UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C.	)	Docket No. ER26-2446-000

ANSWER AND MOTION FOR LEAVE TO ANSWER OF THE INDEPENDENT MARKET MONITOR FOR PJM

Pursuant to Rules 212 and 213 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 this answer to comments submitted on May 22, 2026, by the PJM Power Providers Group ("Power Providers"). Power Providers respond to PJM's filing submitted May 1, 2026 ("May 1st Filing"), in which PJM requested a two month extension of the current implementation date for PJM's Regulation market redesign "Phase 2," from October 1, 2026, to December 1, 2026. Power Providers state (at 3): "Instead of debuting a material system overhaul on the cusp of winter peak demand, P3 suggests that a March 1, 2027, implementation date would provide a significantly safer operational window." The Market Monitor supports deferring the implementation date to March 1, 2027, at the earliest. More specifically, deferred implementation of Phase 2 is warranted until PJM can demonstrate that it has eliminated identified problems with the Phase 1 market design and has incorporated these fixes in the Phase 2 market rules and software design. In addition, consistent with Power Providers and

---

1 18 CFR §§ 385.212 & 385.213 (2025).

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").

prior PJM practice, the Market Monitor recommends that any implementation of Phase 2 not be during the winter peak or the summer peak.

I. ANSWER

PJM filed significant changes to the regulation market design with the Commission on April 16, 2024. The Commission Order of June 14, 2024, accepted the PJM proposal as filed, including a two phase implementation. Phase 1, implemented on October 1, 2025, is a single product, single signal market with one clearing price. Phase 2, originally intended to be implemented on October 1, 2026, is a complex design that will include separate regulation up and regulation down markets for the first time in the PJM Regulation Market.

While the Phase 1 changes eliminated many of the significant issues identified by the Market Monitor that resulted from the prior two product, two signal market design, a number of issues have plagued the Phase 1 market since its introduction in October 2025. The Market Monitor described these issues in the attached 2026 Quarterly State of the Market Report for PJM: January through March, pages 656–661.[3] The Market Monitor has discussed the issues with PJM and has made several presentations to stakeholders on this topic.

Given PJM's experience with the Phase 1 market to date, Power Providers have proposed postponing the original October 1, 2026, implementation date until March 1, 2027. The Market Monitor believes that a delay in the Phase 2 implementation is prudent until such time that PJM eliminated problems with the Phase 1 market and has incorporated these fixes in the Phase 2 market rule and software design and completed comprehensive testing of the Phase 2 software.

II. MOTION FOR LEAVE TO ANSWER

The Commission's Rules of Practice and Procedure, 18 CFR § 385.213(a)(2), do not permit answers to answers or protests unless otherwise ordered by the decisional authority.

---

[3] *See* Attachment.

The Commission has made exceptions, however, where an answer clarifies the issues or assists in creating a complete record.[4] In this answer, the Market Monitor provides the Commission with information useful to the Commission's decision making process and which provides a more complete record. Accordingly, the Market Monitor respectfully requests that this answer be permitted.

III. CONCLUSION

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

Respectfully submitted,

Joseph E. Bowring
Independent Market Monitor for PJM
President
Monitoring Analytics, LLC
2621 Van Buren Avenue, Suite 160
Eagleville, Pennsylvania 19403
(610) 271-8051
joseph.bowring@monitoringanalytics.com

Jeffrey W. Mayes

General Counsel
Monitoring Analytics, LLC
2621 Van Buren Avenue, Suite 160
Eagleville, Pennsylvania 19403
(610) 271-8053
jeffrey.mayes@monitoringanalytics.com

Dated: June 2, 2026

[4] *See, e.g., PJM Interconnection, L.L.C., 119 FERC ¶61,318 at P 36 (2007) (*accepted answer to answer that "provided information that assisted … decision-making process*"); California Independent System Operator Corporation*, 110 FERC ¶ 61,007 (2005) (answer to answer permitted to assist Commission in decision-making process); *New Power Company v. PJM Interconnection, L.L.C.*, 98 FERC ¶ 61,208 (2002) (answer accepted to provide new factual and legal material to assist the Commission in decision-making process); *N.Y. Independent System Operator, Inc.*, 121 FERC ¶61,112 at P 4 (2007) (answer to protest accepted because it provided information that assisted the Commission in its decision-making process).

