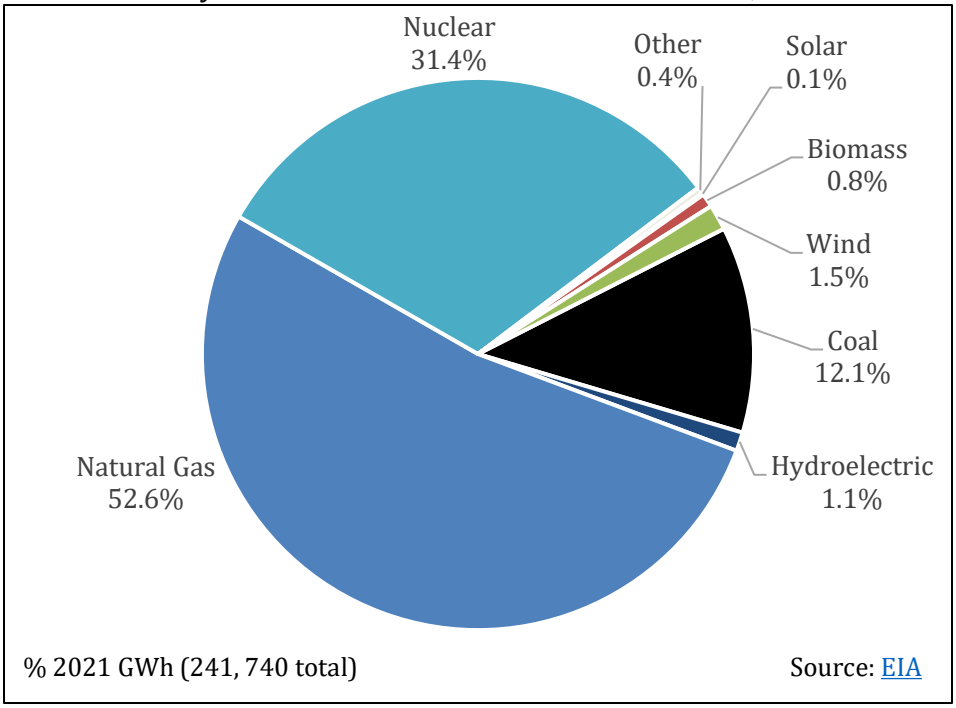
State Brief: Pennsylvania

BACKGROUND

Pennsylvania ranks second in the country (behind Texas) for total energy production, second in natural gas production (behind Texas), and third in coal production (behind Wyoming and West Virginia). The Keystone State ranks first in the nation for electricity exports to other states.

Pennsylvania's Net Annual Electric Generation, 2021



% 2021 GWh (241, 740 total) Source: EIA

With the expansion of natural gas production, Pennsylvania's electric generation mix has shifted dramatically in recent years. In 2010, coal accounted for 48% of the state's net electricity generation, while natural gas accounted for about 15%. By 2021, these sources supplied 12% and 53% of the state's generation, respectively. Nuclear has remained a significant contributor to the state's generation portfolio, but the aging infrastructure has become less cost competitive over time. For instance, the 819 megawatt (MW) Three Mile Island nuclear powerplant was retired in 2019 because it was no longer profitable. While the Beaver Valley reactors were scheduled to be shuttered in 2021, deactivation notices were rescinded by the station's new owners, Energy Harbor Corporation, following Governor Wolf's push for Pennsylvania to join Regional Greenhouse Gas Initiative (RGGI), a cap-and-trade initiative to reduce carbon dioxide emissions.

In 2022, the Solar Energy Industries Association (SEIA) ranked Pennsylvania 23rd in the country in terms of installed capacity (936 MW) and 17th for projected growth (1,593 MW) over the next five years. The 2022 U.S. Energy and Employment Report found that Pennsylvania has 258,202 energy workers (4.6% of total state employment), which includes 67,782 workers employed in energy efficiency. In 2021, Pennsylvania ranked 11th nationally for clean energy jobs, with 87,313 Pennsylvanians employed by the industry.[1]

The Pennsylvania Public Utility Commission (PUC) regulates 11 electric distribution companies and 25 gas utilities. The bipartisan PUC has five seats, two of which are currently vacant. There are two Republicans and one Democrat on the Commission; Democrat Gladys Brown Dutrieuille is Chair. Republican majorities control both chambers of the General Assembly. Democratic Governor Tom Wolf was elected in 2014.

POLICY STRENGTHS AND OPPORTUNITIES

The National Renewable Energy Laboratory (NREL) developed the notion of "policy stacking,"[2] an important framework for policymakers to consider. The basic idea behind policy stacking is that there is an interdependency and sequencing of state policy that, when done effectively, can yield greater market certainty, private sector investment, and likelihood of achieving stated public policy objectives.

[1] To see clean energy job numbers for your Congressional District, visit: https://cleanjobsamerica.e2.org/#map.

[2] V.A. Krasko and E. Doris. 2012. "Strategic Sequencing for State Distributed PV Policies: A Quantitative Analysis of Policy Impacts and Interactions." *National Renewable Energy Laboratory*. Available: http://www.nrel.gov/docs/fy13osti/56428.pdf.

In theory, but not always in practice, clean energy policies can be categorized into one of three tiers of the policy stack. Tier 1, market preparation policies, remove technical, legal, regulatory, and infrastructure-related barriers to clean energy technology adoption. Tier 2, market creation policies, create a market and/or signal state support for clean energy technologies. Tier 3, market expansion policies, create incentives and other programs to expand an existing clean energy market by encouraging or facilitating technology uptake by additional market participants.

For example, before financial incentives for combined heat and power (CHP) will be successful, two key considerations for deployment are having clear interconnection standards and favorable stand-by rates for customers who opt to add CHP. In this example, states should adopt policies to address interconnection and stand-by rates before adopting financial incentive programs.

MODERNIZING UTILITIES AND EMPOWERING CONSUMERS

Digital technologies have enabled utilities to better manage the grid and provide opportunities for consumers to customize their services to fit their priorities. These technologies allow a two-way flow of information between the electric grid and grid operators and between utilities and their customers.

