Ohio Resource Adequacy Analysis

February 2025

The data included in and used to inform this presentation is 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 Ohio**.

This analysis reflects supply/demand fundamentals purely in Ohio and should be considered an “Ohio only” balance sheet.

Of note, the Clifty Creek Station in Madison, Indiana is owned by the Ohio Valley Electric Corporation and may be used to serve Ohio retail customers, but it is not included in this analysis.

- This should not be interpreted as a PJM forecast of resource adequacy in Ohio or as a forecast of any of the resource adequacy values.
- This analysis cannot account for owned or contracted for capacity which located outside of the state and may be used to serve Ohio consumers.
- 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.

Executive Summary and Key Takeaways

Ohio is currently a net importer and relies on the region to meet its demand; this analysis shows that this reliance will become greater by 2032.

Ohio starts the analysis in 2025 as a net importer of at least ~8 GW of capacity from outside the state. **By 2032, this margin is projected to widen to about ~21 GW.**

- Rapid demand growth with limited new entry contributes 6 GW to this 21GW deficit outlook.
- In-state generation which is at-risk of retirements due to U.S. EPA regulations contributes 6.5 GW to this 21GW deficit outlook.

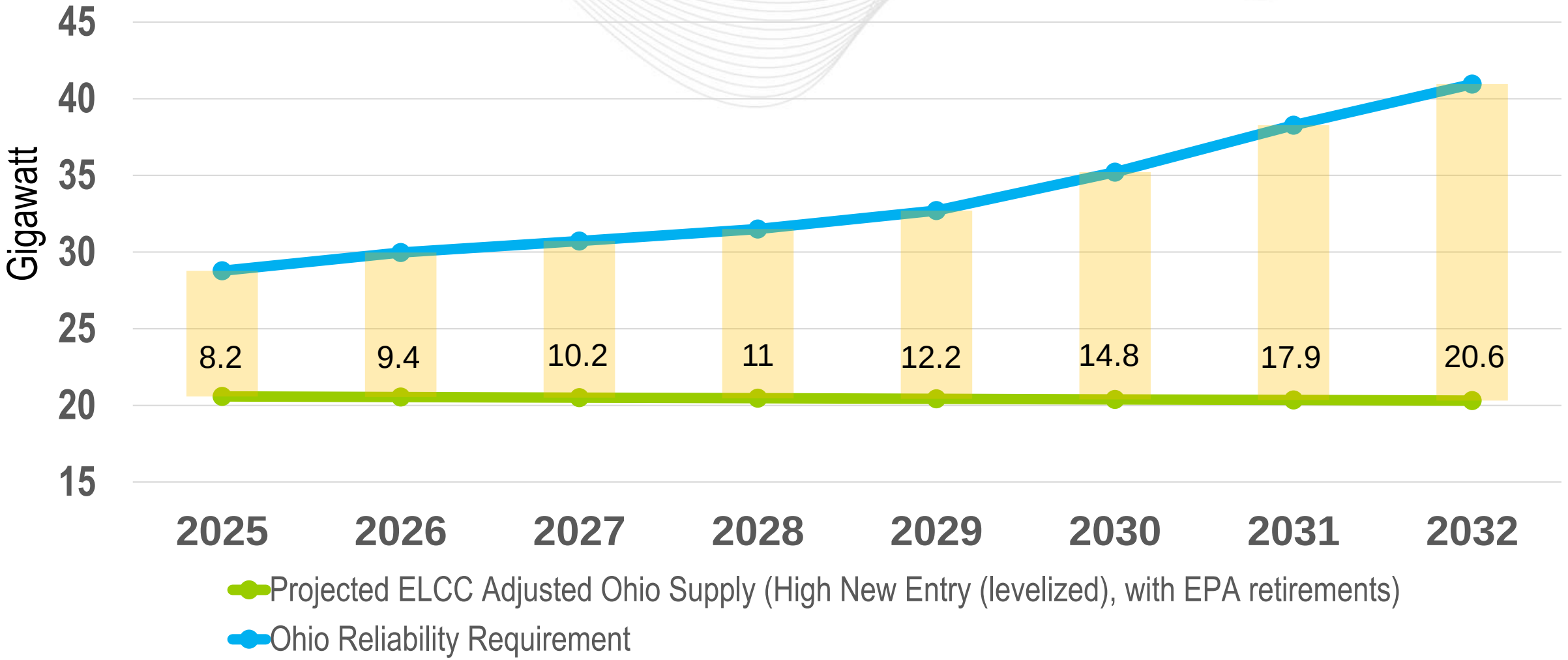
Policy Takeaways

- **States should avoid policies intended to push *existing generation resources* off of the system until an adequate quantity of replacement generation is online and has been shown to be operating**

- **States should help to bring *new generation resources* onto the system as soon as possible**

- **States should address state and local challenges in the siting/permitting of all electricity infrastructure including *transmission infrastructure***

