EKPC Packages Executive Summary

PJM Critical Issues Fast Path – Resource Adequacy

August 16, 2023

Overview of EKPC's Three Packages & Advocacy Rationale

East Kentucky Power Cooperative (EKPC) is a generation and transmission owning electric cooperative that supplies the energy needs of sixteen distribution electric cooperatives in rural Kentucky. EKPC has a generation portfolio designed to satisfy the supply needs of its owner-member distribution cooperatives and meet the requirements of being a Load Serving entity in PJM. EKPC joined PJM ten years ago to harness the benefits of a broad, regional market. EKPC is concerned that, without reforms, the capacity market will no longer continue to provide the reliability assurances that it was created to provide.

Given those concerns, EKPC has been deeply engaged in the capacity market reform process and has invested significant resources and time in the development of market-based solutions to the region's evolving reliability concerns. Through the Critical Issue Fast Path (CIFP) for Resource Adequacy that the Board initiated in February 2023, EKPC has developed a comprehensive capacity market design approach (i.e., a complete alternative to the current Capacity Performance market design) that addresses the four critical issues that the Board raised:

1. Enhanced risk modelling to address winter risk and correlated outages in its reliability planning
2. Evaluation of potential modifications to the Capacity Performance construct and alignment of permitted offers to the risk taken by suppliers
3. Improved accreditation to ensure that the reliability contribution of each resource is accurately determined and aligned with compensation
4. Align Fixed Resource Requirement (FRR) rules with changes to RPM rules

The design: (a) is based on sound market and reliability principles, (b) is administratively and technically straight- forward to implement, and (c) provides a solid foundation for the PJM market going forward.

However, we appreciate that more discussion may be beneficial to stakeholder understanding of design details of such comprehensive proposals. Other proposals, including the IMM's and PJM's proposal similarly may benefit from additional stakeholder discussions. We believe it is appropriate to take additional time to have those discussions. Ultimately, though, we believe it will be necessary to adopt and implement a comprehensive design such as what we have proposed in **EKPC Package #2.**

While additional time may be beneficial to finalize a more comprehensive set of reforms, EKPC urges that we not delay making important, beneficial improvements I the interim. The near-term, beneficial improvements we propose are needed to ensure resource adequacy is assured and the benefits of the regional market realized. They also are relatively straightforward and non-controversial and should be adopted for the 2025/26 and 2026/27 Delivery Years. These improvements are proposed in **EKPC Package #1**.

EKPC Package #1 reforms the penalty rate and stop loss provisions of the current market design by basing them on the LDA Clearing Price and retains the PAI trigger recently approved by the Federal

Energy Regulatory Commission along with the other status quo elements of the Capacity Performance Market design. EKPC's advocacy of these reforms for the interim period (2025/26 and 2026/27) is not an agreement that penalty provisions are necessary to ensure resource performance but rather agreement that compromise may be necessary to ensure that resource adequacy is best assured for those delivery years. EKPC more fully articulates its view of the penalty provisions in a pending docket at FERC (EL23-74). These changes are consistent with the proposal that a supermajority of PJM members endorsed in May 2023. These changes should be implemented for the 2025/26 DY auction scheduled for June 2024. Upon finalization of these interim changes, PJM stakeholders can resume discussion of additional and more comprehensive capacity market reforms to implement in time for the 2027/28 DY.

Should a transition not be supported and the PJM Board determines at this time to adopt a complete package for immediate implementation, PJM also puts forth **EKPC Package #3** for consideration. **EKPC Package #3** which includes some common elements in the IMM Package #2 and PJM Package #2 and elements from EKPC Package #2. This package adopts the reformed risk modeling to establish the reserve requirement proposed by PJM, eliminates CP penalties, and adopts the simpler means of measuring and compensating resource performance in all hours of the year proposed by EKPC (and the IMM). This approach does not require (but could accommodate, if adopted) the complex marginal ELCC accreditation methodology PJM has proposed while ensuring appropriate accounting for each resource's contribution to reliability.

