



A Distributed-Generation Solution for Pennsylvania's Energy Future

Executive Summary

Pennsylvania's energy landscape is experiencing rapid transformation. The Commonwealth is contending with rising capacity market costs, increased regional electricity demand, and aging transmission infrastructure. Simultaneously, families and small businesses are dealing with unpredictable utility bills, while rural communities are searching for new avenues of economic growth. In this context, distributed generation, including community solar, offers a compelling opportunity to modernize Pennsylvania's energy mix in a cost-effective and locally driven way.

Distributed generation refers to energy resources, like solar, geothermal, or biogas, produced close to the point of use. These technologies reduce the need for long-distance transmission and offer a nimbler response to demand peaks and grid disruptions. For Pennsylvania, this means more reliable electricity for

consumers and less vulnerability to interstate capacity auctions that can drive up prices without adding local value. While large-scale utility projects remain essential, they should be complemented by a flexible, diversified portfolio that includes distributed resources owned by households, businesses, farms, and community groups.

One of the most promising models within distributed generation is community solar. Unlike traditional rooftop solar, which requires property ownership and upfront capital, community solar allows ratepayers to subscribe to a shared local solar project and receive credit on their utility bill for the energy produced. Programs in numerous other states have demonstrated that community solar can lower bills, attract private capital, and reduce utility risk by diversifying the generation base. The Coalition for Community Solar Access estimates that about 750 MW of community solar development generates approximately \$2.1 billion in economic impact and

creates more than 14,000 local jobs (Coalition for Community Solar Access, 2025a).

Research shows that in Pennsylvania, specifically, community solar could be an economic boon. In a study conducted by the Center for Economic and Community Development at Penn State, researchers found that adding community solar installations currently in the early planning stages could generate \$1.8 billion in economic output for Pennsylvania. When operational, these projects could lead to an estimated \$83.3 million increase in economic output and \$574,260 increase in property tax collections for the Commonwealth (PSU Center for Economic and Community Development, 2020).

Despite these benefits, policy uncertainty remains a significant barrier. Pennsylvania does not yet have enabling legislation to authorize a full-scale community solar program. Moreover, efforts to roll back net energy metering (NEM), a policy that ensures fair compensation for consumers who supply excess energy back to the grid, continue to emerge. Undermining NEM or failing to advance community solar legislation would limit Pennsylvanians' ability to invest in distributed energy, stifling innovation and locking the state into a one-size-fits-all energy model that no longer meets the needs of a modern, diversified economy.

Opposition to distributed generation projects such as community solar often arises from misconceptions or limited concerns. Some contend that it constitutes an unfair subsidy or might impose a burden on nonparticipating ratepayers. However, well-designed programs in other states have demonstrated that community solar can be implemented in a manner that is revenue-neutral, cost-transparent, and equitable. Furthermore, community solar does not seek special treatment; it merely aims to compete on an equal footing and offer more Pennsylvanians a stake in their energy future.

Failing to embrace distributed generation could be more costly for Pennsylvania in the long run. The regional transmission grid serving Pennsylvania is facing growing reliability challenges. Capacity prices from the 2025–2026 PJM auction surged, with the costs passed on to Pennsylvania consumers, even though the state has sufficient generation capacity. Distributed generation can act as a buffer against market volatility, giving communities more control over their energy destiny.

Now is the time for state leaders to act. By advancing legislation that protects NEM and allows for distributed generation projects, policymakers can open the door to private investment,

job creation, and greater resilience across the Commonwealth. With thoughtful legislation and regulatory clarity, the Commonwealth can harness these technologies to support its residents, protect its grid, and strengthen its economy, without sacrificing competition or choice. The risks of inaction are real, but the opportunities are even greater.

Introduction

Economic growth and innovation are driving significant changes in the energy landscape, creating new demands and opportunities for Pennsylvania's electric grid. As more households and businesses adopt digital technologies, electricity consumption is rising, putting added pressure on grid infrastructure already challenged by the retirement of aging power plants (Ashfaq et al., 2024; Yang et al., 2025). These trends are especially important in the PJM Interconnection region, which serves over 65 million people, including Pennsylvanians. To meet this growing demand, the rapid deployment of flexible and decentralized energy solutions is needed. Distributed generation, including solar, is set to play a crucial role in this transition.

Distributed generation refers to small- to midscale electricity production located near the point of use, such as geothermal wells at homes or shared systems like community solar projects. Unlike large, centralized power plants, distributed generation reduces the need for expensive long-distance transmission and gives consumers more control over their energy choices. Distributed generation represents a common-sense, market-driven approach to energy as it promotes competition, encourages private investment, strengthens grid reliability, and reduces dependence on a limited number of utilities. By lowering peak demand and offering new revenue streams to landowners and entrepreneurs, distributed generation can cut costs for ratepayers and support local economic growth (Adefarati & Bansal, 2016; Massey, 2010).

This report explores the role distributed energy can play in helping Pennsylvania meet its growing energy needs by utilizing local resources. It discusses distributed generation projects, focusing on solar merchant generation and community solar; outlines their economic, environmental, and social benefits; and evaluates the regulatory and policy conditions necessary for successful deployment. Special attention is given to the evolving roles of state agencies, utilities,

and local governments, as well as the evolving federal and state policy environments.

**Electricity Generation in Pennsylvania:
A Changing Landscape**

The Commonwealth stands as the nation’s leading net exporter of electricity, delivering more power than it consumes (PJM staff, 2024b). In 2024, Pennsylvania exported approximately 87 million megawatt hours (MWh) of electricity, nearly twice that of the second-highest exporting state. The electricity generated in Pennsylvania supplies energy to PJM Interconnection, the regional transmission organization (RTO) responsible for managing the wholesale power market and electric grid system across all or parts of 13 mid-Atlantic states, including Pennsylvania. PJM is one of six RTOs and independent system operators (with Texas having its own system) overseeing wholesale electricity flow in various U.S. regions to ensure a reliable and stable power system (FERC, 2025). PJM subsequently sells the wholesale power to 11 electric distribution companies (EDCs) throughout Pennsylvania and manages the electricity flow through the regional grid.

PJM’s generation mix is dominated by natural gas (39 percent) and nuclear energy (32 percent), though renewable energy sources, including solar, wind, and hydropower, are increasing and now account for more generation than coal, as shown in Figure 1 below (PJM staff, 2024b). As natural gas, nuclear, and renewables have supplanted coal as the largest generation source, there has been an accompanying reduction in carbon

emissions. Within the renewable sector, solar and wind energy have become increasingly significant components of the energy portfolio, with proposed solar projects now constituting 82 percent of the PJM queue (PJM staff, 2024b).

Growth in Demand for Electric Power

Electric demand in the PJM region has surged rapidly over the past five to seven years. Total annual energy consumption across the PJM footprint is projected to grow by nearly 40 percent by 2039, increasing from 800,000 gigawatt-hours (GWh) to approximately 1.1 million GWh (PJM staff, 2024). This rise is fueled by the growing electrification of homes and industries and the swift expansion of data centers throughout the PJM area.

