UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Independent Market Monitor for PJM	)	
v.	)	Docket No. EL19-___-000
PJM Interconnection, L.L.C.	)	

COMPLAINT OF THE INDEPENDENT MARKET MONITOR FOR PJM

Pursuant to Rule 206 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] files this Complaint seeking an order directing PJM to update the assumptions regarding the expected number of performance assessment intervals ("PAI"), formerly known as performance assessment hours ("PAH"), in calculating the default capacity market seller offer cap ("MSOC").[3] As a result of using an unreasonable and unsupported number of expected PAI (PAH) with the current nonperformance charge rate based on 30 hours, the default MSOC is overstated. This means

---

1 18 CFR § 385.206 (2018).

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 PAH was changed to PAI when the market rules were revised in Compliance with Order No. 825, to evaluate performance and settle on a five minute basis instead of an hourly basis. *See PJM Interconnection, L.L.C.*, 162 FERC ¶ 61,150 (2018). It has no substantive impact on the mathematics of the competitive offer calculation of Capacity Performance resources. One PAH (hour) is equivalent to 12 PAIs (five minute intervals).

that only a small number of very high offers are subject to unit specific cost review for market power. Most offers, including the offers setting price, are not subject to unit specific cost review for market power. An excessive default MSOC prevents effective mitigation of market power in the PJM Capacity Market. The lack of effective market power mitigation in the capacity market, where structural market power is endemic, is unjust and unreasonable.[4] The public cannot rely on RPM auctions using the current default MSOC to ensure just and reasonable capacity market prices. PJM should be directed to revise the expected number of PAI (PAH) used to set the default MSOC.

The Commission identified the significance of a reasonable and supportable estimate for the expected number of PAI (PAH) and its impact on the default MSOC in the orders approving Capacity Performance ("CP"). The Market Monitor identified the issue and raised it in the recent stakeholder process convened to address this and related issues. That process concluded with no revisions to the estimated number of PAI (PAH). The issue remains. This complaint affords the Commission an opportunity to require PJM to make the required adjustment to PAI (PAH), and restore confidence that RPM auctions result in efficient and competitive pricing, and, therefore, just and reasonable rates.

I. COMPLAINT

A. The Default Market Seller Offer Cap (MSOC) Is Overstated.

Section 6.4(a) of Attachment DD to the OATT defines market seller offer caps in RPM auctions. The provision defines unit specific MSOCs calculated based on avoidable costs and the default MSOC based on the opportunity cost of taking on a capacity performance obligation in the presence of expected bonus and penalty payments:

---

[4] *2018 Quarterly State of the Market Report for PJM: January through September*, Vol. 2, Section 5: Capacity Market, Table 5-9 (November 8, 2018), which can be accessed at: <*http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2018/2018q3-som-pjm.pdf*>.

> The Market Seller Offer Cap, stated in dollars per MW/day of unforced capacity, applicable to price-quantity offers within the Base Offer Segment for an Existing Generation Capacity Resource shall be the Avoidable Cost Rate for such resource, less the Projected PJM Market Revenues for such resource, stated in dollars per MW/day of unforced capacity, provided, however, that the default Market Seller Offer Cap for any Capacity Performance Resource shall be the product of (the Net Cost of New Entry applicable for the Delivery Year and Locational Deliverability Area for which such Capacity Performance Resource is offered times the average of the Balancing Ratios in the three consecutive calendar years (during the Performance Assessment Intervals in such calendar years) that precede the Base Residual Auction for such Delivery Year), however, for the Base Residual Auction for the 2021/2022 Delivery Year, the Balancing Ratio used in the determination of the default Market Seller Offer Cap shall be 78.5 percent, and provided further that the submission of a Sell Offer with an Offer Price at or below the revised Market Seller Offer Cap permitted under this proviso shall not, in and of itself, be deemed an exercise of market power in the RPM market. Notwithstanding the previous sentence, a Capacity Market Seller may seek and obtain a Market Seller Offer Cap for a Capacity Performance Resource that exceeds the revised Market Seller Offer Cap permitted under the prior sentence, if it supports and obtains approval of such alternative offer cap pursuant to the procedures and standards of subsection (b) of this section 6.4. A Capacity Market Seller may not use the Capacity Performance default Market Seller Offer Cap, and also seek to include any one or more categories of the Avoidable Cost Rate defined in Tariff, Attachment DD, section 6.8 below.

The default MSOC is defined as net CONE times B where B is the average balancing ratio during Performance Assessment Intervals ("PAIs") that occurred in the three calendar years preceding the Base Residual Auction ("BRA").[5] The default MSOC does not rely on any unit specific review or any other review of a resource's costs.[6]

The Commission approved this default MSOC in its order approving CP, issued on June 9, 2015 ("June 9th Order").[7] In the June 9th Order, the Commission explicitly noted (at P 338) that the MSOC is Net CONE times B only under the assumption that the number of PAI (PAH) used to calculate the nonperformance charge rate equals the reasonable and supportable expected number of PAI (PAH):

> PJM's proposed Non-Performance Charge rate is calculated as Net CONE divided by 30 hours. Under the assumption that the number of Performance Assessment Hours is the same as the number used to calculate the Non-Performance Charge rate, this opportunity cost amount is equivalent to Net CONE times the Balancing Ratio (B).

The Commission recognized what the mathematics of the MSOC makes clear.[8] The MSOC equals net CONE times B only under the assumption that the number of expected PAH is the same as the number used to calculate the nonperformance charge rate.

The 30 hours assumption included in the CP market design was significantly overstated and a potentially significant flaw even when CP was originally proposed and approved.[9] [10] [11] [12] Experience under the CP design, and reserve margins that resulted from

---

5 There is also an issue about the definition of B in the absence of any system wide PAI (PAH) but that issue is not the subject of this complaint.

6 *PJM Interconnection, L.L.C., et al.*, 151 FERC ¶ 61,208 at P 344 (2015).

7 *Id.* at P 336 (2015).

8 *Id.* at n. 281 & 283.

9 *Id.* at P 163.

10 *Id.*, including the dissent included in the June 9th Order by Chair Norman Bay, which stated in part:

> To approximate the expected total Non-Performance Charge a resource that fails to perform would pay, one needs to make an assumption about

the CP auctions provide overwhelming evidence that the assumption that it is reasonable and supportable to expect 30 hours of emergency actions that would result in PAI is incorrect and overstated.[13]

Given that the nonperformance charge rate is defined as net CONE divided by 30 hours (360 intervals), and the actual expected number of PAH (PAI) in the energy market is a very small number close to zero, the opportunity cost is below the net avoidable cost of most resources and therefore the competitive offers of most CP resources are not based on the opportunity cost of taking on a capacity performance obligation.[14] The difference

> the expected number of performance assessment hours. The total yearly expected Non-Performance Charge or penalty payment per megawatt of capacity for a resource that never performs is calculated by multiplying .85 of Net CONE by the ratio of the number of actual performance assessment hours in the relevant capacity zone divided by 30. The number 30 is important because it represents PJM's expectation of performance assessment hours in a year. In 2011–12, PJM declared 7; in 2012-13, 5; and in 2013–14, 30. The average over the three-year period is 14. If the outlier is excluded (2013–14), the average is 6. An estimate of 30 expected performance assessment hours appears to be overly generous and, depending upon the number of actual assessment hours, may result in a partial stick. For example, if PJM declared 14 actual performance assessment hours in a capacity zone, a resource that failed to perform during each of those hours would be subject to a total Non-Performance Charge per megawatt of capacity of 14/30 times .85 Net CONE, which equates to .40 of Net CONE for the delivery year.

11 *See* Comments of the Independent Market Monitor for PJM, Docket No. ER15-623-000 at 18, which can be accessed at: <http://www.monitoringanalytics.com/Filings/2015/IMM_Comments_Docket_No_ER15-623-000_EL15-29-000_20150120.pdf>.

12 *See* Limited Request for Rehearing of the Independent Market Monitor for PJM, Docket No. ER15-623-000 at 10–11, which can be accessed at: <http://www.monitoringanalytics.com/Filings/2015/IMM_Limited_Request_for_Rehearing_Docket%20Nos_ER15-623-000_001_and%20EL15-29-000_20150706.pdf>.

13 The Commission also recognized that improving resource performance incentives are at the core of CP. *See* June 9th Order at PP 7 & 9. Improved resource performance contributes to a further reduced likelihood of occurrence of PAIs.

14 *See* Attachment A: Competitive Offer for a Capacity Performance Resource in PJM at 3.

between the number of PAH/PAI used in the nonperformance charge rate (30/360) and a realistic estimate of the number of PAH/PAI (near zero) leads to an opportunity cost of taking on a capacity performance obligation that is much lower than net CONE times B. With a reasonable and supportable estimate of five PAH, the competitive offer for most resources under the Capacity Performance design would be based on their net avoidable cost rate ("ACR"), adjusted with any expected nonperformance charges or bonuses.

