

Market Monitor Report

MC Webinar
1/23/2023

IMM



Monitoring Analytics

MMU Review

- **The MMU is reviewing market behavior and outcomes from Winter Storm Elliott.**
- **Topics of review include**
 - **Outages, including timing and reasons**
 - **Offers, including offers over \$1,000 per MWh and parameter exception requests**
 - **Demand response performance**
 - **Price formation, including shortage pricing, transmission constraint penalty factors, and system marginal price capping**
 - **Reserve market functioning and spin events**

PLS Exceptions for Max Run Time

- **Several units requested and used PLS temporary exceptions in December to decrease their max run times. Max run time is 24 hours by default.**
- **PLS exceptions are only allowed due to equipment, environmental or contractual constraints.**
- **Max run exceptions due to low fuel or consumables inventories are not allowed.**
- **Generators should not use temporary exceptions for max run times due to low fuel or consumables inventory.**

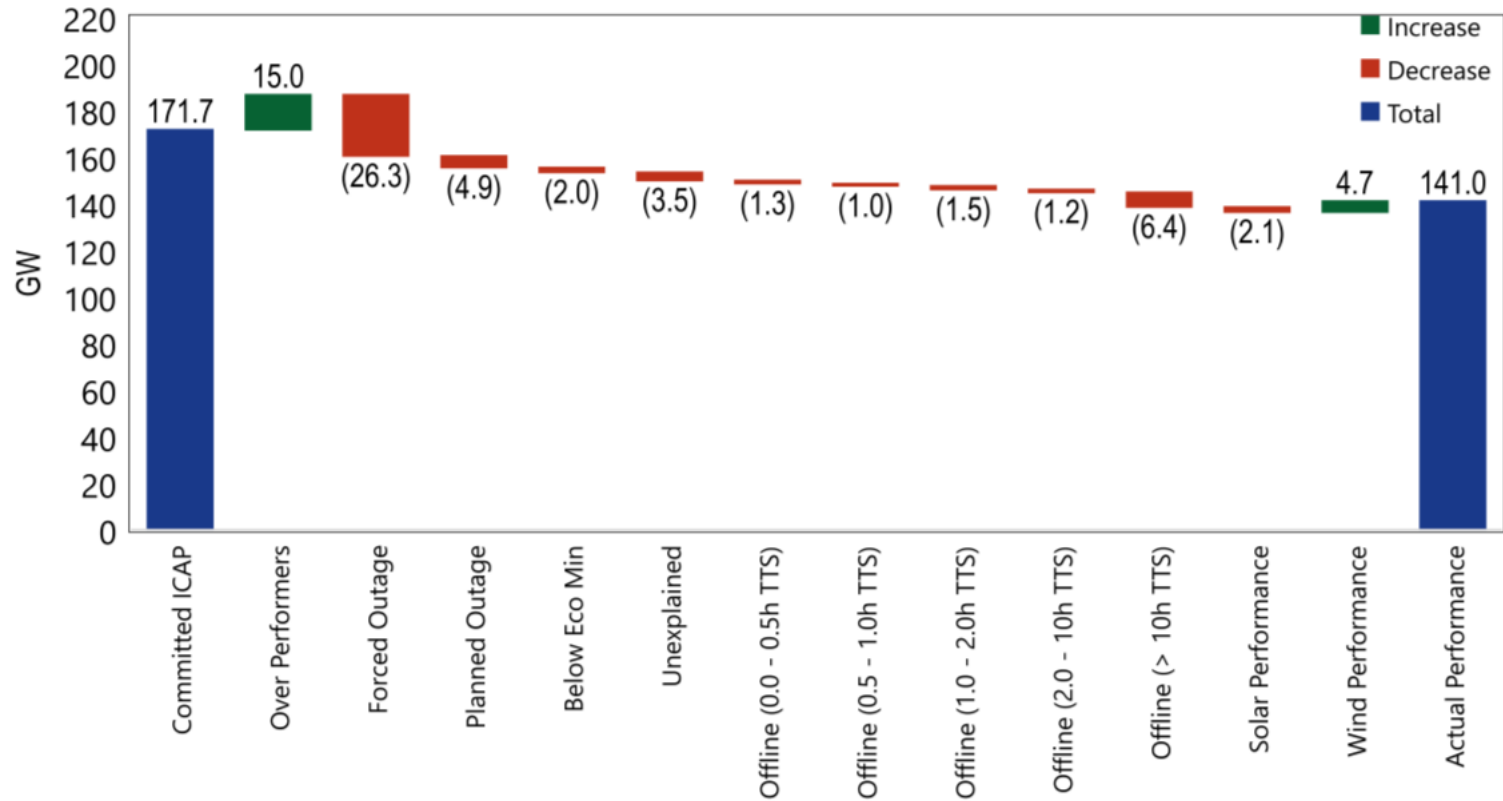
Fuel Limited Maximum Emergency

- **Several units were placed under maximum emergency in December due to low fuel and/or consumables limitations.**
- **Low inventory is only a valid reason for maximum emergency if the unit also meets the OA criteria:**
 - ***Fuel Limits: If physical events beyond the control of the resource owner result in the temporary interruption of fuel supply and there is limited onsite fuel storage. A fuel supplier's exercise of a contractual right to interrupt supply or delivery under an interruptible service agreement shall not qualify as an event beyond the control of the resource owner.***

