UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Modernizing Electricity Market Design	)))	Docket No. AD21-10-000

COMMENTS OF THE INDEPENDENT MARKET MONITOR FOR PJM

Pursuant to the Order Directing Reports issued April 21, 2022 ("April 21st Order"),[1] and the report submitted by PJM Interconnection, L.L.C. ("PJM") on October 18, 2022, responding to the questions posed in the April 21st Order ("October 18th Report"), Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor ("Market Monitor") for PJM, submits these comments. The April 21st Order directed the RTOs to explain how system conditions are changing and what market design reforms it intended to pursue to meet changing system needs. PJM responded that reforms under consideration would provide new compensation mechanisms for flexible resources and include changes to the regulation market, the procurement of additional reserves, a ramping product, and changes to the unit commitment process.[2] The Market Monitor agrees with the PJM and New York ISO reports that the current energy and ancillary services market design framework remains the best approach to efficient, reliable market dispatch and pricing.[3] Locational marginal pricing ("LMP") is the core design element of the energy market. Market power mitigation, shortage pricing, and the capacity market are also necessary to ensure competitive energy market outcomes. The Market Monitor's position is that PJM's proposed market reforms are

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[1] *Modernizing Wholesale Electricity Market Design*, 179 FERC ¶ 61,029 (2022) ("April 21st Order").

[2] PJM at 13.

[3] Capitalized terms used herein and not otherwise defined have the meaning used in the PJM Open Access Transmission Tariff ("OATT") or the PJM Operating Agreement ("OA").

not needed and are not appropriate. Some of the software tools and market rules used by PJM have not kept pace with the evolving generation fleet and system needs. The focus for PJM should be on improving the fundamentals of efficient, reliable dispatch, removing incentives for inflexible resource operation, and providing operators with state of the art software. Creating new ancillary services products and repeatedly revising the existing ones is a distraction from identifying opportunities to improve dispatch tools and enhancing basic market rules to unlock existing resource flexibility.

PJM and its members and the Commission should avoid the temptation to layer on complex new rules to solve problems largely created by existing rules that are either incorrectly applied or inefficiently written.

I. COMMENTS

A. The Importance of Locational Marginal Pricing (LMP)

A recent article and high prices due to the war in Ukraine have led some to question the appropriateness of the LMP market design, and of marginal cost market pricing in general.[4] The responses in the RTO reports are clear, and the Market Monitor agrees, that LMP is the core element of competitive wholesale power markets.[5]

The fundamental purpose of the energy markets is to ensure that load is served at the competitive price. The competitive price may vary by location based on transmission constraints and the lowest cost generation available to serve that locational load. LMP markets efficiently and competitively coordinate the production of energy to serve load

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4 *See* Tony Clark and Vincent Duane, "Stretched to the Breaking Point: RTOs and the Clean Energy Transition," July 2021 at 5, which can be accessed at: <https://www.wbklaw.com/wp-content/uploads/2021/07/Wholesale-Electricity-Markets-White-Paper-07.08.21.pdf>.

5 *See Modernizing Wholesale Electricity Market Design Modernizing Wholesale Electricity Market Design*, Docket No. AD21-10 (October 18, 2022), PJM Report at 39, CAISO Report at 53, ISO New England Report at 91, and New York ISO Report at 47–48.

across locations given the constraints of the transmission system and the requirement that supply and demand remain balanced at all times. This is generally termed security constrained economic dispatch, where security constrained refers to respecting transmission constraints. One market design has proven itself superior in meeting this goal: the real-time LMP market. Hogan and Harvey provide the history of the real-time power markets in their report included in the New York ISO Filing.[6] Hogan and Harvey explain the trials and failures that led to widespread adoption of LMP in the U.S. markets. They also demonstrate the inefficiencies and operational challenges faced by markets employing a regional or zonal pricing design.[7] All of the issues they identify remain relevant. The markets face new challenges, but the need for LMP pricing to support efficient locational incentives for resources and for load remain unchanged.

The issue raised by the April 21st Order, including whether existing energy and ancillary services markets provide appropriate compensation for resources that respond to short term system needs, i.e. flexible resources, is secondary to the problem of economic dispatch. LMP is the price system that supports economic dispatch of resources to provide energy at the right place and at the right time. Ultimately, the purpose of those resources is to be called upon to provide energy when ready and needed. LMP is the only necessary incentive to ensure reliable economic dispatch.

