

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

PJM Interconnection, L.L.C.)	Docket No. ER15-623-000
)	
PJM Interconnection, L.L.C.)	
v.)	Docket No. EL15-29-000
PJM Interconnection, L.L.C.)	
)	(Not Consolidated)

**ANSWER AND MOTION FOR LEAVE TO ANSWER
OF THE INDEPENDENT MARKET MONITOR FOR PJM**

Pursuant to Rules 212 and 213 of the Commission’s Rules and Regulations,¹ Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor for PJM (“Market Monitor”), submits this answer to, and moves for leave to answer, the answers filed by numerous parties on January 20, 2015,² in response to PJM’s December 12, 2014, proposal to reform its capacity market, primarily the Reliability Pricing Model

¹ 18 CFR § 385.212 & 213 (2014).

² See, e.g., Comments and Limited Protest of the NRG Companies and the Dynegy Companies, Dockets Nos. ER15-623 & EL15-29 (“NRG/Dynegy”); Protest and Comments of Coalition of Gas Generators and Project Finance Resources, Dockets Nos. ER15-623 & EL15-29 (“Gas Generators Coalition”); Motion to Intervene, Comments, and Limited Protest of LS Power Associates, L.P., Docket No. ER15-623 (“LS Power”); Protest and Comments of Essential Power, LLC; Essential Power Opp, LLC; Essential Power Rock Springs, LLC; and Lakewood Cogeneration, L.P., Dockets Nos. ER15-623 & EL15-29 (“Essential Power”); Motion to Intervene and Comments of H.Q. Energy Services (U.S.) Inc., Docket No. ER15-623 (“HQ”).

("RPM") based on Capacity Performance requirements and incentives.³ The Market Monitor strongly supports the fundamentals of the Capacity Performance market design and urges that it be approved, with the Market Monitor's proposed modifications, without significant delay.

I. ANSWER

A. Support for Capacity Performance Reform.

The Market Monitor continues to support PJM's Capacity Performance market design because it addresses unit performance incentives in an essential way. These comments of the Market Monitor address price formation and the definition of the default offer cap and proposed clarifying language related to unit performance and unit parameters that are required in order to make performance requirements meaningful and enforceable.

B. Offer Caps in Capacity Performance Design.

The Market Monitor has reviewed in detail the logic and mathematics underlying PJM's proposed offer cap for Capacity Performance resources. PJM proposes that net CONE should be the offer cap for Capacity Performance resources. Under PJM's proposal, the use of net CONE would replace the current unit specific review of Avoidable Cost Rate ("ACR") data for many Capacity Performance Resources. Under PJM's proposal, unit specific review would continue to be required for units with requested offers in excess of net CONE and for units with offers less than net ACR.

However, the Market Monitor's detailed review of the mathematics of the Capacity Performance design lead to the conclusion that default offer cap based on the CP design is

³ See PJM filing, Docket No. ER15-623-000 (December 12, 2014); PJM filing, EL15-29 (December 12, 2014).

less than net CONE.⁴ The default offer cap is (net CONE * B), where B is the expected average balancing ratio, plus any appropriate risk premium, and not net CONE.

It is the Market Monitor's recommendation that the default offer cap be set at (net CONE * B) and that offer caps and offer cap reviews follow the logic defined here. The only difference between the Market Monitor's proposal and PJM's proposal is that the default offer cap would be (net CONE * B) rather than (net CONE). Unit specific review would apply to all other units.

The Market Monitor's detailed review shows that for units that could profitably provide energy under the Capacity Performance design even without a capacity payment because their CP bonus payments exceed their net ACR, based on expected unit specific performance, expected balancing ratio and expected PAH, the competitive, profit maximizing offer is (net CONE * B), where B is the expected average balancing ratio, plus any appropriate risk premium. This is the appropriate offer cap for such units. Unit offers using this offer cap will not require unit specific review. The only exception would be that if the offer is less than the competitive level, the offer should be subject to unit specific review by the Market Monitoring Unit.