The correctly calculated default MSOC would continue to be net CONE times B only if the PAI (PAH) used to calculate the nonperformance charge rate were the same as the reasonably expected PAI (PAH). The nonperformance charge is, within limits, reasonably a matter of judgment informed by empirical observation of market responses. The current detailed nonperformance charges are a function of the relevant locational net CONE and range from $2,684 per MWh in BGE to $3,649 per MWh in ComEd for the 2018/2019 Delivery Year. While the nonperformance charges could be recalculated based on the reasonable and supportable five PAH or 60 PAI recommended by the Market Monitor, the result would be to multiply the nonperformance charge rate by six times. This would increase the nonperformance charge rate to a range of $16,104 per MWh to $21,894 per MWh for the 2018/2019 delivery year. Given the corresponding BRA clearing prices, the nonperformance charges would equal the total capacity market revenue for a unit that failed to perform for just four to six hours, depending on its LDA.[15] The nonperformance charges would reach the annual stop loss for a unit that failed to perform for just nine hours and 25 minutes.[16] Given the corresponding BRA clearing prices, the current nonperformance charges would equal the total capacity market revenue for a unit that

---

15 This analysis assumes that the average balancing ratio during the intervals when performance is evaluated is 0.8.

16 This analysis also assumes that the average balancing ratio during the intervals when performance is evaluated is 0.8. The annual stop loss for nonperformance charges is currently defined at 1.5 times the net CONE in dollars per MW per year. *See* OATT Attachment DD § 10A (f).

failed to perform for 22 to 35 hours, depending on its LDA. The current nonperformance charge rate would reach the annual stop loss for a unit that failed to perform for 56 hours and 15 minutes. The current nonperformance charge rate, along with the currently defined annual stop loss, ensures that resources have an incentive to perform during emergencies, even if the actual number of PAIs were to exceed the reasonable and supportable five PAH.

In the recent stakeholder process, the Market Monitor proposed that the stakeholders consider the use of 60 PAI (5 PAH) for both the nonperformance charge rate and the default MSOC calculation. The Market Monitor's proposal would have increased the nonperformance charge rate to six times its current value, and kept the default MSOC at net CONE times B. This proposal failed in the stakeholder process.[17] But even if the nonperformance charge rates were doubled, based on the use of 15 hours rather than 30 hours, use of the reasonable and supportable five PAH or 60 PAI recommended by the Market Monitor would still mean that the correct MSOC would be one third the current level, using the mathematics of CP competitive offers.[18] [19]

The default MSOC, as currently defined in the PJM tariff, overstates the competitive offers of most resources in PJM. As a result, the current default MSOC permits the exercise

---

17 The issue was discussed at the Market Implementation Committee meetings between February 2018 and August 2018. The Market Monitor's proposal failed with 98 percent of votes opposing, and 2 percent of votes supporting it. *See* "Draft Minutes, Markets Implementation Committee," (August 8, 2018) at 2, which can be accessed at: <*https://www.pjm.com/-/media/committees-groups/committees/mic/20180912/20180912-item-01-draft-minutes-mic-20180808.ashx*>.

18 *See* Attachment A: Competitive Offer for a Capacity Performance Resource in PJM.

19 The nonperformance charge rate in PJM is modeled after the Capacity Performance Payment Rate (PPR) in ISO-NE. The full Performance Payment Rate ("Full PPR") in ISO-NE is set at $5,455 per MWh, scheduled to be implemented on June 1, 2024. It was calculated in 2014, based on the net CONE at that time, and the expected number of scarcity hours at that time of 21.2 hours per year. Even though the inputs (net CONE and scarcity hours) to the calculation of PPR have since changed, it remains at the level that the Commission approved in 2014. *See* ISO New England Inc. Transmission, Markets, and Services Tariff, III.13.7.2.5 Capacity Performance Payment Rate, which can be accessed at <*https://www.iso-ne.com/static-assets/documents/regulatory/tariff/sect_3/mr1_sec_13_14.pdf*>.

of market power. While not dispositive as a result of endemic market power in the capacity market, the fact that less than one percent of resources made unit specific offers is consistent with this conclusion.[20] The fact that 99 percent of resources subject to an offer cap that did not offer zero chose the default MSOC is also consistent with this conclusion. The fact that most resources using the default MSOC offered below the MSOC in CP auctions is also consistent with this conclusion. The fact that capacity market prices were set based on offers less than the resources' MSOC is also consistent with this conclusion. The Market Monitor concluded that market power was exercised in the 2021/2022 Base Residual Auction as a result of the fact that the MSOC exceeded the competitive offer level for most resources.[21]

PJM's CP reforms are modeled after similar reforms (Pay for Performance) implemented by the Independent System Operator for New England ("ISO-NE"). An issue similar to the issue identified in this complaint was addressed by ISO-NE and its Independent Market Monitor, and the Commission took appropriate corrective action.

In an order issued March 9, 2018 ("March 9th Order"), the Commission accepted revisions reducing the ISO-NE's dynamic delist bid threshold, which is the equivalent of the default MSOC in ISO-NE.[22] The Commission recognized (at P 37) the risk posed by a dynamic delist bid threshold that is too high and that does not subject the marginal resource offers to Market Monitor's review of market power:

---

20 *See* "Analysis of the 2021/2022 RPM Base Residual Auction - Revised," which can be accessed at: <*http://www.monitoringanalytics.com/reports/Reports/2018/IMM_Analysis_of_the_20212022_RPM_BRA_Revised_20180824.pdf*> (August 24, 2018) at 41.

21 *See* "Analysis of the 2021/2022 RPM Base Residual Auction - Revised," which can be accessed at: <*http://www.monitoringanalytics.com/reports/Reports/2018/IMM_Analysis_of_the_20212022_RPM_BRA_Revised_20180824.pdf*> (August 24, 2018) at 2–4, 86–88. "Based on the data and this review, the MMU concludes that the results of the 2021/2022 RPM Base Residual Auction were not competitive as a result of economic withholding by resources that used offers that were consistent with the net CONE times B offer cap but not consistent with competitive offers based on the correctly calculated offer cap."

22 *ISO New England Inc.*, 162 FERC ¶ 61,206 (March 9, 2018).

> We find that the IMM's use of implied bids sufficiently addresses the risk associated with setting the Dynamic De-List Bid Threshold too high; that is, the marginal resource's bid may not be subject to IMM review and could therefore reflect the exercise of market power.

PJM's default MSOC functions as a threshold similar to the dynamic delist bid threshold in ISO-NE. Resource offers below the default MSOC in PJM's Capacity Market are not subject to market power review. PJM's currently defined default MSOC level at net CONE times B using an incorrect PAI (PAH) presents the same risk as a dynamic delist bid threshold in ISO-NE that is too high, the risk that marginal resource offers are not subject to market power review and can exercise market power. The Commission should order PJM to revise the default MSOC based on a reasonable and supportable expectation of the number of PAI (PAH), currently five hours.

B. The Default Market Seller Offer Cap (MSOC) Does Not Protect the Capacity Market from the Exercise of Market Power.

When the June 9th Order was issued, it was expected that the marginal units in the capacity market, the units that are expected to set clearing prices, would be units defined as High ACR units and that these offers would be subject to unit-specific offer review. The Commission stated (at P 344):

> As PJM explains, for any Low ACR Resource, the competitive offer formula will simplify to Net CONE times the Balancing Ratio as a permissible offer cap. High ACR Resources, which are those most likely to set the clearing price, will, under PJM's Revised Offer Cap, be subject to unit-specific offer review and must justify the assumptions and estimates in their requested offer price. The unit-specific review for all capacity offers will provide additional protections for consumers.

The offers of resources in the PJM Capacity Market for CP resources are a reflection of PJM market sellers' expectations about the number of PAI (PAH) and of market sellers' ability to exercise market power. The criteria for determining whether a resource is Low ACR or High ACR is based on the expected bonus revenues a resource would earn, if it were an energy only resource. The expected bonus revenues a resource would earn are directly proportional to the expected number of PAI (PAH) in the delivery year that would afford the resource the opportunities to perform and earn these revenues.[23] If a market seller expects a very low or zero PAI, there is very little opportunity or no opportunity to earn bonus revenues as an energy only resource. Under this expectation, the default MSOC would be lower than the net ACR. The competitive offer of such a resource is its net ACR, adjusted by any nonperformance charges or bonus revenues. If a market seller expects a very low or zero PAI, the expected nonperformance charges or bonus revenues are close to zero, and the competitive offer of such a resource is its net ACR.

High ACR units are those units whose net avoidable costs (avoidable costs minus net revenue from energy and ancillary services markets) exceed the expected capacity bonus performance revenues they can earn as an energy only resource.[24] A High ACR resource is not expected to earn enough bonus revenues as an energy only resource to cover its net avoidable costs, and therefore requires a capacity payment to take on a commitment in the capacity market. A High ACR resource is expected to submit offers that exceed the correctly calculated default MSOC of net CONE times B. These High ACR offers are unit-specific based on the net ACR of the resources, and subject to ex ante review by the Market Monitor.

The Commission repeated the importance of reviewing the marginal resource offers for market power again in the March 9th Order (at P 38):

> We agree with ISO-NE that suppliers should not rely on the Dynamic De-List Bid Threshold as an indicator of the likely clearing price in the next auction; the purpose of the Dynamic De-List Bid Threshold is not to signal the likely market clearing price, but instead to help ensure that the marginal bid is subject to IMM review for the potential exercise of market power.

---

23 *See* Attachment A: Competitive Offer for a Capacity Performance Resource in PJM at 2.

24 *See* Attachment A: Competitive Offer for a Capacity Performance Resource in PJM at 4.

