

Alternative Energy Portfolio Standards Act of 2004  
**Compliance for Reporting Year 2021-22**



Prepared by the PA Public Utility Commission  
in cooperation with the  
PA Department of Environmental Protection



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# **Executive Summary**

# Alternative Energy Portfolio Standards Act

## Compliance for Reporting Year 2021-2022

### Tier I Solar Compliance

- **All EDCs and all but three EGSs** met their requirements. One EGS paid the required ACPs to achieve compliance. Two EGSs filed for bankruptcy and failed to meet their compliance obligations.
- **Cost of Purchased Credits: \$28,647,316**
- **ACP Assessments: \$49,574**

### Tier II Compliance

- **All EDCs and all but four EGSs** met their requirements. Two EGSs paid the required ACPs to achieve compliance. Two EGSs filed bankruptcy and failed to meet their compliance obligations.
- **Cost of Purchased Credits: \$147,972,974**
- **ACP Assessments: \$688,950**

### Tier I Non-Solar Compliance

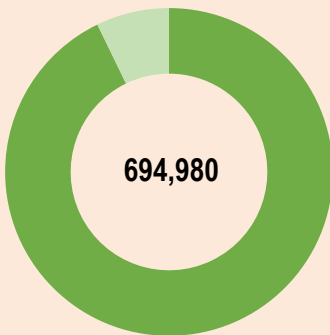
- **All EDCs and all but three EGSs** met their requirements. One EGS paid the required ACPs to achieve compliance. Two EGSs filed bankruptcy and failed to meet their compliance obligations.
- **Cost of Purchased Credits: \$190,648,619**
- **ACP Assessments: \$539,955**

### Total Number of Credits Retired

- **25,482,514** credits retired by **11 EDCs and 117 EGSs**. One EGS paid ACPs for its total obligation, and two EGSs filed for bankruptcy not retiring a combined total of 27,137 credits, and not paying ACPs.
- **Cost of Purchased Credits: \$367,268,908**
- **ACP Assessments: \$1,278,479**

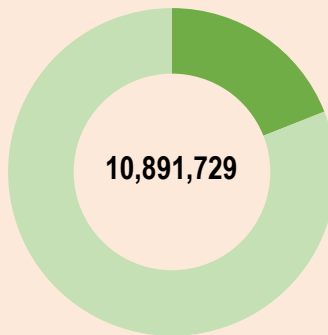
#### Source of Tier I Solar RECs Retired

- **Pennsylvania – 92.8%**
- **Other States – 7.2%**



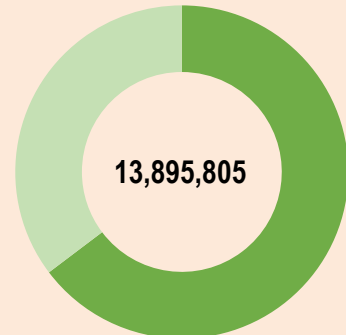
#### Source of Tier I Non-Solar RECs Retired

- **Pennsylvania – 19.0%**
- **Other States – 81.0%**



#### Source of Tier II RECs Retired

- **Pennsylvania – 64.7%**
- **Other States – 35.3%**



The Alternative Energy Portfolio Standards Act of 2004 (AEPS Act) identifies the energy resources that are eligible for consideration in the program.

These resources are classified into two groups, Tier I and Tier II resources. Additionally, although solar photovoltaic is a Tier I resource, it has a standalone requirement. For each reporting period, the Electric Distribution Companies (EDCs) and Electric Generation Suppliers (EGSs) are required to acquire and retire Alternative Energy Credits (AECs) in quantities equal to a percentage of their total retail sales of electricity in Pennsylvania. This percentage gradually increased each year, through 2021. Each successive 12-month reporting year begins on June 1 and concludes on the following May 31, and compliance is monitored during this period. Throughout this report, the terms “reporting year” and “compliance year” are synonymous and used interchangeably.

For the 2022 reporting year June 1, 2021, through May 31, 2022, the Tier I requirement was 8% of all retail sales, of which at least 0.5% of all retail sales was to come from solar photovoltaic (PV) sources. The requirement for Tier II resources was 10% of all retail sales. As required by Act 129 of 2008, a few more alternative energy resources, as identified in the table at the end of Section 1 of this report, were added to the Tier I group in 2009. To account for these additional resources, an annual adjustment to the non-solar portion of the Tier I requirement was added. For this reporting year that adjustment is 0.338146% for a total Tier I requirement of 7.838146%.

At the close of the 2022 reporting year, all the EDCs and all but four EGSs met their requirements by acquiring and retiring sufficient AECs. Two EGSs came into compliance through the submission of alternative compliance payments. One EGS, filed for bankruptcy shortly after the reporting year ended and one EGS, in bankruptcy since the previous year, continued to serve customers for the 2022 reporting year. The bankruptcies are discussed later in this report. Of the total number of AECs retired, 45.9% of AECs were generated within Pennsylvania. A more detailed breakdown of the retired AECs is provided in Chart 1, located in Section 1 of this report.

Analysis of existing and prospective resources indicates that sufficient Solar, Tier I Non-Solar, and Tier II AECs are available to meet the AEPS Act requirements through the 2023 reporting year. The AEPS Act was amended by Act 40 of 2017 that was signed into law on Oct. 30, 2017. This amendment does not allow solar AECs generated by solar facilities outside of Pennsylvania’s borders to be used to satisfy Tier I Solar obligations, though there are exceptions for certain existing

contracts that have been reviewed and approved for use by the Pennsylvania Public Utility Commission (Commission).<sup>1</sup> Similarly, the AEPS Act was amended by Act 114 of 2020 that was signed into law on Nov. 23, 2020. One Section of Act 114 modified Section 4 of the AEPS Act to effectively limit eligibility of Tier II alternative energy sources to facilities located in Pennsylvania. However, Act 114 allows exceptions for existing contracts for AECs from out-of-state Tier II facilities.<sup>2</sup>

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<sup>1</sup> *Implementation of Act 40 of 2017*, Final Implementation Order at Docket No. M-2017-2631527.

<sup>2</sup> *Implementation of Act 114 of 2020*, Final Implementation Order at Docket No. M-2020-3023323.



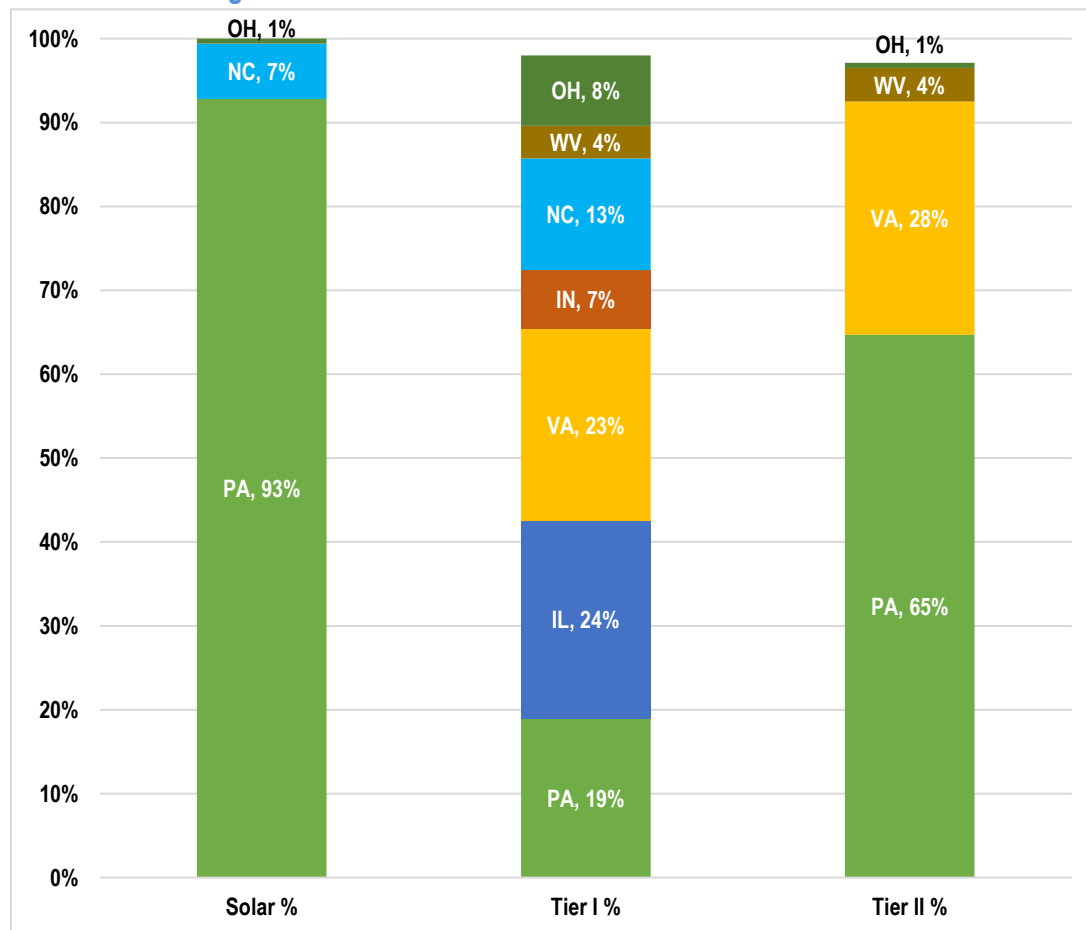
# **1. Compliance Summary**

**A**s of May 31, 2022, a little more than 18% of electricity sold to retail customers was generated by qualifying alternative energy resources.

Of all the AECs retired for compliance, 45.9% were generated in Pennsylvania and the remaining 54.1% were generated from other states in the PJM service territory.

Chart 1 shows the percentage of AECs that were retired in Pennsylvania in the 2022 reporting year and their states of origin. As can be seen, Pennsylvania-sourced AECs accounted for 93% of the Solar PV, 19% of the Tier I Non-Solar, and 65% of the Tier II requirements, respectively.

**Chart 1: Percentage of AECs Retired in 2022**



*Note: Total may not add up to 100% because states supplying less than 3% of credits in any category are not shown and due to rounding.*



Chart 2: Percentage of Retired AECs that Originated in Pennsylvania

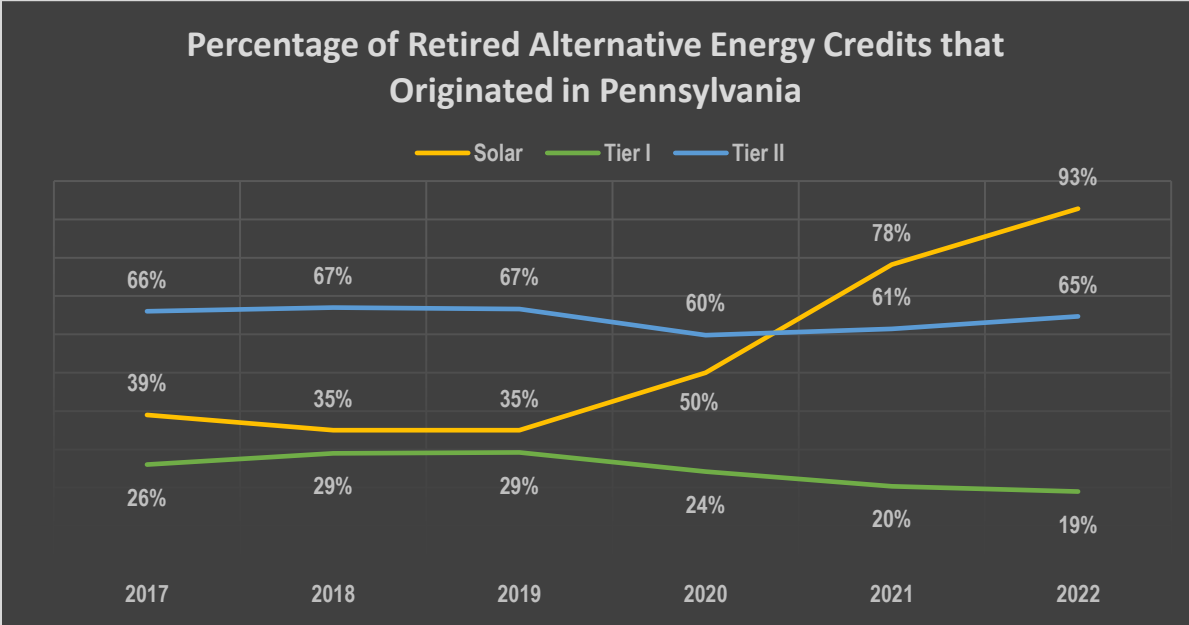


Chart 2 reflects the most recent five-year trend in the percentage of retired AECs that originated in Pennsylvania. Since the passage of Act 40 of 2017, the trend of retiring fewer Solar AECs generated in Pennsylvania has reversed sharply and soon will reach 100%. The same outcome will soon become evident for Tier II, as a result of the passage of Act 114 of 2020.

For additional compliance details turn to Appendix A of this report. For example, Table 2 provides a compliance summary for each tier for the current reporting year. Table 3 provides detailed compliance information for each tier and EDC service territory for the current reporting year and Table 4 shows the actual quantity of AECs, by state of origin, that were used for compliance in each of the three tiers.

During the 2022 reporting year, 11 EDCs and 117 EGSs had compliance obligations. All EDCs achieved compliance in the reporting year by retiring the requisite number of AECs. Four EGSs did not retire sufficient AECs, three of the four did not retire any AECs and one EGS was short just one AEC. Two of the four EGSs achieved compliance by paying the required ACPs. Two EGSs, Liberty Power Holdings, LLC (Liberty Power) and Sunwave USA Holdings Inc. (Sunwave) did not pay the required ACPs as they are no longer in business and have filed for bankruptcy. The Commission is taking steps to recover what it can against the obligations of Liberty Power and Sunwave. Specifically, the Commission is seeking to recover ACP money from the financial assurances posted by both companies. The

ACP amounts for Liberty Power and Sunwave are \$1,171,258.10 and \$71,775.20 respectively.

As previously mentioned, Table 3 of Appendix A presents details of the compliance obligations in each EDC territory and the compliance status for the reporting year 2022. The extent of geographic breadth of service provided by Liberty Power and Sunwave can be seen in the two far-right columns of Table 3; these two EGSs represent the sole reason for compliance being unmet in most of the EDC service territories. EGS compliance via ACP, securitization of bond assets or bankruptcy proceedings bares no reflection on EDC compliance but rather indicates the manner in which EGSs may have complied within those EDC service territories. Commission staff also note that several EGSs retired excess credits beyond the required AEPS obligations. EGS sales information is considered proprietary, therefore, their AEPS credit retirement data are combined and shown in the appropriate EDC service territory. When an EGS retires too few or too many AECs, the excess or deficiency is not always connected to a specific EDC service area. Therefore, Table 3 shows most EDC service territories as having a deficiency of credits.

## **A. Tier I Compliance**

### ***a. Solar Compliance***

For the 2022 reporting year, the Solar PV obligation was 0.5%. All EDCs and all but three EGSs retired the requisite number of Solar AECs. One of the three EGSs paid the ACP for their Solar PV obligation. Two EGSs, Liberty Power and Sunwave did not pay the required ACPs as they are no longer in business and have filed for bankruptcy. The Commission is taking steps to recover what it can against the obligations of Liberty Power and Sunwave. The number of Solar AECs not retired by Liberty Power and Sunwave represented 0.83% of the total Solar AEC obligation.

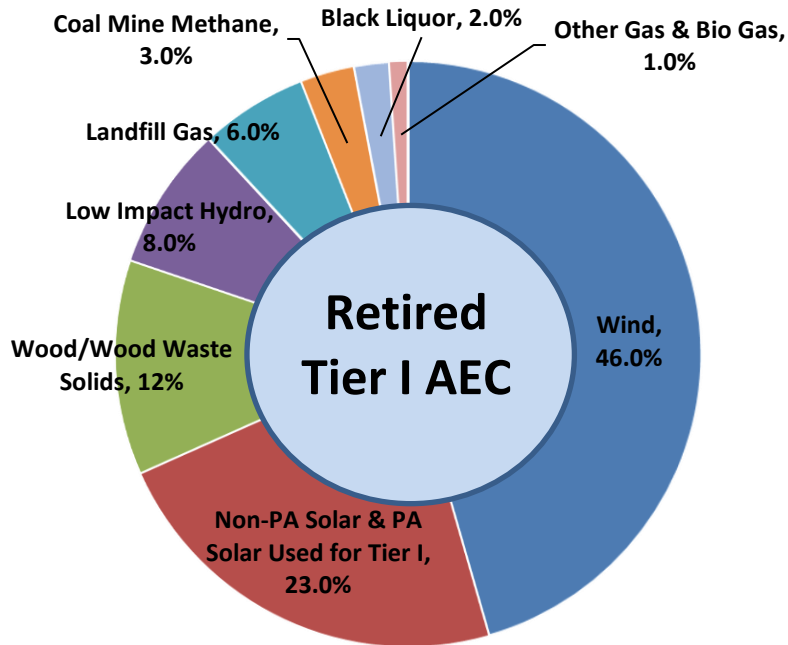
### ***b. Tier I Non-Solar Compliance***

For the 2022 reporting year, the base obligation for non-solar Tier I was 7.5%. The Tier I quarterly adjustment, impacting only non-solar Tier I, added a quarterly increase of 0.2885%, 0.4396%, 0.3879%, and 0.5213%, for quarters one through four, respectively. This resulted in 470,399 AECs added to the base obligation of 10,433,337. All EDCs and all but three EGSs achieved compliance by retiring the requisite number of Tier I AECs. One of the three EGSs paid ACPs for their non-solar Tier I obligations. Liberty Power and Sunwave did not pay the required ACPs as they are no longer in business and have filed for bankruptcy. The Commission is taking steps to recover what it can against the obligations of Liberty Power and

Sunwave. The number of Tier I AECs that were not retired by Liberty Power and Sunwave represented 0.107% of the total Tier I AEC obligation.

