

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

PJM Interconnection, L.L.C.)	Docket No. EL19-58-002;
)	ER19-1486-000
)	
)	

COMMENTS OF THE INDEPENDENT MARKET MONITOR FOR PJM

Pursuant to Rule 211 of the Commission’s Rules and Regulations,¹ Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor (“Market Monitor”) for PJM Interconnection, L.L.C. (“PJM”),² submits these comments responding to the filing submitted by PJM Interconnection, L.L.C. (“PJM”) on July 6, 2020 (“July 6th Filing”) in compliance with the order issued May 21, 2020, in this proceeding (“May 21st Order”).³ The May 21st Order requires PJM to establish specific processes to ensure accurate determination of reserve eligibility and capability. The July 6th Filing fails to address significant issues with PJM’s ability to accurately determine whether a resource is capable of providing reserves by following PJM’s dispatch signal. The July 6th Filing fails to address significant issues with PJM’s ability to accurately measure reserve capability. Remedying PJM’s ability to accurately measure reserves requires changes to PJM’s energy dispatch software and processes, including generator modeling. The May 21st Filing should be found deficient until PJM files the Operating Agreement changes necessary to support the

¹ 18 CFR § 385.211 (2019).

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.*, 171 FERC ¶ 61,153.

upgrades to its systems and processes. Nonetheless, the May 21st Order includes certain changes that correct design flaws and should be implemented immediately (see Section E below).

I. COMMENTS

A. The July 6th Filing Does Not Define Clear and Accurate Calculations of Reserve Capability.

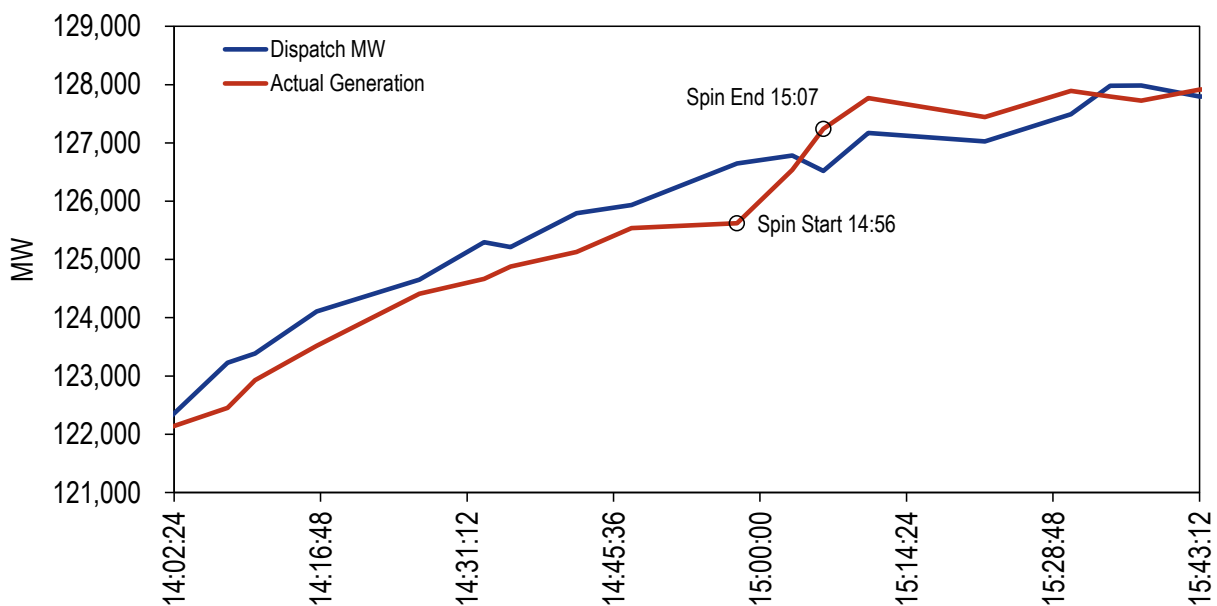
Most resources in the PJM fleet use a change of equipment configuration to produce additional power. Combined cycle plants use multiple combustion turbines, steam turbines, duct burners, and power augmentation. Combustion turbines use over firing and fuel switching. Coal fired units use varying mill configurations and oil topping. Hydroelectric and reciprocating engine generators combine multiple generating units into one market resource. The PJM market software used to dispatch energy and reserves does not explicitly model these equipment configurations. The real world ramping capability is discontinuous. But resources submit ramp rate curves that attempt, but fail, to capture the timing required to transition between configurations. Cleared capacity resources submit economic maximum output levels at their installed capacity MW (ICAP), as required by their must offer requirement, even though the resource cannot achieve its ICAP. Or cleared capacity resources submit economic maximum output levels at less than their installed capacity MW (ICAP), in violation of the must offer requirement, due to unfavorable ambient conditions. In most cases, the transition timing cannot be adequately modelled using ramp rates alone. As a result, resources cannot and do not follow PJM dispatch instructions to provide energy and reserves when following dispatch requires configuration transitions.

