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October 14, 2013

The Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, N.E. Room 1A
Washington, D.C. 20426

Re: *PJM Interconnection, L.L.C.*, Docket No. ER12-1204-004
PJM Interconnection, L.L.C., Docket No. ER12-2391-003
Performance-Based Regulation Revisions

Dear Secretary Bose:

I. DESCRIPTION OF FILING

Pursuant to the Federal Energy Regulatory Commission's ("Commission's") July 18, 2013 order issued in this proceeding,[1] PJM Interconnection, L.L.C. ("PJM") submits a report containing the status of PJM's regulation market since implementing the performance-based revisions required under Order No. 755.[2] The report, which is attached hereto, contains information such as the health of the regulation market and the degree to which the penetration of fast-following regulation resources has approached or exceeded the point at which the benefits of fast-following resources are reduced compared to traditional resources. The report also addresses the specifics as to operational challenges that have arisen as a result of implementation of this order.

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1 *PJM Interconnection, L.L.C.*, 144 FERC ¶ 61,053 at P 34 (2013) ("July 18 Order").

2 *Frequency Regulation Compensation in the Organized Wholesale Power Markets*, Order No. 755, 137 FERC ¶ 61,064 (2011).

Overall, the report concludes that the implementation of performance-based compensation for regulation resources has been successful. Fast-moving resources are participating in the regulation market on an increasing basis and, as a result, system control remains the same or better as measured by North American Electric Reliability Corporation ("NERC") Control Performance Standards 1 ("CPS1") and Balancing Authority ACE Limit ("BAAL") reliability criteria. PJM still believes the marginal benefits factor is a workable construct and, pursuant to the Commission's July 18, 2013 order, will work with stakeholders to determine if additional revisions are needed and submit any such revisions pursuant to section 205 of the Federal Power Act[3] as directed by the Commission.[4]

II. DOCUMENTS ENCLOSED

PJM includes with this filing the report containing a status of PJM's performance-based regulation market (Attachment I).

III. CORRESPONDENCE AND COMMUNICATIONS

The following individuals are designated for inclusion on the official service list in this proceeding and for receipt of any communications regarding this filing:

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[3] 16 U.S.C. § 824d.

[4] July 18 Order at 33.

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated at Norristown, PA, this 14th day of October, 2013.

/s/ James M. Burlew
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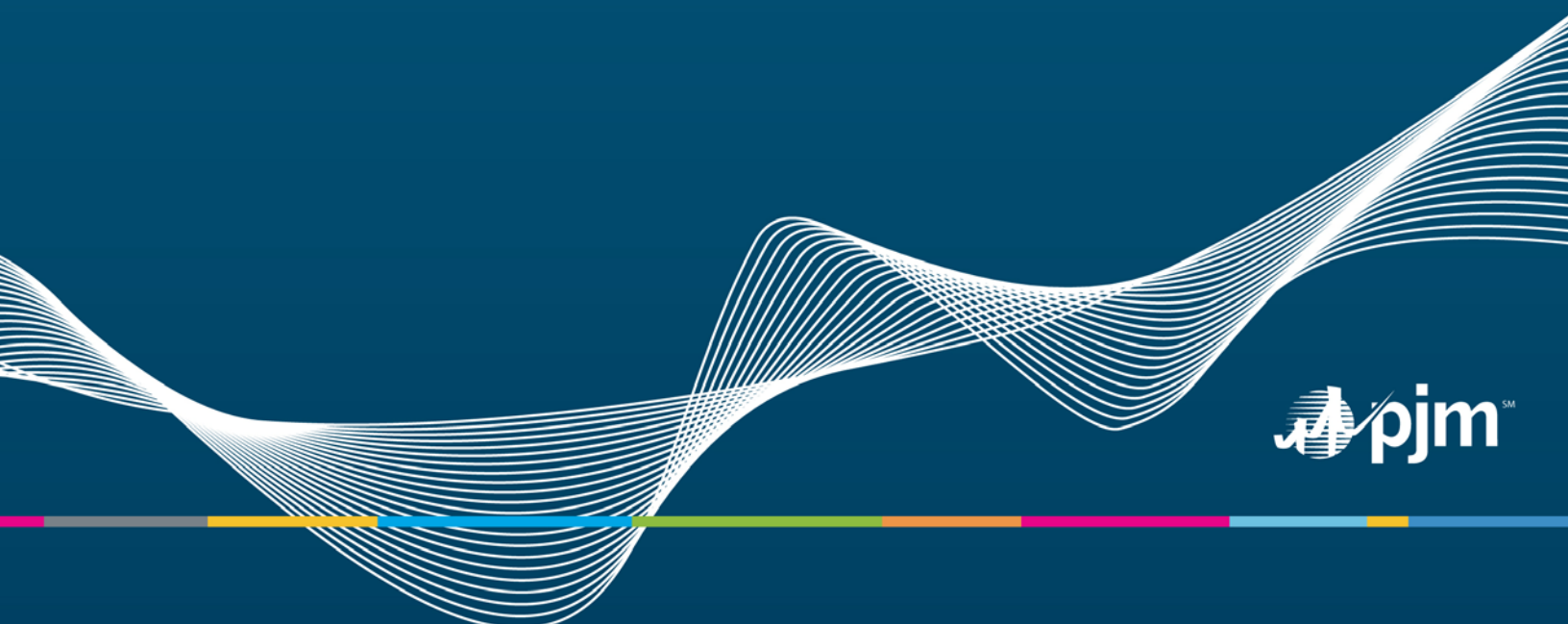
Attachment I

Report on Performance-Based Regulation

Performance Based Regulation: Year One Analysis

Regulation Performance Senior Task Force
PJM Interconnection
October 12, 2013



Contents

Introduction 2

Background 2

Development and Implementation 4

Performance Based Regulation Impact on System Control and Operations 4

- Regulation Performance 4
- Impact of Fast Moving Resources 6
- Regulation Requirement 6

Performance Based Regulation Impact on Markets 9

- Two Part Offer and Clearing 9
- Effective MWs 9
- Regulation Market Clearing Prices 10
- Regulation Market Clearing Prices – Intra Hour Lost Opportunity Cost 13
- Regulation Market Clearing Prices – Mileage 14

Performance Based Regulation Impact on Settlements 15

- Two Part Compensation 15
- Mileage Ratio vs. Marginal Benefits Factor 16

Conclusion 21

Introduction

In response to FERC's Order 755 on Frequency Regulation Compensation in the Organized Wholesale Power Markets[1] PJM Interconnection submitted proposed changes to the Open Access Transmission Tariff (OATT) in March 2012. The proposed rules continued to evolve throughout 2012 and culminated in the January 2013 Compliance Filing made by PJM to the FERC. In this Compliance Filing, PJM proposed to report on the first year of Performance Based Regulation as follows:

> *Because of these risks, PJM proposes to submit to the Commission a report in this docket containing the status of PJM's regulation market one year from the effective date of the Tariff and Operating Agreement revisions proposed herein (i.e. October 12, 2013). The reports would contain information such as the health of the regulation market and the degree to which the penetration of fast-following regulation resources has approached or exceeded the point at which the benefits of fast-following resources are reduced compared to traditional resources. The report would also address the specifics as to operational challenges that have arisen as a result of implementation of this order.*[2]

Accordingly, this report will address the specific impacts that Performance Based Regulation had on PJM operations, markets and settlements. It will also explore the operations and markets challenges that have arisen as a result of these changes. Finally, this report will examine the impact and estimate the magnitude of the re-settlement for fast-moving, Dynamic Regulation (RegD) resources from Performance Based Regulation implementation on October 1, 2013 under the mileage ratio ordered by the FERC and the marginal benefits factor proposed by PJM and approved by PJM Stakeholders.

Background

Regulation is an ancillary service needed to maintain reliability within PJM's control area.[3] It contributes directly to system control as measured by Area Control Error (ACE) and gauged by Control Performance Standards (CPS1 and CPS2) and the Balancing Authority ACE Limit (BAAL) metric.

In 2009, PJM began researching the use of fast moving resources for system control. This research included pilot projects such as a one-megawatt (MW) lithium-ion AES battery, MAGICC Vehicle to Grid sponsored by University of Delaware, Steffes Grid Interactive water heater, Enbala's networked municipal pumps, VCharge's aggregated

[1] *See Frequency Regulation Compensation in the Organized Wholesale Power Markets*, Order No. 755, 137 FERC ¶ 61,064 (2011).

[2] *PJM Interconnection L.L.C.'s Order No. 755 Compliance Filing*, Docket Nos. ER12-1204-004 and ER12-2391-003 (January 15, 2013).

[3] *PJM Open Access Transmission Tariff, Part I, Section 3, Ancillary Services.*

thermal heating bricks, and Viridity/SEPTA's regenerative braking system for trains.[4] These pilots were successful, demonstrating that the resources could follow a fast moving regulation signal; however, no operational or market rules existed to define regulation service for these fast moving resources. In 2011, PJM engaged KEMA to study the impact of altering the mix of regulation resources to include dynamic, fast moving regulation resources, such as batteries, flywheels and demand response. The study focused on what impact these resources would have towards the overall system control as measured by CPS1. KEMA simulations indicated that up to a point fast moving resources would have a positive impact towards system control sufficient to allow a reduction in the overall PJM Regulation Requirement without an impact on system control.[5]

On October 20, 2011, the FERC issued *Order No. 755* in dockets RM11-7-000 and AD10-11-000, directing RTOs/ISOs to modify their rules to make use of and properly compensate resources based on actual service provided including a performance payment.[6] Prior to and following this Order, PJM had engaged stakeholders through the Regulation Performance Senior Task Force (RPSTF) to redesign the Regulation Market. PJM and its stakeholders defined the goal of Performance Based Regulation to align system control requirements with the effective performance of regulating resources and the compensation they receive.