Chart 3 shows the resource percentage of Tier I AECs retired in the 2022 reporting year. Wind energy produced 46% of the retired Tier I AECs, followed by Non-Pennsylvania Solar energy and electricity generation from Wood/Wood Waste to round out the top three resource types.

**Chart 3: Percentage of Sources of Tier I AECs Retired for the 2022 Reporting Year**

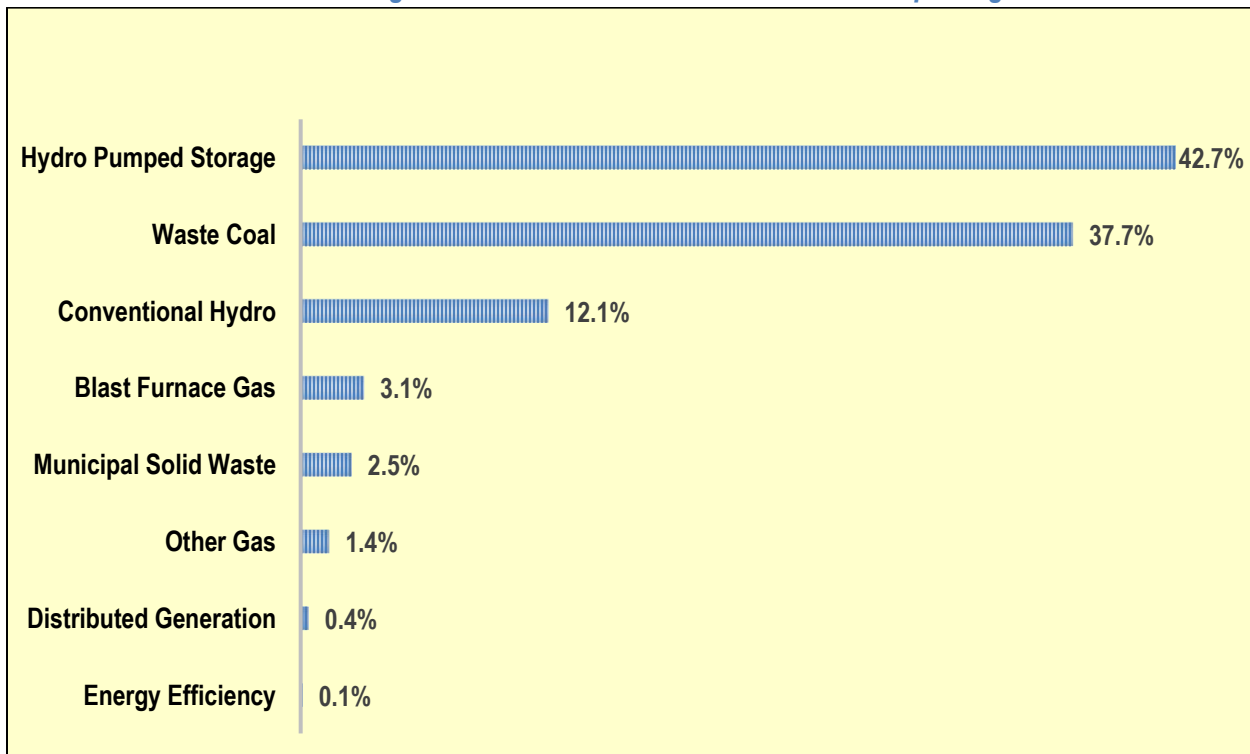


## B. Tier II Compliance

For the 2022 reporting year, the base obligation for Tier II was 10%. All EDCs and all but four EGSs achieved compliance in the reporting year by retiring the requisite number of AECs. Two of the four EGSs paid ACPs for their Tier II obligations. Liberty Power Holdings LLC and Sunwave USA Holdings Inc. did not pay the required ACPs as they are no longer in business and have filed for bankruptcy. The Commission is taking steps to recover what it can against the obligations of Liberty Power Holdings LLC and Sunwave USA Holdings Inc. The number of Tier II AECs not retired by Liberty Power Holdings LLC and Sunwave USA Holdings Inc. represented 0.107% of the total Tier II AEC obligation.

Chart 4 shows sources and percentages of Tier II AECs retired in the 2022 reporting year.

*Chart 4: Sources and Percentages of Tier II AECs Retired for the 2022 Reporting Year*



## C. Compliance Costs

Table 2 of Appendix A provides the compliance details for each of the AEPS tiers, including the costs of alternative energy credits purchased by EDCs and EGSs to meet their compliance obligations for the 2022 reporting year. As shown in the summary table below, total compliance costs were approximately \$367 million. The costs are calculated using data for credits that have a known cost. However, some credits that are retired to meet obligations are self-generated or purchased bundled with the electricity and a cost for those credits is not available. Table 2 also includes the total number of credits, for each tier, that EGSs did not retire to meet their obligations. For the 2022 reporting year, three EGSs did not retire 598 Solar credits, three EGSs did not retire 11,999 Tier I credits and four EGSs did not retire 15,310 Tier II credits needed to meet the AEPS obligations.

*Summary Table of AEPS Compliance Costs*

Tier	Credits Retired	Weighted Average Credit Price	Cost of Purchased Credits
Solar	694,980	\$41.45	\$28,647,315.75
I	10,891,729	\$17.68	\$190,648,618.85
II	13,895,805	\$10.86	\$147,972,973.68
Total	25,482,514	N/A	\$367,268,908.28



## **2. Costs and Benefits of Alternative Energy Generation**

## A. Current Estimated Costs of Future Alternative Energy Generation

The United States Energy Information Administration (EIA) provided estimated cost data for the construction and operation of utility-scale generation plants that may be brought online in 2027.<sup>3</sup> The EIA data is used as the most consistently reliable information available. In using this data, 2027 was selected to account for the lead time needed by some technologies to be brought online. EIA uses average data, including capacity factors, from across the country. Chart 5 compares these levelized costs, in 2021 dollars, for differing generation technologies on a dollar per megawatt-hour (\$/MWh) basis over an assumed financial life of the plant.

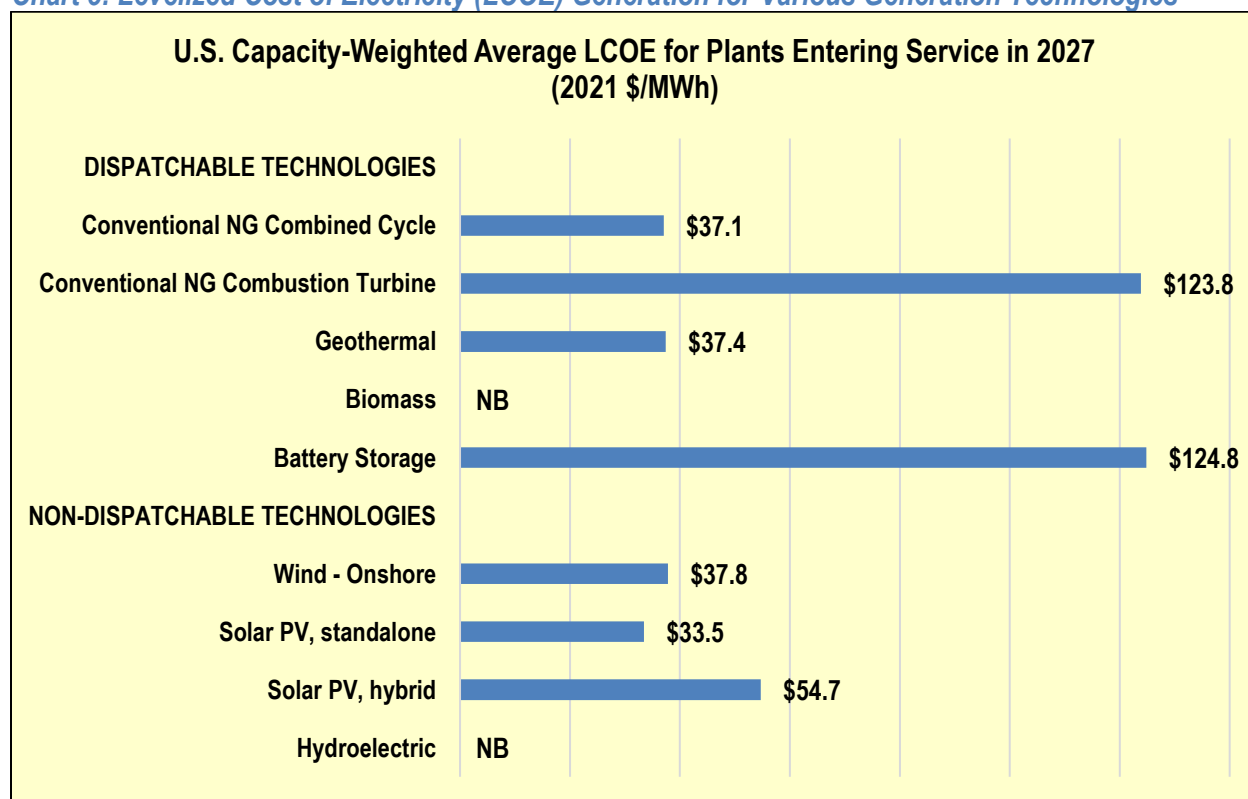
Levelized cost components include overnight capital costs, construction, operation and maintenance (O&M) costs, and an assumed utilization rate for each plant type. O&M costs include items such as fuel costs, maintenance, insurance, taxes, and federal tax incentives, but do not include state or local incentives.<sup>4</sup> EIA notes actual plant investment decisions are affected by the specific technological and regional characteristics of a project and levelized costs are a convenient summary measure of overall competitiveness of generation technologies.

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<sup>3</sup> U.S. Energy Information Administration document titled *Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2021*, February 2021. Available at [https://www.eia.gov/outlooks/aeo/pdf/electricity\\_generation.pdf](https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf).

<sup>4</sup> <https://www.energy.gov/eere/solar/federal-solar-tax-credits-businesses>. Congress passed The Inflation Reduction Act of 2022 which substantially changed and expanded the ITC and PTC provisions.

**Chart 5: Levelized Cost of Electricity (LCOE) Generation for Various Generation Technologies**



**NB=Technologies for which capacity additions are not expected, or not built.**

Solar PV Costs are expressed in terms of net AC power available to the grid for the installed capacity.

Solar PV hybrid is a single axis PV system coupled with four-hour battery storage system.

## **B. Statewide AEPS Credit Price Trend**

Charts 6, 7 and 8, on the following pages, provide a comparison of the average annual (compliance year) spot market prices<sup>5</sup> for the given AEPS tiers, as compared to the weighted average credit prices that have been retired for AEPS compliance. These graphs illustrate the differences between average spot market prices that most readers may be accustomed to seeing and the weighted average price of credits retired for AEPS compliance. This difference is due to the relatively significant volume of credits retired for AEPS compliance that are purchased as part of multi-year procurement processes.

<sup>5</sup> Spot prices from S&P Global Market Intelligence.