Emerging technologies improve system reliability and resiliency by enabling better tracking and management of resources. These technologies allow grid operators to incorporate central and distributed energy resources, energy storage technologies, and electric vehicles, and assist in addressing the challenges associated with planning, congestion, asset utilization, and energy and system efficiency.

On the customer's side of the meter, dynamic pricing, advanced metering infrastructure, and other technologies allow an exchange of information and electricity between a consumer and their electric provider. Grid modernization is associated with greater consumer choice by allowing customers to meet their energy priorities by producing their own energy or through contracting innovative clean energy services from different providers.

Grid modernization will require a suite of state and federal policy changes to support advancements in grid technologies, grid management, and utility regulation.

While Pennsylvania has not conducted a comprehensive grid modernization review process, the state's 2021 Climate Action Plan contemplates future investments in grid modernization. Utilities in the state have invested in improved grid infrastructure. For instance, FirstEnergy's Energizing the Future initiative pledged up to $7 billion in grid investments between 2018 and 2023, including an investment of more than $600 million in transmission projects in Pennsylvania. As part of this initiative, Penn Power is implementing grid modernization technologies and reliability improvements in Lawrence, Mercer, and Butler counties. PPL Electric has adopted GE Digital's Fault Isolation Service Restoration (FISR) which allows power to be rerouted "around trouble spots" to contain the outage and restore power to most customers "within seconds [and] without any human intervention [to create] a self-healing grid."[3]

The Infrastructure Investment and Jobs Act of 2021 (IIJA) is a landmark federal spending bill that includes funding earmarked for grid modernization projects. This includes $11 billion for Department of Energy (DOE) grants directed specifically towards electric infrastructure resiliency projects (including grid hardening against severe weather and cybersecurity improvements), $2.5 billion for transmission development, and $3 billion for the Smart Grid Investment Matching Grant Program.[4] Enacted August 2022, the Inflation Reduction Act (IRA) set aside $2 billion for loans for constructing new high-capacity transmission lines and upgrading interties. The bill includes funding for technical assistance and grants for states and tribal governments, which includes assistance for siting

[3] A. Larson. 2022. "Advanced Power Grid Sensors and Switches Reduce Downtime and Improve System Reliability." *PowerMag.com*. 1 July. Available: https://www.powermag.com/advanced-power-grid-sensors-and-switches-reduce-downtime-and-improve-system-reliability/.

[4] For more information on the grid-related earmarks included in the IIJA, see Potomac Law Group's January 2022 analysis: "The Infrastructure, Investment & Jobs Act of 2021: What's in It for You? (Part V: Grid Infrastructure and Resiliency)" https://www.potomaclaw.com/news-Infrastructure-Investment-Jobs-Act-of-2021-Whats-In-It-For-You-Part-V-Grid-Infrastructure-and-Resiliency.

transmission projects. The bill also directs DOE to undertake interregional transmission planning, modeling, and analysis, including analysis of transmission for offshore wind and the use of grid-enhancing technologies (GETs).[5]

A 2020 analysis by Advanced Energy Economy (AEE) found that $5 billion in investments in transmission and grid modernization (including technology and software development for residential and commercial energy management) in Pennsylvania could generate approximately $10.7 billion in Gross State Product (GSP) and create 100,000 new jobs.[6]

There are policies that Pennsylvania's policymakers could adopt to support in-state grid modernization efforts:

1. Develop a grid modernization strategy through a stakeholder process. Alternatively, states might decide to require that utilities develop and propose a ten-year grid modernization plan to the public utilities commission within a specified timeframe. Utilities would then be required to implement that plan within another specified timeframe. Strategies and/or plans should outline a clear set of grid modernization goals and describe methods to measure, report, verify, and enforce progress towards those goals.

2. States might also provide incentives or cost recovery mechanisms for utilities that meet grid modernization goals. Policymakers could consider directing the PUC to evaluate alternative ratemaking mechanisms, performance-based regulation, and/or new utility business models that support grid modernization.

3. Require that utilities' integrated resource plans (IRPs) include plans to enhance cybersecurity, integrate distributed energy resources (including electric vehicles and energy storage), increase smart meter deployment and demand response and/or demand-side management (DSM) programs, and measure and report on the results of grid modernization efforts.

4. State departments of workforce services or their equivalent can be directed to work with utilities and other stakeholders to develop training programs for grid technicians and engineers. With new grid technology and distributed energy systems coming online, a new generation of workers can be trained to meet evolving needs, which will keep jobs local and contribute to economic development.[7]

The adoption of incentives for or a requirement to integrate a certain amount of renewable energy and energy storage on the grid alongside enhanced building energy standards and electric vehicle policies can support grid modernization efforts.

MAINSTREAMING RENEWABLES

Renewable energy is increasingly seen as the least cost and lowest risk form of energy (excluding energy efficiency). With increased deployment, utilities are learning more about how to integrate renewables effectively, investors are becoming more comfortable with the technologies, and building code officials are recognizing common standards and best practices for integrating distributed renewable energy resources. In the U.S., the expansion of renewable energy has been one of the most consequential shifts in electricity generation over the last decade. The U.S. Energy Information Administration (EIA) predicts that most of the growth in U.S. electricity generation in 2022 and 2023 will be from new renewable energy sources. It is in the interest of policymakers to ensure that their states are well positioned to benefit from this shift.

A $550,000 award from DOE's Sunshot Program funded the Pennsylvania Department of Environmental Protection's Solar Future initiative. The resulting Solar Future Plan, published in November 2018, includes strategies for expanding solar generation in the state and proposes a goal for solar to account for 10% of the state's generation

[5] J. Runyon and J. Engel. 2022. "The Inflation Reduction Act is Signed into Law." *PowerGrid International*. 16 August. Available: https://www.power-grid.com/td/the-inflation-reduction-act-is-signed-into-law/#gref.

[6] P. Hibbard and P. Darling. 2020. "Economic Impact of Stimulus Investment in Advanced Energy: An Economic Assessment of Applying Stimulus Funds to Advanced Energy Technologies, Products, and Services in Pennsylvania." *Analysis Group for Advanced Energy Economy*. October. Available: https://www.aee.net/aee-reports/advanced-energy-state-economic-impact-reports-for-2020.

