

Recent Electricity Price Trends and Drivers in Pennsylvania

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Notice

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Introduction and Purpose

Background

Electricity bills are rising in most parts of the country, and Pennsylvania is no exception. About one in five households in the state struggle to pay their utility bills. At the root of the issue is a rising trend in the price of electricity, with Pennsylvania's 41% nominal price increase ranking third among all states between 2021 and 2025.

Purpose and Approach

To better understand the causes of recent electricity price increases, the Solar and Storage Industries Institute (SI2) commissioned The Brattle Group to conduct a study to quantitatively evaluate recent price trends and their underlying drivers.

We used publicly available data between 2021 and 2025 from credible sources such as Electricity Price Hub, the Federal Energy Regulatory Commission, and the US Energy Information Administration to track what has changed.

Report organization

This report summarizes our findings. First, we provide an overview of the key trends and drivers. Then, we provide more detailed, technical discussion of the drivers.

HOW TO USE THIS REPORT

Historical focus. The analysis exclusively focuses on recent historical price trends and their drivers. It is not a forecast of future trends.

Data availability. Our insights are limited to the level of detail included in publicly available data. Further insights and relationships could be identified through statistical analysis of more granular utility cost data.

Not a policy proposal. The study scope identifies the underlying driver of recent price increases but does not propose new policies or initiatives to mitigate further price increases.

Summary



SUMMARY

How Are Electricity Bills Calculated?

Electricity bills are calculated as the amount of electricity the customer used multiplied by the electricity rate (i.e., price) charged by the utility. **Electricity rates** are designed to fully recover costs to deliver electricity services. In this study, we calculate the **price of electricity** as total revenue collected from all bills divided by all electricity consumption in the state.

Key Considerations

- Pennsylvania is part of a regional wholesale electricity market called PJM that sets wholesale electricity prices for utilities and large customers. PJM is also responsible for ensuring that there is adequate supply and transmission infrastructure to support current and future energy demand.
- Regulators approve retail rates that are reflective of utility costs to serve customers, thus allowing utilities to sufficiently recover those costs.*

*In PA, customers can choose to purchase electricity from competitive suppliers instead of their utilities

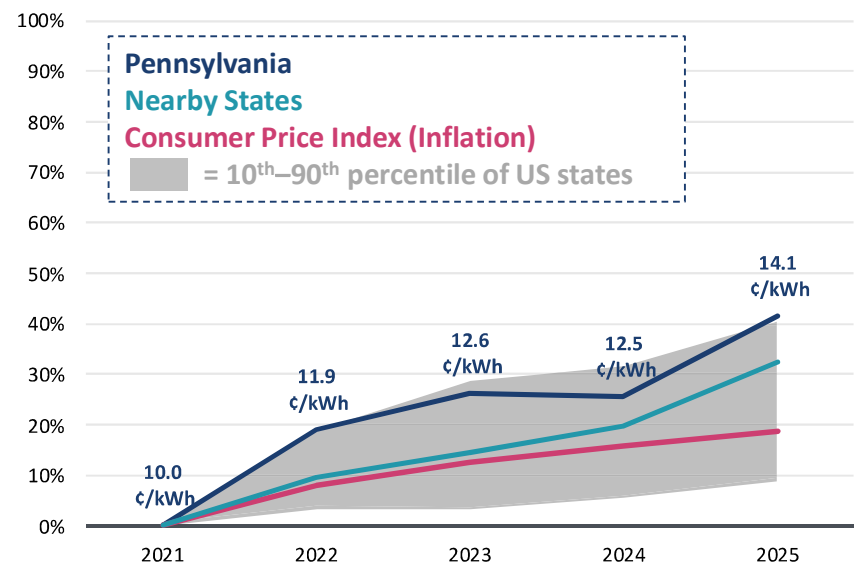
Cost Component of Rate	Description	Cost Determination
Generation (Capacity) 	Costs to build power plants (e.g., capital investment in natural gas power plants, solar plants)	Competitive market: Utilities, other suppliers, and large customers purchase capacity and energy from regional wholesale market; generation prices are based on supply and demand
Generation (Energy) 	Variable costs to operate power plants that scale with the amount of generation (e.g., fuel)	
Transmission 	Costs to build and operate the wires to send electricity over long distances from power plants to towns and cities	Both federal and state regulators review and approve investments and methods for recovering costs from customers
Distribution 	Costs to build poles and wires to deliver electricity to homes and businesses	State regulators review and approve investments and methods for recovering costs from customers

