



Solar Energy in Pennsylvania

February 4, 2020

Who is Glidepath Ventures?

Strategy and Portfolio

- Founded 2017, based just outside Philadelphia
- Developing ground-mounted, grid-tied solar generation and battery energy storage projects in Pennsylvania
- Utility-scale, distributed utility-scale, and community solar
- Initial focus in Pennsylvania
- Current portfolio (all with site control and PJM queue positions):
 - **42 DG projects:** **930.8 MWdc / 751.7 MWac**
 - **4 utility-scale projects:** **887.5 MWdc / 730.7 MWac**
 - 23 standalone community projects (no PJM filing): 114.0 MWdc / 84.4 MWac

Team



Carl J. Jackson, Partner

- Contracted & financed 633MW of projects in 10 states with Cypress Creek, Sol Systems, Safari Energy
- Cofounded, built, sold scholastic products company Graduation Station; Morgan Stanley Smith Barney
- BS, Penn State University



Geoff Underwood, Partner

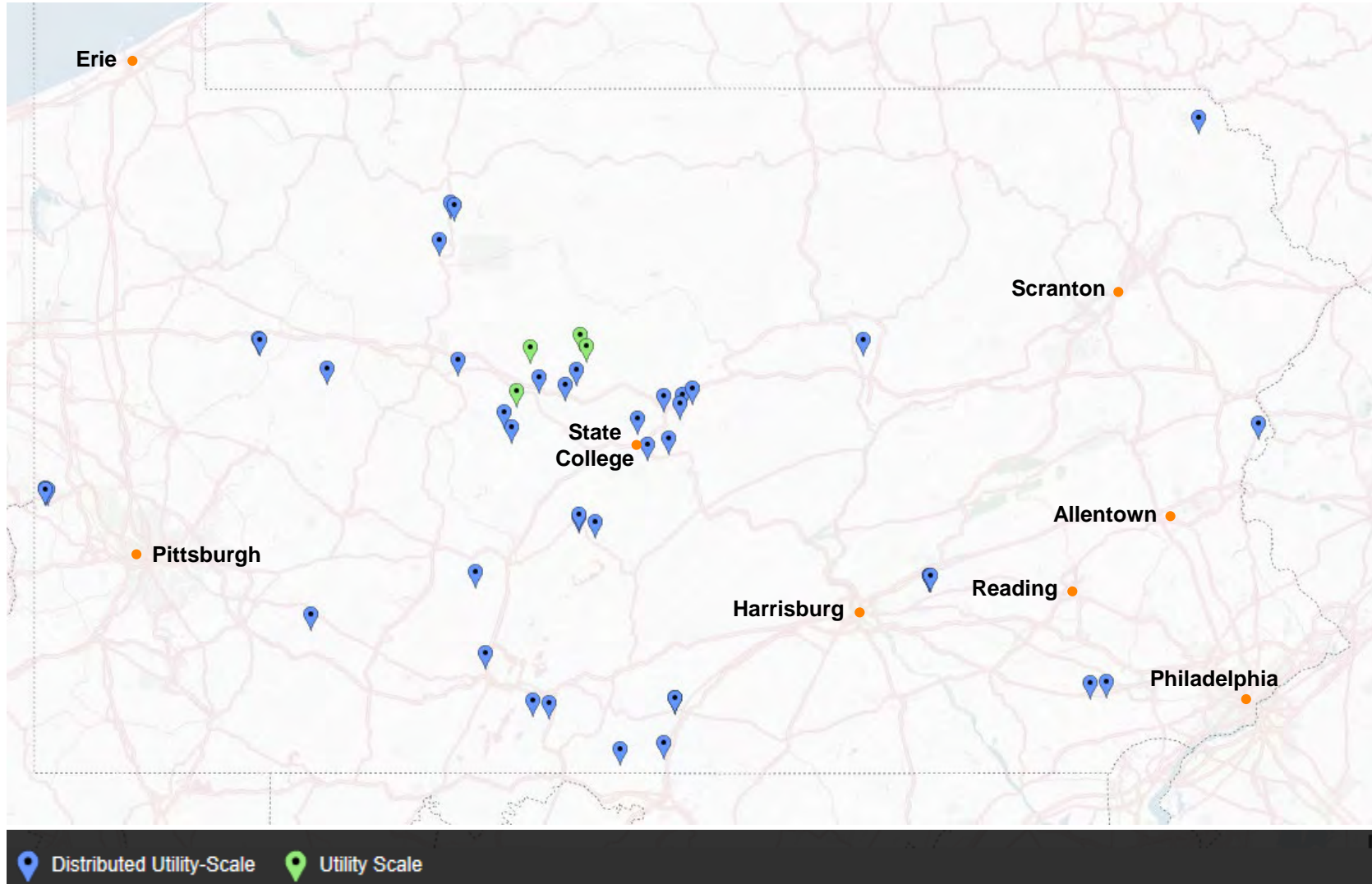
- Contracted more than 500MW of projects in 12 states with Strata Solar, 174 Power Global, Constellation
- Launched renewable energy equities coverage at FBR Capital Markets; 18 years in energy policy and economics, business and venture development in DC
- BA, Univ. of Florida; MBA, Univ. of Maryland.



