New York ISO
Independent System Operator

FERC Order 2222 Consumer Impact Analysis

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November 4, 2025

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Background/Market Design Concept

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FERC Order 2222

- Issued in 2020 with updates in 2021, NYISO plans to implement by end of 2026
  - The NYISO will complete the Software Design in 2025
- Aims to reduce barriers to DER participation, such as allowing DERs to participate as Operating Reserves suppliers
- This analysis focuses on the impact of additional DER participation as Operating Reserves suppliers

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Consumer Impact Analysis (CIA)

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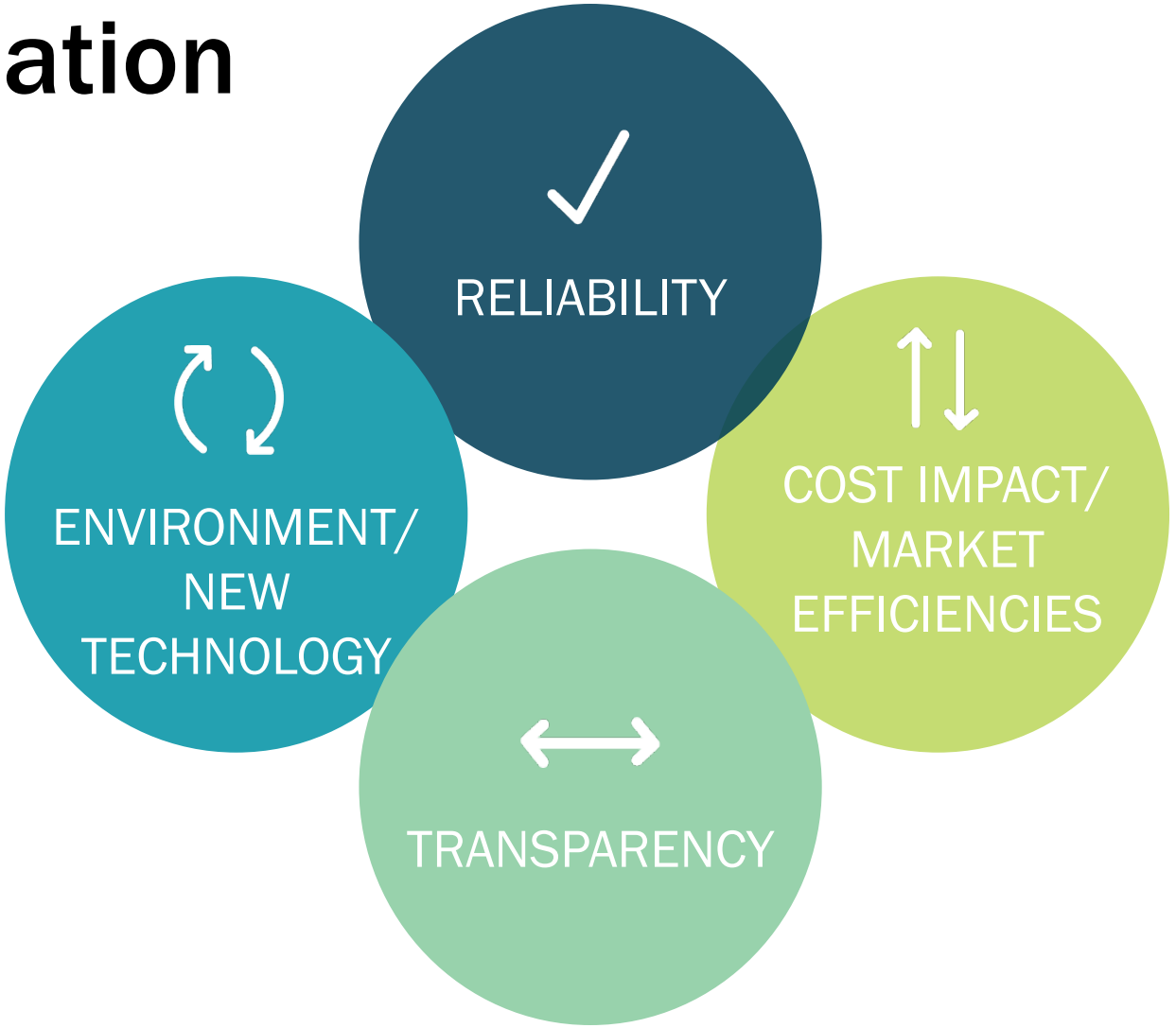
Consumer Impact Analysis (CIA) Evaluation Areas



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Reliability

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More Participation in Operating Reserves

- More participation of suppliers providing Operating Reserves is beneficial to reliability.

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Cost Impact/Market Efficiencies

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Cost Impact/ Market Efficiencies

- **Assumptions and Approach**
  - The economic impacts to consumers from the FERC Order 2222 changes to DER participation rules are likely to span a number of areas. For example, there may be changes to the incentives for new resources, there may be additional participation (from existing or new resources) in the NYISO reserve markets, and there will likely be secondary effects as well.
  - Many of these impacts are not quantifiable but it is possible to estimate the short run sensitivity of reserve prices to additional participation from allowing heterogenous DER aggregations to participate in the reserves market.

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Ancillary Service Market Impact Methodology

Cost Impact/ Market Efficiencies

- **Energy & Ancillary Services Markets**
  - Evaluate the impact of additional participation on the reserve market.
    - Focusing on the 30-minute Total Operating reserves because they are NYCA wide and don't require assumptions about the location of the additional participants.
  - The actual amount of participation is currently unknown so we will evaluate a range of additional participation. Since the requirement is 2620 MW, we look at a range of additional resources from 50 to 500 MW and compare them to what the reserve prices would be with no additional participation.
    - The range was selected based on feedback from NYISO teams.
  - The focus of the analysis is on the Day-Ahead Market.

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Cost Impact/ Market Efficiencies

- **Energy Market & Ancillary Services Markets (cont.)**
  - Use an approach similar to that used for the Balancing Intermittency CIA in 2024.
  - Leverage the day-ahead reserve supply curve to estimate the impact of different levels of additional supply.
  - Refine the approach used in the 2024 analysis by explicitly taking into account the availability of existing resources including the impact of higher quality reserves (10-minute reserves).
    - For every hour of the year, construct the 10-minute spinning reserves, 10-minute total reserves, and 30-minute total operating reserves supply curves in nested order for NYCA total reserves.
    - Remove bids that cannot supply
      - For example, removing from the supply curve large steam units that bid spinning reserves but are not scheduled to be synchronized for energy in that hour.
    - Determine the hourly clearing price of NYCA total reserves with the existing supply and with the additional supply levels.