SUMMARY

Pennsylvania Electricity Prices Have Increased Faster than Inflation Over the Last Five Years

- **The average electricity price in Pennsylvania increased by 41%** from 2021 through 2025
 - From 10 ¢/kWh in 2021 to 14.1 ¢/kWh in 2025, a 4.1 ¢/kWh increase
 - Third highest of any state and outpaced the national average (2.5 ¢/kWh)
 - Nearby states in the same wholesale power market also experienced increases in electricity prices
- **Residential customers in the state saw their prices increase by 40% overall** and 2.3 ¢/kWh more than commercial customers
- **Even after adjusting for inflation, average electricity prices rose** by 2.3 ¢/kWh, or 19%, across all customers
- Several factors are behind the price hikes in PA, each contributing differently, as discussed throughout the remainder of this report

NOMINAL ALL-IN ELECTRICITY PRICE CHANGES SINCE 2021



Source: EIA and BLS. Nearby states include the sales-weighted average of New Jersey, Maryland, Delaware, West Virginia, and Ohio. All states are in the PJM wholesale market. Unless otherwise noted, all \$ values are expressed on a nominal basis.

SUMMARY

Generation Costs Were the Primary Driver of Residential Electricity Price Increases in Pennsylvania

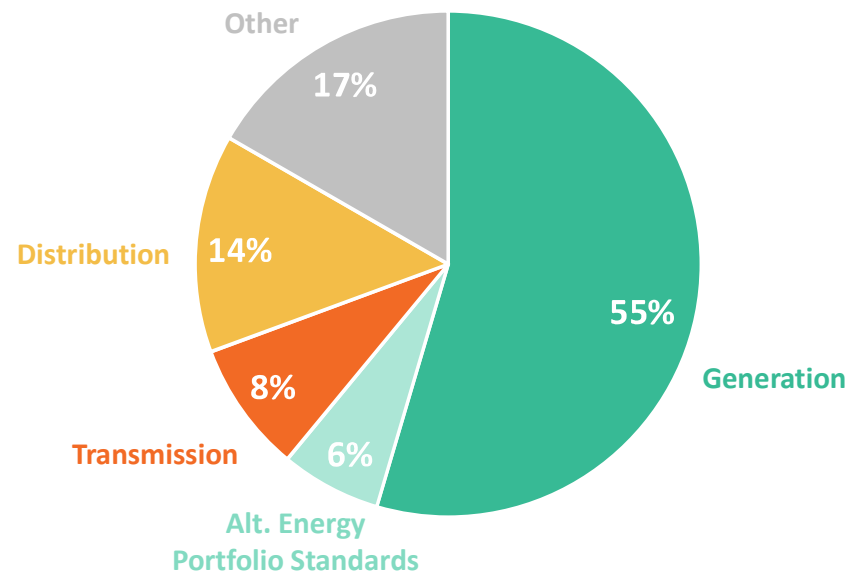
The rising cost of generating electricity, rather than delivering it, was the biggest driver of the price increase in Pennsylvania.

- Around 80% of generation costs are attributable to the cost of producing electricity, driven primarily by the price of natural gas, which accounts for more than half of all generation in the market.
- The remaining 20% of generation costs are associated with keeping power plants available for reliability purposes (“capacity cost”).
- Capacity costs, set by PJM through wholesale auctions years in advance, will double in 2026, due in part to data center load forecasts, further driving up electricity prices.

Secondary drivers of price increases included the cost of delivering electricity (transmission and distribution) and the non-renewable energy sources in Pennsylvania’s Alternative Energy Portfolio Standards (AEPS).

- Electricity delivery costs increased, as PA utilities spent money repairing and upgrading power lines and equipment to maintain grid reliability at a time inflation was making labor and materials more expensive.
- The largest contributor under the AEPS was an increase in the cost of “waste coal,” which qualifies as a source of alternative energy in PA.

