Energy Efficiency & Conservation:

Federal and State Policy Impacting PA

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Sarah Golobish

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Background

Overview of the issues which impact energy efficiency and the important terms.

Demand Response

What is Demand Response?

- Given that energy demand changes throughout the day, demand response programs look to strategically move some of the demand or load on the electricity grid to the periods where demand is low. For example, customers might run their dishwashers during the day rather than right after dinner.
- Reducing peak demand is key to ensuring that older, dirtier, reserve powerplants don't need to come back online during periods of high demand.
- Additionally, reducing periods of high demand can help to reduce stress on aging grid infrastructure and prevent blackouts.
- DR often takes the form of negotiations with larger retail and industrial customers who reduce demand in return for discounts or rebates. This negotiation is facilitated by "Curtailment Service Providers" or "aggregation firms" who manage loads for interconnections and balancing authorities.

Sources: Demand Response, PJM 2017; Curtailment Service Providers, ACEE

Demand Response in the US

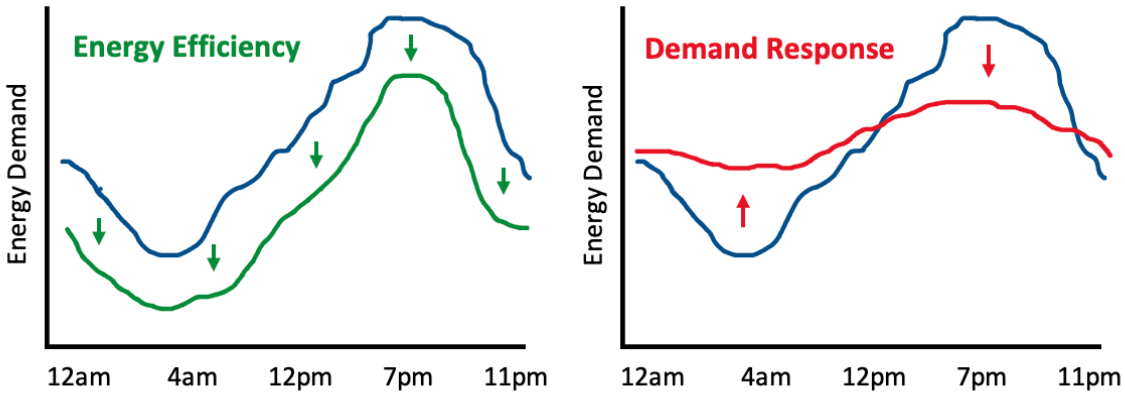
- In 2014, 9.3 million customers were enrolled in demand response programs across the US.
- Through demand response programming, the average residential customer saves about 100 kilowatt-hours annually and receives $40 in rebates.
- A survey of the top 52 utilities in the US by the American Council for an Energy Efficient Economy found that customer demand data (collected through smart meters) is *largely underused by utility companies* to implement programs which use this data to motivate customers to shift demand.

Sources: Demand response saves electricity during times of high demand, EIA 2014; Survey of AMI in 52-Utilites, ACEEE

How does Demand Response relate to energy efficiency?

- Energy efficiency looks to decrease overall energy use whereas demand response specifically targets periods of high demand.
- Demand response programs and energy efficiency programs are both considered forms of "demand-side-management."
- Broadly, demand side management is an effort to reduce user demand for energy, giving more flexibility to utilities and generators.
- Figure 1 shows how each of these policies impact the daily energy demand curve.

Figure 1. Energy Efficiency and Demand Response



Source: Demand-Side Management vs Demand Response, Project Respond; Demand-side management programs save energy and reduce peak demand, EIA 2019

Dynamic Pricing

Three Types of Dynamic Pricing Programs:

- Time of Use (TOU) → Daily energy demand rates, contain peak and off-peak periods (includes potential for some middle-ground or shoulder period).
- Critical Peak Pricing (CPP) → Uses real time prices at times of extreme system peak, which means that these mechanisms come into play only a few times per year and the timing is unpredictable.
- Real Time Pricing (RTP) → Links hourly prices to real-time changes energy prices. This system directly transfers both savings and costs on the wholesale energy market to consumers.

