ELCCSTF Accreditation Proposal: PJM Package C (MRC Main Motion)

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Members Committee

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Package Review

1. **Weather Rotations:** Improve the alignment of load and resource performance draws for each weather day across all weather rotations in the ELCC analysis
2. **Generator Winter Ratings:** Incorporate the incremental winter capability above summer capacity of thermal and other generation in the ELCC analysis and market rules
   A. Tracking of Winter ICAP values, assessment of winter deliverability, energy market must offer requirements and capability testing in winter, etc.
   B. Improve the ability for winter capability to be recognized and cleared in the annual capacity market by allowing a generator's annual Accredited UCAP to exceed summer CIRs (while continuing to apply seasonal CIR / deliverability caps in ELCC analysis), removing the need for seasonal aggregation / pairing in auctions.
3. **Performance Weighting:** Apply a higher weight on more recent performance of resources within each temperature bin in the ELCC model to more quickly capture changes in fleet, class, and individual resource performance over time
4. **ELCC Model Description:** Publish and maintain a comprehensive ELCC model description on ELCC webpage

Package Executive Summary:
Executive-summary.pdf

Weather Rotations

Weather Rotations: Background

- The PJM Load Forecast Model is used to construct the hourly load scenarios from historical weather years that feed into the official Load Forecast, as well as the risk analysis and ELCC model.
- When PJM develops those load scenarios, weather rotations are applied where the historical weather is shifted forward and backward 6 days to create 12 additional load scenarios (13 in total) for each historical weather year.
- This allows the model to recognize that a given weather pattern that historically occurred on a certain month and day in the past may very well occur on a nearby day in the future Delivery Year, and experiencing such weather on a weekday vs. weekend vs. holiday in the future Delivery Year can result in significantly different load profiles.

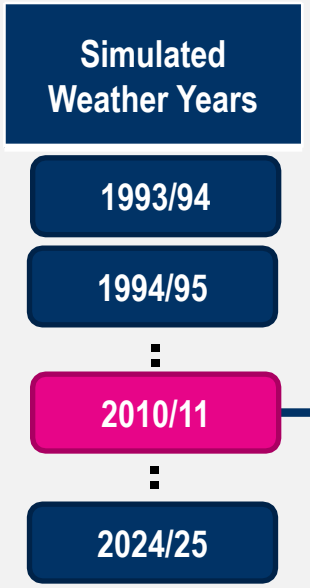
- In the risk analysis and ELCC model today, the load scenarios that reflect a weather rotation (+/- 6 days) are not fully aligned with the historical weather day and corresponding temperature bin used to sample resource performance in the model, and instead rely on a surrounding weather day where weather conditions may have been different (as illustrated in the following slide).
- The result of this misalignment for certain load scenarios is that the relationship between weather, load, and resource performance tends to be underrepresented in the current model.

Weather Rotations: Status Quo Example

Each ELCC study (and RRS) is run for a future Delivery Year (e.g. 2026/27)

Forecast Year 2026/27
June 1, 2026
June 2, 2026
…
Aug 9, 2026
…
May 31, 2026

Weather scenarios are simulated within the ELCC analysis back to 1993/94.



Resource performance profiles are drawn in the analysis from historical observations of performance back to 2012/13 based on a temperature binning methodology.

Weather Day	Temp Bin
June 1, 2010	Max32
…	…
Aug 8, 2010	Max32
Aug 9, 2010	Max34
…	…
May 31, 2010	Max28

100 Monte Carlo draws of resource performance from Temp. Bin "Max34"

Forecast Date	Load Scenario	Weather Date
Aug 9, 2026	M2010	Aug 3, 2010
Aug 9, 2026	L2010	Aug 4, 2010
Aug 9, 2026	K2010	Aug 5, 2010
Aug 9, 2026	J2010	Aug 6, 2010
Aug 9, 2026	I2010	Aug 7, 2010
Aug 9, 2026	H2010	Aug 8, 2010
Aug 9, 2026	A2010	Aug 9, 2010
Aug 9, 2026	B2010	Aug 10, 2010
Aug 9, 2026	C2010	Aug 11, 2010
Aug 9, 2026	D2010	Aug 12, 2010
Aug 9, 2026	E2010	Aug 13, 2010
Aug 9, 2026	F2010	Aug 14, 2010
Aug 9, 2026	G2010	Aug 15, 2010

Weather rotations (+/- 6 days) are used in Load Forecast model and ELCC study to develop **13 load scenarios** (A-M) for each historical weather year and forecast date.

Key Takeaway: In this example using a Forecast Date of Aug. 9, 2026 and Weather Year of 2010/11, resource performance for each of the 13 load scenarios are being drawn from Temp. Bin "Max34". As such, the "A2010" load scenario fully aligns the weather date used for projected load and resource performance, but the other load scenarios with weather rotations are not fully aligned and instead rely on weather conditions in surrounding days. **This tends to underrepresent the relationship between weather, load, and resource performance in the current model.**

Weather Rotations: Proposal

Proposal: Fully align the weather days used to draw resource performance with the weather days used for each load scenario and weather rotation in the ELCC/RRS model to better capture the relationship between weather, load, and resource performance.

- In the example on the prior slide, this proposed change would align each weather rotation date across the load scenarios with the weather date used to draw resource performance in the analysis (e.g. the "H2010" load scenario would be based on Aug. 8, 2010 weather and use the corresponding temperature bin of "Max32" for Aug. 8, 2010 when drawing resource performance)
- Additional information on this proposed change and sensitivity results can be found in slides 11-15 of the May 22nd ELCCSTF presentation: 20250522-item-02---elcc-accreditation-methodology-update-on-sensitivity-analyses---pjm-presentation.pdf

Generator Winter Ratings

Generator Winter Ratings: Proposal Summary

Proposal: Incorporate the incremental winter capability above summer capacity of thermal and other generation in the ELCC analysis and market rules.