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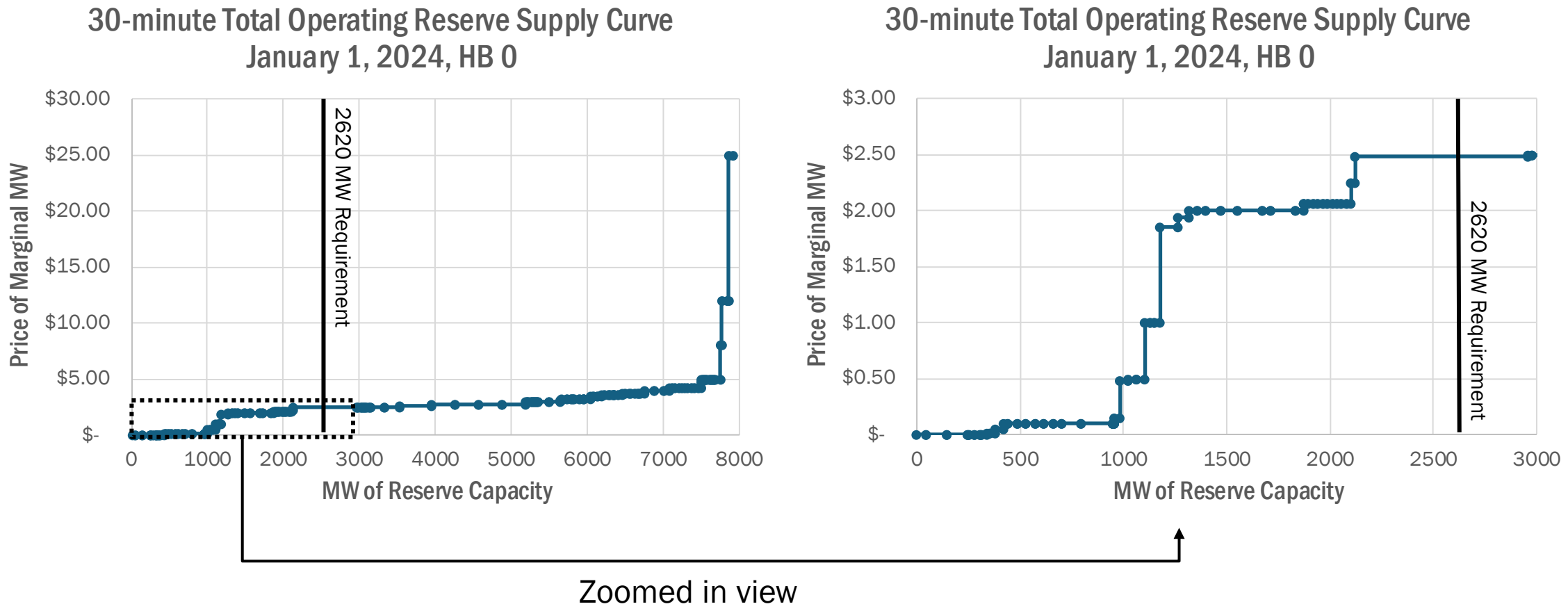
Example of a Reserve Supply Curve

COST IMPACT/ MARKET EFFICIENCIES



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Average Reserve Supply Curves

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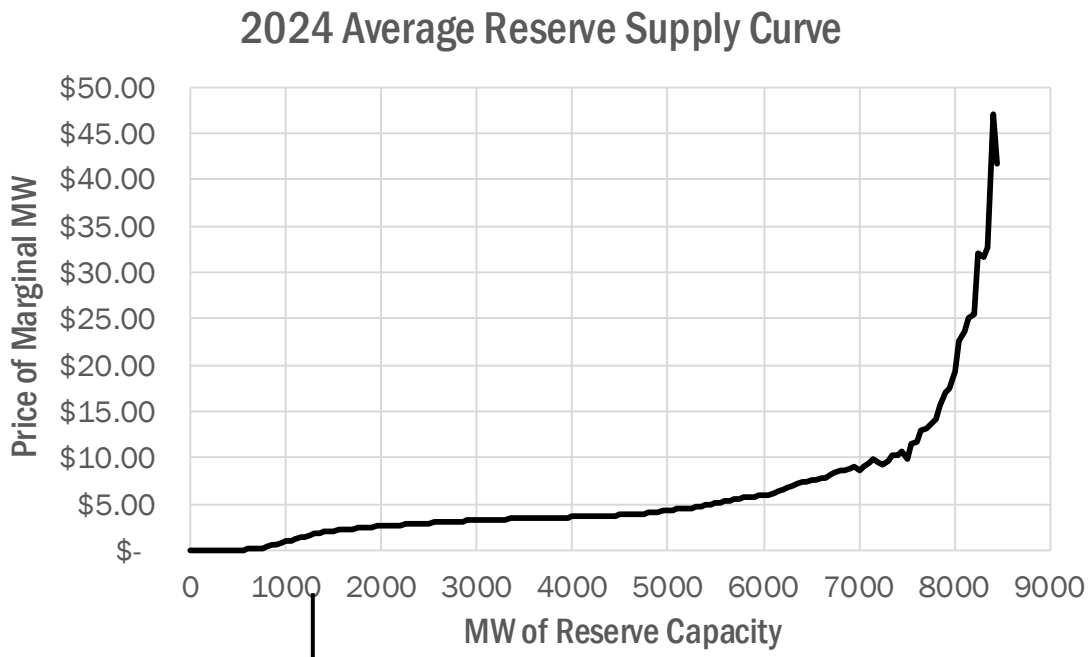

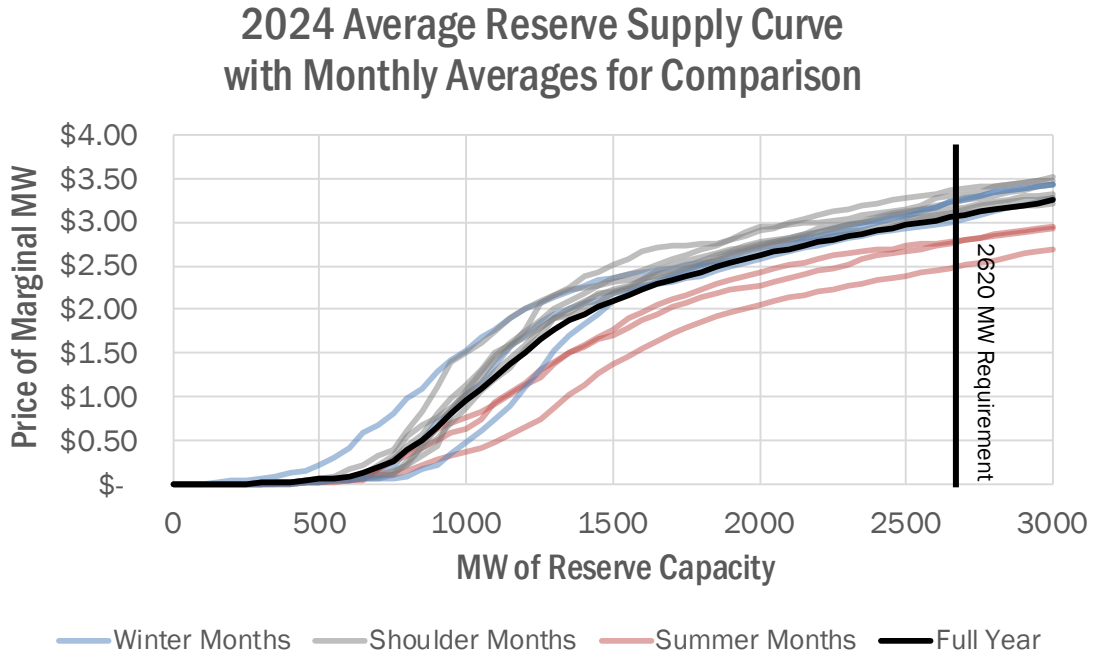

Zoomed in view

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2024 Prices

- For context, the 2024 monthly DAM 30 minute NYCA reserve prices averaged $4.05 and ranged from $3.54 in May to $6.11 in December.