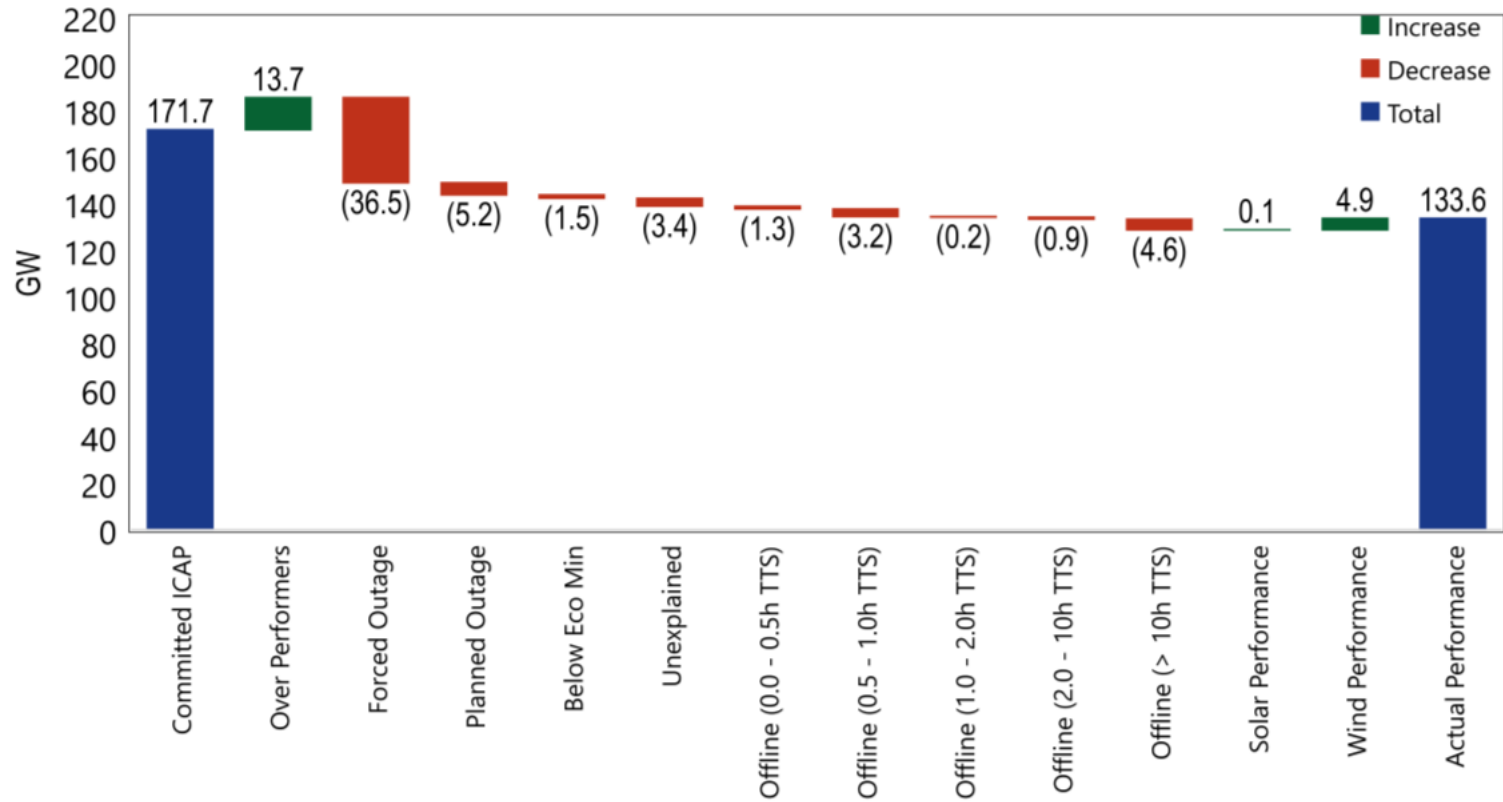
Fuel Limited Maximum Emergency

- **Maximum emergency should only be used when there is an interruption of supply of the commodity. It should not be used for low inventory caused by running the unit. It should not be used for not having contingency plans for extended runs. It should not be used for not having contractual arrangements to secure the commodity.**
- **PJM continues to not have clear rules regarding low inventory scenarios. PJM and stakeholders rejected the Market Monitor's max emergency solution, including clarifying under which situations maximum emergency is valid and that low inventories include consumables.**

December 23 – 18:25 Performance



December 24 – 09:30 Performance



Performance

- **PJM has 186.1 GW of capacity (internal to PJM and pseudo tied into PJM).**
 - **3.0 GW is exported to other RTOs/BAs.**
 - **11.4 GW is not committed in RPM.**
 - **Balance is 171.7 GW.**
- **Actual Performance = Positive RT Generation, Regulation and Reserve Assignments (based on Settlements).**
- **Forced and planned outages were adjusted based on unit's RPM ICAP and actual performance.**
- **Some lack of performance can be explained by units operating below economic min (i.e. starting).**

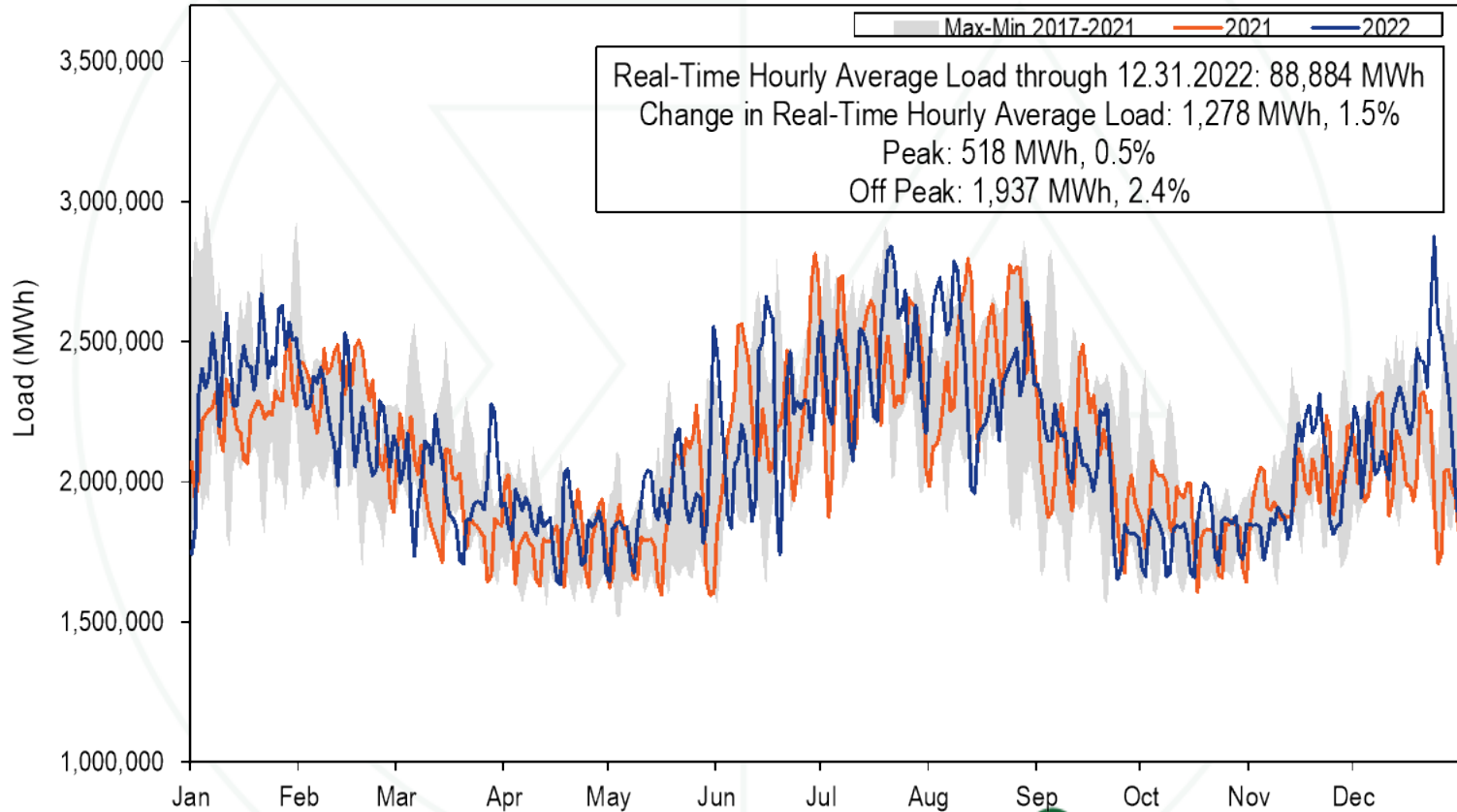
Performance: Next Steps

- **Collect clear reasons for forced outages.**
- **Approximately 3,500 MW of nonperformance from online generation and 4,000 MW of offline generation needs explanation. This is under investigation.**
- **Potential reasons:**
 - **Misreported outage/availability;**
 - **Nondispatchable generation;**
 - **Generation not following dispatch.**

