White Paper

Insights from PJM's 2020/2021 Capacity Auction

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Shareables

- On a demand weighted average, the 2020/2021 PJM capacity prices were approximately the same as the 2019/2020 prices, with greater variation across sub-regions.
- Factors preventing higher RTO prices included lower demand forecasts, higher than expected Demand Response, low penalty expectations, and local price separation.
- Strong price separation was seen across PJM regions (Local Delivery Areas), reflecting differences in supply mix, gas prices, and the expected energy margins of local resources.

Executive Summary

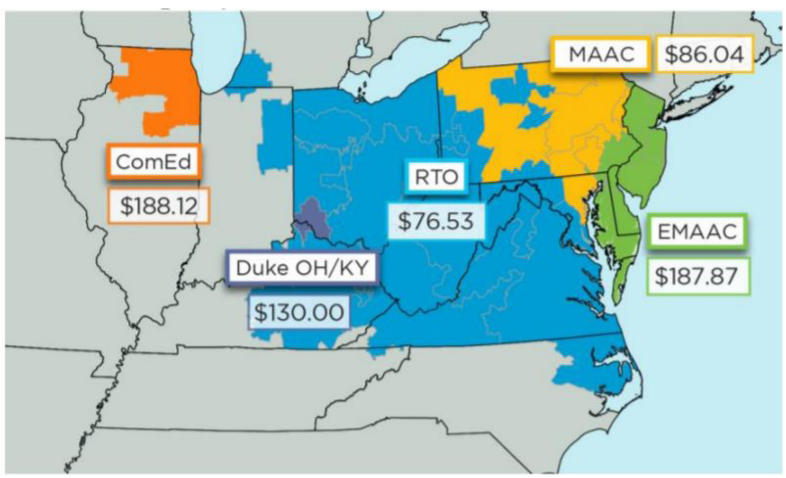
PJM's 2020/2021 Base Residual Auction (BRA) was the first auction fully implementing the Capacity Performance (CP) rules. It was initially expected that prices would increase from this rule change when it was introduced in 2014, but this has thus far not been realized. The factors that prevented higher prices from being seen across PJM were lower demand forecasts, higher than expected Demand Response (DR), low expectations regarding likely penalties, and local price separation. While the RTO as a whole saw lower prices, EMAAC saw significantly higher prices in part due to lower energy margin expectations in the region.

Auction Overview

On May 23, 2017, PJM released the results of the Base Residual Auction (BRA) for the 2020/2021 delivery year. PJM's 2020/2021 BRA was the first auction fully implementing the Capacity Performance (CP) rules. The goal of CP is to increase reliability by having year-round obligations and introducing penalties for non-performance. It was initially expected that prices would increase from this rule change when it was introduced in 2014, but this has thus far not been realized. On a demand-weighted-average basis across PJM, capacity prices for the 2020/2021 capacity period are only slightly higher than for the 2019/2020 period ($121/MW-day vs. $116/MW-day).

While the demand-weighted average price was similar, there was greater regional variation in prices in this auction. RTO prices declined 23%, putting them at $76.5/MW-day, lower than the historical average RTO prices of $99/MW-day. MAAC and Commonwealth Edison (ComEd) both saw price declines of approximately $14/MW-day, representing an 11% and decline 8% respectively. Higher prices were seen in this auction in the EMAAC and DEOK regions. The highest prices overall were seen in the easternmost and westernmost regions, EMAAC and ComEd. The factors that prevented higher prices from being seen across PJM were lower demand forecasts, higher than expected Demand Response (DR), low expectations regarding likely penalties, and local price separation.

EXHIBIT 1. PJM 2020/2021 BASE RESIDUAL AUCTION RESULTS



Source: PJM

Downward Price Pressures

Prices were largely expected to increase this year due to the implementation of the 100% CP Product requirement. In the previous auction, PJM cleared 27 GW of lower cost Base Product capacity. With this product eliminated in this auction, it was expected that PJM would need to clear a large amount of capacity that had a high bid to be CP Product Resource. However, this was unrealized at the RTO-level in this auction. ICF believes this is because of PJM's lower demand forecast, resources' low penalty expectations, higher than expected DR, and the local price separation.

Lower demand forecast: PJM has continuously decreased its peak demand projections over the past three auctions, putting downward pressure on prices. In the most recent revision in the *2017 PJM Load Forecast Report*, PJM decreased projected RTO peak demand in 2020 by 3.2 GW (2%). PJM attributes this decline primarily to worsened economics, solar growth, and forecast methodology adjustments. In combination with other, more minor, changes to the auction parameters, the PJM RTO reliability requirement is 2.7 GW lower than the previous auction after accounting for the Fixed Reliability Requirement load. All else equal, lower demand results in lower prices. Yet, this alone cannot explain the drop in the clearing prices this year as offered supply decreased by nearly the same amount (2.2 GW).