As a result of the fact that B is always expected to be less than or equal to 1.0, the default offer cap is less than or equal to net CONE. This result is consistent with the actual obligation to provide energy during each Performance Assessment Hour (PAH), which is (UCAP * B). Under the Capacity Performance design, units are required to provide their share of the peak load and reserve requirement in every PAH. Units are not required to provide full ICAP or full UCAP. The balancing ratio, B, is defined to be the ratio of load plus reserves to total UCAP cleared in the capacity market.

The logic of the default offer cap is that if expected bonus performance payments as an energy only resource under the CP design are greater than the net ACR, the resource

⁴ See Appendix A: Competitive offer for a Capacity Performance resource in PJM

would not take on a capacity obligation unless it would be better off. In order to offer and take on an obligation, the capacity price must be high enough that the expected profits as a CP resource equal or exceed the profits it would make as an energy only resource. This competitive offer is (net CONE * B).

For those units that could not profitably provide energy under the Capacity Performance design without a capacity payment because their net ACR exceeds their CP bonus payments based on expected unit specific performance, expected balancing ratio and expected PAH, and the units are expected to perform poorly, the competitive, profit maximizing offer is equal to net ACR, plus expected non-performance charges, plus any appropriate risk premium. This is the appropriate offer cap for such units. Unit offers made subject to this offer cap will require unit specific review because they depend on unit specific ACR information and unit specific risk premia.

For those units that could not profitably provide energy under the Capacity Performance design without a capacity payment because their net ACR exceeds their CP bonus payments based on expected unit specific performance, expected balancing ratio and expected PAH, and the units are expected to perform well, the competitive, profit maximizing offer is equal to net ACR minus expected bonus payments, plus any appropriate risk premium. This is the appropriate offer cap for such units. Unit offers made subject to this offer cap will require unit specific review because they depend on unit specific ACR information and unit specific risk premia.

These conclusions about competitive offer caps are the same conclusions reached by ISO-NE in their filings on their capacity market design on which the Capacity Performance design is closely based.⁵ These conclusions about offer caps are fully consistent with the fact

⁵ See ISO New England Inc. and New England Power Pool, Filings of Performance Incentives Market Rule Changes, Docket No. ER14-1050-000 (January 17, 2014), Attachment I-1e (Joint Testimony of David LaPlante and Seyed Parviz Gheblealivand) at 57–58.

that the Capacity Performance product is a fundamentally different product than the current RPM product with both substantially increased performance requirements and correspondingly increased risks.

The Capacity Performance product is an obligation to deliver firm energy during defined hours in a forward period equal to the unit UCAP times the balancing ratio (B). If this energy is not delivered in an hour, the seller must pay the hourly equivalent of the value of the product, defined to be net CONE divided by the expected number of performance assessment hours, multiplied by the unit's obligation (UCAP times the balancing ratio), or the difference between the unit's obligation and the unit's actual performance. For that reason, a logical offer is an offer at properly defined net CONE times the expected average balancing ratio plus an appropriate risk premium in an overall capacity market design that includes the appropriate number of expected performance assessment hours and does not have a monthly stop loss.

In addition, the expected equilibrium price in the capacity market is properly defined net CONE times the expected average balancing ratio and the design goal of the market is to have relatively stable pricing in a narrow bandwidth around properly defined net CONE times the expected average balancing ratio.

The Market Monitor calculated RTO wide balancing ratios for historical hours in the PJM market that would have qualified as PAH under PJM's proposed definition of PAH. Actual balancing ratios in PJM have ranged from an average of 0.74 in January 2014 to an average of 0.90 in July 2010.⁶ It is expected that summer balancing ratios would be relatively

⁶ The Market Monitor calculated RTO wide balancing ratios for all possible performance assessment hours including those that applied only during zonal or regional emergencies. The Market Monitor used the actual load and losses, actual demand response MW, and primary reserve and regulation requirement for the system as a measure of total load and reserve requirement (numerator of balancing ratio) and the total committed UCAP in the denominator.

close to 1.00 and that summer balancing ratios would be higher than winter balancing ratios.