Chart 6: Solar Average Spot Market vs. Weighted Average AEC Credit Prices

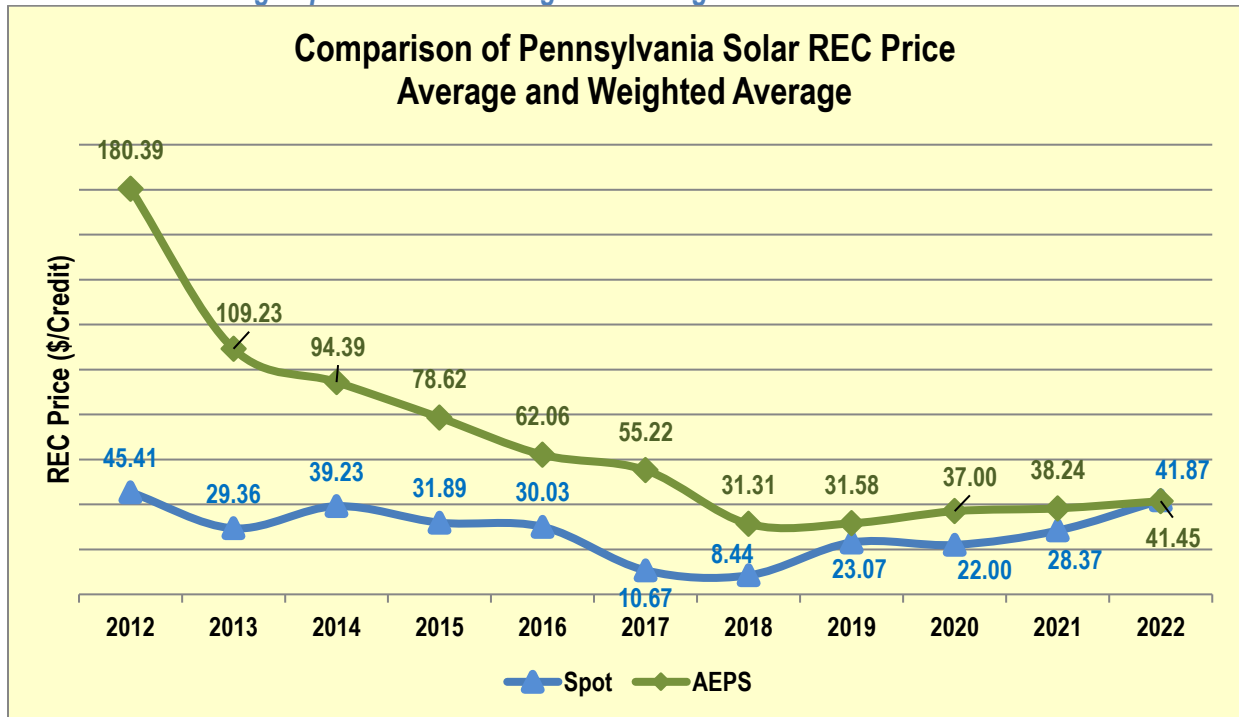


Chart 7: Tier I Average Spot Market vs. Weighted Average AEC Credit Prices

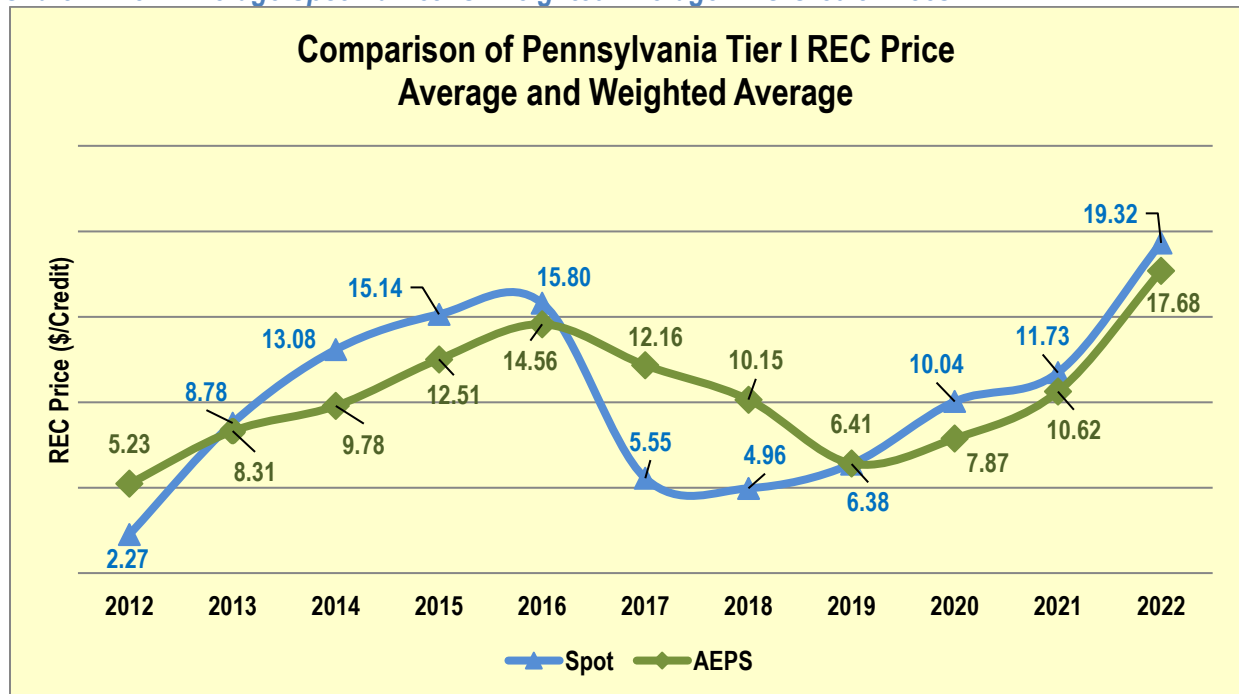
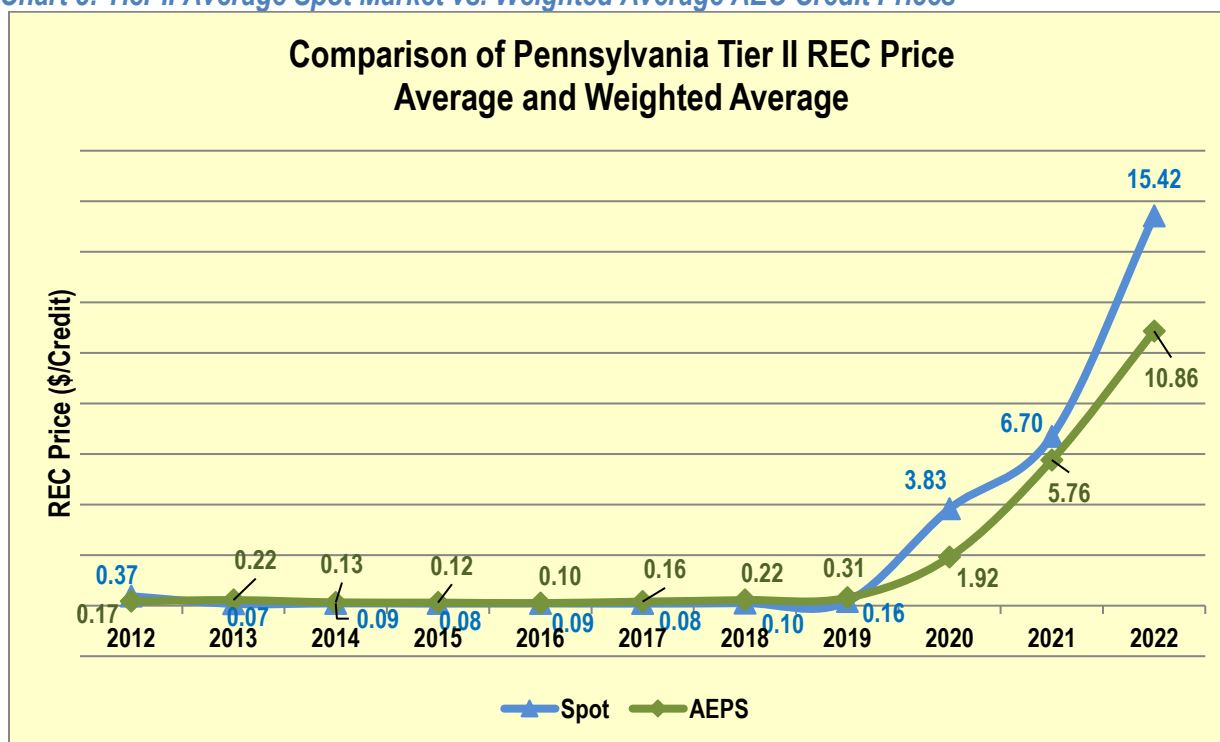


Chart 8: Tier II Average Spot Market vs. Weighted Average AEC Credit Prices



### C. Renewable Energy Economic Benefit – Jobs, Exports, Wages

Economic benefits associated with the development and deployment of renewable and alternative energy sources was a significant consideration in the passage of the AEPS Act. Since its inception, the AEPS Act has been instrumental in sustaining and creating thousands of jobs and business ventures associated with all aspects of renewable and alternative energy generation.

Jobs in the clean energy sector are numerous, varied in discipline, and well paying. As documented in the “2022 Pennsylvania Clean Energy Employment Report,” recently released by the Pennsylvania Department of Environmental Protection (DEP), nearly 95,000 Pennsylvanians are employed in the five broad areas defined as clean energy jobs: clean energy generation, clean grid and [energy] storage, energy efficiency, alternative transportation, and clean fuels, up 5.1% from the end of 2020.<sup>6</sup> After the loss of jobs due to the Coronavirus (COVID-19) pandemic, the

<sup>6</sup> [2022 Pennsylvania Clean Energy Employment Report.](#)

clean energy industry began to rebound. However, this job growth was not enough for a full recovery, and 2021 clean energy employment in Pennsylvania remained comparable to 2018 levels.<sup>7</sup> Despite this, Pennsylvania's clean energy economy growth outpaced the overall economic growth and energy employment growth statewide, nationwide clean energy economic growth, and neighboring clean energy labor markets.

According to the report, roughly 72% of Pennsylvania's clean energy jobs pertain to energy efficiency, which is an AEPS Tier II resource, including manufacturing, construction, and installation of high efficiency appliances and products, high efficiency lighting, and energy efficient buildings and associated building materials. The report also notes that solar industry jobs made up the largest share of the clean energy generation subsector, at 38.7% (5,770 jobs), followed by jobs in the nuclear industry with 4,049 Pennsylvanians employed.

In reporting year 2022, approximately 72 megawatts AC (MWac) of solar-electric generating capacity was installed in Pennsylvania, which brought the in-state total capacity to 606.3 MWac. It should be noted that the above values include only AEPS-certified systems and do not account for other installed systems in Pennsylvania that are not certified in a timely fashion, and systems owned by owners who do not seek certification under AEPS. These installations at private residences, businesses, institutions, and utility-scale solar sites across Pennsylvania, help sustain a workforce of almost 4,200<sup>8</sup> that are engaged in all aspects of the solar industry, including manufacturing, sales, distribution and installation of solar power components and systems and related support services. Nationally, compensation within the solar industry is comparable with similar occupations in other energy industries.<sup>9</sup> Beyond rooftop solar, Pennsylvania has abundant opportunities for solar development beyond productive or high value green spaces, including locations such as marginal use properties, abandoned mine lands, closed landfills, industrial and commercial warehouses, and parking lot/garage canopies.

As of the end of 2021, Pennsylvania ranked 20<sup>th</sup> in the country for installed wind capacity 1,419.5 MW (1,459 MW).<sup>10</sup> Additionally, Pennsylvania supports a number of wind energy jobs. Through Q4 2019, the total number of direct and indirect jobs

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<sup>7</sup> [2021 Pennsylvania Clean Energy Employment Report](#).

<sup>8</sup> [SEIA Pennsylvania State Solar Spotlight 3rd Quarter 2022](#).

<sup>9</sup> [National Solar Jobs Census 2022](https://www.thesolarfoundation.org/national/), available at: <https://www.thesolarfoundation.org/national/>.

<sup>10</sup> The wind capacity installed in Pennsylvania reported by US DOE (1,459 MW) differs from the capacity of certified wind reported by Pennsylvania's AEPS Administrator (1,419.5 MW). See p. 8 at [Land-Based Wind Market Report: 2022 Edition \(energy.gov\)](#).

supporting the wind industry in Pennsylvania was approximately 2,937.<sup>11</sup> Additionally, wind farm development employs hundreds of people and each wind farm typically requires a small, permanent crew of up to 15 people to oversee the maintenance and continued operation of the turbines.

Supporting the growth of hydropower in Pennsylvania and globally are two of the world's largest turbine manufacturers, Voith Hydro and American Hydro, both headquartered in Pennsylvania. According to the National Hydropower Association, approximately 325 Pennsylvania businesses are part of the hydropower supply chain. The largest of these businesses is Voith Hydro whose York County manufacturing facility employs more than 400 people. Given the attention to large-scale hydropower, it is important to note that there is interest in the significant potential to develop low-impact hydropower resources, many of which can take advantage of existing infrastructure. A Navigant Consulting study indicates that for every 10 MW of hydropower generating capacity developed, the equivalent of 5.3 full-time jobs is created.<sup>12</sup> The passage of the federal Hydropower Regulatory Efficiency Act of 2013 helps to streamline some of the Federal Energy Regulatory Commission (FERC) permitting/licensing requirements for smaller hydropower projects and may help facilitate the development of smaller projects in Pennsylvania.

In response to impacts on the clean energy sector as a result of the COVID-19 pandemic, The Pennsylvania Energy Development Authority (PEDA) developed the COVID Restart grant program offering \$1.71 million to Pennsylvania clean energy projects that were disrupted. The grant solicitation required applicants to demonstrate how an award would mitigate the impact of a project disruption caused by the COVID-19 pandemic. This included re-hiring of workers or hiring of additional workers to complete the project quickly, the ability to make immediate equipment payments to restart the supply chain, and the opportunity to overcome lost revenue due to market stagnation.

The projects under this COVID Restart grant included energy efficiency, solar energy, high-performance buildings, and electric vehicle charging projects halted by the pandemic. Five businesses, two municipalities, two school districts, and two nonprofit organizations received grants for a variety of building and transportation projects that had broken ground or were in advanced planning stages before being disrupted by the pandemic. The projects are located in urban and rural areas in

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<sup>11</sup> *Clean Jobs Pennsylvania 2019* - <https://e2.org/reports/clean-jobs-pennsylvania-2020/>.

<sup>12</sup> *Job Creation Opportunities in Hydropower, 2009*, found at: <http://www.hydro.org/waterpower/why-hydro/job-creation/navigant-study/>.

eight counties, and seven are in or will serve Environmental Justice communities. As of the end of 2022, all 11 of the selected COVID Restart projects were completed and operational.

In order to develop greater ability to finance clean energy projects into the future, in 2022, PEDDA initiated a process to develop a Green Bank that is expected to offer attractive financing terms for clean energy projects across Pennsylvania. PEDDA developed a solicitation to hire a financial firm to serve as Green Bank administrator and propose financing products that could leverage public dollars through PEDDA with private capital as a way to finance clean energy projects focusing on building efficiency and onsite renewable energy generation. PEDDA is targeting 2023 for the release these clean energy financing products and plans to seek additional funds through the federal Bipartisan Infrastructure Law and the Inflation Reduction Act to further develop additional financing products for clean energy.

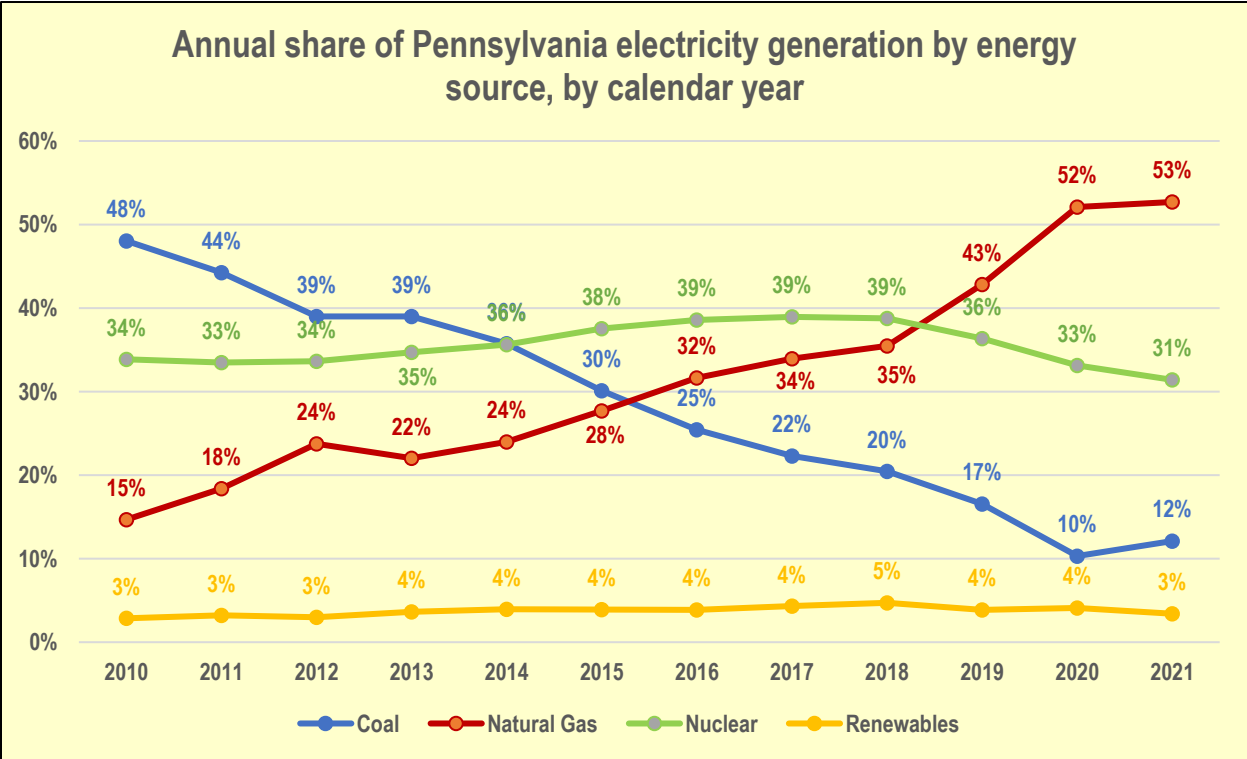


### **3. Status of Pennsylvania's Alternative Energy Marketplace**

The renewable energy industry is becoming one of the most transformative sectors of the global economy. Through technology improvements, cost declines, new financing structures, and regulatory policy, the sector has driven economic growth around the world including in the United States.

Pennsylvania’s AEPS Act required that, by 2021, alternative energy credits equivalent to 18% of all electric power sold in the Commonwealth be obtained from qualifying resources and retired. This has helped the growth of Pennsylvania’s renewable energy generating capacity and has provided cleaner energy options to the Commonwealth’s businesses and homeowners.

*Chart 9: Pennsylvania Annual Electric Generation by Energy Source*



Source: Energy Information Administration Electricity Data Browser

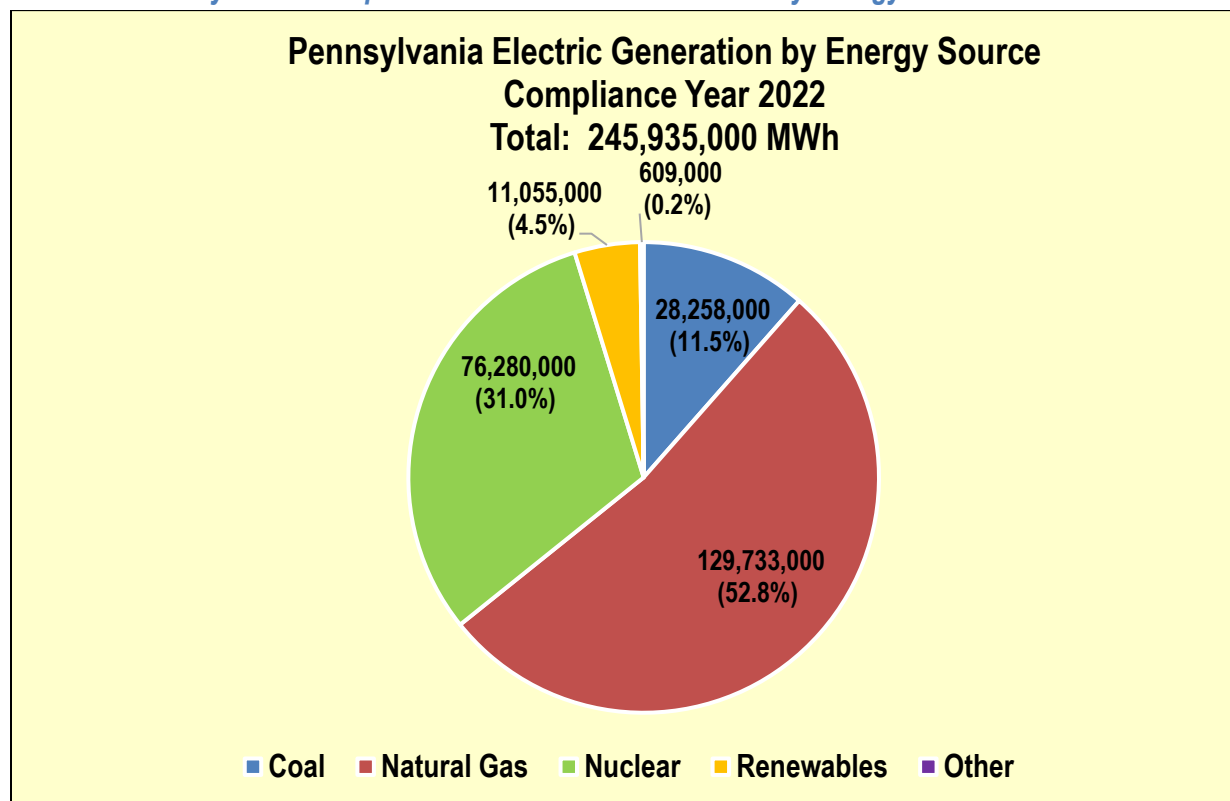
Chart 9 shows annual Pennsylvania electric generation by energy source. In 2021, approximately 3% of the state’s electricity generation was from renewable energy sources.<sup>13</sup> The chart mimics the general trend in U.S. electricity generation where electricity generation from coal is steadily decreasing and natural gas electricity generation is steadily increasing. While U.S. electricity generation from renewable

<sup>13</sup> Energy Information Administration Electricity Data Browser.

sources has grown, Pennsylvania’s electricity generation from renewable sources has not kept pace with the U.S. growth. While there are many differences among the various state renewable and alternative energy portfolio standards, almost all of these standards are based on in-state consumption or sales of electric energy. This is an important consideration to understand because many states are net importers of electricity whereas, Pennsylvania is among the largest net exporters of electricity in the country. Pennsylvania’s AEPS requirements, which are broader than renewables-only requirements, have not kept pace as compared to the requirements of other states with portfolio standards. Additionally, the broad geographic scope of the AEPS Act allows compliance to come from credits generated from out-of-state resources, with the recent exception, as previously noted, for Tier I Solar and Tier II obligations.

