Reserve Requirements IMM Proposal

RCSTF

May 1 2026

IMM

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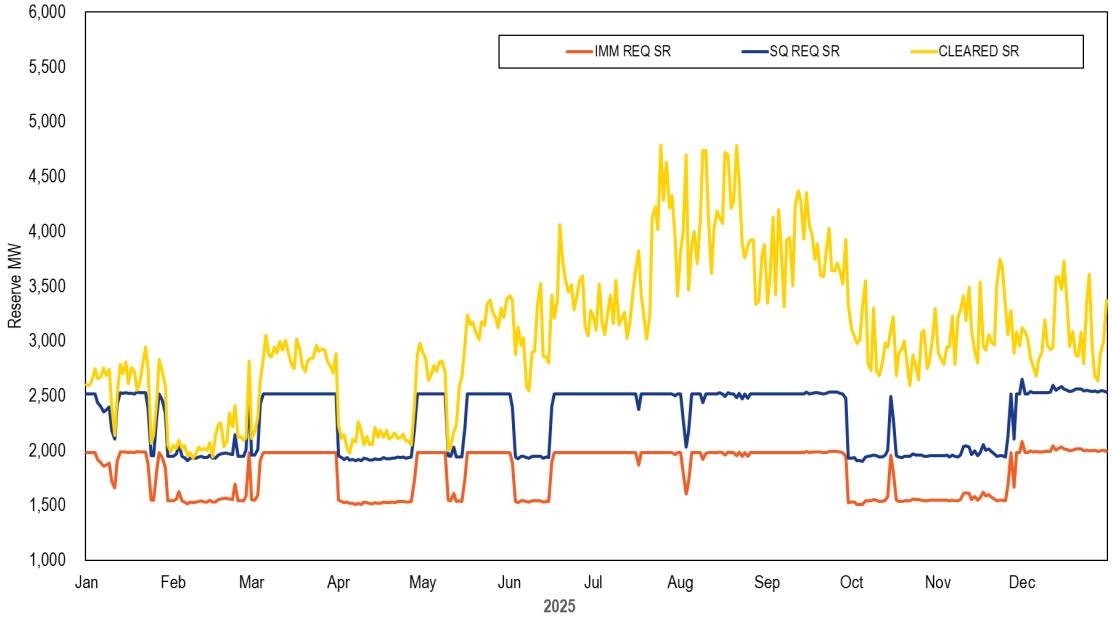
RESERVE REQUIREMENT

Synchronized Reserve Requirement

- **Status Quo (2025): 1.3 x MSSC + 190**
- **IMM proposal: 1.0 x MSSC + 190**



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Primary Reserve Requirement

- **Status Quo (2025):**

  1.5 x Synchronized Reserve

  = 1.5 x 1.3 x MSSC + 190

- **IMM proposal:**

  MSSC + Max (0.5 x MSSC, 30 min Net Load Uncertainty) + 190

Covers supply uncertainty

Covers the net load uncertainty from 30 min look ahead

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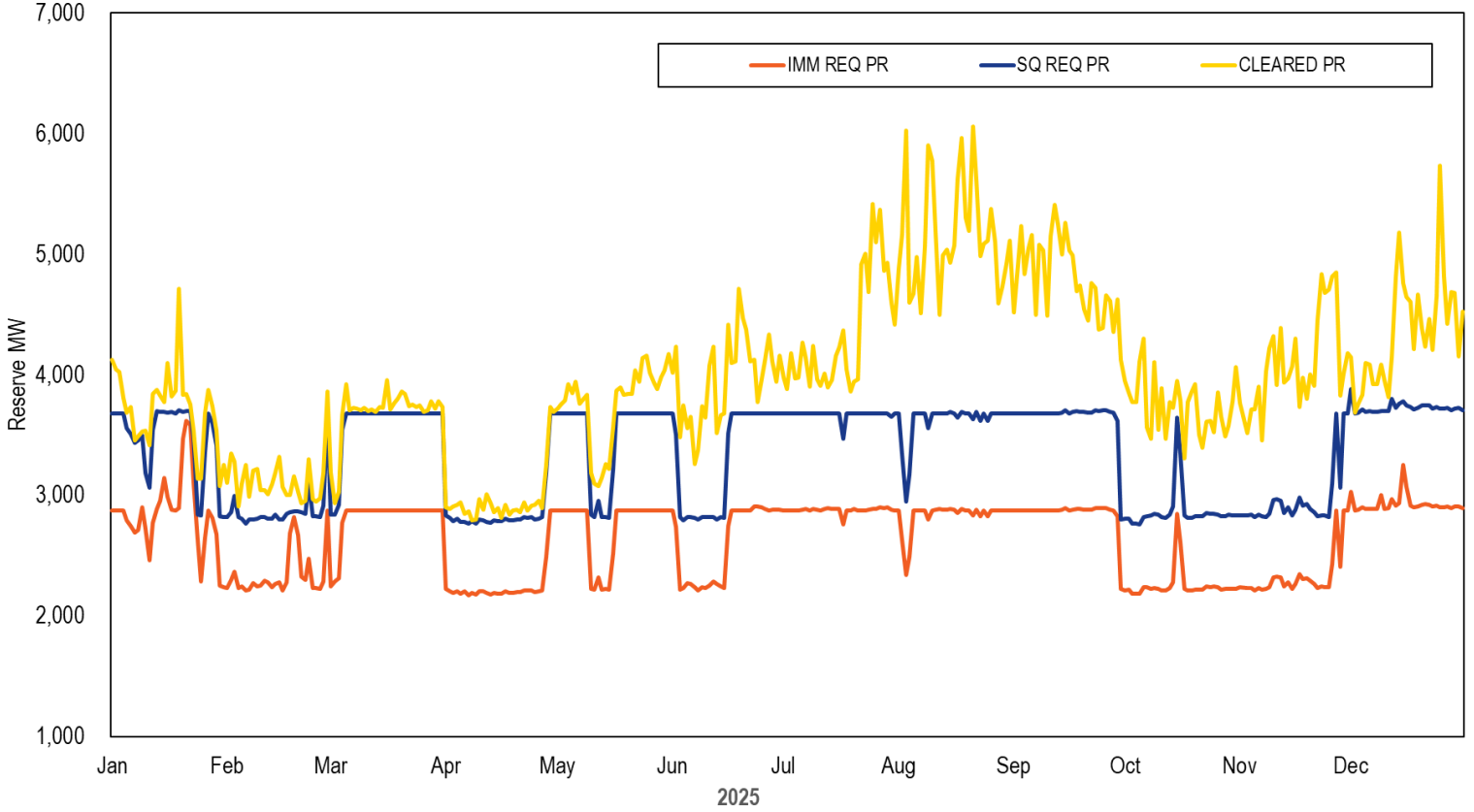
Primary Reserve Requirement



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Thirty Minute Reserve Requirement

