Review of Capacity Accreditation and Historical Look-back Periods in PJM and other ISOs/RTOs

ELCCSTF

December 5, 2024

Model Inputs

Weather Scenarios

Historical weather patterns captured back to 1993 (~30 years)

Load Scenarios

Hourly load profiles derived from PJM's Load Forecast model for each historical weather scenario

- *Weather patterns shifted +/- 6 days to account for day of the week / holiday variables*

Projected Resource Mix and Performance

Unit, class, and fleet performance for thermal and variable generation modeled as a function of temperature by resampling against historical availability **back to 2012** using a binning methodology

- *Dispatch of Demand Resources and Limited Duration Resources simulated in model*

Loss-of-Load Risk Modeling

System simulated under thousands of alternative scenarios to capture a broad range of potential system conditions and reliability outcomes.

30 Alternative Weather Years *

13 Alternative Load Scenarios *

100 Alternative Resource Performance Draws

= **39,000 Simulated Years**

Patterns of Risk

LOLE vs. LOLH vs EUE

- *Summer vs. winter? Morning vs. midday vs. evening? Long vs. short events? Deep vs. shallow?*

ELCC Ratings

Measure of resources' contribution to reliability given patterns of loss-of-load risk

PJM Overview (cont'd)

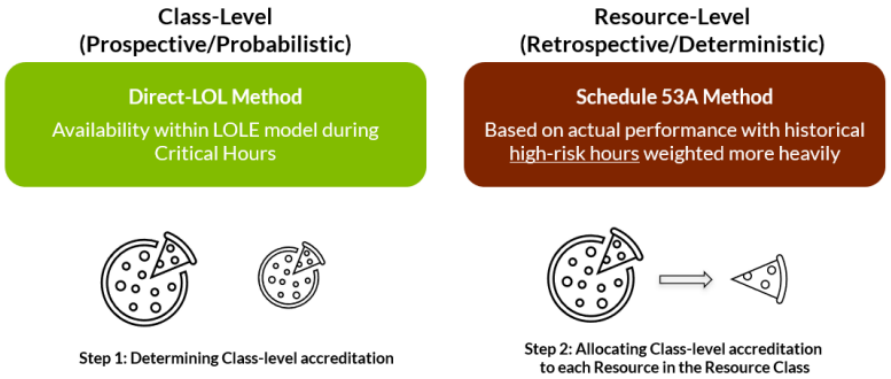
	Resource Performance Modeling Approach
Forced Outages and Ambient De-rates for Unlimited Resources	Historical weather and corresponding forced outages and ambient de-rates since **June 1, 2012** used to characterize thermal outage rates as a function of weather based on a binning methodology
Variable Resource Availability	Historical weather and corresponding variable resource performance (actual and putative) since June 1, 2012 used to characterize performance as a function of weather based on a binning methodology
Planned & Maintenance Outages for Unlimited Resources	The amount (MW-weeks) of planned and maintenance outages per year based on historical data since June 1, 2012. Heuristic used to schedule planned and maintenance outages during periods of lower loads, except for small portion intentionally scheduled during high risk periods as observed since 2012.
Intermittent Hydro	Annual draw of performance since 2012 as a function of closest matching seasonal peak loads
Limited Duration Storage & Combination Resources	Simulated dispatch in the model that depends on other system conditions (e.g. load, other resources' performance, remaining storage) during the hour
Demand Resources	Simulated dispatch in the model where DR is deployed during hours within its defined performance windows when total available Unlimited and Variable Resources is less than the load

MISO Overview

New accreditation approach accepted by FERC in Oct. 2024 (ER24-1638) to be effective with the 28/29 Planning Year

Direct Loss of Load (DLOL) Methodology -Two step approach that measures resources' seasonal availability when reliability risk is greatest based on both prospective (Monte Carlo probabilistic analysis) and retrospective (deterministic) risk assessments

Step 1 (Class-level accreditation): Measures expected marginal contribution to reliability in LOLE analysis based on expected availability and performance of resources within the class during "Critical Hours", which include loss of load hours and low margin hours up to a cap during each season. Critical hours with greater loss of load or lower margin are weighted more heavily in determining the class-level availability and accredited UCAP. Availability of thermal units based on annualized planned maintenance outage rates and seasonal forced outage rates from **prior 5 years**, with incremental cold weather outages modeled for gas & coal.