C. Low Offers in Capacity Performance Design.

For each offer cap defined by the logic of the Capacity Performance design, any offer less than the competitive offer should be subject to review by the Market Monitoring Unit. Thus, for example, if a unit could profitably provide energy under the Capacity Performance design even without a capacity payment because their CP bonus payments exceed their net ACR based on expected unit specific performance, expected balancing ratio and expected PAH, but the unit's offer is less than the competitive, profit maximizing offer of $(\text{net CONE} * B)$, where B is the expected average balancing ratio, plus any appropriate risk premium, it would be appropriate for the MMU to review the offer to ensure that the offer is competitive.

The same is true for all the offers that require unit specific review. That review should be to determine both whether the unit offer is above the competitive level for the unit and whether the unit offer is below the competitive level for the unit. Any participant with an offer below the competitive level for anti-competitive reasons should be informed by the Market Monitor who should also inform PJM.

D. Risk Premia in Offer Caps in Capacity Performance.

Unit specific offer caps may include risk premia. The risk premia should be based on the additional risk associated with making offers in the Capacity Performance design.

From the review of the mathematics of capacity performance proposal, the Market Monitor identified three sources of risk in CP offers by generation resources.⁷ A resource seller can determine the competitive offer based on expected values for the number of performance assessment hours (H), balancing ratio during those hours (B), and a resource's

⁷ See Appendix B: Risk components in a CP Resource Offer

expected performance during those hours (A). These three variables are each a source of risk as a result of the fact that the actual values of each may differ from the expected values on which the offer was based.

E. Locational Emergency Events.

For an RTO wide capacity emergency, PJM's peak load and reserve requirement is expected to be met by resources that have capacity obligations. A resource's obligation is calculated as a share of the total load and reserve requirement on the system, the balancing ratio B, times its UCAP. However, emergency events that trigger performance assessment hours could be declarations of emergency load management or maximum emergency generation in a specific zone or subzone. These zones and subzones may not be the same as the import constrained LDAs modeled in the capacity market.

For emergencies declared at the regional, zonal or sub-zonal level, PJM's calculation of the balancing ratio is not clear. It is not clear from PJM's filing how PJM proposes to calculate the load and reserve requirements for such events. It is not clear how PJM proposes to define the 'net energy imports' into a region, zone or sub-zone.⁸ For regional, zonal, or sub-zonal emergencies, it is not clear what locational subset of generation, storage and demand resources PJM proposes to use, both in the numerator and denominator, for calculating the balancing ratio.

The definition of the balancing ratio, B, must be clarified for PAH at a sub RTO level in order to define offers, non-performance charges, risk and offer caps.

F. Excuses.

NRG/Dynegy argue (at 24) that PJM's proposal discourages market-based energy offers during emergency periods because resources will be subject to non-performance charges if they are dispatched down or not dispatched if their market-based energy offer is

⁸ See PJM proposed revised RAA § 10A(c) for the proposed definition of net energy imports.

greater than their cost-based energy offers. NRG/Dynegy argue (at 26) that resources' short run marginal cost often exceeds their cost-based energy offer, mainly due to intraday price and volume uncertainty. NRG/Dynegy suggest (at 27) that this provision amounts to "discriminatory, back-door energy market mitigation of Capacity Performance Resources." LS Power argues that this would prevent resources from being able to include appropriate margin and risk adders at times when resources are at the highest risk for non-performance. LS Power also argues (at 7) that this will create inaccurate price signals as energy prices would be lower during extreme events.

The Market Monitor disagrees. Generation capacity resources should not include any risk of not performing as a component of their cost-based energy offer. The risk of non-performance in the capacity market is explicitly incorporated in CP offers. The PJM provision prevents generation owners from using high energy offers to avoid performance requirements under the CP design. There should be no excuses for non-performance. The generation owners' argument should be rejected as an effort to introduce excuses for non-performance and weaken the CP design.