[7] For a discussion of specific workforce needs states might explore see: GridWise Alliance and U.S. Department of Energy. 2020. "Grid Modernization Index Insights into a Transformation: Principles for the Next Decade of Progress."

mix by 2030, which would require about 11 gigawatts (GW) of installed capacity, which could generate significant economic benefits.

While the IIJA does not provide money for specific renewable energy projects, the energy funding in the Act will benefit renewable energy development as grid resiliency, increased deployment of energy storage, and modernized transmission are all essential to the successful integration of renewable energy generation. The IRA appropriated $369 billion to fund a variety of energy and climate initiatives – the largest climate investment in U.S. history. The bill also extended the investment tax credit (ITC) and the production tax credit (PTC) through the end of 2024 and revived the PTC for solar projects. For projects placed in service in 2025, the bill "effectively extended" the ITC and PTC by creating new tax credits for zero emission facilities. The bill also extended the residential energy property tax credit through 2034 and created a new advanced manufacturing production credit, to apply to sales of components for constructing wind and solar energy facilities beginning in 2023. [8]

The IRA also includes several provisions related to energy equity, including $3 billion to the Environmental Protection Agency (EPA) for grants for community-led projects in disadvantaged communities and $27 billion for nonprofit, state, and local climate finance institutions supporting the deployment of low- and zero-emission technologies. In support of rural communities, the bill includes a $1 billion appropriation to the U.S. Department of Agriculture (USDA) for loans to finance renewable energy projects, $1 billion for USDA's Rural Energy for America Programs, and $9.7 billion to USDA to finance rural electric cooperatives' purchases of renewable energy.

A 2020 analysis by AEE found that a $10 billion investment in solar and a $5 billion investment in wind energy resources in Pennsylvania could add approximately $63 billion to the GSP and create 405,000 new jobs.[6]

To reduce barriers to customer and utility participation in the renewable energy market, and to build upon the federal initiatives, policymakers in Pennsylvania might consider several options.

Customer-Oriented Policies

1. **Interconnection, Net Metering, and Streamlined Permitting** – In general, customers want a clear, streamlined, affordable, and predictable system for connecting renewable energy systems to the grid. To ensure this, Pennsylvania's policymakers could consider adopting the Interstate Renewable Energy Council's (IREC)'s model interconnection procedures, removing net metering system size limitations and allowing for an ongoing carry-forward of net metering credits beyond an annual true-up payment (which is considered taxable income). The state might also consider establishing either statewide standards for streamlined solar permitting processes, or resources to support local governments that voluntarily implement a streamlined program. In May 2021, NREL launched the SolarAPP+, an online platform designed to automate the solar permitting process. By running compliance checks and processing permit approvals, the service is intended to drastically reduce permit wait times. Currently restricted to rooftop solar, twenty communities in Arizona and California have adopted the platform, processing over 7,750 permits for more than 51 MW of generation with an estimated 7,750 hours saved in permit review time.

2. **Shared Renewables** – Due to building and property attributes and ownership issues, many customers are unable to install renewable energy technologies where they live or work. Allowing shared, or community, renewable energy projects addresses these barriers. These projects have multiple owners or subscribers who pay for a portion of the project or the generation provided by the system. House Bill 1161, currently before the Senate, would allow electric distribution companies to create shared solar programs.

   Low credit ratings often deter participation in renewable energy markets; this can affect low- and moderate-income (LMI) households' adoption of renewable energy solutions. Supportive policies for shared renewables can be designed to encourage participation by LMI households; this can increase adoption of renewable technologies and reduce energy costs. Low-income participation can be ensured either through a percentage mandate for the overall annual contracted capacity, or by offering a higher rate of payment for the portion of shared solar capacity attributed to LMI customers. States that have a shared renewable program may want to

[8] For a detailed discussion of the IRA's tax provisions, see: A.S. Levin-Nussbaum. 2022. "Update: President Biden Signs Historic Legislation Providing Expansive Clean Energy Tax Incentives." *The National Law Review*. 17 August. Available: https://www.natlawreview.com/article/update-president-biden-signs-historic-legislation-providing-expansive-clean-energy

coordinate this program with implementation of the federal Weatherization Assistance Program (WAP) or the Low Income Home Energy Assistance Program (LIHEAP) to provide recipients of assistance with access to participation in a shared renewable system.

3. **Adapt Energy Assistance Programs** – Programs such as LIHEAP and WAP provide assistance for paying utility bills and reducing household energy costs. Including distributed energy resources as eligible for funding under these programs can reduce energy costs and increase energy security for those LMI families who are able to benefit from WAP and LIHEAP. Colorado, for example, includes rooftop solar in their WAP program. For approval to add solar to a state's implementation of WAP, a state must show that the investment would be cost-effective – achieving a Savings to Investment Ratio (SIR) of 1.0 or more.[9] Since 2010, Pennsylvania has received $151.3 million from WAP and $19.2 million from the State Energy Program (SEP) which has helped to fund a number of energy initiatives in the state.

4. **Fund Distributed Generation (DG) for Community Organizations** – Organizations or groups that provide support services for LMI communities can be provided funding to install solar or other distributed energy resources. Sites such as homeless shelters, food banks, clinics, and community centers often have enough rooftop area for solar installations. After installation, these resources can reduce an organization's utility bills, freeing up funds for other activities that support the community. The Adams Electric Cooperative offers loans for projects that "create or improve" community facilities impacting education, health, economic conditions, public safety, and quality of life.

5. **On-Bill Financing/Pay As You Save (PAYS)** – On-bill Financing and Repayment programs enable consumers to invest in energy upgrades with no upfront payment. The utility or a third party will pay the initial costs to install the upgrade with the cost of that upgrade recovered through the utility bill. Because repayment includes consideration of the cost savings resulting from the energy upgrade, customers can see monetary benefits almost immediately. Once equipment costs are recovered, the equipment belongs to the customer. State policies that reduce lending risk by creating a loan loss reserve and/or a credit enhancement fund can encourage lending to customers that might otherwise not qualify for a loan and can keep interest rates low.