The more fundamental issue is to identify the barriers to the provision of flexibility in the absence of any actual evidence that LMP is not the correct pricing signal. In PJM, there are multiple barriers to the provision of flexibility that should be addressed before it is simply

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6 Response of the New York Independent System Operator, Inc. to Order Directing Reports, AD21-10-000 (October 18, 2022), Attachment A: Scott Harvey and William Hogan, Locational Marginal Prices and Electricity Markets (October 17, 2022).

7 *Id*.

assumed that new products are needed and that LMP in a competitive energy market is somehow lacking.

B. Inflexibility in the Current Market Design

PJM argues that new and revised ancillary products will be needed to send price signals for investment in resource flexibility to meet future system needs.[8] PJM uses vague criteria, like "prices reflect system conditions" and "demand curves reflect reliability value." These are not efficient market criteria. Prices should equal the marginal cost of providing a specific service, and demand curves should include explicit demand bids. Where demand curves do not exist, reliability requirements should be modeled as inelastic constraints. System operators' reliability requirements are not price sensitive. PJM's report does not establish any specific system requirements for new or expanded ancillary services products.

New products, like ramp products and uncertainty products, are not the logical approach to achieving more flexible performance from the PJM fleet. The current energy and capacity markets result in ramp and capacity shortages due to incentives for inflexibility rather than flexibility. For example, although it is not logical or efficient, in PJM slow ramping resources pay lower deviation penalties and receive more uplift than fast ramping resources, and the rules permit capacity market payments to unreliable and inflexible capacity that undercut the incentives for the majority of capacity that does perform. Incentives for inflexibility should be removed and existing incentives for flexibility should be clarified and strengthened. Some issues are currently under discussion in the PJM stakeholder process to address uplift, and some limited progress has been made recently.[9] But this should be a comprehensive effort with the explicit goal of removing incentives for inflexibility and increasing incentives for flexibility.

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8 *See* PJM at 3–4.

9 *See* PJM Manual 28: Operating Agreement Accounting § 5.2.1, Rev. 89 (Nov. 1, 2022).

1. Not Following Dispatch

PJM's implementation of the market rules does not adequately or clearly define following dispatch and the consequences of not following dispatch. Resources routinely fail to follow dispatch signals. The Market Monitor has identified some of the issues.[10] [11] The failure to follow dispatch can take different forms including: opting out of economic dispatch using the fixed gen flag; coming online prior to the requested start time; staying online after release by PJM; and simply ignoring the dispatch signal. In addition, in some cases, units are paid uplift based on the costs of a fuel that the unit is not actually burning due to a combination of all these issues.

Resources are routinely paid uplift despite the fact that they are not following dispatch. The Market Monitor has been raising this issue with PJM and publicly for years.[12] As a particularly egregious example, until a rule change implemented on November 1, 2022, CTs were simply assumed to be following dispatch regardless of their actual behavior and were paid a significant portion of all uplift payments as a result.[13] [14]

But, fundamental issues remain. PJM does not enforce the tariff rule requiring that units follow dispatch, preferring to interpret the tariff obligation to follow PJM's instructions

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10 *See* PJM/IMM Joint Problem Statement, Operating Reserve Clarification for Resources Operating as Requested by PJM, Market Implementation Committee (February 9, 2022).

11 *See* Following Dispatch and Uplift Eligibility, IMM Presentation to the Market Implementation Committee (April 13, 2022), which can be accessed: <*http://www.monitoringanalytics.com/reports/Presentations/2022/IMM_MIC_Following_Dispatch_and_Uplift_Eligibility_20220414.pdf*>.

12 *See* Following Dispatch and Uplift Eligibility, Market Monitor presentation to the Market Implementation Committee (April 13, 2022), <http://www.monitoringanalytics.com/reports/Presentations/2022/IMM_MIC_Following_Dispatch_and_Uplift_Eligibility_20220414.pdf>.

13 This change addressed a State of the Market Report recommendation and had both PJM and the Market Monitor's support. *See* Monitoring Analytics, 2022 State of the Market Report for PJM: January through September, Section 4: Uplift at p. 276.

