PJM Recommendations – Quadrennial Review

Cost of New Entry

Turbine Technology
Recommendation: Update the turbine technology used to determine CONE values for both combustion turbine ("CT") and combined cycle ("CC") plants, from GE Frame Model 7FA to GE Frame Model 7HA.

Rationale: Brattle selected 7HA turbines due to project development trends, improved efficiency, and lower costs. Over half of the CC plants installed or under construction in PJM since 2014 have been H/J class turbines, and all CCs cleared in the 19/20 and 20/21 BRAs are installing H/J class turbines. Brattle's review of recent orders for GE turbines shows that future CCs are almost exclusively using the H-class turbine. Although there is limited new frame-type turbines proposed in single-cycle configuration, both the F and H are being considered for development. The 7HA is proposed for development at two sites in ISO-NE and CAISO. The 7HA heat rate and costs on $/kW basis are more attractive and is therefore a reasonable choice for the CT reference resource in PJM.

Reference Resource for VRR Curve Purposes
Recommendation: Adopt a GE Frame Model 7HA combustion turbine with duel fuel capability and SCR as the Reference Resource in all CONE areas.

Rationale: A CT is the appropriate reference resource for the capacity market design because it has the lowest capital cost, provides the shortest time to market, and derives the most significant portion of its revenue from the capacity market as compared to other resources. The fact that the CT receives the smallest amount of its revenue from the energy market means that its Net CONE value is the least likely to be significantly perturbed by potential changes in energy market prices. Thus, certainty is provided through the use of a peaking unit as reference resource because it minimizes the exposure to short-term energy revenue offset volatility. Also, PJM believes that maintaining the same technology type provides market stability and avoids perceived opportunistic switching to units with more favorable economics in any given year. As well, providing certainty in reference technology promotes continued investment in PJM's capacity market. This reasoning is even more critical in the face of significant changes in the CONE detailed in the Brattle reports.

It is also worth noting that the neighboring capacity markets of the New York Independent System Operator ("NYISO") and the Independent System Operator of New England ("ISO-NE") both found it advantageous to employ a CT as the reference resource, with NYISO proposing a GE 7FA in 2016 and ISO-NE proposing a GE 7HA model turbine in 2017. FERC accepted both the NYISO and ISO-NE's use of combustion turbine technology for their respective reference resources. While the reasoning behind the decisions in each of these markets is unique, they do share some significant similarities in that each market is attempting to determine the reference resource that will provide an adequate price signal to ensure ongoing investment to maintain reliability.

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 CT composite index based on 20% labor, 55% materials (increased from 50%), and 25% turbine (decreased from 30%).

Rationale: Weighting more closely corresponds with the updated weighting of each components contribution to the total cost of a new build.

Variable Resource Requirement Curve Shape

VRR Curve Parameters
Recommendation: **Shift the existing curve shape to the left by 1%.**

Rationale: The existing VRR curve represents a 1% shift to the right from the VRR curve recommended by Brattle in the 2014 quadrennial review. In 2014, PJM recommended the 1% right shifted curve due to resource adequacy concerns associated with short-term supply uncertainty that could not have been fully captured by the historical data used in the VRR curve model analysis. Such uncertainties at the time included MATS retirements, low gas prices, EPA's Clean Power Plan, and the D.C. Circuit Court's vacatur of FERC Order 745. Many of these challenges are no longer a concern, and the market has demonstrated robust replacement of retiring resources. While the potential for a significant amount of near-term economic retirements exists, the ongoing potential for economic based retirements do not pose the same resource adequacy challenges as the risk of simultaneous large-scale retirements under MATS. RPM has demonstrated its ability to manage economic retirement by attracting new capacity or incentivizing existing capacity to stay online as the market tightens; therefore, the rationale for the 1% right shift no longer exists.

VRR Curve Parameters for LDAs

Recommendation: Retain the existing practice of using the same curves for LDAs as are used for the system

Rationale: RPM performance under the existing practice has resulted in continued investment and has met the resource adequacy requirements for the RTO as well as at the LDA level.

