UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C.	)	Docket No. ER18-87-000

REQUEST FOR REHEARING OF THE INDEPENDENT MARKET MONITOR FOR PJM

Pursuant to Rule 713 of the Commission's Rules and Regulations,[1] Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor for PJM[2] ("Market Monitor"), submits this request for rehearing of the order issued in this proceeding March 30, 2018 ("March 30th Order"). The March 30th Order rejects a PJM proposal filed under Section 205 of the Federal Power Act with the support of PJM stakeholders.[3] The proposal would belatedly address flaws documented and identified by the Market Monitor and PJM over a six year period.[4] Throughout this period, prices in the PJM Regulation Market have

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1 18 CFR § 385.713 (2017).

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 Filing, Docket No. ER18-87-000 (Oct. 17, 2017) ("PJM's Regulation Proposal").

4 *See*, *e.g.*, 2017 State of the Market Report for PJM, Vol. II (March 8, 2018) at 436–438, 470–491 ("The current market design is critically flawed as it has not properly implemented the MBF as an MRTS between RegA and RegD resource MW and the MBF has not been consistently applied in the optimization, clearing and settlement of the Regulation Market."); 2016 State of the Market Report for PJM, Vol. II (March 9, 2017) at 427–446; 2015 State of the Market Report for PJM, Vol. II (March 10, 2016) at 393–411; 2014 State of the Market Report for PJM, Vol. II (March 12, 2015) at 369–383; 2013 State of the Market Report for PJM, Vol. II (March 13, 2014) at 293–304; 2012 State of the Market Report for PJM, Vol. II (March 3, 2013) at 271–277; 2011 State of the Market Report for PJM, Vol. II (March 15, 2012) at 232–243; Implementation and Rationale for PJM's Conditional Neutrality

not been determined by a functional market and, therefore, have not been just and reasonable.[5] Throughout this period, the PJM Regulation Market has not operated consistent with the Commission's requirement that "compensation for frequency regulation service must provide such compensation based on the actual service provided."[6] The PJM Regulation Proposal addresses this longstanding well documented market design flaw.

The March 30th Order does not consider the PJM Regulation Proposal on the merits.[7] The March 30th Order rejects the PJM Regulation Proposal based solely on the unsubstantiated and incorrect finding (at P 1) that PJM's Regulation Proposal "is inconsistent with the Commission's directives in Order No. 755 and the Commission's regulations." The record does not support such finding with substantial evidence. The record demonstrates that the PJM Regulation Proposal does fully comply with Order No. 755 and its implementing regulations. Indeed, the record demonstrates that approval of the PJM Regulation Proposal is necessary to bring the PJM Regulation Market into compliance with Commission policies. The existing market design fails to comply with Order No. 755

Regulation Signals (Regulation Market Whitepaper, which can be accessed at: <*http://www.pjm.com/-/media/committees-groups/task-forces/rmistf/postings/regulation-market-whitepaper.ashx?la=en*> .

[5] *See*, *e.g.*, Order No. 755 explicitly requires (at P 128): "[U]se of a market-based price, rather than an administratively-determined price, on which to base the frequency regulation performance payment. This price must reflect the market participant bids submitted by resources for the provision of frequency regulation service." Order No. 755 explains (id.): "[A] market-based price will better reflect current system conditions and need for frequency regulation, thereby providing market participants with an efficient price signal."

[6] *Frequency Regulation Compensation in the Organized Wholesale Power Markets*, Order No. 755, FERC Stats. & Regs. ¶ 31,324 (2011) ("Order No. 755"), *reh'g denied*, Order No. 755-A, 138 FERC ¶ 61,123 (2012); 18 CFR § 35.28(g)(8) (2017) ("compensation for frequency regulation service must provide such compensation based on the actual service provided, including a capacity payment that includes the marginal unit's opportunity costs and a payment for performance that reflects the quantity of frequency regulation service provided by a resource when the resource is accurately following the dispatch signal").

[7] March 30th Order at P 51 n.100 & P 56 n.111.

and its implementing regulations. The PJM Regulation Proposal should be approved precisely because it does address the policy goals raised by the Commission. The March 30th Order should be set aside, rehearing granted, and PJM's Regulation Proposal should be accepted.