Chart 10 shows the breakdown of total electricity generation in Pennsylvania by source for compliance year 2022. This information is obtained from EIA using its Electricity Data Browser tool.

**Chart 10: Pennsylvania Compliance Year Electric Generation by Energy Source**



Source: Energy Information Administration Electricity Data Browser

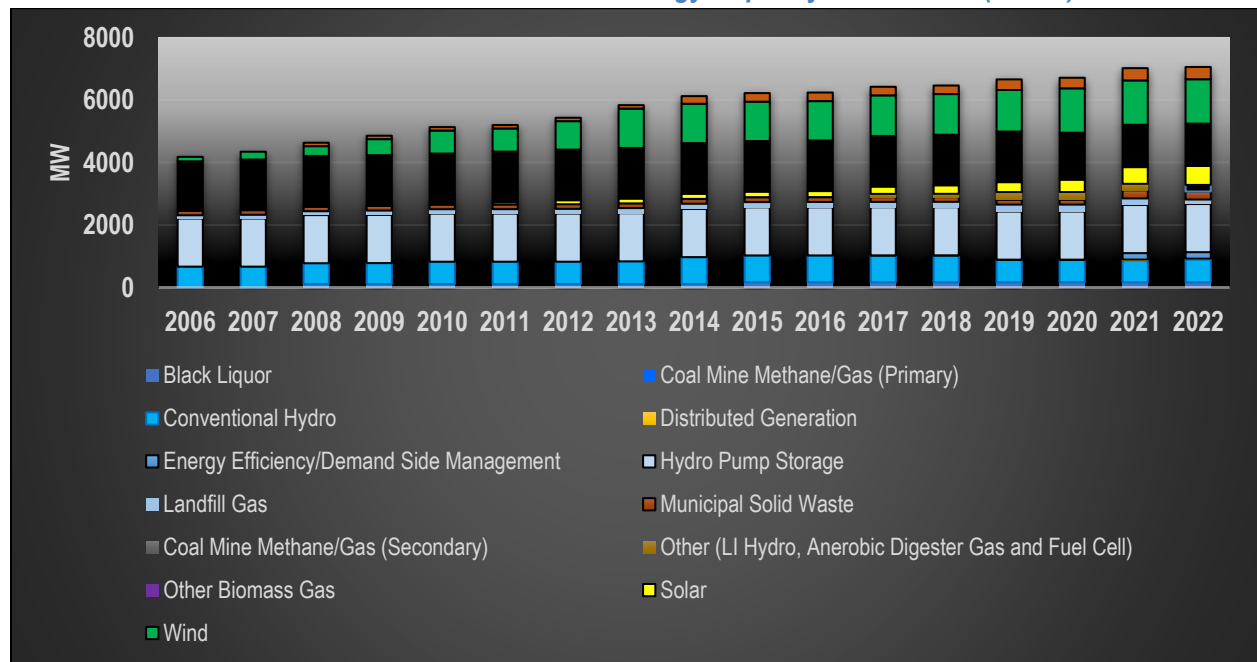
Action at the federal level, such as the Business Energy Investment Tax Credit (ITC) and the Renewable Electricity Production Tax Credit (PTC) helped accelerate



renewable energy investments and developments in the United States. The PTC for wind and the ITC for solar were extended at the end of 2020 when Congress passed a stimulus bill with a goal of minimizing the economic impacts caused by COVID-19. Under the Inflation Reduction Act of 2022, the PTC and ITC were extended through 2034 with some modifications to the programs. The extension and program changes are designed to reduce power sector emission and they will likely accelerate renewable energy growth in the Commonwealth.

Chart 11 shows an historical view of the certified alternative electricity generation capacity available in Pennsylvania. As of the end of the 2021 compliance year, Pennsylvania had approximately 7,019.6 MWac of installed alternative electricity generation capacity.

**Chart 11: PA In-State AEPS-Certified Alternative Energy Capacity – 2006-2022 (MWac)**



Refer to Table 5 in the Appendix for compliance year 2022 specifics.

## A. Solar

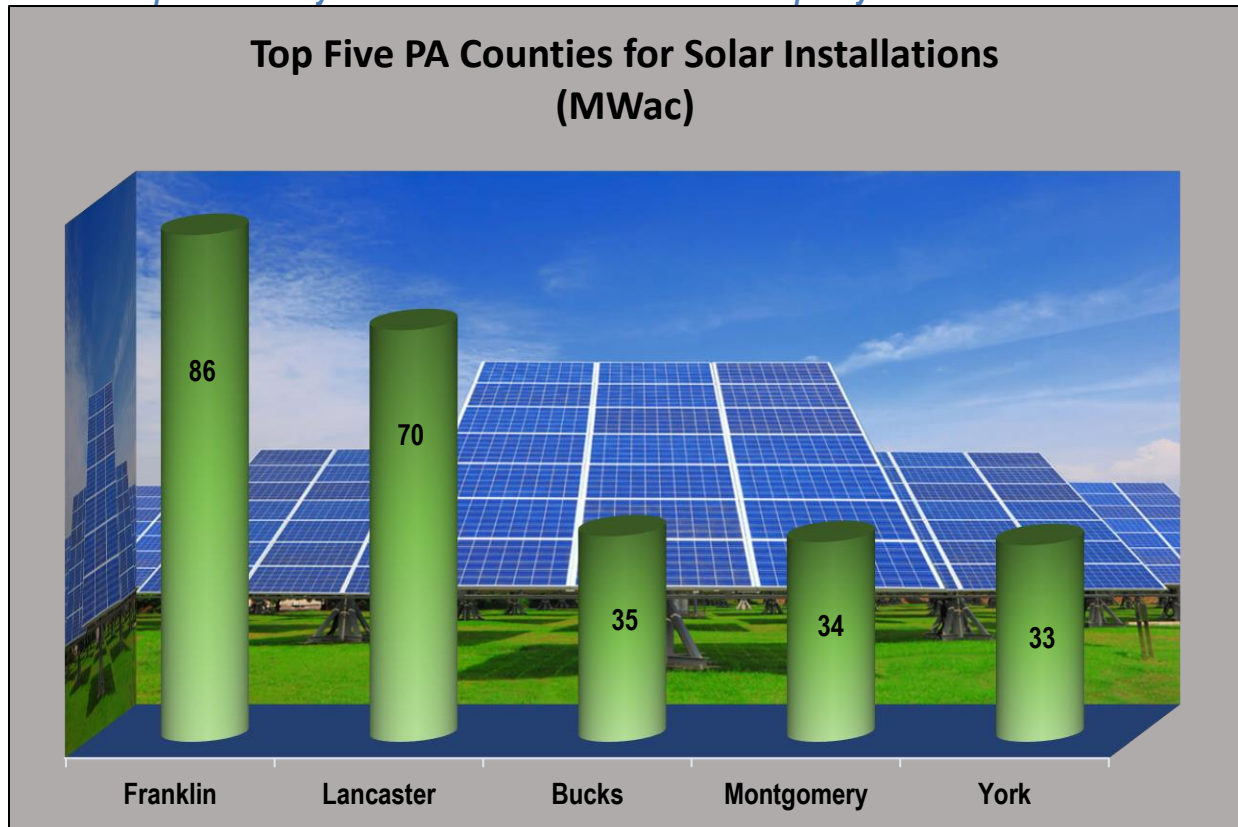
In Pennsylvania, approximately 606.3 MWac (735.5 MWdc) of solar electric capacity had been installed through the end of the 2022 compliance year, enough to power nearly 79,670 homes.<sup>14</sup> It should be noted that the above number includes only AEPS-certified systems. According to the Solar Energy Industries Association

<sup>14</sup> Based on average annual electricity consumption of approximately 10,000 kWh and an average solar capacity factor of 15%.

(SEIA), the solar industry has invested \$2.6 billion in Pennsylvania, including \$266 million in 2022.<sup>15</sup>

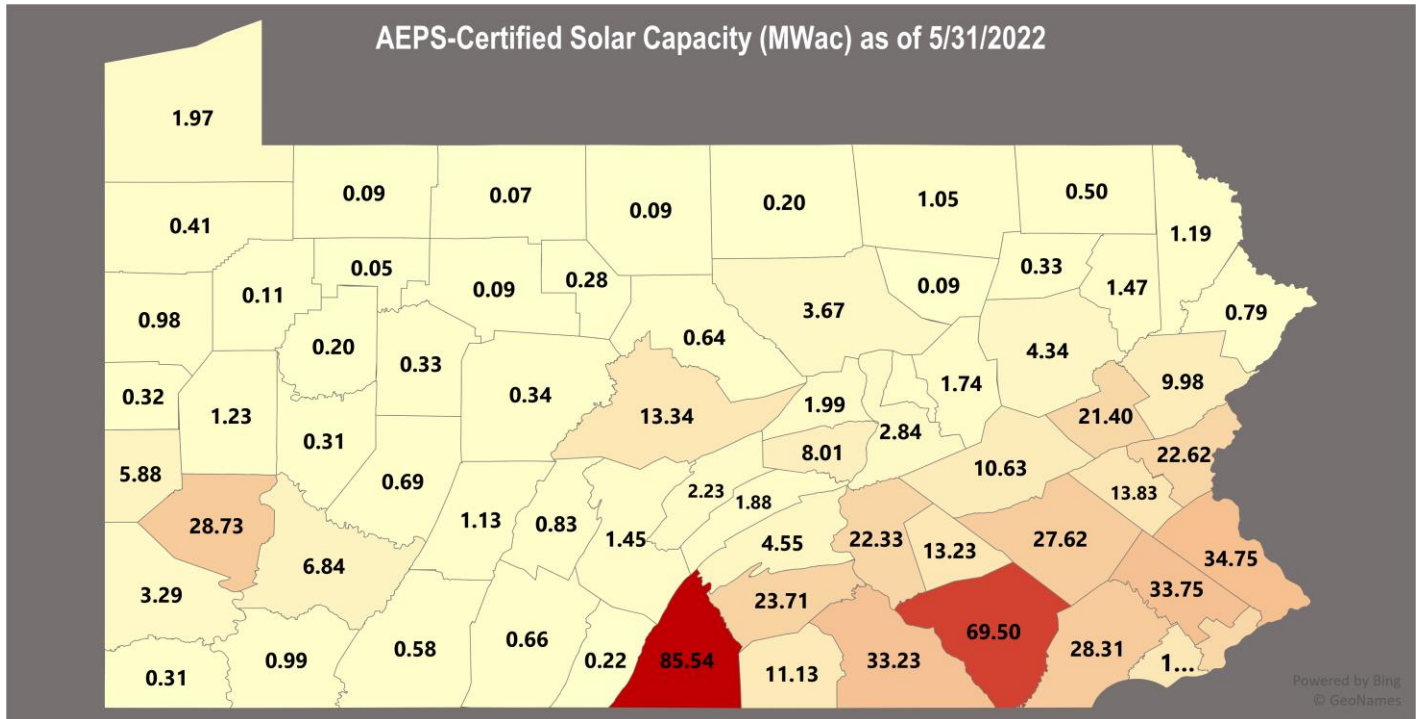
Chart 12 shows the top five Pennsylvania counties for installed solar capacity, as of the end of the compliance year.

*Chart 12: Top Five Pennsylvania Counties for Installed Solar Capacity*

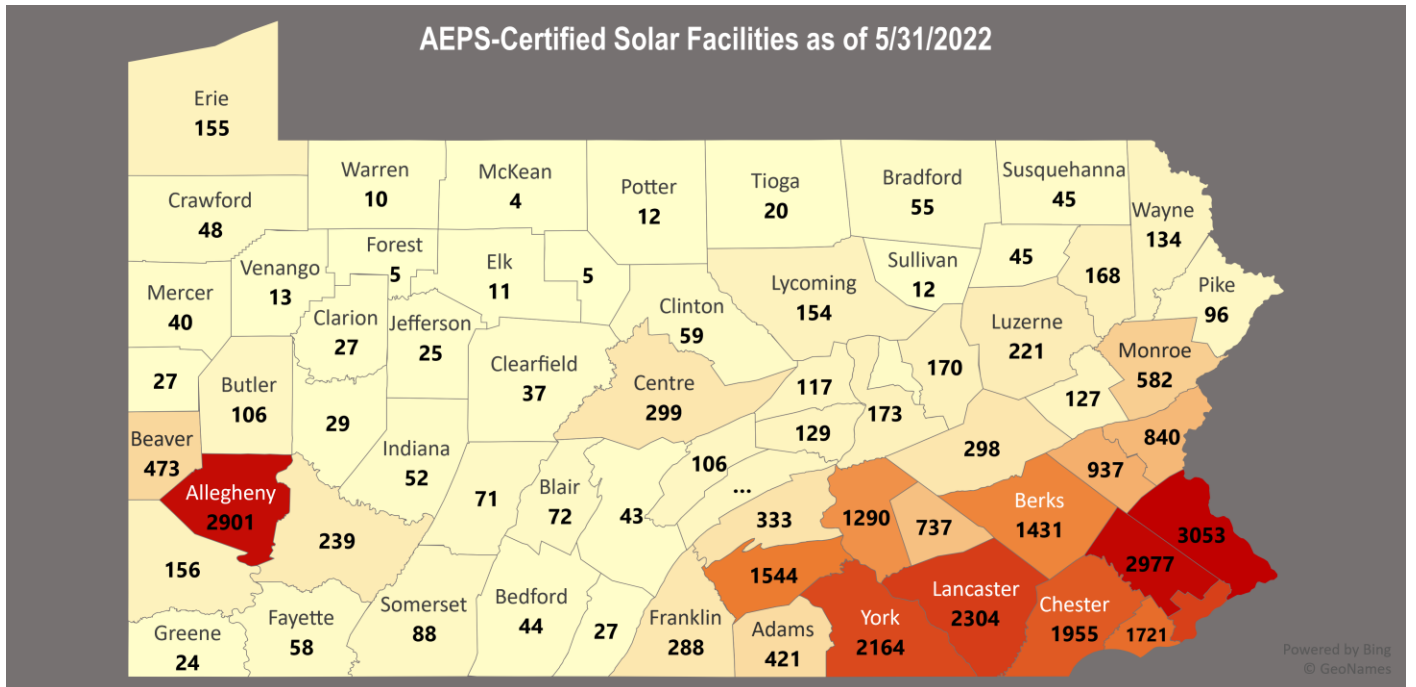


The following two maps show the AEPS certified solar PV electric generating capacity and the number of facilities, by county, in Pennsylvania, as of the end of the compliance year.

<sup>15</sup> [Pennsylvania State-Factsheet-2022-Q3.pdf \(seia.org\)](#).



**Note:** As of 5/31/2022, the AEPS certified solar generation capacity was 12.55 MWac in Delaware County and 21.94 MWac in Philadelphia County.

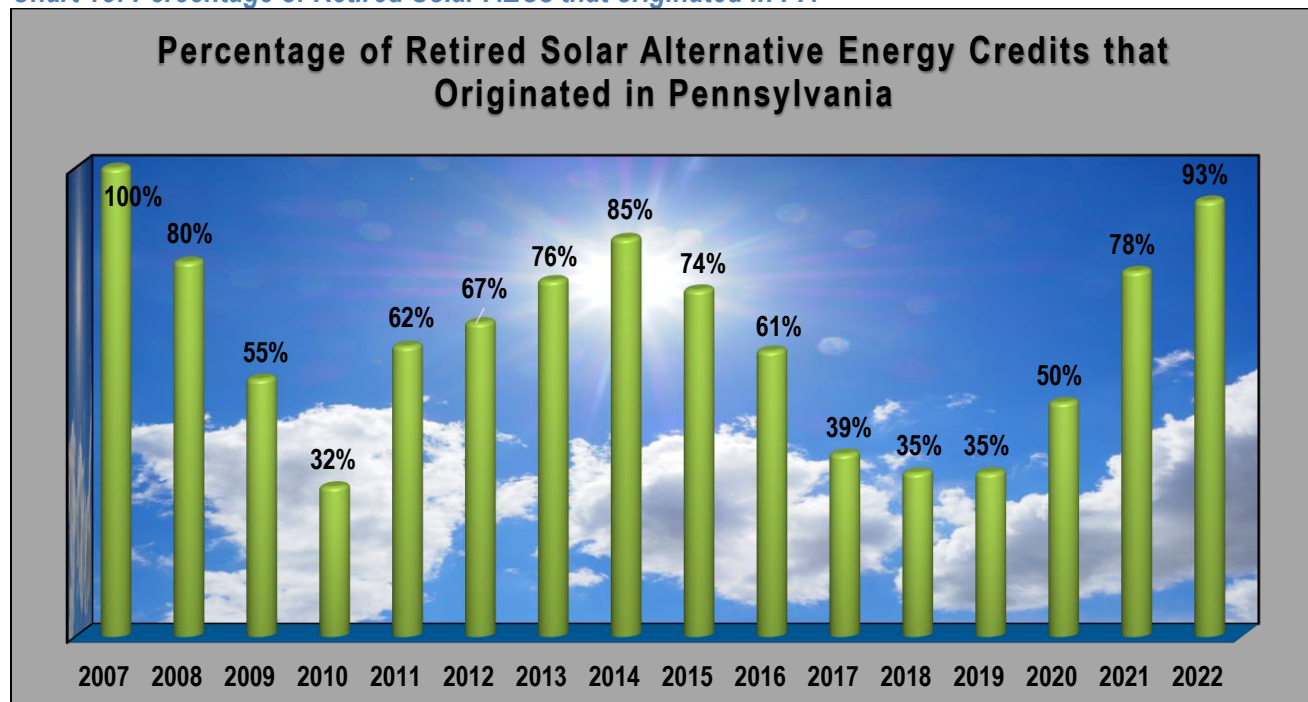


**Note:** As of 5/31/2022, Philadelphia County has 2,277 AEPS certified solar generation facilities.

Chart 13 shows the percentage of retired in-state Solar AECs used for AEPS Act compliance. 2022 data shows a significant increase in the number of retired in-state Solar AECs since 2019. This trend is expected to continue due to the

implementation of Act 40 of 2017, that requires compliance with the Tier I Solar PV requirements of the AEPS Act to be met by using in-state Solar AECs, with an exception for previously issued contracts for out-of-state Solar AECs (now tagged as Non-Solar Tier I (NSTI) credits.