G. More Excuses.

NRG/Dynegy argue (at 28) and the Gas Generators Coalition argues (at 18) that generation resources should be reimbursed for costs incurred on approved maintenance outages if such are canceled by PJM. Essential Power argues (at 12) that if changes in an outage schedule by PJM results in additional costs to the generator, the generator should be compensated for the additional costs.

The Market Monitor disagrees. The generators forget who is responsible for unit performance. It is the generation owners and not PJM. PJM has already provided an exception for scheduled outages which is inconsistent with the ISO-NE filing and which provides an inappropriate opportunity to avoid compliance with performance obligations. The generation owners want to make the situation worse.

PJM should make its best efforts to schedule maintenance during non-emergency periods. If it is necessary to perform maintenance during emergency periods and PJM needs all the resources possible, the resources should be available and pay non-performance charges if not available. PJM should be able to recall such resources at no additional cost. These resources are being compensated under CP to be available when they are needed the most.

H. Energy Imports.

HQ states (at 4) that it understands that market participants who act as energy importers may be eligible for performance payments. HQ states (at 6), "The Commission should confirm the eligibility of energy imports for Bonus Payments in proposed subsection 10A(g). Moreover, PJM should adopt a more appropriate definition of Actual Performance in proposed section 10A of the Attachment DD. The amended definition should clearly include provisions applicable to the measurement of Actual Performance applicable to all imports."

The Market Monitor would like to clarify that PJM has defined actual performance and expected performance as applicable to energy imports from external resources that have obligations as capacity performance resources.

But the imports that HQ is referring to are the "Net Energy Imports" that PJM defines at section 10A(c) as "the sum of interchange transactions importing energy into PJM not including those associated with external Capacity Resources and therefore included in All Actual Generation Performance minus the sum of interchange transactions exporting energy out of PJM, but not less than zero."

PJM dispatches generation resources based on forecast of net interchange flows into the system. Market participants schedule interchange transactions into and out of PJM based on expectations of price differences between PJM and neighboring balancing authorities. During performance assessment hours, energy imports from neighboring balancing authorities help reduce the system load and reserve requirement that needs to be

met by supply resources, and simultaneously energy exports increase the system load and reserve requirement. It is not imports that help meet the PJM load. It is the net of imports and exports, or the actual amount of net interchange, that helps meet the PJM load.

Contrary to HQ, it does not make sense to pay imports capacity bonus payments without considering exports. The Market Monitor agrees that it would be appropriate to make Capacity Performance bonus payments to participants who schedule net energy imports only if PJM simultaneously charges non-performance charges to participants who schedule net energy exports.

II. MOTION FOR LEAVE TO ANSWER

The Commission's Rules of Practice and Procedure, 18 CFR § 385.213(a)(2), do not permit answers to answers or protests unless otherwise ordered by the decisional authority. The Commission has made exceptions, however, where an answer clarifies the issues or assists in creating a complete record.⁹ In this answer, the Market Monitor provides the Commission with information useful to the Commission's decision-making process and which provides a more complete record. Accordingly, the Market Monitor respectfully requests that this answer be permitted.

⁹ See, e.g., *PJM Interconnection, L.L.C.*, 119 FERC ¶61,318 at P 36 (2007) (accepted answer to answer that "provided information that assisted ... decision-making process"); *California Independent System Operator Corporation*, 110 FERC ¶ 61,007 (2005) (answer to answer permitted to assist Commission in decision-making process); *New Power Company v. PJM Interconnection, L.L.C.*, 98 FERC ¶ 61,208 (2002) (answer accepted to provide new factual and legal material to assist the Commission in decision-making process); *N.Y. Independent System Operator, Inc.*, 121 FERC ¶61,112 at P 4 (2007) (answer to protest accepted because it provided information that assisted the Commission in its decision-making process).

III. CONCLUSION

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

Respectfully submitted,



Jeffrey W. Mayes

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

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

Dated: February 25, 2015

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 25th day of February, 2015.