I. STATEMENT OF ISSUES AND SPECIFICATION OF ERRORS

Rule 713 requires identification of each issue for which rehearing is sought and representative precedent in support of its position. The explanation in the March 30th Order that the PJM Regulation Proposal does not comply with Order No. 755 and Commission regulation, including that resources receive compensation based on "actual service provided," does not constitute reasoned decision making and is unsupported by logic or substantial evidence.[8] The March 30th Order errs (at PP 52–55) in finding, with no supporting logic or substantial evidence, that the RRTS displaces the use of actual mileage in the settlement process.

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[8] *See*, *e.g.*, 5 USC § 706(2)(E) ("The reviewing court shall … hold unlawful and set aside … findings … found to be … unsupported by substantial evidence"); Motor Vehicle Mfrs. Ass'n. v. State Farm Mut. Auto. Ins. Co., 463 U.S. 29, 43 (1983) (quoting Burlington Truck Lines, Inc. v. U.S., 371 U.S. 156, 168 (1962) ("Nevertheless, the agency must examine the relevant data and articulate a satisfactory explanation for its action including a 'rational connection between the facts found and the choice made.'"); Illinois Commerce Comm'n, 576 F.3d 470, 477 (7th Cir. 2009) (explaining that a reviewing court cannot "uphold a regulatory decision that is not supported by substantial evidence on the record as a whole"); Pacific Gas & Elec. Co. v. FERC, 373 F.3d 1315, 1319 (D.C. Cir. 2004) ("PG&E"); Missouri Pub. Serv. Comm'n v. FERC, 337 F.3d 1066, 1072–75 (D.C. Cir. 2003) (vacating and remanding Commission orders because it found, among other things, that the Commission had failed to articulate the actual reasons for its decision, and the reasons it did cite were "speculative," unsupported by record evidence, and did not support its decision). *See also* 5 USC § 557(c) (the Commission is charged with addressing "all the material issues of fact, law, or discretion presented on the record"); 5 US.C. § 706(2)(A); Ill. Commerce Comm'n v. FERC, 576 F.3d 470, 477 (7th Cir. 2009) (explaining that a reviewing court cannot "uphold a regulatory decision that is not supported by substantial evidence on the record as a whole"); Ass'n of Oil Pipelines v. FERC, 83 F.3d 1424, 1431 (D.C. Cir. 1996) (the Commission's orders must articulate "'a rational connection between the facts found and the choice made'") (citations omitted); Ne. Util. Serv. Co. v. FERC, 993 F.2d 937, 944 (1st Cir. 1993) (reasoned decision making requires "a reasoned explanation supported by a stated connection between the facts found and the choice made") (citation omitted).

II. REQUEST FOR REHEARING

A. PJM's Regulation Proposal Is Consistent with Order No. 755 and the Commission's Regulations; The Current Market Structure Violates Order No. 755.

The March 30th Order incorrectly found "that PJM's proposal is inconsistent with the Commission's directives in Order No. 755 and Commission regulations because, under the Regulation Proposal, Regulation resources would not be 'compensat[ed] based on the actual service provided, including ... a payment for performance that reflects the quantity of frequency regulation service provided by a resource when the resource is accurately following the dispatch signal.'"[9] The March 30th Order argues (at P 53) that "PJM fails to demonstrate that the Regulation Marginal Rate of Technical Substitution—which estimates the effective megawatts expected to be provided in real time by the marginal RegD resource—compensates resources for the quantity of service actually provided." The March 30th Order's finding is based on the false premise that replacing the mileage ratio with the marginal rate of technical substitution ("MRTS") will not compensate RegD resources for the amount of service provided.[10]

No evidence or logic support the argument that the MRTS, used to determine the relative regulation service (work) done by RegA and RegD in the clearing, pricing and settlement in the Regulation Market Proposal, does not reflect and compensate the relative work done by RegD or RegA in providing ACE correction. No evidence or logic support the assertion that the mileage ratio used in the current market construct is a metric that reflects and compensates the relative work done by RegD or RegA in providing ACE correction,

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9 March 30th Order at P 51, quoting Order No. 755 at P 51.

10 The MRTS is the slope of isoquant defining the combinations of RegA and RegD that provide a desired level of ACE control. In PJM's proposal the MRTS is called the Regulation Rate of Technical Substitution (RRTS). Throughout this document MRTS is used interchangeably with RRTS. The current market rules refer to the MRTS as the Marginal Benefit Factor (MBF). When referencing the MRTS as used in the current market rules this document refers to it as the MBF.

particularly when a portion of the mileage of one of the resource types often runs counter to system control.