6. **Corporate Procurement** – Many Fortune 100 and 500 companies have established either climate goals or commitments to purchase renewable energy. Since 2016, over 41 gigawatts (GW) of renewable contracts have been announced by corporate entities. In 2020 alone, corporations signed 100 agreements for over 10 GW of renewable energy. This is leading policymakers to provide additional avenues for businesses to procure renewable energy. Policymakers in Pennsylvania might consider incorporating corporate renewable procurement targets into the state's IRP process. By integrating these renewable purchase commitments into the IRP process, utilities can avoid over-building resources and stranding generation assets.

Utility-Oriented Policies

Some states have created programs that aim to reduce greenhouse gas (GHG) emissions and increase investments in clean energy resources. Utilities are also setting their own GHG reduction goals and are increasingly investing in clean energy resources. In 2004, Act 213 established an Alternative Energy Portfolio Standard (AEPS) of 18% by 2021. The standard sets minimum thresholds for two tiers of resources: 8% by 2021 from Tier 1 resources including solar, wind, biomass, and low impact hydropower and 10% from Tier II resources including certain coal, large hydropower, energy efficiency, combined heat and power, and distributed energy resources under 5 MW in capacity. The AEPS also includes a 0.5% solar carve-out. All but five of Pennsylvania's Electric Generation Suppliers met the standard by 2021, three of which purchased Alternative Energy Credits for compliance. All of the state's Electric Distribution Companies met the standard. While FirstEnergy has pledged to reduce its GHG emissions 30% from 2019 levels by 2030 and attain carbon neutrality by 2050, PPL has set goals to reduce its GHG emissions 70% from 2010 levels by 2035, 80% by 2040, and reaching net-zero by 2050.

To increase utility adoption of clean energy technologies, Pennsylvania's policymakers might consider the following:

[9] For guidance on the state approval process, see WAP Memorandum 024 (2017), the Solar Template for Incorporating Solar Photovoltaics into WAP, and the Preliminary Assessment Guide for Integrating Renewable Energy into Weatherization (2019).

1. **Emissions Standards** – Emissions targets can take a technology neutral approach that looks at the total emissions of the utility portfolio and drives emissions down with a combination of renewables, traditional fuels, efficiency, and technological advances. Emissions reductions can be achieved through 1) a carbon portfolio standard approach, or 2) a market-based approach. A portfolio emissions standard sets emissions reduction targets to be achieved over time. This can be implemented through the IRP process or by establishing a maximum allowable rate of emissions per unit. Under a market-based approach, a state or a group of states might set a certain emissions reduction target, for example, 50% below 2005 levels by 2030. This reduction is achieved by the distribution of annual emission allowances that decrease to the point that the standard is met in 2030. One of the advantages of a market-based program is that it is designed to reduce emissions in the most economically efficient manner possible. Such a standard can also address other concerns such as pollution, asthma risk, environmental justice, and water use. Executive Order 2019-07 directed the Pennsylvania Department of Environmental Protection to develop rules that would allow Pennsylvania's participation in the Regional Greenhouse Gas Initiative (RGGI). Following the rulemaking, a judge reinstated his injunction in July 2022, halting implementation of the final rules.

2. **Clean Peak Standards (CPS)** – Clean Peak Standards aim to increase the share of clean energy resources used to meet peak demand and decrease energy bills over the long-term by reducing peak demand in the hours when energy costs are highest. These objectives can be met through different policy options, including planning and procurement that focuses on peak demand; a moratorium on the construction of new peaking units or a phase out of existing units; incentives – including carve-outs in states with RPSs – for clean energy resources delivered during peak times; and/or adopting a new clean peak standard that sets a target for clean energy deliveries during peak times.

ENERGY STORAGE

Energy storage offers a unique opportunity to dynamically manage supply and demand while also maximizing the value of grid resources. By deploying storage to strategic locations, utilities can more effectively manage their energy portfolios. First, storage allows utilities to manage intermittent demand – helping reduce peak demand requirements. Because the generation resources that provide peak power are the system's most expensive, reducing peak demand can save consumers money. Second, the responsiveness of energy storage can allow utilities to implement voltage regulation and other ancillary services, which improve system efficiency. Third, because storage technologies can both store and dispatch power, storage enables better integration of intermittent power generation resources, like wind and solar, to the grid.

The flexibility of battery storage combined with advanced metering infrastructure can allow customers to control how and when they use energy from the grid or from solar panels installed on their home or business. In most cases, this can provide greater cost savings than standalone solar systems. Combined with time-varying rates or real-time pricing programs, state policy can further support customer choice and open a new market for energy services. Prices that better reflect the time-varying and location-dependent costs of producing and delivering electricity can also lead to a number of economic and environmental gains.

Energy storage can also help the commercial sector avoid demand charges, which establish an incremental cost above energy usage based on the highest period (highest 15 minutes, for example) of demand during the month. Eliminating spikes in demand with storage can reduce these costly charges for businesses. As utilities around the country consider implementing or extending demand charges to other sectors, energy storage will become more relevant as both a customer cost-saving investment and a system efficiency measure.

Declining costs and technological advancements in battery storage have contributed to increased deployment. State policies can further encourage this by establishing both a framework for easy integration of energy storage resources onto the grid and a marketplace that monetizes the benefits of energy storage for cost-effective investment.

In November 2020, the Pennsylvania PUC initiated a proceeding taking stakeholder comments and exploring enhancements including energy storage, that would increase the reliability and resiliency of the state's electric distribution systems. In September 2021, the Pennsylvania Department of Environmental Protection (DEP) facilitated the first meeting of the Pennsylvania Energy Storage Consortium, a quarterly meeting of stakeholders to discuss energy storage policy and market opportunities in the state, several of which were outlined by Strategen's

April 2021 Pennsylvania Energy Storage Assessment: Status, Barriers and Opportunities. While state agencies are engaging energy storage policy, there are no statewide incentives or targets for distributed or utility scale storage.

The IIJA provides a unique opportunity for funding energy storage projects. According to an analysis by the Energy Storage Association, the IIJA provides $505 million for grants to support energy storage demonstration projects, $6.15 billion for building out the U.S. battery supply chain, and $14.7 billion for grid resilience programs that include energy storage as a qualified technology. The IRA extended the ITC to include standalone energy storage systems. When the ITC is replaced by the technology neutral Clean Electricity Investment Tax Credit (CEITC) in 2025, qualified storage facilities placed in service after 2024 will remain eligible. The advanced manufacturing production credit, established by the bill, will apply to battery cells and modules and the critical minerals used in their production. The $27 billion GHG Reduction Fund, also established by the bill, will provide funding enabling low-income or disadvantaged communities to adopt zero-emission technologies including energy storage.