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Ancillary Service Market Impact

Annual Price Impact of Additional Supply

Supply Added (MW)	0	50	100	150	200	250	300	350	400	450	500
Average Reserves Price ($)	3.03	3.00	2.97	2.94	2.91	2.88	2.85	2.81	2.78	2.74	2.71
Average Hourly Price Delta ($)	n/a	-0.03	-0.06	-0.09	-0.12	-0.16	-0.19	-0.22	-0.25	-0.29	-0.33
Average Hourly Price Delta (%)	n/a	-1.03	-2.08	-3.02	-3.98	-5.13	-6.15	-7.28	-8.33	-9.57	-10.72
Median Hourly Price Delta ($)	n/a	0.00	0.00	0.00	-0.02	-0.05	-0.07	-0.12	-0.15	-0.18	-0.24
Minimum Hourly Price Delta ($)	n/a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum Hourly Price Delta ($)	n/a	-1.00	-1.00	-1.01	-1.01	-1.23	-1.23	-1.50	-1.50	-1.50	-1.50

- **The annual average price impacts of adding 50 to 500MW are small**
  - Average price impacts range from a $0.03 to $0.33 decrease in 30-minute reserve prices.
  - The highest hourly impacts are a decrease of $1.00 to $1.50.
  - The median impacts range from zero to a $0.24 decrease.

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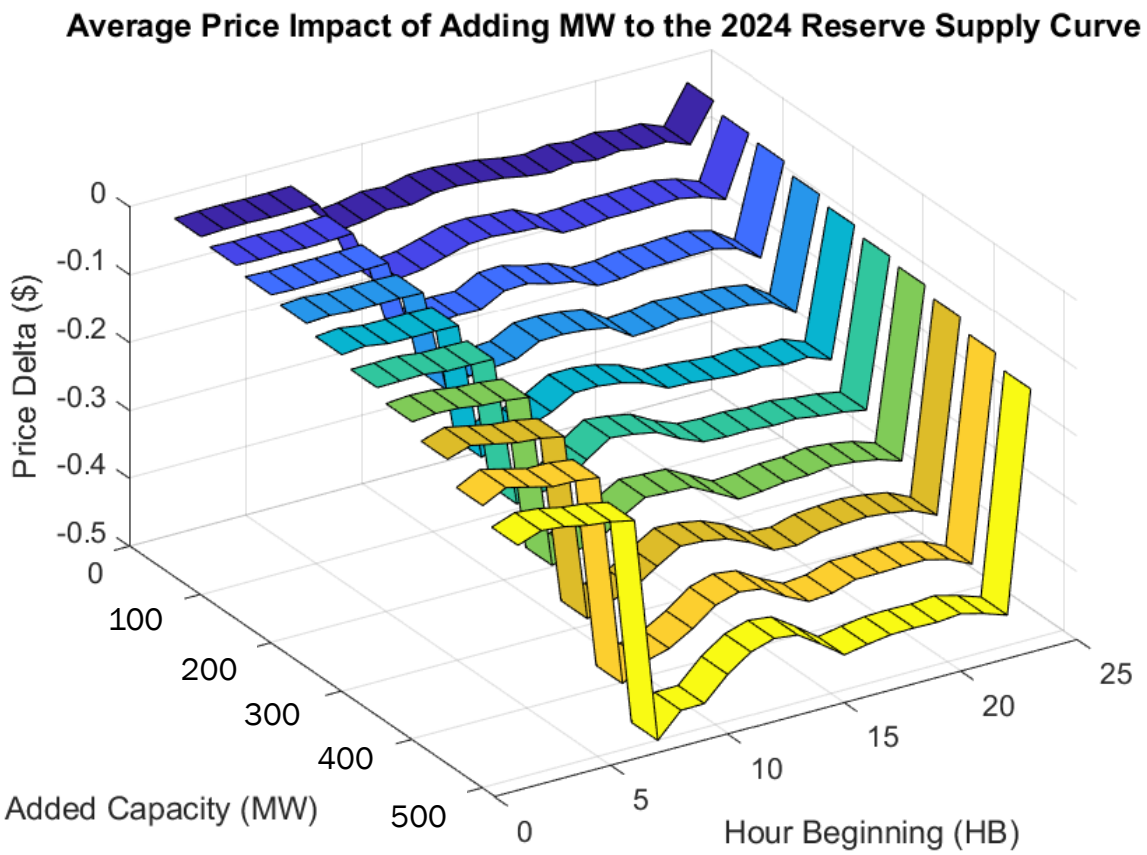
COST IMPACT/ MARKET EFFICIENCIES

Price Impact By Hour of the day

- Peak hours (HB7-22) show the most price impact
- Off peak hours have almost no price impact
- Overall, average hourly impacts remain small
  - less than a $0.50 impact with 500MW added supply



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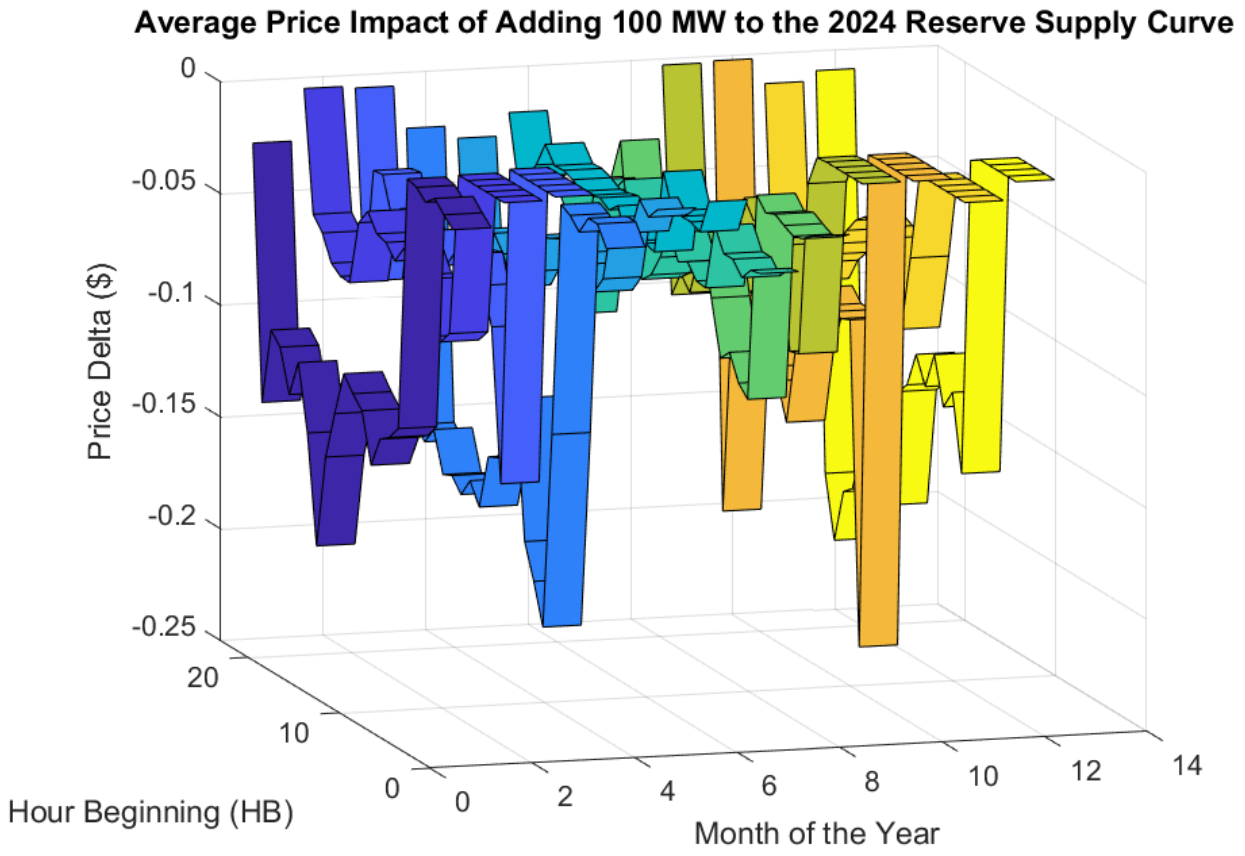
Price Impacts by Month and Hour (100MW)