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



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Appendix A: Competitive offer for a capacity performance resource in PJM

The Independent Market Monitor for PJM

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This document 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

$CPBR_i$ – capacity performance bonus rate for hour i in (\$ per MWh), varies with the hour

PPR – non-performance charge rate (\$ per MWh; Net CONE in \$ per 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

$A_i = (MWh_i/UCAP)$, availability during performance assessment hour i

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

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

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

H – Expected value of total number of performance assessment hours in a delivery year

p – Offer price in RPM on a \$ per MW UCAP basis

Expected net revenues

If a resource is expected to underperform i.e., when expected $A_i < B_i$ for all PAH¹:

The total cash flow for a resource that has a capacity commitment, R^c , can be calculated as:

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

The total cash flow 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} , can be calculated as:

¹ If a resource is expected to over-perform, the competitive offer is lower in each case..

$$R^{nc} = UCAP \times \left[\sum_{i=1}^H (CPBR_i \times A_i) \right] - UCAP \times ACR \quad (2)$$

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 during performance assessment hours.

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.

$$if \ ACR \leq \sum_{i=1}^H (CPBR_i \times A_i)$$

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 additional expected revenue must be greater than or equal to the expected revenue as an energy only resource, or $R^c \geq R^{nc}$.

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

Thus, the competitive offer and therefore the expected equilibrium clearing price in RPM equals equations (1) minus equation (2):

$$p \geq \left[\sum_{i=1}^H CPBR_i \times (A_i) \right] - PPR \times H \times (\bar{A} - \bar{B})$$

or,

$$p \geq PPR \times H \times \bar{B} + \left[\sum_{i=1}^H CPBR_i \times (A_i) \right] - PPR \times H \times \bar{A}$$

For CPBR = PPR, the competitive offer is:

$$p = PPR \times H \times \bar{B} \quad (3)$$

Using PJM's proposed formula for PPR, which defines H as 30, and using the expected value of 30 for H, this is identical to:

$$p = Net \ CONE \times \bar{B} \quad (4)$$

The capacity performance bonus rate (CPBR) depends on the level of non-performance charges collected from underperforming resources during each performance assessment hour. The maximum value of CPBR is the non-performance charge rate, PPR, which occurs when no resource is exempted for under performance. If resources are exempted for under performance, the CPBR would decrease and the competitive offer would decrease.

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.

$$\text{if } ACR > \left[\sum_{i=1}^H (CPBR_i \times A_i) \right]$$

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 would have to be enough to cover the difference between ACR and capacity bonus performance payments.

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

From equation (1):

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

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

The competitive offer is:

$$p = ACR + PPR \times H \times (\bar{B} - \bar{A}) \quad (5)$$



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Appendix B: Risk Components in a CP Resource Offer

The Independent Market Monitor for PJM

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Components of Risk

There are three variables that may lead to resources not receiving expected revenues through RPM under the CP design: the expected number of performance assessment hours (H-risk), the expected average balancing ratio (B-risk), and the expected average performance of a resource (A-risk). All three are dependent on the location where the resource is located and PJM's calculation of expected performance for local emergencies (which is currently not clear in PJM's proposal) and stop loss provisions in the proposal. This is a result of the fact that the optimal offer of a resource is dependent on the expected value of non-performance charges and bonus payments. These are in turn dependent on the number of performance assessment hours (PAH) declared for each resource and the calculation of expected performance during those performance assessment hours. All three risks have an upper limit due to stop loss provisions applied to non-performance charges.

The competitive offer (p) of a resource with low net ACR is defined as¹:

$$p = \left(\frac{\text{Net CONE}}{30}\right) \times H \times \bar{B} + \left[\sum_{i=1}^H \text{CPBR}_i \times (A_i)\right] - \left(\frac{\text{Net CONE}}{30}\right) \times H \times \bar{A} \quad (1)$$

The competitive offer (p) of a resource with high net ACR is defined as:

$$p = \text{NGFC} + \left(\frac{\text{Net CONE}}{30}\right) \times H \times (\bar{B} - \bar{A}) \quad (2)$$

Using equations (1) and (2), the three components of risk due to H, B and A can be computed as the difference in competitive offer of a resource with the expected value of inputs and the competitive offer of a resource with a low probability, extreme value of the inputs, keeping everything else constant.

