PJM's Proposed Changes to Reserve Requirements

MRC

5/31/2023

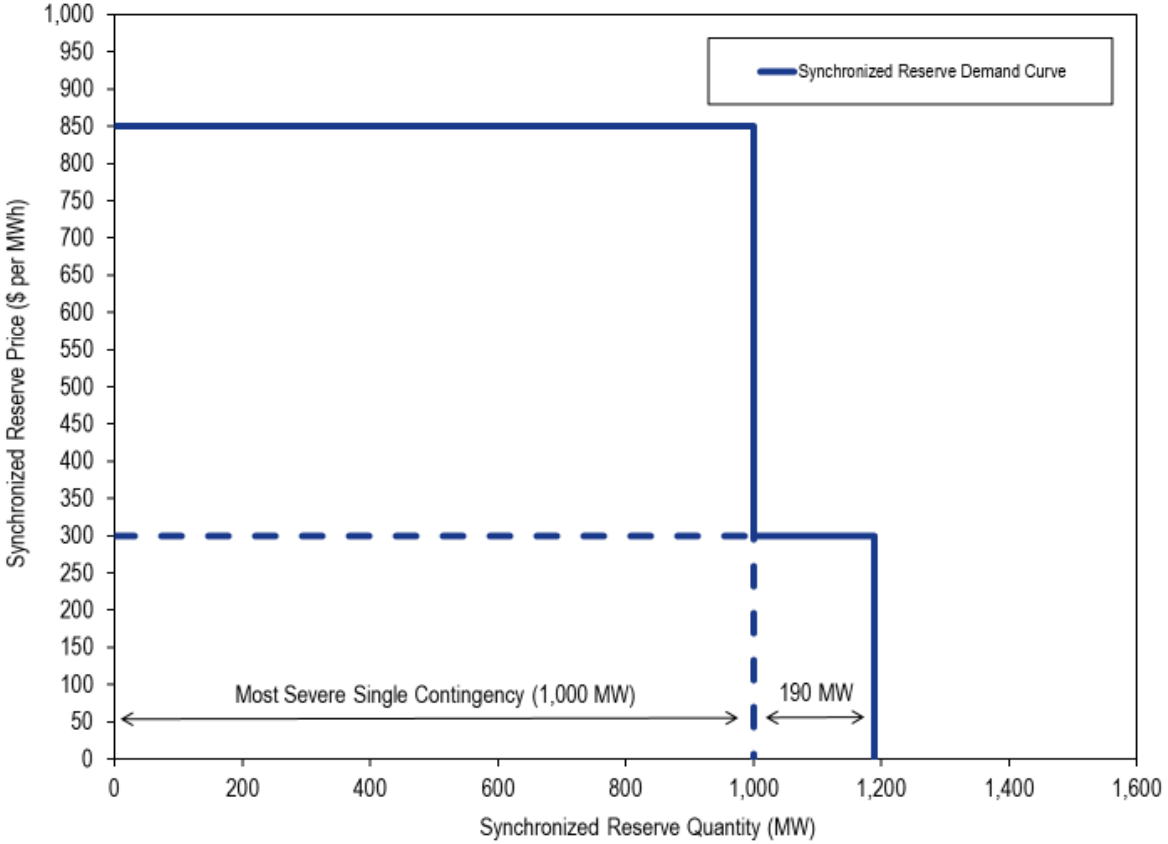
IMM

Monitoring Analytics

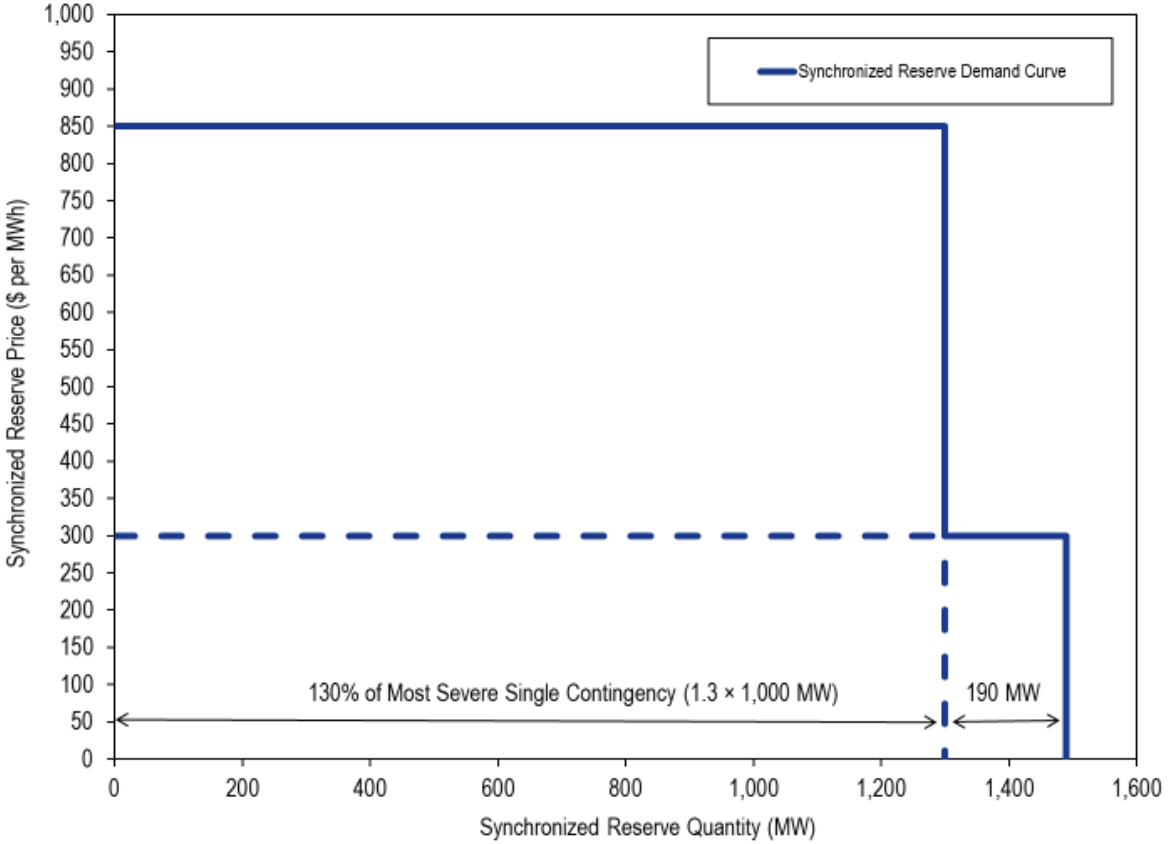
PJM Changes to the Reserve Requirements

- On May 12, 2023, PJM took unilateral action to increase reserve requirements without stakeholder or FERC approval.
- PJM's stated reasons include
  - A decline in synchronized reserve event response rates since October 1, 2022.
  - A potential NERC Disturbance Control Standard violation on December 23, 2022.
- The initial reserve requirement increases were removed on May 16, 2023.
- Modified reserve increases were implemented on May 19, 2023.

RTO ORDC (MSSC = 1,000 MW) (pre May)

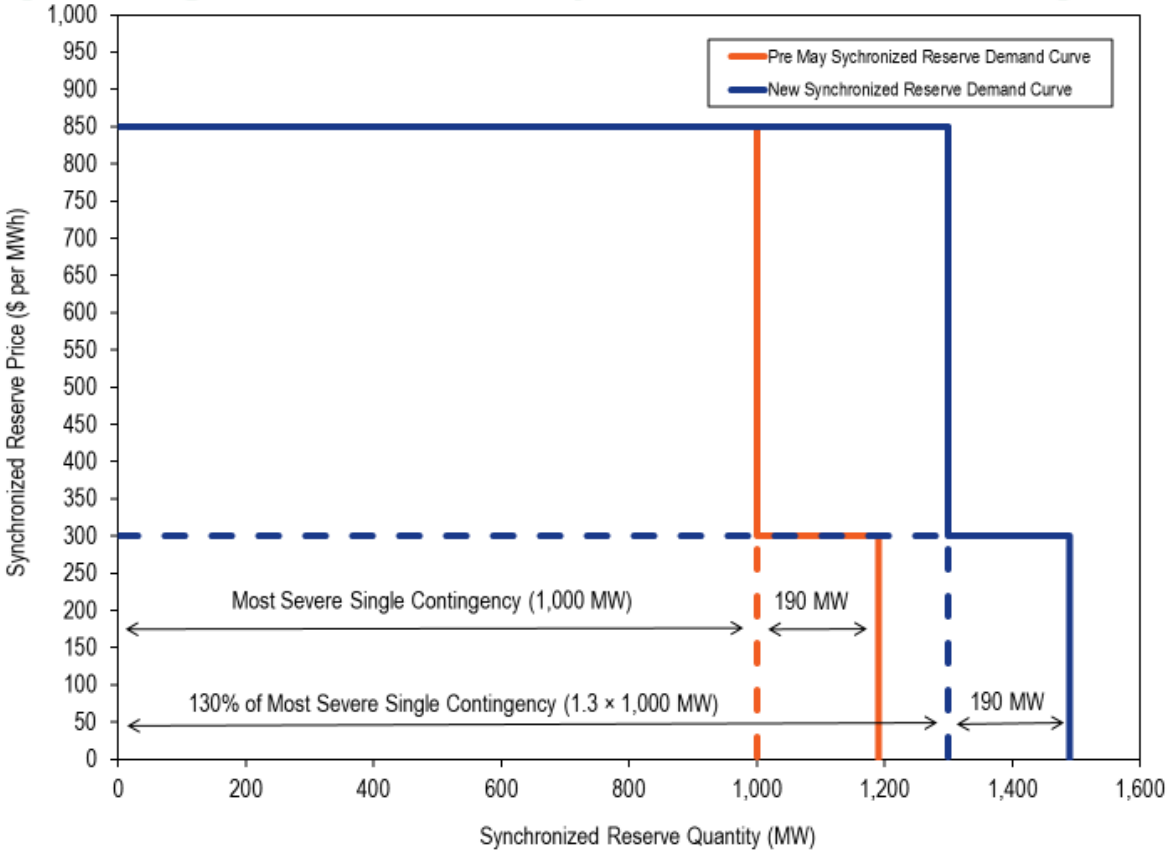


PJM Proposed RTO ORDC (MSSC = 1,000 MW)



