Real-Time Pricing Impacts: Multi-Step ORDCs with Extended Requirements

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Introduction

- Analyze the pricing impacts in the Real-Time Market (RTM) for the following:
  - Unnested Synchronized Reserve (SR) from 30-min Reserve with the 30-min Reserve having a nested 30-min Online product.
  - The proposed reserve products are represented using Operating Reserve Demand Curves (ORDCs) with multi-step segments updated every 15 minutes.
- Simulations are performed for 7 days in 2025 including high-load summer and winter days with a few low-risk shoulder season days.
- PROBE Perfect-Dispatch (PD) was used to run the simulations for the RTM. Only combustion turbines (CTs) and diesel units were allowed to be committed and decommitted by PROBE PD. The unit commitment for steam units was held fixed to actual real-time operations, but were allowed to be redispatched by PROBE PD.
- The MAD reserve sub-zone was not enforced in any of the simulations.

Introduction

PROBE PD does not have a 30-min Online product. Instead, we ran several sensitivities by increasing the SR requirements.

Four scenarios are simulated:

Base Case: Base Case with no changes

1/3rd Case: Updated ORDCs for all products with PR not optimized, 30-min Reserve is unnested from SR with 1/3rd 30-min Online added to SR

2/3rd Case: Updated ORDCs for all products with PR not optimized, 30-min Reserve is unnested from SR with 2/3rd 30-min Online added to SR

Full Case: Updated ORDCs for all products with PR not optimized, 30-min Reserve is unnested from SR with full 30-min Online added to SR

Selected Simulation Days

- The following days were selected for the simulations.

Day	Season	Assessed Risk	Reason
1/22/2025	Winter	High	High-risk winter day with high winter loads
2/16/2025	Winter	Medium	Medium-risk winter day
4/1/2025	Spring	Low	Shoulder season day
6/23/2025	Summer	Low	High-load summer day
7/29/2025	Summer	Low	High-load summer day
9/17/2025	Fall	Low	Shoulder season day
10/1/2025	Fall	Low	Shoulder season day

*6/24/2025 had previously been simulated for the Day-Ahead Market results. Due to convergence issues with PROBE PD, this day is excluded from the real-time simulation results.

Real-Time Simulation Results - LMPs

- The following table shows the daily average generation-weighted LMPs in the RTM.

Day	Base Case ($/MWh)	Multi-step ORDC 1/3rd case ($/MWh)	Multi-step ORDC 2/3rd case ($/MWh)	Multi-step ORDC Full case ($/MWh)
01/22/2025	137.09	133.68	135.66	139.94
02/16/2025	32.2	32.20	32.22	32.29
04/01/2025	39.57	35.77	38.67	43.32
06/23/2025	73.59	74.29	81.69	88.71
07/29/2025	81.14	76.97	84.8	95.59
09/17/2025	42.13	40.47	40.71	41.76
10/01/2025	37.43	39.10	39.55	41.02

* The results are rounded to two decimal places.

Real-Time Simulation Results – AS MCPs

- The following table shows the daily average MCPs for the 10-Min Online Reserve in the RTM.

Day	Base Case ($/MWh)	Multi-step ORDC 1/3rd case ($/MWh)	Multi-step ORDC 2/3rd case ($/MWh)	Multi-step ORDC Full case ($/MWh)
01/22/2025	17.40	8.48	13.80	28.70
02/16/2025	0.00	0.00	0.07	0.35
04/01/2025	12.55	8.92	13.48	22.98
06/23/2025	17.69	17.11	26.80	38.60
07/29/2025	22.88	18.50	28.44	40.08
09/17/2025	7.55	3.04	4.67	7.23
10/01/2025	7.08	4.28	6.45	10.19

Real-Time Simulation Results – AS MCPs

- The following table shows the daily average MCPs for the Primary Reserve and total 30-min Reserve products in the RTM.

Primary Reserve

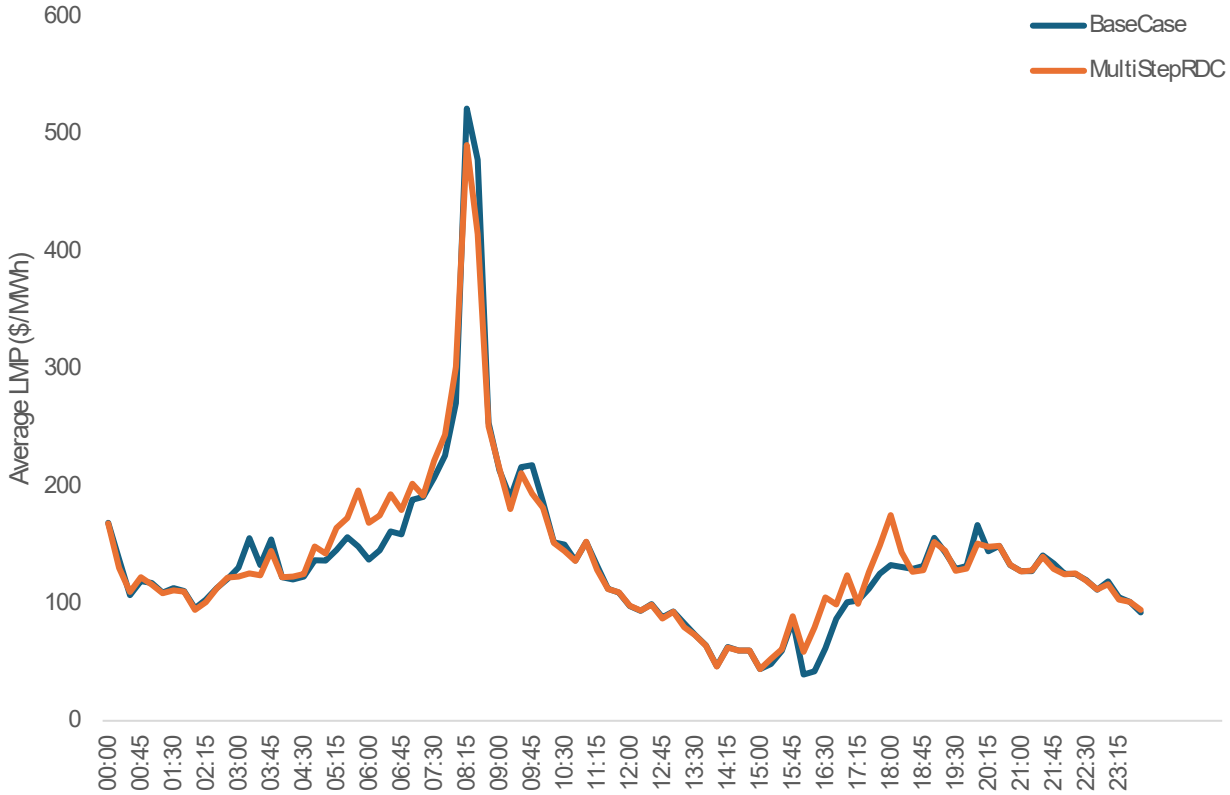
Day	Base Case ($/MWh)	Multi-step ORDC ($/MWh)
01/22/2025	17.40	-
02/16/2025	0.00	-
04/01/2025	12.54	-
06/23/2025	17.69	-
07/29/2025	22.88	-
09/17/2025	7.55	-
10/01/2025	7.08	-

