

PA RGGI 2025 Simulation Results

April 2025

Study Request

- The simulation was conducted at the request of Pennsylvania Senate Majority Leader Joe Pittman.

Simulation Parameters

- The simulation assumes Pennsylvania RGGI membership during PJM model year 2025.
- The simulation models energy prices, generator emissions, and generation production in Pennsylvania and PJM as a whole.
- The simulation does not model RGGI impacts on the PJM capacity market or resource adequacy.

Wholesale Prices

- An increase in marginal production costs will raise spot market energy prices for consumers both within and outside Pennsylvania¹.
 - Under this simulation, Pennsylvania's load payments are projected to increase by 13%, or approximately \$752 million.
 - Under this simulation, all of PJM's load payments are projected to increase by 8%, or approximately \$2.5 billion.

¹These figures assume all load pays the marginal price, or LMP. In reality, a significant quantity of load is hedged against the marginal price through a combination of self-supply, bilateral contracting, financial hedges, etc.

Retail Prices

- Retail price impacts will depend on various factors including auction schedules & what PA chooses to do with RGGI revenues, and thus, retail price impacts were not modeled.

Emissions

- Applying a RGGI-like cost to carbon emissions for Pennsylvania generators will result in lower total emissions in Pennsylvania by reducing their output.
 - Pennsylvania's CO₂ emissions are simulated to decrease by 52%.
 - Total CO₂ emissions across the PJM footprint are projected to remain relatively flat.

Production

- Electricity demand will be met by equivalent out-of-state fossil-fueled power plants.
- Pennsylvania will remain a net exporter of electricity to other states within the PJM region.
- Pennsylvania's net electricity exports are estimated to decrease from 105.6 TWh to 38.3 TWh.

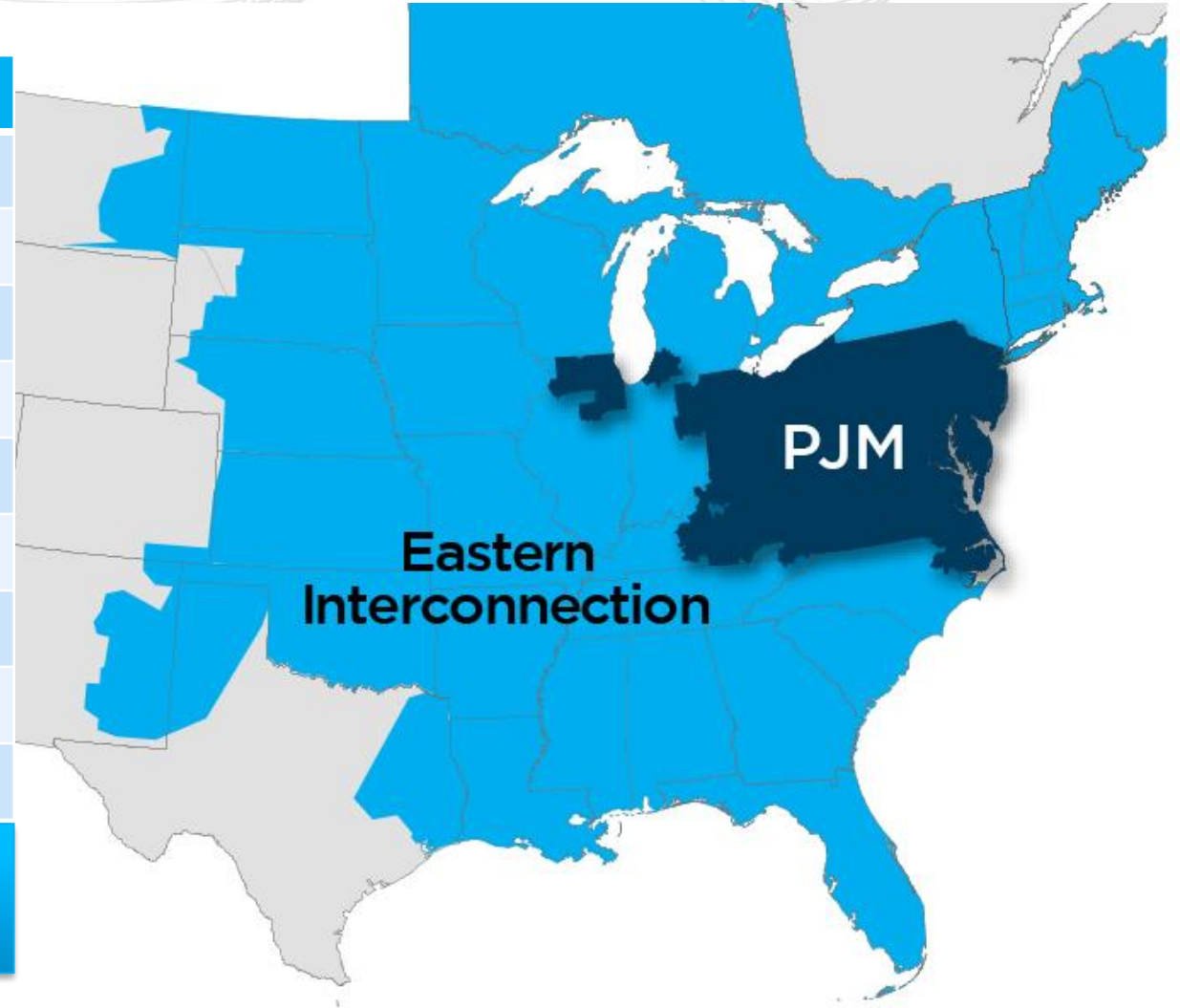
Costs to Pennsylvania Generators / RGGI Revenue to Pennsylvania