As an example, on October 1, 2019, during several intervals, PJM dispatched units to operate at a higher output to meet the greater than forecast load approaching the afternoon peak. Between 1425 EPT and 1455 EPT, at least 79 units failed to achieve the output level to which they were dispatched by PJM. On average, these units together failed to produce a total of 872 MW. The Area Control Error (ACE) at 1455 EPT was -1,064 MW, and at 1454

EPT these units together failed to produce 1,184 MW that they had submitted in their offers and that PJM had dispatched. The failure of these units to meet the output to which they were dispatched by PJM, following their submitted ramp rates, contributed to the low ACE on October 1, 2019. PJM declared a synchronized event at 1456 EPT for low ACE to maintain power balance.

Figure 1 compares the MW dispatched by PJM and the actual output provided by resources on October 1, 2019.⁴

Figure 1 Dispatch MW and actual generation: October 1, 2019



Units did not meet their offered maximum output levels in some cases as a result of ambient conditions, e.g. higher temperatures and higher humidity, for which units had not taken partial forced outages. In addition, combined cycle plants did not meet their offered maximum output levels because the deployment of the power augmentation measures required to increase output (e.g. duct firing, water or steam injection, over firing) was either

⁴ See Monitoring Analytics, LLC, *2019 State of the Market Report for PJM*, Vol. 2, Section 3: Energy Market at 176-180.

delayed or not performed at all, despite PJM's dispatch instructions.⁵ Similar circumstances occurred with another low ACE event on February 7, 2020.⁶

The May 21st Order (at P 273) requires PJM to address "the difficulties associated with predicting [reserve] capability for certain resource types, based on configurations or whether they contain duct burners." PJM fails to address the issues that the May 21st Order required PJM to address. The low ACE events demonstrate that PJM's dispatch is not able to accurately model the MW available to provide energy and reserves because the PJM software does not incorporate the real world discontinuities in plant ramp capability. Correctly measuring reserve capability and joint optimization with energy dispatch requires software changes to correctly model equipment configurations, ramp rates, and dispatch timing. Such capability must be developed and implemented in order for PJM to comply with the applicable directives.

1. Generator Transition Modelling Is Required to Accurately Calculate Reserve Capability.

The July 6th Filing asserts that a resource's ability to update its ramp rate curve in real time will satisfy the need to enhance resource modelling to accurately calculate reserve capability for resources with configuration transitions. This is not the case. The transition of a combined cycle to duct burning mode, or any other generator equipment configuration change, is not equivalent to the gradual, continuous ramp of a unit by adding more fuel. Configuration transitions are discrete changes that require a defined amount of time to complete and the transition is not immediately reversible. Correct modelling requires a transition time and a minimum operating time for the new configuration.

⁵ This information is based on Market Monitor discussions with unit owners.

⁶ See Market Monitor Report, Market Monitor presentation to the Members Committee Webinar (May 26, 2020).

Modelling transition points as a slower ramp rate cannot accurately model the actual discontinuities in plant output. Modelling transitions as a slower ramp rate (e.g. 0.1 MW per minute) at the configuration transition MW point in the ramp rate curve incorrectly implies that the resource takes a long time to make the transition to the next configuration. When the resource is at the transition point, RT SCED will use the resource's very slow ramp rate (e.g. 1 MW per 10 minutes). As a result, the dispatch will not move the unit from the transition point. The ramp rate does not indicate that the resource has significant additional MW at a relatively fast ramp rate, but only after a transition time. As a result, RT SCED will never dispatch the resource into its next configuration unless the resource voluntarily chooses to change configurations and RT SCED observes the additional output placing the resource beyond the slow ramp rate transition point. If expected LMPs are high enough to cover the cost of running the resource at a high output, the resource will ramp up beyond the slow ramp rate. If expected LMPs are not high enough to cover the cost, the resource will not ramp up. In either situation, the resource will not follow the RT SCED dispatch signal and the dispatch of energy and reserves will not be accurate.