*Chart 13: Percentage of Retired Solar AECs that originated in PA*



In January 2017, the DEP began a 30-month stakeholder engagement and modeling initiative, “Finding Pennsylvania’s Solar Future”. The resultant plan identifies that, to meet a goal of 10% in-state solar by 2030, approximately 11 GW of solar generation capacity needs to be installed. The final plan: Pennsylvania’s Solar Future Plan was released in November 2018.<sup>16</sup> The plan includes several recommendations and was provided to the public, the legislature, and the Governor to be used as a guide for policy making. One strategy in the plan recommends increasing the AEPS Solar PV carve-out to between 4% and 8% by 2030. Additionally, the Pennsylvania Climate Action Plan, authored by DEP and released in September 2021, recommends increasing AEPS targets to 100% by 2050 to meet the Commonwealth’s greenhouse gas reduction goal of 80% below 2005 emissions levels by 2050<sup>17</sup>. In response to a multi-GW increase in the PJM Queue for solar, the DEP developed a website for solar resources. The website includes information

<sup>16</sup> <https://www.dep.pa.gov/Business/Energy/OfficeofPollutionPrevention/SolarFuture/Pages/Pennsylvania's-Solar-Future-Plan.aspx>.

<sup>17</sup> Pennsylvania Climate Action Plan 2021, <https://www.dep.pa.gov/citizens/climate/Pages/PA-Climate-Action-Plan.aspx>.

for residential, commercial and grid-scale solar installations.<sup>18</sup> Grid-scale solar installations are being developed within Pennsylvania, yet many local governments have not established zoning ordinances that specifically address this relatively new form of land use. In 2022, DEP worked with the Penn State Cooperative Extension to provide outreach and technical assistance to local governments to better assist them in understanding the various aspects associated with these larger solar projects. This initiative led to the development of the *Municipal Officials' Guide to Grid-Scale Solar Development in Pennsylvania*<sup>19</sup>, an online resource to provide detailed information to local officials regarding physical and environmental impacts, land conversion issues, localized economic impacts, tax implications, and ordinance consideration for grid-scale solar development. Targeted outreach is ongoing and will continue throughout 2023 in partnership with the Pennsylvania State Association of Township Supervisors (PSATS).

## **B. Wind**

Per the Department of Energy's Wind Vision projections, Pennsylvania has the potential to generate enough wind electricity to power the equivalent of 1.6 million average American homes. The report estimates an electricity generation potential of 43,565 MW at a hub height of approximately 360 feet (110 meters). The most recent wind turbines to come online in Pennsylvania have a hub height of roughly 430 feet. As of May 31, 2022, the AEPS-certified installed wind capacity in Pennsylvania is 1,419.5 MW.

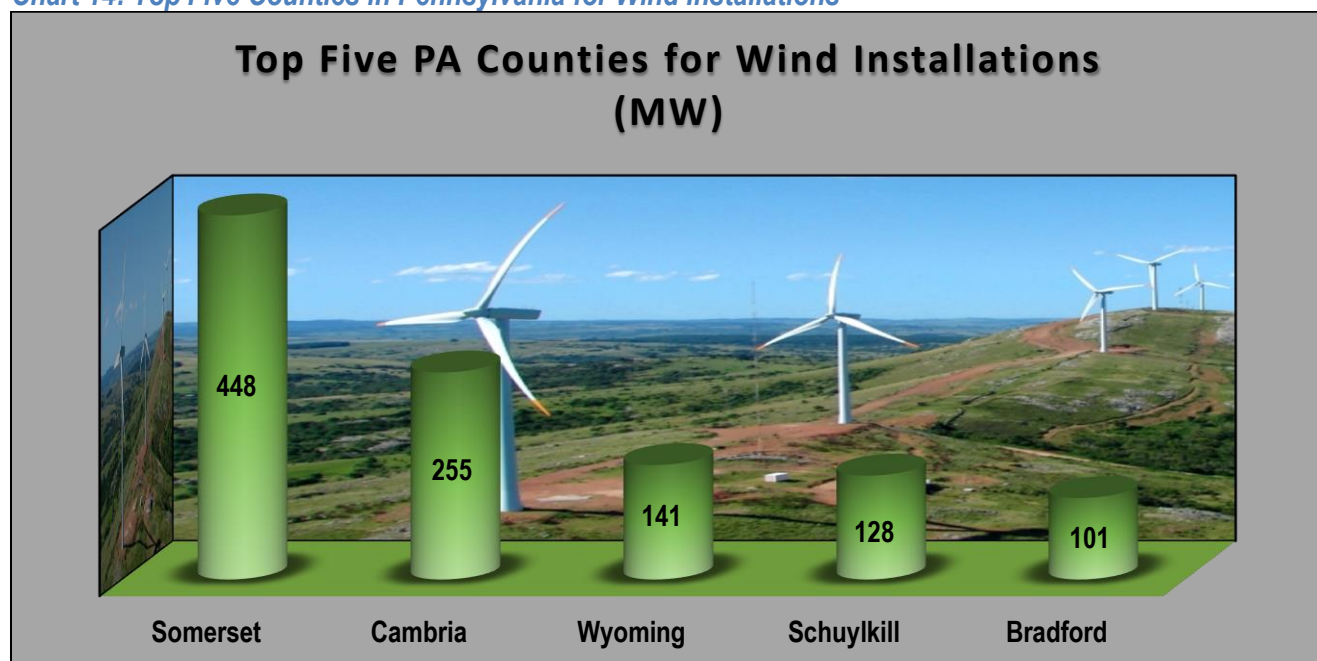
Chart 14 shows the top five counties for wind installations in Pennsylvania.

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<sup>18</sup> <https://www.dep.pa.gov/Citizens/solar/Pages/default.aspx>

<sup>19</sup> <https://marcellus.psu.edu/solar-energy/>

Chart 14: Top Five Counties in Pennsylvania for Wind Installations



### C. Hydropower

A study conducted by the U.S. Department of Energy’s Oak Ridge National Laboratory has concluded that Pennsylvania has the potential for more than 600 MW of incremental hydropower capacity by using existing water control infrastructure representing an underutilized renewable resource in Pennsylvania.<sup>20</sup> Hydropower had been the second largest source of non-fossil fuel generation, behind nuclear power, but has recently been eclipsed by the growth of wind power. Since the 1960s, major hydropower development has essentially stopped. Most future domestic capacity growth is expected to occur in the form of incremental efficiency improvements at existing dams and the installation of power generating equipment at existing locks and dams that were constructed for some other purpose, *i.e.*, river navigation, flood control, etc.<sup>21</sup>

Projects such as these are beginning to take shape in Pennsylvania. The University of Pittsburgh has committed to purchasing 100% of the power output from a 17.8 MW hydropower project being developed at Allegheny Lock and Dam No 2.<sup>22</sup> Similarly, Allegheny County officials have signed a power purchase agreement for a

<sup>20</sup> 2014 *New Stream-reach Development: A comprehensive Assessment of Hydropower Energy Potential in the United States*.

<sup>21</sup> 2016 *International Trade Administration (ITA) Energy Top Markets Report*.

<sup>22</sup> University of Pittsburgh, <http://www.news.pitt.edu/news/university-pittsburgh-purchase-local-hydropower>.

portion of another 16.8 MW hydropower project under development at the Emsworth Lock Main Channel Dam.<sup>23</sup>

As of the end of the 2022 AEPS Act compliance year, Pennsylvania had approximately 2,458 MW of certified hydropower generating capacity of which, 1,540 MW is from pumped storage hydropower projects. Given appropriate regulatory support, baseload hydropower generation at existing water control facilities has the potential to support Pennsylvania's total renewable energy portfolio because of its non-intermittent nature.

#### **D. Growth of AEPS Resources within Pennsylvania**

This section discusses renewable and alternative energy data trends and generation capacity within Pennsylvania and throughout the PJM region. Specifically, this section compares the amount of renewable and alternative energy generation available to the amount of renewable and alternative energy generation which will be needed to meet future AEPS Act requirements.

The Pennsylvania AEPS website<sup>24</sup> maintains a summary of all AEPS-certified generation facilities and certified energy efficiency and demand-side management (EE/DSM) resources. There were 42,831 certified generation facilities as of May 31, 2022.

Statistics for AEPS-certified generators, as of May 31, 2022, include:

- 35,297 generators (82.4%) are located in Pennsylvania with a total nameplate generating capacity of 7,057 MWac
- 7,534 generators are located outside of Pennsylvania with a total nameplate generating capacity of 13,794 MWac
- 35,097 solar facilities are located in Pennsylvania with a total nameplate generating capacity of 606 MWac. This represents 99% of all certified systems located in Pennsylvania but only 8.6% of nameplate generating capacity located in Pennsylvania.

Table 5 in Appendix A summarizes the active, AEPS-certified, alternative energy resources by type, as defined within the AEPS Act, and the capacity of each type inside and outside of Pennsylvania. Generation facilities using biomass are further disaggregated by those using cellulosic or woody biomass and those using black liquor, a by-product of the wood pulping industry. Similarly, biologically derived methane gas is separated into anaerobic digester gas and landfill gas. In some

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<sup>23</sup> [Allegheny County Hydropower](https://alleghenycounty.us/county-executive/allegheny-county-hydropower.aspx), <https://alleghenycounty.us/county-executive/allegheny-county-hydropower.aspx>.

<sup>24</sup> <http://www.pennaeps.com/reports/>

instances, a qualifying AEPS fuel may not be the primary fuel used at a facility for generating electricity. In such cases, attempting to make any conclusory statements by reviewing only the nameplate capacity of the generation facility can cause confusion so we have indicated if an AEPS fuel resource is not the primary fuel used in electricity generation.

The following graphs illustrate the growth of AEPS resources within Pennsylvania. Chart 15 provides the cumulative number of AEPS-certified Tier I systems, inclusive of solar PV, located in Pennsylvania. Solar PV systems account for 99% (35,097 systems) of all Tier I systems. Chart 16 provides the cumulative number of AEPS-certified Tier II systems located in Pennsylvania. Charts 17 and 18 show the cumulative nameplate electric generating capacities for Solar, Tier I Non-Solar, and Tier II installations. The fairly recent and notable changes in Tier II resources reflect the retirement and/or decertification of some waste coal and landfill gas facilities.

**Chart 15: Cumulative Number of In-State Tier I and Solar PV Systems, by Year**

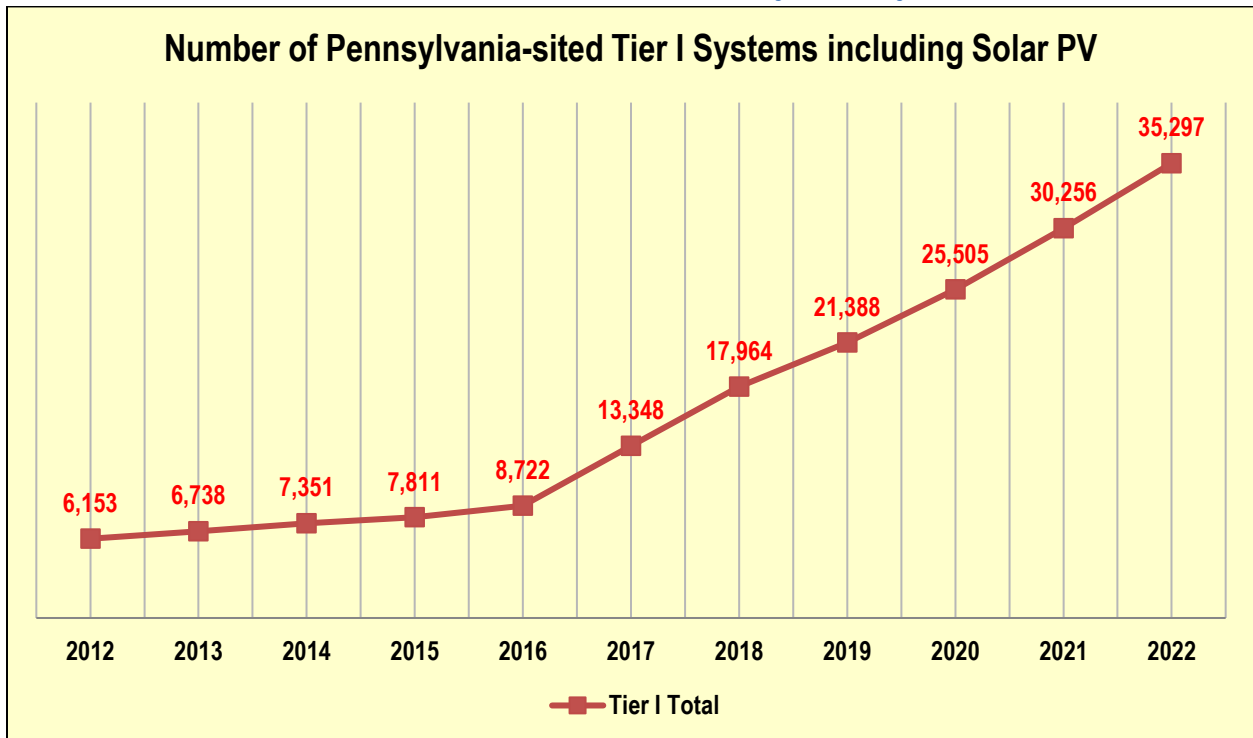
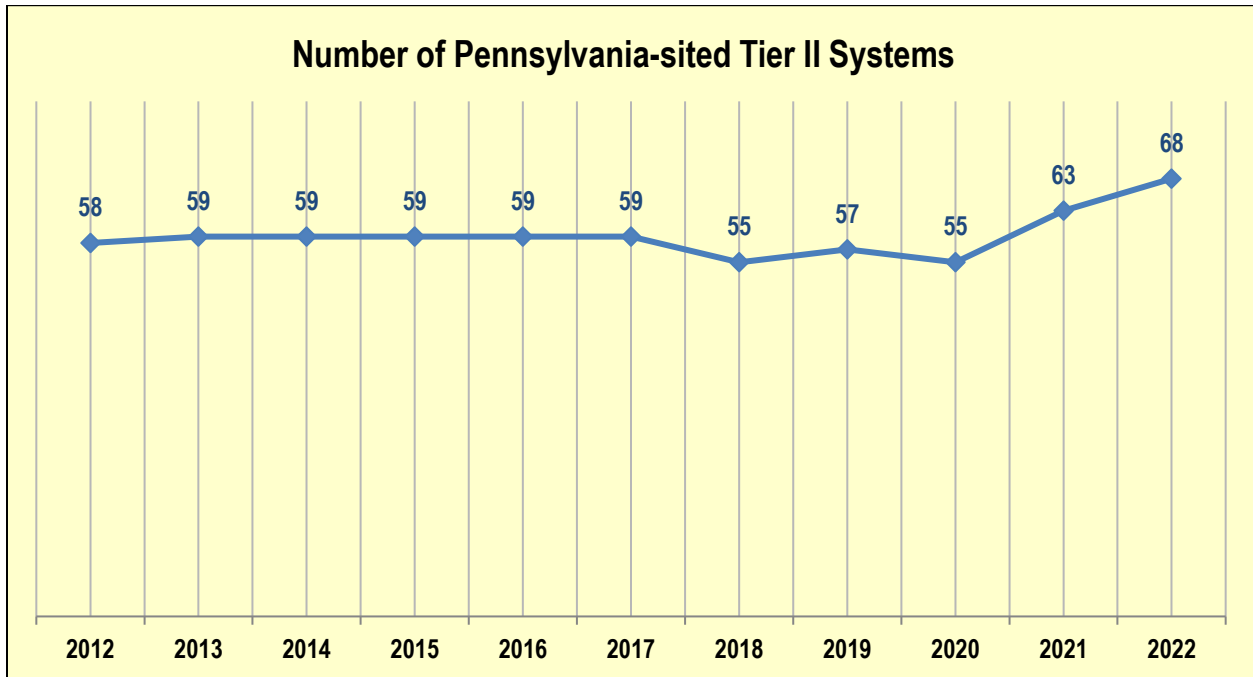




Chart 16: Cumulative Number of In-State Tier II Systems, by Year



*Note:* This chart only shows Tier II certified electric generation facilities. It does not include Energy Efficiency and Demand Response certified resources.

