

**UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION**

PJM Interconnection, L.L.C.)	
)	Docket No. EL21-83-001
v.)	
)	
PJM Interconnection, L.L.C.)	
)	

COMMENTS OF THE INDEPENDENT MARKET MONITOR FOR PJM

Pursuant to Rule 211 of the Commission’s Rules and Regulations,¹ Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor (“Market Monitor”) for PJM Interconnection, L.L.C. (“PJM”),² submits these comments responding to the filing submitted by PJM Interconnection, L.L.C. (“PJM”) under Section 206 of the Federal Power Act on October 19, 2022 (“October 19 Filing”), which is a follow up to PJM’s June 10th Filing (“June 10th Filing”) that “identifies an unjust and unreasonable aspect of the formula for determining the Regulation market performance-clearing price (“RMPCP”) credit.” The Market Monitor agrees that the October 19th Filing identifies a flaw in the PJM market rules and that the flaw should be corrected. The Market Monitor does not agree that PJM’s proposed temporary fix to the identified problem is a reasonable solution to the identified market flaw.

¹ 18 CFR § 385.211 (2022).

² Capitalized terms used herein and not otherwise defined have the meaning used in the PJM Open Access Transmission Tariff (“OATT”), the PJM Operating Agreement (“OA”) or the PJM Reliability Assurance Agreement (“RAA”).

I. BACKGROUND

PJM's current regulation market design is severely flawed and is not efficient or competitive. The market results do not represent the least cost solution for the defined level of regulation service.

In a well functioning market, every resource should be paid the same clearing price per unit produced. That is not true in the PJM Regulation Market. RegA and RegD resources are not paid the same clearing price in dollars per effective MW. RegD resources are paid more than the correct, market clearing price. If all MW of regulation were treated the same in both the clearing of the market and in settlements, many of the issues in the PJM Regulation Market would be resolved. However, the current PJM rules result in the payment to RegD resources up to 100 times the correct, market clearing price.

RegA and RegD have different physical capabilities and follow different signals. The signal design makes Reg A and RegD complements and substitutes.

The PJM regulation market design includes three clearing price components: capability (\$/MW, based on the MW being offered); performance (\$/mile, based on the total MW movement requested by the control signal, known as mileage); and lost opportunity cost (\$/MW of lost revenue from the energy market as a result of providing regulation). Resources are paid Regulation Market Clearing Price (RMCP) credits and lost opportunity cost credits, which are uplift payments. PJM posts clearing prices for the regulation market (RMCCP, RMPCP and RMCP) in dollars per effective MW. The performance clearing price (RMPCP in \$/effective MW) is based on the marginal performance offer (RMPCP) for the hour. The capability clearing price (RMCCP in \$/effective MW) is equal to the difference between the RMCP for the hour and the RMPCP for the hour. This is done so the total of RMPCP plus RMCCP equals the total clearing price (RMCP) but the RMPCP is maximized.

In order to permit RegA and RegD to compete in the single PJM Regulation Market, RegD must be translated into the same units as RegA. One MW of RegA is one effective MW. RegA MW are the common unit of measure because regulation could be provided

solely by RegA MW. The translation is done using the marginal benefit factor (MBF). As more RegD is added to the market, the relative value of RegD declines, based on its actual performance attributes. For example, if the MBF is 0.01, a MW of RegD is worth 0.01 MW of RegA (or 1/100 of a MW of RegA). This is the same thing as saying that 1.0 MW of RegD is equal to 0.01 effective MW when the MBF is 0.01.

Effective MW equal actual MW multiplied by the performance score and benefit factor for each unit. In the case of RegA, the benefit factor is always equal to one, and performance scores are always less than one, so effective MW of RegA are less than actual MW. For RegD resources effective MW can be larger than actual MW, if the benefit factor is greater than one. When adding RegA and RegD total MW together, actual MW can be larger or smaller than effective MW, depending on the influence of RegA MW and RegD MW. The MBF is used in the market clearing to find the least cost combination of RegA and RegD MW to meet the effective MW requirement. The MBF is used in price formation so that the market clearing price is in terms of dollars per effective MW. The MBF is not, however, used in market settlements.

