UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C.	)	Docket No. ER24-1772-000

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 the answer submitted by PJM on May 23, 2024 ("May 23rd Filing"), to the Market Monitor's protest filed in this proceeding May 7, 2024 ("Protest").[3]

It its filing submitted on April 16, 2024 ("April 16th Filing"), PJM proposed to replace the current regulation market design that includes one product and two signals ("RegA and RegD") with a market design that includes one product and one signal in Phase 1, and that would include two products (regulation up and regulation down) and one signal in Phase 2. PJM also proposed a number of other changes to the regulation market, including changes to lost opportunity cost calculations, changes to the inclusion of VOM in cost offers, changes to settlement calculations, changes to price formation, a reduction in the market period from 60 to 30 minutes, and changes to performance score calculations.

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1 18 CFR §§ 385.212 & 385.213 (2023).

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").

3 *PJM Interconnection, L.L.C.*, Protest of Independent Market Monitor, Docket No. ER24-1772-000 (May 7, 2024) ("Protest").

In the May 23rd Filing, PJM continues to fail to show that its proposal for the Phase 2 market design, PJM's target design, is just and reasonable. Important information needed to evaluate Phase 2 is not included. The April 16th Filing should be rejected as it has not been supported as just and reasonable. In the Protest, the Market Monitor identified flaws in the Phase 1 portion of the April 16th Filing that PJM fails to refute in its answer. The issues concerning Phase 1 are relevant to a potential future PJM filing that would include only a modified Phase 1 and would exclude Phase 2. PJM's arguments about Phase 1 issues do not support or justify the April 16th Filing, which defines Phase 2 as the target regulation market design and which asks that the Commission accept a design which has not been tested or adequately reviewed. PJM has stated that it requires two years to develop the actual Phase 2 market design. PJM's filing is premature and not complete. The April 16th Filing should be rejected because it is not just and reasonable for all these reasons.

I. ANSWER

A. Flaws in the Phase 1 Portion of the April 16th Filing Should Be Avoided in a Future PJM Filing to Reform the Regulation Market.

PJM states (at 2): "the Market Monitor's comments on Phase 1 and concerns regarding Phase 2 do not undermine that PJM's proposal is just and reasonable, and the Market Monitor's preference for certain alternative approaches cannot prevent the Commission from accepting PJM's proposal under section 205 of the Federal Power Act ("FPA")." The Protest is not a matter of preferences. The April 16th Filing includes Phase 2 as part of a single package. Phase 2 is simply not supported. As a result, the April 16th Filing should be rejected. Correcting the flaws in Phase 1 without removing Phase 2 from the proposal would not cure the failure to support Phase 2 as just and reasonable, and do not provide a basis for accepting the April 16th Filing.

B. PJM's Proposal Is Not Fully Developed and Was Not Tested.

PJM states (at 4) it vetted the proposal, but cannot implement it. A proposal that cannot be implemented has not been adequately vetted. PJM has made clear that it has failed to test or simulate its proposed Phase 2 approach. PJM has not articulated how it will clear

the market with simultaneous competing offers to provide regulation up, regulation down or both. The mechanics are not fully understood by PJM. The design is not final. The Phase 2 proposal in the April 16th Filing has not been supported as just and reasonable. PJM states (April 16th Filing at 16-17) that it needs "[a] two-year developmental timeframe is required, as PJM will need to make significant software changes to the market clearing engine, the AGC, which is the program that runs every two seconds, calculating ACE—the definitional focus of Regulation, Area Regulation, and economic dispatch, telemetry, and settlements." Phase 2 is clearly not ready and should not have been filed. Phase 2 is the proposed regulation market design in PJM's proposal. As a result, the April 16th Filing should be rejected.

C. PJM Will Require Twice as Many Cleared Regulation MW to Provide the Same Amount of Regulation.

PJM argues (at 5) that the Market Monitor erred when stating that PJM's Phase 2 market will effectively double the number of regulation MW that PJM must procure. PJM claims (at 5) that it will continue to procure the same amount of Regulation MW under current rules, Phase 1 and Phase 2.