- CO₂ emissions costs to PA generators/suppliers of \$968,140,285 would be remitted to the Commonwealth by RGGI, Inc.

Key Statistics

Member companies	1,110
Millions of people served	67+
Peak load in megawatts	165,563
Megawatts of generating capacity	182,036
Miles of transmission lines (BES)	88,333
Gigawatt hours of annual energy	800,004
Generation sources	1,486
Square miles of territory	369,054
States served	13 + DC

- 27% of generation in Eastern Interconnection
- 24% of load in Eastern Interconnection



As of 2/2025

Data & Assumptions

- *PowerGEM's* latest commercially available model data (May 2024)
- Transmission network topology utilized the *MMWG 2024 Series* planning case 2025 expectations
- Energy markets simulated in isolation (no interchange market impact from ISO/RTO neighbors)
- Generation Expansion (2025 expected new entry) consistent with latest planning assumptions

Procedure

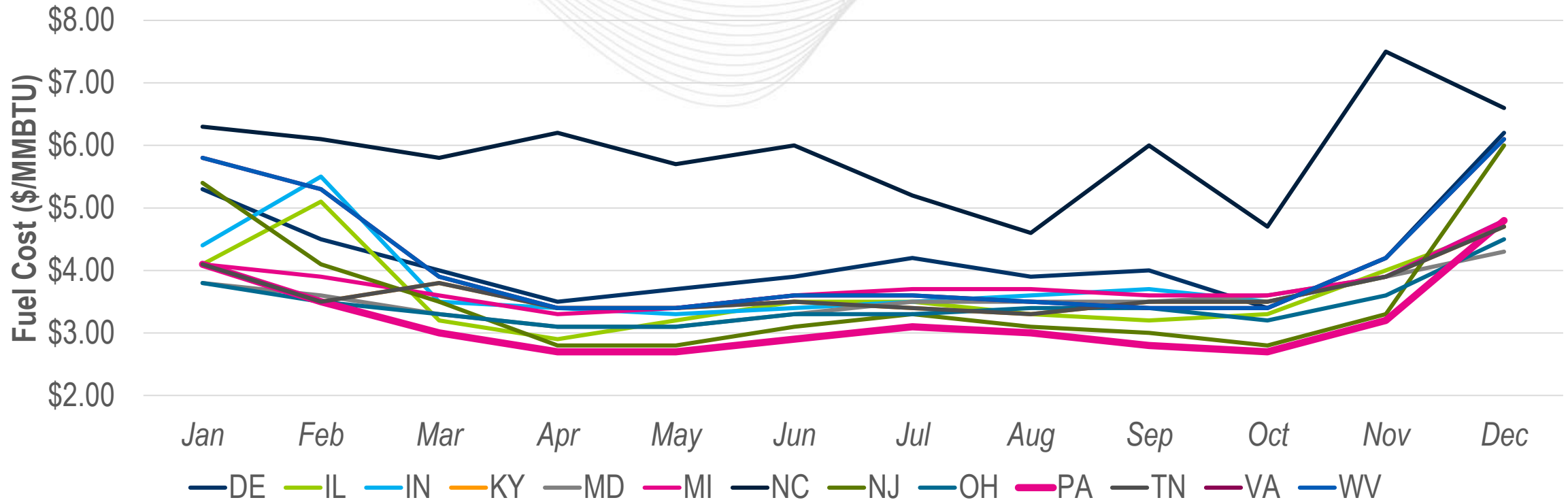
- Utilized *PROBE LT tool* to simulate economic scheduling & dispatch for 2025
- Two 2025 projection simulations (Base and with RGGI adder) were performed to assess the impact of PA joining RGGI
 - *Baseline* did units in RGGI
 - *PA in RGGI* applied CO₂ emission not include PA costs to all PA fossil units