Importantly, regardless of whether a transition or comprehensive solution is adopted now, EKPC strongly believes that there are challenges to energy assurance that the capacity market is not capable of solving on its own. The work of the Electric –Gas Coordination Senior Task Force is critically important. Also, it is imperative that PJM operators utilize their current authorities to ensure that resources are deployed consistent with their advance-known constraints in order to provide the full reliability benefit to the region that they have committed to provide when undertaking a capacity obligation. As system operator, PJM is required to schedule the resources needed to reliably meet load in all hours. The portfolio of resources that PJM draws from are the capacity resources it procures through the market plus the assigned FRR resources. All qualified capacity resources offering into the market have limits on the way they can be used in operations, reflecting the physical attributes of each technology or fuel scheduling requirements. PJM is responsible for scheduling resources. Recognizing that PJM is best positioned to manage regional reliability risks and to deploy the portfolio of resources it has secured through the capacity market, PJM must respect the physical limits, including non-contract-related fuel access issues, start-times, and production profiles (for intermittent resources), of the qualified capacity that it accredits and clears in the capacity market and recognize these constraints schedule capacity resources to meet real-time load to ensure reliable operations. Consequently, should a capacity resource not be picked up in economics, but PJM operations determine additional resources are needed to address a likely reliability condition, posturing capacity resources, up to and including committing resources that need to secure multi-day fuel packages or with long notification and start times, is appropriate.

Additional Detail for EKPC Package #2 – a Complete Capacity Reform Design Alternative

Core Design Principles

EKPC's working definition of capacity is the planned for capability of a resource (physical asset) to deliver energy or provide ancillary services to firm load in each hour. The purpose of the capacity market, therefore, is to procure the lowest cost portfolio of capacity resources that can serve firm load in each hour while meeting the annual resource adequacy targets (i.e., measured using LOLE/EUE). The capacity market secures a portfolio of resources that in aggregate meets reliability target; individually, each resource does not have to perform through all potential events. The capacity market must also allow capacity resources the reasonable opportunity to recover their net going forward costs (the so-called missing money). Consequently, capacity resources must be able to manage and mitigate the risks they take on when assuming a capacity commitment; a highly punitive penalty structure is counterproductive.

EKPC's Concerns With PJM's Current and Proposed Market Design – Why EKPC Proposes EKPC Package #2

Capacity Performance

The RPM was developed as a complement to the energy market, ensuring resource adequacy and providing an opportunity to recover the so-called missing money. The CP model adopts punitive penalties that in practice have had little if any demonstrable impact on regional resource adequacy, but have materially increased the risk of taking a capacity obligation. Penalties are multiples of annual revenues received by resources. Winter Storm Elliot demonstrates that the penalty structure was successful in forcing resources into bankruptcy, which is not the outcome that best ensures regional reliability.[1] Although there were resources that "overperformed" and there was no need for involuntary load shedding, the reasons for non-performance varied (i.e., penalty incentives were irrelevant to some of the non-performance experienced) and there are no real expectation that most resources subject to penalties can make reasonable investments or contracting decisions to mitigate future exposure. There are limited things intermittent resources can do in any near term basis, for example, as firming likely would require investment in battery technology that may not exist and which would need to be studied in the PJM interconnection process.

Punitive penalties are not necessary. Properly functioning energy and ancillary service markets provide the right incentives. The energy and ancillary services markets account for most of the revenues earned by resources in the PJM markets. The pursuit of revenues in those markets provides strong incentives to perform in all hours, but particularly in hours of system stress when prices rise, and profits are very high. The capacity price is based on net-ACR, so total revenues assume that the resource will operate during such events and capture those revenues. An essentially random outage leading to non-performance of a capacity resource during an extreme event is very costly in terms of overall profitability and potential viability.