Source: *Review of dynamic pricing programs in the U.S. and Europe, Hu et al. 2014*

Smart Meters and Dynamic Pricing:

- Dynamic pricing programs are one type of demand response program that allows for customers to pay for the cost of the electricity at the time that they use it, as opposed to a fixed monthly rate.
- Time-varying pricing can result in average peak demand reductions from 7-28% and average demand reduction of approximately 1-7%.
- These programs use automated meters or smart meters (discussed later in this report) to determine the time that customers use energy and charge them

Sources: Demand Response Pricing PJM 2017; Leveraging Advanced Metering Infrastructure To Save Energy, ACEEE 2020

TOU Rates in Action:

- 14% of all US utilities offer a residential TOU but when it comes to investor-owned utilities, nearly half offer one.
- TOU pricing pilot programs in the US and abroad consistently show that rates are successful in incentivizing a shift in customer behavior.
- States with deregulated energy markets (i.e. there is competition in generation) have a slightly lower instance of TOU rates (approx. 37% vs 48% among investor-owned utilities).

- Nationally, 1.7% of residential customers receive TOU rates, and 3.4% of customers who have access to these rates participate in the programs.
- Two utilities in Arizona have an abnormally high instance of customers enrolled in TOU pricing: Salt River Project and Arizona Public Service.
- Brattle attributes low enrollment in these programs to a lack of marketing or customer engagement as well as long "peak periods" which may make TOU rates more expensive than traditional rates.
- Maryland offers default time-varying rate structures that are dynamic in nature rather than static TOU rates.

Source: The National Landscape of Residential TOU Rates, The Brattle Group 2017

Dynamic Pricing and Low-Income Customers:

- There is a general concern that dynamic pricing programs (which tie electricity rates to time of consumption) will fail to benefit low income customers. Low income households have less flexibility in energy use and therefore less potential to shift use and take advantage of savings.
- A 2010 IEE report analyzed the difference in effectiveness of dynamic pricing programs with high- and low-income customers.
- Ultimately data from the programs surveyed indicated that low-income households were responsive to dynamic pricing and were still able to reduce peak demand. However, this reduction was often lower than reductions observed for higher income customers.

Source: The Impact of Dynamic Pricing on Low Income Customers, IEE, 2010

Smart Metering

- Smart Meters differ from traditional electric meters in that they allow two-way communication between you and your utility provider.
- These meters also collect energy usage data on an hourly basis, allowing for more detailed energy efficiency monitoring programs.
- In 2008, Act 129 mandated the installation of smart meters in Pennsylvania for the seven utilities with over 1,000 customers. Nationally, the American Reinvestment and Recovery Act of 2009 incentivized reinvestments into the "smart grid" with $4.5 billion to bring the nation's power-gird into the 21st century.
- The widespread installation of smart meters has the potential to facilitate energy efficiency and demand response programs. However, this remains contingent on innovation and investment on the part of utilities.
- Some states have made headway in integrating smart metering into demand response programs and wider rate structures. In California, for example, all customers with smart meters are, by default, enrolled in a time of use rate.