RESIDENTIAL ELECTRICITY PRICE INCREASE BY COST DRIVER, 2021–2025



Cost drivers based on relative shares in Heatmap’s [Electricity Price Hub](#) data for utilities with disaggregated costs. AEPS calculated from PUC annual report. “Other” includes any costs not directly tied to explicit categories such as taxes, EE/LMI programs, and other administrative costs. The breakdown of costs can be sensitive to the exact starting and ending year analyzed.

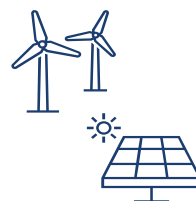
SUMMARY

Data Centers, Renewables, and Extreme Weather Were Less Relevant Factors in Pennsylvania in the Last Five Years

The key drivers of Pennsylvania's electricity price increases generally track with national trends. However, additional drivers of rate increases in other parts of the country are less impactful in Pennsylvania.



Data center load growth. *Historically*, states that experienced the most load growth also experienced downward rate pressure; Pennsylvania's recent load growth was modest. Whether or not future load growth will result in beneficial affordability outcomes depends on [many factors](#).



Market-based renewables procurement. States with access to low-cost renewable energy can experience downward rate pressure through a more diverse and competitive generation mix; Pennsylvania's low share of renewable generation means wind and solar have not been significant drivers of electricity price changes.



Rooftop solar. Although Pennsylvania's existing net energy metering policy could drive further rooftop solar adoption, rooftop solar represents less than 1% of the generation mix in Pennsylvania and does not have a meaningful impact on rates.



Extreme weather and natural disasters. Wildfire risk mitigation costs and storm recovery have had a significant price tag in some states. Pennsylvania's recent price trends do not reflect significant storm recovery costs, though the region is exposed to this risk.

Additional Detail on Electricity Price Drivers



ADDITIONAL DETAIL ON ELECTRICITY PRICE DRIVERS

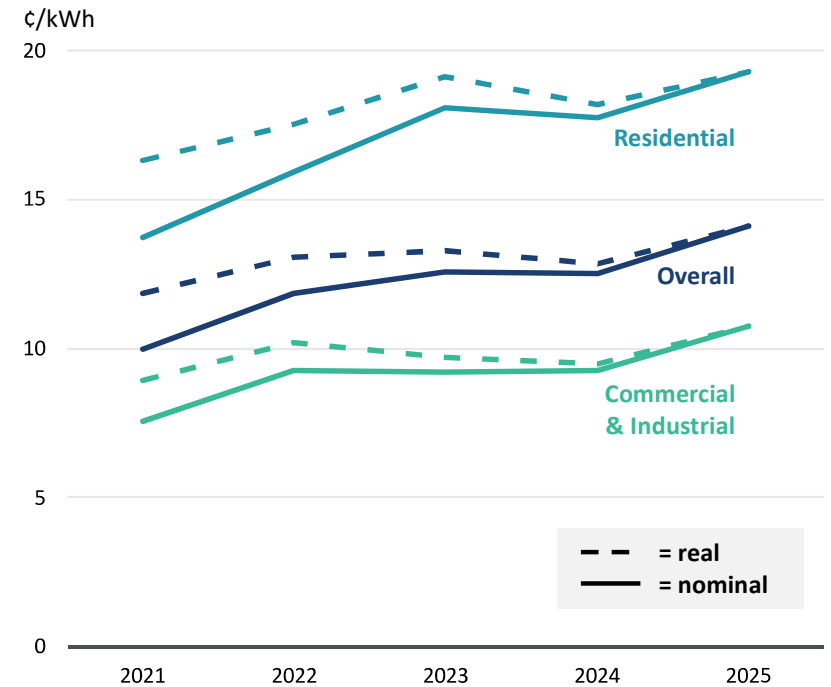
Electricity Prices for Residential Customers Increased Faster than Inflation and More than for Other Customer Segments

When adjusted for inflation, statewide all-in electricity prices increased by 19% (2.3 ¢/kWh from 2021 to 2025).

Home electricity prices increased by 7%, outpacing both business electricity prices and household income growth.

- Residential prices increased by 2.9 ¢/kWh, compared to 1.8 ¢/kWh for commercial and industrial customers.
- Between 2021 and 2024, median household income in PA increased 16%, compared to a 30% increase in residential electricity prices in the same period, indicating a growing electricity cost burden.*
- Energy burdens are especially pronounced for low-income households: incomes for the lowest quintile of households increased by 12%.

