PJM Recommendations – Quadrennial Review

Cost of New Entry

Reference Resource for VRR Curve Purposes

Recommendation:
Shift the reference resource from the current natural gas-fired combustion turbine (CT) to a natural gas-fired combined cycle (CC). CC technical specifications:

- GE 7HA.02(CT), ST F-A650(ST):
- Configuration: Double Train 1x1 Single Shaft
- Net Summer ICAP(without Duct Firing): 1,030 MW
- Net Summer ICAP (with Duct Firing): 1,156 MW
- Power Augmentation: evaporative cooling
- Cooling System: dry air cooled
- Environmental Controls: selective catalytic reduction (SCR) and carbon monoxide catalyst
- firm gas transportation
- heat rate @ 6,369 Btu/kWh without duct firing
- heat rate @ 6,604 Btu/kWh with duct firing
- variable O&M @ $2.10/MWh

Rationale: The CC is economically viable with the largest amount of recent merchant entry and lower estimated Net CONE than the other candidate resources. Conversely, CTs continue not to be built and have a 20% higher Net CONE than the CC. A shift in the CC technical specifications from prior reviews includes configuration to 1x1 double-train single-shaft, dry air cooled cooling system, and firm gas transportation for fuel supply. There has been a shift in CC development within PJM from 2x1 configuration to 1x1. Additionally, double-train 1x1 CCs make up about 42% of capacity for 1x1 CCs that have been built, or are under construction, since 2018. The cooling system is assumed to be a closed-loop circulating water system with a multiple-cell dry air-cooled condenser. Recent trends of CCs under construction in PJM show a switch to air-cooled condensers, most likely because cooling towers have become more difficult to permit due to greater water consumption. For fuel supply, data shows that developers in PJM have shifted from installing dual fuel capability and are instead ensuring fuel availability through firm gas transportation contracts. Only 13% of CCs built since 2018 or under construction have installed fuel oil as a secondary fuel. A majority of CCs that have entered the market since the 2016/17 BRA have obtained some level of firm transportation service.

Escalation Rate used in Annual Update of Gross CONE

Recommendation: Adjust weighting of composite of cost estimates used in annual escalation update to CONE as per Brattle's recommended weighting of the components in the CC composite index based on 40% labor, 45% materials, and 15% turbine.

Rationale: Weighting more closely corresponds with the CC weighting of each component's contribution to the total cost of a new build.

Variable Resource Requirement Curve Shape

VRR Curve Parameters (Quantity)
Recommendation: Update existing curve with CC Net CONE values and shift the points on the curve to the left by the following percentages:

- Point A: 0.1%
- Point B: 0.2%
- Point C: 2.6%

Rationale: Updating the Net CONE values to a CC results in a left-shift of the existing curve due to the lower cost of a CC. PJM Stakeholders have voiced concerns of over-procurement in the capacity market. Shifting Point C to the left reduces the value of capacity procured beyond the reliability requirement, which lowers the risk of over procurement at a conservative rate. In addition to these recommended changes to the VRR Curve parameters, PJM has made significant changes to the load forecast to address over procurement.

VRR Curve Parameters (Price)
Recommendation: Increase the price cap at Point A on the VRR Curve from the greater of gross CONE or 1.5 * Net CONE to the greater of gross CONE or 1.75 * Net CONE.

Rationale: Increasing the potential price cap for Point A on the VRR curve from 1.5 to 1.75 times Net CONE will provide stronger pricing signals if a modeled LDA's clearing price falls between Point A and Point B on the VRR curve. This will not impact pricing below Point B on the VRR curve. Providing robust pricing signals will encourage Capacity Resources to enter PJM at the necessary rate to ensure the one-in-ten LOLE standard. In combination with a reduction in VRR curve quantity parameters, the increased price cap produces a steeper VRR curve that more strongly controls RPM quantity clearing outcomes, increasing certainty that sufficient quantity will be procured while guarding against over procurement. Sharper control over quantity outcomes may be advantageous in the future if there is increased uncertainty over new entrants' true net costs of new entry, driven by uncertainties in Gross CONE and/or E&AS revenues.