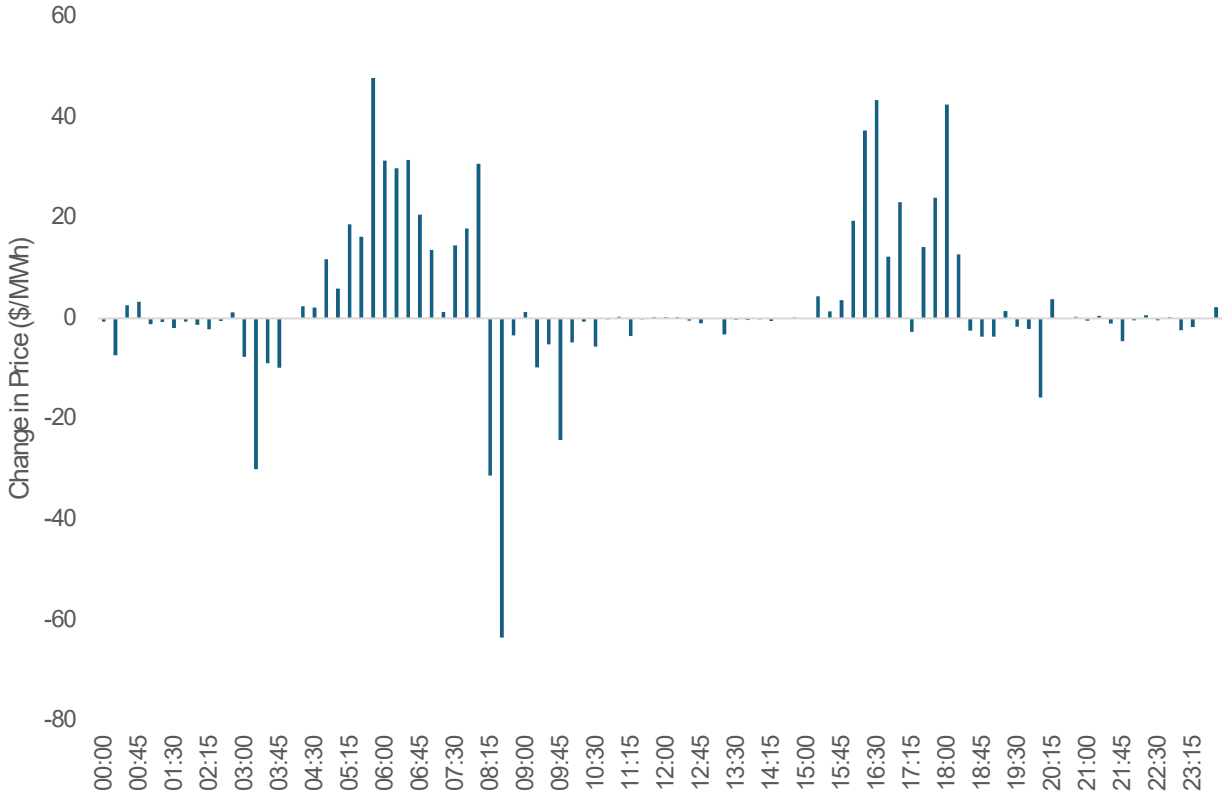
30-min Reserve

Day	Base Case ($/MWh)	Multi-step ORDC ($/MWh)
01/22/2025	0.00	0.00
02/16/2025	0.00	0.00
04/01/2025	0.00	0.00
06/23/2025	0.00	0.00
07/29/2025	0.00	0.00
09/17/2025	0.00	0.00
10/01/2025	0.00	0.00

