RENEWABLE ENERGY IN SOUTHWESTERN PENNSYLVANIA

Prepared for the
Pennsylvania Environmental Council

Prepared by:

Dave Grossman
Principal, Green Light Consulting
www.ConsultGreenLight.com

About this Report

In 2017 the Pennsylvania Environmental Council (PEC) convened a dialogue on opportunities and challenges inherent in decarbonization of our state's electric generation sector. That event spurred a number of issue-focused examinations of different policies and technologies including carbon pricing, grid modernization, carbon capture, and more.

The growth and utilization of renewable generation has been a priority for not just those interested in reducing greenhouse gas emissions, but also for a wide range of individuals and interests: from the farmer looking to save costs and maybe even site renewable generation on their property, to companies and utilities looking to improve energy resiliency and diversity.

Pennsylvania's variation of a statewide renewable portfolio standard, ambitious when enacted but now surpassed in comparison to other states, ceilings in 2021. At the same time, companies, utilities, universities, cities, and others are setting their own clean energy goals and commitments. For Pennsylvania to continue its path toward a net zero future and economy, the growth of renewable generation will be essential.

With this in mind, PEC believed it useful to have a more detailed understanding of how renewable generation has grown in western Pennsylvania, and to gather input from key stakeholders on barriers to that growth. This report presents the findings of that effort, conducted and consolidated by Green Light Consulting.

Our objective is to take these findings and develop specific policy and action recommendations for decisions makers, but we also want to provide this synthesis to the public for their own consideration.

Updates on PEC's ongoing energy and climate work may be found at www.pecpa.org/energy.

PHASE 1

SCENE-SETTING:
RENEWABLE ENERGY IN SOUTHWESTERN PENNSYLVANIA

May 2019

Executive Summary

This paper is the first part of a broader research effort that aims to better understand the potential for increased renewable energy generation in Southwestern Pennsylvania. This paper sets the scene, describing where Southwestern Pennsylvania currently is with respect to both utility-scale and distributed renewable energy generation.

Key findings about the current status of renewables include the following:

- Energy has been a major part of the regional economy for a long time, with the Marcellus shale the current key driver, though renewables are also growing in importance.
- Renewables account for a very small amount of power in both the state as a whole (about 4.5% of electricity generated) and the southwestern region (under 1%).
- As of 2017, there were only two active wind farms in the 10-county Southwestern Pennsylvania area (both in Fayette County), though there are many in the windier areas in the Appalachian range in the neighboring counties to the east. There is one utility-scale solar project operating and another under development. There are nine large hydro plants operating. A few wind, solar, and hydro projects are planned.
- Solar in Pennsylvania is mostly distributed, and distributed solar has begun growing again (after peaking due to a state incentive program and then declining when the program ended). The vast majority of renewable generators in Southwestern Pennsylvania are distributed solar, though only Allegheny County is among the top counties in the state in terms of number of solar installations and solar generating capacity. Many of the surrounding counties have relatively few solar installations.
- The region also has some small bioenergy, landfill methane, geothermal, and micro hydro generation, but there is not much current and/or public data on them.

Barriers to utility-scale renewables deployment and demand in the region appear to be largely at the state level, including the weak state Alternative Energy Portfolio Standard and the near-exclusive focus on least-cost power procurement. The primary barriers to distributed renewables deployment and demand in the region are a mix of state and regional, including limited net metering availability and confusing, overlapping, under-funded, poorly marketed, non-optimized clean energy financing programs.

There are several initiatives underway that could potentially help address some of these barriers in Southwestern Pennsylvania and beyond. These include Pennsylvania's recently released *Climate Action Plan* and *Solar Future Plan*, the City of Pittsburgh's *Climate Action Plan*, efforts to power the growing numbers of electric vehicles, and initiatives by universities and governments to boost procurement of local renewables.

I. Introduction

This paper is intended to set the scene for a broader research effort that aims to better understand the potential for increased renewable energy generation – and its associated benefits – in the Southwestern Pennsylvania region. More specifically, the overall work will seek to address: (1) where Southwestern Pennsylvania currently is with respect to renewable energy generation (utility-scale and distributed); (2) how the region should prioritize supply-side decarbonization strategies for the electric power sector; (3) what the economic development potential is from scaling up renewable energy generation in the region; and (4) how progress can be sustained via customized strategies to meet regional goals. This paper focuses primarily on the first of those questions, while also providing some additional background on the regional energy scene. This paper, in turn, will help inform future work done by others to address the remaining focus areas.

In terms of how the region is defined, this paper primarily focuses on a 10-county area that includes Allegheny, Armstrong, Beaver, Butler, Fayette, Green, Indiana, Lawrence, Washington, and Westmoreland counties (*Figure 1*).

Figure 1: *Southwestern Pennsylvania region (Source: Adapted from Pennsylvania USGS County Map)*

II. Background on the Energy Landscape in Southwestern Pennsylvania

General Regional Trends of Note

The 10-county region occupies more than 7,100 square miles and is home to more than 2.5 million people.[1] More than three-quarters of the regional population currently lives in the 15% of the land area classified as urban. Population in the region has been declining, with much of the decline occurring in older, urbanized industrial centers, but areas by large universities and shale gas development have fared better than others. The region is expected to experience modest population growth (by about 337,000, or under 1% per year) through 2040.[2]

Household sizes in the region have been getting smaller (as in the rest of the country), dropping from an average of 3.52 people per household in 1950 to 2.3 in 2010, which has created demand for more housing even as overall population has declined. As population starts to grow over the next couple of decades, the fact that household size is shrinking means the number of households in the region is expected to grow even faster than population, with about 183,000 new households by 2040.[3]

In addition to its urban areas, agriculture remains a big part of the regional economy and culture, with about 9,700 working farms. Average farm size in acres and the number of farms have been declining in the region. Allegheny County has the fewest farms, Washington County has the most, and Indiana County has the largest.[4]

Regional Energy History

Energy has been a major part of the regional economy for a long time, including extraction of coal, natural gas, and oil. For instance, there are more than 7,000 people in Greene and Washington counties employed by the coal industry, with relatively high average salaries. Four coal-fired power plants in the region have been closed, though, and an additional one has been converted to run on natural gas.[5]

Recently, shale gas exploration, production, and utilization centered around the Marcellus and Utica have continued the trend of energy being a regional economic driver. The Pennsylvania Department of Environmental Protection (DEP) issued only 75 Marcellus well permits in the region in 2007, but it has issued over 6,000 per year in more recent years. There are now more than 40,000 active and operating oil and gas wells in the region. Renewables, too, are growing in importance in the region, and businesses are adding jobs there, as well as in shale. The region has over 800 firms and about 50,000 jobs in its diversified energy economy. Most of the energy workforce needs only a high school degree and some specialized training. Counties with strong

[1] Southwestern Pennsylvania Commission (SPC), *Our Region*, https://www.spcregion.org/reg.asp
[2] SPC, *Comprehensive Economic Development Strategy for Southwestern Pennsylvania*, Jan. 2017, pp.1-3, 1-7, 1-8, 1-10, 1-33, 1-40, https://www.spcregion.org/pdf/ceds/CEDS_Final_2017.pdf
[3] *Id.,* pp.1-5, 1-8
[4] *Id.*, pp.1-6, 1-50
[5] *Id.*, pp.1-51, 1-52

involvement in the energy sector include Armstrong, Beaver, Butler, Fayette, Greene, Indiana, Washington, and Westmoreland.[6]

Overview of Electricity in the Region

PJM operates the wholesale electricity market and manages the high-voltage transmission grid for tens of millions of people throughout all or part of 13 states, including Pennsylvania. Each load-serving entity has to ensure adequate generation resources to meet the needs of its customers, which they do through competitive least-cost procurement processes. Pennsylvania utilities do not own generation. Pennsylvania has a competitive retail electricity market, in which customers can choose their provider of electric services.[7] Pennsylvania customers can buy their electricity from a range of competitive Electric Generation Suppliers (EGSs) or receive default supply service from their local utilities – also known as Electricity Distribution Companies (EDCs). As of 2015, about 36% of customers (34% of residential, 46% of non-residential) got their electricity from an EGS.[8]

Several investor-owned utilities, rural electric co-ops, and municipal utilities serve the electricity needs of regional homes, businesses, and industries. Investor-owned EDCs include Duquesne Light and three subsidiaries of First Energy: West Penn Power, Pennsylvania Electric Company (Penelec), and Pennsylvania Power Company (Penn Power). To review each briefly:

- Duquesne Light provides electric service to more than 590,000 customers in Pittsburgh and in parts of Allegheny and Beaver counties; it is the only investor-owned utility located wholly within the region. Its usage mix is about 31% residential, 48% commercial, and 21% industrial. Its total energy usage in 2017 was 12,673 gigawatt-hours (GWh), down 3.8% from 2016, and total energy usage is projected to decrease over the next 5 years at an average rate of 0.7% per year. Duquesne Light's peak load is projected to grow from 2,682 megawatts (MW) in summer 2017 to 2,869 MW in summer 2022, or about 1.4% per year.[9] Of its 590,000 customers, roughly 89% are residential customers, and of those, about 25% are low-income.[10] Duquesne Light's distribution system was built to serve the steel industry, so it now has extra capacity; its utilization rate is around 50%.[11]
- West Penn serves about 725,000 customers in portions of 24 counties, including all of Armstrong, Fayette, Greene, Washington, and Westmoreland and portions of Butler and Allegheny. Across its territory, its total usage mix is about 34% residential, 22% commercial, and 41% industrial. Its total energy usage in 2017 was 21,554 GWh, down

[6] *Id.*, pp. 1-6, 1-10, 1-12, 1-13, 1-57, 1-58, 3-6
[7] Pennsylvania Public Utilities Commission, *Electric Power Outlook for Pennsylvania 2017-2022*, Aug. 2018, pp. 6-7, 14, http://www.puc.state.pa.us/General/publications_reports/pdf/EPO_2018.pdf
[8] Coalition for Green Capital, *Pennsylvania Clean Energy Market Report*, prepared for The Nature Conservancy, Feb. 28, 2017, p.13, http://coalitionforgreencapital.com/wp-content/uploads/2017/08/PA-Clean-Energy-Market-Report-8.15.17.pdf
[9] Pennsylvania Public Utilities Commission, *Electric Power Outlook for Pennsylvania 2017-2022*, *supra* note 7, pp.24-25
[10] Duquesne Light, *Comments on NARUC Distributed Energy Resources Compensation Manual*, Sept. 2, 2016, https://pubs.naruc.org/pub.cfm?id=4084397F-0FEF-E4DC-1997-433DEFBC9FCF
[11] University of Pittsburgh, *Mission Innovation Workshop on Grid Modernization*, June 24, 2016, p.17, https://www.energy.gov/sites/prod/files/2016/10/f33/Chapter%209_University%20of%20Pittsburgh_Mission%20Innovation%20Workshop%20of%20Grid%20Modernization.pdf

2% from 2016, and total energy usage is projected to increase over the next 5 years at an average rate of 0.3% per year. West Penn's highest peak was 3,879 MW in January 2018, which is expected to decrease to 3,804 MW by winter 2022, or by about 0.4% per year.[12] As of a couple of years ago, roughly 27% of West Penn's residential customers were below 150% of federal poverty income guidelines, including 25.5% in Allegheny County, 29.5% in Armstrong, 21.2% in Butler, 38.7% in Fayette, 31.6% in Greene, 36.8% in Indiana, 23.7% in Washington, and 25.6% in Westmoreland.[13]

- Penelec provides electric service to about 587,000 customers in portions of 29 counties, including all of Indiana County, while Penn Power serves about 164,000 customers in 6 counties, including all of Lawrence and portions of Butler and Beaver.[14] As of a couple of years ago, roughly 33% of Penelec's residential customers were below 150% of federal poverty income guidelines, including 18% in Armstrong, 36.8% in Indiana, and 25.6% in Westmoreland.[15] As of the end of 2016, Penn Power had an estimated 26.5% of its customers below 150% of federal poverty income guidelines.[16] Looking forward, Penelec's high peak of 2,910 MW in January 2018 is projected to decrease to 2,779 MW by 2022. Penn Power's high peak of 926 MW in summer 2017 is projected to increase to 985 MW by 2022.[17]

*Number of Estimated Low-Income Electric Customers**

Company	Number of Estimated Low-Income Customers	Percent of Customers
Duquesne	134,808	25.6%
Met-Ed	123,432	24.9%
PECO-Electric	381,799	26.3%
Penelec	164,713	32.8%
Penn Power	38,034	26.5%
PPL	322,692	26.2%
West Penn	170,286	27.3%
Total/Industry Average	1,335,764	26.9%

*Low-income is defined as household income at or below 150 percent of FPIG.

[12] Pennsylvania Public Utilities Commission, *Electric Power Outlook for Pennsylvania 2017-2022*, *supra* note 7, pp.28, 32-33

[13] West Penn Power Company, *Universal Service & Energy Conservation Plan Program Years 2015, 2016, 2017 and 2018*, Mar. 28, 2017, pp.26, 31, http://www.puc.state.pa.us/General/pdf/USP_FE-WPP.pdf

[14] Pennsylvania Public Utilities Commission, *Electric Power Outlook for Pennsylvania 2017-2022*, *supra* note 7, pp.28, 30

[15] Pennsylvania Electric Company, *Universal Service & Energy Conservation Plan Program Years 2015, 2016, 2017 and 2018*, Mar. 28, 2017, pp.26, 31, http://www.puc.state.pa.us/general/pdf/USP_FE-Penelec.pdf

[16] Pennsylvania PUC, Bureau of Consumer Services, *2016 Report on Universal Service Programs & Collections Performance*, Oct. 2017, p.7, http://www.puc.pa.gov/General/publications_reports/pdf/EDC_NGDC_UniServ_Rpt2016.pdf

[17] Pennsylvania Public Utilities Commission, *Electric Power Outlook for Pennsylvania 2017-2022*, *supra* note 7, pp.30, 32

Figure 2: *Low-income customers (Source: PA PUC, 2016 Report on Universal Service Programs & Collections Performance, p.7)*

In addition to the investor-owned utilities, there are also municipal utilities (munis) and rural electric cooperatives (co-ops) serving the region:

- Munis include the boroughs of Ellwood City (mostly in Lawrence and a bit in Beaver), New Wilmington (Lawrence), Pitcairn (Allegheny), Tarentum (Allegheny), Wampum (Lawrence), and Zelienople (Butler).[18] Ellwood City is apparently at the vanguard of LED lighting efforts, with 100% of its outdoor lighting (e.g., street lights, traffic signals) now converted to LEDs.[19] Tarentum (sometimes referred to as Redcat Power) distributes power that comes from a range of West Penn primary feeds located at the Borough's boundaries,[20] while Pitcairn buys power from the open market.[21]
- Co-ops include Central Electric Cooperative (portions of Butler and Armstrong, as well as outside the region), REA Energy Cooperative (Indiana and a portion of Armstrong, as well as outside the region), United Electric (a portion of Armstrong), and Somerset (a portion of Fayette).[22]

In terms of wholesale electricity prices in the region, so far in 2019 (through mid-March), the PJM Western hub for wholesale electricity (which covers the region) has yielded real-time peak, weighted average prices ranging from $22.58/MWh to $98.64/MWh. The typical range across all of 2018 was similar, with a low of $22.71/MWh, though 2018 saw a couple of outlier days with prices over $100 and one day with prices over $360.[23]

With regard to retail electricity prices, each electricity supplier offers a different rate, and those rates vary by customer class. For instance:

- Duquesne Light's default service supply rates are 6.0654 cents/kWh for residential, 5.7642 cents/kWh for small commercial and industrial, and 6.6810 for medium commercial and industrial,[24] though Duquesne Light lists its class average price-to-compare rates (which include both energy and transmission charges) for general service small and medium businesses as 6.49 cents/kWh for small, 6.78 cents/kWh for medium below 25 kW, and 7.36 cents/kWh for medium equal to or greater than 25 kW (effective March 1, 2019).[25]