14 PJM Manual 28: Operating Agreement Accounting, Rev. 89 (Nov. 1, 2022).

to require only that units come online when committed.[15] Slow ramp units are defined, under PJM's interpretation of the rules, to follow dispatch even when they ignore the dispatch signal for their entire run time, and are paid uplift as if they did follow dispatch.[16] This matters because it provides an incentive, in the form of uplift payments, for inflexible behavior and fails to provide an incentive for flexibility.

Some resources do not follow the dispatch signal because their operating parameters are inaccurate. In these cases, the resources are not capable of following the dispatch signal. Intermittent resources submit, or fail to correct, inaccurate unit parameters when their forecast output changes in real time. Some thermal resources offer output that cannot be achieved due to ambient conditions. The result is that PJM systems rely on resources that cannot perform to their submitted incorrect parameters, their economic maximum output for example.

Some resources that ignore the dispatch signal do not have the ability to receive the dispatch signal from PJM systems. PJM should review the basic communications requirements for participation in the market and stop paying uplift to resources that do not and cannot follow instructions because the plant has not installed communications hardware and software.

Regardless of PJM's interpretation of the current rules, it is a fact that PJM's current practice provides strong incentives for inflexible behavior. A first step towards increased flexibility is eliminating those incentives and ensuring that uplift rules provide an incentive for flexibility.

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15 OA Schedule 1 § 3.2.3(e).

16 *See* Following Dispatch, Market Monitor presentation to the Energy Price Formation Senior Task Force (January 17, 2019), <http://www.monitoringanalytics.com/reports/Presentations/2019/IMM_EPFSTF_Following_Dispatch_20190117.pdf> and Following Dispatch and Deviation Charges, Market Monitor Presentation to the Market Implementation Committee (May 11, 2022), <http://www.monitoringanalytics.com/reports/Presentations/2022/IMM_MIC_Following_Dispatch_and_Deviation_Charges_20220511.pdf> .

2. Inflexible Parameters

All capacity resources, excluding demand response resources, and also excluding intermittent and storage resources, are required to have defined flexible operating parameters, the PLS or parameter limited schedule parameters, that the resources can achieve. All capacity resources should have defined flexible operating parameters. The importance of enforcing that requirement uniformly is more critical given the increased roles of intermittent and storage resources. Even for resources that are covered, resources' flexible parameters are not required for all offers. Flexible parameters are only required in cost-based offers and in price-based PLS offers.[17] Cost-based offers and price-based PLS offers are only used when resource owners fail the market power test ("TPS test") and during weather alerts and emergencies. Even under those circumstances, resources can avoid the use of PLS parameters by structuring their offers so that PJM's implementation of the offer capping process chooses the offers with inflexible parameters. As a result, only 64.4 percent of units failing the TPS test and only 78.8 percent of units on hot and cold weather alert days operate on their flexible parameters.[18] This means that PJM resources are operating with inflexible parameters like time to start, minimum run time, minimum down time, and turn down ratio. PJM anticipates large and fast ramping needs in the next decade.[19] Reliability will require more flexible operation, especially on weather alert high load days and when resources are required to prevent constraint violations.

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17 OA Schedule 1 § 6.6.

18 Monitoring Analytics, L.L.C., 2022 State of the Market Report for PJM: January through September, Section 3: Energy Market at 145.

19 *See* PJM, Energy Transition in PJM: Emerging Characteristics of a Decarbonizing Grid (May 17, 2022) at 21-23.

Combined cycle flexibility is important now and will be even more important with an increased level of renewables.[20] But most combined cycle plants do not offer their start time and down time parameters on their price schedules in a way that would allow PJM to turn them off after a morning peak and restart them for an afternoon peak despite the fact that they are physically capable of doing that.[21] Capacity resources should be required to offer and operate in the energy market on their most flexible parameters at all times even if this requires incurring additional maintenance costs, costs which should be part of offers in the capacity market.

The failure to require that all offers be based on PLS creates a strong incentive for inflexibility. The Commission's investigation of this issue in Docket No. EL21-78 remains pending, and provides an opportunity to address the issue and take a significant step toward achieving a more flexible PJM fleet.[22] PJM supports the status quo, arguing that it is currently choosing the offers and parameters that minimize system production costs. Some resources offer flexible parameters at a higher price for price-based offers in order to ensure that PJM does not select the flexible offer. PJM chooses the lower price offer with the inflexible parameters based on its production cost calculations. Resources also offer inflexible price-based offers with lower offers than cost-based offers for much of the dispatch range but with

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20 *See* Answer and Motion for Leave to Answer of the Independent Market Monitor for PJM, FERC Docket No. EL21-78 (November 16, 2021) at 3–4.

