New York ISO
Independent System Operator

Consumer Impact Analysis: Reserve Enhancements for Constrained Areas (Dynamic Reserves)

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Agenda

- Background
- Study Approach
- Consumer Impact Methodology
- Consumer Impact Analysis
- Next Steps
- Appendix

Background

Operating Reserves Overview

- **Protection against contingencies**
  - Sudden loss of a generator
  - Trip of a network equipment (e.g., transmission line or transformer)
- **Locational reserve requirements**
  - Requirements for EAST (Load Zones F-K), SENY (Load Zones G-K), NYC (Load Zone J) and Long Island (Load Zone K) help ensure reserves are located where needed due to limitations on the transmission system
- **Existing reserve requirements are essentially static**

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Project Background

- **The current static modeling of reserve regions and their associated requirements may not optimally reflect the varying needs of the grid to respond to changes in system conditions, such as considerations of the following:**
  - Scheduling economic energy above 1,310 MW from individual suppliers when sufficient reserves are available and/or
  - Shifting reserve procurements to lower-cost regions when sufficient transmission capability exists.
- **A more dynamic reserve procurement methodology could potentially improve market efficiency and better align market outcomes with how the power system is operated.**

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Study Approach

Study Approach

- **The study is evaluating the feasibility of dynamically scheduling reserves in the SCUC, RTC and RTD intervals**
  - Studying the impact with current reserve products (10-minute spin, 10-minute total, 30-minute total)
  - Studying the ability to apply to all current reserve regions and potential future reserve regions (e.g., certain NYC load pockets)
- **The study is comprised of two primary phases:**
  - Formulation phase
  - Prototyping phase

Formulation Phase

- **The NYISO started with a theoretical approach by developing a generalized mathematical formulation to facilitate solving the procurement of operating reserves dynamically.**
  - The NYISO sought feedback from external consultants on the feasibility of the formulation

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Prototyping Phase

- The NYISO prototyped the mathematical formulation to study the feasibility of the prototype on the day-ahead market solution
- This prototype was stress tested under various scenarios to a) analyze the accuracy of the results; and b) test the effectiveness of incorporating it into the market software and its impacts on the market solution
  - These scenarios were used in performing the Consumer Impact Analysis (CIA) and are included in the study report

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Consumer Impact Methodology

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Consumer Impact Methodology for Study

- **The NYISO performed a simplified version of the Consumer Impact Analysis for this phase of the project**
  - Typically, CIAs are performed prior to the Market Design Complete phase
  - The focus here is on Cost Impact/Market Efficiencies
- **Used the Dynamic Reserves prototype that was developed to run a few SCUC scenarios to demonstrate the applicability of dynamic scheduling of reserves and the impact on market efficiency**

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Consumer Impact Methodology; Contd.

- **Using the market software, established a base case by re-running a Day-Ahead Market (DAM) day, based on the current static reserve requirements**
- **Using the market software, re-ran the same DAM day using the dynamic reserves prototype**
  - All the dynamic reserve constraints are detailed in the Appendix of this presentation
- **Used specific test cases for the dynamic reserves re-runs that were activated incrementally for the different reserve areas**
  - Allows for seeing the impact of introducing dynamic reserve constraints for different reserve regions and reserve products separately and in different combinations
  - The test cases are outlined on Slide 13
- **A comparison of the re-runs based on the dynamic reserve prototype with the base case resulted in several outputs of the analysis**
  - The output of the analysis included total production cost changes, LBMP changes, operating reserve clearing price changes, and changes in consumer costs

Consumer Impact Methodology- Test Cases

Case 1

- Activated dynamic reserve constraints for only NYCA wide reserve products (i.e., 10-minute spin, 10-minute total, 30-minute total)

Case 2

- Activated dynamic reserve constraints for only SENY 30-minute reserve product

Case 3

- Activated dynamic reserve constraints for all NYCA wide reserve products and SENY 30-minute reserve product

Case 4

- Activated dynamic reserve constraints for all current reserve areas and reserve products (i.e., NYCA, EAST, SENY, NYC and LI)

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Approach used to select DAM day for re-runs

- **Select a day based on hot weather conditions during recent months (July through August 2021) so the simulations are based on updated software and market rules.**
  - For the day-ahead case, first ran a base case with the current static operating reserve requirements active for all 24 hours.
  - Next, ran the case with dynamic reserve constraints active for all 24 hours

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Consumer Impact Analysis

Consumer Impact Analysis

- **Market day August 5, 2021, was used to re-run all the cases listed on Slide 13**
  - Selected a hot summer day after the most recent market software changes (e.g., Ancillary Services Shortage Pricing, Reserves for Resource Flexibility).
- **The same day was used for all four cases to compare consistent sets of results.**