The ongoing electrification of homes and industries in Pennsylvania is driving a notable increase in power demand across the Commonwealth. As residential buildings adopt electric heating systems, appliances, and electric vehicles, and as industrial sectors transition from fossil fuels to electric-powered machinery and processes, the overall load on the electrical grid continues to rise (Yang et al., 2025). This shift is part of broader electrification efforts across the United States and other nations (Ashfaq et al., 2024).

Energy consumption by U.S. data centers also increased, reaching 176 TWh by 2023 and accounting for 4.4 percent of the nation’s total electricity use. According to the 2024 U.S. Data Center Usage Report, this figure could rise to between 6.7 percent and 12 percent by 2028 (Shehabi et al., 2024). Some estimates suggest even higher usage, though they

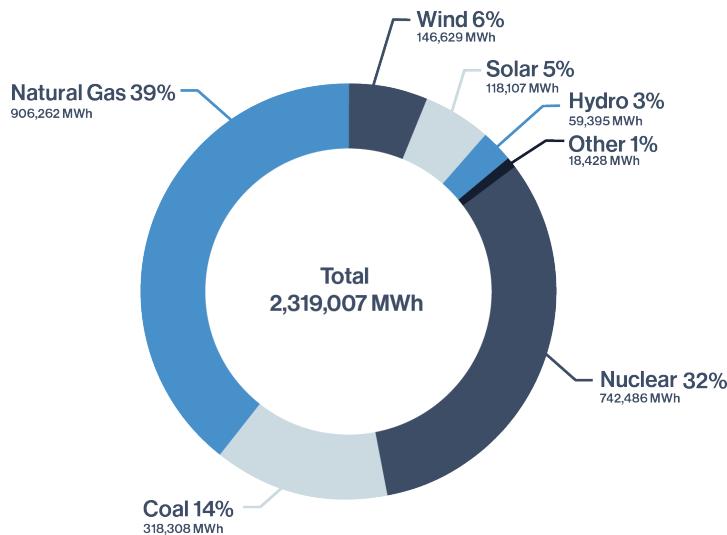


Figure 1: Generation Mix of PJM Interconnection
Data source: U.S. Energy Information Administration

also highlight significant uncertainty due to advancements in efficiency and growing demand in the coming years. While much of the data center development in the PJM territory has been concentrated in Virginia, this trend is now moving to other states. Pennsylvania, in particular, is experiencing a surge in data center projects, with several major announcements of data centers co-locating with new or restarted power generation facilities (Gray, 2025; Plumer, 2025). Currently, Pennsylvania hosts 88 operational data centers, with more under development (DataCenterMap, 2025).

PJM and Rising Prices

Despite Pennsylvania's position as an energy exporter, ratepayers in the Commonwealth will experience higher electricity bills due to demand growth in the PJM region. The PJM capacity auction held in July 2024 issued a strong warning of higher prices and a shortage of generation capacity. The PJM capacity market ensures enough electricity generation resources are available to meet future demand, particularly during high-usage periods (e.g., summer heat waves, polar vortex cold outbreaks). It achieves this through a competitive auction process where power suppliers bid to provide dedicated capacity for a future delivery year.

The 2025–26 delivery auction in July 2024 saw a significant spike in the capacity price paid. The auction produced a price of \$269.92/MW-day for much of the PJM footprint, compared to \$28.92/MW-day for the 2024–2025 auction, a more than 800 percent increase. Capacity auction prices fluctuate annually based on the need to invest in generation resources (PJM staff, 2024c). PJM determines in advance how much power it anticipates needing, and the peak load forecast increased for the 2025–26 year, while the amount of supply resources in the auction decreased.

In addition to growing demand, PJM attributes the higher prices to constrained supply as generating facilities are retiring faster than new generation can be brought online. PJM and North American Electric Reliability Corporation have expressed concerns about future reliability and the possibility of blackouts. PJM projects that 40 GW of capacity is set to retire by 2030. At the same time, more than 90 percent of the projects in the PJM interconnection queue to be added to the grid are renewable energy, which is intermittent and requires multiple MW to replace 1 MW of thermal power (PJM staff, 2023).

PJM argued that higher prices send a “clear investment signal” that new generation capacity is needed; however, the interconnection approval process to bring new generation online is lengthy and complicated (PJM staff, 2024c). PJM is

now working with the Federal Energy Regulatory Commission (FERC) to overhaul its procedures and quickly bring more power generation online. Recently, it announced that 51 projects had been fast-tracked in a one-time Reliability Resource Initiative to be built by 2030.

Costs Incurred by Residents of Pennsylvania

In June 2025, electric customers in Pennsylvania experienced an increase in their bills as the surge from the 2025–26 capacity auction was transferred to consumers. On June 1, the Pennsylvania Public Utility Commission (PUC) adjusted its Price to Compare (PTC) by 5 to 12 percent. The PTC accounts for 40–60 percent of a customer's utility bill (PUC staff, 2025). Commercial and industrial customers might face even larger increases in the future. Although the capacity price rose ninefold, it is just one of the ancillary charges in the overall bill, including energy generation, distribution, and transmission charges now expected to rise.

Higher electricity rates can affect residential customers, businesses, governments, and utilities in various ways. For residential customers, higher monthly bills mean less discretionary income and a tighter household budget, especially during peak usage. This may disproportionately affect lower-income customers who cannot pay more for their electricity, and could result in restricted electric use for air conditioning or heat (Harker Steele & Bergstrom, 2021).

Businesses and governmental entities may also experience increasing operational expenses and strained budgets. Higher utility bills may reduce profit margins, hinder competitiveness, and discourage expansion or investment for businesses, especially for energy-intensive industries. Local governments may face increased costs for powering public buildings, schools, and infrastructure, potentially diverting funds from essential services or requiring tax adjustments. These pressures could slow economic development and place added financial burdens on communities across the state (Bohr & McCreery, 2020; Comerford, 2015; Klein et al., 2021).

While it may seem counterintuitive that costs are rising in a state like Pennsylvania, which currently enjoys a surplus of generation capacity, the explanation lies in how capacity markets allocate costs. In PJM's system, capacity costs are not determined by the location of power plants or the extent of local surplus. Instead, these costs are directly assigned to

electricity load, which refers to the demand placed on the grid by consumers in a specific area. Consequently, even if Pennsylvania has more power plants than necessary, its consumers still bear their share of regional capacity costs based on their electricity usage and the timing of that usage.

State Efforts to Reduce Exposure to Price Increases

Since taking office in 2023, Pennsylvania Governor Josh Shapiro has advocated for an *all-of-the-above* energy strategy to put Pennsylvania at the forefront of economic development while increasing energy efficiency and protecting consumers from rising electric prices. After PJM's 2024 capacity auction resulted in a considerable price increase, Shapiro filed a complaint with the Federal Energy Regulatory Commission (FERC) against PJM, claiming that flaws in the capacity auction design and interconnection procedures were stifling the addition of new generation sources and leading to higher electric bills (Boyer et al., 2024). Shapiro signaled that future capacity auctions could result in \$20 billion in unnecessary costs for Pennsylvania and the PJM region if left unaddressed.

