

## ***PJM Shortage Pricing Proposal Matrix***

| <b>Component:</b>                       | <b>Proposal:</b>  | <b>Details:</b>  |
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| <b>General Methodology</b>              | <ul style="list-style-type: none"> <li>• Real-time joint optimization of energy and reserves</li> <li>• Integration of operating reserve demand curve for all market-based reserve products</li> </ul>                    | <ul style="list-style-type: none"> <li>• Inflexible reserve resources including synchronous condensers and demand resources will be committed for reserves on an hourly basis and locked in during the operating hour</li> <li>• Online generators following dispatch will be dispatched for energy and reserves in real-time as system conditions dictate</li> <li>• Transparent energy and ancillary service price calculations that include the impacts of lost opportunity and product substitution costs</li> </ul> |
| <b>Reserve Products</b>                 | <ul style="list-style-type: none"> <li>• 10-minute Synchronized Reserves</li> <li>• 10-minute Non-Synchronized Reserves</li> </ul>  | <ul style="list-style-type: none"> <li>• Synchronized plus Non-Synchronized Reserves equal Primary Reserves</li> </ul>   |
| <b>Reserve Requirements</b>             | <ul style="list-style-type: none"> <li>• Primary Reserves = 150% of the largest system contingency</li> <li>• Synchronized Reserves = 100% of the largest system contingency</li> </ul>                                   | <ul style="list-style-type: none"> <li>• Synchronized Reserve requirement is nested within the Primary Reserve requirement</li> <li>• These requirements will be enforced in each reserve area/region.</li> </ul>  |
| <b>Reserve Regions</b>                  | <ul style="list-style-type: none"> <li>• For both Primary and Synchronized Reserves <ul style="list-style-type: none"> <li>○ RTO Reserve Area</li> <li>○ Mid-Atlantic plus Dominion Reserve Region</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• Locational nesting of the Mid-Atlantic plus Dominion Reserve Region within the RTO Reserve Area</li> <li>• A minimum quantity (currently 418 MW) of Non-Synchronized Reserves must be located within Dominion Zone.</li> </ul>  |
| <b>Regulation Commitment/Deployment</b> | <ul style="list-style-type: none"> <li>• Regulation commitment and deployment will largely remain unchanged</li> </ul>  | <ul style="list-style-type: none"> <li>• Regulating resources will be committed by 30 minutes prior to the operating hour and will be locked for the entire hour.</li> </ul>   |

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| <b>Market Pricing Periodicity</b>                              | <ul style="list-style-type: none"> <li>5-minute marginal prices for energy, reserves and regulation calculated simultaneously</li> </ul>  | <ul style="list-style-type: none"> <li>5-minute prices will be averaged over the course of an hour for settlement purposes</li> </ul>   |
| <b>Penalty Factors and Shortage Prices and Transition Plan</b> | <ul style="list-style-type: none"> <li>\$850/MWh enforced for both Primary and Synchronized Reserves in all modeled regions.</li> <li>\$850/MWh penalty factors with a \$1,000/MWh offer cap will result in \$2,700/MWh shortage prices (+/- losses and congestion).</li> <li>PJM transition proposal that would work up to \$850/MWh penalty factors over 3 year period</li> </ul> | <ul style="list-style-type: none"> <li>\$850/MWh allows full utilization of all assets within PJM to meet energy and reserves needs and is consistent with empirical and historic analysis.</li> <li>In proposed transition to arrive at \$850/MWh penalty factors, PJM has proposed the following <ul style="list-style-type: none"> <li>Year 1, \$250/MWh penalty factors, \$1500/MWh maximum energy price</li> <li>Year 2, \$400/MWh penalty factors, \$1800/MWh maximum energy price</li> <li>Year 3, \$550/MWh penalty factors, \$2100/MWh maximum energy price</li> <li>Year 4, full \$850 penalty factors, \$2700/MWh maximum energy price</li> </ul> </li> <li>Transition mechanism was put in place to allow PJM and stakeholders to gather operating experience with the new dispatch and pricing mechanisms without having the full pricing implications.</li> </ul> |
| <b>Emergency Procedures and Pricing</b>                        | <ul style="list-style-type: none"> <li>PJM has proposed that emergency procedures impact prices.</li> </ul>   | <ul style="list-style-type: none"> <li>Emergency generating capacity, demand response and purchases from external areas should be eligible to set price.</li> <li>Emergency procedures like a voltage reduction or manual load dump will result in prices consistent with a shortage of all reserve products in the reserve region where the emergency action was initiated.</li> </ul>   |
| <b>Emergency DR Deployment</b>                                 | <ul style="list-style-type: none"> <li>In general no change from the status quo deployment by zone and lead time.</li> <li>Measures implemented to avoid frequent</li> </ul>  | <ul style="list-style-type: none"> <li>Once a zone has been deployed, it will move to the bottom of the list for deployment during the next event. However, if system conditions require it, a single zone may be called multiple times in a row.</li> </ul>  |