Under PJM's proposed Phase 2 rules, the regulation MW required would be the same (e.g. 10 MW of total regulation) as under the current rules. Under the current rules, the resource would offer 10 MW. Under Phase 2, the resource could offer 10 MW of regulation up and 10 MW of regulation down in the same market clearing interval. It could clear for regulation up only (10 MW), regulation down only (10 MW) or for both (10 MW up and 10 MW down or a total of 20 MW). If the price offer of the resource was $1/MW for regulation up and $1/MW for regulation down, the clearing price (assuming no LOC) for regulation up would be $1/MW and the clearing price (assuming no LOC) for regulation down would be $1/MW. The resource would be paid $10 for regulation up and $10 for regulation down under the Phase 2 market, or $20 total. Under the current rules, the resource would be paid $10 total if the offer price were also equal to $1/MW.

PJM provides an example (at 6) in an attempt to disprove this point. PJM argues (at 6) that under the current and Phase 1 rules if a resource is committed to provide 10 MW of

regulation and the set point is 50 MW, then the resource actually is committed to provide 20 MW of regulation in the regulation range of 40 MW to 60 MW. PJM is incorrect. The regulation MW offered and cleared are 10 MW and not 20 MW.

PJM's example does not address or refute the Market Monitor's observation that Phase 2 will require PJM to purchase twice as many regulation MW. PJM's example is incorrect. PJM misstates the level of regulation MW offered and cleared under the current and Phase 1 rules. Under the current and Phase 1 rules, the resource in PJM's example is providing 10 MW of bidirectional regulation, not 20 MW of regulation. The resource in PJM's example (at 6) cannot clear for 20 MW of regulation up, cannot clear for 20 MW of regulation down, and cannot clear for both 20 MW up and 20 MW down. A resource that is only capable of providing 10 MW of bidirectional regulation service cannot move from 40 to 60 MW in a 5 minute period, or 60 to 40 in a 5 minute period.

PJM's Phase 2 proposal will, relative to the Phase 1 proposal, require PJM to clear twice as many regulation MW to provide the same amount of regulation service. This is why the April 16th Filing (at 7) proposes to split all cost-based offer components in half (including LOC) under Phase 2 and limit certain costs to regulation up or regulation down only service. In some cases this results in arbitrary and illogical allocation of costs to regulation down only service (See Protest at 8-9).

D. The Market Monitor's Proposed Approach for Calculating LOC is Based on Actual Output Not Average Output.

PJM states (PJM at 11) that "IMM's proffered approach of using average output could, over time, result in over- or understating the applicable lost opportunity cost."

PJM misunderstands the point.

The Market Monitor did not propose that average output be used in calculating LOC. The purpose of the Market Monitor's discussion (Protest at 6) of average output was to point out that the assumption that the LOC of a resource operating at economic minimum and providing regulation up service will not incur an LOC is incorrect and the assumption that the LOC of a resource operating at economic maximum and providing regulation down

service will not incur an LOC is incorrect. The point is that the actual LOC of a resource is based on the actual output of the unit relative to the economic desired MW of the unit as it provides regulation, not the initial regulation set point used in the market clearing of the regulation resource. PJM actually agrees with this point, as indicated by PJM's proposed use of "regulation bias" to adjust the regulation set point. However, while PJM recognizes (at 10) the difference between predicted LOC used in clearing the market and actual LOC, PJM ignores this same logic when claiming that generation resources operating at economic minimum or economic maximum would not incur an LOC if offering and participating in regulation down services.

The Market Monitor stated (Protest at 16) that LOC should be based on differences in LMP based desired MW and the actual output of the unit (not the regulation set point). The Market Monitor is proposing that LOC should be based on differences in LMP based desired MW and the actual output of the unit. This is effectively the same position that PJM has expressed (at 10) in the proposal to use "Regulation Bias" to adjust the regulation set point used to calculate interval specific LOC.

E. Assertions about Phase 2 Results Are Not Supported by Testing or Evidence.

PJM has failed to test or simulate its proposed Phase 2 approach. Instead PJM presents what it calls illustrative examples which are clearly not a substitute for actual testing. PJM (at 8) states that its examples in the May 23rd Filing (at 20) are illustrative of the benefits and efficiencies that PJM's proposed Phase 2 will provide over PJM's proposed Phase 1. The asserted benefits of Phase 2 over the Phase 1 proposal in PJM's examples are reduced energy market costs and reduced marginal LOC in the price of regulation. PJM's examples are flawed and do not support PJM's assertions. Phase 2 will not result in either lower energy costs or a lower price of regulation.