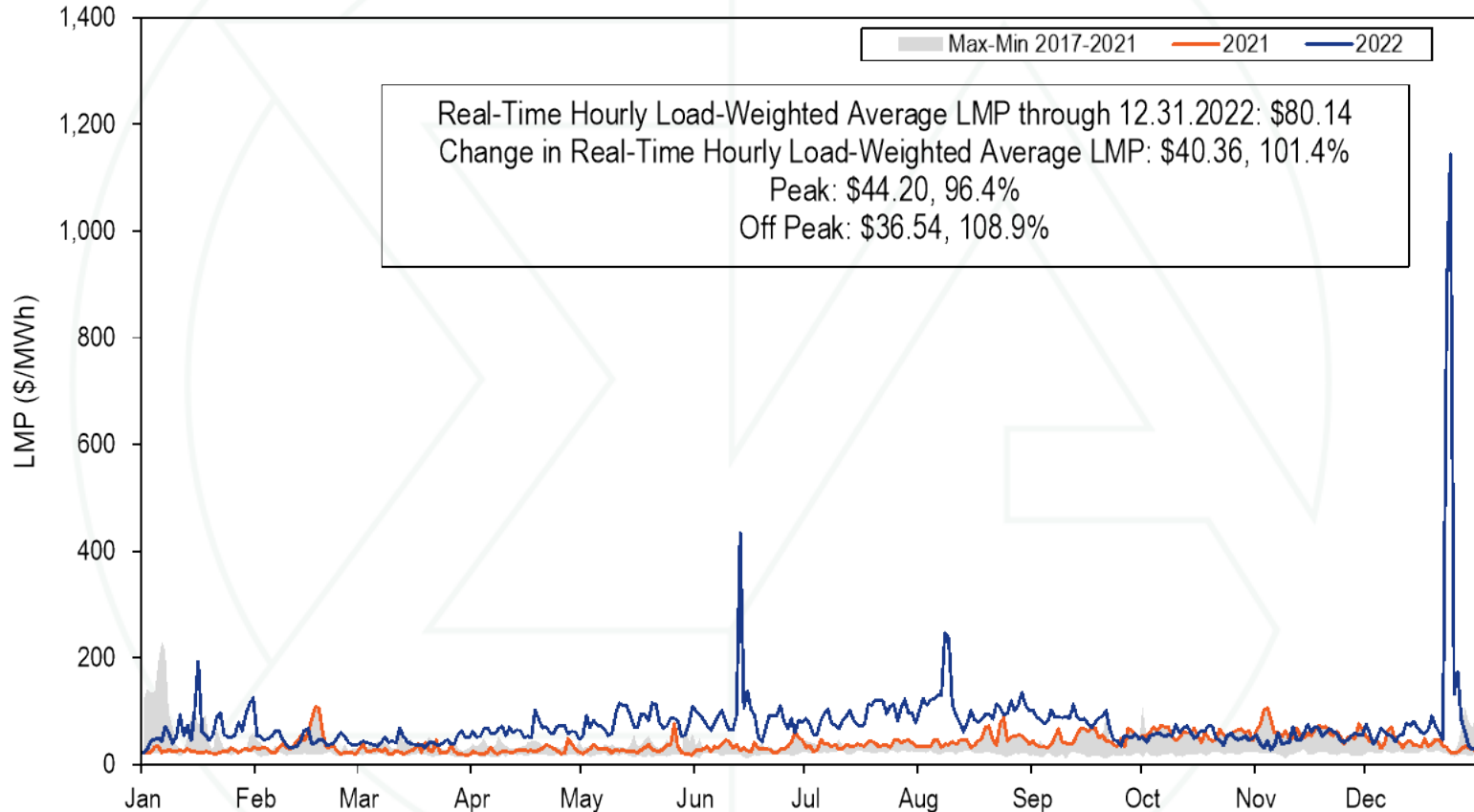
Load, LMP, and Pricing

- **Historic high load and LMP on December 23 and 24**
- **Dispatch run prices exceeded pricing run final LMPs due to price capping of the system marginal price at \$3,700 per MWh in the pricing run only.**
- **Off peak average prices exceed on peak prices in December due to high prices overnight December 23 to 24 and on the weekend and holiday, December 24 and 25.**
- **Transmission constraint penalty factors affected LMP for many hours on December 23, 24, and 25.**

