Pennsylvania Electricity Update

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This update displays recent Pennsylvania and regional electricity market trends through 2024. Pennsylvania remained the top electricity export state while relative carbon emissions from electricity generation continued its long-term decline.

Net Generation and Consumption

Table 1 displays net electricity generation and consumption for Pennsylvania and other states that are part of the PJM grid. PJM is a Regional Transmission Organization that oversees the movement of electricity in Pennsylvania and all or parts of 12 other states and Washington D.C.[1] From 2019 to 2024, net generation in Pennsylvania increased by 5.5%, notably higher than the other PJM states (-1.0%, not shown). In 2024, Pennsylvania produced 18% of total net generation for the PJM region. Only Ohio recorded stronger generation growth, but the state is a net importer of electricity. Conversely, Pennsylvania electricity consumption growth (-3.0%) lagged most other PJM states. Overall, power consumption and generation in PJM states increased at roughly the same rate during the five-year period.

Table 1: Regional Electricity Generation and Consumption

	Net Generation			Consumption		
State	2019	2024	Growth	2019	2024	Growth
Pennsylvania	229	242	5.5%	146	141	-3.0%
Ohio	122	141	16.2	149	154	3.6
Virginia	97	102	5.2	118	132	11.8
New Jersey	71	61	-13.6	74	73	-1.3
West Virginia	64	51	-20.6	33	32	-2.5
Maryland	39	36	-8.9	61	58	-4.3
Other PJM	694	685	-1.4	676	667	-1.3
Total	**1,316**	**1,318**	**0.1**	**1,256**	**1,258**	**0.2**

Note: Amounts in millions of megawatt hours. Other PJM includes all or parts of Delaware, Illinois, Indiana, Kentucky, Michigan, North Carolina, Tennessee and Washington D.C.

Source: U.S. Energy Information Administration. 2024 estimated by the IFO based on EIA data through November.

Consumption growth was largely driven by Virginia, which is home to a large concentration of data centers that are intensive electricity users. Many analysts point to these centers and the increasing prevalence of Artificial Intelligence (AI) as drivers of significant electricity demand in the near term. In its latest load forecast, PJM projects that peak summer demand will increase by 3.1% per annum through 2035 and peak winter demand will increase by 3.8% per annum. Both would be a significant acceleration from prior years. PJM states that this is due to the proliferation of data centers, electrification of buildings and vehicles, and manufacturing.

1 The PJM states include all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia and West Virginia.

Table 2 shows the top five states for net exports of electricity for 2019 and 2024 and total net exports for other PJM states (excludes PA and IL). For 2024, Pennsylvania exported an estimated 87 million megawatt hours of electricity, nearly double the second highest export state. (As defined by the EIA, net exports equal net generation less sales, direct use and line losses.) Net exports from Pennsylvania increased by 24% from 2019 to 2024. For other PJM states, total net exports were -155 million megawatt hours in 2024 and total import demand increased by 7% since 2019.

Table 2: Top Electricity Exporters

State	2019	2024	Change
1 Pennsylvania	70.3	87.3	24.1%
2 Alabama	44.4	44.4	-0.1
3 Illinois	34.6	42.9	23.8
4 Mississippi	12.4	20.8	67.1
5 Arizona	31.0	20.4	-34.1
Other PJM	-144.8	-154.8	7.0

Note: Amounts in millions of megawatt hours. Other PJM excludes Pennsylvania and Illinois.

Source: U.S. Energy Information Administration. 2024 estimated by the IFO based on EIA data through November.

Generation Sources and CO_2 Emissions

For 2024, the fuel sources used for Pennsylvania net generation were as follows: natural gas (60%), nuclear (31%), coal (5%) and other sources (4%, mostly renewables). These shares represent a record high for natural gas and record lows for coal and nuclear (data available since 1990). The **figure below** displays the generation mix for Pennsylvania from 2014 to 2024 based on EIA data through November 2024. During the period shown, generation from nuclear decreased modestly while coal generation was wholly replaced by natural gas. There was an uptick in other renewables for 2024, due entirely to solar generation, which increased by 48% from the prior year. Although it represents a very small share of total generation (1.0% in 2024), solar is the only source outside of natural gas to record a significant relative increase in share over the last five years.

For Pennsylvania, generation from renewable sources is impacted by the Alternative Energy Portfolio Standards (AEPS) Act. The AEPS act requires that electricity suppliers purchase a specific share of sales from alternative sources. The current requirement is that at least 18% of electricity sold to Pennsylvania customers is generated by qualifying alternative energy sources. Qualified sources include three groups: Tier I (7.5%, largely wind), Tier II (10%, largely waste coal and hydropower) and Solar (0.5%). Suppliers must purchase Alternative Energy Credits (AECs) to comply with the requirements of the act. In 2023, these credits were largely comprised of the following generation sources: waste coal (33% of AECs, also subsidized through tax credits), hydropower (21%), wind (17%) and biomass (10%).