As a result of the stakeholder process, PJM filed changes to the OATT in March 2012. In this filing PJM detailed the initial rules for Performance Based Regulation operations, markets and settlements.[7] In August 2012, PJM made an additional filing under a new docket ER12-2391 based on PJM stakeholder's desire to capture the development of the effective MW methodology and its application towards settlement.[8] In September 2012, PJM submitted responses, answers and reports in preparation for the October 1, 2012 Shortage Pricing and Performance Based Regulation implementation. In November 2012, the FERC's *Order on Compliance Filing and Accepting Proposed Tariff Changes, Subject to Conditions* accepted many of PJM's proposed OATT changes; however, the FERC required an additional compliance filing addressing the use of mileage for performance payments. In January 2013, PJM filed proposed changes for the use of the mileage ratio in settlements and those changes have since been accepted by the Commission.[9]

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[4] *PJM Applied Solutions Pilot Narrative, RPSTF Materials, presented May 27, 2011,* *http://www.pjm.com/sitecore%20modules/web/~/media/committees-groups/task-forces/rpstf/20110527/20110527-item-05a-ed-narrative-applied-solutions-pilot.ashx*

[5] *KEMA Study, December 2011.* *http://www.pjm.com/~/media/committees-groups/task-forces/rpstf/postings/pjm-kema-final-study-report.ashx)*

[6] *See Frequency Regulation Compensation in the Organized Wholesale Power Markets*, Order No. 755, 137 FERC ¶ 61,064 (2011).

[7] *PJM Interconnection L.L.C.'s Order No. 755 Compliance Filing*, Docket No. ER12-1204-000 (March 5, 2012).

[8] *PJM Interconnection L.L.C.'s Order No. 755 Compliance Filing*, Docket No. ER12-2391-000 (August 2, 2012).

[9] *PJM Interconnection L.L.C.'s Order No. 755 Compliance Filing*, Docket Nos. ER12-1204-004 and ER12-2391-003 (January 15, 2013).

Development and Implementation

Throughout the spring and summer of 2012, PJM worked with stakeholders to develop and implement the operations, markets and settlements changes needed to support the proposed rule changes.

Performance Based Regulation brought three operational changes. In July 2012, PJM deployed the automated hourly performance calculation of each regulating resource in near real-time on one of PJM's web tools, eMKT. In September 2012, PJM added a second fast moving regulation signal in addition to the existing regulation signal. On October 1, 2012 the Regulation Requirement was reduced, which was repeated in November and December of the same year.

PJM Markets experienced four changes. The Regulation Market was adjusted to allow two-part offer and clearing. All regulation resources now make offers for both capability (reservation of MWs), and performance (movement of MWs). To compare fast and slow regulation resources on an equal basis, the offers for fast moving resources are evaluated against traditional regulating resources based on effective MWs. Effective MW are essentially the offered regulation capability scaled by the historic performance of the resource and any incremental benefits the resource would provide if it was a fast resource as opposed to a slow one. The third and fourth changes impacted clearing prices. The third is the use of intra-hour Lost Opportunity Cost as part of the five minute co-optimized clearing prices for energy, synchronized reserve and regulation. The final change was the use of actual mileage in the evaluation and clearing of the five minute regulation market clearing price.

Two changes impacted the market settlement. The first was two-part compensation for capability and performance credits in accordance with the clearing and prices calculated by PJM Markets. Second, an incentive multiplier was applied to the performance credit for fast moving resources.

Performance Based Regulation Impact on System Control and Operations

Regulation Performance

At the core of the Performance Based Regulation changes is the performance score. All regulating resources are scored based on accuracy, delay and precision which are determined by considering both the resource's output and the share of either the regulation signal the resource is following. In a fully automated process, PJM's Performance Score Calculation Engine calculates performance scores minutes after the conclusion of the operating hour. This change was made in July 2012 in advance of the Performance Based Regulation and Shortage Pricing Market changes effective October 1, 2012 to allow resource owners the opportunity to evaluate and alter their processes. The performance score is pervasive; it is part of the regulating resource qualification, offer evaluation, market clearing and settlement.

Figure 1 below illustrates that seventy percent of the fast moving resources (RegD, shown in green) have performance greater than 0.90 throughout the first year. In the same period forty percent of the traditional resources (RegA, shown in blue) have performed more consistently around 0.80-0.89 with another twenty percent in 0.70-0.79 and 0.90-0.99. Overall twenty percent of the traditional resources performed less than 0.70. In the

same period only a very small percentage (less than two percent) of fast moving resources performed less than 0.70.

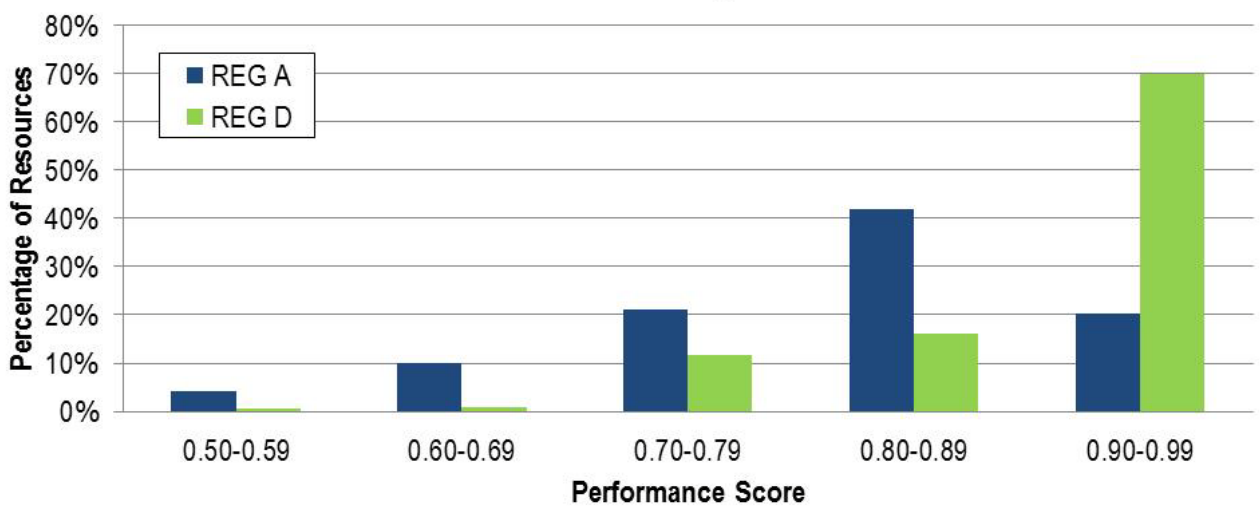

Figure 1 - Regulation Performance Scores First Year Analysis

The average performance score over the past year is shown for regulation signal type in Figure 2. The fast moving regulation signal (RegD) has a large decline in performance score in January due to additional resources qualifying with a lower initial score. Fast moving dynamic regulation (RegD) is thinly populated with resources as discussed in a later section and can be skewed very easily. Traditional resources (RegA) have much larger population in comparison. However, as Figure 2 demonstrates there has been a steady improvement of performance scores over the year.

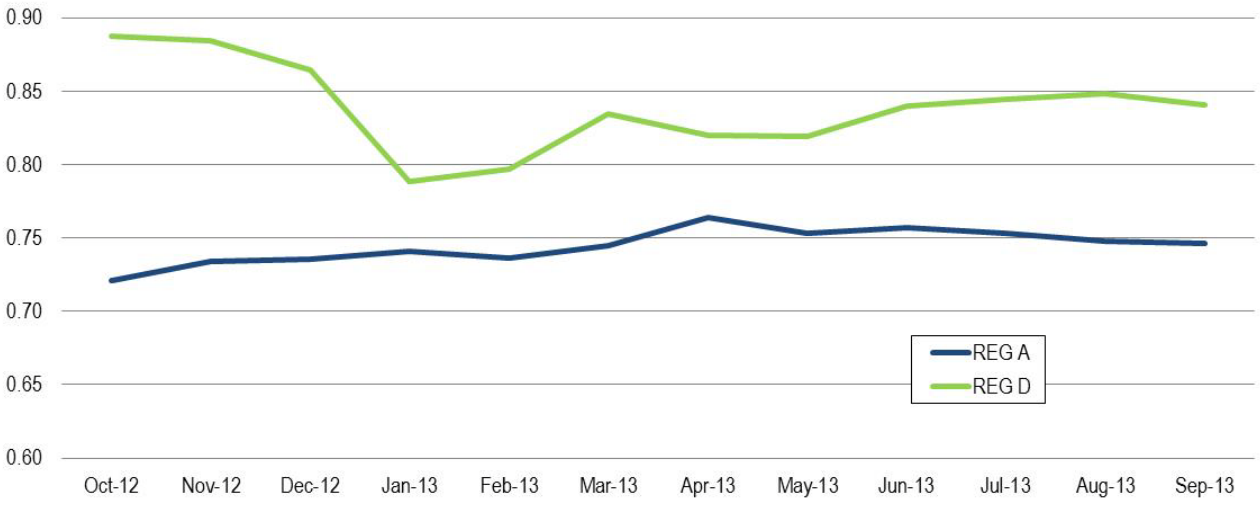

Figure 2 – Average Performance Scores

Impact of Fast Moving Resources

As a result of PJM's experience with the pilot projects, the Dynamic Regulation (RegD) signal was designed for resources with high MW ramp rates and rapid turnaround, such as batteries and flywheels. The resulting RegD signal pushes movement to the outer edges of the resources' capability, however, has a slightly negative bias due to the duration limitations of these resource types. The Traditional Regulation (RegA) signal is a signal designed for control of RTO ACE typically followed by resources with limited ramp rate, but no limitation on duration. The RegA and RegD signals are complementary, where RegD resources respond quickly, but lack the ability to remain at that level for an extended time and RegA resources require time to turn and follow the signal and have unlimited duration.