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[18] Pennsylvania Municipal Electric Association, *Municipal Members*, http://www.pmea.us/municipal.html
[19] AMP Public Power Partners, Member Spotlight Archive, *Ellwood City, Pennsylvania*, https://www.amppartners.org/about/member-spotlight/member-spotlight-archive/amp-spotlight-archive-city/ellwood-city
[20] Borough of Tarentum, *Electric Distribution*, https://tarentumboro.com/departments/electric
[21] Pitcairn Borough, *Pitcairn Power*, http://pitcairnborough.us/index.php?option=com_content&task=view&id=20&Itemid=51
[22] Pennsylvania Rural Electric Association, *Member Cooperatives*, https://www.prea.com/member-cooperatives
[23] EIA, Wholesale Electricity and Natural Gas Market Data, release date: Mar. 14, 2019, https://www.eia.gov/electricity/wholesale/
[24] Duquesne Light Co., *Schedule of Rates*, effective Jan. 1, 2019, p.88, https://www.duquesnelight.com/docs/default-source/default-document-library/CurrentTariff.pdf?sfvrsn=e69ca442_44
[25] Duquesne Light Company, *Business Rates* website, https://www.duquesnelight.com/service-reliability/customer-choice/rates/business-rates

- West Penn Power's default service rate for service rendered through the end of February 2019 was 6.354 cents/kWh for residential and 6.962 cents/kWh for commercial.[26]
- Penn Power's default service rate for service rendered through the end of February 2019 was 7.714 cents/kWh for residential and 7.807 cents/kWh for commercial.[27]
- Penelec's default service rate for service rendered through the end of February 2019 was 6.288 cents/kWh for residential and 6.654 cents/kWh for commercial.[28]

[26] West Penn Power, *Electric Service Tariff*, effective Jan. 1, 2019, p.173, https://firstenergycorp.com/content/dam/customer/Customer%20Choice/Files/PA/tariffs/WPP-Tariff-40-Supp-50.pdf
[27] Pennsylvania Power Company, *Electric Service Tariff*, effective Jan. 1, 2019, p.123, https://firstenergycorp.com/content/dam/customer/Customer%20Choice/Files/PA/tariffs/PP-Tariff-36-Supp-54.pdf
[28] Pennsylvania Electric Company, *Electric Service Tariff*, effective Jan. 1, 2019, p.136, https://firstenergycorp.com/content/dam/customer/Customer%20Choice/Files/PA/tariffs/Penelec-Tariff-81-Supp-68.pdf

III. Status of Renewable Energy in Southwestern Pennsylvania

State and Regional Electricity Mix

Statewide, only about 4.5% of the net electricity generated in Pennsylvania in 2017 came from renewables, with wind a bit over 1.5%, conventional hydro a bit below 1.5%, and solar far below 1%. The largest portions of the state electricity mix are nuclear (about 39%), natural gas (around 34%), and coal (around 22%).[29]

The numbers are different within the Southwestern Pennsylvania region, though not meaningfully so for renewables. As of 2016, coal accounted for more than half of the region's electric generation *capacity*, with natural gas accounting for just over a quarter and nuclear for about 15%. Wind accounted for only 5%, while solar, hydro, and biomass were all well under 1%. Coal is the largest electricity generation source by capacity in Armstrong and Indiana counties, while it is gas in Allegheny, Fayette, and Lawrence, nuclear in Beaver, hydro in Westmoreland, and biomass in Washington. There is no significant electricity generation capacity in Butler or Greene counties.[30]

The only county in the region in the top 10 statewide for renewable *generation* in 2016 was Fayette.[31] As a percentage of utility and non-utility electricity generated locally from sources with over 1 MW of capacity, renewables have largely remained flat in the region (*Figure 3*). Production from utility-scale renewables fell slightly from 2003-14, and renewables remain under 1% of the region's energy portfolio. For example, in 2014, the region produced 82.1 million MWh of electricity, of which 0.6% came from renewables. The region produces far more electricity than it consumes, though, so in terms of consumption, almost half of the electricity consumed locally in 2014 was from local carbon-free sources – though only 1.6% from renewables.[32]

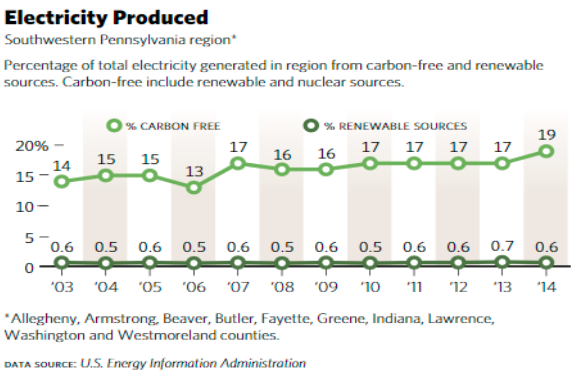

Figure 3: *Southwestern Pennsylvania electricity produced*

(Source: Sustainable Pittsburgh, Southwestern Pennsylvania Sustainability Goals + Indicators Report, p.67)

[29] U.S. EIA, *Detailed State Data: Net Generation by State by Type of Producer by Energy Source 1990-2017*, released Sept. 2018, https://www.eia.gov/electricity/data/state/annual_generation_state.xls; U.S. EIA, *Pennsylvania: State Profile and Energy Estimates*, last updated July 19, 2018, https://www.eia.gov/state/?sid=PA

[30] Liz Reid, *PA Electricity Generation Is Moving Away From Coal. Would It Move Back Under Trump?*, 90.5 WESA, Apr. 17, 2017, https://www.wesa.fm/post/pa-electricity-generation-moving-away-coal-would-it-move-back-under-trump

[31] E2, *Our Energy Renewal: A Pennsylvania Clean Energy Map*, Sept. 26, 2016, https://www.e2.org/reports/energy-renewal-pennsylvania-clean-energy-map/

[32] Sustainable Pittsburgh, *Southwestern Pennsylvania Sustainability Goals + Indicators Report*, 2016, pp.66-67, http://sustainablepittsburgh.org/2016Report/web/viewer.html

Widening the lens, the Power of 32 Region, which unites 32 counties across southwestern Pennsylvania, western Maryland, eastern Ohio, and northern West Virginia, prepared an energy baseline for the region in late 2014 (based on 2011 data) that provides a larger reflection of the situation. Coal dominated the regional profile, accounting for 61% percent of primary energy inputs, 75% of energy production, 86% of fuel consumption for retail electricity generation, and 54% of estimated net energy exports in the region.[33] The analysis revealed very little biomass generation in the 10-county area or in the Power of 32 region, some hydro and wind, and virtually no solar.[34]

Existing Utility-Scale Renewable Energy Projects

Of the renewables that came online in the state between 2010 and 2015, almost 90% was utility-scale, mostly wind and hydro.[35] A map of operating utility-scale wind, hydro, and solar facilities in Southwestern Pennsylvania as of mid-2016 is below (*Figure 4*).

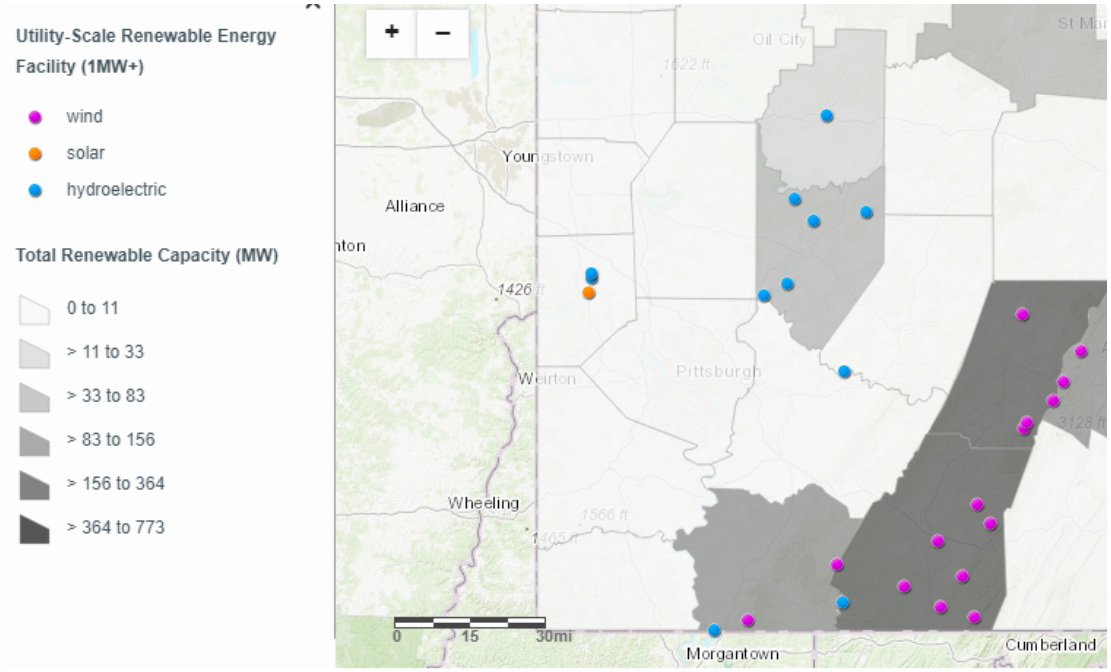

Figure 4: *Pennsylvania utility-scale generation from wind, solar, and hydro as of June 2016 (Source: E2, Our Energy Renewal: A Pennsylvania Clean Energy Map)*

Wind resources at 80 meters and above are excellent around the Appalachian range in Southwestern Pennsylvania (*Figure 5*), and large wind projects have had little trouble accessing capital in the state.[36] Yet new wind farm development in the state has largely stalled. More than

[33] *Energy Baseline for the Power of 32 Region*, Commissioned by Sustainable Pittsburgh, Dec. 2014, p.4, http://www.energy4p32.org/RegionalEnergyBaselineforP32v.2.pdf
[34] *Id.*, pp.84, 86-88
[35] Coalition for Green Capital, *Pennsylvania Clean Energy Market Report*, *supra* note 8, p.17
[36] *Id.,* pp.81-86

two dozen wind farms were developed leading up to 2012, but only one between then and the end of 2017.[37]

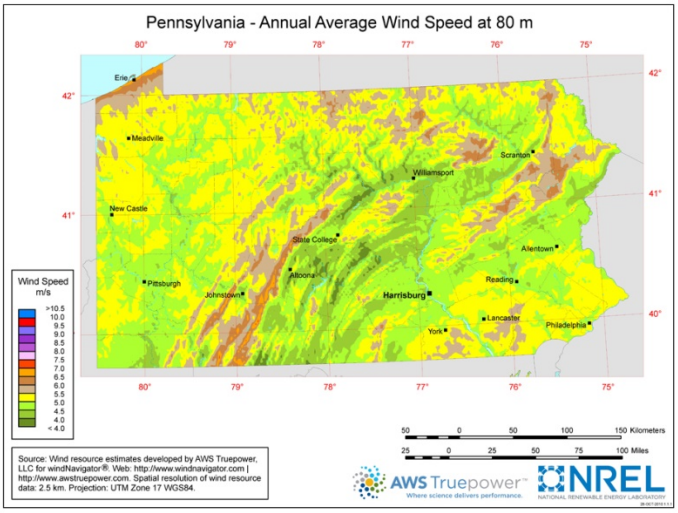

Figure 5:
Pennsylvania wind speed at 80m

(Source: US Department of Energy, WINDExchange, https://windexchange.energy.gov/states/pa)

As of 2017, there were only two active wind farms in the 10-county area, both in Fayette – the Mill Run (10 turbines, 15 MW capacity) and South Chestnut (23 turbines, 46 MW capacity) farms – though there are many in the windier areas in the neighboring counties to the east (*Figure 6*).[38] (The U.S. Energy Information Administration (EIA), which collects information about existing generators with 1 MW or more of combined nameplate capacity, lists only the South Chestnut plant, which it describes as having 50.4 MW of nameplate capacity.[39])

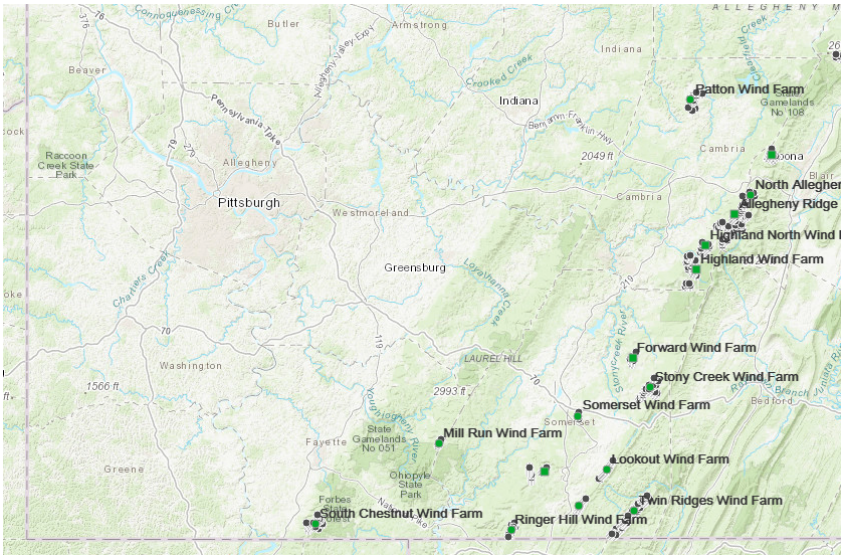

Figure 6:
Regional wind farms as of 2017

(Source: St. Francis University, Pennsylvania Wind Farms)

[37] Amy Sisk, *A surge, then a fade for Pennsylvania's wind industry*, StateImpact Pennsylvania, Jan. 12, 2018, https://stateimpact.npr.org/pennsylvania/2018/01/12/a-surge-then-a-fade-for-pennsylvanias-wind-industry/
[38] St. Francis University, *Pennsylvania Wind Farms*, 2017 data, https://www.francis.edu/Pennsylvania-Wind-Farms/
[39] EIA, *Form EIA-860 detailed data with previous form data (EIA-860A/860B, Schedule 3, 'Wind Technology Data' (Operable Units Only),* Release Date: September 13, 2018, Final 2017 data, https://www.eia.gov/electricity/data/eia860/

With respect to solar, there are at least two utility-scale projects operating or under development in the region as of February 2019: the 1.3 MW Beaver Solar plant (operating) and the 20 MW Claysville Solar Farm (under development) (*Figure 7*).[40]

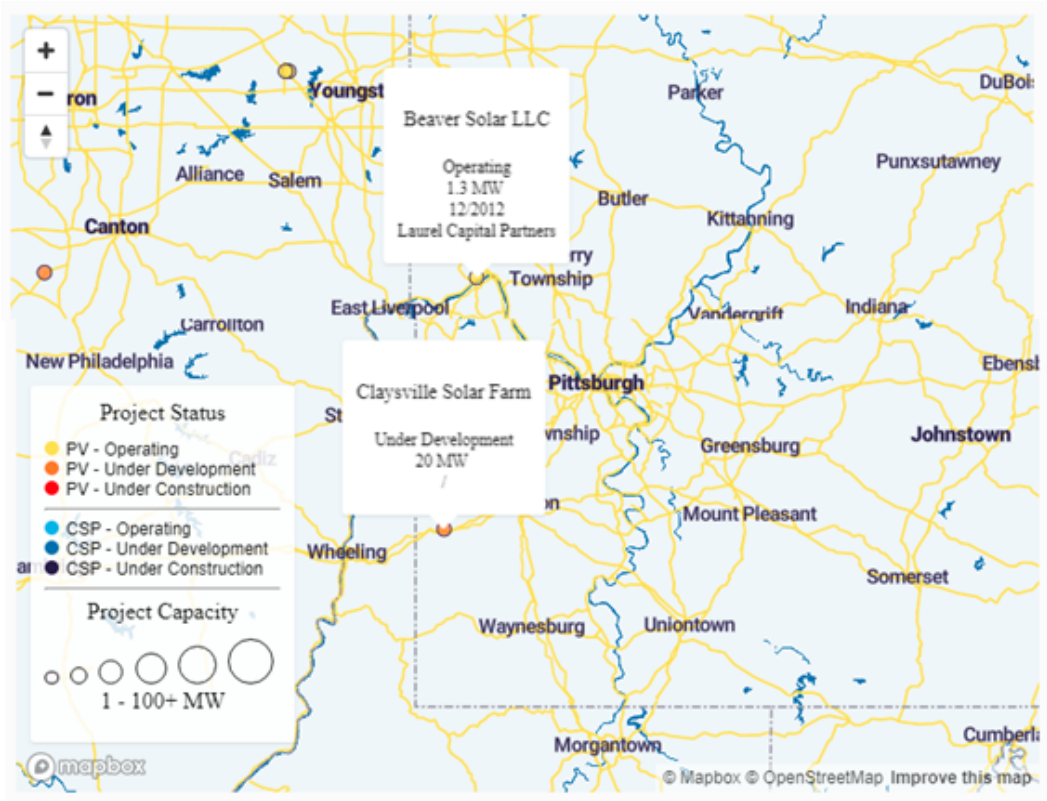

Figure 7: *Major solar projects in the region as of Feb. 2019 (Source: SEIA's Major Solar Projects List)*