- Summer months show the least impact because there are many reserve suppliers available.
- In the shoulder months, higher levels of outages lead to a more constrained supply curve and higher price impacts.
- In the winter, high fuel prices lead to a higher price impacts.



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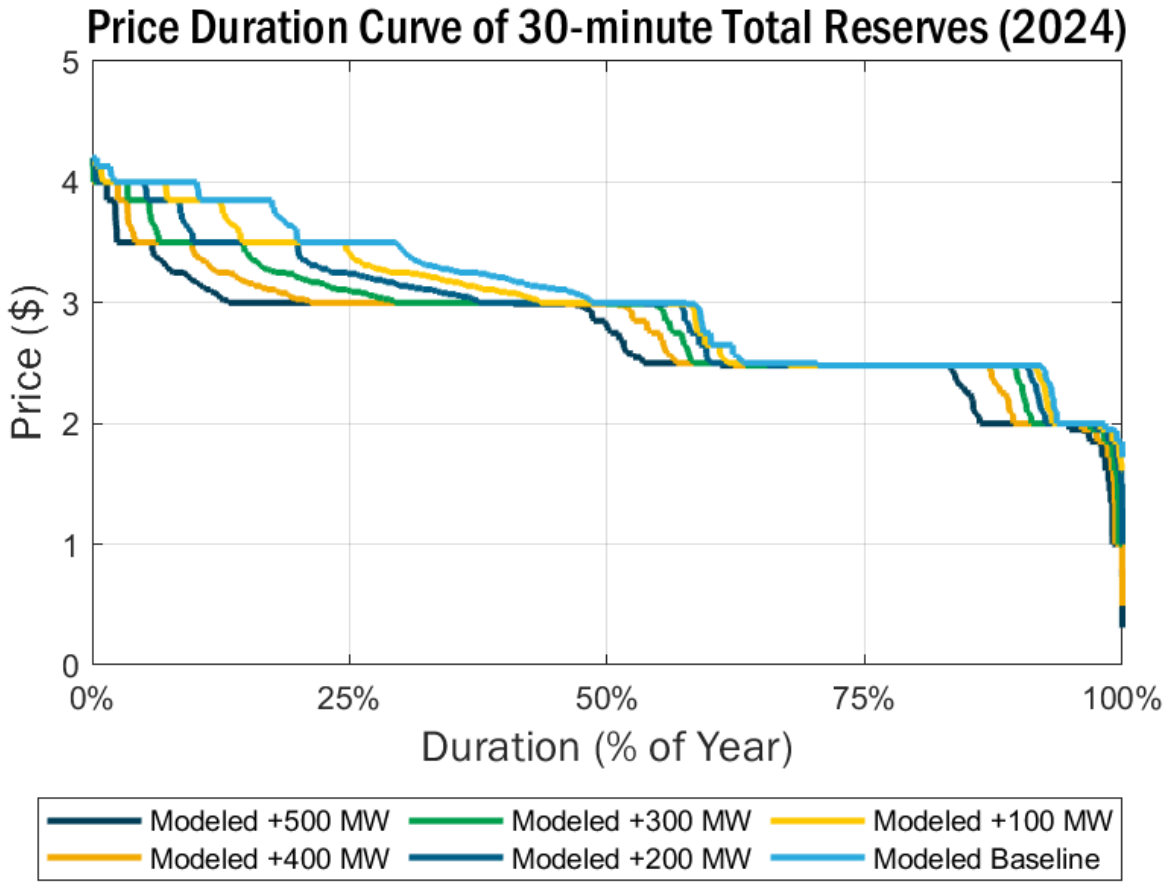
Price Duration Curves

COST IMPACT/ MARKET EFFICIENCIES



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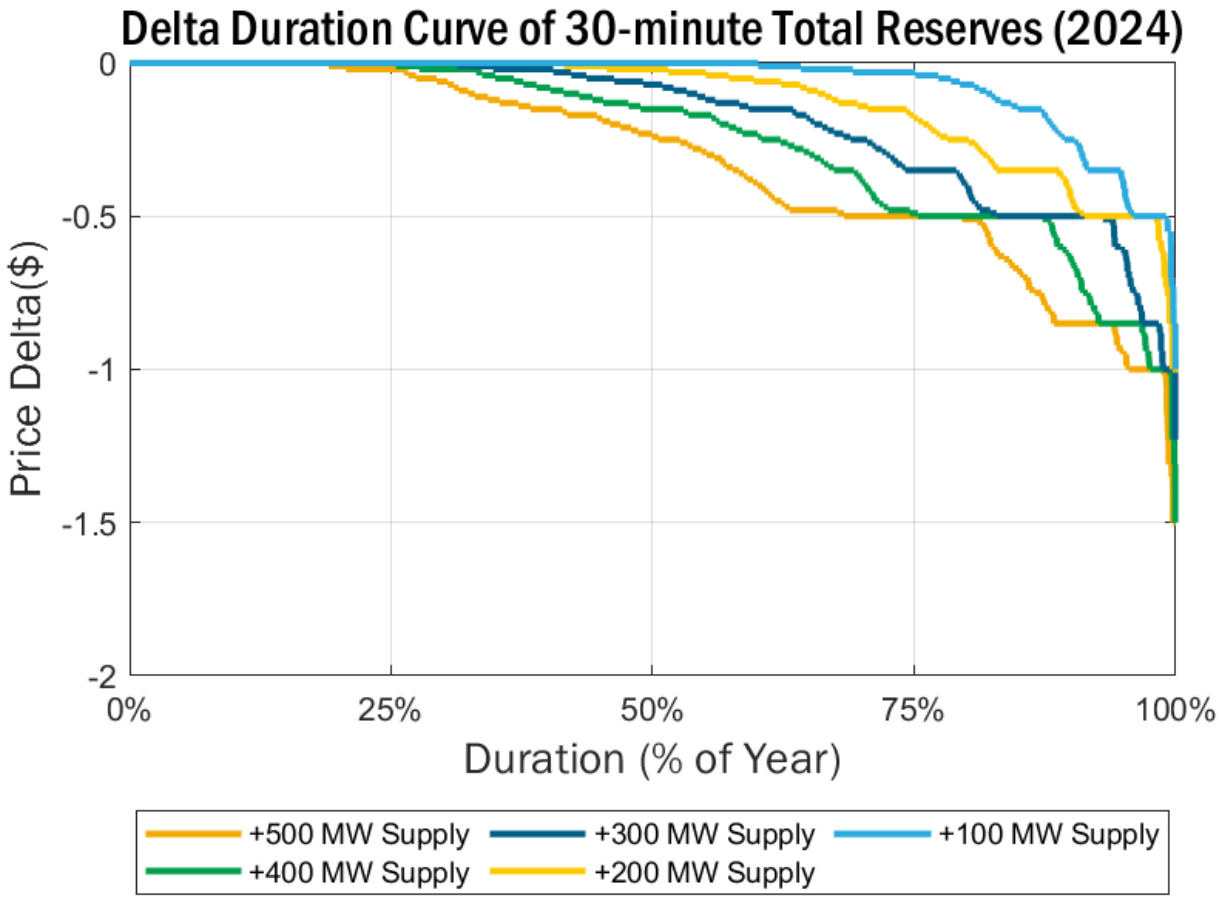
Price Delta Duration Curves

