



Simulation Analysis of PJM CIFP-RA Proposals

CIFP - Resource Adequacy
August 14, 2023

- This document provides information regarding results of simulation analysis PJM has conducted comparing potential clearing results under the Status Quo RPM BRA design with those under the PJM Annual and PJM Seasonal proposals
- The analysis analytically demonstrates (for one potential set of market conditions, as recently observed) the reliability benefits expected from the PJM proposals relative to status quo
- Further, this analysis is responsive to stakeholder requests for analysis to better understand potential clearing, pricing, and reliability outcomes under a seasonal capacity market



Overview of Market Designs Compared in this Analysis

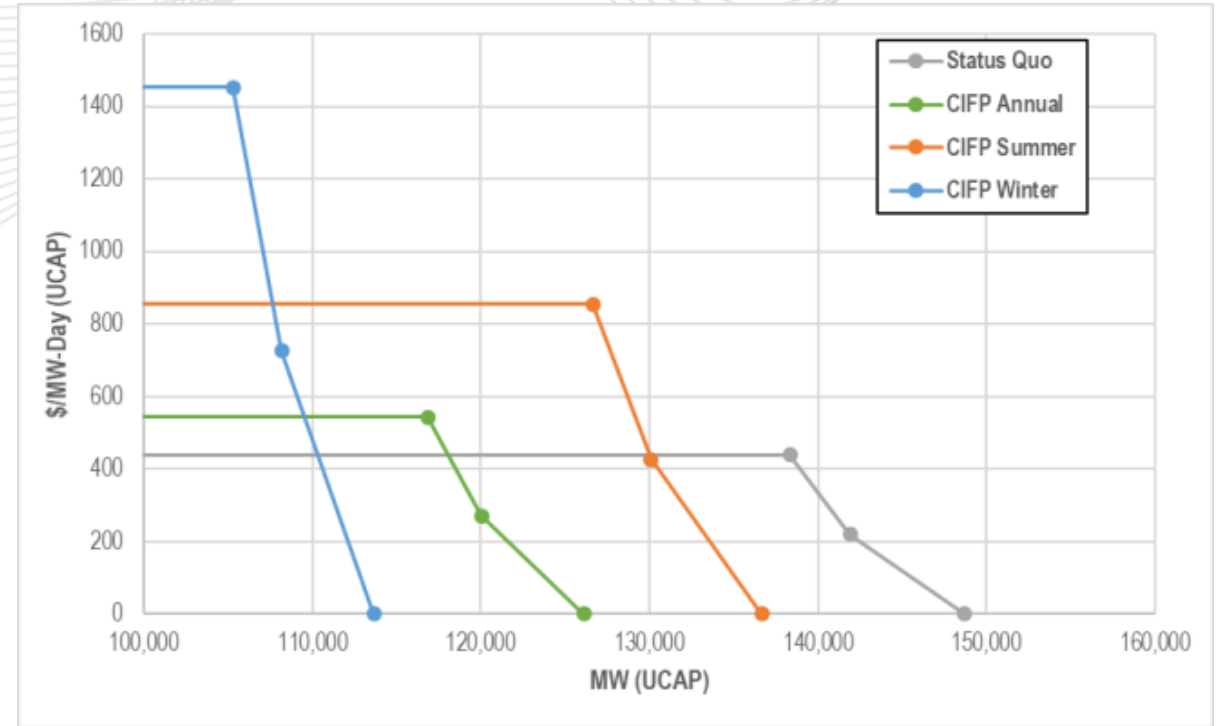
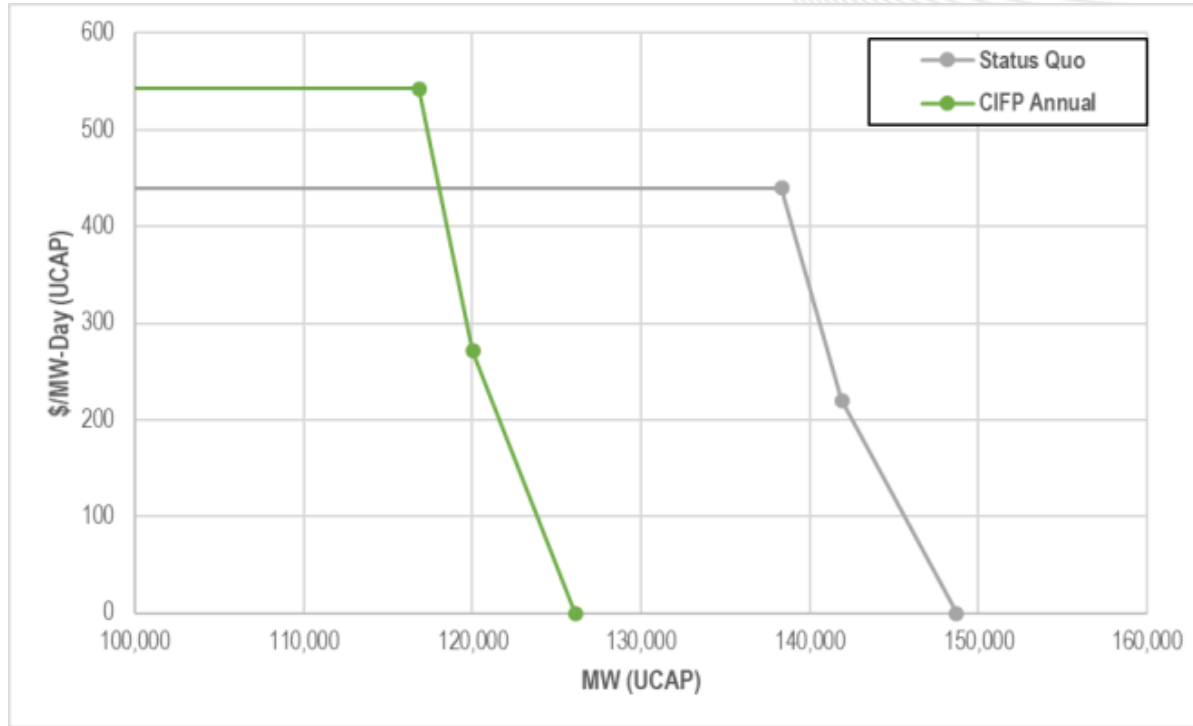
Status Quo	2024/2025 auction based on current market rules, <i>with LDA CETL constraints removed</i>
PJM CIFP Annual	2024/25 offered costs, with updated accreditation and VRR curve reflecting CIFP proposal #2
PJM CIFP Annual + Assumed CPQR	Same as CIFP Annual, <i>with a \$15/MW-day CPQR adder to each offer</i>
PJM CIFP Seasonal	2024/25 offered costs, with seasonal accreditation and VRR curves reflecting CIFP proposal #1