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|                                    | deployment of a single zone.  |  |
| <b>Emergency DR Data Reporting</b> | <ul style="list-style-type: none"> <li>• CSPs will submit aggregated zonal level information for all of their resources by lead time in each zone.</li> </ul>   | <ul style="list-style-type: none"> <li>• CSPs will submit the following information: <ul style="list-style-type: none"> <li>○ Total load available to be curtailed</li> <li>○ Total load already being curtailed</li> <li>○ Total load remaining that can be curtailed (should be the difference between the two above)</li> </ul> </li> <li>• This information will be submitted in the following frequency: <ul style="list-style-type: none"> <li>○ Once per month for non-summer months</li> <li>○ Once per day during summer months</li> <li>○ Once per hour once an emergency alert has been issued.</li> </ul> </li> </ul>            |
| <b>Day Ahead Hedging</b>           | <ul style="list-style-type: none"> <li>• PJM has proposed to allow offer caps commensurate with the annual maximum shortage price for virtual bids and non-capacity demand response resources to allow Day Ahead prices to match real-time.</li> <li>• In separate options PJM has proposed to change the definition of fixed demand bids globally and under certain conditions to protect load customers.</li> </ul> | <ul style="list-style-type: none"> <li>• Option 1: <ul style="list-style-type: none"> <li>○ Raise offer caps for virtual bids and non-capacity demand response.</li> <li>○ No changes to fixed demand bids.</li> </ul> </li> <li>• Option 2: <ul style="list-style-type: none"> <li>○ Raise offer caps for virtual bids and non-capacity demand response and treat fixed demand bids as price-sensitive at \$1,000/MWh all of the time.</li> <li>○ This would require explicit submission of a price sensitive demand bid at prices above \$1,000/MWh to ensure hedging when the Day Ahead price exceeds \$1,000/MWh.</li> </ul> </li> </ul> |

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|  |   | <ul style="list-style-type: none"> <li>• Option 3: <ul style="list-style-type: none"> <li>○ Raise offer caps for virtual bids and non-capacity demand response and treat fixed demand bids as price-sensitive at \$1,000/MWh only during shortages of Day Ahead Scheduling Reserves.</li> <li>○ This would require explicit submission of a price sensitive demand bid at prices above \$1,000/MWh to ensure hedging when the Day Ahead price exceeds \$1,000/MWh when Day Ahead Scheduling Reserves are short.</li> </ul> </li> </ul> |
| <b>Revenue Offset Mechanism in RPM</b> | <ul style="list-style-type: none"> <li>• Maintain today's existing mechanism.</li> </ul>  | <ul style="list-style-type: none"> <li>• 3-year historic average offset for the calculation of Net CONE</li> <li>• 3-year historic average market revenues used to calculate Market Seller Offer Caps</li> </ul>   |
| <b>Regulation Prices</b>               | <ul style="list-style-type: none"> <li>• PJM has proposed the removal of the shoulder hour lost opportunity cost from the regulation clearing price calculation only</li> </ul> | <ul style="list-style-type: none"> <li>• The nature of a 5 minute marginal prices for regulation will make it impossible to incorporate this into the clearing price. The shoulder hour opportunity cost will remain as part of regulation but for after-the-fact opportunity cost purposes only.</li> </ul>   |