- **Status Quo (2025):**

  Max (3,000; Primary Reserve) + 190

- **IMM proposal:**

  2 x MSSC + 2h Net Load Uncertainty + 190

Covers supply uncertainty and recovery of reserves

Covers the net load uncertainty from 2h look ahead

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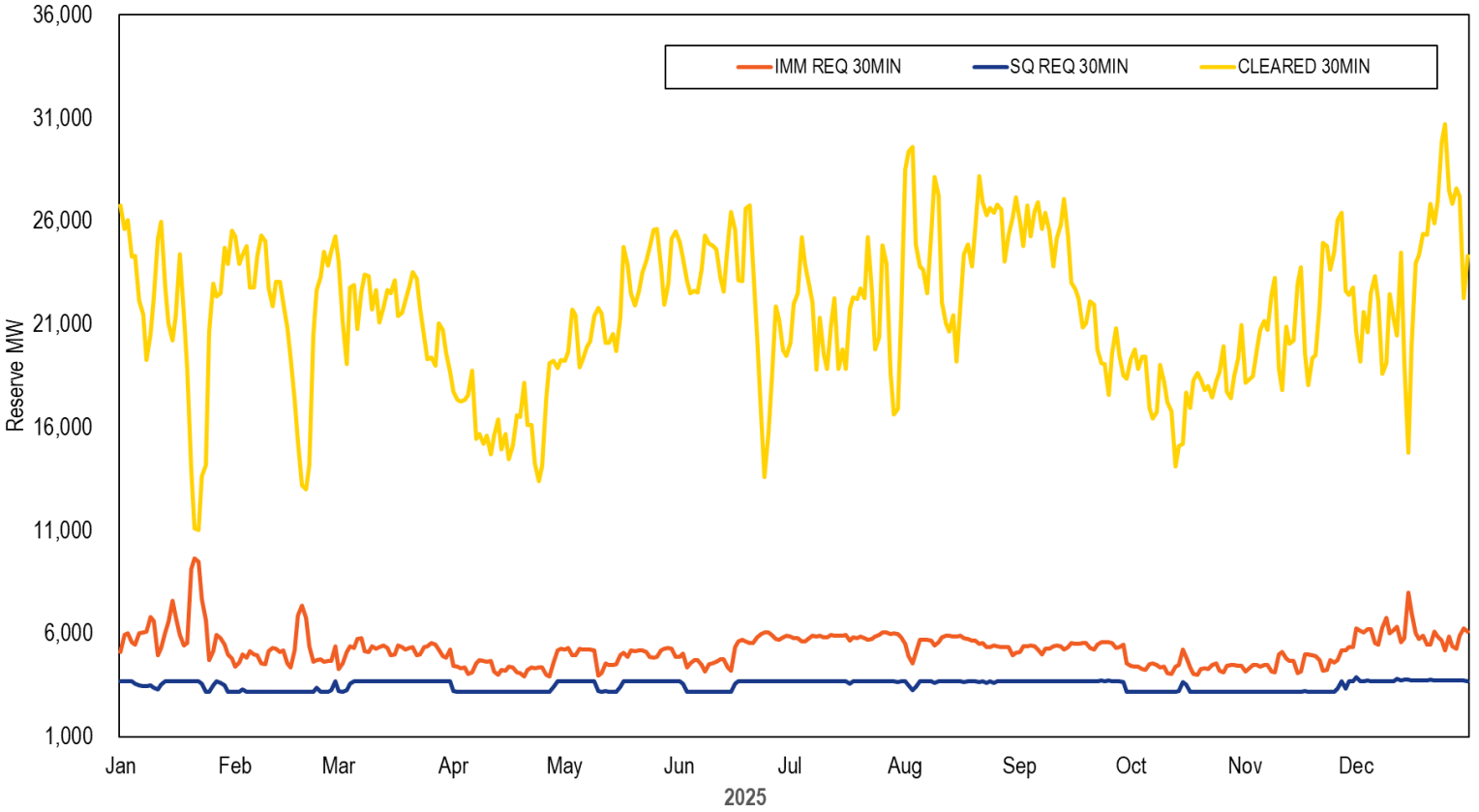
Thirty Minute Reserve Requirement



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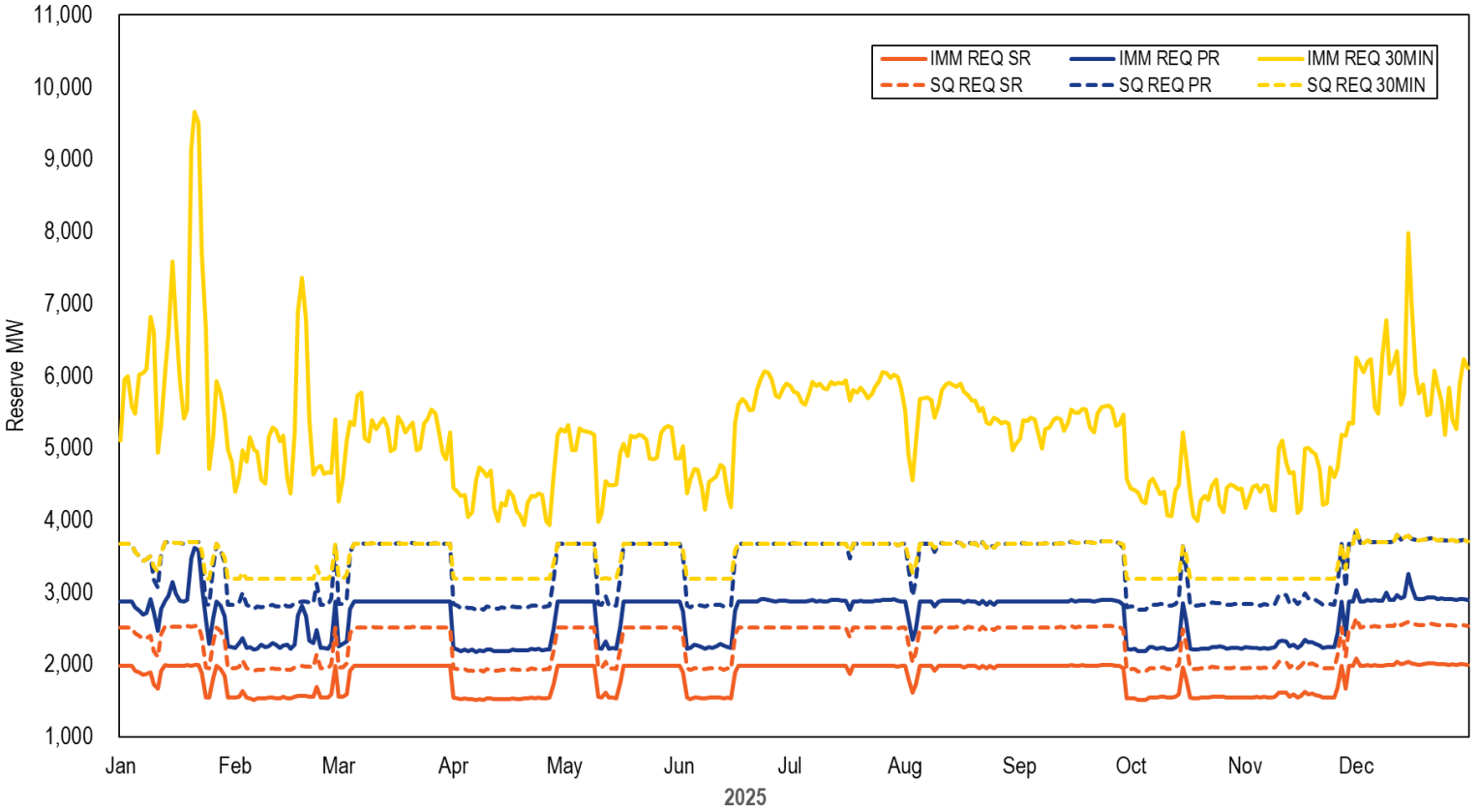
IMM vs Status Quo Reserve Requirement MW



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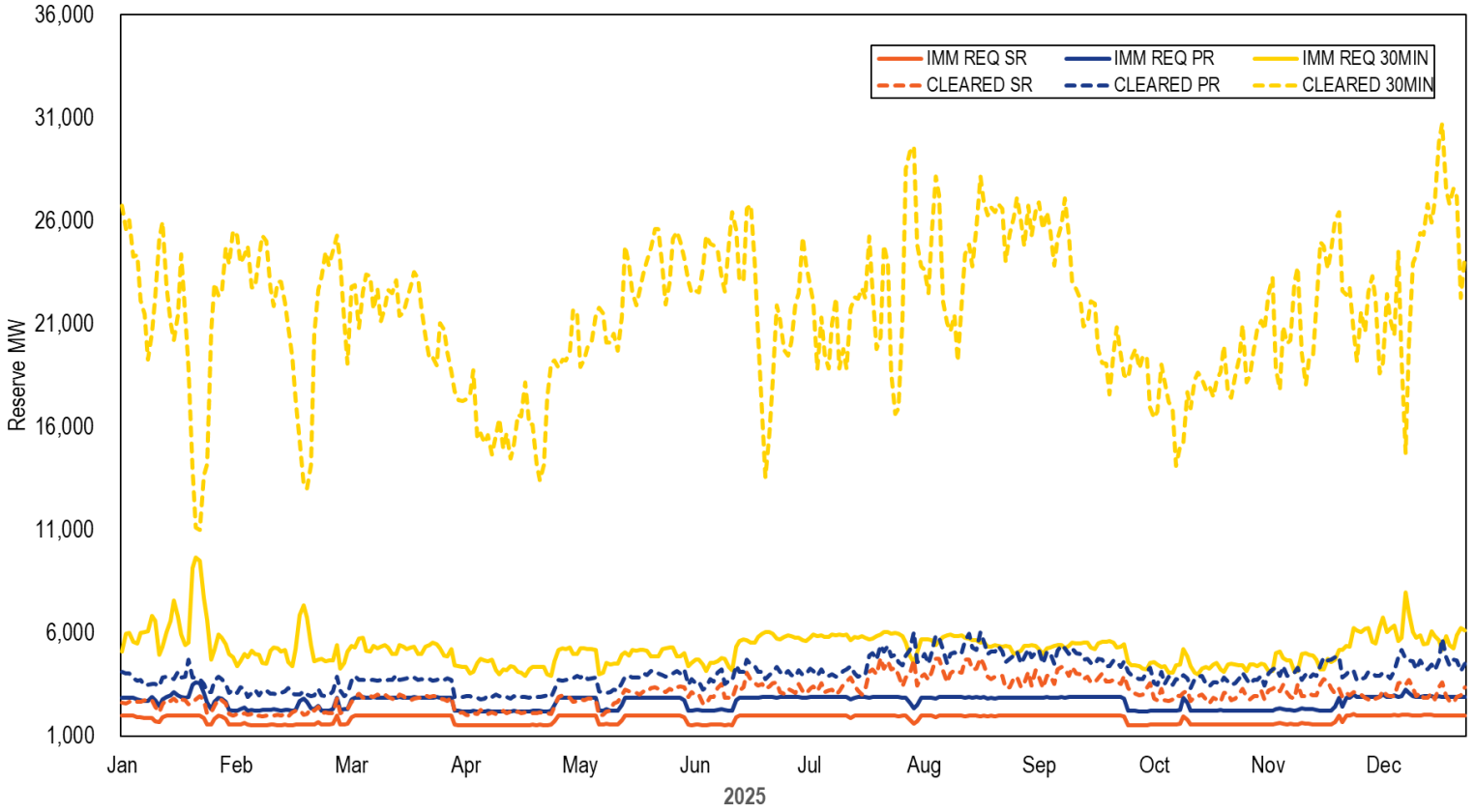
IMM vs RT SCED Cleared Reserve MW