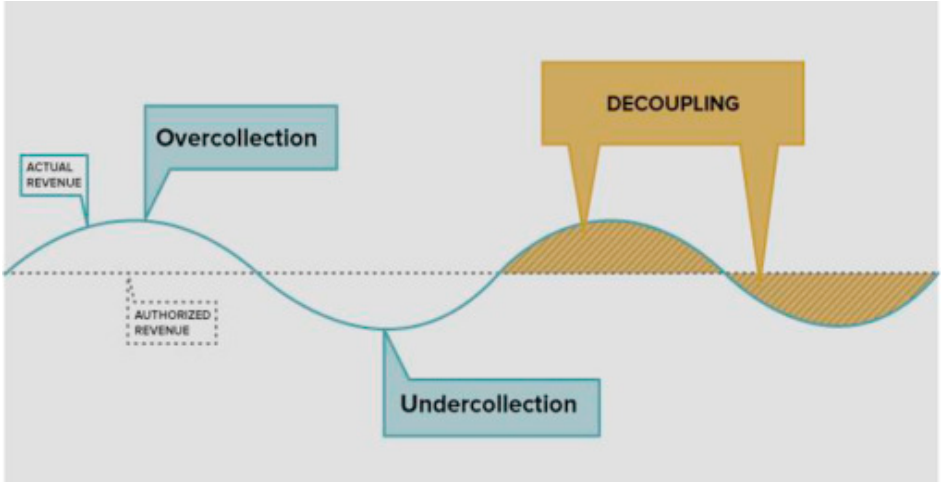
Sources: Electric Meters, Energy.gov; PA Act 129

Decoupling: Incentivizing Utility Participation in Energy Efficiency

- Traditional rate structures are based on the costs associated with each unit of energy generation and utilities are paid for each unit they sell to consumers.

- This link between energy sold and revenue provides no incentive for utilities to invest in energy efficiency and demand side management programs which will ultimately decrease the units of energy sold.
- Decoupled energy rates set an amount of money that a utility can reasonably hope to collect and then as costs vary throughout the periods between rate cases, the actual utility revenue is then adjusted to meet that pre-determined amount. Figure 2 illustrates how over-collection and under-collection work with decoupling.
- Decoupling incentivizes greater investment in efficiency, as reductions in energy usage have no impact on the utility's bottom-line.

Figure 2. Over-collection and Under-collection with Revenue Decoupling



Source: [Decoupling Policies: Options to Encourage Energy Efficiency Policies for Utilities,](#) NREL, 2009

Net Metering

- Net metering allows for distributed generation of energy, and particularly facilitates the deployment of home-level renewable energy generation.
- Smart meters and advanced metering infrastructure have the potential to facilitate net metering as customers already have the technology installed on their households.
- A number of state and federal programs support net metering and tariffs for home-generated renewable energy.
- State net metering regulations establish *if* utilities are required to purchase energy from small and medium scale consumer-generators and at what rate.
- 38 states, Washington DC, and four territories have some sort of net metering policy in place.

Sources: [State Net Metering Policies](#), NCSL 2017

Energy Burden for Low Income Customers

- A 2018 report by the Energy Information Administration found that 31% of US households had difficulty paying for energy bills and that one in five households forewent other necessities to afford their energy bills.
- This report further found only minor differences between urban and rural households and across geographic regions of the US. This indicates that access to affordable energy is not simply a

function of climate or energy prices in certain extreme regions. Rather, there are wider systematic issues at play limiting the ability of low-income households to invest in energy efficiency.

- Other EIA reports have found that low-income customers pay more per square foot than non-low-income households ($1.23 per square foot versus $0.98 per square foot). This difference is attributed to the difficulty in investment in energy efficiency and weatherization for households who rent rather than own their space. Further, low income households commonly spread a fixed amount of energy usage over a smaller physical footprint (resulting in a higher cost per square foot).
- Apart from being a serious social concern, access to affordable energy also poses an issue for utilities themselves who incur additional costs in covering overdue bills or other associated administrative costs. These expenses are then also re-distributed to ratepayers as fixed charges, contributing to further rising energy prices.
- Affordable energy is then a significant concern for customers and utilities and is an important factor in reducing energy costs overall and maintaining equitable access to energy.
- A number of state and federal programs look to remedy the disproportionately high cost of energy for low-income households. Some of these programs look to offer assistance by weatherizing or increasing the efficiency of low-income households. Others cover portions of household's bills or cap energy expenses at a set percentage of a household's income.