Low penalty expectations: The low expectations of penalties is an important issue for generators' bids. The CP Product represents a two-part capacity payment system in which resources receive their auction-based revenue in addition to bonuses/penalties based on their performance. Under this system with higher price caps, generators are allowed to include in their bids a premium for the additional costs necessary to prevent outages or hedge against the risk of penalties. The current penalty rate, however, is set at a level such that generators may not perceive it to have any "bite". This may be one of the key factors offsetting the elimination of the lower cost Base Product this auction.

The penalty rate is low because of the scarcity hour assumption PJM has placed into its calculation.[1] PJM currently assumes 30 scarcity hours in the penalty rate calculation, based on the number of hours with emergency actions during the 2014 Polar Vortex. However, this year was anomalous due to the extreme weather, and scarcity hours for PJM RTO have averaged nine annually since 2005 and zero since 2014. This data strongly supports the view that PJM has overstated the expected hours of penalty, and hence, understated the penalty.

In another, more complicated perspective, lower penalties directly drives lower capacity prices. Bids are conceptually the maximum of expected net fixed costs and the opportunity cost of giving up the opportunity of being an energy only resource. Resources not cleared in the capacity market, i.e. energy-only resources, like resources with capacity commitments, have the opportunity to earn revenue through performance bonuses during performance assessment hours. By committing in the capacity market, resources have a smaller chance of performing above their non-zero commitment, and thus have a smaller probability of earning bonuses. For this reason, one can consider that a soft floor in the capacity market should be the value of this opportunity cost. With low penalty rates and low expectations of scarcity hours, this soft floor is lower.

In its June 9, 2015, order establishing capacity performance, FERC indicated that the PJM penalty rate is inadequately supported (PJM did not offer sufficient historical data or grid modeling) and requires PJM to report on this issue this year.[2] If PJM revisits and decreases their scarcity hour assumptions, bids and capacity prices could increase.

[1] Penalty Rate = Net CONE x Balancing Ration / Assumed Scarcity Hours

[2] PJM Interconnection, L.L.C., 151 FERC ¶ 61,208 (2015) (Capacity Performance Order).

Higher than expected demand response: Interruptible load decreased by approximately 2 GW from 10.4 GW to 8.4 GW. This includes 558 MW of price responsive demand which was included in the auction for the first time. It was generally expected that more Demand Response would have left the market based on how this resource type bid in the previous auction. In the 2019/2020 Base Residual Auction, 6.7 GW of DR bid as Base and did not submit CP bids. This was thought to indicate that these resources did not have the capability to perform year round and be a CP resource. There are three possible explanations for this: new DR programs with annual capabilities could have been formed, existing DR programs could have expanded their scope to ensure annual reliability, or existing resources with summer-only deliverability may have bid as CP, taking on additional penalty risk.

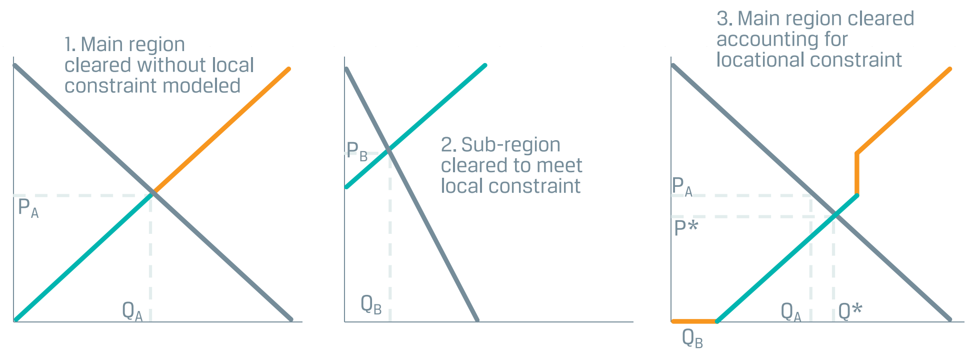
PJM does not release sufficient detail to fully investigate this. There is a combination of utility and non-utility providers, and the contracts and regulated arrangements for these DR programs are not public. However, the low expectation of penalties for non-performance seems to be a large driver.