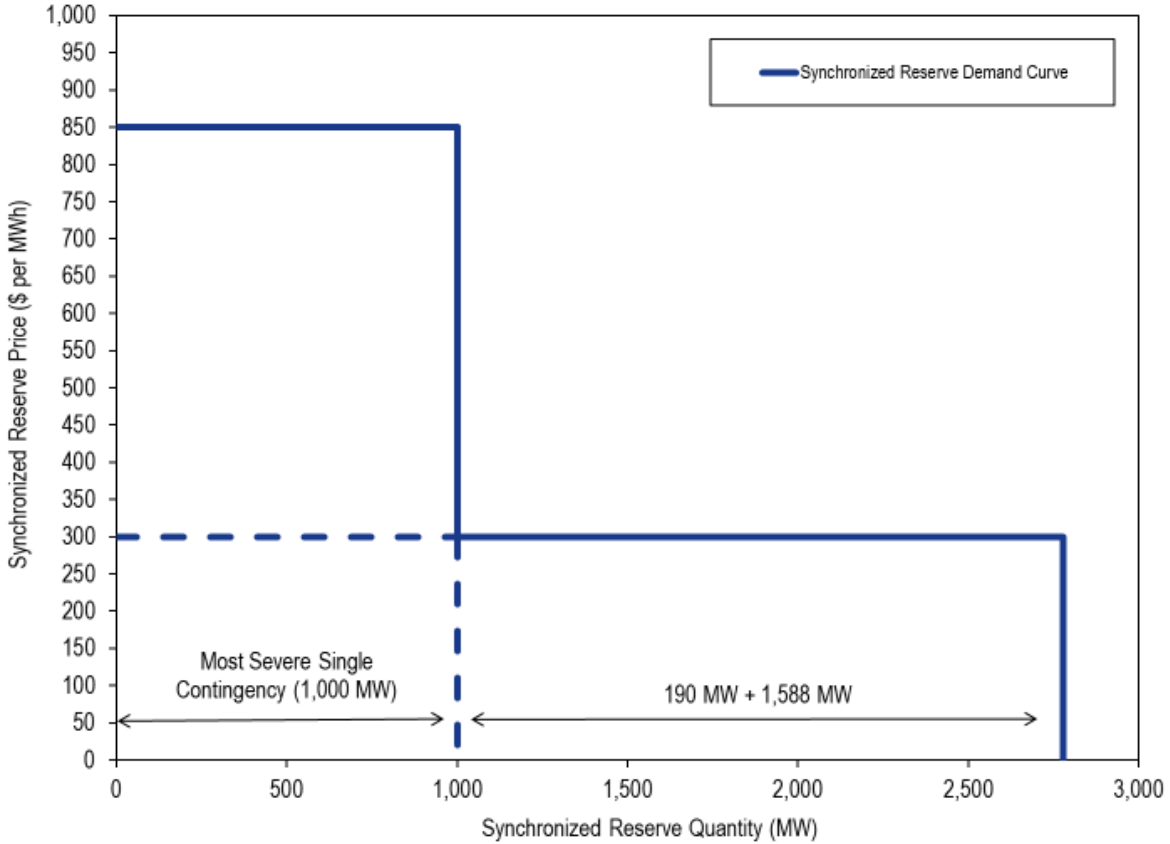
Monitoring Analytics

Comparison of Pre May with PJM Proposal



Monitoring Analytics

PJM May 12: Added 1,588 MW to Second Step



Monitoring Analytics

Synchronized Reserve Event Response

- **The data on synchronized reserve event recovery do not support the conclusion that there is an immediate need to change how reserves clear.**
- **It is not clear that PJM has the authority to or a valid basis for increasing the reserve requirements.**
- **If PJM insists on an immediate change, the focus should be on correcting the supply of reserves rather than increasing demand.**

Failure of Reserves to Respond

- **PJM approach:**
  - **Reserves are responding at an average rate of about 50 percent during spin events.**
  - **PJM solution is to buy twice as many MW of reserves.**
  - **PJM is overpaying for reserve MW**
  - **PJM is paying for 1 MW but receiving 0.5 MW**
  - **PJM solution is to pay for 2 MW in order to receive 1 MW**

Failure of Reserves to Respond

- **IMM proposal:**
  - **IMM proposal is to pay for 0.5 MW from the underperforming unit**
    - Pay for unit specific MW
  - **IMM proposal is to pay for 0.5 MW from each of two underperforming units**
  - **Result is to pay for 1 MW and to receive 1 MW of reserves.**
  - **IMM proposal is to buy the correct amount of reserves.**
    - No increase in demand is required
    - There has been no change in the need for/demand for reserves

Failure of Reserves to Respond

- PJM focuses on the demand for reserves.
  - The demand for reserves is correctly defined and does not need to be increased.
- PJM ignores the supply side
  - The issue is that resources have not provided the reserves that were offered and paid for.
- The solution is not to buy more MW of poorly performing reserves
- The solution is to accurately recognize the actual supply of reserves
- The solution is to buy the correct amount of reserves, accounting for the actual performance of supply.

Failure of Reserves to Respond

- PJM solution should not be implemented.
- Focus on supply side should be implemented immediately:
  - Buy required reliable MW, based on actual performance
  - Pay only for reliable MW based on actual performance
  - Do not pay for MW not provided
  - Do not pay LOC for MW not provided and therefore with no LOC (lost opportunity cost)
- Demand for reserves does not need modification
  - PJM has not said that the need for reserves has changed.

Failure of Reserves to Respond

- **Detailed, unit by unit analysis of the reasons for poor performance is needed.**
- **Potential issues:**
  - **Discontinuities in offer curves**
  - **Accuracy of PJM ramp rates**
  - **Ambient derates**
  - **Fuel availability**
  - **Demand side resource response**
  - **Failure to follow dispatch**
  - **Incorrect eco max or spin max**

Failure of Reserves to Respond

- Generators have a reserve must offer requirement.
- Generators are required to submit accurate ramp rates.
- Generators are required to submit accurate ratings.
- Generators are required to follow PJM's instructions.
- Generators clearing reserves and not deploying them are physically withholding.
- Generators clearing reserves and not deploying them are in violation of the OATT. Unless there is a physical reason (forced outage).

Failure of Reserves to Respond

- **Synchronized reserve events are the only recurrent events in which unit performance is measured.**
- **Failure to deploy reserves is the same as not providing energy.**
- **Not providing energy/reserves when requested is a violation of the ICAP must offer requirement.**
- **Lack of response means data inputs (ramp rates, time to start for condensers, and eco max) are not correct. It is the responsibility of market participants to correct their parameters.**

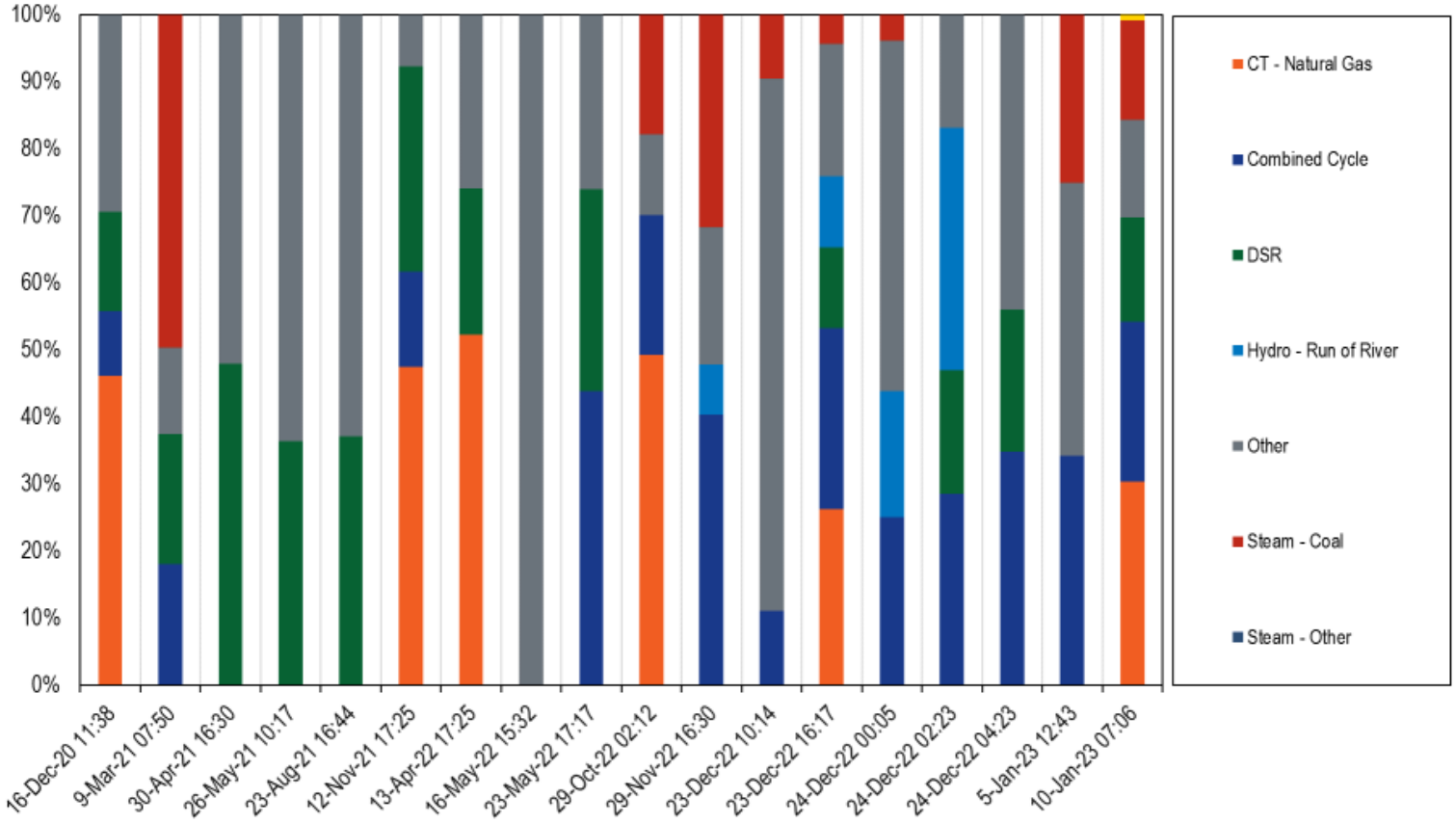
Distribution of Shortfall MW: October 2022 through April 2023 (excluding Winter Storm Elliot)