1. Performance Assessment Hours greater than 30 (H-risk)

H-risk is the risk that the actual performance assessment hours are greater than the expected value used. H-risk is highly dependent on the zone/LDA where the resource is located. The MMU estimated zonal and RTO wide events from 2010 through 2014 that would have qualified as performance assessment hours under the proposed rules. PAH vary based on the number of RTO wide emergencies versus locational emergencies declared by PJM. For example, while RTO wide PAH were 30 in DY 2013/14, BGE and

¹ See Appendix A - Competitive offer for a capacity performance resource in PJM. Variables are defined in Appendix A.

PEPCO had 62 PAH. Similarly in DY 2010/11, while RTO wide PAH was 2, Pepco had 49 PAH and BGE had 37.

Table 1 Historical Performance Assessment Hours by zone and RTO

Delivery Year	AEC	AEP	APS	BGE	PEP	DOM	COM	RTO
2009/10	0	3	0	0	7	0	0	0
2010/11	23	5	34	37	49	21	2	2
2011/12	22	0	0	15	13	0	1	0
2012/13	12	7	7	12	12	7	7	7
2013/14	54	57	47	62	62	56	37	30

For a resource with low net ACR, the optimal offer is a positive function of the value of H (equation (1)).

For a resource with high net ACR, a higher value of H would increase the competitive offer if a resource is expected to underperform (equation (2)), and would decrease the competitive offer if a resource is expected to over perform, as a higher value of H would lead to higher capacity bonus payments.

H-risk can be estimated using the difference between the competitive offer of a resource with the expected value of H and the competitive offer of a resource with a low probability, extreme value of H. In PJM’s proposal, nonperformance charges have an annual stop loss at 1.5 times the Net CONE. This stop loss would be triggered if a unit were to not perform for 45 hours in a delivery year, ignoring monthly stop losses.

2. Actual average balancing ratio greater than expected average balancing ratio (B-risk)

B-risk is the risk that the actual average balancing ratio is greater than the expected average balancing ratio. The competitive offer (equations (1) and (2)) is a function of the expected average balancing ratio. Using balancing ratios calculated for the entire RTO for the period from 2010 through 2014, the maximum average RTO balancing ratio for a delivery year was 0.89 for Delivery Year 2012/2013. For the same period, the maximum hourly RTO balancing ratio was 0.95. However, this RTO balancing ratio was observed during an hour with a zonal emergency and not an RTO wide emergency.² For

² Ideally, the balancing ratio to use is calculated for the region where the performance assessment hours are in effect. However, due to lack of clarity on balancing ratio formula for regional, zonal and local emergencies, the Market Monitor calculated RTO wide balancing ratios for every hour when either a regional or an RTO wide emergency was declared.

emergencies declared at the regional, zonal, or sub-zonal level, PJM's position on the appropriate calculation of balancing ratio is not clear.

B-risk can be estimated using the difference between the competitive offer of a resource with an expected value of B and the competitive offer of a resource with an expected extreme value of B based on history. The relevant history depends on PJM's clarifying how PJM proposes to address CP performance issues when there are PAH at a zonal or subzonal level rather than at the RTO level.

3. Actual average performance lower than expected average performance (A-risk)

A-risk is the risk that actual performance of a resource is lower than expected performance during performance assessment hours. In both equations (1) and (2), the optimal offer of a resource increases as A decreases. A-risk can be estimated using the difference between the competitive offer of a resource calculated with unit specific historical A and the competitive offer of a resource calculated using a lower value of A.

4. Summary

All three components of risk are limited by any applicable stop losses. The total risk is the sum of all three components. The risk premium to add to a CP offer can be calculated using a defined cost for the total calculated risk. This can be described as the premium required to cover the total calculated risk. The risk premium is not equal to the total value of the risk.