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 2nd day of June, 2026.

Jeffrey W. Mayes
General Counsel
Monitoring Analytics, LLC
2621 Van Buren Avenue, Suite 160
Eagleville, Pennsylvania 19403
(610) 271-8053
jeffrey.mayes@monitoringanalytics.com

Attachment

Table 10-34 Monthly secondary reserve settlements: January 2025 through March 2026

Year	Month	Total Day-Ahead Credits	Total Balancing MCP Credits	Total LOC Credits	Total Effective Shortfall Charge	Total Credits
2025	Jan	$0	$0	$243,258	$0	$243,258
2025	Feb	$0	$0	$133,463	$0	$133,463
2025	Mar	$0	$0	$126,843	$0	$126,843
2025	Apr	$0	$0	$135,333	$0	$135,333
2025	May	$0	$0	$420,010	$0	$420,010
2025	Jun	$0	($986,243)	$1,825,703	$0	$839,460
2025	Jul	$0	$0	$1,274,869	$0	$1,274,869
2025	Aug	$0	$0	$1,150,153	$0	$1,150,153
2025	Sep	$0	$0	$850,339	$0	$850,339
2025	Oct	$0	$0	$927,503	$0	$927,503
2025	Nov	$0	$0	$682,979	$0	$682,979
2025	Dec	$0	$0	$1,540,616	$0	$1,540,616
2025	All	$0	($986,243)	$9,311,069	$0	$8,324,826
2026	Jan	$0	$0	$1,669,975	$0	$1,669,975
2026	Feb	$0	$0	$1,833,828	$0	$1,833,828
2026	Mar	$0	$0	$990,352	$0	$990,352
2026	All	$0	$0	$4,494,155	$0	$4,494,155

Table 10-35 provides secondary reserve credits by primary resource and fuel type for the first three months of 2026.

Table 10-35 Secondary reserve credits by primary resource and fuel type: January through March, 2026

Resource / Fuel Type	Day-Ahead MWh	Real-Time Capped MWh	Day-Ahead Credits	Balancing MCP Credits	LOC Credits	Total Credits
Combined Cycle	462	2,554,867	$0	$0	$1,531,645	$1,531,645
Steam - Coal	0	2,156,824	$0	$0	$1,315,799	$1,315,799
CT - Natural Gas	20,017,248	27,861,440	$0	$0	$1,105,652	$1,105,652
CT - Oil	3,246,984	4,169,982	$0	$0	$174,302	$174,302
RICE - Natural Gas	12,004	68,748	$0	$0	$139,141	$139,141
Steam - Natural Gas	0	264,152	$0	$0	$126,553	$126,553
Steam - Other	0	37,013	$0	$0	$96,050	$96,050
RICE - Oil	162,231	199,653	$0	$0	$5,012	$5,012
Hydro - Pumped Storage	36,950	779,514	$0	$0	$0	$0
Other	5,724	106,059	$0	$0	$0	$0

Among other reasons, a secondary reserve resource is paid an LOC credit when PJM determines that the resource was backed down in order to clear more secondary reserve. Because the supply of secondary reserves greatly exceeds the amount needed to meet the 30-minute reserve requirement, PJM does not actually back down resources to clear more secondary reserve. However, because of the method used by PJM to determine whether a resource was backed down, PJM at times pays resources for an incorrectly determined real-time opportunity cost. For example, PJM erroneously treated resources coming online to provide energy as having been backed down to provide secondary reserves. PJM does not back down resources below their economic minimum to provide secondary reserves, but in the first three months of 2026, for secondary reserve resources that did not clear day-ahead and were generating below their economic minimum points, PJM paid $1,122,586 in LOC credits.