COST IMPACT/ MARKET EFFICIENCIES



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Ancillary Market Price Impact Summary

- **On average, the price impact of additional 30-minute reserves is small.**
  - The annual average 30-minute reserve price impacts range $0.03 to $0.33 for 50MW to 500MW of additional supply participation.
- **Off peak hours show almost no price impact.**
- **Summer months show the least impact. Winter and shoulder months show more price sensitivity.**

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Capacity Market Impact

Cost Impact/ Market Efficiencies

- **Capacity Market**
  - No measurable capacity market impact is expected from the FERC Order 2222 additional DER participation in operating reserves.
    - The annual average 30-minute reserve price impacts range from $0.03 to $0.33 for 50MW to 500MW of additional supply participation.
    - This is not expected to impact the revenue assumptions of the demand curve unit.

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Environment/New Technology

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New Technology

- Provides a better price signal of when (and ultimately where) resources are needed.

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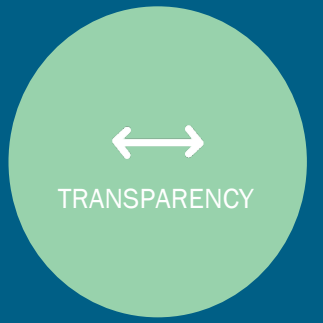

Transparency

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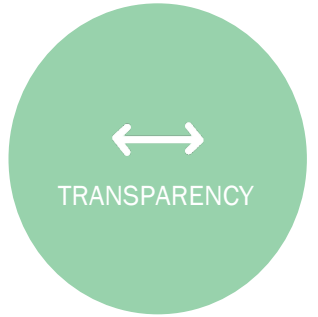
Transparency



- No impacts on transparency have been identified

Next Steps

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Next Steps

- FERC Order 2222 software changes are expected to deploy in 2026.

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Appendix

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NYCA Operating Reserves

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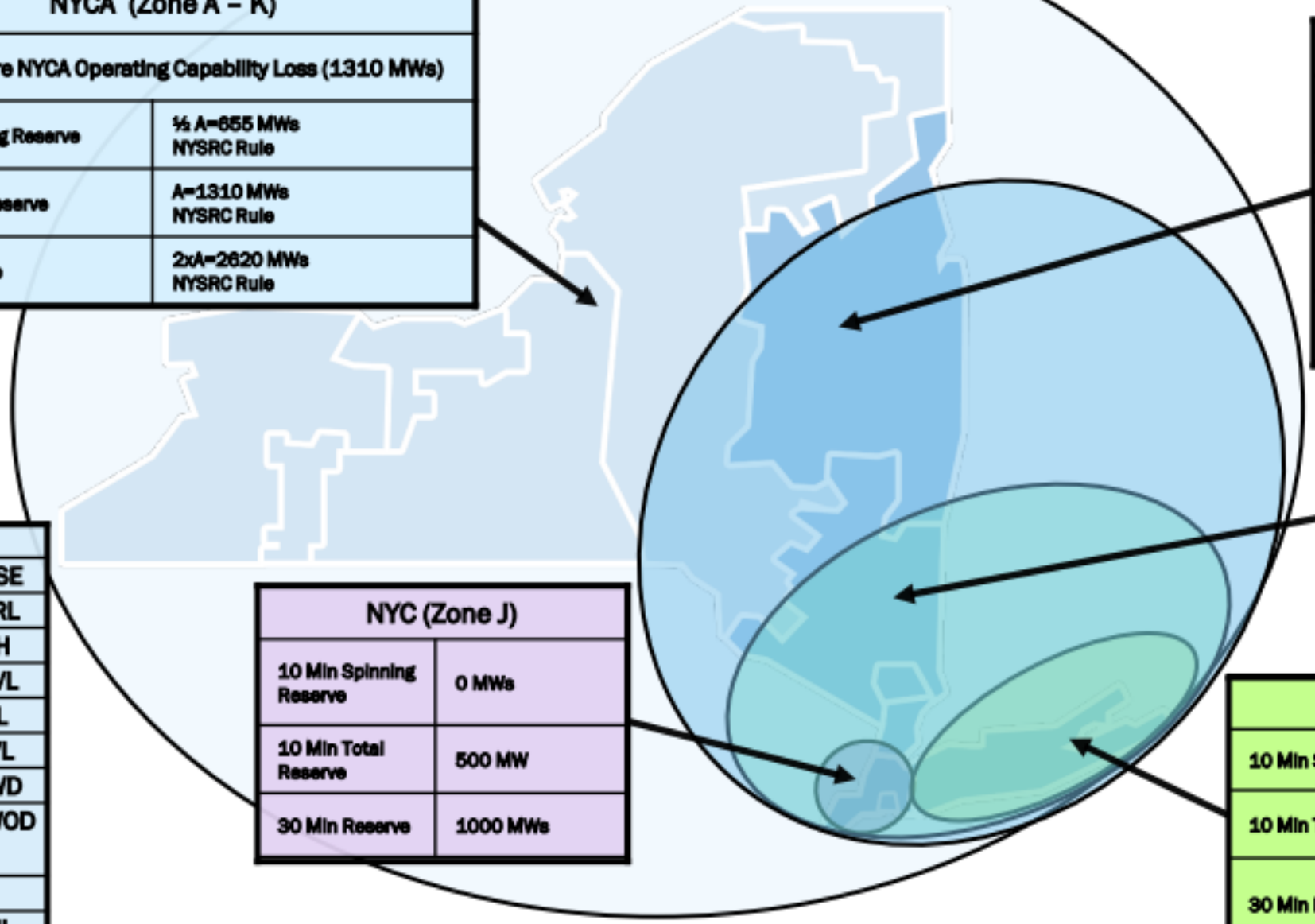
NYCA (Zone A – K)	
A=most severe NYCA Operating Capability Loss (1310 MWs)	
10 Min Spinning Reserve	½ A=655 MWs NYSRC Rule
10 Min Total Reserve	A=1310 MWs NYSRC Rule
30 Min Reserve	2xA=2620 MWs NYSRC Rule