NOMINAL AND REAL PENNSYLVANIA ELECTRICITY PRICES



*American Census Survey Table S1901 and B519081 1-year estimates for 2021 and 2024. 2025 data not yet available. Some PA customers shop for their own electricity supplier. These shoppers generally pay more, and their bills only went up 30% over the 2021–2025 period.

ADDITIONAL DETAIL ON ELECTRICITY PRICE DRIVERS

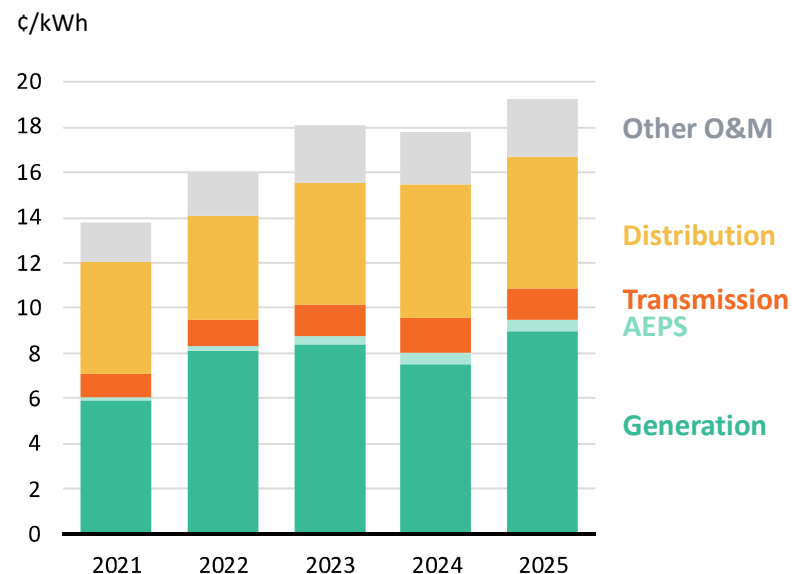
Generation and Distribution Costs Accounted for the Bulk of Residential Electricity Price Increases in Pennsylvania

Generation and **Distribution** are the largest cost categories for Pennsylvania utilities, and these cost categories increased the most over the study period.

- **50%** of the costs are generation, which includes the costs to build power plants and the fuel costs to generate electricity.
- **33%** of the costs are energy delivery to customers, which includes long-distance transmission and short-distance distribution wires.
- **2%** of the costs are alternative energy credit costs, driven primarily by non-renewable sources.
- **15%** are other utility costs, such as administrative costs.

We focus on residential rate changes in this presentation, but trends across other customer classes are similar. **The following slides provide further context for the relative contribution of each factor to the overall cost increase.**

PA NOMINAL RESIDENTIAL RATE TRENDS



Calculated using EIA price trend, decomposed into cost drivers using relative shares in Heatmap's [Electricity Price Hub](#) data for Duquesne Light Company, PECO, PPL, UGI, and FirstEnergy, which represent 99% of PA customers. AEPS calculated from PUC annual report. "Other" includes any costs not directly tied to explicit categories such as taxes, EE/LMI programs, and other administrative costs. AEPS = Alternative Energy Portfolio Standards.

ADDITIONAL DETAIL ON ELECTRICITY PRICE DRIVERS

Generation Costs are the Largest Contributor to Residential Price Increases in Pennsylvania

Generation costs in Pennsylvania rose by 55% between 2021 and 2025. Key drivers include:

- Rising generation capital costs primarily due to supply chain constraints
- Natural gas price fluctuations, which drive electricity price variability due to significant regional dependence on natural gas for electricity generation

