



Capacity Market Reform: PJM's Proposal

RASTF – CIFP

June 14, 2023

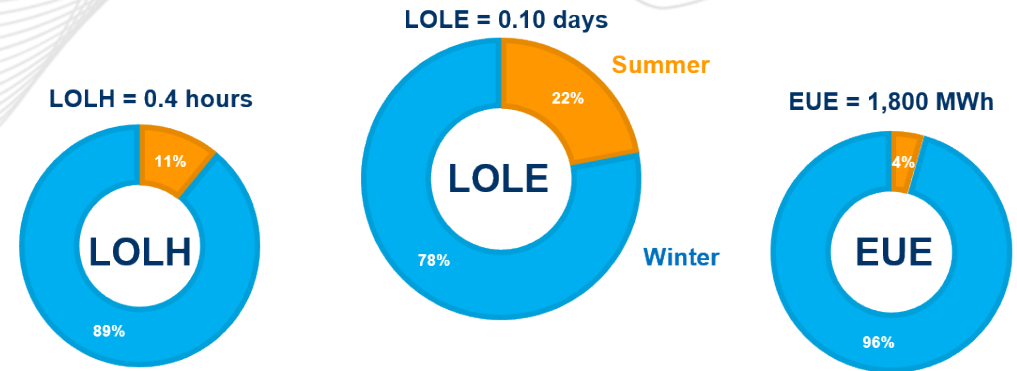
Key Elements of PJM's Proposal:

1. Enhance risk modeling in resource adequacy studies and move to EUE as the primary reliability metric
2. Implement a seasonal capacity market design (two seasons – summer and winter)
3. Improve capacity accreditation to reflect resources' contribution during periods of risk by season
4. Maintain the capacity performance framework with enhancements to the rules and testing requirements
5. Align FRR rules and improve other areas of the market construct, including market power mitigation rules

Focus of the market design reforms is on near-term achievable improvements to the market's ability to meet resource adequacy requirements in an efficient, least-cost manner.

Preliminary results of the enhanced risk modeling show a **significant shift in the patterns of reliability risk to the winter season**, where prior resource adequacy analysis has historically shown almost all risk during summer peaks.

[May 30 CIFP Presentation](#)



Given these results, the reliability and efficiency benefits in moving to a seasonal design are now greater.

- More robust to the uncertainty in relative risk patterns between winter and summer as target reliability requirements in each season are independent.
- Allows for improved market efficiency and price signals for capacity.
- Improves the alignment of system and locational accreditation of resources.
- Solves certain problems with the current annual construct that would need to be addressed given the shift in reliability risk.

Seasonal Demand	Seasonal Supply	Auction Structure	Cost Allocation
<ul style="list-style-type: none"> Seasonal reliability targets and demand curves Seasonal CETL values 	<ul style="list-style-type: none"> Seasonal resource qualifications Seasonal resource accreditation 	<ul style="list-style-type: none"> Offer structure that allows sellers to reflect both annual and/or seasonal going-forward costs of resources Simultaneous (co-optimized) clearing of both seasons with seasonal clearing prices 	<ul style="list-style-type: none"> Seasonal allocation of capacity obligations and charges to LSEs

We'll hit on each of these components as we walk through the different areas of market design. In many cases, we are proposing to start with the simplest translation of existing rules under the annual framework to the seasonal equivalent to get to the benefits of a seasonal design now, while allowing for further improvement and refinement to the design in the future.

Two Season Design

- Summer:** May – October of the Delivery Year
- Winter:** November – April of the Delivery Year



Risk Modeling Enhancements

Improve reliability risk modeling in resource adequacy studies

- Move to hourly risk modeling for reserve requirement and accreditation studies
- Explicitly model how **forced outages and other de-rates vary with temperature** (increasing in extreme cold and hot) *and* are further **correlated across the fleet** even after accounting for unit-specific performance dependence on temperature
- **Expand weather history in reliability modeling** to better capture the full distribution of summer and winter weather outcomes (*updated model currently reflects ~30 years of history*)
- Switch to Expected Unserved Energy (EUE) as the primary metric in reliability studies

Result: reliability risk modeling that better captures the likelihood, severity, and patterns of risk

Model Inputs

Weather Scenarios



Historical weather patterns observed from expanded history

- *Adjusted to capture impact of climate change on temperatures*

Load Profiles

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

- *Weather patterns shifted forward and backward to account for day of the week / holiday variables*

Resource Performance

Characterize unit, class, & fleet historical performance (forced outages) as a function of weather

- *Correlated outages for any reason captured in class/fleet outage rates above the "typical range"*

Resource Adequacy Analysis

Model system resource adequacy under thousands of alternative histories

- *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 resources and historically observed correlations across resources*

Patterns of Reliability Risk

LOLE vs. LOLH vs EUE metrics

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

- **Objective:** Use the best available information to characterize the distribution of potential delivery-year weather outcomes
- **Concern:** Climate change has shifted mean temperatures and extreme temperatures. The extension of the weather history introduces a bias-variance tradeoff:
 - Bias: Longer weather history may introduce bias in understanding the true distribution of temperatures in the delivery year due to climate change-induced trends in temperatures.
 - Variance: Shorter weather history increases the variance in estimating the weather distribution, and may substantially understate or overstate the frequency of extremes of the distribution.
- **Proposed Solution:** Introduce a longer weather history coupled with algorithmic adjustments to reduce bias and variance. Specifically, adjust historical weather observations for the impacts of climate change already measured across the PJM region.

