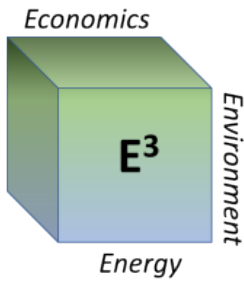


Update on Default MSOC Proposal: Back Cast with Historic Prices and Net CONE

Paul M. Sotkiewicz, Ph.D.

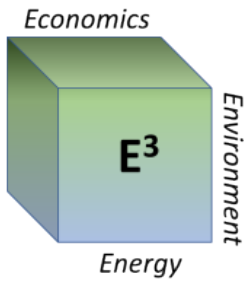
June 10, 2022

RASTF



Overview and Context

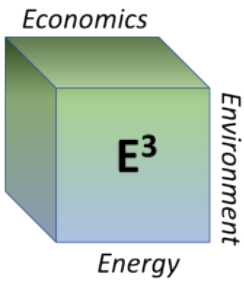
- This presentation is in response to requests for a back cast on the MSOC proposed by E-Cubed that is the variant on Net CONE*B.
- Question is to look at historic PAH/PAI, Net CONE, and Prices to see if the marginal offer may have been reviewed.
 - Note, E-Cubed does not endorse the idea that marginal offers must be reviewed.
 - But for some exceptions, the IMM has noted RPM BRA outcomes have been competitive but for a few bad actors
- Conclusion: Back cast shows that the proposed method would, in most LDAs, results in the marginal offers having been reviewed.
 - Exceptions are in BGE, Pepco, and ATSI



Proposed Default MSOC

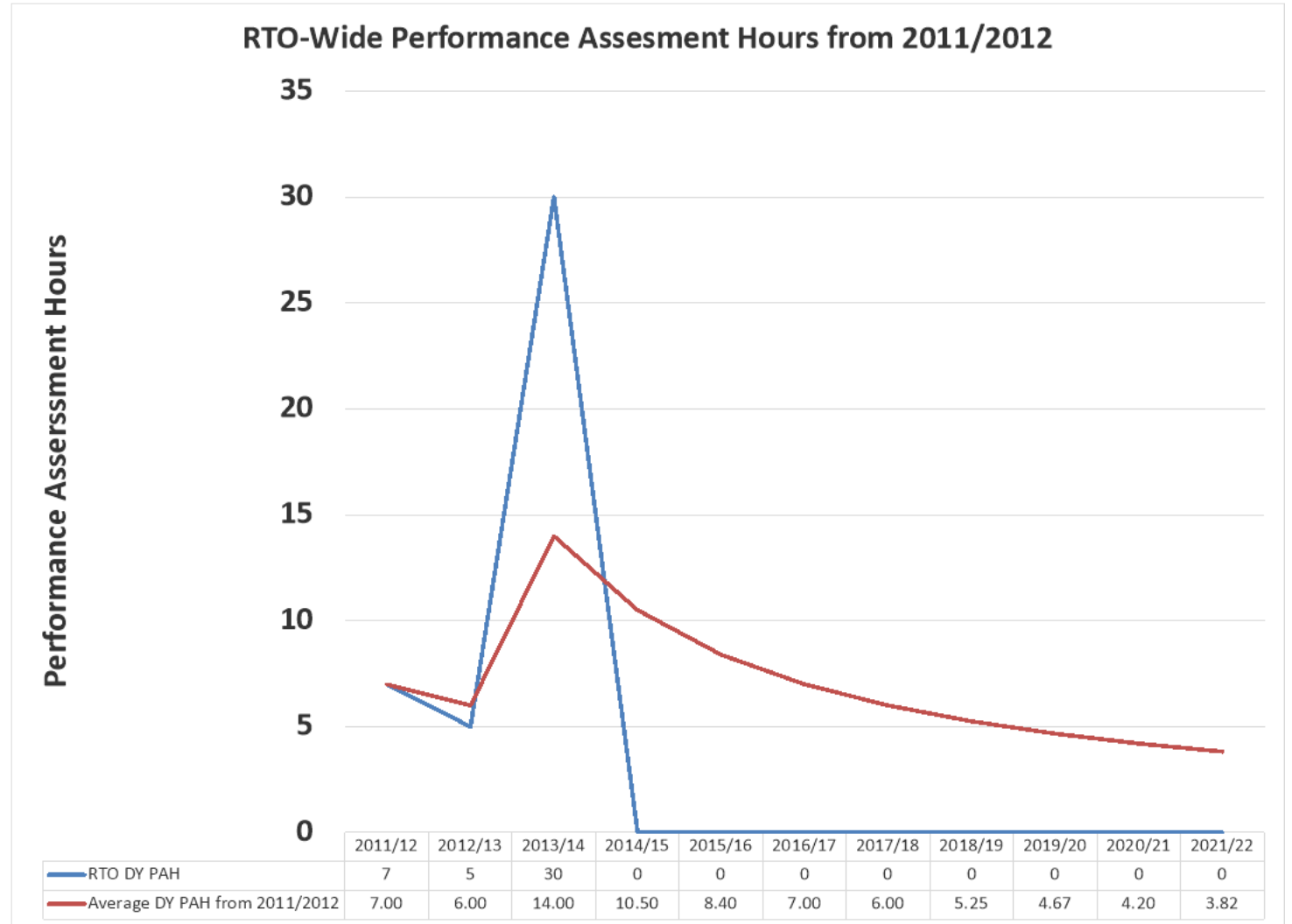
$$P \geq \text{Net CONE} \times \frac{H_{\text{expected}}}{H_{\text{penalty}}} \times \bar{B}$$