Ohio – Supply and Demand Trends



OH 2032 Reliability Scenario Balance Sheet

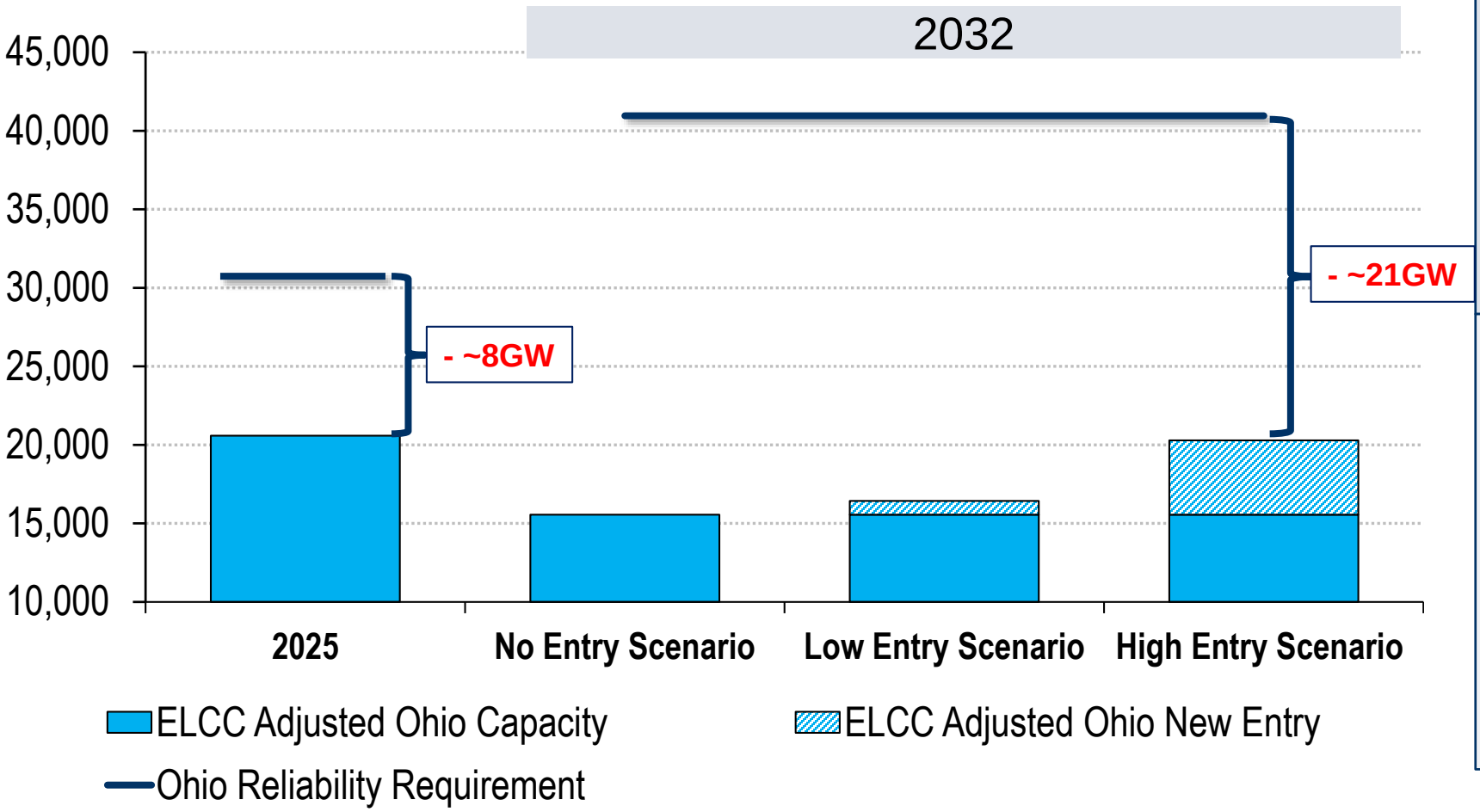
Study Year: **2032** Forecasted Summer Peak: **44,469** Preliminary Forecast Pool Requirement: **0.9210**		Scenario: **No** New Entry (MW)	Scenario: **Low** New Entry (MW)	Scenario: **High** New Entry (MW)
Supply	2032/33 ELCC Adjusted Ohio Capacity *(Inclusive of projected deactivations)**	15,552	15,552	15,552
Supply	2032/33 ELCC Adjusted Ohio New Resource Entry	0	881	4,738
	Total	15,552	16,433	20,290
Demand	**2032/33 Ohio Reliability Requirement** *(Ohio Summer Peak * RTO Forecast Pool Requirement)*	40,956	40,956	40,956
	Balance Sheet	**-25,404**	**-24,523**	**-20,666**