Resource owners face weak or nonexistent incentives to increase output into the next configuration. The incentives are further attenuated by the fact that the transition is not smoothly bidirectional. The transition is sticky and the resources typically must remain at the higher output levels for a minimum operating period. As a result, resource operators frequently do not have an incentive to shift the plant to a higher output configuration. Neither energy nor reserves are available in the higher configuration MW range until the resource owner makes the decision to make the transition. The only way to accurately dispatch energy and clear reserves is to explicitly model the configuration transition.

2. The July 6th Filing Does Not Provide Rules for the Determination of Synchronized Reserve Maximum.

Use of the synchronized reserve maximum parameter ("spin max") is not an acceptable substitute for modelling configuration transitions; use of spin max simply ignores the actual capability of units and their must offer MW. Spin max allows resources to

withhold capacity from the reserve market. It is illogical and inconsistent to facilitate withholding MW from the reserve market while requiring the resource to offer the withheld MW as available for energy dispatch using the same ramp rates. If the MW of a higher resource configuration are not available to provide reserves within 10 minutes, the MW are not available to provide energy based on a 10 minute dispatch signal either. The use of spin max should not be permitted because its purpose is to incorrectly represent the actual capability of generating resources. If the actual capability is limited to the submitted spin max level, the resource's economic max should be limited to the same level and the resource should be required to take a forced outage for the difference between ICAP and economic max.

PJM argues that the implementation of hourly differentiated segmented ramp rates will obviate the need for spin max. PJM has failed to explain how hourly differentiated segmented ramp rates solve the identified issue of understating the capability of resources, and failing to require outages when units cannot meet their ICAP output levels, both of which are a result of the use of spin max. But PJM is proposing to keep spin max and is therefore not meeting the directive of the May 21st Order. The May 21st Order directs PJM to "provide a mechanism, within the Tariff, to help guide the determination of reserve capability that PJM will use as an input when determining the Synchronized Reserve maximum." PJM did not provide any mechanism or rules for the determination of spin max or secondary reserve maximum.

3. The July 6th Filing Does Not Adequately Define Synchronized Reserve Eligibility

Currently PJM automatically or manually deselects resources from providing tier 1 synchronized reserves. Some reasons for deselection are clear, such as making nuclear,

wind, solar energy storage and some hydro units ineligible to provide tier 1.⁷ Other reasons for deselection are not defined. For example, PJM currently automatically deselects resources from providing tier 1 reserves while they are testing, released by PJM for shutdown, or providing regulation. The July 6th Filing does not propose rules to implement the same exclusions from reserve calculations while resources are testing, shutting down, or providing regulation. Some of these reasons are appropriate and should be documented in the rules. PJM should disclose all reasons for which resources are currently deselected from providing tier 1. PJM should explain if such reasons will remain after the consolidation of tier 1 and tier 2 reserves, and PJM should incorporate in the market rules implications for not providing reserves.⁸

4. The Timing of PJM's Dispatch Process Creates Inaccurate Reserve Capability and Performance Measurement.

PJM clears reserves using the real-time security constrained economic dispatch (RT SCED) software. RT SCED determines the optimal clearing of energy and synchronized reserves for a target point in time that is 14 minutes in the future, calculated based on a 10 minute resource ramp time.⁹ The reserve target is met if resources follow the dispatch signal for the target time for the full 10 minutes. However, this is rarely the case. PJM systematically overrides the dispatch signal before the full 10 minutes of ramping is complete. The process does not ensure that resources following dispatch will ever achieve the cleared reserve target.