However, in the four base residual auctions that PJM has conducted under the capacity performance design, High ACR resources never set the clearing price at their unit specific offer cap. The additional protection that the Commission expected from review of offers that were most likely to set clearing prices was not provided. In fact, the Market Monitor's analysis of the most recent 2021/2022 BRA showed that some capacity offers were in excess of competitive levels, and that an overstated default MSOC allowed these market sellers to exercise market power without the offers being subject to review for market power concerns.[25] The current definition of the default MSOC does not allow the Market Monitor to review the offers at or below net CONE times B to ensure that there is no market power exercised, even if these offers set prices, because the tariff deems submission of offers at or below net CONE times B to not be an exercise of market power.[26]

Based on the analysis of the impact of these offers on the auction results, the Market Monitor concluded that the results of the 2021/2022 RPM Base Residual Auction were not competitive as a result of economic withholding by resources that used offers that were consistent with the net CONE times B offer cap but not consistent with competitive offers based on the correctly calculated offer cap.[27] Table 1 shows the results if the noncompetitive offers identified by the Market Monitor had been capped at net ACR for the 2021/2022 RPM Base Residual Auction.[28] Based on actual auction clearing prices and quantities and make whole MW, total RPM market revenues for the 2021/2022 RPM Base Residual Auction were $9,300,877,106. If the identified noncompetitive offers had been capped at net ACR in the

---

25 *See* "Analysis of the 2021/2022 RPM Base Residual Auction - Revised," which can be accessed at: <*http://www.monitoringanalytics.com/reports/Reports/2018/IMM_Analysis_of_the_20212022_RPM_BRA_Revised_20180824.pdf*> (August 24, 2018) at 2–4, 86–88.

26 OATT Attachment DD § 6.4 (a).

27 *Id* at 3.

28 *Id* at Table 47.

2021/2022 RPM Base Residual Auction and everything else had remained the same, total RPM market revenues for the 2021/2022 RPM Base Residual Auction would have been $8,070,050,631, a decrease of $1,230,826,475, or 13.2 percent, compared to the actual results. From another perspective, the noncompetitive offers resulted in a 15.3 percent increase in RPM revenues for the 2021/2022 RPM Base Residual Auction compared to what RPM revenues would have been had the noncompetitive offers been capped at net ACR.

Table 1 Impact of noncompetitive offers: 2021/2022 RPM Base Residual Auction

		Actual Auction Results		Noncompetitive Offers capped at net ACR	
LDA	Product Type	Clearing Prices ($ per MW-day)	Cleared UCAP (MW)	Clearing Prices ($ per MW-day)	Cleared UCAP (MW)
RTO	Annual	$140.00	162,911.8	$124.40	163,416.6
	Summer	$140.00	715.5	$124.40	715.5
	Winter	$140.00	715.5	$124.40	715.5
RTO Total			163,627.3		164,132.1
ATSI	Annual	$171.33	8,007.3	$169.65	8,013.1
	Summer	$171.33	6.3	$169.65	6.3
	Winter	$171.33	0.0	$169.65	0.0
ATSI Total			8,007.3		8,013.1
EMAAC	Annual	$165.73	29,287.5	$155.93	29,363.9
	Summer	$165.73	88.0	$155.93	87.9
	Winter	$165.73	1.0	$155.93	1.0
EMAAC Total			29,288.5		29,364.9
PSEG	Annual	$204.29	5,366.6	$204.29	5,366.6
	Summer	$204.29	9.3	$204.29	9.3
	Winter	$204.29	1.0	$204.29	1.0
PSEG Total			5,367.6		5,367.6
BGE	Annual	$200.30	1,937.7	$124.40	2,492.0
	Summer	$200.30	85.0	$124.40	84.6
	Winter	$200.30	0.0	$124.40	0.0
BGE Total			1,937.7		2,492.0
ComEd	Annual	$195.55	22,083.6	$130.04	22,421.0
	Summer	$195.55	274.5	$130.04	274.5
	Winter	$195.55	274.5	$130.04	274.5
ComEd Total			22,358.1		22,695.5
DEOK	Annual	$140.00	2,733.3	$128.47	2,636.3
	Summer	$140.00	25.4	$128.47	25.2
	Winter	$140.00	0.0	$128.47	0.0
DEOK Total			2,733.3		2,636.3

Even though PJM's tariff has not been updated with a default offer cap that is consistent with a reasonable and supportable estimate of the number of PAIs, the offer behavior of most market sellers reflects the expectation of low PAIs. However, some market sellers with capacity in constrained LDAs were able to exercise market power through economic withholding and set clearing prices at greater than competitive levels. The current definition of the default MSOC does not allow the Market Monitor to review the offers at or below net CONE times B to ensure that there is no market power exercised, even if these offers set prices, because the tariff deems submission of offers at or below net CONE times B to not be an exercise of market power.[29] Sellers are not required to support such offers and do not provide the data required to perform a competitiveness review.

C. PJM Failed to Submit Revised MSOC Based on Reassessment of PAI (PAH).

The Commission recognized the importance of monitoring the number of PAI (PAH), its impact on the default offer cap and updating the number of PAI (PAH) and therefore the default offer cap, as PJM gained more experience with the Capacity Performance rules. In the June 9th order, the Commission stated (at P 163):

> However, given that the Performance Assessment Hour estimate affects core components of the Capacity Performance design, including the Non-Performance Charge rate and the default offer cap, we condition our acceptance of PJM's proposal on PJM making annual informational filings with the Commission to provide updates on the use of 30 hours for this parameter…We also encourage PJM to reassess the assumed number of Performance Assessment Hours after it has gained more experience with Capacity Performance and submit a filing if it finds a revision is warranted.

As PJM gained additional experience operating the energy market with resources committed as CP and conducting RPM auctions to procure CP resources, PJM reassessed but, despite the evidence, did not change the number of PAI (PAH) in the definition of the MSOC. PJM let the default MSOC be set at a level that exceeds the MSOC based on a reasonable and supportable expectation of the number of PAI (PAH), five PAH, and at a level that is greater than the competitive offers of most resources. The Market Monitor's

---

29 OATT Attachment DD § 6.4 (a).

analysis of the most recent base residual auction shows that some market sellers exercised market power, even though the clearing prices were below the tariff defined default MSOC for the marginal units.[30]

The continued level of PJM's excess reserve margins further reduces the likelihood of having emergency actions that could trigger PAIs. During the stakeholder process to discuss updating the balancing ratio and the number of PAH, PJM presented the results of a simulation study using a resource adequacy planning tool to estimate the number of PAH under two scenarios: one where the reserve margin equals the target IRM of 15.8 percent; the second where the reserve margin equals the actual IRM in the latest BRA, 21.8 percent.[31] PJM's study showed that if the capacity market cleared at the target IRM, the expected number of PAH is 15, and if the capacity market cleared with actual observed IRM, the expected number of PAH is two. The results based on the actual reserve margins are aligned with the market's expectations of the number of PAI (PAH). Using an assumption of 30 expected PAH (equivalent to 360 PAI), and a default MSOC of net CONE times B, is not consistent with expectations of PAI that are based on the supply and demand conditions for capacity in PJM.

Table 2 shows the calculated reserve margins using the RPM peak load forecast for the delivery year and the committed installed capacity (ICAP) MW that accounts for cleared capacity, replacement capacity, and deficiency MW for all auctions held for each of the delivery years.[32] The forecast peak load values shown in Table 2 account for the updated

---

30 *See* "Analysis of the 2021/2022 RPM Base Residual Auction— Revised," which can be accessed at: <http://www.monitoringanalytics.com/reports/Reports/2018/IMM_Analysis_of_the_20212022_RPM_BRA_Revised_20180824.pdf> (August 24, 2018) at 2–4, 86–88.

31 *See* Attachment B at 16.

32 The calculated reserve margins for June 1, 2019, and June 1, 2020, do not account for cleared buy bids that have not been used in replacement capacity transactions. Without an approved early replacement transaction requested for defined physical reasons, replacement capacity transactions

forecast peak loads that were revised down in subsequent revisions after the BRA, but prior to the beginning of the delivery year. Table 2 shows that for each of the delivery years, the actual IRM exceeded the target IRM by a minimum of 6.2 percentage points to a maximum of 12.3 percentage points.

Table 2 Installed reserve margins: June 1, 2018, to June 1, 2021

Delivery Year Beginning	RPM Peak Load	Target Installed Reserve Margin (IRM)	Generation and DR RPM Committed Less Deficiency ICAP (MW)	Actual Installed Reserve Margin (IRM)	Reserve Margin in Excess of IRM	
					Percent	ICAP (MW)
01-Jun-18	139,675.0	16.1%	171,662.5	22.9%	6.8%	9,499.8
01-Jun-19	139,359.3	16.0%	178,760.9	28.3%	12.3%	17,104.1
01-Jun-20	139,622.2	15.9%	176,479.2	26.4%	10.5%	14,657.1
01-Jun-21	140,030.3	15.8%	170,858.9	22.0%	6.2%	8,703.8

On November 20, 2018, PJM submitted an informational filing to provide the Commission with an update on the use of 30 hours (or 360 intervals) as the assumed number of PAH.[33] PJM stated:

> PJM Members considered the possible development of alternative methods to determine the Non-Performance Charge Rate, including consideration of the number of intervals used in the denominator to calculate the rate. While several possible alternatives were considered, none of the packages met the requisite stakeholder consensus for PJM to file revisions to the methodology for calculating the Balancing Ratio or the existing number of Performance Assessment Intervals used in the determination of the Non-Performance Charge at this time.
>
> Based on the foregoing, PJM does not have a basis for proposing any change to the current 360 interval value used to establish the Non-Performance Charge rate at this time.

---

can be completed only after the EFORds for the delivery year are finalized, on November 30 in the year prior to the delivery year, but before the start of the delivery day.

33 *See* PJM. "Informational Filing on the use of 30 hours as the number of Performance Assessment Hours," Docket Nos ER15-623-000 and EL15-29-000 (November 20, 2018).

PJM misses the point. PJM fails to address the level of the MSOC that was discussed at some length in the stakeholder process.[34] [35] Given the decision to leave the nonperformance charge rate unchanged, the expected PAI (PAH) used in the calculation of the MSOC is incorrect and too high, as a result the MSOC is significantly overstated and the result of that will be the continued inadequate protection against the exercise of market power in the upcoming base residual auction.