- **All cases** use the most recent 2024/25 Base Residual Auction data with energy efficiency resources removed
 - Offers, summer & winter load forecasts, resource mix in risk modeling, etc.
- **Status Quo case.** LDA/CTEL constraints removed to yield “unconstrained” RTO price
 - Maximizes comparability with other cases given we do not yet have LDA requirements
- **PJM Annual.** Resource accreditation (MW UCAP) updated consistent with the PJM proposals, and resource offers (\$/MW-day) translated to maintain the total cost (\$) in 24/25 offers
 - Example: An 8 MW UCAP resource offered at \$50/MW-day, reflecting costs of \$400/day; if now accredited at 5 MW UCAP, the offer would be \$8/MW-day corresponding to the same \$400/day
- **PJM Annual + CPQR.** Simple assumption of \$15/MW-day increase in all offers
- **PJM Seasonal.** Accreditation updated as per PJM Annual, and all offered costs assumed to be in “Annual Offer Component”; Seasonal Offer Components assumed zero for all resources

Caveats - Results not intended to represent a forecast of future auction outcomes.
- Analysis & results may be different under different assumptions.

- Context: Status quo 2024/25 RPM Base auction *actual clearing results*: **139,810 UCAP MW** at **28.92 \$/MW-day**
- In this analysis under “unconstrained” (no LDA constraint) base case: **139,145 UCAP MW** at **43.33 \$/MW-day**
- This corresponds to ~**15%** reserve margin (in terms of UCAP MW divided 50/50 summer peak load), which under the previous (status quo) risk modeling corresponded to ~1 in 100 LOLE and ~75 MWh EUE
- Under updated risk modeling of resources cleared in the status we expect ~**1 in 40 LOLE** and **348 EUE MWh**
- **Initial interpretation: we are much tighter than we thought**