2022 PJM Real-Time Daily Load



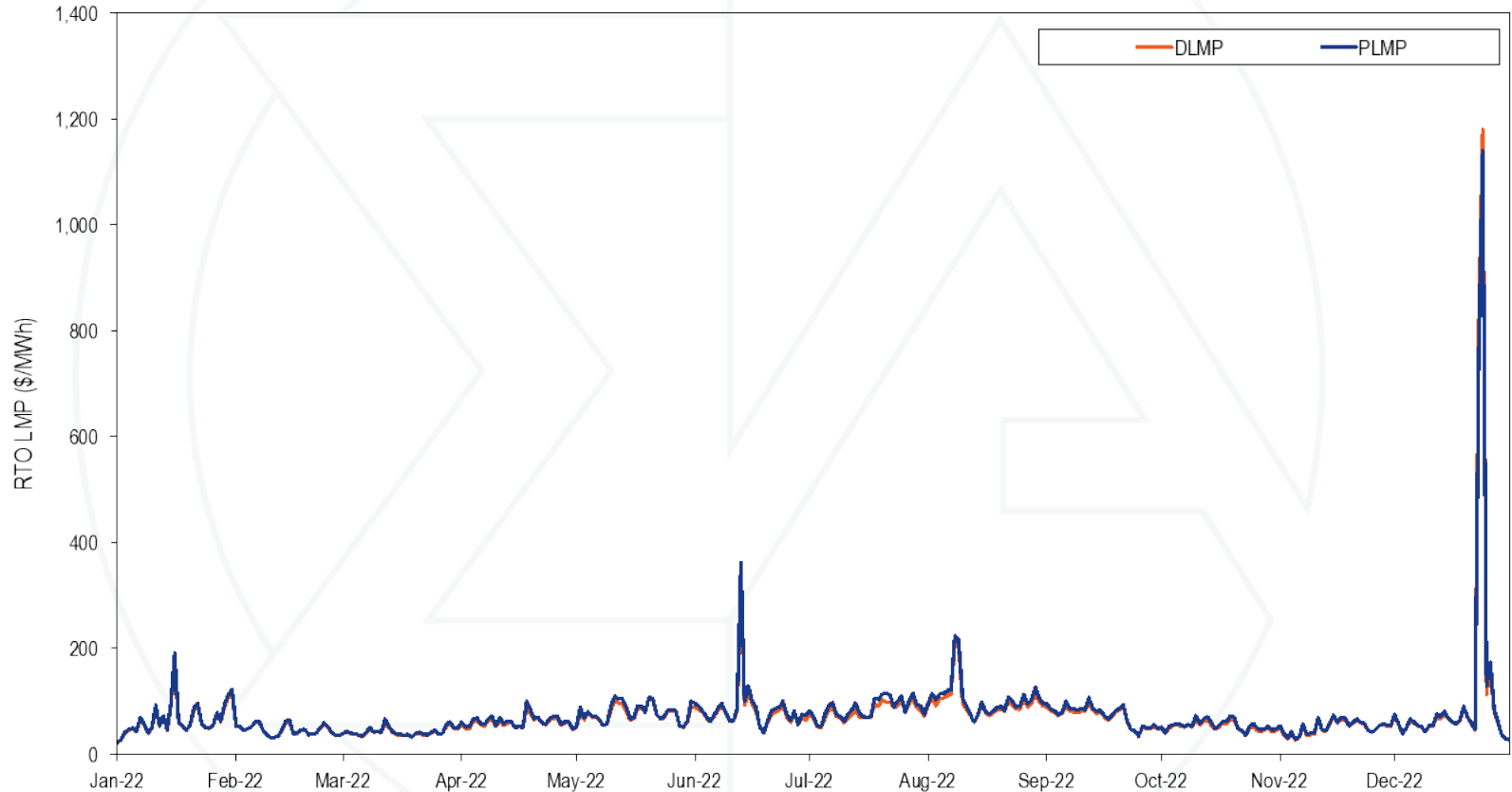
2022 PJM Real-Time Daily LMP



Monthly Average Load-Weighted DLMP and PLMP

Year	Month	Day-Ahead Load-Weighted Average				Real-Time Load-Weighted Average			
		DLMP	PLMP	Difference	Percent Difference	DLMP	PLMP	Difference	Percent Difference
2021	Sep	\$46.00	\$46.14	\$0.13	0.3%	\$47.73	\$49.63	\$1.90	4.0%
2021	Oct	\$57.86	\$57.98	\$0.12	0.2%	\$54.53	\$58.42	\$3.89	7.1%
2021	Nov	\$60.76	\$61.00	\$0.24	0.4%	\$59.27	\$63.01	\$3.74	6.3%
2021	Dec	\$37.74	\$37.85	\$0.11	0.3%	\$37.37	\$38.92	\$1.55	4.2%
2021	Sep - Dec	\$50.30	\$50.46	\$0.15	0.3%	\$49.47	\$52.20	\$2.73	5.5%
2022	Jan	\$64.57	\$64.80	\$0.22	0.3%	\$66.43	\$69.06	\$2.64	4.0%
2022	Feb	\$49.96	\$50.35	\$0.39	0.8%	\$45.93	\$46.76	\$0.83	1.8%
2022	Mar	\$45.25	\$45.50	\$0.25	0.6%	\$41.83	\$43.56	\$1.73	4.1%
2022	Apr	\$64.10	\$64.18	\$0.08	0.1%	\$60.38	\$63.91	\$3.52	5.8%
2022	May	\$83.17	\$83.24	\$0.06	0.1%	\$79.04	\$83.16	\$4.12	5.2%
2022	Jun	\$90.24	\$90.54	\$0.29	0.3%	\$91.44	\$97.89	\$6.46	7.1%
2022	Jul	\$96.07	\$96.38	\$0.32	0.3%	\$84.03	\$92.48	\$8.45	10.1%
2022	Aug	\$106.18	\$106.07	-\$0.10	(0.1%)	\$105.68	\$113.74	\$8.06	7.6%
2022	Sep	\$82.86	\$82.80	-\$0.06	(0.1%)	\$74.08	\$78.29	\$4.22	5.7%
2022	Oct	\$58.30	\$58.37	\$0.07	0.1%	\$52.27	\$55.90	\$3.63	6.9%
2022	Nov	\$56.29	\$55.24	-\$1.05	(1.9%)	\$50.86	\$52.93	\$2.07	4.1%
2022	Dec	\$93.02	\$93.39	\$0.37	0.4%	\$143.65	\$142.22	-\$1.42	(1.0%)
2022	Jan - Dec	\$75.35	\$75.44	\$0.08	0.1%	\$76.34	\$80.14	\$3.80	5.0%

Daily Average Real-Time DLMP and PLMP



Hourly Difference: PLMP – DLMP



Fast Start Units as a Percent of Marginal Units

Month	Dispatch Run				Pricing Run			
	CT	Diesel	Wind	All Fast Start Units	CT	Diesel	Wind	All Fast Start Units
Sep	1.3%	0.3%	0.2%	1.8%	5.0%	0.9%	0.2%	6.2%
Oct	0.6%	0.2%	0.3%	1.2%	3.3%	0.5%	0.3%	4.0%
Nov	0.5%	0.2%	0.4%	1.1%	3.5%	0.5%	0.4%	4.4%
Dec	0.9%	0.1%	0.1%	1.2%	4.6%	0.3%	0.1%	5.0%
Jan	1.3%	0.3%	0.2%	1.8%	4.9%	0.9%	0.2%	6.2%
Feb	0.6%	0.2%	0.3%	1.1%	3.2%	0.5%	0.3%	4.0%
Mar	0.5%	0.2%	0.4%	1.1%	3.4%	0.5%	0.4%	4.4%
Apr	0.8%	0.1%	0.1%	1.2%	4.4%	0.3%	0.1%	5.0%
May	1.4%	0.7%	0.1%	2.4%	6.6%	1.2%	0.1%	8.1%
Jun	2.3%	0.3%	0.1%	2.6%	9.3%	0.8%	0.1%	10.2%
Jul	2.7%	0.6%	0.1%	3.3%	16.3%	1.4%	0.0%	17.7%
Aug	2.0%	0.4%	0.0%	2.4%	12.0%	1.3%	0.0%	13.3%
Sep	0.8%	0.3%	0.1%	1.2%	5.6%	1.0%	0.1%	6.7%
Oct	2.2%	0.2%	0.3%	2.6%	6.6%	0.9%	0.2%	7.7%
Nov	1.3%	0.2%	0.2%	1.7%	5.1%	0.9%	0.2%	6.1%
Dec	1.2%	0.3%	0.0%	1.6%	6.3%	0.8%	0.0%	7.1%

Fast Start Impacts: Zonal Average Differences

Zone	2022							
	Day-Ahead				Real-Time			
	Average DLMP	Average PLMP	Difference	Percent Difference	Average DLMP	Average PLMP	Difference	Percent Difference
ACEC	\$62.81	\$62.97	\$0.16	0.3%	\$63.13	\$65.76	\$2.63	4.2%
AEP	\$69.95	\$70.09	\$0.15	0.2%	\$68.74	\$72.02	\$3.28	4.8%
APS	\$70.97	\$71.19	\$0.22	0.3%	\$69.54	\$72.98	\$3.44	4.9%
ATSI	\$69.27	\$69.44	\$0.18	0.3%	\$67.21	\$70.45	\$3.23	4.8%
BGE	\$81.65	\$81.83	\$0.18	0.2%	\$80.53	\$84.65	\$4.12	5.1%
COMED	\$60.26	\$60.39	\$0.13	0.2%	\$57.97	\$60.90	\$2.94	5.1%
DAY	\$72.43	\$72.59	\$0.16	0.2%	\$70.83	\$74.22	\$3.40	4.8%
DUKE	\$71.12	\$71.27	\$0.15	0.2%	\$69.28	\$72.62	\$3.34	4.8%
DOM	\$84.12	\$83.56	-\$0.56	(0.7%)	\$85.78	\$89.37	\$3.59	4.2%
DPL	\$67.25	\$67.43	\$0.18	0.3%	\$67.95	\$71.57	\$3.62	5.3%
DUQ	\$68.01	\$68.18	\$0.18	0.3%	\$66.31	\$69.51	\$3.20	4.8%
EKPC	\$70.30	\$70.44	\$0.14	0.2%	\$69.60	\$72.89	\$3.29	4.7%
JOPLC	\$64.02	\$64.19	\$0.17	0.3%	\$64.51	\$67.30	\$2.80	4.3%
MEC	\$73.12	\$73.27	\$0.15	0.2%	\$71.84	\$75.09	\$3.25	4.5%
OVEC	\$68.49	\$68.64	\$0.15	0.2%	\$66.99	\$70.18	\$3.20	4.8%
PECO	\$61.64	\$61.80	\$0.16	0.3%	\$61.91	\$64.43	\$2.52	4.1%
PE	\$68.50	\$68.68	\$0.19	0.3%	\$66.55	\$69.62	\$3.08	4.6%
PEPCO	\$78.90	\$79.07	\$0.17	0.2%	\$77.90	\$81.80	\$3.90	5.0%
PPL	\$67.50	\$67.66	\$0.16	0.2%	\$66.74	\$69.69	\$2.95	4.4%
PSEG	\$64.82	\$64.99	\$0.17	0.3%	\$65.44	\$68.27	\$2.83	4.3%
REC	\$67.13	\$67.29	\$0.17	0.2%	\$67.16	\$70.15	\$2.99	4.4%