Since October 1, 2012, the number of fast moving resources following the RegD signal and participating in the Regulation market has grown from six to nineteen. In total, they represent a combined regulating capability of approximately 490 MWs though their impact fluctuates based on effective MW evaluation.

Figure 3 below depicts the monthly average Regulation Requirement calculated as a percentage of load. It shows the unadjusted Regulation Requirement and the Regulation Requirement adjusted down due to the gains from the speed and accuracy of fast moving regulation resources. In order to make an equivalent comparison, fast moving regulation MWs must be evaluated as traditional regulation MWs. Additionally, the graphic depicts the reduction of the Regulation Requirement of peak and valley load from October 2012 through present charted against the change in the Regulation Requirement percentage over the same period.

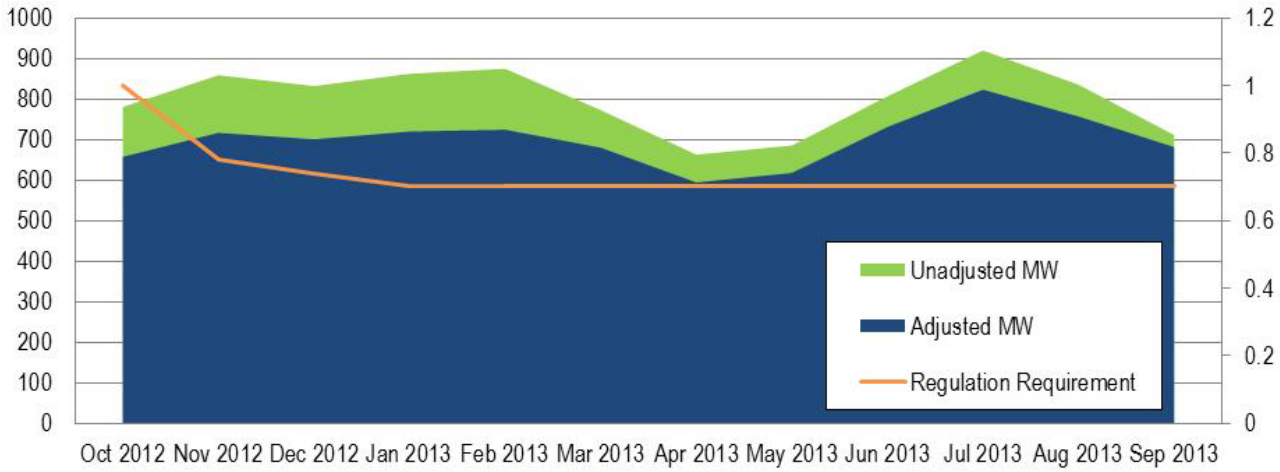

Figure 3 - Average Regulation Requirement Unadjusted vs. Adjusted against Historic Regulation Requirement %

Regulation Requirement

As classified by NERC, ancillary services such as Regulation provide load balancing used for secondary system control. Regulation is dispatched with Automatic Generation Control (AGC), which uses system frequency and

net actual interchange plus net scheduled interchange to determine system energy balance in near real time.[10] System control is evaluated against Control Performance Standards. The two primary standards used for measuring system control at PJM are Control Performance Standard 1 (CPS1) and Balancing Authority ACE Limit (BAAL). CPS1 is a statistical measure of Area Control Error (ACE) variability and its relationship to frequency error. It is intended to provide a frequency-sensitive evaluation of how well PJM meets its demand requirements with its supply resources. Balancing Authority ACE Limit (BAAL) seeks to maintain interconnection frequency by measuring ACE variations up or down that benefit or hurt system control. The BAAL percentage adds an additional dimension by represents the amount of time the system operated within the upper and lower boundaries.

The CPS1 and BAAL metrics were used by KEMA as a proxy for system control during its study of relative performance between fast and traditional regulation resources and the analysis of MW/mileage and accuracy of resources with different responses to the PJM control signals. KEMA demonstrated that the addition of fast moving resources improved the CPS1 scores above the base case while Regulation Requirement was held constant. However, KEMA also found that if the Regulation Requirement was reduced while adding fast moving regulating resources there was no decrease to CPS1.[11] Based on these findings, Performance Based Regulation assumes that a mix of traditional and fast moving resources is optimal. Additionally, the gains from introducing fast moving resources as well as improvements from using performance scores allowed for a reduction of the Regulation Requirement.[12]

Since October 1, 2012, PJM has lowered the Regulation Requirement on several occasions. In October 2012, the requirement was reduced from 1.0 to 0.78 percent of the peak/valley load forecast. It was further reduced in November 2012 from 0.78 to 0.74 percent. Finally, in December 2012, the Regulation Requirement was lowered to its current value of 0.70 percent of the peak/valley load. Even with these significant reductions to the Regulation Requirement, CPS1 and BAAL metrics have held steady throughout 2013 and show an increase starting in the summer of 2013 as depicted in Figure 4.

[10] *Balancing and Frequency Control: A Technical Document, NERC Resources Subcommittee, January 26, 2011,* *http://www.nerc.com/comm/OC/RS%20Landing%20Page%20DL/Related%20Files/NERC%20Balancing%20and%20Frequency%20Control%20040520111.pdf*

[11] *KEMA Study, p 2-3. December 2011.* *http://www.pjm.com/~/media/committees-groups/task-forces/rpstf/postings/pjm-kema-final-study-report.ashx*

[12] *Additional Manual 12 Language needed for October 1st, presented at the Operating Committee, August 23, 2012.* http://www.pjm.com/~/media/committees-groups/committees/oc/20120911/20120911-item-05-additional-m12-language-needed.ashx

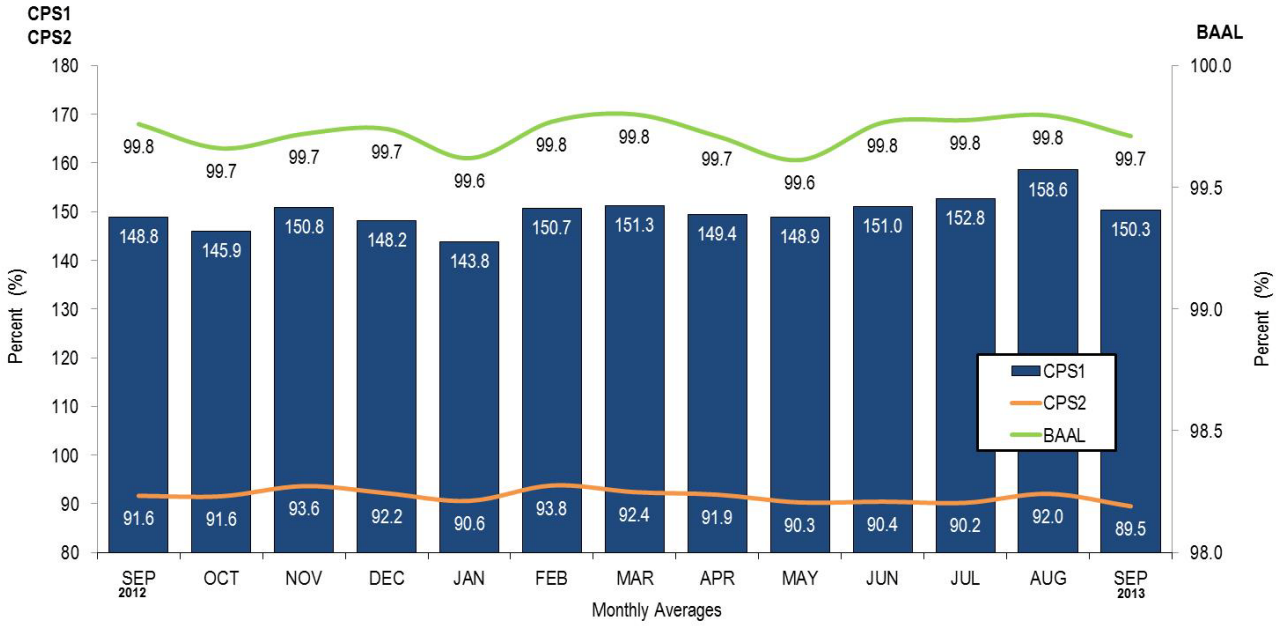

Figure 4 – PJM Control Performance

Figure 5 below reveals that CPS1 and BAAL monthly results have become more tightly clustered, respectively, and have trended upwards since October 2012.