Charlie Silio, Partner

- VP-Strategy, Corp. Dev., Mktg, Agility Fuel Solutions
- 14 years in private equity investing and investment banking with Element Partners, D. E. Shaw, GTCR, Lazard
- CPA; BSE, Princeton; MSc.²London School of Economics; MBA, Univ. of Chicago

Glidepath Ventures project locations within Pennsylvania

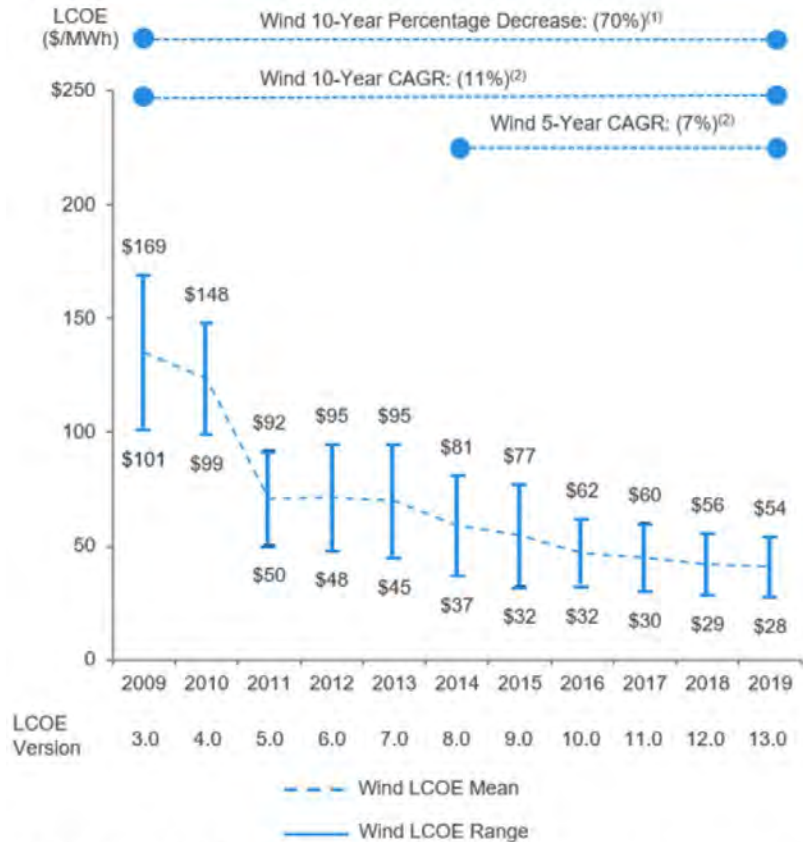


What am I going to tell you?

- Renewable energy is cheap and getting cheaper
- You can buy renewable energy without onsite facilities
- Pennsylvania is positioned to be the solar hub of the Mid-Atlantic
- Solar brings significant benefits to rural communities
- To make a transition to renewable energy, market certainty is needed

Renewable energy is getting cheaper: wind down 70%, solar down 89% in last ten years

Unsubsidized Wind LCOE

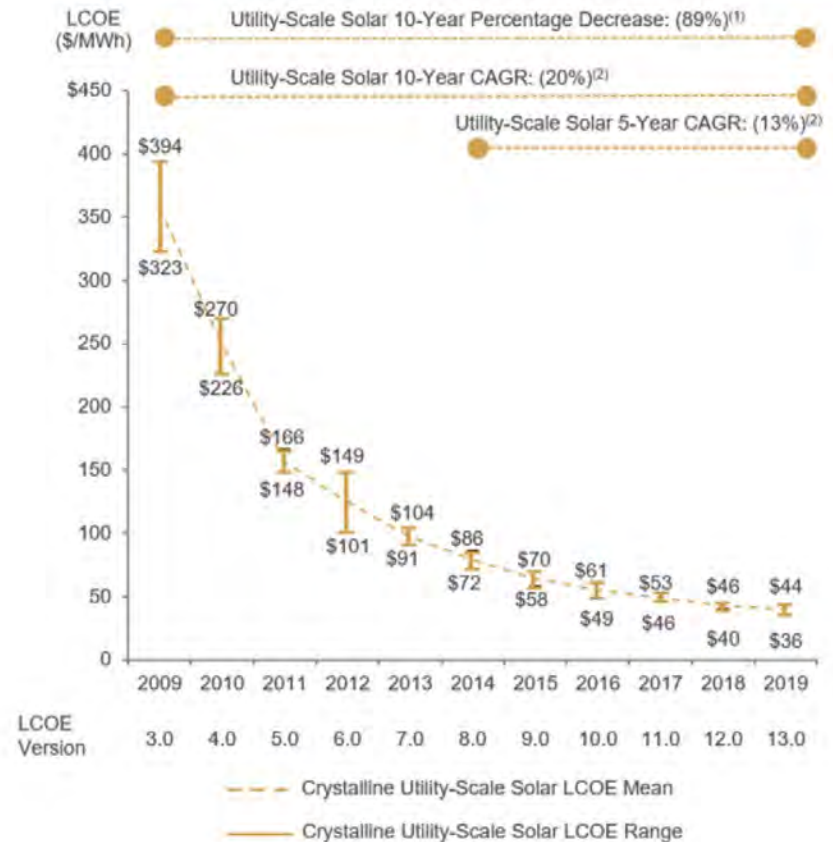


Source: Lazard estimates

(1) Represents the average percentage decrease of the high end and low end of the LCOE range.