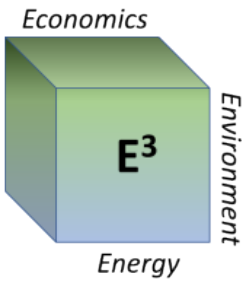
- With an RTO Net CONE of \$274.95/MW-day for the 20, and the known historic hours at 4.2 in RTO since 2011/2012, and 30 used for the penalty, and a balancing ratio of 0.85, the new MSOC would be \$/MW-day in RTO.
 - $\$32.72 \geq 274.95 \times \frac{4.2}{30} \times \overline{0.85}$
- For Mid-Atlantic, 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
 - $\$49.10 \geq 275.08 \times \frac{6.3}{30} \times \overline{0.85}$
- Based on the idea of being indifferent between taking on a capacity commitment and being energy only given the resources stays in service regardless of clearing the BRA.



RTO-Wide PAH

- There have been no PAH in the RTO-wide area since 2013/2014 DY.
- Through today, only 3.82 PAH on average since 2011/2012
- PAH in sub regions of RTO are additive to the RTO value.



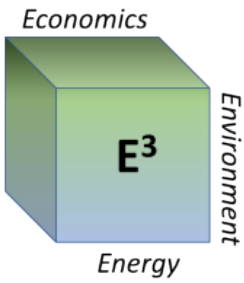


Mid-Atlantic & Dominion

- More hours in this subregion as it includes RTO-wide and PAH for Mid Atl-Dom only.
- Since 2011/2012, the current PAH is 5.73 PAH to date.
- Mid-Atl-Dom wide since 2013/2014

**Mid Atlantic & Dom Performance Assessment Hours Since 2011/2012
(Includes RTO-wide PAH since Mid Atl & Dom is a Subregion of RTO)**