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NET LOAD UNCERTAINTY CALCULATION

Defining Net Load Uncertainty

- **For each market interval, net load uncertainty is defined as a percent of the current net load forecast.**
- **Using the current net load forecast captures real time market conditions.**
- **The multiplier is defined as the 95th percentile of all the percent uncertainty values in the historic data for similar weather conditions and peak/off peak status.**

30 min Net Load Uncertainty Calculation

- **Net Load Uncertainty is calculated by multiplying the net load forecast for each interval by the percent multiplier.**

30 min Net Load Uncertainty

= Net Load forecast @30 min look ahead

× 30 min Net Load percent multiplier

Where:

Net Load forecast @30 min look ahead

= Load Forecast @30min

– Solar Forecast @30 min – Wind Forecast @30 min

30 min Net Load Percent Multiplier

The IMM proposes to calculate the percent multiplier based on a rolling 24 month history to capture ongoing changes due to new resources, especially solar.

For this example, the multipliers were calculated using 2023 and 2024 calendar year data.

1. Create temperature categories (° F).

System wide load weighted temperatures

Assigned Temp Level	Temp Range
1	<20
2	20-40
3	40-50
4	50-60
5	60-75
6	75-85
7	>85

30 min Net Load Percent Multiplier

2. For each historic market interval, the 30 minute look ahead net load forecast is calculated, the temperature category is assigned based on the actual temperature, and the on peak or off peak hour indicator is assigned.

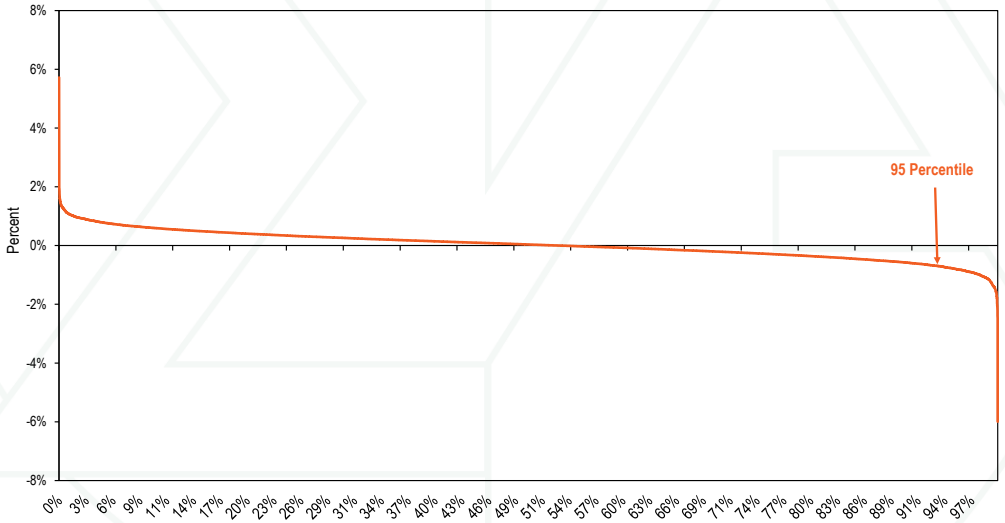
3. For each interval, the net load forecast error percent is calculated as:

$$\text{Net Load ERR PCT @ 30min} = \frac{\text{(Net Load forecast @ 30min - Net Load RT)}}{\text{(Net Load forecast @ 30min)}}$$

Note: Net Load RT is using Net Load Forecast @ 5 min to remove the impact of PJM's curtailment of solar and wind in real time.

30 min Net Load Percent Multiplier

4. All intervals were assigned to one of 14 categories based on temperature level and on peak/off peak status. For each category, the interval data were rank ordered from positive to negative, and the 95th percentile was selected to define the percent multiplier.



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30 min Net Load percent Multiplier

5. The 30 minute net load percent multiplier was calculated for each category.

6. The same method was applied to calculate the 2 hour net load percent multiplier.

Is Peak	Temp Level	30min NL Mutiplier	2h NL Mutiplier
N	1	0.64%	1.77%
Y	1	1.29%	4.67%
N	2	0.79%	1.80%
Y	2	0.72%	2.30%
N	3	0.80%	1.66%
Y	3	0.77%	2.16%
N	4	0.91%	1.74%
Y	4	0.80%	1.89%
N	5	0.80%	1.60%
Y	5	0.78%	1.95%
N	6	0.78%	2.20%
Y	6	0.73%	1.90%
N	7	0.64%	1.82%
Y	7	0.67%	1.75%

Reserve Requirement Calculation for 2025

1. For each interval in 2025, the net load forecast was calculated for the 30 minute and 2 hour look ahead time frames.

2. The temperature category was assigned based on the actual RTO average temperature.

3. Each day is assigned as on peak or off peak. Days are used instead of hours to avoid large intraday swings in reserve requirements.

Reserve Requirement Calculation for 2025

4. Net load percent multipliers obtained from the previous calculation were applied to each interval based on the temperature level and on peak/off peak indicator.

5. The 30min and 2hour Net Load Uncertainty for each interval was calculated as:

30min Net Load Uncertainty = Net Load forecast @30min look ahead × 30 min Net Load percent multiplier

2hour Net Load Uncertainty = Net Load forecast @ 2hour look ahead × 2hour Net Load percent multiplier

Reserve Requirement Calculation for 2025

6. The MSSC for each interval was determined as below, removing the status quo performance adder.

Synchronized Reserve Requirement
= MSSC + 190

Primary Reserve Requirement
= MSSC + Max (0.5 x MSSC, 30min Net Load Uncertainty) + 190

Thirty Minute Reserve Requirement
= 2 x MSSC + 2h Net Load Uncertainty + 190

CONCERNS & IMPROVEMENTS

Addressing General Concerns

1. **Projected Growth in Solar MW in the Near Term**
   - **IMM proposes to use rolling 24 month historical data to calculate a percent multiplier that reflects the impact of increasing solar capacity.**

2. **Real-Time System Dynamics**
   - **IMM proposes to apply the calculated percent multiplier to each load forecast interval to capture real-time system conditions, including solar variability, even on days that do not exhibit typical high load characteristics.**

Addressing General Concerns

3. Recovery of Reserves

- IMM proposes to use 2× MSSC for the 30 minute reserve requirement to ensure sufficient recovery of primary reserves following a loss of supply.

4. Extreme Weather Impact

- IMM proposes to use seven temperature categories with on peak and off peak indicators to capture demand variation and forecast error under different weather conditions.

Addressing General Concerns

5. Frequent Interval to Interval Requirement Changes

- IMM proposes to use the higher of 0.5 × MSSC or net load uncertainty. This will minimize unnecessary interval to interval requirement changes.
- In 2025, the net load uncertainty exceeded 0.5 × MSSC about 20 percent of the time.