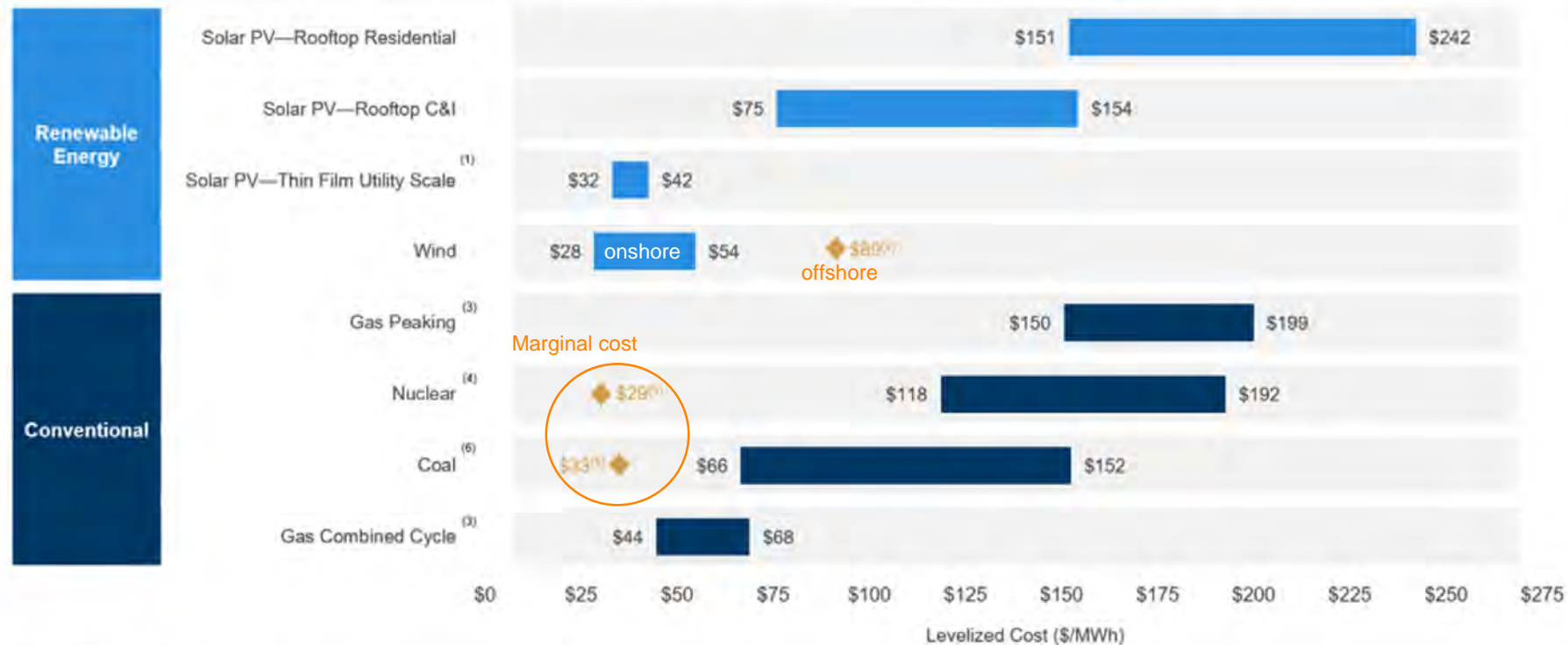
(2) Represents the average compounded annual rate of decline of the high end and low end of the LCOE range.

Unsubsidized Solar PV LCOE



Renewable electricity is now cheaper than dirty electricity on an unsubsidized levelized-cost basis

Selected renewable energy generation technologies are cost-competitive with conventional generation technologies under certain circumstances



Source: Lazard estimates.

Note: Here and throughout this presentation, unless otherwise indicated, the analysis assumes 60% debt at 8% interest rate and 40% equity at 12% cost. Please see page titled "Levelized Cost of Energy Comparison—Sensitivity to Cost of Capital" for cost of capital sensitivities. These results are not intended to represent any particular geography. Please see page titled "Solar PV versus Gas Peaking and Wind versus CCGT—Global Markets" for regional sensitivities to selected technologies.

(1) Unless otherwise indicated herein, the low end represents a single-axis tracking system and the high end represents a fixed-tilt system.

(2) Represents the estimated implied midpoint of the LCOE of offshore wind, assuming a capital cost range of approximately \$2.33 – \$3.53 per watt.