- Climate change has had measurable impacts over the last 100+ years. Most of the warming has occurred since 1950.
- Changes in temperature means and extremes are detectable and statistically significant. An increase in global mean surface temperature (GMST) has had statistically significant impacts on observed temperature means and extremes in the historical record and over the last 50 years.
- **Approach:**
 - Determine historical trend in annual mean temperature across the PJM region.
 - Confirm relationship between trend in mean temperatures and trends in extreme temperatures
 - Apply appropriate adjustment to mean temperature and extreme temperatures for each historical year based on historical trends
 - Model load forecast and resource performance reflecting post-adjustment data

Thermal Generation

Forced outages (including ambient de-rates) modeled as a function of temperature based on historically observed performance back to 2012

- *Each historical day provides an observation of hourly forced outage rates for individual units and classes*
- *Each historical day of observed generator performance is grouped into daily temperature bins (based on min daily temperature in winter and max in summer)*
 - *e.g. bin1 for winter might include all days of observed performance with min. daily temp. below 0°*
- *The Monte Carlo analysis then draws against observed performance from the appropriate temperature bin for a given day (and temperature) of the historical weather scenarios*
 - *e.g. if Jan X, '94 has a daily min temp. of -10°, the analysis will draw against all observations of performance in bin1*

Planned / maintenance outages “optimally” scheduled for a given weather scenario and load profile

Variable Resources

Performance modeled as a function of weather and historically observed performance (or back-casts) back to 2012

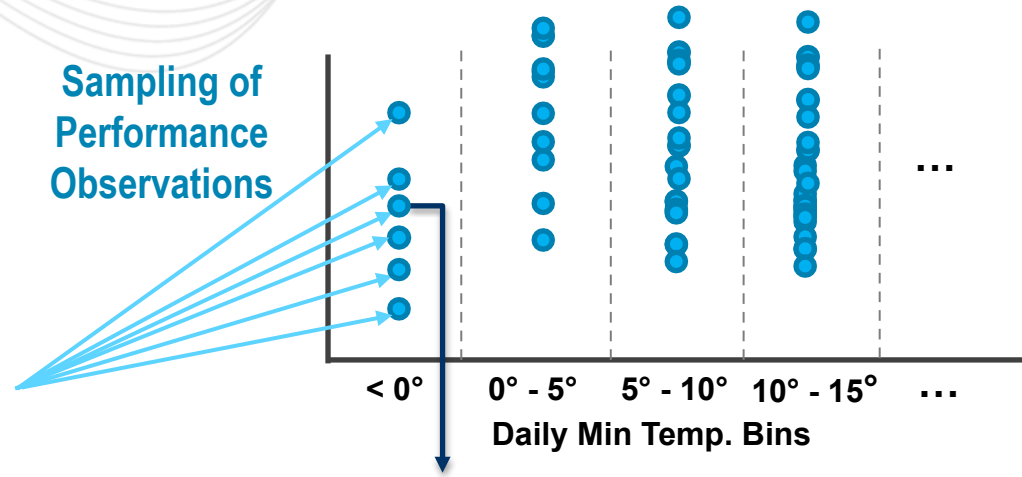
- *Monte Carlo analysis draws from performance data in similar manner as thermal availability / forced outage rates*

Sampling of Thermal & Variable Resource Performance (Illustrative Example)

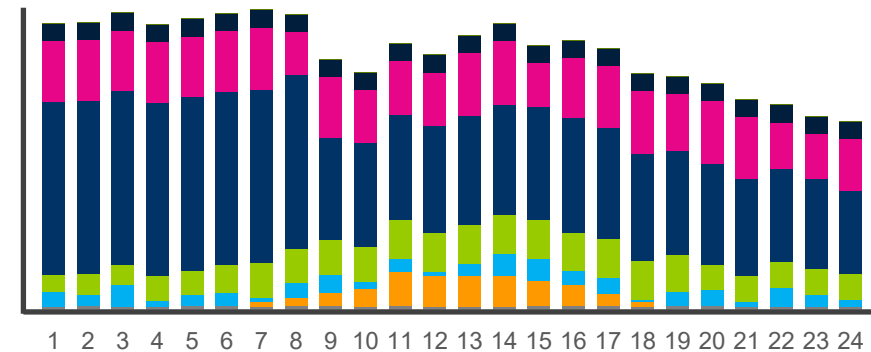
Weather Scenarios

Weather Year	Date	Season	Daily Temp.
197X	Jan. 1	Winter	4° (min)
197X	Jan. 2	Winter	8° (min)
197X	Jan. 3	Winter	7° (min)
...
1994	Jan. X	Winter	-5° (min)
...
2012	7/15/12	Summer	92° (max)
2012	7/16/22	Summer	89° (max)
...
2022	Dec. 31	Winter	12° (min)

Daily Historical Winter Observations of Availability / Performance by Temperature Bin (since 2012)