PJM's assertion of reduced costs for regulation and reduced energy costs under Phase 2 compared to Phase 1 is based on the unsupported and incorrect assumption of zero LOC costs for resources providing regulation up and regulation down service while at economic minimum and economic maximum; the unsupported assumption that resources at economic

minimum and economic maximum will set the regulation prices for regulation up and regulation down service; and the unsupported assumption that regulation resources will be able to supply twice as many MW under Phase 2 rules compared to Phase 1 rules. These assertions are incorrect.

The example (April 16th Filing at 20) assumes that a generation resource operating at economic minimum would be able to offer and participate in regulation up services without incurring LOC and generation resource operating at economic maximum (e.g. a wind resource) would not incur a lost opportunity cost if offering and participating in regulation down services. These assumptions are incorrect.

It cannot be assumed that resources at economic minimum that are providing regulation up service will not incur an LOC. It cannot be assumed that resources at economic maximum that are providing regulation down service will not incur an LOC. LOC is only zero when the economic desired MW is equal to the actual output of the unit providing regulation in each interval that an LOC is determined. PJM has actually recognized (at 10-11) this in its proposal to use "Regulation Signal Bias" to adjust a resource's regulation set point during the commitment period. PJM defines (at 10) Regulation Signal Bias as "the discrepancy between the regulation set point on which the resource was committed and the amount of energy PJM actually asked the resource to provide in that interval." PJM states (at 10) that "application of the Regulation Signal Bias [to the regulation set point] reflects the fact that PJM may have requested more or less energy from the resources providing the regulation service (e.g., RegUp or RegDown) than was contemplated at the time of commitment, through the Regulation set point." Under the PJM proposal, the regulation signal bias adjusted regulation set point is used to determine the LOC of the resource in any interval by comparing the adjusted regulation set point to the economic desired output of the resources providing regulation. In other words, PJM recognizes, in a roundabout way, that there is an LOC.

In other words, the actual LOC of a resource is based on the actual output of the unit relative to the economic desired MW of the unit as it provides regulation, not the initial

regulation set point used in the market clearing of the regulation resource. A wind resource with an economic desired MW equal to economic maximum (e.g. 30 MW) that clears in PJM's Phase 2 market as a 20 MW regulation down resource will incur an LOC any time it is dispatched below the 30 MW of output to provide regulation down service. The LOC of the wind resource will not be zero in this case. PJM recognizes the difference between the expected LOC used in clearing the market and the actual LOC incurred based on actual unit behavior when discussing regulation bias adjustments to the regulation set point. However PJM ignores the implication when asserting lower prices from Phase 2 over Phase 1 market results.

F. PJM's Conclusions about LOC Calculations Are Not Correct.

PJM's calculation of LOC for resources providing regulation service under Phase 1 and Phase 2 are mathematically identical in terms of total LOC. Both calculations are based on calculating the area (the triangle) formed by the difference between the regulation set point and the economic desired MW of the resource and the difference between the marginal offer of the resource at the regulation set point and the marginal cost at the economic desired output.[4] A resource providing bidirectional regulation service, with an LOC, and setting price under Phase 1 will, under the same circumstances, set a comparable price(s) in the regulation up market and regulation down market (one half of the LOC will be expressed in regulation up market price and one half the LOC will be expressed in the regulation down market) and receive the same compensation, and result in the same costs to the market if marginal, under the Phase 2 rules. In both cases, the total LOC is divided by the number of regulation MW provided to provide the $/MW LOC of the resource. A resource that clears for 10 MW of regulation up only will have its total LOC divided by 10 MW to provide the $/MW LOC for

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[4] See PJM. Meeting materials for the RMDSTF <https://www.pjm.com/-/media/committees-groups/task-forces/rmdstf/2023/20230718/20230718-item-5---rmdstf---pjm-package-summary.ashx>, pp. 20-26.

regulation up. If that same resource clears for 10 MW of regulation up and 10 MW of regulation down, the total LOC of the resource will be divided by 20 MW to provide the $/MW LOC for regulation up and for regulation down.[5]

More generally, there is no basis for the assertion that resources operating at economic minimum and economic maximum will be marginal for regulation up and regulation down service. There is, therefore, not basis for the assertion that the Phase 2 will generally reduce regulation market costs relative to Phase 1.

