Capacity Market Reform:
PJM CIFP Proposal Preview

RASTF - CIFP

March 15, 2023

Proposal Preview – Key Elements

1. Improve modeling of reliability risk drivers and system impacts
2. Improve accreditation to more accurately and equitably reflect resources' contribution to reliability, with consideration of specific winter risks
3. Enhance testing and performance assessment construct to better balance value of incentives with cost and impact of resulting financial risks
4. Improve Market Power Mitigation rules – MSOC / Must Offer

Proposed design continues to focus the capacity product on resources' contribution to reliability and ability to perform when needed during hours of highest reliability risk

Reliability Risk Modeling

Enhance reliability risk modeling, especially that of winter risks

- Enhance risk modeling by explicitly modeling how forced outage and other de-rates vary with temperature (increasing in extreme cold and hot)
- Expand weather history in reliability modeling to 50+ years to better represent the full distribution of summer and winter weather outcomes
- Move to Expected Unserved Energy (EUE) as the primary reliability metric
- Collectively, these enhancements result in models that better reflect the likelihood and severity of extreme event risk, so those events are properly weighted when determining procurement target and in accreditation

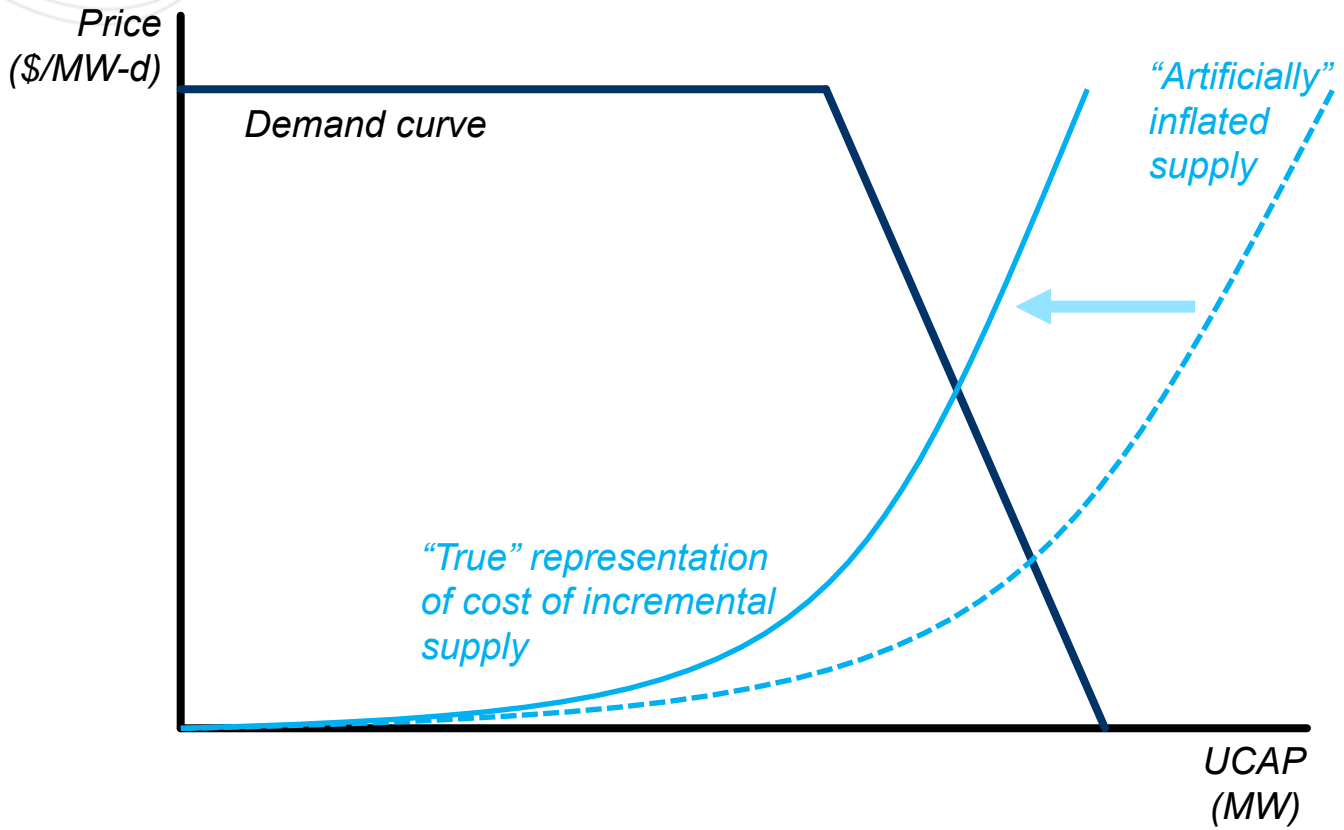
Other model enhancements:

- Load forecast improvements, including move to hourly forecast
- Move to hourly models for RTO and LDA reserve studies

Capacity Accreditation

Motivation for Accreditation Focus

- Motivation: Accreditation that over-states resources' contribution to reliability artificially **inflates supply, depresses clearing prices** introducing risks of uneconomic retirement, and **harms reliability**
- Improving accreditation framework:
  - Improves reliability
  - Puts upward pressure on prices to better reflect cost of reliability
  - Aligns resource compensation with their relative contribution to reliability



Accreditation Proposal Overview

Proposal improves accreditation to better capture resources' contribution during system risks and more accurately and equitably determine resources' relative contributions to resource adequacy.