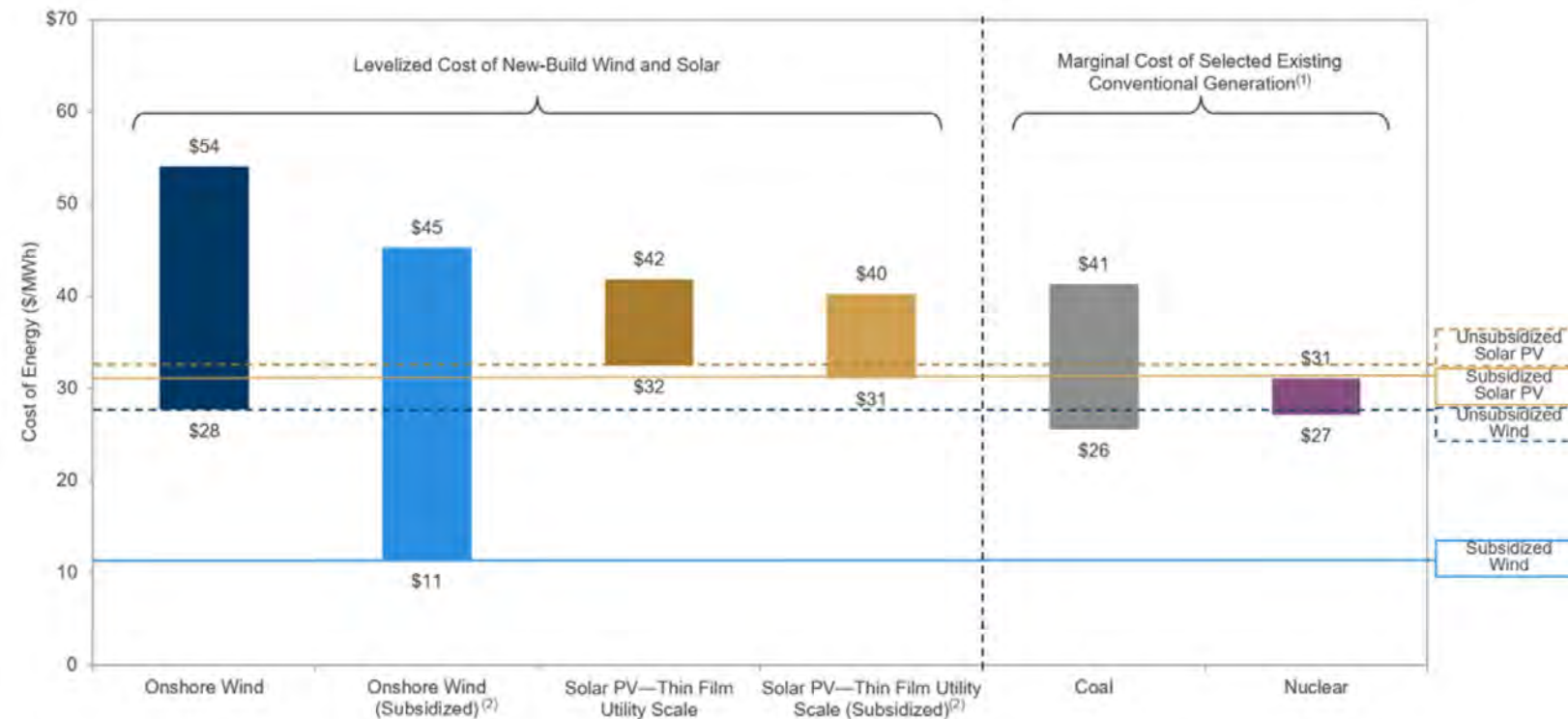
(3) The fuel cost assumption for Lazard's global, unsubsidized analysis for gas-fired generation resources is \$3.45/MMBTU.

(4) Unless otherwise indicated, the analysis herein does not reflect decommissioning costs, ongoing maintenance-related capital expenditures or the potential economic impacts of federal loan guarantees or other subsidies.

(5) Represents the midpoint of the marginal cost of operating coal and nuclear facilities, inclusive of decommissioning costs for nuclear facilities. Analysis assumes that the salvage value for a decommissioned coal plant is equivalent to its decommissioning and site restoration costs. Inputs are derived from a benchmark of operating coal and nuclear assets across the U.S. Capacity factors, fuel and variable and fixed operating expenses are based on upper and lower quartile estimates derived from Lazard's research. Please see page titled "Levelized Cost of Energy Comparison—Renewable Energy versus Marginal Cost of Selected Existing Conventional Generation" for additional details.

(6) High end incorporates 90% carbon capture and compression. Does not include cost of transportation and storage.

Renewables are competitive on a levelized-cost with the *marginal cost* of existing coal and nuclear