In April 2025, FERC approved a previously negotiated settlement between Shapiro and PJM that will lower PJM's auction price cap from more than \$500 per megawatt-day to \$325 per megawatt-day to reduce customer cost increases. The settlement also sets a minimum capacity price at \$175 per megawatt-day to provide stability to electric generators. This temporary solution will be in place for the following two capacity auctions. At the same time, PJM continues to work to overhaul its interconnection and auction processes to meet the changing electric demand landscape.

Shapiro has also championed long-term changes to PJM, which include accelerating the interconnection queue for projects aiming to connect to the grid. This process currently demands years of study. He suggests relying on member states to identify shovel-ready projects and reforming the capacity market (Starr, 2024). Additionally, Governor Shapiro has proposed a new comprehensive energy plan for Pennsylvania. The "Lightning Plan" encompasses various initiatives to promote an all-inclusive approach to energy development (Staff, 2025). They include:

- Creation of the Pennsylvania Reliable Energy Siting and Electric Transition (RESET) Board to speed up permitting and reduce red tape. Pennsylvania is one of just 12 states without a state entity to handle siting decisions for key energy projects.
- Revamp the unused Pennsylvania Economic Development for a Growing Economy (PA EDGE) Tax Credit Program,

established in 2022, to provide up to \$100 million per facility in tax credits for three years for adding reliable generation sources to the grid.

- Establish PACER (Pennsylvania Climate Emissions Reduction Act) that would establish a cap-and-invest program to set Pennsylvania's carbon limit and invest in reducing electricity costs. Seventy percent of the revenue generated would be returned to consumers as rebates on their electric bills. This program would replace Pennsylvania's stalled efforts to join the Regional Greenhouse Gas Initiative.
- Establish the Pennsylvania Reliable Energy Sustainability Standard (PRESS), which would update the state's 2004 alternative energy portfolio standards (AEPS) to increase to 35 percent the amount of Pennsylvania's energy that must come from renewable sources, including solar, up from 8 percent now, with just 0.5 percent of that mandated to be solar.
- Propose lower energy costs for rural communities, farmers, and low-income Pennsylvanians through initiatives in the 2025–26 budget proposal, including one to establish community energy.
- Update Act 129, which sets appliance energy efficiency standards and provides rebates for these purchases.

An analysis of the proposed policies revealed that they would lead to the construction of an additional 4.1 GW of clean energy resources in Pennsylvania from 2025 to 2040. This expansion would increase the generation resources eligible for PRESS fivefold. Furthermore, PACER and PRESS are projected to reduce Pennsylvania's in-state carbon dioxide emissions by 38 percent, or 138 million tons (Knight et al., 2025).

Distributed Energy: An Overview

To address the growing strain on Pennsylvania's electric grid from increased demand and rising energy costs, innovative and decentralized solutions are becoming increasingly vital. Distributed generation, including solar, biogas, and battery storage solutions, offers a path to reduce peak demand and enhance grid resilience by generating power closer to where it is used. By integrating distributed generation projects like community solar into the state's energy strategy, Pennsylvania can alleviate pressure on the grid while promoting economic growth.

Defining Distributed Energy Projects

A distributed energy project generates electricity typically using alternative technologies, such as solar panels or geothermal systems, installed on individual properties, like homes or businesses, rather than large-scale power plants. This decentralized approach contrasts with utility-scale generation, where a large amount of electricity is produced in a central location, sent through high-voltage transmission lines to be purchased by the regional grid, and then distributed to customers. Distributed energy can be either residential or commercial, with the electricity generated used on-site or fed back into the electric distribution company's grid. The benefits of distributed energy projects include increased energy independence, reduced transmission losses, and improved grid resilience. By generating electricity closer to the point of consumption, these systems can help mitigate the impact of power outages and reduce strain on the existing grid infrastructure (Adefarati & Bansal, 2016).

Existing Programs in Pennsylvania: Net Energy Metering (NEM) and Merchant Generation

In recent years, Pennsylvania has seen rapid growth in distributed energy generation. Until recently, most projects were either very large, utility-scale installations or very small, like rooftop solar on individual homes. That changed in 2021, when the Pennsylvania Supreme Court ruled in *Hommrich v. Commonwealth*. The decision clarified how net energy metering (NEM) is regulated in the state, allowing midsize solar projects of up to 3 to 5 MW in size to qualify as customer-generators if the companies meet PUC regulations on size, location, and interconnection. NEM is a payment system that gives energy producers credit for excess electricity they send to the grid in the form of bill credits, which can be used to offset future energy costs. By overturning changes proposed by the PUC, the court decision allowed merchant generators, independent producers who sell almost all of their electricity into the market rather than use it on-site, to participate in net metering. As a result, Pennsylvania opened the door to a new wave of midsize solar projects that fall between traditional residential and utility-scale installations. In Pennsylvania's decentralized and competitive electric provider market, these merchant generators develop midsize solar arrays and sell the much-needed electricity they produce back to the EDC, reaping the economic benefit of net metering (Aldebot, 2022).

Today, distributed energy by way of merchant generation continues to grow. In 2024, the PUC received more than 1,800 merchant generator interconnection requests with an average size of more than 2,300 KW (The 2024 AEPS Annual

Report, 2024). This surge in merchant generator interconnection requests reflects the increasing popularity of distributed energy solutions among businesses and individuals. The trend toward larger average system sizes suggests a shift toward more substantial installations, potentially driven by economies of scale and improved technology.

Community Solar: A Promising Form of Distributed Energy

Community solar is a type of distributed generation project. The U.S. Department of Energy (DOE) describes community solar as "any solar project or purchasing program, within a geographic area, in which the benefits of a solar project flow to multiple customers such as individuals, businesses, nonprofits, and other groups" (U.S. Dept. of Energy, 2025). This model benefits those who cannot install rooftop solar due to renting, residing in multi-tenant buildings, having shaded roofs, or being unable to afford the upfront installation costs (Dillman-Hasso & Sintov, 2025; O'Shaughnessy et al., 2024; Xu et al., 2022). Residents subscribe to purchase or lease a share of a community solar project and generally receive a monthly bill credit for the electricity generated by their share of the system, similar to those with rooftop solar. They can also earn bill credits for excess power sent to the electric grid (NREL, 2025).

Typical community solar systems produce between 1 and 5 MW of electricity, with a national average of each MW powering about 168 homes. Because of Pennsylvania's topography and sun exposure, the Solar Energy Industries Association (SEIA) estimate is lower, at 121 homes (SEIA staff, 2025). Five to seven acres of suitable land is needed to produce a megawatt of solar power, thus, with the proposed Pennsylvania maximum of 5 MW, a system would require 25–35 acres of property, a much smaller footprint than a utility-scale project that might require hundreds of acres (SEIA staff, 2025a).