While DR in PJM is down from its peak in the 2015/2016 auction (15 GW), it still represents a relatively larger share of capacity than in other northeastern markets. It represents 5% of the total demand and over half of the total reserves. In contrast, in ISO-NE, interruptible load in the most recent auction totaled 420 MW, or approximately 1% of demand.

Local price separation: Local price separation can also depress prices for the rest-of-RTO. Thus, the additional price separation in this auction from the MAAC and DEOK, and the greater premium for EMAAC may have contributed to the lower RTO prices. PJM's capacity market design includes a series of nested sub-regions, which can separate in price from the rest of the market in order to meet their individual capacity requirements. When a region separates in price, it causes capacity to clear the market out of merit order, which can result in depressed clearing prices in the broader region. The capacity that cleared out of merit order can displace cheaper, marginal capacity, which allows other regions to meet their capacity requirements at a lower price than would be otherwise possible. The magnitude of this effect depends on the amount of extra capacity cleared in the region(s) that separated in price, and the shape of the supply curve.

Exhibit 2 illustrates this dynamic in a simplified market with a single sub-region. When the sub-region is not modeled, the main region clears Q_A of capacity at a price of P_A. None of the cleared capacity comes from the sub-region. When the sub-region is modeled, it clears Q_B of capacity at a price of P_B. This capacity must then clear in the main region, even though it is out of merit order. When this capacity is cleared in the main region, a total of Q* of capacity clears at a price of P*. Note that this price is below the initial clearing price of P_A from when the sub-region was not included in the model, while the total capacity cleared is above the initial quantity of Q_A. However, less capacity is cleared from the main region, as it has been displaced by the more expensive capacity from the sub-region that cleared out of merit order.

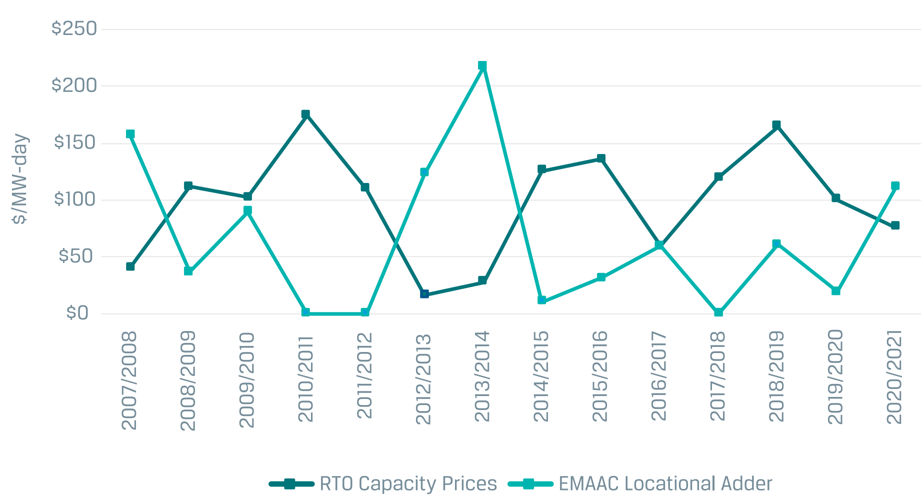
EXHIBIT 2. ILLUSTRATION OF LOCATIONAL CONSTRAINTS ON AUCTION CLEARING RESULTS



Source: ICF

This mechanism can be seen in the historical relationship between EMAAC and RTO prices. As shown in Exhibit 3, there is an inverse correlation between the RTO capacity prices and the EMAAC locational price adder. The higher the price adder for EMAAC is, the lower the RTO price.

EXHIBIT 3. HISTORICAL RTO CAPACITY PRICES AND EMAAC LOCATIONAL PRICE ADDER



Source: PJM

Additional Notes on the 2020/2021 Auction Results

EMAAC: EMAAC saw a 56% increase in prices this auction to $187/MW-day. Part of this uplift was likely from the transition to the 100% CP Product, but declining energy margin expectation in the region could also have bolstered prices. Exhibit 4 summarizes forward price projections before last year's auction for the 2019/2020 capacity period compared to those trading over the last twelve months before the 2020/2021 auction. Both forward energy prices and forward gas prices are down year-over-year in EMAAC. The drop in energy prices outpaced the drop in gas prices, causing the forward spark spread in EMAAC to decrease by over 30% from last year. This large spark spread decrease indicates lower potential energy margins for gas-fired generators in EMAAC, which will make them more dependent on capacity payments to recover their going-forward costs. This increased dependence results in higher capacity market bid prices. EMAAC is particularly sensitive to changes in gas unit's expected energy margins, as gas-fired generation makes up a large portion of EMAAC capacity.