21 *See* Answer and Motion for Leave to Answer of the Independent Market Monitor for PJM, Docket No. EL21-78 (November 16, 2021) at 3-4.

22 *See PJM Interconnection, L.L.C.*, Order to Show Cause, 175 FERC ¶ 61,231 at PP 16–17 (2021) ("We find that the PJM Tariff appears to be unjust and unreasonable based on the ability of sellers to avoid being subject to parameter-limited offers when it is appropriate for those sellers to be subject to mitigation. We make this preliminary finding in light of the Market Monitor's 2020 PJM State of the Market Report, Real Time Values Filing, and the Market Monitor's MBR protests, which suggest that PJM's Tariff is not adequately mitigating against the potential exercise of market power in two ways. First, we are concerned that the Tariff provisions that dictate how PJM determines which offer is least cost are not just and reasonable. … Second, we are concerned that the PJM Tariff appears to be unjust and unreasonable because it fails to contain provisions governing what happens if a seller is unable to meet its unit-specific parameters in real time.").

a significant mark up in a tail block. The lower system production costs calculated by the day-ahead market may not materialize when real-time conditions differ from day-ahead, for example when the tail block is needed, and PJM's approximations of system production cost are not always accurate. Generation owners and PJM support the use of inflexible parameter limited offers based on assertions that such offers avoid resource maintenance costs. But maintenance costs are includable in capacity and energy market offers. In a competitive market, resources would not have the ability to avoid flexible dispatch. Avoiding flexible dispatch is a way that generators take advantage of market power. As the need for flexibility to maintain reliability increases, resources under the current rules will not operate based on their true flexibility, even when maintaining reliability requires it. Resources should be required to offer based on their capabilities; all unit offers should be based on PLS flexible parameters.

The significance of creating a new combined cycle model has been exaggerated. The current approach to combined cycle offers does create inflexibility and fails to take advantage of the physical flexibility of combined cycles. The key issues associated with combined cycle offers can be addressed without all the complex features of a new combined cycle model and without weakening market power mitigation as PJM currently proposes. PJM currently does not model the energy produced when a steam unit ramps up from the time of grid synchronization to the time when dispatchable output is available, called soak time. During this time, the generator injects energy into the grid but cannot follow the dispatch signal. Because these MW injections are significant, affect power balance and affect constraint control, PJM dispatchers must make offsetting manual adjustments in real time to maintain reliability that are not optimized or priced by the market. Explicit inclusion of soak times in offers would more accurately represent the availability of combined cycles to the market, create accountability for inflexible operation, and reduce uplift. The solution exists, has been discussed at length in the stakeholder process and simply needs to be implemented.[23]

Combined cycle and combustion turbine offers do not accurately account for the time required to deploy their power augmentation modes of operation because the market software does not account for the transitions. Power augmentation can be duct firing, peak firing, water/steam injection, among other techniques, to increase output at the end of the offer curve. These operating modes tend to require generators to bring additional equipment in service in order to increase output, which requires a delay prior to the increase. This increase in output can be approximated using ramp rates but in reality, there is not a continuous, smooth ramp through the point at which power augmentation begins. Moving to power augmentation is a commitment instruction that should be modeled as such. The result of the inadequate modeling is that the additional capacity, included in the must offer requirement, is frequently not used by PJM operations because in reality deploying these MW require additional steps. PJM committed capacity resources are required to offer their full installed capacity ("ICAP") in the energy market every day. Units offer the additional capacity associated with power augmentation in the capacity market and offer it in the energy market. But there are no guidelines regarding the deployment of the power augmentation MW. As a result, some combined cycle plant owners deploy power augmentation MW as soon as the dispatch signal dictates that they should, some wait several consecutive dispatch signals before they deploy the power augmentation, some wait for a PJM manual instruction to deploy power augmentation MW and some do not deploy the power augmentation MW at all.