Events included:

- **October 29, 2022**
- **November 29, 2022**
- **January 5, 2023**
- **January 10, 2023**

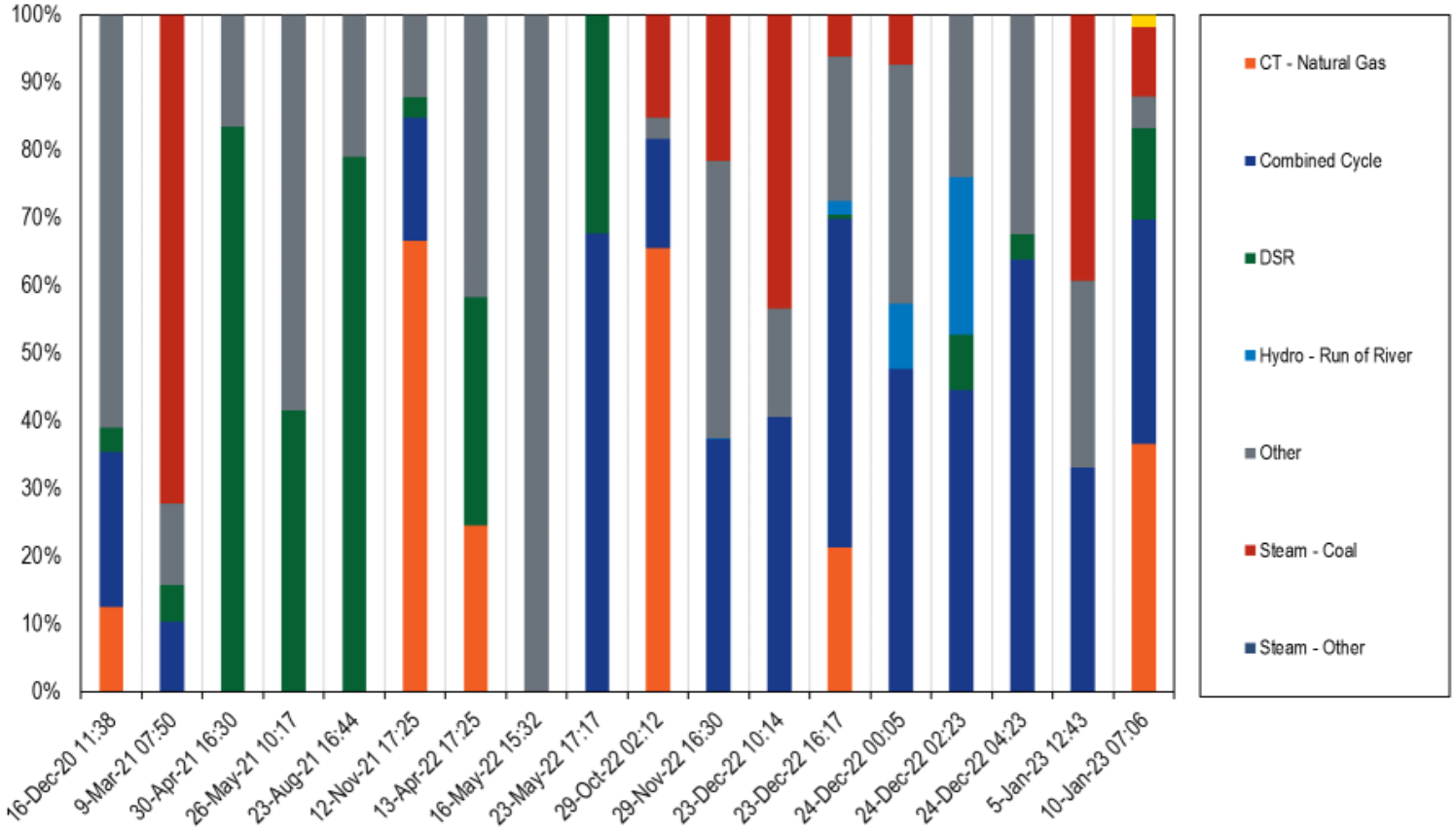
Resource/Fuel Type	Shortfall MW	Percent of Total
CT - Natural Gas	1,604.2	41.8%
Combined Cycle	1,108.5	28.9%
Steam - Coal	761.5	19.8%
DSR	188.4	4.9%
Other	174.7	4.6%

Percentages of Event Scheduled MW



Monitoring Analytics

Percentages of Event Shortfall MW



Monitoring Analytics

Share of Reserves (Sched) vs. Shortfall (SF)

	CT - Natural Gas			Combined Cycle			DSR			Hydro - Run of River			Other			Steam - Coal			Steam - Other		
	Sched.	SF	Diff.	Sched.	SF	Diff.	Sched.	SF	Diff.	Sched.	SF	Diff.	Sched.	SF	Diff.	Sched.	SF	Diff.	Sched.	SF	Diff.
2020-12-16 11:38	0.46	0.12	0.34	0.10	0.23	(0.13)	0.15	0.04	0.11				0.29	0.61	(0.32)						
2021-03-09 07:50				0.18	0.10	0.08	0.19	0.05	0.14				0.13	0.12	0.01	0.50	0.72	(0.22)			
2021-04-30 16:30							0.48	0.83	(0.35)				0.52	0.17	0.35						
2021-05-26 10:17							0.36	0.42	(0.05)				0.64	0.58	0.05						
2021-08-23 16:44							0.37	0.79	(0.42)				0.63	0.21	0.42						
2021-11-12 17:25	0.47	0.67	(0.19)	0.14	0.18	(0.04)	0.31	0.03	0.28				0.08	0.12	(0.05)						
2022-04-13 17:25	0.52	0.25	0.28				0.22	0.34	(0.12)				0.26	0.42	(0.16)						
2022-05-16 15:32													1.00	1.00	0.00						
2022-05-23 17:17				0.44	0.68	(0.24)	0.30	0.32	(0.02)				0.26	0.00	0.26						
2022-10-29 02:12	0.49	0.66	(0.16)	0.21	0.16	0.05							0.12	0.03	0.09	0.18	0.15	0.03			
2022-11-29 16:30				0.40	0.37	0.03				0.08	0.00	0.07	0.20	0.41	(0.20)	0.32	0.22	0.10			
2022-12-23 10:14				0.11	0.41	(0.30)							0.79	0.16	0.63	0.10	0.43	(0.34)			
2022-12-23 16:17	0.26	0.21	0.05	0.27	0.49	(0.22)	0.12	0.01	0.12	0.11	0.02	0.08	0.20	0.21	(0.02)	0.04	0.06	(0.02)			
2022-12-24 00:05				0.25	0.48	(0.23)				0.19	0.10	0.09	0.52	0.35	0.17	0.04	0.07	(0.04)			
2022-12-24 02:23				0.29	0.45	(0.16)	0.18	0.08	0.10	0.36	0.23	0.13	0.17	0.24	(0.07)						
2022-12-24 04:23				0.35	0.64	(0.29)	0.21	0.04	0.18				0.44	0.32	0.11						
2023-01-05 12:43				0.34	0.33	0.01							0.41	0.28	0.13	0.25	0.39	(0.14)			
2023-01-10 07:06	0.30	0.37	(0.06)	0.24	0.33	(0.09)	0.16	0.13	0.02				0.14	0.05	0.10	0.15	0.10	0.05	0.01	0.02	(0.01)

Synchronized Reserve Event Analysis

- **Many spin events, defined by PJM, are longer than the corresponding DCS event.**
- **PJM frequently overshoots when recovering ACE.**
  - **PJM defines the end of spin events minutes after ACE has returned to NERC required levels.**