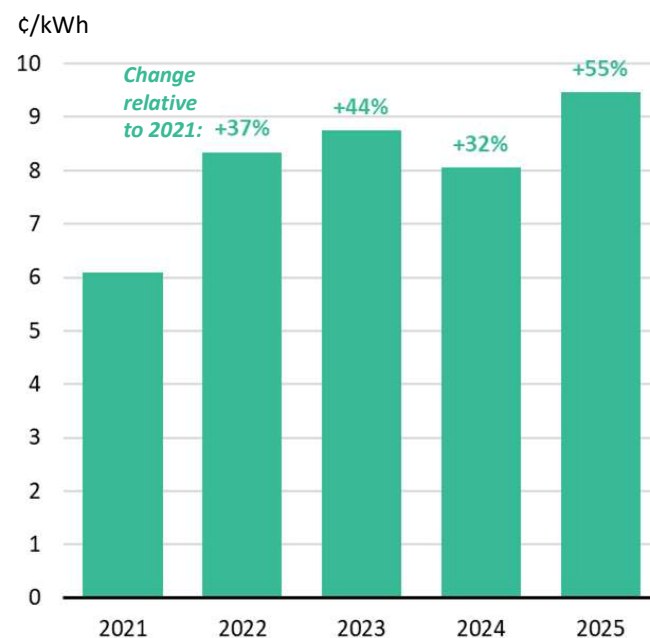
Generation costs are generally composed of two elements:

- **Generation energy:** Includes variable costs such as fuel costs and accounts for around 80%* of total generation costs. Increases in fuel prices drive up the cost of generating electricity and ultimately the retail electricity prices that customers pay.
- **Generation capacity:** Includes costs for assets to remain available for system reliability purposes and accounts for around 20% of total generation costs.

Note that utilities purchase power in advance through contracts of various durations with energy suppliers and generators, so generation cost fluctuations can have a lagged effect on electricity prices.

*[PJM Fact Sheet](#)

PA GENERATION COST TRENDS



Source: EIA price trend, decomposed into cost drivers using relative shares in Heat Map data [Electricity Price Hub](#) data. Costs include AEPS.

ADDITIONAL DETAIL ON ELECTRICITY PRICE DRIVERS

Generation Cost Deep Dive: Capital Costs Increased, Particularly for Natural Gas Generation

The cost to develop all power generation resource types increased between 2021 and 2025.

Key cost drivers of gas generation:

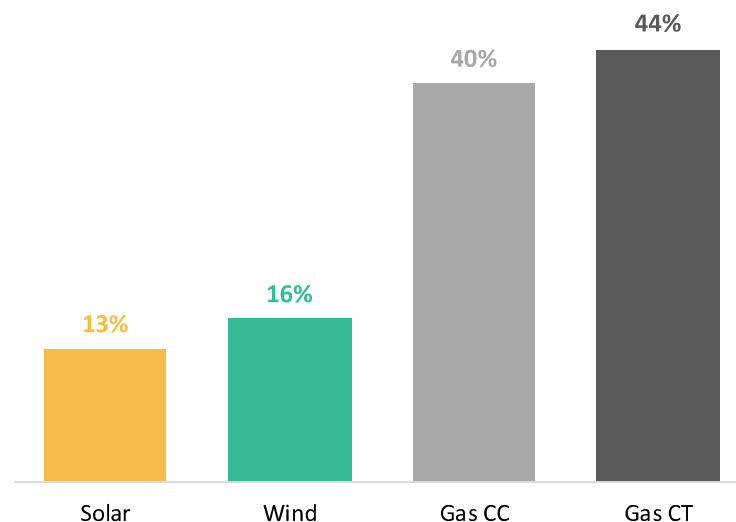
- Plants rely on complex, supply-constrained equipment
- Large turbine equipment manufacturers facing bottlenecks, increased materials costs, and long lead times
- Strong demand for new gas capacity has pushed up construction pricing, labor, and interconnection costs

Key cost drivers of wind and solar:

- Benefit from modular, globally scaled supply chains
- Equipment is mass-produced with multiple suppliers, and technology improvements offset some inflation
- Shorter build times and simpler construction also reduce exposure to rising labor and financing costs
- Tariffs have driven the cost of underlying equipment, including solar cells, higher in recent years

Sources: [White House Press Release](#), [AP News](#)

INCREASE IN CAPITAL COST OF POWER GENERATION RESOURCE TYPES, 2021–2025



Source: 2021 values from NREL ATB 2021. 2025 values are forecasts from NREL ATB 2024, the most recent release. Anecdotal evidence, including [discussion](#) from NextEra Energy's CEO, suggests that gas generation capital cost increases may be higher.