Real-Time Simulation Results – LMPs

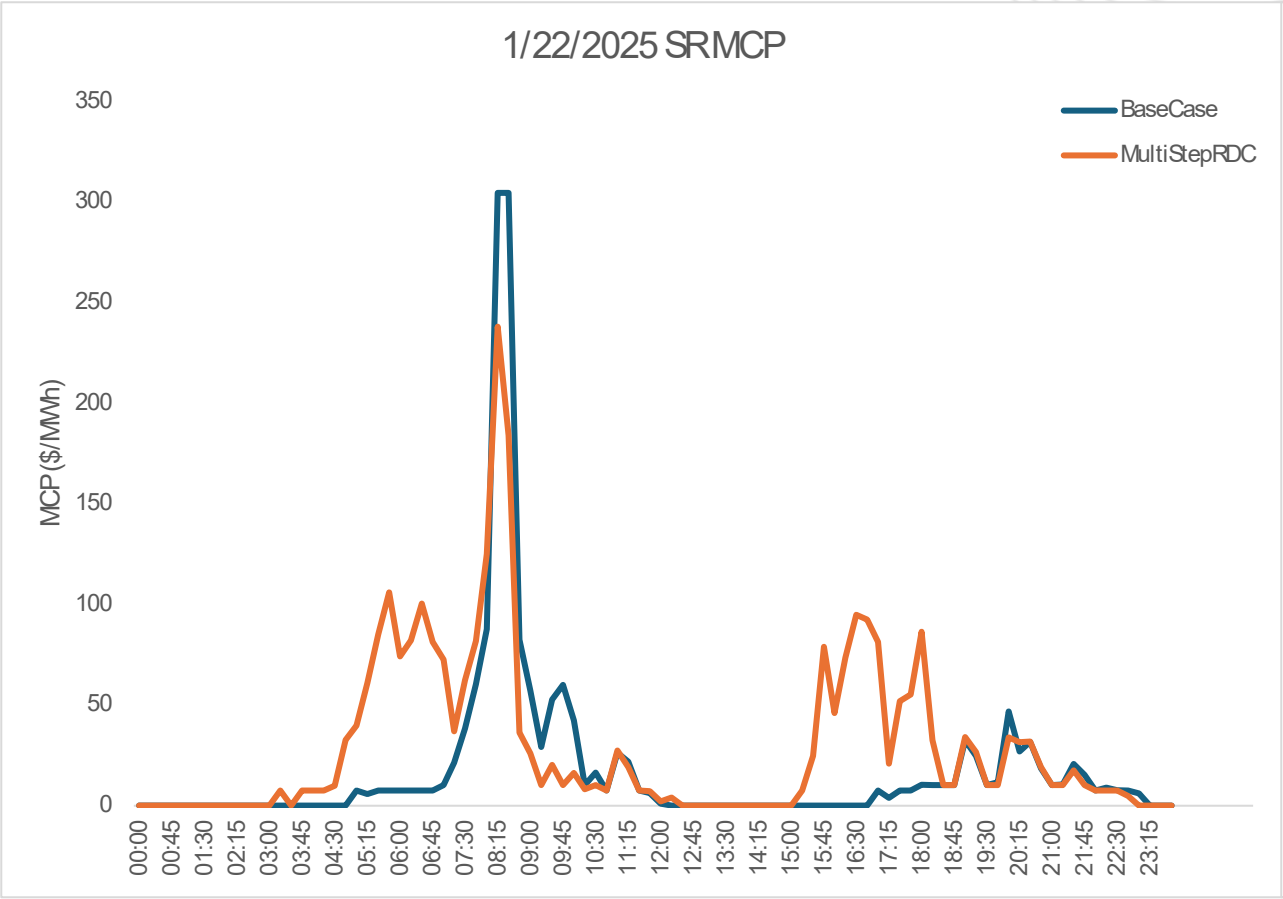
- High-Risk Winter day 1/22/2025, Full Case