- But: there are several GW of supply that did not clear but would be economic at prices below \$100/MW-day
 - The posted [24/25 Scenario Analysis](#) demonstrates the substantial elasticity of the supply curve
 - Removing 3 GW of supply (Scenario 2) increases prices only to \$42.20/MW-day
 - Removing 6 GW of supply (Scenario 4) increases prices only to \$56.26/MW-day
- **This moderates impact of even substantial adjustment of demand and/or supply** from risk modeling & accreditation changes



CIFP Annual:

curve shifts left (relative to **Status Quo**) due to the decrease in accredited UCAP for reference resource
 curve shifts up (relative to **Status Quo**) due to higher \$ cost per MW UCAP for reference resource

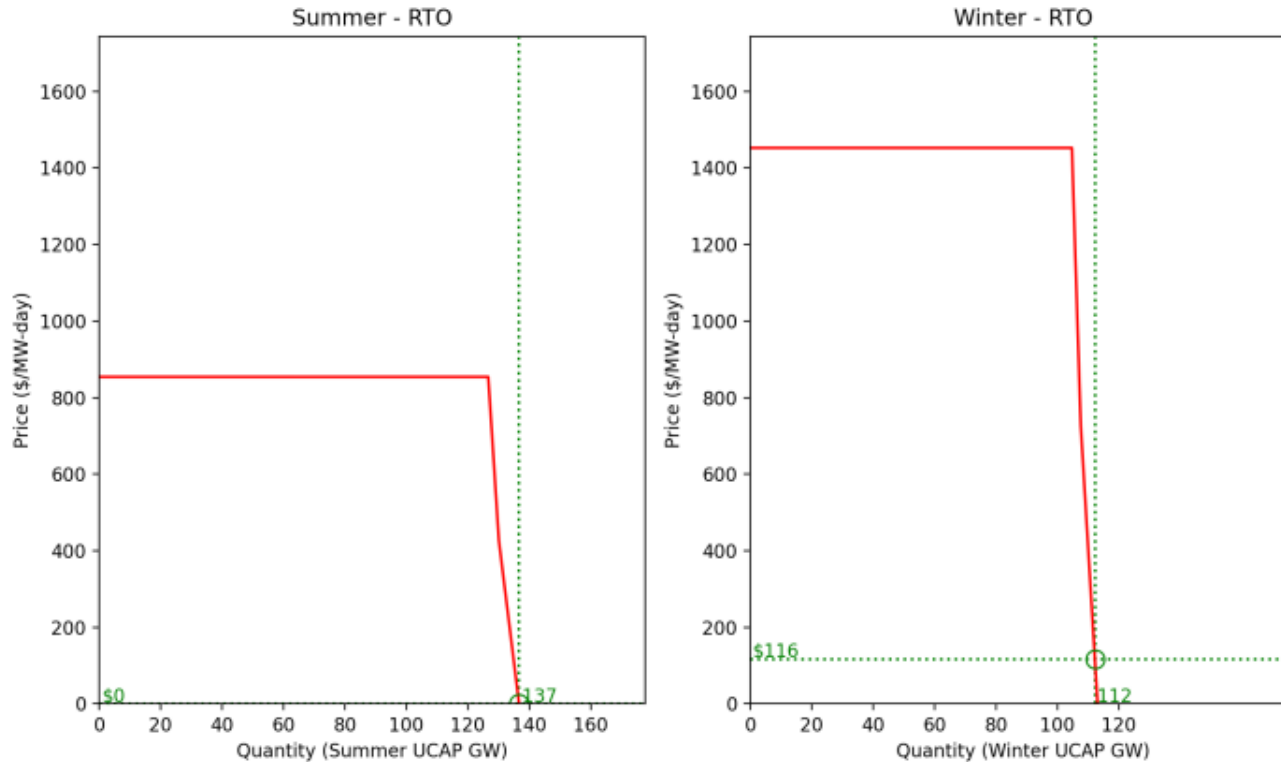
CIFP Seasonal:

Summer
Winter

curves shift up (relative to **CIFP Annual**) due to lower UCAP ratings and fewer days
 curve shifts right (relative to **CIFP Annual**) due to a higher seasonal Reliability Requirement
 curve shifts left (relative to **CIFP Annual**) due to a lower seasonal Reliability Requirement