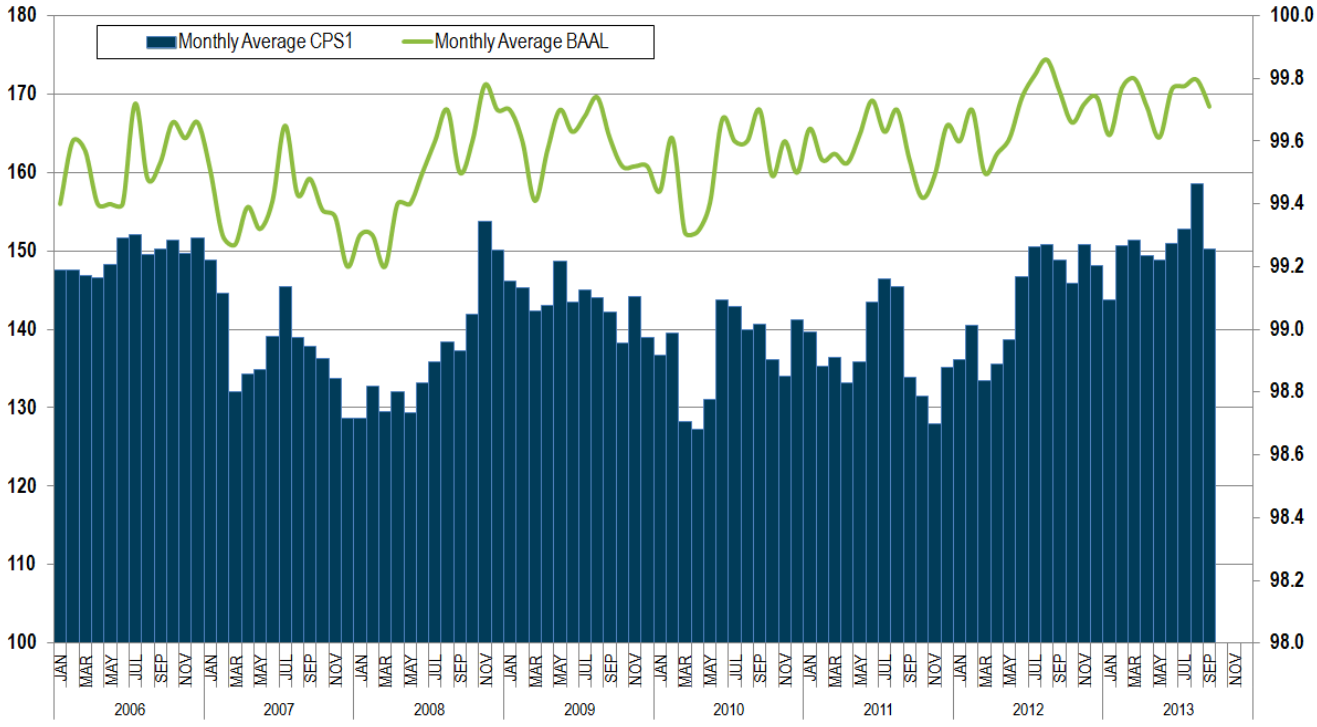

Figure 5

Performance Based Regulation Impact on Markets

Two Part Offer and Clearing

Under the Performance Based Regulation changes, resources submit two offers; one for capability or the cost of reserving MWs, and one for performance or the cost of providing movement of their output including mileage. The performance offer is measured in $/ΔMW. In order to evaluate it with the capability offer, which is in $/MWh of regulation, it must be converted to $/MW by multiplying the $/ΔMW offer by the mileage ratio of the offered signal type measured in ΔMW/MW. This number is calculated on a 30 day rolling average and posted in PJM's web-based application, eMarket (eMKT) for seven days into the future. The previous market power mitigation construct of a price offer and cost offer remained in place.

Effective MWs

As discussed in the Operations section, effective MWs were necessary to evaluate fast moving resource MWs against traditional resource MWs for an equivalent comparison. Without this evaluation PJM would over-procure regulation MWs by clearing fast moving MWs without consideration of their speed or accuracy. Additionally, PJM could face the potential of reaching diminishing returns by procuring too many fast moving resources and face system instability because of lack of duration or over-shooting of the control signal.

Conversion to effective MW is a two-fold evaluation. It considers the historic performance score of the resource as calculated by a 100 hour rolling average and the unit-specific benefits factor. The unit-specific benefits factor is a multiplier to the regulation capability of an assigned fast regulation resource that indicates how much additional value it adds by providing fast regulation service instead of slow. This value can range from 3 to 0 and incorporates how much fast regulation is currently assigned. Figure 6 shows the actual Benefits Factor curve used by PJM. If no fast regulation resources are assigned than the unit-specific factor for the first MW of fast regulation assigned would be 3. Further if roughly 20% of the regulation requirement is already being met by fast regulation resources, the next fast regulation resource would be assigned a unit-specific benefits factor of about 2.

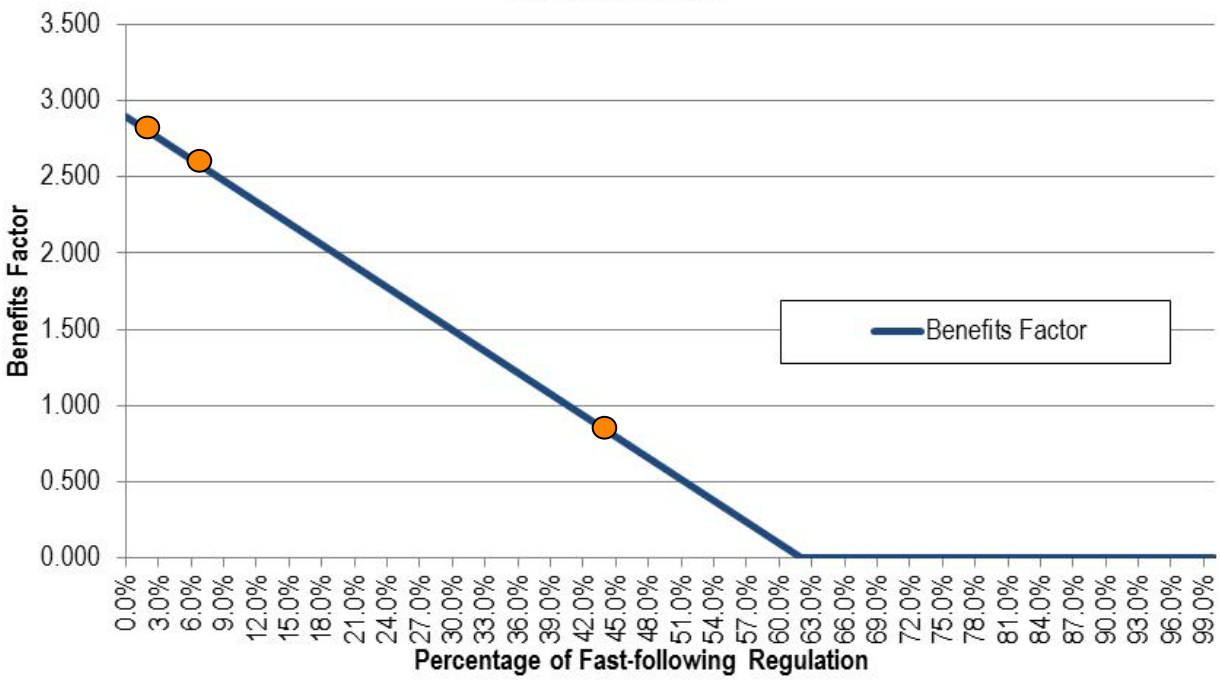

Figure 6 – Benefits Factor Function

The premise behind the unit-specific benefits factor is to illustrate the diminishing returns when assigning higher quantities of fast regulation resources. In summary, the graph above shows that the first MW of fast regulation offsets 3 MW of slow regulation (assuming performance scores are equal). It also shows that assigning more than 60% of the requirement in fast regulation resources has no discernible benefit.

While unit specific benefits factors are considered market sensitive information and not posted, the marginal benefits factor of the last cleared fast moving resource on average has been 2.6 since October 2012. In Figure 6, points on the line indicate the high (2.9), average (2.6) and low (0.7) Marginal Benefits factor since October 1, 2012.Using the Marginal Benefits Factor as a proxy, a Marginal Benefits Factor of 2.6 indicates that there are few fast moving resources. Also, the point of diminishing returns, where Marginal Benefits Factor is below 1, is seldom reached. In reviewing the Marginal Benefits Factor since October 1, 2012, out of the 7961 hours, only 16 are less than 1. Of those 16 hours, nine of those hours occurred on October 1, 2012 during cutover.

Regulation Market Clearing Prices

Under the Performance Based Regulation, the average Regulation Market total clearing price for October 2012 (Oct 1- Oct 31) was $38.75/MWh, September 2012 (Sept 1- Sept 30) without Performance Based Regulation was $13.75/MWh. This difference in price is due to timing changes of the Regulation Market Clearing. Prior to October 2012, Regulation Market Clearing Price was produced an hour ahead and relied on an LMP forecast that could and usually did change in the operating hour. Any difference would be made up with make whole payments outside of market clearing.

