



# Quadrennial Review of VRR Curve Parameters: PJM Preliminary Recommendations

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- In accordance with the Tariff, PJM staff has developed preliminary recommendations based on review of the analysis and reports prepared by The Brattle Group with regard to:
  - Cost of New Entry (CONE)
  - Shape of the Variable Resource Requirement (VRR) Curve
  - Net Energy & Ancillary Services Revenue (E&AS) Offset methodology
- Preliminary recommendations focused on ensuring PJM maintains adequate resources to meet reliability requirements at a reasonable cost
- Preliminary recommendations used to kickoff discussion with stakeholders

- Adopt GE Frame Model 7HA.02 CT (320 MW) combustion turbine (CT) as the Reference Resource
- Adopt updated CONE values using GE Frame Model 7HA technology
- Adopt updated weighting of the Bureau of Labor Statistics (BLS) composite cost index used in the escalation of CONE each year
  - Labor: 20%, Materials: 55% (was 50%), Turbine: 25% (was 30%)

- Recommendation: Adopt Single GE Frame Model 7HA.02 CT (320 MW)
  - Currently two GE Frame Model 7FA CTs, 190 MW x 2 (380 MW)
- Rationale:
  - Representative of a peaking unit in the energy market that derives a significant portion of its revenues from the capacity market
  - Minimizes exposure to short-term energy revenue offset volatility
  - Continues to have lowest capital costs and shortest time to market



# CONE PJM Preliminary Recommendations: Adopt Updated CONE Values

- Adopt updated CT CONE values (\$/MW-Year)

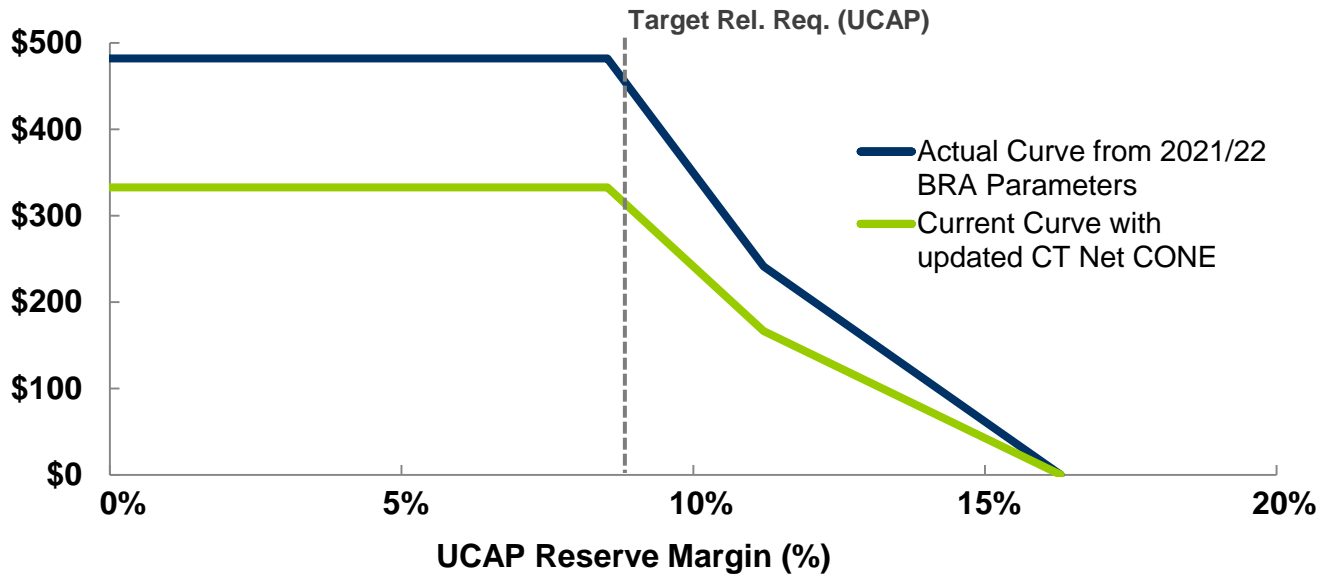
|                             | <b>EMAAC</b>     | <b>SWMAAC</b>    | <b>Rest of RTO</b> | <b>WMAAC</b>     |
|-----------------------------|------------------|------------------|--------------------|------------------|
| 2021/22 Auction Parameter   | \$133,144        | \$140,953        | \$133,016          | \$134,124        |
| ...Escalated to 2022/23     | \$136,900        | \$144,900        | \$136,700          | \$137,900        |
| <b>Updated 2022/23 CONE</b> | <b>\$106,400</b> | <b>\$108,400</b> | <b>\$103,000</b>   | <b>\$103,800</b> |
| Difference from Prior CONE  | -22%             | -25%             | -25%               | -25%             |

- Continue use of dual fuel and emissions control costs in CONE modeling for all areas, including Rest of RTO
  - Selective Catalytic Reduction (SCR)
  - Carbon Monoxide (CO) catalyst



# Shape of the VRR Curve PJM Preliminary Recommendations

- Recommendation: Maintain existing CT-based VRR curve, updated with CT Net CONE values
- Rationale:
  - Meets 1-in-10 LOLE objective on average and under stressed conditions
  - Balances reliability and overall costs, particularly in the face of changing market conditions (e.g. estimated 23,000 MW of capacity at risk in 2017 SOM)



## RTO Net CONE (\$/MW-Day UCAP)

|                  |       |
|------------------|-------|
| 2021/22 BRA (CT) | \$322 |
|------------------|-------|

|                                  |              |
|----------------------------------|--------------|
| <b>2022/23 Brattle Est. (CT)</b> | <b>\$222</b> |
|----------------------------------|--------------|

|            |      |
|------------|------|
| Difference | -31% |
|------------|------|