Chart 17: Cumulative In-State Tier I and Solar Nameplate Capacity Installed by Reporting Year

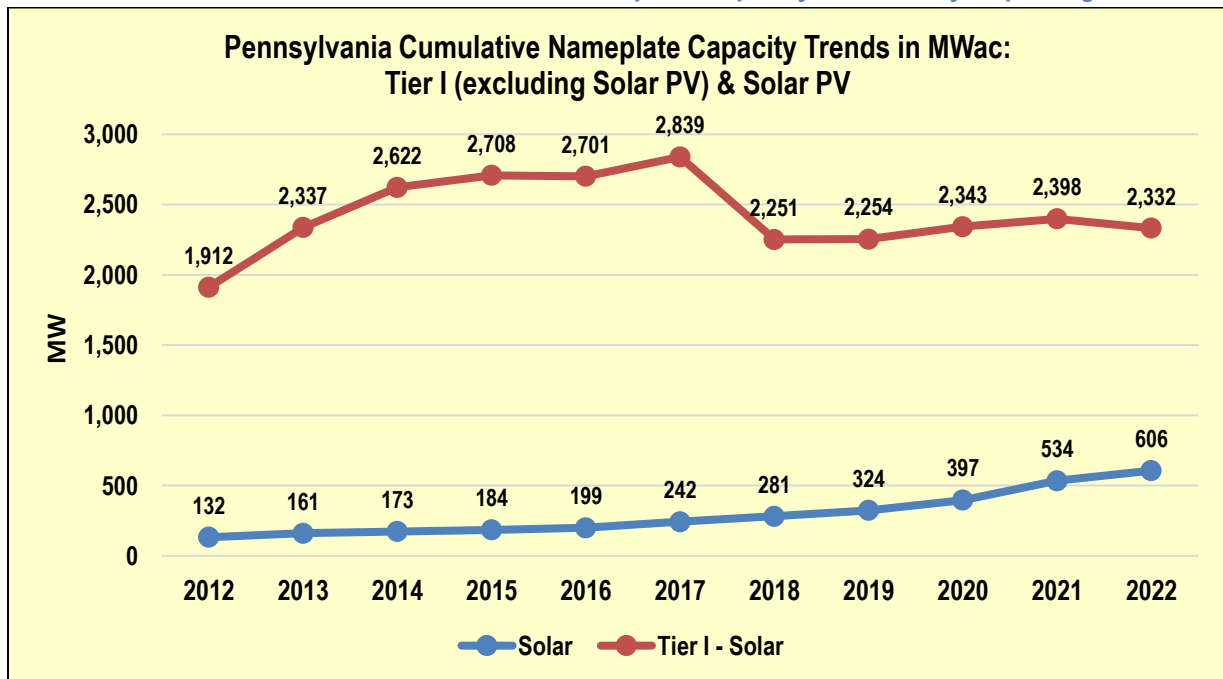
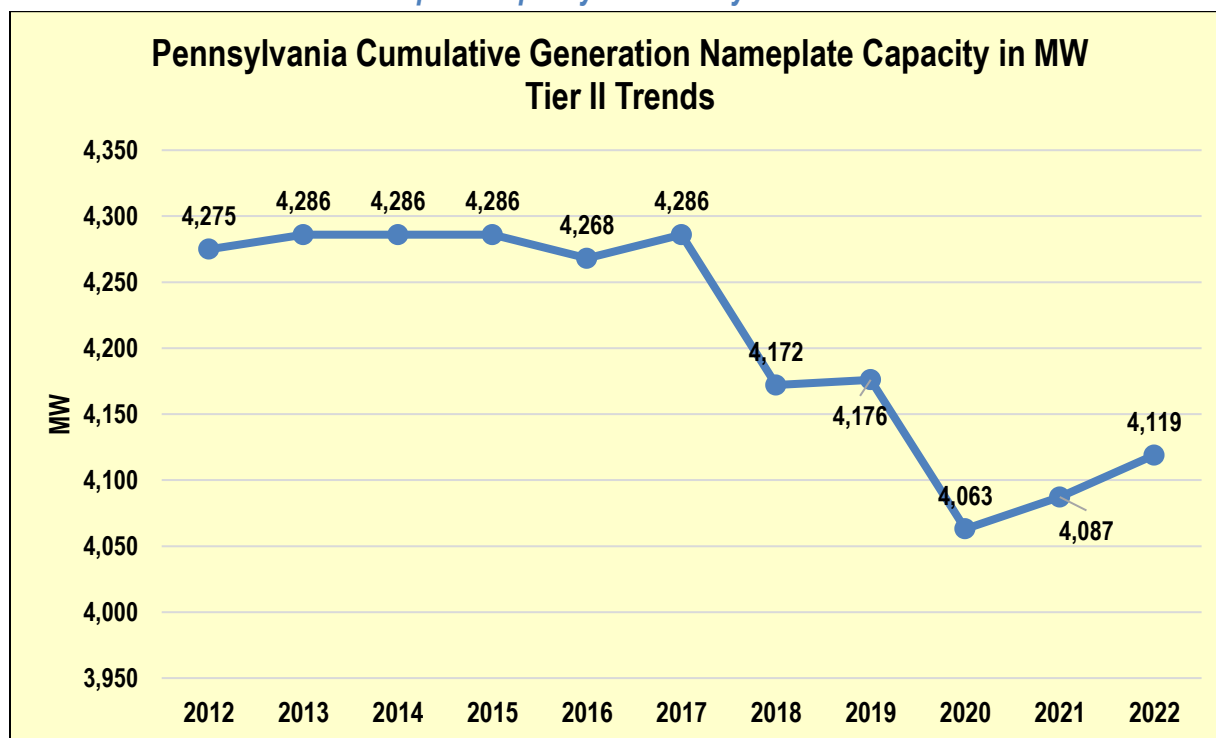


Chart 18: Cumulative Tier II Nameplate Capacity Installed by Year



## E. Impact of Act 40 and Act 114 Implementation

The AEPS marketplace for Pennsylvania is quite complex due to numerous factors which must be considered. Since the implementation of Act 40 of 2017, the AEPS Act allows Pennsylvania EDCs and EGSs to purchase Tier I Solar AECs only from in-state facilities, unless the contracts for NSTI credits from out-of-state facilities have been approved by the Commission. To meet the Tier I Solar AEPS obligations, EDCs and EGSs must purchase in-state Solar AECs, with the exception of NSTI credits from pre-existing contracts that the PUC has subsequently reviewed and approved.

As noted in previous AEPS annual reports, a significant volume of out-of-state credits had been used for solar compliance, which had a notable impact on the price of in-state Solar AECs, and the associated economic viability to develop in-state solar capacity. Since the implementation of Act 40, credit prices have risen, and significant investments have built up in-state solar electricity generation capacity to meet the demand. Chart 19 shows the impact Act 40 had on increasing the build-out of in-state solar capacity. Chart 20 shows an estimate of the approved NSTI credits available for use in each compliance year. Although Chart 20 shows over

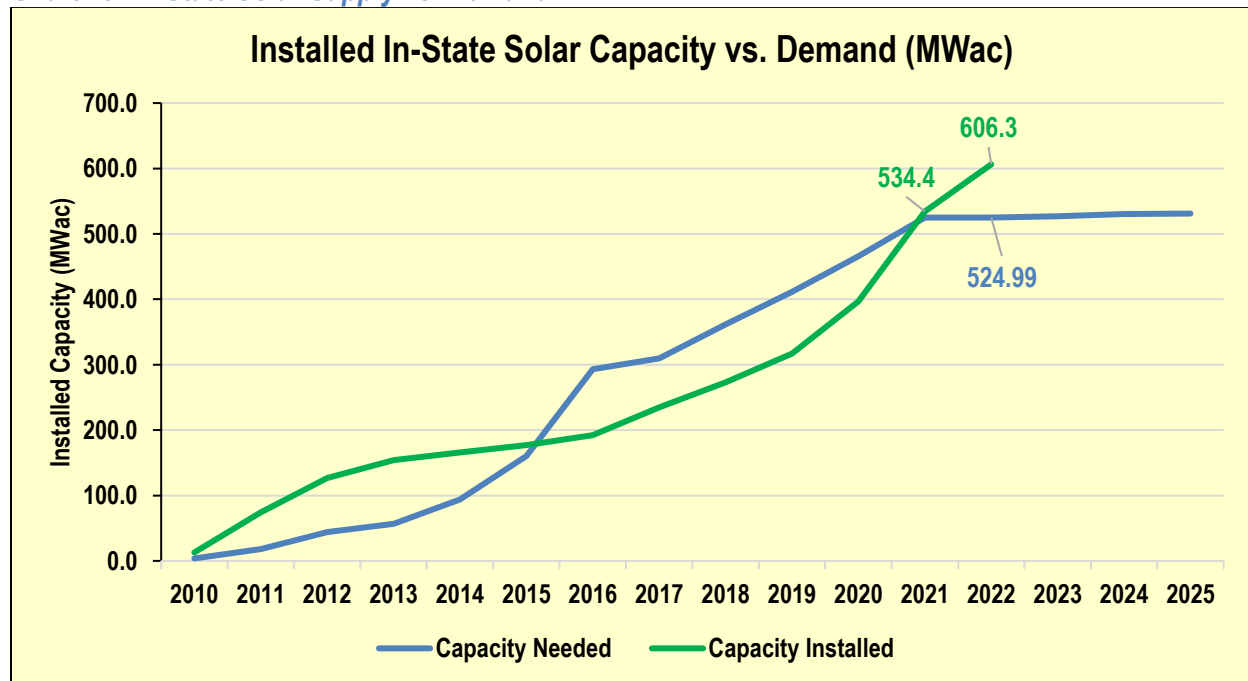
145,000 NSTI credits were available from compliance year 2022, only 50,193 NSTI credits were retired for 2022 obligations.

EDCs and EGSs may continue to obtain Tier I AECs from anywhere within the PJM region to use for their respective AEPS obligations.

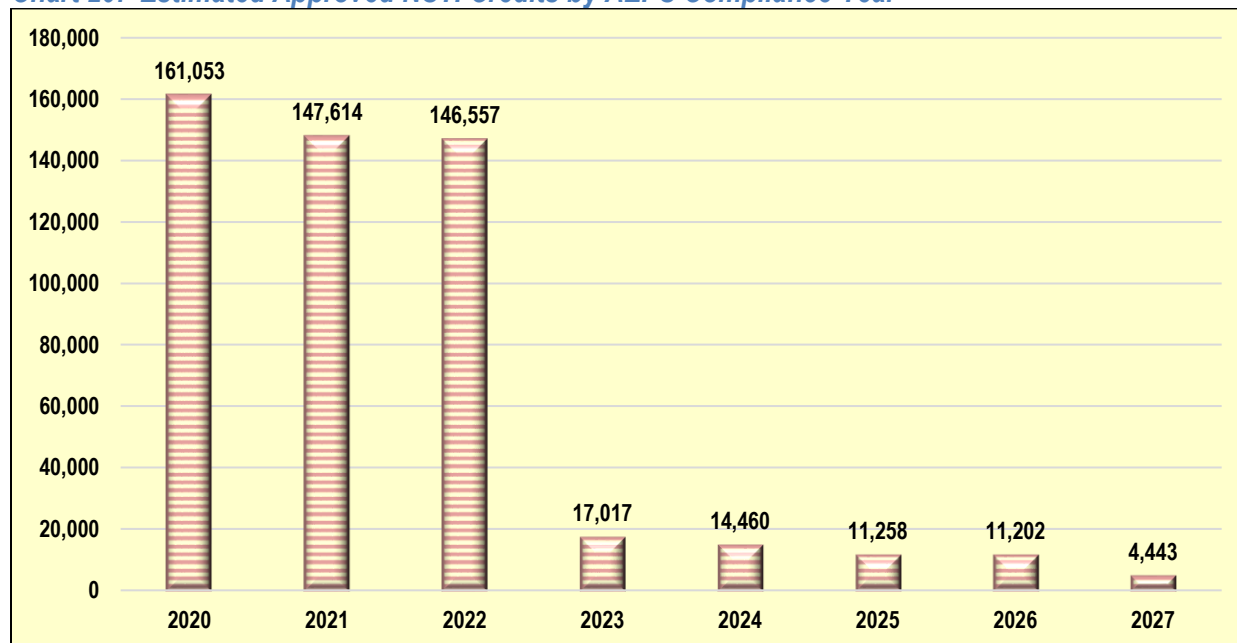
Up to and through compliance year 2020, EDCs and EGSs were permitted to obtain Tier II AECs from anywhere within the PJM region to use for their respective AEPS obligations. With the passage of Act 114 of 2020, EDCs and EGSs are required to meet their Tier II obligations by using AECs from Tier II resources located within Pennsylvania. Tier II AECs generated prior to December 2020 from out-of-state resources maintain eligibility for the AEC's life. Eligibility of AECs from out-of-state Tier II resources with pre-existing contracts was determined based on the Commission's Act 114 Final Implementation Order, issued May 6, 2021.

Based on existing resources within PJM, and in consideration of other state requirements, staff estimates that adequate Solar, Tier I Non-Solar, and Tier II supply exists to meet compliance obligations through 2023. Shortly after the passage of Act 40 there had been some speculation about the availability of in-state solar available to meet AEPS compliance requirements. As Chart 19 shows, there should not be any concerns for solar credit availability for AEPS compliance purposes through 2025.

**Chart 19: In-State Solar Supply vs. Demand**



**Chart 20: Estimated Approved NSTI Credits by AEPS Compliance Year**



Due to nuances associated with the multitude of contracts, the numbers shown in the chart above are approximate.

## **F. PJM Construction Queue**

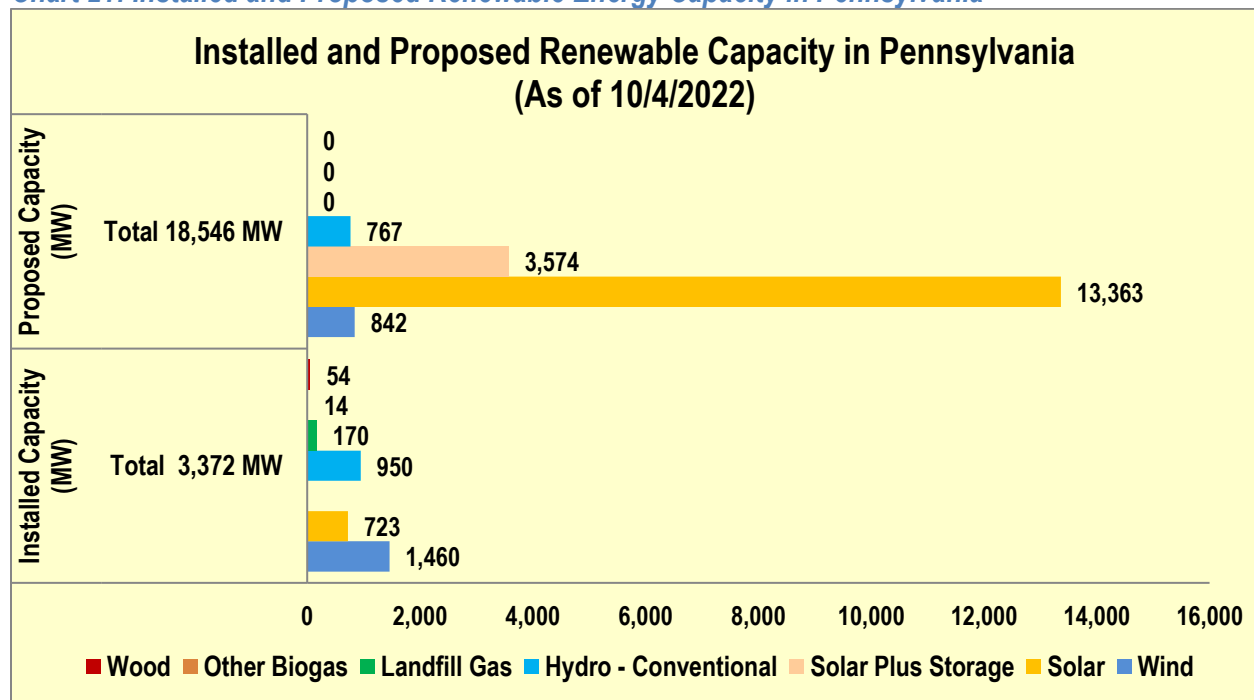
PJM manages grid interconnection requests in construction queues. Not all projects submitted to PJM for interconnection are constructed. Chart 21 summarizes the proposed renewable energy generation projects in the queue for Pennsylvania, as of Jan. 26, 2022, with expected completion dates through third quarter of 2025.<sup>25</sup> Only active projects, projects in engineering and procurement phase and projects under construction are included in this analysis, totaling 10,120 MW of generating capacity. It is also worth noting that among the many projects in the PJM queue, there are several solar signed Power Purchase Agreements (PPAs) totaling more than 820 MWac from several Pennsylvania institutions and businesses. Some of the more significant PPAs were initiated by The Pennsylvania State University, The University of Pittsburgh, The University of Pennsylvania, The City of Philadelphia, the Southeastern Pennsylvania Transportation Authority (SEPTA), and the Commonwealth of Pennsylvania, as part of their ongoing commitments to reducing greenhouse gas emissions, thereby lessening their contribution to climate change. In doing so, however, the solar credits associated with these projects must be kept

<sup>25</sup> <https://www.pjm.com/planning/services-requests/interconnection-queues.aspx>.

and retired by each of these entities and therefore are not expected to be available for use by the EDCs and EGSs for AEPS compliance.