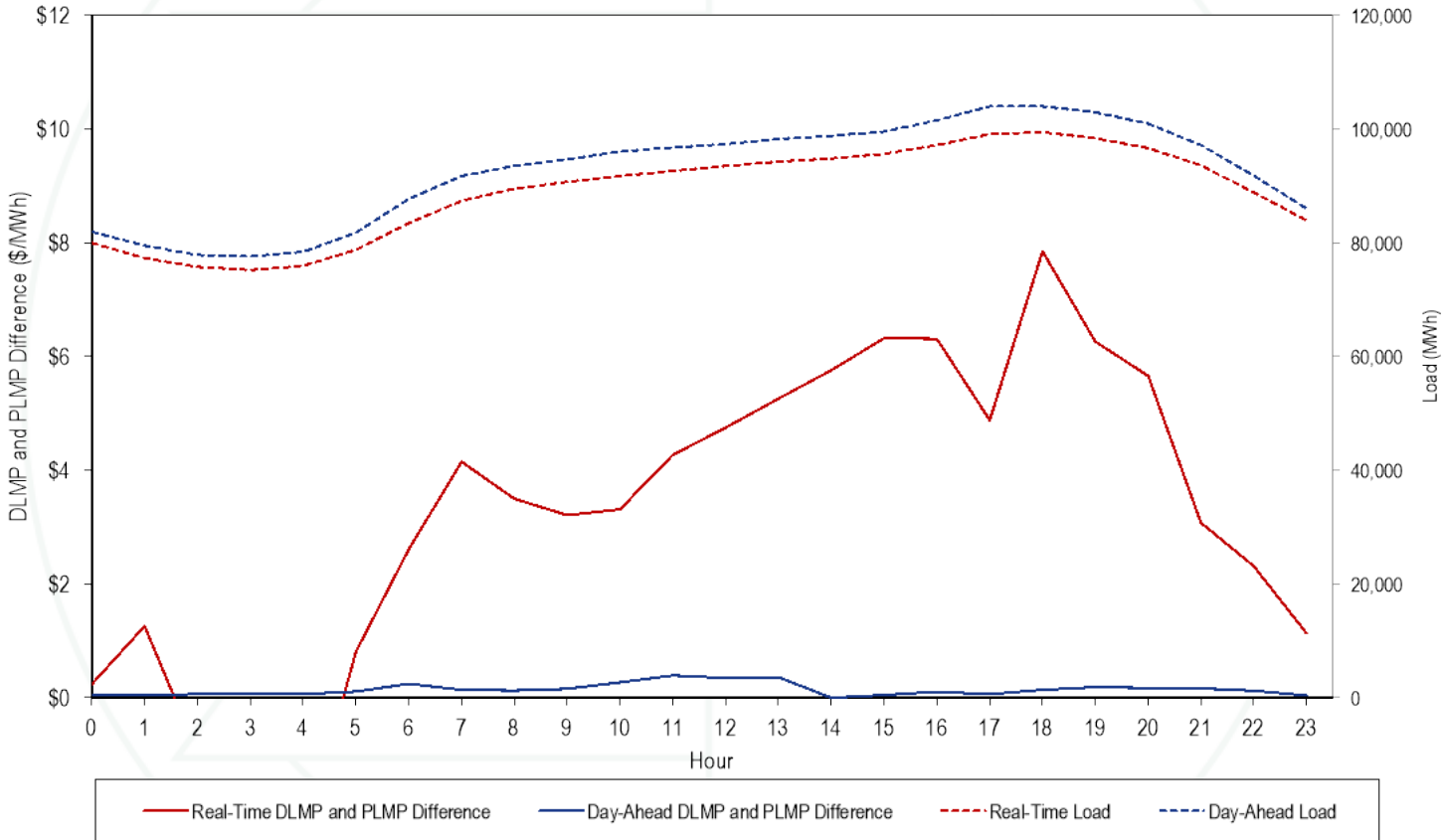
Fast Start Impacts: Hub Average Differences

Hub	2022							
	Day-Ahead				Real-Time			
	Average DLMP	Average PLMP	Difference	Percent Difference	Average DLMP	Average PLMP	Difference	Percent Difference
AEP GEN HUB	\$67.92	\$68.08	\$0.16	0.2%	\$66.11	\$69.25	\$3.14	4.7%
AEP-DAYTON HUB	\$69.26	\$69.41	\$0.15	0.2%	\$67.45	\$70.68	\$3.23	4.8%
ATSI GEN HUB	\$67.90	\$68.07	\$0.18	0.3%	\$65.60	\$68.74	\$3.14	4.8%
CHICAGO GEN HUB	\$59.32	\$59.45	\$0.13	0.2%	\$56.89	\$59.80	\$2.90	5.1%
CHICAGO HUB	\$60.52	\$60.65	\$0.13	0.2%	\$58.19	\$61.15	\$2.96	5.1%
DOMINION HUB	\$76.47	\$76.50	\$0.03	0.0%	\$76.04	\$79.56	\$3.52	4.6%
EASTERN HUB	\$67.31	\$67.50	\$0.18	0.3%	\$67.29	\$70.80	\$3.51	5.2%
N ILLINOIS HUB	\$60.03	\$60.17	\$0.13	0.2%	\$57.79	\$60.71	\$2.92	5.1%
NEW JERSEY HUB	\$64.15	\$64.31	\$0.17	0.3%	\$64.64	\$67.42	\$2.78	4.3%
OHIO HUB	\$69.14	\$69.30	\$0.15	0.2%	\$67.28	\$70.51	\$3.23	4.8%
WEST INT HUB	\$71.04	\$71.13	\$0.09	0.1%	\$69.37	\$72.66	\$3.29	4.7%
WESTERN HUB	\$72.90	\$73.09	\$0.18	0.3%	\$70.82	\$74.25	\$3.43	4.8%

Zonal PLMP-DLMP Difference Frequency

Zone	2022									
	< (\$50)	(\$50) to (\$10)	(\$10) to \$0	\$0	\$0 to \$10	\$10 to \$20	\$20 to \$50	\$50 to \$100	\$100 to \$200	>= \$200
PJM-RTO	0.1%	0.0%	0.6%	48.0%	39.7%	6.7%	4.3%	0.5%	0.1%	0.0%
AECO	0.1%	0.2%	6.7%	48.3%	35.5%	4.9%	3.6%	0.6%	0.1%	0.0%
AEP	0.1%	0.0%	0.8%	48.1%	39.4%	6.8%	4.3%	0.5%	0.1%	0.0%
APS	0.1%	0.0%	0.6%	48.1%	39.2%	6.9%	4.4%	0.5%	0.2%	0.0%
ATSI	0.0%	0.0%	0.8%	48.0%	39.8%	6.6%	4.2%	0.5%	0.1%	0.0%
BGE	0.1%	0.1%	2.6%	48.0%	35.5%	7.1%	5.4%	1.1%	0.2%	0.0%
COMED	0.0%	0.1%	1.9%	48.3%	39.0%	6.2%	3.9%	0.4%	0.1%	0.0%
DAY	0.0%	0.0%	0.7%	48.1%	39.1%	6.9%	4.5%	0.5%	0.1%	0.0%
DEOK	0.1%	0.0%	0.9%	48.1%	39.0%	7.0%	4.3%	0.5%	0.1%	0.0%
DOM	0.1%	0.3%	1.9%	48.1%	36.9%	6.7%	4.9%	0.8%	0.1%	0.0%
DPL	0.1%	0.3%	10.8%	48.2%	30.6%	4.6%	3.4%	1.4%	0.5%	0.0%
DUQ	0.0%	0.0%	0.8%	48.1%	39.8%	6.5%	4.1%	0.5%	0.1%	0.0%
EKPC	0.0%	0.0%	0.9%	48.1%	39.2%	6.9%	4.3%	0.5%	0.1%	0.0%
JCPL	0.1%	0.1%	3.3%	48.2%	38.9%	5.1%	3.7%	0.6%	0.1%	0.0%
METED	0.1%	0.3%	2.0%	48.0%	38.7%	6.1%	4.0%	0.8%	0.1%	0.0%
OVEC	0.1%	0.0%	1.0%	48.1%	39.4%	6.8%	4.1%	0.5%	0.1%	0.0%
PECO	0.1%	0.2%	9.6%	48.2%	32.8%	4.9%	3.5%	0.6%	0.1%	0.0%
PENELEC	0.1%	0.1%	0.7%	47.9%	40.2%	6.6%	3.9%	0.4%	0.0%	0.0%
PEPCO	0.1%	0.1%	2.3%	48.0%	36.3%	7.0%	5.1%	0.9%	0.1%	0.0%
PPL	0.1%	0.1%	2.0%	48.0%	39.7%	5.8%	3.7%	0.6%	0.1%	0.0%
PSEG	0.1%	0.1%	2.9%	48.2%	39.0%	5.2%	3.8%	0.6%	0.1%	0.0%
RECO	0.1%	0.1%	1.7%	48.1%	40.0%	5.5%	3.9%	0.6%	0.1%	0.0%