1 Sample Observation: Feb. X, 2015 Hourly Availability



Seasonal Demand

RTO Reserve Requirement

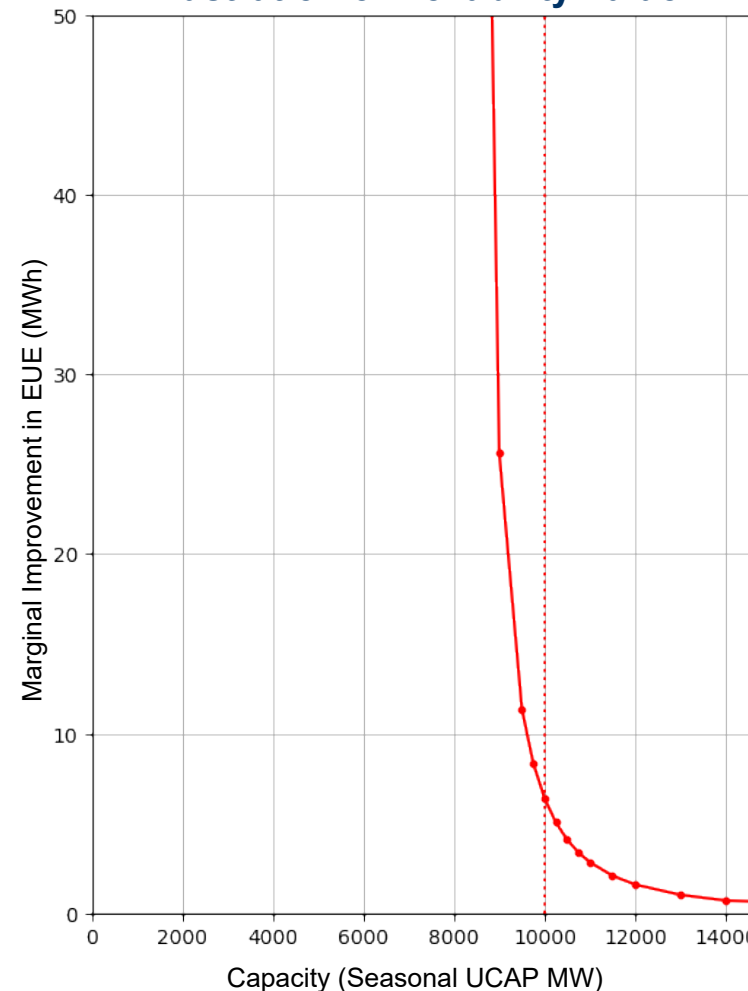
- Annual target criteria based on the EUE when at 1-in-10 LOLE in delivery year
- Seasonal target criteria based on seasonal EUE expected at annual target criteria in delivery year
- Do not rely on emergency imports (Capacity Benefit of Ties) to meet target EUE criteria
- Modeling improvements as previously described to improve modeling of risks

LDA Reserve Requirement (CETO Study)

- Annual target criteria based on similar level of additional risk relative to the RTO accepted today for LDAs
- Seasonal target criteria based on seasonal EUE expected at annual criteria in delivery year
- Require earlier notification of intent to offer for planned generation resources
- Modeling improvements consistent with previously described RTO improvements

- **Maintain annual VRR curve** based on annual reserve requirement, reflecting expected risks under expected delivery-year fleet, as today, *and*
- **Introduce seasonal demand curves** proportional to, in each season: incremental avoided EUE vs. cleared capacity
 - Each seasonal curve is calculated as the derivative of EUE with respect to seasonal capacity ($dEUE/dQ$)
 - This is equivalent to LOLH as a function of quantity, as each incremental MW of UCAP reduces seasonal EUE by the number of loss of load hours expected at that reserve margin
 - Translation: the marginal reliability impact of an increment of capacity in a given season is equal to the expected number of MWh of unserved energy that such capacity can serve (i.e., $1 \text{ MW} \times \text{LOLH hours}$)

Illustration of Reliability Value





Seasonal Supply: Qualification

Resources must meet seasonal eligibility requirements to participate in that season

- Allow for resources that meet the qualification requirements for only the summer or winter season to participate on a standalone basis in that season (e.g. summer-only DR may offer and clear for just the summer season with no requirement to match a winter-only offer in the clearing process)
- Generation Capacity Resources must meet seasonal qualification requirements to participate in each season (e.g. studied to be deliverable / CIRs, seasonal accredited value greater than zero, etc.)
- Demand Resources, Energy Efficiency Resources, and Price Responsive Demand qualified and accredited based on reduction capabilities in each season
- Qualifying Transmission Upgrades (QTUs) qualified and accredited based on incremental improvement to seasonal CETL values

Summary of approach to deliverability and CIRs: Apply existing Capacity Interconnection Rights (CIRs) construct to seasonal design, without modification of existing rights. CIRs continue to be an annual right with sub-annual components, as today.

CIR Requirement

- Capacity resources must be deliverable to total system load
- CIRs ensure that transmission limits would not be expected to limit the output of a generator to be exported to the rest of PJM under summer peak, winter peak, and light load conditions, as today
- CIRs provide eligibility for capacity resource to participate in RPM auctions

Summer Season

- CIRs applied as today
- Resource output is capped at CIRs in ELCC modeling (similar to today)