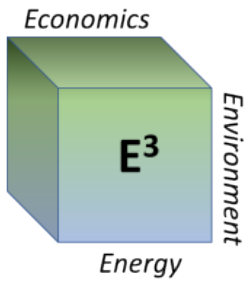




Zonal Alone PAH events on Average Since 2011/2012

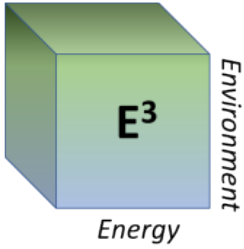
	BGE		Pepco		Dom		Comed		AEP		ATSI		AE		DLCO	
2011/12	11	11.00	0	0.00	0	0.00	1	1.00	0	0.00	0	0.00	9	9.00	4	4.00
2012/13	0	5.50	0	0.00	0	0.00	0	0.50	0	0.00	0	0.00	0	4.50	0	2.00
2013/14	10	7.00	10	3.33		0.00	6	2.33	21	7.00	21	7.00	0	3.00	0	1.33
2014/15	0	5.25	0	2.50	0	0.00	2	2.25	0	5.25	0	5.25	0	2.25	0	1.00
2015/16	0	4.20	0	2.00	0	0.00	0	1.80	0	4.20	0	4.20	0	1.80	0	0.80
2016/17	0	3.50	0	1.67	0	0.00	0	1.50	0	3.50	0	3.50	0	1.50	0	0.67
2017/18	0	3.00	0	1.43	0	0.00	0	1.29	0	3.00	0	3.00	0	1.29	0	0.57
2018/19	0	2.63	0	1.25	0	0.00	0	1.13	0	2.63	0	2.63	0	1.13	0	0.50
2019/20	6	3.00	6	1.78	6	0.75	0	1.00	6	3.00	0	2.33	0	1.00	0	0.44
2020/21	0	2.70	0	1.60	0	0.67	0	0.90	0	2.70	0	2.10	0	0.90	0	0.40
2021/22	0	2.45	0	1.45	0	0.60	0	0.82	0	2.45	0	1.91	0	0.82	0	0.36

<https://www.pjm.com/-/media/committees-groups/committees/elc/postings/performance-assessment-hours-2011-2014.xls.ashx> and <https://emergencyprocedures.pjm.com/ep/pages/dashboard.jsf>



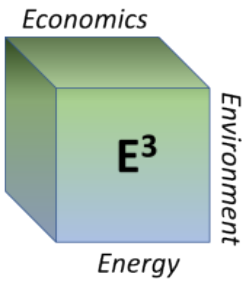
Historic CP Clearing Prices by LDA

BRA Year	RTO	MAAC	EMAAC	SWMAAC	PS	PS NORTH	DPL SOUTH	PEPCO	ATSI	ATSI-CLEVELA ND	COMED	BGE	PL	DAYTON	DEOK
16/17	\$134.00	\$134.00	\$134.00	\$134.00	\$134.00	\$134.00	\$134.00	\$134.00	\$134.00	\$134.00	**	**	**	**	**
17/18	\$151.50	\$151.50	\$151.50	\$151.50	\$151.50	\$151.50	\$151.50	\$151.50	\$151.50	\$151.50	\$151.50	\$151.50	\$151.50	**	**
18/19	\$164.77	\$164.77	\$225.42	\$164.77	\$225.42	\$225.42	\$225.42	\$164.77	\$164.77	\$164.77	\$215.00	\$164.77	\$164.77	**	**
19/20	\$100.00	\$100.00	\$119.77	\$100.00	\$119.77	\$119.77	\$119.77	\$100.00	\$100.00	\$100.00	\$202.77	\$100.30	\$100.00	**	**
20/21	\$76.53	\$86.04	\$187.87	\$86.04	\$187.87	\$187.87	\$187.87	\$86.04	\$76.53	\$76.53	\$188.12	\$86.04	\$86.04	\$76.53	\$130.00
21/22	\$140.00	\$140.00	\$165.73	\$140.00	\$204.29	\$204.29	\$165.73	\$140.00	\$171.33	\$171.33	\$195.55	\$200.30	\$140.00	\$140.00	\$140.00
22/23	\$50.00	\$95.79	\$97.86	\$95.79	\$97.86	\$97.86	\$97.86	\$95.79	\$50.00	\$50.00	\$68.96	\$126.50	\$95.79	\$50.00	\$71.69