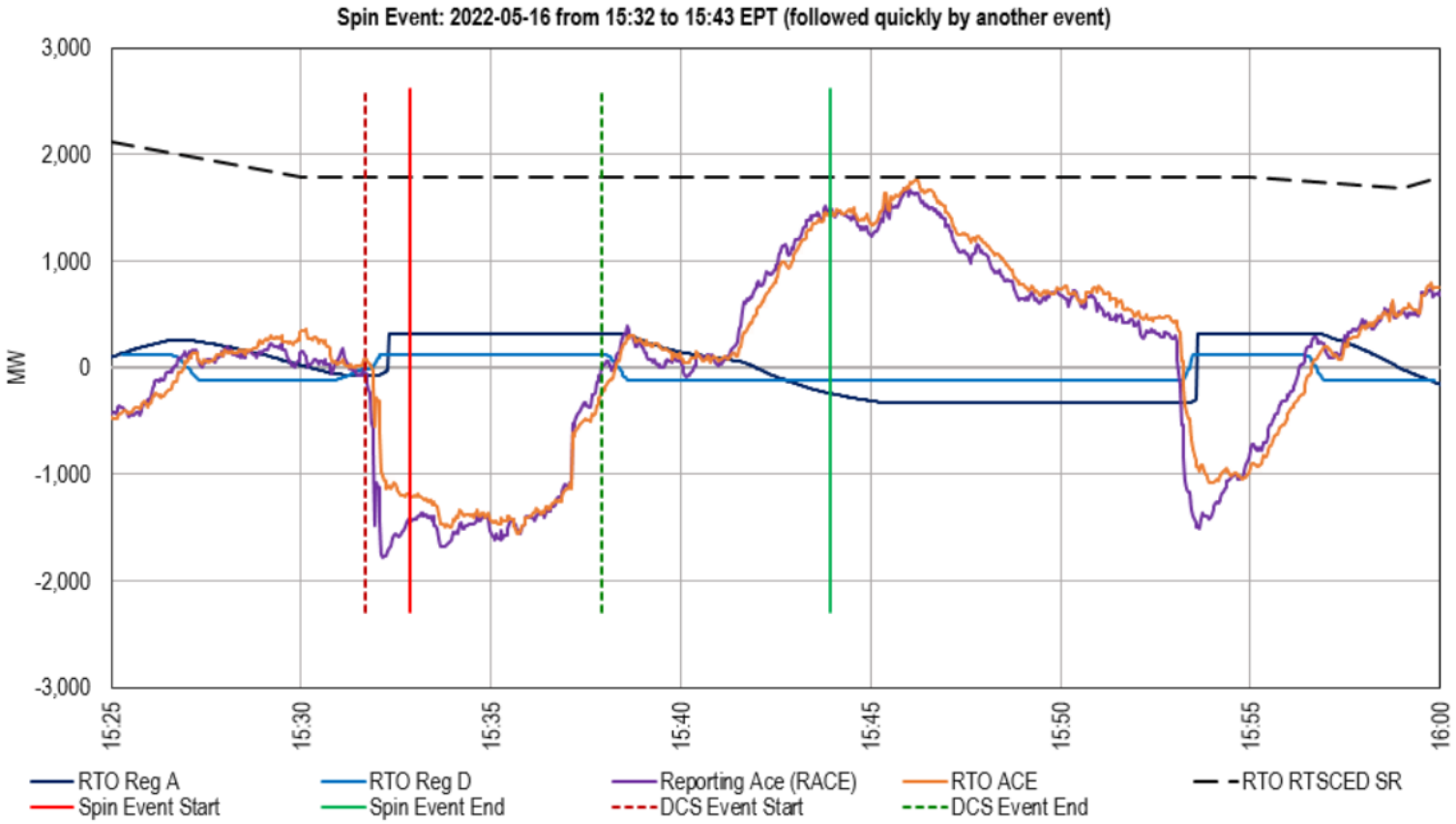
DCS Events vs Spin Events: Start/End/Duration

DCS Start	DCS End	DCS Length	Spin Start	Spin End	Spin Length
2022-03-03 12:18	2022-03-03 12:24	00:06:03	2022-03-03 12:20	2022-03-03 12:27	00:07:21
2022-04-06 11:44	2022-04-06 11:49	00:05:12	2022-04-06 11:45	2022-04-06 11:55	00:09:43
2022-04-14 09:28	2022-04-14 09:34	00:05:40	2022-04-14 09:30	2022-04-14 09:38	00:08:07
2022-05-16 15:31	2022-05-16 15:37	00:06:12	2022-05-16 15:32	2022-05-16 15:43	00:11:05
2022-05-16 15:53	2022-05-16 15:56	00:03:18	2022-05-16 15:53	2022-05-16 16:03	00:09:34
2022-05-23 17:17	2022-05-23 17:20	00:03:17	2022-05-23 17:17	2022-05-23 17:32	00:15:00
2022-06-27 17:00	2022-06-27 17:04	00:04:16	2022-06-27 17:01	2022-06-27 17:10	00:09:03
2022-07-07 17:20	2022-07-07 17:24	00:03:27	2022-07-07 17:21	2022-07-07 17:29	00:07:52
2022-09-26 03:35	2022-09-26 03:42	00:06:16	2022-09-26 03:39	2022-09-26 03:45	00:06:02
2022-10-29 02:10	2022-10-29 02:15	00:04:42	2022-10-29 02:12	2022-10-29 02:24	00:11:52
2022-11-04 15:01	2022-11-04 15:04	00:02:58	2022-11-04 15:03	2022-11-04 15:07	00:04:25
2022-11-29 16:29	2022-11-29 16:38	00:08:23	2022-11-29 16:30	2022-11-29 16:47	00:16:45
2022-12-24 02:23	2022-12-24 02:28	00:05:15	2022-12-24 02:23	2022-12-24 02:54	00:30:35
2023-01-05 12:42	2023-01-05 12:47	00:04:56	2023-01-05 12:43	2023-01-05 12:55	00:11:33

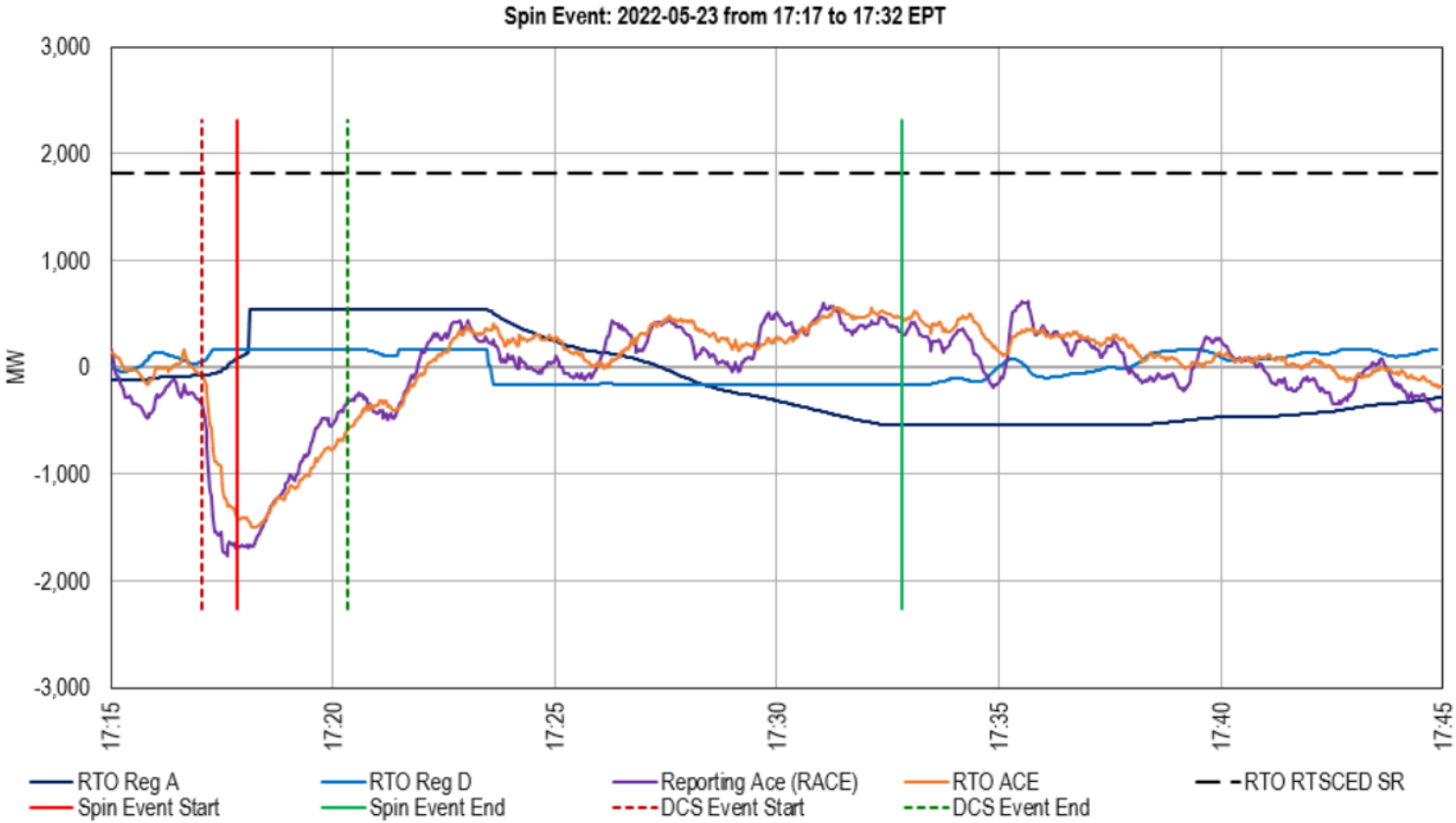
DCS Events vs Spin Events: Start/End/Duration

DCS Start	DCS End	DCS Length	Spin Start	Spin End	Spin Length
2022-06-15 07:24	2022-06-15 07:30	00:05:39	*No corresponding spin event.*		
2022-07-04 02:04	2022-07-04 02:07	00:02:42	*No corresponding spin event.*		
2022-08-28 13:48	2022-08-28 13:49	00:01:40	*No corresponding spin event.*		
2022-12-11 09:18	2022-12-11 09:25	00:07:13	*No corresponding spin event.*		
2022-12-23 16:58	2022-12-23 17:14	00:15:52	*No corresponding spin event.*	*Occurs during Low ACE event.*	
2022-12-24 15:26	2022-12-24 15:29	00:03:07	*No corresponding spin event.*		
2023-02-03 20:43	2023-02-03 20:47	00:03:53	*No corresponding spin event.*		