The PJM Regulation Proposal is consistent with Order No. 755 requirements. In PJM's Regulation Proposal the Marginal Rate of Technical Substitution (MRTS) converts RegA and RegD resources, on the margin, to equal units of work (effective MW and effective miles) for purposes of optimization, market clearing, price setting and compensation. Under PJM's proposal the market price is the provided in terms of price per unit of regulation service (work) provided (effective MW and effective mile) and every unit is paid on the basis of the units of effective work provided. The PJM proposal would result in compensation that is based on the actual service (work) provided and payment for performance that reflects the quantity of frequency regulation provided (work) by a resource.

In contrast to PJM's Regulation Proposal, the current rules that this proposal would replace do not comply with Order No. 755's requirement.

The current market's use of the mileage ratio instead of the MRTS in settlement is inconsistent with Order No. 755 because the use of the mileage ratio in settlement causes undue discrimination in the procurement of regulation in the PJM market and ensures that providers of frequency regulation service receive unduly discriminatory or preferential rates. The use of the mileage ratio in settlement instead of the MRTS does not result in compensation based on the actual regulation service provided and does not result in payments for performance that reflect the quantity of frequency regulation service provided.

PJM's Regulation Proposal, by replacing the mileage ratio with the MRTS in settlement, remedies the undue discrimination in the procurement of Regulation in PJM's current regulation market construct and ensures that providers of regulation service receive just and reasonable and not unduly discriminatory or preferential rates.

As noted by PJM in its initial filing (at 22), the current market construct, which includes the mileage ratio in settlements "does not properly take into account the effective

megawatts of resources, thus incorrectly compensating resources and sending incorrect financial signals to the market." PJM states (*id*.) "[f]or a consistent optimization, resources should be settled on the effective megawatts they provide to the system, consistent with clearing and operating the resources." In order to make sure that every MW is evaluated, priced and settled on an effective MW basis, marginal regulation rate of technical substitution ("RRTS") used in the optimization, clearing and pricing of the regulation market must also be used in the settlement of the market.

The mileage of RegD relative to the mileage of RegA in any instance, or averaged over any period, is not an indication of the relative work done by RegD or RegA in providing ACE correction. This means that the mileage ratio, expected or actual, has nothing to do with the relative or direct valuation of the amount of ACE control provided by RegD or RegA. The relative value of the RegA and RegD, for any given combination of RegA and RegD, in providing an expected level of ACE control is measured by the MRTS.

If the mileage ratio was the determinant of the relative contribution of RegD and RegA to ACE control, the mileage ratio would be the basis for the marginal rate of technical substitution ("MRTS/RRTS") function and the mileage ratio would be used as the marginal RRTS between RegD and RegA in the optimization, clearing, pricing and settlement in PJM's proposal. This is not the case. The mileage ratio does not result from an engineering study or operational experience that describes the combinations of RegA and RegD that can provide an expected level of ACE control. The mileage ratio is merely an outcome of the regulation signal design, the proportion of the RegA MW and RegD MW operating at the direction of PJM in a given period and system conditions.

PJM's signal design results in mileage and mileage ratios that have no relationship to the actual amount of ACE correction provided by a particular resource type. There are system conditions where extreme mileage ratios result when the RegA signal is fixed at a single value for an extended period ("pegged") to control ACE and the RegD signal is not. If RegA is held at a constant MW output, mileage is zero for RegA. In this circumstance, RegA is providing ACE control and may be, due to the conditional neutrality signal design,

supporting a recharge of RegD, which means that RegD is actually moving to hurt rather than help ACE, it is doing negative work. In such an event, RegA is controlling for ACE and contributing to the future ability of RegD to provide ACE control in a later interval. The result of a fixed RegA signal is that RegA mileage is very small and therefore the mileage ratio is very large but the contribution of RegA to ACE control is critical and RegD is not only not contributing to ACE control but is actively hurting it.

By using the mileage ratio instead of the MRTS in settlement, the current market design does not compensate RegD resources on the basis of the actual frequency regulation service provided (i.e. work). This is a design flaw that fails to compensate resources for work provided consistent with Order No. 755 and results in incorrect payments for regulation. If the MRTS were consistently applied, every resource would receive the same clearing price per marginal effective MW. But the MRTS is not consistently applied and resources do not receive the same clearing price per marginal effective MW.