- Relevant moving pieces:
 1. Some resources have higher accreditation than before; these offer MORE MW at LOWER prices
 2. Others (most) receive lower accreditation than before, and offer FEWER MW at HIGHER prices
 3. Demand curve moves up and to the left
- Combined effect of 1 & 2: even without changes to RR & demand curve, we see some beneficial swapping of cleared & uncleared resources — yielding more reliable cleared resource mix.
- Effect of 3: relatively less tight than without demand adjustment, but in combination with aggregate reductions in accreditation, see slightly tighter supply-demand balance
- Combined effect: Higher prices, higher delivered reliability, yielding **~1 in 50 LOLE** and **259 MWh EUE** (26% improvement in EUE vs. status quo)
- **Takeaway:** Risk modeling and accreditation improvements improve reliability at moderate costs by enabling PJM to identify and procure the low-hanging fruit of reliability beyond the margin

Seasonal Auction Clearing



- Seasonal auction clears: –1,934 MW summer accredited capacity, +225 MW winter
- Reduction of 99 MWh EUE annual risk: +6 MWh EUE summer, –106 EUE MWh winter
- Clearing prices reflect high marginal EUE in winter and low marginal EUE in summer: \$0/MW-day summer, \$116/MW-day winter
- No impact on annual average price or total load costs
- Putting it all together:
 - Relative to the annual case, substitution of winter UCAP for summer UCAP at 10-to-1 on the margin improves reliability with negligible impact on cost, yielding expected efficiencies
 - The seasonal market clearing naturally recognizes the higher marginal value of winter capacity given resource offered costs & seasonal accreditation. Thus market is willing to pay more for resources with relatively more winter than summer MW
 - This higher winter price is more than enough to procure up to and beyond point C of the summer demand curve

	Reliability Requirement* (MW UCAP)	Cleared Quantity (MW UCAP)	Cleared Quantity (MW ICAP)	Clearing Price (\$/MW-Day UCAP)
Status Quo	132,056	139,145	149,077	\$43.33
CIFP Annual	118,087	124,610	151,915	\$52.48
CIFP Annual + CPQR **	118,087	124,280	151,519	\$67.19
CIFP Seasonal	S: 127,295 / W: 106,413	122,747	149,763	\$52.25

* Reliability Requirements are reduced by the Committed FRR resources for 24/25 DY, based on updated ELCC values.

** Includes a simple adjustment to all offers to reflect a \$15/MW-Day UCAP CPQR assumption

	Total RTO Summer Committed MW (UCAP) ♦	Total RTO Winter Committed MW (UCAP) ♦	Summer Risk (EUE MWh)	Winter Risk (EUE MWh)	Total Risk (EUE MWh)	Total Annual Cost
Status Quo	168,749	136,040	9.9	338.1	347.9	\$2.2 Billion
CIFP Annual	171,047	138,270	2.3	256.2	258.5	\$2.4 Billion
CIFP Annual + CPQR	170,659	138,005	3.1	280.1	283.2	\$3.0 Billion
CIFP Seasonal	169,113	138,495	8.7	150.4	159.2	\$2.4 Billion

Takeaways:

- Risk modeling and accreditation improvements allow for more efficient clearing outcomes
- Seasonal market design further improves outcomes by substantially increasing annual reliability at no cost to consumers by procuring significantly less summer UCAP and additional winter UCAP

♦ Under Annual cases, annual UCAP of cleared resources is converted to seasonal UCAP using the class average ELCC values

	Status Quo (ICAP)	CIFP Annual (ICAP)	CIFP Annual + CPQR (ICAP)	CIFP Seasonal (Summer ICAP)	CIFP Seasonal (Winter ICAP)
CC	48,941	49,320	49,195	49,161	49,161
CT	19,362	19,307	19,138	18,789	18,789
Coal	21,972	23,646	23,646	22,662	23,480
Nuclear	26,091	26,091	26,091	26,091	26,091
DR	7,896	7,993	7,909	7,870	7,870
Wind	4,264	5,169	5,169	4,264	4,264
Solar	5,248	5,027	5,027	4,671	4,641
Other Thermal	11,318	11,593	11,576	11,452	11,452

- Resources that have relatively higher winter accreditation (compared to the PJM fleet average) are more likely to clear under the PJM proposed annual approach, and even more so under the PJM proposed seasonal approach.