* See slide 12

OH ELCC Reliability Scenario Outlook

ELCC-Adjusted In-State Capacity Projections

	2025	No Entry Scenario	Low Entry Scenario	High Entry Scenario
TOTAL	20,583 MW	15,552 MW	16,433 MW	20,290 MW

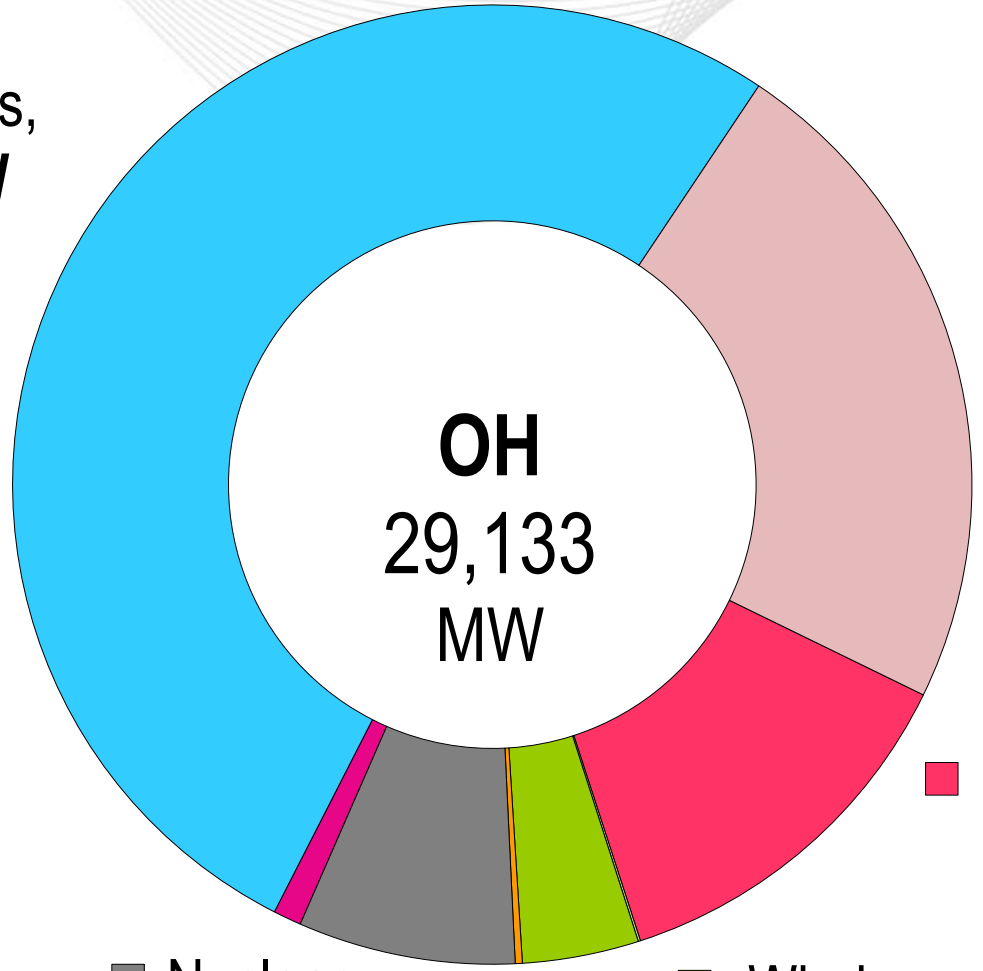


Because these are ELCC adjusted installed capacity megawatt values, they do not show a trend in how many megawatts of installed capacity are available in OH. This graph shows a trend of how many accredited reliability megawatts are available in a given delivery year. The same pool of resources may represent 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 (reference slide)
- ELCC adjusted low new entry projection based historical completion rate of 5% for wind, solar and storage resources (reference slide)
- ELCC adjusted high new entry projection assumes all projects in the queue as of Jan. 30, 2025, come in service (reference slide)

Ohio – Existing Installed Capacity (MW) by Fuel Type

(as of Dec. 31, 2024)