Trends in Community Solar

According to the U.S. Department of Energy, community solar is among the fastest-growing sectors in the U.S. solar market. From 2010 to 2021, community solar more than doubled annually, though it still constitutes a small portion of the overall solar market (NREL staff, 2023). A 2023 report by consulting firm Wood Mackenzie forecasts 118 percent growth in the U.S. community solar market over the next five years, with at least 6 GW of capacity anticipated to be operational by 2027 (Thomton, 2023). In 2023, the Coalition for Community Solar Adoption set an ambitious target to extend community solar to 10 million people by 2030, requiring 30 GW of installed capacity (Coalition for Community Solar Access, 2025a).

Although a definitive number of distributed solar projects in Pennsylvania is not readily available, numerous ongoing projects and initiatives are underway.

The growth in community solar has been facilitated by public policies that make it easier for community solar projects to be developed. Twenty-three states have adopted community solar policies, plus the District of Columbia, representing more than 7,800 MW of total installed capacity. About 73 percent of the total market is concentrated in the top four states: Florida, New York, Massachusetts, and Minnesota, all of which have such policies (Dillman-Hasso & Sintov, 2025; Xu et al., 2022).

Trends in Solar Power in Pennsylvania

The EIA reports that solar power generation in Pennsylvania doubled from 2015 to 2020 (U.S. EIA, 2022). By February 2025, solar generation reached 2,552 MW, an increase of nearly 1,000 MW from February 2024. Of this total, 1,563 MW was derived from small-scale capacity in February 2025, up from almost 831 MW the previous year (U.S. Energy Information Administration, 2025). The EIA defines small-scale solar as projects with a generating capacity of less than 1 MW. These systems, often installed as rooftop solar panels on homes, constitute the majority of small-scale solar capacity in the United States. However, they are also utilized in the commercial sector. U.S. small-scale solar capacity expanded from 7.3 GW in 2014 to 39.5 GW in 2022, accounting for about one-third of the nation's total solar capacity (U.S. EIA, 2023).

As of May 2025, Pennsylvania had 62 utility solar farms, with a total operating capacity of 991 MW. In 2024, 11 solar farms were built in Pennsylvania (Cleanview, 2025). The SEIA projects that Pennsylvania will add almost 4 GW of solar power over the next five years. However, the state still ranks 22nd for installed solar capacity, and less than 1 percent of electricity generated in Pennsylvania is from solar (SEIA staff, 2025b). Pennsylvania's average utility-scale solar farm spans 218 acres and produces 12.2 MW of electricity under optimal conditions. The largest solar project in Pennsylvania, Great Cove I and II, covers 1,600 acres and has a capacity of 220 MW (Hispa, 2024).

Distributed Generation in Pennsylvania

In recent years, Pennsylvania has witnessed significant growth in distributed energy generation, mirroring broader national trends toward decentralizing electricity production.

Technologies like rooftop solar and on-site biogas systems have increasingly enabled households, businesses, and institutions to generate electricity closer to where it is used. This shift has been propelled by policy changes, declining technology costs, and a growing interest in energy independence and sustainability. However, despite this progress, Pennsylvania's distributed generation market remains underdeveloped. Reviewing how legislative and regulatory forces in Pennsylvania have shaped the solar market can reveal challenges for distributed generation overall.

Legislative Headwinds: The Story of Solar

Pennsylvania has faced legislative headwinds in expanding solar access for years. During consideration of a bill that would have authorized the federal Solar for All program in Pennsylvania to provide residential solar in low-income neighborhoods, an amendment was offered requiring the state's utility regulator, the PUC, to promulgate regulations on net metering. The amendment would have nullified the *Hommrich* decision by placing rulemaking in the hands of the PUC rather than the legislature. Proponents of the measure argued that the amendment promoted fairness in the market, while opponents, including environmental groups, contended it could end net metering, which provides a major financial incentive for residential solar owners.

In addition, utilities have seen distributed solar as a challenge to their business model, arguing that compensating solar customers at retail rather than wholesale rates through net metering, along with customer loss, hurts profitability (Sunar & Swaminathan, 2021). Some groups claim that non-solar utility consumers subsidize distribution costs for solar adopters. This has led to policy debates and regulatory changes in many states regarding net metering and solar compensation structures. Utilities have proposed alternatives like time-of-use rates, reduced export credits, or a maximum amount of power that can be sold back to address their concerns. Meanwhile, solar advocates argue that distributed generation provides grid benefits and should be valued, creating ongoing tension between stakeholders (Aldebot, 2022).

There have also been legislative efforts to impose bonding and decommissioning requirements (PennFuture, 2023). The state Senate has passed legislation, S.B. 349, requiring solar developers to have a third-party independent analysis of decommissioning costs and post a bond equal to 10 percent of that amount. A House committee is now considering the

bill. If passed, the legislation would establish a standardized approach to ensuring responsible end-of-life management for solar installations across Pennsylvania. Critics argue that the bonding requirement may create barriers for smaller solar developers, while proponents maintain it is necessary to protect landowners and local communities from potential abandonment costs.

Pennsylvania's challenges in expanding solar energy reflect broader tensions in energy policy concerning distributed energy, particularly the need to balance innovation with fairness, fiscal responsibility, and regulatory clarity. As technologies like residential solar become more accessible, questions arise about integrating them into longstanding utility and regulatory frameworks. Debates over net metering, for example, highlight concerns about market fairness and cost distribution. Utilities argue that paying solar customers retail rates for excess electricity, while other customers cover fixed infrastructure costs, creates a cross-subsidy that ultimately burdens nonsolar ratepayers. This was the underlying reason that the PUC unsuccessfully attempted to change net metering rules to prevent merchant generators from reaping the benefits of net metering (Aldebot, 2022). Similarly, proposed bonding and decommissioning requirements ensure that developers, not taxpayers or landowners, are held accountable for long-term maintenance and cleanup. While solar advocates emphasize the environmental and grid benefits of distributed generation, it is equally important to consider the financial and operational implications for existing infrastructure and rural communities. Pennsylvania's experience illustrates the need for a thoughtful, balanced policy that encourages energy innovation without compromising fairness, transparency, or local control.

Challenges at the Local Level

Legislative efforts also extend to the local level through zoning ordinances that address, or fail to address, distributed generation. Local zoning is one of the most crucial regulatory components, as having a municipal ordinance in place can assist developers in determining necessary actions, estimating costs, and fostering community acceptance (PennFuture, 2023). A recent research project by Penn State Dickinson School of Law examined over 2,500 local zoning ordinances in Pennsylvania to assess the level of guidance available for developing solar energy systems. Preliminary findings revealed that 87 percent of local zoning codes offer no guidance, while 8 percent primarily focus on rooftop and accessory solar. Just 5 percent of zoning codes have adopted regulations for utility-scale solar energy systems (Badissy, 2021a). This

lack of precise regulation poses a significant risk for project developers, as there is no clear guidance on what to expect when seeking project permits. It could result in lengthy delays, diminished community acceptance, increased pushback, and higher legal costs to navigate the municipal hearing and legal process (Badissy, 2021b).