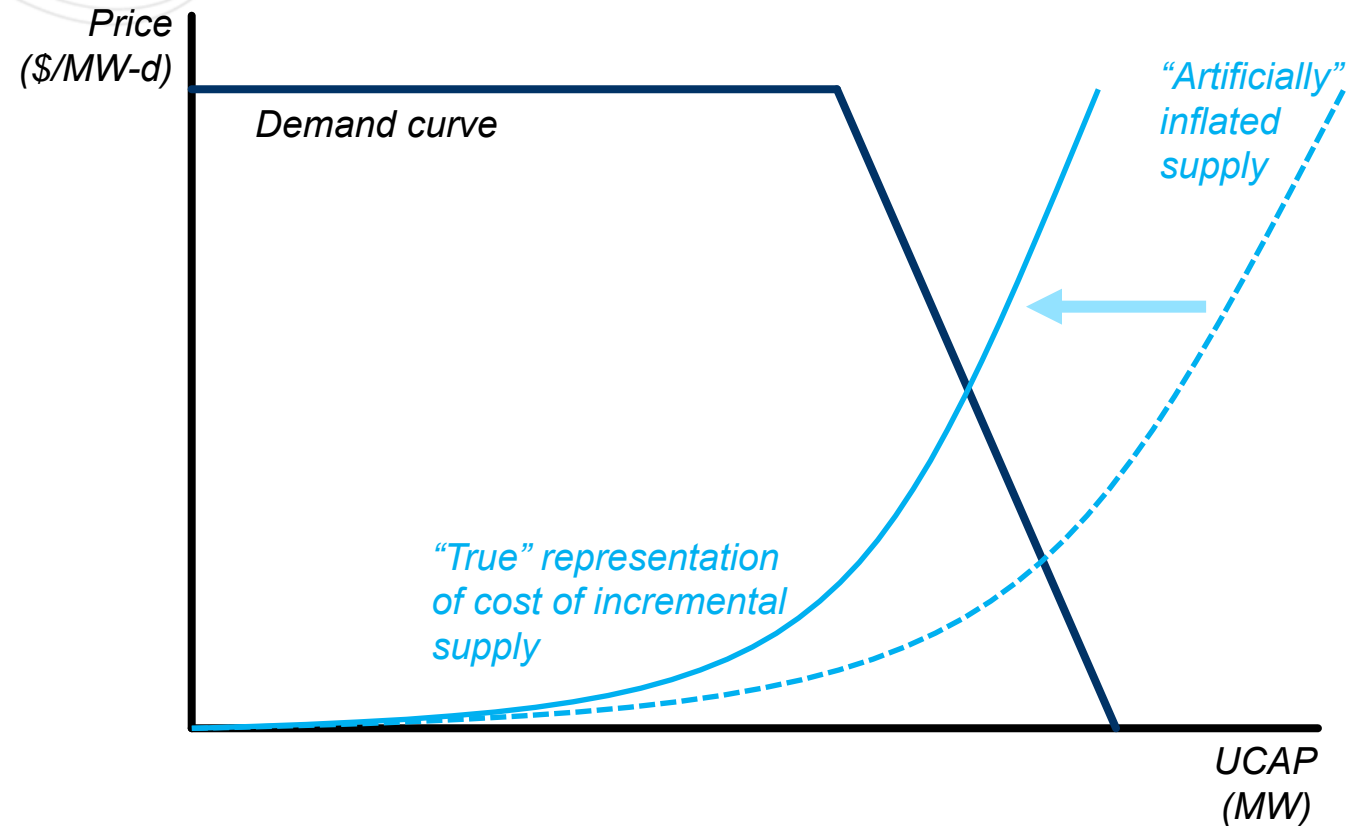
Winter Season

- Capacity resources with CIRs allowed to offer up to annual CIRs or additional winter deliverability that has been studied (no higher than winter accredited value)
- Resource output is capped at winter deliverability in ELCC modeling (similar to today)

- **Approach:** Set minimum winterization requirements, exceeding NERC minimum requirements ([EOP-012-1](#)) and aligned with IRC comments ([IRC comments](#))
- **Enforcement:** Require officer certification that required winterization has been completed
 - *Considering requiring site inspections by PJM staff, contracted personnel and/or private qualified Professional Engineer, including inspection that required winterization has been completed. Not yet part of current proposal.*
 - *Motivation: winter preparedness is important, and 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. Verification of physical plant may add value and is consistent with practices across other ISOs (including at least: ERCOT, NYISO)*
- **How to treat resources that fail to winterize?** Resource does not qualify to sell winter capacity product; receives zero winter commitment/obligation; enabled by seasonal commitment periods

Seasonal Supply: Accreditation

- **Motivation:** Accreditation that overstates 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



Accredit Generation and DR based on their expected contribution during periods of system reliability risk in each season

- Consistently account for supply-side availability risks for all resource types
- Use marginal Effective Load Carrying Capability (ELCC) with the risk modeling enhancements to determine the seasonal accredited value of all generation resource types and DR

Thermal Resources		Demand Response	Intermittents and Storage
<ul style="list-style-type: none"> • Adjust for temperature-dependent forced outage rates and impact of correlated outages 	<ul style="list-style-type: none"> • Model historical performance of individual resources and across classes & fleet under normal and extreme conditions in each season 	<p>Account for availability limitations coinciding with periods of risk in each season</p>	<p>Modeled as today, but accreditation will reflect different patterns of risks and changing risk weighting in each season</p>

- Thermal ELCC Classes:



↓ ↓

Considering separate ELCC classes reflecting security of fuel (onsite backup fuel)

- Existing ELCC Classes for Variable, Limited Duration, and Combination Resources
 - (e.g. fixed / tracking solar, onshore / offshore wind, limited duration resource classes, etc.)
- DR ELCC Class

Methodology to Determine Class Ratings by Season

1. Start with the expected resource mix and system at the annual target reliability criteria in the ELCC model
2. Add an increment of “perfect” seasonal capacity for the season under study (e.g. add 100 MW of 24x7 “perfect” capacity in winter to the model)
3. Run the ELCC and measure the reduction in EUE from adding the increment of “perfect” seasonal capacity (e.g. assume results show 20 MWh of EUE reduction)
4. Replace the “perfect” seasonal capacity with the same amount of incremental capacity from the class under study (e.g. add 100 MW nameplate of “Gas CC”) for just the relevant season
5. Run the ELCC and measure the reduction in EUE from adding the increment of class capacity in the relevant season only (e.g. assume results show 14 MWh of EUE reduction)
6. Set the ELCC Class Rating based on the class EUE reduction relative to that of “perfect” capacity (e.g. “Gas CC” Class Rating = $14 \text{ MWh} / 20 \text{ MWh} = 70\%$)

Summary: Unit-specific performance factor reflects each resources' average historically-observed performance, in those weather conditions (temperature bins) in which the system experiences reliability risk, relative to class average historically-observed performance

Details of computation:

- For each temperature bin:
 - Calculate unit's average availability across all observations in that bin: A_{ub}
 - Calculate class' average availability across all observations in that bin: A_{cb}
 - Calculate relative risk weighting of the bin (as a share of total risk): R_b
- Compute weighted average of unit availability across all bins: $A_u = \sum_b R_b \cdot A_{ub}$
- Compute weighted average of class availability across all bins: $A_c = \sum_b R_b \cdot A_{cb}$
- Compute unit-specific performance factor: $Factor_u = \frac{A_u}{A_c}$