Natural Gas, **15,112 MW**

Storage, **22 MW**

Oil, **275 MW**

Hydro, **69 MW**

Coal, **6,655 MW**

Solar, **3,723 MW**

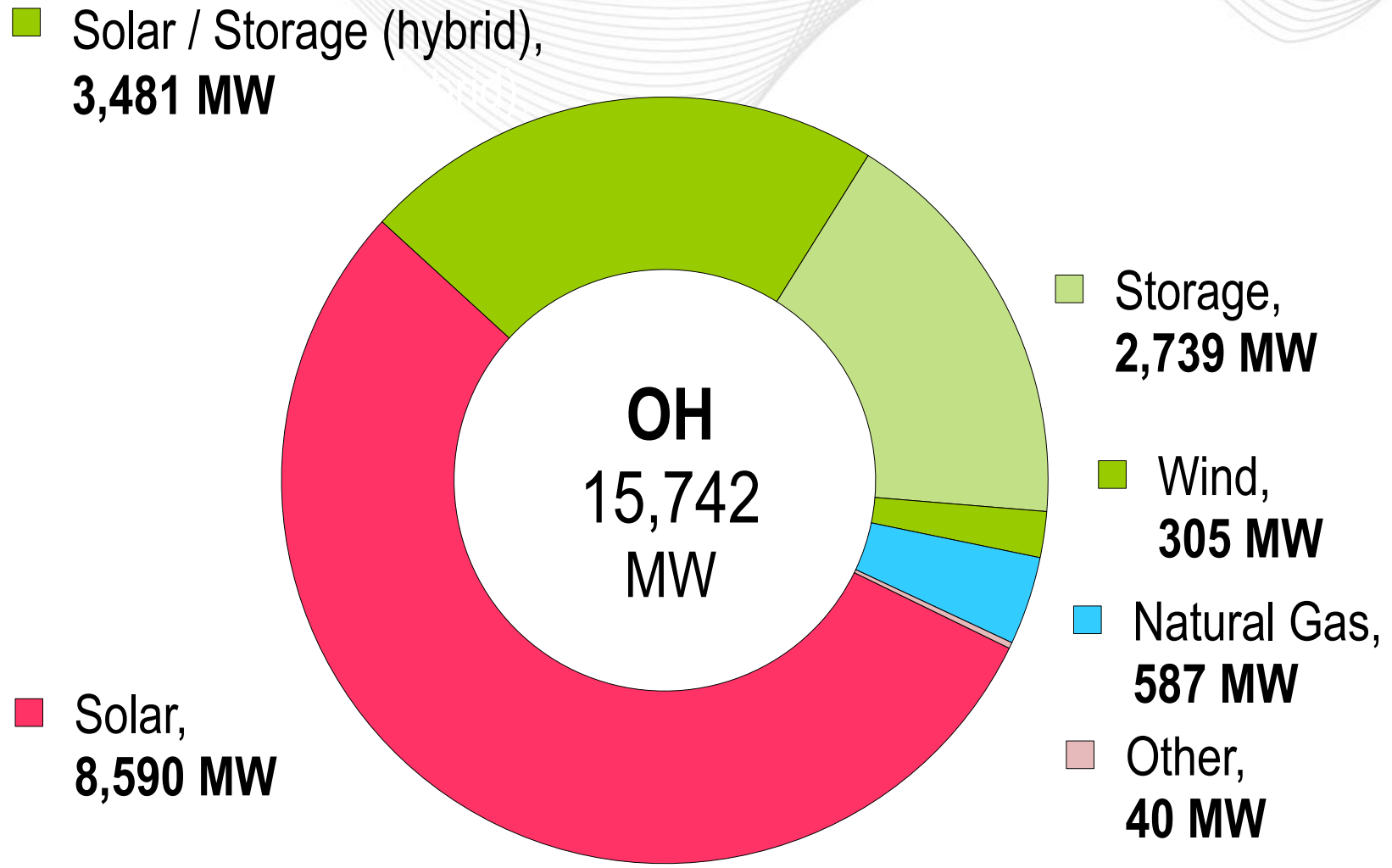
Wind, **1,143 MW**

Nuclear, **2,134 MW**

Solar, storage, and wind reflect nameplate capacity that has come into service through the PJM queue. Capacity values for all other listed resources reflect Capacity Interconnection Rights.

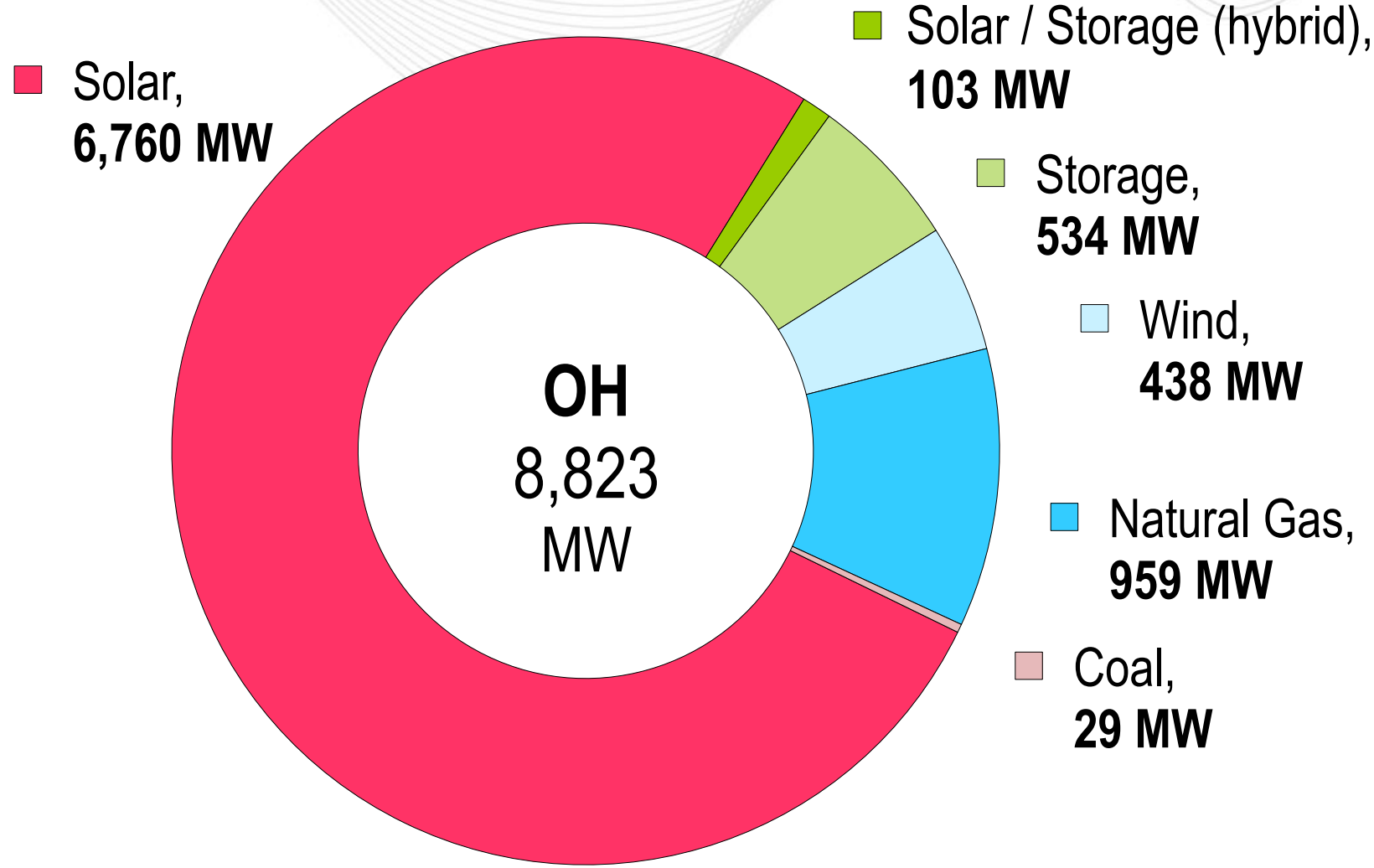
Ohio Queued Capacity (Nameplate) by Fuel Type