- Consistently account for supply-side availability risks for all resource types
  - Enhance modeling of winter & extreme weather risks by extending weather history to better understand & characterize extremes, and reflect risks driven by combination of generator performance and load
- Marginal Accreditation: Accredit each resource to reflect its expected incremental contribution to system reliability during periods of risk

Thermal Resources	Demand Response	Intermittents and Storage
• Adjust for temperature-dependent forced outage rates and impact of correlated outages • Model historical performance of individual resources and across classes & fleet under normal and extreme conditions	Account for availability limitations coinciding with periods of risk	Modeled as today, but accreditation will reflect different patterns of risks and changing risk weighting

Overview of Methodological Approach

1 **Characterize resources' historical performance:**

- ***Individual*** performance (forced outages, ambient de-rates, production capability, etc.) as a function of temperature (and other weather for wind/solar back-casts)
- ***Class*** and ***fleet*** performance as a function of temperature

  Correlated outages for any reason are observed as class/fleet outage rates substantially above the "typical range," i.e., outliers relative to the statistical distribution of class/fleet outage rates expected given independent random draws of individual performance expectations

2 **Model system resource adequacy under thousands of alternative histories,** each with:

- One alternative weather history, reflecting distribution of uncertainty given 50 years' of history
- One alternative load history, reflecting distribution of load forecasts given weather, time/date, etc.
- One alternative realization of capacity resource performance, reflecting distribution of potential performance of individual "independent" resources and adjusted for historically observed correlations

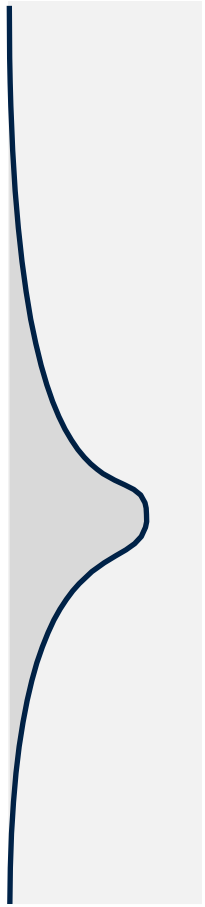
3 **Extract:** patterns of system reliability risk throughout the year

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

4 **Extract:** each resources' contribution to avoiding load shed in each alternative history

RESULT **Resource-specific accreditation reflecting reliability-neutral "exchange rate" across resources and resource types while maintaining target reliability metric**

Capturing Correlated Outage Risk in Accreditation

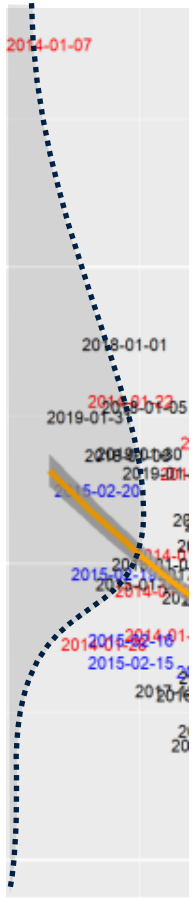


~~System-wide outage rate distribution~~

Independent draws given resources' forced outage rates yield artificially narrow distribution of system-wide outage rates given weather

But relatively severe system-wide outcomes happen (relatively) frequently under extreme weather

And severe weather occurs rarely but **much** more often than never



System-wide outage rate distribution

Proposed approach uses the observed "empirical distribution" of outage rates to adjust resource performance during extreme weather

And proposed approach better characterizes frequency of extreme events by extending our weather history

Next Steps in Accreditation

We are currently implementing the proposed approach to develop:

- Expected distribution of annual risk across seasons
- Indicative estimates of resource accredited values

We propose to benchmark model outcomes against historical data, comparing historical risk outcomes to model predictions (understanding data limitations given that “near misses” are relatively rare, and actual load shed even more so). Will seek to answer:

- *Is the pattern of risk experienced over the last decade within the statistical range of what the model would report (given historical resource mix) if the model accurately captured patterns of risk?*

Winter Qualification Requirements

- **Fundamentally difficult issue:** winter preparedness is important, but matters most in extreme cold weather which is seldom observed, so historical data alone are insufficient to fully characterize its effects on resource-specific performance
- **Proposed approach:** set minimum winterization requirements, exceeding NERC minimum requirements (EOP-012-1) and aligned with IRC comments (IRC comments)
  - Considering specifics of physical compliance assessments, officer certifications etc.

How to treat resources that fail to winterize?	Option 1: "Winter Disqualification"	Option 2: "Annual Disqualification"
	Resource receives no winter capacity commitment, no winter capacity obligation, and receives an annual accredited value reflecting zero winter performance. *Example: If 30% of modeled EUE risk is in winter, non-winterized resource accredited value could not exceed 70% of ICAP*	Resource ineligible to offer any capacity value into market, summer or winter. No capacity commitments; no capacity revenue.