Source: Lazard estimates

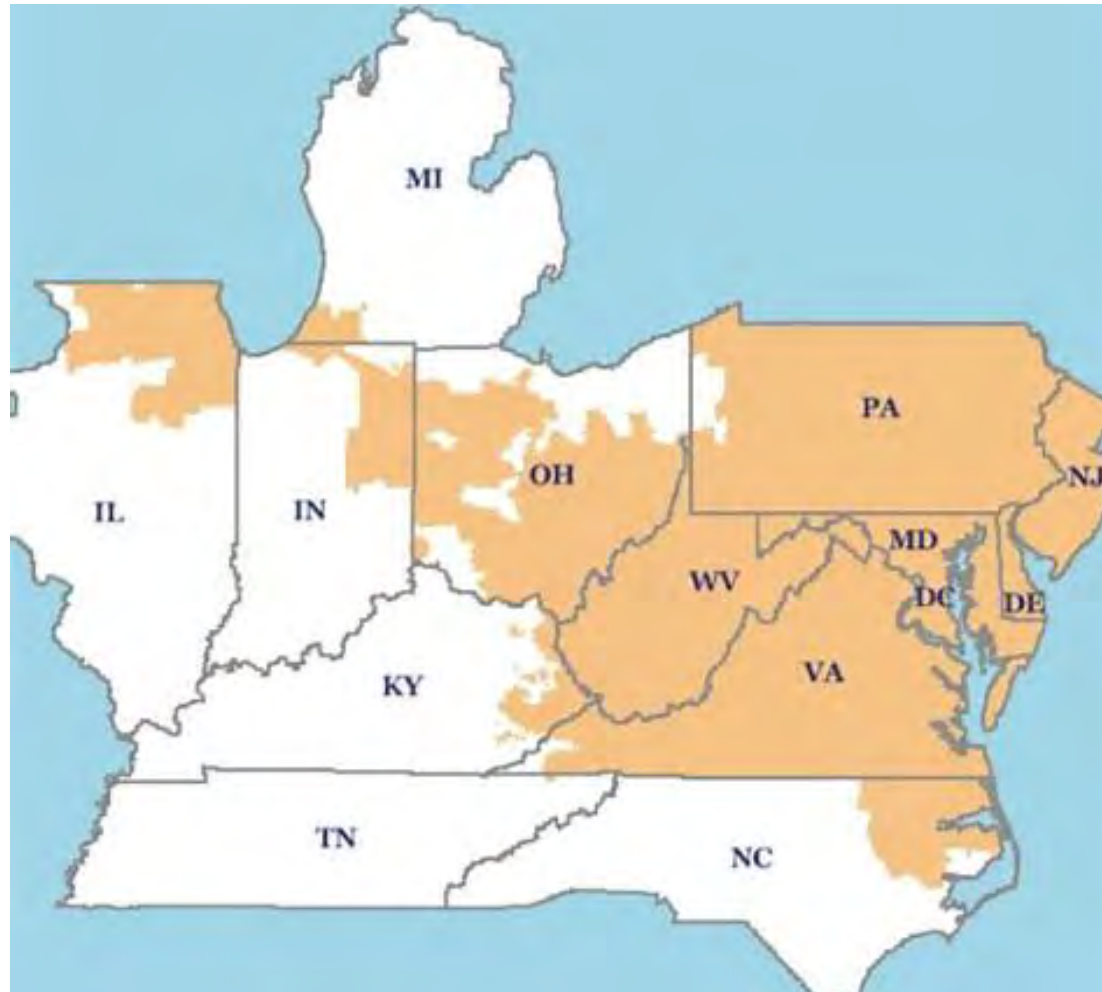
Note: Unless otherwise noted, the assumptions used in this sensitivity correspond to those used in the global, unsubsidized analysis as presented on the page titled "Levelized Cost of Energy Comparison—Unsubsidized Analysis"

(1) Represents the marginal cost of operating coal and nuclear facilities, inclusive of decommissioning costs for nuclear facilities. Analysis assumes that the salvage value for a decommissioned coal plant is equivalent to its decommissioning and site restoration costs. Inputs are derived from a benchmark of operating coal and nuclear assets across the U.S. Capacity factors, fuel and variable and fixed operating expenses are based on upper and lower quartile estimates derived from Lazard's research.

(2) The subsidized analysis includes sensitivities related to the TCJA and U.S. federal tax subsidies. Please see page titled "Levelized Cost of Energy Comparison—Sensitivity to U.S. Federal Tax Subsidies" for additional details.

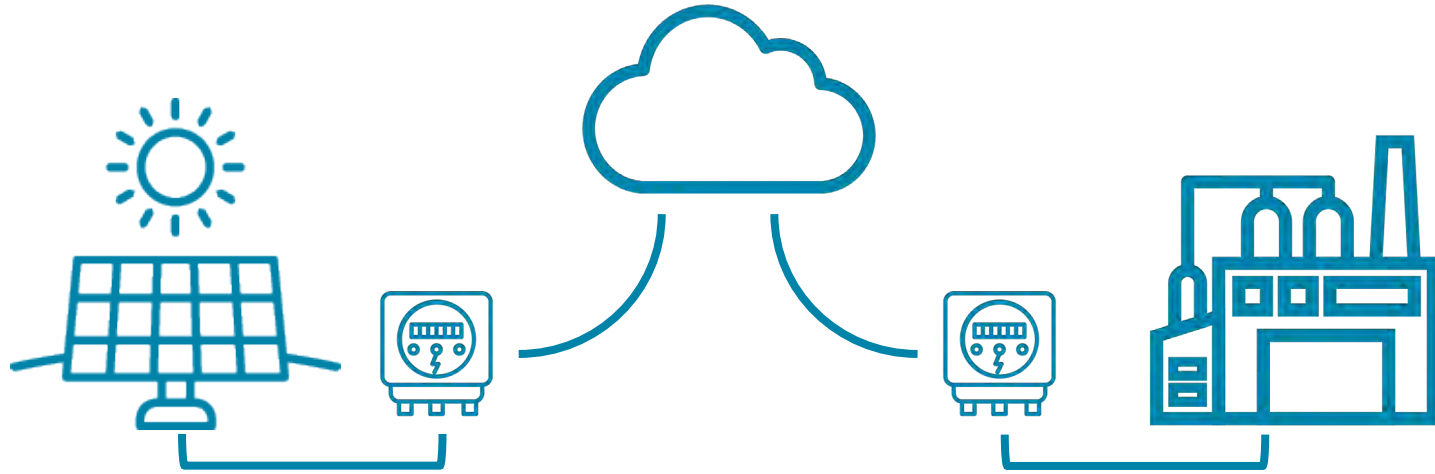
- This is driving coal and nuclear plant retirements
- Declining cost of storage will increasingly let solar and wind replace baseload
- Some gas needed near-term for peaking
- Uneconomical to invest in gas-fired power plants or pipelines with payback past ~2025

