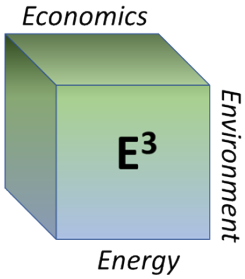


PAUL M. SOTKIEWICZ, PH.D.
PRESIDENT AND FOUNDER
E-CUBED POLICY ASSOCIATES, LLC
5502 NW 81ST AVENUE
GAINESVILLE, FLORIDA, 32653
PAUL.SOTKIEWICZ@E-CUBEDPOLICY.COM

Memorandum

Subject: Proposed Default MSOC and CPQR

From: Paul M. Sotkiewicz, Ph.D.

To:

CC:

Date: June 10, 2022

Current Issues

Under the now effective MSOC in the RPM Capacity Market any Generation Capacity Resource that wishes to submit a non-zero offer, must go through either a default ACR or unit specific ACR process. As was observed going into the 2023/2024 BRA prior to its delay, this created a much larger load of work administratively for Capacity Market Sellers, the IMM, and PJM staff.

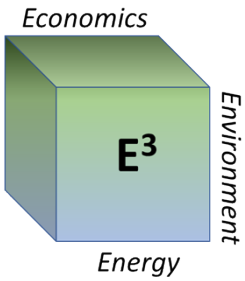
Also, there has been no standard by which to measure the CPQR or to account for the fact that historic average Performance Assessment Intervals ("PAI") or Performance Assessment Hours ("PAH"), where PAH = PAI/12, is quite low relative to the assumed numbers of hours to assess penalties for non-performance.

This proposal uses the logic behind Capacity Performance ("CP") and reframing of the choices and outcomes for Capacity Market Sellers that allows for non-zero default MSOC and CPQR that reduces administrative burden, maintains CP performance incentives, and allows for flexibility in offers while guarding against exercises of market power through economic withholding.

Deriving the Optimal No-Look Offer Cap Considering Only Performance Penalties

The optimal offer cap under Capacity Performance is based on the trade-off for Generation Capacity Resource accept an RPM capacity commitment or to remain in service but as an Energy Resource from an RPM perspective. Given the must offer-requirement, this is not a choice prior to RPM Auctions, but is a reality if risk/reward trade-offs can be reflected in RPM offers.

In taking on the obligations to become a Capacity Resource, a Generation Capacity Resource accepts revenues up front to take on the risk it incurs by being subject to performance penalties for not delivering its committed capacity when needed. The



prospect of bonus payments, while possible, is limited there is little room for over-performance beyond the committed UCAP multiplied by the balancing ratio.

In contrast, if a Generation Capacity Resource does not receive an RPM capacity commitment, it is an Energy Resource. As a result, a Generation Capacity Resource forgoes the upfront capacity payment but faces no performance risk of penalties and can only earn performance bonuses if it performs during a capacity emergency. Any performance greater than zero will earn bonus payments as the expected performance of an energy only resource is zero under Capacity Performance.

In this sense, a Generation Capacity Resource should be able to reflect in its capacity market offers this trade-off such that if it is awarded a commitment, the Generation Capacity Resource will submit an offer based on a capacity price at which its expected net revenue equates these two potential outcomes: whether taking on a capacity commitment but be exposed to penalty risk is equal, or to or greater than its expected net revenues as an energy-only resource where it would forego capacity revenue as an energy only resource but also avoid the downside performance risk.