East (Zone F – K)	
A=most severe NYCA Operating Capability Loss (1310 MWs)	
10 Min Spinning Reserve	¼ A=330 MWs NERC, NPCC Rule
10 Min Total Reserve	1200 MWs NYSRC Rule
30 Min Reserve	1200 MWs NERC, NPCC Rule

SENY (Zone G – K)	
10 Min Spinning Reserve	0 MWs
10 Min Total Reserve	0 MWs
30 Min Reserve	1300 MWs NYSRC Rule

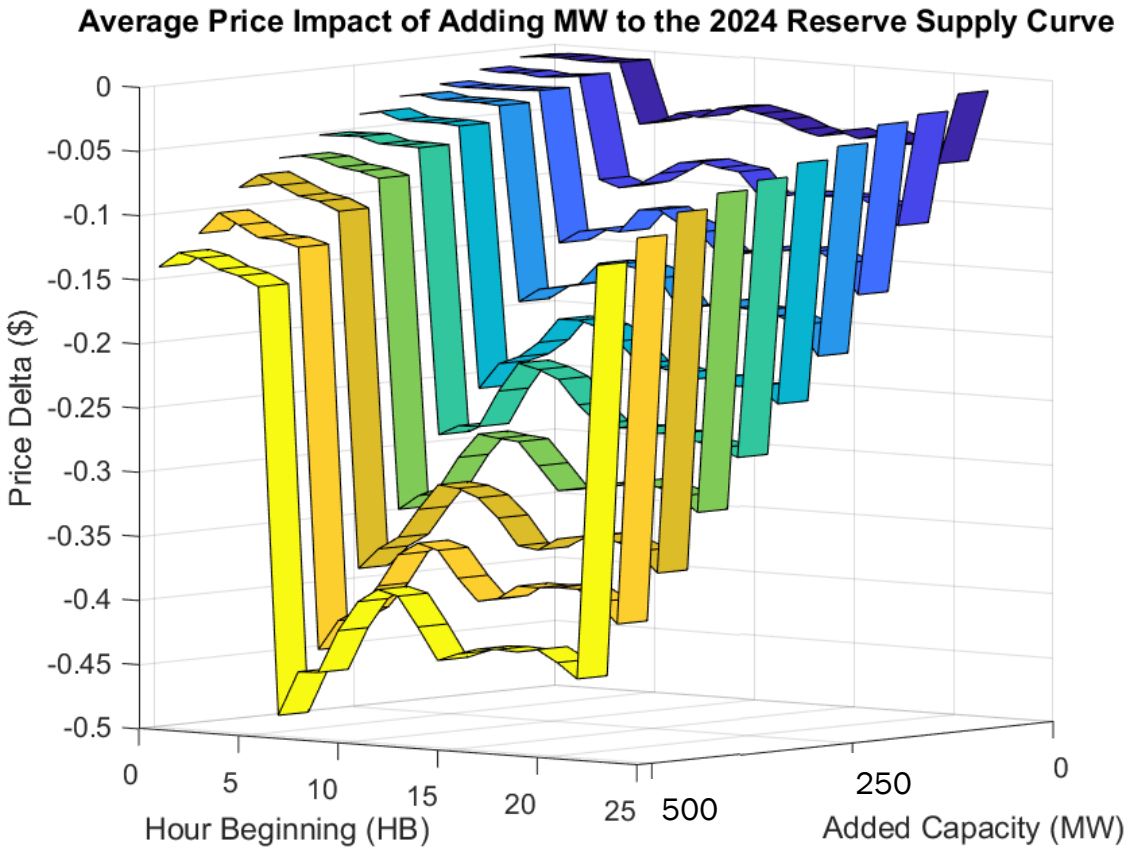
A	WEST
B	GENESE
C	CENTRL
D	NORTH
E	MHK VL
F	CAPITL
G	HUD VL
H	MILLWD
I	DUNWOD
J	N.Y.C.
K	LONGIL

NYC (Zone J)	
10 Min Spinning Reserve	0 MWs
10 Min Total Reserve	500 MW
30 Min Reserve	1000 MWs

Long Island (Zone K)	
10 Min Spinning Reserve	0 MWs
10 Min Total Reserve	120 MW NERC, NPCC Rule
30 Min Reserve	270 – 540 MWs Max limits NYSRC Rule

Price Impact By Hour of the day

COST IMPACT/ MARKET EFFICIENCIES



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Price Impact of 100 MW By Hour

Hour Beginning (HB)	0	1	2	3	4	5	6	7	8	9	10	11
Average Reserves Price ($)	2.44	2.44	2.44	2.44	2.44	2.44	2.43	3.21	3.38	3.37	3.33	3.29
Average Reserves Price After 100 MW Supply Increase ($)	2.42	2.43	2.43	2.43	2.42	2.42	2.42	3.12	3.28	3.28	3.25	3.22
Average Hourly Price Delta ($)	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.09	-0.10	-0.09	-0.08	-0.07
Average Hourly Price Delta (%)	-0.46	-0.37	-0.40	-0.39	-0.45	-0.41	-0.35	-2.97	-3.14	-3.02	-2.70	-2.39
Median Hourly Price Delta ($)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	0.00	0.00
Minimum Hourly Price Delta ($)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum Hourly Price Delta ($)	-0.48	-0.48	-0.48	-0.48	-0.48	-0.48	-0.48	-1.00	-0.75	-0.73	-0.73	-0.55
Hour Beginning (HB)	12	13	14	15	16	17	18	19	20	21	22	23
Average Reserves Price ($)	3.28	3.28	3.30	3.36	3.36	3.37	3.37	3.36	3.36	3.36	3.27	2.47
Average Reserves Price After 100 MW Supply Increase ($)	3.21	3.20	3.23	3.27	3.27	3.28	3.27	3.27	3.27	3.26	3.16	2.45
Average Hourly Price Delta ($)	-0.07	-0.07	-0.08	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.10	-0.11	-0.02
Average Hourly Price Delta (%)	-2.33	-2.44	-2.51	-3.07	-3.07	-2.97	-2.99	-2.96	-2.94	-3.17	-3.59	-0.69
Median Hourly Price Delta ($)	0.00	0.00	0.00	-0.01	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00
Minimum Hourly Price Delta ($)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum Hourly Price Delta ($)	-0.51	-0.51	-0.55	-0.73	-0.73	-0.73	-0.73	-0.73	-0.73	-0.73	-1.00	-0.53

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Price Impacts by Month and Hour

(100MW)