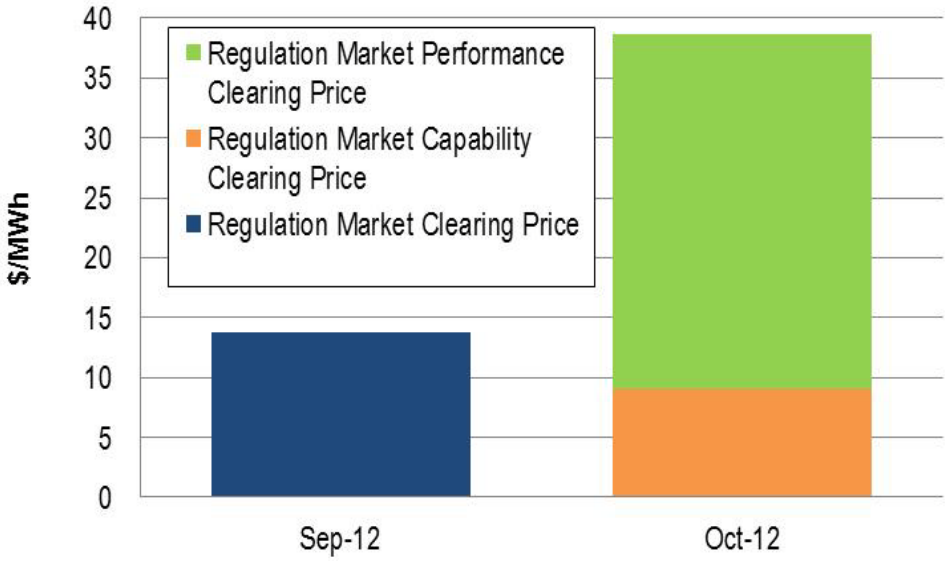

Figure 7 – Regulation Prices

Average Market Clearing prices continued to trend higher than previous years as shown in Figure 8. The Regulation Market Capability Clearing Price (RMCCP) makes up the largest portion of the overall market clearing price while the Regulation Market Performance Clearing Price (RMPCP) is relatively small in comparison. Average Regulation Market Clearing Price from October 2012 through September 2013 was $31.64/MWh.

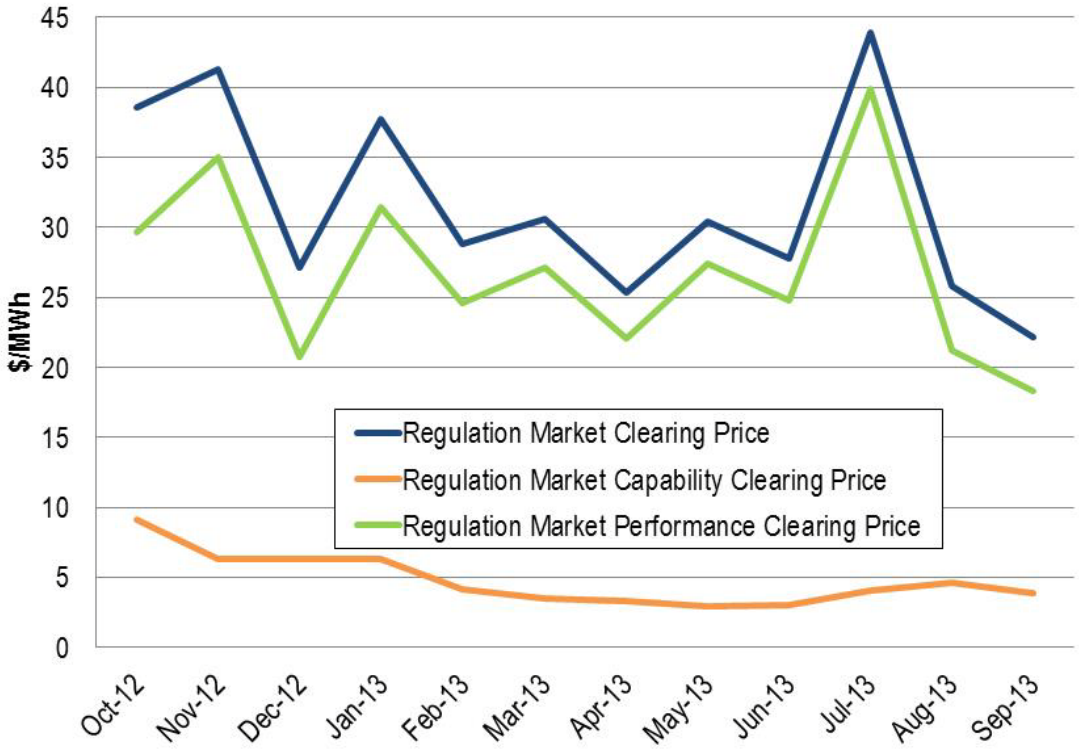

Figure 8 – Average Regulation Market Clearing Prices

As shown in Figure 9, overall regulation costs (in blue) have not signficantly changed from prior years until you take into account the lost opportunity cost (Figure 10). Adding back the lost opportunity cost to regulation costs shows that overall regulation costs have trended down and opportunity cost has decreased.