With respect to hydro, there are 9 hydro plants operating within the 10-county area according to the EIA: Allegheny No. 5 (9.2 MW combined nameplate capacity), No.6 (9.2 MW), No. 8 (13.6 MW), and No. 9 (17.8 MW) in Armstrong; Mahoning Creek (6.0 MW) in Armstrong; Townsend (5.2 MW) and Beaver Valley Patterson (1.2 MW) in Beaver; Lake Lynn (38.4 MW) in Fayette; and Conemaugh (15 MW) in Westmoreland.[41] Within Duquesne Light's service territory, only 0.27% of electrical generation is hydro.[42]

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[40] SEIA, *Major Solar Projects List*, last updated Feb. 2019, https://www.seia.org/research-resources/major-solar-projects-list; EIA, *Form EIA-860 detailed data with previous form data (EIA-860A/860B, Schedule 3, 'Solar Technology Data' (Operable Units Only),* Release Date: September 13, 2018, Final 2017 data, https://www.eia.gov/electricity/data/eia860/

[41] EIA, *Form EIA-860 detailed data with previous form data (EIA-860A/860B, Schedule 3, 'Generator Data' (Operable Units Only),* Release Date: September 13, 2018, Final 2017 data, https://www.eia.gov/electricity/data/eia860/

[42] City of Pittsburgh, *Climate Action Plan Version 3.0*, 2018, p.23, https://pittsburgh.legistar.com/View.ashx?M=F&ID=5817176&GUID=075303EF-B062-46D5-A5EE-68A209C2B01A

Proposed Renewable Energy Projects

There are many proposed renewable resources in the region under study for possible interconnection to the PJM grid, as shown in the map below.[43]

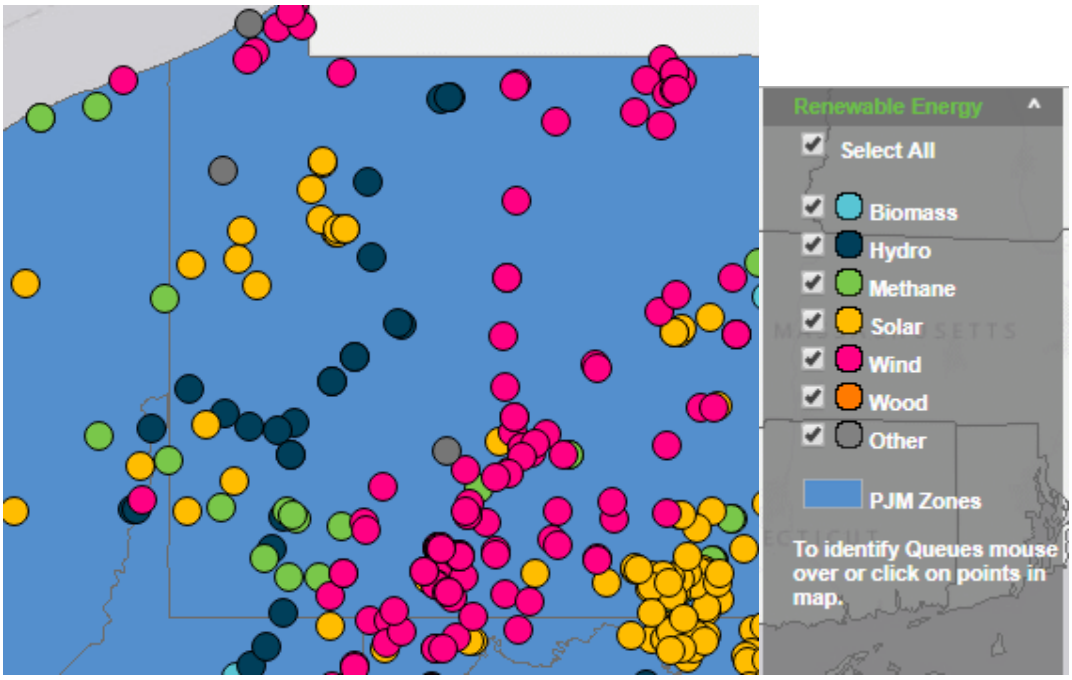

Figure 8: *Proposed renewables projects for grid interconnection (Source: PJM, Proposed Renewables Projects Map)*

PJM's New Services Queue as of mid-February 2019 included four wind farms: Mill Run in Fayette for both energy and capacity, South Chestnut in Fayette for capacity, Iron Bridge in Fayette for capacity, and Dans Mountain in Allegheny for capacity. It also included two solar farms (both Gaucho Solar) in Washington and Gardy's Mill Solar in Westmoreland, a landfill methane project in Washington, three hydro projects in Armstrong, and three storage projects (two in Allegheny, one in Fayette). Many of these projects are already active or in service, though some are under construction or in the engineering and procurement stage.[44]

There are about a dozen hydro projects planned in the region to provide power at existing dams on the Allegheny, Ohio, and Monongahela rivers. If all are built, they would have a combined capacity greater than 200 MW. For instance, a proposed hydro plant at Lock and Dam No. 2 on the Allegheny, below the Highland Park Bridge, could produce 11 MW when it comes online in 2022, and the University of Pittsburgh signed a letter of intent in November 2018 to purchase 100% of its power.[45]

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[43] PJM, *Proposed Renewables Projects Map*, accessed Feb. 15, 2019 , https://mapservices.pjm.com/renewables/
[44] PJM, *New Services Queue*, accessed Feb. 15, 2019, https://www.pjm.com/planning/services-requests/interconnection-queues.aspx
[45] Laura Legere, *Developers of hydro plants see role in Pittsburgh region*, Pittsburgh Post-Gazette, Dec. 26, 2015, https://www.post-gazette.com/business/powersource/2015/12/26/developers-of-hydro-plants-see-role-in-pittsburgh-

Distributed Generation Trends

It is difficult to determine exactly how many and what kind of distributed energy resources have been deployed in the region. Since they operate behind the meter, they are essentially invisible to distribution utilities unless they displace all load or send power back into the distribution system.[46] As of mid-2016, though, only about 350 of Duquesne Light's customers (0.06%) used net metering.[47]

Still, there is a fair amount of data on distributed solar. Statewide, in 2016, more than 250 MW of distributed solar was connected to the grid, three-quarters of which was in the commercial and industrial sectors. Solar in Pennsylvania is mostly distributed; only 22 MW of solar in the state was utility-scale as of early 2017.[48] Growth rates for distributed solar from 2013-17 were 22% for residential and 7% for commercial. As of the end of 2017, Pennsylvania had 318 MW of installed solar capacity from more than 16,000 solar power systems across the state, accounting for about 0.25% of the state's electricity consumption. More than 70% of that generation came from systems with capacity under 1 MW. Installation trends (*Figure 9*) reflect the incentives offered under the state-run Sunshine Grant program from 2009-12, the significant shrinking of the market (and loss of solar contractors) after the program's termination, the plummeting costs for solar, and the rise of residential solar leasing starting in 2016.[49] The growing demand for distributed solar is generally paid for with cash, credit card debt, or home equity financing.[50]

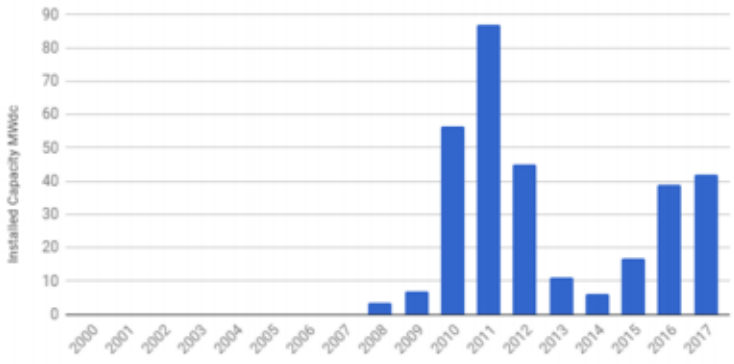

Figure 9: *Installed solar capacity in PA (Source: PA DEP, Pennsylvania's Solar Future Plan, p.24)*

Within Southwestern Pennsylvania, there is a decent amount of solar. Of the more than 2,700 facilities in the 10-county area that qualify for the state Alternative Energy Portfolio Standard

region/stories/201512260010; Reid Frazier, *Are We Heading for a Hydropower Boom on the Three Rivers?*, The Allegheny Front, May 26, 2017, https://www.alleghenyfront.org/are-we-heading-for-a-hydropower-boom-on-the-three-rivers/; Rita Michel, *Firm plans hydroelectric plant below Highland Park Bridge*, Pittsburgh Post-Gazette, Oct. 18, 2018, https://www.post-gazette.com/local/north/2018/10/18/Firm-plans-hydroelectric-plant-below-Highland-Park-Bridge/stories/201809270006; Bill Shackner, *Pitt planning to buy all power generated from planned hydroelectric plant*, Pittsburgh Post-Gazette, Nov. 29, 2018, https://www.post-gazette.com/business/powersource/2018/11/29/University-of-Pittsburgh-Pitt-sustainable-renewable-energy-hydroelectric-Rye-Development-environment/stories/201811290092

[46] Duquesne Light, *Comments on NARUC Distributed Energy Resources Compensation Manual*, *supra* note 10

[47] University of Pittsburgh, *Mission Innovation Workshop on Grid Modernization*, *supra* note 11, pp.15, 17

[48] Coalition for Green Capital, *Pennsylvania Clean Energy Market Report*, *supra* note 8, p.17

[49] PA DEP, *Pennsylvania's Solar Future Plan*, Nov. 2018, pp.xiv, 23, http://files.dep.state.pa.us/Energy/Office%20of%20Energy%20and%20Technology/OETDPortalFiles/Pollution%20prevention%20and%20Energy%20assiatance/SolarFuture/Pennsylvania%27s%20Solar%20Future%20Plan.pdf

[50] Coalition for Green Capital, *Pennsylvania Clean Energy Market Report*, *supra* note 8, pp.8, 97-98

(AEPS), the vast majority are solar.[51] According to PJM's Generation Attribute Tracking System (GATS), registered renewable generators in the region break down as follows:[52]

County	# of Renewable Generators	Breakdown of Generators
Allegheny	2085	2 hydro, 1 natural gas CHP, 2 blast furnace gas, 2 other gas, all the rest solar
Armstrong	14	2 hydro, rest solar
Beaver	264	2 hydro, rest solar
Butler	36	All solar
Fayette	37	1 wind, 1 hydro, rest solar
Greene	7	All solar
Indiana	21	1 hydro, 1 waste coal, rest solar
Lawrence	14	All solar
Washington	77	1 landfill gas, rest solar
Westmoreland	116	1 wind, 1 hydro, rest solar

As of 2016, Allegheny County was among the top 10 counties in the state in terms of number of solar installations and among the top 20 for solar generating capacity – the only county in the region to reach the rankings. (As of mid-2016, the City of Pittsburgh alone had about 130 MW of potential renewable generation in the pipeline, from hydropower and the installation of solar panels on parking garages.[53]) As the table above shows, many of the surrounding counties have relatively few solar installations.[54] However, spurred by Solar United Neighbors, solar co-ops started launching in the region in 2018 to solicit bids as a group (and thus get better prices) from solar installers, including co-ops in Allegheny and Indiana counties. Additional co-ops may launch this year in Butler and Beaver.[55]

Solar is not the only distributed renewable energy option to consider. For example, the region also has some bioenergy generation. Bioenergy encompasses a range of technologies and feedstocks, and its carbon neutrality is a matter of debate. There were numerous existing and proposed biomass-burning facilities in the region as of 2012 (*Figure 10*), including the Babcock Lumber Mill in Allegheny, Coastal Lumber/Hopewood Sawmill in Fayette, Furnace Tri State Biofuels in Fayette, Holt & Bugbee Hardwoods Mill in Fayette, Greene Team Pellet Fuel Company in Greene, Stein-David Hardwood in Lawrence (proposed), Babcock Lumber Mill in

[51] PA PUC, *Pennsylvania Alternative Energy Credit Program*, "Qualified Facilities," accessed Feb. 15, 2019, http://www.pennaeps.com/reports/

[52] PJM, *Generation Attribute Tracking System*, *Renewable Generators Registered in GATS*, Report includes all data up to 2/19/2019 12:10:00 AM, https://gats.pjm-eis.com/gats2/PublicReports/RenewableGeneratorsRegisteredinGATS

[53] University of Pittsburgh, *Mission Innovation Workshop on Grid Modernization*, *supra* note 11, p.15

[54] Andy Schell, Paradise Energy Solutions, *Top 10 Counties for Solar in Pennsylvania*, Nov. 19, 2017, https://www.paradisesolarenergy.com/blog/solar-counties-pa/

[55] Amy Sisk, *Solar co-ops grow in western PA*, StateImpact Pennsylvania, Dec. 26, 2018, https://stateimpact.npr.org/pennsylvania/2018/12/26/solar-co-ops-grow-in-western-pa/

Westmoreland, Greensburg Thermal in Westmoreland, Gutchess Hardwoods Mill in Westmoreland, and Coskata (ethanol) in Westmoreland.[56]

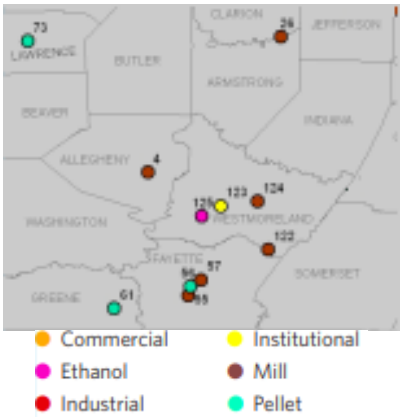

Figure 10: *Existing & proposed biomass-burning facilities in Southwestern Pennsylvania in 2012 (Source: Adapted from Booth, Biomass Energy in Pennsylvania)*

The region also has two biogas plants (*Figure 11*), at Brookside Dairy and at the Ambridge Sewage Treatment Plant.[57] As of mid-2011, there were also six landfill methane projects in the region, at the Imperial and Monroeville Landfills in Allegheny, J.J. Bruner Landfill in Beaver, Seneca Landfill in Butler, Arden Landfill in Washington, and USA Valley Landfill in Westmoreland.[58] (The EIA lists only the Arden plant in its 2017 EIA-860 database.[59])

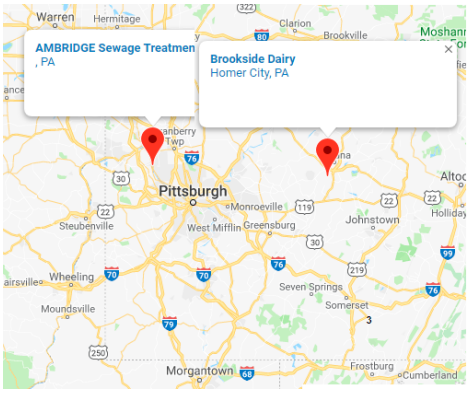

Figure 11: *Regional biogas plants as of May 2017 (Source: U.S. Biogas Plants, Biomass Magazine)*

Pennsylvania is also considered a good location for installation of geothermal heating and cooling, and many contractors offer installation services, but there is no public information on

[56] Mary S. Booth, Partnership for Public Integrity, *Biomass Energy in Pennsylvania: Implications for Air Quality, Carbon Emissions, and Forests*, Dec. 2012, https://www.pfpi.net/wp-content/uploads/2012/12/PFPI-PA-Biomass-Energy-Report_12_18_12.pdf

[57] *U.S. Biogas Plants,* Biomass Magazine, last modified May 24, 2017, http://biomassmagazine.com/plants/map/biogas

[58] PA DEP, *Pennsylvania Landfill Methane Projects*, updated July 28, 2011, https://www.dep.pa.gov/Business/Land/Waste/SolidWaste/MunicipalWaste/Landfill-Methane-Outreach-Program/Pages/PA-Landfill-Methane-Projects.aspx

[59] EIA, *Form EIA-860 detailed data with previous form data (EIA-860A/860B, Schedule 3, 'Generator Data' (Operable Units Only), supra* note 41

the number of geothermal heat pump installations in the state. There likewise is no public data on micro hydro systems (under 1 MW) in Pennsylvania.[60]

[60] Coalition for Green Capital, *Pennsylvania Clean Energy Market Report*, *supra* note 8, pp.89-92

