Pennsylvania Energy Programs Office

Clean Energy Program Plan

ICF

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Y&A

7200-BK-DEP5299 11/2020 G2445-NOV2020

Acknowledgments

This report and the analyses contained within it were prepared by the Pennsylvania DEP with support from ICF and Yborra & Associates, mainly:

- David Althoff, Pennsylvania Department of Environmental Protection
- Kerry Campbell, Pennsylvania Department of Environmental Protection
- Libby Dodson, Pennsylvania Department of Environmental Protection
- Adam Agalloco, ICF
- Carolyn Pugh, ICF
- Deb Harris, ICF
- Grace Tamble, ICF
- Logan Pfeiffer, ICF
- Tyler Brewer, ICF
- William Prindle, ICF
- Stephe Yborra, Yborra & Associates

Additionally, a number of professionals and experts from these organizations and others contributed to this report by providing guidance and feedback through a structured Workgroup process over the course of the plan development. Members of the Workgroup represented:

- Various offices and agencies within the Pennsylvania government,
- Non-Governmental organizations,
- Regional planning commissions,
- Energy policy consultants,
- Higher education institutions,
- Technology experts,
- Utilities, and
- Advocacy organizations.

This material is based upon work supported by the United States Department of Energy, Office of Energy Efficiency and Renewable Energy, under State Energy Program Award Number DE-EE0008293.

Table of Contents

Foreword

The Energy Programs Office (EPO) is the U.S. Department of Energy-recognized Pennsylvania State Energy Office and has operated within the Department of Environmental Protection (DEP) since 1995. Through the years the office has been identified by various names, but its function and mission have remained the same: to maintain the statutory responsibilities of the Pennsylvania Energy Office and to support the development of clean and indigenous energy resources, while striving to achieve the mission of DEP to protect Pennsylvania's air, land, and water from pollution and provide for the health and safety of its citizens through a cleaner environment.

Recent changes in the energy marketplace, as well as additional responsibilities including an ever-greater focus on the relationship between energy use and its impact on our climate, have increased EPO's leadership role. Over 85% of Pennsylvania's greenhouse gas emissions come from production and use of energy, and clean energy and energy efficiency are key to reduce these emissions. The Energy Programs Office has been leading efforts through climate planning, energy assurance resiliency planning, solar future planning, transportation electrification and the continuous prioritization of energy conservation and efficiency throughout all sectors.

While EPO has been engaged on many fronts, a comprehensive look at the office and the opportunities identified in each recent subject matter-specific planning effort has not been conducted. This plan was commissioned to seek input from a cross section of stakeholders who could evaluate the office's recent efforts and assist in charting a path towards ensuring the office's collective programmatic efforts are both achieving near-term needs and continuing progress towards significant long-term goals. It is our sincere hope that the information this plan contains on: the history, roles, responsibilities, guiding principles and the ongoing short and long term efforts of this office will inform those who currently work with us as partners and collaborators and those who may seek to work with us on achieving Pennsylvania's long term clean energy and climate goals. We invite you to read this plan and consider how we may work together as partners on our programs and successfully deploy more clean energy programs in Pennsylvania.

David A. Althoff, Jr.
Director
Energy Programs Office

Executive Summary

This Clean Energy Program (CEP) Plan summarizes the Commonwealth of Pennsylvania's energy-related plans, supporting policies, and programs; recommends new clean energy actions to be taken over the next one to three years; and explores approaches that may be taken to anticipate future events and mitigate disruptions to ensure energy resilience and security.

The CEP Plan guides the Pennsylvania Energy Programs Office (EPO) at the Department of Environmental Protection (DEP) toward achieving its ambitious long-term clean energy goals while fulfilling its obligations to support energy conservation and efficiency, advance clean energy technologies, and ensure energy security and resilience. The CEP Plan will help give all Pennsylvanians cleaner, healthier, and more affordable and reliable energy choices.

Pennsylvania's Current Energy Profile and Policies

Pennsylvania's energy profile has become increasingly dynamic in recent decades, as both fossil fuel and renewable energy production have grown. The Commonwealth is one of the nation's leading natural gas producers; at the same time, falling costs for renewable energy and policies such as the Alternative Energy Portfolio Standard (AEPS) have boosted the role of renewables in the energy mix.

Energy efficiency has also become a significant energy resource, through state policies such as Act 129 of 2008, requiring the seven largest electric distribution companies to develop energy efficiency and conservation plans and other methods of reducing customers' electricity consumption. The Climate Change Act of 2008 (Act 70) and Governor Tom Wolf's establishment of a statewide climate goal (Executive Order 2019-1) add a new mandate for DEP and EPO, and affect many EPO program decisions and goals.

Additionally, at the direction of Governor Wolf, DEP is currently undertaking a rulemaking process to enable Pennsylvania to join the Regional Greenhouse Gas Initiative (RGGI). Participation in RGGI could lead to a significant increase in clean energy programs, beginning in 2022.

About the DEP Energy Programs Office

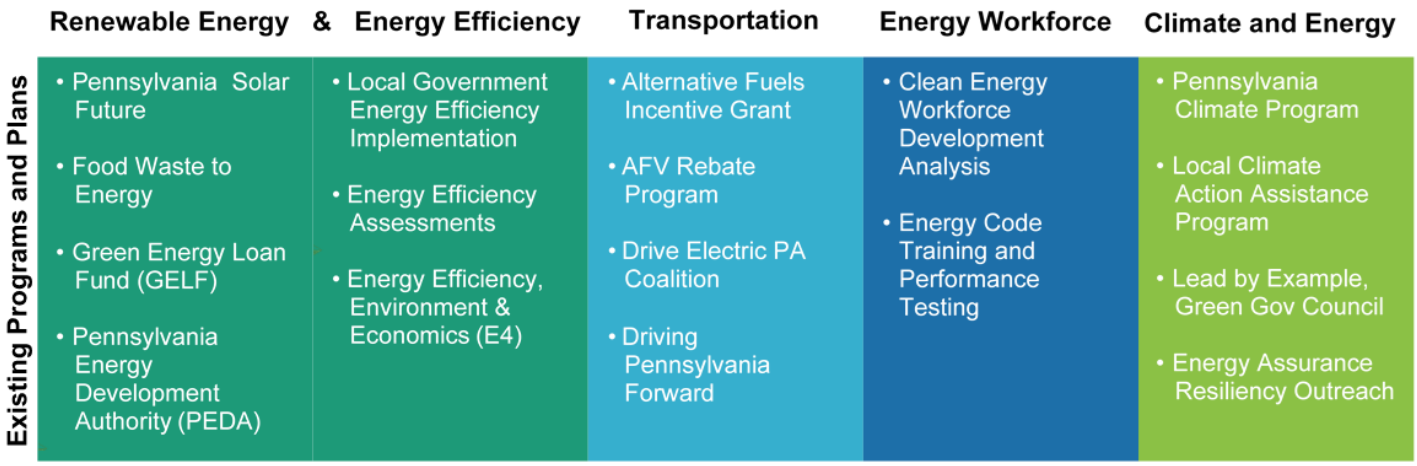
The DEP Energy Programs Office is the primary agency responsible for implementing clean energy programs in the Commonwealth of Pennsylvania. It's responsible for supporting renewable energy, energy efficiency and conservation, climate change mitigation and adaptation, alternative transportation, energy assurance, and associated education, outreach and technical support efforts. EPO works with its partners to implement, coordinate, and facilitate clean energy programs as part of meeting broader state goals for energy, climate, social equity, and inclusion. EPO's goals to develop clean energy resources fall within the overarching mission of DEP to protect Pennsylvania's air, land, and water from pollution and to provide for the health and safety of its citizens through a cleaner environment.

Originally established in 1979 as the Pennsylvania State Energy Office, EPO plays a key role in maintaining the Commonwealth's energy economy while advancing indigenous clean and renewable energy sources. It serves mandates stemming from a series of executive orders and legislative actions, and performs its duties within an ecosystem of state, federal, and local government agencies and industry stakeholders, with funding from the U.S. Department of Energy's State Energy Program (SEP) and a range of other federal and state sources.

The Energy Programs Office is also the primary entity for programmatic support of the Commonwealth's Emergency Support Function #12, specifically addressing energy emergencies involving petroleum and propane supply disruptions. EPO provides support to other Commonwealth staff in charge of preparing for, responding to, and recovering from energy emergencies.

Figure ES-1 summarizes EPO's current program slate, showing the breadth of focus areas affecting the power, fuels, buildings, transportation, industrial, and government facilities sectors.

Figure ES-1. Summary of Current Energy Programs



Recommendations: How the Energy Programs Office Can Build, Enhance, and Expand Its Portfolio

The development of this CEP Plan involved a review of existing programs, interviews with EPO staff, analysis of plans and actions from other states and localities, and engagement of a range of stakeholders to generate recommendations for evolving EPO's work. Figure ES-2 summarizes these recommendations, which were consolidated from a list of more than 100 potential actions.

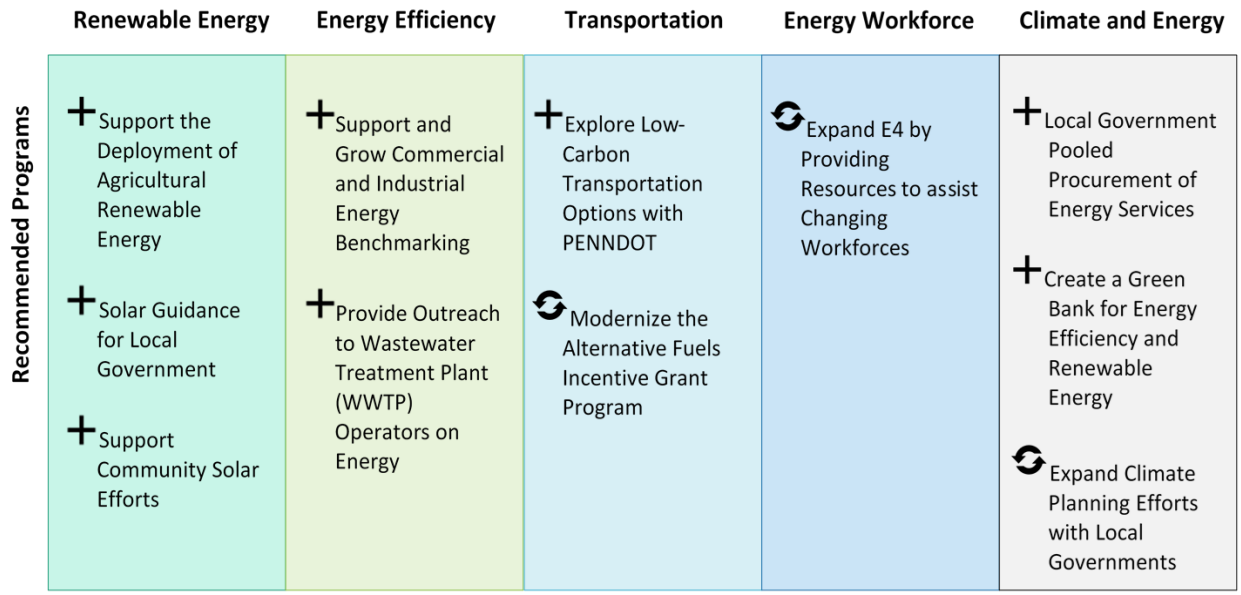
All of these recommendations are short-term program actions or initiatives that will develop a pathway to achieving long-term Commonwealth climate and energy goals while providing residents and businesses with clean, reliable energy. Some of the recommendations focus on expanding or enhancing existing programs; others propose new programs.

The Energy Programs Office developed broad guiding principles and best practices for identifying approaches to implement the recommendations in this plan over the next few years.

Guiding Principles and Best Practices for EPO Planning and Programming

- Enhance collaboration between government and stakeholders.
- Consider the needs of vulnerable communities and the effects of actions on equity, access, and inclusion.
- Enhance the marketing of programs and communication of results.
- Conduct program impact assessments.
- Create a program tracker.
- Integrate energy assurance and resilience in planning efforts.

Figure ES-2. Recommended Additional Actions for the Energy Programs Office



+ Indicates a new program

Indicates expanding a current program

Adapting for the Future and Ensuring Success

The CEP Plan process gave considerable thought to making EPO's programs more resilient and adaptable while ensuring success as technologies and other potentially disruptive activities occur. This includes integrating the aforementioned guiding principles and best practices into future planning and programming efforts as well as implementing robust measurement and verification of program outcomes.

To plan for the future as a means of ensuring success, EPO proposes tracking energy trends and technologies to anticipate and take advantage of emerging technologies and associated strategies as they evolve.

Technology Areas for Trend Tracking

- Carbon capture utilization and sequestration (CCUS)
- Offshore wind
- Disruptive digital technologies
- Small and large distributed energy resources
- Alternative fuels
- Transportation innovations

Another aspect of ensuring success involves a focus on energy resilience, an overarching priority for EPO's programs both today and into the future. EPO must maintain its preparedness and ability to respond to and assist in recovery from disruptive events that affect Pennsylvania's energy systems.

The new and expanded programs described in this CEP Plan — along with the accompanying guiding principles, best practices, and measurement and evaluation tools and strategies — will shape EPO's design and deployment of clean energy programs over the next one to three years and beyond. It is EPO's sincere intent that the CEP Plan will make the Commonwealth a stronger energy leader by serving its clean energy goals within DEP's mission to create a cleaner environment for all Pennsylvanians.

1. Purpose of the Clean Energy Program Plan

As the primary entity implementing energy programs in the Commonwealth of Pennsylvania under the leadership of DEP, EPO's mission is "to work with citizens groups, businesses, trade organizations, local governments, and communities through innovation, education, partnerships, pollution prevention, and financial and technical assistance." EPO carries out its mission by focusing its work in five areas:

EPO Five Focus Areas

- Energy conservation and efficiency
- Advanced energy technologies
- Energy security and resilience
- Climate change mitigation and adaptation
- Education and outreach

Through this work, EPO helps Pennsylvanians make smarter energy choices that reduce pollution and energy use and expand the use of renewable and other alternative energy solutions.

A central focus of EPO's work is helping government leaders and stakeholders understand the current and potential future landscape of energy programs and initiatives, as well as the social equity, health, and economic benefits of these programs for Pennsylvania's citizens.

Key factors such as socioeconomic status, race and ethnicity, sex, gender, age, English language proficiency, and disability are major factors in Pennsylvanians' vulnerability to energy disruptions, disasters, and climate change. EPO considers and addresses these issues in the development of its long-term energy goals and plans. Within this longer-term context, EPO implements near-term actions that progress toward achieving its goals.

With a range of concurrent energy-related initiatives being carried out by federal and Commonwealth agencies and organizations, as well as recent policy developments and new and ambitious goals within and for Pennsylvania, it is critical that EPO have a comprehensive plan that integrates all of its energy-related endeavors. This Clean Energy Program (CEP) Plan meets this need by:

- Describing Pennsylvania's current energy profile and hallmark energy policies and programs across sectors;
- Describing EPO's roles and responsibilities for current policy implementation and programs;
- Recommending actions that EPO intends to undertake in the next one to three years to build, enhance, and expand on past and current programs, consistent with long-term goals and state policies;
- Discussing how to anticipate potential future events and mitigate disruptions that may impact the CEP Plan; and
- Concluding with a summary of the plan and key considerations.

By presenting an overview of all of EPO's work on plans, supporting policies, and designing and implementing programs, the CEP Plan enables government officials and other leaders, as well as analysts and other technical experts, to quickly understand and access information on Pennsylvania's energy plans and programs. The plan provides a one-stop summary of information and access to the program resources that EPO is and will be developing to achieve its mission and objectives.

The CEP Plan is intended to guide EPO in fulfilling its obligations to support energy conservation and efficiency, advance clean energy technologies, and provide energy security and resilience while improving the environment and health of Pennsylvanians through education, outreach, funding, and technical support. EPO's sincere intent is that this plan will further the role of the Commonwealth of Pennsylvania as an energy leader by laying out an actionable, near-term plan to achieve its ambitious long-term clean energy goals. This plan, and the efforts described within it, will help give all Pennsylvanians cleaner, healthier, and more affordable and reliable energy choices.

2. Pennsylvania's Current Energy Profile and Policies

The Commonwealth of Pennsylvania (hereinafter "Commonwealth") is a leader in developing clean energy sources. This position builds on the deep energy history of the Commonwealth, which presents both opportunities and challenges. Being a leading energy-producing state rooted in its rich natural resources, over the past decades Pennsylvania has led the transition to lower-carbon fuels such as natural gas and alternative transportation fuels and is continuing to lead the transition to clean energy by developing renewable and other alternative energy resources.

Pennsylvania's Energy Profile

Pennsylvania's Comprehensive Energy Assessment Report (EAR), published in 2019, characterizes the trends in Pennsylvania's energy production and consumption under a business-as-usual (BAU) scenario; Box 1 provides a snapshot of Pennsylvania's energy profile.[1]

Key trends identified in the EAR related to energy production and consumption under the BAU scenario include the following:

- Overall energy consumption would increase slightly through 2050, with an increase in all fuel types except direct-use fossil fuels.
- Energy used to generate electricity is projected to increase, while overall end-use electricity consumption is projected to slightly decrease.
- Natural gas consumption is projected to increase almost two-fold from 2005 to 2050, bringing both economic impacts (i.e., jobs and growth) and environmental risks associated with production, transport, and combustion.
- Similarly, natural gas production is projected to increasingly be the Commonwealth's largest energy source through 2050 in a BAU scenario.
- Use of renewable and alternative fuels is projected to keep increasing.
- Electricity generation is projected to increase overall, with the largest increases coming from natural gas and renewable energy sources, including wind, hydroelectric, and wood/biogenic waste.

Box 1: Pennsylvania Energy by the Numbers

- **8,168 trillion Btu** – total annual energy produced in 2017.
- **3,808 trillion Btu** – total annual energy consumption in 2017.
- **39%** – Share of state's electricity generated by nuclear power.
- **36%** – Share of state's electricity generated by natural gas in 2018 (double the rate in 2010).
- **51.1%** – Share of households using natural gas for home heating in 2018.

Source: Energy Assessment Report for the Commonwealth of Pennsylvania

The EAR concludes that increasing the amount of electricity generated from renewables and other alternative fuels will improve the share of Pennsylvania's energy consumption that comes from clean sources; however, fossil fuels still play an important role in the BAU scenario.

[1] Pennsylvania Department of Environmental Protection. 2019. Energy Assessment Report for the Commonwealth of Pennsylvania (Report No. 0220-RE-DEP5081). Prepared by ICF.

Figure 1. Total Pennsylvania Electricity Generation by Fossil Fuels, Nuclear, and Renewables: Business As Usual Scenario displays electricity generation from three sources—fossil fuels, renewable and other alternative fuels, and nuclear—in 2005, 2018, and 2050 (under BAU conditions). **Figure 2. Pennsylvania Renewable Electricity Generation through 2050: Gigawatt Hours** shows historical and projected electricity generation from renewable sources (e.g., wind, solar PV, and hydroelectric) and other alternative fuels in a BAU scenario.