Regulation Market

Regulation matches generation with short term changes in load by moving the output of selected resources up and down via an automatic control signal. Regulation is provided by generators with a short-term response capability (less than five minutes) or by demand response (DR). The PJM Regulation Market is operated as a single real-time market.

PJM filed proposed significant changes to the regulation market design with FERC on April 16, 2024.[108] The Commission Order of June 14, 2024, accepted the PJM proposal as filed. PJM will implement the changes to the regulation market in two phases.[109] Phase 1, implemented on October 1, 2025, is a single product, single signal market with one clearing price. Phase 2, to be implemented on October 1, 2026, will include separate regulation up and regulation down markets. The Phase 1 changes eliminated many of the significant issues identified by the MMU that resulted from the prior two product, two signal market design, including the incorrect and inconsistent use and application of the MBF/MRTS.[110]

108 PJM, "Regulation Market Design Filing," Docket No. ER24-1772-000.
109 See 187 FERC ¶ 61,173.
110 See Order No. 755, 137 FERC ¶ 61,064 at P 2 (2011).

This report analyzes the regulation market results from the first quarter of 2026 under the new Phase 1 regulation market design.

Market Design

The objective of PJM's regulation market design should be to minimize the cost to provide regulation. The new design, as actually implemented, does not meet that goal.

The regulation market design includes three clearing price components: capability ($/MW, based on the MW offered); performance ($/MW*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). The performance score translates actual MW into effective MW, and offers and clearing prices into $/effective MW.

Phase 1 of PJM's regulation market redesign was implemented on October 1, 2025. The new market design replaced two separate RegA/RegD signals/products with a single signal/product, eliminating the need for the benefit factor. The new market design includes the LOC in the market price, although there are issues with the LOC calculation. The new market design simplifies the performance score calculation.

Market solution software relevant to regulation consists of the Ancillary Services Optimizer (ASO) solving each half hour; the intermediate term security constrained economic dispatch market solution (IT SCED) solving every 15 minutes; and the real-time security constrained economic dispatch market solution (RT SCED) solving every five minutes. The ASO, incorporating the forecast LMP values in the LOC calculation, defines the cleared regulation MW. The regulation market clearing price is a function of the defined demand for regulation and the offer prices that incorporate LOC based on real-time LMP based on the most recently approved RT SCED case, approximately 10 minutes ahead of the target solution time. The regulation market clears based on the resultant offer prices over 30 minute periods.

The current design includes new definitions of regulation demand. The demand for regulation is defined by the categories of ramp hours, nonramp hours, and shoulder hours. In addition, the length of the regulation seasons and the regulation requirements for each category were modified (Table10-36). The regulation requirement for ramp hours was changed from 800 effective MW to 750 effective MW, for nonramp hours was changed from 525 effective MW to 550 effective MW, and for the new shoulder hours was set to 650 effective MW. The definition of the hours for each category of ramp hours changes by season. These changes together will increase the yearly regulation effective MW demand by 3.9 percent.

Table 10-36 Seasonal regulation requirement definitions.

Season	Dates	Nonramp Hours (550 MW)	Shoulder Hours (650 MW)	Ramp Hours (750 MW)
Winter	Nov 1 - Feb 28(29)	01:00 - 03:59 11:00 - 15:59	0:00 - 0:59 10:00 - 10:59	04:00 - 09:59 16:00 - 23:59
Spring	Mar 1 - Apr 30	02:00 - 04:59 10:00 - 17:59	1:00 - 1:59 9:00 - 9:59	05:00 - 08:59 18:00 - 00:59
Summer	May 1 - Sep 15	02:00 - 03:59	1:00 - 1:59	04:00 - 00:59
Fall	Sep 16 - Oct 31	01:00 - 04:59 10:00 - 16:59	0:00 - 0:59 9:00 - 9:59	05:00 - 08:59 17:00 - 23:59

Each cleared resource is allocated a portion of the signal based on the cleared regulation MW of the resource relative to the total cleared MW of regulation. This signal is called the Total Regulation Signal (TREG) for the resource. A resource that cleared 10 MW of capability (Assigned Regulation or AREG) will be provided a percent TREG signal asking for a positive or negative regulation movement between negative and positive 100 percent around its regulation set point.