Effective Load Carry Capability (ELCC)

[1] Utility Dive, "Lincoln Power files for bankruptcy…" - URL

PJM has proposed to adopt marginal (ELCC) to accredit all capacity resources. Fundamentally, ELCC is a resource planning tool that measures how much load a system of generators can reliability serve at a selected reliability target (e.g., LOLE or EUE). Marginal ELCC specifically measures the incremental amount of load that can be served by the new system when a resource is added. As a planning tool ELCC is well-established and sound. As a means of establishing the amount of capacity a resource can sell into the market, it is fundamentally flawed.

- Marginal ELCC requires the planner to assume a base system against which to calculate the incremental load carrying capability. Since the purpose of PJM's capacity market is to procure the set of resources that will meet load three years hence, to accredit resources using marginal ELCC, the PJM planners will have to assume what is likely to clear to estimate their accredited values. The load carrying capability of the resulting system, and the individual contributions of each cleared resource may or may not match the assumptions and the clearing may be distorted due to the assumptions made.
- Marginal ELCC presents a black box to capacity sellers; it is highly assumption sensitive and computationally difficult. Its complexity rapidly increases with the addition of transmission constraints, conditional probabilities on modeled outage states, and stochastic production and loads.
- As proposed, the marginal ELCC accreditation values fail to distinguish resource performance capabilities by time of day. This approach leads to the illogical outcome that, for example, solar resources are expected to operate at night and are thus subject to penalties if a PAI were to occur in the night.

Diversified Portfolios for Diversified Needs

PJM's approach to capacity markets establishes a common set of obligations and accreditation rules for all resources. The implicit assumption is that all resources should be expected to operate through all operating conditions. EKPC asserts that this assumption is flawed and leads to the procurement of a portfolio that, while reliable, is likely more costly than necessary. PJM has wrestled with this issue and has recognized the challenges and cost implications of imposing firm fuel and strict winterization requirements on all resources. Rather, we assert that procuring a portfolio of resources structured to address normal and extreme conditions will provide a balanced and cost-effective solution. Beneficially, the approach that EKPC proposes would support resources with stored fuels and peaking resources now only allowed to operate under restricted "emergency" conditions.

Overview of the EKPC design – EKPC Package #2

1. **Reliability Risk Modeling**

   At a high level, EKPC and PJM's preferred approaches to modeling the region's reliability risks are similar. EKPC proposes to model resource adequacy assuming hourly granularity, including weather, ambient air reductions, production profiles, forced and planned outages. Unlike PJM, EKPC proposes to reflect locational deliverability constraints using a modified transmission system planning model topology and load flow. Risks associated with extreme (outlier) weather and fuel delivery force majeure will be modeled as emergency conditions.

2. **Resource Adequacy Requirement**

The reliability target will be based on annual Expected Unserved Energy, or EUE (magnitude) and Loss of Load Expectation, or LOLE (frequency). We propose that the market procure a portfolio consisting of two products: Base Capacity (BC) and Emergency Capacity (EC). The BC requirement is set to meet target LOLE/EUE assuming expected/normal weather, resource availability, production profiles, and the EC requirement is set to supplement the base requirement to ensure that the region meets target LOLE/EUE under extreme weather conditions and other identified outlier events.

BC requirement = hourly expected load + reserve margin$_B$
EC requirement = hourly extreme load – hourly expected load + reserve margin$_E$

3. Resource Qualification

All capacity resources must be fully deliverable to firm load. All capacity must demonstrate maximum dependable output (ICAP) via periodic testing. Qualified ICAP is limited to CIR value. All capacity meets NERC minimum requirements (EOP-012-1).