Define and Apply Winter ICAP Values	
Winter ICAP	Winter ICAP will be defined and set for thermal generation resources based on rated capability under average ambient conditions at the site during the PJM winter coincident peaks of the last 15 years, consistent with the current conditions prescribed in M21B today for winter net capability verification testing. Winter ICAP values will be capped at MFO and may not exceed studied winter deliverability / CIRs. A process to review and confirm values with owners would be utilized prior to the 2028/29 BRA ELCC analysis.
Winter Deliverability Studies and CIRs	Deliverability of incremental Winter ICAP and awarded Winter CIRs above summer capacity and annual CIRs will be confirmed based on winter deliverability studies performed by PJM Planning. • For the 2028/29 Delivery Year, a transitional study will be run to assess the deliverability of incremental winter capability of generators and allocate available system headroom ahead of the 2028/29 BRA ELCC study • For the 2029/30 Delivery Year and forward, the higher winter generator test levels are incorporated into the RTEP and interconnection winter deliverability studies.

Generator Winter Ratings: Proposal Summary (cont'd)

Define and Apply Winter ICAP Values (cont'd)	
Application in ELCC Model and Accredited UCAP	During the winter period (November through April), capability of thermal generation will be based on Winter ICAP in the risk analysis and ELCC model, adjusted for any outages. This change will incorporate the incremental winter capability of resources that has been available in the past within the ELCC analysis and recognize the contribution of those resources in the resulting annual Accredited UCAP values. • Seasonal Accredited UCAP Factors will be used to convert a resource's differentiated seasonal ICAP to the annual Accredited UCAP resulting from the ELCC accreditation. • Summer Accredited UCAP Factor = Accredited UCAP / Summer ICAP • Winter Accredited UCAP Factor = Accredited UCAP / Winter ICAP
Energy Market Must Offer & Winter Capability Testing	During the winter period of the Delivery Year, energy market must offer requirements will be based on the Winter ICAP equivalent of committed UCAP (i.e. committed Winter ICAP). Winter Capability Tests will also be assessed against the committed winter ICAP of resources.

Generator Winter Ratings: Proposal Summary (cont'd)

Thermal Resource Example	Status Quo	Proposal
Summer ICAP and Annual CIRs	180 MW	180 MW
Incremental Winter Deliverability / CIRs	-	20 MW
Winter ICAP	-	200 MW ICAP
ELCC Model: Deliverability Cap on Output	180 MW	180 MW in summer, 200 MW in winter
ELCC Rating	75%	80%
Annual Accredited UCAP	180 MW x 0.75 = 135 MW	180 MW x 0.8 = 144 MW
Committed Capacity (if fully cleared)	Annual Committed UCAP = 135 MW Annual Committed ICAP = 180 MW	Annual Committed UCAP = 144 MW Summer Committed ICAP = 180 MW Winter Committed ICAP = 200 MW
Basis for Energy Market Must Offer Requirement	180 MW ICAP	180 MW ICAP in summer, 200 MW ICAP in winter
Basis for PAI Expected Performance	135 MW UCAP	144 MW UCAP

Generator Winter Ratings: Proposal Summary (cont'd)

Improve Ability for Winter Capability to be Recognized and Cleared in the Annual Capacity Market

Status Quo:

Today, annual capacity offers are allowed up to annual AUCAP, which utilizes an annual AUCAP factor multiplied by annual ICAP and may not exceed annual CIRs.

Intermittent resources with accredited capability above annual CIRs are eligible to reflect incremental winter capability as winter-period capacity, which may offer into RPM auctions as winter-only offers and may clear if matched with summer-only offers. In practice, this primarily applies to wind.

In recent auctions, we have observed a significant portion of winter-only offers not being matched and not clearing the auctions. For example, about 1 GW UCAP of winter offers were not matched with summer offers in the 2025/26 BRA.

Proposal: Allow a generator's annual Accredited UCAP to exceed summer CIRs (while continuing to apply seasonal CIR / deliverability caps in ELCC analysis), removing the need for seasonal aggregation and pairing to clear in RPM auctions.

Benefits relative to status quo:

- More fully recognizes the resource adequacy value provided by resources with incremental winter capability above annual CIRs
- Enables more winter capacity to clear and take on a capacity obligation during the Delivery Year, particularly given the relatively low amount of seasonal matching that has occurred in recent auctions
- Simplifies certain aspects of the market construct in place today that were added to facilitate participation by certain resources with significant differences in seasonal performance prior to moving to ELCC accreditation

Generator Winter Ratings: Proposal Summary (cont'd)

Wind Farm Example w/ Incremental Winter CIRs and ELCC Rating greater than Summer CIRs	**Status Quo**	**Proposal**
Effective Nameplate Capacity (ENC)	100 MW	100 MW
Summer ICAP and Annual CIRs	20 MW	20 MW
Incremental Winter Deliverability	50 MW	50 MW
ELCC Model: Deliverability Cap on Output	20 MW in summer, 70 MW in winter	20 MW in summer, 70 MW in winter
ELCC Rating	40%	40%
Accredited UCAP	20 MW in summer (capped at Annual CIRs), 40 MW in winter (with awarded Winter CIRs)	100 x 0.4 = 40 MW
Committed Capacity (if fully cleared)	Summer Committed UCAP = 20 MW Winter Committed UCAP = 40 MW	Annual Committed UCAP = 40 MW
Basis for PAI Expected Performance	20 MW UCAP in summer 40 MW UCAP in winter	40 MW UCAP

Treatment of Summer-Only Demand Response When Seasonal Capacity Pairing is Sunset

Within the PJM proposal, all winter capability would be reflected as annual capacity for generation, sunsetting the need for winter-only and summer-only resources to pair to clear as an annual resource. This leaves no winter-only generation resources to pair with summer-only DR.

To provide comparable treatment and recognition of summer-only capability of DR, PJM would:

1. Calculate an annual equivalent ELCC rating of any excess summer-only DR to allow summer only DR to be recognized in an annual UCAP offer (in a manner equivalent to annualized treatment of different seasonal capabilities of generation under this proposal).

   Example: If an incremental 100 ICAP MW of summer-only DR provides an expected EUE reduction of 10 MWh in the ELCC analysis, while 100 MW of "perfect" annual capacity provides 50 MWh EUE reduction, summer-only DR would receive an annual equivalent ELCC rating of 20% (10 MWh / 50 MWh).