ADDITIONAL DETAIL ON ELECTRICITY PRICE DRIVERS

Generation Cost Deep Dive: Natural Gas Fuel Price Fluctuations Contributed to Recent Increases in Generation Costs

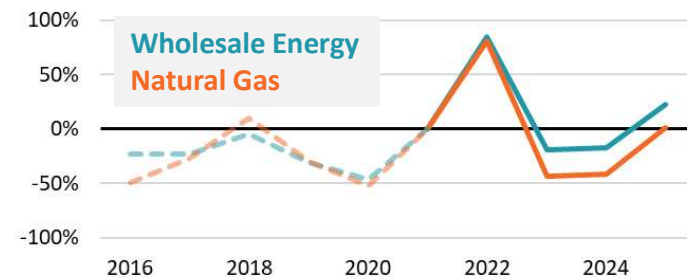
In Pennsylvania, the wholesale price of electricity tracks closely with the price of natural gas.

- **Gas generation accounts for more than half of all generation capacity in the wholesale market** and often the sets the price *utilities* pay for electricity.

Recent upward trends in Pennsylvania generation costs likely reflect a lagged impact of natural gas price spike.

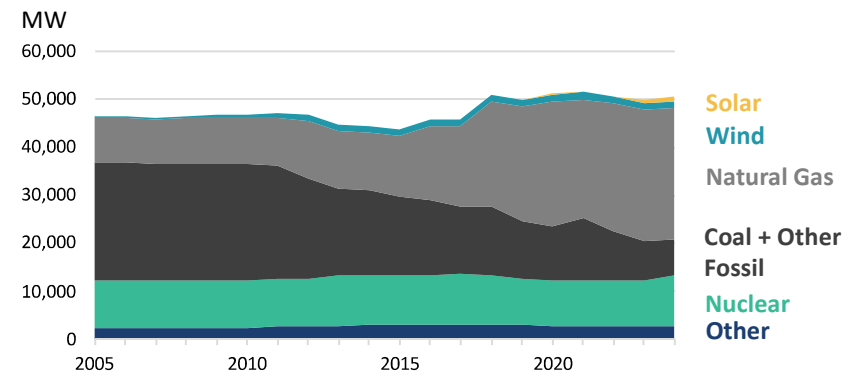
- In 2022, Russia's invasion of Ukraine increased global natural gas prices, including in the US.
- PA generation costs reflect the rolling average price of contracts with varying term lengths that were signed by utilities in the past, resulting in a general lag between trends in gas prices and in the average cost of generation incurred by the utility.
- **Generation cost increase may also reflect a higher hedging premium associated with a more volatile and uncertain market.**

WHOLESALE ENERGY AND GAS PRICE CHANGES SINCE 2021



Sources: Day-ahead LMP from PJM-RTO; gas from Tetco M3 from SNL

PENNSYLVANIA GENERATION MIX



Source: EIA net summer capacity by energy source for electric generators

ADDITIONAL DETAIL ON ELECTRICITY PRICE DRIVERS

Generation Cost Deep Dive: AEPS Costs, Driven Primarily by Non-Renewables, Represent a Small Share Of Overall Price Increase

The **Alternative Energy Portfolio Standards Act (AEPS)** is Pennsylvania's requirement that a share of the electricity sold come from "alternative cleaner energy sources." Three AEPS categories determine what types of generation resources can count toward the requirements:

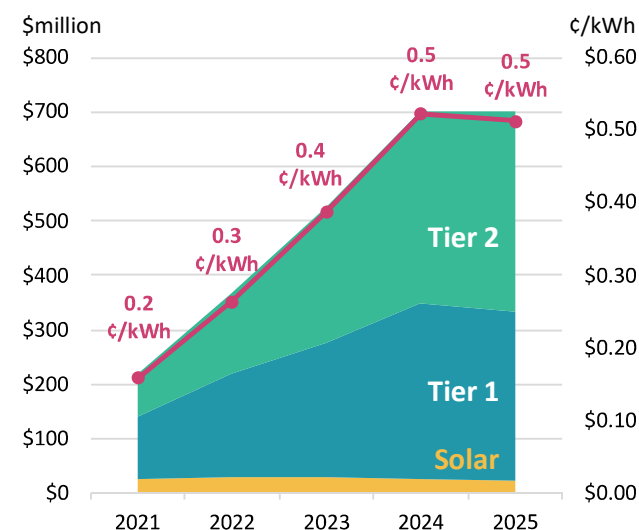
- **Tier 2:** Comprised primarily of waste coal generation plants (51%), hydro plants (36%), and generators that burn trash (7%).
- **Tier 1:** Comprised primarily of coal mine methane (34%), out-of-state solar (23%), and wind (17%).
- **Solar:** Small in-state solar requirement equivalent to 0.5% of total load.