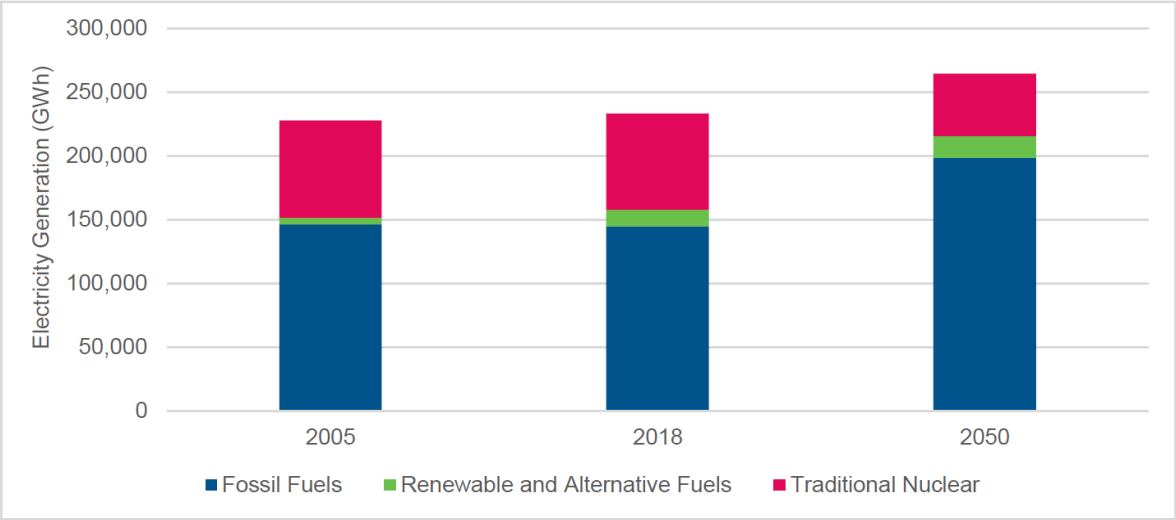
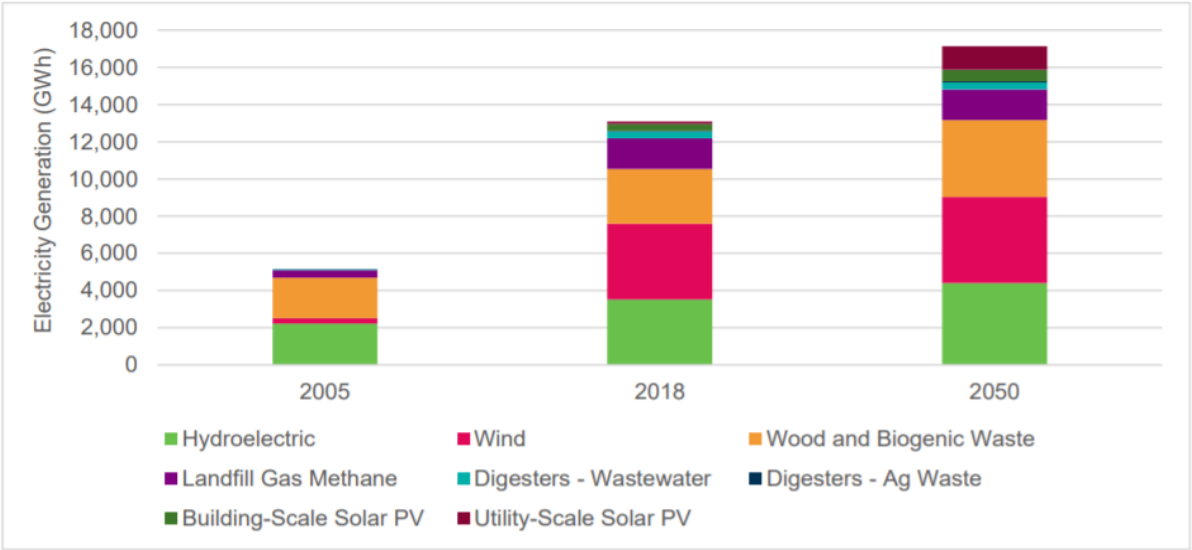


Figure 1. Total Pennsylvania Electricity Generation by Fossil Fuels, Nuclear, and Renewables: Business As Usual Scenario

Figure 2. Pennsylvania Renewable Electricity Generation through 2050: Gigawatt Hours



Energy production plays an important role in the strength of Pennsylvania's economy. The power sector has the potential for substantial transformation as the projected reductions in coal and nuclear generation make way for increased use of natural gas, renewables, and combined heat and power (CHP) resources, all of which will play a more significant role in the grid mix by 2050 under the BAU scenario.[2] The potential for growing demand through electrification may provide Pennsylvania the chance to decarbonize the electricity grid while increasing generation capacity from clean energy sources, creating opportunities for additional renewable or alternative sources of energy.

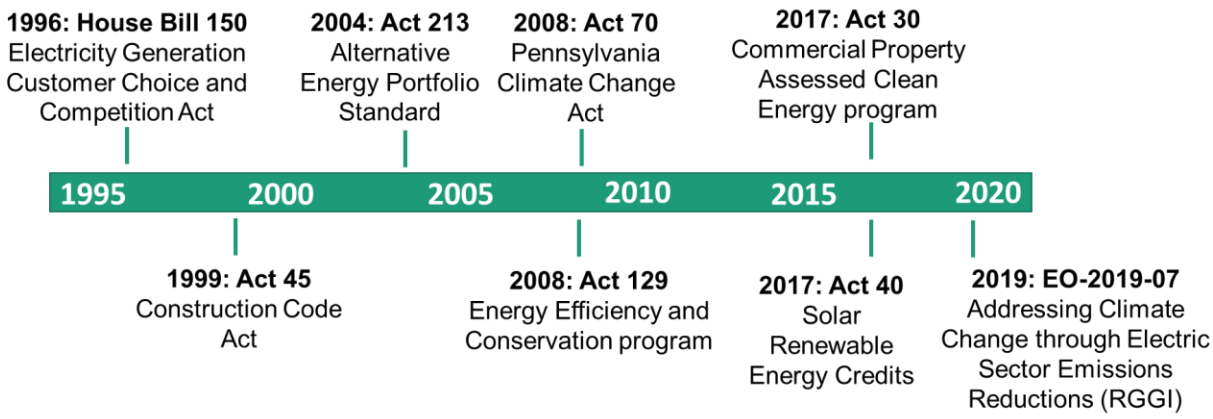
Pennsylvania's Key Clean Energy Policies To Date

Pennsylvania has implemented a number of key energy policies and programs over the past three decades. EPO plays major and supporting roles or takes on responsibilities as a result of the policies and programs described in this section. Many of these policies were factored into the BAU projections discussed in the previous section.

Hallmark energy policies implemented in Pennsylvania over the past three decades are shown in

Figure 3. Timeline of Pennsylvania's Recent Hallmark Energy Policies and summarized below.

Figure 3. Timeline of Pennsylvania's Recent Hallmark Energy Policies



Electricity Generation Customer Choice and Competition Act of 1996: Making Pennsylvania a National Pioneer in Offering Choice of Supplier

Pennsylvania is one of the states that pioneered the deregulation of retail electricity markets in the 1990s. In the Commonwealth's deregulated retail electricity market, electric generation suppliers can market electricity supply and other services directly to utility customers at competitive prices. Pennsylvania's traditional electric utilities continue to serve as electric distribution companies (EDCs), with generation suppliers competing for the generation portion of the customer's electric bill. In December 1996, Governor Ridge enacted

[2] Ibid.

the Electricity Generation Customer Choice and Competition Act, which outlined the transition from a regulated to deregulated retail electricity markets. In 1997, the Commonwealth launched the country's largest electric-choice pilot program at that time, and by 2000 all of Pennsylvania's electric customers had access to choose an electric generation supplier. As of April 2020, nearly 1.5 million residential customers, over 300,000 commercial customers, and over 10,000 industrial customers receive service from an alternative generation supplier.[3]

Construction Code Act of 1999: Setting Energy Efficiency Standards

The Pennsylvania Construction Code Act (Act 45 of 1999), also known as Pennsylvania's Uniform Construction Code (UCC), establishes codes and standards for work requiring a construction permit. For the commercial sector, over 90 percent, and for the residential sector, 100 percent of the Commonwealth of Pennsylvania's 2,562 municipalities administer and enforce the UCC locally, either using their own employees or via certified third-party private code enforcement entities. Although the UCC is required to be enforced under Act 45, in these municipalities the Department of Labor and Industry does not enforce the UCC except where the municipality lacks the services of a certified accessibility inspector or plans examiner. Labor and Industry is responsible for all commercial code enforcement in the less than 10 percent of municipalities that have opted out of the UCC (i.e., have chosen not to enforce the UCC locally) and also has sole jurisdiction for all elevators and all state-owned buildings regardless of where they are located.

The UCC Administration and Enforcement regulation has adopted 11 international and national codes, including the International Building Code 2015, the National Electric Code, and International Energy Conservation Code 2015. Since becoming law under Act 45, the UCC has been amended 13 times, most recently through Act 35 of 2017 and Act 36 of 2017. Act 36 requires a re-review of the 2015 International Building Codes and authorizes the Commonwealth of Pennsylvania to adopt the 2018 commercial International Code Council (ICC) codes, among other institutional organization amendments and permit application requirements.[4] In May of 2018 the Pennsylvania Uniform Construction Code Review and Advisory Council voted in favor of adopting the 2015 International Energy Conservation Codes with minimal Pennsylvania-specific amendments. In Philadelphia, the 2018 IECC was approved.

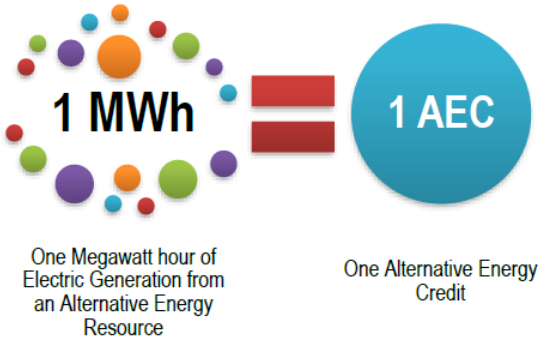
[3] Pennsylvania Office of Consumer Advocate. (2020). "Pennsylvania Electric Shopping Statistics As of April 1, 2020." http://www.oca.state.pa.us/Industry/Electric/elecstats/ElecStats_April2020.pdf.

[4] Department of Labor & Industry. 2020. *Uniform Construction Code (UCC).* https://www.dli.pa.gov/pages/search.aspx.

Alternative Energy Portfolio Standards of 2004: Requiring Renewable and Cleaner Sources of Electricity

Enacted in 2004, the Alternative Energy Portfolio Standards (AEPS) Act, also known as Act 213, requires that 18 percent of Pennsylvania's retail electricity must be generated from alternative energy resources by 2021.[5] Energy resources that are eligible for consideration in this program are classified into two groups:

- Tier I: renewable energy sources
- Tier II: alternative energy sources



Tier I sources include solar energy, wind power, low-impact hydropower, geothermal energy, biologically derived methane gas fuel cells, biomass energy, and coal mine methane. Eight percent of all sales must come from Tier I sources by 2021.

The remaining 10 percent of the AEPS sales requirement must be met through Tier II sources, which include waste coal, distributed generation systems, demand-side management, large-scale hydropower, municipal solid waste, generation from wood byproducts, and integrated gasification combined cycle technology.

For the 2018 reporting year, all EDCs and all but one electric generation suppliers met their requirements for acquiring and retiring sufficient alternative energy credits (AECs).[6]

Energy Efficiency and Conservation Program of 2008: Requiring Electricity Distribution Companies to Save Energy

The Act 129 Energy Efficiency and Conservation program, enacted in 2008, established energy efficiency and demand response obligations for the seven largest Pennsylvania EDCs and is overseen by the Pennsylvania Public Utility Commission (PUC).

Phase III of Act 129 began in June 2016 and ends in June 2021. Over this five-year period, the EDCs have a collective, cumulative incremental annual energy savings goal of 5.7 million MWh/year.[7] In addition, each EDC must obtain at least 5.5 percent of its consumption reduction requirements from programs solely directed at low-income customers or low-income-verified participants in multifamily housing programs. Each EDC must also obtain at least 3.5 percent of all consumption reduction requirements from government, nonprofit, and institutional entities.[8]

---

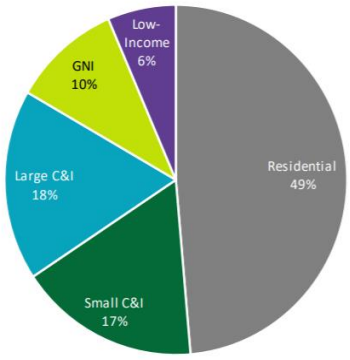
[5] Pennsylvania Department of Environmental Protection. 2018. "2017-2018 Annual Report to the Pennsylvania Legislature: Alternative Fuels Incentive Act Fund (Report No. 0220-RE-DEP4466)." https://www.dep.pa.gov/Citizens/GrantsLoansRebates/Alternative-Fuels-Incentive-Grant/Pages/default.aspx.

[6] Pennsylvania Department of Environmental Protection. 2019. *Alternative Energy Portfolio Standards Act: Compliance for Reporting Year 2018.* Harrisonburg, PA: Pennsylvania Public Utility Commission.

[7] Pennsylvania Public Utility Commission. 2020. "Alternative Energy."

[8] Ibid.

In response, the seven EDCs implemented a wide range of strategies to save energy including residential, commercial, and industrial lighting programs; home energy reports; and demand response efforts that save energy while reducing peak load. Residential lighting, home energy reports, and non-residential lighting programs were responsible for 78 percent of gross energy savings. Overall, lighting measures accounted for the majority (65 percent) of statewide verified gross savings in program year 10 (June 1, 2019 to May 31, 2019).[9]



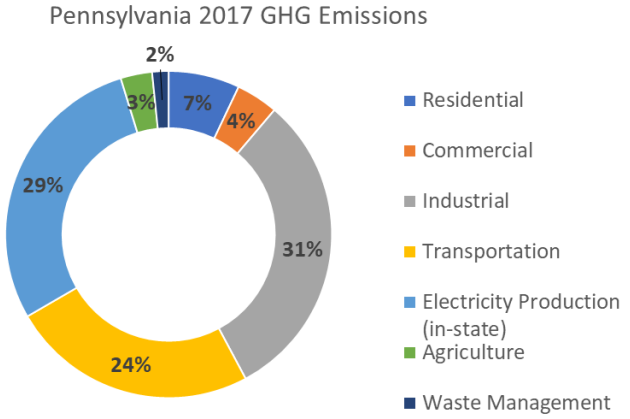
Program Year 10 verified gross savings by customer segment, statewide.

Program year 10 efforts saved the Commonwealth of Pennsylvania an estimated $230.3 million (benefits minus costs). As of May 2019, the seven EDCs saved 1,493,258 MWh/year of verified gross energy savings in program year 10 (approximately 26 percent of the statewide Phase III target) and 4,029,968 MWh/year of verified gross energy savings for Phase III to date (71 percent of the statewide Phase III target). Progress toward the 5.5 percent low-income target ranged from 47 percent (by Duquesne Light) to 119 percent (by Penn Power) of the verified gross savings goal in program year 10. These programs have avoided approximately 1 million first-year CO_2 short tons and 9.8 million lifetime CO_2 short tons, respectively.[10]

Pennsylvania Climate Change Act of 2008: Mandating DEP to Generate Greenhouse Gas Emissions Data, Project Climate Change Impacts, and Recommend Actions

Act 70 of 2008, also known as the Pennsylvania Climate Change Act, requires DEP to annually compile an inventory of greenhouse gas (GHG) emissions, create a voluntary GHG registry, establish a Climate Change Advisory Committee, develop a Climate Change Action Plan, and conduct a Climate Change Impacts Assessment.[11]

Act 70 resulted in the development of Pennsylvania's first Climate Change Action Plan, published in 2009. The plan was a science-based report that examined potential threats to Pennsylvania from climate change and recommended actions to curb future impacts. The Act requires that the plan be updated once every three years.



Graphic from the DEP, displaying the Commonwealth's 2017 GHG Inventory in line with Act 70.

[9] Ibid.
[10] Ibid.
[11] Commonwealth of Pennsylvania. 2014. "Energy Equals Jobs: Pennsylvania State Energy Plan." January. http://www.governor.pa.gov/energy.

The Climate Change Advisory Committee provides advice to DEP regarding implementation of the provisions of Act 70. The committee comprises appointed members from the science, business and industry, transportation, labor, and other affiliated communities, and oversees the development of climate change-related reports such as the Climate Change Action Plan and Climate Change Impacts Assessment.[12] The voluntary GHG registry established as a result of Act 70 is now part of The Climate Registry, a nationwide organization that operates GHG reporting programs for states, cities, and businesses. This registry helps governments and other institutions with GHG measurement, reporting, and verification efforts.[13]

Commercial Property Assessed Clean Energy Program Act of 2017: Enabling Local Governments to Offer Businesses Low Interest Financing for Energy Improvements

In 2017, the General Assembly authorized Act 30, which established the Commercial Property Assessed Clean Energy program, or C-PACE. C-PACE enables local jurisdictions to provide accessible, long-term, low-interest financing for agricultural, commercial, and industrial properties to implement energy efficiency, clean energy, and water conservation projects.

Graphic from the Office of Energy Efficiency & Renewable Energy on Commercial Property Assessed Clean Energy (C-PACE) Programs.

C-PACE financing can provide up to 100 percent of the total project costs including equipment, labor, and soft costs. The loan payment is then added to the property tax bill and collected as an added assessment by the county or municipality.[14] If property ownership changes, the loan obligation is passed on to the new property owner and continues to be repaid through the property tax bill. Projects eligible for financing range from whole-building insulation to CHP to smart building systems and beyond. C-PACE has been adopted in cities and counties across the Commonwealth since the program launched in 2018.[15]

[12] Pennsylvania DEP. 2020. *Climate Change Advisory Committee.* Accessed March 11, 2020. https://www.dep.pa.gov/Citizens/climate/Pages/CCAC.aspx.
[13] The Climate Registry. n.d. *Abouts Us.* Accessed March 11, 2020. https://www.theclimateregistry.org/who-we-are/about-us/.
[14] Pennsylvania C-PACE. 2020. *Pennsylvania C-PACE Case Studies.* https://pennsylvaniacpace.org/case-studies/.
[15] Pennsylvania Department of Environmental Protection. 2019. "Draft - Pennsylvania Energy Development Authority Annual Report 2019." http://www.depgreenport.state.pa.us/elibrary/PDFProvider.ashx?action=PDFStream&docID=1547639&chksum=&revision=0&docName=DRAFT+-+PENNSYLVANIA+ENERGY+DEVELOPMENT+AUTHORITY%E2%80%99S+ENERGY+DEVELOPMENT+PLAN+(2019)&nativeExt=pdf&PromptToSave=False&Size=244433.

Currently, eight counties — Chester, Northampton, Allegheny, Wayne, Lawrence, Lebanon, Bedford, and Philadelphia Counties — have adopted the C-PACE program. A collaboration including the Sustainable Energy Fund (SEF), Keystone Energy Efficiency Alliance, Philadelphia Energy Authority, and the City of Pittsburgh, with input from stakeholders, developed guidance for local governments that are interested in implementing C-PACE. "C-PACE in a Box" resources include a sample resolution, an executive summary of the program guidelines, a template cooperation agreement, a sample Statement of Levy and Lien Agreement, and other key documents needed to establish a C-PACE program.[16]

Property owners, private lenders, and surrounding communities all benefit from building improvements implemented with C-PACE financing. These benefits include increased building resilience, lower electric and water utility costs for property owners, increased property values, improved cash flows and reduced credit risks for private lenders, and cleaner air and water.[17]

Act 40 of 2017: Solar Renewable Energy Credits

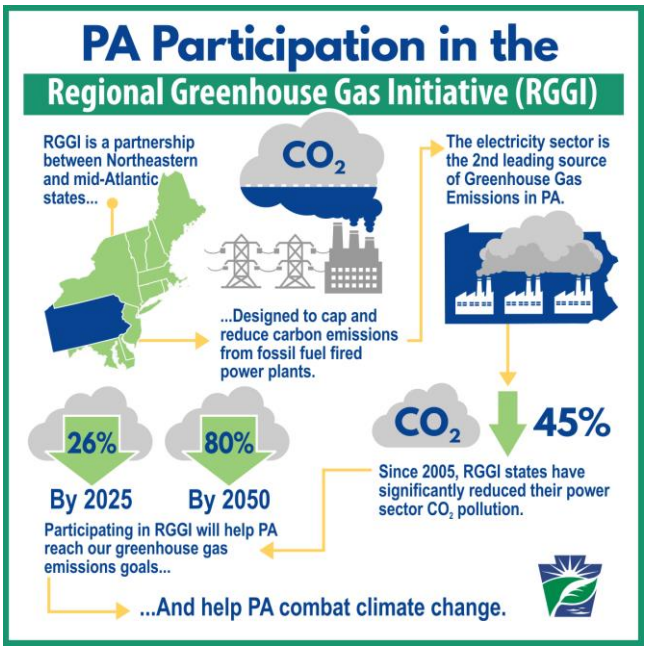
Signed into law in 2017, Act 40 requires that electricity distribution companies obtain their AEPS solar PV carve-out—requiring that 0.5 percent of their eight percent Tier I target be met with solar PV) — from facilities producing solar power within Pennsylvania to ensure the economic and environmental benefits remain within the Commonwealth of Pennsylvania.[18] Previously, alternative energy credits (AECs) could be sold into the Pennsylvania AEC market from other states based on Pennsylvania prices.