EXHIBIT 4. EMAAC ILLUSTRATIVE SPARK SPREADS

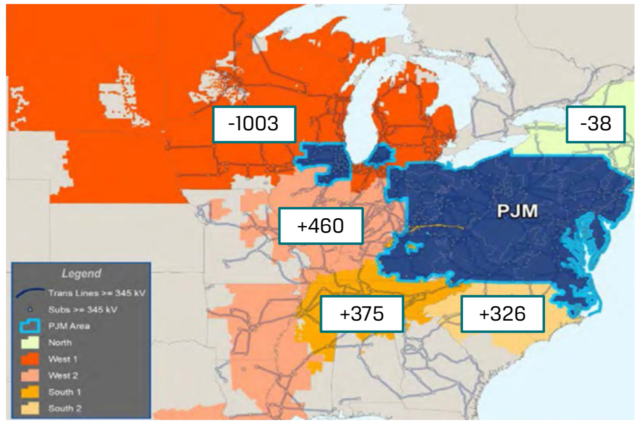
	All-Hours Energy Price ($/MWh)	Gas Price ($/MMBtu)	Spark Spread ($/MWh)
2019/2020 Forwards (traded LTM before auction)	36.2	3.42	11.9
2020/2021 Forwards (traded LTM before auction)	31.2	3.24	8.2
Delta	-13.7%	-5.3%	-31.0%

Note: **1.** Energy price reflect PSEG forwards and gas prices reflect Transco Zone 6 Non-NY. **2.** Forward prices reflect the auction period averages (June to May) traded during the last twelve months before the auction. **3.** Spark spreads assume a heat rate of 7,100 Btu/kWh.

Source: SNL

Imports: The total level of imports in this auction was similar to the 2019/2020 auction; however, the location of the imported resources changed. In total, only 121 MW more imports cleared this auction than last year (3,997 MW vs 3,876 MW). Exhibit 5 illustrates the change in cleared import capacity by external source zone. As seen in this exhibit, imports declined from the northwest and increased in the zones west and south of PJM. First, this is indicative of the tightening supply/demand balance in Northern MISO. Second, the location of these imports could be key for next auction if FERC accepts PJM's proposed rules regarding imports. These rules would increase requirements for imported resources to ensure they are "operationally deliverable" into PJM. However, PJM has not yet clearly specified what this requirement will constitute. If these cleared imports are electrically distant to PJM, they may not be able to participate in next year's auction.

EXHIBIT 5. CHANGE IN IMPORT CAPACITY BY EXTERNAL SOURCE ZONES



Source: PJM, ICF

Going Forward Supply Dynamics

Retirements: With 18.2 GW of uncleared capacity, ICF expects significant retirements in the next two to four years. There was the same level of uncleared capacity in the last auction, indicating that many of these plants could be uncleared for multiple years.[3] In the 2019/2020 auction, 7.7 GW of the uncleared capacity was coal-fired. Uncleared capacity has been generally increasing since the implementation of the BRA. The market can only hold out for so long; units will need to retire soon for the market to become rational. Exelon has already announced that it will retire its uncleared Three Mile Island nuclear facility unless the state of Pennsylvania intervenes.

Combined-Cycle Builds: New combined-cycle capacity is likely to slow in the next several auctions. By 2020, 18.5 GW of combined-cycle capacity will become operational in PJM. While increasing gas prices may mitigate downward pressure from these builds, the impact of this on the market has not yet been realized. Capital is drying up for new builds, and with low capacity prices and declining spark spreads, many of the projects currently under development may be put on hold. Some developments could still be profitable (brownfield sites, sites with access to low-cost gas), thus ICF projects a handful of projects to come online in the 2021 to 2023 time period. Over the long term, there will likely need to be a recovery of the capacity prices to induce further new builds.

Subsidized Resources: PJM is currently exploring changes to the capacity market participation rules for resources that receive subsidies. This is a critical issue that needs a solution because of the emergence of out-of-market payment proposals for existing facilities. For example, there has been a growing trend of nuclear units receiving state subsidies. The state of Illinois passed legislation that can provide payments to the Quad Cities nuclear facility, and Pennsylvania might do the same for Three Mile Island. The role of subsidized resources in the capacity market is an evolving issue and could change market dynamics in PJM as soon as the next auction for the 2021/2022 period.

[3] More details on this will be available in the Independent Market Monitor's analysis

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