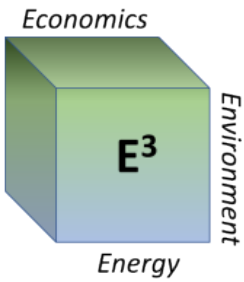
Historic Net CONE by LDA

BRA Year	RTO	MAAC	EMAAC	SWMAAC	PS	PS NORTH	DPL SOUTH	PEPCO	ATSI	ATSI-CLEVELA ND	COMED	BGE	PL	DAYTON	DEOK
16/17	\$330.53	\$276.90	\$329.94	\$276.90	\$329.94	\$329.94	\$329.94	\$276.90	\$362.64	\$362.64					
17/18	\$351.39	\$313.00	\$365.87	\$313.00	\$365.87	\$365.87	\$365.87	\$313.00	\$373.75	\$373.75	\$373.75	\$313.00	\$354.46		
18/19	\$300.57	\$271.67	\$284.82	\$243.17	\$297.99	\$297.99	\$258.32	\$250.74	\$271.72	\$271.72	\$320.29	\$235.59	\$284.79		
19/20	\$299.30	\$262.02	\$283.63	\$229.93	\$303.30	\$303.30	\$262.27	\$244.23	\$264.06	\$264.06	\$328.44	\$215.62	\$277.74		
20/21	\$292.95	\$252.40	\$283.10	\$202.43	\$306.92	\$306.92	\$254.97	\$226.53	\$261.17	\$261.17	\$329.81	\$178.33	\$267.33	\$273.14	\$282.46
21/22	\$321.57	\$292.69	\$313.77	\$264.88	\$330.61	\$330.61	\$300.18	\$285.42	\$306.87	\$306.87	\$344.36	\$244.33	\$300.72	\$312.56	\$312.80
22/23	\$260.50	\$245.12	\$259.36	\$242.95	\$268.44	\$268.44	\$236.18	\$259.52	\$230.50	\$230.50	\$247.86	\$226.37	\$250.41	\$226.32	\$223.63
23/24	\$274.96	\$275.08	\$291.36	\$244.72	\$299.61	\$299.61	\$264.91	\$270.00	\$263.07	\$263.07	\$284.97	\$219.44	\$279.52	\$246.93	\$252.63



MSOC Calculation: Zone/LDA Specific

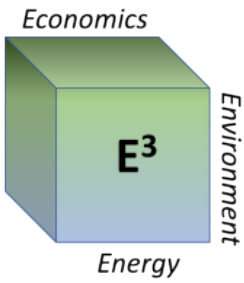
- For each modeled LDA and Zone, the MSOC is specific based on:
 - Net CONE
 - Historic rolling average of PAH.
- Some zones within LDAs have had events that would be considered PAH and these zonal differences should be reflected.
- These can be easily plugged into the MSOC formula.
- For each BRA, use the rolling average from the most recent completed Delivery Year at the start of auction timeline for MSOC



Zonal Alone PAH events on Average Since 2011/2012

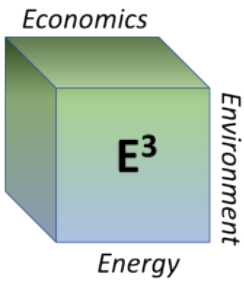
Zone	Average PAH since 2011/2012
BGE	2.45
Pepco	1.45
Dominion	0.6
ComEd	0.82
AEP	2.45
ATSI	1.91
AE	0.82
DLCO	0.36

- These hours would be additive to the PAH or the wider parent LDA/zone in which the transmission zone resides.
- For example, AEP and ATSI would be added to RTO-wide, increasing the “risk” of PAH
 - AEP 2.45 + RTO 3.82 = 6.27 PAH
 - ATSI 1.91 + RTO 3.82 = 5.73 PAH
- However, BGE and Pepco are in Mid-Atl
 - BGE 2.45 + MidAtl 5.73 = 8.28 PAH



MSOC for Mid-Atlantic Zones: Rolling Average Used

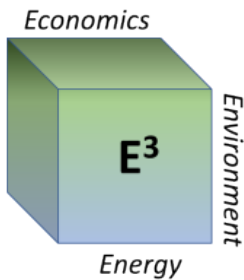
	Avg. PAH Hours
16/17 BRA in 2013 use thru 11/12	11
17/18 BRA in 2014 use thru 12/13	7.5
18/19 BRA in 2015 use thru 13/14	21
19/20 BRA in 2016 use thru 14/15	15.75
20/21 BRA in 2017 use thru 15/16	12.6
21/22 BRA in 2018 use thru 16/17	10.5
22/23 BRA in 2021 use thru 19/20 due to delay	7
23/24 BRA in 2022 use thru 20/21 due to delay	6.3