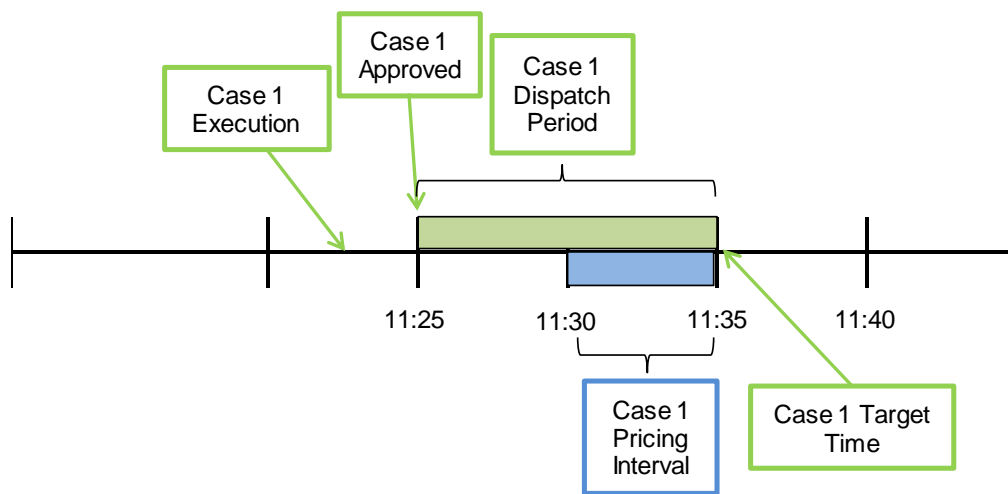
⁷ See "PJM Manual 11: Energy & Ancillary Services Market Operations," Section 4.2.1. Rev. 108 (Dec. 3, 2019).

⁸ See PJM Tier 1 Compensation Education. (January 5, 2015) <<https://www.pjm-ais.com/~media/committees-groups/committees/mic/20150105-tierone/20150105-tier-1-compensation-education-session.ashx>> .

⁹ This is the current timing for auto executed RT SCED cases, as of July, 2020.

Figure 2 depicts the timing of the real-time dispatch under the status quo and PJM’s proposed changes that were approved by the PJM Members Committee on July 23, 2020. In this scenario, PJM approves a case (Case 1) at 11:25 for target time 11:35 that sends dispatch signals to resources at 11:25, when the case is approved. The LMPs and reserve clearing prices that are calculated using the energy and reserve dispatch solution from Case 1 apply to the five minute interval between 11:30 and 11:35 with the recently approved changes.

Figure 2 PJM real-time market dispatch timing for one target time



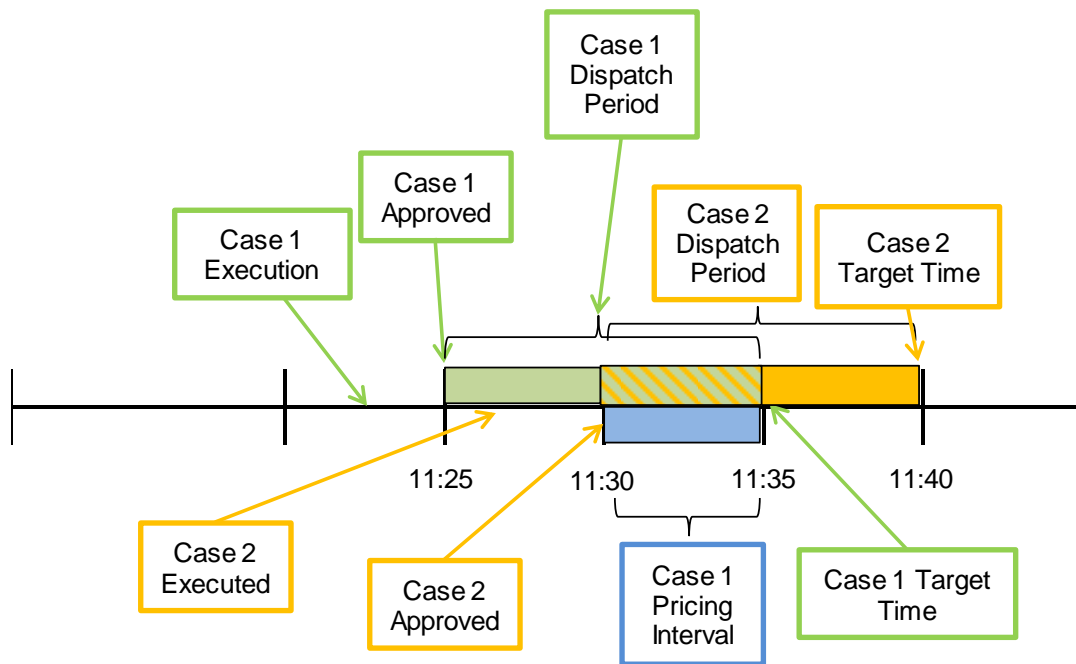
According to changes approved by stakeholders, PJM would settle reserves from five to ten minutes after sending the dispatch instruction. During this five minute interval, PJM will have already sent a new dispatch instruction that, in many cases, will contradict the dispatch instruction corresponding to the settlement, as depicted in Figure 3.