Almost all of the issues in PJM's Regulation Market are caused by the failure to use the MBF in settlement. Because the MBF is not included in settlements, when the MBF is less than 1.0, RegD resources are paid too much. When the MBF is less than 1.0, each MW of RegD is worth less than 1.0 MW of RegA. The market design buys the correct amount of RegD to compensate for its performance, recognizing the correct MBF value, but pays RegD as if the MBF were 1.0. In an extreme case, when the MBF is 0.01, RegD MW are paid 100 times too much. The extreme case does occur. If the market clearing price is \$1.00 per MW of RegA, RegD is paid \$100 per effective MW. Resolution of this problem requires that PJM pay RegD for the same effective MW it provides in regulation, 0.01 MW.

The current settlement process does not result in paying RegA and RegD resources the same price per effective MW. RegA resources are paid on the basis of dollars per effective MW. RegD resources are not paid on the basis of dollars per effective MW because the MBF is not used in settlements. Instead of being paid based on the MBF, (RMCCP +

RMPCP)*MBF, RegD resources are paid based on the mileage ratio (RMCCP + (RMPCP*mileage ratio)). The mileage ratio is set equal to the ratio of RegD movement in the hour relative to RegA movement in the hour (RegD mileage/RegA mileage). Because the RMCCP component makes up the majority of the overall clearing price, when the MBF is above one, RegD resources are underpaid on a per effective MW basis by the current payment method, unless offset by a high mileage ratio. When the MBF is less than one, RegD resources are overpaid on a per effective MW basis, unless offset by a low mileage ratio. The average MBF was greater than 1.0 in the first nine months of 2022 (1.25).

The effect of using the mileage ratio instead of the MBF for purposes of settlement is illustrated in Table I-1. Table I-1 shows how much RegD resources are currently paid, on an effective MW basis, on average, in the first nine months of 2021 and 2022 under the current rules, compared to how much RegD resources should have been paid if they were actually paid for effective MW. Using the MBF consistently throughout the PJM regulation market would result in RegA and RegD resources being paid exactly the same on a per effective MW basis. However, the PJM regulation market only uses the MBF in the market clearing and setting of price on a dollar per effective MW basis. The PJM regulation market does not use the MBF to convert RegD MW into effective MW for purposes of settlement. This causes the MW value of RegD resources to be inflated in settlement when the MBF is less than one and to be undervalued in settlement when the MBF is greater than one. In the first nine months of 2022, the MBF averaged 1.25, while the average daily mileage ratio was 6.25, resulting in RegD resources being paid \$6.4 million less than they would have been paid on an effective MW basis if the MBF were correctly implemented. In the first nine months of 2021, the MBF averaged 0.79, and the average mileage ratio was 7.06, resulting in RegD resources being paid \$7.4 million more than they would have been paid if the MBF were correctly implemented. The shift from overpayment to underpayment of RegD resources between 2021 and the first nine months of 2022 is the result of an incorrect calculation of the MBF, as a result of the way dual offers are handled by PJM. This error has led to a decrease

in the amount of RegD cleared and a resulting increase in the MBF of RegD resources. The higher MBF values have not been accurately reflected in settlement.

Table I-1 Average monthly price paid per effective MW of RegD and RegA under mileage and MBF based settlement: January 2021 through September 2022