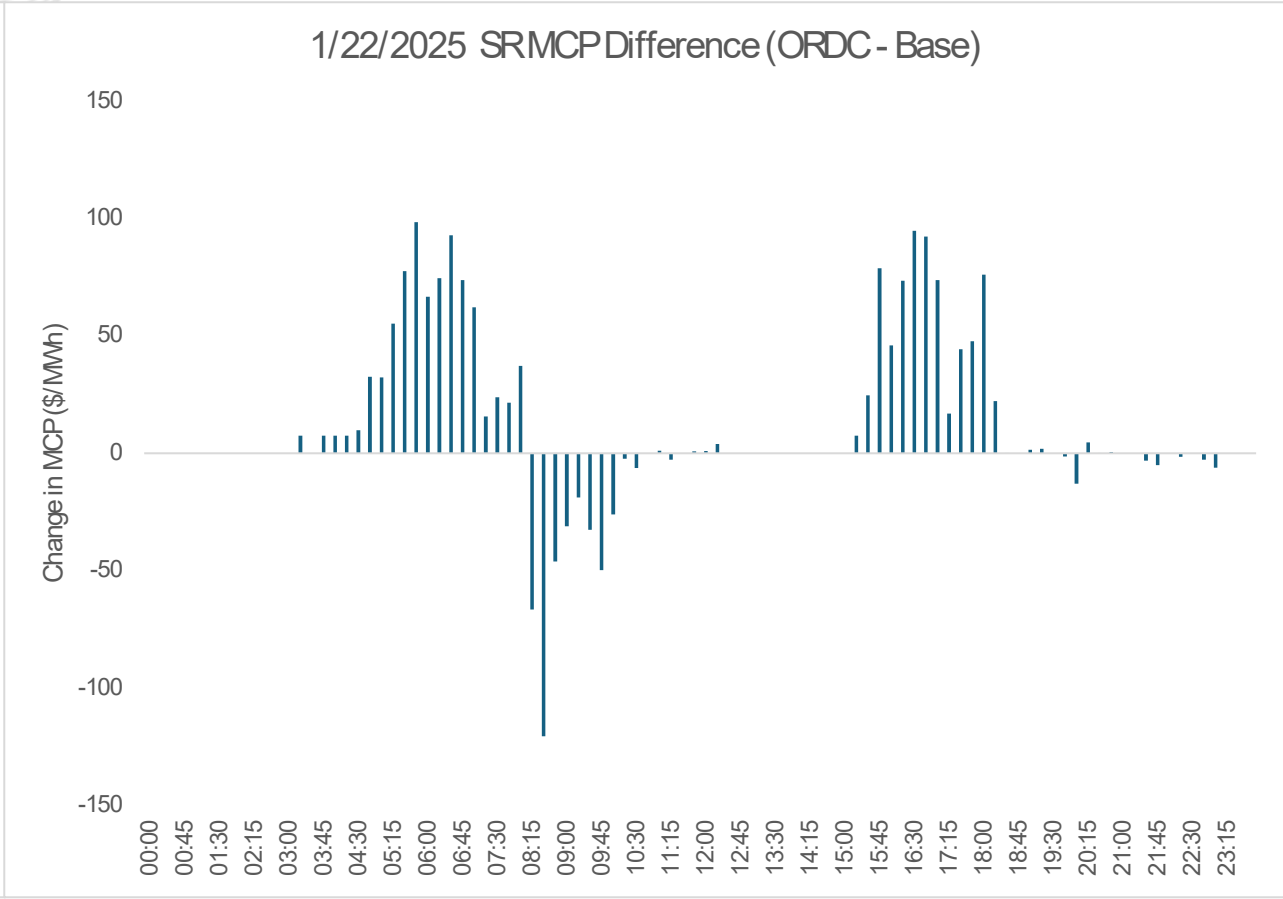




Real-Time Simulation Results – MCPs

- High-Risk Winter day 1/22/2025, Full Case

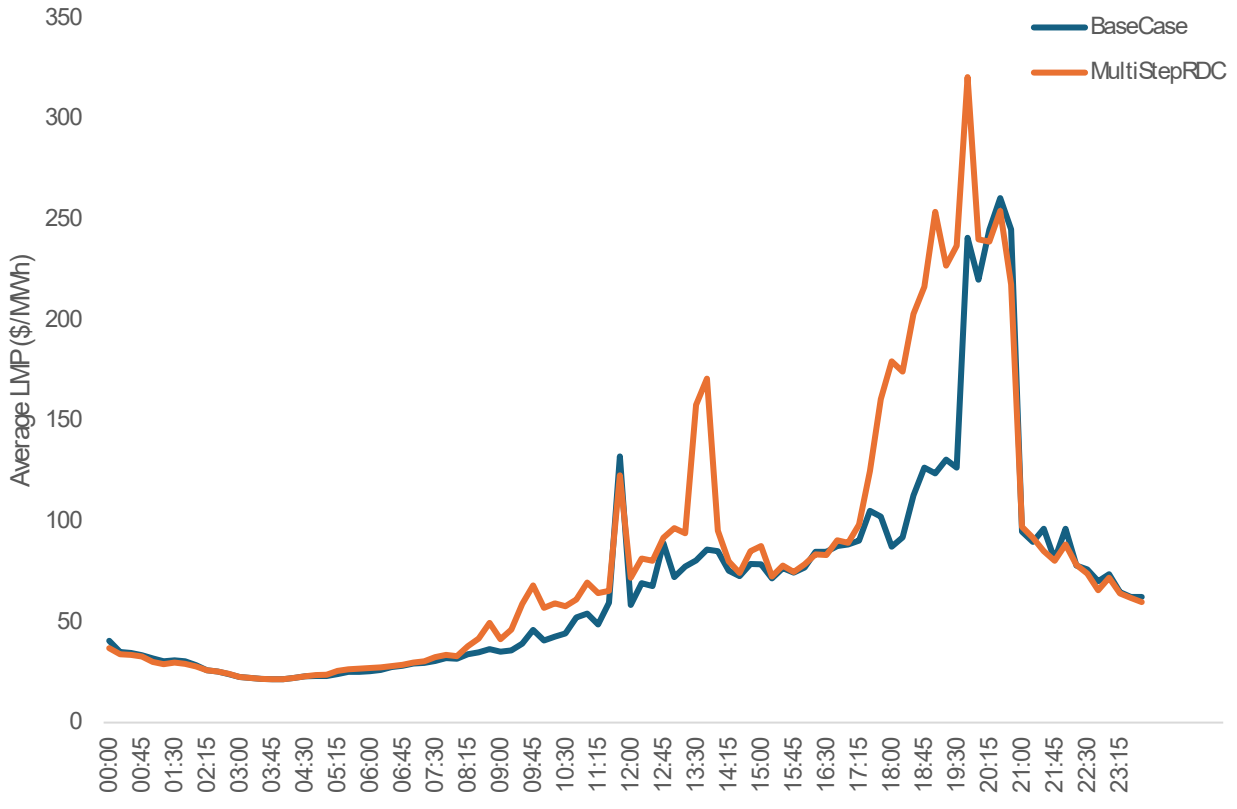


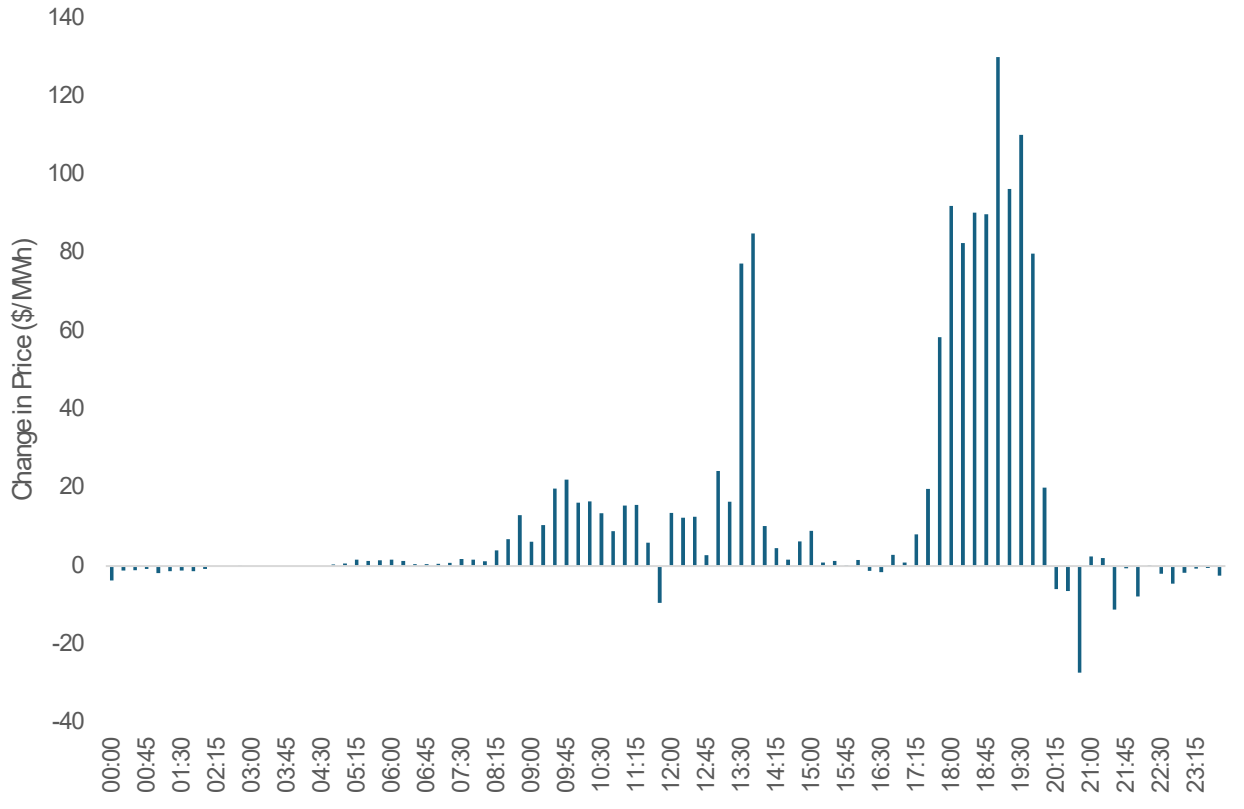