Hourly Average Load and LMP Difference: 2022



Real-Time Monthly Average On Peak and Off Peak Load-Weighted LMP

	2021				2022			
	Off Peak	On Peak	Difference	Percent Difference	Off Peak	On Peak	Difference	Percent Difference
Jan	\$23.53	\$27.45	\$3.91	16.6%	\$74.99	\$62.54	(\$12.46)	(16.6%)
Feb	\$35.40	\$46.40	\$11.01	31.1%	\$45.70	\$47.86	\$2.16	4.7%
Mar	\$23.98	\$28.43	\$4.45	18.6%	\$41.58	\$45.41	\$3.83	9.2%
Apr	\$22.60	\$30.45	\$7.86	34.8%	\$55.93	\$71.89	\$15.96	28.5%
May	\$22.58	\$36.80	\$14.23	63.0%	\$66.12	\$100.85	\$34.73	52.5%
Jun	\$27.50	\$39.88	\$12.38	45.0%	\$61.63	\$126.83	\$65.20	105.8%
Jul	\$31.52	\$42.83	\$11.31	35.9%	\$71.83	\$114.14	\$42.31	58.9%
Aug	\$36.74	\$56.71	\$19.97	54.4%	\$85.89	\$136.31	\$50.42	58.7%
Sep	\$39.47	\$59.03	\$19.56	49.6%	\$66.36	\$89.76	\$23.40	35.3%
Oct	\$49.53	\$67.34	\$17.81	36.0%	\$47.61	\$64.50	\$16.90	35.5%
Nov	\$55.73	\$70.49	\$14.76	26.5%	\$45.48	\$60.50	\$15.01	33.0%
Dec	\$34.83	\$42.56	\$7.73	22.2%	\$153.54	\$129.51	(\$24.03)	(15.7%)

Top Violated Transmission Constraints

(December 23, 24 and 25)

Constraint Name	Contingency Description	Number of Five Minute Intervals	Average Shadow Price	Average reduction in line limit (Percentage)
ABINGDON-CLINCHRI B 138 KV	L500.Broadford-Sullivan (TVA) Tie	253	\$2,000	2.00%
HOWARD2-MELMORE B 138 KV	L345.SouthBerwick-Galion	204	\$2,000	5.00%
HUMMELCR-GREENTO2 TIE B 138 KV	L765.Dumont-Sorenson	142	\$2,000	5.00%
BROADFO2-SALT VILL 2 A 138 KV	L500.Broadford-Sullivan (TVA) Tie	119	\$2,000	4.98%
EWAYNESB-RINGGOLD RWA1 B 138 KV	L138.Reid-Antrim (Sctnlz)	100	\$2,000	5.00%
MAKAHOY-STRAWTON MAK-STR B 138 KV	L138.Aladdin-Strawton	95	\$2,000	5.00%
ASHBURN-COCHRANM 227A B 230 KV	L230.Beaumead-Ashburn-PleasantView.274	94	\$2,000	2.23%
PIPECREE-MULFBT AP MUL-PIP1 B 138 KV	L765.Dumont-Sorenson	91	\$2,000	5.00%
NOTTINGHAM 2-3 SER DEVA 230 KV	L500.Conastone-PeachBottom.5012	90	\$2,000	7.00%
CANYON -ETOWANDACAN-EAS B 230 KV	BASE	88	\$2,000	8.09%
PIPECREE-STRAWTON PIP-STR B 138 KV	L765.Dumont-Sorenson	75	\$2,000	5.00%
JUNIATA 1 XFORMER H 500 KV	L500.Conastone-PeachBottom.5012	68	\$2,000	1.85%
PITTSBUR-PITTS_EK TIE B 161 KV	161/69.LaurelCo.T188	68	\$2,000	1.97%
BROADFO2-KEYWOOD BRO-KEY1 A 138 KV	L500.Broadford-Sullivan (TVA) Tie	65	\$2,000	2.00%
SWLIMA-WMOULTON A 138 KV	L345.SouthWestLima-Gristmill	62	\$2,000	2.00%
LAUSCHTO-SAKRON LAU-SAK4 A 230 KV	L500.Conastone-PeachBottom.5012	52	\$2,000	5.00%
TRANSFER INTERFACE: AEP-DOM	L765.Culloden-Wyoming	51	\$2,000	3.00%
HOWARD2-MELMORE B 138 KV	BASE	44	\$2,000	5.00%
BROADFO2 T6 XFORMER H 765 KV	BASE	28	\$2,000	4.93%

Reserves

- **The MMU continues to monitor the performance of the new reserve products.**
- **Synchronized and Primary reserves were short for several hours on December 23 and 24.**
- **Settlements show large buy backs of day-ahead reserves positions, synchronized reserve penalties, and capped reserve positions when cleared reserves were not provided.**

RTO Real-Time and Day-Ahead Cleared MW

- Real-time market clearing**

Month	Synchronized Reserve MW	Nonsynchronized Reserve MW	Total Primary Reserve MW	Secondary Reserve MW	Total Thirty-Minute Reserve MW
Oct	1,832	955	2,787	1,843	4,630
Nov	1,822	1,012	2,834	1,331	4,165
Dec	1,900	965	2,865	1,131	3,996

- Day-ahead market clearing**

Month	Synchronized Reserve MW	Nonsynchronized Reserve MW	Total Primary Reserve MW	Secondary Reserve MW	Total Thirty-Minute Reserve MW
Oct	2,078	1,650	3,728	11,992	8,264
Nov	2,128	1,080	3,207	12,075	8,867
Dec	1,993	1,324	3,317	13,742	10,425