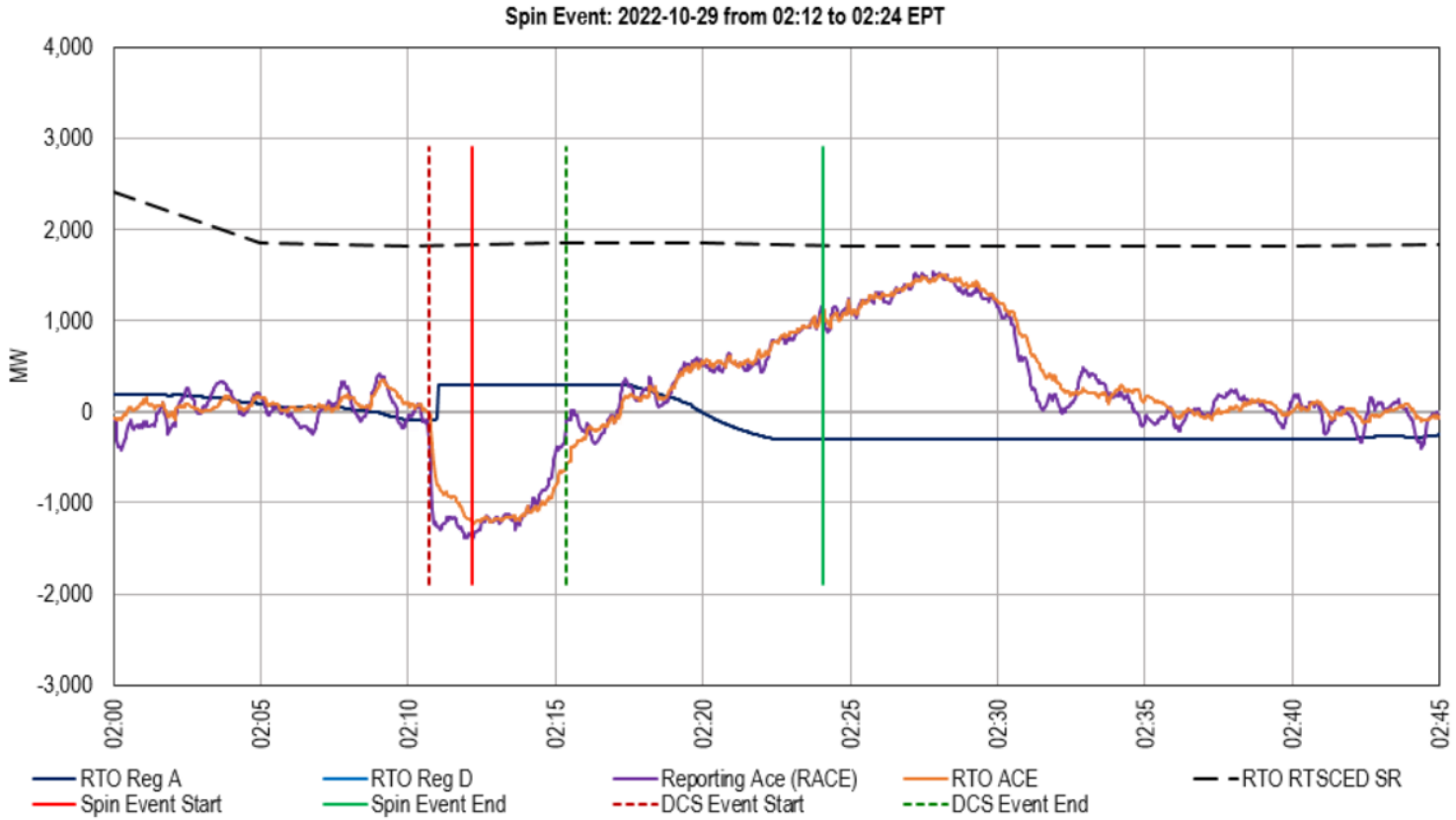
2022-05-16 (~6 min. DCS vs ~11 min. spin)



2022-05-23 (~3 min. DCS vs ~15 min. spin)

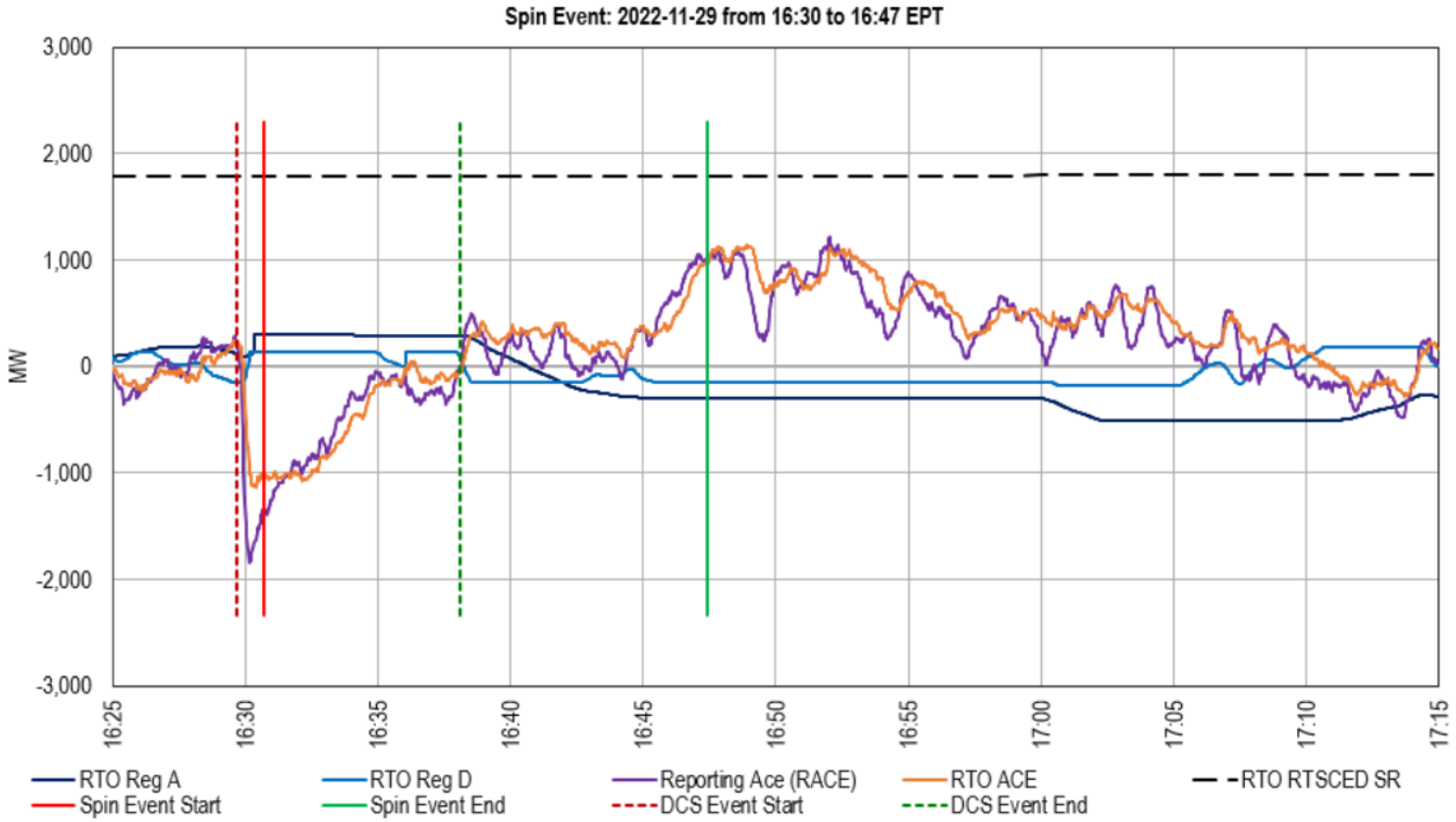


2022-10-29 (~5 min. DCS vs ~12 min. spin)