Back Cast MSOC for Mid-Atlantic Zones

	Avg. PAH Hours	MAAC	EMAAC	SWMAAC	PS	PS NORTH	DPL SOUTH	PEPCO	BGE	PL
16/17 BRA in 2013 use thru 11/12	11	\$86.30	\$102.83	\$86.30	\$102.83	\$102.83	\$102.83	\$86.30	\$172.60	\$0.00
17/18 BRA in 2014 use thru 12/13	7.5	\$66.51	\$77.75	\$66.51	\$77.75	\$77.75	\$77.75	\$66.51	\$115.29	\$75.32
18/19 BRA in 2015 use thru 13/14	21	\$161.64	\$169.47	\$144.69	\$177.30	\$177.30	\$153.70	\$172.87	\$186.90	\$169.45
19/20 BRA in 2016 use thru 14/15	15.75	\$116.93	\$126.57	\$102.61	\$135.35	\$135.35	\$117.04	\$126.29	\$128.29	\$123.94
20/21 BRA in 2017 use thru 15/16	12.6	\$90.11	\$101.07	\$72.27	\$109.57	\$109.57	\$91.02	\$93.71	\$84.89	\$95.44
21/22 BRA in 2018 use thru 16/17	10.5	\$87.08	\$93.35	\$78.80	\$98.36	\$98.36	\$89.30	\$98.39	\$96.92	\$89.46
22/23 BRA in 2021 use thru 19/20 due to delay	7	\$48.62	\$51.44	\$48.19	\$53.24	\$53.24	\$46.84	\$64.54	\$64.14	\$49.66
23/24 BRA in 2022 use thru 20/21 due to delay	6.3	\$49.10	\$52.01	\$43.68	\$53.48	\$53.48	\$47.29	\$60.44	\$55.96	\$49.89

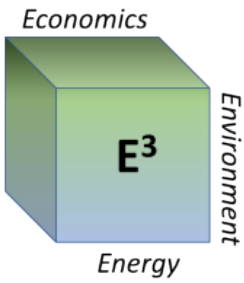
Some Zones such as Pepco and BGE use different PAH values since they had zonal specific events



BRA Price minus MSOC Back Cast for Mid-Atlantic Zones

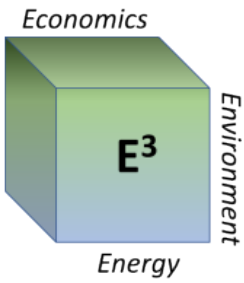
	MAAC	EMAAC	SWMAAC	PS	PS NORTH	DPL SOUTH	PEPCO	BGE	PL
16/17 BRA in 2013 use thru 11/12	\$ 47.70	\$ 31.17	\$ 47.70	\$ 31.17	\$ 31.17	\$ 31.17	\$47.70	-\$38.60	\$0.00
17/18 BRA in 2014 use thru 12/13	\$ 84.99	\$ 73.75	\$ 84.99	\$ 73.75	\$ 73.75	\$ 73.75	\$84.99	\$36.21	\$75.32
18/19 BRA in 2015 use thru 13/14	\$ 3.13	\$ 55.95	\$ 20.08	\$ 48.12	\$ 48.12	\$ 71.72	-\$8.10	-\$22.13	\$169.45
19/20 BRA in 2016 use thru 14/15	\$ (16.93)	\$ (6.80)	\$ (2.61)	\$ (15.58)	\$ (15.58)	\$ 2.73	-\$26.29	-\$27.99	\$123.94
20/21 BRA in 2017 use thru 15/16	\$ (4.07)	\$ 86.80	\$ 13.77	\$ 78.30	\$ 78.30	\$ 96.85	-\$7.67	\$1.15	\$95.44
21/22 BRA in 2018 use thru 16/17	\$ 52.92	\$ 72.38	\$ 61.20	\$ 105.93	\$ 105.93	\$ 76.43	\$41.61	\$103.38	\$89.46
22/23 BRA in 2021 use thru 19/20 due to delay	\$ 47.17	\$ 46.42	\$ 47.60	\$ 44.62	\$ 44.62	\$ 51.02	\$31.25	\$62.36	\$49.66
23/24 BRA in 2022 use thru 20/21 due to delay									