MAD Real-Time and Day-Ahead Cleared MW

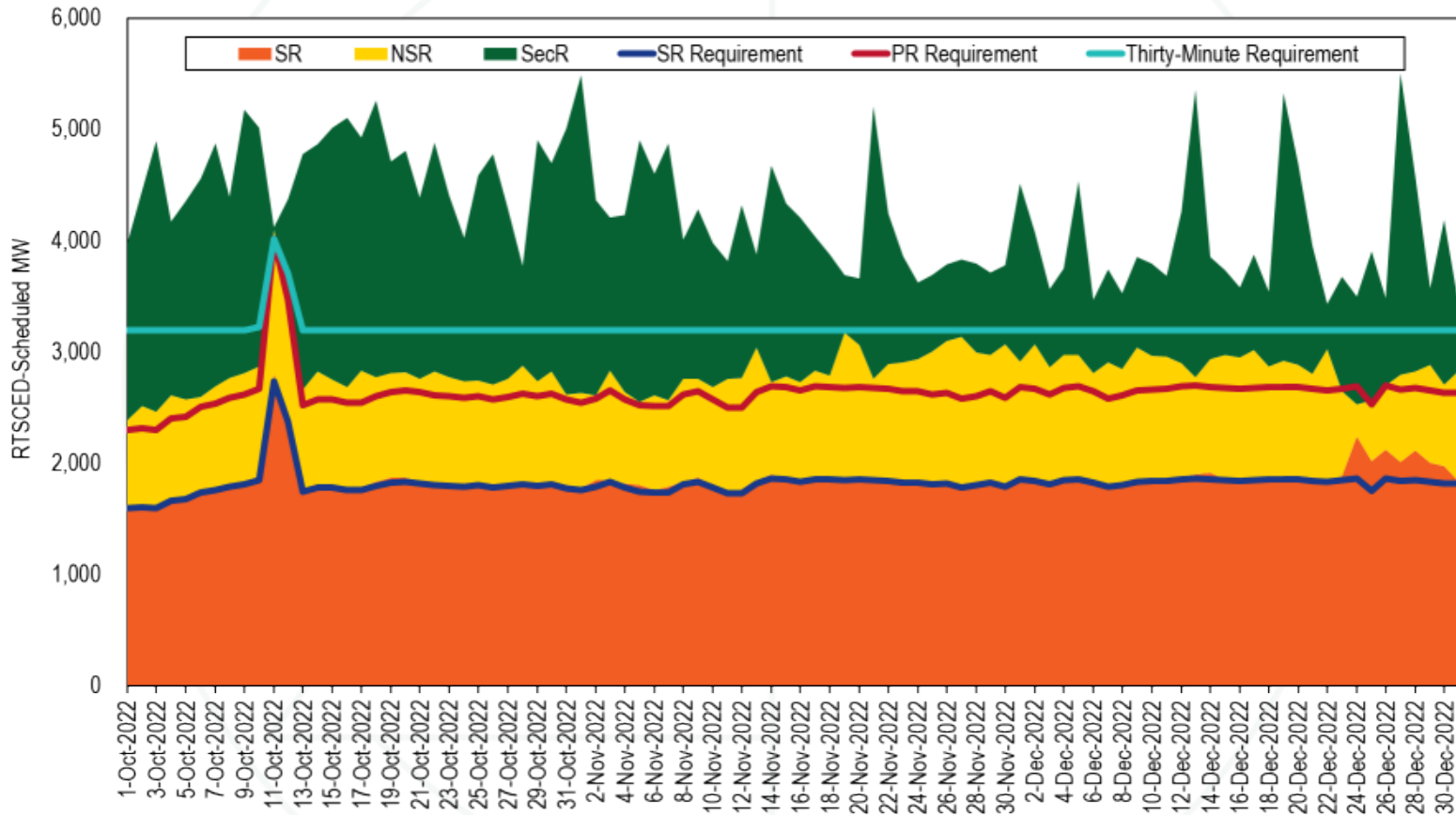
- Real-time market clearing**

Month	Synchronized Reserve MW	Nonsynchronized Reserve MW	Total Primary Reserve MW	Secondary Reserve MW	Total Thirty-Minute Reserve MW
Oct	1,831	810	2,641	NA	NA
Nov	1,820	857	2,677	NA	NA
Dec	1,896	823	2,719	NA	NA

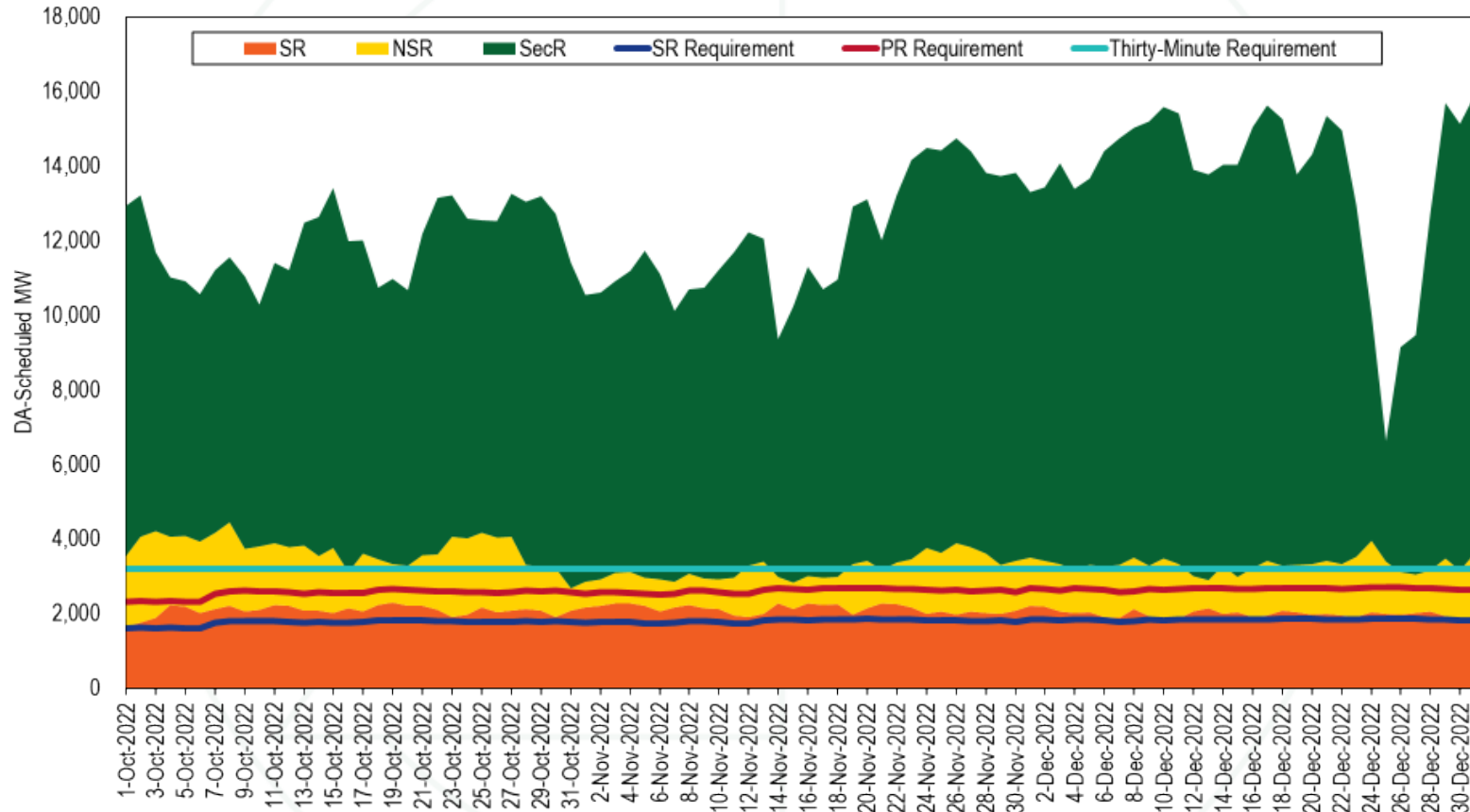
- Day-ahead market clearing**

Month	Synchronized Reserve MW	Nonsynchronized Reserve MW	Total Primary Reserve MW	Secondary Reserve MW	Total Thirty-Minute Reserve MW
Oct	1,926	815	2,740	NA	NA
Nov	1,994	930	2,924	NA	NA
Dec	1,941	1,062	3,004	NA	NA

Real-Time Reserves and Requirements



Day-Ahead Reserves and Requirements



Reserve Settlements by Month

- Synchronized**

Year	Month	Total	Total	Total	Total	Total
		Day-Ahead	Balancing	LOC	Shotfall	
		Credits	MCP	Credits	Charges	Credits
2022	Oct	676,211	(67,992)	1,711,285	19,273	2,300,231
2022	Nov	2,275,752	(121,388)	1,357,764	14,882	3,497,246
2022	Dec	4,874,437	(12,713,479)	14,121,464	14,636,427	(8,354,005)