The failure of stakeholders with divergent financial interests to agree on this issue is not evidence supporting the continued use of a number of PAI (PAH) that was excessive when it was introduced and which evidence shows is even more excessive now. The failure to act is effectively support for the excessive MSOC.

PJM's opposition to updating the number of PAH used in the default MSOC calculation is inconsistent with PJM's analysis of the issue. PJM conducted and presented the results of a study that indicate that 30 is a significant overestimate, and is unjustified.[36]

D. The Default MSOC Should Be Set to One-Sixth of Net CONE Times B.

The default MSOC should be set at a reasonable and supportable level based on the current nonperformance charge rate and based on a reasonable and supportable PAH, five hours.

The competitive offer of a CP resource (in dollars per MW-year) is defined as:[37]

$$p = \left(\frac{1}{12}\right)(PPR \times H \times \bar{B}) + \, max\left\{0, (ACR - \left(\frac{1}{12}\right)(PPR \times H \times \bar{A}))\right\} \quad (1)$$

---

34 *See* "MIC Balancing Ratio," IMM presentation to the Markets Implementation Committee, (April 4, 2018). <*https://www.pjm.com/-/media/committees-groups/committees/mic/20180404/20180404-item-10a-imm-balancing-ratio.ashx*>.

35 *See* "CP Balancing Ratio and Offer Cap," IMM presentation to the Markets Implementation Committee, (August 8, 2018). <*https://www.pjm.com/-/media/committees-groups/committees/mic/20180808/20180808-item-02e-balancing-ratio-and-offer-cap-imm.ashx*>.

36 *See* Attachment B at 16.

37 *See* Attachment A "Competitive Offer for a Capacity Performance Resource in PJM," equation 8.

Where PPR is the nonperformance charge rate (in dollars per MWh), defined as net CONE (in dollars per ICAP MW-year) divided by 30 hours, H is the expected number of PAI in the delivery year, $\bar{B}$ is the expected average balancing ratio during the PAI, ACR is the net going forward costs of a resource, and $\bar{A}$ is the expected average performance of a resource during PAI. The factor (1/12) is a conversion factor to convert H, the expected number of performance assessment intervals per year (PAI) into hours per year (PAH).

Under the assumption of 360 PAI (30 PAH) for H, the first component of equation (1) equals net CONE times B. For resources whose net ACR is lower than the bonuses they would earn as energy only resource $\left(\left(\frac{1}{12}\right)(\mathrm{PPR} \times \mathrm{H} \times \bar{\mathrm{A}})\right)$, the second component of equation (1) equals zero.

The first component of equation (1) is the competitive offer of such resources, called Low ACR resources. This is also the basis for the default MSOC under CP.

$$p = \left(\frac{1}{12}\right)\left(\frac{Net\ CONE}{30}\right) \times 360 \times \bar{B}$$

$$p = Net\ CONE \times \bar{B}$$

To adjust the default MSOC using a reasonable and supportable estimate of H, the Market Monitor proposes using 60 intervals (5 hours) as the estimate for H, while keeping the nonperformance charge rate unchanged. The value of five hours is based on using the two hour estimate that PJM's resource adequacy study estimated for the number of PAH with the actual, observed IRM of 21.8 percent, and adding three hours to account for the possibility of additional emergency events that might occur during the winter period.[38] During 2015, 2016 and 2017, there were zero emergency events that would have triggered a PAI in PJM. In 2018, there were 24 five-minute PAIs (equivalent to 2 PAH) triggered in small, localized areas in PJM during two separate load shed events due to multiple transmission contingencies, where no capacity resources were subject to performance

38 *See* Attachment B at 16.

assessment penalties.[39] [40] Given recent history without any PAIs, five hours is a conservatively high estimate.

Using 60 PAI, and the definition of nonperformance charge rate as net CONE divided by 30, the default offer cap is calculated as:

$$p = \left(\frac{1}{12}\right)\left(\frac{Net\ CONE}{30}\right) \times 60 \times \bar{B}$$

$$p = \left(\frac{1}{6}\right) \times Net\ CONE \times \bar{B}$$

Using a default MSOC of one-sixth of net CONE times B does not prevent resources that have net avoidable costs that are greater than the default MSOC from requesting unit specific offer caps. The competitive offer of a High ACR resource is:[41]

$$p = ACR + (PPR \times H \times (\bar{B} - \bar{A}))/12$$

Using the definition of nonperformance charge rate as net CONE divided by 30, and the expected number of PAIs as 60 (5 hours), the competitive offer is:

$$p = ACR + \left(\frac{1}{6}\right)(Net\ CONE \times (\bar{B} - \bar{A}))$$

In other words, the competitive offer is the resource's net avoidable costs, plus any additional expected nonperformance charges, or bonus payments.

Setting the default MSOC at one sixth of net CONE times B is a just and reasonable outcome, because it incorporates a reasonable and supportable, updated estimate for the expected number of PAIs given the supply and demand conditions in the PJM Capacity Market together with the current nonperformance charge rate. The updated estimate for the

---

39 *See* "Twin Branch/Edison Area Load Shed Event May 29, 2018," PJM presentation to the Operating Committee, (July 10, 2018) at 9. <*https://www.pjm.com/-/media/committees-groups/committees/oc/20180710/20180710-item-17-twin-branch-area-load-shed-oc.ashx*>.

40 *See* "Lonesome Pine Load Shed Event July 18, 2018," PJM presentation to the Operating Committee, (August 7, 2018) at 6. <*https://www.pjm.com/-/media/committees-groups/committees/oc/20180807/20180807-item-05b-sos-oc-lonesome-pine-load-shed-event.ashx*>.

41 *See* Attachment A "Competitive Offer for a Capacity Performance Resource in PJM," equation 6.

expected number of PAIs (60 intervals, or 5 hours) is a conservatively high estimate based on the recent history of emergency actions in PJM, actual offer behavior and existing and expected reserve margins.

Setting the default MSOC at one-sixth of net CONE times B also allows resources whose net avoidable costs are above the default MSOC to submit unit specific offer caps for review by the Market Monitor for market power, while letting resources that choose to offer at or below the default MSOC to forego the unit specific review process. Setting the default MSOC at one-sixth of net CONE times B will ensure that resource offers that set clearing prices in PJM capacity auctions are reviewed prior to the auction, as the Commission envisioned in the June 9th Order.

II. RULE 206 REQUIREMENTS

A. Rule 206(b)(1): Action or Inaction Alleged To Violate Statutory Standards or Regulatory Requirements

The evidence shows that the Capacity Performance default Market Seller Offer Cap ("MSOC") currently defined in the PJM OATT is overstated based on the existing nonperformance charge and on an overstated number of expected Performance Assessment Intervals (PAI). An overstated expected PAI is unjust and unreasonable because it results in an overstated MSOC that is unjust and unreasonable because it allows the exercise of market power and the attempted exercise of market power.

B. Rule 206(b)(2): Legal Bases for Complaint

The legal bases for this Complaint are set forth in detail in Section I.

C. Rules 206(b)(3) and 206(b)(4): Issues Presented as They Relate to the Complainant and Quantification of Financial Impact on Complainant

The financial impacts are set forth in Section I.A - C.

D. Rule 206(b)(5): Nonfinancial Impacts on Complainant

The overstated PAI and its effect on the level of default MSOC interferes with market monitoring because, as a direct consequence, the Market Monitor does not receive unit specific cost information on most units and therefore cannot engage in sufficient unit specific review of offers expected to set prices.

E. Rule 206(b)(6): Related Proceedings

Complainant is not aware of any other pending proceedings that are directly related to the issues raised in this Complaint.

F. Rule 206(b)(7): Specific Relief Requested

PJM should be directed to revise the expected number of PAI used to set the default MSOC with the current nonperformance charge rate. The Market Monitor recommends a specific value in Section I.C. PAI should be set to a level consistent with a reasonable and supportable expectation of PAI, five PAH or 60 PAI.

G. Rule 206(b)(8): Documents that Support the Complaint

This pleading and its attachments support the complaint.

H. Rule 206(b)(9): Dispute Resolution

The Market Monitor has not contacted the Enforcement Hotline or Dispute Resolution Service or made use of the tariff-based dispute resolution mechanisms. Such mechanisms are neither intended nor appropriate for resolving disputes of this nature.

I. Rule 206(b)(10): Form of Notice

A form of notice suitable for publication in the Federal Register is included as an Attachment C.

J. Rule 206(c): Service on Respondent

The Market Monitor certifies that copies of this Complaint were served by email and overnight mail on Respondent.

III. COMMUNICATIONS

All communications with respect to this pleading and in connection with this proceeding should be addressed to the following:

Joseph E. Bowring[42]
Independent Market Monitor for PJM
President
Monitoring Analytics, LLC
2621 Van Buren Avenue, Suite 160
Eagleville, Pennsylvania 19403
(610) 271-8051
joseph.bowring@monitoringanalytics.com

Jeffrey W. Mayes[43]

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

[42] Designated to receive service.

[43] Designated to receive service.

IV. CONCLUSION

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

Respectfully submitted,

Jeffrey W. Mayes

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

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

Siva Josyula
Senior Analyst
Monitoring Analytics, LLC
2621 Van Buren Avenue, Suite 160
Eagleville, Pennsylvania 19403
(610) 271-8050
siva.josyula@monitoringanalytics.com

Alexandra Salaneck
Senior Analyst
Monitoring Analytics, LLC
2621 Van Buren Avenue, Suite 160
Eagleville, Pennsylvania 19403
(610) 271-8050
alexandra.salaneck@monitoringanalytics.com

Dated: February 21, 2019

ATTACHMENT A

Competitive Offer for a Capacity Performance Resource in PJM

This attachment describes the mathematics of the calculation of a competitive capacity performance resource offer in PJM.

