Utility-Scale Solar Development in Pennsylvania

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PennState Extension

Solar Development in the region

There's enough sun everywhere in this region of the country

A number of sites near high-transmission lines and substations have seen interest from solar developers

Many (most) proposed projects will fit into existing infrastructure, but some have bigger ambitions

Different Scales of Solar:

Residential (behind the meter)

Comn Any project must be approved by PJM Interconnect (to connect to the grid)

Utility-scale or grid-scale (sold to the grid)



"Utility-Scale" Solar Projects

- Not regulated by PUC
- Conservation Districts approve earthmoving projects
 - Not approving solar development, just approving E&S plan
- Facilities interconnected to the grid under the control of the regional transmission organization called PJM Interconnect
 - This is an interconnection request, not a permit (not regulatory)



• Local governments?



Why Solar in PA (and the region)

Close to end-users

Reduced equipment cost

Lots of infrastructure in place – transmission lines and substations with capacity

- Due to power gen capacity? (export)
- Due to legacy manufacturing?

Investor support?



Solar Cost Decline -- 70+% Since 2010

U.S. Solar Historic Installed Costs and Cost Forecast



Sources: Tracking the Sun, Installs Price trends for Distributed PV Systems in the US, 2016 and 2018 Edition, LBNL; Utility-Scale Solar Price Trends 2016 Edition, LBNL; NREL, U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018; Open PV Link to excel with historic cost data



PJM Zone Map

https://www.pjm.com



Legend

ZONE

- Allegheny Power Systems (AP)
 American Electric Power (AEP)
 American Transmission Systems, Inc. (ATSI)
 Atlantic City Electric Co. (AE)
 Baltimore Gas and Electric Co. (BGE)
 Commonwealth Edison Company (ComEd)
 Dayton Power & Light Co. (DAY)
 Delmarva Power & Light Co. (DP&L)
 Dominion (Dominion)
 Duke Energy Ohio and Kentucky Corp. (DEO&K)
 Duquesne Light Co. (DLCO)
- East Kentucky Power Cooperative (EKPC)
 Jersey Central Power & Light (JCP&L)
 Met-Ed (METED)
 Ohio Valley Electric Corp. (OVEC)
 PPL Electric Utilities (PPL)
 PECO Energy Co. (PECO)
 Pennsylvania Electric Co. (PENELEC)
 Potomac Electric Power Co. (PEPCO)
 PSEG (PSEG)
 Rockland Electric Co. (RECO)









Statewide Development Potential

Review Phase:

151 Initial Review147 Advanced Review

- 65 Project Design
- 7 Operations

Total Number of Projects in PJM New Services Queue

370 Total Projects

Map Developed with our partners at PA DEP

About 20% of these projects include battery storage



Development Potential

Electric Generation Capacity of Projects in Megawatts (MW)

Total: 12.1 GW

Map Developed with our partners at PA DEP

Estimated costs: About \$1.13 million per MW



Land Use Impact

Acres Needed for Project Development

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

Map Developed with our partners at PA DEP

Assumption: All of these acres are currently under contract (through an option agreement)*. Approximately 60-80K acres?



3 Market Drivers of Utility-Scale Solar Development

Utilities – probably bidding for cheapest projects to achieve goals (will there be mandates?)

Companies with sustainability goals – cheaper or other goals? (reputations may be at stake)

Institutions with sustainability goals – Universities, governments (federal, state, local), NGOs – these may have goals other than least expensive

This may change how projects are chosen



The Market-Based AEPS – Solar SREC Program

- •Solar renewable energy credits (SRECs) are the instruments used by utilities and retail suppliers to measure their compliance with the PAAEPS
 - $_{\rm \circ}$ Could also be used by corporations and institutions for the same means
- •Developers and brokers can sell SRECs to utilities and retail suppliers through the state SREC program
- •SRECs are equal to 1 MWh of solar energy generated from a qualifying facility
- •SRECs must be PA generated to count for compliance
- •The fundamental theory is one of supply and demand. If the market is short, then prices will rise; and conversely if the market is long, prices will fall
- •PA SRECs have a useful life of three years



Market Prices



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State	SREC Price
Maryland	\$77.50
Massachusetts	\$273.00
New Jersey	\$231.50
Ohio	\$7.00
Pennsylvania	\$36.00
Washington, D.C.	\$400.00



Investment Tax Credit for Solar

This credit allows you to deduct up to 26% of your project's cost from your federal taxes (for 2021 and 2022). If you don't have enough tax liability to claim the entire credit in a single year, you can carry the remainder over the following 20 years

The solar ITC discounts the value of solar equipment against the yearly tax bill. Because solar companies often don't have much profit to tax, the tax credit has become an investment vehicle.