Pennsylvania is part of the PJM market



- Deregulated electricity market
- Utilities separate from generators
- Competitive wholesale and retail power market

In PJM, power can be purchased *virtually* in a financial transaction



- You can buy renewable energy directly from generators
- No need to put solar panels or wind turbines onsite
- These purchases are a “contract for differences” and offset your utility bill
- Renewable energy can be purchased for less than your current energy rate

Pennsylvania is positioned to be the solar hub of the Mid-Atlantic

- Central to the PJM market and close to major load centers: NYC, NJ, Philadelphia, Pittsburgh, DC
- Abundant land at reasonable cost
- Grid infrastructure with available capacity
- Investment-friendly local permitting in rural areas

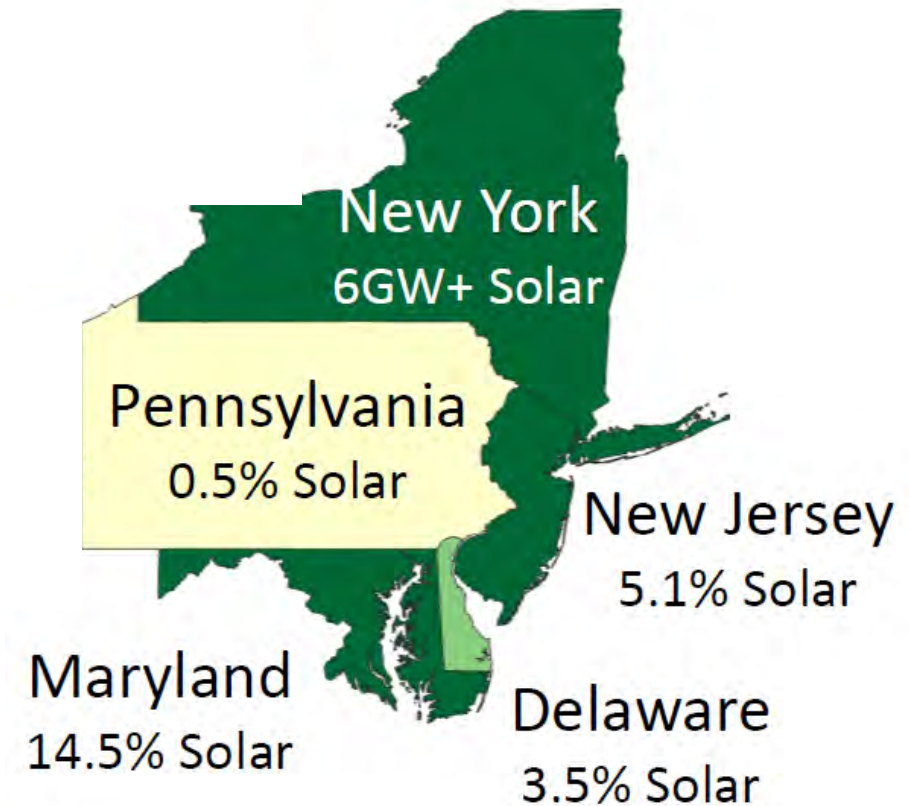
- The DEP's 2018 Finding Pennsylvania's Solar Future report:
 - The commonwealth could support 11GW of solar capacity by 2030
 - That's an increase from ~400MW today
 - Recommended increase of solar portion of Alternative Energy Portfolio Standard from current 0.5% to 4-8%
 - Would create 101k construction period jobs and 1.1k ongoing jobs
 - Net economic benefits to PA over \$25 billion from 2018-2030

Solar is a boon to rural Pennsylvania communities

- Beneficial reuse of closed mine sites
- Electrons a higher-value crop than soy or dairy, less impact on environment
 - Solar farms can offer rent 3-4x traditional crop or livestock \$/acre/year
- Solar sites can be planted with pollinator habitat, providing ecosystem services to surrounding farms
- Property tax revenue to stressed communities
- Huge capital investment (~\$1M per MW), a significant portion of which is locally spent (civil, construction, fencing)
- Ongoing O&M services from local contractors