IV. Barriers to Renewables Deployment and Demand in the Region

Barriers to Utility-Scale Renewables

The primary barriers to greater development of utility-scale renewables in the region appear to be at the state level. Some of them are circumstantial, such as the fact that the wind in Pennsylvania does not compare to places like the Great Plains. Some are competitive, such as the fact that the natural gas boom led to a surge of cheap gas-fired power plants.[61] Some are regulatory, such as the lengthy, complex permitting and licensing process in the state for hydro, which can deter investors.[62]

The central barrier appears to be the state's Alternative Energy Portfolio Standard, which is weak compared to other states. Its targets are low, and its design and resource scope (e.g., waste coal) have spurred little renewable energy activity beyond the required minimum. Large, out-of-state solar projects have registered in the AEPS compliance system, leading to very low solar renewable energy credit (SREC) prices in Pennsylvania, which mean the SRECs have virtually no impact on the economics of solar projects. (Act 40, passed in October 2017, may help support solar growth by requiring resources qualified to meet the AEPS solar carve-out to be in-state, though out-of-state resources can still be used to meet the rest of the AEPS.[63]) The ability to use non-renewable resources to meet the AEPS and the reliance on out-of-state resources for AEPS compliance significantly reduce the incentive for in-state development of renewable generation.[64] For instance, one of the key conclusions that came out of the *Pennsylvania's Solar Future* stakeholder process (described more in Part V) is that AEPS reform is absolutely key to solar growth in the state.[65] Wind developers have likewise suggested that more wind development could happen in the state if it increased the percentage of renewables in the AEPS and/or required qualified wind power to be in-state.[66]

AEPS reform may also be an avenue for altering the regulatory compact in Pennsylvania, as the structure of utility power purchasing currently makes utilities poor targets for those seeking to increase renewables deployment in the region. While customers can contract directly with EGSs for renewable power if they want to, utilities purchasing power for their default customers do so through contracts with suppliers that are focused primarily on least-cost. Default service plans have to be approved by the PA Public Utility Commission (PUC), after which an RFP is issued for 1- or 2-year full-service contracts with suppliers (to provide power, ancillary services, AEPS credits, and anything else needed), and the PUC then has to approve those contracts. Beyond ensuring they meet the AEPS requirements (through stipulations with suppliers), utilities do not really track where the power they deliver comes from. Utilities have no incentive to go beyond

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[61] Amy Sisk, *A surge, then a fade for Pennsylvania's wind industry*, *supra* note 37
[62] Laura Legere, *Developers of hydro plants see role in Pittsburgh region*, *supra* note 45
[63] Herman K. Trabish, *Two roads diverging: Pennsylvania lawmakers rethink their renewables mandate*, Utility Dive, Aug. 30, 2018, https://www.utilitydive.com/news/two-roads-diverging-pennsylvania-lawmakers-rethink-their-renewables-mandat/530950/; Rob Altenburg, *What Act 40 Means for Solar Energy in PA*, PennFuture Blog, Apr. 26, 2018, https://pennfuture.org/Blog-Item-What-Act-40-Means-for-Solar-Energy-in-PA
[64] Coalition for Green Capital, *Pennsylvania Clean Energy Market Report*, *supra* note 8, pp.8, 39, 33-34; Amy Sisk, *A surge, then a fade for Pennsylvania's wind industry*, *supra* note 37
[65] Herman K. Trabish, *Two roads diverging: Pennsylvania lawmakers rethink their renewables mandate*, supra note 63
[66] Amy Sisk, *A surge, then a fade for Pennsylvania's wind industry*, *supra* note 37

the AEPS requirements – and are almost prohibited from actively trying to add zero-carbon resources to the default mix due to the focus on cost and having an open competitive market without preferences for particular resources. The PUC is unlikely to include integration of environmental attributes absent direction from the legislature, such as through revision of the AEPS.

In addition, Act 129 includes language instructing utilities to enter into a mix of short-, medium-, and long-term contracts, but it defines long-term as being relatively short (e.g., 4 years). Amending Act 129 to say that a portion of utility energy should be sourced through actual long-term contracts (e.g., 20 years) could better match contracting to the lifespan of renewable energy assets and lead to more such contracting. Long-term contracts for something like solar may require some kind of price certainty, though, given the volatility of the SREC market. Developers need long-term power purchase agreements to build, but utilities are reluctant to lock themselves in given the volatile SREC prices; if the prices go down, utilities could be locked into a bad deal.[67]

Barriers to Distributed Renewables

The barriers to distributed renewables in Southwestern Pennsylvania are both regional and statewide. As with utility-scale, some of these barriers are circumstantial, such as the fact that wind resources at lower heights are not particularly attractive in Pennsylvania, limiting the market potential of distributed, small-scale wind.[68] Distributed solar in the region may be low due to smaller population size and fewer competitive solar installers.[69] Limited net metering is another hurdle; while all EDCs are required to offer net metering to their customers, EGSs can choose not to offer it, and most do not. Where net metering is in place, there are often caps on generation that can limit the economic viability of resources such as micro hydro.[70]

Another significant hurdle in the region and the state is financing. Across almost all clean energy technologies and market segments, information gaps and overlapping, hard-to-navigate financing programs (sometimes with similar acronyms) inhibit consumer demand and market growth; the market landscape in the state is complex and full of hurdles and transaction costs. In addition, many high-profile clean energy funding programs, particularly for distributed generation, have finite or depleted funds and are not annually recapitalized during budget appropriations. They also offer large numbers of grants, which reduce the amount available as revolving loan funds. (Grants are helpful for building initial market uptake and project viability, but they do not help develop an independent market for mature technologies or attract private investors into clean energy projects.) The funding programs generally do very little marketing, so demand for clean energy capital, especially loans, from Pennsylvania programs is low at least partly because the market is unaware of them. Furthermore, most clean energy funding programs do not originate deals and are not structured to manage deal volume; instead, they offer products on a case-by-case basis and passively receive and review applications. The short lending terms generally offered also tend to be a poor match for clean energy projects, which

[67] Herman K. Trabish, *Two roads diverging: Pennsylvania lawmakers rethink their renewables mandate*, supra note 63
[68] Coalition for Green Capital, *Pennsylvania Clean Energy Market Report*, *supra* note 8, pp.81-86
[69] Andy Schell, Paradise Energy Solutions, *Top 10 Counties for Solar in Pennsylvania*, *supra* note 54
[70] Coalition for Green Capital, *Pennsylvania Clean Energy Market Report*, *supra* note 8, pp.74, 89-90

often have long expected useful lives and would benefit from financing terms that match their lifespans.[71] (Similarly, a 2015 study commissioned by the PUC about the state's distributed generation potential – focused on rooftop solar and combined heat and power – found that the technologies showed little or no cost-effective potential when screened using the state total resource cost test due in part to a limitation of consideration of benefits to 15 years, as required under Act 129, even though the technologies typically last 20-30.[72])

Some of these issues can be illuminated by looking at the example of commercial/industrial distributed solar, which has two main financing options: the Solar Energy Program (SEP) run by the Commonwealth Financing Authority (CFA) and the regional Sustainable Energy Funds (SEFs). The SEP has good lending capacity (around $30 million as of 2017) and attractive terms (20+ years at about 5%), but it requires a matching investment for 25% of project costs, which creates additional transaction costs for projects. It also does little marketing, so the program is not well-known among building owners and contractors, and participation has been low. The SEFs, meanwhile, were capitalized more than a decade ago and have received few if any infusions of new capital. They tend to have underutilized lending capacity, given low volumes of applications. The SEFs determine their financing terms case-by-case (as opposed to having defined products), with short terms (generally in the 3-10 year range) that reduce the potential for projects to be cash-flow positive. Each SEF has its own application, underwriting process, and lending capacity, and SEFs tend to do minimal marketing. They also tend not to originate deals. All of these contribute to the low levels of commercial/industrial solar projects in Pennsylvania.[73] (Within the region, the Met Ed and Penelec SEFs – which operate jointly – have largely funded energy efficiency projects in recent years, as well as some solar and landfill methane projects. West Penn Power's SEF has likewise directed most of its efforts at energy efficiency, funding about 80% of projects with grants and 20% with loans, though those percentages are reversed in terms of the amount of capital disbursed.[74])

The only distributed solar financing products for homeowners (e.g., leases, loans) are offered by the big national installers that are active in Philadelphia, Pittsburgh, and central Pennsylvania. Local and regional installers tend to serve the richer parts of the market that can pay for solar in cash or arrange their own financing, which is a pretty small part of the market.[75]

Interviews by the Coalition for Green Capital with Pennsylvania stakeholders regarding distributed clean energy projects revealed several underdeveloped market segments, including residential solar, commercial and industrial solar, residential whole-house energy efficiency, small-to-medium-sized commercial and industrial efficiency retrofits, low-to-moderate income residential solar and efficiency, and residential and commercial micro hydro and geothermal

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[71] Coalition for Green Capital, *Pennsylvania Energy Investment Partnership Report*, prepared for The Nature Conservancy, July 6, 2017, pp.9, 13-14, http://coalitionforgreencapital.com/wp-content/uploads/2017/08/PA-Energy-Investment-Partnership-Report-7.19.17.pdf; Coalition for Green Capital, *Pennsylvania Clean Energy Market Report*, *supra* note 8, pp.58-60, 93-95, 97-98

[72] Statewide Evaluation Team, *Distributed Generation Potential Study for Pennsylvania*, prepared for the Pennsylvania Public Utilities Commission, March 2015, pp.7-11, http://www.puc.pa.gov/pcdocs/1355000.pdf

[73] Coalition for Green Capital, *Pennsylvania Energy Investment Partnership Report*, *supra* note 71, pp.9-10, 13; Coalition for Green Capital, *Pennsylvania Clean Energy Market Report*, *supra* note 8, pp.58-60, 97

[74] Coalition for Green Capital, *Pennsylvania Clean Energy Market Report*, *supra* note 8, pp.62-64

[75] Coalition for Green Capital, *Pennsylvania Energy Investment Partnership Report*, *supra* note 71, pp.8-9

heating.[76] With regard to those last ones, many capital providers and consumers are less familiar with micro hydro and geothermal than with solar and efficiency, limiting both capital availability and consumer demand. The CFA's Renewable Energy Program (REP) offers loans with decent terms for geothermal systems – and has made numerous such loans – but it will only finance half of the total project costs. Financing is available from the REP and the SEFs for geothermal and from the SEFs for micro hydro, but the lack of understanding of the technologies and their benefits limits demand and deal volume.[77]

[76] *Id.*, p.8
[77] *Id.*, pp.12-13

V. Potentially Relevant Initiatives

Pennsylvania Climate Action Plan

The *Pennsylvania Climate Action Plan* released in April 2019 by DEP was based on emission reduction targets of 26% below 2005 levels by 2025 and 80% by 2050 – levels assumed to keep global temperature rise below 2°C if all other states and nations met comparable goals. (That may not be a warranted assumption, however, and arguments could be made that the United States, as a developed country and the largest historical emitter, should go further.) The *Plan* identifies 19 decarbonization strategies, including increasing use of distributed and utility-scale clean electricity generation resources through tactics such as investing in building-scale solar, incentivizing combined heat and power, increasing AEPS Tier 1 targets, increasing in-state generation and use of renewables, maintaining existing nuclear generation, and limiting emissions through an electricity sector cap-and-trade program.[78]

Clearly, if these statewide strategies and tactics are actually implemented, they could affect the level of renewables in Southwestern Pennsylvania. Again, the AEPS emerges as a key strategy. Recent debates about the fate of the existing nuclear power fleet and the Governor's executive order setting greenhouse gas reductions goals for the state could increase pressure for implementation of the strategies and tactics, but it remains to be seen if and how they move forward.

Pennsylvania's Solar Future

PA DEP assembled a group of experts who worked together to identify 15 strategies for boosting solar to the level of providing 10% of in-state electricity consumption by 2030, under *Pennsylvania's Solar Future Plan*, released in 2018.[79] These strategies include the following (*Figure 12*):

[78] PA DEP, *Pennsylvania Climate Action Plan 2018*, Apr. 29, 2019, pp.15-19, http://www.depgreenport.state.pa.us/elibrary/GetDocument?docId=1451278&DocName=2018%20PA%20CLIMATE%20ACTION%20PLAN.PDF%20%20%20%3cspan%20style%3D%22color:blue%3b%22%3e%28NEW%29%3c/span%3e

[79] PA DEP, *Pennsylvania's Solar Future Plan*, *supra* note 49

Cross-Cutting Strategies	
Alternative Energy Portfolio Standards	1. Implement an increase in the AEPS solar PV carve-out to between 4 and 8 percent by 2030 and ensure creditable Solar Renewable Energy Credits (SRECs) are limited to those generated in Pennsylvania wherever possible.
Access to Capital	2. Increase access to capital by expanding availability of solar lending products to residential and commercial projects to enable solar ownership. 3. Provide loan guarantees to lower interest rates and incentivize deployment of solar generation.
Carbon Pricing	4. Implement a carbon pricing program and invest the proceeds in renewable energy and energy efficiency measures.
Siting and Land Use	5. Support the creation and adoption of uniform policies to streamline siting and land-use issues while encouraging conservation.
Tax Incentives	6. Evaluate the state tax policy and consider exemptions that encourage the development of solar PV systems. 7. Assist solar project sponsors in identifying investors and/or companies that have sufficient tax equity appetite to take full advantage of the federal Investment Tax Credit (ITC) and Modified Accelerated Cost Recovery System (MACRS) depreciation if sponsors cannot do so themselves.

Distributed Generation Strategies	
Virtual Net Metering	8. Expand customers' ability to use net metering.
Community Solar	9. Identify and remove the barriers to the deployment of community solar systems in Pennsylvania.
Alternative Ratemaking	10. Ensure alternative ratemaking is addressed in a manner that does not create a disincentive for solar deployment.
Property Assessed Clean Energy (PACE)	11. Enable and encourage municipalities to offer PACE programs that include solar projects.
Addressing Interconnection Issues	12. Accelerate use of smart inverters to manage over-voltage concerns on low voltage distribution lines and avoid unnecessarily adding costs on small solar distributed generation projects.

Grid Scale Strategies	
Long-Term Contracts	13. Develop guidelines for limited use of long term contracts (LTCs) for a period of 10 or more years to ensure Pennsylvania benefits from grid scale solar energy. 14. Evaluate and consider utility ownership of solar generation especially in cases where market-driven deployment may be insufficient to achieve public goals and/or reliability concerns. This may include solar for low-income and Customer Assistance Programs in particular.
Grid Modernization	15. Investigate opportunities for grid modernization to enable increased solar generation.