("Active" in the PJM Queue (under study with no interconnection agreement, as of Jan 30, 2025)



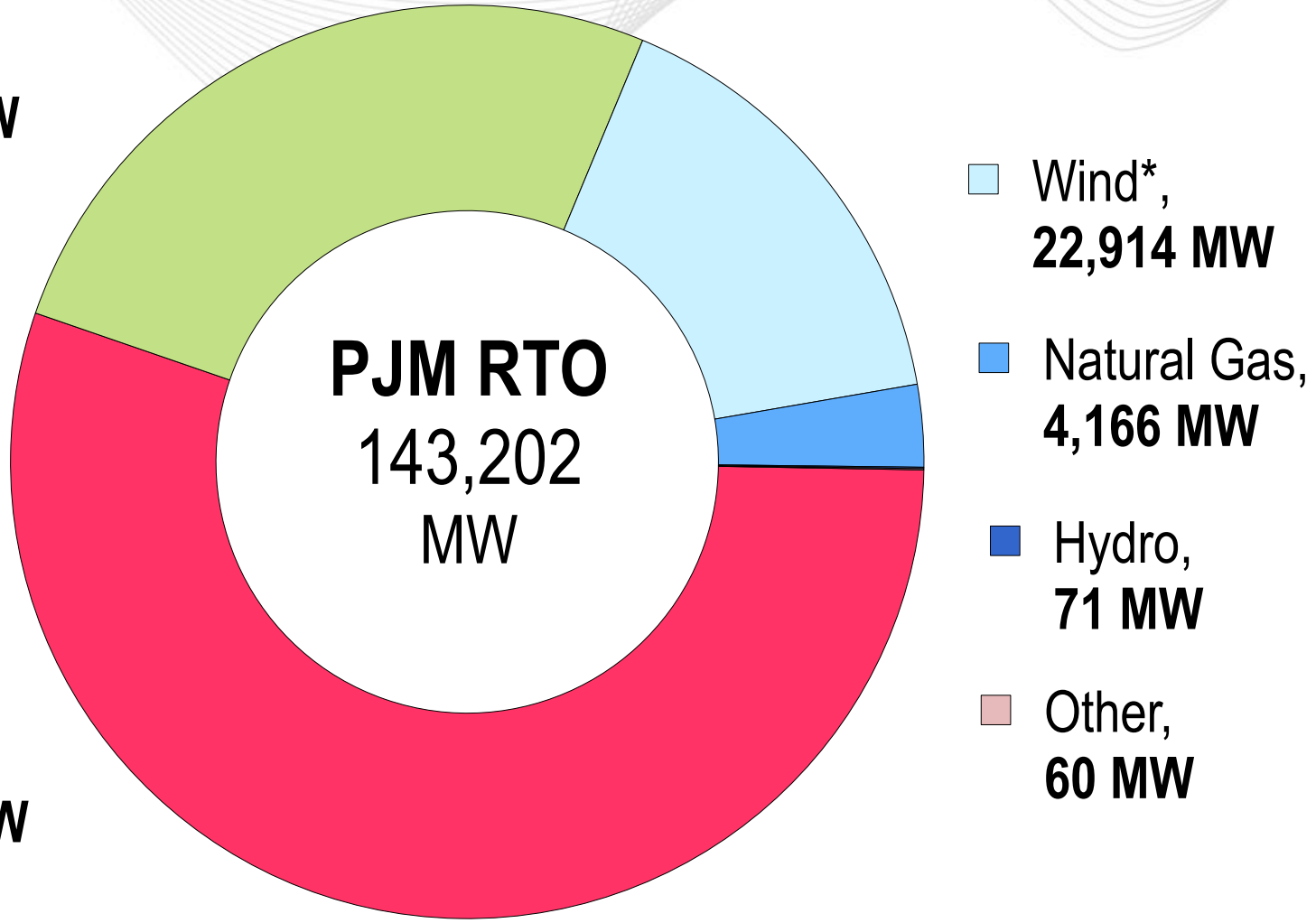
Ohio Queued Capacity (Nameplate) by Fuel Type

