loss of local ag services/suppliers/acreage
- **Immersed in a study of related impacts in PA**
  - What change will occur at local level
  - Where and how will communities manage change

Ag Land Considerations

- **Farmland preservation**
  - New modifications to existing programs??
- **Local community considerations**
- **Ordinance language to protect Ag**
- **Restrict agland usage**
  - % of parcel or acres in solar
  - Agrivoltaic metrics
  - Use of marginal land
- **Industrial land**
  - Animal grazing
  - Vegetation maintenance clauses

Agrivoltaics

- **Agrivoltaics Overview:**
  https://vod.video.cornell.edu/media/Planning+with+Agrivoltaics+in+MindA+Part+2+Overview+of+Agrivoltaics/1_8rnbhhom
- **Agrivoltaics and Land Planning:**
  https://vod.video.cornell.edu/media/Planning+with+Agrivoltaics+in+MindA+Preserving+Agricultural+in+the+Face+of+Growing+Solar+Development/1_kadkbe4n
- **Site Planning and Agrivoltaics:**
  https://vod.video.cornell.edu/media/Planning+with+Agrivoltaics+in+MindA+Planning+with+Agrivoltaics+in+Mind+-+Part+3/1_gbolqks5

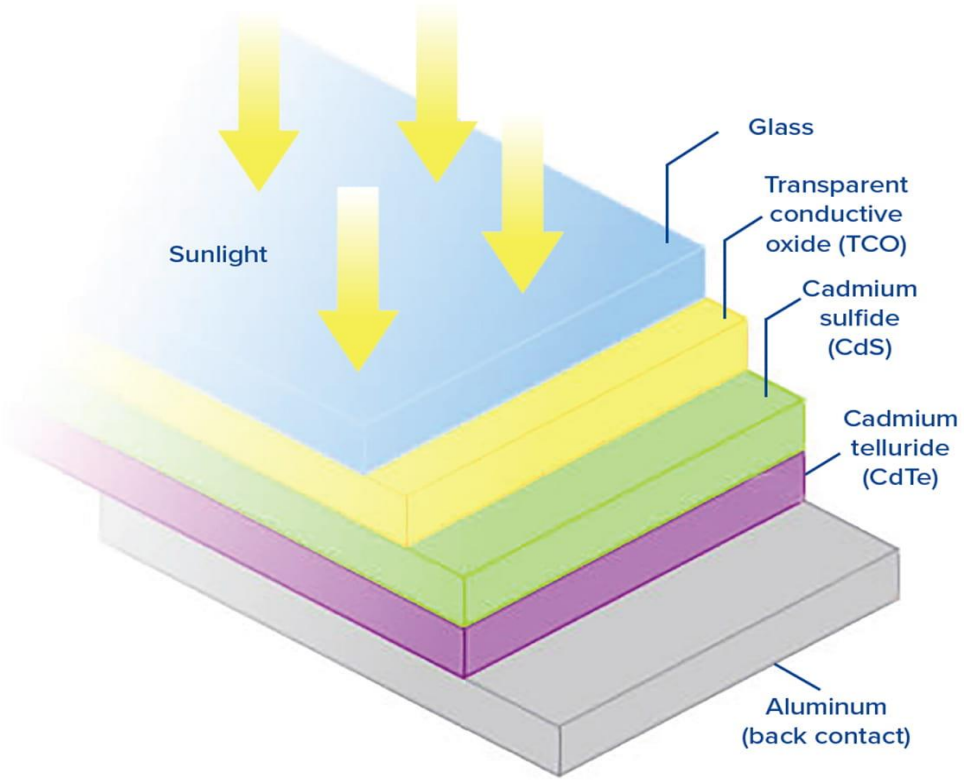
Hot Issues

- **What is in a solar option/lease contract**
  - Heading to 80K+ acres
  - Emerging trend to look at Ag first, energy to compliment
  - New EU-oriented agrivoltaic models
- **Siting Considerations**
  - Overall land use issues
  - Energy vs. Ag vs. Warehousing vs. ???
- **Impacts to existing infrastructure**
- **Grid access**
  - New transmission capacity
- **Environmental impacts**
  - Baseline testing/water
- **Stormwater/impervious surfaces**

Leasing for Solar

- USE an attorney for lease review, etc.
- Caution signing solar option and lease
- More than the $$$. Understand the terms
- Lease extension 20-25 years, plus
- Dual use clause Maintenance contracts
- Amount of acreage actually being leased
- Options on residual acreage -- Access??
- Tax changes on acreage – responsible party
- https://extension.psu.edu/utility-scale-and-community-solar-in-new-york-and-pennsylvania
- https://extension.psu.edu/leasing-your-land-for-solar-energy-development

Panel Concerns



Thin Film Panel Construction

- Crystalline Silicon-based panels
- Thin Film Panels
- Numerous layers of protective covering
- Rated as non-hazardous waste
- Breakage??
- EPA Toxicity Characteristic Leaching Procedure (TCLP)

Battery Storage

- **Several types of storage**
  - Battery
  - Pumped
  - Hydrogen
  - Emerging tech
- **Purpose is peak usage cycles**
- **Storage but still system production**
- **Should centrally locate on site**
- **Fans/emergency release**
- **Switch at central access**
- **First responder training**
- **https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Siting/battery-Energy-Storage-Guidebook**
- **BESS Emergency Information**

Common Solar Ordinance Themes

- Definitions
- Accessory vs Principal Solar Energy Systems
- Setbacks & Fencing
- Screening Options
- Agland/prime soils protections
- Decommissioning

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