A 2020 analysis by AEE found that a $2.5 billion investment in energy storage in Pennsylvania could add approximately $7 billion to the GSP and create 62,000 new jobs.[6]

There are several policy opportunities to take advantage of the growing technological advances in and declining costs of energy storage and build upon recent federal initiatives. The recommendations here draw heavily from IREC's 2017 report, "Charging Ahead – An Energy Storage Guide for Policymakers." Policymakers in Pennsylvania could consider the following:

1. Amend existing interconnection policies to ensure that storage can connect to the grid through a transparent and simple process. IREC has produced a series of interconnection protocols that states can easily adopt. The state could establish best practices for interconnecting storage in statute, or legislation could provide an instruction to the PUC to update existing policy.

2. Instruct the utilities commission to evaluate the value of energy storage in multiple strategic locations across the utility system and consider a requirement to deploy storage where it is cost-effective or identify the price point at which it will be cost-effective. Ensure that cost-effectiveness calculations include all the benefits storage can deliver to the system, including frequency regulation and avoided investments in new infrastructure.

3. Require the inclusion of energy storage as a critical piece of the energy system as both a demand and supply management resource. Some states have required that utilities evaluate the cost effectiveness of non-wires alternatives (NWAs) to large transmission and generation investments. Alternatively, states might want to require that utilities develop a distribution investment plan that identifies the locations on the distribution system where energy storage or other distributed resources would offer the greatest value.

4. Consider creating a mandatory energy storage procurement target or requirement for energy storage with a documented process for periodic review of progress towards that goal. Procurement targets can limit the amount of utility owned storage to be procured; require that a certain amount of storage be targeted to low-income customers; and create carve-outs for specific amounts of storage to be procured at the transmission, distribution, and customer levels. Procurement targets can jump-start market creation, spur fast learning, and guide the development of a regulatory framework.

5. Finance and incentivize energy storage for customers and utilities. Incentives could enable customers to use storage to manage their electric load and store locally produced renewable energy. Incentives in the form of rebates, grants, and tax credits can provide a bridge to scalable deployment of storage. Incentives can be designed to decline as storage values become more readily monetized and/or as the cost of storage decreases. Policymakers could allow utilities that provide incentives to customers to recover the costs of installing smart meters. This would enable dynamic and time-varying energy management from multiple distributed battery systems. This could also signal to customers the value of leveraging storage and better align customer costs with system costs. Financing energy storage installations for commercial customers could help reduce their demand charges. Policymakers might want to start first with a policy that provides grants to pilot projects. Policy might also target solar system owners. Financial incentives should be designed to ensure that the state will meet other goals including emissions and peak demand reductions, and equitable access to clean energy.

6. Clear data access policies that allow third parties to provide energy management services based on signals from the utility can greatly increase the value of efforts to monetize the value stream offered by energy storage. State policy should include measures to protect customer data, while also encouraging the use of this information to facilitate additional improvements to grid management and customer services. To address this, policymakers can develop legislation or rules that clarify who owns the energy data associated with customer energy usage; protect customer privacy; outline the process for allowing direct access to data by third parties; and promote access to the highest resolution of data possible.

THE BUILT ENVIRONMENT

In the U.S., buildings consume nearly 40% of total energy used.[10] Because it reduces energy demand and emissions, and creates savings for utility customers, energy efficiency[11] often plays a prominent role in state energy and climate policies. Coupled with beneficial electrification, which involves replacing direct fossil fuel use with electricity, there is even greater potential to reduce energy costs and pollution, and provide more resilient, comfortable, and healthy buildings. This is especially the case in states where increasing levels of low carbon resources are supplying the electric grid. When policies are adopted to shift energy uses based on fossil fuels (such as natural gas) for building heating, water heating, and appliances, to highly efficient electric alternatives, states can maximize achieving the dual objectives of increased energy efficiency and reduced emissions. In some cases, this can also result in lower energy costs.

Pennsylvania has taken several steps to incorporate energy efficiency and beneficial electrification into its built environment. The state has adopted, as a mandatory building code, the International Energy Conservation Code (IECC) 2018 Edition, with amendments for commercial and residential energy efficiency and conservation.

House Bill 1782, enacted in 2018, allows utilities to petition the PUC for alternative ratemaking mechanisms, including revenue decoupling and performance-based incentives, as part of their base rate proceedings. House Bill 2200, adopted as Act 129 of 2008, expanded the PUC's oversight responsibilities and introduced a number of energy efficiency obligations, including a requirement that the commission adopt an Energy Efficiency Resource Standard (EERS), or energy efficiency and conservation program by 2009. Beginning in 2013, the PUC is required to evaluate the costs and benefits of the program every five years. If program benefits exceed costs, the commission is required to adopt additional energy efficiency targets electric distribution companies must meet. The Guaranteed Energy Savings Act, as first enacted in 1998, and amended in 2004 and 2010, allows local governments, schools, and agencies to receive state funding to enter into guaranteed energy savings contracts for energy efficiency upgrades.

The IIJA provides $500 million for grants to fund energy efficiency and renewable energy upgrades in public schools, $3.5 billion for the Weatherization Assistance Program, and further funds the Energy Efficiency and Conservation Block Grant program by $550 million and the State Energy Program by $500 million. The IRA appropriates $4.3 billion to DOE for an energy efficiency rebate program that will be administered through state energy offices. Another $4.3 billion appropriation will fund electrification rebates for single- and multi-family homes. The bill also extends the tax credits for residential energy efficiency improvements and new efficient home construction and increases the maximum deduction for energy efficient commercial buildings. A $837.5 million appropriation will be used by the Department of Housing and Urban Development (HUD) for resiliency, energy efficiency, renewable energy, and grid integration projects at public housing units.

A 2020 analysis by AEE found that a $12.5 billion investment in energy efficiency in Pennsylvania could add approximately $287 billion to the GSP and create over 1.6 million new jobs.[6]

Policymakers in Pennsylvania can consider a variety of policies to encourage energy efficiency and beneficial electrification:

Energy Efficiency Policies

1. **Building Codes** – The Department of Energy projects that, over time, improvements in building codes can have the greatest single impact in energy efficiency within the built environment. On average, commercial buildings

[10] For additional information, see ACEEE Building Policies and Codes.