Definitions

R^c – net revenue for a resource with a capacity commitment

R^{nc} – net revenue for a resource without a capacity commitment that sells energy and ancillary services

A_i = (MW_i/UCAP), availability during performance assessment interval i, calculated as the MW power output in an interval divided by the MW UCAP of the resource. The MWh output in an interval is equal to one-twelfth of the MW power output of the resource.

$\bar{A}$ - average availability across all performance assessment intervals defined as $\sum_{\mathrm{i=1}}^{\mathrm{H}} \mathrm{MW_i}/(\mathrm{H} \times \mathrm{UCAP})$

B_i – balancing ratio during performance assessment interval i, ratio of total load and reserve requirement during the hour to total committed UCAP.

$\bar{B}$ – average balancing ratio across all performance assessment intervals in a delivery year

H – expected value of total number of performance assessment intervals in a delivery year. The equivalent number of performance assessment hours is (H/12).

$CPBR_i$ – capacity performance bonus rate for interval i in ($ per MWh), varies by interval

CPBR – average capacity performance bonus rate over all performance assessment intervals ($ per MWh) in a delivery year, calculated as $\sum_{i=1}^{H}(CPBR_i \times A_i)/(H \times \bar{A})$

PPR – nonperformance charge rate ($ per MWh; net CONE in $ per ICAP MW-year divided by 30, fixed for the delivery year for a particular net CONE area)

ACR – net ACR (net going forward costs) for the resource on a per MW UCAP basis, not including any risk premium.

p – offer price in RPM on a $ per MW-year UCAP basis

Competitive Offer Calculation

The actual capacity performance bonus rate (CPBR) will depend on the level of nonperformance charges collected from underperforming resources during each performance assessment interval. The maximum value of CPBR is the nonperformance charge rate, PPR, which occurs when no resource is exempted for under performance for any reason. If resources are exempted for under performance, the CPBR would decrease. For this derivation, we assume that CPBR = PPR. However, a market seller can calculate the competitive offer under different assumptions about the level of CPBR.

The net revenue for a resource that has a capacity commitment, R^c, is calculated as:

$$R^c = UCAP \times [p + (PPR \times H \times (\bar{A} - \bar{B}))/12] - UCAP \times ACR \tag{1}$$

This can be summarized as the MW of capacity multiplied by the capacity clearing price net of performance penalties or bonuses less the annual avoidable costs of operating the unit. The term $(PPR \times H \times (\bar{A} - \bar{B}))/12$ is positive and represents bonuses if the unit over performs on average during PAI, i.e. $\bar{A} > \bar{B}$. It is negative and represents penalties if the unit under performs on average during PAI, i.e. $\bar{A} < \bar{B}$.

The net revenue for that same resource that does not have a capacity commitment but participates in the energy and ancillary services markets and earns capacity bonus performance payments, R^{nc}, is calculated as:

$$R^{nc} = UCAP \times [\,(1/12)PPR \times H \times \bar{A}\,] - UCAP \times ACR \tag{2}$$

This can be summarized as the MW of capacity multiplied by the bonus payments less the annual avoidable costs of operating the unit.

In equation (2) since the resource does not have a capacity performance obligation, the resource earns capacity bonus performance payments for all of its energy and reserves provided during performance assessment intervals.

Low ACR Case

If $R^{nc} \geq 0$, a resource is expected to make enough revenues to cover net going forward costs without a capacity commitment and has the opportunity to be profitable as an energy only resource in the CP design.

$$if\ ACR \leq \left(\frac{1}{12}\right) PPR \times H \times \bar{A}$$

In order for such a resource to have an incentive to take on the obligation to be a capacity resource under the CP design, the expected revenue with the capacity performance obligation must be greater than or equal to the expected revenue as an energy only resource, or $R^c \geq R^{nc}$.

Taking on a capacity obligation is profitable and competitive if: $R^c - R^{nc} \geq 0$. R^c and R^{nc} are defined in equation (1) and equation (2).

Thus, the competitive offer and therefore the expected equilibrium clearing price in RPM equals a value of p such that equation (1) minus equation (2) is greater than or equal to zero:

$$p \geq \left(\frac{1}{12}\right)[PPR \times H \times \bar{A} + PPR \times H \times (\bar{B} - \bar{A})]$$

Therefore the competitive offer is:

$$p = \left(\frac{1}{12}\right)(PPR \times H \times \bar{B}) \tag{3}$$

Equation (3) is the competitive offer formula for a low ACR resource. The competitive offer for a low ACR resource equals the expected bonus payments as an energy only resource plus the expected nonperformance charges as a capacity resource.

Using PJM's formula for PPR as net CONE divided by 30, the competitive offer is:

$$p = \left(\frac{1}{12}\right)\left[\left(\frac{Net\ CONE}{30}\right) \times H \times \bar{B}\right]$$

If the number of expected performance assessment intervals, H, is expected to be 360 (30 hours), this is identical to:

$$p = Net\ CONE \times \bar{B} \tag{4}$$

These are the assumptions made in the PJM filing and result in the definition of the current default MSOC. However, if the expected number of performance assessment intervals(H) is updated to a smaller number, say 60 intervals (5 hours), and if the assumption of a low ACR resource still holds true ($ACR \leq (CPBR \times H \times \bar{A})/12$), the competitive offer for such a resource is:

$$p = \left(\frac{1}{12}\right)\left[\left(\frac{Net\ CONE}{30}\right) \times 60 \times \bar{B}\right]$$

$$p = \left(\frac{1}{6}\right)[Net\ CONE \times \bar{B}] \tag{5}$$

The assumption to be a low ACR resource, $ACR \leq \left(\frac{1}{12}\right) PPR \times H \times \bar{A}$, is less likely to be true as the value of H is lowered. This is because under low PAI, the opportunity to earn bonuses is reduced, and the likelihood of earning enough bonuses to exceed the avoidable costs is also reduced. Under this updated estimate for the number of performance assessment intervals, more resources are likely to have their net ACR greater than the energy only bonuses, and become 'High ACR' resources. The competitive offers for High ACR resources are discussed in the following section.

High ACR Case

If $R^{nc} < 0$, a resource is not expected to make enough revenues to cover net going forward costs without a capacity payment.

$$if\ ACR > \left(\frac{1}{12}\right) PPR \times H \times \bar{A}$$

In order for such a resource to have an incentive to take on the obligation to be a capacity resource under the CP design, the expected revenue from the capacity payment and any bonus payments must be enough to cover all the costs of the unit including ACR and any capacity nonperformance charges.

If taking on a capacity obligation is to be profitable and competitive: $R^c \geq 0$.

From equation (1):

$$UCAP \times [p + (PPR \times H \times (\bar{A} - \bar{B}))/12] - UCAP \times ACR \geq 0$$

$$or, p \geq ACR + (PPR \times H \times (\bar{B} - \bar{A}))/12$$

The competitive offer is:

$$p = ACR + (PPR \times H \times (\bar{B} - \bar{A}))/12 \tag{6}$$

$$or, \qquad p = ACR + \left(\frac{Net\ CONE}{30} \times H \times (\bar{B} - \bar{A})\right)/12$$

The competitive offer for a High ACR unit equals its avoidable costs plus expected nonperformance charges as a CP resource.

Rearranging the terms:

$$p = \left(\frac{1}{12}\right) (PPR \times H \times \bar{B}) + \left[ACR - \left(\frac{1}{12}\right)(PPR \times H \times \bar{A})\right] \tag{7}$$

Comparing equation (3) (Low ACR unit competitive offer) and equation (6) (High ACR unit competitive offer), there is a common component of $(PPR \times H \times \bar{B})/12$ in both equations.

Revisiting the assumption for a unit to be High ACR:

$$ACR > \left(\frac{1}{12}\right) PPR \times H \times \bar{A}$$

$$or, \qquad ACR - \left(\frac{1}{12}\right) PPR \times H \times \bar{A} > 0$$

Comparing equations (3) and (7) and the assumption for a High ACR unit, the High ACR unit competitive offer from equation (7) is always greater than the Low ACR unit competitive offer from equation (3).

The offer of any resource can therefore be written as:

$$p = \left(\frac{1}{12}\right)(PPR \times H \times \bar{B}) + max\left\{0, (ACR - \left(\frac{1}{12}\right)(PPR \times H \times \bar{A}))\right\} \quad (8)$$

Using an assumption of 60 intervals (5 hours) for H, and PPR as net CONE divided by 30 hours:

$$p = \left(\frac{1}{6}\right)(Net\ CONE \times \bar{B}) + max\left\{0, (ACR - \left(\frac{1}{6}\right)(Net\ CONE \times \bar{A}))\right\}$$

If a resource's net going forward costs (ACR) are greater than the expected energy only bonuses it will earn, calculated as $\left(\frac{1}{6}\right)(Net\ CONE \times \bar{A})$, the competitive offer is its ACR adjusted with expected non-performance charges or bonus payments.

Note on Capacity Bonus Performance Rate

The actual capacity performance bonus rate (CPBR) will depend on the level of nonperformance charges collected from underperforming resources during each performance assessment interval. The maximum value of CPBR is the nonperformance charge rate, PPR, which occurs when no resource is exempted for under performance for any reason. If resources are exempted for under performance, the CPBR would decrease and the competitive offer would decrease because the value of being an energy only resource and relying solely on bonus payments would decrease as the value of the bonus payments decreases.