Improvements to Status Quo

- **Reflect real-time system dynamics**
  - **IMM proposal replaces rigid standards with a more adaptive framework that enables interval level adjustments to better reflect real-time dynamics and account for both supply and demand under varying conditions.**

- **Incorporating Load Side Uncertainty**
  - **IMM proposal incorporates load side uncertainty as well as solar and wind variability, whereas the current approach does not.**

Improvements to Status Quo

- **Optimized Synchronized and Primary Reserves**
  - **IMM proposal reduces MW requirements for synchronized and primary reserves while still incorporating both supply and demand uncertainty.**

- **Ensuring Adequate Recovery**
  - **IMM proposal increases the thirty minute reserve requirement to ensure sufficient recovery capability following generation loss.**

RESERVE COST ESTIMATE

Cost Estimation for IMM Proposal

- The IMM takes a conservative approach to estimating costs without market simulations.
  - An overestimate of the cost of the IMM proposal
  - No simulation of pricing outcomes
- Two components of cost estimation
  1. Cost savings relative to status quo for synchronized and primary reserves due to removal of the 30 percent event performance adder calculated at historic reserve prices. Prices would have actually been lower with IMM proposal.
  2. Cost increases relative to status quo due to higher requirements calculated at shortage pricing levels if the proposed requirement exceeds historic cleared MW.

Reserve Cost Comparison

- **Using the most conservative estimation method, the total additional reserve cost would be $374M with IMM proposal.**
- **This estimation used the status quo MCPs and status quo cleared MW as a benchmark for available reserves.**

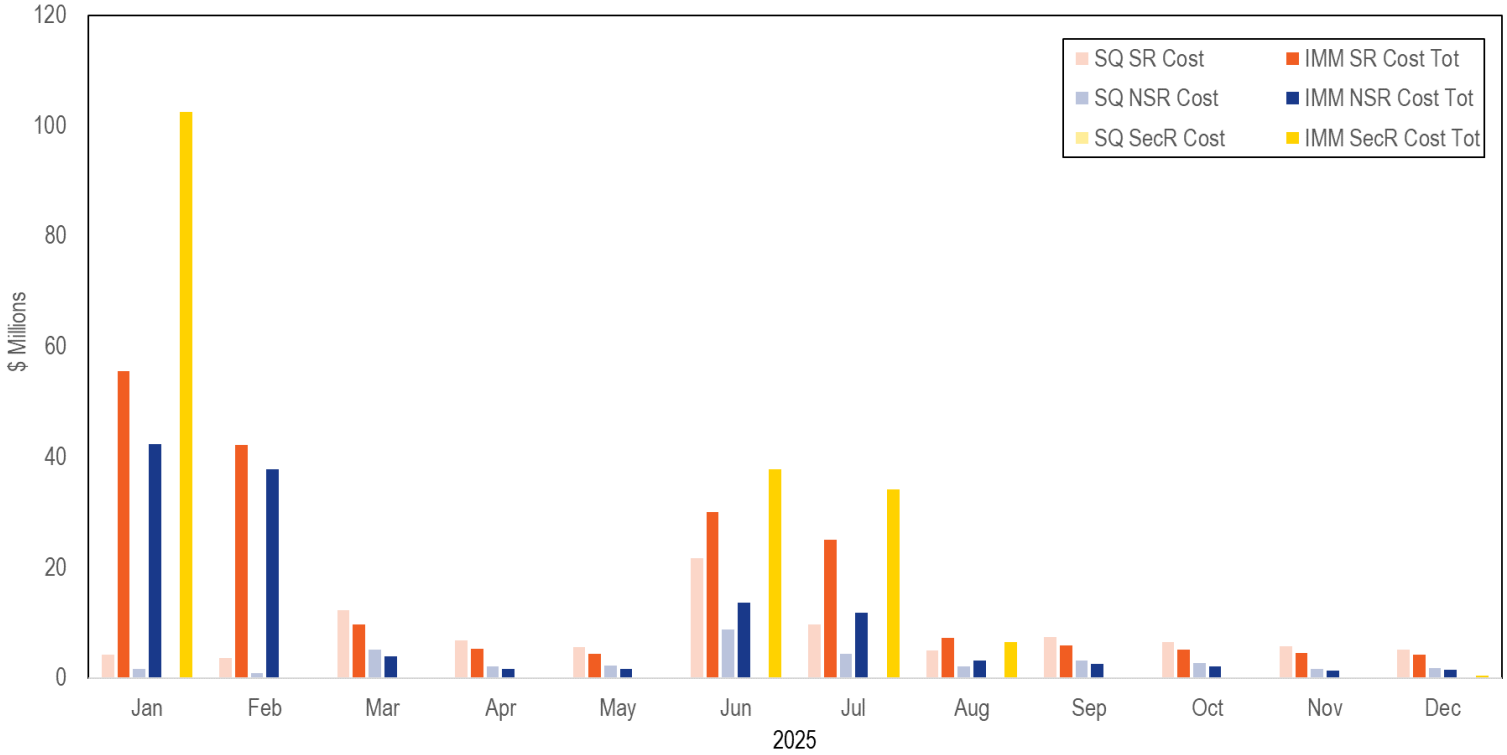
	SQ Cost (Millions)	IMM Cost (Millions)	Difference (Millions)
SR	93.67	198.98	105.31
NSR	36.24	123.47	87.22
SecR	-	181.34	181.34
Total	129.91	503.79	373.88

Reserve Cost Detail

	2025											
Month	SQ SR Cost (Millions)	IMM SR Cost (Millions)	IMM SR Additional Cost	IMM SR Total (Millions)	SQ NSR Cost (Millions)	IMM NSR Cost (Millions)	IMM NSR Additional Cost	IMM NSR Total (Millions)	SQ SecR Cost (Millions)	IMM SecR Cost (Millions)	IMM SecR Additional Cost	IMM SecR Total (Millions)
Jan	4.25	2.98	52.49	55.47	1.56	1.20	41.10	42.30	-	-	102.53	102.53
Feb	3.68	2.78	39.41	42.19	0.90	0.74	37.03	37.78	-	-	-	-
Mar	12.24	9.63	-	9.63	5.10	3.93	-	3.93	-	-	-	-
Apr	6.81	4.93	0.32	5.25	2.08	1.50	0.14	1.65	-	-	-	-
May	5.56	4.37	-	4.37	2.17	1.67	-	1.67	-	-	-	-
Jun	21.71	4.13	25.93	30.06	8.76	1.55	12.13	13.68	-	-	37.80	37.80
Jul	9.68	4.11	20.85	24.96	4.31	1.78	10.07	11.86	-	-	34.14	34.14
Aug	4.91	3.24	3.96	7.20	2.09	1.37	1.82	3.19	-	-	6.43	6.43
Sep	7.37	5.77	0.14	5.91	3.16	2.42	0.06	2.49	-	-	-	-
Oct	6.55	4.96	0.21	5.18	2.66	2.04	0.10	2.14	-	-	-	-
Nov	5.76	4.55	-	4.55	1.62	1.26	-	1.26	-	-	-	-
Dec	5.18	4.07	0.14	4.21	1.84	1.42	0.12	1.54	-	-	0.43	0.43
Total	93.67	55.53	143.46	198.98	36.24	20.89	102.58	123.47	-	-	181.34	181.34

Note: Only RT pricing was considered, not DA and balancing pricing.