2. In order to calculate committed ICAP for purposes of performance assessment of DR:

   a. Annual ICAP Committed = $\frac{\text{Annual UCAP}_{\text{Committed}}}{\text{Annual UCAP}_{\text{Owned}}} \times \text{Registered Annual ICAP}$

   b. Summer-Only ICAP Committed = $\frac{\text{Annual UCAP}_{\text{Committed}}}{\text{Annual UCAP}_{\text{Owned}}} \times \text{Registered Summer ICAP}$

Performance Weighting

Performance Weighting: Background

Reflect improvements or changes in performance in the accreditation and risk model as it happens, and quicker than status quo

- Under status quo, all historical days in a temperature-performance bin are weighted equally when making Monte Carlo draws
- By using a weighting approach, more recent historical days in a temperature-performance bin can receive a higher weight, making such days to be more likely to be drawn by the Monte Carlo (and therefore, older historical days in a bin, less likely to be drawn)
- This increases investment incentives given more recent observations of performance will now hold greater weight when determining the capacity value of resources and the capacity compensation they can receive going forward

Performance Weighting: Approach to Weight Years (Exponential Smoothing)

Exponential smoothing to apply a greater weight to more recent observations of performance.

Delivery Year Rank (Performance Temperature bin)	Weight	alpha = 0.1	alpha = 0.2
1	α	0.1000	0.2000
2	$\alpha(1-\alpha)$	0.0900	0.1600
3	$\alpha(1-\alpha)^2$	0.0810	0.1280
4	$\alpha(1-\alpha)^3$	0.0729	0.1024
5	$\alpha(1-\alpha)^4$	0.0656	0.0819
6	$\alpha(1-\alpha)^5$	0.0590	0.0655
7	$\alpha(1-\alpha)^6$	0.0531	0.0524
8	$\alpha(1-\alpha)^7$	0.0478	0.0419
9	$\alpha(1-\alpha)^8$	0.0430	0.0336
10	$\alpha(1-\alpha)^9$	0.0387	0.0268
11	$\alpha(1-\alpha)^{10}$	0.0349	0.0215

Interpretation:
If alpha=0.2, the Monte Carlo method will sample 0.2/0.0268, which is about 7.5 times more often from performance in a day in Delivery Year Rank 1 than from performance in a day in Delivery Year Rank 10

Performance Weighting: Proposal

Proposal: Apply a higher weight to more recent observations of performance within each temperature bin in the ELCC/RRS analysis using exponential smoothing and an alpha value equal to 0.2.

- Reflects improvements or changes in fleet, class, and resource performance more quickly in the ELCC accreditation and RRS results
- Continues to rely on demonstrated performance of resources during extreme weather conditions and does not require erasing / re-writing of history, or making assumptions of improved performance in future
- Increases incentives for resources to invest or improve performance of their resources relative to status quo given the most recent observations of performance during the more extreme weather conditions that drive resource adequacy risk will have the greatest weight on accreditation value and compensation going forward
- Given current data and sensitivity runs, we believe exponential smoothing with an alpha equal to 0.2 provides a balanced approach of (a) gradually reducing the impact of older performance patterns in the risk analysis and accreditation, and (b) more quickly reflecting the impact of recent performance patterns in ELCC/RRS without making such recent performance patterns the overwhelming driver of the results

ELCC Sensitivity Runs and Estimated Proposal Impact

ELCC Sensitivity Runs and Estimated Proposal Impact

A significant number of ELCC sensitivities were run and discussed at the ELCCSTF meetings to help inform the group's understanding of different input assumptions into the analyses and proposed changes. A summary of many of those sensitivities can be found in the following presentations:

- May-22-2025-pjm-presentation-on-sensitivity-analyses.pdf
- May-30-2025-pjm-presentation-on-additional-sensitivity-analyses.pdf
- May-30-2025-pjm-presentation-on-sensitivity-analyses-of-weighting-approach.pdf

The following slide provides an overview of the estimated impact of the proposed reforms in PJM's package based on the sensitivity analyses. Please note that any ELCC sensitivity analysis relies on a certain set of input assumptions, as described in the presentations, which may differ from those used in future ELCC studies and therefore result in different outcomes.

ELCC Sensitivity Runs and Estimated Proposal Impact (cont'd)

Estimated Impact of Proposed Reforms based on Sensitivity Analyses:

Proposed Reform	Relative Impact of the Individual Reform	Combined Impact of Reforms
1. Weather Rotation Alignment	**IRM:** +3.3% **Winter LOLH Risk Share:** +18% **UCAP Margin:** -4,000 MW	
2. Generator Winter Ratings	**IRM:** -1.1% **Winter LOLH Risk Share:** -33% **UCAP Margin:** +1,800 MW [1]	**IRM:** +1% (Combined Impact of 1 + 2) **Winter LOLH Risk Share:** -3% **UCAP Margin:** -1,200 MW [1]
3. Performance Weighting	**IRM:** Near zero impact in short term **Winter LOLH Risk Share:** +4%	**IRM:** +1% (Combined Impact of 1 + 2 + 3) **Winter LOLH Risk Share:** +1% **UCAP Margin:** -1,200 MW [1]

Footnote 1: The estimated impacts to UCAP margins in rows 2 and 3 do not include the expected impact of the proposed change to enable generation resources with incremental winter capability to receive an annual Accredited UCAP above summer CIRs when the ELCC rating supports it. This element of the proposal is expected to provide a significant increase in available annual UCAP to be offered in the RPM auctions as it unlocks much of the UCAP value of wind generation that has been required to offer in as winter-only in the past and gone unmatched in recent BRAs (see Table 8 of the BRA reports where 800 to 1,000 MW have not matched).

- Sensitivity analyses and values in this table were made relative to a base case using the 2026/2027 BRA analysis with the inclusion of the recently accepted DR reforms, where the resulting IRM was 18.8% and winter LOLH risk share was 78.2% in the base case.
- UCAP Margins reflect the net impact to estimated supply and demand UCAP, where a negative value represents a tightening of supply and demand.

ELCC Sensitivity Runs and Estimated Proposal Impact (cont'd)

- **Weather Rotation Alignment:** The impact of this change alone results in the model showing higher overall system risk, particularly in the winter, and a net tightening of supply and demand. This is primarily driven by the increased alignment of resource performance profiles observed during certain extreme weather days with the higher forecasted demand on those same weather days, which is muted to a certain extent today in the analysis for a number of the load scenarios.

- **Generator Winter Ratings:** The impact of this change alone results in the model showing less overall system risk and a significant decrease in the winter risk share, as well as a relative increase in the UCAP margin (i.e. a decrease in supply / demand tightness). This is driven by the incorporation of the incremental winter capability of thermal generation in the analysis.