A positive difference implies the BRA Clearing Price was greater than the MSOC in the back cast



MSOC for RTO: Rolling Average Used

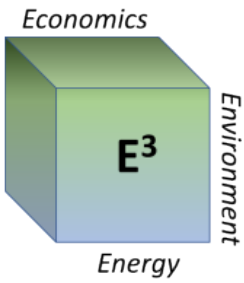
	Avg. PAH Hours
16/17 BRA in 2013 use thru 11/12	7
17/18 BRA in 2014 use thru 12/13	6
18/19 BRA in 2015 use thru 13/14	14
19/20 BRA in 2016 use thru 14/15	10.5
20/21 BRA in 2017 use thru 15/16	8.4
21/22 BRA in 2018 use thru 16/17	7
22/23 BRA in 2021 use thru 19/20 due to delay	4.67
23/24 BRA in 2022 use thru 20/21 due to delay	4.2



Back Cast MSOC for RTO

	Avg. PAH Hours	RTO	ATSI	ATSI-CLEVELAND	COMED	DAYTON	DEOK
16/17 BRA in 2013 use thru 11/12	7	\$65.56	\$113.02	\$113.02	\$112.38		
17/18 BRA in 2014 use thru 12/13	6	\$59.74	\$79.42	\$79.42	\$84.72		
18/19 BRA in 2015 use thru 13/14	14	\$119.23	\$215.56	\$215.56	\$211.75		
19/20 BRA in 2016 use thru 14/15	10.5	\$89.04	\$157.12	\$157.12	\$167.50		
20/21 BRA in 2017 use thru 15/16	8.4	\$69.72	\$124.32	\$124.32	\$134.56	\$65.01	\$67.23
21/22 BRA in 2018 use thru 16/17	7	\$63.78	\$121.73	\$121.73	\$117.08	\$61.99	\$62.04
22/23 BRA in 2021 use thru 19/20 due to delay	4.67	\$34.44	\$60.95	\$60.95	\$56.18	\$29.92	\$29.57
23/24 BRA in 2022 use thru 20/21 due to delay	4.2	\$32.72	\$62.61	\$62.61	\$58.13	\$29.38	\$30.06

Some Zones such as AEP, ATSI, DOM, ComEd use different PAH values since they had zonal specific events



BRA Price minus MSOC Back Cast for RTO

	RTO	ATSI	ATSI- CLEVELAND	COMED	DAYTON	DEOK
16/17 BRA in 2013 use thru 11/12	\$68.44	\$20.98	\$20.98	\$21.62		
17/18 BRA in 2014 use thru 12/13	\$91.76	\$72.08	\$72.08	\$66.78		
18/19 BRA in 2015 use thru 13/14	\$45.54	-\$50.79	-\$50.79	\$3.25		
19/20 BRA in 2016 use thru 14/15	\$10.96	-\$57.12	-\$57.12	\$35.27		
20/21 BRA in 2017 use thru 15/16	\$6.81	-\$47.79	-\$47.79	\$53.56	\$11.52	\$62.77
21/22 BRA in 2018 use thru 16/17	\$76.22	\$49.60	\$49.60	\$78.47	\$78.01	\$77.96
22/23 BRA in 2021 use thru 19/20 due to delay	\$15.56	-\$10.95	-\$10.95	\$12.78	\$20.08	\$42.12
23/24 BRA in 2022 use thru 20/21 due to delay						

A positive difference implies the BRA Clearing Price was greater than the MSOC in the back cast