Addressing both soak time and power augmentation mode transition time issues would provide significant increases in the flexibility of combined cycle plants and does not

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23 See the PJM Modeling Generation Senior Task Force (MGSTF) discussions of Soak Time Implementation, which can be found at: <https://www.pjm.com/committees-and-groups/task-forces/mgstf>.

require implementation of the long awaited Enhanced Combined Cycle ("ECC") model. The larger ECC project also includes the complex problem of evaluating the commitment of multiple combined cycle configurations. PJM should implement soak time and power augmentation transition improvements and revisit the cost-benefit analysis for the full ECC model compared to other market improvements, including the ability to commit combined cycle plants in real time, which PJM software cannot do.

3. Unavailable Capacity

Flexible capacity is withheld in the energy market through the use of inflexible parameters, emergency capacity designation, and unachievable parameters. At the same time, unreliable and inflexible capacity clears in the capacity market because the rules do not require performance in the energy market, crowding out new entry by flexible resources. The interactions between the energy and capacity markets, including energy market must offer requirements and regular and realistic capacity testing, are critical, because the capacity market creates incentives for resources to find ways to receive capacity payments while not providing the flexible energy associated with those capacity payments. Resources that clear the capacity market are not required to be available when needed. The market rules need to address this behavior.

For example, new rules proposed by PJM and added to the Manuals following a stakeholder vote, allow coal units with large dispatchable ranges, and oil units with fast start times to use maximum emergency status for an extended period when they have not purchased adequate fuel while still receiving capacity payments.[24] That is an extreme case of inflexibility. The new rules shift investor risk to customers. The new rules create an incentive to not purchase fuel. Without fuel, resources cannot respond when PJM needs their energy

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24 *See* Maximum Emergency Proposal, IMM Presentation to the Operating Committee (August 11, 2022), which can be accessed at: <*http://www.monitoringanalytics.com/reports/Presentations/2022/IMM_OC_Max_Emergency_Proposal_20220811.pdf*>.

and flexibility. Accommodating this behavior and allowing these resources to receive their full capacity payments is an incentive for inflexibility.

Unreliable capacity also includes ICAP MW that cannot be achieved during hot weather or require stressing units beyond normal operations.[25] PJM does not enforce the must offer requirement for gas fired units with significant ambient derates while increasing the reliability requirement in the capacity market to purchase more capacity to offset the reductions. There are also MW of capacity resources that operate rarely or not at all and face little to no financial consequences.[26]

4. Inflexible Gas Supply

Gas supply arrangements can also contribute to inflexibility and have the potential to create inflexibility for gas fired units that override other market design features that provide incentives for flexibility. PJM has not explained how the speculative new flexibility products would address the underlying issues with gas supply inflexibility. Gas pipelines have the authority to impose operational flow orders (OFOs) under which the pipelines have the authority to require all gas purchasers to buy gas ratably, meaning the same amount every hour for the entire gas day. OFOs have been used in the summer and the winter. PJM generation owners have requested and received PLS exceptions including 24 hour minimum run times based on pipeline OFOs. Such minimum run times mean that the generators are inflexible.

Another limitation is that under some OFOs, pipelines require units to nominate gas prior to the timely nomination cycle (2:00 PM ET). In this situation, PJM generators request

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25 See Market Monitor Report, MC Webinar (September 19, 2022), which can be accessed at: <*http://www.monitoringanalytics.com/reports/Presentations/2022/IMM_MC_Webinar_Market_Monitor_Report_20220919.pdf*>.

26 See Market Monitor Report, MC Webinar (June 27, 2022), which can be accessed: <*http://www.monitoringanalytics.com/reports/Presentations/2022/IMM_MC_Webinar_Market_Monitor_Report_20220627.pdf*>.

lengthy notification times in order to procure the fuel they need to operate. This means that the resources are not available unless they are clear in the day-ahead market. In a situation where they are needed due to unforeseen changes in net load, they will not be available. The resources cannot be flexibly committed. The combination of these gas market inflexibilities with the high gas prices that PJM experiences on cold days results in extreme levels of uplift payments. Since the costs associated with these inflexibilities are not borne by the generators, there is no incentive to procure more flexible arrangements. It is not clear whether more flexible gas supply arrangements are available.