  The combined impact of this proposed reform and the weather rotation alignment is shown in the right column of the table on the prior slide where this reform offsets much of the increase in overall system risk and tightening of supply and demand observed in the weather rotation alignment scenario alone, and the UCAP tightening would expected to be further offset by the proposed reform that enables generation with incremental winter capability to have an annual Accredited UCAP above summer CIRs. The net impact on seasonal risk share shows results very close to the base case with a slight decrease in winter LOLH risk share.

- **Performance Weighting:** The sensitivity runs on performance weighting show little impact in the near-term on overall system risk, with a slight increase in winter risk share. This would likely change over time as more observations of performance during severe weather conditions are observed and rolled into the model. The near-term impact of performance weighting is more prevalent in the individual accreditation of resources where more recent performance observations would now hold greater weight on their accredited values.

Appendix

Appendix: Additional Info on Performance Weighting Sensitivity Runs

Review: Performance Weighting and Sensitivities

- A review of the performance weighting methodology using exponential smoothing and prior sensitivity analyses against the old 26/27 BRA case run back in June 2024 can be found below:
  - 20250219-item-04---continued-discussion-on-accreditation-reforms---weighting-approach---pjm-presentation.pdf
- At the April 22nd ELCCSTF meeting, an initial set of sensitivity results against the following case were provided (see https://www.pjm.com/-/media/DotCom/committees-groups/task-forces/elccstf/2025/20250422/20250422-item-03---accreditation-reforms---sensitivity-analyses-of-weighting-approach---pjm-presentation.pdf):
  - The 26/27 BRA case using preliminary 24/25 weather, load and resource performance data
  - The above case using performance weighting alpha values of: 0.1, 0.2 and 0.3

Review: Performance Weighting and Sensitivities (cont'd)

- At the May 30 ELCCSTF, the latest set of sensitivity results on Performance Weighting were provided that incorporated the following:
  - The 26/27 BRA case +
  - DR changes DR changes recently accepted by FERC in Docket No. ER25-1525 +
  - Improved Weather Rotation Alignment or "Align" sensitivity (as described in slides 11-15 at https://www.pjm.com/-/media/DotCom/committees-groups/task-forces/elccstf/2025/20250522/20250522-item-02---elcc-accreditation-methodology-update-on-sensitivity-analyses---pjm-presentation.pdf) +
  - Generator Winter Ratings or "WICAP" sensitivity (as described in slides 15-18 at https://www.pjm.com/-/media/DotCom/committees-groups/task-forces/elccstf/2025/20250522/20250522-item-02---elcc-accreditation-methodology-update-on-sensitivity-analyses---pjm-presentation.pdf) +
  - Preliminary 2024/25 weather, load and resource performance data (repeated once and twice)
  - Performance weighting alpha values of: 0.2 and 0.3

Performance Weighting Sensitivity (May 30 ELCCSTF)

Results	24/25 Data* x1 No Alpha	24/25 Data* x1 Alpha=0.2	24/25 Data* x1 Alpha=0.3	24/25 Data* x2 No Alpha	24/25 Data* x2 Alpha=0.2	24/25 Data* x2 Alpha=0.3
Solved Load	160,476	160,759	160,242	160,560	160,682	161,087
IRM	19.2%	19.0%	19.4%	19.2%	19.1%	18.8%
Overall Winter LOLH Share	69%	68%	77%	64%	68%	59%
LOLH Risk Contribution of Jan 7, 2014 Performance Pattern	32%	16 %	12%	27%	14%	10%
LOLH Risk Contribution of Dec 24, 2022 Performance Pattern	34%	49%	63%	35%	51%	46%
Conditional Probability of Drawing PV1 or WSE Performance	9.1%	9.9%	10.6%	8.3%	8.1%	7.9%
Conditional Probability of Drawing 2024/25 winter perf (x1 or x2)	9.1%	17.6%	24.4%	16.7%	32.5%	43.9%
Weight in Perf. Adj. Calculation of 2024/25 winter performance (x1 or x2)	6.1%	11.9%	18.7%	10.5%	21.8%	25.5%

** The 24/25 data to calculate loads, temperature bins and resource performance is preliminary. For some hours, estimated values have been used*

Appendix: Additional Background on Generator Winter Ratings

Unlimited Resources: Proposed Definition of Winter ICAP

Winter ICAP set to winter rated capability for capacity resources based on a specified set of winter conditions defined in M21B today

- Winter rated capability determined by adjusting the generator capability for generator site conditions coincident with the dates and times of the last 15 years PJM winter peaks.
- These are the conditions currently prescribed under the Winter Net Capability Verification Test.
- A review and verification process would require Generation Owner to submit Winter ICAP. PJM would review against Winter Net Capability Verification Test data to confirm the value.
- Winter ICAP may not exceed MFO or studied winter deliverability and granted Winter CIRs.

This approach is consistent with the definition and application of Summer ICAP.

Analysis comparing Summer ICAP, Winter ICAP, and MFO to observed capability that supports PJM's rationale for utilizing Winter ICAP (discussed at previous meetings) is in Appendix slides 41 - 43.

Update to Approach for Winter CIRs

Status Quo

- Winter CIRs are only available to Intermittent Resources and Environmentally Limited Resources which seek to obtain additional CIRs related to the winter period for purposes of submitting sell offers as winter-period capacity.
- Requested Winter CIRs are studied and granted based on values submitted through a solicitation process ahead of each delivery year. This is separate and distinct from the winter generator deliverability test.
- More details in Appendix slide 46

Proposal

- For purposes of ensuring deliverability of Winter ICAP to be represented in the calculation of Accredited UCAP, Winter CIRs for each delivery year will be granted to all Generation Capacity Resources based on levels assessed in winter generator deliverability tests.
- Status quo solicitation and separate study process will be sunset.

Winter Generator Deliverability Test Overview

To become a capacity resource, a generator must pass generator deliverability tests under summer, winter, and light load conditions. Equivalent rigor is applied to the defined test level for each set of conditions.

As part of this proposal, deliverability of Winter ICAP will be confirmed via PJM planning winter generator deliverability tests.

- Status quo generator deliverability test is applicable for 2029/30 and beyond, where winter deliverability above CIRs is already the studied test level for all resources.
- A transitional study is needed to test higher winter output for all resources (i.e. not just wind) for 2028/29 the target delivery year for this proposal.