Regulation performance scores (0.0 to 1.0) measure the response of a regulating resource to the assigned regulation signal every 10 seconds by measuring the precision, defined to be the difference between the regulation response and the regulation requested.[111] Performance scores are reported on a half hour basis for each resource.

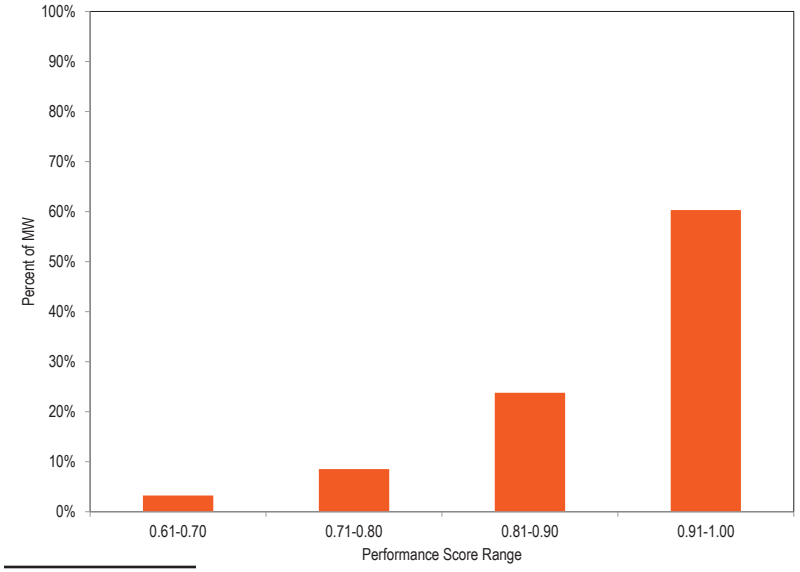
111 PJM "Manual 12: Balancing Operations," § 4.5.6 Performance Score Calculation, Rev. 54 (July Dec. 17, 2024).

Table 10-37 and Figure 10-32 show the average half hour performance score by resource type in the first three months of 2026.[112] Each category is based on the percentage of the full performance score distribution for each resource type.[113] In the first three months of 2026, 60.3 percent of all regulation resources had average performance scores within the 0.91-1.00 range.

Table 10-37 Half hour average performance score by unit type: January through March, 2026

	Performance Score Range			
Unit Type	61-70	71-80	81-90	91-100
Battery	1.2%	2.0%	5.7%	88.5%
CT	2.8%	9.1%	32.6%	51.6%
Diesel	0.9%	2.7%	18.8%	75.7%
DSR	2.3%	2.8%	4.3%	84.3%
Hydro	2.4%	7.2%	29.7%	58.2%
Steam	5.1%	14.1%	34.5%	40.9%