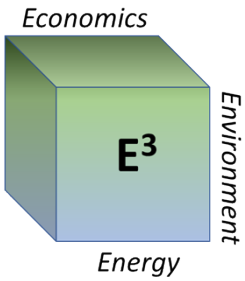
I. *Deriving the Offer at Which a Resource is Indifferent to Taking on a Capacity Obligation or Being Energy Only*

The analysis and recommendation set out below is based on a derivation provided by the PJM Independent Market Monitor ("IMM") following ISO-NE's derivation.[1]

The net revenue from taking on a capacity obligation is defined as the following:

$$R_{cap} = UCAP \times [P + \sum_{i=1}^{H_{expected}} (Penalty_i \times H_{expected} \times (\overline{A} - \overline{B})) - Net\ ACR]$$

[1] *See Answer and Motion for Leave to Answer of the Independent Market Monitor for PJM*, PJM Interconnection, LLC Docket No. ER15-623-000, PJM Interconnection, LLC V. PJM Interconnection, LLC, Docket No. EL15-29-000, *Appendix A: Competitive offer for a Capacity Performance Resource in PJM*, February 25, 2015. Available at http://www.monitoringanalytics.com/Filings/2015/IMM_Answer_and_Motion_for_Leave_to_Answer_Docket_Nos_ER15-623-000_EL15-29-000_20150225.pdf. *See also*, 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. (as cited).



The net revenue from being an energy only resource is:

$$R_{energy} = UCAP \times [\sum_{i=1}^{H_{expected}} (Bonus_i \times A_i) - Net\ ACR]$$

Where:

R_{cap} – net revenue for a resource with a capacity commitment.

$UCAP$– is the unforced capacity or ELCC capacity committed for a resource with a capacity commitment.

P – capacity market price at which a resource is indifferent between taking a capacity commitment and being an energy only resource. This is also the optimal offer $/MW-year UCAP.

i – index of performance assessment hours.

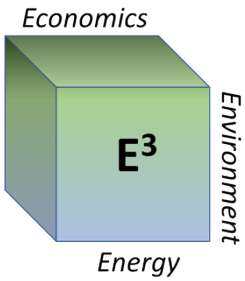
$Penalty_i$– non-performance penalty rate expressed in $/MWh. The penalty rate is Net CONE in $/MW-year divided by the number of assumed hours, $H_{penalty}$, $Penalty_i = (Net\ CONE/H_{penalty})$ the expected number of performance hours during the year. The penalty rate is the same for all performance assessment hours.

$H_{expected}$ – is the number of expected performance assessment hours in the obligation period. PJM historical data from the 2011/2012 Delivery Year to present is used.

$Bonus_i$ – capacity performance bonus rate for hour i in ($/MWh), varies with the hour

$A_i = (MWh_i/UCAP)$ - availability or MWh output during performance assessment hour i. The maximum value of A_i for a generator is *ICAP*/*UCAP*.

$\overline{A} = \frac{\sum_{i=1}^{H_{expected}} (MWh_i/UCAP)}{H_{expected}}$- average availability across all expected performance assessment hours.



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

$\overline{B} = \sum_{i=1}^{H_{expected}} (B_i)/H_{expected}$– average balancing ratio across all performance assessment hours in a delivery year.

$Net\ ACR$ – net avoidable costs incurred by a resource to remain available and in commercial operation. The net going forward costs are equal to the total fixed going forward costs which includes fixed O&M and future capital investments needed to remain in commercial operation less expected net energy and ancillary service revenues.

R_{energy} – net revenue for a resource that is energy only and that does not have a capacity commitment that sells energy and ancillary services only.

To be indifferent between taking on a capacity obligation and being an energy only resource, the net revenues from taking on the capacity obligation should be equal to those of being an energy only resource. To unambiguously take on a capacity obligation, the net revenues from doing so must be greater than being an energy only resource. The following condition accounts for both cases:

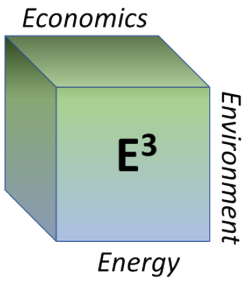
$$R_{cap} \geq R_{energy}$$

Since Net ACR appears in both equations and is multiplied by the UCAP value, these offset one another. This makes sense such that if the resource intends to remain in commercial operation no matter whether it clears in RPM or not, it must cover its Net ACR.