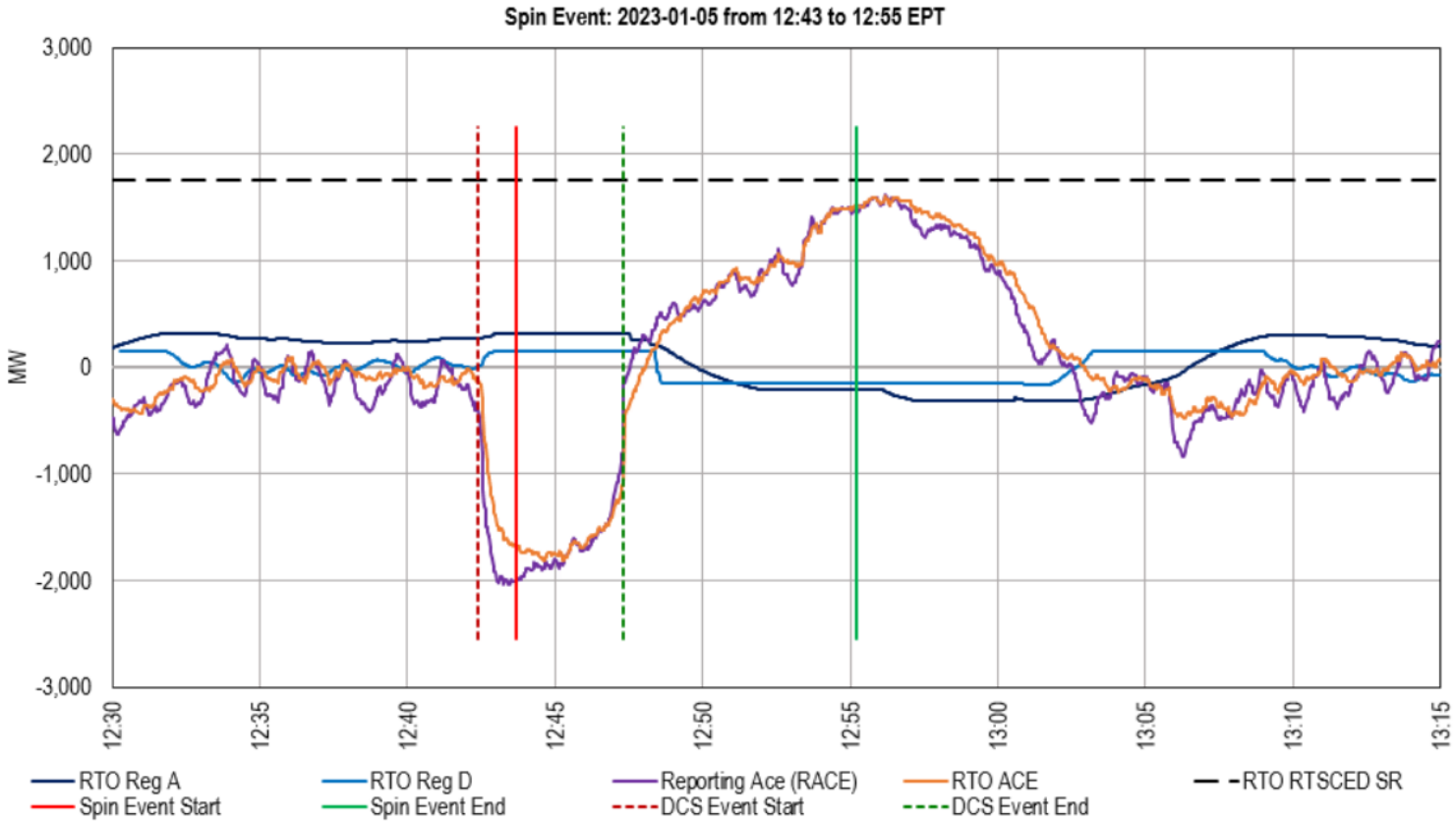


Monitoring Analytics

2022-11-29 (~8 min. DCS vs ~17 min. spin)

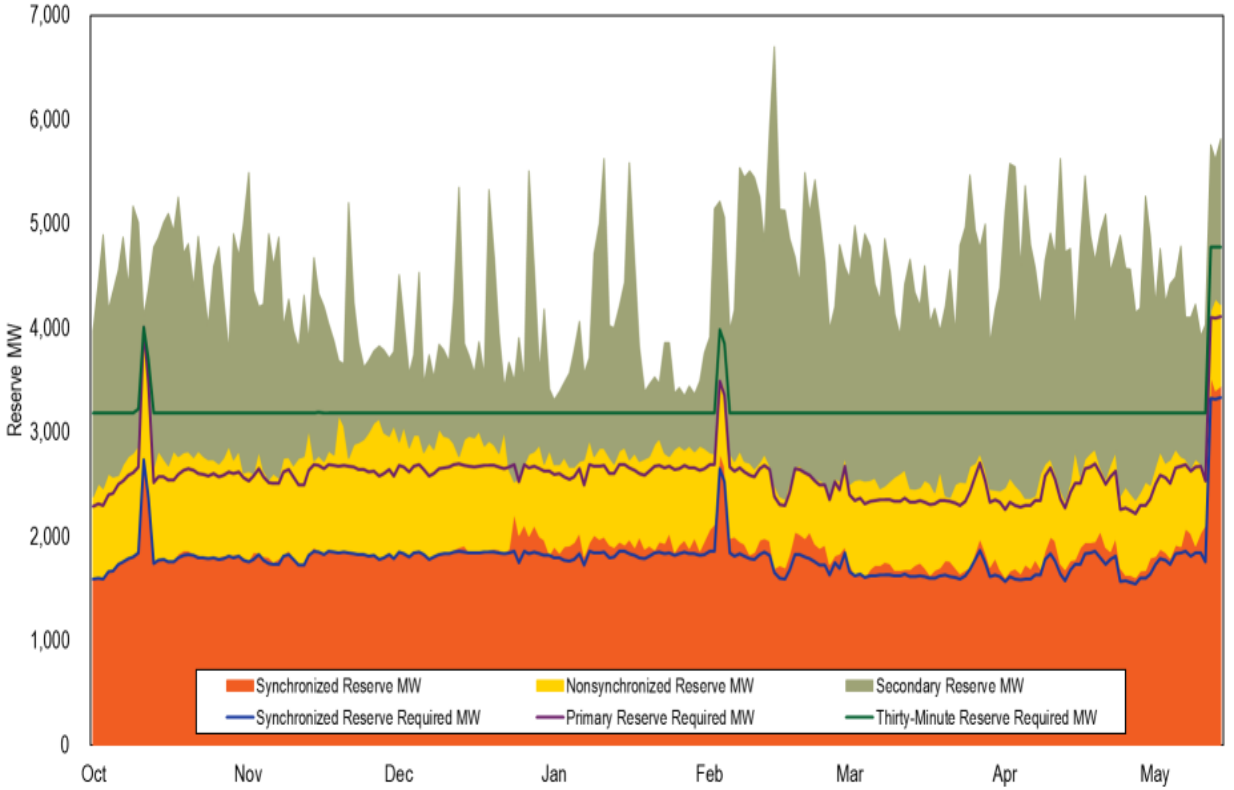


2023-01-05 (~5 min. DCS vs ~12 min. spin)



Monitoring Analytics

Real-Time Reserves and Requirements



Monitoring Analytics

RTO Reserve MW

- **Real-time market clearing**

Year	Month	Synchronized Reserve MW	Nonsynchronized Reserve MW	Total Primary Reserve MW	Secondary Reserve MW	Total Thirty-Minute Reserve MW
2023	Jan	1,935	861	2,796	1,100	3,895
2023	Feb	1,975	718	2,693	2,295	4,988
2023	Mar	1,722	812	2,534	1,965	4,499
2023	Apr	1,788	771	2,559	2,265	4,824

- **Day-ahead market clearing**

Year	Month	Synchronized Reserve MW	Nonsynchronized Reserve MW	Total Primary Reserve MW	Secondary Reserve MW	Total Thirty-Minute Reserve MW
2023	Jan	1,904	1,403	3,308	11,940	15,248
2023	Feb	1,889	1,311	3,200	16,793	19,993
2023	Mar	1,682	1,179	2,861	15,073	17,934
2023	Apr	1,766	968	2,734	10,955	13,689

MAD Reserve MW

- **Real-time market clearing**

Year	Month	Synchronized Reserve MW	Nonsynchronized Reserve MW	Total Primary Reserve MW	Secondary Reserve MW	Total Thirty-Minute Reserve MW
2023	Jan	1,933	792	2,725	NA	NA
2023	Feb	1,955	673	2,628	NA	NA
2023	Mar	1,695	678	2,374	NA	NA
2023	Apr	1,664	615	2,279	NA	NA

- **Day-ahead market clearing**

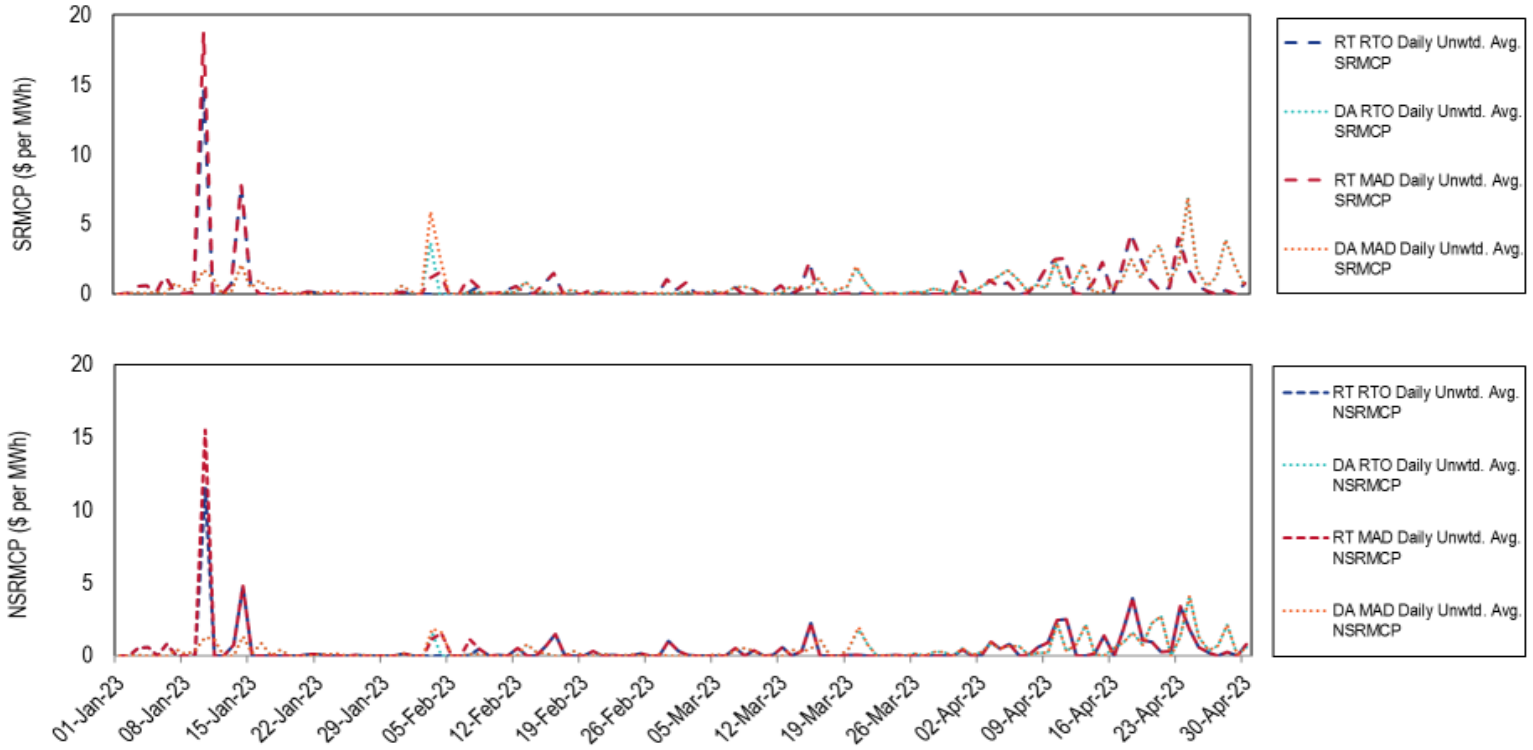
Year	Month	Synchronized Reserve MW	Nonsynchronized Reserve MW	Total Primary Reserve MW	Secondary Reserve MW	Total Thirty-Minute Reserve MW
2023	Jan	1,891	1,118	3,009	NA	NA
2023	Feb	1,874	992	2,866	NA	NA
2023	Mar	1,671	839	2,510	NA	NA
2023	Apr	1,690	684	2,374	NA	NA