In the scenario shown in Figure 3, PJM approves another case (Case 2) at 11:30 for target time 11:40 that sends revised dispatch signals to resources at 11:30, when Case 2 is approved. From 11:30 to 11:35, resources are expected to follow the dispatch instructions from Case 2, while the LMPs and ancillary service prices are calculated using Case 1.

PJM would pay a resource that cleared reserves while that resource follows a new dispatch signal in which it may not have cleared reserves or cleared a different quantity of reserves. The incorrect compensation extends to the five minute uplift payments that PJM

will pay under the May 21st Order. The result is not logical. In fact, PJM's five minute dispatch and pricing process would result in consistently unmatched dispatch and pricing signals. The only logical solution is to dispatch, clear, and settle reserves for one single five minute period. This requires shortening PJM's dispatch timeframe from 10 minutes to 5 minutes.

Figure 3 PJM real-time market dispatch timing for consecutive target times

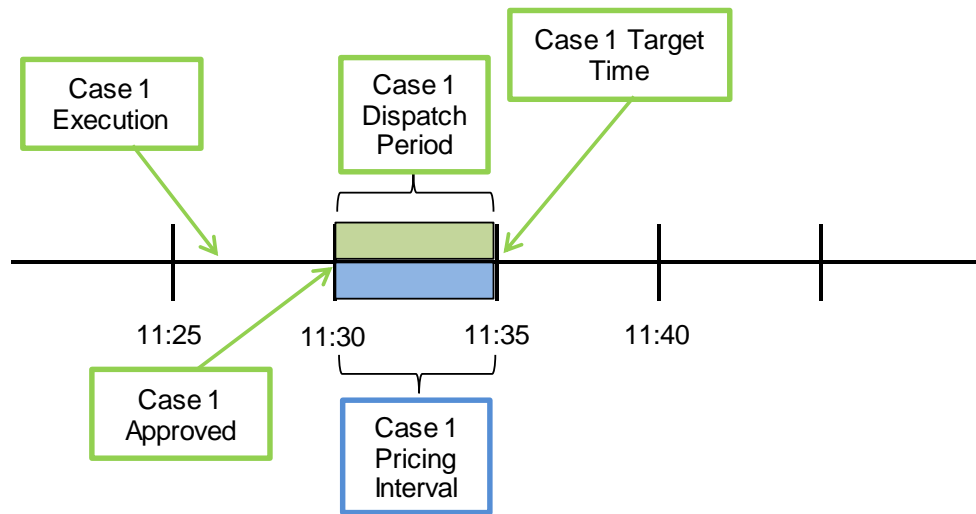


The measure of reserve performance during synchronized reserve events is also unclear based on the overlapping dispatch periods. It is not clear which resources PJM expects to perform, those cleared by the new dispatch case that are following the dispatch signal that indicates reserves at the time of the event or those cleared on the previous dispatch case that is priced and settled at the time of the event.

PJM should not implement the reserve market changes without correcting the overlapping dispatch periods. When the dispatch periods overlap, resources that need to reduce output to provide reserves do not have time to reach the target reserve level before a new signal comes. Under the extended ORDC, reserve prices and corresponding LMPs are based on the reserve targets, not what is actually provided. The dispatch overlap creates a

situation where customers will pay higher prices for reserves that resources following PJM’s dispatch instructions would not achieve. (The resources are physically capable, but PJM’s signals will not lead them to meet the cleared reserves.) A correct five minute market timeline, with a reduced ramp time of five minutes, as shown in Figure 4, would eliminate the overlapping dispatch periods. PJM must resolve this issue, which it has defined as a long term issue, in order for the reserve market design changes to function as intended.¹⁰

Figure 4 Corrected real-time market dispatch timing



5. Multiunit Configurations Create Inaccurate Synchronized Reserve Calculations.

Generator modelling also results in inaccurate reserve assignment when multiple physical units are aggregated as one resource in the energy and reserve market. For example, aggregated hydro units, multiple combustion turbines, or multiple diesel engines at a single site will cause PJM to over calculate synchronized reserves and under count nonsynchronized reserves by treating offline units as if they were online units. Under the

¹⁰ See PJM Package Highlights: 5 Minute Dispatch and Pricing, PJM Presentation to the Markets and Reliability Committee (July 23, 2020) at 6, 10–12, <<https://pjm.com/-/media/committees-groups/committees/mrc/2020/20200723/20200723-item-01-1-five-minute-dispatch-and-pricing-pjm-proposal.ashx>>.