Year	Month	RegD Settlement Payments				
		Mileage Based RegD (\$/Effective MW)	Marginal Rate of Technical Substitution Based RegD (\$/Effective MW)	RegA (\$/Effective MW)	Percent RegD Overpayment (\$/Effective MW)	Total RegD Overpayment (\$)
2021	Jan	\$30.47	\$11.43	\$11.43	166.6%	\$558,397
	Feb	\$88.91	\$19.90	\$19.90	346.7%	\$1,310,279
	Mar	\$61.03	\$17.93	\$17.93	240.4%	\$1,277,850
	Apr	\$65.99	\$16.73	\$16.73	294.3%	\$1,492,094
	May	\$39.55	\$16.42	\$16.42	140.9%	\$1,081,445
	Jun	\$26.57	\$18.40	\$18.40	44.4%	\$457,543
	Jul	\$27.36	\$19.34	\$19.34	41.5%	\$513,073
	Aug	\$38.23	\$31.77	\$31.77	20.4%	\$288,112
	Sep	\$35.63	\$28.59	\$28.59	24.6%	\$410,694
	Oct	\$51.13	\$38.91	\$38.91	31.4%	\$688,515
	Nov	\$63.20	\$52.92	\$52.92	19.4%	\$377,458
	Dec	\$33.94	\$26.85	\$26.85	26.4%	\$399,675
Yearly		\$46.48	\$24.93	\$24.93	86.4%	\$8,855,253
2022	Jan	\$62.73	\$68.59	\$68.59	(8.5%)	(\$1,580,376)
	Feb	\$29.38	\$31.51	\$31.51	(6.8%)	(\$516,687)
	Mar	\$31.86	\$25.56	\$25.56	24.7%	\$281,052
	Apr	\$46.90	\$49.00	\$49.00	(4.3%)	(\$550,585)
	May	\$39.30	\$41.57	\$41.57	(5.4%)	(\$582,040)
	Jun	\$47.78	\$54.47	\$54.47	(12.3%)	(\$1,133,591)
	Jul	\$45.45	\$53.40	\$53.40	(14.9%)	(\$1,438,918)
	Aug	\$60.51	\$63.64	\$63.64	(4.9%)	(\$1,069,872)
	Sep	\$55.46	\$46.90	\$46.90	18.2%	\$239,007
Yearly		\$46.75	\$48.46	\$48.46	(3.5%)	(\$6,352,011)

II. COMMENTS

A. PJM's Targeted Solution Does Not Correct the Identified Market Flaw

In PJM's June 10, 2022, filing (at 4), PJM recognized that an efficient market requires that resources be paid credits in accordance with the applicable clearing price. In PJM's October 19 Filing, it is noted (pp. 4-5) that the use of the mileage ratio as a scalar on performance credits paid to RegD resources results in RegD resources being incorrectly compensated when the RegA signal, in support of RegD, is set to zero mileage for an extended period. Most RegD resources cannot, without reductions in regulation MW offered, respond to a regulation signal in one direction (e.g. regulation up) for more than 15 minutes. When a regulation signal requires more than that duration, RegD resources actually move in the wrong direction, increasing the need for regulation rather than

supplying regulation. RegA has to not only respond as it would have, but must also compensate for the RegD moving in the wrong direction. When RegA must remain at full regulation output for an extended period, the RegA mileage is measured as zero while the RegD mileage is positive. Under these circumstances the mileage ratio scalar used in the settlement calculation for RegD becomes undefined and “potentially” results in undefined RMPCP credits. To address this market result, PJM proposes to replace a RegA mileage value of zero in any hour with a mileage value of 0.1. PJM claims (at 6) that “the value of 0.1 is a reasonable substitute for 0, because it is close to zero.” PJM states (at 7) that it is “hopeful that this narrow issue could be addressed more comprehensively as part of a set of reforms to the Regulation market that is currently being developed with PJM stakeholders.”

PJM’s proposal to put a floor of 0.1 on RegA mileage as a fix to the undefined mileage ratio problem was presented to, and rejected by, the PJM stakeholders at the Market Integration Committee (MIC) meeting of September 9, 2021.³ At this same meeting, the Market Monitor proposed an alternative temporary fix of the issue by capping the mileage ratio at 1.0.⁴ Based on the resulting stakeholder discussions, PJM withdrew its proposal to put a floor of 0.1 on RegA mileage and agreed to support a stakeholder process to develop a more holistic review and overhaul of the regulation market.

The Market Monitor agrees that an efficient market requires that resources be paid credits in accordance with the applicable clearing price. There is no basis, however, for PJM’s assertion (at 6) that putting a floor of 0.1 miles on RegA mileage in the mileage ratio

³ See PJM Presentation “Regulation Mileage Ratio Calculation,” September 9, 2021 <<https://pjm.com/-/media/committees-groups/committees/mic/2021/20210909/20210909-item-05a-undefined-regulation-mileage-ratio-calculation-pjm-presentation.ashx>>.