5. Inferior Capacity Resources

The treatment of demand side resources in the capacity and energy market is one of the most significant issues in the PJM market design. While paid the capacity market clearing price and displacing actual generators, demand side resources are an inferior resource. The inclusion of demand side in the capacity market without the requirement to be comparable to other capacity resources suppresses capacity market prices and therefore the incentives for the entry of flexible generation. Unlike other capacity resources, demand side resources do not have a must offer requirement in the energy market and have an extremely high strike price that must be paid whenever called, and cause emergencies, including imposing penalties on generators, simply by being called. PJM does not know the exact nodal location of demand side resources and therefore cannot call them on with the appropriate granularity needed in a nodal system. PJM does not require adequate metering of demand side resources and therefore has inadequate information about the actual response of demand side resources when called. The actual response of demand side resources tends to degrade relatively quickly when called on for multiple hours or days in a row, or when called on for multiple discrete events in a year. Demand side resources, if properly defined, have the potential to be an extremely valuable and flexible resource. But the current rules need a complete overhaul. This is a significant issue because PJM currently clears about 8,000 MW of demand side resources in the capacity market, comprising 33.1 percent of total PJM reserves.[27]

The capacity market treats all resources as comparable. A resource that can run only 100 hours per year is treated the same as a resource that can run 8,760 hours per year. ELCC treats derated MW as if they were available for all hours despite the fact that solar is not available at night and intermittent output depends on variable weather conditions.

A basic principle of the PJM Capacity Market is that all capacity resources must offer into the capacity market and that load must buy all cleared capacity. Current rules exempt intermittent and storage resources and demand side resources from that requirement. This exemption creates uncertainty for all market participants and permits the exercise of market power in the capacity market. All capacity resources should have an enforceable must offer requirement in the capacity market.

C. Tools

The changing system needs, including more intermittent resources both in front of and behind the meter, require PJM operators to meet new challenges including responding quickly in real time to unexpected changes in generation. The purpose of the LMP market design is to ensure that market incentives support reliable dispatch.

LMP is the price that supports the least cost economic dispatch of energy while maintaining flows on transmission constraints consistent with reliable operation. To change LMP is to deviate from the core element of competitive wholesale power prices. Proponents of any new market payment or product should be required to demonstrate why LMP does not and cannot solve the problem in a more efficient and competitive way.

It has been apparent for some time that the intertemporal dispatch tool used for real-time resource commitment ("IT SCED") requires improvements to ensure its accuracy,

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27 *See* Monitoring Analytics, L.L.C., 2022 State of the Market Report for PJM: January through September, Section 5: Capacity Market at p. 323.

performance and the granularity of its look ahead market dispatch. To improve the accuracy of IT SCED, the length of look ahead intervals and the simplifications made to the load, wind, and solar forecasts should be evaluated and modified to meet the changing needs of the system. For example, in 2021 the Market Monitor identified that the solar forecast in IT SCED remained constant over the afternoon load peak when the sun was going down and solar output declined rapidly. This resulted in IT SCED assuming that thousands of MW of solar were available after sunset. PJM has not yet modified IT SCED to resolve this issue. The length of the look ahead time frames of IT SCED, currently at a maximum of two hours, should be reevaluated, along with the set of resources available to IT SCED for commitment, based on changing system needs. More advanced automation of IT SCED will require other software changes. PJM should also evaluate the need for a look ahead, multiperiod RT SCED dispatch tool.

In addition to determining least cost real-time commitments, IT SCED can also be used to determine the least cost means to create available ramp on dispatchable resources prior to an increase in net load. This may mean backing down resources, like combined cycles, in anticipation of market ramping needs. Identifying the least cost means of creating available ramping capacity is a current capability of the IT SCED software that PJM may not be using effectively. IT SCED is an economic dispatch and unit commitment tool that calculates economic unit output results that can show when a change to resource output could address a multiperiod dispatch need.

The processes for committing, decommitting, and assessing dispatch following require manual actions that could be automated or, at least, enhanced by automation. PJM should rely more on electronic signals sent to generators and fewer phone calls. This does not mean the PJM operators should not talk to generators. It means that those conversations should be reserved for situations that cannot be reflected or addressed with an electronic signal or for required confirmation of electronic instructions.

Manual dispatch should also be replaced by economic dispatch for hydro resources. PJM does not maximize the efficiency of its most flexible capacity, pumped hydro resources.

Pumped hydro resources can rapidly switch from load to generation and have nearly instantaneous ramp rates. Almost their entire capacity can be used as either energy or reserves at all times. This should be done optimally using generation offers and load bids in both the day-ahead and real-time markets. This will require changes to system modelling, dispatcher processes, the use of RT SCED and IT SCED software, and market rules.