May 21st Order PJM would pay synchronized reserve revenues to offline units. To ensure accurate reserve capability determinations, PJM should eliminate multiunit modelling when the operation of each unit is physically independent.

6. The Use of DGP for Calculating Energy Requirements Creates Inaccurate Reserve Measurement.

The July 6th Filing proposes to rely on ramp rates to determine reserve clearing and not adjust them using the degree of generator performance (“DGP”), but fails to clarify how PJM adjusts ramp rates in calculating energy and reserves. PJM routinely changes resource ramp rates using DGP in IT SCED and RT SCED in order to calculate dispatchable energy and reserves.¹¹ The May 21st Order notes that PJM will no longer adjust market data using DGP due to the consolidation of the tier 1 and tier 2 reserve products. The May 21st Order is correct that DGP will no longer be used in the tier 1 reserves estimate, because there will be tier 1 reserves estimate. However, PJM has not proposed to eliminate the use of DGP for calculating dispatchable energy and reserves. The continued use of DGP will alter the real-time submitted ramp rates from the values submitted by market sellers, inconsistent with the Operating Agreement requirement that unit owners have exclusive responsibility for their own offers and inconsistent with the goal to accurately model resources using the most current ramp rate information.¹²

7. Unclear Schedule for Offline Reserves

The accurate measurement of reserve capability for offline reserves, nonsynchronized reserves and secondary reserves, requires choosing from among multiple offer schedules submitted for a resource to determine start and notification times and ramp

¹¹ See PJM, Generator Performance Monitor and the Degree of Generator Performance Whitepaper (June 30, 2020), <https://go.pjm.com/e/678183/ormance-white-paper-ashx-lan/3yhmd/141037643?h=wAWC9cCCapaBmy1lgq2QiaIpwp4qE1wDqlYAmi-u_Nc>.

¹² See OA Schedule 1 § 6.4.2(d).

rates. The July 6th Filing does not clarify how PJM will choose a schedule to calculate offline reserve capability.

B. The July 6th Filing Creates Inconsistent Use of Emergency Resources.

The May 21st Order requires that PJM allow an unlimited quantity of demand response resources to clear in the reserve markets. The July 6th Filing complies by removing the cap on demand response clearing as synchronized reserve. The July 6th Filing does not remove the prohibition on 30 minute pre-emergency and emergency demand response resources clearing in the secondary (30 minute) reserve market. Currently, PJM allows combustion turbines with emergency remote start capability to clear as nonsynchronized reserves despite their emergency status. This is inconsistent treatment between demand response and thermal resources. PJM should be required to clarify and document in the Operating Agreement whether or not emergency capacity can clear in the reserve markets and apply the same standard to all resources.

C. The July 6th Filing Fails to Account for Reserves Dedicated to VACAR.

Under the VACAR reserve sharing agreement, Dominion Virginia Power provides reserves to VACAR in addition to PJM.¹³ With the increased amount of reserves PJM would clear under the May 21st Order, conflicts between providing reserves to both PJM and VACAR will arise more frequently than in the past. Before accepting the July 6th Filing, PJM should be required to revisit the arrangements with Dominion and VACAR to determine whether Dominion is able to provide reserves to both entities from the same resources and to avoid potential significant issues that may arise if Dominion cannot do so. It should be clear that PJM capacity resources are reserves for PJM and not for any other area. The rules need to be made explicit and enforceable.

¹³ See SERC Regional Criteria, Contingency Reserve Policy: NERC Reliability Standard BAL-002, <[https://www.nerc.org/docs/default-source/program-areas/standards-regional-criteria/regional-criteria-and-guidelines/archive/contingency-reserve-policy-\(serc-regional-criteria\).pdf?sforsn=432d34ff_2](https://www.nerc.org/docs/default-source/program-areas/standards-regional-criteria/regional-criteria-and-guidelines/archive/contingency-reserve-policy-(serc-regional-criteria).pdf?sforsn=432d34ff_2)>, accessed July 24, 2020.