This change was intended to ensure the AEPS solar carve-out credit projects under the state AEPS are built in Pennsylvania for as long as the 0.5 percent mandate is in effect, with the exception of certified out-of-state facilities, which are permitted to retain their certifications under AEPS until their contract expires through a grandfathering mechanism.[19]

[16] Pennsylvania C-PACE. 2020. *Pennsylvania C-PACE Case Studies.* https://pennsylvaniacpace.org/case-studies/.
[17] Pennsylvania DEP. 2020. *PA.Gov.* https://www.dep.pa.gov/Business/Energy/OfficeofPollutionPrevention/FinancialOptions/Pages/C-PACE.aspx.
[18] Pennsylvania Department of Environmental Protection. 2019. "Draft - Pennsylvania Energy Development Authority Annual Report 2019." http://www.depgreenport.state.pa.us/elibrary/PDFProvider.ashx?action=PDFStream&docID=1547639&chksum=&revision=0&docName=DRAFT+-+PENNSYLVANIA+ENERGY+DEVELOPMENT+AUTHORITY%E2%80%99S+ENERGY+DEVELOPMENT+PLAN+(2019)&nativeExt=pdf&PromptToSave=False&Size=244433.
[19] Pennsylvania General Assembly. 2017. "2017 Act 40." October.

Executive Order 2019-07: Addressing Climate Change Through Electric Sector Emissions Reductions

Executive Order 2019-07 requires DEP to develop and present a proposed rule package to control or abate carbon dioxide emissions from fossil fuel electric power generators. The rulemaking package must be designed to be consistent and compatible with RGGI, as its purpose is to prepare the Commonwealth to join RGGI. RGGI is an initiative of 10 New England and Mid-Atlantic states to reduce GHG emissions from the power sector while generating economic growth. Together Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont cap and reduce their power sector carbon dioxide emissions. This is achieved by setting a regional cap or limit on these emissions from electric power plants in the participating states. Executive Order 2019-07 also directs DEP, in collaboration with the PUC, to engage with PJM to implement the proposed rule in a way that preserves reliable and affordable energy while reducing emissions.



Graphic by the PA DEP displaying the benefits of Pennsylvania's participation in RGGI.

3. DEP Energy Programs Office: Context and Programs

The Commonwealth of Pennsylvania is a leader in developing clean energy sources. This position builds on the deep energy history of the Commonwealth, which presents both opportunities and challenges. As a leading energy-producing state rich with natural resources, Pennsylvania has over decades led the transition to lower-carbon fuels such as natural gas and alternative transportation fuels, and is continuing to lead the transition to clean energy by developing renewable and other alternative energy resources.

Clean energy development and use have increased in Pennsylvania in the past decade because of advances in technology and policies promoting development and in part because of the efforts of the Pennsylvania Energy Programs Office (EPO) and its partners. EPO has played, and will continue to play, a key role in maintaining the Commonwealth's energy economy while advancing indigenous clean and renewable energy sources. EPO works with its partners to implement, coordinate, and facilitate clean energy programs which are intended to meet both state energy and climate goals including social equity, health, and economic benefits for Pennsylvania's citizens.

History and Function of the Energy Programs Office

The Pennsylvania State Energy Office (SEO), now known as EPO, was first established as the Governor's Energy Council under Executive Order 1979-7. SEO was responsible for developing a Comprehensive Energy Plan for the Commonwealth, distributing federal and private energy funds, collecting and distributing information for the public related to energy conservation and sources, and helping to assess, track, and regulate energy resources.

Since then several other relevant executive orders related to the SEO's operations have informed EPO's functions.[20]

- **Executive Order 1983-6** required the Department of Commerce to provide staff services to the then-recently created Pennsylvania Energy Development Authority (PEDA), which provided financing for energy projects.
- **Executive Order 1984-2** designated the SEO as the agency responsible for monitoring supplies of petroleum and for implementing measures to allocate petroleum in the case of an emergency.
- **Executive Order 1987-15** designated the SEO as the lead Commonwealth agency for energy policy development.
- **Act 18 of 1995** transferred the SEO and its responsibilities to be within DEP, including the duties under the Building Energy Conservation Act, the Energy Conservation and Assistance Act, and related to alternative fuels.
- **Executive Order 2004-5** designated DEP as the agency primarily responsible for providing staffing services to PEDA. As the chair of PEDA, the Secretary of DEP leads a 19-member board that oversees the authority.

[20] Pennsylvania Department of Environmental Protection. 2019. *PA DEP Energy Programs Office.* May.

Today, EPO works within the DEP to implement energy programs, with a focus on energy efficiency, energy conservation, and the promotion of indigenous, clean, and diverse energy resources.[21] Development of clean energy resources falls within DEP's overarching mission to protect Pennsylvania's air, land, and water from pollution and to provide for the health and safety of its citizens through a cleaner environment. DEP partners with individuals, organizations, governments, and businesses to prevent pollution and protect the Commonwealth's natural resources. EPO works to assist, educate, and encourage Pennsylvanians to advance conservation and efficient use of energy, to provide for a healthier environment, and to achieve greater energy security for future generations. The EPO organizational structure includes 18 full time staff (see Appendix A).

Recent EPO Clean Energy Leadership

EPO has developed several significant subject matter plans and reports which have informed a wide range of stakeholders ranging from government leaders, to industry participants, to Pennsylvania citizens on the status, accomplishments, opportunities clean energy programs and policy are having on the economy, health and the environment. These plans and reports, while in some cases are subject specific have created a foundation of information and strategies from which comprehensive energy program planning is required.

2018 Pennsylvania Climate Action Plan[22]. The 2018 Plan includes over 100 actions that leaders can take to work toward greenhouse gas (GHG) reduction goals of 26 percent reduction in GHG emissions by 2025, and 80 percent reduction in GHG emissions by 2050.

Pennsylvania Comprehensive Energy Assessment Report[23]. This report characterized the technical and economic potential of Pennsylvania's available energy resources from 2016 through 2050 and informed the development of the Climate Action Plan 2018.

2019 Local Government Liquid Fuels Assurance Planning Guide[24]. EPO provided tools and resources to support local governments with energy assurance planning, providing foundational guidance for advancing Pennsylvania's energy security and sustainability.

Pennsylvania's Solar Future Plan[25]. Beginning in 2017, EPO led a 30-month "Finding Pennsylvania's Solar Future" project that convened hundreds of community, industry, government, and other stakeholders to collaboratively identify and plan pathways toward the goal of 10 percent of in-state electricity sales generated by in-state solar energy sources by 2030.

[21] Ibid.
[22] Pennsylvania Department of Environmental Protection. 2019. "Pennsylvania Climate Action Plan." Government Report.
[23] Pennsylvania Department of Environmental Protection. 2019. "Energy Assessment Report for the Commonwealth of Pennsylvania." Government Report.
[24] Pennsylvania Department of Environmental Protection. 2020. " Liquid Fuels Shortage Planning Guidebook for Pennsylvania Local Governments." Government Report.
[25] Pennsylvania Department of Environmental Protection. 2018. "Pennsylvania's Solar Future Plan." Government Report.

2019 Pennsylvania Electric Vehicle Roadmap[26]. EPO formed the Drive Electric PA Coalition in 2017 to advise on electric vehicle policies and planning**.** The EV Roadmap was a stakeholder-driven planning effort to identify strategies to increase the adoption of electric vehicles. The Roadmap identifies near-, mid-, and long-term strategies to incentivize and remove barriers to EV adoption.

Driving Pennsylvania Forward. EPO has provided significant partnership to the DEP Bureau of Air Quality to support the transition toward zero-emission, low-emission, and alternative fuel vehicles through the development and deployment of new and innovative grant and rebate programs funded by Pennsylvania's Volkswagen settlement.

Energy Efficiency, Environment & Economics (E4) Initiative[27]. EPO coordinates a set of stakeholder-suggested industrial energy efficiency and conservation activities and EPO's near-term actions underway in 2020 include analysis projects involving food-waste biogas potential, battery storage, promotion of CHP and microgrids, as well as various activities aimed at development and implementation of local climate action planning.

[26] Pennsylvania Department of Environmental Protection. 2019. " Pennsylvania Electric Vehicle Roadmap." Government Report.

[27] Energy Efficiency, Environment, and Economics (E4) Initaitive. PA DEP. 2020. https://www.dep.pa.gov/Business/Energy/OfficeofPollutionPrevention/EnergyEfficiency_Environment_and_EconomicsInitiative/Pages/default.aspx. Accessed June 28, 2020.

Partnerships with Other Agencies and Programs

The Energy Programs Office's past and future successes are closely tied to the support and interactions from other agencies and programs. EPO's partnerships and relationships with other agencies and federal, state, and local programs are essential to the office's success as energy and climate touch almost every aspect of operations and day-to-day life in the Commonwealth.

Federal Agencies and Programs

The Energy Programs Office partners with the U.S. Department of Energy and, as the designated Pennsylvania Energy Office, receives funding from its State Energy Program (SEP). SEP provides funds and technical assistance to state energy offices to enhance energy security, advance state-led energy programs, and minimize energy waste. The SEP Annual Formula Grant Award from the U.S. Department of Energy's Weatherization and Intergovernmental Programs Office provides annual funding for EPO staff and programs and drives programming. Since 2010, Pennsylvania has received $13.2 million from SEP.[28]

Pennsylvania Agencies and Programs

The Energy Programs Office partners and coordinates with many Pennsylvania agencies and programs. For example, EPO coordinates with the PUC to enforce the AEPS, together monitoring and tracking compliance.[29] Executive Order 2019-1 directs DEP, the Department of General Services, and the Department of Conservation and Natural Resources to chair the Green Government Council and requires DEP to provide technical support to develop strategies to meet state climate change, sustainable governance, and energy conservation goals. DEP delivers this support through resources provided by EPO.[30] A more complete list of partner agencies and programs EPO supports is provided in Box 2.

Box 2: Partner Agencies and Supported Programs

Agencies:

- Department of Conservation and Natural Resources
- Department of Community and Economic Development
- Public Utility Commission
- Department of General Services
- Department of Agriculture
- Department of Transportation
- Pennsylvania Emergency Management Agency
- Department of Labor and Industry

Programs:

- Commonwealth Finance Authority
- Green Government Council
- Pennsylvania Energy Development Authority
- Alternative Energy Portfolio Standard
- Energy Efficiency and Conservation Program (Act 129)
- Weatherization Assistance Program
- Other DEP Programs

[28] Office of Energy Efficiency and Renewable Energy, DOE. 2020. *Weatherization and Intergovernmental Programs Office Project Map – Pennsylvania.* Accessed April 21, 2020. https://www.energy.gov/eere/wipo/downloads/weatherization-and-intergovernmental-programs-office-project-map-pennsylvania.

[29] Pennsylvania Department of Environmental Protection. 2017. *2017 Annual Report: Alternative Energy Portfolio Standards Act of 2004.* Harrisonburg, PA: Pennsylvania Public Utility Commission.

[30] Pennsylvania Department of Environmental Protection. 2019. *PA DEP Energy Programs Office.* May.

Pennsylvania DEP Programs

The Energy Programs Office partners and coordinates with many other programs within DEP. As a non-regulatory office, EPO coordinates policy and program design and delivery of energy-related initiatives with the DEP Policy and Legislative Offices. EPO collaborates with the Bureau of Air Quality (BAQ) on climate policy and programming, including modeling the costs and benefits of implementing energy-focused carbon cap and trade programs. DEP worked with BAQ to develop the 2018 Climate Action Plan, and assists BAQ with design and management of Driving PA Forward. EPO and the DEP Chesapeake Bay Program partnered on development of the 2018 Climate Impacts Assessment. EPO is working with the Office of Environmental Justice on climate outreach to communities and organizations in its network. It has coordinated with the Small Business Ombudsman (SBO) on programming and evaluation of the Small Business Advantage Grant program. Additionally, EPO coordinates with industrial energy efficiency assessment contractors to work with the SBO in assisting customers applying to the grant program to implement energy conservation measures. Recently, EPO has begun an evaluation of opportunities for converting food waste to energy with the Bureau of Waste Management Recycling Program.

Participation in Networks

EPO participates actively in the U.S. Climate Alliance, the National Association of State Energy Officials (NASEO), and the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy State Energy Advisory Board (STEAB).

In 2019, Pennsylvania was the 23rd state to sign on to the U.S. Climate Alliance.[31] By joining as a member, the Commonwealth is committed to:

- Implement policies that advance the goals of the Paris Agreement, aiming to reduce GHG emission by at least 26–28 percent below 2005 levels by 2025,
- Track and report progress to the global community in appropriate settings, including when the world convenes to take stock of the Paris Agreement, and
- Accelerate new and existing policies to reduce carbon pollution and promote clean energy deployment at the state and federal levels.

The EPO director currently serves on the board of directors for NASEO as a regional representative for the Mid-Atlantic Region. NASEO is a national nonprofit association for the governor-designated energy officials from each of the 56 states and territories. Formed by the states in 1986, NASEO facilitates peer learning among state energy officials, serves as a resource for and about state energy offices, and advocates the interests of the state energy offices to Congress and federal agencies.[32]

[31] National Association of State Energy Officials (NASEO). 2020. *About NASEO.* Accessed June 3, 2020. https://www.naseo.org/about-naseo.
[32] Ibid.

Additionally, the director serves as part of the STEAB. The STEAB was established by Public Law 101-440 (The State Energy Efficiency Programs Improvement Act of 1990) to advise the U.S. Department of Energy on the operation of its federal grant programs. The board also advises on energy efficiency and renewable energy programs in general and on the federal agency's efforts relating to research and market deployment of energy efficiency and renewable energy technologies.[33]

EPO's Obligation to Act 70 and the Commonwealth's Climate Goals

Act 70 of 2008, also known as the Pennsylvania Climate Change Act, requires DEP to annually compile an inventory of Pennsylvania's GHG emissions, develop a voluntary registry of GHG emissions, conduct a Climate Change Impacts Assessment, develop a Climate Action Plan, and administer a Climate Change Advisory Committee.

These mandates are tied to EPO's mission and therefore directly affect its programming efforts. EPO prepares the update to the Commonwealth's Climate Action Plan and Climate Impacts Assessment, which outlines Pennsylvania's emissions goals and reductions strategies. EPO then crafts its program planning with significant consideration given to the strategies outlined in the plan to assist in achieving emissions reduction targets.

The Climate Change Advisory Committee provides advice to the DEP regarding the implementation of the provisions of Act 70. The Committee, which includes appointed members from the science, business and industry, transportation, labor, and other affiliated communities, provides input and guidance for the development of climate change-related reports such as the Climate Action Plan (and its updates) and Impacts Assessment (and its updates). EPO oversees the operation of the Committee.[34]

In addition to directives from Act 70, several executive orders have been guiding EPO's future program planning efforts by setting long-term goals and establishing near-term planning and implementation directives:

- In 2019, Governor Wolf issued **Executive Order 2019-01**, which includes a Lead by Example provision for state government that commits the Commonwealth to addressing climate change and establishes the GreenGov Council.[35]
- Moreover, EO 2019-1 established a goal to achieve a 26 percent reduction of net GHG emissions statewide by 2025 from 2005 levels, and an 80 percent reduction of net GHG emissions by 2050 from 2005 levels.[36]

[33] DOE Office of Energy Efficiency and Renewable Energy. What is STEAB?. Accessed June 12, 2020. https://www.energy.gov/eere/steab/state-energy-advisory-board

[34] Pennsylvania DEP. 2020. *Climate Change Advisory Committee.* Accessed March 11, 2020. https://www.dep.pa.gov/Citizens/climate/Pages/CCAC.aspx.

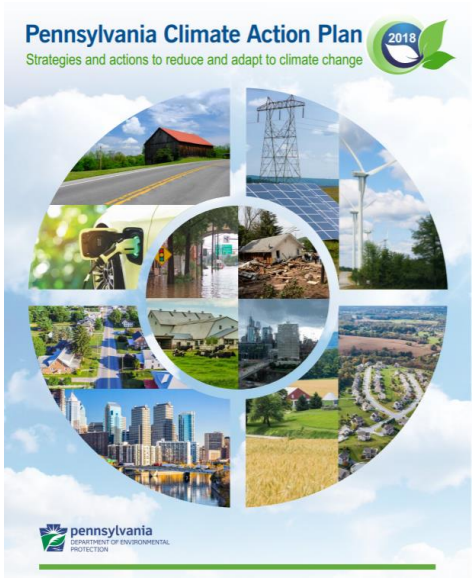
[35] Pennsylvania Department of Environmental Protection. 2019. "Draft - Pennsylvania Energy Development Authority Annual Report 2019." http://www.depgreenport.state.pa.us/elibrary/PDFProvider.ashx?action=PDFStream&docID=1547639&chksum=&revision=0&docName=DRAFT++PENNSYLVANIA+ENERGY+DEVELOPMENT+AUTHORITY%E2%80%99S+ENERGY+DEVELOPMENT+PLAN+(2019)&nativeExt=pdf&PromptToSave=False&Size=244433.

[36] Department of General Services. (2020). GreenGov Council. https://www.dgs.pa.gov/greengov/Pages/default.aspx.

- Additionally, **Executive Order 2019-07**, *Commonwealth Leadership in Addressing Climate Change through Electric Sector Emissions Reductions,* directs DEP to propose a regulation that will cut carbon pollution from power plants and enable the state to participate in RGGI.

2018 Pennsylvania Climate Action Plan Update

As noted above, Act 70 requires DEP to prepare a Climate Action Plan (CAP) update every three years. The latest CAP update was completed in 2018; it assesses the paths toward achieving the mitigation goals outlined in Governor Wolf's Executive Order.



The 2018 CAP update also identifies two adaptation-focused goals: (1) to mated hazards; and (2) to increase Pennsylvania's ability to anticipate, prepare for, and adapt to changing conditions, and to withstand, respond to, and recover rapidly from climate-related disruptions.

To achieve the Commonwealth's long-term goals, the 2018 CAP update outlines 19 strategies across eight sectors that have either mitigation or adaptation benefits or both. Each strategy comprises multiple actions, defined as specific policies and programs, and presents additional information on benefits and costs.[37] The 15 most impactful actions across seven strategies were explicitly modeled for mitigation benefits. Six of the seven strategies relate to energy and the programs to which the EPO implements.

Six 2018 Climate Action Plan Strategies Related to EPO Work

1. Increase end-use energy conservation and efficiency.
2. Implement sustainable transportation planning and practices.
3. Increase use of clean, distributed electricity generation resources.
4. Create a diverse portfolio of clean, utility-scale electricity generation.
5. Reduce impacts of fossil fuel energy production and distribution.
6. Increase production and use of alternative fuels.

The 2018 CAP found that implementing these strategies would significantly reduce GHG emissions and could result in a 21 percent decrease in annual GHG emissions in 2025 compared with 2005 levels. While these results indicate that the Commonwealth is on track to achieve its long-term goals, they also emphasize the need for more ambitious and rapid climate action across all sectors.[38] DEP and EPO play a significant part in many of the modeled strategies and have already begun implementing some of the recommended actions. In light of the need for greater action to achieve long-term goals, EPO is actively planning to implement new or expanded programs and initiatives to increase clean energy development in the near-term.

[37] Pennsylvania Department of Environmental Protection. 2019. "Pennsylvania Climate Action Plan." https://www.dep.pa.gov/Citizens/climate/Pages/PA-Climate-Action-Plan.aspx.
[38] Ibid.

Key Current Energy and Climate Programs

The Energy Programs Office leads and supports many clean energy programs, particularly in the areas of renewable energy, transportation, energy efficiency, the energy workforce, and climate and energy.

Many of these programs help implement the policies and plans outlined above. The programs in which EPO is currently engaged and expending resources for are summarized in **Figure 4**. EPO's role in these programs and in the implementation of the policies described above is covered in the subsequent section.

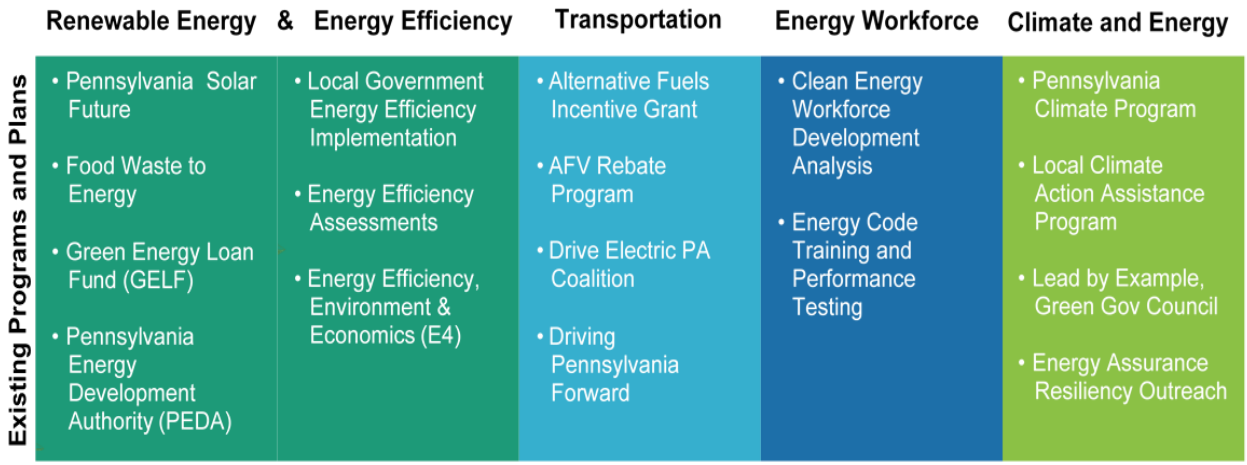


Figure 4. Summary of Current Energy Programs in Pennsylvania

Pennsylvania State Energy Program

The goal of the Pennsylvania SEP is to expand the use of renewable energy and improve energy efficiency in the state. This is achieved through outreach programs, training opportunities, grants, and technical assistance. The Pennsylvania SEP is funded by the U.S. Department of Energy (DOE) through an annual formula grant, and DEP submits an annual plan to DOE detailing upcoming projects.[39] The SEP via DOE provides a substantial portion of the resources used by EPO annually. SEP funding supports EPO staff positions that conduct many of the programs described in the following sections.