*All 30-Min reserve products had 0 $/MWh MCP

Real-Time Simulation Results – SR MCPs

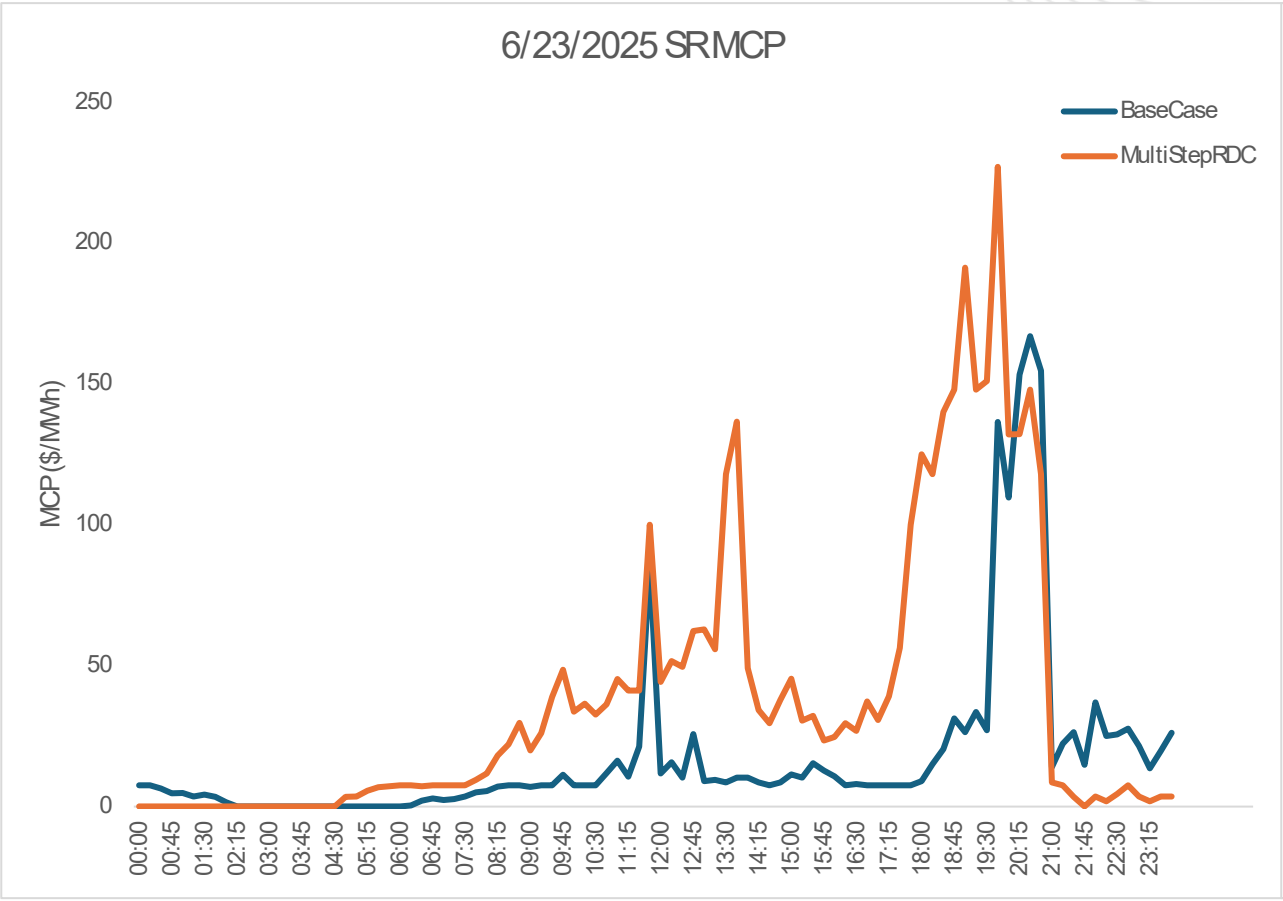
- High-Load Summer day 6/23/2025, Full Case