This can be seen in recent news reports of proposed Pennsylvania solar projects that have been denied permission to build at the municipal level after extensive hearings and incurred costs for planning, engineering, and legal services (Himler, 2024). In another recent case, a county commission voted to approve a countywide solar development ordinance after a local request to develop a solar farm was denied (Petroff, 2025).

Why Focus on Distributed Energy Solutions?

Distributed generation, such as community solar, farm-based biogas, and on-site geothermal systems, offers a practical, market-driven approach to strengthening Pennsylvania's energy future. Unlike large-scale utility projects that often require significant land use with limited local return, distributed generation keeps energy production closer to where it is consumed, empowering property owners, small businesses, and local governments to invest in and benefit from their energy systems. These technologies promote energy independence, reduce strain on the transmission grid, and can bolster rural economies through diversified income streams. Notably, distributed energy systems expand access to affordable energy solutions without relying solely on taxpayer-funded subsidies or top-down mandates. By supporting policies that remove regulatory barriers and allow voluntary participation in programs like community solar, Pennsylvania can foster innovation, competition, and resilience in its energy markets—all while respecting local control and private enterprise (Massey, 2010; Sunar & Swaminathan, 2021).

Energy Independence

Distributed generation offers another way for Pennsylvania to build upon its reputation as an energy-producing state and contribute to its energy independence. Pennsylvania is a net energy exporter, but more power is being demanded throughout the mid-Atlantic region for industrial and computing functions (Ashfaq et al., 2024; Gray, 2025; PJM staff, 2025). In order to be able to continue to export energy to other states,

Pennsylvania must ensure that its residents have abundant resources ready to meet the electric needs within this state. Distributed generation offers an additional source that can help reduce stress on the electrical grid by providing alternate sources closer to the end user. Distributed energy, such as merchant generation, community solar, and biogas produced from agricultural methane digesters, can economically benefit rural parts of the state and increase energy security. In more urban parts of the state, community energy projects will allow residents who cannot otherwise utilize rooftop solar, such as renters, access to its economic benefits.

Because the energy is generated and used in the local distribution grid, it can help communities become more resilient in the event of outages in other parts of the grid. In addition, it gives communities additional choices in their energy source, allows participating residents to lower their electrical bills, and provides farmers and other landowners with an extra source of revenue through leasing. In the case of community solar, the benefits of solar power are shared among the subscribers, who receive credits on their electric bill through net metering.

Economic Benefits

The economic benefits of distributed generation, like community solar, are numerous. The Coalition for Community Solar Access estimates that a nationwide average of 750 MW of community solar development generates approximately \$2.1 billion in economic impact and creates more than 14,000 local jobs (Coalition for Community Solar Access, 2025). A recent study by Penn State University's Center for Economic and Community Development estimated the potential benefit of adding community solar in Pennsylvania. Using conservative assumptions, the study found that the construction of 235 currently planned community solar facilities in the Commonwealth could generate an upfront \$1.8 billion increase in economic output. After these facilities are in operation, they are projected to generate \$83.3 million in economic output. In addition, the facilities will increase annual property tax collections by about \$574,260 across the state (PSU Center for Economic and Community Development, 2020).

Job creation and economic output will be higher during the construction phase, when significant upfront investment occurs in leasing or purchasing land, equipment, supplies, and services, and employing workers to build the facilities. The direct economic benefits will be seen in construction jobs. Still, indirect benefits will also be seen in businesses selling goods and services to the facility's developers and ancillary effects

from the increased spending by construction and the indirect jobs created. The Penn State study estimates that 11,631 jobs will be created during construction. Once operating, these 235 facilities will support 520 jobs, including 114 directly related to operations, 53 in businesses that will provide goods and services, and 354 resulting from increased spending from employees, landowners spending lease money, and consumers spending money they are saving by being part of the community solar projects (PSU Center for Economic and Community Development, 2020).

Landowners also stand to gain substantial economic benefits by leasing their land for distributed energy projects. These lease payments, which typically range from \$800 to \$2,200 annually, commence during the construction phase and extend throughout the average lease term of 25–30 years or longer (Goldberg et al., 2024). The economic impact of these payments can be further enhanced through the multiplier effect, as landowners increase their spending at other businesses.

Farmers can diversify their income by leasing the less productive portions of their land while continuing to farm the rest, or by employing photovoltaic solar methods to maintain some agricultural use alongside a solar array. For farmers approaching retirement, solar leasing offers the possibility of retaining ownership of their land rather than selling it for residential development, thereby preserving open space and allowing for future agricultural use once the solar lease concludes and the property is decommissioned.

Increased tax revenue benefits will be observed at the state, county, municipal, and school district levels. The projected \$83.3 million in economic output during the operational phase will lead to higher state sales taxes on goods and services purchased and income taxes paid by the 520 permanent workers added. The construction and operation of community solar facilities will also boost annual county, local, and school district property tax collections due to land improvements that will enhance their assessment.

According to the Penn State study, experiences in other states suggest that property taxes on solar parcels will increase by 2–5 times their previous value. Furthermore, local governments and school districts will likely experience one-time increases in property tax collections, as the construction and operation of a solar array on farmland will disqualify it from the state's "Clean and Green" program. This program offers tax breaks for properties of at least 10 acres that are not developed (Pennsylvania Dept. of Agriculture, 2025). Land withdrawn

from the Clean and Green program must repay the tax savings for the past seven years, plus 6 percent interest (PSU Center for Economic and Community Development, 2020). It is noteworthy that Pennsylvania has enacted a limited rollback provision for oil and gas and commercial wind activity, but solar developers are ready and willing to develop projects without this subsidy.

At the individual level, subscribers to a community solar project will also see savings in their electric bill through bill credits. There are varying estimates of the amounts, but generally subscribers can see savings of between 5 percent and 20 percent. A PennFuture report indicates that residents with solar power can save more than \$1,300 annually on energy costs (PennFuture, 2023). These savings can have a significant impact on household budgets, especially for low-income families who often spend a disproportionate amount of their income on energy costs (Bednar & Reames, 2020).

These economic benefits are only magnified with the growth in merchant generation projects, multiplying the expected leasing and tax revenue, and creating more jobs that help boost local communities and save residents money on their electric bills.

Strategic Benefits

Introducing community solar programs in Pennsylvania offers several strategic benefits for the state and its residents. These advantages include lower electricity costs, increased access to solar energy, and opportunities for economic growth. Community solar can also play a role in diversifying the energy grid, making it more resilient to outages and weather events. Decentralized systems, such as rooftop installations and small-scale solar, can provide additional power to the grid and offer greater flexibility. By distributing generation and storage assets across the grid and connecting them at multiple points closer to end users, these systems help mitigate the impact of failures in other generation sources, thereby reducing the risk of widespread outages and bolstering the system's resilience (Auon et al., 2024).