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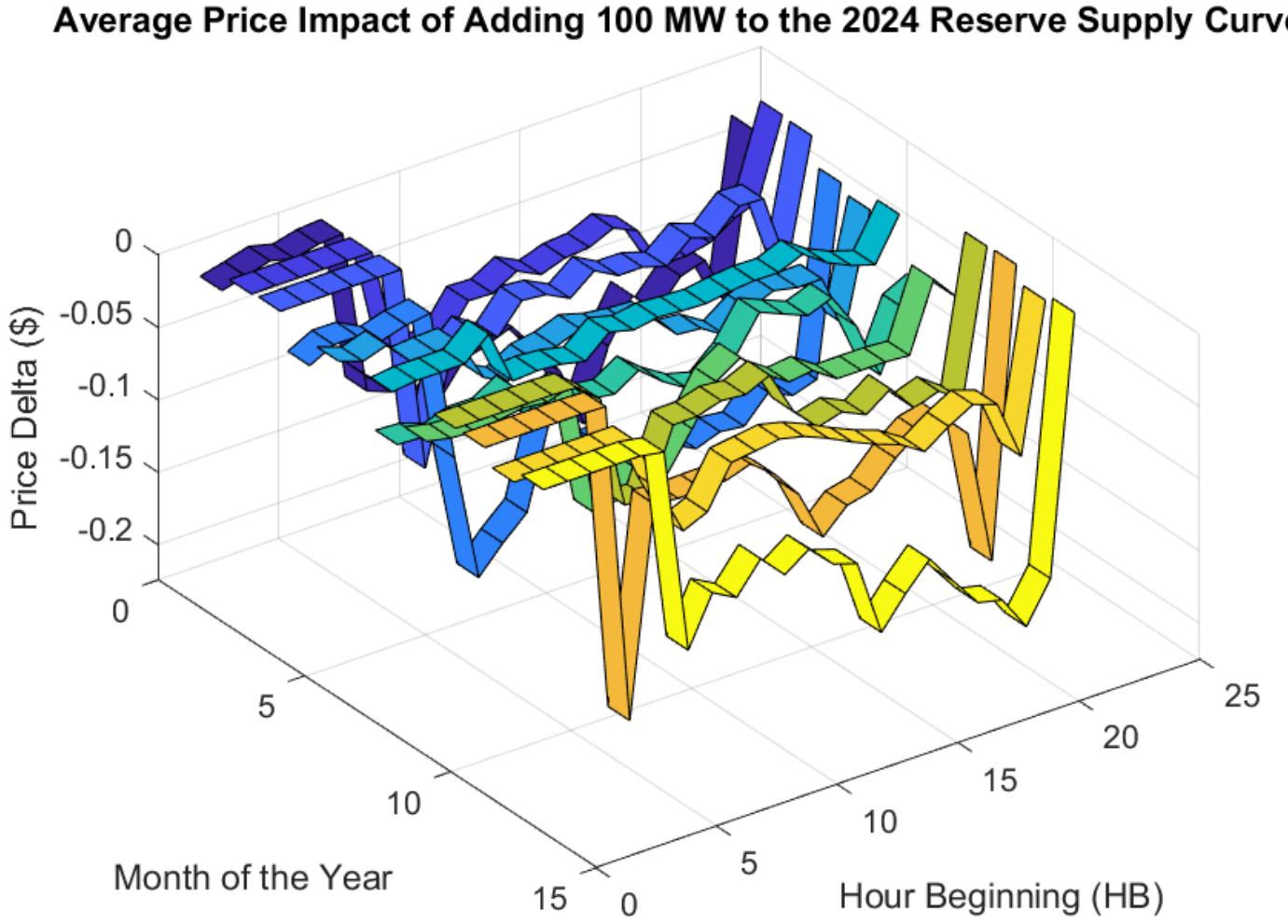

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Price Impact of 100 MW by Month

Month	1	2	3	4	5	6	7	8	9	10	11	12
Average Reserves Price ($)	3.20	2.98	3.09	3.27	3.13	2.76	2.45	2.74	3.06	3.20	3.34	3.19
Average Reserves Price After 100 MW Supply Increase ($)	3.11	2.94	3.04	3.16	3.09	2.73	2.40	2.68	3.01	3.12	3.28	3.09
Average Hourly Price Delta ($)	-0.09	-0.04	-0.04	-0.11	-0.05	-0.03	-0.05	-0.06	-0.05	-0.08	-0.05	-0.10
Average Hourly Price Delta (%)	-2.93	-1.41	-1.38	-3.76	-1.60	-0.98	-1.79	-1.90	-1.58	-2.51	-1.65	-3.36
Median Hourly Price Delta ($)	0.00	0.00	0.00	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Minimum Hourly Price Delta ($)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum Hourly Price Delta ($)	-1.00	-0.51	-0.85	-1.00	-0.53	-0.85	-0.56	-0.50	-0.50	-0.85	-0.88	-1.00

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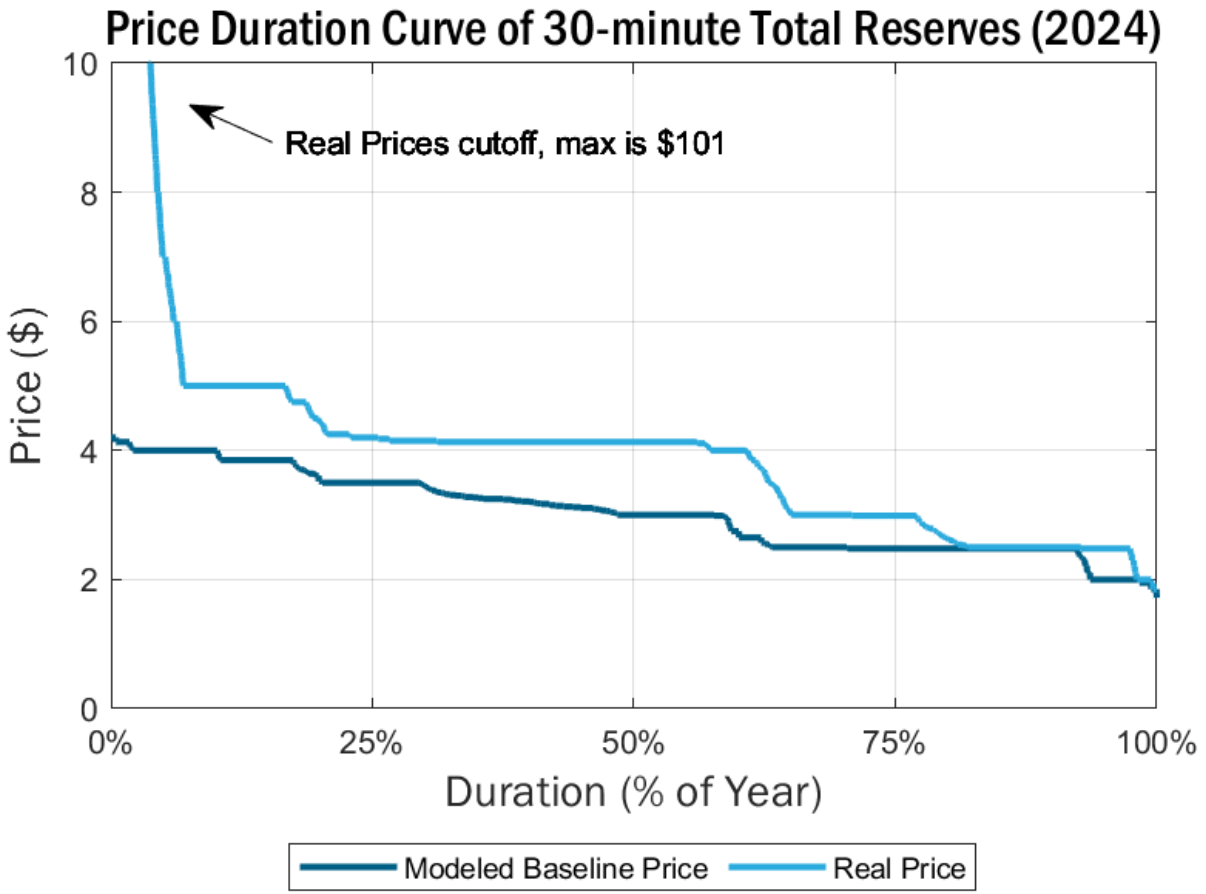
Price Duration vs. Actual 2024 Prices