2029/2030+ Winter Generator Deliverability Test

The RTEP and interconnection process will both study up to higher winter generator deliverability test levels for all resources beginning with 2024 RTEP cycle, with full alignment for the 2029/30 delivery year.

- RTEP studies up to the new test levels beginning in 2029 winter RTEP model
- Interconnection studies up to the new test levels beginning with Transition Cycle 2 (2028 winter model)

No changes to the status quo winter generator deliverability test levels for 2029 and beyond (see next slide) are being included in this proposal, given the complexity and additional time needed to vet such changes with stakeholders. An additional stakeholder process will be needed to more holistically align winter planning studies with the use of Winter ICAP. This may dovetail with the deferred CETL Issue Charge.

As part of this proposal, there will be no separate solicitation and study for Winter CIRs as there is today, given the higher winter output studied in the RTEP.

Status Quo Winter Generator Deliverability Test Levels

Capacity Resource Type	Contingency Type	Winter Gen Deliv Test Levels	
		Old	New in 2029
All Thermal	single	CIR	MFO
	common mode	CIR	MFO
Onshore Wind**	single	80% MFO	p90%*
	common mode	MFO	p90%*
Solar (Fixed & Tracking)**	single	10% MFO	5% MFO
	common mode	MFO	5% MFO
Offshore Wind**	single	80% MFO	p80%*
	common mode	MFO	p80%*
Batteries	single	CIR	MFO
	common mode	MFO	MFO
Pumped Storage / Hydro	single	CIR	MFO
	common mode	CIR	MFO
Hybrid Resource	All	Based on test levels for each resource type	MFO

*p90% for onshore wind in 2025 RTEP is 71% MFO for MAAC, 84% MFO for PJM West and 77% MFO for Dominion

*p80% for offshore wind in 2025 RTEP is 95% MFO for MAAC and 97% for Dominion

** Already assessed at new winter generator deliverability test levels

Transitional Study of Winter Capability for 2028/2029

A study process for the 2028/29 deliver year to “backfill” 2028 RTEP winter generator deliverability study with higher winter output; impacts existing capacity resources and planned capacity resources providing binding offer notification (NOIs):

1. Collect and confirm Winter ICAP ratings to be utilized in the study
    a. For this new transitional study for the 2028/2029 delivery year, PJM proposes utilizing test levels of Winter ICAP instead of MFO for a more accurate representation of resource capability and more efficient allocation of system headroom.
2. Run the winter generator deliverability test
3. Determine winter deliverability and grant Winter CIRs for all generation using the following conditions:
    a. If a resource's Winter ICAP only contributes to flowgates with a post-study loading less than 100% or has less than a 5% DFAX contribution to an overloaded facility, the resource's Winter ICAP is fully deliverable and will be allocated Winter CIRs.
    b. Winter CIRs will be allocated, considering each resource's DFAX, the total additional winter MW above annual CIRs, and the remaining facility headroom.
        i. When multiple resources are contributing to an overloaded facility, this approach maximizes the amount of additional MW with minimum impact on the overloaded facility.
        ii. This allocation approach is consistent with the approach for the summer transitional system capability study.

Transitional Study of Winter Capability for 2028/2029 Test Levels

Capacity Resource Type	Contingency Type	Winter Gen Deliv Test Levels	
		Already Studied	New for Transitional Study
All Thermal	single	CIR	Winter ICAP
	common mode	CIR	Winter ICAP
Onshore Wind	single	p90%*	p90%*
	common mode	p90%*	p90%*
Solar (Fixed & Tracking)	single	5% MFO	5% MFO
	common mode	5% MFO	5% MFO
Offshore Wind	single	p80%*	p80%*
	common mode	p80%*	p80%*
Batteries	single	CIR	Winter ICAP
	common mode	MFO	Winter ICAP
Pumped Storage / Hydro	single	CIR	Winter ICAP
	common mode	CIR	Winter ICAP
Hybrid Resource	All	Based on test levels for each resource type	Winter ICAP

*p90% for onshore wind in 2025 RTEP is 71% MFO for MAAC, 84% MFO for PJM West and 77% MFO for Dominion

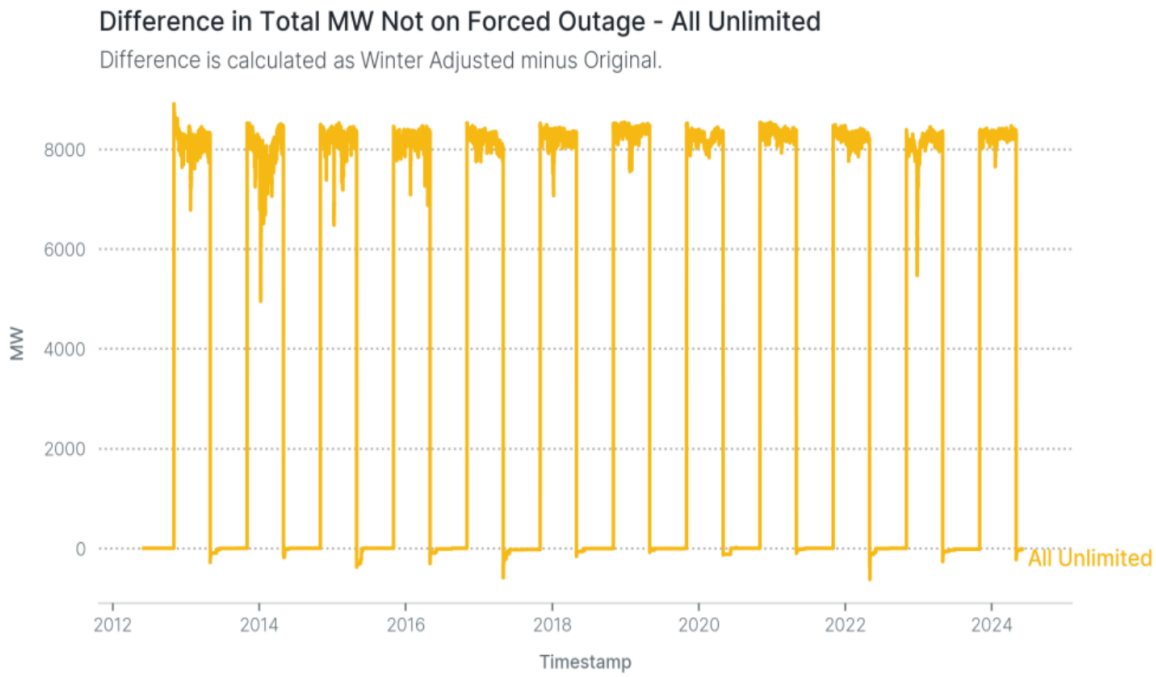
*p80% for offshore wind in 2025 RTEP is 95% MFO for MAAC and 97% for Dominion

Unlimited Resources: Application in Accreditation Model

During the winter period (November through April) resource capability will be based on Winter ICAP, adjusted for outages.