Reserve Cost Comparison



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Additional Information

- **Interval Data for 2025**

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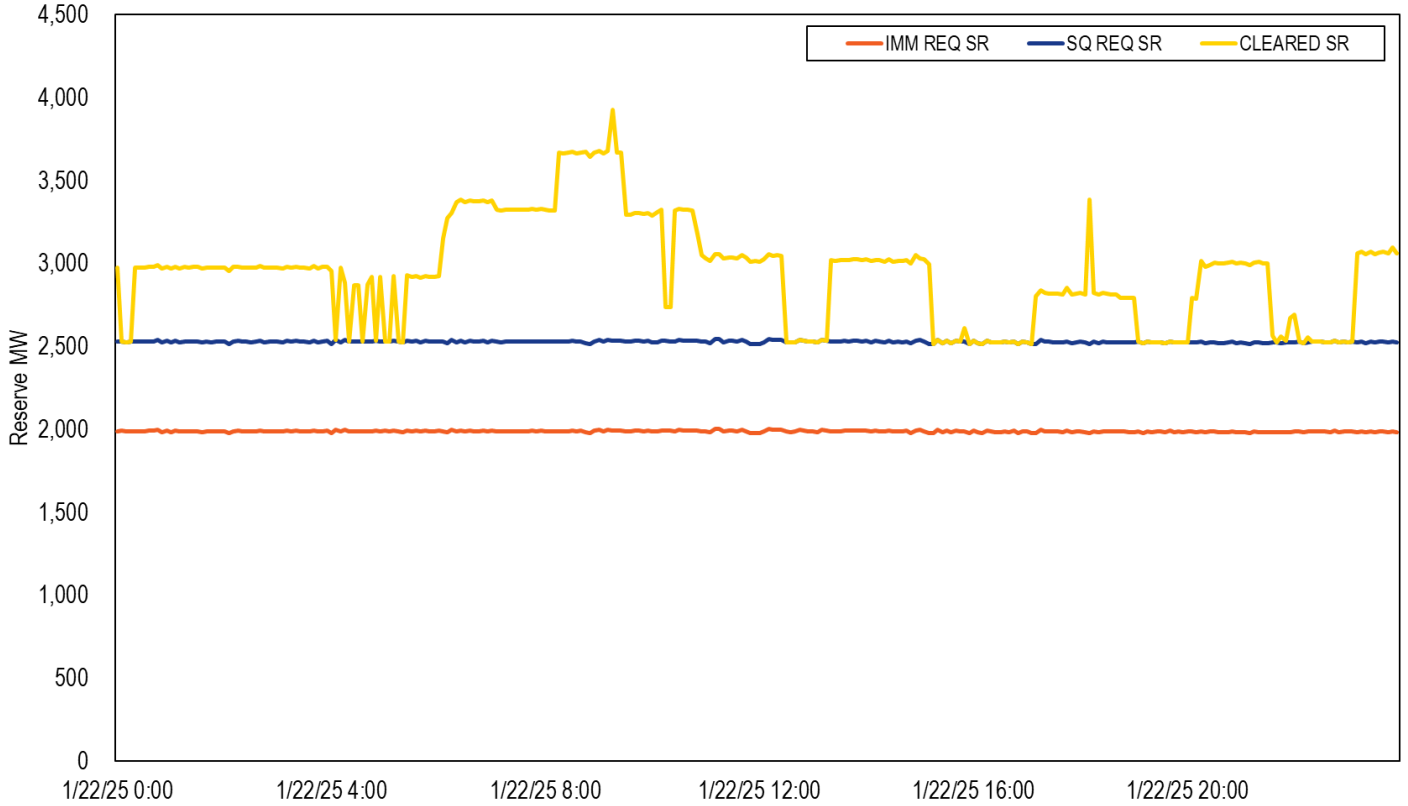
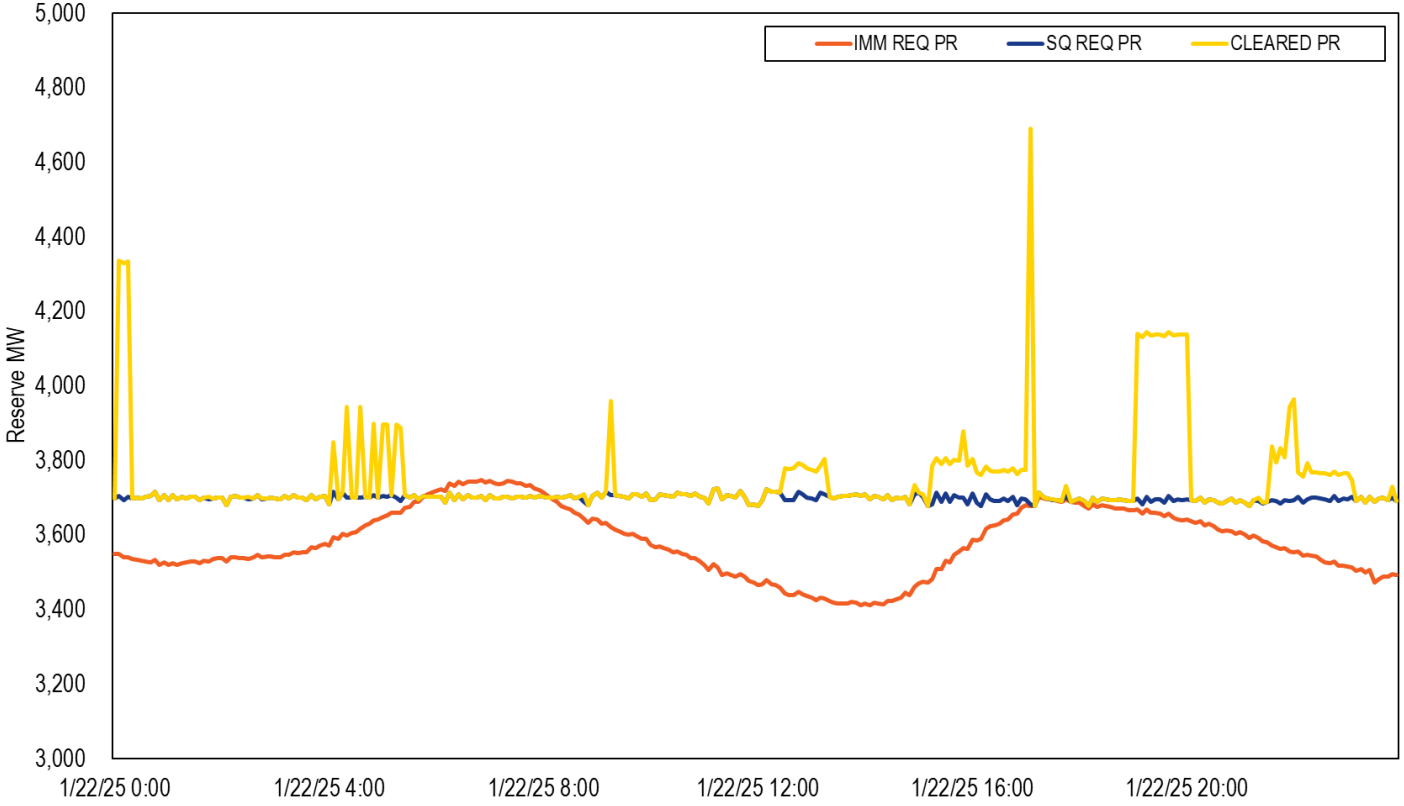
Appendix

EXAMPLE DAYS

Example Day: Jan 22 Synchronized Reserve



Example Day: Jan 22 Primary Reserve



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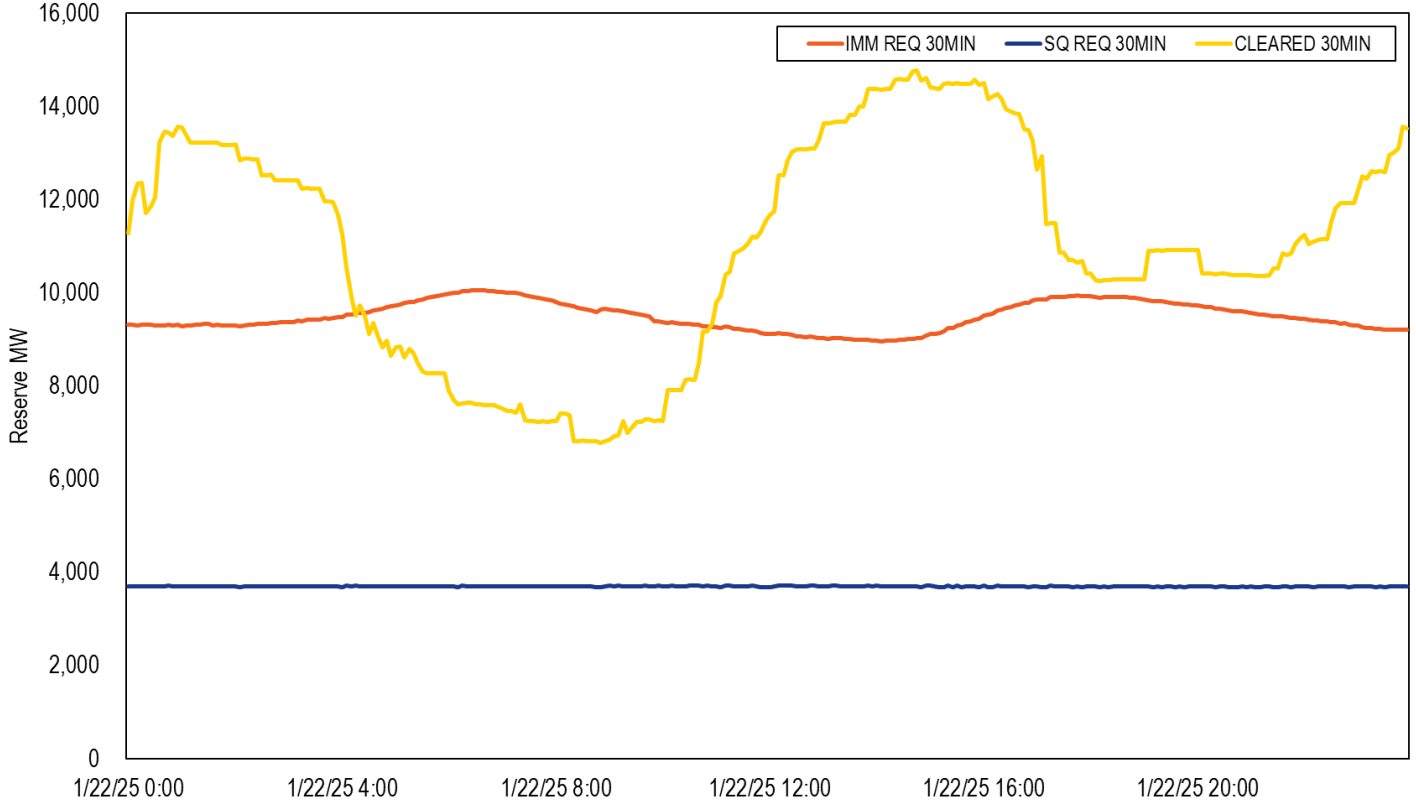
Example Day: Jan 22 30MIN Reserve