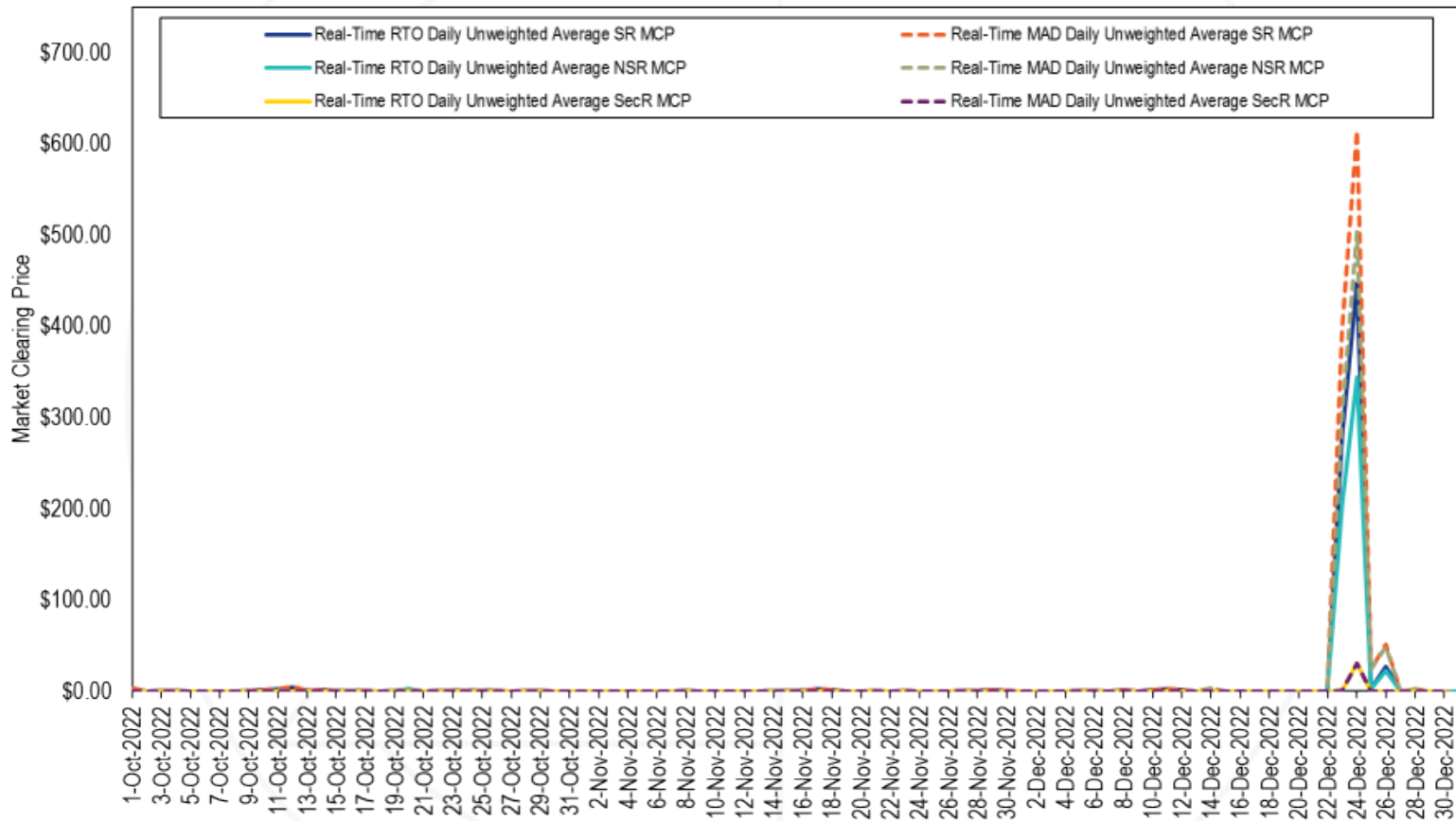
- Nonsynchronized**

Year	Month	Total	Total	Total	Total	Total
		Day-Ahead	Balancing	LOC	Shortfall	
		Credits	MCP	Credits	Charges	Credits
2022	Oct	137,051	(13,639)	1,051	NA	124,464
2022	Nov	395,965	1,731	0	NA	397,696
2022	Dec	292,838	(24,666,147)	608,585	NA	(23,764,724)

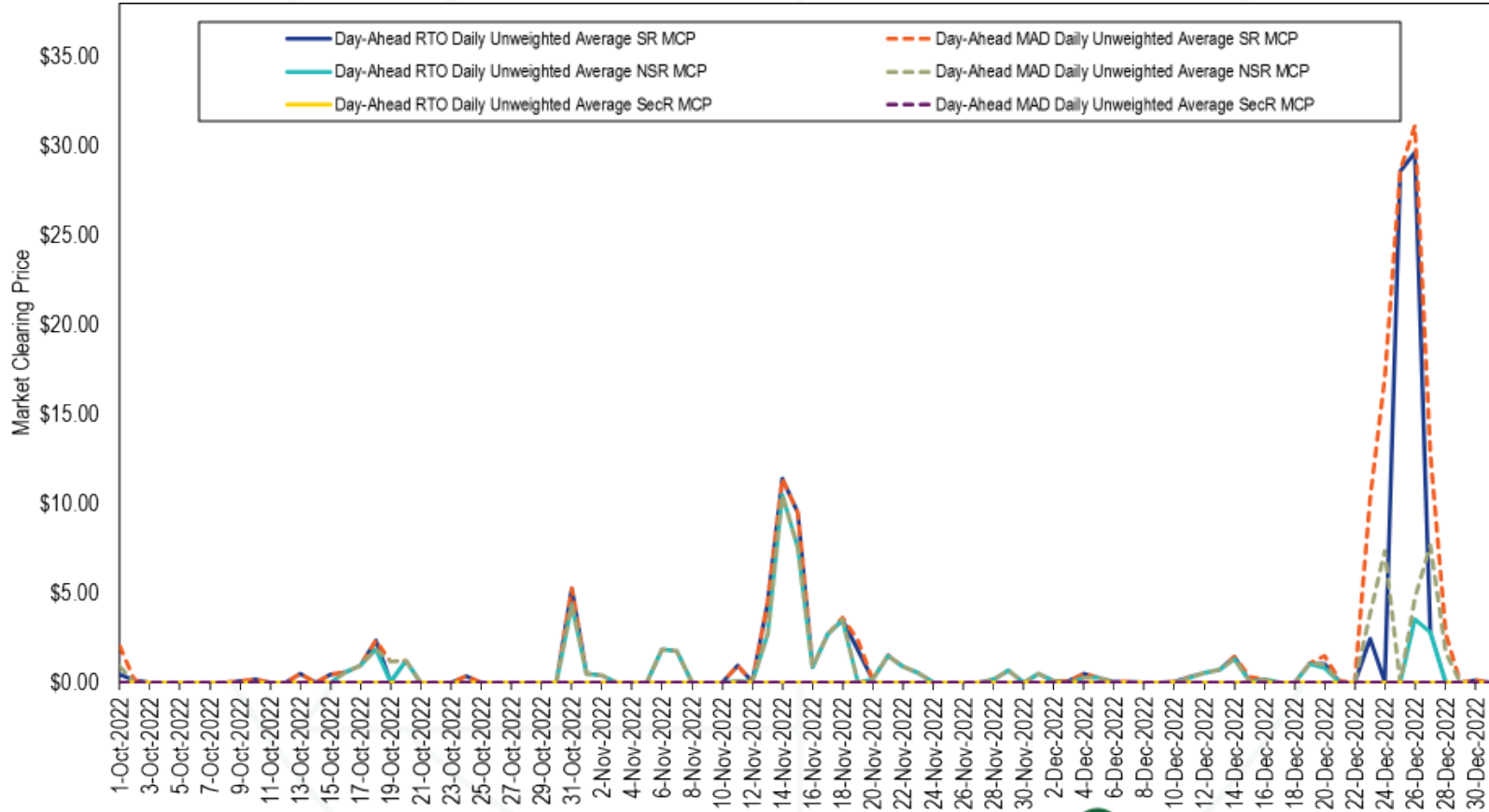
- Secondary**

Year	Month	Total	Total	Total	Total	Total
		Day-Ahead	Balancing	LOC	Effective	
		Credits	MCP	Credits	Shortfall	Credits
2022	Oct	0	0	61,173	0	61,173
2022	Nov	0	0	10,667	0	10,667
2022	Dec	0	(3,780,047)	4,452,344	0	672,296

Real-Time Daily Average Reserve Prices



Day-Ahead Daily Average Reserve Prices



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