While prices are set on the basis of dollars per effective MW, only RegA resources receive payments based on this price per effective MW.[11] RegA resources are paid the RMCCP times MW times the performance factor times the MBF, plus the RMPCP times MW times the performance factor times the MBF. (The RegA MBF is 1.0.) RegD resources do not receive payments based on this price per effective MW. RegD resources are paid the RMCCP times MW times the performance factor, plus the RMPCP times MW times the performance factor times the mileage ratio.[12] As a result, the current market design does not send the correct price signal to the RegD resources.

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[11] This is due to the fact that RegA resources performance adjusted MW are their effective MW as the MRTS of RegA resources is always equal to one, as effective MW are defined in terms of RegA performance adjusted MW.

[12] Performance adjusted RegD MW are converted to effective MW by multiplying the performance adjusted MW by the market clearing MRTS.

The use of the mileage ratio in the current settlement process does not result in a market construct that pays RegA and RegD resources the same price per effective MW. Only RegA resources are paid on the basis of dollars per effective MW of RegA. RegD resources are not paid in terms of dollars per effective MW of RegA because the MRTS/MBF is not used in settlements. When the MBF is above one, RegD resources are underpaid on a per effective MW basis, although this could be offset by a high mileage ratio. When the MRTS/MBF is less than one, RegD resources are overpaid on a per effective MW basis.

Further, the regulation market clearing engine, as currently implemented, does not recognize the actual, inflated marginal cost of using RegD in the market caused by the use of the mileage ratio instead of the MRTS/MBF in settlement. Instead, the market clearing engine only sees the MRTS/MBF adjusted prices of RegD resources (which are offering at zero) and acquires too much RegD. This disconnect between the marginal resource cost in the optimization and the realized marginal costs in the market settlement, due to the failure to consistently apply the MRTS/MBF throughout the construct, has resulted in over procurement, over supply and excessive costs to provide regulation service. It has also contributed to wasteful investment in RegD capability in a saturated market.

These issues would self correct if the MRTS were consistently applied throughout the regulation market. If the MRTS were properly defined and consistently applied, every resource would receive the same clearing price per marginal effective MW. But the MRTS is not consistently applied and resources do not receive the same clearing price per marginal effective MW.

B. PJM's Regulation Proposal Is Consistent with Order No. 755 Because It Does Account for Actual Mileage in Settlement.

The March 30th Order states (at P 53) that "the Regulation Proposal is inconsistent with the Commission's regulations and Order No. 755 because it does not account for actual mileage in settlement." The March 30th Order states that nowhere in PJM's proposed offer formula or settlements formula is there a value for the volume of actual mileage a resource—only a historical expectation of that mileage. The March 30th Order states (at P 54)

that "Accounting for the dollar per mile cost of resources in the Regulation clearing process only helps determine what the clearing price for regulation should be….Once the price is determined, the resource must also be compensated based on the quantity of Regulation service actually provided."

There is no basis for such a statement. The March 30th Order apparently confuses the elimination of the mileage ratio in settlement with the elimination of actual mileage in settlement. The PJM Regulation Proposal does not eliminate actual mileage from the settlement calculation.[13] The PJM Regulation Proposal specifically includes actual mileage in the determination of actual within hour offers, the within hour marginal offer, the within hour price of regulation and the within hour settlement.

All performance offers are provided on a $/mile basis. The historic, expected mileage of a signal (rolling average mileage for the signal) is used to determine the ex-ante offer on a $/MW basis for purposes of clearing the market. However, once a resource clears, the actual within hour mileage of followed signal is used to convert every $/mile offer into the actual $/MW performance hour based on the actual mileage of the followed signal within the hour among all cleared resources. Actual mileage is therefore used in the determination of the clearing price and in the settlement of resources.