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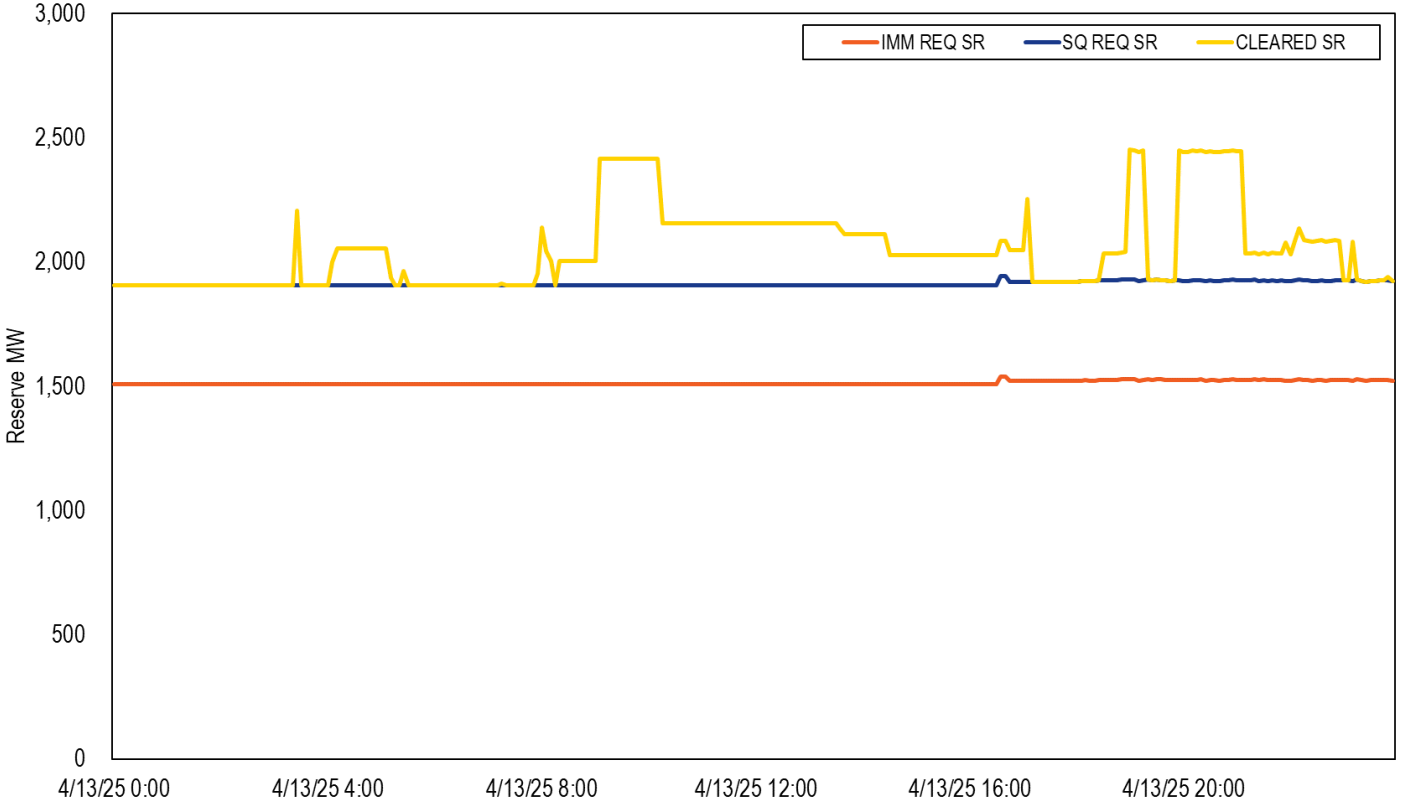
Example Day: April 13 Synchronized Reserve



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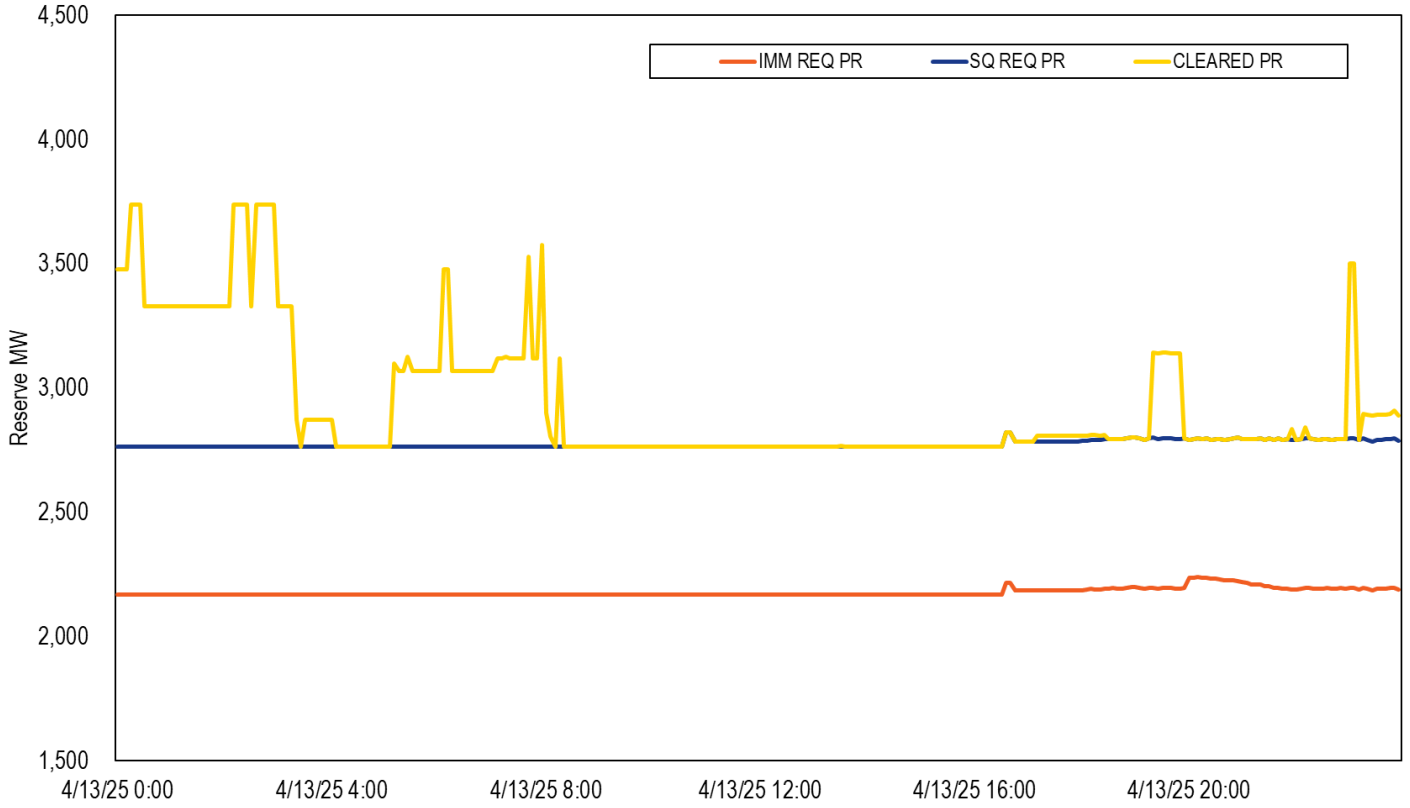
Example Day: April 13 Primary Reserve