Figure 12: *Strategies to boost PA solar (Source: PA DEP, Pennsylvania's Solar Future Plan)*

These strategies address some of the barriers identified earlier (e.g., AEPS reform, access to capital, long-term contracts). As with the state *Climate Action Plan*, the real question is whether these strategies actually get implemented. According to the published report, "[t]he Pennsylvania's Solar Future Project Team and stakeholders will continue to discuss these strategies with a focus on implementation details",[80] and a report describing how the plan could be implemented is expected within the next couple of years.[81]

Transportation Electrification

Pennsylvania is making strides in transportation electrification.[82] Recent gains include an electric vehicle (EV) roadmap drafted by the DEP-led Drive Electric coalition that describes the state's current EV market and suggests new strategies. Statewide, EVs (plug-in hybrids and full battery-electric) had 0.6% market share in 2017, with the number of EVs sold growing an average of 36% per year between 2011 and 2017. Most of the EVs are in urban areas. In Pittsburgh, for instance, there were more than 700 battery EVs and more than 1,300 plug-in hybrids in 2017. Strategies to boost EVs described in the roadmap include statewide electrification mandates and EV sales goals, pricing policies (e.g., rate design, rebates), public planning and investment (e.g., in EV charging infrastructure), marketing and outreach, amending building codes, and exploring financing and business models.[83] In the legislature this session, HB 1446 would set a goal of increasing transportation electrification in the state 50% by 2030 and would set a range of other requirements to achieve that goal (e.g., infrastructure deployment).[84]

Given the concentration of EVs in urban areas, it is encouraging that Duquesne Light is leading the way on EVs in the region. Duquesne Light's proposal to own and operate charging stations was supported by charging station company ChargePoint. Duquesne Light included some guiding principles in its EV ChargeUp proposal – a $2 million, 5-year pilot program – that allow it to complement the competitive market. Duquesne Light will invest in fast-charging stations and prepare infrastructure for electric buses and for private companies' charging stations.[85] The City of Pittsburgh, meanwhile, has a goal of converting to a 100% clean fleet, and its Equipment Leasing Authority has drafted a 3-year, $5 million Electric Vehicle Acquisition Plan for 2017-19. The City is also beginning to transition Port Authority public transit buses to electric buses. Recognizing the added load EVs will add to the grid, the City plans to install, where possible,

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[80] *Id.*, p.xvii
[81] PA DEP, *Finding Pennsylvania's Solar Future* website, https://www.dep.pa.gov/Business/Energy/OfficeofPollutionPrevention/SolarFuture/Pages/Finding-Pennsylvania%E2%80%99s-Solar-Future.aspx
[82] Herman K. Trabish, *The Keystone State may have found the key to the next wave of transportation electrification*, Utility Dive, Jan. 11, 2019, https://www.utilitydive.com/news/the-keystone-state-may-have-found-the-key-to-the-next-wave-of-transportatio/545008/
[83] Meister Consultants Group, Drive Electric PA Coalition, *Pennsylvania Electric Vehicle Roadmap*, presentation, Apr. 30, 2018, http://files.dep.state.pa.us/Energy/OfficeofPollutionPrevention/StateEnergyProgram/PA_EV_Quarterly_Meeting_4_Slides.pptx
[84] HB 1446, https://www.legis.state.pa.us/cfdocs/billInfo/billInfo.cfm?sYear=2017&sInd=0&body=H&type=B&bn=1446
[85] Herman K. Trabish, *The Keystone State may have found the key to the next wave of transportation electrification*, supra note 82

carbon-free EV charging infrastructure (e.g., portable solar-powered charging stations that do not need to be tied into the grid).[86]

City Climate Action Plan

The City of Pittsburgh's 2018 *Climate Action Plan* includes a focus on six areas – energy generation & distribution, buildings & end-use efficiency, transportation & land use, waste & resource recovery, food & agriculture, and urban ecosystems – which basically creates two clusters of action around energy and ecosystems. The goal is to reduce Pittsburgh's emissions 20% below 2003 levels by 2023, 50% by 2030, 80% by 2050, and carbon neutral at some point. The plan also sets internal city operational goals, including 100% renewable electricity use. The plan aims to install 200 MW of local clean power by 2030 and convert half of city customers to clean electricity, including through support for Duquesne Light's solar microgrid pilot at Woods Run, support for alternative ratemaking, and support for Duquesne Light to install local renewables to meet AEPS standards for default service customers. The plan recognizes, though, that many regulations and policies regarding electricity are set at the state level, so it also has some local plans, including creating a local energy authority and supporting community choice aggregation. In addition, the City is partnering with the U.S. Department of Energy, the National Energy Technology Lab, Duquesne Light, and the University of Pittsburgh Center for Energy to develop a local energy infrastructure plan that expands district-scale energy systems (e.g., microgrids, combined heat and power) and distributed energy resources (e.g., distributed solar) to boost efficiency and use of local renewable power. The Division of Sustainability and Resilience, part of the Department of City Planning, will be supporting implementation of the plan over the next year.[87]

Other Institutional Action

Some leading institutions in the region are working to support renewables. Carnegie Mellon, for instance, has sought to produce or purchase renewable energy equivalent to 100% of its electricity needs. In 2017, it purchased more than 126 GWh of renewable energy credits (RECs) for Midwest wind power and generated 12 MWh of solar.[88] The University of Pittsburgh, as noted earlier, announced a commitment to purchase local hydro from Allegheny No. 2 when it is completed in 2022, which will provide about a quarter of the electricity on the Oakland campus; it is Pitt's first major investment in renewables, but it wants half its power to be from renewables by 2030.[89]

The Western Pennsylvania Energy Consortium, managed by the City of Pittsburgh, is a group of local governments and universities using reverse auctions to buy electricity at lower cost. The Consortium currently purchases 35% non-local, non-certified RECs. The City of Pittsburgh, as noted above, is looking to meet its own operational loads with 100% renewables by 2030 through city-owned generation and power purchase agreements with local renewables producers,

[86] City of Pittsburgh, *Climate Action Plan Version 3.0*, *supra* note 42, pp.51-53
[87] *Id.*, pp.6, 11, 19, 22, 26-27
[88] Carnegie Mellon Univeristy, *Campus Energy Mix* webpage, https://www.cmu.edu/environment/energy-water/energy-mix/index.html
[89] Bill Shackner, *Pitt planning to buy all power generated from planned hydroelectric plant*, *supra* note 45

and the City will be working with other members of the Consortium to design options that let members transition to 100% local renewable electricity purchases.[90]

Sustainable Pittsburgh, CEOs for Sustainability, and the Power of 32 have also launched a Renewable Energy for the Power of 32 (RE4P32) effort to facilitate direct renewable energy purchases – either within the P32 region or the broader PJM region – by aggregating the purchasing power of large and medium-sized energy consumers.[91]

[90] City of Pittsburgh, *Climate Action Plan Version 3.0*, *supra* note 42, pp.25-26
[91] Sustainable Pittsburgh, *Renewable Energy for the Power of 32* website, http://sustainablepittsburgh.org/renewables/overview/; Sustainable Pittsburgh, *New partnership invites region's largest energy users to accelerate trends of purchasing renewables, advance sustainable development goals*, Press Release, Jan. 24, 2018, http://sustainablepittsburgh.org/new-partnership-invites-regions-largest-energy-users-to-accelerate-trends-of-purchasing-renewables-advance-sustainable-development-goals/

PHASE 2

BARRIERS TO RENEWABLE ENERGY IN SOUTHWESTERN PENNSYLVANIA

December 2019

Executive Summary

This paper is the second part of a broader research effort that aims to better understand the potential for increased renewable energy generation in Southwestern Pennsylvania. The first part of the project, completed in May 2019, set the scene, describing where Southwestern Pennsylvania currently is with respect to both utility-scale and distributed renewable energy generation and preliminarily identifying barriers to renewables deployment and demand in the region. The second phase of the project sought to ground-truth the barriers to renewables deployment and demand identified in the first, by interviewing both developers of renewable energy projects and large purchasers of electricity in the region. This report synthesizes the findings from these interviews.

Some of the key barriers and potential solutions that emerged from the interviews are summarized in the table below:

Barriers	Potential Solutions
For Developers	
Limited renewable resource potential	Try to offset with policies, incentives, and market mechanisms
Challenging topography	Try to offset with policies, incentives, and market mechanisms, and target development in desirable locations (e.g., brownfields)
Low electricity rates	Enact carbon pricing, provide subsidies & incentives, etc.
Weak state renewables standard	Strengthen the AEPS (or RPS, CES, etc.)
Lack of long-term contracting & utility leadership	Clarify Act 129 and/or push for PUC action re: long-term contracting
Lack of state commitment & the power of the natural gas lobby	Boost education and awareness efforts
Local misinformation & opposition	Boost education and awareness efforts
Lack of mature organizational / human infrastructure	Will develop over time if renewables deployment rises
Net metering limitations	Raise the net metering limit & enable virtual net metering (e.g., community solar)
FERC rules	Will be resolved soon, one way or another
Lack of customer demand	Build demand via solutions below
For Buyers	
Cost	Raise REC prices (via AEPS reform), provide subsidies & incentives, and promote buyer aggregations
Lack of incentives	Provide more, clearer, targeted subsidies & incentives
Lack of knowledge, capacity, & experience	Boost education & enhance capacity
Lack of trusted advisors	Help utilities be advisors

In a nutshell, the renewables development potential in the region is not great (due to resource and land constraints), it is hard for renewables to be competitive against super-cheap electricity from shale gas, the state has not prioritized renewables (which has created a range of other barriers), and renewables developers have been unable to get the long-term certainty they need to get financing to build.

Potential solutions could include a mix of top-down measures (e.g., state policies) and bottom-up approaches (e.g., buyer action). The former could have more substantial impact, primarily statewide, but their political viability will have to be determined. The latter could advance deployment of renewables in the region, but it is unclear if they will be able to do so in a large, rapid, systemic way.

I. Introduction

In this project, the Pennsylvania Environmental Council, funded by the Hillman Family Foundations, has sought to understand the potential for increased renewable energy generation – and its associated benefits – in the 10-county Southwestern Pennsylvania region (*see map in Figure 1 below*).

Figure 1: Southwestern Pennsylvania region
(Source: Adapted from Pennsylvania USGS County Map)

The first part of the project, completed in May 2019, set the scene and laid the groundwork. Based mostly on reviews of databases, reports, articles, and other resources, it described where Southwestern Pennsylvania currently is with respect to both utility-scale and distributed renewable energy generation, and it preliminarily identified barriers to renewables deployment and demand in the region. Briefly, the first paper found that:

- Renewables account for a very small amount of power in both the state as a whole (about 4.5% of electricity generated) and the southwestern region (under 1%).
- As of 2017, there were only two active wind farms in the 10-county Southwestern Pennsylvania area, one utility-scale solar project operating and another under development, nine large hydro plants operating, some small bioenergy, landfill methane, geothermal, and micro hydro generation, and a few more renewables projects planned.
- The vast majority of renewable generators in Southwestern Pennsylvania are distributed solar, though only Allegheny County is among the top counties in the state in terms of number of solar installations and solar generating capacity. Many of the surrounding counties have relatively few solar installations.
- The barriers to *utility-scale* renewables deployment and demand in the region appear to be largely at the state level, including the weak state Alternative Energy Portfolio Standard (AEPS) and the near-exclusive focus of the Public Utility Commission (PUC) on least-cost power procurement.
- The primary barriers to *distributed* renewables deployment and demand in the region appear to be a mix of state and regional, including limited net metering availability and confusing, overlapping, under-funded, poorly marketed, non-optimized clean energy financing programs.

As the first phase of the project did not rely on interviews, it was determined that a second phase was needed to ground-truth the barriers preliminarily identified in the first. With a focus particularly on large-scale renewables (i.e., utility-scale or large commercial and industrial distributed installations), the second phase sought to gather insights from both the supply and demand sides. Accordingly, interviews were conducted with both developers of renewable energy projects and large purchasers of electricity in the region (*see* Appendix) to get their perspectives on barriers to deployment and/or procurement of large-scale renewables in the region.

This report synthesizes the findings from these interviews.

II. Barriers to Renewables Deployment and Demand in the Region

Discussions with renewable energy developers and large electricity buyers revealed a range of barriers to greater deployment of large-scale renewables in Southwestern Pennsylvania.

A. Barriers for Renewables Developers

Some renewables developers are optimistic about the potential that Pennsylvania holds, while others are skeptical that meaningful renewables development will occur in the state anytime soon. Either way, there was relative agreement on some of the key barriers in the state and/or in the southwestern part of the state for renewables developers.

Resource Realities

The 10-county Southwestern Pennsylvania area does not really have a commercial wind resource that is developable, both in terms of wind speeds (*see map in Figure 2 below*) and terrain. Wind resources in Pennsylvania (and in the Mid-Atlantic and Northeast in general) tend to be associated with elevation, and the Allegheny Ridge is just to the east of the 10-county area. Outside of the region, Pennsylvania has some relatively attractive wind resources, but many of the good sites for wind in Pennsylvania have already been built out, and the resource still is not as good as in other states in PJM and elsewhere.

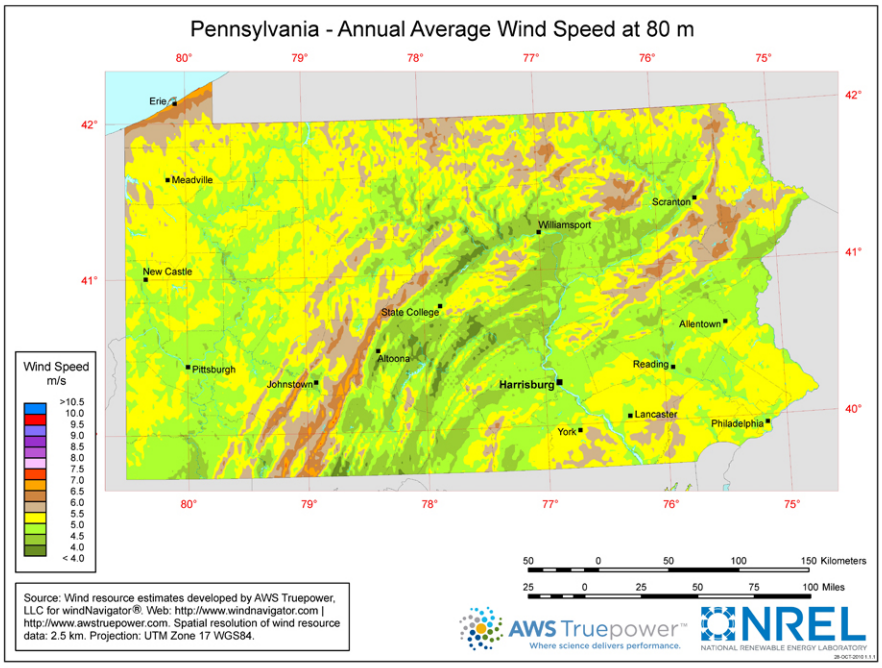

Figure 2: Annual Average Wind Speed at 80m in Pennsylvania
(Source: NREL, https://windexchange.energy.gov/maps-data/107)

Likewise, the solar resource in Pennsylvania is not as good as in other parts of the country. As one developer put it, insolation in the Northeast and Mid-Atlantic as a whole is good in the summer and bad the rest of the year. Focusing within PJM, the best solar resource appears to be

in Virginia, which is where a lot of interest seems to be focused at the moment (though attention may shift to Pennsylvania as Virginia grows more saturated). Even just within Pennsylvania, insolation in the Southwest is not as good as in the East, though it is better than in the Northwest (*see map in Figure 3 below*). In general, the solar resource in the region is not great, but it is not terrible.

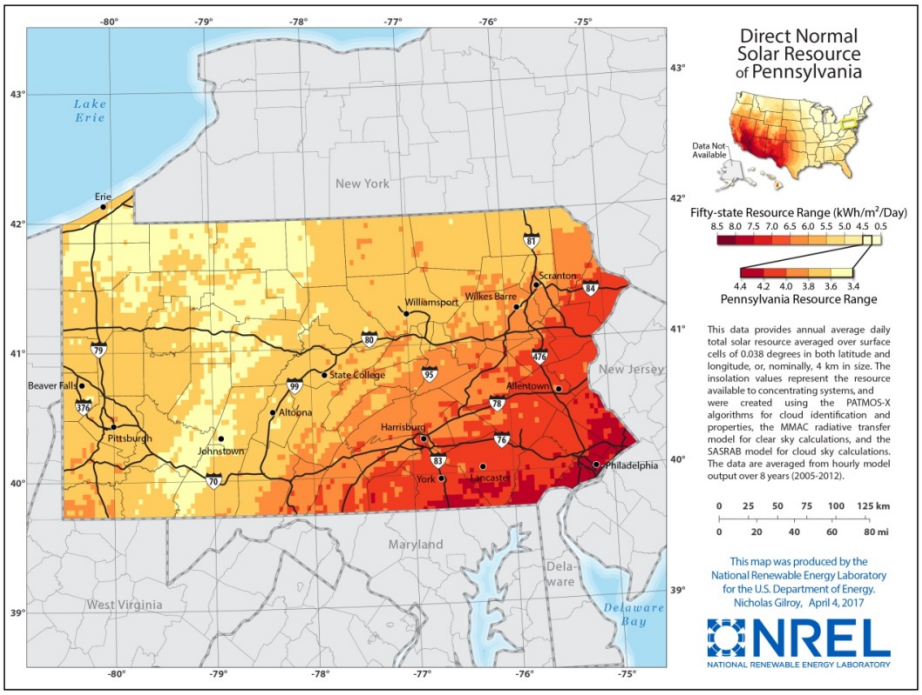

Figure 3: Direct Normal Solar Resource of Pennsylvania
(Source: NREL, https://www.nrel.gov/gis/solar.html)

Southwestern Pennsylvania does have a strong resource base of existing, unpowered dams that could be converted to generate hydropower, but the potential scale of hydro development is seen as being relatively small.

While there are other renewable resources as well (e.g., geothermal), wind and solar are the renewable resources that generally have been – and have the greatest potential to be – deployed widely, rapidly, and at scale. Because the wind and solar resources are not as good in Southwestern Pennsylvania, the costs of renewable power produced tend to be higher compared to other regions.

Land Realities

The super-low prices for wind and solar that have gotten national media attention have generally been in places that not only have great wind and solar resources but also have large amounts of flat, low-cost, less populated land, such as the Southwestern United States, where mega-projects that can achieve economies of scale in near-optimal conditions can be built. Within PJM, Illinois has developed more and cheaper wind than Pennsylvania due in part to its geography and its ability to site larger wind farms, which produce cheaper electricity. Likewise, Dominion

Energy's territory in North Carolina has been appealing for wind and solar development for several reasons, including lots of flat land, good resource, and proximity to loads in Virginia. In contrast, the Northeast and Mid-Atlantic are much more heavily populated, and the topography is much less flat, so construction and engineering costs and costs related to the land are higher. In addition, open areas tend to be forests or farms, sometimes putting renewables development in conflict with conservation efforts.