Base Case

- Established a base case by running the current static reserve requirements for all reserve areas. Used the same base case for all four scenarios.
- To simulate typical operating conditions, major transmission line outages were put back in service (i.e., Y-50 on Long Island).
- The Upper Operating Limit (UOL) on 3 external transactions were increased to allow economic energy to flow into NYCA.
  - By increasing the UOL on these transactions, the base case created more imports and, therefore, decreased the total system cost in the base case as compared to the previous production case

Case 1: NYCA reserve requirements set dynamically

- Only the NYCA wide reserve requirements (i.e., NYCA 10-minute spinning, NYCA 10-minute total and NYCA 30-minute total) were modeled dynamically
- Energy was scheduled above 1,310 MW in the hours it was economic
  - To secure this increase, additional operating reserves were also scheduled
- The savings from energy outweighed the additional cost of procuring reserves, thereby resulting in a lower total system cost
- On average, LBMPs decreased between $0.60/MWh and $2.55/MWh in the different load zones and reserve clearing prices increased by less than $0.10/MWh in the reserve areas

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Case 2: SENY 30-minute reserve requirements set dynamically

- Only the SENY 30-minute reserve requirements were modeled dynamically
- The overall 30-minute reserve requirement of 2,620 MW was maintained as the NYCA region’s static requirement
  - An average of 200 additional MWs of 30-minute reserves were held in the SENY reserve area based on economics offers and transmission limitations
- The changes in total production costs were less than the tolerance utilized in the optimization and, therefore, the results for the production costs, LBMPs, and operating reserve clearing prices are insignificant.

Case 3: NYCA and SENY reserve requirements set dynamically

- Both NYCA wide reserve requirements (i.e., NYCA 10-minute spinning, NYCA 10-minute total and NYCA 30-minute total) and SENY 30-minute reserve requirements were modeled dynamically
- In the hours it was economic, energy was scheduled above 1,310 MW
  - To secure this, additional operating reserves were also scheduled
- The savings from energy outweighed the additional cost of procuring reserves, thereby resulting in a lower total system production cost
- On average, the LBMPs decreased between $0.50/MWh and $2.50/MWh in the different load zones and reserve clearing prices increased by less than $0.10/MWh in the reserve areas

Case 4: Reserve requirements set dynamically for all reserve areas

- All current reserve requirements were modeled dynamically
- In the hours it was economic, energy was scheduled above 1,310 MW
  - To secure this, additional operating reserves were also scheduled
- This case resulted in the largest decrease in total production cost
  - Most of the decrease can be attributed to better modeling of transmission capabilities on Long Island
- On average, LBMPs decreased between $0.60/MWh and $2.60/MWh in the different load zones and reserve clearing prices either decreased or changed insignificantly even though additional reserves were secured

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Consumer Impact Analysis: Results

Summary Table [Dynamic Reserves Case - Base Case]			
	Total production cost delta [$]	**Price cap load delta [MW]**	**LBMP delta (Ref bus) [$/MWh]**
NYCA only	-47554.00	1330.00	-0.97
SENY only	858.00	-8.00	0.01
NYCA and SENY	-47230.00	1375.00	-0.63
Full Dynamic	-48645.00	1502.00	-0.69

Note:

- Negative values in any of the above columns imply the base case costs, load, or LBMPs were higher than the respective dynamic reserves case
- Positive values in any of the above columns imply the base case costs, load, or LBMPs were lower than the respective dynamic reserves case

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Next Steps

Next Steps

- Continue work on Prototype
- Market Design Concept Proposed

Appendix I: Graphs

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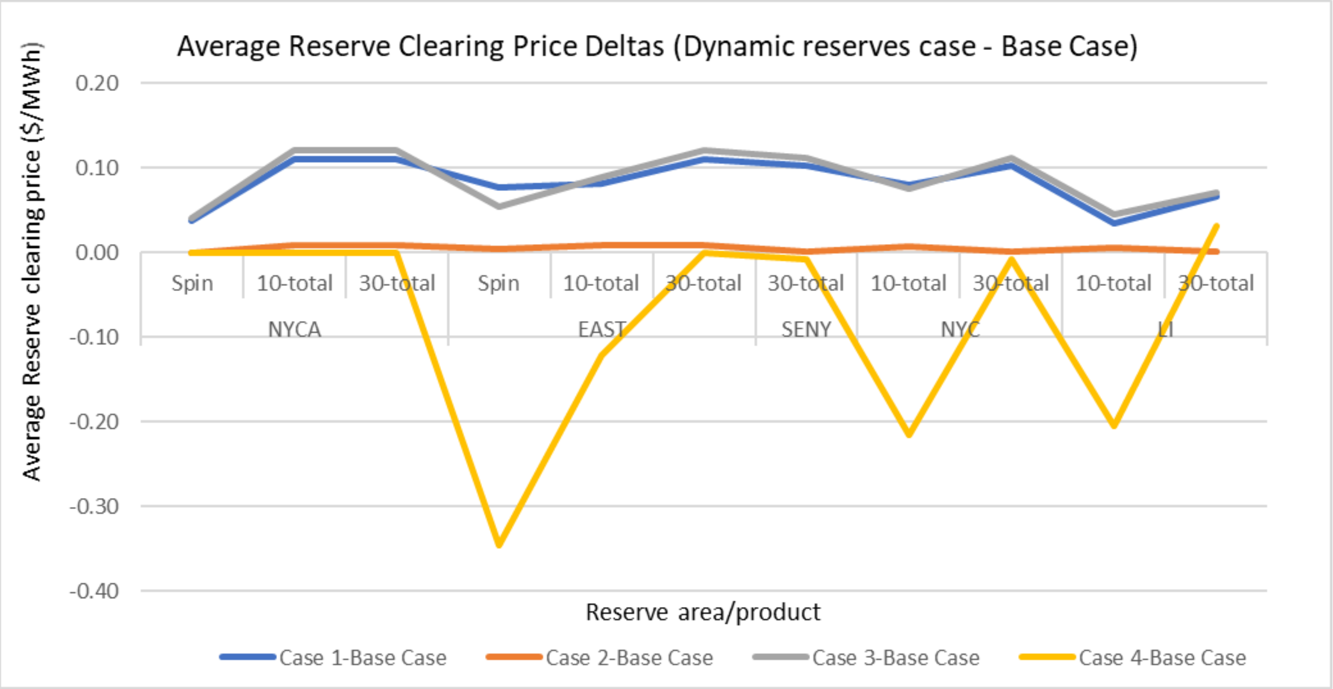
Change in Average Reserve Clearing Prices