Figure 10-32 Half hour average performance score: January through March, 2026



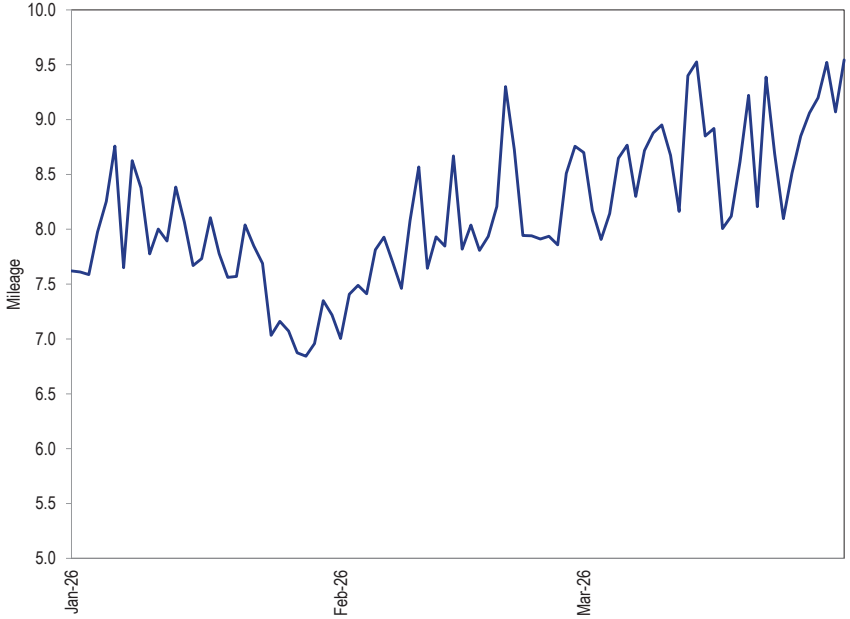
112 Except where explicitly referred to as effective MW or effective regulation MW, MW means actual MW unadjusted for performance score.

113 PJM "Manual 12: Balancing Operations," § 4.5.6 Performance Score Calculation, Rev. 54 (July Dec. 17, 2024).

The October 1, 2025, redesign eliminated the marginal benefit factor, and changed the definition of the mileage ratio. The mileage ratio is defined as the actual mileage divided by the 100 hour historical average mileage. The new design uses this mileage ratio to calculate the regulation mileage credits portion of settlements.

Figure 10-33 shows the daily average mileage ratio in the first three months of 2026.

Figure 10-33 Daily average mileage ratio: January through March, 2026



Market Design Issues

While the new market design corrected a number of issues with the old design, new issues have been identified in the new design.

The performance score is incorrect. All else being held equal, the current design inappropriately calculates a lower error for units with larger MW

regulation assignments than units that perform exactly the same but with a smaller regulation assignment.

Under the new regulation market design, PJM determines the five minute interval performance score by evaluating a unit's performance every 10 seconds. This performance score is determined by calculating the error in a unit's output based on the average regulation signal MW during the entire half hour clearing interval.

The numerator is the difference between the actual regulation MW and the assigned regulation MW based on the regulation signal. The denominator is calculated as the average of the unit's assigned regulation and the average of the absolute value of the regulation signal calculated over the half hour clearing interval. This has the effect of scaling each 10 second performance score based on the clearing interval average of the overall regulation signal. The MMU disagrees with this calculation method because it scales the actual response based on the average signal over the clearing interval for no apparent reason. Identical behavior of the same unit can yield different results if the overall interval average signal is different. More importantly, the inclusion of the assigned regulation MW (AREG) in the denominator results means that identical responses from units with different levels of committed regulation MW will have different performance scores. Both results are illogical.

The MMU proposes to define regulation performance using only the ratio of the unit's response to the regulation signal.

The total performance score for the clearing interval is the average of each 10 second performance score. This means that any unit providing a steady 7.5 MW to a signal calling for 10 MW would logically receive a performance score of 0.75, regardless of the assigned regulation MW of the unit. Using PJM's equation in this case would result in different performance scores for units with the same 75 percent response, based solely on the magnitude of regulation assignment. Table10-38 illustrates the variation in performance scores that result from different assigned regulation MW amounts and average interval signals under the current calculation, compared to the MMU's proposal.

