Regulation Market Pricing

Problem / Opportunity Statement

Performance-based Regulation became effective on October 1, 2012 and was constructed to compensate resources providing Regulation service based on Performance Score (PS), Mileage, and Benefits Factor (BF). Since fast-responding (RegD) resources are cleared together with traditional (RegA) resources, the Benefits Factor is used to translate RegD MWs into effective RegA MWs for this common clearing. For example at a BF of 2.0, 1 MW of RegD would be the equivalent of 2 MWs of RegA. The Benefits Factor for RegA resources is always 1. The Benefits Factor curve is a function of the percentage of RegD performance-adjusted MWs to the RTO Effective Requirement such that more RegD MWs lead to lower Benefits Factors.

Under Performance-based Regulation, the regulation offers that RegD and RegA resources submit into the market are adjusted by PS, Mileage, and BF to produce an adjusted offer which accounts for the performance of each resource and the differences between the RegA and RegD signals. Those calculations are as follows:

$$Adjusted\ Capability\ Offer = \frac{Capability\ Offer}{Benefits\ Factor * Performance\ Score}$$

$$Adjusted\ Performance\ Offer = \frac{Performance\ Offer}{Benefits\ Factor * Performance\ Score}$$

$$Adjusted\ Lost\ Opportunity\ Cost\ (LOC) = \frac{LMP - Marginal\ Cost}{Benefits\ Factor * Performance\ Score}$$

$$Total\ Adjusted\ Offer = Adjusted\ Capability\ Offer + Adjusted\ Performance\ Offer + Adjusted\ LOC$$

The Regulation Market is cleared hour-ahead. Using submitted offers and projected LMPs, the least cost set of RegA and RegD resources is cleared to meet the Regulation requirement and those resources are assigned to provide Regulation service for the entire operating hour.

In real-time, the Regulation Market Clearing Price (RMCP) is calculated for each 5 minute interval during the operating hour. It is set by the cleared regulation resource (from the hour-ahead clearing) with the highest Total Adjusted Offer.

$$Regulation\ Market\ Clearing\ Price = Max\ (Total\ Adjusted\ Offer\ for\ each\ Cleared\ Regulation\ Resource)$$

Since the Benefits Factor and Performance Score terms are in the denominator of the adjusted offers, any low values will dramatically increase the adjusted offer or adjusted LOC, and hence the RMCP. Typically, a resource with a very high Adjusted Capability Offer or Adjusted Performance Offer will not clear in the hour-ahead ASO engine. These components of the total adjusted offer stay constant during the operating hour. LOC on the other hand, can change between the hour-ahead market clearing and real-time due to differences in the projected LMP used in the hour-ahead clearing and the actual real-time LMP. This produces scenarios where the total adjusted offer (which includes LOC) used in the hour-ahead market clearing is

$0/MWh and a resource therefore clears, but in the real-time, the LOC increases to a non-zero value and that resource then sets the RMCP.

In fact, PJM has observed recent intervals in the Regulation market where the marginal unit had a very low BF (less than 0.1) and a non-zero adjusted LOC in real-time, and as a result the RMCPs were significantly elevated. RMCPs as high as $7000/MWh have been observed due to this phenomenon. Between May 1, 2018 and August 31, 2018 PJM has observed 80 intervals where the RMCP was above $500/MWh and 16 of these hours had marginal benefits factors less than 0.1.

PJM believes the opportunity to limit Regulation price spikes caused by this issue should be considered.