COST IMPACT/ MARKET EFFICIENCIES



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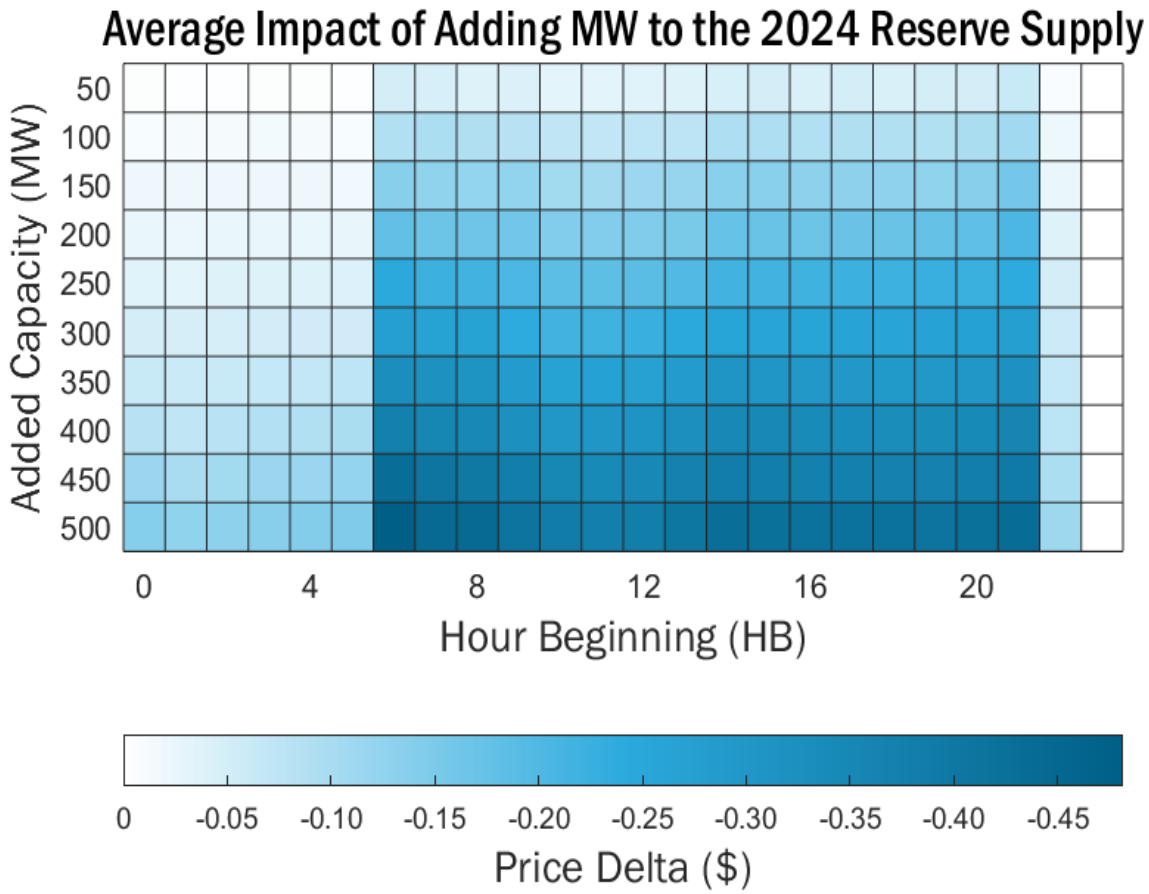
Heatmap: Adding MW by hour

COST IMPACT/ MARKET EFFICIENCIES



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Heatmap: Adding 100MW by Month and Hour

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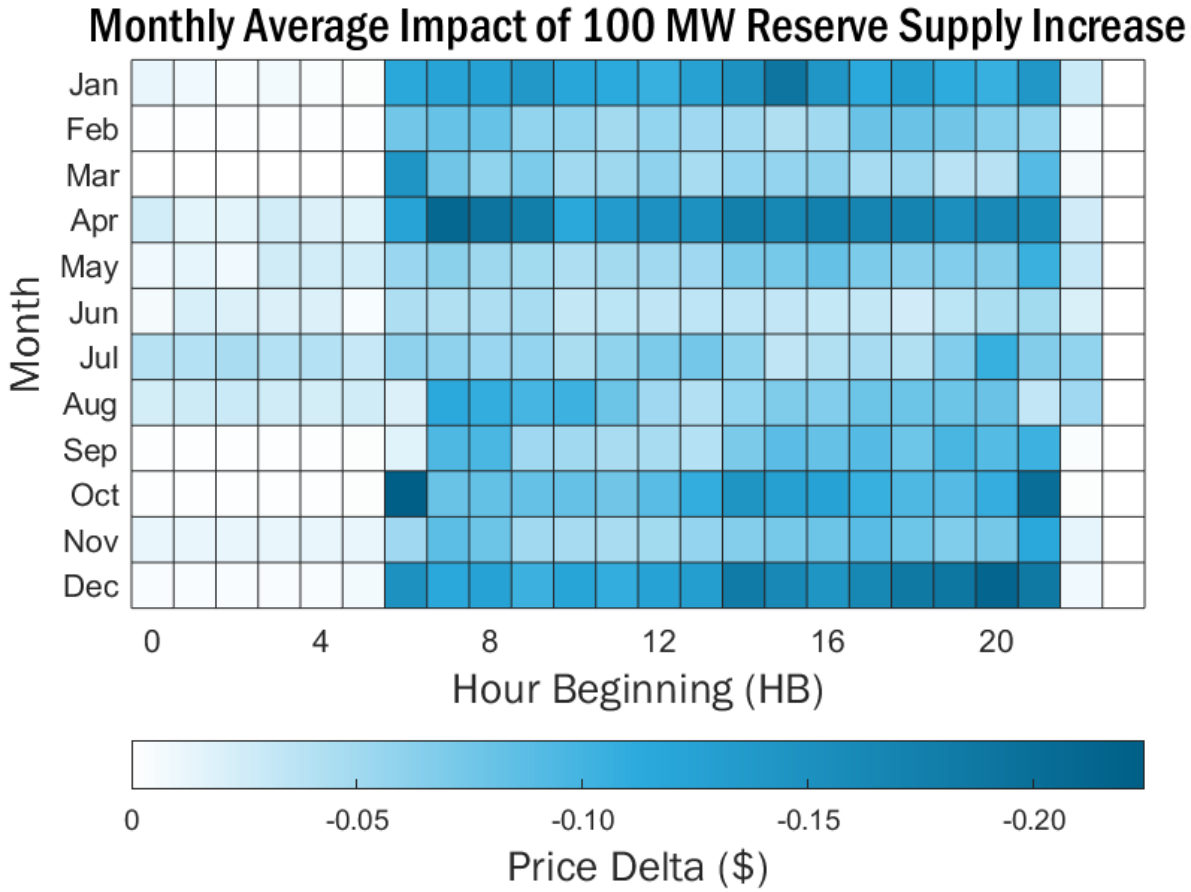

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