Table 10-38 Performance scores under different market conditions: Current versus MMU proposed calculation

				Performance Score	
Clearing Interval Average Absolute Signal MW	Assigned Regulation MW	Regulation Output MW	Signal MW	PJM	MMU
5.0	10.0	7.5	10.0	66.7%	75.0%
	50.0	7.5	10.0	90.9%	75.0%
	100.0	7.5	10.0	95.2%	75.0%
10.0	10.0	7.5	10.0	75.0%	75.0%
	50.0	7.5	10.0	91.7%	75.0%
	100.0	7.5	10.0	95.5%	75.0%
20.0	10.0	7.5	10.0	83.3%	75.0%
	50.0	7.5	10.0	92.9%	75.0%
	100.0	7.5	10.0	95.8%	75.0%

The MMU recommends that the performance score be revised to eliminate the effect of the size of the regulation assignment and to directly calculate the performance score based on the actual performance and the requested performance.

In October 2025, PJM identified that the clearing of less than 1.0 MW for resources was a contributing factor to extremely high prices in the regulation market, particularly during reserve shortages.

As an initial workaround, PJM told participants that they could set a minimum regulation MW level in their regulation offers. In addition, PJM implemented an after the fact (after market clearing) step that replaces any fractional MW regulation assignments with a 1.0 MW regulation assignment for any units that are eligible for LOC and have a regulation capability greater than 1.0 MW. While this override reduced the LOC contributions to regulation prices, the override did not eliminate all associated high prices and is an ad hoc fix that ignores the underlying issue.

The MMU does not agree that asking participants to make inflexible regulation offers is the correct way to address the fractional MW clearing results of the current market clearing engine design. Relying on participants to make their offers less flexible to correct for an optimization issue is not efficient or reasonable. The MMU does not agree that overriding the fractional

MW assignment with a 1.0 MW assignment is a correct way to address the fractional MW clearing results of the current market clearing engine design.

The MMU recommends that the regulation market optimization be reviewed to address the logic that allows the partial clearing of inframarginal resources.

Since the implementation of the inflexible offers and the 1.0 MW override, it became clear that the very high regulation prices are a result of interactions between offer parameters (differences between the regulation range and economic range of units and differences in offered ramp and actual ramp of units) and differences between ASO forecasted LMP and actual LMP used to set LOC for cleared regulation resources.

More fundamentally, the LOC calculation is incorrect. Regulation prices and total costs were expected to increase due to the inclusion of LOC in clearing prices rather than being paid as unit specific uplift. However, prices have been higher than appropriate in some hours as a result of differences between the regulation ranges and economic ranges of units and differences in offered ramp and actual ramp of units. Offer parameters define a regulation maximum MW (RegMax) and an economic maximum MW (EcoMax). The RegMax is the upper limit on the regulation offer and the EcoMax is the upper limit on the energy offer. RegMax should equal EcoMax. For some resources, the EcoMax is incorrectly offered as greater than the RegMax. The result is to artificially increase the LOC because the LOC is defined as the revenues that could have been earned in the energy market if the unit were not providing regulation. If RegMax and EcoMax are matched, the LOC is correctly defined by matching each MW of regulation offered with a MW of energy not sold. If the EcoMax is greater than the RegMax, the LOC is incorrectly defined by a higher MW level on the energy offer than the unit's regulation offer defines as the maximum MW for which it can provide regulation. The LOC calculation is based on the incorrect assumption that the unit gives up multiple MW of energy output for every MW of regulation. That can and does lead to extremely high LOC calculations that incorrectly inflate the clearing prices in the regulation market.

Differences between ASO forecasted LMPs and real time LMPs used to set LOC for cleared regulation resources can significantly amplify the RegMax/EcoMax issue and have resulted in the extremely high regulation prices observed at times since October 1, 2025.