Sources: Low-Income Households Pay A Lot for Energy, Park 2018; Lifting the High Energy Burden in America's Largest Cities, Drehobl and Ross 2016

Survey of Energy Efficiency Policies by State

- According to a survey of state energy efficiency policies by the American Council for an Energy Efficient Economy, PA ranks 18th in the nation for its efficiency programs.
- Figure 3 shows the rankings of all of the states. Note that PA's eastern neighbors in NY and NJ rank higher at 5th and 17th.

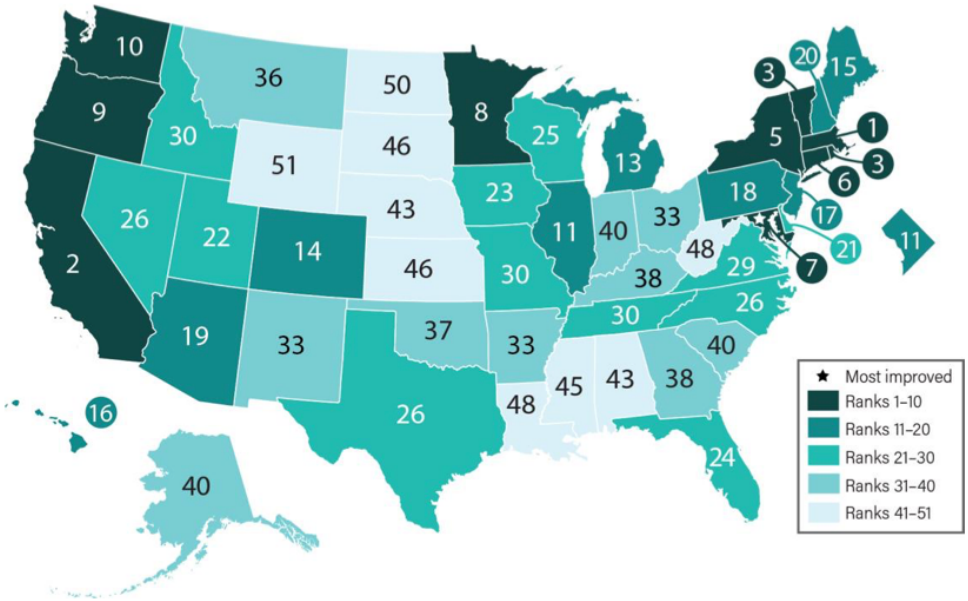


Figure 3. Ranking of States by Efficiency Policies

- Rankings are based of policy performance in six areas: utility programs (20 pts), transportation (10pts), building efficiency (8pts), CHP policy (3pts), state-led programming (6pts), and appliance standards (3pts).
- Table 1 shows a comparison between PA and the best and worst performing states in the report.

Table 1. Ranking of Best and Worst States for Energy Efficiency Policy

Rank	State	Utility Programs	Transport.	Building Policy	CHP	State Programs	Appliances	Total
1	MA	20	8.5	7	3	6	0	44.5
18	PA	4.5	5.5	7	2	4.5	0	23.5
51	WY	1	1.5	0	-0.5	2.5	0	4.5

Source: *State Energy Efficiency Scorecard*, ACEEE 2019

Federal

Public Utility Regulatory Policy Act of 1978 (PURPA)

- PURPA was the first major federal push to incentivize states to adopt conservation and efficiency policies.
- As regulating utilities is a task left to states, PURPA falls short of requiring states to adopt certain policies. Instead, it mandates that states "consider" a number of efficiency and conservation measures and present a rational as to why they were or were not adopted.