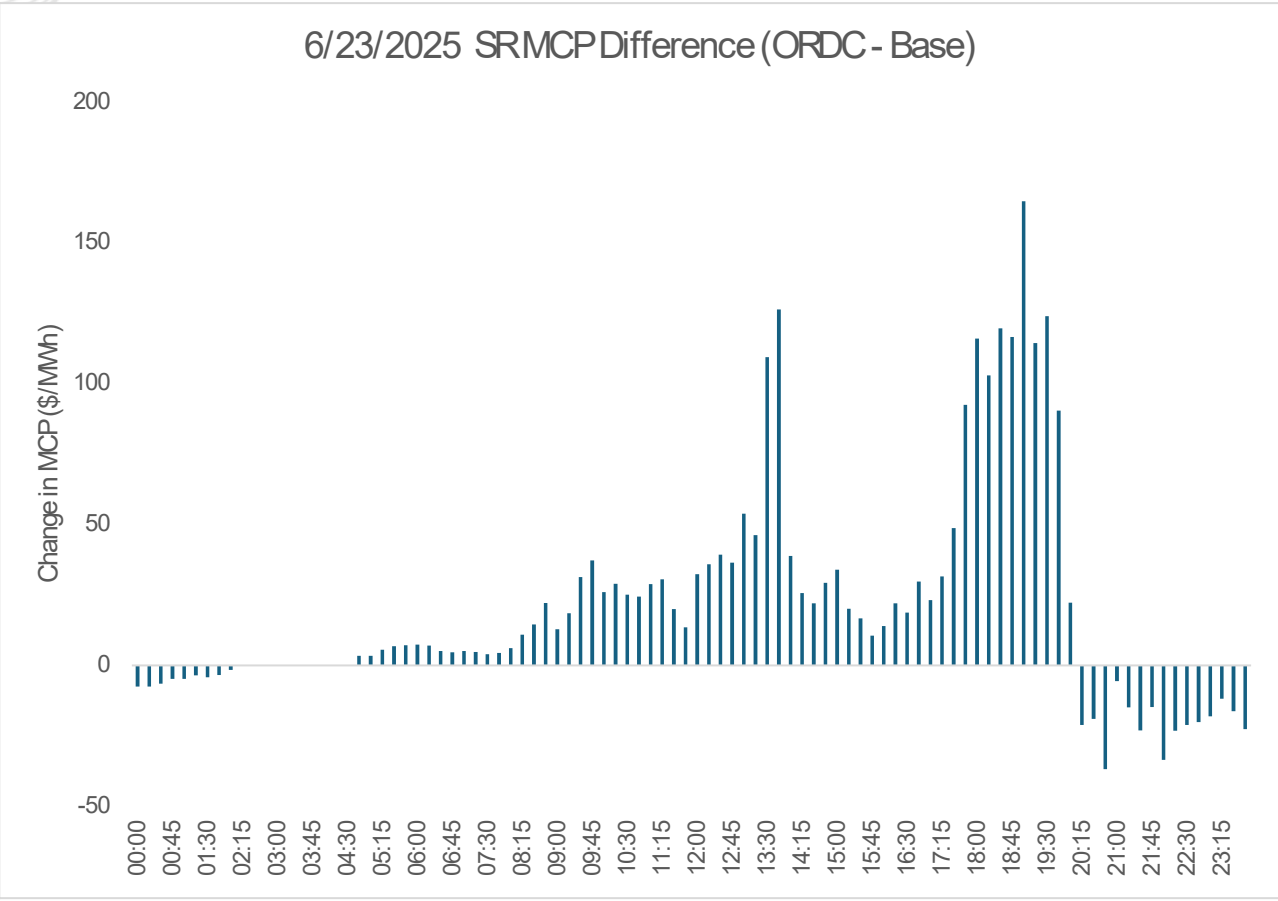




Real-Time Simulation Results – MCPs

- High-Load Summer day 6/23/2025, Full Case

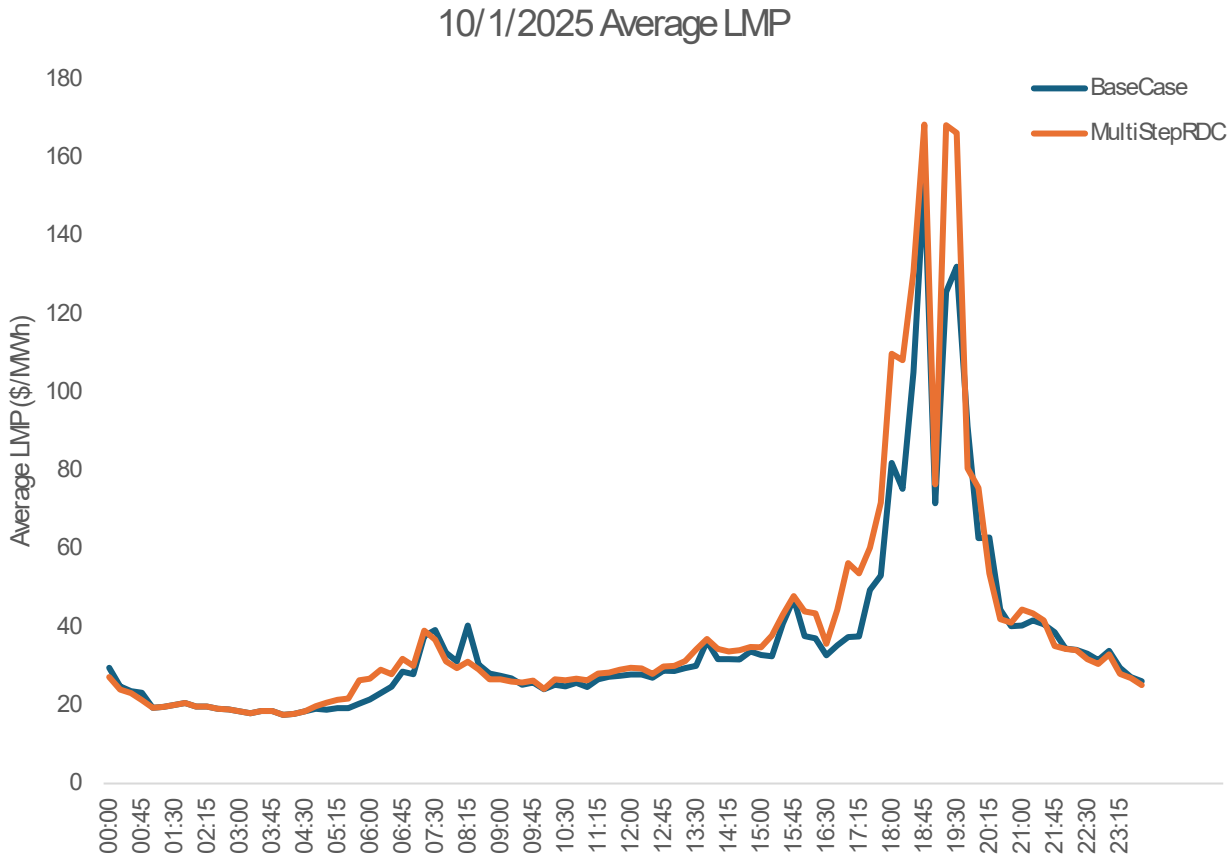


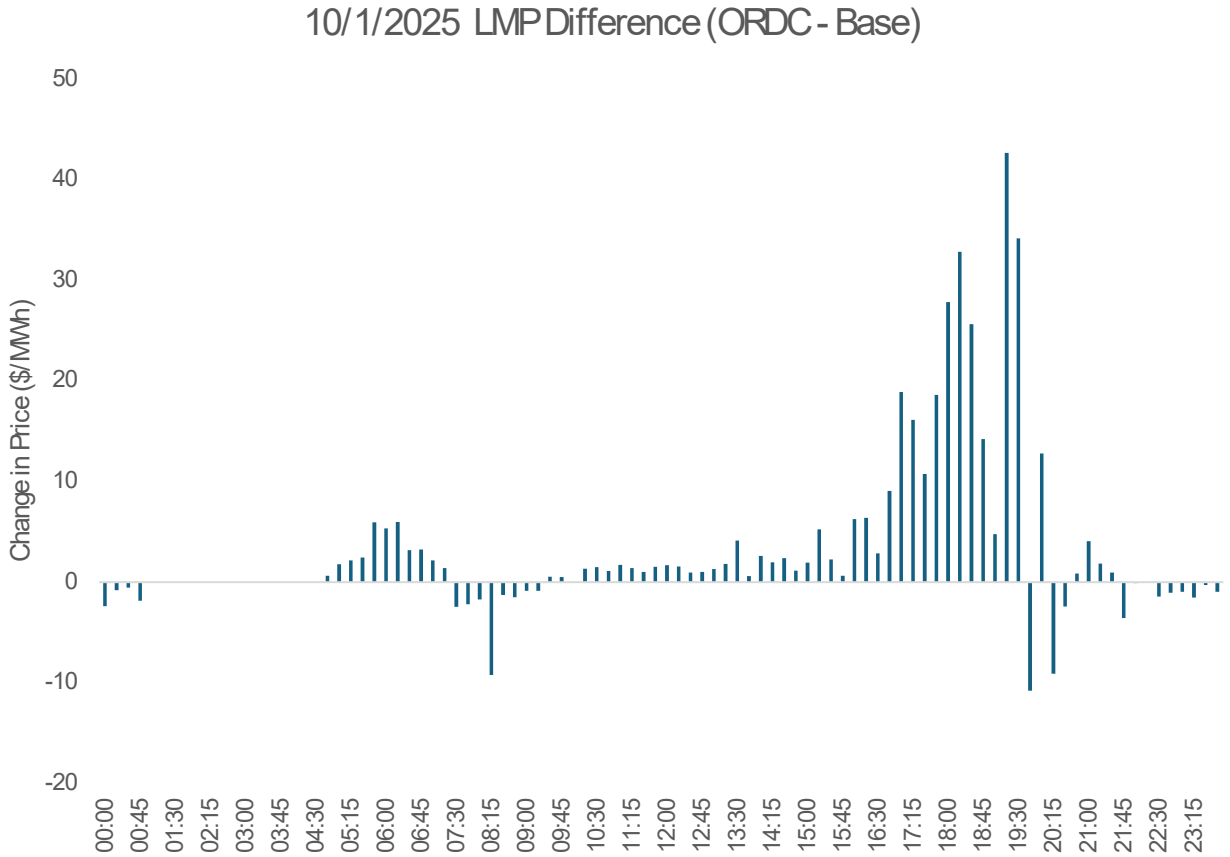