In 2019, Pennsylvania's SEP supported the implementation of many programs and initiatives to address energy efficiency and renewable energy sources. Focus areas include energy emergency and resilience planning, industry, buildings; transportation, electric power and renewable energy, energy education, and policy, planning, and energy security.[40] For example, the 2019–20 Pennsylvania SEP supported the implementation of the following programs to promote and deploy energy efficiency:

- **Building Re-tuning Training:** Trainings and webinars on energy in commercial and residential buildings for facility personnel.
- **Building Operator Certification Training:** Plan and conduct a conference for building operators, facility managers, and financial decisions makers.
- **Energy Assessments for Small to Medium-Size Businesses:** Provide energy assessments and conduct educational outreach for small to medium-size manufacturers and agricultural-related business.
- **Wastewater Treatment Plant Operators Energy Outreach:** Hands-on workshops, an audit report, an energy opportunities marketing program, and tools for wastewater treatment plant operators.
- **Building Energy Codes:** Building energy code performance testing in rural areas, as well as energy codes training.
- **The Role of Energy Efficiency in Community Resilience:** Education and outreach about the importance of energy efficiency and resilience planning to municipalities through webinars, videos, and flyers to share with their respective communities.
- **Energy Assurance Planning:** develop tools and provide energy resilience training for local governments.

By encouraging reduced energy use and renewable energy development, the program aims to reduce air pollution, provide opportunities for technology development and job growth, improve quality of life, and increase energy security.[41]

[39] Pennsylvania Department of Environmental Protection. 2019. *State Energy Program Narrative Information Worksheet.* DOE F 540.1, U.S. Department of Energy.
[40] Ibid.
[41] Ibid.

Energy Assurance and Resilience

Energy assurance and resilience programs are designed to provide a reliable energy supply in the face of unexpected events. Shortages in energy supply can be caused by natural disasters, supply chain disruptions, and infrastructure issues. EPO is the primary entity for programmatic support of the Commonwealth's Emergency Support Function #12, and provides support to other Commonwealth staff in charge of preparing for, responding to, and recovering from energy emergencies. Responsibilities include maintaining situational awareness of energy systems and informing emergency preparedness liaison officers, the DEP Environmental Emergency Response Manager, and senior government leaders of supply shortages and mitigation measures.

Box 3: Energy Assurance and the Public Utility Commission

The Pennsylvania PUC plays a critical role in balancing the needs of consumers and utilities. Through its regulation of utilities, it prioritizes resilience of electricity and natural gas systems by ensuring that their short- and long-term infrastructure plans provide the right balance of investments to maintain systems. The Pennsylvania PUC also increasingly plays a role in protecting utility customers by ensuring cybersecurity of utility systems.

EPO plays a primary role in ensuring preparedness for energy system disruptions by developing and maintaining the Pennsylvania Energy Assurance Plan[42] and other subject matter plans such as the Petroleum Shortage Response Plan, and by providing education and training to county and local governments on energy assurance and emergency planning.

EPO also develops weekly situational reports, including data from the State Heating Oil and Propane Program. While key energy assurance partners such as the PUC and PJM take lead roles in electricity, natural gas, and cybersecurity resilience planning, EPO's role is vital in advancing the resilience of energy systems through the programs it offers and the projects and technologies it helps advance.

[42] Pennsylvania Department of Environmental Protection. 2019. *PA DEP Energy Programs Office.* May.

State Energy Program Climate Initiatives

Pennsylvania's SEP (also discussed above) includes initiatives to reduce emissions and impacts of climate change such as local government climate planning, resilience planning with ICLEI, and Climate Leadership Training through the Association of Climate Change Officers. Additionally, SEP supports initiatives linked to the CAP, including third-party Pennsylvania energy and resource assessments. Some examples are listed below.

Box 4: Energy Resilience and PJM

PJM, the regional transmission organization that operates the electricity grid in Pennsylvania, plays a leading role in ensuring the reliability of electricity across the Commonwealth through its electricity grid operations long-term energy resource planning for large-scale electricity generators. Because PJM's rules and ratemaking are applicable in multiple states, PJM and interstate natural gas pipelines are regulated by FERC, which provides a framework for reliability and resilience of multi-state energy system resilience.

- **Energy Workforce Development**: This program involves working with a consultant to create energy jobs reports and examining what clean energy workforce development initiatives exist, where there are gaps, and what can be done to expand efforts or fill gaps. This and the next two projects below were outcomes from the E4 project.
- **Comprehensive Analysis of Agricultural Energy Use in Pennsylvania:** This project provided a technical assessment of energy efficiency and economic opportunities within the Pennsylvania agricultural sector, focusing on crop and animal producers.
- **DEP Outreach to Agriculture Sector:** Ongoing work with Penn State University Agricultural Extension to provide workshops on energy efficiency and renewable energy opportunities targeted at the agricultural sector.
- **Local Government Climate Change Action Plan Outreach:** Ongoing work with ICLEI to provide outreach and training on the 2018 CAP update and GHG inventory tools for local government and other sectors to create their own CAPs (see Box 5).
- **Energy System Modeling and Planning:** SEP funds were included with other DEP funding to model the energy impacts of an economy-wide GHG cap and trade program, including an analysis of the potential renewable energy and energy efficiency benefits of Pennsylvania joining RGGI.

Box 5: Pennsylvania Communities Develop Climate Action Plans with the Support of EPO and ICLEI

Through funding from the U.S. DOE, EPO had the opportunity to work with municipalities, pair them with college students, and provide technical assistance and training from ICLEI to support municipalities in producing GHG inventories, identifying local hazards, reviewing and aligning with strategy recommendations in the 2018 Pennsylvania CAP, engaging with stakeholders, and developing climate plans to reduce GHG emissions and manage climate change impacts.

Source: https://icleiusa.org/20-pennsylvania-communities-develop-local-climate-action-plans/

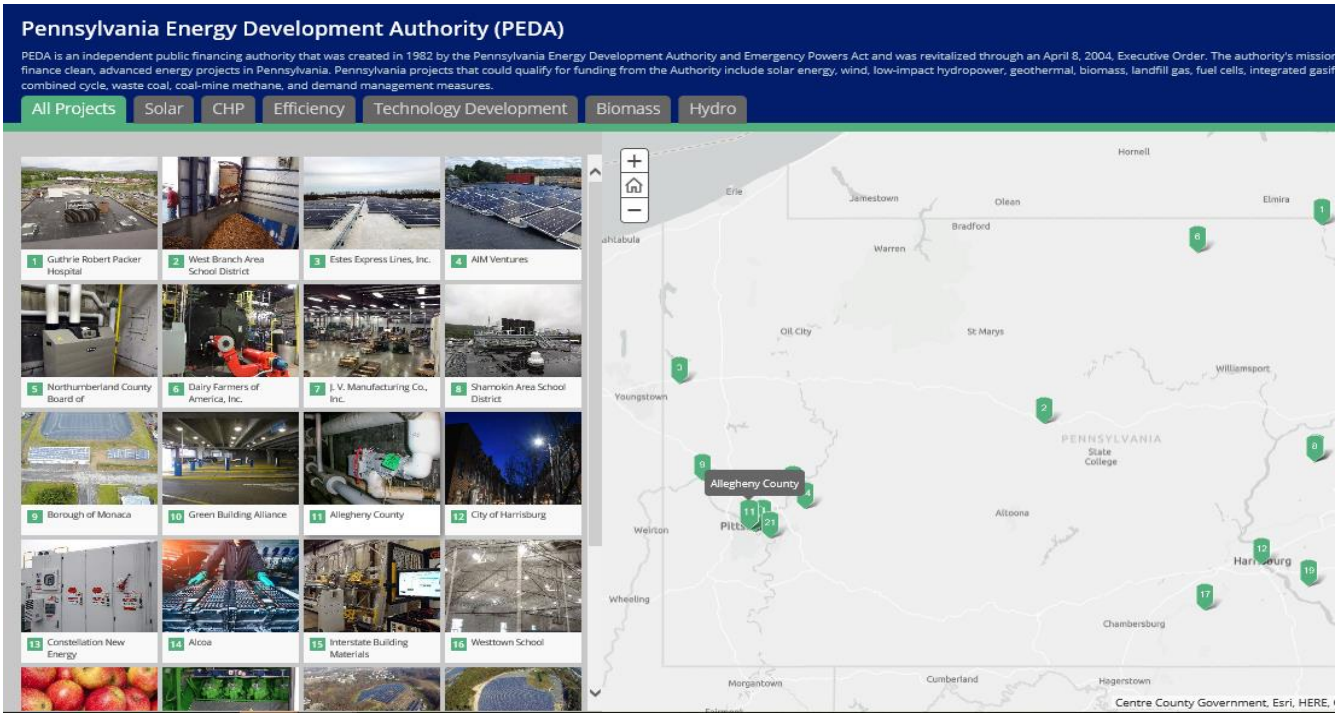
Pennsylvania Energy Development Authority

The Pennsylvania Energy Development Authority (PEDA) was created by the Energy Development Authority and Emergency Powers Act of 1982. Executive Order 2004-5 transferred PEDA to DEP's management. EPO provides an executive director and staffing services to PEDA. PEDA's mission is to "expand the market for Pennsylvania's clean, diverse, indigenous energy resources, and to make contributions to energy conservation, energy efficiency, and development." To carry out its mission, PEDA helps finance energy projects by awarding grants, providing loans and loan guarantees, and by issuing revenue bonds or notes.[43]

The Authority promotes increased energy security by supporting projects that: (1) develop indigenous energy resources including natural gas, waste coal, hydro, wind, solar, biomass, and biogas; (2) diversify energy generation; and (3) deploy distributed generation systems. The criteria for evaluating funding decisions remain flexible, yet projects must broadly align with PEDA's mission and guiding principles.

Recent PEDA projects are displayed as case studies, which are available on the DEP website through a Story Map and an interactive ArcGIS map (see **Figure 5**). These case studies highlight each project's outcomes, including energy improvements and financial savings.

Figure 5. The PEDA Story Map on DEP's Website



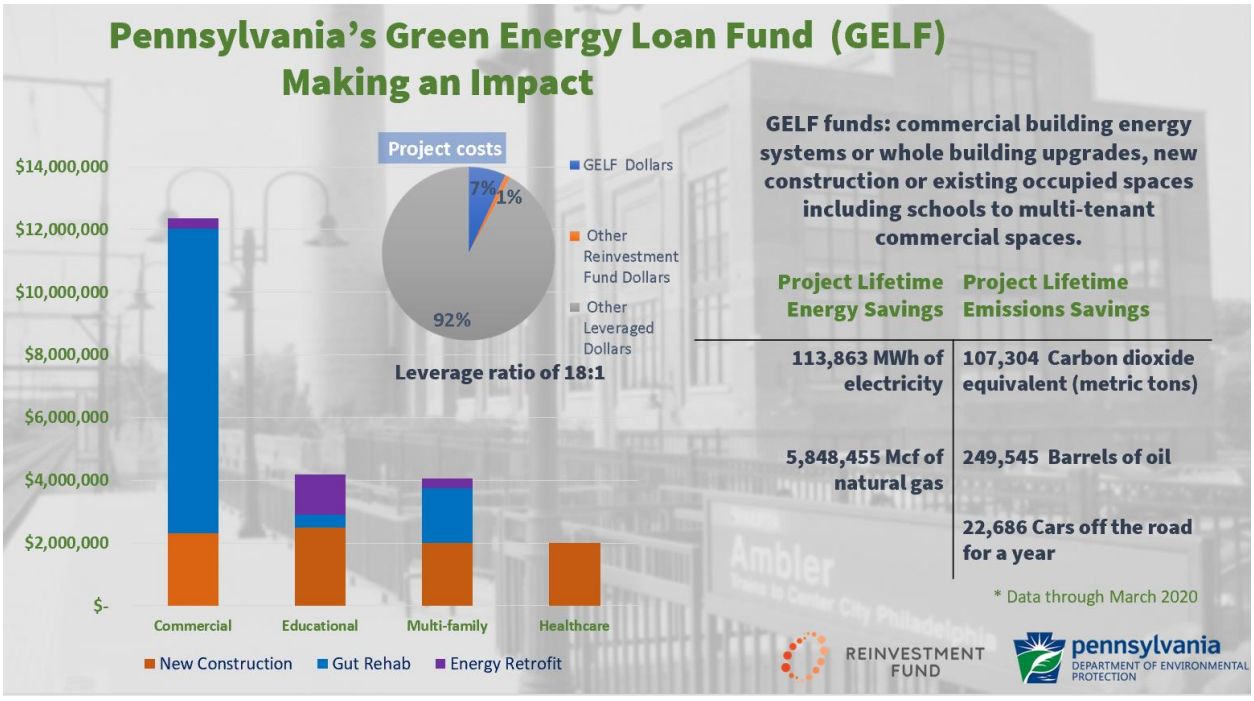
[43] Pennsylvania Department of Environmental Protection. (2019). *Draft - Pennsylvania Energy Development Authority Annual Report 2019*.

Green Energy Loan Fund

The Green Energy Loan Fund (GELF) provides loans for energy conservation and efficiency improvements in commercial, nonprofit, government, residential, and industrial buildings and facilities. Initial funding for this program came from the U.S. DOE SEP during the American Recovery and Reinvestment Act of 2009. Additional SEP funds in later years supplemented this program. Reinvestment Fund, a financial capital and loan venture company, manages GELF in coordination with DEP.[44] The loan program has lent more than $17 million to energy projects across Pennsylvania.[45] Similar to projects funded by PEDA, projects funded by GELF can be viewed in an online, interactive map that includes information on expected or observed energy reduction and cost savings (see

Figure 6. Impacts of Green Energy Loan Funding in Pennsylvania).

Figure 6. Impacts of Green Energy Loan Funding in Pennsylvania



Projects are eligible for GELF funding if they fall into one of four distinct categories:

- Projects involving one or two energy retrofit measures or the replacement of single systems or equipment in an existing, occupied building;
- Projects involving multiple energy retrofit measures in an existing, occupied building;
- Projects involving the gut rehab of an existing building; or
- Projects involving new construction of a building or an addition to a building.

[44] Commonwealth of Pennsylvania. 2014. "Energy Equals Jobs: Pennsylvania State Energy Plan." January. http://www.governor.pa.gov/energy.
[45] Pennsylvania DEP.2020. "The Green Energy Loan Fund (GELF)."

In addition, projects must demonstrate they will result in a 25 percent reduction in energy consumption to be eligible. GELF can finance on-site renewable energy and CHP systems only when they are part of a larger building energy efficiency project. Eligible applicants include building owners, developers, and commercial tenants, but not single-family homeowners.[46]

DEP Industrial Energy Efficiency, Environment & Economics Initiative

The Energy Efficiency, Environment & Economics (E4) initiative builds upon EPO's many years of experience working with and administering programs for energy efficiency within the industrial and large commercial sectors.

EPO focuses its efforts on technical assistance, including contracted on-site energy efficiency assessments, implementation of DOE training programs (such as Energy Efficiency and Renewable Energy Industrial Technologies/Best Practices), ISO 14000 & 50000 outreach, peer-to-peer forums (roundtables), and contracted technical assistance services (PennTAP, ETAC, EMAP). EPO also has experience developing and implementing financial assistance programs for these sectors by working with PEDA, the Department of Community and Economic Development (DCED), the Small Business Ombudsman's Office, and partnering with utilities and PUCs on Act 129 implementation.

Upon reviewing the recommendations posed by both the steering committee and ACEEE, EPO has developed identified four potential initiatives for industrial and commercial energy efficiency projects, listed below in order of priority.

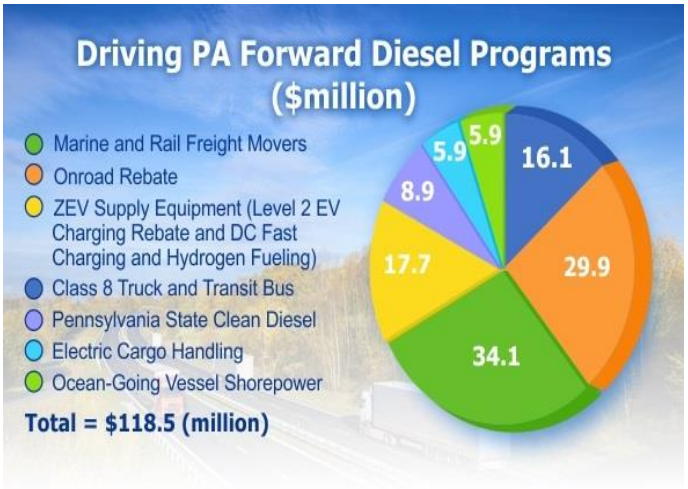
- **Initiative 1: Agricultural and Dairy Sector Energy Efficiency Outreach**: To help identify opportunities for energy efficiency programs and measures in the agriculture sector, DEP conducted an Energy Use Analysis that summarizes potential energy savings and current energy efficiency initiatives in the agriculture sector across the Commonwealth of Pennsylvania. The Energy Use Analysis identified dairy and poultry operations as having the largest energy use and the greatest potential for energy savings through measures like equipment and lighting upgrades.
- **Initiative 2: Workforce Development:** Pennsylvania has made significant progress in the clean energy sector by supporting workforce development and job creation in renewables, energy efficiency, clean vehicles, and grid modernization. Energy efficiency occupations, such as ENERGY STAR and lighting upgrades, continue to be the largest clean energy employer category with almost 69,000 jobs as of 2019.
- **Initiative 3: Expansion of Technical Assistance Workshops:** A variety of organizations, including DEP, Penn State Ag Extension, and USDA, offer technical assistance workshops for agricultural energy efficiency projects and initiatives in Pennsylvania. These programs, targeted to farmers, provide resources such as financial assistance and technical guidance on implementing energy efficiency measures.

[46] Reinvestment Fund. n.d. *Pernnsylvania Green Energy Loan Fund.* Accessed March 11, 2020. https://www.reinvestment.com/GELF/PAGELF.html.

- **Initiative 4: Development of more effective marketing and an energy efficiency resource website:** Maintaining open lines of communication with the agricultural sector can be difficult due to the broad geographic spread of farmers and the seasonality of each subsector. To maximize the impact of program marketing and outreach efforts, EPO is focusing its efforts on developing an effective marketing strategy, including a comprehensive energy efficiency resource website.

Driving PA Forward

The Driving PA Forward initiative includes a suite of grant and rebate programs aimed at improving air quality in Pennsylvania by spurring the transition from older, polluting diesel engines to clean engine technologies powered by electricity, compressed natural gas, propane, or clean diesel.[47] The grant and rebate programs, funded by the Volkswagen emissions standards lawsuit, apply to a number of vehicle and engine classes, including buses, marine vessels, heavy-duty trucks, and trains. These fuel technologies significantly reduce air pollution compared with diesel-powered vehicles. The goal of the governor's initiative is to reduce NO_x (oxides of nitrogen) emissions by as much as 27,700 tons, equivalent to more than 10 percent of Pennsylvania's NO_x emissions from mobile sources in 2014. In total, Driving PA Forward's grant and rebate programs offer $118.5 million in total incentives and savings.[48]



DEP's distribution of program funding to seven eligible categories.

Alternative Fuels Incentive Grants Program

The Alternative Fuels Incentive Grants (AFIG) Program promotes the use of alternative fuels in the Commonwealth of Pennsylvania under the Alternative Fuels Incentive Act of 2004. The AFIG Program houses four specific incentive programs:

- **Alternative Fuel Vehicle Rebate Program:** Pennsylvania residents can receive rebates for the purchase of new and pre-owned plug-in hybrid, plug-in electric, natural gas, propane, and hydrogen fuel cell vehicles.