(Received an interconnection agreement but not yet in service, as of Jan. 30, 2025)



PJM Queued Capacity (Nameplate) by Fuel Type

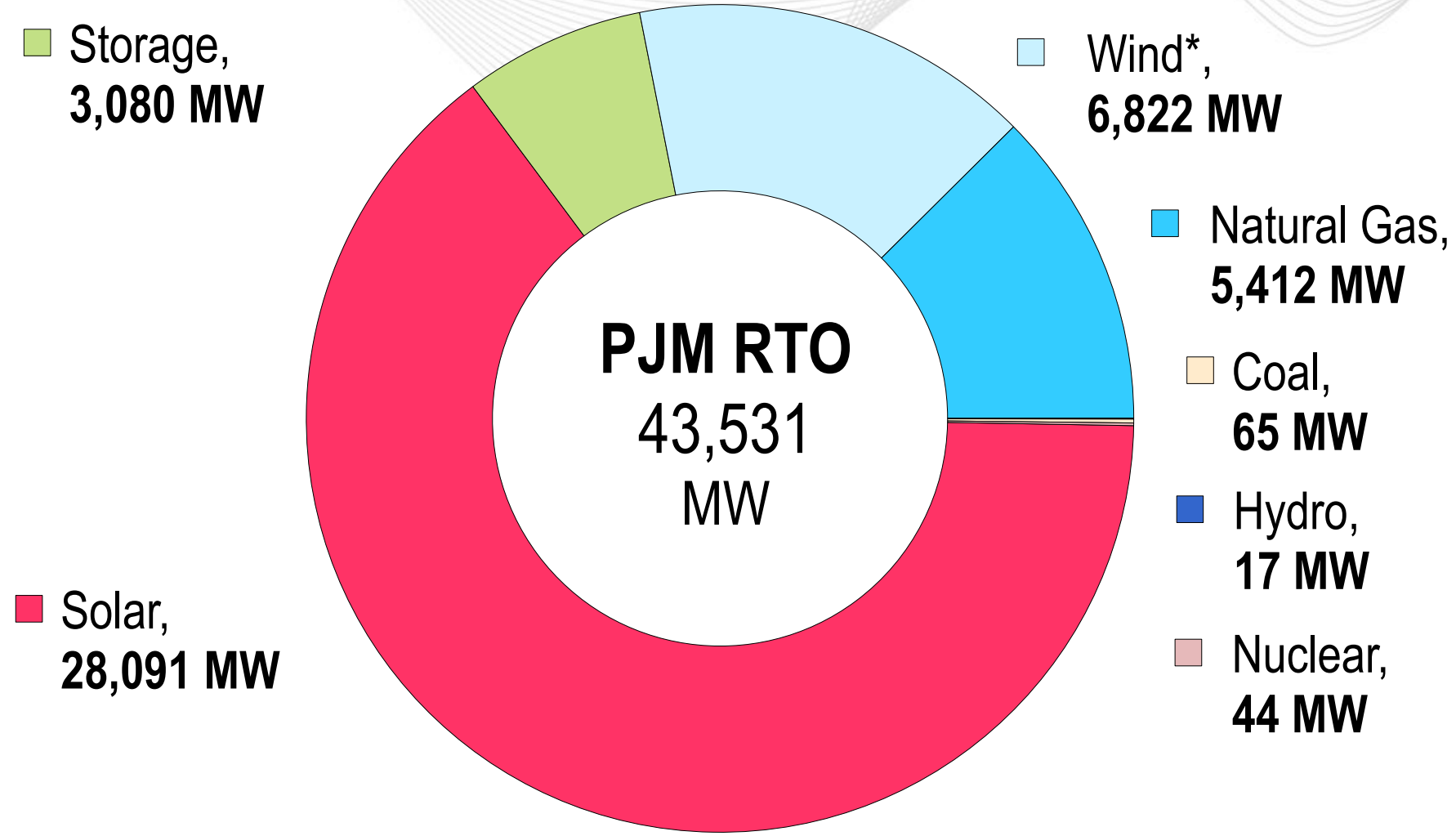
("Active" in the PJM Queue as of Jan. 31, 2025)