Overall, the cost of AEPS compliance more than tripled between 2021 and 2025, but still represents only 7% of the total utility cost increase.

- Increase driven by waste coal, a low-quality coal discarded during the coal mining process, that increased in cost due to a state restriction limiting the eligible supply to plants located within PA.
- **A decline in the cost of solar credits slightly offset this cost increase in the later years of the study period.**

Source: [AEPS Compliance Report 2025](#)

COST OF PURCHASED CREDITS UNDER AEPS (¢/kWh)



Source: Alternative Energy Portfolio Standards (AEPS) Reports. Resources include 0.5% of load from solar, ~7.5% from Tier 1 resources (primarily coal mine methane, out-of-state solar, and wind), and 10% from Tier 2 resources (primarily waste coal, pumped hydro, and hydro). Values rounded to the nearest 10th of a cent.

ADDITIONAL DETAIL ON ELECTRICITY PRICE DRIVERS

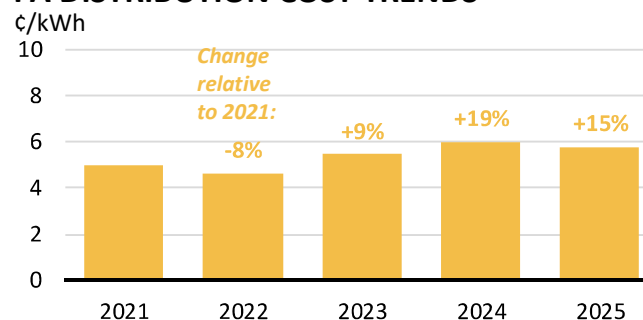
Distribution Cost Deep Dive: Distribution Costs are Second Largest Driver of Pennsylvania's Residential Price Increases

Distribution costs have increased in Pennsylvania by 15% since 2021, driven primarily by new capital investments.

- System reliability declined has declined in the state, as evidenced by an increasing number of outages and longer duration of overall outages statewide.
- Worsening system reliability has increased pressure on utilities to invest in system upgrades that limit damage during heavy storms (e.g., tree removal near power lines) and improve the durability of the distribution system.
- PA utilities have added investment projects to their long-term infrastructure improvement plans designed to address these issues.
- Undertaking these investment projects in an environment of high inflation adds to these project costs and their impact on prices.

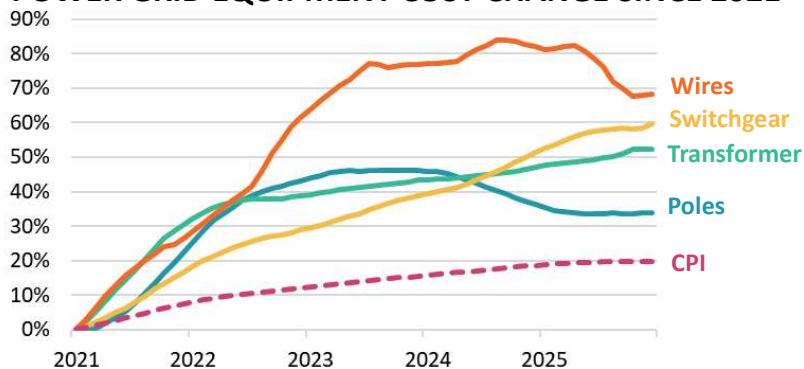
Sources: [PA Electric Reliability Report](#), [PPL 2024 Annual Report](#), [First Energy](#)

PA DISTRIBUTION COST TRENDS



Source: EIA price trend, decomposed into cost drivers using relative shares in Heat Map data [Electricity Price Hub](#) data

POWER GRID EQUIPMENT COST CHANGE SINCE 2021



Source: BLS 12-month rolling average. Production Price Index measures inflation at the wholesale level tracking price shifts for specific manufacturing goods.