Analysis

- The results of the two simulations were used to assess the impacts of PA joining RGGI on three key components
 1. Prices
 2. Exports
 3. Carbon Emissions

2025 Fuel Cost Forecast Assumptions

Monthly Average Natural Gas Costs by State



Fuel	Annual	Fuel	Annual	Fuel	Annual
Kerosene	\$10.00	Landfill Gas	\$4.70	Wood	\$3.00
Fuel Oil	\$9.50	Biomass	\$4.00	Coal	\$2.90
Black Liquor	\$7.00	Other Fuel	\$4.00	Muni Solid Waste	\$0.60

PA average Natural Gas fuel costs are typically the lowest within PJM

RGGI CO₂ price est. \$21.35/ton*

Modifies the *short-run marginal cost* used to dispatch thermal generating units and set prices in the energy markets:

Heat Rate (MMBTU/MWh) x
Emission Rate (lb/MMBTU) x
Emission Cost (\$/lb) → + \$/MWh

Software will commit & dispatch in least cost merit order, subject to transmission limits and operational constraints

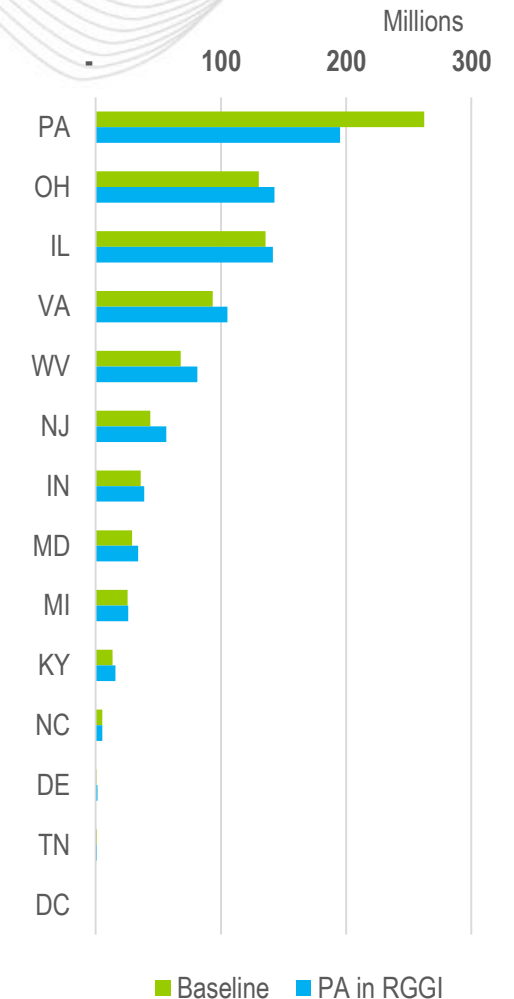
	CO ₂	NOx	SO ₂
Fuel Type	Average Emission Rate (lbs/MMBTU)		
Biomass	130.00	0.18	0.01
Coal	205.03	0.46	0.57
Fuel Oil	156.30	0.18	0.01
Kerosene	156.30	0.18	0.01
Natural Gas	117.00	0.08	0.00