ATTACHMENT B

Balancing Ratio Determination Issue

Patrick Bruno
Sr. Engineer, Capacity Market Operations
Markets Implementation Committee
April 4, 2018

Issue Recap

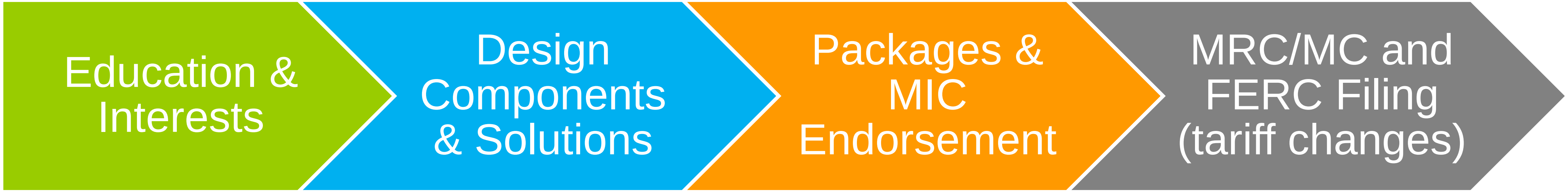
1. The current rules set the default Market Seller Offer Cap ("MSOC") for Capacity Performance ("CP") Resources equal to Net CONE times the average historical Balancing Ratios experienced during Performance Assessment *Intervals* in the three calendar years that immediately precede the Base Residual Auction ("BRA") for the Delivery Year
   - Average historical Balancing Ratio becomes indeterminable when no Performance Assessment Intervals have occurred during the prior three calendar years
   - If determinable, may not be in time to inform the unit-specific MSOC submission deadline 120 days prior to the BRA (mid-January)

2. The CP Non-Performance Charge Rate currently uses an assumed 30 Performance Assessment Hours for the Delivery Year
   - 30 hour assumption should be reviewed; No emergency actions triggering Performance Assessments Hours/Intervals have occurred since CP implementation

Key Work Activities

1. Provide education on the calculation of the MSOC and Balancing Ratio
2. Provide education on the determination of Non-Performance Charge Rates
3. Develop and discuss alternative Balancing Ratio calculation methodologies for use in the determination of the default MSOC
4. Develop and discuss alternative methods to determine the Non-Performance Charge Rate

Timeline



Feb-Mar MIC	Mar-May MIC	Jun-Jul MIC	Jul-Aug MRC (Sept MC)

★ File endorsed changes with FERC by early October 2018

MSOC Balancing Ratio Solution Option A

Solution Description

To estimate an expected future average Balancing Ratio for use in the default MSOC…

Take the average Balancing Ratios during the three Delivery Years that immediately precede the BRA using:

a) actual Balancing Ratios calculated during RTO PAIs of the Delivery Year, and

b) for any Delivery Year with less than “H” clock hours of PAIs, estimated Balancing Ratios calculated during the peak load hours of the RTO that do not overlap a PAI

- “H” represents expected number of hours of PAIs in the DY (currently 30)

CP Default MSOC = Net CONE x estimated Balancing Ratio

Example of Delivery Year with less than "H" Clock Hours (30) of PAIs

Hour Count	Date	HE	PAIs	Peak Hour	Hourly Avg Bal Ratio
1	Jul 18	14	8	Y	93.4%
2	Jul 18	15	12	Y	93.7%
3	Jul 18	16	12	Y	95.2%
4	Jul 18	17	12	Y	95.1%
5	Jul 18	18	4	Y	90.8%
6	Aug 2	15	12	Y	89.5%
7	Aug 2	16	12	Y	90.9%
8	Jan 11	7	4	-	83.4%
9	Jan 11	8	12	Y	84.2%
10	Jan 11	17	6	Y	84.3%
11	Jan 11	18	12	-	76.7%
12	Jan 11	19	12	-	78.5%
13	Jul 18	13	-	Y	93.1%
14	Jul 19	16	-	Y	92.8%
15	Jul 19	17	-	Y	92.5%
16 - 30	…	…	…	…	…

(a) 12 hourly average Balancing Ratios from actual PAIs (118 in total)

(b) 18 hourly estimated Balancing Ratios during RTO peak hours that do not overlap a PAI

Balancing Ratio for the DY equals average of both (a) and (b)

Solution Pros

1. Straight-forward solution that augments the existing methodology by providing reasonable proxy hours and Balancing Ratios to use when no, or relatively few, actual PAIs occur
   – Peak load hours used as reasonable proxies due to correlation of high load hours and PAI triggers

2. Resultant Balancing Ratios appear on par with the values calculated from actual data during historical RTO emergency actions

3. Determinable in time to inform the unit-specific offer cap submission deadline for documentation
   – 120 days prior to the BRA (mid-January)

Comparison of Balancing Ratios under Existing and Proposed Methodologies

Delivery Year	Existing	Proposed	Prior 3 DYs
2018/2019	85.0%	88.3%	11/12, 12/13, 13/14
2019/2020	81.0%	85.3%	12/13, 13/14, 14/15
2020/2021	78.5%	83.8%	13/14, 14/15, 15/16
2021/2022	78.5% *	86.8%	14/15, 15/16, 16/17

Balancing Ratios during historical RTO emergency actions from 2011-14

Summer (16 hours): Avg = 93.5% Min = 87.7% Max = 95.1%

Winter (26 hours): Avg = 78.3% Min = 71.5% Max = 84.9%

Assumed Performance Assessment Hours “H” in the Non-Performance Charge Rate

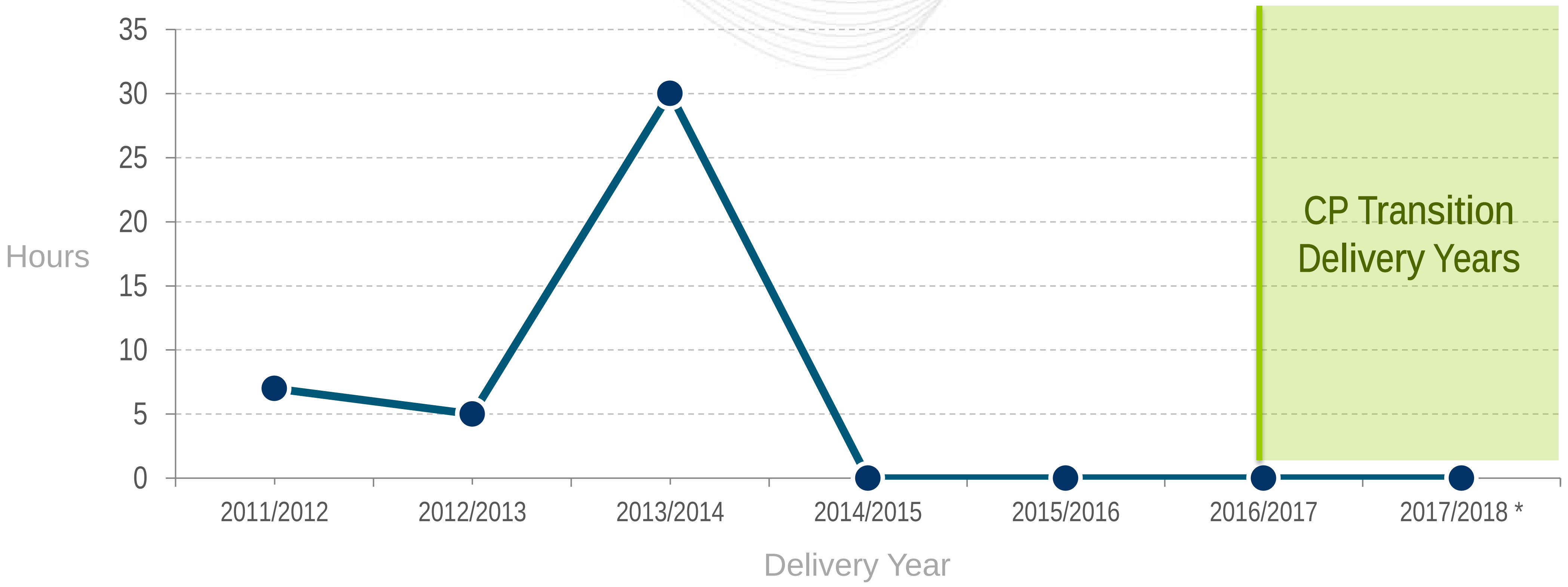
Non-Perf. Charge Rate* = **Net CONE x 365 days / "H" (30 hours)**

Where:

- Net CONE is the Net Cost of New Entry (stated in $/MW-Day, ICAP terms) for the relevant Delivery Year and LDA in which the resource is modeled
- "H" or 30 hours is the current estimated number of Performance Assessment Hours that may occur in a Delivery Year
- Non-Performance Charge Rate is expressed in $/MWh to be multiplied by a unit's Performance Shortfall to calculate the assessed penalty charges

* Charge Rate does not reflect the filed change with 5-minute Settlements, which further divides the rate by the number of Real-Time Settlement Intervals in an hour

Historical RTO Performance Assessment Hours



Note: Hours shown prior to 2016/2017 reflect Emergency Actions that would have triggered a Performance Assessment Hour under the CP rules

GE MARS Preliminary Study to Estimate “H”

GE MARS is a planning software tool capable of calculating standard reliability indices for a given power system (e.g. daily and hourly LOLE)

The tool also allows for review of emergency operating procedures, by calculating the expected number of days per year at a specified margin