- Use median of zonal E&AS Offsets for RTO and multi-zone LDAs
- Update natural gas pricing hubs for 6 zones
- Use sum of median monthly revenues for each zone
- Include a 10% cost adder
- Update Reference Resource characteristics and costs

- Recommendation: Update the methodology for determining the Net E&AS Offset for each multi-zone LDA and the RTO to use the median of Net E&AS Offset values across all zones residing within the region
- Rationale:
  - Median provides a reasonable E&AS Offset for CTs located within the LDA or RTO, and dampens the influence of outliers when compared to the average
  - Updating the RTO methodology will help ensure consistency between electricity and gas prices, and eliminate prices against which no actual resource would be dispatched





# E&AS Offset PJM Preliminary Recommendations: Update Natural Gas Pricing Hubs

- Recommendation: Update natural gas pricing hubs for the 6 zones indicated below

| <b>Zone</b> | <b>Current Hub</b>    | <b>Recommended Hub</b> |
|-------------|-----------------------|------------------------|
| APS         | Columbia-APP/TCO Pool | Dominion-South         |
| DUQ         | Columbia-APP/TCO Pool | Dominion-South         |
| PENELEC     | Dominion-North        | Transco-Leidy Line     |
| PEPCO       | Transco-Z6 (non-NY)   | Transco-Z5 Div         |
| PPL         | TETCO M3              | Transco-Leidy Line     |
| PSEG        | Transco-Z6 (NY)       | Blend Z6 (NY/non-NY)   |

- Rationale: Recommended hubs are more reflective of the gas prices for generators in that zone



# E&AS Offset PJM Preliminary Recommendations: Monthly Median Net Energy Revenues

- Recommendation: Use sum of median monthly revenues from last three calendar years
  - Currently using average annual revenues from last three calendar years
- Rationale:
  - Less volatile year-over-year E&AS Offset by dampening distortion caused from single anomalous month of unusual weather or fuel market conditions

- **CONE**
  - Adopt GE Frame Model 7HA CT as the Reference Resource
  - Update CONE values
  - Adopt updated weighting of BLS composite cost index
- **Shape of the VRR Curve**
  - Maintain the current CT-based VRR curve shape for RTO and LDAs
- **E&AS Offset**
  - Use median of zonal E&AS Offsets for RTO & multi-zone LDAs
  - Update natural gas pricing hubs for 6 zones
  - Use sum of median monthly revenues for each year
  - Include a 10% cost adder
  - Update Reference Resource characteristics and costs

- PJM's Preliminary Recommendations by May 15, 2018
  - Posted April 24, 2018
- PJM Member Vote by August 31, 2018
- FERC Filing by October 1, 2018
  - Required for modifications approved by the PJM Board

- MIC and MIC Special sessions (Apr 25 – Jul 27)
  - Brattle presentation on Apr 25, 2018
  - Polling throughout
- MRC/MC vote\* on Aug 23, 2018
  - PJM's recommendations
  - packages > 50% approval at MIC
- PJM Board Review / FERC Filing by Oct 1, 2018

\* MC conference call date TBD

# Appendix



# Summary: Brattle & PJM's Preliminary Recommendations

| CONE Recommendations   | E&AS Recommendations  | VRR Curve Recommendations  | Ancillary Recommendations  |
|--|---|--|--|
| <b>Update turbine technology to GE 7HA</b>   | Consider adopting CC as reference resource  | System   | Consider defining local reliability objectives in terms of normalized unserved energy                                      |
|  | Adopt a forward-looking CC E&AS calculation methodology   | CC-based VRR Curve (Curve 'E') <ul style="list-style-type: none"> <li>• Left-shift curve</li> <li>• Alternate price cap</li> </ul> |  |
| <b>Adopt updated CONE estimates</b> <ul style="list-style-type: none"> <li>• <i>PJM: Agree, except CT for CONE Area 3 (include SCR and CO Catalyst)</i></li> </ul> | <b>Use median Net E&amp;AS across all zones to determine RTO Net E&amp;AS offset</b>  | CT-based VRR Curve (Curve 'B') <ul style="list-style-type: none"> <li>• Left-shift curve</li> </ul>                                | Consider alternatives to the “nested” LDA structure  |
|  | <b>Calibrate historical E&amp;AS estimates to reflect plant actuals</b>   | Local  |  |
| <b>Adjust CONE annually to account for bonus depreciation unit its phased out</b>  | <b>Update Reference Resource Operating Characteristics and Costs</b>  | Ensure the LDA price cap is at least 1.7 x Net CONE  | Evaluate options for increasing stability of capacity emergency transfer limits (CETL)                                     |
|  | <b>Update natural gas pricing hubs for six zones</b>  | Impose a minimum curve width equal to 25% of CETL  |  |
| <b>Adjust weighting of composite of cost estimates for annual CONE updates</b>   | <b>Consider applying a 10% cost offer adder</b>   |  | Develop reliability modeling to simultaneously assess system and locational reliability risks and account for correlations |
|  | Include an estimate of CP performance payments  |  |  |
|  | Consider the elimination of all transportation adders   |  |  |
| <u><b>Additional PJM recommendations:</b></u>  | <u><b>Additional PJM recommendations:</b></u> <ul style="list-style-type: none"> <li>• <i>Use sum of median monthly revenues from last three calendar years rather than average annual revenues from last three calendar years</i></li> </ul> | <u><b>Additional PJM recommendations:</b></u>  | <u><b>Additional PJM recommendations</b></u>   |