Table 10-39 shows three different resources (Unit 1, Unit 2 and Unit 3) with identical costs curves (each MW of output increases marginal cost by $1), the same Reg Max, but different Eco Max. Unit 1 has Eco Max equal to Reg Max (20 MW). Unit 2 has Eco Max (30 MW) greater than Reg Max (20 MW). Unit 3 has Eco Max (40 MW) greater than Reg Max (20 MW). The clearing engine (ASO) has a forecasted LMP for all three units at $15. At $15, the economic desired MW equals the regulation set point at 15 MW for all three units, the total LOC is equal to $0.00 for all three units and each resource can clear for 5 MW of regulation at an offer of $0.00 per MW of regulation. If the real time LMP is equal to $15 (no change from the ASO forecast LMP), $/MW LOC stays at $0.00 per MW of regulation provided (first result for each unit in Table 10-39). If, however, the real time LMP is $200, the calculated $/MW LOC of Unit 1 is $182.50, the calculated $/MW LOC of Unit 2 is $532.50, and the calculated $/MW LOC of Unit 3 is $862.50.

Table 10-39 Regulation LOC Examples: Eco Max Greater than or Equal to Reg Max

Unit	Energy Price	Reg MW	Reg Set Point	Economic Desired MW	Reg Max	EcoMax	Marginal Cost at Reg Set Point	MC at Economic Desired	LOC $/MW	Total LOC
Unit 1	$15.00	5	15	15	20	20	$15.00	$15.00	$0.00	$0.00
Unit 1	$20.00	5	15	20	20	20	$15.00	$20.00	$2.50	$12.50
Unit 1	$25.00	5	15	20	20	20	$15.00	$20.00	$7.50	$37.50
Unit 1	$200.00	5	15	20	20	20	$15.00	$20.00	$182.50	$912.50
Unit 2	$15.00	5	15	15	20	30	$15.00	$15.00	$0.00	$0.00
Unit 2	$20.00	5	15	20	20	30	$15.00	$20.00	$2.50	$12.50
Unit 2	$25.00	5	15	25	20	30	$15.00	$25.00	$10.00	$50.00
Unit 2	$200.00	5	15	30	20	30	$15.00	$30.00	$532.50	$2,662.50
Unit 3	$15.00	5	15	15	20	40	$15.00	$15.00	$0.00	$0.00
Unit 3	$20.00	5	15	20	20	40	$15.00	$20.00	$2.50	$12.50
Unit 3	$25.00	5	15	25	20	40	$15.00	$25.00	$10.00	$50.00
Unit 3	$200.00	5	15	40	20	40	$15.00	$40.00	$862.50	$4,312.50

In evaluating the available supply for an interval, the clearing engine can clear less than the entire offer of a unit and can also clear less than 1.0 MW of a unit's offer. When the economic max of the unit is higher than the regulation max of the unit, clearing less than 1.0 of regulation can generate an extreme version of the problem shown in Table 10-39 above. Even after replacing the fractional MW with 1.0 MW, the market results when EcoMax is greater than regMax can be extreme.

The MMU recommends that if a unit sets its economic maximum at a value greater than its regulation maximum, the lost opportunity cost (LOC) of the unit should be calculated assuming the economic maximum of the unit is equal to the regulation maximum of the unit. The MMU recommends that, in cases where offered ramp is greater than actual ramp, the actual ramp be used to calculate the LOC of the unit. The MMU recommends that these fixes to the LOC logic be implemented prior to implementing Phase 2 of the regulation market design.

Market Redesign Phase 2

PJM is planning to introduce implement its Phase 2 regulation market design in October 2026, as approved by FERC. [114] In PJM's Phase 2 design, the regulation market will once again be split into two products with two separate prices: one product that only needs to respond when the regulation signal is above zero (RegUp), and one product that only needs to respond when the regulation signal is below zero (RegDown). In Phase 2, market resources will be able to clear as RegUp, RegDown or both in any given 30 minute market interval. PJM has not done any systematic testing of the proposal. PJM has not explained what problem this design change is intended to fix, analyzed what impact this design would have on reliability, or how this will affect the cost of regulation. The MMU continues to recommend a single product market with a single signal. Phase 1 with the issues corrected is preferable to Phase 2.

114 See Docket No. ER24-1772-000.