Southwestern Pennsylvania reflects these realities. Developers see the topography as being tough. While there are pockets of space with good conditions, the region generally has rocky soils, hard subsurface conditions, and steep slopes – all of which drive up engineering and construction costs. There is also a lot of tree cover and farmland. Pennsylvania land that is in agricultural use, agricultural reserve, or forest reserve can get preferential tax assessment treatment under the "clean and green" program, but those landowners could face rollback taxes for any areas they convert to use for renewables development – which could raise the costs of pursuing such development.[92]

Existing oil and gas infrastructure is another siting challenge in the region, given the boom in the Marcellus. The challenge can be worked through, as some developers have had to do in Texas, but avoiding sites with oil and gas infrastructure, as well as dealing with subsurface mineral rights holders, adds further constraints to renewables siting. Like wetlands or excessive slopes, oil and gas infrastructure become yet another factor that can reduce the acres in a parcel available for development.

Low Electricity Rates

Because of the Marcellus, natural gas is extremely cheap in Pennsylvania, so gas generation is some of the lowest-cost electricity generation in the country. That means that middling renewable resources on challenging terrain are competing against some of the best gas resources anywhere. The plummeting price of renewables has made them competitive with gas in parts of the country, but it is more of a toss-up in Pennsylvania, and gas often wins. It is hard for renewables to compete; the super-low retail electricity rates make the business case for renewables in Pennsylvania fairly fragile. Absent strong carbon reduction or carbon neutrality targets, that situation is seen as unlikely to change.

Weak Renewables Standard

Several developers mentioned a state's renewable portfolio standard (RPS) as a big driver for developing there. Pennsylvania was one of the early movers to establish requirements for renewables, but its AEPS has stalled, failing to advance at the pace that other states have, both nationally and within PJM. In other deregulated states, renewables development has been driven in part by a combination of the RPS and some other state incentive(s) – such as carve-outs for particular renewable technologies, which give developers an incentive to come in and capture that part of the market. In Pennsylvania, the AEPS target is small, and the specific renewables carve-outs within it are likewise small.

[92] Pennsylvania Department of Agriculture, *Clean & Green* website, https://www.agriculture.pa.gov/Plants_Land_Water/farmland/clean/Pages/default.aspx

To promote in-state development of renewables, measures to limit the ability to meet the AEPS with renewables imported from outside the state are important too. Until recently, Pennsylvania lacked such measures. The Pennsylvania market has been receiving renewable energy credits (RECs) from Virginia, New Jersey, and elsewhere, which has limited the incentive to build in-state. That barrier, however, appears to have been at least somewhat reduced. In 2017, the state passed Act 40, which limited eligibility for solar RECs (SRECs) to in-state solar generation. After the PUC clarified interpretations of Act 40, SREC prices started going up meaningfully in early 2019.[93] According to some interviewees, the closing of the SREC borders and the increase in SREC prices over the past year have led developers to start showing more interest in solar development in the state and have led commercial and industrial (C&I) customers to start thinking of Pennsylvania as an option.

Lack of Long-Term Contracting and Utility Leadership

Even with Pennsylvania's new in-state requirements for solar, some developers were of the view that inadequate contract lengths would continue to stymie solar (and other renewables) development in the state.

For a developer to get any renewable energy project built, whether utility-scale or for a C&I customer, long-term power purchase agreements (PPAs) are necessary. Just as developers of an office building want to lease the space to pay the returns on capital, developers of renewables projects need off-takers. Some entity has to purchase the power from the facility, and for the developer to secure financing for a long-lived asset like a wind farm or solar installation, that purchase agreement needs to be long-term. To get financing, developers need something like a 15- to 20-year contract term, with a bankable, creditworthy entity (e.g., utility, big company, university) as an off-taker that is reliable enough that banks will issue debt on that basis. Relying on a new customer coming in to take the load (for behind-the-meter projects) or on receiving adequate revenues from selling into wholesale PJM markets (for in-front-of-the-meter projects) is risky, and risk drives up developers' costs of capital. Renewable energy credits can provide some of the missing money for developers, but RECs are very liquid, and it is generally not possible to get a long-term contract for RECs from the market absent a bilateral contract, so counting on REC sales puts significant risk on project developers and owners too.

Long-term contracts are therefore essential for underpinning the economics of projects, which makes the current market construct in Pennsylvania poorly designed for renewables development. Utilities in Pennsylvania are providers of last resort in a retail choice structure. As default service providers, they are incentivized to provide cheap, brown power on a short-term basis to their customers. Utilities purchase electricity for default customers through full-service contracts with suppliers, who are responsible for providing the power, ancillary services, AEPS credits, and anything else needed. These contracts, which are approved by the PUC, are generally for three years or less. Since default service providers do not know how much demand they will have, buying a lot of electricity far into the future could lead to big losses of money if they end up with little power demand, and the PUC will not sanction that kind of risk. Large-

[93] Ben Adams, SolSystems, *Pennsylvania SRECs Two Years After Act 40*, Aug. 29, 2019, https://www.solsystems.com/blog/2019/08/29/pa-srecs-two-years-after-act-40/

scale renewables, though, cannot be developed in a system with only three-year contracts; if the contract tenure is not long enough to ensure capital recovery, then investment will not flow.[94]

At least in theory, utilities do have authority to enter into long-term contracts. Section 2807(e) of Act 129 (2008) requires default service providers to obtain power through a "prudent mix" of spot market purchases, short-term contracts, and long-term contracts of more than 4 and not more than 20 years, though long-term contracts cannot make up more than 25% of the default service provider's load unless the PUC determines it is necessary to achieve least-cost procurement. What constitutes a "prudent mix", however, has been left up to providers. The PUC has declined to require a specific mix or percentages of types of contracts, has declined to require a minimum of two types of products, and has cautioned providers not to be too reliant on long-term contracts as major factors in their portfolio requirements.[95] In addition, one developer observed that some long-term distributed generation contracts have been disallowed because of an inability to show consumer benefits within the first few years. Utilities such as Duquesne Light have therefore operated for years under PUC-approved plans that lack any long-term contracts,[96] though Duquesne has explored long-term contracts for solar, and other electric distribution companies (EDCs) have signed 10-year PPAs for solar credits.[97]

Short-term markets do not incentivize investment in wind, solar, hydro, or other long-lasting renewables projects, but utilities are not alone in focusing on the short term. Most load-serving entities in Pennsylvania are bidding the retail load for three years or less. The retailers serving much of the load in Pennsylvania have no incentive to enter into a long-term contract. They see no reason to enter into a 20-year agreement when renewables prices are declining so rapidly and the contract may be out of the money in a few years. In other jurisdictions, where PUCs emphasize the value of long-term contracts, where renewables are prioritized, and where utilities are more involved than they are in Pennsylvania, the benefits of having a diverse energy mix and greater amounts of renewables are seen as outweighing the risks that some contracts may be out of the money in a few years. Unlike in these other states, utilities in Pennsylvania have not been directed by the legislature or the PUC to contract over a long term for big chunks of renewable power and then put those costs into the rate base.

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[94] Interviewees clarified that while utilities have focused on short-term contracts, other large electricity buyers do not have to follow suit. Even if the power that a buyer procures from a renewables project will flow through a utility's grid, the utility itself is not the off-taker, so the same contracting concerns do not arise.

[95] PA PUC, *Final Rulemaking Order*, Default Service and Retail Electric Markets, Docket No. L-2009-2095604, Order entered Oct. 4, 2011, pp.38, 44, 59-60, 65-67, http://www.puc.state.pa.us/pcdocs/1188111.docx. *See also: The Changing Face of Default Service Procurements in PA*, Buchanan, Ingersoll & Rooney PC, Feb. 3, 2014, https://www.bipc.com/the-changing-face-of-default-service-procurements-in-pa; Paul Ring, *Lack Of Evidence Concerning Consideration of Long-Term Contracts Prompts Two Pa. PUC Commissioners To Dissent From Approval of Duquesne Light Default Service Settlement*, Energy Choice Matters, Dec. 23, 2016, http://www.energychoicematters.com/stories/20161223b.html

[96] Duquesne Light Statement No. 3, Petition Of Duquesne Light Company For Approval Of Default Service Plan For The Period June 1,2017 Through Mav 31.2021, *Direct Testimony of Neil S. Fisher*, May 2, 2016, p.33, https://www.duquesnelight.com/docs/default-source/pdf-library/procurement/direct_testimony_of_neil_s_fisher.pdf?sfvrsn=d365a142_2

[97] Duquesne Light Statement No. 1, Petition Of Duquesne Light Company For Approval Of Default Service Plan For The Period June 1,2017 Through Mav 31.2021, *Direct Testimony of C. James Davis*, May 2, 2016, p.14, http://www.puc.state.pa.us/pcdocs/1437232.pdf

More broadly, developers observed that the absence of utilities as a big driver in Pennsylvania hinders renewables market growth. Such growth can happen without them, but it will be slow and scattershot rather than rapid and systemic. The absence of utility leadership leaves renewables development largely to universities, municipalities, or other large buyers with sustainability goals and the savvy to figure out how to contract for it.

Lack of State Commitment & the Power of the Gas Lobby

Some developers (and buyers) view Pennsylvania as having focused its energy policy apparatus writ large almost exclusively toward supporting fracking over the past decade. The state is seen as actively supporting natural gas and other non-renewables, without showing the same support for renewables, both in terms of funding and more generally. Some developers, for instance, think that the state has done a terrible job in promoting renewables, in making it easy for developers and buyers to advance renewables, and in communicating about renewable energy successes in the state. In terms of funding, the last real state program to drive renewables in a systemic way was around 2009-12, but Pennsylvania never came back to it. The legislature is also seen as being resistant to climate action. When the state treats renewables as not being a priority, developers look elsewhere for places they are welcomed and incentivized to be.

Several developers mentioned that one potential reason for the lack of renewables prioritization by the state is the power of the natural gas lobby – a situation that is seen as being rather unique to Pennsylvania (and West Virginia and Ohio). These developers, some of whom have tried to do renewables deals in the region, said the biggest barrier was the ever-presence and strength of the natural gas industry, which made it hard to break through to state and local people and policymakers; even local economic development agencies reacted to renewables developers as if they were being sold a bill of goods. One developer described the Pennsylvania gas lobby as the strongest lobby in energy on the East Coast. Gas utilities are also actively and repeatedly engaging large energy users in the region to try to get them to use natural gas for a range of uses; there is no comparable push by anyone regarding renewables.

In addition, renewables development in Pennsylvania may be somewhat stalled until it is clear how things will shake out with nuclear power. A few developers noted that if the nuclear lobby succeeds in getting a subsidy that is not available to other forms of zero-carbon generation, that subsidy could put renewables at a competitive disadvantage (depending on how the nuclear subsidy relates to or affects the AEPS, support for renewables, and the like).

Local Misinformation & Opposition

Related to the lack of state support and the power of the gas lobby is a perception among developers (and buyers) that there is a general fear of change in the region and a lack of education among people, including government officials, about renewables. While one developer saw towns and counties in the region as generally being favorable to the idea of renewables development, given the tax revenue and job benefits, a few other developers thought an education effort was needed to overcome NIMBYism, correct misconceptions about solar (e.g., its effectiveness when cloudy or during winter), and explain to towns and counties that solar will not take over, destroy the rural nature of the region, or gobble up all the farmland. One developer, for instance, noted substantial well-organized opposition to renewables siting in

Pennsylvania (not necessarily in the region), with failed town votes and personal threats against developers. Some have walked away from projects due to local opposition, a prospect that some saw as continuing to be likely without visible support from the state – especially the legislature.

Lack of Mature Organizational / Human Infrastructure

Also related to the lack of state support and the limited amount of existing renewables is the fact that Pennsylvania therefore lacks some of the intangible infrastructure that can facilitate renewables deployment. For example, states that have been leaders in deploying renewables have often been proactive in kick-starting the industry within their states, helping to create the jobs and industry infrastructure to enable future growth. Subsidizing and mandating renewables created demand in those states, spurring local industries and jobs. Some neighboring states therefore have far more renewables companies, installers, and jobs than Pennsylvania (and especially Southwestern Pennsylvania). One large buyer noted that there are only two local solar installers in the region of any scale.

Likewise, states that have been renewables leaders for a long time have already worked through a lot of the issues that come up in emerging markets, such as how to incentivize renewables deployment and what kind of tax treatment to provide. Utilities in those states have learned how to work out the kinks in the interconnection process and have been thinking through how the grid will be reinvented and reimagined to support renewables deployment. In some states with more experience, developers can go to utilities for interconnection and encounter a fast, easy process with a menu of prices and experienced staff. In Pennsylvania, a few developers felt the process is slower, costlier, and more opaque, with utilities seeming busy with other things, lacking menu pricing, and lacking knowledge and experience. One developer, for instance, observed that utilities in Southwestern Pennsylvania are still in the early stages when it comes to providing renewables developers with data and insight on where they can build (e.g., hosting capacity maps that tell developers at the substation and feeder line levels how much capacity a line has).[98]

The more that intangible infrastructure is in place in a state, the more developers can really push the envelope in driving costs as low as possible. This, of course, is a somewhat circular situation, or it could be thought of as a self-fulfilling prophecy. The lack of infrastructure and support means developers look less at Pennsylvania, which means there are fewer projects developed, which means there is less infrastructure, and so forth.

Net Metering Limitations

The current limits for net metering in Pennsylvania are 50 kW of capacity for residential systems, 3 MW for non-residential, and 5 MW for microgrids and emergency support systems.[99] There are large C&I facilities in the state, however, that could host systems larger than 3 MW, leading one developer to identify the limits as being overly restrictive.

An additional obstacle to developing large-scale projects is the virtual net metering limitation under current statute, which says that a user must be within two miles of the generation location

[98] Some developers' studies have shown that the region's *physical* infrastructure is not bad in this regard, with little congestion, though some projects have had challenges with utilities in tying into the grid.
[99] 52 Pa. Code §§75.13, 75.16

and that the power can only go to one meter.[100] Institutions with multiple facilities may not be able to generate at one and transfer the power to another. There are also no provisions for collaborative or shared projects, which means developers have to find entities willing to pay for and take all the power from a large generation facility.

To the extent there has been a focus on net metering and solar in the region, it has been on the residential side more than the commercial side. Most of the installations are therefore residential, even though the scale of opportunity is larger on the commercial side.

Federal Energy Regulatory Commission

The Federal Energy Regulatory Commission (FERC) is considering its Minimum Offer Price Rule (MOPR), which affects PJM's capacity market. MOPR would raise the market bids of resources that receive state subsidies, including renewables. One developer observed that the uncertainty around the rule, which should be resolved soon, has led some renewables developers and financers to be less than bullish about continuing to deploy capital in the PJM region, though some is still happening.

Lack of Customer Demand

In a deregulated market, most of the projects being developed will be buyer-driven. Developers only put into the market what they think the market will buy, driving development to where customer demand is. Nationally, renewables have traditionally been a policy-driven business, but recently, C&I demand, particularly from big tech companies, has been one of the key drivers of renewables deployment. Ohio, for instance, hosts a lot of datacenters, and demand from tech companies that would like to power their datacenters with in-state renewable resources has spurred a fair amount of solar development in Ohio – despite retreating state policy support for renewables. These companies, however, have not tended to view Pennsylvania as a priority. A couple of developers observed that while there has been some institutional customer demand in Pennsylvania (often but not solely in the Philadelphia area), there are several large organizations and Fortune 500 company headquarters in Southwestern Pennsylvania that have yet to demonstrate a desire to buy local renewables. The reasons for that are discussed more below.

B. Barriers for Large Electricity Buyers

The lack of regional customer demand for renewables raises the question of what the barriers are for large electricity buyers.

Cost

The barrier identified time and again for large electricity buyers is the price of renewables, particularly local renewables, compared to the cheap electricity in the region. When electricity is

[100] 52 Pa. Code § 75.12: "Virtual meter aggregation on properties owned or leased and operated by the same customer-generator and located within 2 miles of the boundaries of the customer-generator's property and within a single EDC's service territory shall be eligible for net metering. Service locations to be aggregated must be EDC service location accounts, held by the same individual or legal entity, receiving retail electric service from the same EDC and have measureable electric load independent of the alternative energy system."

so cheap, electricity buyers that run the numbers find it hard to make renewables purchases pencil, much less purchases of local renewables. There is always a premium in Pennsylvania for renewable electricity, and some buyers will not make the switch until renewables get to the point where they are cost-competitive.