So, to take on a capacity obligation means that the capacity payment, less any expected net penalties must be greater than the stream of bonus payments as an energy only resource can also receive such bonus payments):

$$UCAP \times [P + (Penalty_i \times H_{expected} \times (\overline{A} - \overline{B})] \geq UCAP \times \sum_{i=1}^{H_{expected}} (Bonus_i \times A_i).$$

UCAP appears in both equations as a multiplier so it can be eliminated. Then rearranging to solve for the capacity offer price results in the following:



$$P \geq \sum_{i=1}^{H_{expected}} (Bonus_i \times A_i) - (Penalty_i \times H_{expected} \times (\overline{A} - \overline{B})).$$

Then substituting the penalty rate $Penalty_i = (Net\ CONE/H_{penalty})$ into the above equation for the optimal offer results in the following:

$$P \geq \sum_{i=1}^{H_{expected}} (Bonus_i \times A_i) - (Net\ CONE/H_{penalty}) \times H_{expected} \times (\overline{A} - \overline{B}).$$

II. *Deriving the Net CONE * B Offer*

The MSOC of Net CONE x B that has prevailed prior the recent FERC Order preceding the upcoming 2023/2024 BRA relies on two critical assumptions:

(1) For each performance assessment hour the penalty rate is equal to the bonus rate, $Penalty_i = Bonus_i$; and

(2) the number of hours used to set the penalty is exactly equal to the number of expected performance hours, $H_{penalty} = H_{expected}$.

Other than in 2014 when there were more than 30 hours PAH, even in the years prior (2011-2013) there were never than 30 hours that would qualify as PAH prior to 2014. And since 2014, only 9 PAH occurred in 2019 and not even RTO-wide or for the entire Mid-Atlantic region.

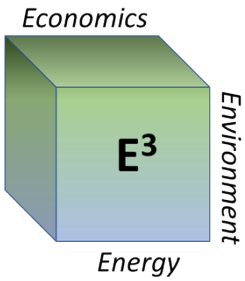
With respect to the penalty payments equaling bonus payments, it is highly unlikely that this would occur which implies a one-to-one replacement of non-performing, committed capacity from performing energy only resources. Whether bonus payments are higher or lower than penalty payments is likely to be situationally specific.

Only under these two critical assumptions the does the “optimal offer” reduce to:

$$P \geq Net\ CONE \times \overline{B}$$

III. *Deriving a Modified MSOC where Penalty Hours and Expected Hours Differ*

The FERC Order on the MSOC identified the mismatch of expected performance assessment hours and the number of hours, yet the Commission did nothing to work within the existing CP framework to correct this discrepancy. Given historic data since



2011 through 2021, the average number of performance assessment hours RTO-wide has been just over 4 hours. The current penalty rate remains based upon 30 hours.

If the Commission had adjusted the penalty hours to the historic expectation, which would have adjusted the penalty rate upward considerably, the Net CONE x B offer cap could have remained in place without any further adjustment.

However, the new MSOC could have also been adjusted for the difference in expected performance hours (6.3 and 4.2 PAH on average in Mid-Atlantic and RTO, respectively, from 2011/2012-2020/2021) and hours used to calculate the penalty rate (30).

This can be easily derived if the assumption about the penalty hours and expected hours differ and could have been easily derived. More generally, if $H_{penalty}$ representing the assumed hours to determine the penalty factor and $H_{expected}$ represents the expected assessment hours with $H_{expected} \leq H_{penalty}$, then the optimal offer is:

$$P \geq Net\ CONE \times \frac{H_{expected}}{H_{penalty}} \times \overline{B}$$

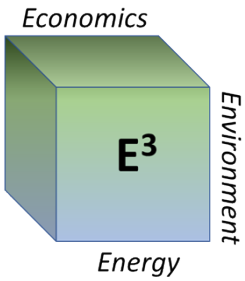
With an RTO Net CONE of $274.95/MW-day for the 20, and the known historic hours at 4.2 in RTO since 2011/2012, and 30 used for the penalty, and a balancing ratio of 0.85, the new MSOC would be $/MW-day in RTO.

$$\$32.72 \geq 274.95 \times \frac{4.2}{30} \times \overline{0.85}$$

For Mid-Atlantic, there are 6.3 PAH on average since 2011/2012, and using the MAAC Net CONE of $275/.08/MW-day the new MSOC would be

$$\$49.10 \geq 275.08 \times \frac{6.3}{30} \times \overline{0.85}$$

That is the MSOC should differ by transmission zone or LDA based on the Net CONE value and using the historic average of the PAH in each zone which can differ widely.