Energy & Ancillary Services Methodology

Determination of Net EAS for Reference Resource CC
Recommendation: Implement an optimized dispatch methodology to determine Net EAS revenues for a reference resource of a CC.

Rationale: The current methodology for dispatching the reference resource in the tariff applies only to a CT, and needs to be updated for a CC resource. The current peak hour block dispatch methodology, applied to a CC resource, simulates whether the resource will be dispatched in the day-ahead and real-time energy market in a 16 hour "peak" block (between hour ending 8:00 and hour ending 23:00) each day. The unit will be committed if the average LMP is greater than or equal to the cost to generate for at least eight hours during that block. This methodology does not capture the operating parameters of a CC as granularly as the optimized dispatch approach, which was originally developed in 2020 for PJM's implementation of a forward-looking energy and ancillary services offset[1]. The optimized method utilizes hourly day-ahead and real-time simulations to commit and dispatch the resource with the objective of maximizing its net energy and ancillary services revenues, subject to operating parameters and cost. The block peak-hour dispatch approach also omits ancillary services revenues except for cost-based reactive service. The optimized approach allows for co-optimization of the resource's ability to provide energy and ancillary services. The optimized dispatch methodology provides a more accurate representation of how CCs would be dispatched by PJM today.

[1] PJM Interconnection, L.L.C., Compliance Filing, Docket No. EL19-58-003 (Aug. 5, 2020)

EAS Offset Methodology Approach

Recommendation: Switch from a historical to a forward-looking EAS methodology to determine EAS Revenues. See matrix for technical specifications of the forward-looking EAS methodology.

Rationale: During its 2020 proceedings on reserve market design, FERC found that "a forward-looking methodology for determining the [EAS] Offset will allow changes to energy and ancillary services revenues stemming from energy market design modifications to be more readily incorporated into capacity market parameters and prices."[2] PJM evaluated a number of different approaches with support of stakeholders, the IMM and Brattle to develop a forward-looking EAS Offset approach that ensures energy and reserve market design changes would be incorporated in the capacity market.[3] The forward-looking methodology provides a better reflection of what gas and electric prices would be in future delivery years, and is more consistent with commercial expectations of the revenue a resource can reasonably expect to earn in PJM's energy and ancillary services markets. The historic EAS methodology does not account for the current changes to the markets or pricing. In its November 2020 Order, FERC found this approach to be just and reasonable. PJM is proposing to use the same approach with a few additional adjustments based on the Quadrennial Review CONE analysis performed by Brattle[4].

Recommended Gas Hub Changes

Recommendation: Update EKPC natural gas hub mapping from Columbia-App TCO to MichCon.

Rationale: Due to lack of liquidity at Columbia-App TCO, MichCon provides a better representation of gas prices in EKPC.

Recommended Ancillary Services Price Input Changes

Recommendation: Scale historical hourly synchronized and non-synchronized reserve prices by forward energy prices, and remove regulation from the EAS calculation methodology.

Rationale: Scaling historical hourly synchronized and non-synchronized reserve prices utilizing forward energy prices is intended to consistently capture the relationship between energy and reserve prices. In the 2020 implementation, this scaling was determined to be a second phase approach after a relationship between reserve market pricing reforms and energy prices could be established. The removal of regulation revenues is recommended because of the small size of the market and new entrants not expecting to earn significant revenues in the regulation market.

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[2] *PJM Interconnection, L.L.C.*, 171 FERC ¶ 61,153 (2020) at P 320

[3] PJM Interconnection, L.L.C., Compliance Filing, Docket No. EL19-58-003 (Aug. 5, 2020)

[4] https://www.pjm.com/-/media/committees-groups/committees/mic/2022/20220422-special/brattle-pjm-cone-2026-27-report---final.ashx