Pennsylvania Electricity Update

This update displays recent trends for the Pennsylvania and regional electricity markets. The latest data show that Pennsylvania remained the top electricity export state and reached a new low for CO_2 emissions from electricity generation in 2023. All data shown are from the U.S. Energy Information Administration.

Net Generation

Table 1: Regional Net Electricity Generation

State	Net Generation 2018	Net Generation 2023	% Change	2023 Generation Share: Nat. Gas	Coal	Nuclear	Other
Pennsylvania	215	236	9.6%	59.0%	5.4%	31.9%	3.7%
Ohio	128	132	3.3	58.8	23.8	12.3	5.1
New York	133	125	-5.9	47.7	0.0	22.1	30.2
New Jersey	75	64	-14.3	51.4	0.0	44.1	4.5
West Virginia	67	52	-22.2	6.9	85.6	0.0	7.5
Maryland	44	36	-17.6	42.5	4.7	41.6	11.1

Note: Amounts in millions of megawatt hours. Other category includes petroleum and other renewables.

Source: U.S. Energy Information Administration.

Table 1 displays net electricity generation for Pennsylvania and regional states, and the composition of generation by major fuel source. For 2023, Pennsylvania net generation totaled 236 million megawatt hours, an increase of 9.6% from 2018, and only 8% less than the net generation of New York and Ohio combined. The fuel sources for Pennsylvania's net generation in 2023 were: 59.0% from natural gas, 5.4% from coal, 31.9% from nuclear and 3.7% from other sources. Ohio was the only other regional state to record an increase in net electricity generation since 2018.

Table 2 shows the top five states for net exports of electricity for 2023 and net exports for regional states. For 2023, Pennsylvania exported an estimated 83 million megawatt hours of electricity, notably higher (85%) than the second highest export state. (As defined by the EIA, net exports equal net generation less sales, direct use and line losses.)

Table 2: Net Exports of Electricity

State	2018	2023	Change
Top 5			
Pennsylvania	52	83	58.6%
Alabama	45	45	0.9
Illinois	33	36	8.9
Wyoming	27	24	-10.7
Arizona	29	21	-25.7
Regional			
West Virginia	31	18	-42.5%
New Jersey	-7	-14	-107.4
Ohio	-35	-24	31.9
Maryland	-23	-24	-5.6
New York	-12	-30	-139.4

Note: Amounts in millions of megawatt hours.

Source: U.S. Energy Information Administration. The calculation for 2023 uses 2022 amounts for direct use and line losses, which are not yet available for 2023.

CO_2 Emissions

Despite generation growth since 2018, the IFO estimates that the Pennsylvania power sector continues to reduce both absolute and per unit CO_2 emissions. Estimated emissions for 2023 (68 million tons) declined by 10.8% from the prior year, the largest year-over-year decline for Pennsylvania on record (since 1990). The estimated 2023 decline is nearly double the 2020 rate (-6.6%), when emissions were impacted by the COVID-19 pandemic and reduced economic activity. **Table 3** shows net generation, estimated emissions and emissions per unit of generation for Pennsylvania and regional states. Pennsylvania and Ohio were the only states to increase generation and reduce emissions.

Table 3: Carbon Emissions from Electricity Generation

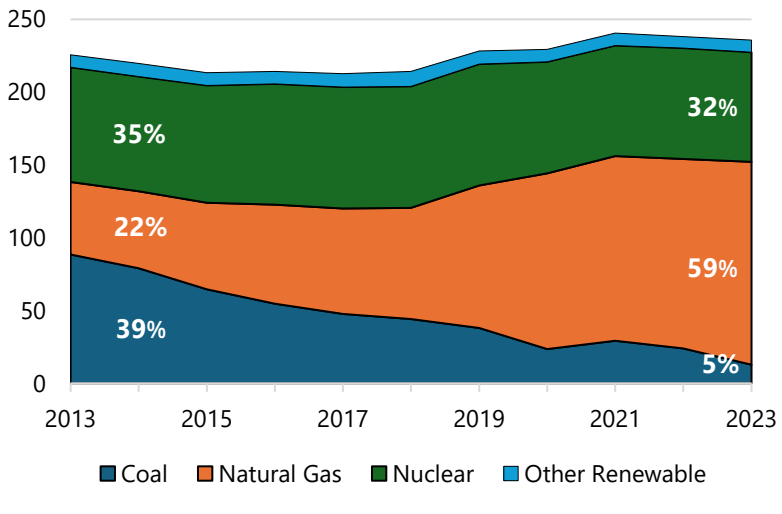
	Generation		Emissions		Per Unit	
State	2018	2023	2018	2023	2018	2023
New York	133	125	28	27	0.21	0.22
New Jersey	75	64	19	14	0.25	0.22
Maryland	44	36	18	8	0.41	0.22
Pennsylvania	215	236	77	68	0.36	0.29
Ohio	128	132	78	62	0.61	0.47
West Virginia	67	52	60	45	0.90	0.87

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

Sources: U.S. Energy Information Administration. 2023 emissions are estimated by the IFO based on 2023 generation.