[11] Energy efficiency includes a multitude of measures to reduce the energy consumption of a building. These measures range from installing energy efficient appliances to full building renovations updating a building envelope.

waste 30% of energy used.[12] Because buildings will be around for generations, energy efficiency within the built environment is a matter of statewide and long-term importance. States can set requirements for energy systems, require disclosure of energy use, and set performance standards for energy use or emissions. Building codes can be required by state legislation or implemented through 'home rule,' where local governments set their own standards.

The IIJA appropriated $225 million for a competitive grant program to support the "sustained cost-effective implementation of updated building energy codes." The grant program will run for five years, through fiscal years 2022 – 2026. On July 21, 2022, DOE issued a Notice of Intent (NOI) to publish a funding opportunity to support the implementation of "resilient and efficient" building energy codes. This competitive grant program requires the participation of a "relevant state agency" and projects must be tied to "an updated building energy code."

2. **Appliance Efficiency Standards** – Appliance efficiency standards set minimum requirements for efficiency in everything from washing machines to water heaters. Efficiency standards save consumers money on utility bills and reduce energy demand on the grid, most importantly reducing peak energy demand. Some states have elected to adopt the federal appliance standards that were in effect on January 1, 2017.[13] These include, among other things, standards on metal halide lamp fixtures, residential furnaces and boilers, and external AC to DC power supplies.

3. **Energy Saving Performance Contracts (ESPCs)** – ESPCs are a financing mechanism for energy efficiency upgrades. ESPCs are often used within large institutions, such as college or government campuses, allowing them to meet their energy and environmental goals. An energy service company will pay the upfront cost of efficiency upgrades and execute the project, often guaranteeing the projected energy savings. The large institution will then pay back the service company with savings from their utility bills. This allows institutions to pay for their upgrades from their operating budget, instead of finding new financing, such as loans or bonds, for capital upgrades. Essentially, they pay their upgrade costs with their energy savings. As noted above, ESPCs are permitted in Pennsylvania.

4. **Low-Income Energy Efficiency Programs** – While equity should be incorporated into all policy development, it is often necessary to ensure that specific programs are targeted towards historically underserved populations. Recent research suggests that weatherization can reduce energy use by 25-35%, allowing households to reduce their financial energy burden. The federal Weatherization Assistance Program (WAP) provides energy efficiency upgrades for income qualified homeowners. However, in many states there is difficulty in reaching individuals who may be eligible. Lawmakers can pass legislation requiring outreach and education to groups eligible for WAP. Pennsylvania's LIHEAP program currently offers assistance with heating bills; the Whole Home Repairs Program, a $125 million fund created within the state's budget by the General Assembly in 2022, will pay for the home repairs, like leaking roofs and other structural issues, that often cause deferrals in receiving WAP assistance. The Program will also build administrative capacity for assisting consumers in applying for WAP and developing the skilled workforce needed to complete both the home repairs needed before weatherization can take place and the weatherization projects themselves.

5. **Energy Efficiency Resource Standards (EERS)** – EERS require utilities to demonstrate a reduction in energy demand from programs offered to their consumers. Because this means selling less energy and reducing revenues, there is not always an incentive for utilities to make their consumers more productive or efficient users of energy. If legislatures want to ensure a more productive and efficient energy distribution system that takes advantage of the latest technological innovations, they may want to require that a utility demonstrate a percent reduction in demand through efficiency or "demand side" programs. Legislators can also instruct their utility commissions to consider energy efficiency when approving rate cases by allowing cost-recovery of energy efficiency improvements on utility bills.

   Pennsylvania's EERS, also known as the energy efficiency and conservation (EE&C) program, has been implemented in four phases beginning in 2009. The EE&C program applies to electric distribution companies with at least 100,000 customers in the state. As noted above, the PUC is required to evaluate the costs and

[12] For more information, see the Office of Energy Efficiency & Renewable Energy's Commercial Buildings Integration (CBI) Program.

[13] Based upon research conducted by the Center for the New Energy Economy.

benefits of this program every five years and is mandated to adopt new standards for reductions in consumption and peak demand if it finds that program benefits outweigh costs. In a June 18, 2020 Implementation Order, the PUC adopted new incremental targets requiring that electric distribution companies meet a combined 3.1% reduction in consumption, from a 2009-2010 baseline and a combined 3.3% reduction in statewide peak demand, from a 2007-2008 reference between 2021 and 2026. The Implementation Order maintains the low-income carve-out added in phases II and III of the EE&C program.[14]

6. **Revenue Decoupling and Performance-Based Incentives** – Utilities earn revenue by selling energy. As a result, there is little to no incentive for them to promote energy efficiency because it leads to a reduction in sales, and therefore a reduction in revenue. Revenue decoupling disconnects revenue from the amount of energy sold. Rather than selling as much energy as they can, utilities are allowed a set amount of revenue regardless of the amount of energy sold. While this does not directly incentivize energy efficiency, it does remove the inherent disincentive to promote energy efficiency.

   Incentive policies can be layered on top of a decoupling policy. For example, if a utility meets set energy reduction targets, performance-based incentives, as determined by a state's PUC, can provide monetary rewards for meeting those targets. While Pennsylvania allows decoupling, as noted above, as the electricity generation mix changes, it is important to incorporate a regular review of decoupling and other incentive policies to ensure they are still meeting their intended purpose.

Electrification Policies

1. **Strategically Target Beneficial Electrification** – Target areas of beneficial electrification in buildings include space and water heating systems and other systems and appliances that typically use natural gas or another fossil fuel as an energy source. According to the Environment and Energy Study Institute, new electric heat pump technology can heat space and water at efficiencies of 200 to 300%, compared to 67% efficiency in typical Energy Star gas water heaters.[15] This not only allows savings on energy bills, it also results in reduced greenhouse gas emissions and improved indoor air quality.