⁴ See Market Monitor presentation: “Mileage Ratio Issue,” September 9, 2021 <<https://pjm.com/-/media/committees-groups/committees/mic/2021/20210909/20210909-item-05b-undefined-regulation-mileage-ratio-calculation-imm-presentation.ashx>>.

scalar calculation will result in regulation resources being properly compensated. There is no economic justification for a mileage ratio scalar, regardless of a value, to be used to modify the marginal performance price (RMPCP) paid to RegD resources. The fact that the use of the mileage ratio in settlement calculations can result in an undefined result is clear evidence that the mileage ratio is an irrational and counterproductive component of the PJM regulation market.

Under the current signal design (adopted in 2017), the RegA signal is explicitly used to support the conditional energy neutrality of RegD. Conditional energy neutrality of RegD means that PJM's RegA and RegD signals are designed to try to keep the RegD signal energy neutral over a 30 minute period. This means that the total regulation up MW of the RegD signal will equal the total regulation down MW of the RegD signal over a 30 minute period. But conditional energy neutrality is a euphemism for the fact that many RegD resources cannot move in the direction required for ACE control for more than 15 minutes in the absence of support from RegA. More generally, the RegD energy neutrality constraint in the signal design is conditional on there being enough RegA support, in combination with system conditions, to allow it. The RegD signal is defined to be the difference between ACE and RegA. This is not required by an efficient market design; it is required because RegD regularly moves in a direction opposite to PJM's actual need for regulation. Thus, under the current design, RegA is required to offset RegD when RegD moves in the opposite direction of that required by ACE control in order to permit RegD to recharge or discharge to sustain neutrality. When RegA is used to provide not only ACE control but support for RegD energy neutrality, RegA can be pegged at a fixed value or slowed for an extended period of time (no or little change in output). Under these conditions, RegA movement (mileage) is artificially reduced relative to what it would be with optimal RegA only regulation, and RegD movement (mileage) is artificially increased. When RegA is supporting RegD neutrality, RegD can move in a direction that, in the absence of RegA support, would be inconsistent with ACE control. Surprisingly, the mileage of RegD when it is counter productive to ACE control, and/or inflated due to support by RegA, is still

credited as mileage for purposes of price formation (RMPCP) and for purposes of calculating the mileage ratio (RegD mileage/RegA mileage).

The MBF, properly defined, provides the relative amount of effective regulation that is provided by RegA and RegD, based on the amount of RegA and RegD that clear the market. The mileage ratio is not a reasonable substitute or approximation of the MBF. Since total ACE control is provided by a combination of RegA and RegD interactions, the relative and total work provided by RegA and RegD in providing ACE control is not and cannot be reflected in the mileage ratio. The relative value of RegD when RegA is pegged at zero mileage is not infinite (undefined), since the sum of RegA and RegD movement is ACE control. REG A with zero mileage is providing ACE control under the direction of PJM (it is providing maximum regulation MW up or maximum regulation MW down or some fixed regulation MW between) and is supporting RegD. The resulting mileage ratio is merely an artifact of the interdependent RegA/RegD signal design, not of relative work or value provided. Using the mileage ratio as a proxy for relative value in settlement instead of the MBF is a market distortion and results in RegD resources not being paid the market clearing price.

The Market Monitor recommends that, rather than use the mileage ratio as a scalar in RegD settlement of performance credits, the MBF should be used to convert RegD MW into effective MW in settlement. Paying RegD resources \$/effective MW prices for effective MW provided would correct the observed market flaws and would eliminate the irrational market results observed by PJM and would eliminate the need for PJM's proposed change.

If the Commission does not direct PJM to immediately correct the identified market flaw in the regulation market and make a filing that would apply the MBF in settlement calculations, the Market Monitor recommends that the Commission cap the mileage ratio at 1.0. Capping the mileage ratio at 1.0 would limit the market distortion caused by the mileage ratio in the context of the current flawed market design. Capping the mileage ratio at 1.0 would bring the mileage ratio more in line with observed average MBF values. In addition, capping the mileage ratio at 1.0 recognizes that RegA resources are providing

regulation and doing significant work to offset the shortcomings of RegD resources even when the mileage calculation shows zero.

III. CONCLUSION

The Market Monitor respectfully requests that the Commission afford due consideration to these comments as it resolves the issues raised in this proceeding.

Respectfully submitted,



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Dated: November 8, 2022

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 Eagleville, Pennsylvania,
this 8th day of November, 2022.



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