Source: *Smart Meters and Federal Law*, Rose 2014; *Public Utility Regulatory Policies Act*, US DoE

Energy Policy Act of 2005 (EPACT 2005)

- Federal involvement in smart metering began with the Energy Policy Act of 2005 (EPACT 2005), which amends PURPA and adds five new standards for states to consider: net metering, diversification of fuel sources, fossil fuel generation efficiency, smart metering, and mandatory interconnection.
- Source: *Smart Meters and Federal Law*, Rose 2014; *Public Utility Regulatory Policies Act*, US DoE

The Energy Independence and Security Act of 2007

- EISA charges DOE with establishing a federal Smart Grid Advisory Committee and a Smart Grid Task Force and a federal program to support research into deployment of the Smart Grid and provided $100,000 per year from 2008-2012.
- It also adds four new federal standards to PURPA: integrated resource planning, rate designs which promote energy efficiency, smart grid investments, and smart grid information.

Source: *Smart Meters and Federal Law*, Rose 2014; *Public Utility Regulatory Policies Act*, US DoE

The American Recovery and Reinvestment Act of 2009 (Recovery Act)

- Established grant funding for utility smart-meter programs and provided DOE with $4.5 billion to modernize the electric power grid across the US.
- Smart Grid Investment grants have provided over 9 billion dollars to support utilities in deploying advance metering infrastructure.

- PA has received $99.6 million through the State Energy Program and $253 million through the Weatherization Assistance Program. State Energy Program funding helps the state to realize its energy efficiency and renewables targets.

Source: *Smart Meters and Federal Law*, Rose 2014; *American Recovery and Reinvestment Act*, Casey 2010

ENERGY STAR

- ENERGY STAR is the federal government's program that certifies energy efficient technologies and was established in 1992 by the Clean Air Act.
- These technologies are certified by the EPA for their energy savings potential. In 2018 ENERGY STAR technologies saved nearly 430 billion kilowatt-hours of electricity and avoided $35 billion in energy costs.
- The ENRGY STAR program also certifies buildings, plants, and homes which are built to be more efficient than their standard counterparts.
- These certifications also play an important role in utility programming with utilities offering rebates for the purchase of certified appliances and compliant home improvements.

Sources: *Statutory Authority for ENERGY STAR*, energystar.gov; *ENERGY STAR Overview*, energystar.gov

State

Low Income Home Energy Assistance Program (LIHEAP)

- This program is built to "assist households with low incomes, particularly those with the lowest incomes that pay a high proportion of household income for home energy, primarily in meeting their immediate home energy needs."
- 2019 Funding: Block grant of $3.69 billion administered by the department of Health and Human Services.
- Funding is passed from federal government to states and territories who administer state-level programs.
- In FY 2019 Pennsylvania received $181,868,996 in funding. This funding is then administered by the PA Department of Human Services.

Figure 4. Estimated Electric LIHEAP Participation Rate (2016-2018)

Utility	2016	2017	2018	Percent Change 2016-18
Duquesne	10.1%	20.3%	32.8%	224.8%
Met-Ed	12.3%	12.0%	11.7%	-4.9%
PECO-Electric	57.1%	42.7%	39.2%	-31.3%
Penelec	13.5%	14.0%	12.2%	-9.6%
Penn Power	16.7%	15.5%	14.0%	-16.2%
PPL	14.8%	11.9%	20.3%	37.2%
West Penn	19.0%	18.9%	16.8%	-11.6%
Total/Industry Average	**25.9%**	**21.3%**	**22.9%**	**-11.6%**

Note: "The estimated LIHEAP participation rate is determined by dividing the number of LIHEAP cash grants by the number of confirmed low-income customers for each public utility."

Source: PAPUC, 2019 Universal Service Report

Low Income Usage Reduction Programs (LIURP)

- LIURP "requires covered utilities to establish fair, effective and efficient energy usage reduction programs for their low-income customers. The programs are intended to assist low income customers conserve energy and reduce residential energy bills."
- The program is financed by utilities who are allowed to re-coop a portion of expenses through tariffs which are distributed amongst the residential ratepaying class.