In the PJM Regulation Proposal (at 28), in the calculation the Adjusted Performance Cost, expected mileage is used in determining offers for purposes of the clearing of the regulation market, but the actual mileage of the resource signals are used to adjust within hour performance offers of cleared resources and thereby sets the clearing price for regulation:

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[13] *See* PJM Proposal at 27–28, PJM Answer (Dec. 6, 2017) at 8; PJM presentation: "Regulation Market Overview" (Nov/ 16, 2015) at 17, which can be accessed at: <*http://www.pjm.com/-/media/committees-groups/task-forces/rmistf/20151016/20151016-item-03-regulation-market-overview.ashx*> ; and Market Monitor Answer (Jan. 2, 2018) at 4.

$$\text{Adjusted Performance Cost } (\$) = \frac{\left(\begin{array}{c}\text{Performance}\\ \text{Offer } (\$/\Delta MW)\end{array}\right) * \left(\begin{array}{c}\text{Mileage}\\ \text{of}\\ \text{Offered Resource}\\ \text{Signal Type } (\Delta MW/MW)\end{array}\right)}{\left(\begin{array}{c}\text{Benefits Factor}\\ \text{of}\\ \text{Offered Resource}\end{array}\right) * \left(\begin{array}{c}\text{Historic}\\ \text{Performance}\\ \text{Score}\end{array}\right)} * \left(\begin{array}{c}\text{Capability}\\ (MW)\end{array}\right)$$

This means that every offer is adjusted to reflect actual work done within the market hour, which, in turn means that the realized clearing price in the regulation market reflects the actual work done within the market hour.

C. PJM Regulation Proposal Is Consistent with Order No. 755 Because Using the MRTS in Settlement Accurately Reflects the Effective Megawatts Contribution of RegD Resources when They Operate in a Given Hour.

The March 30th Order errs when it states (at P 54) that "because the Regulation Proposal compensates capacity from all RegD resources based on the marginal (i.e., lowest) substitution benefit provided by the last resource cleared, the proposal does not accurately reflect the effective megawatts contribution of RegD resources when they operate in a given hour."

The March 30th Order relies on the argument that using the marginal resource's marginal RRTS from the downward sloping RRTS function in settlement will cause an undervaluing of all RegD MW relative to the effective MW contributed by RegD in that market solution. Such reliance is misplaced. There is no mathematical or economic theorem that supports the premise or the resulting conclusion.

The faulty logic in the March 30th Order is based on a misunderstanding of the interaction between a function (a mathematical expression involving one or more variables) and a derivative of that function (a mathematical expression representing the rate of change of the value of a function with respect to an independent variable). More specifically, the statements in the March 30th Order fail to appreciate the importance of including an isoquant with a diminishing marginal rate of technical substitution between the two inputs, where adding more and more of a particular input is less and less effective as a substitute for another input, holding output constant. The KEMA study and the PJM studies have

provided isoquants indicating diminishing returns to RegD as a substitute for RegA.[14] This relationship is not unusual in production models.[15]

An isoquant is a mathematical function that describes the combinations of two or more input variables that provide the same output.[16] More specifically, the isoquant describes the amount of one input that is needed given a specified amount of another input to produce a fixed amount of output. In PJM's case, the isoquant function is described in terms of RegA MW (vertical axis) needed for a given amount of RegD MW (horizontal axis) to produce the target level of ACE control.[17] Any combination of RegA MW and RegD MW on the isoquant will provide the same level of ACE control.

The derivative of the isoquant defines the marginal rate of technical substitution (MRTS) between the two inputs, holding output constant.[18] The MRTS is the point specific slope (rate of change) between the two inputs at every point on the isoquant. In PJM's application, the derivative of the isoquant (the change in RegA for a change in RegD) defines the marginal rate of technical substitution function (MRTS) between RegA and

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[14] See KEMA, Inc., KERMIT Study Report: To Determine the Effectiveness of the AGC in Controlling Fast and Conventional Resources in the PJM Frequency Regulation Market (Dec. 13, 2011) (the "KEMA Study"), which can be accessed at: <http://www.pjm.com/-/media/committees-groups/task-forces/rmistf/postings/pjm-kema-final-study-report.ashx?la=en>.

[15] *See* Michael Katz and Harvey Rosen, *Microeconomics* (Irwin 1991) ("Katz/Rosen") at 265 ("Most technologies exhibit a diminishing marginal rate of technical substitution.").

[16] An isoquant is a common term of art in the economics literature that refers to a curve that defines all of the input combinations that yield a fixed level of output. *See* Katz/Rosen at 253–254.

[17] The isoquant could also be expressed in terms of RegD MW needed for any given amount of RegA. This would change the MRTS (point specific slope) to describe a change in RegD MW for a change in RegA MW. This would not change the outcome of the market solution or pricing, so long as the functional form was consistently applied through the regulation market design.

[18] The marginal rate of technical substitution (MRTS) is a common term of art in the economics literature that refers to a slope of the isoquant. The slope of the isoquant is the rate at which the production function (available technology) allows the substitution of one input for another while holding output constant. *See* Katz/Rosen at 264–272.