Resource Type	Summer Season	Winter Season
Generation Capacity Resources	<p>ICAP = Summer net capability, capped at CIRs</p> <p>UCAP = ICAP * Summer Class ELCC * Summer Unit-Specific Performance Adjustment</p>	<p>ICAP = Winter net capability, capped at CIRs</p> <p>UCAP = ICAP * Winter Class ELCC * Winter Unit-Specific Performance Adjustment</p>
Demand Resources	<p>ICAP = Summer PLC – (Summer FSL * Losses)</p> <p>UCAP = ICAP * DR Summer Class ELCC</p>	<p>ICAP = Winter PLC – (Winter FSL * Losses)</p> <p>UCAP = ICAP * DR Winter Class ELCC</p>
Energy Efficiency Resources	<p>ICAP = Summer Nominated Value</p> <p>UCAP = ICAP * Summer FPR</p>	<p>ICAP = Winter Nominated Value</p> <p>UCAP = ICAP * Winter FPR</p>
Price Responsive Demand (PRD)	<p>ICAP = Summer PLC – (Summer FSL * Losses)</p> <p>UCAP = ICAP * Summer FPR</p>	<p>ICAP = Winter PLC – (Winter FSL * Losses)</p> <p>UCAP = ICAP * Winter FPR</p>
Qualifying Transmission Upgrades (QTUs)	<p>UCAP = Improvement in Summer CETL</p>	<p>UCAP = Improvement in Winter CETL</p>

Auction Structure

(Simplified) Illustrative Examples

- Each resource is enabled to offer in a way that best reflects its economic going-forward avoidable costs of accepting a capacity obligation:
 - **Summer offer component:** reflects costs avoidable only if not committed for summer commitment period
 - **Winter offer component:** parallel with summer
 - **Annual offer component:** reflects costs avoidable only if not committed in either season. *May be zero if resource plans continued operation and relevant costs (CPQR, etc.) of a capacity commitment are seasonal and included in seasonal offer components.*

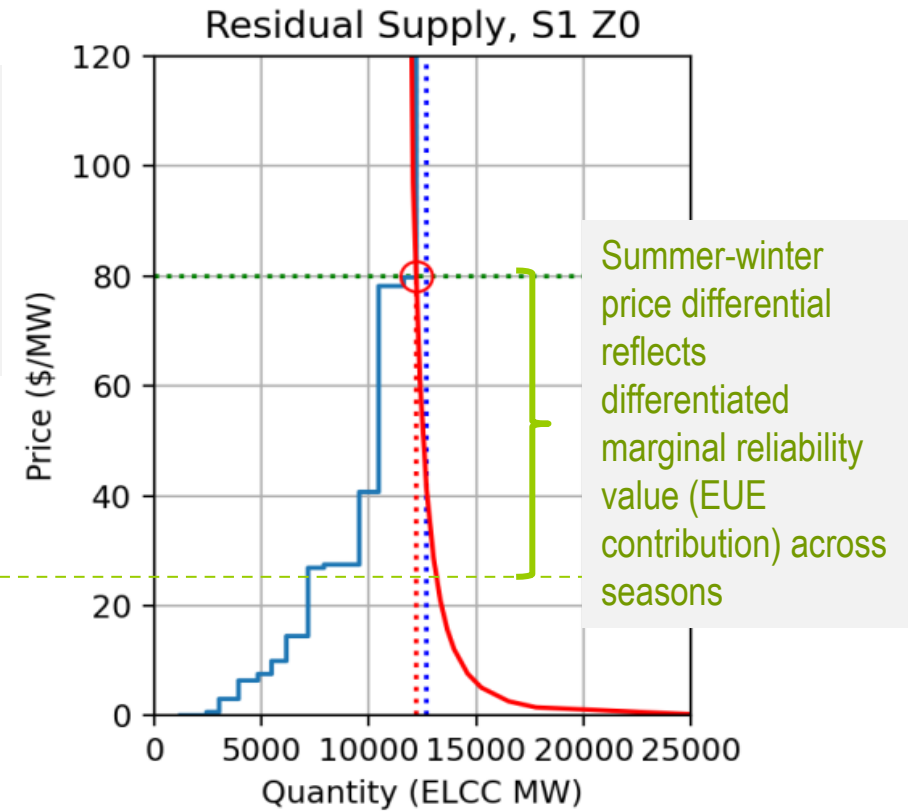
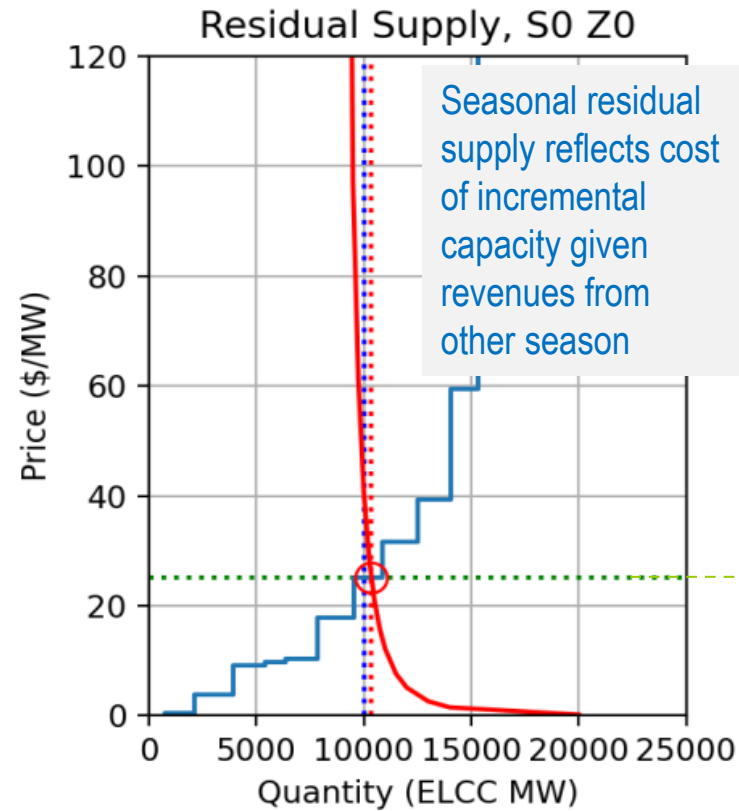
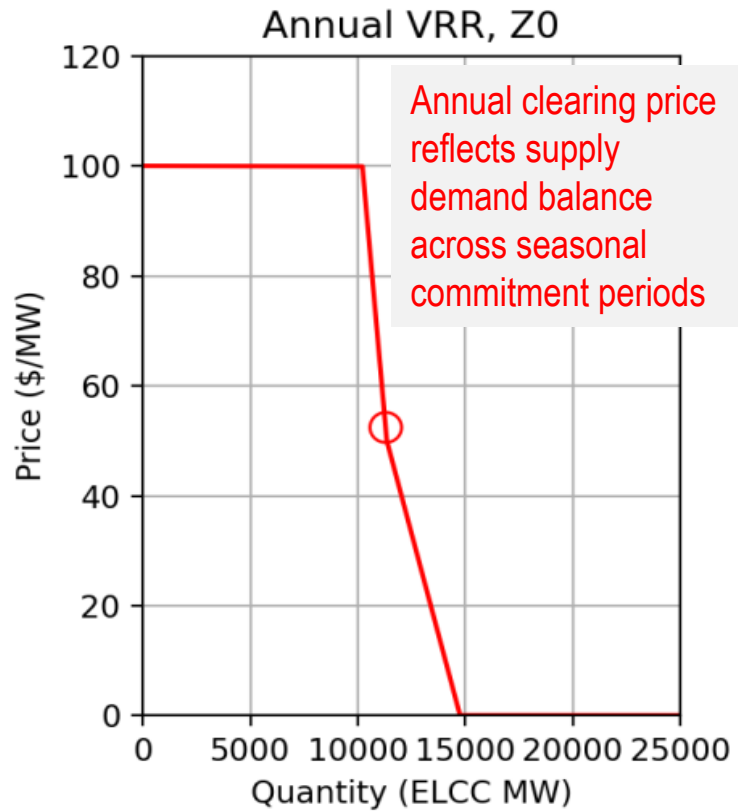
Resource with qualified & accredited capacity in summer only (“summer only resource”)	Includes all costs in summer offer component
Resource with qualified & accredited capacity in both seasons (“annual resource”) whose avoidable costs are incurred for continued operation, but is indifferent to receiving revenues in one or both seasons, AND is indifferent to receiving commitment in one or both seasons	Includes all costs in annual offer component; seasonal offer components equal zero
Annual resource who plans to continue operation whose avoidable costs are entirely attributable to one season or the other	Separate all costs into summer and winter costs; annual offer component equals zero
Annual resource who incurs some costs it could avoid if uncommitted in both seasons, and other costs it could avoid if uncommitted in one season or the other	Provide non-zero offer summer, winter, and annual offer components reflecting costs