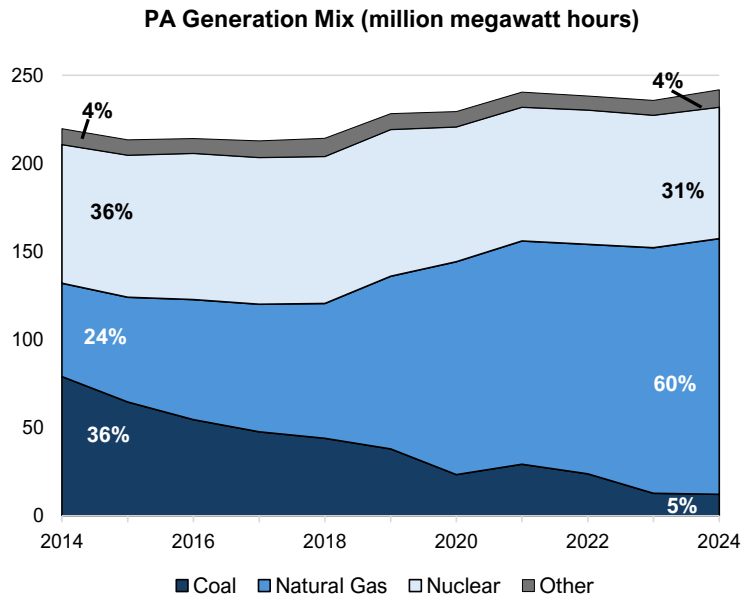

Table 3 shows estimated carbon emissions from the electric power sector. For 2024, the IFO estimates that emissions totaled 70 million metric tons, nearly the same as the prior year and a decrease of 9% from 2019. These data also show that Pennsylvania's emissions per unit for 2024 (0.29 tons per megawatt hour) was notably lower than the average rate for the PJM region (0.38) because other PJM states use coal for a much higher share of generation: Indiana (46%), Ohio (24%), Michigan (20%) and Illinois (15%).

Table 3: Carbon Emissions from Electricity Generation

	Generation		Emissions		Per Unit	
State	2019	2024	2019	2024	2019	2024
New Jersey	71	61	19	13	0.27	0.22
Maryland	39	36	13	9	0.33	0.25
Virginia	97	102	30	26	0.31	0.26
Pennsylvania	229	242	77	70	0.34	0.29
Ohio	122	141	68	63	0.56	0.45
West Virginia	64	51	57	44	0.89	0.87
Other PJM	694	685	334	280	0.48	0.41
Total	**1,316**	**1,318**	**599**	**505**	**0.45**	**0.38**

Note: Generation in million megawatt hours. Emissions in million metric tons.

Source: U.S. Energy Information Administration. 2024 estimated by IFO using EIA data through November.

Electricity Prices

Table 4 shows average residential retail electricity prices for Pennsylvania and other PJM states and annual AEPS costs from 2019 to 2024. The spike in prices from 2021 to 2023 was likely due in part to the nationwide surge in natural gas prices. The increase was larger in Pennsylvania because of its heavier reliance on natural gas as a fuel source (60% in PA vs. 40% in other PJM states). Another factor that could impact electricity prices in Pennsylvania is the compliance cost of electricity suppliers related to the AEPS Act. According to the 2023 AEPS Annual Report published by the Pennsylvania Public Utility Commission, statewide compliance costs totaled $528 million, up $161 million (44%) from the prior year. The increase in costs was largely due to the rise in the average price of AECs that are purchased by suppliers. More than half of the credits purchased for 2023 (55%) came from Tier II sources (largely waste coal and hydropower). From 2019 to 2024, the average price of an AEC for a Tier II source increased from $0.31 to $26.47. During the same period, the average price of an AEC for a Tier I source (43% of AECs) increased by 383%, while an AEC for solar increased by just 17%. Based on published AEC prices for 2024 and a similar generation mix, the IFO estimates that compliance costs for 2024 will total nearly $690 million, an increase of 31% from 2023 and 712% from 2019.

Table 4: Electricity Prices and AEPS Costs

Year	PA	Other PJM	AEPS Cost
2019	13.8	12.7	$85
2020	13.6	12.8	$123
2021	13.8	13.1	$217
2022	15.9	14.2	$367
2023	18.1	15.2	$528
2024	17.9	16.1	$690
19-24 Change	30%	26%	712%

Notes: Prices for residential sector, in cents per kilowatt hour. AEPS cost in millions of dollars.

Sources: Prices from EIA, AEPS costs from PUC. 2024 AEPS costs estimated by the IFO.

Staff Contact

Questions regarding this report can be directed to jbushman@ifo.state.pa.us.