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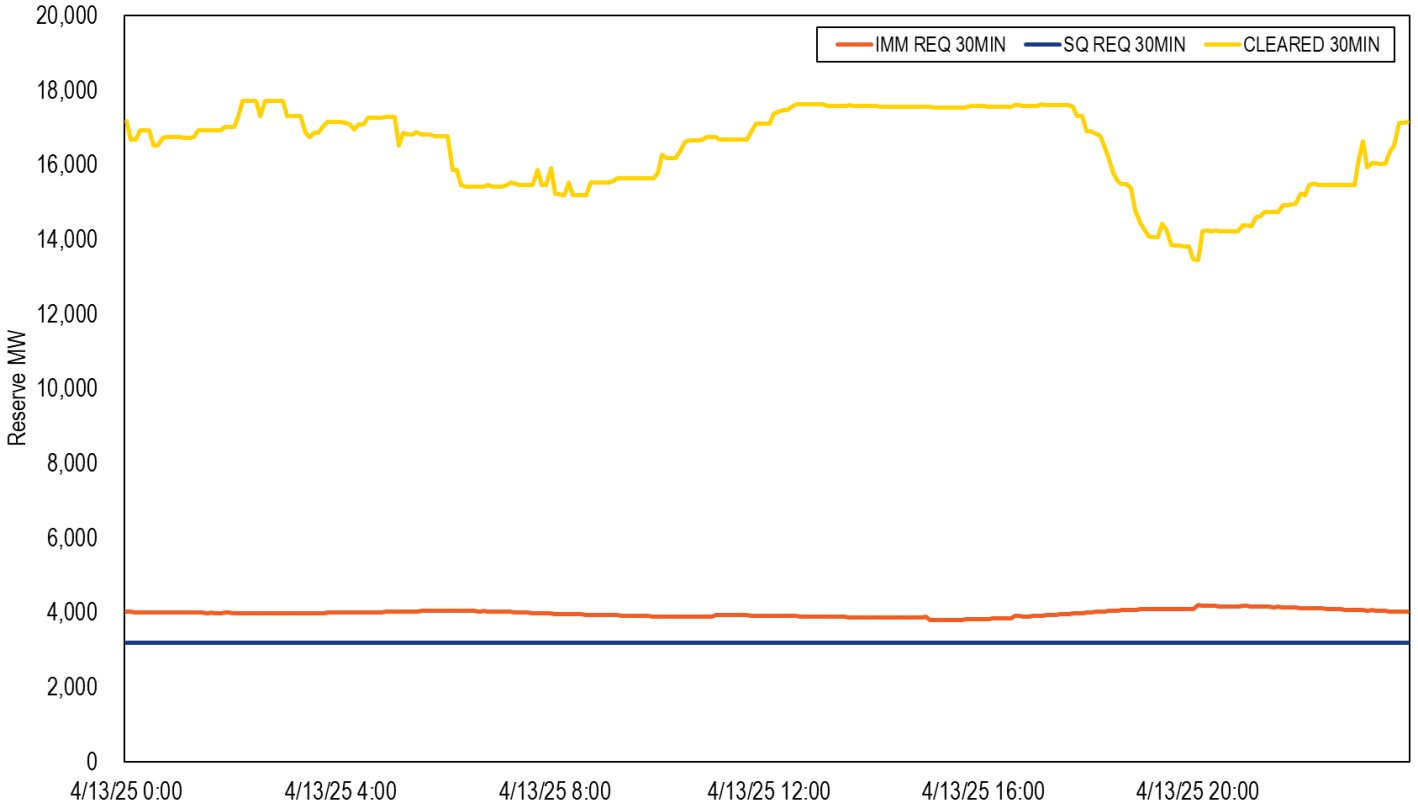
Example Day: April 13 30MIN Reserve



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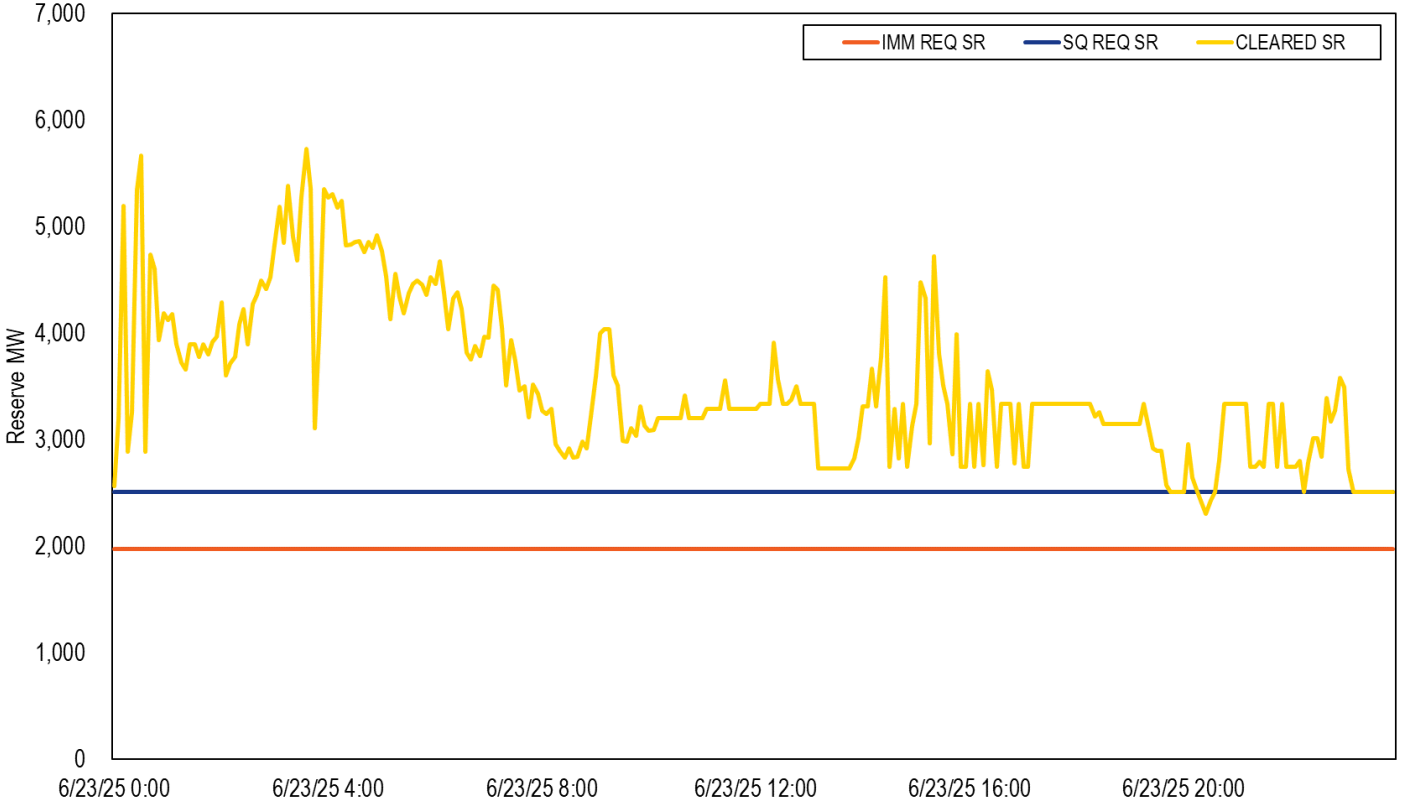
Example Day: June 23 Synchronized Reserve