Auction clearing summary: Clear along annual VRR curve while choosing summer and winter capacity at least cost, given relative contributions of each resource as a function of seasonal cleared capacity

- **Objective:** Implement existing clearing methodology in a seasonal framework as straightforwardly as possible, introducing no new design choices that conflict with status quo clearing approach
- **Approach:** Choose lowest-cost resources to clear market, minimizing clearing error (“deadweight loss”), while:
 - Enabling efficient substitution of capacity in one season for capacity in another season if and when the marginal contribution to reliability is higher per dollar, and
 - Recognizing differentiated capacity value of each resource and differentiated annual, summer, and winter costs
- **Pricing:** Seasonal prices reflect marginal value of incremental capacity in each season at equilibrium supply/demand balance. These prices will:
 - **Efficiently equalize marginal EUE per dollar across seasons**
 - **Ensure that the market clearing is market equilibrium** and no competitive participant prefers a different outcome than the clearing outcome given the seasonal clearing prices. Auction revenues cover costs of each cleared resource:

$$\text{ClearedSummerCapacity} \times \text{SummerPrice} + \text{ClearedWinterCapacity} \times \text{Winter Price} \geq \text{ClearedSummerCosts} + \text{ClearedWinterCosts} + \text{AnnualCosts}$$
 - **Ensure “incentive compatibility” constraint is satisfied**, such that every participant achieves the best outcome by revealing their true costs. No participant can strategically bid to achieve a better outcome.
 - **Avoid any need for make whole payments** or uplift (excepting inflexible resource offers, as today)