The investors who use it are (often) large entities that could use a deduction on their taxes, such as banks, insurance companies, pension funds or other big corporations.



- Lots of leasing options and purchase options are being offered (5k, 10k)
- Not much development (yet)
- Solar development process:
 - 1) Lease/Purchase Option
 - 2) Studies
 - 3) Pre-permitting/site design
 - 4) Investors?
 - 5) Utility Auction?
 - 6) Approval?
 - 7) Commitment for electron purchase? (won't get built on spec)
 * PPA
 - 8) Selling project to developer?
 - 9) Construction

Power Purchase Agreement (PPA):

- PPA is a long-term supply agreement (typically 10 25 years)
 This agreement says "we will build this solar array if you agree to purchase the electrons"
 End of contract may give purchaser the ability to extend contract or purchase the system
- This is a contract that could have a lot of variability depending on the needs and wants of the developer, the financier, the broker, and the end user
 - $_{\circ}$ PPA between the end user and the developer
 - $_{\circ}$ PPA between the licensed supplier and the developer



The Economics of Prime Farmland over marginal acreage

- Easier/cheaper to engineer, construct (rocks, slope, welldrained soils)?
- Less regulation barriers (brownfields, wetlands, E&S permits)?
- A lot of concern over this in PA?
- Private contract between landowner and developer (new regulation could diminish property value?)







Economics of Leasing Utility-Scale Solar vs. Growing Crops: The margin of net profit per acre will vary from highly productive ground to marginal ground, but solar likely wins on a per acre basis. But...





If Farming is my business, I may have other factors to consider other than \$/acre:

- Can I move?
- Downsize my enterprise?
- Can I rent/purchase other acreage?
- Can I restrict solar to marginal acreage?
- Can I purchase feed?
- Forage?



Things that are (economically) puzzling about dual use/agrivoltaics:

- Do I want to get into sheep grazing? (especially if I'm a crop or dairy farm)
- Do pollinators make money?
- What are the economics/limitations of growing/harvesting around solar panels? (less MW or higher development cost for accommodating ag?)
- Other crops that may fit? (small fruits, vegetables what about pesticides and equipment?)
- Will developer make accommodations?



Utility Scale Site Selection Criteria

Physical features (Philip will cover this in a later session)
 Intangible costs



So, what are some of the intangibles to site selection?

 Goodwill
 Political environment – clear path or long series of hearings, debate, inaction

Your neighbors may not like this

There's a lot of bad information

The hesitancy to get legal help.



Lots of offers (options), few developed (so far)

* What are developers waiting for?

Available land? Regulation to appear?

Public Policy to get settled? Investors lined up?

Someone to purchase electrons?



Things that could change development dynamics

•New Federal Policies Climate policies?

•State Policy changes?

•EVs and other new demands

•Public perception (social license)



Wednesday, May 26, 2021

SEIA Amps Up Storage Advocacy

Senate bill proposes expansion of Pennsylvania's renewable energy targets

By Christen Smith | The Center Square Mar 29, 2021

Pa. still facing uphill battle to join Regional Greenhouse Gas Initiative

https://www.whitehouse.gov > 2021/04/22 > fact-sheet-...

FACT SHEET: President Biden Sets 2030 Greenhouse Gas ...

Apr 22, 2021 — Today, President **Biden** will announce a new **target** for the United States to achieve a 50-52 percent reduction from 2005 levels in economy-wide ...

https://www.pewtrusts.org > blogs > stateline > 2020/01/09

Electric Cars Will Challenge State Power Grids | The Pew ...

https://gettysburgconnection.org > mt-joy-solar-hearing-w...

Mt. Joy Solar Hearing Wrapping Up after a Year of Meetings ...







What do lease offers look like? (so far)

Operations

Length of term has been 20-50 years... (and many could have a renewal clause)

• Useful life expectancy of solar PV panels 20-25 years

All of the offers (we have seen so far) have been on a per acre used basis

Variety of price range _____ to _____

per acre

Rent escalation is the standard, but the amount varies, 1 - 2.5 percent?

Landowner might assume this will include all acres leased under option – probably not

• What are you seeing in your area?



 You probably can't reach energy goals 2мw or less at a time

 You can't put energy projects where they won't bother anyone

Lease Contracts are typically not great (but can be made good) • Not all options will be exercised The topic is controversial and polarizing at different levels in different places

Photo courtesy Marcellus Center for Outreach and Research

Questions?