Emergency Capacity has additional qualification requirements. In addition to meeting all C requirements, EC must (1) demonstrate the ability to operate through extreme temp/humidity conditions (consider PJM's enhanced winterization concepts); (2) demonstrate the financial capacity to absorb non-performance penalties; (3) have a verifiable firm fuel source (e.g., on site fuel or firm fuel supply and delivery contracts)

Importantly, EC can be provided from the top end of a resource (recognizing that under extreme conditions on-line resources are most likely to continue to perform and are frequently postured for that reason) in a normally online state or from a resource in a normally off-line state. Finally, Emergency Capacity is intended to be technology neutral.

4. Resource Accreditation

A resource's accredited value is the maximum amount of capacity that it can offer into the capacity auction. All modeling and market clearing is performed hourly under our proposal. Hence, the accredited value is an accounting value that simplifies the process of making a capacity offer and performing capacity market settlements.

The accredited UCAP MW is the average of the hourly "Adjusted ICAP" values

Adjusted ICAP is the qualified ICAP modified to reflect weather correlated ambient air reductions and outages (thermal resources) or weather correlated production profiles (intermittent renewable resources) in each hour. Resources that qualify as BC and EC will have both BC and EC accreditation values. For existing resources, the adjustment parameters are based on historical data. For new resources, the adjustment parameters are based on like-class data until sufficient actual performance data is collected.

5. Market Clearing Mechanism

We propose fundamental changes to the clearing mechanism. We propose an annual market clearing model that ensures sufficient resources clear to meet firm load each hour, subject to

satisfying the annual EUE and LOLE targets. *The proposed clearing model has been built and tested for proof of concept.*

Each capacity market offer is (UCAP MW, $/MW-year). The unit-specific UCAP offers are translated into a set of daily 24-hourly Adjusted ICAP schedules using the planning data from the accreditation model. A resource that clears in any hour in the year gains a capacity obligation for the year; the highest cost resource cleared in any hour, sets the annual price for the market. The transmission topology is reflected in the market using an N-0 planning model that reflects expected transmission maintenance outages and upgrades.

The market will simultaneously clear the lowest cost set of resources that meet the BC and EC requirements in all hours. Resources will take a BC position or an EC position, not both. BC is purchased annually for annual positions; EC can be purchased in tranches (some discretion around timing and quantity). EC commitments are for 3-years periods.

6. Resource Performance Obligations and Compensation

Performance is measured in every hour of the year. A capacity resource is deemed to perform if it offers all its Available ICAP into the DA and RT energy markets. BC and EC resources are paid an amount equal to hourly Available ICAP x the applicable hourly capacity rate for all capacity properly offered into the DA and RT market. If a resource's hourly available ICAP matches its historical availability, then its annual capacity revenues will exactly match those expected coming from the auction.

Emergency capacity has stricter performance requirements. If EC is unavailable at any time during a dispatch day when emergency conditions occur, EC incurs a penalty calculated as 120 x the daily capacity rate x UCAP (after 3 non-performance events, removed as EC for the balance of the 3-year procurement period).

BC and EC resources may, prior to the DA market offer deadline, assign qualified replacement UCAP to meet an obligation; commercial arrangements are bilateral.

Importantly, a resource that correctly offers its available ICAP but is not committed or dispatched by PJM is paid for its capacity – irrespective of system conditions.

7. Fixed Resource Requirement (FRR)

FRR entities would have two requirements: BC and EC. An entity may choose FRR for one or both types of capacity—and for only a portion of either. Any requirement not satisfied through the FRR would need to be satisfied in the capacity market. For FRR, a penalty will apply to entities that do not provide the planned amount of capacity. Assigned BC or EC resources that are not available at all (or most of the capacity commitment period) will be charged a penalty of 1.5 times the capacity clearing price reflecting replacement cost. For EC, penalties for non-performance would be the equivalent of non-performance penalties for EC resources that cleared in the RPM, including, after three occurrences, being disqualified as EC. FRR may use qualified UCAP from their owned or contracted asset portfolio that have not been assigned or available in the market without a capacity obligation to cover a position short term or long term – arrangements must be made prior to the settlement period.