D. Price Signals and Investment in Flexible Capacity

The April 21st Order asks (at Question 6.2.1) whether energy and ancillary services markets provide efficient long run price signals for new resources to meet changing system needs. Energy and ancillary services prices can signal a need for investment, supplemented by capacity market revenues. Shortage prices also send a price signal where and when reliability requirements are not met, but the imperative of system reliability does not allow shortage conditions to prevail long enough to ensure energy and ancillary service markets cover fixed costs. But market prices cannot overcome rules that permit inflexible operation and provide incentives for inflexible operation. Wholesale power markets require a combination of good rules and efficient prices.

1. Extended ORDCs

PJM's 2018 extended ORDC proposal would have expanded the reserve requirement at all times regardless of whether there was a specific need to dispatch resources other than for the existing energy, reserves, and transmission constraint requirements. It would have required customers to pay for an unjustified extra buffer of reserves and associated shortage prices when no shortage existed.

PJM's October 18th Report (at 23) reiterates arguments rejected by the Commission.[28] PJM has not established that an expanded ORDC is required to deal with wind and solar variability, or variability based on other factors. PJM has not established a relationship between net load variability and IT SCED load bias to affect unit commitment. PJM currently

[28] *See* Order on Voluntary Remand, 177 FERC ¶ 61,209 (December 22, 2021) at P. 36.

has the ability to expand reserve requirements to meet specific needs rather than creating a permanent extension to the ORDCs that alters the market in a fundamental way.

The extended ORDC proposal was too broad to address any specific system need. It expanded all reserve requirements, synchronized reserve, nonsynchronized reserve, and secondary reserve in the same way and based on the same historical calculation of average forced outages, load forecast error, and intermittent resource forecast error. Extreme weather events in PJM demonstrate that carrying reserves to cover historic forecast error and average forced outage rates is not sufficient to ensure system reliability.[29] Weather, load, and the resource mix are evolving such that more targeted approaches are needed.

Ultimately, the extended ORDC was a pricing proposal, intended to increase LMP through frequent scarcity pricing. It would have moved the current maximum shortage pricing adder to LMP of $1,700 per MWh to $20,000 per MWh with no demonstration that any market response requires prices that high. Its revenue benefits to baseload resources greatly surpassed any revenues to the flexible ramping and fast cycling resources that are required to meet sudden increases in load or drops in wind and solar output. The extended ORDC should not be reconsidered as a market design element to address the needs of the evolving PJM system.

2. Ramp and Uncertainty Products

Ramp and uncertainty products have been adopted by other RTOs. These products do not address underlying sources of inflexibility in the market. A resource can clear a ramp product, but, without a performance obligation to follow dispatch and provide ramp when dispatched up for energy, it has been paid additional revenue for no reason. A resource can provide supplemental offline reserves through an uncertainty product, but that resource provides no support for the system if it cannot acquire gas when called to come online for

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29 See PJM. "Winter Storm Elliot," presentation to the Market Implementation Committee (MIC) at the January 11, 2023 meeting, which can be accessed at: <*https://www.pjm.com/-/media/committees-groups/committees/mic/2023/20230111/item-0x---winter-storm-elliott-overview.ashx*>.

energy. The basic needs of the system for flexible performance can be met based on LMP and economic dispatch together with good rules that permit those incentives to work. The short run marginal cost of dispatch to create ramp or uncertainty reserves is the lost opportunity cost.

The various ISO/RTOs' fleets are evolving in different ways based on their geography and proximity to natural resources and their fundamental market design which in many cases continues to rely on cost of service regulation or capacity contracts rather than a full set of sustainable markets as in the PJM design. No clearly effective, efficient, competitive approach to addressing the flexibility needs associated with increased reliance on intermittent resources has emerged. In the PJM design, it has not been demonstrated that the system requires ramp or uncertainty products either to support dispatch or to provide price signals for investment in flexible resources. PJM has a flexible fleet and many opportunities to create better incentives for resources to take full advantage of that flexibility. The first task is to eliminate the rules that create incentives for inflexible resources before new complexities with questionable efficiency characteristics are layered on top of the current design. The guide to improved market design must continue to be getting the prices right in an efficient and competitive market. Those prices in the energy market are locational marginal prices.

II. CONCLUSION

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

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