*Includes offshore wind

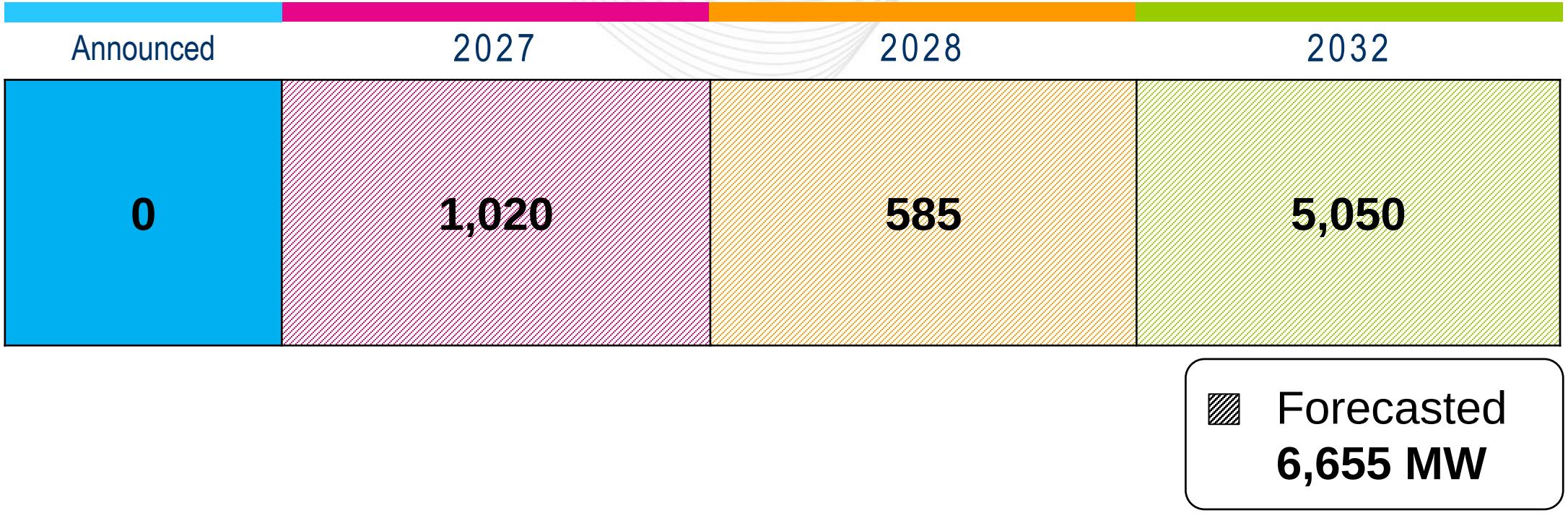
PJM Queued Capacity (Nameplate) by Fuel Type

(Received an interconnection agreement but not yet in service, as of Feb. 18, 2025)



*Includes offshore wind

OH 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.

Use of 2025/26 ELCC class average adjusts the 6,655 MW to 5,590 MW of available capacity.

OH Installed Capacity Adjusted for Preliminary ELCC Values

	Gas	Nuclear	Coal	Oil	Hydro	Solar	Storage	Wind	Total
	MW								
2025 installed capacity	15,112	2,134	6,655	275	69	3,723	22	1,143	29,133
2025 installed capacity approximate ELCC value based on the final values for the 2025/2026 DY	**11,939**	**2,027**	**5,590**	**253**	**26**	**335**	**13**	**400**	**20,583**
2032 possible installed capacity (2024 resource mix less expected retirement)	15,112	2,134	0	275	69	3,723	22	1,143	22,478
Approximate ELCC value based on the preliminary results for 2032/33 DY	**12,846**	**2,049**	**0**	**255**	**27**	**149**	**9**	**217**	**15,552**

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 Ohio 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 assumptions slide in this presentation.