Reserve Settlements by Month

Product	Year	Month	Total Day-Ahead Credits	Total Balancing MCP Credits	Total LOC Credits	Total Shortfall Charges	Total Credits
Synchronized Reserve	2023	Jan	$505,419	($114,061)	$983,619	$335,995	$1,038,982
	2023	Feb	$735,351	$99,577	$495,474	$0	$1,330,401
	2023	Mar	$439,364	($5,106)	$744,883	$0	$1,179,141
	2023	Apr	$2,088,876	$55,121	$701,874	$0	$2,845,871
Nonsynchronized Reserve	2023	Jan	$73,610	($155,466)	$4,850	NA	($77,007)
	2023	Feb	$72,133	($113,200)	$31,094	NA	($9,973)
	2023	Mar	$72,194	($37,214)	$3,368	NA	$38,348
	2023	Apr	$220,075	($112,776)	$59,662	NA	$166,961
Secondary Reserve	2023	Jan	$0	$0	$5,150	$0	$5,150
	2023	Feb	$0	$0	$34,129	$0	$34,129
	2023	Mar	$0	$0	$12,363	$0	$12,363
	2023	Apr	$0	$0	$15,125	$0	$15,125

- For secondary reserve, the shortfall charge is part of the balancing MCP credit. For synchronized reserve, it is separate.
- The only spin events that were 10 minutes or longer happened in January, so only January has SR shortfall charges.

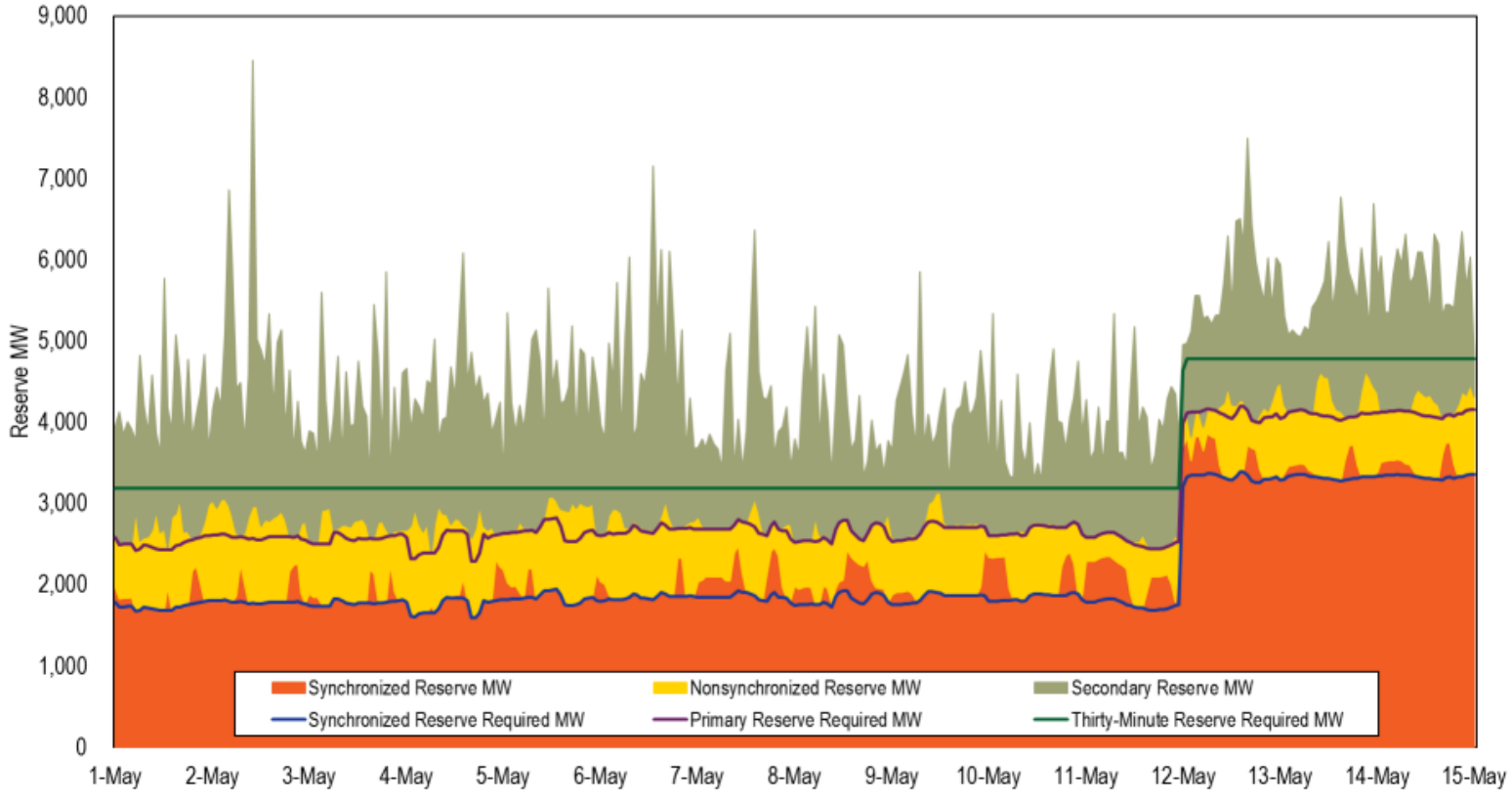
Reserve Prices



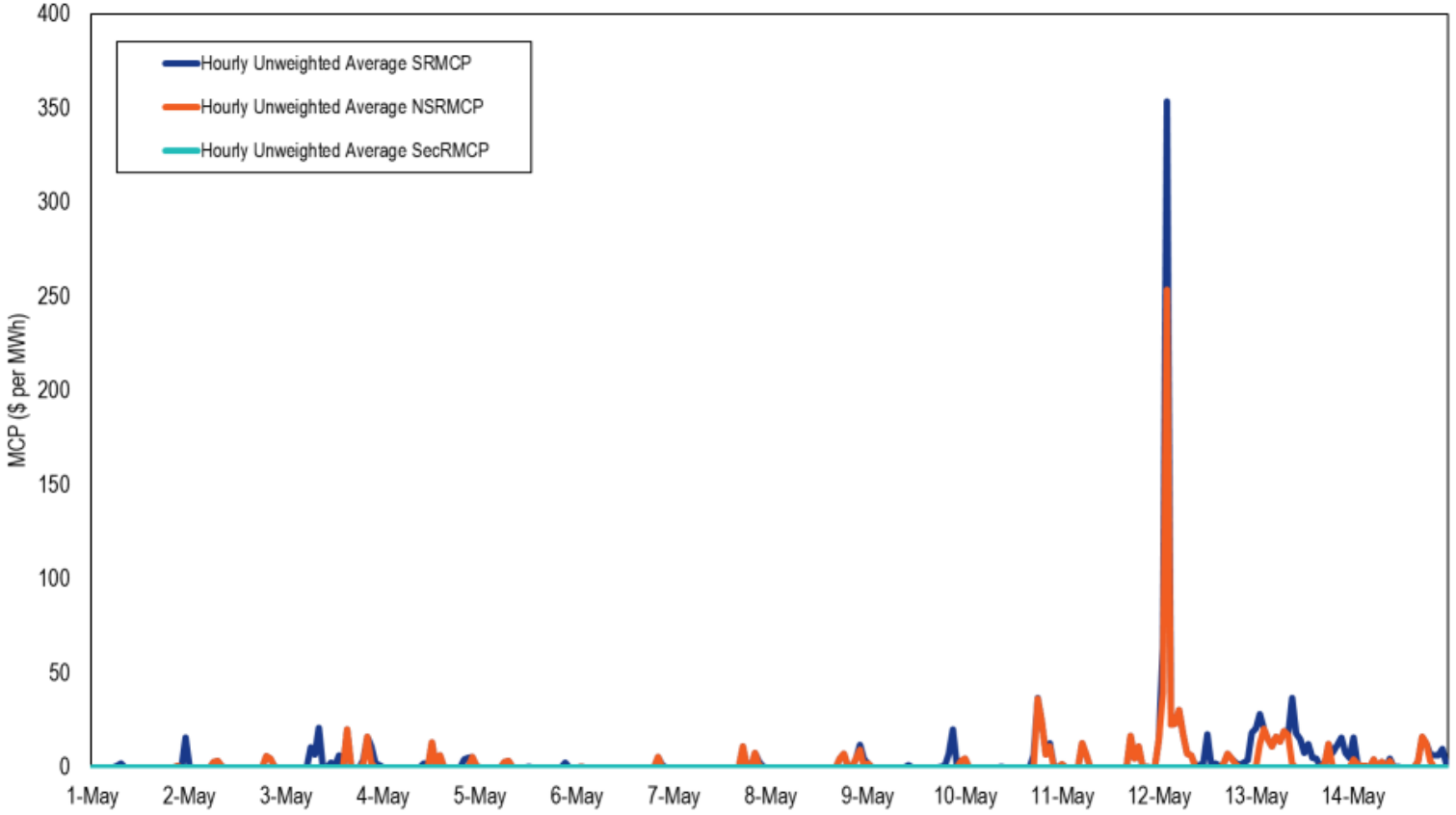
- SecRMCP always $0 per MWh, so far.