2. **Adopt Tools for Advancing Electrification** – Building codes and financial incentive programs can be used to advance beneficial electrification. While in some states, local governments are primarily responsible for adopting and implementing building energy codes, in other states, a state legislature, or a code commission tasked by the legislature, adopts and implements statewide standards. Incentive programs established and implemented by states, local governments, or utilities can target replacing systems and appliances that traditionally rely on fossil fuel resources with high efficiency electric systems and appliances including water heaters, furnaces, ovens, and ranges. As an example, heat pump water heaters and space heating systems are being promoted as high efficiency replacements for traditionally fossil-based equipment. In conjunction with utility regulatory policy, these technologies can also serve as demand response management tools by utilities in exchange for compensation to the ratepaying customer.

   As a note, cities across the country are implementing new building codes promoting beneficial electrification by limiting or banning the installation of natural gas in new construction. State legislatures can pass enabling legislation, allowing municipalities to make independent decisions on beneficial electrification. On the other hand, some states have adopted pre-emptive legislation, banning local governments from adopting policies that limit utility service.[16]

Programmatically, there will always be greatest benefit by combining measures – incentives that bundle improvements will generate greater gains than individual measures. For example, a high efficiency heat pump will be much more effective and efficient when coupled with improved building insulation. Rather than only realizing the gains of the new mechanical component, this combination of measures will increase the efficiency of the entire system.

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[14] Final Low-Income MWh Savings Targets are provided on page 35 of the Final Implementation Order, available here: https://www.puc.pa.gov/pcdocs/1666981.docx.

[15] For more information, see EESI's Beneficial Electrification.

[16] See, "Battle Brews over Banning Natural Gas to Homes." The Wall Street Journal, 1 June 2021, https://www.wsj.com/articles/battle-brews-over-banning-natural-gas-to-homes-11622334674.

ELECTRIFICATION OF THE TRANSPORTATION SECTOR

Bloomberg New Energy Finance estimates that nearly 80% of new car sales in the U.S. will be electric by 2040. Therefore, a key part of building a modernized grid involves designing infrastructure that will facilitate easy connection of electric vehicles (EVs) to the grid. One of the most important barriers to increased adoption of EVs is the consumer's awareness of the availability of EV charging stations. Ultimately, drivers want to be sure that their car will get them where they need to go. The good news is that both supportive policies for developing charging infrastructure and technological advancements have eased this "range anxiety."

A few incentives for alternatively fueled vehicles, including EVs, are currently available in Pennsylvania. These incentives include rebates and grants for both vehicles and charging infrastructure. Two utilities in the state, Duquesne Light Company and PECO Energy Company also offer incentives for EVs and charging infrastructure. Executive Order 2019-01 set a goal of replacing 25% of the state-owned passenger vehicle fleet with EVs or plug-in electric hybrids by 2025. In February 2019, the Pennsylvania Department of Environmental Protection released the Pennsylvania Electric Vehicle Roadmap. The report identifies a number of policy opportunities, including establishing an electrification directive for utilities and the PUC, expanding charging infrastructure, increasing incentives for vehicle purchases, and adopting EV ready building codes.

The American Council for an Energy-Efficient Economy (ACEEE) published a State Transportation Electrification Scorecard in 2021 that evaluates states' progress in electrifying transportation in six key policy areas and offers nationally applicable policy recommendations. Pennsylvania ranked 17th out of the 31 states ranked in the 2021 report.

The IIJA provides nearly $5 billion over the next five years to support the electrification of the transportation sector. In 2022, $615 million will be made available for the installation of charging stations along designated alternative fuel corridors. The Act also provides approximately $1.1 billion for grants to state and local governments to assist with the purchase or lease of low- or no-emission vehicles for transportation fleets. To be eligible, a state must have a Zero-Emission Fleet Transition Plan in place.

The IRA extended the $7,500 EV tax credit for purchases of new plug-in EVs through 2032 and removed the eligibility cap based on number of vehicles sold by manufacturers. The Act includes requirements for material sourcing that must be met by manufacturers starting in 2027. The IRA also created a new $4,000 refundable tax credit for the purchase of used EVs and a new credit for commercial EVs. Appropriations in the Act include $1 billion for replacing medium- and heavy-duty vehicles with EVs, $3 billion to fund projects to reduce transportation sector emissions, and $3 billion to procure alternatively fueled vehicles for the federal fleet.

A 2020 analysis by AEE found that a $10 billion investment in EVs including financial incentives to reduce up-front costs of purchases and state support for charging infrastructure deployment in Pennsylvania could add approximately $32 billion to the GSP and create 259,000 new jobs.[6]

There are several policy opportunities to further encourage and prepare for increased market penetration of EVs in the state, including:

1. **Charging Infrastructure Plan** – Locating charging infrastructure is different from locating conventional fueling stations. While some drivers will need to charge more quickly, others will refuel when they are parked for longer periods of time, for example when shopping at the mall or going to work. Charging infrastructure plans should attempt to pair the appropriate level of charging (level 2 or direct current fast charging) with a reasonable amount of time a person will be at that location.

   The IIJA included a new National Electric Vehicle Infrastructure (NEVI) formula grant program to provide dedicated funding to states to deploy charging infrastructure with the goal of creating an interconnected network of vehicle charging stations across the nation's highways. To be eligible to receive funding, states must develop and submit a NEVI plan to the Federal Highway Administration (FHWA) by August 1, 2022. NEVI funds cannot be obligated until a state's plan is approved by the FHWA. The Pennsylvania Department of Transportation developed and submitted (on July 21, 2022) a NEVI state plan to coordinate the use of Pennsylvania's expected allocation of $171.5 million in formula funding from the IIJA.

2. **Parking Infrastructure Requirements** – Legislation could set requirements for parking lots and other infrastructure. Some states have adopted permitting standards for parking lots, requiring, for instance, that for every 100 parking spaces, there must be at least one EV charging space. Legislation could also incentivize utilities to develop make-ready locations. These locations supply power to the point where a utility or third-party developer might install an EV charging station. Pennsylvania's Statewide Building Energy Codes could also be updated to include requirements for EV charging infrastructure.