With respect to decisions about on-site installations, the low cost of grid electricity lengthens the payback period, often well beyond what some institutions are willing to accept. A project with a 15-20 year payback will not move forward when an entity's acceptable internal payback period is more like 5 years or fewer. For some buyers, the acceptable payback period is only 6 months to 1 year. Even when longer payback periods are allowed, cost recovery on projects can take too long to make sense. For instance, some buyers found that on-site solar projects, even ones as basic as solar hot water systems, had payback periods (19-20 years) nearly as long as the life of the systems themselves, so those projects did not move forward. It is possible, though, that onsite solar projects that fell apart when Pennsylvania SREC prices were very low might be more viable as SREC prices have risen. Still, several buyers felt the market has not yet gotten to the point where installing on-site renewables in the region can be done at anywhere close to the cost of just buying RECs or grid power.

The core reality for some buyers is that they simply will not pay any more for electricity than they need to. Buyers do not have unlimited capital, and energy is viewed as a sunk cost that they would like to minimize. Whether they are non-profits with limited budgets or for-profits with tight profit margins (and a need to keep their products' prices low), there is often little appetite for buyers to stretch themselves financially by spending more money on energy than they have to. Even when entities believe they have a social responsibility, they are reluctant to divert money toward higher-cost renewables and away from their primary missions – which often have societal benefits as well. The lowest price possible for energy is often the main directive.

Different buyers, however, have different tolerances for price premiums for renewables. While some are not willing to pay anything more than grid electricity costs, some will pay a premium for renewables in the form of national RECs. Indeed, many large buyers seeking to purchase renewables will purchase the cheapest RECs available, which are often Texas wind. These are basically financial transactions. Even for those committed to renewables, if local renewables are much pricier than, say, Texas wind, it is hard for buyers to get internal support for making the local choice. On a pure economics basis, local, in-state renewables are not competitive (though they are cheaper than they have been historically).

While many C&I customers are focused on getting the cheapest resource – or the cheapest renewables – that they can, some companies and institutions are interested in having the generation be in the same grid as where they are consuming it. If they want to be within the PJM footprint, they will purchase the cheapest RECs within PJM, which are often from Illinois wind. Some buyers are also starting to look at securing generation that offsets dirtier generators in the portfolio, in order to displace the most carbon. Again, local RECs are a more expensive option for buyers with these sorts of goals.

Still, some institutions with strong local ties are interested in supporting renewables generation in the region and will pay a higher premium for local renewables. Some like the tactile element of having renewables (e.g., solar) more integrated into their buildings and facilities, adding energy

provision to the functions and services those buildings already provide. Some like the potential of being able to visit their local generation facilities, have ribbon cuttings, and so forth; they like the publicity and reputational benefits, and pointing to a REC certificate is not a great press conference. Some buyers like the community stakeholder aspect of local procurement, including the support of local jobs, the local economy, local health, and a cleaner local environment.

Some buyers also see local procurement as a better and more honest way to be powered by renewables than just buying national RECs that have no tie to their actual operations. Interestingly, this has sometimes led buyers to take no action at all on renewables. For instance, one buyer who had the option of buying cheap Texas wind RECs saw no point in doing so because those RECs had no tie to supporting local projects, the local economy, and the local environment, but the buyer did not buy local RECs or initiate local projects either, as those were too expensive.

Lack of Incentives

Given the cost hurdles, some buyers are looking for incentives. Resources that can mitigate the cost barrier and improve the economics can be helpful in getting the approval of an institution's high-level finance staff. Buyers, however, do not perceive there to be many incentives for on-site renewables projects in Pennsylvania (unlike for energy efficiency projects). Pennsylvania is seen as being far behind other states in the region in this regard. Some buyers felt there was only a very limited set of minor grant and low-interest loan programs available, but those still require buyers to come up with a hefty portion of the funding for a project. When the rare state programs have existed that offered significant grants, those grants have been welcomed. Federal tax credits and state RECs can also help the financial aspects of projects.

Many incentive and finance programs, however, do not work for particular types of customers. For instance, non-profits and public entities that lack tax exposure cannot access federal tax incentives for renewables unless they do a PPA with a private third party that can; the tax savings are then factored into the long-term price, but the existence of a third party means the cost may also be higher than direct ownership would have been. Grants from entities such as the Sustainable Energy Funds, meanwhile, are seen as rarely going to for-profit entities, and some for-profit entities refuse to do financing or loan programs. Some incentives also have requirements tied to them (e.g., data-sharing) that dissuade some buyers from participating. One buyer further noted that there are no incentives directly aimed at electricity buyers (as opposed to project owners and developers) to offset the increased cost of buying RECs (or local RECs).

While some buyers definitely consider the range of financing programs, federal tax credits, and other measures to improve the economics of renewables in their decision-making, other interviewees suggested that such programs were rarely a factor in their decision-making. Sometimes this is due to a desire to keep transactions as simple as possible; customers are not in the energy business and will not devote huge amounts of internal resources to figuring out complex energy transactions. PPAs alone are hard enough to explain and get approved internally. In addition, the range of financing and incentive options may be too much for some people to navigate, while other buyers do not even research incentive programs (outside of Act 129) anymore because such incentives have not been there in the past.

Lack of Knowledge, Capacity, & Experience

In some large institutions in the region, there has been no one responsible for exploring renewables or doing anything other than just buying the cheapest electricity available on the grid. Even when there are people tasked with coming up with and/or implementing a renewables strategy, those efforts are often fairly nascent. Internal policies on renewables purchasing and the levels of internal commitment to renewables are sometimes still being developed, and sometimes they do not exist at all. There is a lot of inertia behind existing ways of operating. If things seem to be chugging along fine, it can be hard for people to rethink their energy purchasing.

The fact that many organizations – public and private – do not have someone dedicated to this task or are fairly new in the space can make the commitments involved in a PPA or an on-site installation a barrier. More accurately, perhaps, the inexperience of the institutions is a barrier. As one interviewee put it, a huge part of the difficulty in doing renewables projects is that key players do not know how to do them and do not understand what is required. Many large consumers have not really explored other options, particularly in any kind of deep way. Moving from buying the cheapest electricity available to figuring out the type of electricity, the contract terms, fixed versus variable pricing, the types of loads and peak demands the institution has, internal tolerances for price hedging and price premiums, the available offerings in the market, how the various options fit into the institution's overall portfolio of energy needs, the risks of locking in REC prices in a 20-year (or longer) PPA, and much more can take time to figure out. Some buyers feel they do not understand those variables well enough yet to move forward on renewables. Institutions can sometimes be paralyzed by the options before them, such as choosing between on-site generation and bulk purchasing with a supplier, which makes it hard to mobilize people and can translate into projects being slow to move forward. The more nuanced and complex it gets, the more challenging it is to get people to understand, and the harder it is for decision-makers to wrap their heads around. Organizations are still figuring a lot of this space out. It is all a learning process.

The knowledge and understanding barriers can also exist at fairly basic, fundamental levels. Lots of electricity users, for instance, still may not understand that they are in a deregulated state. People in some institutions also simply do not believe the benefits of renewables are real and do not fully understand how long-term agreements work. Buying RECs without being able to see the energy being generated is confusing to people and feels like it is not real. Furthermore, many people, even those in organizations doing projects with renewable energy components, do not always understand the difference between RECs and the power itself.

Lack of Trusted Advisors

Amidst the inexperience and complexity, some buyers flagged as a barrier the lack of trusted experts who can interpret and navigate the complexity for them, weigh the costs and benefits of various options, and so forth. Renewables developers are often not trusted, and they generally focus only on the particular technologies they are pushing. Regional utilities are not seen as expert partners either. The utilities are seen by some buyers as doing a pretty good job with energy efficiency and electric vehicle charging, but buyers do not work with, say, Duquesne Light to help them get renewables either onsite or in the market.

Interconnection

While the overall grid infrastructure system may be robust, there are neighborhoods and parts of the system that have constraints and congestion, which can inhibit on-site renewables development that ties into the grid.

C. Key Takeaways on Barriers

Many of the barriers identified here are linked. Relatively poor renewable resources, tough topography, and cheap shale gas all combine to make it harder for renewables to be an economic choice in Southwestern Pennsylvania for developers or buyers. Unlike many other states in the region, Pennsylvania has not instituted policies and incentives to meaningfully advance renewables in the face of those hurdles, which means the state lacks some of the intangible elements that make renewables development easier and cheaper. The largest buyers of electricity, both utility and institutional, are focused on short-term, least-cost procurement, and many relatively large institutional buyers are still trying to understand the renewables space – all of which means developers generally do not have the long-term forward revenue certainty they need to finance renewables projects in the region.

III. Potential Ways to Overcome the Barriers to Renewables in the Region

States with lots of renewables generally either have great resources or terrific policies and incentives, or sometimes both. Pennsylvania currently has neither. All else being equal then, the Southwestern Pennsylvania region will lose out to other regions that can generate renewable energy more cheaply. If the goal is to deploy more renewables in the region, then the question is how to use policy and market levers so that all else is *not* equal. Potential solutions could include a mix of top-down measures (e.g., state policies) and bottom-up approaches (e.g., buyer action).

A. Policy Measures

Strengthened AEPS

In states where utilities own generation, some utilities are actively pushing renewables even if not required to do so by law, for the simple reason that it is good business for them. Given the utility market structure and other barriers in Pennsylvania, however, policy is needed to drive significantly increased deployment of renewables in the state. Utilities and other retail suppliers generally will meet their AEPS requirements and go no further. If the goal is to boost deployment of renewables in Pennsylvania, a more robust AEPS (or RPS, Clean Energy Standard, or greenhouse gas reduction goal) could help. Numerous interviewees flagged AEPS reform as a key to unlocking renewables deployment in the region and the state.

There are at least two aspects of AEPS reform that seem to be of particular importance. First, and most basic, is to raise the ambition of the overall target and to increase the level of renewables required within that. Some interviewees preferred a standard that was solely focused on renewables, while others liked having a broad mix of resources, but the prevailing sentiment either way was that the current standard is woefully inadequate. Several neighboring states have RPSs at 50% or higher. Whether Pennsylvania goes as high as that or not, interviewees felt a more ambitious target could attract more renewables developers to the state. The key is to have a construct that works for all renewable resources and that has a target large enough to draw in more large-scale projects. A higher AEPS will lead to higher REC prices, which would help the economics of renewables projects both for developers and for buyers looking to build on-site generation.

To spur local development, the second key aspect of AEPS reform flagged by interviewees is closing the borders (i.e., in-state requirements). Again, the higher REC prices for local renewables under such a construct would help drive development. As noted earlier, passage of Act 40 limiting eligibility for SRECs to in-state solar generation has already helped increase SREC prices and interest from developers. Some interviewees suggested that the in-state requirements in the AEPS could be increased and expanded. New York, for instance, largely closed off its borders and had success in promoting in-state development.

Larger, tech-specific carve-outs within the AEPS are another possibility. If the incentive is large enough, such carve-outs can drive significant deployment, though they create an uneven playing field by their very nature.

Long-Term Revenue Certainty

Some developers were of the view that, even with higher renewables targets and in-state requirements, increasing developers' ability to secure quantifiable, long-term off-take commitments is the element that is most important for boosting renewables deployment.

The long-term contracting barrier has been overcome in some states. In New York, for instance, the state (via the New York State Energy Research and Development Authority, or NYSERDA) issues requests for proposals (RFPs) to enter into 20-year REC contracts (or the project's useful life, whichever is shorter) with developers and their projects, which takes REC risk off of developers and project owners.[101] Taking REC exposure off the table is part of what has enticed developers to New York. Illinois likewise has done a series of long-term state-run REC procurements,[102] while Connecticut law guarantees developers of distributed systems that utilities will enter into 15-year contracts for RECs.[103] Developers with guaranteed long-term backing will have investment-grade secured revenue that de-risks the business case, enables them to get financing for building projects, and allows them to offer lower prices to buyers.

While Pennsylvania's market structure is different than in those other states, it has nothing similar that provides developers with the long-term certainty they need to secure financing. As noted earlier, utilities do have authority to enter into long-term contracts under §2807(e) of Act 129, but that authority has rarely been exercised. One solution to this could be to amend Act 129 to make clearer that a portion of utility energy should be sourced through long-term contracts of at least a certain length (e.g., 15-20 years). Alternatively, in its 2011 order on default service providers, the PUC reserved the right to return to rules around contracting in future proceedings once it has "sufficient expertise with the developing market in renewable resources."[104] In January 2019, the PUC initiated an investigation into default service that includes, among other things, a request for comments on the prudency of including more long-term contracts as hedges in default service plans given the decline in the costs of renewable wind and solar technologies.[105] The locus of action for change in long-term contracting could thus lie at the PUC as well.

Long-term contracting by other large electricity buyers would also spur renewables development in the region and the state. Ohio, for instance, also has retail competition and utilities procuring power in three-year tranches, but as noted earlier, demand from large C&I buyers seeking long-term renewable electricity from new resources to power their datacenters is spurring retail providers there to show more willingness to enter into longer-term arrangements. Some of the

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[101] NYSERDA. *Clean Energy Standard: Solicitations for Large-scale Renewables* website, https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Standard/Renewable-Generators-and-Developers/RES-Tier-One-Eligibility/Solicitations-for-Long-term-Contracts

[102] *See* Illinois Power Agency, *Long-Term Renewable Resources Procurement Plan*, Aug. 6, 2018, https://www2.illinois.gov/sites/ipa/Documents/2019ProcurementPlan/Long%20Term%20Renewable%20Resources%20Procurement%20Plan%20%288-6-18%29.pdf

[103] CT Gen Stat §§ 16-244r, 16-244s

[104] PA PUC, *Final Rulemaking Order*, Default Service and Retail Electric Markets, Docket No. L-2009-2095604, p.78

[105] PA PUC, *Order*, Investigations into Default Service and PJM Interconnection, LLC Settlement Reforms, Docket No. M-2019-3007101, Order entered Feb. 26, 2019, http://www.puc.state.pa.us/pcdocs/1607178.docx

other measures mentioned later in this section could help increase Pennsylvanian buyer willingness to sign long-term contracts for renewables.

Developers benefit from having some forward certainty in the revenue stream about more than just power offtake and RECs. For example, New York went beyond net metering to a Value of Distributed Energy Resources (VDER) calculation that allows developers to put that revenue stream into their spreadsheets for 25 years. The 25-year New York VDER stream further squeezes down the amount of risk for developers. Pennsylvania, again, has nothing similar to provide that forward certainty.

Subsidies & Incentives

Subsidies and incentives, too, can aid developers' long-term planning and financial analysis. Turning again to New York, the NY Sun incentive (through NYSERDA) has been a key driver of solar deployment in that state. As one developer described it, developers know by law what the subsidy rates will be for decades, which means they can plug the subsidy into their financial analysis spreadsheets to see if it gets projects over the needed return hurdle.

Developers and buyers alike stressed the importance of having incentives be around long enough to provide some certainty and to be useful. Short pilot programs that disappear are less useful than programs with more continuity. In addition, in larger organizations, it can take months to get all the necessary internal people together to even make a decision about moving forward with a renewables project or purchase, so programs to spur action need to be around long enough to allow for that.

Subsidies, incentives, rebates, and the like can bring down the cost of development, shorten payback periods, and make more projects pencil out. Grants, in general, seem to be popular with buyers, and as noted earlier, some buyers will only consider grants and not financing. Some mentioned the grants that Pennsylvania makes available for electric vehicle chargers, which are easy to take advantage of, help offset some of the costs, and can jumpstart institutional consideration or action. Some buyers also recalled the state-run Sunshine Grant program from 2009-12.

Low-interest loans can be effective as well (and, unlike grants, are repaid, allowing the funds to be cycled back out again to new projects). In New York, for instance, the New York Green Bank has been a helpful facilitator in bridging the gap from early-stage risk to project operation, as no one else in the market was providing those loans, which are paid back once the project is operating. In Pennsylvania, the Commercial Property Assessed Clean Energy (C-PACE) program gives commercial, industrial, and agricultural property owners access to low-interest, long-term loans for clean energy projects, which are repaid on the property tax bill (even if the property changes owners). The program only launched in 2018, though, and only 7 counties in the state have adopted C-PACE resolutions so far (including Allegheny in September 2019 and Lawrence in November 2019).[106] It therefore remains to be seen how C-PACE will affect the market, though some interviewees anticipate it having a substantial impact on both retrofits and new construction.