ADDITIONAL DETAIL ON ELECTRICITY PRICE DRIVERS

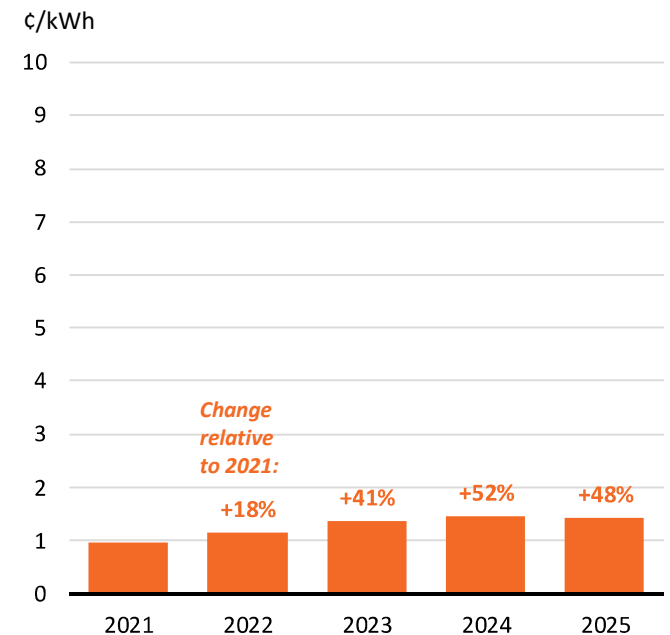
Transmission Cost Deep Dive: Transmission Costs Increased at the Fastest Rate, Though Remain a Small Part of Costs

Transmission costs increased by 48% between 2021 and 2025 and account for 8% of the total increase in utility costs.

- Drivers of higher transmission costs included projects executed during supply chain constraints, high inflation, and rising tariffs.
- Spending on high-voltage power lines in the Mid-Atlantic region increased from \$920 million in 2021 to \$11.8 billion in 2025.
 - These projects replaced aging equipment to ensure grid reliability.
 - Some projects were executed to meet forecasted growth in electricity demand and connect new customers.
- Cost of components— such as wires, transformers, switchgears, and other equipment – increased faster than inflation during this period, increasing the cost of the projects.

Source: PJM Regional Transmission Expansion Plan [2021](#), [2025](#)

PA TRANSMISSION COST TRENDS



Source: EIA price trend, decomposed into cost drivers using relative shares in Heat Map data [Electricity Price Hub](#) data

ADDITIONAL DETAIL ON ELECTRICITY PRICE DRIVERS

Takeaways and Considerations

- **Pennsylvania electricity prices jumped 41% in five years**, rising from 10¢ to 14.1¢ per kWh. That outpaced both inflation and the national average. PA homeowners were hit the hardest, as residential electricity prices rose more than commercial and industrial rates and outpaced household income growth.
- **Generation costs rose 55%, driven by higher natural gas prices, increasing energy demand, and supply chain constraints** that recently increased the capital costs of power plants (particularly natural gas-fired generators).
- **Electricity distribution system costs rose 15% as utilities invested in aging infrastructure and reducing outages**, all while inflation made labor and materials more expensive.
- **Alternative energy resource procurement requirements were a minor contributor to the total price increase**, driven primarily by an increase in the cost of non-renewables, particularly waste coal.
- **Transmission investment added roughly 0.6 ¢/kWh of cost increase**, with large investment projects occurring against the backdrop of high inflation.

Appendix



APPENDIX

Glossary

AEPS: The Alternative Energy Portfolio Standards Act is a Pennsylvania law requiring that a certain percentage of energy be from alternative energy resources, including waste coal, coal mine methane, hydro, and renewable resources.

All-in Electricity Price: The average retail price of electricity for all customers statewide, approximated by dividing total utility revenues by total utility electricity sales.

PJM: The Mid-Atlantic's regional transmission organization that coordinates the wholesale electricity market to ensure reliability and planning across utilities

Purchased Power: What a utility pays to buy electricity from suppliers to serve its customers.

Waste Coal: Coal mining waste (i.e., low-quality coal mixed with rock, dirt, and other materials) that was discarded during mining and coal processing but can later be burned to generate electricity.