Environmental Benefits

Distributed generation offers several important environmental benefits by producing electricity closer to the point of use, often through cleaner and more efficient technologies. Systems such as rooftop solar, community solar arrays, small-scale wind, biogas digesters, and ground-source heat pumps reduce the need for long-distance transmission, decreasing energy losses and lowering overall emissions. Many forms of distributed generation rely on renewable or low-emission

energy sources, reducing dependence on fossil fuels and cutting greenhouse gas emissions. Additionally, distributed systems can help reduce local air pollutants such as nitrogen oxides, sulfur dioxide, and particulate matter, which are commonly associated with large-scale fossil fuel power plants. This can improve air quality, especially in urban and industrial areas, contributing to better public health outcomes (Huang et al., 2012; Massey, 2010; Sunar & Swaminathan, 2021).

Major Stakeholders in Pennsylvania Distributed Generation and Community Solar Deployment

The US Department of Energy's National Community Solar Partnership identifies four key stakeholders in developing and deploying community solar projects: the host, sponsor, utility, and subscribers. The host, often owning the land where the solar array is located, leases space to the project under long-term agreements, usually spanning 25 to 30 years. These lease agreements generally include annual per-acre payments, with rates in Pennsylvania ranging from \$800 to \$2,200 per acre, often adjusted for inflation. The sponsor, typically a solar developer, oversees project financing, site selection, permitting, and subscriber relations. These developers collaborate with utilities and regulatory bodies, generating revenue from subscription sales, tax incentives, and renewable energy certificates. The utility's role is to integrate solar power into the electric distribution grid, ensure distribution reliability, and manage net metering credits for participants. Lastly, subscribers, which may include residents, businesses, nonprofits, and local governments, purchase or lease shares of the solar output and receive bill credits proportional to their share. Community solar facilitates access to clean energy for individuals without suitable on-site solar potential. It often includes measures to support participation by low- to moderate-income households, thereby promoting equity and expanding access to renewable energy benefits.

For development of a merchant generator project, the key stakeholders would be the solar developer, the utility, and the landowner. The developer oversees the project siting, permitting, and construction, while the landowner agrees to lease their property for a yearly per-acre rate. The developer works with the utility and governmental bodies on siting, permitting, and interconnection.

While each of these stakeholders plays a critical role in the development and operation of distributed solar projects, the success and scalability of such initiatives depend heavily on supportive policy frameworks and active coordination among public entities. Municipal governments, state agencies, and other organizations have unique and influential roles in shaping the regulatory environment, streamlining permitting processes, and incentivizing equitable participation. Their involvement can either accelerate or hinder deployment. Understanding how these entities contribute to, or can better support, community solar adoption is essential to unlocking the full potential of this model and ensuring its benefits are broadly shared.

Municipal Governments

Local governments are heavily involved in solar project permitting and zoning processes. They also have a vested interest in these projects' economic and environmental impacts on their communities. Many of Pennsylvania's municipalities do not have zoning ordinances that address solar development, particularly large-scale development. According to the PA Solar Center, the absence of uniform municipal oversight could lead to some uncertainty for solar stakeholders at different levels (PA Solar Center, 2023).

State Agencies

The Pennsylvania Department of Environmental Protection (DEP) and other state agencies, like the Department of Agriculture, are involved in developing and implementing policies and regulations related to solar energy. They also provide guidance and resources for stakeholders. DEP officials develop and implement regulations and policies pertaining to solar energy, including the Grid-Scale Solar Siting Policy. The agency must also issue permits for stormwater management, erosion control, stream crossings, and other ground disturbance. In addition, the Pennsylvania Department of Agriculture focuses on farmland preservation and the potential impacts of solar projects on agriculture while the Department of Conservation and Natural Resources may be involved if the project could affect threatened or endangered species.

Pennsylvania Legislature

The legislature is tasked with crafting a state policy framework that promotes the expansion of solar energy and facilitates community solar development. The community solar legislation might include provisions aimed at achieving specific policy objectives, such as offering additional savings to low- and moderate-income families to encourage their participation and expanding access to populations unable to benefit from rooftop solar.

Disadvantaged Communities

Residents of predominantly low-income areas or those with a history of significant industrial emissions can benefit from reduced energy costs through subsidies, increased access to clean energy, lower emissions, enhanced energy resilience, and potential economic and job creation advantages from community solar initiatives. Communities facing energy poverty, especially those impacted by the decline of fossil fuel industries, could also gain from reduced energy prices, the potential placement of community solar arrays on brownfields, and opportunities for job creation and economic diversification.

Trade and Environmental Groups

Environmental groups, such as PennFuture and the Clean Air Council, would strongly support and assist in working toward the addition of clean energy sources to the grid, thereby reducing emissions and increasing energy resilience, while energy trade organizations would provide information on the facts surrounding community solar and work for its development. One key trade group is the Solar Energy Industries Association.

Workforce Development Organizations

Unions and other workforce development programs can significantly contribute to the expansion of solar energy by training workers for solar jobs, while also benefiting from increased job creation and the resulting additional revenue. State legislation might mandate union workers receive prevailing wages, which could potentially raise the cost of solar projects. However, this requirement may also result in higher-quality installations and enhanced worker safety. The involvement of unions in solar expansion could address concerns about job security and fair compensation within the rapidly growing renewable energy sector. Moreover, collaboration between unions and solar companies could spur innovation in training programs, ensuring that workers are equipped with the latest skills and knowledge necessary for the evolving solar industry.

Deploying Solar in Pennsylvania

Distributed solar projects differ from utility-scale projects in the interconnection process in that they typically connect to the local utility's distribution grid, rather than directly connecting to the PJM Interconnection high-voltage transmission lines. Therefore, the interconnection process for distributed solar systems, including merchant generation and community solar, would be under the oversight of the electric distribution

company in the area in which the project will be located. This allows these solar projects to bypass the long and arduous process of connecting to the grid through PJM, a major benefit.

In Pennsylvania, utility interconnection for distributed generation involves a process governed by PUC that all utility companies must follow, with four review levels based on system size and complexity. The process typically starts with an application to the electric distribution company and payment of applicable fees, followed by technical review, installation, and final approval to operate (U.S. Dept. of Energy, 2020). The developer submits an interconnection application with technical details and specifications, which the utility then reviews to determine if it can be safely connected to the grid. Distributed solar projects usually fall under Level 3 review, for systems up to 5 MW. Interconnection fees vary by level.

For developers of a distributed solar project, one of the primary considerations is identifying an interconnection point to the distribution grid near a substation in an area with slack capacity. Slack capacity refers to the excess capacity on a line that remains unused. This is crucial to avoid costly infrastructure upgrades that the developer might have to finance. Consultants working for the developer will conduct an analysis, potentially in collaboration with the electric distribution company. During the technical review of the proposed project, the utility will perform a hosting capacity analysis to assess how much additional capacity their system can accommodate and evaluate the suitability of the connection point. Subsequently, the utility will inform the developer whether the application has been approved (FirstEnergy, 2025).

Before the project can begin, the developer must secure the necessary permits from state and local agencies. This process typically occurs alongside the interconnection application. Developers must apply to the State Department of Environmental Protection for permits concerning stormwater management, erosion and sedimentation, and source water protection. They may also need to apply to the State Department of Agriculture for permits related to farmland preservation.