In a market with inframarginal resources for energy and regulation service, the resources at or near the top of the energy stack (higher offers) will be at the bottom (lower offers) of the regulation supply stack due to LOC. In other words, resources which would be more efficient to commit as regulation up or regulation down only will be inframarginal, not marginal for regulation. This means that Phase 2 will not provide cost reductions relative to Phase 1. Phase 2 changes in the inframarginal LOC costs will not change the marginal price in the regulation market. Phase 2 is not changing the amount of regulation (supply) that can supplied by a resource relative to Phase 1. Phase 2 asserted efficiencies are based on reducing the cost of the MW that are supplied due to reductions in LOC in some special cases. These reductions in LOC will only occur among inframarginal units. This means that the changes in LOC related to moving from the Phase 1 to the Phase 2 market design will not affect the price of regulation. Only changes in the realized offer price of marginal resources will affect regulation clearing price(s). If the most expensive unit for regulation down is $10, changing an inframarginal resource LOC from $5 to $0 does not change the $10 clearing price.

G. PJM's Conclusions about Energy Costs Are Not Correct.

There is also no basis for PJM's assertion that Phase 2 will result in lower energy costs than Phase 1. PJM's assertion of lower energy costs under Phase 2 is based on the assumption that regulation resources will provide twice as much regulation under Phase 2 than under

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[5] Id. at pp. 20-26

Phase 1. This assumption and the resulting conclusion about energy cost savings is incorrect. As the Market Monitor stated (Protest at 3-4), moving from a bidirectional regulation signal market (Phase 1) to a separate regulation up and regulation down signal based market (Phase 2) does not and cannot increase the amount of regulation MW that a regulation resource can provide. Correcting for this error in PJM's example shows that Phase 1 and Phase 2 have the same costs for regulation, the same energy market prices and the same energy market costs. Correcting for the error requires both Resource A and Resource B to clear for both regulation up and regulation down, as there is not enough regulation up only MW offered by Resource B to meet the regulation up requirement and not enough regulation down only MW offered by Resource A to meet the regulation down only requirement. The market needs 10 MW regulation up from both Resource A and B to meet the regulation up requirement and the market needs 10 MW of regulation down from both Resource A and B to meet the regulation down requirement. The change in regulation set point of Resource B in the corrected example from 10 to 20 MW (in order to provide 10 MW of regulation up and 10 MW of regulation down), means that Resource B is providing 20 MW of energy, not 10 MW. This increases the LMP from $50 to $100 in the corrected example, eliminating the professed energy cost savings in the PJM example. Similarly, Resource A must have a regulation set point (and energy output) of 30, not 40, to provide 10 MW of regulation up and 10 MW of regulation down in the corrected example. Resource A does not set the energy price in the PJM example or the corrected example.

Table 1 shows the original and corrected resource assumptions from PJM's example (April 16th Filing, at 20) for the Phase 1 and Phase 2 market. Table 2 shows the PJM Phase 1 result and the PJM original and corrected Phase 2 market results for PJM's example.

Table 1 Original and corrected assumptions for PJM example

PJM Assumption under Phase 1					
Resource A	MW	Price	Resource B	MW	Price
Eco Min	10	$10.00	Eco Min	10	$50.00
Eco Max	40	$40.00	Eco Max	30	$150.00
Regulation Offer	15	$0.00	Regulation Offer	10	$0.00
PJM assumption under Phase 2					
Resource A	MW	Price	Resource B	MW	Price
RegUp Offer	30	$0.00	RegUp Offer	20	$0.00
RegDown Offer	30	$0.00	RegDown Offer	20	$0.00
Corrected assumption under Phase 2					
Resource A	MW	Price	Resource B	MW	Price
RegUp Offer	15	$0.00	RegUp Offer	10	$0.00
RegDown Offer	15	$0.00	RegDown Offer	10	$0.00