*Source: Evolution Markets, Inc. RGGI OTC spot price, 2025 YTD

Simulated Generation by State Results

- 26% reduction in PA generation (**67.3 TWh**)
- PA simulated demand was held constant at **156.8 TWh**
- PA remains a *net exporter*, from **105.6 TWh** to **38.3 TWh**

	Baseline	PA in RGGI	Delta
State	MWh		% change
PA	262,393,769	195,137,072	-26%
OH	130,159,819	142,751,425	10%
IL	135,564,103	141,555,057	4%
VA	93,597,145	105,116,168	12%
WV	67,962,289	81,325,051	20%
NJ	43,574,839	56,425,608	29%
IN	35,890,445	38,846,266	8%
MD	29,116,745	34,043,712	17%
MI	25,639,313	26,102,495	2%
KY	13,554,428	15,888,909	17%
NC	5,375,966	5,417,676	1%
DE	685,003	1,487,119	117%
TN	1,043,120	1,067,200	2%
DC	31,301	49,034	57%
Grand Total	844,588,286	845,212,792	0.07%



Simulated Emissions by State Results

52% decrease in PA CO2 emissions from RGGI

- Reductions of 69% NOx and 95% SO2 emissions via lower fossil run hours

1% overall decrease in PJM CO2 emissions

- Fossil in other PJM states increase their output to serve the load
- PA CO2 emissions costs to suppliers would increase \$968,140,285
- This is remitted to the state under RGGI.

State	Baseline			PA in RGGI		
	CO2 (tons)	NOx (tons)	SO2 (tons)	CO2 (tons)	NOx (tons)	SO2 (tons)
PA	95,332,342	107,238	75,630	45,346,150	32,857	3,537
OH	65,990,543	99,335	97,214	75,557,981	112,353	108,834
WV	65,923,011	146,540	181,648	80,872,502	179,522	222,396
VA	23,273,912	16,043	344	29,169,492	20,149	507
IN	20,508,432	38,988	44,717	23,414,981	44,866	51,683
IL	14,679,866	15,203	9,300	18,628,600	20,214	13,449
KY	12,589,771	26,793	32,558	14,702,016	30,467	36,554
NJ	5,072,414	3,468	26	10,657,441	7,287	55
MD	4,023,577	3,011	476	6,267,875	4,646	666
MI	2,632,538	1,800	14	2,880,615	1,970	15
TN	557,366	974	1,062	565,743	980	1,063
DE	231,790	203	81	600,597	474	116
DC	21,234	29	1	33,374	45	1
NC	1,114	1	0	1,159	1	0
PJM	310,837,912	459,626	443,070	308,698,525	455,830	438,877

Simulated Load Payments by Zone

Increase in supplier marginal costs reflect as higher costs to consumers through LMP¹