Year over year, as there are fewer PAH or no PAH, this historic average should fall. If there are several years with many PAH, then this average goes up and the MSOC goes up.

This MSOC offers generators the ability to craft their offers based on their assessment of risk and uncertainty while also being low enough to have any offer over this value to be evaluated by the IMM and PJM for market power. It also allows those resources with zero or below zero Net ACR offers (before accounting for risk) to reflect these risks in their offers. Coincidentally, this also with 10 percent of the clearing price in the previous BRA in which Net CONE x B was still in place, which should provide assurances to loads concerned about market power that this would be an avenue to exercise market power. Finally, this will reduce the administrative burden on the IMM and PJM to evaluate so many offers when most of those offers have no ability to exercise market power.

The proposed mechanism also has a key updating feature in that the average number of hours declines with each year there are no performance hours. On the other hand, if we get a year with many performance hours, such as 2014 would have been if CP had been in place, the default MSOC will increase based on the expectation of more hours on average over time.

IV. *The Modified MSOC also acts as a default Risk Premium for Taking on a Capacity Commitment*

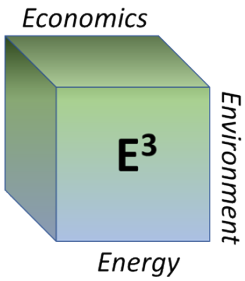
To see this, suppose that a resource if it does not receive a capacity commitment, will retire (or at least not operate). This means that the revenue from taking on capacity commitment must be greater than zero.

$$R_{cap} = UCAP \times [P + \sum_{i=1}^{H_{expected}} (Penalty_i \times H_{expected} \times (\overline{A} - \overline{B})) - Net\ ACR]$$

$$P \geq \sum_{i=1}^{H_{expected}} (Penalty_i \times H_{expected} \times (\overline{B} - \overline{A})) + Net\ ACR$$

This says that the offer cap is the Net ACR plus expected penalties. This is the case where absent a commitment, the resource shuts down or retires.

This now just looks like



$$P = Net\ CONE \times \frac{H_{expected}}{H_{penalty}} \times \left(\overline{B} - \overline{A}\right) + Net\ ACR$$

Where the risk premium is $Net\ CONE \times \frac{H_{expected}}{H_{penalty}} \times \left(\overline{B} - \overline{A}\right)$. This is upside risk if upside risk (negative risk premium) if expected performance is greater than the balancing ratio, $\left(\overline{B} < \overline{A}\right)$, and reduces the offer. This is downside risk (positive risk premium) if expected performance is less than the balancing ratio, $\left(\overline{B} > \overline{A}\right)$, and increases the offer.

The case of greatest interest is when there is a risk premium. The penalty hours already given by $H_{penalty}$ and assume the expected penalty hours are consistent with the historical rolling average. The worst downside risk is that in the few hours where PAH are effective, is no performance at all.

This causes the risk premium to look at $Net\ CONE \times \frac{H_{expected}}{H_{penalty}} \times \left(\overline{B}\right)$ which is the default MSOC as derived above. The Capacity Market Seller still faces risks over and above this should the balancing ratio in actual PAH exceed that used in the MSOC and the default risk premium, and if actual hours exceed those from history.

However, Capacity Market Sellers with significantly high Net ACR have incentives to reduce their performance risk as it makes them more competitive. Or in the alternative, the Capacity Market seller has the incentive to make investments that would appear in the Net ACR portion of the MSOC calculation.