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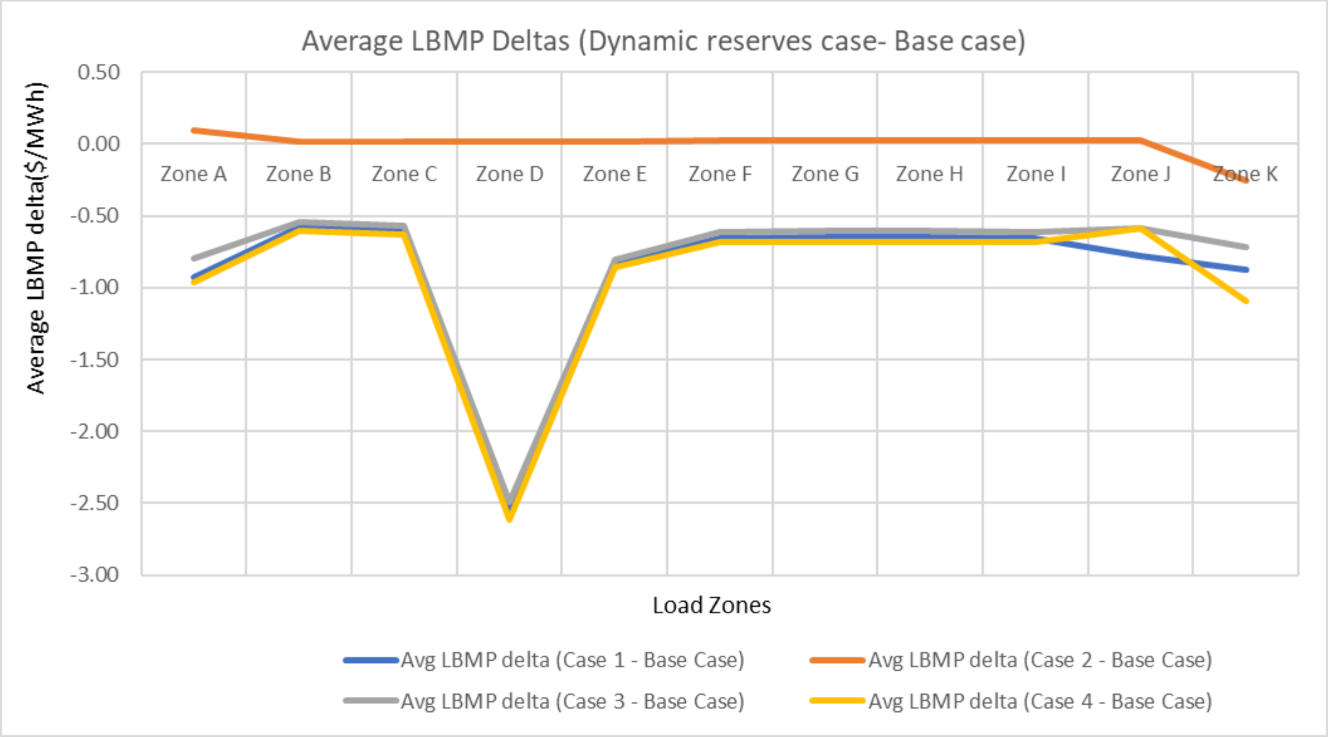
Change in LBMPs



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Our Mission & Vision

Mission

Ensure power system reliability and competitive markets for New York in a clean energy future

Vision

Working together with stakeholders to build the cleanest, most reliable electric system in the nation

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