[106] Pennsylvania C-PACE website, http://pennsylvaniacpace.org/

Whether grants, loans, or other incentives, the view of many buyers and developers was that the state should be offering more to spur more renewables development. Some felt incentives were particularly important for non-profit organizations and government agencies, who cannot take advantage of federal tax credits except through third-party PPAs. One buyer also suggested a need for incentives targeted at end users who want to go renewable but cannot pay more for electricity, with the state incentives making up the cost difference.

Another potential approach is to offer tax incentives or funding/financing programs around developing renewables on brownfields, which Southwestern Pennsylvania has plenty of. Incentives to reuse old mine lands or other previously developed sites could be an economic development approach that also requires less civil engineering (and thus less cost) for renewables developers. Massachusetts, for instance, incentivizes development in brownfields to focus development in spaces not otherwise being used; the state actually penalizes greenfield development.[107] Relatedly, some states have created economic development zones through public policy that streamline the renewables siting process and/or come with real estate tax abatement. Some states have shown interest in using retired coal plants and the space around them to develop solar, as the large transmission infrastructure is already in place. Pennsylvania could take a similar approach to guiding renewables development to where it is most desirable.

Carbon Pricing & RGGI

Some developers identified a carbon price as among the best ways to increase renewables deployment, since incorporating the cost of carbon would make emission-free energy economically advantageous, or at least more competitive with emitting resources. Some buyers likewise suggested that better regulatory limits on carbon emissions could help balance out the competitive advantage that cheap shale gas currently has. (One noted that not everyone seems to understand that shale gas is still an emitting source.)

There are somewhat mixed views on how much difference Pennsylvania joining the Regional Greenhouse Gas Initiative (RGGI) would make in terms of renewables deployment in Southwestern Pennsylvania (or in Pennsylvania more broadly). RGGI's carbon price could push some coal-fired generation that is on the margin out of the market, but coal plants in the region are being shut for market reasons now anyway. The real competition for renewables in the region is natural gas, as well as potentially nuclear, and RGGI would have less and no impact, respectively, on those resources. The general view seems to be that the carbon price charged in RGGI allowance auctions is too low to have much impact. One developer described RGGI as being a revenue mechanism for the participating states more than an incentive to build renewables.

It is possible that the revenues raised by RGGI auctions could be utilized in ways that spur deployment. As cost curves for renewable technologies continue to come down, RGGI investments can be one more revenue stream to help make projects pencil out in less optimal

[107] Commonwealth of Massachusetts, Executive Office of Energy and Environmental Affairs, Department of Energy Resources, *Solar Massachusetts Renewable Target Program (225 CMR 20.00), Guideline, SMART Land Use and Siting Guideline*, effective Apr. 26, 2018, https://www.mass.gov/doc/smart-land-use-and-siting-guideline-final/download and *Guideline Regarding the Definition of "Brownfield"*, https://www.mass.gov/doc/smart-brownfields-guideline-final/download.

locations like Southwestern Pennsylvania. Some developers therefore think joining RGGI could make at least some difference, though others harbor great skepticism about how the revenues would actually be used in Pennsylvania.

A higher state carbon price could have more effect on the balance between renewables and natural gas, but no one expressed any expectation of such a price being enacted by the legislature.

Net Metering & Virtual Net Metering

As noted earlier, one obstacle to development of large-scale projects is the requirement under current state statute that a user must be within two miles of the generation location and that the power can only go to one meter. Each of those aspects could be altered to enable more renewables deployment. The two-mile-radius limitation could be expanded, and provisions could be enacted to allow for collaborative or shared projects. Legislation opening the Pennsylvania market to community solar, for instance, could remove a market barrier, particularly if removal of the single-owner requirement applies to both the residential and non-residential sectors.

In addition, some interviewees stressed how critical net metering will be for them in deploying renewables. Net metering limits could be raised to allow for bigger distributed installations.

B. Market & Other Non-Policy Measures

Community Choice Aggregation & Co-ops

The higher the level of incentives, the stricter the mandates, and/or the higher the carbon price, the more expensive projects can be and still make economic sense – which can lead to higher rates for ratepayers. Some developers are skeptical that such policies are feasible in Pennsylvania, particularly Western Pennsylvania, given concerns about energy affordability and a lack of political will. Market solutions that can lead to lower rates may be an alternative path to pursue. (Of course, the market and policy solutions could also work together in concert, driving development more quickly.)

Some have proposed creating community choice aggregation (CCA) entities or power-providing co-ops in the region. CCAs, also known as municipal aggregation, are when local governments aggregate the demand of their residents and procure power on their behalf. Unlike utilities in Pennsylvania, they are providers not of last resort but of first resort, with residents able to – but having to affirmatively act to – get power from another entity. In California, CCAs are signing long-term PPAs, but they have not yet bought power plants (though some developers expect that to happen). CCAs are also currently authorized in Illinois, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Rhode Island, and Virginia, and some other states are investigating the idea.[108] The City of Cincinnati, for instance, has a community aggregation program that offers

[108] Bruce Lieberman, *Community choice aggregation: a brief introduction*, Yale Climate Connections, Dec. 9, 2019, https://www.yaleclimateconnections.org/2019/12/community-choice-aggregation-a-brief-introduction/.

customers carbon-free energy for both electricity and gas.[109] In the current market structure in Pennsylvania, there is no such public entity, but if one could be created, the costs for renewable power could be much lower. Instead of a PPA that includes a markup so the developer/operator earns a return, the CCA could buy and directly own the project; cutting out the middle entity can reduce the costs. A CCA could theoretically sign contracts with developers, buy and operate renewable electricity projects, and serve community customers at lower cost. It is unclear if the authority exists for a community in Pennsylvania to form such an entity, and existing retail providers would probably fight it vigorously. Further legal and policy analysis are advisable to assess feasibility and obstacles. (If policy is needed to enable CCAs, then the CCA option would belong in the Policy Measures category above.)

Another option could be to form an electric co-op that owns retail service. Co-ops, which exist under state law, are member-owned, not-for-profit entities that are not as geographically constrained as CCAs. (Pittsburgh Allegheny County Thermal is already a co-op that exists in the region to provide district heating to some downtown Pittsburgh buildings.) A co-op could be formed with a range of types of customers focused on buying renewables. The U.S. Department of Agriculture's Rural Utilities Service has a lot of very cheap money it lends to co-ops with a rural nexus, so a co-op could borrow money to cover the costs of a renewable electricity plant, which would enable costs of power to be much lower. This could enable financing for new renewables projects that might otherwise not be financeable. This has not yet been done, but it is not clear if there are barriers to doing it. Again, legal and policy analysis would probably be advisable.

While these types of ideas appear to be emerging in various markets and could, in theory, provide renewables generators with opportunities to contract for energy sales, some developers are skeptical that they are necessary additions in PJM and Pennsylvania. As one developer noted, the PJM market is fairly liquid, and offtake can be secured through instruments such as financial hedges on the open market, bilateral C&I procurement, and other measures. While the creation of CCAs and co-ops would add to that pool, which would be beneficial, this developer did not see the current size of the pool as a significant hurdle to development at the moment. As noted earlier, though, others see the pool of ways to build and tap into customer demand as being a barrier.

Buyer Action & Aggregation

CCAs and co-ops involve the creation of new entities that procure energy or perhaps own generation. Another approach to aggregating demand involves creating informal groups that solicit bids collectively (thus getting better prices) but sign contracts individually. At the homeowner level, for example, "solar co-ops" started launching in the region in 2018 to organize neighbors into groups and then solicit bulk bids from solar installers; such co-ops now exist in Allegheny, Beaver, Butler, Indiana, and Westmoreland counties.[110] Depending on the size and load of the aggregated entities, buyer aggregation might also be able to drive some deployment

[109] City of Cincinnati, Office of Environment & Sustainability, *Aggregation Program* website, https://www.cincinnati-oh.gov/oes/residential-programs/aggregation-program/

[110] Solar United Neighbors, *Go solar in a Pennsylvania co-op* website, https://www.solarunitedneighbors.org/co-ops/pennsylvania/; Amy Sisk, *Solar co-ops grow in western PA*, StateImpact Pennsylvania, Dec. 26, 2018, https://stateimpact.npr.org/pennsylvania/2018/12/26/solar-co-ops-grow-in-western-pa/

of things like community solar (if legislation is enacted authorizing community solar); going out and finding the customers to take the power from community solar projects is otherwise an expensive proposition for developers.

Some large buyers do not see the benefit in joining buyer aggregations. Their load is large enough on its own to get good pricing. Aggregating small or medium-sized entities that do not have the capacity or buying power to go it alone might be more fruitful.

Some medium-sized and larger institutions in the region are already part of the Western Pennsylvania Energy Consortium. The Consortium got institutions comfortable with not taking the lowest cost for electricity and purchasing renewables instead, and the current contract with Direct Energy seeks to purchase RECs to cover 35% of the group's aggregate load. So far, the Consortium has led to reduced prices for renewables, but not to local development of projects. There are currently no stipulations on where the energy is generated, so the renewables requirements are being met with national RECs.

A new Consortium strategy is being formulated for next year, though, that might stimulate a more local market. Consortium members are exploring forming their own sub-accounts (under an entity with a well-capitalized portfolio) that would allow them as a group to go into PJM directly as wholesale purchasers, which would enable them to get much cheaper prices in the wholesale market and to stimulate local renewables projects that are looking for a buyer. The cheaper wholesale prices, combined with lower costs from reduced consumption (e.g., via energy efficiency and demand response initiatives), can help offset cost premiums for local renewables. The new structure can also allow individual members to decrease or increase their renewables percentage or procure more local renewables, rather than having all members utilizing the same terms; this could allow members with more ambitious renewables goals to move forward without waiting for everyone else to have similar levels of risk tolerance. The aim will be to develop RFPs for renewables in Southwestern Pennsylvania and across PJM by late 2020. The Consortium would thus be following the lead of cities such as Philadelphia and Baltimore that have already shifted procurement from the retail to the wholesale market by establishing sub-accounts at PJM.[111]

While aggregating buyers such as through the Consortium can have impact, some buyers cautioned that the impact should not be overstated. Substantially increasing renewables generation in the region will involve overcoming bigger hurdles, such as the abundance of cheap shale gas and the weak state policies mentioned earlier. Some buyers noted that purchasers alone will be unable to stimulate renewables at the scale and speed desired – and that government policy changes will be needed. Of course, aggregated buyers can also be a political force to push for such changes.

Valuing Local Renewables Generation

[111] *See, e.g.,* EnerNOC, *Wholesale Portfolio Program for Electric Procurement*, https://www.esmec.org/Wholesale_Portfollio_Program_for_Electric_-_EnerNOC-201104[1].pdf; Philadelphia Energy Authority and City of Philadelphia, *Request for Proposals for Renewable Energy Power Purchasing*, 2017, http://www.philaenergy.org/wp-content/uploads/2017/09/Renewable-Energy-PPA-Request-For-Proposals.pdf

Several interviewees observed that the local social, health, economic development, and environmental benefits of local renewables generation are not usually factored into the procurement decisions of large electricity users. Some suggested that large buyers in the region could assign a value – even a qualitative one – to locally generated renewables, capturing some of those benefits and helping to elevate consideration of those projects. One buyer suggested that it would be helpful if there were ways to actually quantify the benefits to the region from local renewables, which could potentially be included in an organization's calculations. This may be a feasible path for some buyers, but it likely will be difficult or impractical for the many seeking solely to minimize their expenditures on electricity.

Utilities as Partners

Act 58 (2018) allows utilities to propose performance-based ratemaking (PBR) systems to the PUC. PBR is a utility business model that rewards utilities for performance (e.g., on customer service, efficiency, emission reductions) rather than for capital investment. One expert suggested it could be worth looking at how to get action around implementation of Act 58 in ways that could make utilities partners in the renewables effort, such as by serving as trusted energy advisors to customers looking for greener power.

Another interviewee also suggested that Pennsylvania may need to revisit some decades-old deregulation decisions and give distribution utilities more flexibility to include new technologies (e.g., distributed energy resources) in their grid management mandate.

Education & Awareness

Some interviewees suggested that broad education efforts in the region around renewables and their benefits could be of value. In addition to the general population, a couple of interviewees observed that efforts to educate key experts in the region, such as architects, engineers, lawyers, and accountants (and their professional associations), might be particularly valuable. One interviewee suggested that counties could drive some of that education by requiring a percentage of renewables (or at least exploration of renewables) for all projects getting public financing.

Generating more awareness of existing renewables projects can also help. When big entities make significant moves on local renewables projects, the public salience of renewables is increased, and others start thinking more about them. Having projects that are actually more visible could be beneficial for the same reason. One interviewee observed that most renewables installations in the region are not visible; most solar is not ground-mount, and there is not a lot of big wind outside of Somerset County. People are not seeing renewables, hearing about their benefits, hearing about their cost-effectiveness, and the like, and so they do not think about them much.

Capacity

As noted earlier, some large institutions in the region have no one responsible for exploring renewables, while others have very nascent efforts to develop renewables strategies. Increasing the capacity of organizations to explore, assess, and implement renewables strategies could be beneficial. The arrival of even one person dedicated to this task – a change agent who can push

others and can initiate, engineer, and manage new ways of pursuing energy procurement – can yield dramatic changes in organizational choices.

Dedicated funding for staff focused on renewables could help institutions that currently lack capacity. Potential models for such an effort could be the 100 Resilient Cities initiative from the Rockefeller Foundation, which funded salaries for resilience officers in cities, and Environmental Defense Fund's Climate Corps, which pairs organizations with fellows to address energy-related challenges and opportunities. Connecting inexperienced buyers with experienced ones could also help them navigate this complex terrain.

Similarly, philanthropy could supplement the budget capacity of institutions to drive local renewables purchasing. Buyers who are reluctant to divert additional funding from their primary missions in order to procure more expensive local renewables might do so if philanthropists came in to cover the difference (or supported them more in other ways).

C. Key Takeaways on Overcoming Barriers

There is little that can be done to address some of the barriers identified earlier, such as the nature of the renewable resources and the topography in Southwestern Pennsylvania, apart from trying to make the state or region more appealing in other ways. Other barriers, however, can be overcome by policy measures (generally at the state level), market and other non-policy initiatives, or a mix of those. The policy measures – such as increasing state mandates, providing incentives, and increasing long-term revenue certainty for developers – have the potential to produce more sweeping, systemic, and rapid impact in Pennsylvania, but the political feasibility of at least some of those is unclear. Their impacts are also likely to be statewide, as opposed to focused in Southwestern Pennsylvania. The non-policy measures, on the other hand, could enable more regionally focused action, but it is unclear if they could yield renewables deployment at the speed and scale that many desire.

Appendix

This work was supported by a grant from the Hillman Foundation.

Thanks to the following individuals, who agreed to be interviewed during the first or second phase of this project and who contributed their valuable insights and perspectives. (Affiliations are listed for identification purposes only.)

- Marty Altschul, Don Coffelt, & Steve Guenther (*Carnegie Mellon University*)
- Phyllis Barber (*Highmark Health*) & Rizwan Syed (*Allegheny Health Network*)
- Heather Barone, Billy Brooks, & Jennifer DeValerio (*NextEra*)
- Lindsay Baxter (*Duquesne Light*)
- Drew Chidester (*University of Pittsburgh Medical Center (UPMC)*)
- Angelica Ciranni (*Advantus Engineers (formerly with Pittsburgh 2030 District)*)
- Grant Ervin (*City of Pittsburgh)*
- Kevin Helmich (*Avangrid*)
- Paul Jacob (*Rye Development*)
- Amol Kapur (*GE Renewables*)
- David Lauteri, Susan Fernandez, Masahiro Ogiso, & Seth Wilmore (*Mitsubishi Hitachi Power Systems (MHPS) Americas*)
- Chris Mathey (*Renewable Energy Buyers Alliance*)
- Brittany Prischak & Abby Lawler-Morycz (*Allegheny County*)
- Kryn Sausedo (*Urban Redevelopment Authority of Pittsburgh*)
- Aurora Sharrard (*University of Pittsburgh*)
- Jim Spencer & Chris Rugh (*Exus Management Partners* / *Trireme Energy Development*)
- Mike Stanton (*Cypress Creek Renewables*)
- James Stitt (*Pittsburgh Water & Sewer Authority*)
- Jeff Weiss & Alex Radcliffe (*Distributed Sun*)

Thanks also to those individuals who offered their insights but wished to remain anonymous.