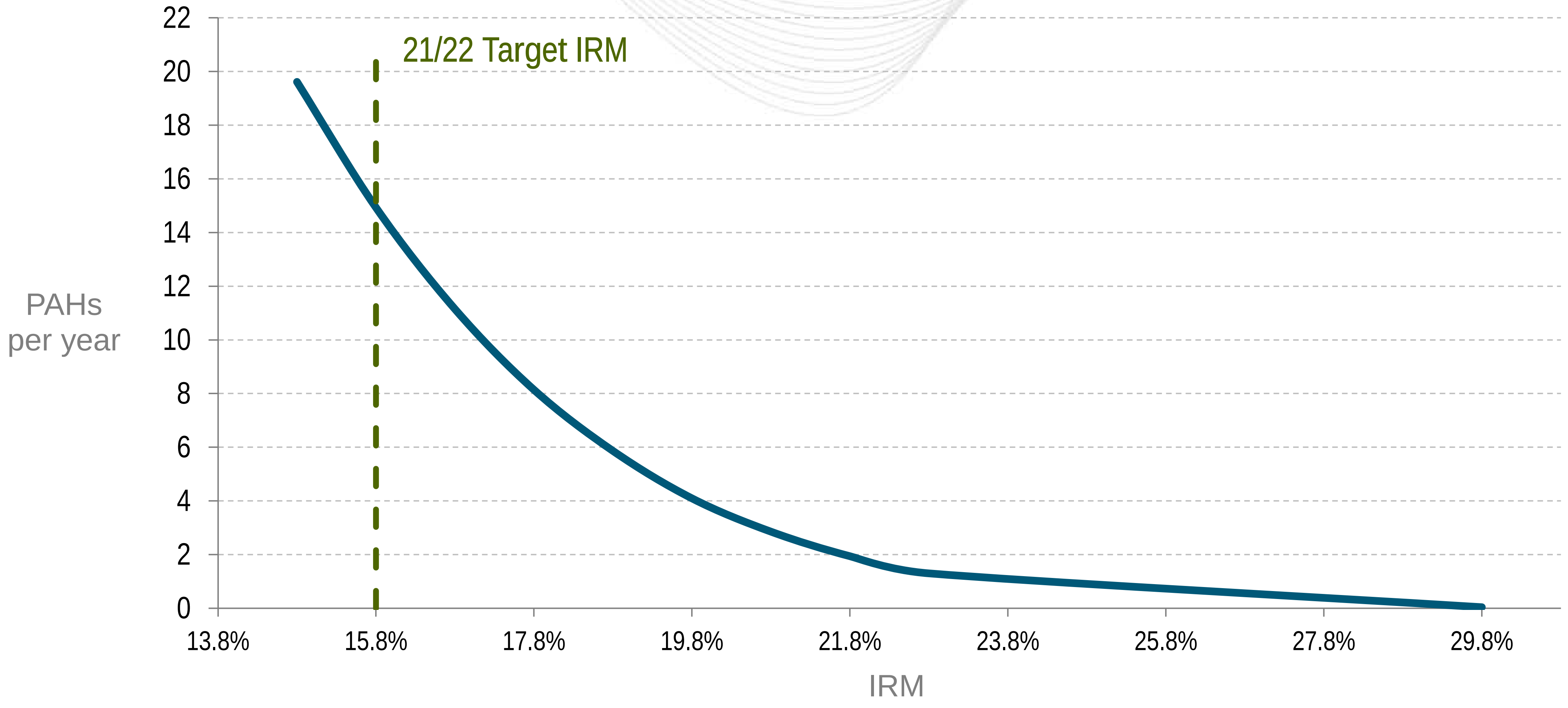
- e.g. A margin set at the typical Primary Reserve requirement might be used to estimate the number of Primary Reserve Warnings

The tool uses a sequential Monte Carlo simulation to calculate the probability of events, and requires a fair number of inputs and assumptions to run

GE MARS Study Assumptions

1. Same generator supply used in IRM Study
   - Operating histories randomly generated with each Monte Carlo replication for all units (reflects unit-specific forced outages rates)
   - Total Available Capacity determined for each hour
2. Solved peak load from IRM Study at reserve requirement
   - Monthly load shape using forecasted monthly peak loads; daily and hourly loads determined from an historical typical load shape
   - Hourly load levels varied in MARS simulations based on 7 load uncertainty levels, each with an associated probability
3. Specified Margin based on dispatch of Pre-Emergency DR
   - Estimated DR (8200 MW)
   - Operating Reserves/Regulation (3400 MW)

GE MARS Study Results
(1,000 replications run at each load level)



GE MARS Study Results / Observations

"H" significantly varies at different assumed reserve levels for the future DY

- IRM of 15.8%: ~ 15 Hours
- IRM of 21.8%: ~ 2 Hours

Virtually no Performance Assessment Hours occurred in winter months of the preliminary analysis; almost all risk and emergency hours in summer months

- Balancing Ratios calculated during the triggered Performance Assessment Hours of the program around 95 to 96 percent on average

GE MARS Study Conclusions

“H” in the Non-Performance Charge Rate should reflect the expected PAHs at the target IRM

- Consistent with using Net CONE in the numerator, as both represent the long-term market at equilibrium
- Consistent with CP design that aims to discourage non-performing resources from taking on capacity obligations due to penalties offsetting capacity revenues, especially when new entry is needed

Recommend using an “H” between 15 and 30 hours in denominator of the Non-Performance Charge Rate

- 15 hours seen at target IRM in GE MARS Study for just summer months
- 30 hours seen historically (i.e. 13/14 DY, even with high reserve margin)

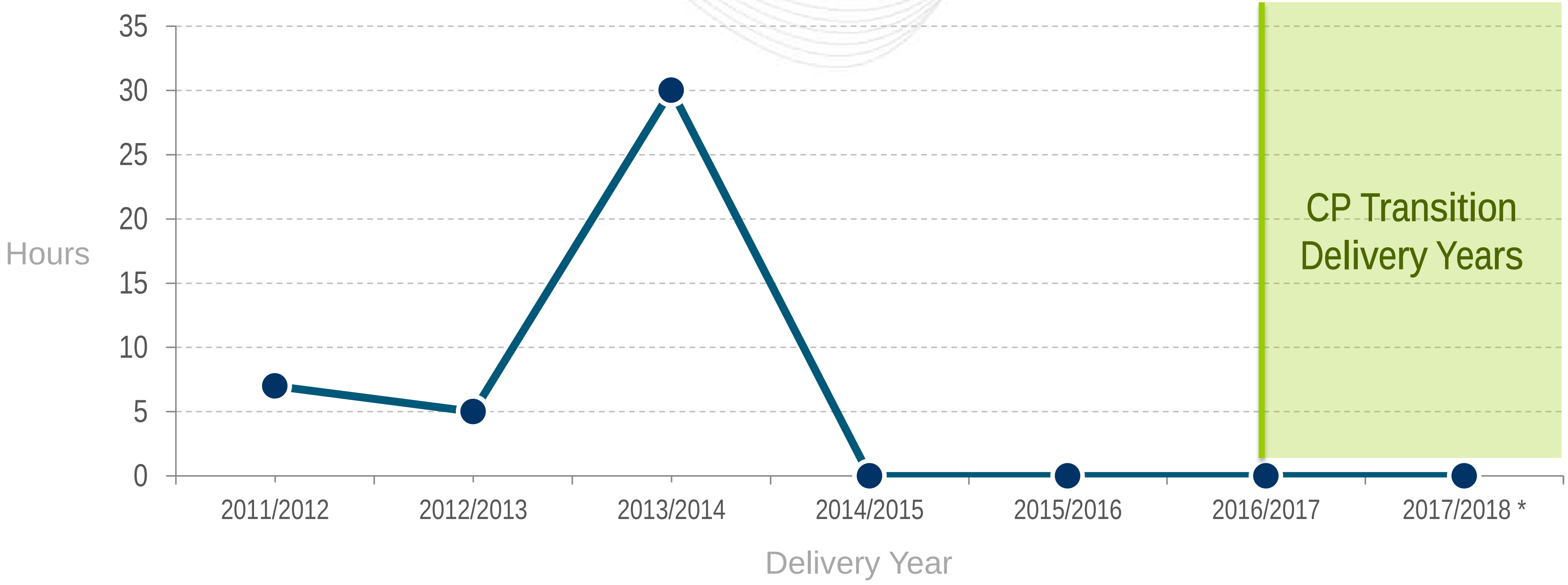
Appendix - Prior Education

CP default MSOC = **Net CONE x Balancing Ratio (B')**

Where:

- Net CONE is the Net Cost of New Entry (stated in $/MW-Day, ICAP terms) for the relevant Delivery Year and zone in which the resource is located
- Balancing Ratio (B') is the historical average of the Balancing Ratios experienced during Performance Assessment Intervals/Hours in the three most recent calendar years preceding the Base Residual Auction for such Delivery Year
  - Represents the expected Balancing Ratio across all Performance Assessment Intervals/Hours for a Delivery Year
- CP default MSOC is expressed in $/MW-Day

Historical RTO Performance Assessment Hours



Note: Hours shown prior to 2016/2017 reflect Emergency Actions that would have triggered a Performance Assessment Hour under the CP rules

Historical MSOC Balancing Ratios

- Average Balancing Ratios calculated for use in the default MSOC by Delivery Year

Delivery Year	MSOC Balancing Ratio
2018/2019	85.0%
2019/2020	81.0%
2020/2021	78.5%
2021/2022	78.5% *