As noted above, Act 40 of 2017, and Act 114 of 2020, require Pennsylvania EDCs and EGSs to purchase Tier I Solar AECs and Tier II AECs only from in-state facilities. Tier I Non-Solar AECs may be purchased from anywhere within the PJM region. The PJM planning queue is used primarily to track the development of generation projects that will enter the wholesale electricity market, rather than the smaller projects being interconnected on distribution circuits managed by the EDCs. Chart 21 shows proposed renewable generation capacity in PJM’s queue, to be built in Pennsylvania, and existing certified renewable generation capacity installed in Pennsylvania.<sup>26</sup>

**Chart 21: Installed and Proposed Renewable Energy Capacity in Pennsylvania**



**Note:** Solar PV supply includes existing supply and 25 percent of the new capacity in the PJM construction queues. It does not account for small, behind the meter systems.

<sup>26</sup> PJM-EIS Public Reports, Renewable Generators Registered in GATS and PJM queue. Includes “Active”, “Engineering and Procurement” and projects “Under Construction”.



## **4. Recommendations for Program Improvements**

Pennsylvania achieved its goal of the AEPS program. As required by statute 73 P.S. § 1648.7(c), the Commission and the DEP developed recommendations for consideration by the Chairman and Minority Chairman of the Environmental Resources and Energy Committee of the Pennsylvania Senate and the Chairman and Minority Chairman of the Environmental Resources and Energy Committee of the Pennsylvania House of Representatives. DEP's recommendations in the following section do not represent the recommendations of the PUC nor do the PUC's recommendations represent that of the DEP.

## **DEP Recommendations for the Legislature:**

### **A. Consider Increasing the percentages of electricity consumption from alternative energy resources:**

Now that Pennsylvania has achieved its initial goal of 18% of electricity consumption from alternative energy resources, it may be time to consider expanding the program to encourage more electricity generation from alternative energy resources. With the passage to the Inflation Reduction Act (IRA), a considerable amount of federal funds are available to increase renewable energy capacities in the state. While interest in developing solar electricity generation in the state has increased considerably, expanding the AEPS solar electricity percentage may help maintain the current solar AEC prices.

The Pennsylvania Climate Action Plan 2021 (Climate Action Plan) includes a strategy to increase the AEPS to an in-state requirement of 100% by 2050 to achieve a carbon-free electricity grid. Under this strategy, as stated in the Climate Action Plan:

*“Tier 1 targets and the solar carve-out would be increased. The solar carve-out can be supplied by in-state grid-scale and distributed solar resources. Nuclear and fossil energy with carbon capture and sequestration, as well as energy storage, would be added to the definition of eligible energy sources for Tier 1, or a new tier could be created in the portfolio of options to meet the 100% target. The Tier 2 requirement is maintained at the current level of 10% through 2050. To implement this strategy successfully, additional efforts will be needed, such as strategies to expand the development of solar and wind*

*projects and legislation to help develop a robust solar industry. Increasing the solar carve-out to 10% by 2030 would help increase the value of solar renewable energy credits (SRECs). This aligns with the DEP’s Pennsylvania Solar Future Plan...”*

As modeled in the Climate Action Plan, the success of this strategy relies on nuclear energy generation remaining at current levels.

## **B. Consider adding other clean energy resources to the mix:**

The Climate Action Plan calls for an increase in the production and use of biogas and renewable natural gas (RNG). Modeling done for the Climate Action Plan assumes that the RNG supply would increase to 75% of total feedstocks by 2050. This strategy could decrease Pennsylvania’s annual greenhouse gas emissions by 10.5 million metric tons of CO<sub>2</sub> equivalents by 2050.

## **PUC Recommendations for the Legislature:**

### **A. Community Solar:**

Community solar is recognized as a way to provide customers greater access to solar-powered electricity. Community solar should be structured in a manner that does not allow costs to be shared or subsidized by non-participants and should avoid providing excess compensation to developers for installing equipment, such as smart inverters, that is already required under current interconnection practices.

### **B. Modify the structure of net metering:**

On February 17, 2021, the PA Supreme Court, invalidated the Commission’s regulations at 52 Pa. Code Sections 75.12 which defined virtual meter aggregation in relation to the independent load of virtual-metered facilities. Further, the Court found the definitions of “customer-generator” and “utility” in 52 Pa. Code § 75.1 to be invalid and unenforceable pertaining virtual meter aggregation.<sup>27</sup>

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<sup>27</sup> Hommrich v. PUC



The Court's decision encourages the development of net metered systems up to 3 MW solar projects that have no electric load but for the project's parasitic load. This presents an enticing ratepayer subsidized business model whereby the developer can reap retail compensation for what is otherwise wholesale merchant generation. The overturned regulations avoided that type of subsidy from occurring at the expense of increased costs to non-residential customer rate classes. For example, the Commission recently reviewed a 3 MW non-residential solar project estimated to have an annual electric load of approximately 2,000 kWh, which is far less than even a small residential customer would use annually. Yet the proposed system is expected to sell more than 5.5 million kWh at a retail rate, net metering 275,000% of the load. The result will likely net the project owner more than \$500,000 per year. The proliferation of this type of masked subsidy of wholesale generation will unnecessarily increase non-residential customer rates. During the past twelve months, the Commission has received more than 60 such net metering requests, totaling more than 140 MW of generation. The Commission therefore recommends that the General Assembly consider modifying the structure of net metering by placing reasonable bounds on net metering to curb the economic harms of subsidizing excessive wholesale generation at retail, rather than wholesale, rates.

### **C. Plan to mitigate risks associated with relying too much on intermittent renewable energy:**

As more intermittent renewable resources such as solar and wind are deployed, balancing the grid becomes more complicated. Some states that have a significant amount of renewable electricity generation in their mix are struggling to operate their grids without blackouts and curtailment of surplus power that is generated when it is not needed. The policies encouraging the use of more electric vehicles and increased deployment of electric heat pumps, are likely to increase the demands on the grid. Therefore, implementing appropriate solutions now may help minimize the negative impacts on the distribution system as this growth continues.

For example, combining roof-top-solar with behind-the-meter battery backup can mitigate impacts on the distribution system, particularly on circuits with higher concentrations of solar electricity generating systems.

Pooling the storage capacities of electric vehicles with bi-directional charging capabilities (this capability will be available on many vehicles coming out in 2023) and allowing them to operate as a virtual power plant may help with load balancing and help mitigate the negative impacts on the grid.

Also, Pennsylvania should not overlook the potential to develop its hydropower generation resources. In addition to a supply of non-powered water management facilities, Pennsylvania is the home to two of the world's largest hydropower turbine manufacturers, Voith Hydro and American Hydro. In addition to its renewable aspects, hydropower can provide ancillary grid services to support the development of a portfolio of renewable generation resources. These include black start capability, demand response, voltage and frequency regulation, and generation reserves that work hand-in-glove with intermittent generation like solar and wind.

Taking a holistic approach of focusing not just on expanding the electricity generation capacity of intermittent resources, but also focusing on implementing risk mitigation technologies may help to mitigate negative impacts on the grid and maintain the availability of reliable power.



## **5. Appendix**

## Appendix A

Table 1: Overview of AEPS Percentage Sales Requirements





















Year	Period	Tier I			Tier II
		Total	Solar PV	Non-Solar	
1	June 1, 2006 – May 31, 2007	1.50%	0.0013%	1.4987%	4.20%
2	June 1, 2007 – May 31, 2008	1.50%	0.0030%	1.4970%	4.20%
3	June 1, 2008 – May 31, 2009	2.00%	0.0063%	1.9937%	4.20%
4	June 1, 2009 – May 31, 2010	2.50%	0.0120%	2.4880%	4.20%
5	June 1, 2010 – May 31, 2011	3.00%	0.0203%	2.9797%	6.20%
6	June 1, 2011 – May 31, 2012	3.50%	0.0325%	3.4675%	6.20%
7	June 1, 2012 – May 31, 2013	4.00%	0.0510%	3.9490%	6.20%
8	June 1, 2013 – May 31, 2014	4.50%	0.0840%	4.4160%	6.20%
9	June 1, 2014 – May 31, 2015	5.00%	0.1440%	4.8560%	6.20%
10	June 1, 2015 – May 31, 2016	5.50%	0.2500%	5.2500%	8.20%
11	June 1, 2016 – May 31, 2017	6.00%	0.2933%	5.7067%	8.20%
12	June 1, 2017 – May 31, 2018	6.50%	0.3400%	6.1600%	8.20%
13	June 1, 2018 – May 31, 2019	7.00%	0.3900%	6.6100%	8.20%
14	June 1, 2019 – May 31, 2020	7.50%	0.4433%	7.0567%	8.20%
15	June 1, 2020 – May 31, 2021	8.00%	0.5000%	7.5000%	10.00%
16	Each reporting year after May 31, 2021	8.00%	0.5000%	7.5000%	10.00%

**Table 2: 2022 AEPS Compliance Report by Tier**

MWhs	Alternative Energy Requirement		Number of Credits Reserved	Weighted Average Credit Price	Cost of Purchased Credits	Credit Deficit Requiring Alternative Compliance Payments
	Tier	Percent of Total Energy Sold				
139,111,166	Solar	0.5	694,980	\$41.45	\$28,647,315.75	598
	I	7.5	10,891,729	\$17.68	\$190,648,618.85	11,999
	II	10.0	13,895,805	\$10.86	\$147,972,973.68	15,310
	Total	18.0	25,482,514	N/A	\$367,268,908.28	27,907

The weighted average credit prices reflected above are calculated using data for credits that have a known cost. Some credits that are retired to meet obligations are self-generated or purchased bundled with the electricity and a cost for those credits is not available. Therefore, dividing the cost of purchased credits by the number of credits reserved will not yield the weighted average credit price reflected in the table. The weighted average credit price is used to calculate the solar ACP. The solar ACP, as established in statute, is 200% of the sum of the weighted average credit price of Solar AECs sold during the reporting year plus the value of any in-state and out-of-state solar rebates. The statutorily established ACP for Tier I and Tier II is \$45.

**Table 3: 2022 AEPS Compliance Report by EDC Service Territory<sup>28,29</sup>**


















Distribution Service Territory	Total Energy Sold (MWhs)	Alternative Energy Requirement	Credits Required	Credits Retired <sup>30</sup>	Compliance Status <sup>31</sup>	
					ACPs Required	Met  / Unmet 
<b>Citizens' Electric and EGS</b>	166,017					
Solar		0.500%	830	830		
Tier I (non-solar)		7.838%	13,013	13,012		
Tier II		10.000%	16,602	16,602		
<b>Duquesne Light and EGSs</b>	12,389,028					
Solar		0.500%	61,945	61,891	✓	
Tier I (non-solar)		7.838%	971,070	970,263	✓	
Tier II		10.000%	1,238,903	1,237,874	✓	
<b>Met Ed and EGSs</b>	14,562,946					
Solar		0.500%	72,815	72,822		
Tier I (non-solar)		7.838%	1,141,465	1,139,830	✓	
Tier II		10.000%	1,456,295	1,454,205	✓	
<b>PECO and EGSs</b>	36,335,838					
Solar		0.500%	181,679	181,508	✓	
Tier I (non-solar)		7.838%	2,848,056	2,845,348	✓	
Tier II		10.000%	3,633,584	3,630,127	✓	
<b>Penelec and EGSs</b>	13,440,360					
Solar		0.500%	67,202	67,201		
Tier I (non-solar)		7.838%	1,053,475	1,052,820	✓	
Tier II		10.000%	1,344,036	1,343,205	✓	
<b>Penn Power and EGSs</b>	4,507,648					
Solar		0.500%	22,538	22,549		
Tier I (non-solar)		7.804%	353,316	352,970	✓	
Tier II		10.000%	450,765	450,325	✓	

<sup>28</sup> The data reported for each Distribution Service Territory is aggregated for the EDC and all EGSs that served customers in that territory.

<sup>29</sup> The Tier I (Non-Solar) percentage requirement includes the quarterly adjustment.

<sup>30</sup> The Credits Retired column shows an overage in some instances because numerous EGSs retired credits in excess of their required AEPS obligations. A few apparent shortages in the Credits Retired column occurred when EGSs retired AECs in another EDC territory. While these AEPS obligations show as a shortage in the Credit Retired column, these EGSs did meet their obligations on a statewide basis.

<sup>31</sup> Two EGSs, Liberty Power Holdings, LLC and Sunwave USA Holdings Inc. failed to meet their 2022 AEPS obligations.

Distribution Service Territory	Total Energy Sold (MWhs)	Alternative Energy Requirement	Credits Required	Credits Retired <sup>30</sup>	Compliance Status <sup>31</sup>	
					ACPs Required	Met  / Unmet 
Pike County and EGSs	77,813					
Solar		0.500%	389	389		
Tier I (non-solar)		7.838%	6,099	6,099		
Tier II		10.000%	7,781	7,782		
PPL and EGSs	37,030,669					
Solar		0.500%	185,153	184,863	✓	
Tier I (non-solar)		7.838%	2,902,518	2,898,008	✓	
Tier II		10.000%	3,703,067	3,697,312	✓	
UGI Electric and EGSs	1,039,384					
Solar		0.500%	5,197	5,150	✓	
Tier I (non-solar)		7.838%	81,468	80,740	✓	
Tier II		10.000%	103,938	103,008	✓	
Wellsboro Electric and EGSs	103,093					
Solar		0.500%	515	515		
Tier I (non-solar)		7.838%	8,081	8,080		
Tier II		10.000%	10,309	10,309		
West Penn Power and EGSs	19,458,371					
Solar		0.500%	97,292	97,262	✓	
Tier I (non-solar)		7.838%	1,525,176	1,524,559	✓	
Tier II		10.000%	1,945,837	1,945,056	✓	

**Table 4: AEC State of Origin – Retired for Compliance in 2022**

State	Solar		Tier I		Tier II		Total Credits Retired	% of Total Credits Retired
	Retired	%	Retired	%	Retired	%		
PA	644,787	92.8%	2,072,457	19.0%	8,986,414	64.7%	11,703,658	46%
VA			2,493,543	22.9%	3,857,452	27.8%	6,350,995	25%
IL			2,563,977	23.5%			2,563,977	10%
WV			429,617	3.9%	549,754	4.0%	979,371	4%
NC	45,788	6.6%	1,443,459	13.3%			1,489,247	6%
OH	4,405	0.6%	914,015	8.4%	77,698	<1%	996,118	4%
IN			763,964	7.0%			763,964	3%
NJ			36,157	<1%	186,795	1.3%	222,952	<1%
MD			70,710	<1%	135,730	1.0%	206,440	<1%
KY			58,615	<1%	101,962	<1%	160,577	<1%
DE			19,210	<1%			19,210	<1%
DC			25,972	<1%			25,972	<1%
TN			22	<1%			22	<1%
MI			11	<1%			11	<1%
<b>Total</b>	<b>694,980</b>	<b>100%</b>	<b>10,0891,729</b>	<b>100%</b>	<b>13,895,805</b>	<b>100%</b>	<b>25,482,514</b>	<b>100%</b>



**Table 5: AEPS Existing Capacities of Certified, Active Facilities**

AEPS Tier	Alternative Energy Resource Types	Nameplate Capacity of PA Facilities (MWac)	Nameplate Capacity of Out-of-State Facilities (MWac)	Total Nameplate Capacity (MWac)
I	Biomass Energy			
	Cellulosic (woody) Biomass	392.8	1,122.4	1,515.2
	Black Liquor	163.7	0.0	163.7
I	Coal Mine Methane* (primary fuel source)	0.0	0.0	0.0
I	Coal Mine Methane (secondary fuel source)	0.0	88.0	88.0
I	Fuel Cell	0.8	0.0	0.8
I	Low-Impact Hydropower	192.7	46.2	238.9
I	Biologically Derived Methane Gas			
	Other Biomass Gas	3.3	0.0	3.3
	Anaerobic Digester Gas (primary fuel source)	15.1	20.1	35.2
	Anaerobic Digester Gas (secondary fuel source)	0.0	0.0	0.0
	Landfill Gas (primary fuel source)	144.2*	371.4	515.6
	Landfill Gas (secondary fuel source)	0.0**	0.0	0.0
I	Solar PV	606.3	3,243.3	3,849.6
I	Wind	1,419.5	8,902.1	10,321.6
I	<b>TOTAL of Tier I</b>	<b>2,938.5</b>	<b>13,793.5</b>	<b>16,732.0</b>
II	Biomass Energy			
	Cellulosic (woody) Biomass	0.0		0.0
II	Distributed Generation	29.2		29.2
II	Hydropower			
	Conventional, Non-Low Impact	725.5		725.5
	Pumped Storage	1,540.0		1,540.0
II	Municipal Solid Waste	256.8		256.8
II	Demand Side Management			
	Energy Efficiency	4.0		3.7
	Blast Furnace Gas	55.5		55.5
	Other Gases	85.5		85.5
	Waste Heat	62.6		62.6
	Industrial By-product	3.3		0.0
II	Waste Coal	1356.4		1,356.4
II	<b>TOTAL of Tier II</b>	<b>4,118.9</b>		<b>4,118.9</b>
I & II	<b>TOTAL of Tiers I &amp; II</b>	<b>7,057.4</b>	<b>13,793.5</b>	<b>20,850.9</b>

\* Nameplate capacity for some alternative energy resource types have decreased due to system decertification in the compliance year.