RegD. PJM terms this the RRTS function. The RRTS function describes the rate of change in required RegA MW for a change in RegD MW at every point along the isoquant, in order to provide a constant level of ACE control constant.

The cumulative marginal RRTS values (which can be calculated as the area under the RRTS curve) at any given amount of one input (RegD MW) provides the total change in the second input (RegA MW) relative to the vertical intercept point of the isoquant curve. This result is expected, as the RRTS is the derivative of the isoquant, and describes the point specific changes in the one input (RegA) for changes in the second input (RegD MW) along the isoquant. For any given level of the one input, the isoquant provides the corresponding level of the second input needed to maintain fixed output by definition.

The area under the RRTS curve is therefore not providing the relative value of RegA and RegD for any level of RegD for purposes of meeting the ACE control target. All the area under the RRTS curve is providing is assurance that the resulting combination of RegA and RegD that is clearing, is consistent with the isoquant that defines the desired target level of ACE control.

While all the points on the isoquant are equally good for purposes of providing ACE control, the purpose of a market (or a cost minimization function) is to determine the least cost combination of inputs on that isoquant.

Determining the least cost combination requires an examination of marginal relative prices of the inputs and the marginal relative values of output along the isoquant. In an optimization, inputs are used until the incremental value for doing so is equal to the incremental cost (the price of the marginal unit of an input) of doing so. This requires a direct comparison of the marginal value and marginal prices of the two inputs. At the least cost market solution, the slope of the isoquant (the MRTS which shows the relative value of the inputs in the production function) will equal the ratio of the input prices. At this solution the effective marginal value of each resource in terms of contributing to the fixed output is equal to the marginal price of input and all inputs are paid the same in terms of this marginal value. This means that each input is paid the same marginal price in a

common unit, the marginal contribution to output. At the same time, at the least cost market solution, the marginal price for each input is paid to every unit of that input, and this is equal to the marginal price of the marginal contribution to output. That is how single price markets work, where the marginal resource sets the price for the market for that resource. This result is dependent on consistent marginal valuation in the market solution, pricing and settlement.

In the PJM proposal, RegD will be used until the marginal value of RegD as a substitute for RegA is equal to the marginal price of RegD (the price of the most expensive RegD resource cleared). Conversely, and in the same market solution, RegA will be used until the marginal value of RegA as a substitute for RegD is equal to the marginal price of RegA (the price of the most expensive RegA resource cleared). At this solution the effective marginal value of each resource in terms of contribution to the fixed output (in terms of marginal effective MW) is equal to the marginal price of that input and all inputs are paid the same in terms of this marginal effective MW value. Under these conditions, no resource is underpaid. Every resource is correctly paid its respective market clearing price and, at the same time, every resource is correctly paid the single marginal clearing price per effective MW.

Further, the Commission has accepted, in the existing market construct, that the marginal benefit factor (MBF) (acting as an MRTS) converts RegA and RegD resources, on the margin, to equitable units (effective MW and effective miles) for purposes of optimization, market clearing and price setting. The PJM Regulation Proposal MRTS is a rebranded MBF that converts RegA and RegD resources, on the margin, to equitable units (effective MW and effective miles) for purposes of optimization, market clearing and price setting. It is illogical and unreasonable to accept a MBF/MRTS that converts RegA and RegD resources, on the margin, into to equitable units (effective MW and effective miles) for purposes of optimization, market clearing and price setting and then reject the same MBF/MRTS being used to compensate resources on the same basis. Units determined to be equitable should receive equitable compensation.

D. The Existing Flawed Market Design Caused System Control Issues that Required Out of Market Solutions to Counter.

The March 30th Order states (at P 55) that "PJM has failed to provide evidence that its particular proposal, which eliminates any consideration of actual mileage in settlement, is required to address the operational issues that PJM states it has experienced."

The March 30th Order errs in the assessment that an absence of current operational issues is a sign that the market is working or that the results of this market are consistent with Order No. 755 or that the market results are just and reasonable.

Due to significant flaws that were identified in the proceeding, the existing market design caused operational issues. PJM made several ad hoc modifications to the design to address these operational issues, but these modifications exacerbated rather that corrected the identified market flaws and inappropriately increased the costs of regulation service. The current market design and associated results violate Order No. 755's requirements and, more generally, provide unjust and unreasonable results.