*All 30-Min reserve products had 0 $/MWh MCP

Real-Time Simulation Results – LMPs

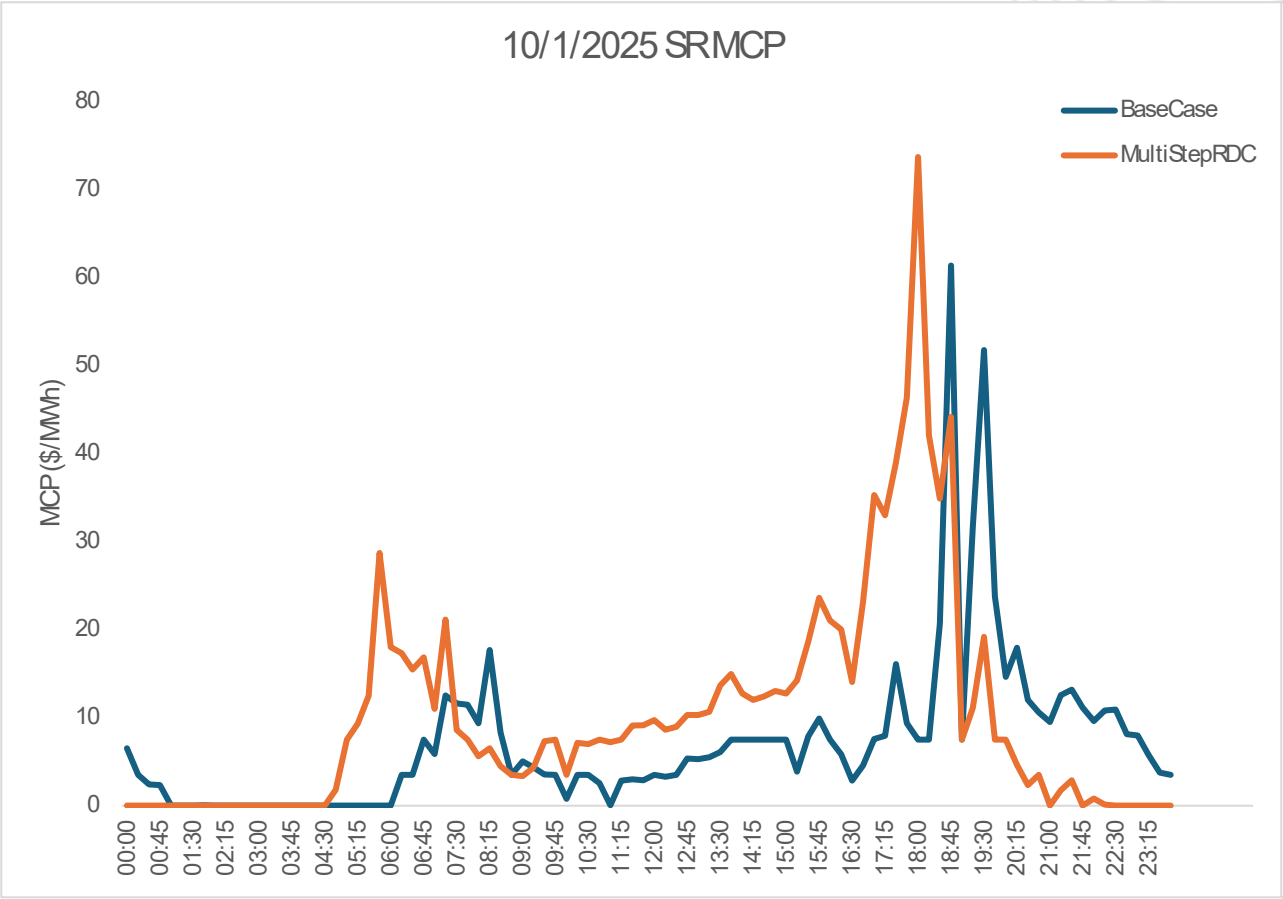
- Representative Fall day 10/1/2025, Full Case