Energy & Ancillary Services Methodology

Determination of Net EAS for Reference Resource CT

Recommendation: Retain Existing Peak-Hour Dispatch Methodology used to Determine Net EAS for Reference Resource CT

Rationale: The Peak-Hour Dispatch Method provides a practical and repeatable method of estimating the net energy revenues expected for the reference resource CT. The methodology was validated by comparison of Net EAS revenues estimated for the reference resource CT (and CC) to Net EAS revenues of actual representative resources. The comparison showed the estimated Net EAS revenues to be reasonably consistent with the Net EAS revenues of actual resources albeit estimated values tended to be higher than those of the actual resources. The Peak-Hour Dispatch Method assumes the reference resource CT to be available for economic dispatch each day in four-hour dispatchable blocks between the hours of 8 AM to 10 PM, inclusive – reasonable assumptions for a technology type that is expected to be available to meet demand during the peak hours of each day rather than a technology type that is expected to operate as a base load generation resource. Any changes in input assumptions to expand this window, or otherwise increase the assumed flexibility of the reference resource CT would only act to exacerbate the over-estimation seen in the current results.

Recommendation: Incorporate the 10% Cost Margin into the Peak-Hour Dispatch Methodology

Rationale: The 10% margin that is permitted to be included in the cost-based energy market offers of actual generation resources to account for uncertainties in the determination of these costs should likewise be incorporated into the cost-based energy market offer assumed for the reference resource in the Peak-Hour Dispatch. These same uncertainties are applicable to the cost-based energy market offer of the reference resource introduced through the assumptions that are made regarding the applicable gas index hub, day-ahead vs intra-gas use, assigned LMP, etc., therefore, it is reasonable and consistent to apply the 10% margin to the cost-based energy market offer of the reference resource. Introduction of the 10% margin into the Peak-Hour Dispatch of the reference resource provides an offset around these uncertainties and also accounts for differences between the key assumptions made for the reference resource relative to actual attributes of a similarly-situated representative resource. The current omission of the 10% adder explains the tendency discussed in the prior section for the estimated Net EAS values of the reference resource to be higher than the actual observed Net EAS values of representative units as the introduction of the 10% adder was found to produce results that more closely correspond.

Determination of Net EAS for Multi-Zone LDAs and the RTO

Recommendation: Retain the current practices used to determine the Net CONE of the RTO and the Net CONE of multi-zone LDAs. Currently, the Net CONE of the RTO VRR Curve is set equal to the average gross CONE of the four CONE Regions reduced by a Net EAS value that is determined by a Peak-Hour Dispatch of the reference resource CT against the hourly PJM RTO LMPs at a fuel price based on an average of gas pricing points located throughout the RTO. The Net CONE of a multi-zone LDA VRR Curve is currently determined as the average of the Net CONE values determined for each zone that resides in the LDA.

Rationale: The current practices used to determine the Net CONE of the RTO and the Net CONE of multi-zone LDAs produce a Net CONE value that reasonably represents the economic expectations for a representative resource located somewhere within the expansive footprint of the entire RTO region or entire multi-zone LDA region. PJM's preliminary recommendations included revisions to these current practices that were intended to provide a Net CONE value that would tend to be less volatile year-over-year and a value that would be more representative of expectations over a larger portion of the RTO or multi-zone LDA footprint. However, PJM believes that no changes are needed at this time because the current practices provide reasonable results and because the year-over-year volatility addressed by the preliminary recommendations is tempered somewhat in an indirect way by the introduction of the 10% energy market cost margin.

3-Year Monthly Median versus 3-Year Monthly Average

Recommendation: Retain the current practice of determining the annual Net EAS Revenues of the reference resource as the average annual Net EAS revenues determined for the most recent three calendar years.

Rationale: The current practice produces reasonable estimates of Net EAS revenues expected for the reference resource CT and the use of the three-year average mitigates the disproportionate influence of a single year having an abnormally high or low Net EAS. PJM's preliminary recommendations included revisions to the status quo that were intended to mitigate the disproportionate influence of a Net EAS value associated with single anomalous month thereby providing a Net EAS value that would be more representative of annual expectations under normal conditions and a value that would tend to be less volatile year-over-year than that produced by the current practice. However, as above, PJM believes that no changes are needed at this time because the current practice provides reasonable estimates of annual Net EAS revenues that would converge with and be nearly the same as the result produced by PJM's preliminary recommendation in the absence of an anomalous month in the three year period. Also, the year-over-year volatility addressed by the preliminary recommendation is tempered somewhat in an indirect way by the introduction of the 10% energy market cost margin.

Recommended Gas Hub Changes

Recommendation: See matrix for recommended changes.

Rationale: Changes to the current mapping of zonal gas hubs have been recommended to better reflect the shifting natural gas flows in the PJM footprint caused by the proliferation in cost-effective natural gas production in the Marcellus and Utica shale gas regions.