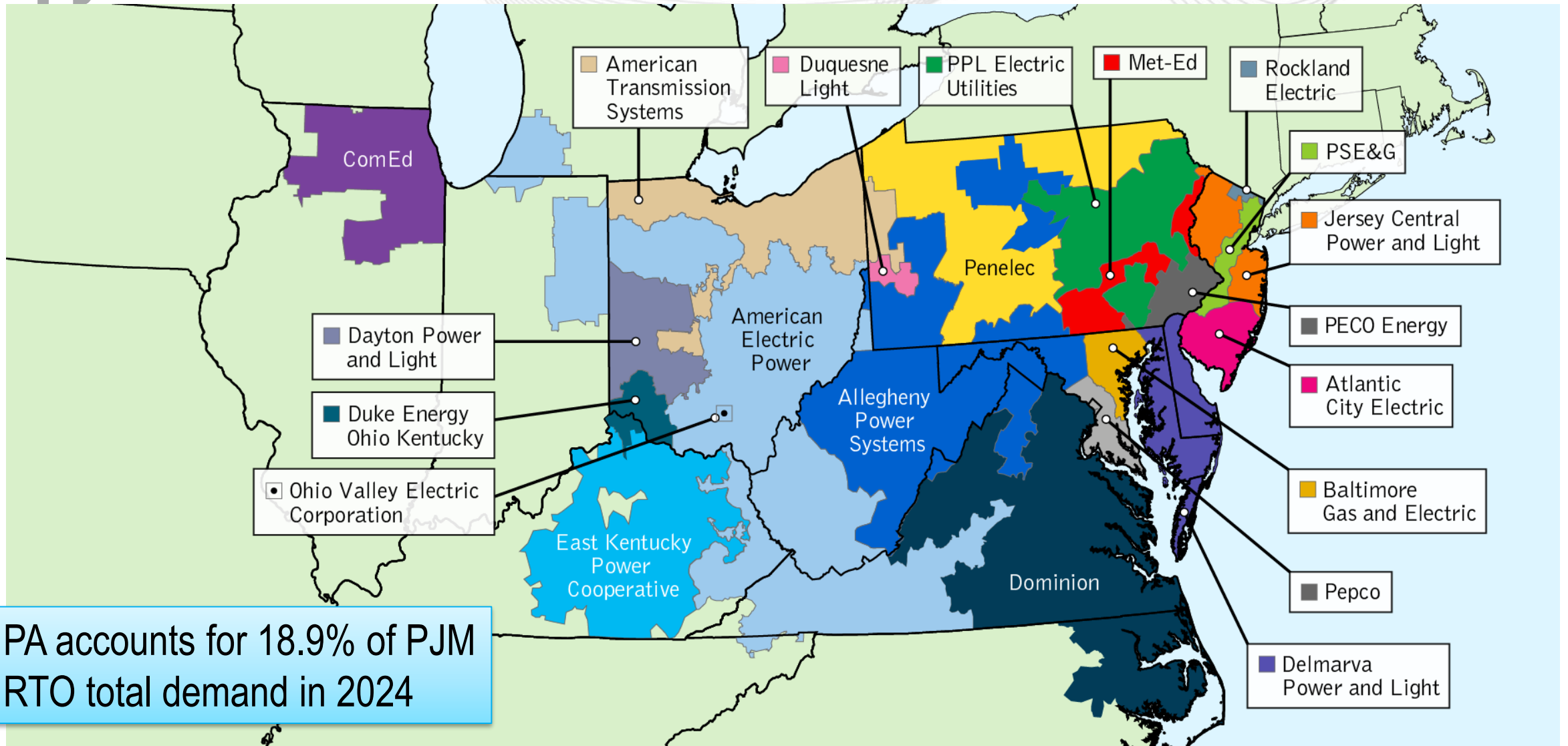
- 13% increase in PA load payments in PJM zones:
AP*, ATSI², DLCO, METED, PECO, PENELEC, PL, UGI
- 8% increase in PJM load payments overall
- Simulated PA average cost to load increases from \$44.18/MWh to \$49.50/MWh

¹ Consumer prices may not correlate directly to LMP

² Est. 45% of AP / 8% of ATSI load is in PA

	Baseline	PA in RGGI	Delta
Zone	Load Payments (\$)		% change
UGI	38,329,967	44,546,214	16%
Penelec	664,347,911	757,996,379	14%
PECO Energy	1,499,627,232	1,709,583,956	14%
PPL Electric Utilities	1,550,772,125	1,767,268,996	14%
Jersey Central Power & Light	919,409,699	1,045,621,539	14%
PSE&G	1,723,710,218	1,958,281,549	14%
Atlantic City Electric	399,503,095	453,793,355	14%
Rockland Electric	58,293,180	66,098,623	13%
Met-Ed	647,371,480	730,125,044	13%
Delmarva Power & Light	742,855,916	833,106,030	12%
Duquesne Light	492,867,367	540,001,659	10%
Allegheny Power Systems*	2,034,943,498	2,213,466,925	9%
American Transmission Systems*	2,516,535,199	2,710,513,090	8%
Pepco	1,212,023,804	1,296,590,577	7%
Baltimore Gas & Electric	1,317,493,539	1,406,270,203	7%
Dominion	5,498,069,734	5,866,662,885	7%
American Electric Power	5,243,472,078	5,476,054,595	4%
Duke Energy Ohio Kentucky	1,042,938,489	1,083,239,882	4%
East Kentucky Power Coop.	436,246,159	452,914,434	4%
Dayton Power & Light	672,962,424	697,321,636	4%
ComEd	3,335,691,946	3,452,719,788	4%
PJM Total	32,047,465,060	34,562,177,357	8%
PA Total	6,010,363,471	6,762,423,411	13%

Appendix



PA accounts for 18.9% of PJM RTO total demand in 2024

2025 Fuel Forecast Assumptions