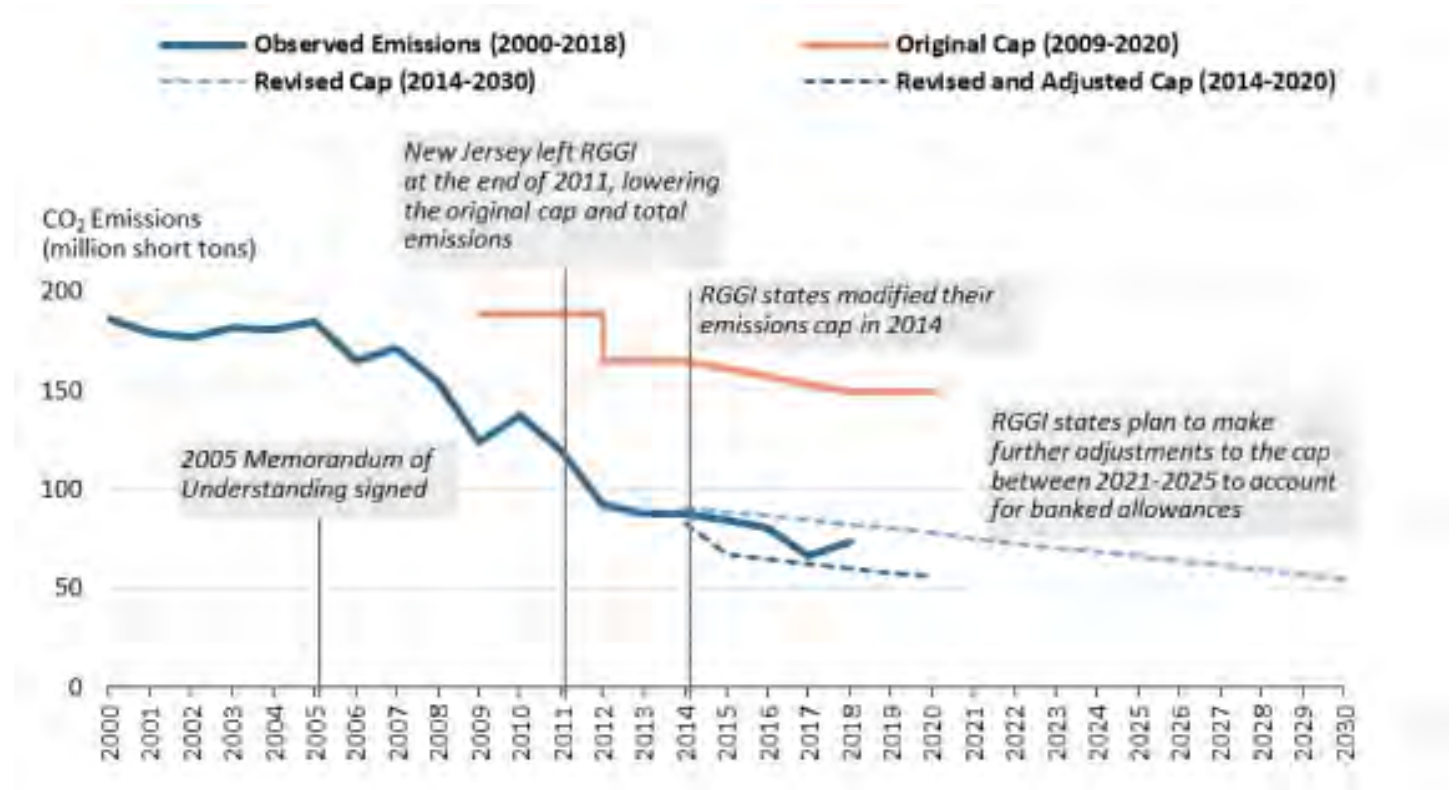
What does it take to get solar built?

- Technology is known
- Projects get built based on project finance, where substantially all investment is up front
- This requires revenue and costs to be locked in for the first 10-20 years of the project+
 - Costs are locked in for long term (rent, property tax O&M)
 - Revenue
 - Need certainty through PPA or hedge
 - Price must be \$40+ per MWh above current brown power prices to partially offset heavy subsidies to gas and coal generation (unpriced carbon emissions, upstream fuel subsidies, capacity payments)
 - Expanding AEPS per *PA Solar Future* recommendations would do this
 - Note: all other states around PA have much more aggressive renewable portfolio standards, and investment is currently flowing there instead of here



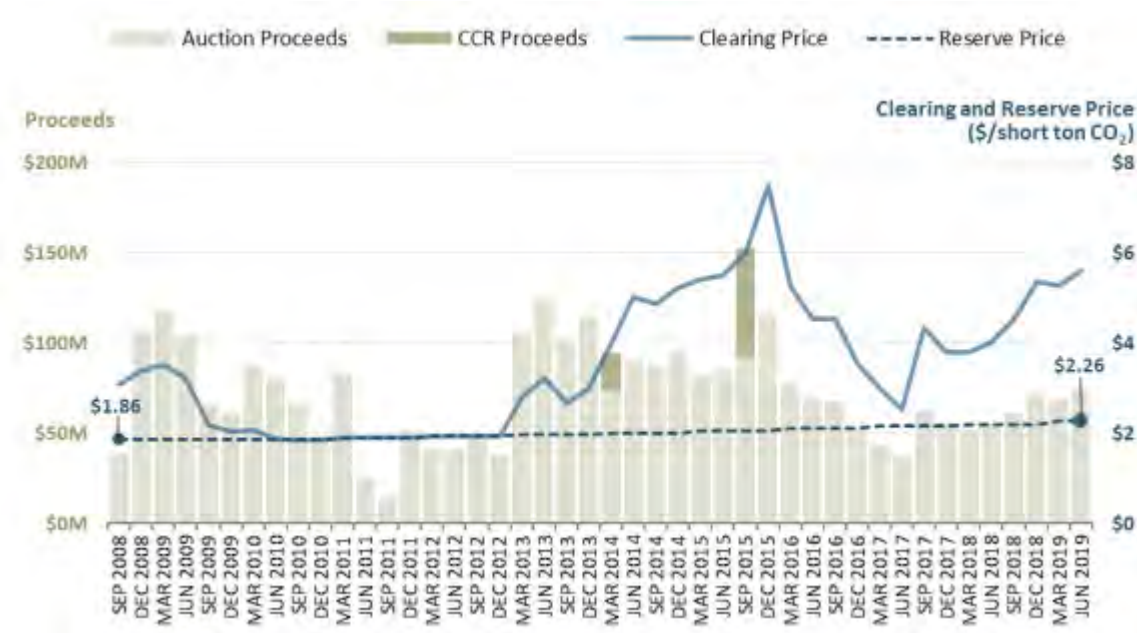
Does joining the Regional Greenhouse Gas Initiative help?