- In hours with no outages, resource will be available up to Winter ICAP adjusted for ambient derates.
- Winter ICAP will be used to calculate outage rates used in the ELCC model during the winter. Outages will be applied in the same manner as today.
- Planned and maintenance outages during the winter period will account for Winter ICAP values

Example of availability from sensitivity analysis, slides 16-18:



Unlimited Resources: Downstream Requirements

Reporting Requirements

- eDART reporting reflective of Winter ICAP
- GADS reporting should reflect higher capability during winter months

Winter Testing and Verification Requirements

- Status quo approach to Winter Net Capability Verification Testing, with the shortfall calculation utilizing the committed Winter ICAP

Energy Must Offer Requirement

- Status quo calculation, ICAP equivalent of cleared UCAP, utilizing seasonal Accredited UCAP Factors to convert from committed UCAP to seasonal ICAP equivalent.

Variable, Combination and Limited Duration Resources

To apply a consistent application of winter capability across resources types, some additional modeling and process changes would be needed for variable, combination, and limited duration resources:

- Winter ICAP would be defined as equal to the Effective Nameplate Capacity of the resource, not to exceed studied winter deliverability and granted Winter CIRs.
- The separate Winter CIR request and study process would be consolidated with process utilized to assess winter deliverability for all resource types, as described in slide 12.

Annual Capacity Market Offers in UCAP Terms with Seasonal AUCAP Factors and Seasonal ICAPs

Status Quo

Capacity market offers are in ICAP terms and resource Accredited UCAP Factors (calculated as Accredited UCAP / Installed Capacity) are utilized in auction clearing and calculation of daily positions.

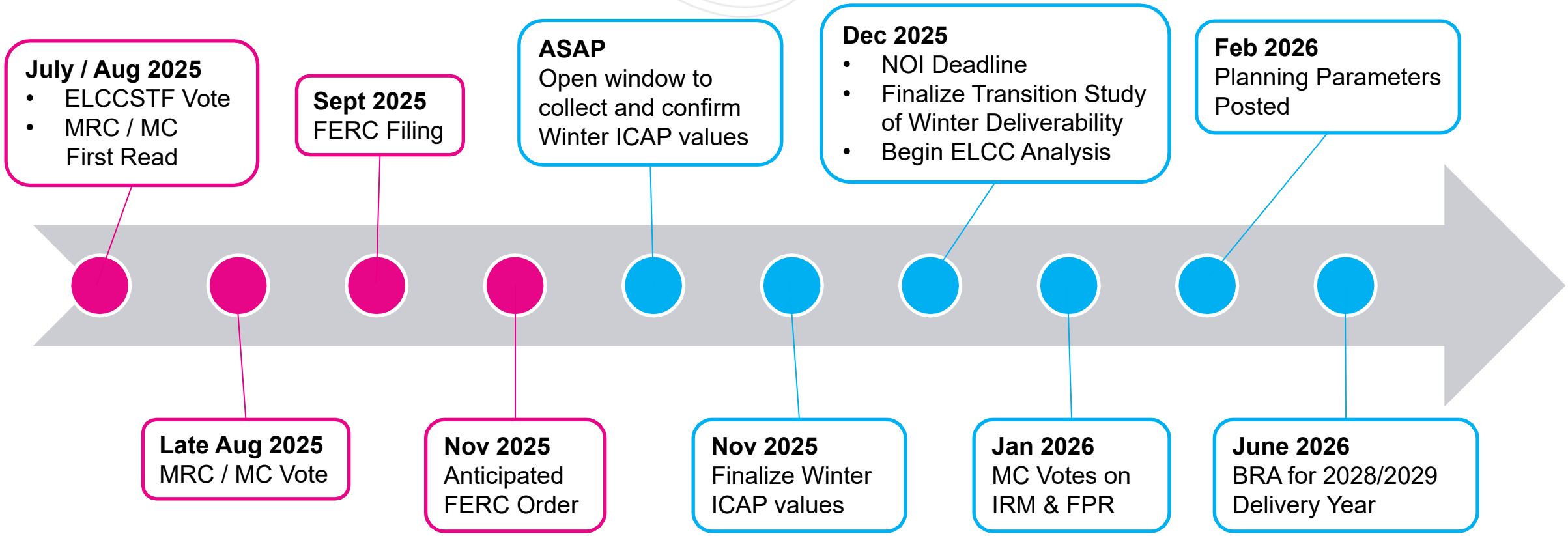
Proposal

To simplify RPM auction offers, given proposed use of seasonal ICAPs, offers would be submitted in UCAP terms (rather than having separate seasonal ICAP offers that need to be converted into annual UCAP). Seasonal Accredited UCAP Factors would be calculated to apply downstream in RPM.

- Summer Accredited UCAP Factor = Accredited UCAP / Summer ICAP
- Winter Accredited UCAP Factor = Accredited UCAP / Winter ICAP
- Seasonal ICAPs and seasonal AUCAP Factors utilized to calculate annual available owned UCAP to support offers

Timing Considerations for 2028/29 Delivery Year

- **Remaining ELCCSTF Work Plan**
- **Activities to Support Proposal Implementation for 2028/29 Delivery Year**



Q&A on Generator Winter Rating Reforms

Q: Does allowing annual Accredited UCAP to exceed annual CIRs present a reliability concern from a Planning studied deliverability perspective?

A: No, we do not believe this creates a reliability concern given the level of studied deliverability and CIRs for generation will still be respected in the underlying risk analysis for the respective time periods.