- Spikes on Jan. 10th due to shortage pricing.
- Spikes on Feb. 3rd & 4th due to conservative operations.

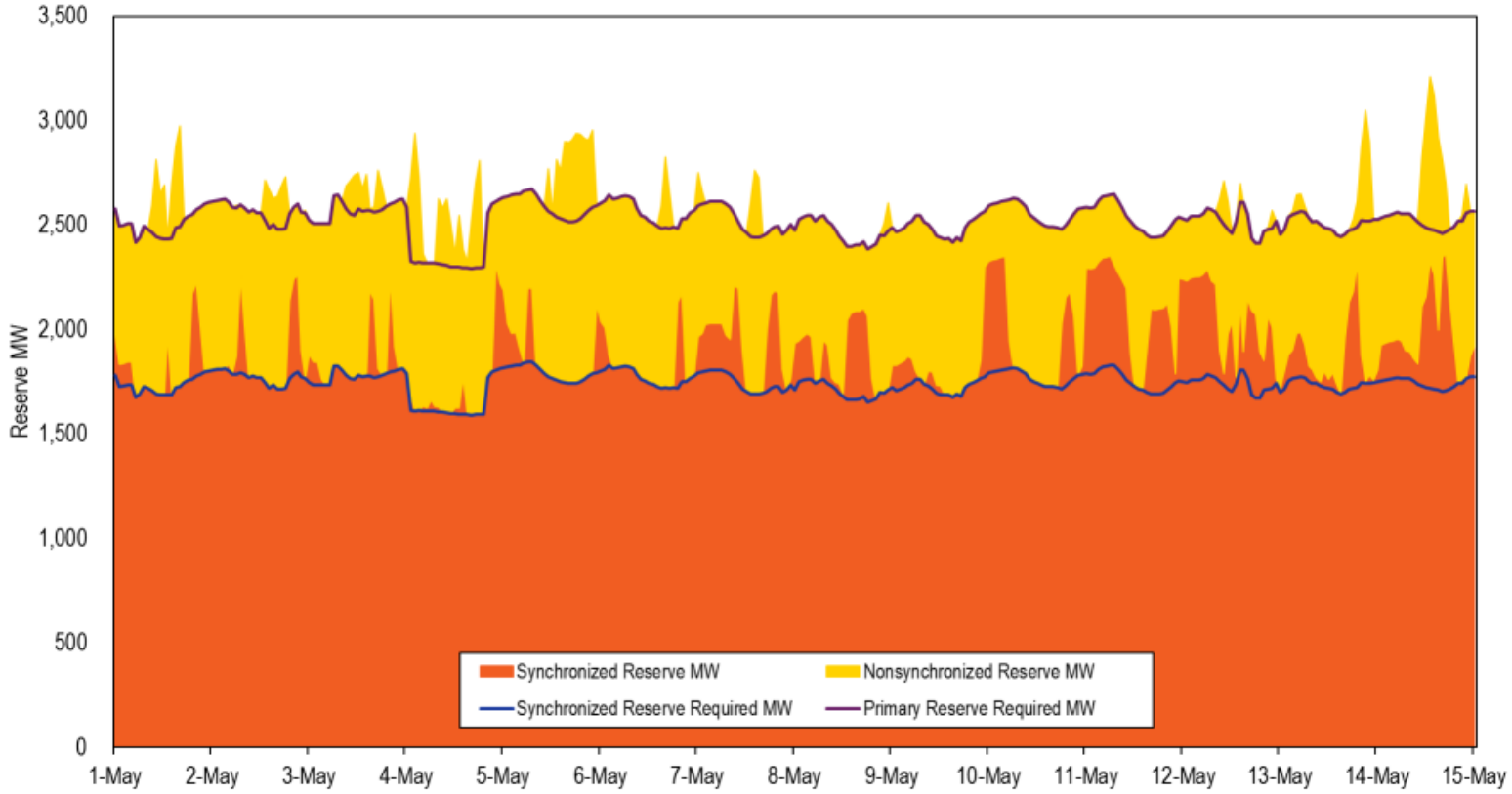
Recent RTO Hourly Average Requirements/Cleared MW



Recent RTO Hourly Unweighted Average MCPs

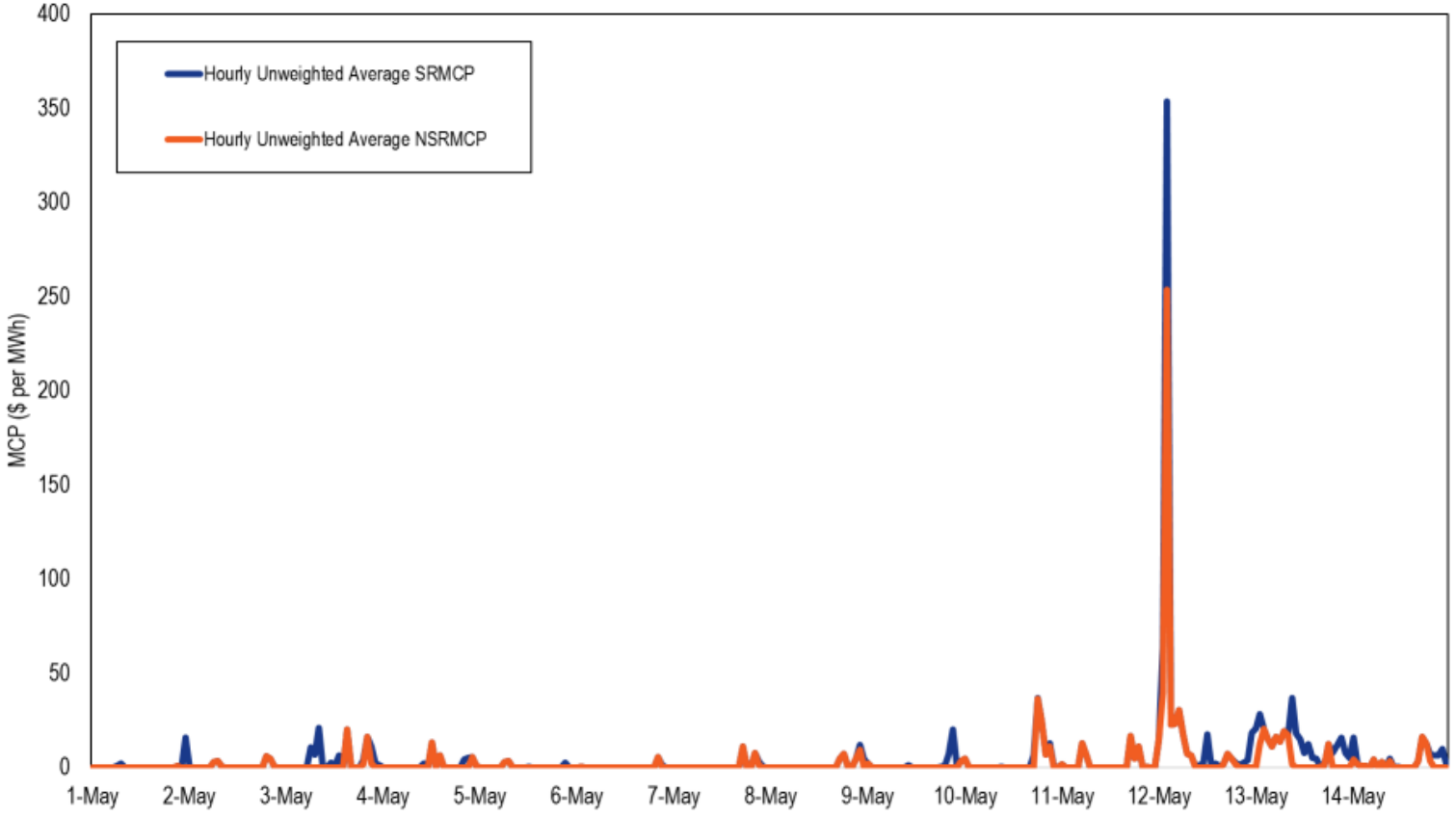


Recent MAD Hourly Average Requirements/Cleared MW



Monitoring Analytics

Recent MAD Hourly Unweighted Average MCPs



Monitoring Analytics

Monitoring Analytics, LLC
2621 Van Buren Avenue
Suite 160
Eagleville, PA
19403
(610) 271-8050

MA@monitoringanalytics.com
www.MonitoringAnalytics.com