At the local level, the developer must engage with the municipality where the proposed solar array will be situated to ascertain local ordinance requirements. Many municipalities in Pennsylvania lack zoning ordinances that address land development for solar projects, potentially complicating the process and causing delays. Some municipalities may allow

solar development only in specific areas, such as industrial zones, while others may treat such development as a conditional use, necessitating a zoning hearing and recommendation before a board of supervisors or council votes on its approval (PA Solar Center, 2024). A common feature in local zoning ordinances is lot coverage specifications, which generally define the maximum percentage of the plot that impervious surfaces, such as solar panels, can cover. Setback distances, or the distance from the property line where development can occur, may also be stipulated, along with vegetation buffer requirements to enhance the project's aesthetics and reduce its visibility to neighboring property owners. Developers must access local ordinances early in the planning process to ensure compliance with the regulations (PA Solar Center, 2024).

Once the developer has the needed state and local approvals and interconnection approval from the utility, the system can be built in accordance with the specifications. The developer then submits documentation, including a certificate of completion and proof of electrical inspection, to the utility. The utility reviews the installation and final documentation for compliance and issues approval to connect. The utility is then responsible for enabling net metering, allowing subscribers to receive utility bill credit for excess energy they send to the grid from their distributed generation system. The local utility then manages the interconnection and distribution of the generated electricity. In some cases, the local utility may sell the excess energy from community solar projects into the PJM wholesale market (U.S. Dept. of Energy, 2020).

Factors Affecting Community Acceptance of Solar Projects

Studies have shown that a number of factors influence the acceptance of large-scale solar projects. Personal views, environmental concerns, and financial factors all play major roles (Mohd Sobri et al., 2021). While there is overwhelming support for large-scale solar (defined as greater than 1 MW) overall, the level of support is lower for residents who live close to a solar array, and very large projects result in substantially more negative views than small and midsize projects (Nilson & Stedman, 2022; NREL staff, 2023). Often, widespread support for solar, based on its multiple benefits, does not necessarily translate to the community level (Crawford et al., 2022).

Perceived Economic Benefits

One of the key benefits perceived by state residents is the economic boon that solar projects are expected to bring to

them and their communities (Crawford et al., 2022). As outlined in prior sections, the introduction of distributed solar projects will attract significant private investment and create well-paying jobs, although many of these positions will be temporary during the construction phase (PSU Center for Economic and Community Development, 2020). The development pattern of solar energy may somewhat mirror that of the Marcellus shale natural gas in the early 2000s, where the highest demand for labor occurred during the initial construction of the wells, followed by a decline as fewer workers were needed for maintenance (Penn State Extension, 2025).

Solar development will bring direct economic benefits through increased economic activity, along with indirect advantages from the heightened spending by employees of companies collaborating with the developer. Residents will also gain economically from the rise in tax revenues for county and municipal governments and school districts, as land improvements will elevate property tax assessments. This additional revenue reduces the likelihood that these governmental bodies will need to raise property taxes on residents. Moreover, eligible residents who subscribe to a community solar system can power their homes with clean energy while saving money on their electric bills. These savings are accessible to all residents in the project area, regardless of their living arrangements, and require no upfront costs (Coalition for Community Solar Access, 2025b; NREL staff, 2023).

Another notable economic benefit is the financial boost that solar projects provide to landowners who lease their property for solar arrays. With annual leasing rates ranging from \$800 to \$2,200 per acre, landowners can enjoy a diversified income stream over the 25- to 30-year lease period. This additional income can potentially increase spending, further amplifying the economic benefits. However, there are economic concerns among homeowners living near solar developments regarding potential decreases in property values. A recent study found that one in five residents living within three miles of a solar project believes it has reduced local property values, while nearly 50 percent think the values have either remained unchanged or increased (Rand et al., 2024).

Environmental Considerations

Several environmental factors play a crucial role in shaping Pennsylvanians' support for or opposition to community solar projects. A significant concern that might impede community acceptance is the potential loss of prime agricultural land to solar projects, which could last for 30 years or more. In Pennsylvania, farmland is an ideal location for such expansion

due to its flat terrain, good drainage, and proximity to infrastructure like transmission lines or substations. The PA Solar Future Plan aims for 10 percent solar generation by 2030, utilizing two economic models that would require between 56,800 and 79,200 acres of farmland. If all grid-scale solar were placed solely on farmland in Pennsylvania, it would impact about 0.8 percent to 1.1 percent of total farmland, a relatively small loss (Goldberg et al., 2024). A PennFuture report highlights that the greater threat to farmland comes from low-density housing development rather than solar projects, as farm incomes decline and retiring farmers lack successors (PennFuture, 2023). Unlike housing developments, which permanently remove land from farming, farmland can be returned to agricultural use once a solar project is decommissioned (Goldberg et al., 2024).

To reduce farmland loss, some have emphasized agrivoltaics, which co-locates agricultural uses with solar arrays. This can be achieved by growing shade-tolerant crops under solar panels, allowing sheep to graze beneath them for natural mowing, or planting pollinator-friendly habitats around the panels (PennFuture, 2023). Co-location can create more favorable views on using farmland for solar projects.

Utilizing disturbed sites, such as brownfields, landfills, and industrial areas, is strongly favored over productive farmland for the placement of solar arrays (Rand et al., 2024). Developing these sites does not provoke the same concerns about losing valuable land and offers the advantage of repurposing already disturbed land for productive use. Additionally, many of these sites have existing grid connections nearby, and several states permit larger projects on them. Developers might consider these sites to gain broader community acceptance for a project. However, these sites carry the risk of legacy contamination, even after remediation, which could be a potential drawback.

Concerns about stormwater, erosion, and potential hazardous material contamination if panels are not properly removed at the end of a project's life are common. Developers must demonstrate their ability to prevent stormwater runoff and erosion to obtain state permits for construction, while municipalities and leaseholders require decommissioning plans to ensure proper equipment removal. Some states also mandate a bond to cover decommissioning costs. Additionally, there are worries about changes in biodiversity and the loss of wildlife habitat in the area of the array. Addressing these concerns can offer community benefits, thereby increasing the acceptance of projects on farmland.

The expansion of solar development offers environmental benefits, such as cleaner air and water, by reducing reliance on fossil-fuel generation from coal and natural gas. This shift decreases the emission of carbon dioxide and other greenhouse gases into the atmosphere, aiding in the fight against climate change. Additionally, less fossil-fuel generation translates to reduced coal mining and unconventional natural gas drilling, both of which introduce pollutants and hazardous substances into groundwater and aquifers, while also cutting emissions during industrial processes. Consequently, residents will experience fewer health risks, including asthma, lung issues, and cancer from hazardous chemicals.