Winter Qualification Requirements: Fuel Security

Proposed accreditation approach accounting for temperature dependent outages and outages correlated across resources naturally reflects differences in reliability value of *any* resource characteristic that affects reliability value…

… to the extent that it has been observed historically, and

… to the extent that contribution to supporting reliability during historical risks reflects value going forward

Ongoing Winter Storm Elliot review will help inform value of *requirements or class-based accreditation* for fuel security (paralleling options re: winterization)

Impact of Accreditation Reforms in Other Areas

Reliability Requirement in UCAP	• Procurement target should reflect the quantity of accredited UCAP needed to meet reliability criteria – Reduced by shifting certain supply-side risks accounted for on the demand-side today into accreditation – Reduced by moving from average to marginal ELCC
Prices denominated in $/MW UCAP	• Market Seller offers may be impacted on a $/MW-day (UCAP) basis • Administrative prices may be impacted on a $/MW-day (UCAP) basis, such as the reference resource Net CONE used in the VRR
Performance obligations	• Impacts Expected Performance throughout the year • Informs calculation of variable baseline of Expected Performance

Performance Assessments and Testing

Performance Assessments and Testing

Multi-tiered framework of performance assessments and testing to help ensure delivery of the capacity that has been committed through forward auctions

- **Daily Commitment Deficiency Assessment** – Retain existing assessment of unit's in-service MW and capacity value to meet their daily capacity commitment. No proposed changes to this assessment.
- **Generator Summer / Winter Rating Tests*** – Improve existing assessment of unit's capability to operate at their committed ICAP in the season. Proposed improvements to this assessment include:
  - Require physical demonstration of capability in each season
  - Remove excusals for inability to test to committed ICAP in each season
- **Energy Market Must Offer Obligation Assessment** – New proposed assessment of compliance with obligation to make available capacity accessible to PJM for scheduling. Proposed penalty rate set to 120% of daily or hourly capacity revenue.
- **PAIs** – Refined assessment of performance during times of relative system stress. Shortfall MW penalized at rate based on Net CONE / 30 hours. Proposed reforms to this assessment provided in following slides.

PAI Trigger Options under Consideration

Assessment Periods focused on times of relative system stress

Option 1	Option 2	Option 3
Maintain status quo triggers for PAIs which include deployment of pre-emergency DR	Limit existing triggers to exclude pre-emergency actions (including pre-emergency DR) and warnings	Trigger PAI during operating reserve shortages

Option 4

Combine any of the above options with hours of tightest operating reserve margins to maintain a minimum number of hours (i.e. 30 hours) that resources are assessed each year

PAI Penalty Rate and Stop-loss

Maintain the current penalty rate based on Net CONE and 30 hours

Non-Performance Charge Rate =
(Net CONE * # days in the Delivery Year) /
(30 hours * 12 settlement intervals)

Propose to base the annual stop-loss off of the auction clearing prices rather than Net CONE to limit financial exposure in years where the clearing price is significantly below Net CONE

Annual Stop-loss = 1.5 to 2 times resource's annual capacity revenues

PAI Performance Baselines

- Today, the static annual UCAP MW commitment of a generator is used as the baseline for setting a resource's Expected Performance during PAIs (adjusted by the balancing ratio), regardless of when the PAIs occur

- This approach fails to reflect *expected* differences in a resource's performance across the year
  - This can significantly increase the financial risk of non-performance even when resources perform as expected and modeled in accreditation

Propose to move to a resource-specific time-varying baseline to better align Expected Performance during PAIs with the underlying capability modeled for resources in the accreditation process

Baselines will reflect risk-weighted capability expected of resources and aligned with accreditation assumptions

PAI Excusals and Transparency

Propose to excuse generators that were available, but not instructed to run by PJM.

- Resources that are available for scheduling, but not committed and scheduled to provide energy or reserves will be excused for non-performance.
- Incentivizes availability and more accurate reporting of operating parameters
- Continue to excuse resources on approved planned and maintenance outages

Improve clarity and transparency of PAI rules in the governing documents and/or manuals.

Market Power Mitigation Rules

Market Power Mitigation Reforms

1 MSOC reforms proposed by PJM and presented to stakeholders in 2022 that included:

- Improvements to the unit-specific MSOC calculation to help ensure sellers are able to reflect their full costs of taking on a capacity commitment
- Clarifications around CPQR in the tariff
- Improvements to the unit-specific review process

2 Move to a forward-looking E&AS offset calculation for MSOC (and MOPR)

3 Remove categorical exemptions for Existing Generation Capacity Resources that currently apply to intermittent and storage resources

Topics not included in CIFP Proposal

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There are topics within the scope of the RASTF that are not included in our CIFP proposal, but continue to be important to PJM for further consideration and discussion with stakeholders beyond the timeline of the CIFP, including:

- Seasonal capacity market construct
- Locational accreditation