- **AFIG Grant Program:** The program provides up to $5 million in grants annually to Pennsylvania school districts, local governments, nonprofit entities, and companies for the purchase of alternative fuel vehicles, construction of alternative fuel infrastructure, and implementation of related innovative technology.

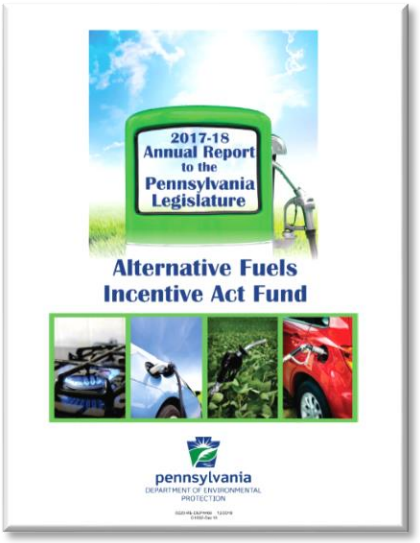
- **AFIG Fixing America's Surface Transportation (FAST) Act Infrastructure Program:** About $1 million in grants is awarded annually for alternative fuel infrastructure projects located along Pennsylvania highway corridors.

[47] Pennsylvania DEP. 2018. *Driving PA Forward.* Accessed January 2020. https://www.dep.pa.gov/Business/Air/Volkswagen/Pages/default.aspx.
[48] Ibid.

- **Alternative Fuels Technical Assistance Program:** The Alternative Fuels Technical Assistance Program provides technical assistance to eligible organizations to develop technically viable and economically sustainable alternative fueling strategies.[49]

Together these programs encourage a statewide shift to alternative fuel use to improve local air quality, reduce CO_2 emissions, and spur development of Pennsylvania's indigenous fuels market.

Since 2013, AFIG program grantees have spent more than $13.4 million in total incremental costs for alternative vehicle purchases, purchased or converted more than 900 alternative fuel vehicles, and saved an estimated 3.2 million gasoline gallon equivalents annually.[50]



2017-18 Report by PA DEP on the Alternative Fuels Incentive Act Fund.

Interagency Program Support

EPO supports a number of energy programs that span multiple government agencies. Some efforts support legislative requirements, such as the AEPS and Act 129. Other efforts aim primarily to assist low-income households in improving their household energy efficiency. Though the level of support for these interagency programs varies, each is integral to DEP's and EPO's mission to advance energy efficiency and clean energy. These programs are listed below.

Alternative Energy Portfolio Standards

The Pennsylvania PUC and DEP partner to implement the AEPS program. The two agencies work cooperatively to monitor the performance of the AEPS and prepare an annual report. This report is provided to the chair and minority chair of both the House and Senate's Environmental Resources and Energy Committees.[51]

Act 129

Act 129 implementation (see information on the program above) is supported by the PUC and DEP. DEP is an official stakeholder in working with the PUC to monitor the performance toward Act 129 energy saving goals.

[49] Pennsylvania Department of Environmental Protection. 2018. "2017-2018 Annual Report to the Pennsylvania Legislature: Alternative Fuels Incentive Act Fund (Report No. 0220-RE-DEP4466)." https://www.dep.pa.gov/Citizens/GrantsLoansRebates/Alternative-Fuels-Incentive-Grant/Pages/default.aspx.
[50] Ibid.
[51] Pennsylvania Department of Environmental Protection. 2017. *2017 Annual Report: Alternative Energy Portfolio Standards Act of 2004.* Harrisonburg, PA: Pennsylvania Public Utility Commission.

Commonwealth Financing Authority

The Commonwealth Financing Authority (CFA), an independent agency of the DCED, provides financial assistance to help deploy renewable energy and energy efficiency projects across Pennsylvania, among other economic development programs. EPO provides the technical review and funding recommendations for projects submitted under four energy programs, including the High-Performance Building Program, the Renewable Energy Program, the Solar Energy Program, and the Alternative and Clean Energy Program. CFA has awarded more than $30.7 million in loans and $252.3 million in grants to 365 renewable energy and HPB projects since inception in 2008.[52]

Weatherization Assistance Program

In 2015 in Pennsylvania, residents that were 50% below the federal poverty guidelines spent 30% of their income on energy; approximately 300,000 homes.[53] DCED administers Pennsylvania's Weatherization Assistance Program (WAP), which helps low-income residents increase the energy efficiency of their homes and lower their energy costs. WAP is funded primarily by the U.S. DOE's federal WAP state grants. This grant program is under DOE's Weatherization and Intergovernmental Programs, which also houses the State Energy Program. Pennsylvania residents with an income at or below 200 percent of the federal poverty guidelines are eligible to receive no-cost, direct weatherization services including home energy audits, identification of air leakages, insulation and ventilation systems, and other services. According to DCED, the average WAP expenditure per household is $7,105.[54] This support is critical as lower-income households must devote significantly higher proportions of their income to energy expenses, and Black, Indigenous, and other populations of persons of color face disproportionately higher rates of disconnection of utilities, which can be life-threatening. WAP programming is informed by a dedicated Policy Advisory Council (PAC) that includes EPO, representatives from local electric utilities, service providers, advocacy groups, and government agencies.

Photo of Pennsylvania Weatherization Instruction Training from the PA Department of Community & Economic Development.

[52] Commonwealth Financing Authority. 2019. "Approved Projects - Energy Programs." https://dced.pa.gov/download/approved-projects-energy-programs/?wpdmdl=83617&refresh=5e6014e61423b1583355110.

[53] Pennsylvania Utility Law Project and The Energy Project, a Program of Opportunity Council. 2017. "Weatherization Leveraged Partnerships Project". https://communityactionpartnership.com/wp-content/uploads/2018/05/Protecting-Utility-Consumers-in-Fast-Changing-Markets-Community-Actions-Role.pdf

[54] Department of Community & Economic Development. 2020. "Weatherization Assistance Program Factsheet." February 13. https://dced.pa.gov/download/weatherization-assistance-program-factsheet/?wpdmdl=93099.

The PAC also includes the Department of Human Services-administered Low-Income Home Energy Assistance Program (LIHEAP), a federally funded program that helps low-income households meet their heating needs, and the Low-Income Usage Reduction Program (LIURP), a statewide program to reduce low-income households' energy use mandated by the Pennsylvania PUC. The Pennsylvania PUC provides information on home energy affordability in Pennsylvania through a regular report, including information on the impacts of LIHEAP grants within the Commonwealth.[55]

Key Emerging and Future Energy and Climate Initiatives

As Pennsylvania continues to advance its energy and climate policies, EPO's role will evolve as needed to support new mandates and initiatives. The most significant emerging efforts are summarized in this section.

Regional Greenhouse Gas Initiative

The Regional Greenhouse Gas Initiative (RGGI) was founded over 15 years ago by a group of Northeastern governors who wanted to move forward on climate change policy. Focusing on the power sector, a 10-state working group chose the power sector as its first focus, and designed a cap and trade CO_2 emissions reduction policy framework. States participate in RGGI by signing a memorandum of understanding; some states have also undergone legislative processes on RGGI participation. Based on Executive Order 2019-07, Pennsylvania is committed to a rulemaking process that would likely result in the Commonwealth participate in the RGGI program. While this rulemaking is not complete, DEP is responsible for the rulemaking process. If RGGI participation becomes reality, EPO could play one or more roles, including the possibility of implementing programs funded by the proceeds of RGGI allowance auctions. Other state energy offices in the region, including those in Maryland and New York, play such roles.

Transportation and Climate Initiative

In December 2018, Pennsylvania joined the Transportation and Climate Initiative (TCI), a coalition of nine states and the District of Columbia that aims to reduce pollution from the transportation sector while making critical investments in low-carbon and electric transportation infrastructure.[56]

Transportation and Climate Initiative website logo.

[55] Pennsylvania PUC. 2019. "Home Energy Affordability for Low-Income Customers in Pennsylvania." http://www.puc.pa.gov/pcdocs/1602386.pdf

[56] Energy Entrepreneurs/Keystone Energy Efficiency Alliance. 2019. "Clean Jobs Pennsylvania 2019." *E2.* https://www.e2.org/reports/clean-jobs-pennsylvania-2019/.

4. Recommendations to Build EPO's Portfolio

This section provides targeted recommendations that could expand the reach of EPO in its effort to accelerate the clean energy transition in Pennsylvania. EPO, along with ICF and Y&A, reviewed more than 100 potential options for inclusion in this plan, ultimately narrowing the list to 11 recommendations for EPO to consider as enhancements to program planning in the next one to three years.

Due to resource and time constraints, not every good or great idea could be included in this plan. However, EPO recognizes the need to remain agile as energy technologies and trends continue to evolve (see the future-focus section below) and as opportunities and challenges arise. Appendix B contains a list of program ideas that were not chosen for detailed recommended actions but are still worthy of consideration in the future.

Recommendations Development Process

A multi-step process was employed to identify, evaluate, and recommend potential clean energy programs and actions.

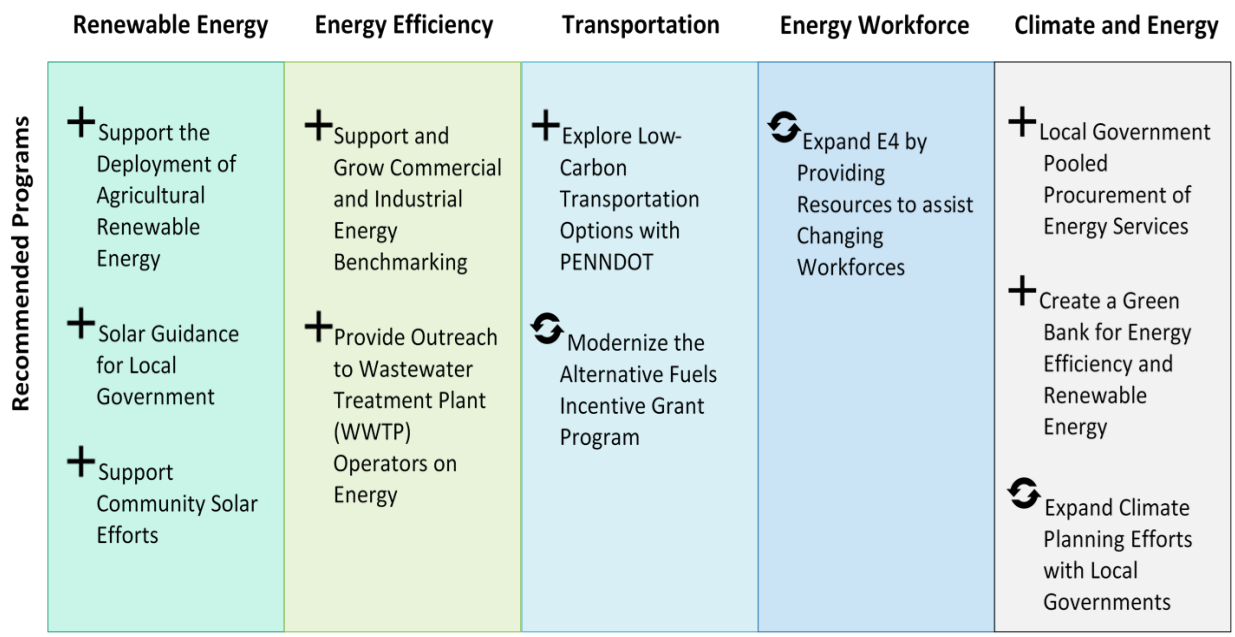
- First, ICF identified and researched existing programs and plans in Pennsylvania and in other states to capture a wide range of possible options.
- ICF and Y&A interviewed EPO staff and internal experts to collect additional programmatic ideas.
- EPO, ICF, and Y&A held two meetings with a workgroup of stakeholders (the Workgroup) to receive feedback on the existing list of programs and plans, identify additional ideas, and refine the list of recommended actions.
- Next, ICF conducted an initial screening to combine or remove actions, and then developed and applied scoring criteria consisting of several factors such as cost-effectiveness, contribution to EPO's long-term goals, and equity, among others.
- Through an iterative evaluation process with ICF, Y&A, and the Workgroup, EPO reduced the initial list considerably. EPO leadership then critically analyzed the remaining list and identified a selected list of new and expanded actions that EPO should prioritize for implementation in the next one to three years.

Recommended Actions: Advancing the Energy Programs Office Within Three Years

The actions summarized in

Figure 7 and described below by sector were selected by EPO leadership as key actions to implement in the next one to three years.

Figure 7. Additional Recommended Programs for EPO



+ Indicates a new program

Indicates expanding a current program

Renewable Energy

ACTION: Support Deployment of Agricultural Renewable Energy

In collaboration with the Pennsylvania Department of Agriculture and Pennsylvania universities, EPO can work to identify and support implementation of high-value renewable energy opportunities for Pennsylvania's farms and agriculture systems. This applies for the agricultural sector to identify ways in which on-site solar installations, biogas digesters, CHP, and electrification can coexist and benefit existing or evolving uses of agriculture. For this action to be successful, coordination with solar developers and farmers is needed to understand how crops, agricultural equipment, and renewable energy opportunities can operate together.

Rationale

- Aligns with EPO's mission to support emissions-free electricity.
- Supports Pennsylvania farmers and helps preserve agricultural land by offering opportunities to invest in a new revenue stream or reduce electricity costs through renewable energy technologies.

EPO's Role

- EPO will coordinate with the Pennsylvania Department of Agriculture, higher education institutions, and farmers to identify opportunities for renewable energy deployment and associated research on agriculture and renewable energy land use. EPO will work with these groups and other organizations to determine how renewable energy, including solar PV systems, could best support Pennsylvania's agricultural and energy goals.

Expected Outcomes

- Create opportunities for farmers and other key players in the agriculture industry to adopt solar PV systems while maintaining farming operations and generating revenue from carbon-free sources.

Partnerships Required

- Pennsylvania farmers, universities, and utility companies.

Applicability

- This action will support agriculture and farmers throughout the Commonwealth.

Evidence for Feasibility

- Penn State Extension has already worked to educate Pennsylvania farmers on utility-scale solar projects to help ensure that the leases they sign make sense for their operations and economics.[57]

[57] PennState Extension. 2019. *Landowner Leasing for Utility Scale Solar Farms.* September 23. Accessed June 3, 2020. https://extension.psu.edu/landowner-leasing-for-utility-scale-solar-farms.

ACTION: Develop More Solar Guidance for Local Governments

To accelerate the use of solar energy across the Commonwealth, EPO could develop solar guidance resources that provide local governments and communities with a wealth of information, tools, and instructions to facilitate local solar energy development. Guidance resources will benefit local officials, installers/providers, and residents, and contain recommendations and information for permitting, planning, zoning, and utility interconnection. Resources that lead to significant growth in solar electricity need to be living documents that are updated and maintained as an online resource for users. EPO guidance could help support a broad set of solar initiatives, including programs such as Solarize and permitting resources for utility-scale solar developers.

Rationale

- Aligns with EPO's mission to support emissions-free electricity.
- Facilitates adoption of solar projects by local governments, providing resources and information on solar-related topics to guide local officials, installers/providers, and residents.

EPO's Role

- EPO will lead the development and maintenance of the online resources by researching and synthesizing available information on solar development into an easily digestible and readily available format.
- Working with partners such as DCED, EPO can publicize and distribute these materials though networks, associations, or events, for example.

Expected Outcomes

- Solar guidance resources will assist local officials, planners, residents, solar developers, and business owners who are interested in pursuing solar development projects in the Commonwealth. Resources and information will be applicable and available to a wide range of public and private stakeholders to plan for and implement solar projects.

Partnerships Required

- Pennsylvania local governments, renewable energy developers, utility companies, businesses, and landowners/homeowners.

Applicability

- Guidance will be applicable throughout Pennsylvania at the local or regional level.

Evidence for Feasibility

- The New York State Solar Guidebook is a successful model for statewide solar guidance. It contains information, tools, and step-by-step instructions to support local governments in managing solar energy development in their communities. The Guidebook's chapters cover a variety of solar energy topics including the permitting process, property taxes, a model solar energy law, and more. EPO can leverage this and other existing materials to develop resources specific to and applicable in Pennsylvania.

ACTION: Support Community Solar Efforts

Community solar refers to local solar facilities shared by multiple community subscribers who receive credit and/or renewable attributes for their share of the power produced.[58] Community solar expands access to solar for all, including in particular low-to-moderate income customers most affected by a lack of access. EPO-developed guidance that identifies and removes the barriers to the deployment of community solar systems in Pennsylvania will further facilitate the use of solar energy in communities across the Commonwealth. This guidance would provide resources to promote existing community solar solutions and prepare Pennsylvania to promote community solar should legislative action expand available options. It would also explore ways to enable community solar shares or similar programs that are currently implementable allowing for broad participation by businesses and residents.

Rationale

- Aligns with EPO's mission to support emissions-free electricity.
- Improves access to and deployment of solar systems and their associated environmental and economic benefits.

EPO's Role

- EPO will provide technical assistance through guidance materials for and interactions with communities interested in pursuing solar projects by removing barriers to deployment and outlining the various methods for community solar.

Expected Outcomes

- EPO's support and guidance will make it easier for communities to successfully implement solar projects, accelerating the use of solar electricity.

Partnerships Required

- Pennsylvania local governments and officials, schools, businesses, houses of worship, and NGOs, and residents.

Applicability

- This effort will be applicable to Pennsylvania towns and cities interested in adopting community solar projects.

Evidence for Feasibility

- NYSERDA's Community Solar program in neighboring New York State has helped contribute to New York's growing solar market, which has leveraged $4 billion in private investment, fueling nearly 12,000 jobs since 2011 and contributing to the decreased cost of solar by nearly 60 percent.[59]

---

[58] Solar Energy Industries Association. SEIA. 2020 https://seia.org/initiatives/community-solar. Accessed June 28, 2020.

[59] New York State Energy Research and Development Authority (NYSERDA). 2019. *NYSERDA Announces Milestone of Two Gigawatts of Solar Capacity Installed in New York, Enough to Power Over 244,000 Homes.* December 17. Accessed Jun 3, 2020. https://www.nyserda.ny.gov/About/Newsroom/2019-Announcements/2019-12-17-NYSERDA-Announces-Milestone-of-Two-Gigawatts-of-Solar-Capacity-Installed-in-New-York.

Energy Efficiency

ACTION: Support and Grow Commercial Building Energy Benchmarking

Energy benchmarking is strongly correlated with energy savings: when building owners and managers see data on their buildings' energy performance, it typically encourages them to find ways to improve energy efficiency and reduce energy costs.

In this recommended action, EPO would promote the benefits of benchmarking energy metrics of facilities to building owners and operators. EPA's ENERGY STAR Portfolio Manager can be used to benchmark performance data, which can in turn educate building owners and empower them to reduce energy use and emissions. Through outreach and education, EPO can encourage and incentivize benchmarking and create a platform for sharing results to promote transparency and drive competition.

In addition to promoting benchmarking, EPO may elect to explore incentivizing municipalities to evaluate the benefits of benchmarking legislation by creating example legislation and developing a public platform for sharing data. EPO can also leverage resources available through ENERGY STAR to promote benchmarking, communicate benefits and actions, and provide sample existing municipal benchmarking orders.

Rationale

- Aligns with EPO's mission to reduce GHG emissions and promote energy conservation.

EPO's Role

- EPO will promote benchmarking to Pennsylvania building owners and coordinate with local governments on existing benchmarking programs to build a platform capable of aggregating benchmarking information.

Expected Outcomes

- Educate building owners on their energy use, drive energy use reductions, and promote transparency among energy use in buildings.

Partnerships Required

- Pennsylvania local governments, businesses, hospitals, universities, and multifamily housing.

Applicability

- This action will be applicable for a wide range of Pennsylvanian governments, nonprofits, and businesses that are interested in energy benchmarking.

Evidence for Feasibility

- Programs that require commercial building energy benchmarking have become popular in U.S. cities and counties. For example, the City of Philadelphia has run a benchmarking program for commercial and multifamily properties for years. Since 2013, these benchmarked buildings have demonstrated a five percent reduction in overall energy use and more than half of all reporting buildings have achieved energy savings.[60]

[60] Philadelphia, City of. 2019. "Philadelphia Building Energy Benchmarking 2019 Report." https://www.phila.gov/media/20191210092812/2019-Citywide-Energy-Benchmarking-Report.pdf.

ACTION: Provide Outreach to Wastewater Treatment Plant Operators on Energy Efficient Operations

Under this action, EPO—in collaboration with the DEP Bureau of Clean Water—would explore providing comprehensive outreach and training to wastewater treatment plant (WWTP) operators to increase energy and operational efficiency, as well as resilience. According to DOE's WWTP Energy Data Management Manual, electricity alone can constitute 25 to 40 percent of a wastewater treatment plant's annual operating budget.[61] A series of training events followed by technical assistance and incentives to implement new technologies could be provided for operators of small to mid-sized municipally owned WWTPs. WWTPs can benefit greatly from online training and collaboration with other operators who can present case studies on programs or projects that have enhanced energy efficiency and resilience through either operational practices or investments.

