

Pennsylvania Resource Adequacy Analysis

Q3 2024



The data included in and used to inform this presentation publicly available though PJM and other public sources.

About This Analysis

Preliminary resource adequacy values for a given delivery year were used to study a 2032 resource adequacy scenario in Pennsylvania.

- This should not be interpreted as a PJM forecast of resource adequacy in Pennsylvania or as a forecast of any of the resource adequacy values.
- The resource adequacy values used are the outcome of running a resource adequacy model using a specific assumed resource mix for the delivery year. Significant uncertainty surrounds each assumed resource portfolio out to the study year.
- Assumptions made can be found at the end of this presentation.



Pennsylvania's ELCC adjusted resource mix would remain resource adequate in 2032, even in a no new resource entry scenario, under the parameters studied in this analysis.

- However, even in a high new resource entry scenario, resource adequacy reserve margins are tighter than what Pennsylvania enjoys today due to increasing demand and retiring resources.
- High new resource entry is not replacing 1:1 the loss of retiring resources.
- This outlook would change if Pennsylvania experiences a sharp increase in demand or decrease in supply.

Pennsylvania should avoid policies that force premature generation deactivation.



PA 2032 Reliability Scenario Balance Sheet

			Scenario	
Study Foreo Prelir	/ Year: 2032 casted Summer Peak: 30,495 minary Forecast Pool Requirement: 0.9210	No New Entry (MW)	Low New Entry (MW)	High New Entry (MW)
ıpply	ELCC Adjusted Capacity (inclusive of forecasted deactivations)	29,507	29,507	29,507
Su	ELCC Adjusted New Resource Entry	0	166	2,180
	Total	29,507	29,673	31,687
Demand	Reliability Requirement (Summer Peak * Forecast Pool Requirement)	28,086	28,086	28,086
	Balance Sheet	+1,421	+1,587	+3,601



PA ELCC Reliability Scenario Outlook



Because these are ELCC adjusted installed capacity megawatt values, they do not show a trend in how many megawatts of installed capacity are available in PA. This graph shows a trend of how many accredited reliability megawatts are available in a given delivery year. The same pool of resources may represent a higher or lower reliability value in a given delivery year due to changes in ELCC class values.

- Installed capacity adjusted for ELCC class values in a given delivery year (reference slide)
- Forecast Pool Requirement and summer peak load assumptions (<u>reference slide</u>)
- ELCC adjusted low new entry projection based historical completion rate of 5% for wind, solar and storage resources (<u>reference slide</u>)
- ELCC adjusted high new entry projection assumes all projects in the queue as of August 1, 2024, come in service (<u>reference slide</u>)







Pennsylvania – 2023 Actual and Announced Generator Deactivations

Unit	TO Zone	Fuel Type	Request Received to Deactivate	Actual or Projected Deactivation Date	Age (Years)	Capacity (MW)
EDDYSTONE 4	DECO	Oil	10/1/0000	5/21/2025	52	380
EDDYSTONE 3	PECO	Oli	12/1/2023	5/31/2025	53	380
HOMER CITY 3			3/31/2023		46	650
HOMER CITY 2	PENLEC	Coal		7/1/2023	54	614
HOMER CITY 1						620
MARTINS CREEK CT 1						18
MARTINS CREEK CT 1	PPL OII		2/10/2022	6/1/2023	50	17.3
MARTINS CREEK CT 1	PPL	Natural Gas				17.3

m[°] PA Announced and Forecasted Deactivations (MWs ICAP)



Forecasted policy retirements include generation impacted by the EPA's Cross-State Air Pollution Rule, Effluent Limitation Guidelines, and the Greenhouse Gas Emissions rule.