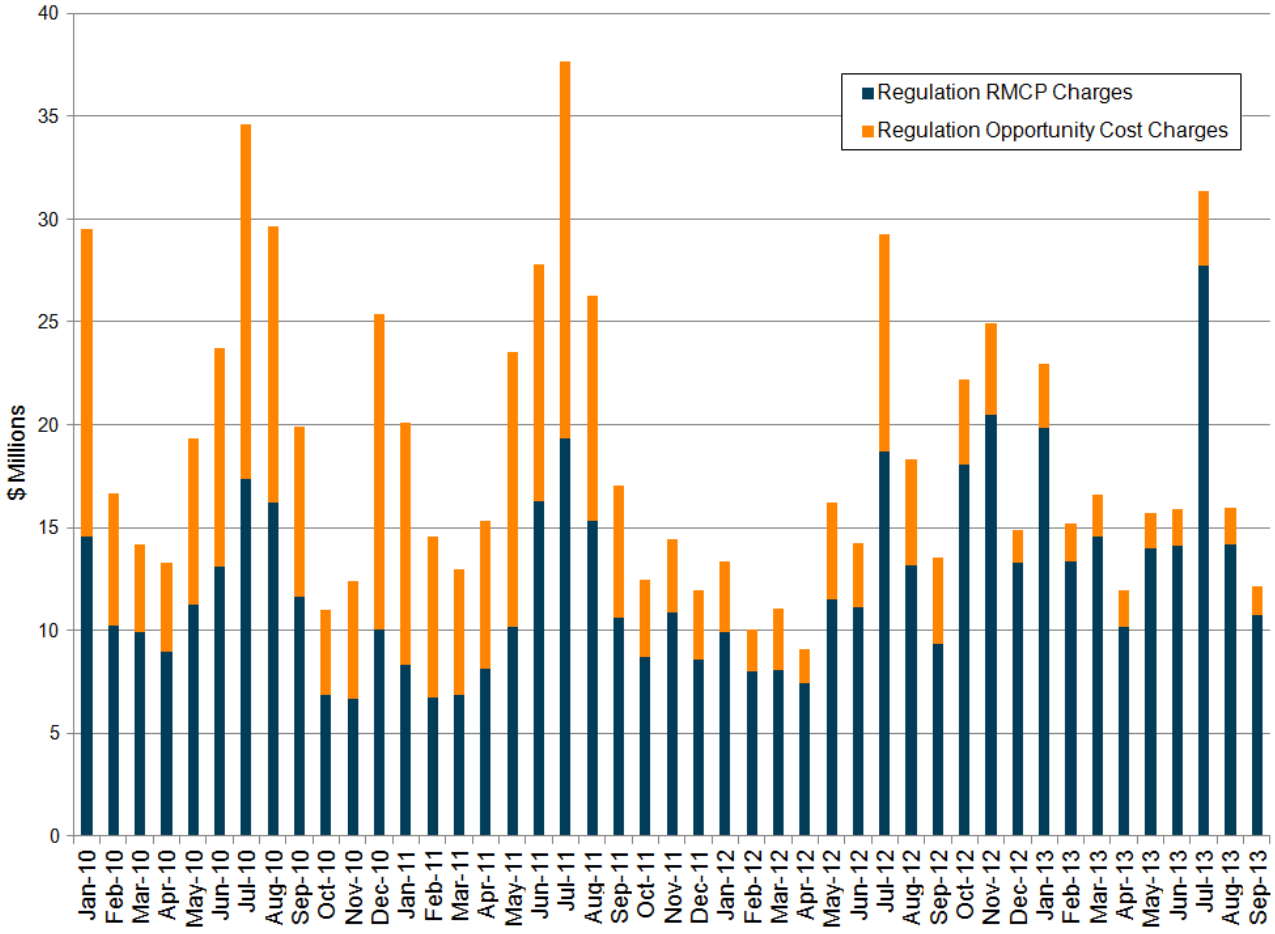

Figure 9 – PJM Monthly Regulation Charges

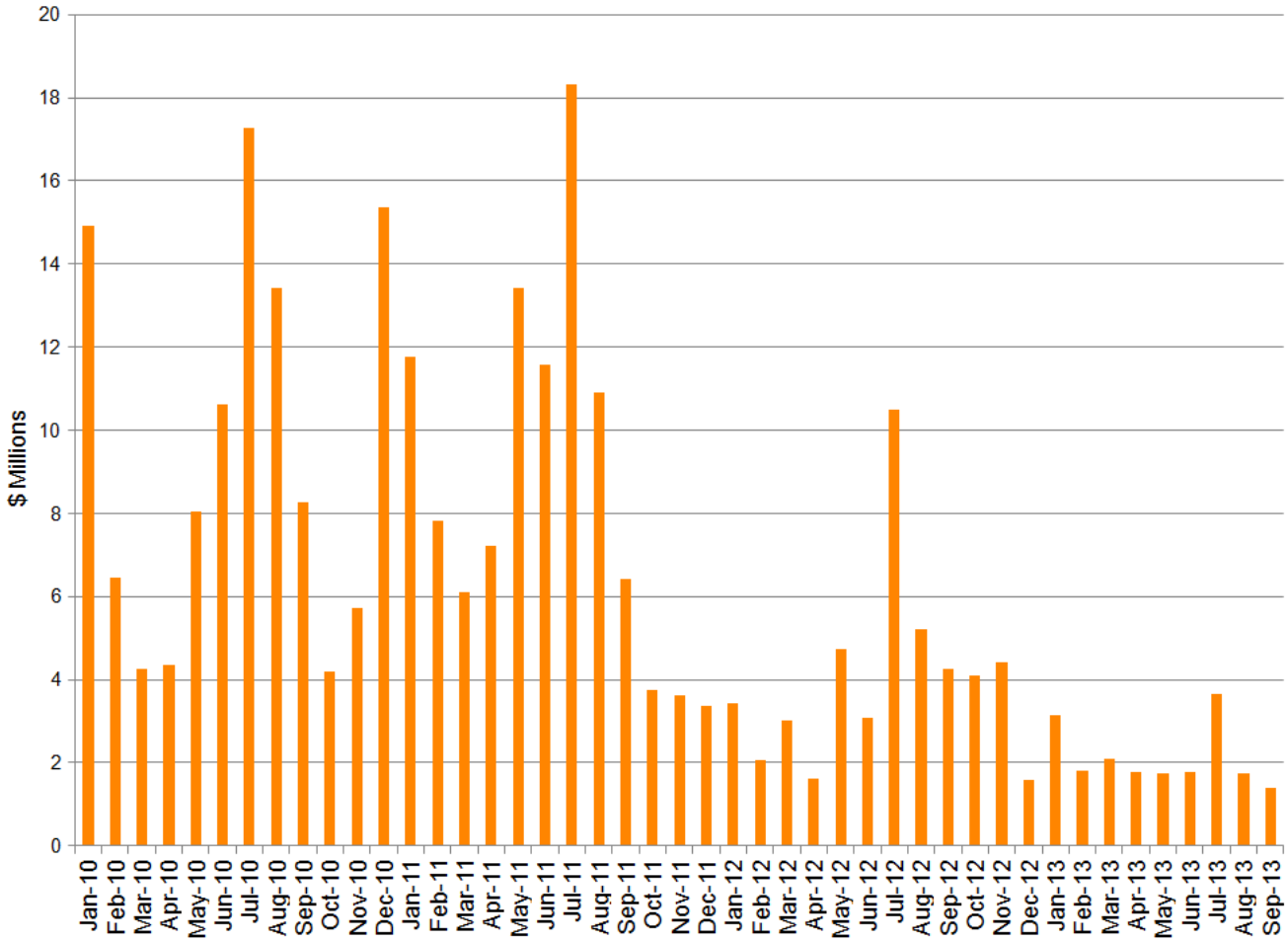

Figure 10 – Regulation Oppurtunity Cost Charges

Regulation Market Clearing Prices – Intra Hour Lost Opportunity Cost

One of the factors driving the increase of the Regulation Market Clearing price is the incorporation of the lost opportunity cost into each five-minute pricing interval. Effective October 1, 2013, the regulation market clearing price was calculated on a five minute basis using the actual energy dispatch in that interval. As part of this calculation, Lost Opportunity Cost is evaluated on a five minute basis and incorporated into the prices as the intra-hour LOC price. Previously, the Regulation Market Clearing Price was calculated one hour prior to the actual hour of operation. Under that method, the hour-ahead estimation of Lost Opportunity Cost used by the Regulation Market Clearing Price often would diverge from the actual lost opportunity cost during the operating hour due to the dynamic nature of the power system and the inherent difficulties in forecasting generator outputs and LMPs. As a result, roughly 30 to 40 percent of the regulation cost was made outside the market in the “make-whole”/up-lift payments captured in the lost opportunity cost credit.

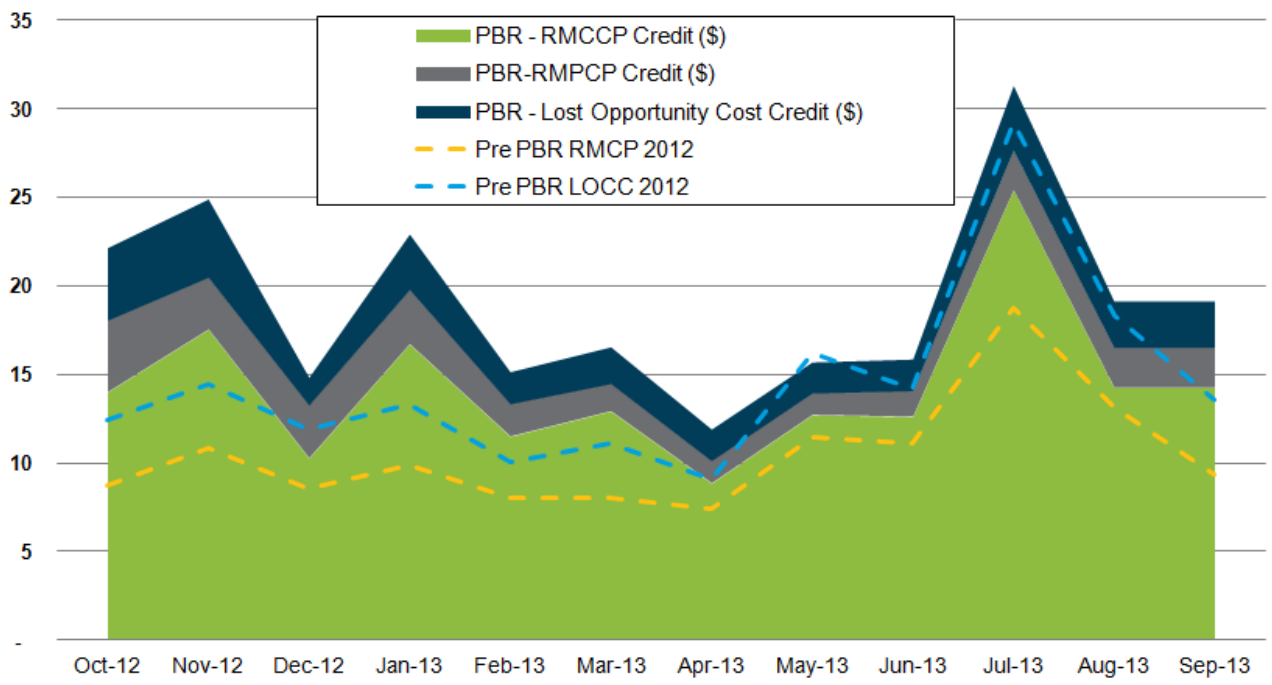

Figure 11 - Capability, Performance and Lost Opportunity Credits in Millions $ October 2012 Through Present

(Includes August and September estimates dashed line is 2011-2012 pre PBR)

Regulation Market Clearing Prices – Mileage

The second driver of increased Regulation Market Clearing Price is the use the five-minute actual mileage of resources by signal type in pricing. Under the Performance Based Regulation, once the overall Regulation Market Clearing Price is set, it is then broken into two pieces – capability and performance. In order to price based on current system conditions, actual five minute mileage by signal type is used to set the Regulation Market Performance Clearing Price. Specifically, the mileage is used to convert all the Performance Offers of cleared resources from $/ΔMW into $/MW to find the maximum performance offer. The maximum performance cleared performance offer is then subtracted from the overall Regulation Market clearing price; the residual between these two is the capability clearing price for the reservation of regulating MWs.

As discussed in previous sections the fast moving signal travels more miles than the traditional signal, it is built to do so. Figure 12 below illustrates the difference between the mileage the two signals request. On average, for every 5.7 MW we request a slow regulation resource to move, we request a fast regulating resource to move 16.2 MW for a ratio of roughly 3:1 when comparing the RegD signal to the RegA signal. Figure 12 also indicates that there is variability around both these values.