The reduction in CO_2 emissions is largely due to the long-term trend decline in coal generation. **Figure 1** displays the generation mix for Pennsylvania from 2013 to 2023 and shows the precipitous decline in coal generation over the last ten years. For 2023, coal was used for just 5.4% of total generation and contracted by 46.5% from 2022, the largest year-over-year drop on record. According to EIA emissions data for 2022, Pennsylvania coal generation emits approximately 2.5 times the amount of CO_2 per unit (1.1 metric tons per megawatt hour) than natural gas generation (0.4 metric tons). During the time period shown, generation from nuclear decreased modestly while generation from other renewables (wind, solar, hydroelectric, biomass) was flat. The figure shows that coal generation was wholly replaced by natural gas over the last decade.

Figure 1: PA Generation Mix (million megawatt hours)



For 2023, waste or refuse coal accounted for 24.9% of total coal generation in Pennsylvania, up from 9.7% in 2013. Non-waste coal generation has declined at a much faster rate than waste coal generation. From 2018 to 2023, non-waste coal generation declined by 73.7%, while waste coal generation declined by 57.6%.

A factor that likely impacts that outcome is the Commonwealth provides tax credits to eligible facilities that generate electricity with coal refuse. The annual cap for the Coal Refuse Energy and Reclamation tax credit is $20 million, and the entire amount was awarded in FY 2022-23. For 2021, an IFO report found that the state tax credit subsidized waste coal generation by $2.09 per MWh.[1]

Electricity Prices

Figure 2 shows average national and Pennsylvania electricity prices for residential customers since 2018 Q2. The data show three general phases: (1) 2018 and 2019 when the Pennsylvania price was generally one cent per kilowatt hour (8%) higher than the U.S. average, (2) the period most impacted by COVID-19 (2020-2021) when prices converged, and (3) a third phase when both prices surged in response to high natural gas prices before diverging. From 2021 Q1 to 2022 Q4, the Pennsylvania price increased by 33.8% and the U.S. price increased by 19.6%. The weaker national increase was likely due to a more diverse generation mix: Pennsylvania uses more natural gas (59.0% of 2023 generation) compared to the U.S. average (43.1%). For 2023 Q4, the average Pennsylvania price was two cents (12%) higher. It is likely that prices will converge during 2024 if natural gas prices remain low.

Figure 2: Residential Electricity Price (cents/ kwh)

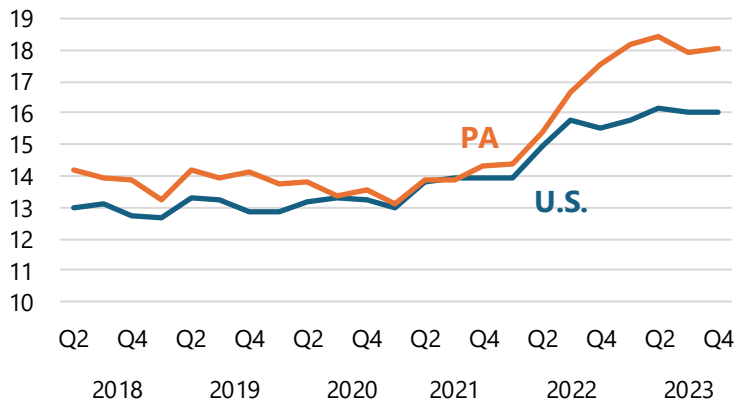


Table 4 shows trends in the average residential price for electricity for Pennsylvania, regional states and the U.S. The states are listed in descending order based on the percent change in average price from 2018 to 2023. The Pennsylvania residential price increased by 30.3% during the five-year period, the most among regional states. The entire Pennsylvania price increase occurred in 2022 and 2023, as the average residential price in 2021 was 13.8 cents, 0.7% lower than 2018.

Table 4: Regional Residential Prices

State	Avg. Residential Price 2018	Avg. Residential Price 2023	% Change
Pennsylvania	13.9	18.1	30.3%
West Virginia	11.2	14.1	25.8
Maryland	13.3	16.6	24.7
Ohio	12.6	15.5	23.1
New York	18.5	22.3	20.1
New Jersey	15.4	17.7	15.1
U.S. Average	12.9	16.0	24.2

Note: Amounts in cents per kilowatthour.

Source: U.S. Energy Information Administration.

Staff Acknowledgments

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[1] See "Coal Refuse Energy and Reclamation Tax Credit," IFO (January 2022).