D. The July 6th Filing Places Inappropriate Limitations on the Market Monitor.

The July 6th Filing creates a process for PJM and the Market Monitor to review the eligibility of nuclear, wind, and solar resources to provide reserves. The July 6th Filing also adds language to Schedule 1 of the Operating Agreement:¹⁴

The Office of the Interconnection and the Market Monitoring Unit shall review, in an open and transparent manner as between the Market Seller, the Market Monitoring Unit, and the Office of the Interconnection, the information and documentation in support of the request for approval to provide reserves.

The Market Monitor already has a defined role in reviewing whether there are market power issues associated with participant requests to be ineligible for providing reserves. PJM's language is not about the market power review.

It is not clear exactly what PJM's objective is with this language about the nature of the review process. PJM has not asserted a need for the language or explained its inclusion in any way. PJM did not discuss the language with the Market Monitor. PJM has, in recent years, attempted to assert that it should be included in written and oral communications between the Market Monitor and market participants. To the extent that PJM is attempting to ease the nose of that camel under the tent in this filing, it is entirely inappropriate.

It is not appropriate to constrain the communications of PJM or the Market Monitor in the proposed manner, as either may, in order to effectively perform their role, determine there is a need to engage in confidential communications with market participants or each other.

It is the Market Monitor's responsibility to reach decisions and to explain its decisions. The Market Monitor will continue to do so without PJM's proposed language.

¹⁴ July 6th Filing, Attachment A, Proposed Operating Agreement Schedule 1 §§ 1.7.19A(a), 1.7.19A.01(a), and 1.7.19A.02(a).

The rules should not suggest that PJM monitors communications between the Market Monitor and market participants. It is not PJM's role to shield participants from oversight or arbitrate disputes over Market Monitor information requests. If the Market Monitor or a participant has a complaint about a request or a response in the review process, they can raise it with and explain it to the Commission.

The Market Monitor has the exclusive authority to implement the Market Monitoring Plan, Attachment M to the OATT.¹⁵ The Commission's Rules require consolidation in one place of all rules core to the market monitoring function.¹⁶ The designated place in the PJM Market Rules is Attachment M. The revisions proposed in the July 6th Filing violate this rule. The language proposing to interfere with the Market Monitor's ability to independently communicate with market participants should be rejected.

E. Select Revisions to the Reserve Markets Should be Implemented Prior to May 2022.

The July 6th Filing requests an implementation date of May 2022 for the revised energy and reserve market design. While the extended ORDC requires additional time to implement, other beneficial changes approved with the May 21st Order could easily be implemented sooner. The removal of the \$7.50 per MW margin and the unsupported synchronized reserve VOM cost require no implementation time and would provide immediate benefits.¹⁷ PJM is implementing real-time adjustments to ramp rates on a separate timeline.¹⁸ The requirement for accurate ramp rates should be implemented along

¹⁵ OATT Attachment M § IV.D-1.

¹⁶ See 18 CFR § 35.28(g)(3)(i)(F).

¹⁷ See May 21st Order at P 121.

¹⁸ See *PJM Interconnection, L.L.C.*, 172 FERC ¶ 61,055. ("July 16th Order")

with those changes without delay.¹⁹ Due to dramatic changes in congestion patterns on the PJM system in recent years, there is an immediate need to change the definition of the reserve subzone to support reliability.²⁰ In the stakeholder process, PJM defined a change from the current Mid-Atlantic Dominion reserve subzone to a redefined subzone as part of the reforms to the reserve markets.²¹ Redefining the reserve subzone should be implemented as soon as possible on its own timeline. The Market Monitor recommends that the indicated provisions be made effective immediately.

¹⁹ See July 16th Order, Concurrence of Comm. Glick at P 3.

²⁰ See 2019 State of the Market Report for PJM, Vol. 2 (March 12, 2020) at 456.

²¹ Proposed Reserve Market Enhancements, PJM Presentation to the Energy Price Formation Senior Task Force (December 14, 2018) at 8–10, <<https://www.pjm.com/-/media/committees-groups/task-forces/epfstf/20181214/20181214-item-04-price-formation-paper.ashx>>.

II. CONCLUSION

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

Respectfully submitted,



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Dated: July 27, 2020

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 July, 2020.



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