Source: *Pennsylvania LIURP Legislation*, DHS

Alternative Energy Portfolio Standards

- Similar to the renewable portfolio standards passed by other states, PA has an Alternative Energy Portfolio Standard that sets targets for alternative energy in the state.
- Passed in 2004, the AEPS requires that all electric distribution companies and generation suppliers source at least 18% of the total energy in PA from alternative sources.
- Out of this 18%, 0.5% must come from solar with 7.5% from Tier I sources and the final 10% from Tier 2 sources. Table 2 shows the breakdown of energy sources between the tiers.

Table 2. AEPS Tier I and Tier II

Alternative Energy Portfolio Standards Resources		
Tier I		**Tier II**
• Solar Photovoltaic (PV) (Solar PV is a Tier I resource but also has a stand-alone requirement)	• Wind power • Low-impact hydropower • Geothermal energy • Biologically derived methane gas • Fuel cells • Biomass energy • Solar thermal • Generation of electricity inside of Pennsylvania utilizing by-products of the pulping process and wood manufacturing process# • Certain muni and coop-owned hydropower#	• Waste coal • Distributed generation systems • Demand-side management • Large-scale hydropower • Municipal solid waste • Generation of electricity outside of Pennsylvania utilizing by-products of the pulping process and wood manufacturing process

#These were added to Tier I in 2009. To account for these additional resources, an annual adjustment is added to the non-solar portion of the Tier I requirement.

Table Source: *AEPS 2018 Report*, PAPUC

- PA differs from its neighbors in that its thresholds are much lower (0.5% solar vs 4.1% solar in NJ) and that it provides incentives for the burning of waste coal and MSW. A full comparison between RPS in PA and neighboring states was published by PJM in 2019.
- Strengthening the APES will help to better incentivize both energy efficiency and green energy in PA.

Sources: *AEPS 2018 Report*, PA PUC; *Comparison of Renewable Portfolio Standards (RPS) Programs in PJM States,* PJM 2019

Utility

Regional Transmission Organization Policy – PJM

- All utilities are a part of a regional transmission organization (RTO) which helps to coordinate energy supply and demand between utilities and states. PJM is the RTO which includes Pennsylvania, New Jersey, Delaware, Maryland, Virginia, West Virginia and the District of Columbia along with portions of other neighboring states.
- To ensure that supply always matches up with demand, PJM operates the wholesale energy market where energy is bought and sold. Importantly, as a part of this market, Curtailment Service Providers can also sell demand response into the market (see Demand Response section).
- PJM's demand response policies have a significant influence on the development of demand response in PA, as these policies help to determine incentives for participation.
- Recent changes in PJM DR policy effectively prohibit dual participation in the PJM wholesale market and the next phase of Act 129 – as that would count savings twice.
- PJM's Peak Shaving Adjustment is based on a thermal index that triggers reductions on the hottest days in the summer.

Sources: *About PJM,* PJM; *Peak Shaving Forecast Adjustments*, PJM 2018; *Phase IV Demand Response Potential Study*, Statewide Evaluation Team 2020

Overview of an Energy Bill

- An overview of what utilities are able to charge for and what that money goes towards.
- **Generation Charges** → Charges for the actual generation of electricity.
- **Transmission Charges** → Charges for the movement of high voltage energy from where its generated to local wires. These are regulated at the federal level.
- **Distribution Charges** → Charges for the use of local wires and infrastructure owned by the utility operating in your service area.
- **State Tax Adjustment Surcharge** → This allows utilities to recover certain tax increases from ratepayers or return money in the event of a tax decrease.
- **Distribution System Improvement Charge (DSIC)** → these charges cover the expense of any infrastructure maintenance and are determined by the utility and reviewed by the PUC's Bureau of Technical Utility Services on a quarterly basis. Further, this charge may not exceed 5% of the billed distribution rate and is reset if the utility exceeds its allowable rate of return for the quarter (see pp. 97 of 2018 Ratemaking Guide)
- Utilities may also recoup the following charges…
    - Implementing consumer energy choice programs