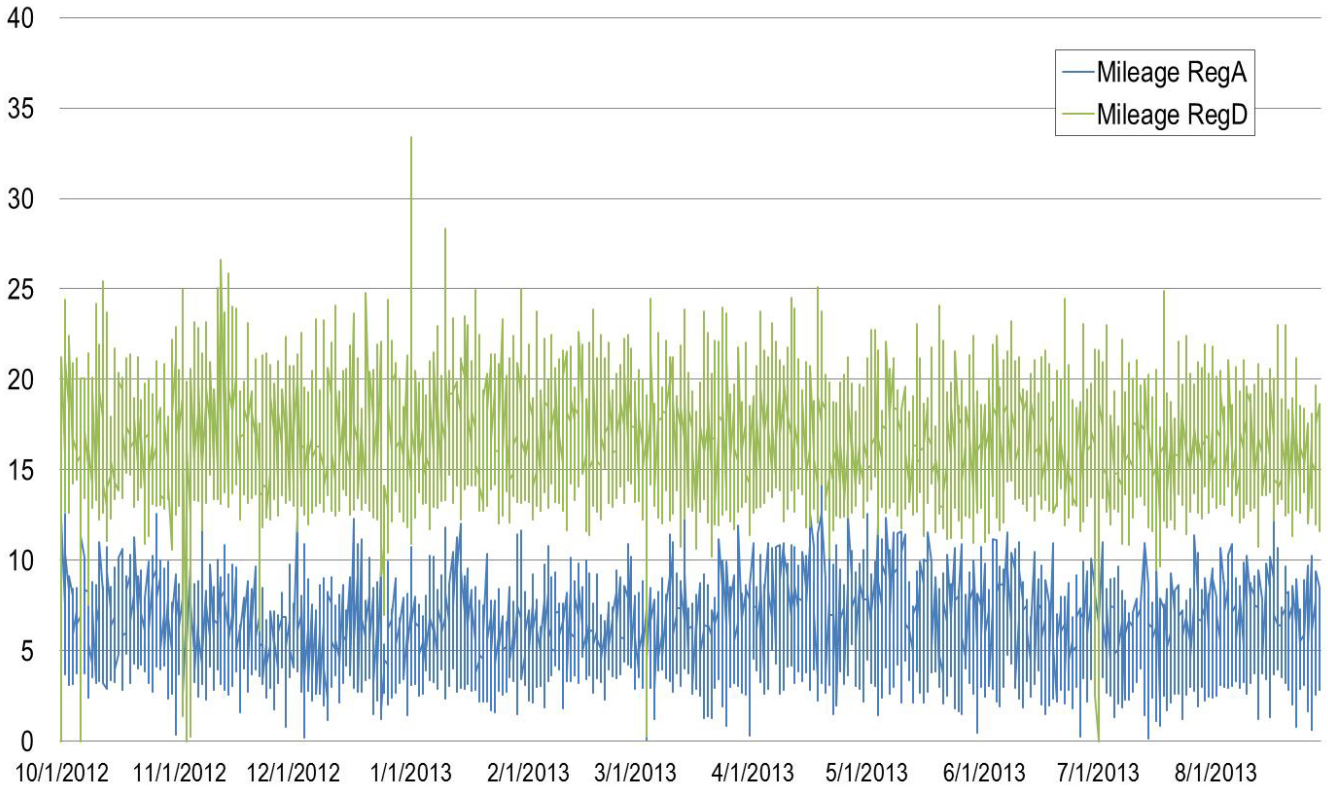

Figure 12 - Mileage RegD vs. RegA

October 2012 - August 2013

Performance Based Regulation Impact on Settlements

Two Part Compensation

Consistent with the clearing of the Performance Based Regulation Market, PJM Settlements compensates regulating resources with a capability and performance credit. For the regulation capability credit, PJM identifies each resource that supplied Regulation (both pool-scheduled and self-scheduled) with an hourly performance score greater than or equal to the applicable threshold for minimum hourly performance during an hour. PJM calculates the hourly Regulation Market Capability Clearing Price Credit for each applicable regulating resource by multiplying the individual resource's hourly Regulation megawatts by the Regulation Market Capability Clearing Price (RMCCP), and the resource's actual performance score. PJM calculates the hourly Regulation Market Performance Clearing Price Credit for each applicable regulating resource by multiplying the individual resource's hourly Regulation megawatts by the Regulation Market Performance Clearing Price (RMPCP) for that hour, a performance multiplier, and the resource's actual performance score for that hour.

Mileage Ratio vs. Marginal Benefits Factor

Since October 2012, PJM has set the Marginal Benefits Factor, which was intended to be the multiplier and performance incentive for fast moving resources to 1 in response to FERC's Deficiency Notice. In subsequent FERC Orders, PJM developed a Mileage Ratio multiplier as ordered to replace the Marginal Benefits Factor, which was developed and endorsed by PJM Stakeholders. While all resources have been paid under the two part settlements since October 1, 2013, those fast moving resources following RegD signal providing additional benefit have not been fully compensated for their performance.

As discussed previously, fast moving MWs were evaluated against traditional MWs by use of the effective MWs, which represents performance and benefits factor. For offer adjustment and market clearing the unit specific benefits factor is used. For compensation via market settlement, the Marginal Benefits Factor, which is the unit specific benefits factor of the last cleared fast moving resource was intended to be used. The Mileage Ratio is the hourly miles of the Regulation signal the resource is following (either RegD or RegA) divided by the hourly of miles traveled by the RegA signal. The Mileage Ratio compensates purely on mileage traveled without any consideration towards effective control represented either by performance or by actual benefit as described through the benefits factor curve. This eliminates the diminishing return of assigning large quantities of fast regulation identified in the KEMA study.

Because of the unresolved performance incentive for fast moving regulating resources since the market changes were implemented on October 1st, 2012, fast move regulation resources have been undervalued and under-compensated. The Load Serving Entities that pay the regulation charge continue to face an ever growing and unknown resettlement amount that will impact their financial positions. Prior to receiving FERC's *Order on Rehearing and Compliance*[13] PJM Settlements estimated the adjustment that would be necessary to compensate fast moving resources for their performance from October 1, 2012 through September. The table is based on the following assumptions:

- Multiplier either Marginal Benefits Factor (MBF) or Mileage Ratio is applied only to the Regulation Performance Credit (see FERC Order November 16, 2012[14]).
- RMPCP does not change
- Lost Opportunity Cost Credit is evaluated against the new compensation
- RMCCP and the Capability cost credit does not change based on FERC's July 2013 Order[15]
- August and September are an average of October 2012 – July 2013

[13] *See Order on Rehearing and Compliance*, 144 FERC ¶ 61,053 (2013).

[14] *See Order on Compliance Filing and Accepting Proposed Tariff Changes, Subject to Conditions*, 141 FERC ¶ 61,134 (2012).

[15] *See Order on Rehearing and Compliance*, 144 FERC ¶ 61,053 (2013).

Scenario	Performance Credit	Lost Opportunity Cost Credit (LOCC)	Net from Base Case (includes LOC)
Gen Base Case	$ 27,379,000	$ 26,085,000	
Gen MBF	$ 29,732,000	$ 26,012,000	$ 2,279,000
Gen Mileage Ratio	**$ 30,206,000**	**$ 25,982,000**	**$ 2,724,000**
DR Base Case	$ 49,000	$ -	
DR MBF	$ 126,000	$ -	$ 78,000
DR Mileage Ratio	**$ 144,000**	**$ -**	**$ 95,000**

Table 1 – Settlements Estimates

The table depicts the impact to the Regulation Market Performance Credits as a result of resettling fast regulation resources using either the Marginal Benefits Factor (MBF) method as proposed by PJM or the Mileage Ratio method from October 1, 2012. Moving from left to right, the first column is the scenario assumption. The Base Case is what has already been paid out by PJM Settlements since October 2012. The MBF scenario is the Regulation Market Performance Credit multiplied by the Marginal Benefits Factor as contemplated by PJM's August 2012 Filing. However, there is one difference from this filing in the MBF scenario, no performance payment is made for the Regulation Market Capability Credit. The Mileage Ratio scenario uses the FERC ordered ratio between mileage of the fast moving RegD signal divided by the mileage of the traditional RegA signal. The second column is the total of the Regulation Market Performance Credit for the estimate period October 2012 through September 2013 where August and September are averages of October 2012 through July 2013. The third column is the Lost Opportunity Cost Credit (LOCC). The last column is the difference of each scenario compared to what has already been paid. When the outstanding Regulation Market Performance Credit for fast moving regulating resources that are generators and demand response resources is totaled it is approximately $2.8 million.

Since October 1, 2012 through September 2013, the Regulation Market totals to approximately $229.7 million which includes estimates for August and September of 2013. This number breaks down to $171 million for Regulation Market Capability Credit and as depicted in the table above $27.4 million for the Regulation Market Performance Credit base case. Additionally, the Lost Opportunity Cost Credit which represents the intra-hour LOC, make-whole payments and the shoulder hour compensation for resources is $31.3 million. For reference, the total Regulation Market Credit for October 2011 through September 2012 was $125.3 million. The Lost Opportunity Cost Credit for this period was $48.6 million.

The estimate illustrates that the Mileage Ratio is larger than the Marginal Benefits Factor. Since October 2012 the Mileage Ratio has average 3.1 and the Marginal Benefits Factor has averaged 2.6. The Marginal Benefits factor as specified by the Benefits Factor Function cannot go beyond 3, the Mileage Ratio has no such ceiling other than those operational parameters that are used to create the signal. Any changes to the fast moving RegD signal parameter could push the mileage ratio up or down. With the disconnect between compensation based on mileage ratio and clearing based on unit specific benefits factor, RegD resources will likely be incentivized by the

mileage payment regardless of whether it adds value to overall system control or not. All resources, even those with only fair performance, will have an incentive to follow the fast moving RegD signal even if the unit is only capable of following at 50% because their compensation on average will be multiplied 3 times or more.

Additionally, the unrestricted value of the mileage ratio will lead to a disconnect between clearing and compensation. The clearing engine will still evaluate the resource based on unit specific benefits factor and when the RegA/RegD equilibrium is reached the clearing engine will dispatch a dual qualified resource on the RegA signal instead of RegD signal. The dual qualified unit owner will be expecting the mileage ratio multiplier and will not receive it. And the fast moving resource owner who may be cleared with a unit specific benefits factor below 1 will paid the mileage multiplier.

The statistics in the table below show the average and range (highest and lowest values) of the Marginal Benefits Factor and the Mileage Ratio and the potential for disconnect. For illustration, the coincident value for either Marginal Benefits Factor or Mileage Ratio is included.

Statistics	Marginal Benefits Factor	Mileage Ratio
Average	2.63	3.11
Standard Deviation	0.2	1.87
High Marginal Benefits Factor w/coincident Mileage Ratio (November 6, 2012)	2.9	4.32
Low Marginal Benefits Factor w/coincident Mileage Ratio (August 13, 2013)	0.68	4.46
High Mileage Ratio w/coincident Marginal Benefits Factor (July 14, 2013)	2.4	94.2
Low Mileage Ratio w/coincident Marginal Benefits Factor (July 1, 2013)	2.89	0.31

Table 2 – Statistics for Marginal Benefits Factor and Mileage Ratio October 2012 Through Present

Tables 3 & 4 detail the frequency distribution of the Marginal Benefits Factor and the Mileage Ratio from October 2012 through August 2013. Frequency is the discrete count of observations in the Bin. Cumulative % is the Frequency as a percentage of all observations (7959).