Rationale

- Aligns with EPO's mission to reduce GHG emissions.

EPO's Role

- EPO will coordinate with the DEP Bureau of Clean Water to create and distribute online trainings and foster collaboration that enhances energy efficiency at plants.

Expected Outcome

- Support WWTP operators by providing them access to resources and industry leaders that can enhance their operations and lower energy use.

Partnerships Required

- Pennsylvania local governments and businesses, Pennsylvania WWTPs and utility companies.

Applicability

- This action will be applicable to WWTP operators throughout the state.

Evidence for Feasibility

- DEP has already assisted dozens of WWTPs and operators in reducing their energy use and improving water quality through enhanced technical assistance evaluations.[62]

[61] U.S. DOE. 2017. "Energy Data Management Manual for the Wastewater Treatment Sector." https://www.energy.gov/sites/prod/files/2018/03/f49/WastewaterTreatmentDataGuide_0122.pdf.

[62] Pennsylvania DEP. 2020. *Helping Facilities Succeed.* Accessed June 3, 2020. https://www.dep.pa.gov/Business/Water/CleanWater/WastewaterOps/Pages/Helping-Facilities-Succeed.aspx.

Transportation

ACTION: Modernize the AFIG program

A number of options exist for EPO to modernize the AFIG program. Opportunities include:

- Explore focused low-income programming across new and existing AFIG programs;
- Develop applicant surveys for AFIG to better evaluate interest in available funds;
- Realign funding to support more diverse set of projects and applicants, potentially offering a variety of funding levels to make EVs more accessible to a wider range of applicants;
- Apply emissions-based measures to project evaluations (not gasoline gallon equivalents) to better align with EPO goals;
- Adjust budgets or evaluation criteria to facilitate more complex and transformational projects to help support a broader set of applicants;
- Tier incentives to either Manufactured Suggested Retail Price (MSRP) or applicant income to provide more equitable incentives; and
- Add non-traditional transportation and electrification options, e.g., scooters, to more broadly promote clean alternative transportation.

Implementing these suggestions and modernizing the underlying statute, Act 178, would help ensure that AFIG remains relevant and effective in future efforts to reduce GHG emissions from traditional fuels.

Rationale

- Facilitates transition to less carbon-intensive fuel options and reduces transportation emissions across the Commonwealth.

EPO's Role

- EPO will investigate potential expansions and modernizations to AFIG, and implement strategies that will have the most impact on the Commonwealth's fuel profile.

Expected Outcome

- By providing a suite of financial incentives (in addition to Drive PA Forward funds) and programs that promote adopting alternative fuels, this action will help Pennsylvanians transition to electric and alternative fuel vehicles.

Partnerships Required

- Pennsylvania vehicle owners, fleet owners, and transit authorities and organizations.

Applicability

- This will be applicable to vehicle and fleet owners in Pennsylvania who are interested in transitioning to alternative fuels and EVs. These programs may also assist other businesses and organizations that require transportation as part of their supply chain.

Evidence for Feasibility

- DEP estimates that by 2023, each mile driven by a new EV would emit 50 percent less GHGs than a new gasoline-powered car, significantly contributing to reducing state carbon emissions.[63]

[63] Pennsyvlania Department of Environmental Protection. (2019). Pennsylvania Electric Vehicle Roadmap.

ACTION: Explore Low-Carbon Transportation Options with PENNDOT

Understanding and then implementing a full range of alternative transportation options, including transportation demand management (TDM) and incremental EV goal setting and incentives options, will require EPO to work with PENNDOT. TDM strategies and policies emphasize the movement of people and goods, rather than motor vehicles, and gives priority to walking, cycling, ride- and bike-sharing, public transit, and telecommuting. Research to further understand how the Pennsylvania EV Roadmap would be realized in the Commonwealth can be coupled with looking at potential additional TDM strategies to accelerate carbon reductions. Following research, EPO could help implement a variety of TDM applications and EV policies such as bicycle- and pedestrian-friendly street design policies by collaborating with PENNDOT, municipalities, metropolitan planning organizations, and large employers.

Rationale

- This action aligns with EPO's mission to reduce GHG emissions.
- This action also aligns with the Pennsylvania EV Roadmap.

EPO's role

- EPO will work closely with PENNDOT to perform a study and provide recommendations for next steps.

Expected Outcome

- This will help EPO and PENNDOT understand how TDM and vehicle electrification contribute to meeting Pennsylvania's climate goals.

Partnerships Required

- PENNDOT, Pennsylvania local governments, Pennsylvania transportation agencies, Metropolitan planning organizations, and large employers.

Applicability

- This will be most applicable in Pennsylvania's large cities and metro areas.

Evidence for Feasibility

- Through the Northeast Electric Vehicle Network, Northeastern states, including Pennsylvania, have laid the groundwork for the region to lead the way in the deployment of EVs, capturing the many economic, employment, and environmental benefits associated with EVs.[64]

[64] Transportation & Climate Initiative. n.d. The Northeast Electric Vehicle Network will enable travelers to drive their plug-in cars and trucks from northern New England to D.C. and everywhere in between. Accessed June 3, 2020. https://www.transportationandclimate.org/node/30.

Energy Workforce

ACTION: Expand the E4 Initiative by Providing Resources for Changing Workforces

By assessing and updating its existing industrial workforce and development programs for large industries under the E4 umbrella, EPO can work with partners, including DCED, to develop new workforce training programs that focus on a diverse workforce—inclusive of a variety of ages, races and ethnicities, and abilities—and that benefit local residents and businesses, including the Fairness for Workers and Communities Programs, to be implemented in coordination with large fossil-based energy industries.

To be effective, this effort needs to use tactics such as creating expanded online energy efficiency training programs, social media, case studies, and video trainings. EPO can work with stakeholders to target industries with high energy use, businesses within vulnerable communities heavily affected by climate change and COVID-19, and energy-related industries that may be most affected by a clean energy transition to create economic opportunities. To better understand the effects of this action in the immediate future, EPO can work with partners to assess the energy labor force affected by COVID-19 or energy transitions and partner to develop workforce programs.

Rationale

- Industrial energy use is a significant contributor to Pennsylvania's GHG emissions.
- Clean energy solutions have been proven to create family sustaining jobs.
- Environmental justice, a diverse workforce, and an equitable transition to a clean energy economy are paramount to Pennsylvania's future.

EPO's Role

- EPO will create workforce training development resources as part of E4.
- EPO will evaluate industries to determine which are the best to target.
- EPO will work closely with other state agencies and Pennsylvania-based colleges and universities to develop workforce training programs.

Expected Outcome

- This program will develop a workforce training program and associated resources targeted to the clean energy economy.

Partnerships Required

- Pennsylvania businesses, universities, workers, and residents.

Applicability

- This will be applicable to select Pennsylvanian industries and diverse training programs.

Evidence for Feasibility

- PEA's workforce-focused planning has led to job growth and new investments in energy. In 2018, over $48 million of new projects were completed, creating nearly 1,000 jobs.[65]

[65] Philadelphia Energy Authority. 2018. "The Philadelphia Energy Campaign." http://phlcouncil.com/wp-content/uploads/2019/08/PEA-AR-final_7_17_Web-1.pdf.

Climate and Energy

ACTION: Expand Climate Planning Efforts with Local Governments

Building on its successful work with ICLEI, EPO, in collaboration with local governments, has the opportunity to develop a comprehensive CAP Toolkit for local governments. The toolkit would include best practices, drawing from the Pennsylvania CAP and recent experiences working with municipalities to develop plans that align with the statewide plan, to help local governments do their part in supporting the Commonwealth's climate goals. The toolkit would be an online collection of tools that could include an inventory checklist, templates for programs and projects, and techniques for coordinating with local student populations. Each new local climate action and adaptation plans will amplify EPO's impact.

Rationale

- This action aligns with EPO's mission to help local government partners to mitigate GHG emissions and adapt to climate change.
- It will also help EPO and the Commonwealth accelerate the path toward achieving its GHG reduction and adaptation goals.

EPO's Role

- EPO will work closely with local governments to build and grow the impact of their climate action plans and facilitate cooperation between local and state government.

Expected Outcome

- Increase emissions-free energy in the state.
- Reduce GHG emissions and pollution.
- Improve cooperation and collaboration between local governments and EPO.
- Prepare the Commonwealth to adapt to climate change.

Partnerships Required

- Pennsylvania local governments and residents.

Applicability

- Local governments that are interested in collaborating with EPO and learning best practices from one another.

Evidence for Feasibility

- The City of Lancaster completed its climate action plan in 2019. The plan is focused on reducing the climate impact of government operations by 80 percent by 2025 and establishing a goal to be fully carbon-neutral by 2050.[66]

[66] Lancaster Online. 2019. *Lancaster Enacts Municipal Climate Plan.* September 27. Accessed June 3, 2020. http://phlcouncil.com/wp-content/uploads/2019/08/PEA-AR-final_7_17_Web-1.pdf.

ACTION: Help Pool Local Government Procurement of Energy Services

EPO should work with local governments to identify and establish pooled procurement programs for energy services such as renewable energy Power Purchase Agreements (PPAs), LED streetlighting, or energy efficiency services. By pooling their collective resources, local governments can achieve more together than they could do alone, and EPO can help facilitate this collaboration. Such joint programs can also foster regional collaboration to provide greater consistency and coverage of energy services.

Rationale

- Aligns with EPO's missions to support emissions-free electricity.

EPO's Role

- EPO will work closely with local governments to facilitate cooperation among governments and to identify potential programs.
- EPO will explore serving as a convener and primary point of contact for procurement advice.

Expected Outcome

- Increase emissions-free energy and energy efficiency in the Commonwealth.
- Reduce GHG emissions and pollution.
- Improve cooperation and collaboration among local governments.

Partnerships Required

- Pennsylvania local governments, renewable energy developers, and businesses.

Applicability

- Local governments that are interested in collaborating with one another to secure renewable energy opportunities and energy efficiency services.

Evidence for Feasibility

- EPO previously worked with the Delaware Valley Regional Planning Commission to enhance a successful program and tools that can be used as a model for LED streetlighting, and is expanding it to include other energy efficiency opportunities for municipalities.

ACTION: Create a Green Bank for Energy Efficiency and Renewable Energy

Recognizing the success of green banks in other states, EPO can learn from these experiences and use its authority and capabilities as both State Energy Office and PEDA to create a green bank aimed at expanding energy efficiency and renewable energy for Pennsylvania local governments, nonprofits, and businesses. This green bank would work in connection with existing clean energy financing programs, e.g., SEFs, private lending, and C-PACE. In addition to funding, the green bank should create an online clearinghouse for clean energy resources (financial, technical, and training).

Rationale

- Aligns with EPO's missions to support emissions-free electricity and increase energy efficiency.
- Creates a centralized, state-branded assistance program to support all clean energy policies by ensuring that funded projects advance progress to achieve multiple long-term goals.

EPO's Role

- EPO will coordinate with stakeholders to establish the green bank and work with local business and governments to acquire funds.

Expected Outcome

- Establish a new, flexible financial mechanism for supporting gaps in existing energy efficiency and renewable projects at the local level.

Partnerships Required

- PEDA, Pennsylvania local governments, renewable energy developers, and Pennsylvania businesses.

Applicability

- This action will be applicable for a wide range of Pennsylvanian governments, nonprofits, and businesses that are interested in receiving funding for energy efficiency and renewable energy programs.

Evidence for Feasibility

- Connecticut's Green Bank supports investments in clean energy projects with a total project cost of over $350 million in aggregate, based on overall investments to date of more than $40 million. These investments have driven estimated gross lifetime GHG emissions reductions of approximately 1.2 million metric tons.[67]

[67] Connecticut's Green Bank. 2019. *"FY19 Annual Report"* https://ctgreenbank.com/wp-content/uploads/2019/12/AR-FY19-layout-single-pages-1.pdf

5. Adapting for the Future and Ensuring Success

The future is inherently unpredictable and unforeseen events that divert resources or require changes are likely to affect even the most comprehensive and thoughtful plans. However, EPO together with the workgroup has identified methods and considerations to review, anticipate, prepare for, and respond to developments that could potentially affect EPOs products and service. The workgroup identified practices for EPO to follow when moving ahead with this CEP Plan. To that end, this section describes some methods EPO will implement in conjunction with the recommended actions outlined above. It also outlines the types of technologies, policies, and recommendations that tomorrow's Pennsylvania EPO should look to as further energy program development opportunities.

Box 6: Future Planning Example: Energy Horizons Report

In 2017, the Team Pennsylvania Foundation convened a group of Pennsylvania stakeholders, including EPO, to forecast the evolution of the Commonwealth's energy landscape into the 2040s. The resulting report, Pennsylvania Energy Horizons, details two potential scenarios: Rivers and Roots. These scenarios consider potential shifts in the Commonwealth of Pennsylvania's political and economic landscapes, demographics, and civic engagement, as well as new innovations in technologies and business models. These scenarios showcase two possible boundary outcomes: either turning to hyper-localization that favors reliance on community-led investment and innovation in energy solutions, or continuing to embrace and deepen centralized energy that may favor significant and ongoing fossil energy use.

The Future of Energy in Pennsylvania

Innovations in energy systems are constant, and EPO can best serve Pennsylvania's residents, businesses, and government by evolving its programming to align with changing energy systems. Tracking changes in energy systems allow EPO's programs to be more agile and adaptable. While most of the content in the CEP Plan focuses on the next one to three years, this section looks beyond that time horizon to factors and technologies that are worthy of consideration when following on the recommendations listed above to ensure all options remain on the table to achieve a clean energy transition. The information presented here aims to anticipate the answers to key questions about Pennsylvania's energy future by reviewing technology and related market and policy trends that could influence future decisions, identifying technology and policies to track, and outlining energy systems risks and resilience trends.

To anticipate and take advantage of potential future changes, EPO will need to pay attention to trends in energy system technology, services, and policy. Innovation in the information technology sector has significantly changed how Pennsylvanians live, work, and play. The same will occur in energy and climate technology as more funding for innovation and research is put in place. Some energy systems technology innovations have already accelerated, with new clean energy products and services being made available such as grid-enabled building technologies or energy storage. Each new technology and service has the potential to change EPO's program thrust areas by altering program effectiveness or uptake.

While technology change can be anticipated, some disruptions to energy systems are best avoided by building resilience. Nationally, natural disasters have demonstrated the importance of building resilient energy systems. For example, Hurricane Sandy led to long-term power outages in New Jersey and severely damaged New York City's infrastructure. In 2018, Hurricane Maria devastated Puerto Rico causing a black sky[68] event, and California wildfires in the summer of 2019 required grid operators to institute rolling brownouts in the San Francisco Bay area. Most recently, the COVID-19 pandemic has shown the importance of resilience for healthcare and other critical systems during times of crisis, and helped identify essential facilities and workers.

Box 7: Of-the-Moment Issues for EPO Tracking

- Workforce programs related to COVID-19 and disaster recovery.
- Methods to support low-income individuals and their service providers. An increased focus on equity and energy affordability in programs generally.
- RGGI impacts to energy systems and how revenue might be used to support EPO programs.
- Opportunities to leverage other funding sources for EPO programs such as DOE grants and programs that benefit Pennsylvania.

These disasters show that resilience must be integral to all critical systems, and that energy systems in particular must be made resilient. Implementing lessons learned from past natural disasters and the current pandemic, EPO can better identify critical facilities and adjust programs to better target and increase their resilience. The Resilience of Energy Systems section below outlines areas where EPO is helping prepare Pennsylvania and highlights programs it should consider in the future to further prepare for the disasters ahead.

In addition to anticipating technology changes and developing resilience, EPO should track best practices and analyze successful programs in other states. Future programs should review these case studies and adopt appropriate best practices to ensure past lessons inform future actions.

How EPO Can Ensure Success

While there is no certainty on what the future will bring, there are a number of techniques EPO can employ to ensure that programs are as effective as possible in the face of uncertainty. For example:

- Striving to identify and recognize the potential for technology to both solve problems and disrupt normal business practices in the energy marketplace.
- Using the tools at its disposal to anticipate needs and implement adjustments to programs (see the Enabling Technologies section below for a discussion on the technologies and services with the potential to have the largest effect, either by broad implementation or via transformational breakthroughs in technology).
- Dedicating deliberate staff time and efforts to focus planning and build relationships with a broad set of stakeholders of differing perspectives.

[68] Per the Electric Infrastructure Security Council, "black sky hazard" is defined as is a catastrophic event that severely disrupts the normal functioning of critical infrastructures in multiple regions for long durations. https://www.eiscouncil.org/Blacksky.aspx. Accessed on June 17, 2020.

- Integrating a future adaptation concept into program design, by creating programs with the flexibility to adapt and change to evolving new technologies, energy markets, and resilience considerations.
- Maintaining streamlined third-party support for technical assistance to allow staff and program managers to quickly understand energy system changes and adjust programs accordingly.
- Seeking regular input from stakeholders to keep program implementers up to date on what is happening around the Commonwealth and how technology, program, and project implementation is changing.

Box 8: Lessons from EPO Workgroup

A consistent theme in feedback from the EPO Workgroup is that EPO should seek many avenues to continue to gather feedback, including open houses, topic specific forums, and additional informal workgroups on EPO planning processes. Leaders from throughout the Commonwealth are best suited to identify changes, and some state energy offices hold annual symposiums or conferences to gather energy and climate leaders to discuss implementation models and technology changes relevant to their work.

Implementing Guiding Principles and Best Practices

Through internal DEP consultations, feedback from the Workgroup, and evaluation of potential programs and plans, EPO identified guiding principles and best practices that can be integrated into future planning and programming efforts. These principles and practices do not relate to one specific action or set of recommended actions, but are concepts that are key to the success of EPO's work. These practices and principles include:

- Collaborate with other agencies and organizations
- Consider effects on equity, access, and inclusion and the needs of and effects on vulnerable communities
- Ensure effective marketing of programs and results
- Conduct program impact assessments
- Create and use a program tracker
- Integrate energy assurance and resilience in planning efforts

EPO is already applying many of these principles and practices, but ensuring that they are expanded and integrated broadly in future programs can help EPO improve its program planning and better achieve its goals. These are described further below.

Collaborate with Other Agencies and Organizations

Collaboration is often synergistic, as it pools resources and information to achieve more than agencies or organizations could accomplish individually. EPO programs focus on energy, but they often overlap with the work of other agencies and local governments. For example, EPO's work to foster EV adoption affects the work of the Department of Transportation. To ensure EPO's work is not counterproductive to or duplicative of the work of other agencies, EPO should actively seek to collaborate with other agencies to ensure their programs are mutually supportive and coordinated. Collaboration begins with coordination in the planning stages

of any program so both agencies understand the goals and scope of current and planned activities. True collaboration is a two-way street, and EPO should encourage other agencies to proactively reach out to EPO to support those agencies' energy-related programs. EPO has successfully collaborated on many past projects, such as working with the DCED's CFA to distribute financial assistance for clean energy and energy efficiency projects. EPO should continue to increase its collaborative efforts in future program planning with other agencies. Furthermore, EPO should seek collaboration with local governments and nongovernmental organizations as well.

Consider Equity, Access, and Inclusion and the Needs of and Effects on Vulnerable Populations

The effects of climate change are growing more pronounced and increasingly threaten the well-being of society; however, the burdens of climate change are not equally distributed. Communities that are especially vulnerable or underrepresented often suffer the most, and climate change impacts can exacerbate existing social inequalities. A growing demand to address the intersection of climate change and social inequality has led to greater consideration for mitigating the negative effects on low-income and vulnerable communities and making more concerted efforts to address their needs. Access to clean, affordable energy is a key strategy to address both concerns. Therefore, EPO should work with the DEP Environmental Justice Office and other agencies to create programs to benefit vulnerable communities and consider the needs and concerns of these communities in all program planning activities to ensure Pennsylvanians equitably benefit from its programs.

Ensure Effective Marketing of Programs and Results

The best-designed program will have little to no impact if no one is aware of it. Communicating the launch of a new program and its intended results, along with providing details on how to enroll, are key components of raising the awareness of stakeholders and potential participants. To ensure that target audiences of programs are aware of the program and its associated benefits, EPO should develop a marketing strategy and materials for its programs that are tailored to the intended audiences. The marketing effort should be focused, specific, and easily understood. EPO should work with the DEP Environmental Justice Program and other agencies to improve outreach specifically to vulnerable communities. Additionally, once a program is underway, sharing the interim results, case studies, or success stories can help promote the program and garner greater participation.