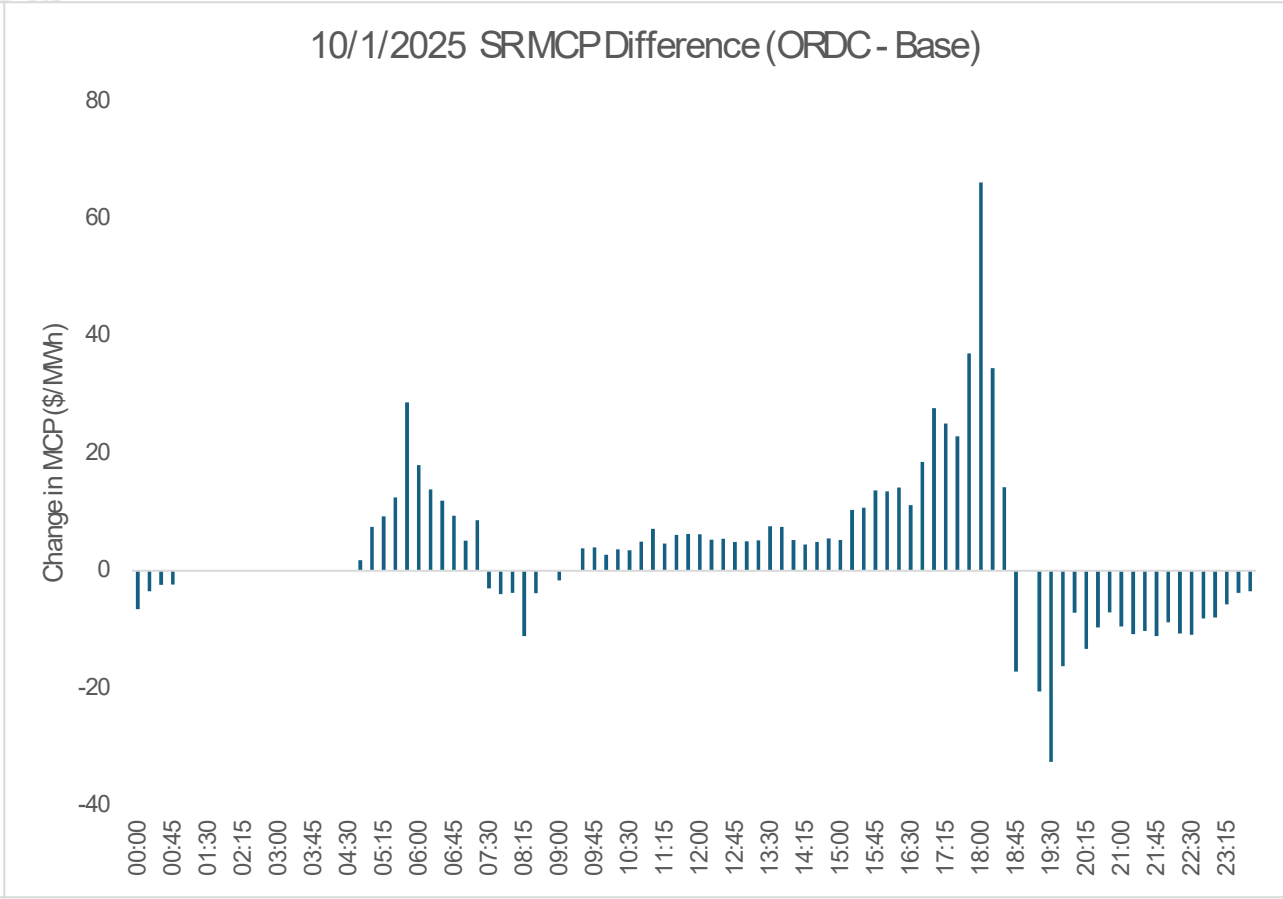




Real-Time Simulation Results – SR MCPs

- Representative Fall day 10/1/2025, Full Case





*All 30-Min reserve products had 0 $/MWh MCP

Simulation Results Summary

- Real-time energy LMPs see a slight increase in the Full Multi-step ORDC Case compared to the Base Case.
- Generally, higher LMPs are observed leading up to the daily peak load and lower LMPs coming off the daily peak load.
- The Full Multi-step ORDC Case results in higher average Online 10-Minute Reserve MCPs compared to the Base Case, especially during the peak hours. In the Base Case, the AS MCPs are mainly driven by Primary Reserve. In the Full Multi-step ORDC case, the AS MCPs are driven by the large Online 10-Minute Reserve requirement.