Seasonal Auction Clearing – Single Zone



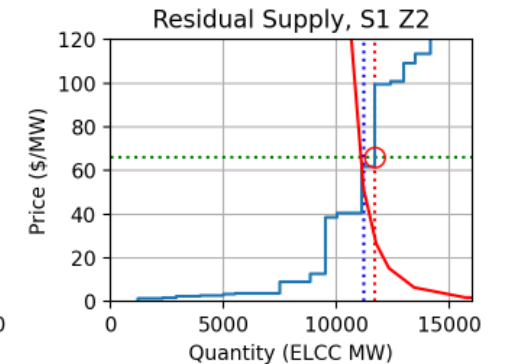
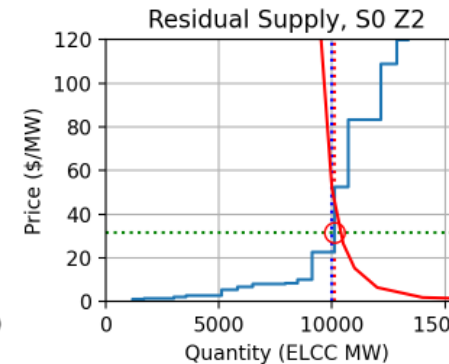
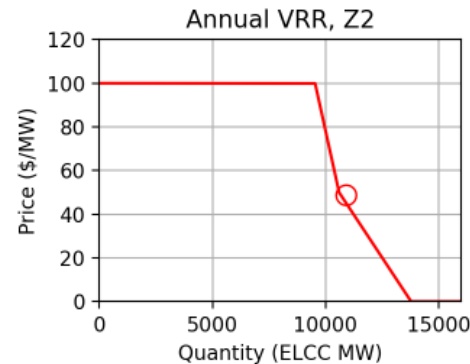
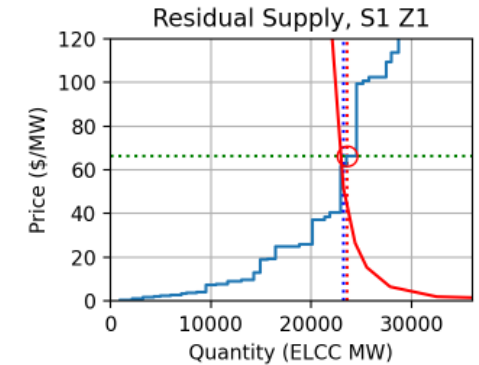
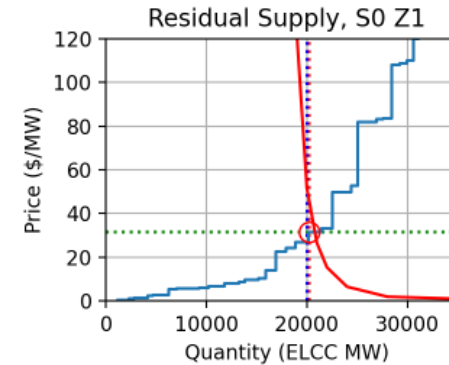
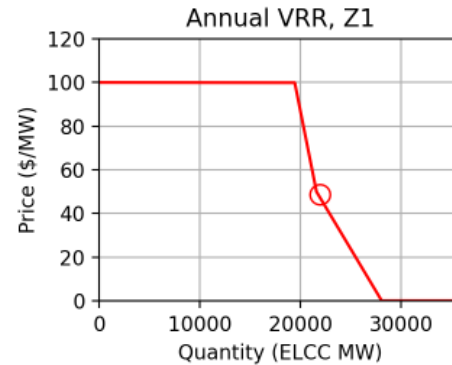
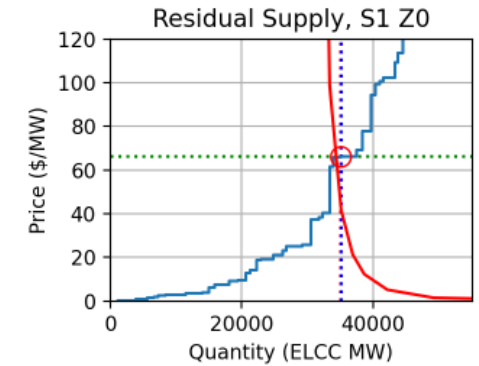
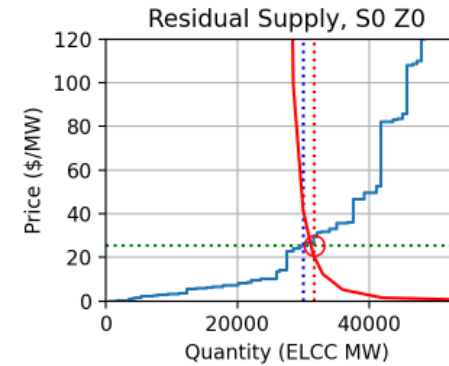
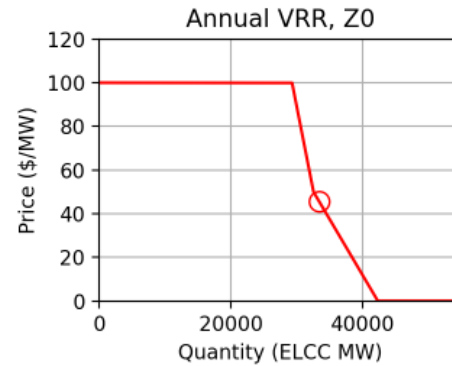
Auction clearing summary: Clear along annual VRR curve while choosing summer and winter capacity at least cost, given relative contributions of each resource as a function of seasonal cleared capacity

Illustrative example, assumptions:

- RTO with two nested LDAs: {0 {1 {2}}}
- Resources offer summer and/or winter capacity using summer, winter, and/or annual cost components
- Across nested LDAs, auctions clears as today, where parent can contribute to child up to CETL, and child price will be higher only if CETL is binding
- In each LDA, auction clears as described on previous slides

Observations:

- LDA Z1 has binding CETL (thus higher price) in season S0 but not S1
- LDA Z2 procures excess capacity in S1 as it contributes to RTO (Z0) and LDA Z1 reliability at least cost
- Marginal EUE per MW at equilibrium clearing point is higher in S1 than S0, so seasonal prices reflect relative reliability value being higher





Seasonal Cost Allocation

Load obligations and locational reliability charges assessed following current approach under the annual construct, naturally applied to each season

Summer Season

- RTO summer capacity obligations allocated to each zone based on zonal share of summer peak load forecast
- Summer Peak Load Contributions (PLCs) and obligation peak loads provided by EDC for allocation of summer capacity charges to LSEs

Winter Season

- RTO winter capacity obligations allocated to each zone based on zonal share of winter peak load forecast
- Winter Peak Load Contributions (PLCs) and obligation peak loads provided by EDC for allocation of winter capacity charges to LSEs

CTRs and ICTRs calculated similar to today, but separately for each season

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

Does the physical capacity exist to meet its commitment?

Is the unit prepared to run if needed?

Does the unit perform during reliability events?

- **Daily Commitment Compliance** – Assesses if a resource has sufficient accredited capacity to satisfy its capacity commitment. Daily penalty rate set at seasonal clearing price (\$/MW-day) + higher of (\$20, or 20% of clearing price).
- **Generator Seasonal Capability Testing** – Assesses if a resource can demonstrate it's capable of operating at its committed ICAP in both summer and winter seasons. Same penalty rate as above, but retroactively assessed each day of season if short.
- **Availability / Operational Testing** – PJM initiated testing of a generator's availability status to better ensure they are capable of operating if/when needed for reliability.
- **PAIs** – Assesses if a resource actually performs during true reliability events with a significant penalty for failure to meet expected performance levels.