The Market Monitor and PJM have provided an extensive record of the operational issues that were directly caused by the current flawed market design and its incorrectly defined and implemented marginal benefit factor and use of a mileage ratio in settlements. As stated in the record, the MBF was not, and is not, correctly defined in the current PJM market rules and is not correctly or consistently implemented in the optimization, clearing and settlement of the regulation market. The MBF, as implemented in the PJM Regulation Market is not correctly implemented as the MRTS between RegA and RegD. The calculation of total regulation cleared using the MBF is incorrect. The results were perverse economic incentives and PJM operational problems.

Through a series of interim, ad hoc changes, PJM has mitigated many of the operational issues caused by the flawed market design, but these have come at the costs of greatly increased costs of providing regulation, with no equivalent countervailing benefit, and an exacerbation of the perverse economic signals caused by the incorrect use of mileage

ratio instead of a MRTS in settlement. Protests to these stop gap measures is under review in another proceeding before the Commission.[19]

The initial interim fixes focused on reducing the proportion of RegD cleared so as to reduce the operational issues associated with the over procurement of RegD. The initial approach simply capped the amount of RegD and forced the market to clear more RegA MW. In a properly structured market with a correctly implemented MRTS curve, as outlined in the PJM proposal, the same level of operational control could be achieved with fewer total regulation MW and at a lower cost.

In January 9, 2017, PJM introduced a new interim fix. PJM adopted new RegA and RegD signals and increased the total regulation requirement. The signal design changes appear to have been intended to make RegD more valuable and allow the accommodation of more RegD, rather than provide the most efficient use of the resources available. The RegD signal is now the difference between ACE and RegA. The new RegA signal is slower and designed to offset RegD when RegD hurts ACE control because it is moving in the opposite direction of that required by ACE control in order to permit RegD to recharge. The new signal design is not making the most efficient use of RegA and RegD resources. The explicit reliance on RegA to offset issues with RegD is a significant conceptual change to the design that is inconsistent with the long term design goal for regulation. This change in the RegA signal made RegA less valuable as a direct provider of ACE, but more valuable as a resource to accommodate, support and subsidize the use of RegD. This cross subsidization comes at the expense of the least cost solution. The new signal design required an increase in the regulation requirement (the total regulation MW carried) in order to maintain acceptable levels of control. Requiring RegA resources to subsidize RegD resources is

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[19] *See Energy Storage Assoc., et al. v PJM*, 162 FERC ¶ 61,296 (March 30, 2018), FERC Docket Nos. EL17-64-000 and EL17-65-000.

inconsistent with Commission orders on regulation and inconsistent with a competitive and efficient market design.

Due to the continued inclusion of mileage ratio in settlements, the change in the signal design further exacerbated the inefficient economic signals generated by the flawed market design and greatly increased the cost of regulation.

The new signal design, where RegA was used to support RegD, resulted in extreme mileage ratios and very high overpayment of RegD resources. Under frequent market conditions the new signal design caused the RegA signal to be fixed at a single value for an extended period ("pegged") to control ACE, while the RegD signal is not. If RegA is held at a constant MW output, mileage is zero for RegA. In this circumstance, RegA is providing ACE control and may be, due to the conditional neutrality signal design, supporting a recharge of RegD, which involve RegD moving to hurt ACE. In such an event, RegA is controlling for ACE, while RegD is hurting ACE control. The result of a fixed RegA signal is that RegA mileage is very small and therefore the mileage ratio is very large but the contribution of RegA to ACE control is critical. In these events, RegA resources are providing ACE control by providing a fixed level of MW output which means zero mileage, while RegD resources alternate between helping and hurting ACE control, both of which result in positive mileage.

The extreme mileage ratios that result from the interaction between the RegA and RegD signal in the conditional signal design have exacerbated the discriminatory treatment of RegA and RegD in settlement and have caused significant, inefficient increases in the costs of regulation service relative to the efficient market design found in the PJM Regulation Proposal.

The stop gap results did not resolve the issues facing the market and did not result in a coherent market that accurately reflects the marginal cost of service marginal price or a market that meets the requirements of Order No. 755.

III. CONCLUSION

For the reasons provided above, the Market Monitor respectfully requests that the Commission grant rehearing.

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 Eagleville, Pennsylvania,
this 27th day of April, 2018.

Jeffrey W. Mayes
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