- Annual CIRs are based on a summer generator deliverability test, and those CIRs will continue to set the cap on availability or performance during summer months in the ELCC analysis as it does today.
- For resources that are studied and deliverable in the winter at a level above annual CIRs, that higher level of studied deliverability will be respected in the ELCC analysis during the winter months.
- As such, the risk analysis used in the Reserve Requirement Study and ELCC accreditation is not relying on hourly output from generation above studied deliverability for the respective season or time period.

Q&A on Generator Winter Rating Reforms (cont'd)

Q: If the ELCC analysis limits performance to studied deliverability, how can a resource receive an annual ELCC rating and Accredited UCAP greater than its annual CIRs?

A: Generally speaking, annual ELCC ratings and AUCAP values reflect resources' **average expected performance during hours of resource adequacy risk** on the system across the year.

- The underlying analysis used in determining those values is hourly and considers the differences in resources' availability or expected performance throughout the year under different weather conditions and studied deliverability.
- Today, most risk falls in the winter season, and for resources that are studied to be deliverable and perform considerably above annual CIRs during winter risk hours, the higher winter performance can result in an annual average expected performance that exceeds annual CIRs.

Wind Example (100 MW Nameplate)	Summer	Winter
Seasonal Studied Deliverability (cap on performance)	20 MW (Annual CIRs)	70 MW
Seasonal Average Performance during Risk Hours	10 MW	47.5 MW
Seasonal Percentage Share of Risk Hours	20%	80%
Annual Average Performance during Risk Hours	**40 MW (AUCAP)**	

Q&A on Generator Winter Rating Reforms (cont'd)

Q: If annual AUCAP is allowed to exceed annual CIRs, is there a reliability concern that the committed UCAP obligation for a resource can exceed its seasonal ICAP or studied deliverability / CIRs in one of the seasons, or even what the resource can physically provide at certain times of the year?

A: We do not believe this creates a reliability concern for a few reasons:

- The underlying risk analysis used to set the IRM/FPR and ELCC accreditation is not relying on committed UCAP from each resource in every hour, but rather considers the expected differences in performance and studied deliverability throughout the year.
- Committed UCAP represents a financial obligation (not physical) with which resources are assessed against during PAIs and reflects the average expected performance from a resource across hours of risk. It is expected and planned for that resources will underperform relative to their committed UCAP in some hours and over-perform in others. This is the case for all generation, but solar provides one clear example of this where in some risk hours (e.g. summer afternoon), solar is generally expected to exceed their AUCAP while in other hours (e.g. at night), solar would not be able to physically meet it's committed UCAP level.
- Committed resources still have the physical requirement to make their full committed ICAP or capability available to PJM for dispatch (adjusted for any outages). As such, even though some resources are expected to have a UCAP commitment that exceeds their physical capability in certain times of the year, other committed resources are expected and must make available to PJM their capability beyond committed UCAP at those times.

Winter Capability Analysis

PJM performed analysis to determine how much winter capability can be reasonably relied upon for resource adequacy.

For each Unlimited Resource in the 2026/27 portfolio:

1. Estimated **"Winter ICAP"** as the maximum Winter Net Capability Test since 22/23 DY, capped at Maximum Facility Output (MFO).

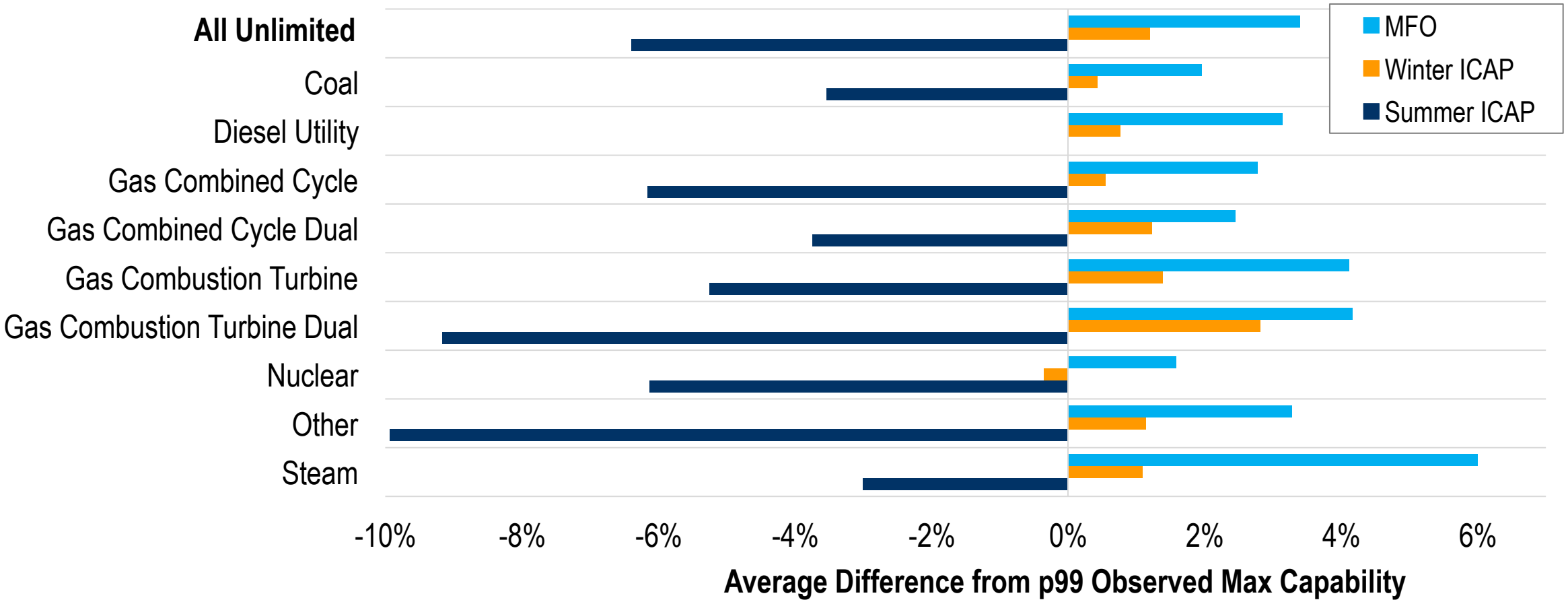
2. Calculated hourly **"Observed Max Capability"** as the maximum of actual output or emergency max, in hours where the unit had no outages. This was calculated using all available data for each unit back to 2012, November through April.