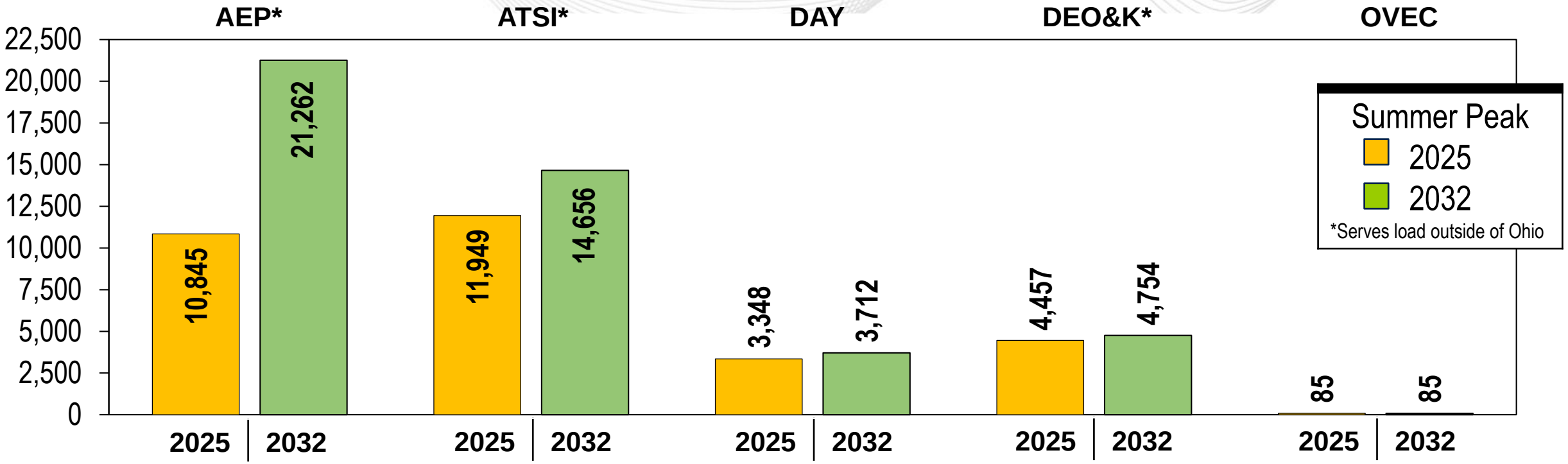
OH Potential New Entry ELCC Impact

	Solar	Storage	Solar / Storage (hybrid)	Wind	Natural Gas	Coal	Other	Total
	MW							
Queue MW (nameplate) – Active	8,590	2,739	3,481	305	587	0	40	15,742
Queue MW (nameplate) – with GIA	6,760	534	103	438	959	-	0	8,794
Approximate ELCC value based on the preliminary results for 2032/33 DY	**614**	**1,375**	**1,254**	**141**	**1,314**	**-**	**40**	**4,738**
Estimated MW (CIRs) to come in service based on historical completion rate – Active	430	137	174	15	29	-	2	787
Estimated MW (CIRs) to come in service based on historical completion rate – with GIA	3,380	267	52	219	480	-	0	4,398
Approximate ELCC value based on the preliminary results for 2032/33 DY	**152**	**170**	**79**	**45**	**433**	**-**	**2**	**881**

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 January 30, 2025 and the projected in-service megawatts based on assumed historical queue completion rate of 5% (for projects without a GIA/WMPA) and 50% (for projects with a GIA/WMPA). ELCC class values assumed for each fuel type found in the assumptions slide of this presentation.

Ohio Load Forecast

Summer Peak 2025 – 2032



The summer peak megawatt values, based on the 2025 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.

OH Summer Peak

2025	2032
30,684 MW	**44,469** MW

OH Resource Adequacy Analysis Assumptions

New entry estimates for 2032 based on active projects in the PJM New Services Interconnection process as of January 30, 2025

- 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 Ohio

- 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.

OH Resource Adequacy Analysis Assumptions Continued

Reliability Analysis Values Assumed

- 2032/2033 Forecast Pool Requirement of .9210 based on this resource adequacy analysis[1] and can be found in the appendix of this presentation.
- 2032 Summer Peak Load Forecast for Ohio 44,469 MW based on 2025 PJM load forecast (reference slide).
- Final 2025/2026 and Preliminary 2032/2033 ELCC values can be found in the appendix.

- Applied gas combined cycle 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 35% ELCC for solar / storage (hybrid)
- 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
- Applied 100% ELCC for other

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

Glossary

Term	Definition
Delivery Year	The 12 months beginning June 1 and extending through May 31 of the following year. Delivery year may also be referred to as planning year or planning period.
Installed Reserve Margin (IRM)	A percentage value used to establish the level of installed capacity resources required to satisfy reliability criteria. The IRM is expressed as a percent of the forecasted 50/50 peak load.
Accredited Unforced Capacity (AUCAP)	The megawatt value of a capacity resource in the PJM capacity market. For generating units, the unforced capacity value is equal to installed capacity of the unit multiplied by its ELCC rating.
Capacity Benefit of Ties (CBOT)	The CBOT represents the emergency electricity imports available from outside of PJM, such as from neighboring systems in New York, the South or Midwest.
Forecasted Pool Requirement (FPR)	The FPR is the PJM installed reserve margin expressed in unforced capacity terms. The FPR is applied to a peak load forecast in order to establish the level of unforced capacity that will provide an acceptable level of reliability.

ELCC Class Ratings

	2025/2026 BRA ELCC Class Ratings
Onshore Wind	35%
Offshore Wind	60%
Fixed-Tilt Solar	9%
Tracking Solar	14%
Landfill Intermittent	54%
Hydro Intermittent	37%
4-hr Storage	59%
6-hr Storage	67%
8-hr Storage	68%
10-hr Storage	78%
Demand Resource	76%
Nuclear	95%
Coal	84%
Gas Combined Cycle	79%
Gas Combustion Turbine	62%
Gas Combustion Turbine Dual Fuel	79%
Diesel Utility	92%
Steam	75%

Final 2025/2026 BRA 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	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
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 Turbine	61%	63%	66%	68%	70%	71%	74%	76%	78%
Gas Combustion Turbine Dual Fuel	79%	79%	80%	80%	81%	82%	83%	83%	83%
Diesel Utility	92%	92%	92%	92%	92%	93%	93%	93%	92%
Steam	74%	73%	74%	75%	74%	75%	76%	74%	73%

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