3. **EV and Charging Equipment Financing and Financial Incentives** – Providing financial incentives and innovative financing options can help spur greater market penetration of EVs. Sales, property, and income tax credits are some of the simplest methods for addressing the high up-front costs of EVs and EV charging equipment. While sales tax credits are typically applied at the time of purchase, property and income tax credits may do less to address upfront cost barriers, as the credit is not applied at the time of purchase.[17] States have adopted other financial incentives including low-interest loans, grants, vouchers, and rebates. A handful of states qualify EV charging equipment under their property assessed clean energy (PACE) programs. A simple solution is to increase and expand existing tax credits to incentivize commercial, publicly available charging stations.

   States might consider adopting programs to incentivize the purchase of used EVs. With increasing battery capacities and falling prices, there are an increasing number of EVs with relatively low milage that are being traded in. States might also consider programs that target low- and moderate-income (LMI) customers that may not qualify for a loan directly. Such a program could facilitate sales through such things as loan loss reserve and interest buy down programs.

NEWS

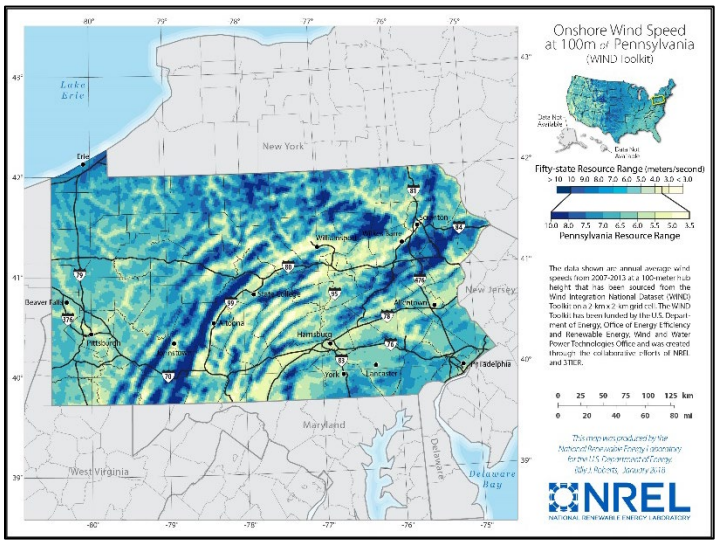
- August 23, 2022: Montgomery County Commissioners OK Expansion of State Funding for Green Projects
- August 22, 2022: Centre Region Awarded Silver Designation for Advancing Solar Energy Growth
- July 18, 2022: A Key US Energy Efficiency Program Has A Major Flaw – and Pennsylvania is Trying to Fit It
- June 19, 2022: Pennsylvania Survey Seeks Input on Location of Electric Vehicle Charging Stations
- June 17, 2022: Exus to Manage 244 MW Vitol Wind Farms in Pennsylvania
- June 14, 2022: Penn Breaks Ground on One of State's Largest Solar Projects in Effort to Reduce Carbon Emissions
- June 13. 2022: Pennsylvania's Difficult Shift for Funding Roads
- May 27, 2022: Influx of Renewables Has Regional Operator Planning for Future Electric Grid
- May 25,2022: 50 States of Solar Incentives: Pennsylvania
- May 19, 2022: Pennsylvania Proposed as a Cleaner Energy Hydrogen Hub
- April 26, 2022: Pennsylvania Reaches the Regional Greenhouse Gas Initiative Starting Line
- March 2, 2022: Poll Finds Overwhelming Support for Solar Power in Pennsylvania

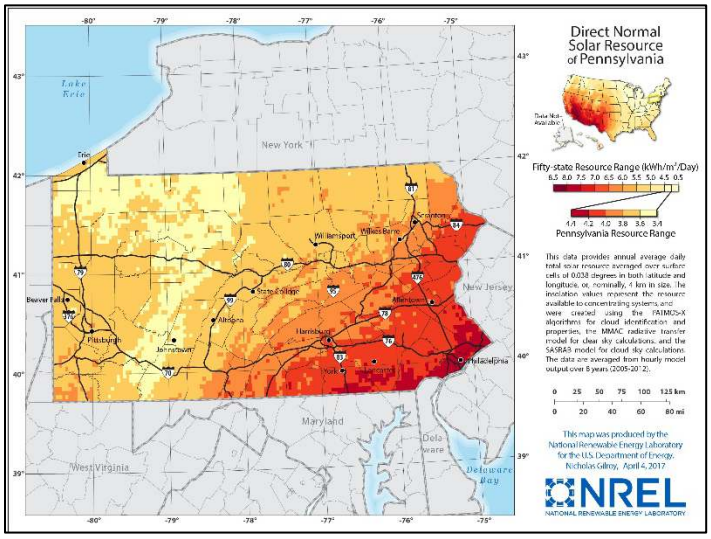
OTHER RESOURCES

- Keystone Energy Efficiency Alliance: https://keealliance.org/
- Pennsylvania Conservative Energy Forum: https://penncef.org/
- Pennsylvania Department of Environmental Protection – Energy Programs Office: https://www.dep.pa.gov/Business/Energy/OfficeofPollutionPrevention/Pages/default.aspx
- The American Council for an Energy-Efficient Economy State and Local Policy Database, Pennsylvania: https://database.aceee.org/state/pennsylvania
- The Database of State Incentives for Renewables and Efficiency, Pennsylvania: http://programs.dsireusa.org/system/program?fromSir=0&state=PA
- U.S. Department of Energy's Alternative Fuels Data Center, Pennsylvania: https://www.afdc.energy.gov/states/pa
- U.S. Energy Information Administration, Pennsylvania: https://www.eia.gov/state/?sid=PA
- American Clean Power Association, Pennsylvania State Fact Sheet: https://cleanpower.org/wp-content/uploads/2022/07/Pennsylvania_clean_energy_factsheet.pdf
- SPOT for Clean Energy, Pennsylvania: https://spotforcleanenergy.org/state/pennsylvania/

[17] A study by the Congressional Research Service suggests that tax credits are important tools for ensuring increased adoption of alternative-fueled vehicles.

PENNSYLVANIA'S WIND AND SOLAR RESOURCES
WIND https://windexchange.energy.gov/states/pa





Our Resources

CNEE Homepage: https://cnee.colostate.edu/

The SPOT for Clean Energy: https://spotforcleanenergy.org/

The Advanced Energy Legislation (AEL) Tracker: https://www.aeltracker.org/

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