Social Impacts

Numerous studies have identified the aesthetic impact of a project as a significant factor influencing community attitudes (Crawford et al., 2022). While support for renewable energy and the shift away from fossil fuels shape individuals' perceptions of solar development, social factors such as quality of life and procedural fairness are also taken into account (Scovell et al., 2024). Opposition to solar projects, both nationwide and in Pennsylvania, frequently revolves around concerns related to the viewshed, the aesthetics of large solar arrays, glare, alterations to the rural character of the area, and associated quality of life issues. Several studies have also found a correlation between the size of a solar project and community support, with smaller projects being perceived much more favorably than larger ones (Nilson & Stedman, 2022; Rand et al., 2024).

The community's view on a proposed project can be significantly shaped by residents' perceptions of trust in the developer and the fairness of the planning process (Scovell et al., 2024). Many communities throughout Pennsylvania have experienced frustration due to shortcomings in the development of unconventional natural gas wells, leading to a lack of trust in municipal and state agencies, as well as energy developers in general. The importance of early engagement with residents by local officials and developers cannot be overstated. A failure to engage meaningfully and transparently fosters distrust, potentially allowing a small, vocal minority to dominate the narrative opposing a project, while the majority remains silent. Enhanced communication and earlier engagement by local officials and developers with residents, aligning a project well with the agricultural values of a rural area, and better organization of project supporters may increase opportunities to influence solar projects (Crawford et al., 2022). Because most residents are unfamiliar with the concept of community solar, additional outreach and education to garner political and

developer support by explaining the financial, environmental, and resiliency benefits is warranted (Hirsh Bar Gai et al., 2021).

The Changing Policy Landscape

Pennsylvania has fallen behind at the state level, currently ranking 49th in solar growth over the past decade, with 95 percent of its electricity still produced from fossil fuels and nuclear sources (PennFuture, 2023). In response, Governor Josh Shapiro has introduced the "Lightning Plan," a policy package designed to accelerate the deployment of clean energy. The plan includes measures to authorize community initiatives, increase tax credits for clean energy, expand renewable energy portfolio standards to 35 percent by 2030, and streamline permitting through a statewide siting board. However, progress has been hindered by political gridlock in the state legislature.

Legislative debate over the future of net metering, a crucial policy that allows solar customers to earn credits for excess electricity sent to the grid continues to threaten distributed generation and community solar. Opponents of net metering argue it unfairly shifts grid maintenance costs to nonsolar customers, while utilities resist paying full retail rates for excess solar energy. Limiting or repealing net metering would undermine solar economics and disincentivize future adoption.

While a community energy authorization bill has passed the Pennsylvania House, its fate in the Senate remains uncertain. If enacted, it could unlock access for residents unable to install rooftop systems, especially low- and moderate-income households. One proposal suggests tying existing energy assistance programs to community solar participation to offset costs and ensure equitable access (Hirsh Bar Gai et al., 2021). Strategic alignment between federal incentives and state policy innovation will be essential to realizing the full promise of community solar in Pennsylvania.

Conclusion and Future Directions

As electricity demand continues to rise across Pennsylvania and the broader PJM Interconnection region, expanding renewable energy capacity is crucial for ensuring residents have access to reliable, affordable power. The urgency to add more distributed energy sources is increasing, particularly as traditional baseload generation struggles to keep up with electrification and growing grid reliability concerns. Solar power has become a central pillar in this effort, with solar and battery storage expected to account for about 80 percent of the planned growth in electric capacity this year, according

to EIA forecasts. While grid-scale solar has dominated recent capacity additions, community solar presents a complementary model with distinct strategic, economic, and equity-oriented advantages.

This report demonstrates that community solar, characterized by its localized ownership, off-site generation, and adaptable subscriber base, is an effective strategy for addressing current concerns. It generates local economic benefits, enhances grid resilience through distributed generation, and promotes energy independence by reducing reliance on centralized infrastructure. Moreover, it is uniquely positioned to extend solar access to populations historically excluded from the rooftop solar market. From renters to low- and moderate-income households, this model enables broader participation while still contributing to Pennsylvania's clean energy goals.

Policy remains the primary obstacle to adoption. The state legislature will play a crucial role in shaping Pennsylvania's energy future, which will, in turn, influence its capacity to attract economic development by offering low-cost, abundant power. Additionally, the legislature and other policymakers will have significant input in modernizing the PJM regional electric grid and ensuring the state's energy independence. A key aspect of the discussion is developing a standardized method for large electric consumers, such as data centers, to contribute fairly to the costs of grid infrastructure upgrades.

The expansion of distributed energy projects in the Commonwealth, which provide more affordable alternative power sources to customers while simultaneously reducing demand on the PJM grid, should be encouraged as the Legislature considers future energy policies. In scenarios where significant growth in electric demand is expected, all forms of energy will be crucial to meet the energy needs of the state and region. Distributed solar energy, through an increasing number of market generator projects and the addition of community energy options, can play a vital role in addressing these pressing challenges.

Looking forward, several key directions should guide Pennsylvania's approach:

- **Legislative Action to Enhance Pennsylvania's Strengths:** The state boasts a rich history as an energy-producing powerhouse and stands as the nation's largest net exporter of electricity, drawing from a variety of energy sources. As electricity demand continues to rise, additional generation sources will be necessary to fuel

economic growth and job creation, likely leading to increased costs. Incorporating community energy into the state's portfolio allows residents to enjoy lower costs through bill credits and reduced dependence on the wholesale electric market and transmission grid. Implementing community solar legislation with provisions for low-income participation, standardized interconnection rules, and long-term regulatory certainty will be crucial for unlocking development and attracting private investment.

- **Ensuring the Future of Net Metering:** Pennsylvania residents gain advantages from distributed energy sources like community solar through net metering, a requirement for utilities under state law. Net metering enables individuals to sell surplus electricity back to the grid, with customers receiving credits at the full retail rate. This provision can significantly reduce or even eliminate a homeowner's electric bill, offering additional savings since there is no cap on the amount of net-metered energy sold to the grid. This incentivizes residents to opt for distributed energy as it proves more cost-effective. Ensuring the future viability of net metering is crucial for promoting the use of distributed energy sources. It will also help decrease reliance on the transmission grid and enhance resilience. Simultaneously, the system should ensure that electric customers who do not choose community energy sources are not subsidizing the operation of the electric grid for everyone.
- **Integrated Energy Assistance Models:** Future programs should explore integrating existing public assistance with community solar subscriptions, offering stable cost offsets while increasing participation among low-income residents.
- **Research and Planning within PJM:** As PJM grapples with reliability, congestion, and capacity forecasting, research on how distributed generation like community solar can reduce peak load, improve locational grid stability, minimize cost increases, and promote energy independence should be prioritized.

- Public Engagement and Municipal Leadership: Local governments, school districts, and public agencies should be encouraged to host or sponsor community solar projects. Demonstration programs could also help build public trust and illustrate tangible cost savings. Local governments must also be proactive in developing regulations for the siting and operation of distributed energy projects.

Distributed solar extends beyond merely an energy technology; it serves as a platform for inclusive growth, grid modernization, and energy resilience. By integrating community solar into broader strategies to address increasing electricity demand, Pennsylvania can establish itself as a regional leader in sustainable and lower-cost energy development. The opportunity for action is now, and the state's next steps will shape its energy future for decades.

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