Marginal Benefits Factor Frequency Distribution		
Range	Frequency	Cumulative %
0	19	0.24%
0.1 - 0.2	0	0.24%
0.2 -0.4	8	0.34%
0.4 - 0.6	3	0.38%
0.6 - 0.8	5	0.44%
0.8 - 1.0	0	0.44%
1.0 - 1.2	0	0.44%
1.2 - 1.4	2	0.46%
1.4 - 1.6	6	0.54%
1.6 - 1.8	1	0.55%
1.8 - 2.0	6	0.63%
2.0 - 2.2	137	2.35%
2.2 - 2.4	551	9.27%
2.4 - 2.6	815	19.51%
2.6 - 2.8	6153	96.82%
2.8 - 3.0	253	100.00%

Mileage Ratio Frequency Distribution		
Range	Frequency	Cumulative %
0	10	0.13%
0 - 0.99	5	0.19%
1 - 1.99	541	6.99%
2 - 2.99	3742	54.00%
3 - 3.99	2776	88.88%
4 - 4.99	597	96.38%
5 - 5.99	157	98.35%
6 - 6.99	62	99.13%
7 - 7.99	28	99.48%
8 - 8.99	7	99.57%
9 - 9.99	12	99.72%
10 - 14.99	12	99.87%
15 - 19.99	3	99.91%
20 - 24.99	1	99.92%
25 - 29.99	1	99.94%
30 - 34.99	0	99.94%
35 - 39.99	1	99.95%
40 - 44.99	0	99.95%
45 - 49.99	1	99.96%
50 - 54.99	0	99.96%
55 - 59.99	1	99.97%
60 - 64.99	0	99.97%
65 - 69.99	1	99.99%
70 - 74.99	0	99.99%
75 - 79.99	0	99.99%
80 - 84.99	0	99.99%
85 - 89.99	0	99.99%
90 - 94.99	1	100.00%

Table 3 & 4 – Marginal Benefits Factor and Mileage Ratio Frequency Distribution

Looking at the time series of Marginal Benefits Factor versus the Mileage Ratio, there are 7 hours where the mileage ratio is over 20. There are 22 hours where the Mileage Ratio is above 10. In all there are 36 hours above 8.72, which is three standard deviations above the average of 3.11. However, in reality there is no cap on Mileage Ratio itself which exposes LSEs that pay for regulation services to unnecessarily high regulation charges with potentially little or no incremental benefit to excessive costs.

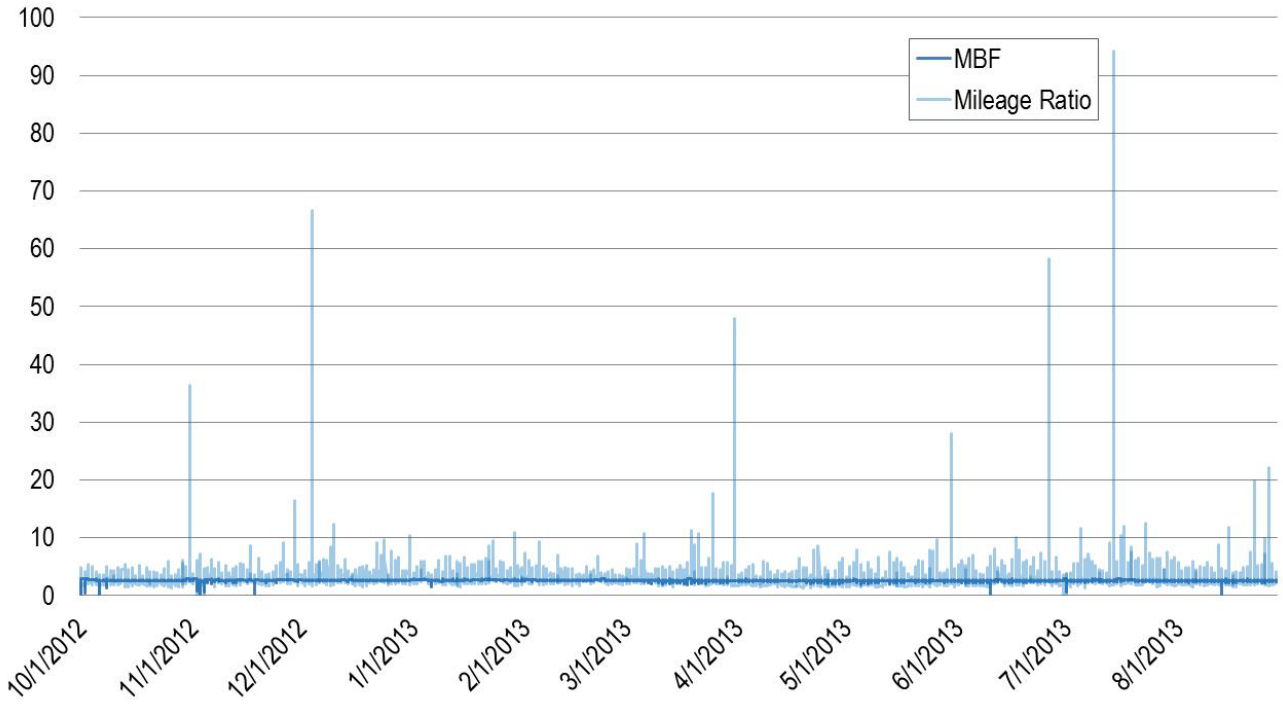

Figure 13 - Mileage Ratio vs. Marginal Benefits Factor

October 2012- August 2013

Because the Mileage Ratio outliers skew the data, Marginal Benefits Factor is depicted as a series by itself below.

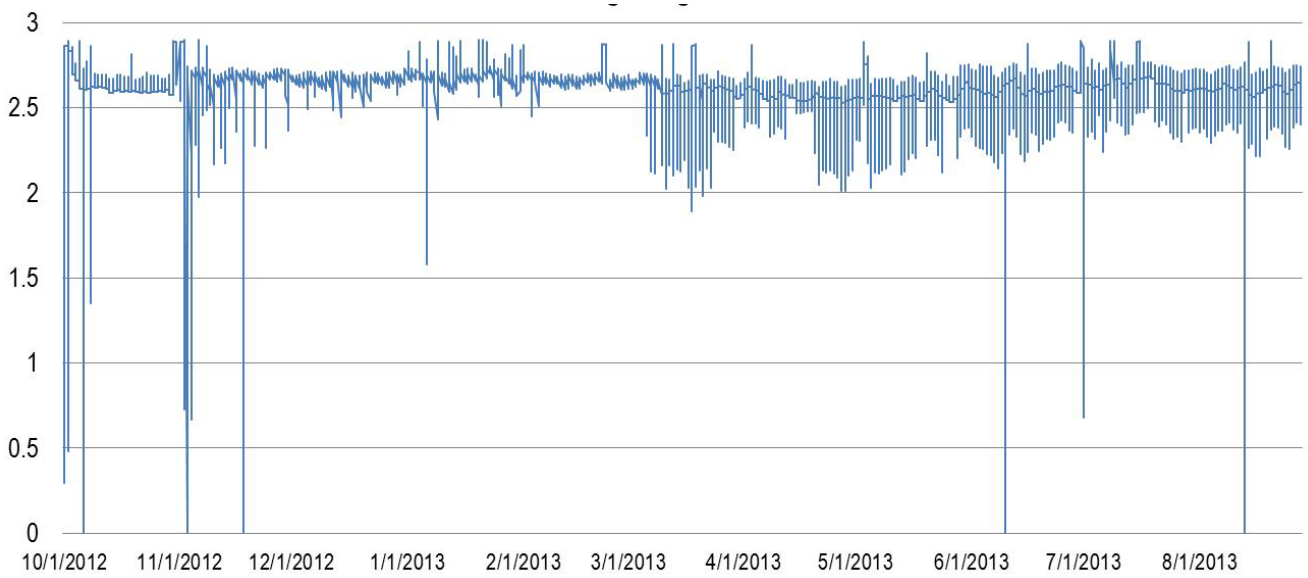

Figure 14 - Hourly Marginal Benefits Factor

October 2012 through August 2013

Because there is currently only a small group of fast moving regulation providers, some may see this as no cause for alarm. However, current resource owners in PJM as well developers will find a multiplier starting at 3.1 a powerful incentive to enter the market following the RegD signal. Resources must consider the costs of this strategy; traditional resource equipment will be damaged by following a signal too fast for mechanical processes. Also as more resource owners request to become fast moving regulation providers additional time will be added to connect resources into the network, test resources and support member questions.

Conclusion

The implementation of Performance Based Regulation occurred on October 1, 2012 making significant changes to the pricing of energy, reserves and regulation as well as changes to the structure of the regulation and reserve markets. Overall, the implementation of the Performance Based Regulation has been successful. System control remains at the same or better performance as measured by CPS1 and BAAL despite reductions in the regulation requirement. Fast moving resources participated in the market and were an increasing part of the Regulation Market. Regulation clearing prices have increased, but this increase is due to exposure to Lost Opportunity Cost which previously had been outside of the pricing and mileage which is part of the Performance Based Regulation changes. As PJM prepares to implement the final piece of the Performance Based Regulation changes, the mileage ratio for the fast moving performance incentive compensation, there still remains lingering doubt about this new method for market settlement as it misaligns incentives with the true operation of the system and creates an unbounded market settlement value for fast regulation resources.