PA Installed Capacity Adjusted for Preliminary ELCC Values

	Gas	Nuclear	Coal	Waste	Oil	Hydro	Solar	Storage	Wind	Total
					M	W				
2024 installed capacity	23,341	8,928	7,553	252	2,159	2,232	144	0	280	44,889
2024 installed capacity approximate ELCC value based on the final values for the 2025/2026 DY	14,471	8,482	6,345	136	1,986	826	13	0	98	32,357
2032 possible installed capacity (2024 resource mix less expected retirement)	23,341	8,928	1,504	252	1,399	2,232	144	0	280	38,080
Approximate ELCC value based on the preliminary results for 2032/33 DY	17,272	8,571	1,293	141	1,301	870	6	0	53	29,507

This chart is based on applying the final 25/26 ELCC and preliminary 32/33 ELCC class ratings found in the appendix of this presentation to the Pennsylvania installed capacity mix as of Dec. 31, 2024, minus announced and forecasted retirements. This slide does not consider new entry. ELCC class values assumed for each fuel type can be found on the <u>assumptions slide</u> in this presentation.



PA Potential New Entry ELCC Impact

	Solar	Storage	Wind	Natural Gas	Hydro	Other	Total
				MW			
Queue (CIRs)	8,965	4,016	388	65	24	3	13,461
Approximate ELCC value based on the preliminary results for 2032/33 DY	359	1,687	74	48	9	3	2,180
Estimated queue (CIRs) to come in service based on historical completion rate	448	201	19	65	24	3	760
Approximate ELCC value based on the preliminary results for 2032/33 DY	18	84	4	48	9	3	166

This chart is based on applying the preliminary 2032/2033 ELCC class value found in the preliminary ELCC class values in the appendix of this presentation to megawatts in the queue as of August 1, 2024 and the projected in-service megawatts based on assumed historical queue completion rate of 5%. ELCC class values assumed for each fuel type found in the <u>assumptions slide</u> of this presentation.



The summer peak megawatt values, based on the 2024 PJM load forecast report, reflect the estimated amount of forecast load to be served by each transmission owner. Estimated amounts were calculated based on the average share of each transmission owner's real-time summer and winter peak load in those areas over the past five years.

PA Summer Peak							
2024	2032						
29,226	30,495						
MW	MW						
Growth Rate 0.4%							



New entry estimates for 2032 based on active projects in the PJM New Services Interconnection process as of August 1, 2024

- Hybrid resources in the queue are categorized as the fuel type listed first.
- Assumed historical queue completion rate of 5% for solar, wind and storage resources for 2032 low entry scenario.
- Assumed 100% completion rate for 2032 high entry scenario.

Preliminary ELCC values used to examine a 2032 reliability scenario for Pennsylvania

- Actual ELCC values calculated for the 2032/2033 Delivery Year may be different and are impacted by a number of factors, including the projected resource mix, including as the projected resource mix evolves.
- ELCC adjusted values only considered the primary fuel and did not calculate specific ELCCs for hybrid resources.
- Capacity resources receive individual performance adjusted ELCC ratings for auction participation. Only class values were used for this presentation.



PA Resource Adequacy Analysis Assumptions Continued

Reliability Analysis Values Assumed

- 2032/2033 Forecast Pool Requirement of .9210 based on this <u>resource adequacy analysis</u>¹ and can be found in the <u>appendix</u> of this presentation.
- Summer Peak Load Forecast for Pennsylvania 30,495 MW based on 2024 PJM load forecast (reference slide).
- Final 2025/2026 and Preliminary 2032/2033 ELCC values can be found in the appendix.
 - Applied gas combustion turbine ELCC for all gas
 - Applied fixed-tilt solar class ELCC for all solar
 - Applied 4-hour storage class ELCC for all storage
 - Applied onshore wind class ELCC for all wind
 - Applied intermittent landfill ELCC for all waste

- Applied nuclear class ELCC for all nuclear
- Applied diesel utility ELCC for all oil
- Applied hydro intermittent ELCC for all hydro
- Applied coal ELCC for all coal

1: https://pjm.com/-/media/committees-groups/committees/pc/2024/20240806/20240806-item-08---supplementary-information---elcc-class-ratings.ashx



Appendix



IRM, AUCAP Factor, FPR for period 27/28 – 34/35

Delivery Year	IRM (%)	AUCAP Factor	CBOT (%)	FPR
2027/28	20.1%	0.7718	1.5	0.9269
2028/29	21.9%	0.7609	1.5	0.9275
2029/30	23.9%	0.7544	1.5	0.9347
2030/31	26.3%	0.7360	1.5	0.9296
2031/32	28.9%	0.7193	1.5	0.9272
2032/33	30.8%	0.7041	1.5	0.9210
2033/34	33.0%	0.6766	1.5	0.8999
2034/35	35.1%	0.6446	1.5	0.8709