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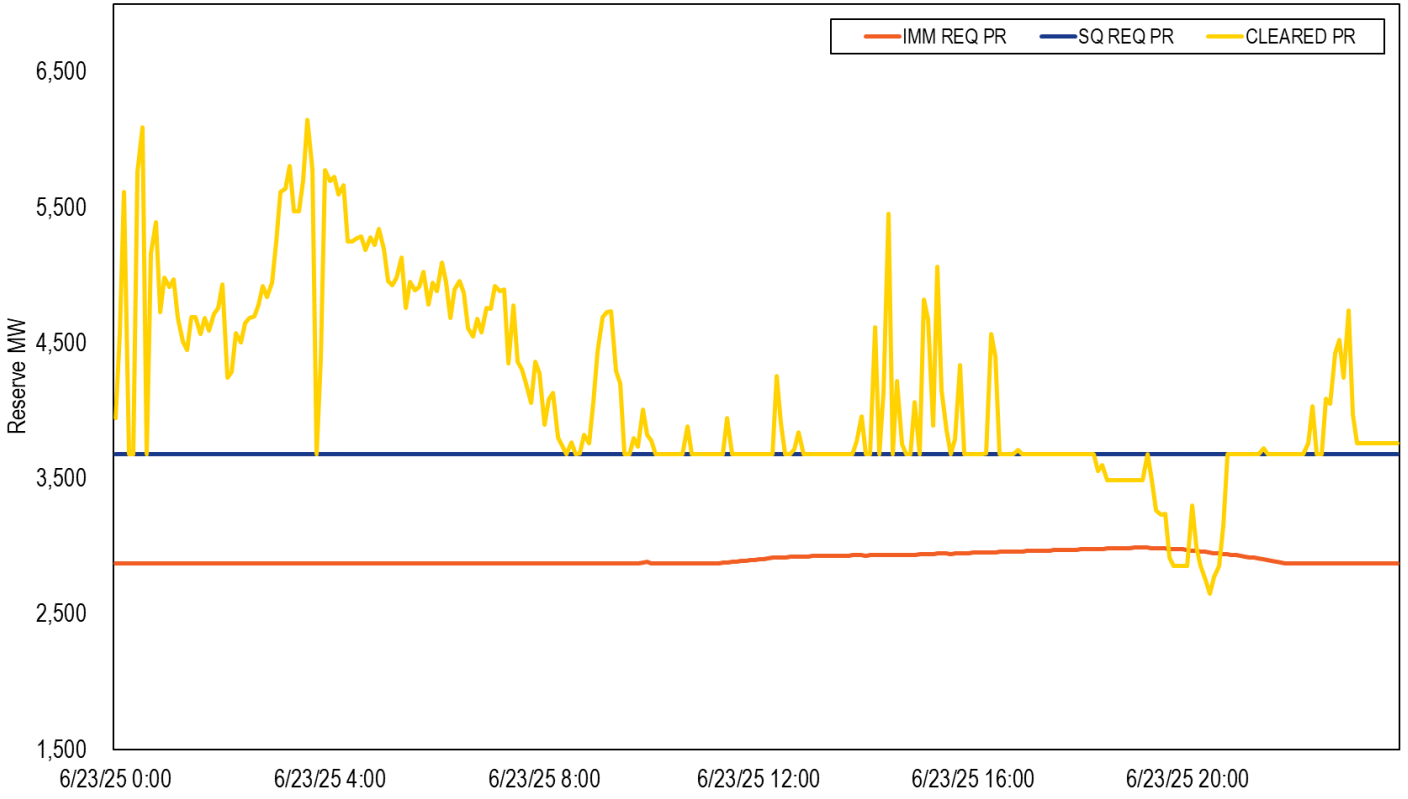
Example Day: June 23 Primary Reserve



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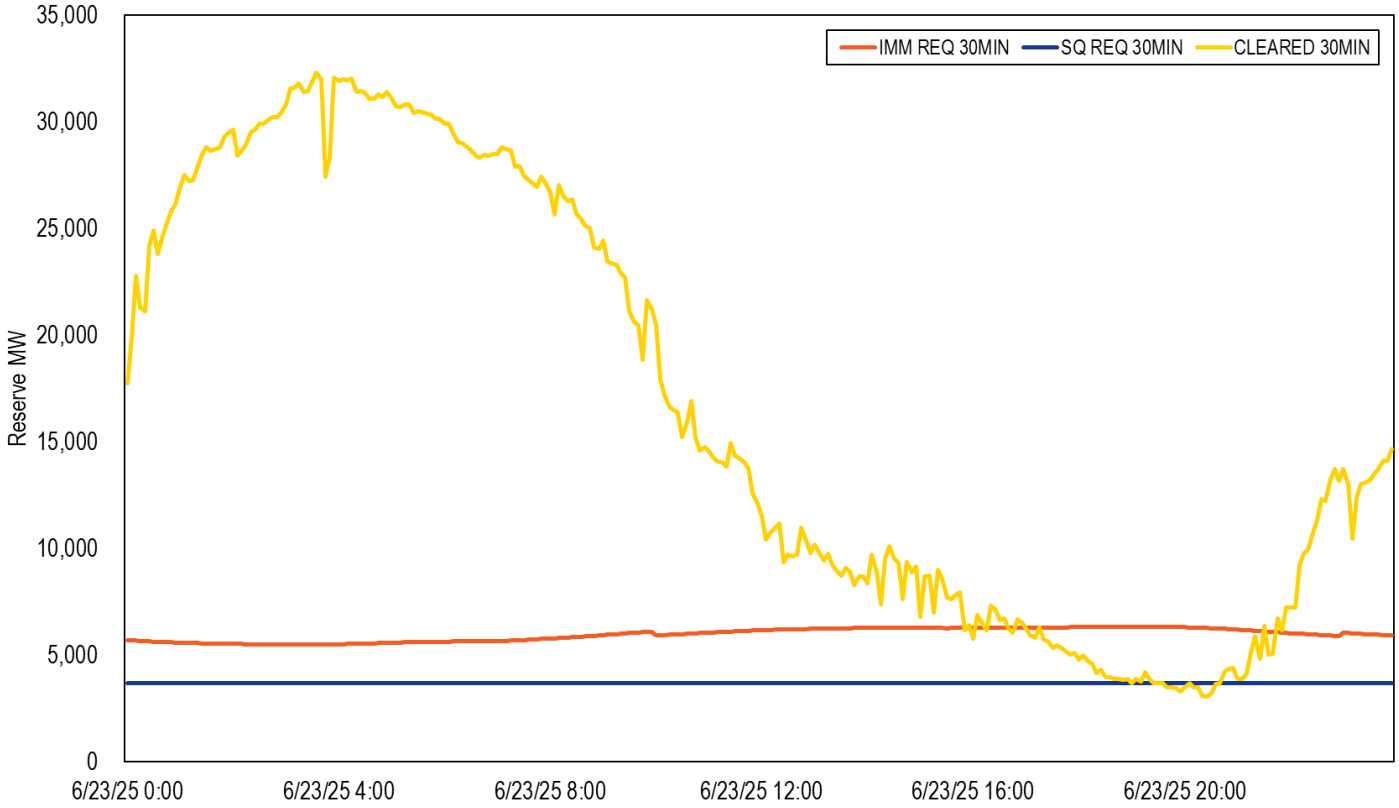
Example Day: June 23 30MIN Reserve



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Appendix

COST ESTIMATION DETAILS

Synchronized Reserve Cost Estimation

- **If IMM PR ≤ Cleared PR and IMM 30MIN ≤ Cleared 30MIN:**

  IMM SR Cost = IMM SR x SR MCP / 12

- **If IMM PR > Cleared PR and IMM 30MIN ≤ Cleared 30MIN or IMM PR ≤ Cleared PR and IMM 30MIN > Cleared 30MIN:**

  IMM SR Additional Cost = IMM SR x 850/12

- **If IMM PR > Cleared PR and IMM 30MIN > Cleared 30MIN:**

  IMM SR Additional Cost = IMM SR x 1700/12

Non-Synchronized Reserve Cost Estimation

- **If IMM PR ≤ Cleared PR and IMM 30MIN ≤ Cleared 30MIN:**

  IMM NSR Cost = IMM NSR x NSR MCP / 12

- **If IMM PR > Cleared PR and IMM 30MIN ≤ Cleared 30MIN**
  or IMM PR ≤ Cleared PR and IMM 30MIN > Cleared 30MIN:

  IMM NSR Additional Cost = IMM NSR x 850/12

- **If IMM PR > Cleared PR and IMM 30MIN > Cleared 30MIN:**

  IMM NSR Additional Cost = IMM NSR x 1275/12

Secondary Reserve Cost Estimation

- **If IMM 30MIN ≤ Cleared 30MIN:**

IMM SecR Cost = IMM SecR x SecR MCP

- **If IMM 30MIN > Cleared 30MIN:**

IMM SecR Additional Cost = IMM SecR x 850 /12