Generator Seasonal Capability Testing

Status quo rules with the following proposed reforms:

- Require a physical demonstration of capability in each season (no longer allow summer test data to be adjusted for winter ambient conditions and submitted as demonstration of winter capability)
- Set expected performance at average committed ICAP in each season and remove existing administrative rules that allow generators that fall short in their tests to avoid a penalty
- Penalty rate set for each season based on seasonal clearing price + higher of (\$20, or 20% of seasonal clearing price). Testing shortfalls assessed for each day in season.

Generator Availability / Operational Testing

- Allow for PJM to initiate up to 2 operational tests per season for each unit to better ensure resources are capable of operating if/when needed for reliability.
 - PJM initiated tests will respect parameter limits of the available schedule for which the unit is committed on
 - Units will be made whole for their costs during PJM initiated tests, but not re-tests following a failed test
 - A unit is considered to have passed if it successfully comes online within 2 hours of the scheduled time.
 - Impact of a failed test:
 - Status updated to unavailable and a Forced Outage (FO) ticket in GADS will be required back to last time the unit successfully operated or was on an approved planned / maintenance outage
 - Unit remains on FO until it successfully operates or addresses the issue that caused the unit to fail to start
 - To verify, PJM may issue a re-test (at the owners cost) if the unit has not operated within 5 days since the switch to be available to verify the unit is truly capable of operating. Re-tests following a failed test do not count towards the allowable tests per season.
 - Failed tests subject to potential capacity penalty charges

Category	Proposal
PAI Trigger(s) Keep the recently as-filed PAI triggers from ER23-1996	<ul style="list-style-type: none"> Primary Reserve shortages coupled with certain Emergency Actions (e.g. Voltage Reduction Warnings, Manual Load Dump Warnings, Max Gen Emergency, etc.) Deploy all resources action, voltage reduction action, manual load dump action, or load shed directive for an entire Reserve Zone or Reserve Sub-zone
Assessed Resources	Only committed capacity resources (up to committed ICAP)
Balancing Ratio	Actual Performance of committed generation capacity / committed UCAP of generation (adjusted for excused MW), not to exceed 1
Expected Performance	Status quo (Gen: Committed UCAP * Balancing Ratio; DR / EE / PRD: Committed ICAP)
Actual Performance	Status quo, but capped at committed ICAP
Excusals	Limited to planned and maintenance outages approved by PJM, manual dispatch instructions, and transmission security limitations
Penalty Rate	Status quo (Net CONE * 365 days / 30 hours / 12 intervals)
Annual Stop-loss	Status quo (1.5 * Net CONE * 365 days)

Additional Changes

- Remove the option to adjust commitments after a PAI through retroactive replacement transactions
- Apply the same penalty structure to all participants for PAIs – remove the option for FRR Entities to elect a physical penalty



Market Power Mitigation Rules

Proposed Reforms

- 1 MSOC reforms largely consistent with those previously [proposed by PJM](#):
 - Improve unit-specific review process
 - Introduce explicit PJM calculation of CP risk based on reliability risk modeling & unit-specific parameters
 - Ensure sellers are able to reflect their full economic costs of taking on a capacity commitment (note that this no longer includes CP opportunity costs given proposed PAI reforms)
- 2 Move to a forward-looking E&AS offset calculation for MSOC / MOPR purposes
- 3 Remove categorical must offer exemptions for Existing Generation Capacity Resources that currently apply to intermittent and storage resources
- 4 Modify mitigation rules for Planned Generation Capacity Resources to enable up to unit-specific or default technology-specific Net CONE prices when triggered

Current Planned Mitigation Offers

- Planned Generation Sell Offers do not know what price they could be mitigated to until the auction window closes.
 - Mitigated prices are determined based on (1) other offers of the same resource type in the auction if available, or (2) average planned resource offer over the entirety of the RPM if available, or (3) Net CONE.
- There is no unit-specific process for Planned Generation Sell Offers if their costs support an offer above a mitigated price.

Proposed Planned Mitigation Offers

- Rewrite part C of Attachment DD §6.5 to reject a sell offer if the offer exceeds the default Net CONE value for the applicable technology for such Delivery Year in the Zone for which the Sell Offer was submitted (or an accepted unit-specific value). If there is not an applicable default technology type, use the VRR Net CONE price for the LDA.
- Introduce a unit-specific process that aligns with current unit-specific process described in Attachment DD §5.14.

FRR

- **Seasonal Construct Alignment**

- FRR Plan obligations determined for each season
- Resources qualified and accredited by season, consistent with RPM

- **Performance Assessments and Testing**

- PAI and testing reforms consistent with RPM changes

- **Deficiency Assessments in the Delivery Year**

- FRR resource deficiency charges in the Delivery Year based on a penalty rate of 2x CONE rather than the BRA clearing price, consistent with the insufficiency charge rate.

Appendix

- **Key takeaways:**

- Market participants must:
 - Establish & maintain weather preparation measures for winter and summer seasons
 - Provide notarized declarations of preparedness
 - Create list of hot and cold weather critical components
- ERCOT conducts inspections to determine compliance
 - Develops inspection checklists
 - Conducts resource inspections (in both winter and summer)
 - Provides inspection reports & establishes cure periods for deficiencies

- **References:**

- Weather Emergency Preparedness Overview
<https://www.ercot.com/files/docs/2022/10/28/ERCOT%20Generation%20Entity%20Winter%20Weatherization%20Workshop%20-%20Combined%202022-10-25.pdf>
- Generation Entity and Transmission Service Provider Summer Inspection Checklists
<https://www.ercot.com/files/docs/2023/04/21/GE-and-TSP-Checklists-2023-04-20.pdf>

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