- The upward IRM trend shows a higher need of installed capacity to meet the LOLE criteria.
- At the same time, the downward AUCAP Factor trend reveals that the higher installed capacity has lower reliability value (AUCAP Factor = Total UCAP / Total ICAP)
- The above yields a downward FPR trend signifying that the reliability requirement changes are driven by supply side adjustments (i.e. lower reliability value of additions) rather than demand side adjustments (e.g. higher load uncertainty)

Resource adequacy analysis

ELCC Class Ratings

Preliminary ELCC Class Ratings for period Delivery Year 2026/27 – Delivery Year 2034/35

The following table provides the preliminary ELCC Class Ratings for Delivery Years in the period 2026/27 – 2034/35 as calculated under the methodology approved by FERC on January 30th, 2024 in Docket No. ER24-99. These preliminary ELCC Class Ratings are non-binding and are only for indicative purposes.

ELCC Class	2026/	2027/	2028/	2029/	2030/	2031/	2032/	2033/	2034/
	27	28	29	30	31	32	33	34	35
Onshore Wind	35%	33%	28%	25%	23%	21%	19%	17%	15%
Offshore Wind	61%	56%	47%	44%	38%	37%	33%	27%	20%
Fixed-Tilt Solar	7%	6%	5%	5%	4%	4%	4%	4%	3%
Tracking Solar	11%	8%	7%	7%	6%	5%	5%	5%	4%
Landfill Intermittent	54%	55%	55%	56%	56%	56%	56%	56%	54%
Hydro Intermittent	38%	40%	37%	37%	37%	37%	39%	38%	38%
4-hr Storage	56%	52%	55%	51%	49%	42%	42%	40%	38%
6-hr Storage	64%	61%	65%	61%	61%	54%	54%	53%	52%
8-hr Storage	67%	64%	67%	64%	65%	60%	60%	60%	60%
10-hr Storage	76%	73%	75%	72%	73%	68%	69%	70%	70%
Demand Resource	70%	66%	65%	63%	60%	56%	55%	53%	51%
Nuclear	95%	95%	95%	96%	95%	96%	96%	94%	93%
Coal	84%	84%	84%	85%	85%	86%	86%	83%	79%
Gas Combined Cycle	79%	80%	81%	83%	83%	85%	85%	84%	82%
Gas Combustion	61%	63%	66%	68%	70%	71%	74%	76%	78%
Turbine									
Gas Combustion	79%	79%	80%	80%	81%	82%	83%	83%	83%
Turbine Dual Fuel									
Diesel Utility	92%	92%	92%	92%	92%	93%	93%	93%	92%
Steam	74%	73%	74%	75%	74%	75%	76%	74%	73%

Final	2025/2026	BRA	FI CC	Class	Ratings
i iiiai	2020/2020			01000	ruungo

Preliminary ELCC Class Ratings for period Delivery Year 26/27 through 34/35

Apim

Onshore Wind

Offshore Wind

Fixed-Tilt Solar

Tracking Solar

4-hr Storage

6-hr Storage

8-hr Storage

10-hr Storage

Diesel Utility

Steam

Nuclear

Coal

Demand Resource

Gas Combined Cycle

Gas Combustion Turbine

Gas Combustion Turbine Dual Fuel

Landfill Intermittent

Hydro Intermittent

2025/2026 BRA

ELCC Class Ratings

35%

60%

9%

14%

54%

37%

59%

67%

68%

78%

76%

95%

84%

79%

62%

79%

92% 75%



Pennsylvania – 2024 Load Forecast Report



* Allegheny Power and ATSI serve load other than in Pennsylvania. The summer and winter peak megawatt values reflect the estimated amount of forecast load to be served by each transmission owner in the noted state/district. Estimated amounts were calculated based on the average share of each transmission owner's real-time summer and winter peak load in those areas over the past five years.