    - Installing smart meters in compliance with Act 129
    - Funding consumer energy efficiency and conservation measures
    - Repairs following major storm damage
    - A full list of each of these charges for each utility can be found on their website and are further outlined in the riders of the utility bill.
- The scope of these charges allows utilities to push a significant amount of costs back onto the ratepayer. This cost shifting may provide little incentive for utilities to change or improve. For example, if utilities do not pay for smart metering infrastructure there is less of an incentive to quickly realize the energy saving benefits.
- Further, the charging of customers for storm damage represents an instance where the costs of climate change and the associated severe storms are pushed onto the consumer, despite the role of the utility in burning polluting fossil fuels customers are stuck with the bill for the damage.

Sources: *Electric Bill Breakdown*, PA PUC; *2018 Ratemaking Guide*, Cawley and Kennard 2018

Resident

Personal Efficiency Measures

- What steps can the average consumer take to increase their personal energy efficiency?
- Home Weatherization → Updating the insulation, windows, or other home fixtures can help reduce heating and cooling costs for your home.
- Updated and Smart Home Appliances → Appliances certified through ENERGY STAR are certified to use less energy and save you money on your bill. Utilities, like PECO, will sometimes provide rebates for the purchase of these appliances.
- You can further choose to invest in a smart thermostat or other home device which will cycle heating off when you are not home or once the home reaches a certain temperature.
- Home Lighting → Purchasing efficient LEDs is also a good option that allows renters to realize some savings. PECO offers discounted LEDs through a number of participating stores which will also help you to realize energy savings.

Sources: *Appliance Rebates*, PECO

Distributed/Home Generation

- On top of traditional efficiency measures, some customers may choose to generate their own energy on site by installing solar panels.
- Utilities also often offer rebates or discounts for customers who use electric cars.
- Distributed generation, with the help of smart metering, is an important way in which consumers can take control of their energy needs and help contribute to a greener grid.
- Net metering will allow those who are able to generate their own electricity to sell that energy back for credit on their electricity bill.

Community Solar

- Community solar allows people who might not have the means to invest in traditional solar power to participate in renewable energy generation. A group of people are able to purchase a solar

installation that is not directly located on their homes, but they apply the energy generated to their own bills and receive credits through net metering.

- This practice is complicated in PA, as net metering is only allowed when the generation site is within two miles from the customer residence – this means that many who live in cities are still unable to participate.
- Further, the low solar cap on PA's AEPS (less than 0.5%) provides little financial incentive for the construction of these project.
- Many states have passed legislation to explicitly incentivize community solar legislation, and House Bill 531 and Senate Bill 705 look to do the same in PA by explicitly adding community solar to the AEPS.

Sources*: Scaling-Up Access to Solar for All Pennsylvanians*, NRDC 2019*; PA Solar Policies*, NREL

Purchase Renewable Energy

- There are 55 renewable energy providers available to customers in the Philadelphia area with an average energy price of $0.0712 per kWh as compared to PECO's $0.0659 per kWh. Assuming the average American uses 900 kWh of energy per month, this translates into a difference of $4.76 per month (not counting any monthly fees).
- Out of these renewable options, 8 offer variable pricing plans, similar to the plans discussed earlier in the Dynamic Pricing section. These plans may help those who are able to shift their energy use to off-peak times reduce their bills, making investment in renewables more affordable.

Sources: *How Much Energy Does an American Home Use*, EIA 2019; *PA Power Switch*, PA PUC

Useful Links

- Utility Rate Database - The Utility Rate Database (URDB) provides rate structure information for over 3,700 U.S. utilities.
- PA Public Utility Commission – Website for the PAPUC.
- American Council for an Energy-Efficient Economy – ACEEE's research on energy efficiency as a utility resource. They release reports every few years which rank both utilities and