Conduct Program Impact Assessments

When a plan or program is completed, EPO has had little ability to evaluate whether it had an impact or achieved its stated goals. Going beyond periodic planning, EPO and partners should begin to measure program results and incorporate the findings into updated or new plans and programs. For example, the Pennsylvania CAP is updated every three years, and future iterations should review the results of the previous Plan to inform the update. In addition to assessing programs after the fact, EPO should continue to periodically assess progress over the program duration to ensure projects stay on track and to permit mid-course corrections.

Create and Use a Program Tracker

EPO works on many projects concurrently, but its current project tracking approach is very limited. Having a centralized and up-to-date program tracker will help EPO better understand the status of its projects and provide a comprehensive overview of ongoing efforts. Technologies and systems are available to help EPO improve tracking of its programs. A program tracker could also be tied to individual program implementation plans and impact assessments: as programs enter a new phase or as results are collected, they could be fed into the tracker. A tracker would help EPO better distribute resources, recognize programming synergies, and take corrective or proactive action so that programs achieve their intended goals.

Integrate Energy Assurance and Resilience in Planning Efforts

The goal of energy assurance planning is to provide a robust and reliable energy supply that is also resilient to natural and manmade hazards. Owners and operators are responsible for their energy infrastructures and delivery systems, and state and local officials are responsible for working with energy providers and stakeholders, government agencies, businesses, and related organizations to reduce consequences, ensure public safety, and provide for rapid recovery.[69] EPO is the primary entity responsible for energy assurance in the Commonwealth, and should continue to actively consider how to bolster assurance and resilience in planning efforts, and how to effectively communicate the importance of assurance and resilience with partners.

Measurement and Evaluation

To ensure that programs are on track and are delivering the expected results, it is vital that M&E procedures are implemented as part of any program. There are a number of tools and strategies that can be used to track progress against program goals. Two of the best practices outlined above—conducting program impact assessments and creating and using a program tracker—are excellent examples of M&E tools and strategies. EPO should implement these and other M&E strategies so that it can quickly assess the status of any ongoing program. Evaluating collected data as they are received allows program managers to understand what is going well and to make mid-course corrections if program goals are not being achieved. Ideally, program M&E would continue after a program ends to track the long-term impacts of a program; this will lead to a more robust dataset and can inform subsequent programming efforts or updates to long-term plans such as the CAP.

Box 12: Example Metrics EPO Could Track to Measure Progress

- Funds invested in clean energy programs.
- Number of business or people trained.
- Website hits or downloads on specific resources or training materials.
- Number of new solar projects implemented across the state, or total installed solar capacity.
- Number of new renewable energy (non-solar) projects implemented across the state, or total potential production capacity.
- Number of communities directly benefitting from EPO-funded programs, and varied characteristics of those communities to ensure equity.
- Regular touch points with stakeholders to keep abreast of trends (e.g., roundtables).

[69] National Association of State Energy Officials (NASEO). 2020. *About NASEO.* Accessed June 3, 2020. https://www.naseo.org/about-naseo.

Enabling Technologies

A common thread across EPO programs is the role they can play in advancing new technologies. Today's programs, in some cases, are designed to enable what were yesterday's emerging technologies. EPO programs provide broad technical support, funding for pilot projects, and incentives for projects that help reduce energy use and associated pollution. As new clean energy options emerge and develop, EPO will need to continue to work with organizations such as NASEO, STEAB, DOE National Labs, and the many Pennsylvania energy-focused research institutions to lead the Commonwealth forward by keeping tabs on emerging technologies, providing supporting programs, and leveraging partner programs that enable a mix of demonstration pilot projects and scalable implementation models.

Based on feedback from the Workgroup and stakeholders, EPO outlines several key technology and service model categories that could affect current and future programs. The identified technologies provide potential opportunities to advance short- and long-term goals for EPO and, in some cases, work together synergistically to produce more impactful results.

Carbon Capture, Utilization, and Sequestration (CCUS)

Description: CCUS technology captures CO_2 emissions from fossil fuel combustion and prevents CO_2 from entering the atmosphere. Captured CO_2 can be transported underground via pipeline to be stored in geologic rock formations or reused in industrial processes and products. CO_2 can also be captured and stored through natural processes in soils and biomass.

Why it matters for Pennsylvania: Pennsylvania electricity generators, fossil fuel producers and processors, and high-emitting industries could incorporate CCUS technology as a solution for achieving statewide GHG emission reduction goals while preserving a viable fossil fuel-based energy industry. CCUS is expected to play a critical role in achieving GHG reduction goals, but to date CCUS technologies have had low market penetration due to high costs, lack of policy support, and perceived risks.

Box 9: Sequestering CO2 in Natural and Working Lands

In addition to geologic sequestration, techniques could also be employed in Pennsylvania that sequester CO_2 in soils and biomass through forest and agriculture applications. Considerable research is focused on this opportunity within Pennsylvania and throughout the country through agencies and organizations such as the Pennsylvania DCNR, Penn State University, the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA), and the U.S. Climate Alliance (USCA). Pennsylvania's more than 16 million acres of forest land could be a key tool for reducing carbon emissions. Recent research by the Pennsylvania DCNR has shown that of the 2.2 million acres of state forests in Pennsylvania, an average acre stores 250 tons of carbon.

Offshore Wind

Description: Offshore wind involves the installation of fixed-foundation wind turbines in bodies of water to harvest high wind speeds to generate electricity. Oceans, lakes, and shallow coastal areas are typical locations for offshore wind farms. Floating wind turbines for use in deeper waters are in the early stages of development. Offshore wind is a relatively mature renewable energy technology with strong market growth projected over the next several decades. Though project development costs remain high, offshore wind has the potential to become one of the most cost-competitive sources of electricity, given favorable market conditions and government policies. Long-term planning will require attention to sustainable supply chains and maritime coordination strategies.

Why it matters for Pennsylvania: The areas bordering Lake Erie have some of the highest wind speeds in the United States; this has prompted Erie County to join the Lake Erie Energy Development Corporation (LEEDCo) to advance offshore wind development in the region. Pennsylvanian ports are well positioned to serve as hubs for assembly and manufacturing to support the considerable offshore wind development plans and policies that are being adopted along the eastern seaboard. Offshore wind development has the potential to create hundreds of local jobs, generate additional state revenue, maintain cheap electricity prices for customers, and lower electric power sector emissions, and is especially important for Pennsylvania as part of keeping options available for the clean energy transition as a large energy producing and consuming state. Box 10 outlines opportunities available to Pennsylvania as a partner in offshore wind development.[70]

Box 10: Offshore Wind in Pennsylvania's neighboring states

Pennsylvania's offshore wind resources are limited to Lake Erie; however, neighboring states have robust policies in place aimed at developing offshore wind resources:

- Maryland passed an offshore wind mandate of 1,200 MW by 2030
- New Jersey passed legislation to raise its offshore wind target from 3,500 MW by 2030
- New York passed legislation to develop 9,000 MW of offshore wind by 2035

Pennsylvania can support this development as a key provider of materials, labor, and manufacturing to support regional offshore wind.

[70] American Wind Energy Association (AWEA 2020. Offshore Factsheet. Accessed June 16, 2020. https://www.awea.org/Awea/media/Resources/Fact%20Sheets/Offshore-Fact-Sheet.pdf

Digital Technologies

Description: Digital technologies, enabled through the Internet of Things (IoT) and high-speed networks such as 5G, are disrupting traditional business models and standard industry processes. IoT allows everyday objects to connect to the internet and transmit data (e.g., smart thermostats); widespread application of the IoT necessitates a high-speed 5G network to exchange data, implement updates, and track performance. The potential costs, barriers to implementation, and impacts of digital technologies vary greatly based on the scale and scope of application, yet they will undoubtedly reshape the energy sector over next decade.

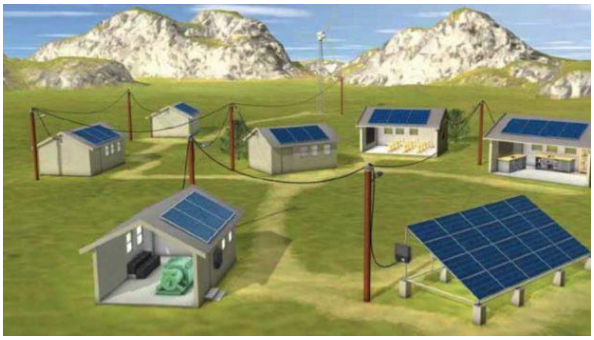
The energy sector has historically been an early adopter of digital solutions and has already seen digital technologies penetrate and disrupt energy system supply and demand, from smart metering to distributed grid optimization. Energy end-use sectors such as transport systems, buildings, and industrial plants have already adopted some disruptive technologies, including autonomous cars, smart home systems, and 3D printing processes. Energy companies and utilities are expected to increasingly invest in disruptive technologies to revolutionize remote automation capabilities, real-time automation, and hazard and maintenance sensing ability.

Box 11. Drivers for Technology Change

Increased deployment and use of a technology is not always due to technological breakthroughs: targeted education and key changes in regulations or rules that adjust market conditions can also stimulate the installation or economic viability of certain technologies.

Why it matters for Pennsylvania: Disruptive digital technologies have the potential to significantly enhance Pennsylvania's energy sector by improving efficiency and optimization. Integrating 5G and the IoT into energy generation and transmission can potentially reduce operation costs, lessen negative environmental impacts and GHG emissions, and increase transparency for industry stakeholders. Energy demand will also shift due to increased connectivity, and the Commonwealth must improve its capability to respond and adapt to the changing energy landscape.

Large Distributed Energy Resources: Microgrids, CHP, District Energy



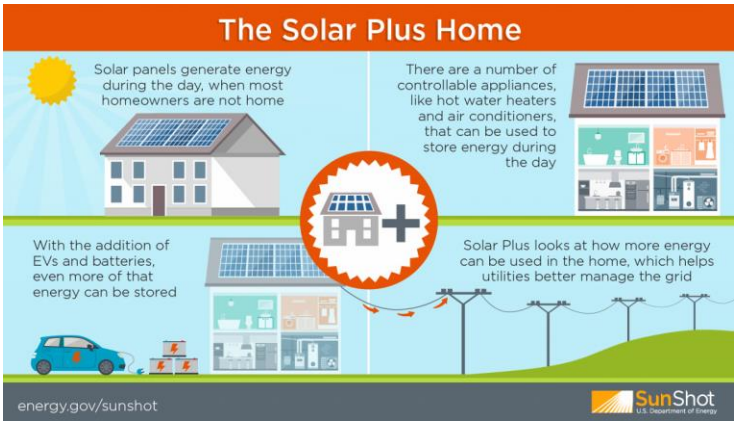
Description: There is significant potential to develop new applications for large distributed energy systems to power critical facilities or to serve as hubs for resilience in energy emergencies. Examples include:

- *Microgrids* are groups of interconnected electricity loads and distributed energy resources that work together to provide and use energy services. Microgrids have increasingly been deployed to create reliable electricity for districts or campuses in lieu of grid resources.
- *CHP systems* produce electricity and thermal energy (i.e., heating and cooling) from a single energy source, and are located near consumption points as opposed to a centralized power plant.
- *District energy systems* provide heating and cooling needs from a centralized plant to a connected network of geographically grouped buildings. District energy systems are often connected to CHP plants. Pennsylvania has many CHP and district energy systems that serve campuses or city sections.

Why it matters for Pennsylvania: Pennsylvania already has a number of microgrids and district energy systems, some of which are powered by CHP systems. Existing and new large distributed energy resources can add resilience to critical infrastructure while using cleaner, efficient, and lower-carbon technologies such as Pennsylvania's abundant indigenous natural gas.

Small Distributed Energy Resources: Solar, Battery Energy Storage, Micro CHP, Demand Response

Description: A distributed energy resource (DER) is a power generation system that operates on a localized level and is connected to a larger power grid at the distribution level. DER systems feed the energy needs of a specific set of end users, and can feed back to the grid as part of helping achieve the AEPS or balancing the grid, for example. DERs include many forms of technologies and energy sources such as solar, gas, electric water heaters, or micro CHP.



Solar plus storage systems include a solar PV system that is backed up and charged by a battery to allow for greater predictability and continuity of service across the grid and in times of shortages. Batteries can also be paired with other forms of renewable energy, including wind and other variable energy resources. Battery technology costs have dropped significantly in recent years, and battery energy storage systems such as solar plus will also continue to gain traction as new technologies facilitate aggregation and grid optimization in wholesale markets.

The declining cost of solar generation has already accelerated widespread adoption and utilities have demonstrated a strong interest in integrating solar into their systems due to reduced costs, maturing technologies, and innovative financing models. The Solar Energy Industries Association anticipates that total installed PV capacity will more than double in the next five years.[71]

Why it matters for Pennsylvania: DERs allow for increased resilience and safeguards against shocks to the system (e.g., extreme weather events) while providing a zero-emission alternative to traditional energy sources.

Alternative Fuels: Biogas, RNG, and Hydrogen

Description: Alternative fuels and bio-based fuels are renewable fuel substitutes for traditional natural gas or transportation fuels such as gasoline and diesel fuel. Alternative fuels have the potential to move transportation fuels closer to net zero carbon. Alternative fuels include:

- *Biogas*, which is generated during the decomposition of any organic waste, including food, agricultural waste, or byproducts from wastewater treatment facilities. Biogas can be collected and refined to produce pipeline-quality renewable natural gas (RNG) and used as an alternative to natural gas.
- *Hydrogen fuel*, which emits zero emissions when consumed and can be produced from a variety of resources, including natural gas and biomass. Hydrogen can be produced via electrolysis using electricity. The use of a zero-carbon electricity source, such as renewables or nuclear energy, will thus create zero-carbon hydrogen fuel.

Nationwide, natural gas utilities have outlined strategies to lower emissions that include the use of RNG and biogas, which can serve as lower-carbon substitutes for natural gas.

Why it matters for Pennsylvania: Continued investment in alternative fuels is expected due to their cost effectiveness and versatility. RNG is compatible with existing natural gas infrastructure. Utilities and transportation fleets can easily integrate biomass, RNG, and hydrogen into operations with little capital cost while reducing GHG emissions. The potential to create, store, and distribute hydrogen in Pennsylvania using excess electricity generated from nuclear, in-state solar, and planned offshore wind projects could be a unique and important opportunity.

[71] Solar Energy Industries Association. 2020. *Solar Industry Research Data.* Accessed June 3, 2020. https://www.seia.org/solar-industry-research-data.

Transportation Innovations

Description: Innovative technologies such as electric vehicles (EVs), alternative fuels, and digital planning and transit systems are driving significant changes in the transportation sector. EVs are powered by electricity rather than traditional transportation fuels such as gasoline or diesel fuel. EV bus deployment is expanding due to lower costs, improved battery ranges, and continually evolving technologies. Transit agencies across the United States are adopting EV and CNG fleets while lowering operational and fuel costs and contributing to emission reduction targets.

Utilities will play a key role in transportation electrification in the coming years and will continue to partner with the transportation sector to adapt to changing demands. Models predict that EVs will account for up to 15 percent of national electricity demand by 2050.[72]

Why it matters for Pennsylvania: As the electric power sector decarbonizes, the shift toward electrifying the transportation sector will result in reduced GHG emissions and cleaner air.

Focus on Energy Resilience

Statewide energy problems can be due, in part, to complications stemming from the failure of large integrated energy systems, but can be avoided by enhanced resilience planning and programs. Based on feedback from the Workgroup and stakeholders, EPO identified several areas where a lack of resilience in energy systems could affect current and future programs. The "Energy Assurance and Resilience" discussion above in Section 2 outlined the various agency roles, but more work is needed to advance energy resilience in Pennsylvania.

As Pennsylvania's large energy systems shift, resilience measures must adapt. For example, the integration of large amounts of utility-scale renewable electricity requires a grid that is capable of ramping up and down quickly so that electricity use and generation always match. Though PJM manages the integration of these systems, EPO must understand how these systems interact and understand if there are opportunities to develop programs that avoid resilience concerns. For example, while microgrids and solar plus storage provide additional resiliency to an energy system, they also have the potential to be vulnerable to cyber-attack, and such attacks could have implications to the operation of the larger grid. Similarly, the electrification of sectors such as transportation and heating has the potential to shift traditional electricity load curves and create challenges and opportunities for energy system resilience. Just as EPO should track technologies, it should also understand the interplay between technologies and integrated energy systems to fully implement resilience into its programs.

[72] BloombergNEF. 2020. *Electric Vehicle Outlook 2020.* Accessed June 3, 2020. https://www.seia.org/solar-industry-research-data.

Large energy systems often have clear boundaries and responsibilities for ensuring resilience, but smaller energy systems—such as those for small businesses and local government operations—are necessary to meet many of the most critical demands during emergencies and do not always have such clear guidance. To improve the resilience of these smaller energy systems, EPO provides local energy assurance training for local governments and can further these efforts in future programs. As a best practice, all EPO projects should strive to increase the resilience of all affected systems. EPO already supports increasing the resilience of small energy systems through its DER system programs. A variety of Pennsylvania funding programs such as PEDA provide financing vehicles for new DERs. EPO can leverage these programs to pilot technologies, provide or review the technologies and models used, and explore future incentive programs. Energy resilience can be a more complex concept with respect to decision making because the return on investment is more abstract, but EPO can learn from decision makers who have included resilience-forward technologies or concepts in their projects.

Experts from the Clean Energy Program Plan Workgroup suggested several resilience-forward programs based on technologies (e.g., battery energy storage) or studies (e.g., beneficial electrification) for EPO to consider as part of this plan. EPO will remain vigilant in exploring the role that technologies such as CHP, short- and long-term energy storage, load shifting, and beneficial electrification could play in resilience. Similarly, several states and organizations offer frameworks for increasing resilience that EPO could follow; examples include:

- **The New Jersey Energy Resilience Bank** provides funding to support energy infrastructure projects that address energy vulnerabilities.
- **USGBC's Performance Excellence in Electricity Renewal (PEER) rating system** is used to assess grid reliability and resilience and outline gaps in systems thinking on grid and campus projects. Pennsylvania was the second state in the United States to pilot a PEER certification program during the 2019–20 fiscal year.
- **NY State's NYSERDA's research programs** provide several competitions that reward students, companies, and communities that address resilience or develop new clean energy businesses.

6. Next Steps

EPO has and will continue to play a key role in maintaining the Commonwealth's energy economy while advancing indigenous clean and renewable energy sources by working with its partners to implement, coordinate, and facilitate clean energy programs. This plan describes the ongoing and future work EPO plans to undertake to achieve its mission and to fulfill its obligations for supporting energy conservation and efficiency, advancing clean energy technologies, and providing energy security and resilience while improving the environment and health of Pennsylvania through education, outreach, and technical support.

In addition to ongoing programs, this document describes EPO's intent to expand existing programs and create new ones in the next one to three years to further achieve its mission. EPO identified and developed these opportunities through stakeholder engagement and a critical evaluation process. As a result, EPO intends over the next 3 years to expand three existing programs and to work to create opportunities to develop 8 new programs, distributed among five key sectors. EPO will do this while maintaining its foundational programs, statutory responsibilities, partnerships and while also considering the opportunities that future technologies and strategies will undoubtedly deliver. By taking these 11 actions in the next one to three years, EPO will fill existing gaps in its programming activities, address current and future energy priorities, and better fulfill its mission and the climate and energy goals for Pennsylvania.

These sectors and associated programs are:

- **Renewable Energy**
  - Support the development of agricultural renewable energy
  - Provide guidance on solar development to local governments
  - Support deployment of community solar
- **Energy Efficiency**
  - Support and grow commercial building energy benchmarking across PA
  - Provide significant outreach to wastewater treatment plant operators
- **Transportation**
  - Modernize the AFIG program
  - Develop and deploy low-carbon transportation options with PENNDOT
- **Energy Workforce**
  - Expand EPO's Industrial E4 Initiative by providing resources for changing workforces
- **Climate and Energy**
  - Expand climate planning efforts with local governments
  - Promote local government pooled procurement of energy resources
  - Create additional innovative financing opportunities such as a green bank for renewable energy and energy efficiency.

As outlined in the Guiding Principles and Best Practices section, successful program results will require EPO to track its programs for effectiveness and ensure that each program is achieving its desired outcomes. A robust effort to track programs by gathering service provider feedback or participant information will help EPO further understand technical successes and financial breakthroughs. EPO can best accomplish this through a well-designed Measurement and Evaluation (M&E) plan that links data metrics to strategic goals and plans. EPO will focus on efficient and cost-effective data collection measures, include a streamlined and consistent reporting mechanisms, and be actively evaluating all programs. EPO recognizes that the most critical aspect of M&E is the design of data collection processes, particularly identifying and quantifying key metrics and consistently reporting the results. These key metrics are best applied when mapped directly to program goals, allowing managers to track and adjust progress toward meeting Pennsylvania's energy and climate goals.