** 2021/2022 Balancing Ratio in the MSOC set to the same value as prior Delivery Year due to absence of Performance Assessment Hours in prior three calendar years (2015 - 2017), as approved by FERC*

- A list of the underlying Performance Assessment Hours and corresponding Balancing Ratios used to determine the above averages are included in Appendix 2 of PJM's response to FERC on April 10, 2015 in Docket No. ER15-623-001

Balancing Ratio in Performance Assessment Intervals

- The calculated Balancing Ratio for a Performance Assessment Interval represents the percentage share of total generation capacity commitments needed to support the load and reserves on the system within the Emergency Action Area during the interval
  - i.e. (Load + Reserves) / Generation Capacity Commitments

- The Balancing Ratio is used to set the Expected Performance level of Generation Capacity Performance Resources within the Emergency Action Area during the Performance Assessment Interval
  - Expected Performance = Capacity Commitment (UCAP) x Balancing Ratio

$$\frac{\text{Total Actual Generation and Storage Performance + Net Energy Imports * + Demand Response Bonus Performance}}{\text{All Generation and Storage Committed UCAP}}$$

Non-Perf. Charge Rate* = **Net CONE x 365 days / 30 hours**

Where:

– Net CONE is the Net Cost of New Entry (stated in $/MW-Day, ICAP terms) for the relevant Delivery Year and LDA in which the resource is modeled

– 30 hours is the estimated number of Performance Assessment Hours that may occur in a Delivery Year
  - Based on Emergency Action hours seen during 2013/2014

– Non-Performance Charge Rate is expressed in $/MWh to be multiplied by a unit's Performance Shortfall to calculate the assessed penalty charges

* Charge Rate does not reflect the filed change with 5-minute Settlements, which further divides the rate by the number of Real-Time Settlement Intervals in an hour

Non-Performance Charge Rates

LDA	18/19 Non-Performance Charge Rate ($/MWh)	19/20 Non-Performance Charge Rate ($/MWh)	20/21 Non-Performance Charge Rate ($/MWh)
RTO	$3,424.80	$3,401.17	$3,329.31
MAAC	$3,095.44	$2,977.55	$2,868.54
EMAAC	$3,245.22	$3,223.07	$3,217.35
SWMAAC	$2,770.72	$2,612.79	$2,300.60
PSEG	$3,395.35	$3,446.56	$3,488.06
PS-NORTH	$3,395.35	$3,446.56	$3,488.06
DPL-SOUTH	$2,943.36	$2,980.31	$2,897.73
PEPCO	$2,856.98	$2,775.37	$2,574.50
ATSI	$3,096.05	$3,000.64	$2,968.21
ATSI-CLEVELAND	$3,096.05	$3,000.64	$2,968.21
COMED	$3,649.39	$3,732.33	$3,748.21
BGE	$2,684.33	$2,450.29	$2,026.74
PPL	$3,244.97	$3,156.12	$3,038.16
DAYTON			$3,104.21
DEOK			$3,210.14

Annual Stop-Loss of Non-Performance Charges

Stop-Loss = **Net CONE x 365 days x 1.5 x Committed MW**

Where:

- Net CONE is the Net Cost of New Entry (stated in $/MW-Day, ICAP terms) for the relevant Delivery Year and modeled LDA in which the resource resides
- Committed MW is the resource's capacity commitment in UCAP

- Based on the maximum clearing price allowed by the VRR curve at Net CONE times 1.5
- At 30 assumed Performance Assessment Hours in the Non-Performance Charge Rate, a resource will hit the stop-loss after 45 hours of zero Actual Performance

CP Default MSOC Rationale

CP Default MSOC

- The default MSOC reflects the amount that a competitive resource with low net going forward costs (Low ACR Resource) would accept in the capacity market
  - A Low ACR Resource is one whose net avoidable costs are less than its total expected Bonus Performance payments as an energy-only resource
  - Represents the lost opportunity costs incurred by taking on a capacity obligation and foregoing some expected Bonus Performance payments
- The Balancing Ratio (B’) is a component of the default MSOC calculation to reflect the percentage share of expected Bonus Performance payments that are foregone by taking on a capacity obligation
  - A resource will receive Bonus Payments for its production that exceeds the Balancing Ratio share of its capacity obligation during Performance Assessment Intervals/Hours regardless of it having a capacity obligation

Note: A resource with high net going forward costs that exceed expected Bonus Performance payments can go through the resource-specific MSOC process for a higher CP offer cap

CP Default MSOC – Example

	Capacity Resource	Energy-Only
Nameplate (MW)	100	100
Capacity Obligation (UCAP MW)	100	0
Net CONE ($/MW-day)	$250	$250
Balancing Ratio (B')	0.9	0.9
Actual Performance (A')	100	100
Expected Performance (MW)	90	-
Bonus Performance (MW)	10	100
Bonus Rate ($/MWh)	$3,042	$3,042
Bonus Performance Hours	30	30
Annual Bonus Performance ($/year)	$912,500	$9,125,000
Foregone Bonus Performance ($/year)	$8,212,500	-
Lost Opportunity Cost ($/MW-day)	**$225**	-
Default MSOC of Net CONE x B' ($/MW-day)	**$225**	-

p = PPR x H x B’ + max{0, (ACR – PPR x H x A’)}

Where:

- p: Offer price in RPM on a UCAP basis ($/MW-year)
- PPR: Non-Performance Charge Rate ($/MWh)
  - Assumed to be equivalent to the Bonus Performance Rate
- H: Expected number of Performance Assessment Hours in the year (hours/year)
- B’: Expected value of balancing ratio across all Performance Assessment Hours in year
- ACR: Net ACR (net going forward costs) for a resource ($/MW-year)
- A’: Expected value of availability across all Performance Assessment Hours in year

Note: The full overview and explanation of the Capacity Performance Offer Cap Logic can be found in Appendix 1 of PJM’s April 10, 2015 response to FERC in Docket No. ER15-623-001

CP Competitive Offer for Low ACR Resource

Low ACR Resource is one whose net avoidable costs are less than its total expected Bonus Performance payments as an energy-only resource

- Second term of competitive offer drops to zero
- PPR substituted with Non-Performance Charge Rate

$$p_{(\$/MW\text{-}year)} = PPR \times H \times B' \cancel{+ \max\{0, (ACR - PPR \times H \times A')\}}$$

$$p_{(\$/MW\text{-}year)} = (\text{Net CONE} \times 365 / H) \times H \times B'$$

$$p_{(\$/MW\text{-}year)} = \text{Net CONE} \times 365 \times B'$$

$$p_{(\$/MW\text{-}day)} = \mathbf{Net\ CONE \times B'} \longrightarrow \text{CP default MSOC}$$

CP Competitive Offer for High ACR Resource

High ACR Resource is one whose net avoidable costs are greater than its total expected Bonus Performance payments as an energy-only resource

- Second term of competitive offer remains greater than zero
- PPR substituted with Non-Performance Charge Rate
- Competitive offer dependent on unit-specific ACR and expected resource performance compared to B’, requiring a unit-specific review of its MSOC
  - An appropriate unit-specific risk premium may also be included in the unit-specific review

$$p_{(\$/MW\text{-}year)} = PPR \times H \times B' + (ACR - PPR \times H \times A')$$
$$p_{(\$/MW\text{-}year)} = ACR + PPR \times H \times (B' - A')$$
$$p_{(\$/MW\text{-}year)} = ACR + (\text{Net CONE} \times 365 / H) \times H \times (B' - A')$$

$$p_{(\$/MW\text{-}day)} = ACR + \text{Net CONE} \times (B' - A')$$

ATTACHMENT C

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Independent Market Monitor for PJM	)	
v.	)	Docket No. EL19-___-000
PJM Interconnection, L.L.C.	)	

NOTICE OF COMPLAINT

(____, 2019)

Take notice that on February{__}, 2019, pursuant to section 206 of the Rules and Practice and Procedure of the Federal Energy Regulatory Commission (Commission), 18 CFR § 385.206 (2011), Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor for PJM (Complainant) filed a formal complaint against PJM Interconnection, L.L.C. (Respondent) requesting that the Commission direct Respondent to revise the expected number of Performance Assessment Intervals (PAI) used to set the default Market Seller Offer Cap in RPM auctions to a level consistent with a reasonable and supportable expectation of PAI.

The Complainant states that copies of the complaint were served on representatives of the Respondent.

Any person desiring to intervene or to protest this filing must file in accordance with Rules 211 and 214 of the Commission's Rules of Practice and Procedure (18 CFR 385.211, 385.214). Protests will be considered by the Commission in determining the appropriate action to be taken, but will not serve to make protestants parties to the proceeding. Any person wishing to become a party must file a notice of intervention or motion to intervene, as appropriate. The Respondent's answer and all interventions, or protests must be filed on or before the comment date. The Respondent's answer, motions to intervene, and protests must be served on the Complainants.

The Commission encourages electronic submission of protests and interventions in lieu of paper using the "eFiling" link at *http://www.ferc.gov*. Persons unable to file electronically should submit an original and 14 copies of the protest or intervention to the Federal Energy Regulatory Commission, 888 First Street, NE, Washington, DC 20426.

This filing is accessible on-line at *http://www.ferc.gov*, using the "eLibrary" link and is available for review in the Commission's Public Reference Room in Washington, DC. There is an "eSubscription" link on the web site that enables subscribers to receive email notification when a document is added to a subscribed docket(s). For assistance with any FERC Online service, please email *FERCOnlineSupport@ferc.gov*, or call (866) 208-3676 (toll free). For TTY, call (202) 502-8659.

Comment Date: 5:00 pm Eastern Time on __, 2019.

Kimberly D. Bose,
Secretary