\*\* Several facilities have the capability of utilizing multiple fuel sources that may include a combination of Tier I, Tier II, or even non-eligible AEPS fuels to generate electricity. For example, a facility may co-fire coal and biomass or blend landfill gas and natural gas. Methodologies are in place to ensure that only AEPS-certified generation is awarded AECs, but it is not possible to designate a single, static AEPS nameplate capacity associated with these generators.

**Table 6: Snapshot of the key chronology of events to date**

Event	Date
Act 213 of 2004	Nov. 30, 2004
Act 213 of 2004 Effective Date	Feb.28, 2005
PUC Adopts Implementation Order I (M-00051865)	March 23, 2005
PUC Adopts Implementation Order II (M-00051865)	July 14, 2005
PUC Adopts Order: Standards for DSM Resources (M-00051865)	Sept. 25, 2005
PUC Adopts Order: Designates PJM GATS Registry (M-00051865)	Jan. 27, 2006
Final Net Metering/Interconnection Regulations in the <i>Pennsylvania Bulletin</i>	Dec. 16, 2006
PUC Contracts with Clean Power Markets as Program Administrator	March 28, 2007
Compliance Required for Pennsylvania Power Co. & UGI Utilities Inc.	May 31, 2007
Act 35 of 2007	July 19, 2007
Compliance Required for Citizens' Electric Co., Duquesne Light Co., Pike County Light & Power, and Wellsboro Electric Co.	Jan. 1, 2008
PUC Adopts Final Rulemaking Implementation Order (L-00060180)	Sept. 25, 2008
Act 129 of 2008	Oct. 15, 2008
Final Omitted Rulemaking Order (Net Metering) – Published in PA Bulletin (L00050174)	Nov. 29, 2008
PUC Adopts Act 129 Implementation Order – Relating to AEPS	May 28, 2009
Compliance Required for PPL Electric Utilities	Jan.1, 2010
PUC Adopts Solar Policy Statement	Sept. 16, 2010
Compliance Required for PECO Energy Co., Pennsylvania Electric Co., Metropolitan Edison Co., and West Penn Power Co.	Jan. 1, 2011
PUC Adopts Policy Statement, Net Metering – Use of Third-Party Operators	March 29, 2012
PUC Approves Selection of InClimate as Program Administrator	Sept.3 2015
PUC Adopts Second Amended Final Rulemaking Order (L-2014-2404361)	Oct. 27, 2016
Act 40 of 2017	Oct. 30, 2017
Final Implementation Order - Implementation of Act 40 of 2017 (Entered May 3, 2019)	April 19, 2019
Act 114 of 2020	Nov. 23, 2020
Final Implementation Order – Implementation of Act 114 of 2020	May 6, 2021

## **Appendix B**

### **Tier I Resources**

#### **Biologically Derived Methane Gas**

Biologically derived methane gas is produced from the anaerobic digestion of organic materials from yard waste such as grass clippings and leaves, food waste, animal waste and sewage sludge. It also includes landfill methane gas. Biologically derived methane gas is used as fuel to power engines that drive generators to generate electricity.

#### **Biomass Energy**

Biomass energy electricity that is generated utilizing the following:

- A. Organic material from a plant that is grown for the purpose of being used to produce electricity or is protected by the Federal Conservation Reserve Program (CRP) and provided further that crop production on CRP lands does not prevent the achievement of the water quality protection, soil erosion prevention or wildlife enhancement purposes for which the land was primarily set aside.
- B. Solid nonhazardous, cellulosic waste material that is segregated from other waste materials, such as waste pallets, crates and landscape or right-of-way tree trimmings or agricultural sources, including orchard tree crops, vineyards, grain, legumes, sugar and other byproducts or residues.
- C. Generation of electricity utilizing by-products of the pulping process and wood manufacturing process, including bark, wood chips, sawdust and lignin in spent pulping liquors from alternative energy systems located in this Commonwealth.

#### **Coal Mine Methane**

Generation utilizing methane gas emitted and collected from abandoned or working coal mines.

#### **Fuel Cells**

Fuel cells are electrochemical devices that convert chemical energy in a hydrogen-rich fuel directly into electricity, heat, and water without combustion.

## Geothermal Energy

Geothermal electricity generation extracts hot water or steam from geothermal reserves in the earth's crust and supplies it to steam turbines that drive generators to produce electricity. The three commercial types of conventional geothermal power plants are flash, dry steam and binary.

In a geothermal flash power plant, high pressure geothermal water and steam are extracted, and the steam is separated and delivered to a turbine that drives a generator.

In a dry steam geothermal power plant, steam alone is extracted from a geothermal reservoir and is used to drive the turbine and generator.<sup>32</sup>

In a binary plant, the geothermal fluid heats and vaporizes a separate working fluid with a lower boiling point than water, which drives a turbine for power generation. Each fluid cycle is closed, and the geothermal fluid is re-injected into the heat reservoir. The binary cycle allows an effective and efficient extraction of heat for power generation from relatively low-temperature geothermal fluids.<sup>33</sup>

## Low-Impact Hydropower

Low-impact hydropower consists of any technology that produces electric power and that harnesses the hydroelectric potential of moving water impoundments if one of the following applies:

- A. The hydropower source has a Federal Energy Regulatory Commission (FERC) licensed capacity of 21 MW or less and was issued its license by January 1, 1984, and was held on July 1, 2007, in whole or in part, by a municipality located wholly within this Commonwealth or by an electric cooperative incorporated in this Commonwealth.
- B. The incremental hydroelectric development:
  - i. Does not adversely change existing impacts to aquatic systems;
  - ii. Meets the certification standards established by the Low Impact Hydropower Institute and American Rivers, Inc., or their successors;
  - iii. Provides an adequate water flow for protection of aquatic life and for safe and effective fish passage;
  - iv. Protects against erosion;
  - v. Protects cultural and historic resources; and

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<sup>32</sup> Geothermal Energy Association – Geothermal Basics Q&A, 2012

<sup>33</sup> Renewable Energy Policy Network (REN21) – Renewables 2016 Global Status Report

vi. Was completed after Feb. 28, 2005.

### **Solar Photovoltaic (PV)**

A Solar PV System<sup>34</sup> generates electricity from sunlight. A solar photovoltaic cell is made of semiconductor material and can generate 1 to 2 watts of power. To increase the power output, multiple cells are connected together to form modules or panels. These modules or panels may be connected together to form arrays. A solar photovoltaic system consists of the PV panels, mounting structures, and an inverter that converts the direct current (DC) generated by the system to alternating current (AC).

### **Solar Thermal**

Solar thermal power plant<sup>35</sup> technology uses heat from the sun's rays to generate electricity. The heat from the sun's rays is collected and used to heat a fluid to high temperatures. This high temperature fluid is used to heat water and generate steam. The steam is then used to spin a turbine that turns a generator attached to its drive shaft and generate electricity.

### **Wind Power**

Wind power generation technology uses energy from the wind to turn large blades of a wind turbine which are connected to a drive shaft that turns a generator to generate electricity.

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<sup>34</sup> Solar Photovoltaic Technology Basics at [www.energy.gov](http://www.energy.gov).

<sup>35</sup> Solar Thermal Power Plants at [www.eia.gov](http://www.eia.gov).

## **Tier II Resources**

Act 114 of 2020 signed into law Nov. 23, 2020, modified Section 4 of the AEPS Act, effectively limiting eligibility of Tier II alternative energy sources to facilities located in Pennsylvania.

### **Distributed generation systems**

Distributed generation systems are small-scale and generate electricity and useful thermal energy (*i.e.*, combined heat and power plants) from systems with a nameplate capacity not greater than 5 MW.

### **Demand-side management**

Demand-side management consisting of the management of customer consumption of electricity or the demand for electricity through the implementation of:

- A. Energy efficient technologies, management practices or other strategies in residential, commercial, industrial, institutional and government customers that shift electric load from periods of higher demand to periods of lower demand.
- B. Load management or demand response technologies, management practices or other strategies in residential, commercial, industrial, institutional and government customers that shift electric load from periods of higher demand to periods of lower demand.
- C. Industrial by-product technologies consisting of the use of a by-product from an industrial process, including reuse of energy from exhaust gases or other manufacturing by-products that are used in the direct production of electricity at the facility of a customer.

### **Large-scale hydropower**

Large-scale hydropower plants produce electricity by harnessing the hydroelectric potential of moving water impoundments that do not meet the requirements of low-impact hydropower. The term also applies to pumped storage hydropower which is electricity produced by the force of rushing water released from an upper reservoir. That water is temporarily stored in a lower elevation reservoir and later returned to the upper reservoir when electricity is least expensive.

### **Municipal solid waste**

Municipal solid waste is burned at special waste-to-energy plants that use the heat to make steam to generate electricity or to heat buildings.

## Waste Coal

Waste coal facilities generate electricity by combusting waste coal that was disposed or abandoned prior to July 31, 1982 or disposed of thereafter in permitted coal refuse disposal sites or other waste coal combustion meeting alternate eligibility requirements established by regulation.

## Appendix C - AEPS Program

The AEPS Act requires that EDCs and EGSs obtain a prescribed percentage of their retail electric sales from qualifying alternative energy resources. This is accomplished by procuring and retiring an equivalent number of AECs. AECs are tradable instruments created as the AEPS-certified alternative energy resources generate electricity. EDCs and EGSs must acquire sufficient AECs from qualifying resources corresponding to the percentage of electricity sold to meet their AEPS requirement.

AECs are used to track and verify generation of electricity from AEPS-certified alternative energy resources. *When a qualified and registered alternative energy resource, located within the PJM footprint, generates one megawatt hour (MWh) of electricity, one AEC is created. Similarly, qualified and registered energy efficiency projects can create AECs for each MWh of electricity saved.* The AECs are created, serialized, tracked, and verified via creation of certificates. The credit certificates are serialized for tracking purposes. The AECs can be used and retired by the generating entity itself, sold, or traded to another entity in the marketplace. PJM Environmental Information Services Inc.'s (PJM-EIS) Generation Attribute Tracking System (GATS) is the Commission-designated AEC registry used to track generation, ownership and retirement of AECs. An EDC or EGS may acquire AECs from the marketplace and retire them. Retirement of AECs is necessary to ensure that the same AECs are not used again anywhere, by any other entity, for any other purpose. Retirement of AECs removes them from the marketplace. Pennsylvania EDCs and EGSs were permitted to obtain AECs from resources located within the entire PJM Interconnection, LLC<sup>36</sup> (regional transmission organization) area, except as limited by Act 40 of 2017 and Act 114 of 2020.

AECs are eligible for use during the reporting year in which they were created. If unused, these AECs may be banked for later use during either of the following two reporting years.

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<sup>36</sup> PJM Interconnection, LLC is the regional transmission organization for all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia. <http://www.pjm.com/about-pjm/who-we-are/territory-served.aspx>.



The Commission and the DEP work cooperatively to monitor the performance of the AEPS program and prepare an annual report, which is provided to the Chairman and Minority Chairman of the Pennsylvania Senate Environmental Resources and Energy Committee and the Chairman and Minority Chairman of the Pennsylvania House Environmental Resources and Energy Committee.

The law provides for a three-month true-up period that runs from the conclusion of each reporting year, May 31, until September 1 of the same calendar year. During the true-up period, EDCs and EGSs may acquire any additional alternative energy credits needed for compliance. After the conclusion of the true-up period, the Commission verifies compliance and imposes alternative compliance payments (ACPs), as appropriate, by providing notice of the payment due as well as an opportunity to challenge whether the ACP was appropriately applied.

The Commission is responsible for carrying out and enforcing the provisions of the law. DEP is charged with rendering determinations of resource eligibility and ensuring that AEPS-certified generating entities are following applicable environmental laws and standards. The Commission and DEP are charged with monitoring compliance with the Act and monitoring the alternative energy market and its associated costs of energy generation, as well as conducting an ongoing alternative energy planning assessment. The Commission and DEP are to report their findings and any recommendations for changes to the Act to the Pennsylvania General Assembly via an annual report.

On July 19, 2007, Act 35 of 2007 was signed into law, amending the AEPS Act by changing the compliance schedule for the Solar PV requirement. Act 35 also amended other provisions of the law, including definitions for customer-generator and net metering. On December 20, 2008, a Commission rulemaking based on the Act 35 changes became effective.<sup>37</sup>

The 2008 final rule provides clarification of the Solar PV obligation and includes the revised 15-year schedule for Solar PV requirements. The clarification of the Solar PV obligation affirms that the percentage requirement is a percentage of all retail sales, and that the solar percentage is a part of the total Tier I obligation. Table 1 in Appendix A provides an overview of the AEPS percentage sales requirements with the revised Solar PV schedule.

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<sup>37</sup> See, 38 Pa. B. 6908 at <https://www.pabulletin.com/secure/data/vol38/38-51/2286.html>.

Table 1 in Appendix A shows the AEPS percentage sales requirements for each of the 15 compliance years mandated by the law. Appendix B provides general information about the Tier I and Tier II resources.

## AEPS Resources

Qualifying alternative energy resources are grouped into two categories, Tier I and Tier II, as described in the following table.

Alternative Energy Portfolio Standards Resources		
Tier I		Tier II
<ul style="list-style-type: none"> <li>Solar Photovoltaic (PV) (Solar PV is a Tier I resource but also has a stand-alone requirement)</li> </ul>	<ul style="list-style-type: none"> <li>Wind power</li> <li>Low-impact hydropower</li> <li>Geothermal energy</li> <li>Biologically derived methane gas</li> <li>Fuel cells</li> <li>Biomass energy</li> <li>Solar thermal</li> <li>Generation of electricity inside of Pennsylvania utilizing by-products of the pulping process and wood manufacturing process<sup>#</sup></li> <li>Certain muni and coop-owned hydropower<sup>#</sup></li> </ul>	<ul style="list-style-type: none"> <li>Waste coal</li> <li>Distributed generation systems</li> <li>Demand-side management*</li> <li>Large-scale hydropower</li> <li>Municipal solid waste</li> </ul>

<sup>#</sup>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.

\*Includes energy efficiency, demand response and use of industrial by-products and technologies such as waste heat.

Although Solar PV is a Tier I resource, it also has a standalone requirement for each reporting year.

The AEPS Act established a 15-year phased-in schedule to reach the final goal of 18%, after which, the requirements are maintained at this level in perpetuity or

until the AEPS Act is amended. May 31, 2021, was the end of the 15-year schedule to reach the goal of 18%.



## **6. Glossary**

***Alternative Compliance Payments (ACP):*** A payment made by non-complying EDCs and EGSs. These payments are made available to the sustainable energy funds established through the Commission's orders and are utilized solely for projects that increase the amount of electric energy generated from alternative energy resources.

***Business Energy Investment Tax Credit (ITC):*** The Investment Tax Credit (ITC) reduces federal income taxes for qualified tax-paying owners based on capital investment in renewable energy projects.

***Capacity Factor:*** A ratio of the actual power output for a time period to the maximum possible power output if the plant was operating at full name plate capacity for the same time period.

***Demand Side Management:*** The process of managing the consumption of energy, generally to optimize available and planned generation resources.

***Dispatchable Sources of Electricity:*** Power plants that can be turned on or off as needed; adjust their output supplied to the electrical grid based on demand. Conventional power plants using coal and natural gas can adjust their output to meet the always changing electricity demands of the consumers.

***Non-Dispatchable Sources of Electricity:*** Power plants that use some renewable energy sources such as wind and solar cannot be turned on or off as needed or adjust their output supplied to the electrical grid based on demand.

***Non-Solar Tier I (NSTI):*** Alternative energy credits originating from out-of-state solar generating facilities. All solar PV credits generated by out-of-state solar facilities on or after Nov. 1, 2017, are designated as NSTI credits.

***Renewable Electricity Production Tax Credit (PTC):*** The Production Tax Credit (PTC) reduces the federal income taxes of qualified tax-paying owners of renewable energy projects based on the electrical output, measured in kilowatt-hours, of grid-connected renewable energy facilities.

***Utility-scale Wind Turbines:*** Individual turbines that exceed 100 kW in size.

***Utility-scale Solar Plants:*** EIA defines utility scale solar plants as plants with a capacity of at least one megawatt.



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