In addition to these actions, EPO will endeavor to incorporate the six guiding principles and best practices identified in this report into all future programming and planning efforts:

- Collaborate with other agencies and organizations
- Consider equity, access, and inclusion and the needs of and effects on vulnerable communities
- Ensure effective marketing of programs and results
- Conduct program impact assessments
- Create and use a program tracker
- Integrate energy assurance and resilience in planning efforts

Integrating these practices and principles in future programs will help EPO more effectively plan and execute its programs and better achieve its goals.

Finally, to ensure that EPO's programs are more resilient and able to adapt to and plan for future needs, EPO will track developments in energy systems and technologies. This will help to have add a future-focus to EPO's programming efforts and to keep it informed and prepared to take advantage of emerging technologies and strategies as they mature. In particular, EPO will be exploring opportunities with carbon capture and use technologies, offshore wind, disruptive digital technologies, small and large distributed energy resources, alternative fuels, and transportation innovations so as to develop program or adjust goals to achieve maximum benefits of these emerging opportunities. Additionally, EPO will continue to drive energy system resilience measures in the Commonwealth.

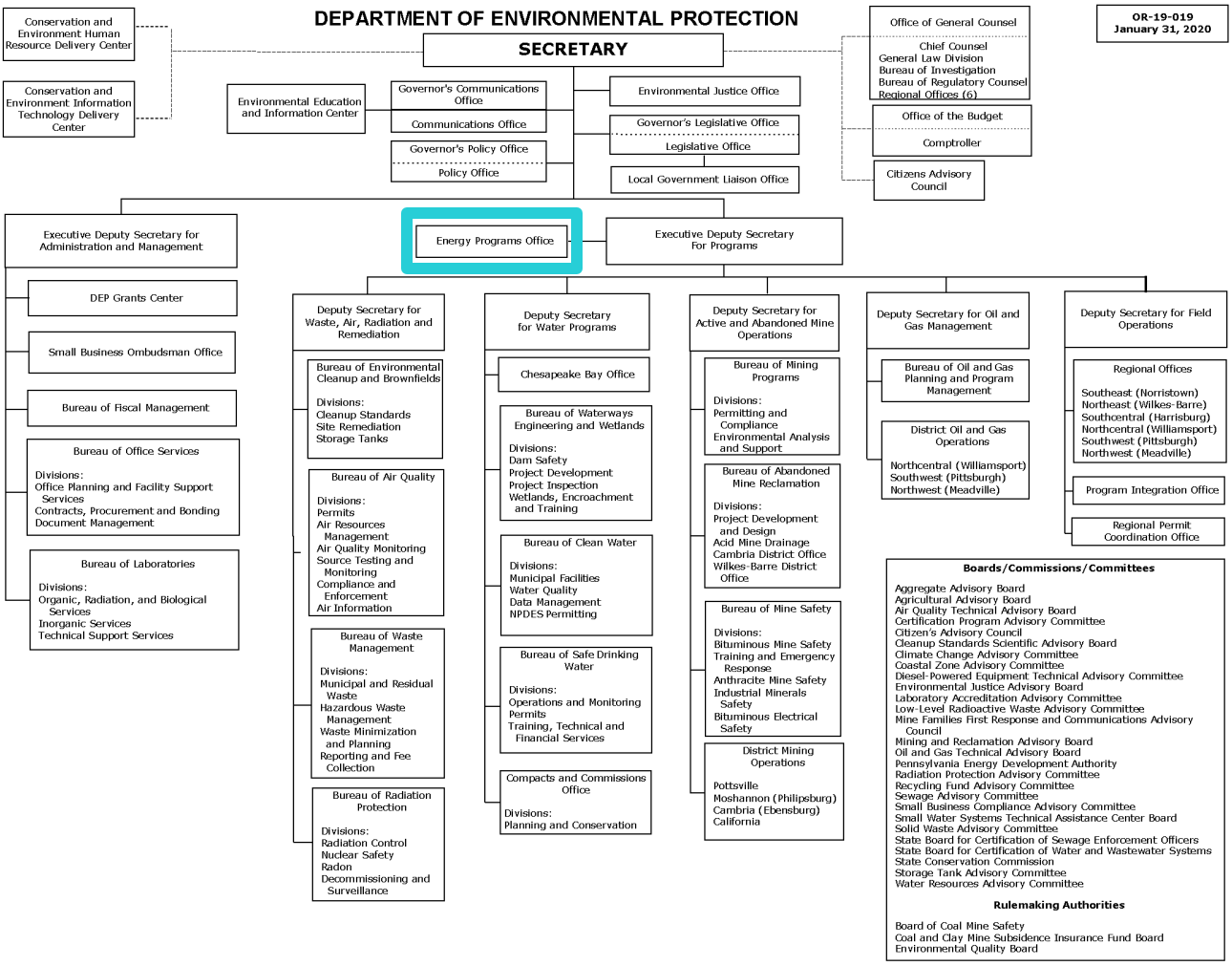
Altogether, these new and expanded programs, guiding principles and best practices, and a future-focus effort will shape EPO's clean energy programs over the next one to three years. EPO's sincere intent is that this actionable plan will further the role of the Commonwealth of Pennsylvania as an energy leader and help it achieve its ambitious long-term clean energy goals.

Appendix A. EPO and DEP Organizational Chart

The Energy Programs Office (EPO) is a stand-alone office that reports directly to the Executive Deputy Secretary for Programs, who has a direct reporting relationship to the Secretary of the DEP. This reporting relationship is depicted in Figure A-1 below. The EPO's team is diverse and includes the following positions:

- Director
- Program Manager
- PEDA Executive Director - Energy Incentive Programs
- Energy Workgroup Manager (Regions)
    - Energy Program Specialist Southeast – Energy Codes, GELF
    - Energy Program Specialist Northeast – Community Resilience, Energy Storage
    - Energy Program Specialist Northcentral – Agriculture, Energy Efficiency
    - Energy Program Specialist Southcentral – DEPA, Electric Vehicles, Climate
    - Energy Program Specialist Southwest – Microgrids, Anerobic Digestion
- Energy Workgroup Manager (Harrisburg)
    - Energy Program Specialist – Act 129, State Energy Program
    - Energy Program Specialist – AEPS, Solar
    - Energy Program Specialist – AFIG, PEDA
    - Energy Program Specialist – ESF 12, Energy Assurance/COOP Planning
    - Climate Program Specialist – Act 70, Climate Change, Green Gov T/A
    - Sr. Civil Engineer – Technical Reviewer, Energy Systems
- Administrative Officer
    - Administrative Assistant

Figure A-1. DEP Organizational Structure.



Appendix B. Additional Clean Energy Program Ideas

EPO evaluated many potential ideas prior to identifying a final set of recommendations to include in the CEP. EPO does not want to lose sight of these ideas as they are potentially viable and successful solutions to consider as technologies, policies, and stakeholder needs continue to evolve. The list below represents a brief summary of these additional ideas.

Equity, Access, and Inclusion Focused Ideas

Additional Support for WAP: Partner to a greater extent with Pennsylvania's Weatherization Assistance Program to help achieve the mission of increasing energy efficiency in low-income homes by reducing energy costs and increasing comfort while safeguarding health and safety.

Energy Assistance Programs for Low-Income Populations. Provide education and outreach for low-income focused programs such as Budget Billing, Customer Assistance Program, Customer Assistance Referral and Evaluation Program, Low-Income Usage Reduction Program, Hardship Funds.

Innovative financing for EVs: Develop innovative financing mechanisms for EV/EVSE deployment with priority focused on residential, fleet vehicles EVSE, and supporting low-income households' ability to afford EV technologies.

Low-Income incentives: Identify mechanisms to increase energy incentives for transportation companies and organizations and services that serve low-income individuals to increase uptake of projects

PA Sunshine program: Re-establish a PA Sunshine-type program, which provided rebates for residential and small commercial solar projects. A new program could contain a significant low-income component, helping to ensure solar for all.

Renewable Energy

Alternative and Clean Energy Program: Promote and educate potential applicants on the use of the Alternative and Clean Energy Program for high-value projects.

Campus Challenge: Encourage and recognize Pennsylvania institutions of higher education that are taking clean energy ideas from the classroom and putting them to work—both on campus and in their communities.

Clean and Renewable Energy Permitting: Provide support for streamlining the process for accessing permitting information and obtaining, completing, submitting, and tracking applications.

C-PACE Expansion that includes any clean energy technology: Develop information to encourage the expansion of C-PACE to include any clean energy technology.

Critical Value Solar: Promote all ownership options for solar generation where market-driven deployment may be insufficient to achieve public goals such as resilience, reliability, and environmental justice.

Developer and Investor Center and comprehensive website for renewable energy permitting: Create and staff a renewable energy development office and comprehensive website with the goal of supporting renewable energy developers and investors while simplifying permitting processes.

Farmland Preservation research partnership: Partner with the Department of Agriculture to research and support the retention of agricultural land and promote renewable energy projects to power farm operations.

Grid Modernization Plan: Develop a grid modernization plan that includes goals to provide utility-owned and -operated wind and solar resources, rooftop solar resources, investment in EE programs by IOUs, and cost recovery structures for projects that modernize the grid and support the integration of DERs.

Innovation Challenges: Create or support incentive programs that result in demonstration projects that show how new products and services can capture latent value on the grid, and how new business models can monetize and distribute that value among customers, third parties, and utilities.

Net metering: Support customers' ability to use net metering as an incentive to deploy intermittent renewable energy sources that meet all of a customer's annual energy needs.

Renewable Energy at Abandoned Mine Sites: Develop a comprehensive evaluation of clean energy projects to be conducted at abandoned mines to reclaim the land and increase clean energy.

Renewable Energy Permitting: Support building permit fee waivers for Tier I renewable energy projects under 5kW, as well as support/encourage local jurisdictions to adopt an ordinance that expedites the permitting process for residential PV systems under 10kW.

Renewable Energy Transition: Support a transition of the state to 100% renewable energy. Support a variety of committees and councils to implement this transition such as the Clean Energy Transition Task Force, Just Transition Community Advisory Committee, Clean Energy Center of Excellence, Council for Clean Energy Workforce Development, and a Clean Energy Workforce Development Fund.

Renewable Heating: Promote and educate homeowners on opportunities for deploying advanced heating technologies within homes, including advanced wood heating equipment and sustainable sourcing of biomass wood products.

Renewable Interconnection: Support implementation of streamlined interconnection protocols for renewable and alternative energy systems. Effects are powerful but hard to measure and not very visible.

Renewable Potential for Farms: Encourage or develop a third-party assessment of the potential energy generation and cost-effectiveness of renewable energy or provide service to properly evaluate competing renewable energy proposals and vendor bids.

Smart Inverter Technology: Support and encourage the use of smart inverters to manage over-voltage concerns on low voltage distribution lines.

Solar Brownfields: Participate in the development of an inventory and ranking of brownfields sites for deployment of solar.

Solar Tax Incentives: Evaluate the state tax policy and consider exemptions that encourage the development of solar PV systems. Assist solar project sponsors in identifying investors and/or companies that have sufficient tax equity appetite to take full advantage of the federal Solar Investment Tax Credit and Modified Accelerated Cost Recovery System depreciation, if sponsors can't do so themselves.

Solarize Schools: Provide tools, technical expertise (including free solar feasibility assessments), and access to financing to help K-12 schools cost-effectively go solar.

Solarize Toolkit for industries and for residents: Develop a toolkit to help industries and residents implement solar energy. A comprehensive document could cover a range of subjects from PV basics to case studies on how specific industries could and have used solar.

Utility- and Building-Scale Renewable Energy Support Program: Develop a program aimed at providing funding, technical assistance, or both to a broad set of renewable energy technologies. Program would focus on supporting community solar and other near-term advancements, including solar on grayfields and brownfields, but would also aim to further technologies such as RNG, reusing food/WWTP waste, energy storage, etc.

Energy Efficiency

Agricultural Energy Audits or Circuit Rider Programs: Support energy audits that would evaluate all energy-using equipment on the farm, educate farmers about the availability of incentives, and support their application process.

Agriculture Energy Efficiency Loan Program: Develop a low-interest loan program to assist farmers with energy efficiency projects.

Building Assessments: Increase emphasis on existing building assessments via walkthroughs of facilities and workshops for local governments and schools.

Building Code Standards: Promote alternative building code methodologies such as support the ZERO Code or California’s building code methodology. The ZERO Code integrates cost-effective energy efficiency measures with on-site and/or off-site renewable energy requirements resulting in Zero-Net-Carbon buildings.

Energy Code Training: Expand work on energy code training to offer additional 2015 International Energy Conservation Code (IECC) trainings.

Energy Efficiency in Energy Transmission and Distribution: Promote and educate energy utilities to determine how to solve transmission energy loss prevention through innovation and new technology.

Expansion of Technical Assistance Workshops about EE: Convene an advisory group for technical assistance workshops along with key business and industry associations. The advisory group will help determine the types of workshops that will be of greatest value and the target audience within the commercial and industrial sectors.

High-Performance Building Program: Provide financial assistance in the form of a grant or loan to individuals or small businesses to underwrite the cost premiums associated with the design and construction or major renovation of high-performance buildings.

Homeowner Energy Efficiency Loans: Provide outreach and marketing support for the Pennsylvania Housing Finance Agency's (PHFA) HEELP loans.

Roundtable Collaboration. Develop a comprehensive roundtable program to partner with regional or local organizations (manufacturing and utilities) to identify specific energy system best practices that can be replicated through education and outreach provided through coordinated learning sessions.

State Appliance Efficiency Standards: Support new state appliance efficiency standards for equipment and appliances not covered by federal efficiency standards.

Sustainable Energy Funds Recapitalization: Consider using incentive funding to support the recapitalization of various regional SEFs to ensure regional programing and lending continues.

Workforce Education Building Operations: Develop a long-term agreement with Pennsylvania College of Technology's National Sustainable Structures Center to provide Building Operator Certification Level 1 trainings to PA facility managers and HVAC mechanics/technicians from K-12 schools, higher education, and government agencies.

Transportation

Create an EV marking and education campaign for consumers: Create a consumer-oriented educational programs include: creating and maintaining a Drive Electric Pennsylvania Coalition centralized website, branded materials, social media presence, and potential media campaign informed by consumer survey research, and supporting Ride and Drives and other events designed to increase exposure to EVs.

Drive PA Forward: Participate in the evaluation or development of a tool to target locations for EV development or better consider regional infrastructure coordination.

Electrification of Medium- to Heavy-Duty Fleets: Consider targeting bus fleets, truck fleets, transit agencies for education, and use of electrification incentive program.

Electrification of Commonwealth Fleet. Using technical assistance and incentives, support the early achievement and promote exceedance of PA Executive Order 2019-01, which requires the replacement of 25% of the state government passenger car fleet with battery electric and plug-in electric hybrid cars by 2025.

Encourage Residential and Commercial EV Rate Designs: Develop information for use in conjunction with the PUC to enable specialized EV rates. This strategy could also encourage the deployment of advanced meters and other hardware and software technologies that may be needed to enable lower rates for off-peak charging.

Establish Vehicle Dealer Outreach and Support Program: Perform statewide dealer outreach, education, and support program to provide tools and resources needed for dealers to sell more EVs, with an initial goal to recruit at least 10 dealerships across several key participating regions of Pennsylvania, both in urban and rural areas.

EV-Ready: Support amending the state's building code to ensure EV readiness in new construction (such as pre-wiring for charging stations) is promoted through the building codes.

EVSE Deployment: Conduct outreach and provide technical support for EVSE deployment to organizations such as large employers, higher education institutions, and multifamily property owners or management firms.

Fleet Education, Cooperative Purchase, and Technical Assistance Program: Explore a program to include a variety of programs to support public and private fleet investment in EVs and infrastructure, including: Outreach to fleet managers, including Ride and Drive events for fleet operators; Development of specialized tools, procurement guides, procurement templates, sample RFP language, and other materials to support fleet EV and EVSE procurement.

Incentivize More Opportunities for EV Purchases: Provide rebates to Pennsylvania residents through partnerships with car manufacturers and dealers for the purchase of new and pre-owned plug-in hybrid, plug-in electric, natural gas, propane, and hydrogen fuel cell vehicles.

Local Government EV Assistance: Provide centralized support to municipalities to implement EV readiness policy and planning at the local level.

Tailpipe Emissions Standard: Support a rule requiring automakers to phase in lower-emitting cars and trucks, with new standards for model years 2017-2025. Support an update zero-emission vehicle program that requires increasing production of plug-in and fuel cell vehicles.

Transportation and Climate: Continue to identify and develop programs that help to implement the goals identified in the Regional Transportation and Climate Initiative to reduce the use and carbon intensity of fossil-based transportation fuels in Pennsylvania.

Transportation Electrification Strategy: Support an action to enable and encourage utilities to invest in transportation electrification including EVSE investment, EV rates, and marketing and outreach.

Energy Workforce

Energy Efficiency Assessment for Small Business and Manufacturers: Provide support for Pennsylvania assistance programs that deliver EE assessments and technical assistance for small to mid-sized manufacturers.

Energy Workforce: Encourage or support the development of energy manager training programs through the state system of higher education and community colleges and other venues.

Climate and Energy

Beneficial Electrification Evaluation: Evaluate an incentive program to switch to all electric heating/cooling.

Broad Statewide Energy Education Messaging: Expand influence beyond existing stakeholders, should develop a broad, statewide messaging effort to educate new groups. Need partners to amplify message. Not fact sheets and guides.

Carbon Capture Use and Sequestration (CCUS) Opportunities and Technology Project: Investigate developing information regarding the state of CCUS technologies with an aim to understand specific opportunities and applicability of the technology in Pennsylvania, Information would be used to develop programs or opportunities to support energy generation.

Clean Grid: Support a diverse and clean electricity grid that is critical to reducing GHG emissions, accomplish through support of an increase in AEPS Tier 1 targets and further increase in-state generation and use of renewables. Implement policy to maintain nuclear generation at current levels.

Community Microgrid Competition: Explore a competition to engage communities in advancing plans for local power and resilience. The competition offers awards in three stages: feasibility studies, audit-grade design, and project build. The competition would challenge local communities, businesses, entrepreneurs, and electric utilities to design and implement community-based microgrids.

Comprehensive Impacts Assessments: Implement a program for consistent and continuous improvement based on the measurement of the impact of programs deployed to feed results back into new program planning.

Consider an EPO role within the EPA Smart Sector Program: EPA's Smart Sectors is a partnership program that provides a platform to collaborate with regulated sectors and develop sensible approaches that better protect the environment and public health.

Energy Incentives Tracker: Develop an online resource that catalogs all state and federal grant opportunities with filters for groups, sectors, etc.

Energy Resilience Bank: Explore an Energy Resilience Bank that provides funding to support energy infrastructure projects that will address energy vulnerabilities and maximize energy resilience by supporting projects such as fuel cells, CHP, solar with storage, and dynamic microgrids.

Energy Storage and Batteries Plan: Develop and market an analysis of the needs and capabilities of PA to fulfill the future battery storage marketplace of both PA and the Region. Energy Storage and Batteries will be a key component to achieving Clean Energy policy goals through enabling intermittent renewable resources.

Establish Local Energy Authorities: Work with local governments to identify and set up local or PA regional municipal energy authorities that can work to facilitate local energy projects and programs.

Green Schools: Support the PA Green & Healthy Schools Partnership plans to organize and implement several workshops focusing on Eco-Schools USA, a framework for engaging students in school environmental initiatives, including energy.

Innovation and R&D: Explore investments in energy innovation to deliver market-ready solutions that can produce meaningful reductions in GHG emissions and provide for greater energy affordability, system resilience, and consumer choice. These investments facilitate the development, commercialization, and market entry of new clean energy technologies, and aim specifically to grow the clean energy market sector in Pennsylvania.

Interagency Energy/Climate Collaboration: Increase collaboration with Ag, DCED, Dept. of Transportation, DOH, and L&I on energy and climate strategies including adaptation.

Local Waste to Energy: Investigate potential to reduce waste and GHGs through the use of agriculture byproducts, wastewater, and biomass from MSW for energy generation.

PJM Advocacy via Consumer Advocate and CAPS: Expand DEP's relationship with PJM with a focus on growing clean energy in Pennsylvania. Work will include collaborating with PA's Office of Consumer Advocate and the PJM CAPS program to advocate for clean energy friendly rulemaking by PJM.