3. Compared these metrics to Summer ICAP and MFO.

The delta between Summer ICAP and "Winter ICAP" for Unlimited Resources in this portfolio is 8,561 MW. See sensitivity analysis, slides 16-18.

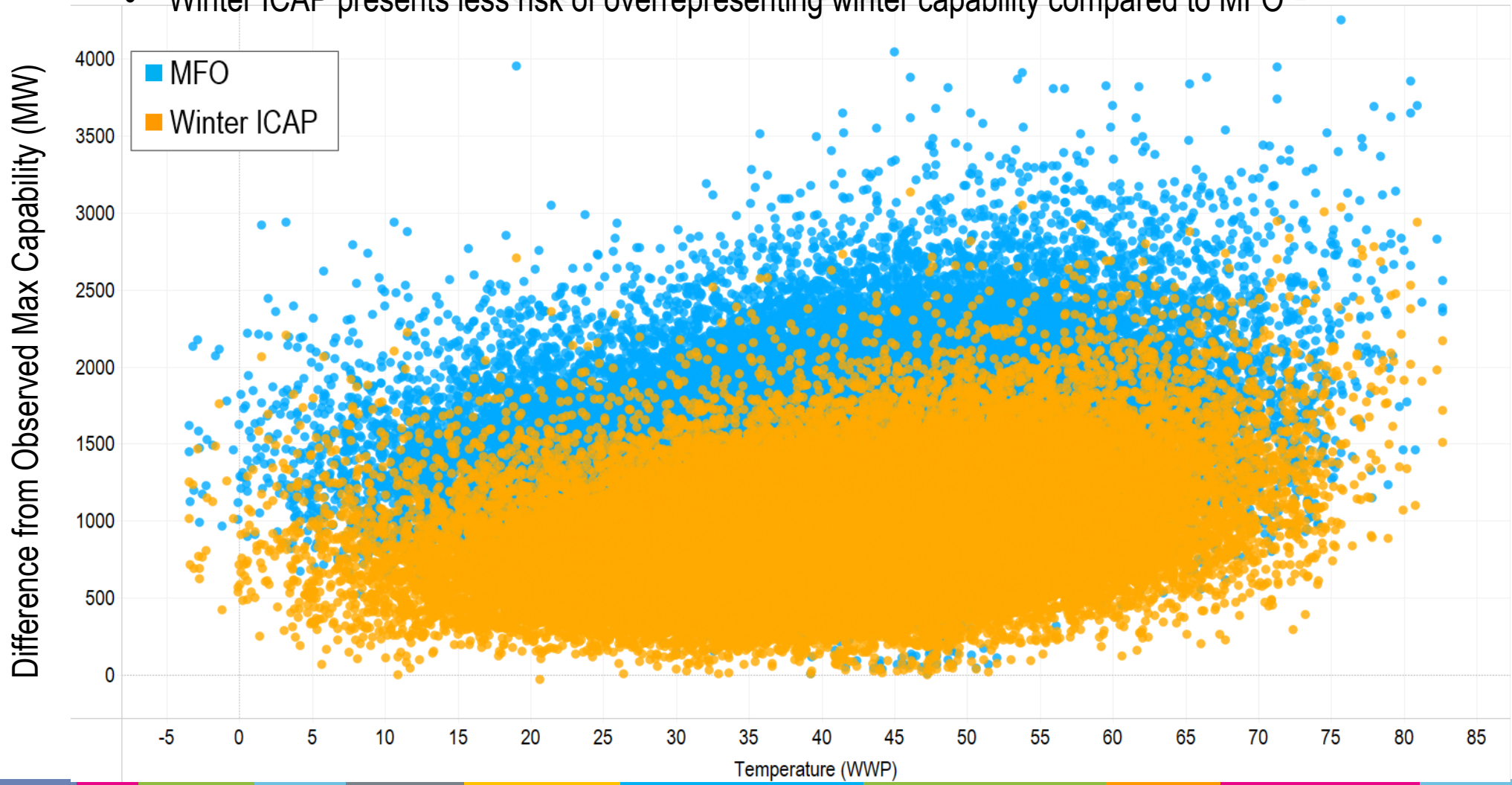
Winter ICAP is Most Aligned with Observed Winter Capability

Unlimited resources' 99th percentile observed max capability in winter is on average **6.4% (11 GW) higher than Summer ICAP**, **3.4% (6 GW) lower than MFO**, and **1.2% (2 GW) lower than Winter ICAP**.



Comparison of Winter ICAP and MFO to Observed Max Capability

- Some decreased variability between observed max capability and ratings as temperature decreases
- Winter ICAP presents less risk of overrepresenting winter capability compared to MFO



Preliminary Assessment of Deliverability of Additional Thermal Winter Capability

Sensitivity study of the 2026 Winter RTEP Case with status quo generator deliverability test levels:

- The total MFO MW for thermal units in 2026 is 165,069 MW.
- The total annual CIR MW for thermal units was 155,230 MW, resulting 9,839 MW being assessed for deliverability.
- The total additional MW determined to be deliverable in winter was 6,307 MW. This is **64% of MFO**.

Caveats

- This assessed deliverability cannot be guaranteed for the official 2028/2029 study (target delivery year for implementation of this proposal) given the changes to various input substantial increase in data center load, updated generation profiles, recent deactivations, and available transmission projects.
- For the new transitional study for the 2028/2029 delivery year, PJM proposes utilizing test levels of Winter ICAP instead of MFO for a more accurate representation of resource capability and more efficient allocation of system headroom.

Status Quo Winter CIR Solicitation & Study Process

Who?

Generation Owners of Intermittent Resources and Environmentally Limited Resources

Existing resources & planned resources eligible for BRA

When are Winter CIRs requested?

Modified auction schedule
10-day request window opening 145 days prior to the BRA

3-Year auction schedule
Request window is Aug. 31 – Oct. 31 of the year prior to the May BRA

What?

Eligible to request additional CIRs for the winter period of each delivery year.

Requests for CIRs greater than 40% of MFO must provide supporting documentation to verify the facility is capable of reliably achieving the requested output

Study details

- Single contingency generator deliverability study is performed
- Winter RTEP model for the delivery year under study (latest winter peak load forecast, winter transmission facility ratings)
- Additional/requested Winter CIRs are found either fully deliverable, partially deliverable, or not deliverable
- Results are published prior to the DR Sell Offer Plan due date

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MRC: Review of ELCCSTF Package C

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