- It's a step in the right direction
- RGGI pretty weak
 - Only applies to power plants over 25MW
 - Doesn't take into account massive GHG impacts of methane from natural gas value chain
 - Trajectory for reduction of carbon cap is unambitious at ~30% from current levels by 2030
 - To limit global warming to 1.5°C, 45% emissions reduction by 2030 is required across all sectors



Does joining the Regional Greenhouse Gas Initiative help?

- It won't get any solar built or make a material dent in transitioning to clean energy
- Price per ton of carbon currently too low because cap is *much* too loose
 - Social cost of carbon in a world where real long-term discount rate is ~0% is much more than \$75/ton (global SCC at 2.5% discount rate)
 - RGGI clearing price <\$6/ton
 - Amounts to a huge continued subsidy for coal and gas – though reduced slightly vs. without RGGI
- Price is volatile – does not offer price certainty to project finance debt/equity investors



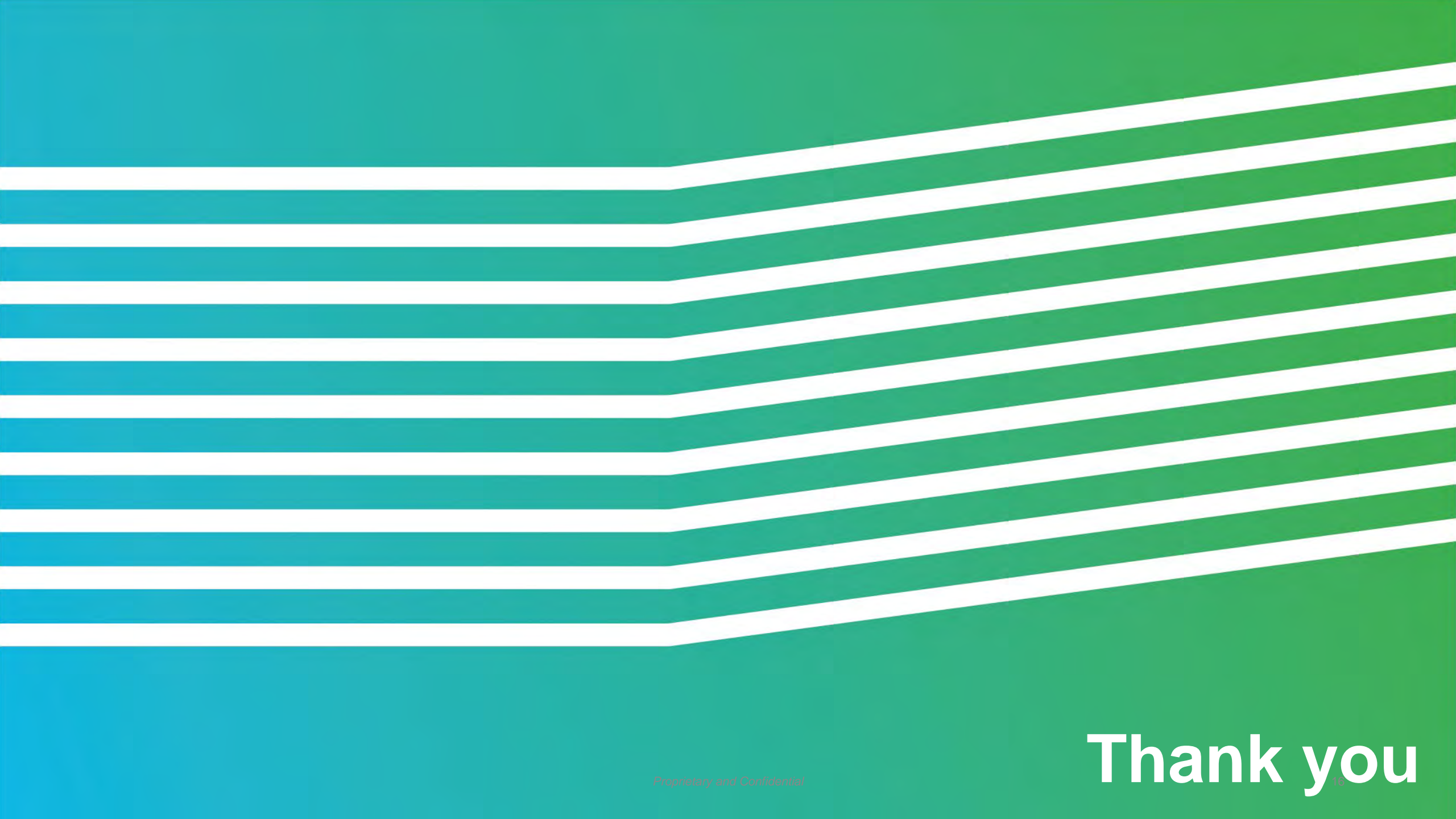
Recap

What I told you

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- You can buy renewable energy without onsite facilities
- Pennsylvania is positioned to be the solar hub of the Mid-Atlantic
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What you can do

- If you want to buy renewable electricity, call me
- If you want to support clean energy development to reinvigorate rural PA, call on your state reps and senators to support AEPS expansion



Thank you