Table 2 Original and corrected results for PJM example

			Energy MW (Price)		Regulation MW (Price)			LOC ($/MWh)		
Assumption Set	Load	Regulation Required	Resource A	Resource B	Resource A	Resource B	LMP ($/MWh)	Resource A	Resource B	Total Production Cost
PJM Phase 1	50	20	30 ($30)	20 ($100)	10 ($0)	10 ($0)	100	$70	$0	$6,400

				Energy MW (Price)		Regulation Up MW (Price)		Regulation Down MW (Price)		LMP	RegUp LOC		RegDown LOC		
	Assumption Set	Load	Regulation Required	Resource A	Resource B	Resource A	Resource B	Resource A	Resource B		Resource A	Resource B	Resource A	Resource B	Total Production Cost
PJM	PJM Phase 2	50	20	40 ($40)	10 ($50)	0 (0)	20 (0)	20 (0)	0 (0)	$50.00	$0.00	$0.00	$0.00	$0.00	$2,500.00
Corrected	Corrected Phase	50	20	30 ($30)	20 ($100)	10 (0)	10 (0)	10 (0)	10 (0)	$100.00	$35.00	$35.00	$35.00	$35.00	$6,400.00

There is no generalizable theoretical or practical basis for the assertion that Phase 2 will reduce costs relative to Phase 1.

H. The Efficiency Gains of Moving from 60 Minute to a 30 Minute Commitment Interval Aare Included in Phase 1.

PJM argues that one of the reasons for an efficiency gain from moving from Phase 1 to Phase 2 is the proposed switch from a 60-minute commitment interval to a 30-minute commitment interval. PJM states (May 23rd Filing 7-8) that moving from the 60-minute commitment Interval to a 30-commitment interval "would mitigate the disparity in the resource opportunity cost estimated in the clearing and commitment process with that observed in real-time."

The Market Monitor agrees that the proposal to reduce the market period for regulation from 60 to 30 minutes will tend to reduce LOC relative to the current market

design. However, the proposal to move from a 60-minute commitment interval to a 30-minute commitment interval is part of the Phase 1 proposal. Moving from a 60-minute commitment Interval to a 30-minute commitment interval does not require Phase 2.

I. PJM's Phase 2 Market Design Does Not Improve Opportunities For Renewable Resources to Provide Regulation.

PJM claims (at 1) that "[m]oving to a more granular Regulation market—in Phase 2, when the Regulation-Up ("RegUp") and Regulation-Down ("RegDown") Services are introduced—reduces barriers to entry by creating participation opportunities to resources that generally cannot provide Regulation bidirectionally, as required under the current rules."

PJM is incorrect.

PJM cannot have it both ways. PJM cannot reasonably claim that Phase 2 will have lower prices and lower compensation for regulation service than Phase 1 and also claim that there will be more opportunities and incentives for resources to participate in the regulation market under Phase 2.

There is no basis for PJM claims that Phase 2 will reduce barriers to entry compared to Phase 2 by creating participation opportunities to resources that generally cannot provide regulation bidirectionally. Providing regulation service requires a resource be able to be dispatched up and down (bidirectionally) in response to a regulation signal. This is true whether a resource is providing "Regup" or the "RegDown" service described by PJM. A resource that can provide RegDown can provide bidirectional regulation service. A resource that can provide RegUp can provide bidirectional regulation service. PJM's Phase 2 design does not create more opportunities or ability to participate in regulation markets. .

J. The Existence of Separate Regulation Products in other RTOs Does Not Support PJM's Phase 2 Proposal.

PJM notes (at 9) that the two product regulation market designs, which PJM claims are similar to that proposed by PJM, have been in place in SPP, CAISO, and ERCOT markets. PJM asserts (at 9) that the use of two product markets in these other RTOs is evidence to

support PJM's Phase 2 design. PJM has not provided any analysis to support this conclusion based on market outcomes from SPP, CAISO, or ERCOT.

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 protests, answers, or requests for rehearing unless otherwise ordered by the decisional authority. The Commission has made exceptions, however, where an answer clarifies the issues or assists in creating a complete record.[6] 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,

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[6] *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).

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Dated: June 7, 2024

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 7th day of June, 2024.

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