Step 2 (Resource-level accreditation): Allocates class-level accredited UCAP to resources within the class based on resources' historical performance during RA Hours (Tier 2) and Non-RA Hours (Tier 1) for each season over the **prior 3 years**. Tier 2 availability is based on each resource's real-time offered availability during hours with the most difficult operating conditions, including max gen events, and receives higher weighting (80%) than Tier 1 hours within the season (20%).

ISONE Overview

FERC approved delay of Forward Capacity Auction (FCA) 19 to Feb. 2028 to provide time for development of significant capacity market reforms in ISONE that are currently being worked on and include:

- Prompt auction and retirement reforms (target filing date of Q4 2025)
- Seasonal market and marginal accreditation (target filing date of Q4 2026)

Status Quo Accreditation

Non-intermittent Generation: Summer and winter qualified capacity calculated as the median of summer and winter claimed capability ratings from **most recent 5 years**.

FCA Qualified Capacity = lesser of the resource's summer or winter qualified capacity

Intermittent Generation: Summer qualified capacity calculated as average of the median of the resource's output during summer reliability hours (hours ending 2pm to 6pm of summer months and any summer scarcity hours from prior 5 years. Winter qualified capacity calculated similarly during winter reliability hours (hours ending 6pm to 7pm of winter months and any winter scarcity hours) from **most recent 5 years**.

FCA Qualified Capacity = resource's summer qualified capacity

Reserve Requirement Study

Thermal forced outages modeled in reserve study using EFORd-5 (5 year history), with planned maintenance outages scheduled during periods of low risk.

Intermittents modeled at 100% summer qualified capacity level.

Marginal accreditation approach accepted by FERC in May 2022 (ER22-772); effective for May 2024 Capability Year

MRI-based approach: Class-based approach where Capacity Accreditation Factors (CAF) are calculated using a probabilistic study and reflect the marginal reliability contribution of the representative unit (i.e. improvement in system LOLE relative to that of a perfect resource) for each resource class and modeling zone. The CAF and a resource-specific derating factor are used to determine each resource's accredited UCAP value for the capability period.

UCAP = ICAP * CAF * (1 – resource-specific derating factor)

Performance assumptions for representative unit in CAF determinations:

- Availability based generation (e.g. thermals) – modeled with no forced outages
- Intermittent (solar, wind, etc.) – weighted average hourly production profiles of resources in class from **most recent five-year period**

Resource-specific derating factors:

- Availability based generation – seasonal EFORd calculated from forced outage data from applicable season in **most recent 2 years**
- Intermittent – average capacity factor during seasonal peak hours of applicable season from **most recent 2 years** relative to that of the class reference unit

Final 2024-2025 Winter Capability Period CAFs

CARC	Rest of State	GHI	NYC Locality	LI Locality
2-Hour Energy Duration Limited	55.20%	55.33%	55.27%	52.91%
4-Hour Energy Duration Limited	66.80%	66.80%	67.49%	79.19%
6-Hour Energy Duration Limited	91.36%	90.96%	89.34%	92.15%
8-Hour Energy Duration Limited	99.33%	99.33%	98.70%	99.79%
Landfill Gas	61.27%	–	–	–
Solar	13.63%	13.36%	13.65%	11.98%
Offshore Wind	–	–	–	32.31%
Land-based Wind	12.28%	–	–	–
Limited Control Run of River	35.76%	39.14%	–	–
Large Hydro	100.00%	–	–	–
Large Hydro with partial Pump Storage	100.00%	–	–	–
Generator	100.00%	100.00%	100.00%	100.00%

Review of Look-back Periods

PJM	Unit, class, and fleet performance for thermal and variable generation modeled as a function of temperature by resampling against historical availability back to 2012 using a binning methodology
MISO	Thermal outage data based on prior 5 years for class-level accreditation and prior 3 years for resource-specific allocation. Wind based on historical performance back to ~2013 with synthetic data pre-2013. Solar performance based on NREL's national solar radiation database.
ISONE	In progress of significant capacity market reforms, including accreditation. Status quo relies on prior 5 years for estimating seasonal capability to derive Qualified Capacity (similar to ICAP for thermals). ICR study considers 5 years of forced outage data for thermals.
NYISO	For thermals, class-level accreditation assumes no outages and seasonal resource-specific adjustment based on forced outage data of applicable season from prior 2 years. IRM study considers prior 5 years of forced outage data. For Intermittents, class-level accreditation based on historical hourly production profiles from prior 5 years and seasonal resource-specific adjustment based on output during defined seasonal peak load hours from prior 2 years relative to that of the reference unit for the class.

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