Day-Ahead Window Optimization Study

Fred Adadjo
Planning Engineer
New York Independent System Operator

Muhammad Marwali
Manager, Technology Development
New York Independent System Operator

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Overview

- Study Highlights
- Background
- Model Framework & Setup
- Results
- Conclusion
Study Highlights

- This study was motivated by the question of whether the Day-Ahead market could be better optimized by shifting the operating period through changing the electric day start times.
- The analysis looked at several metrics, such as:
  - changes in production cost
  - unit commitment
  - energy marginal costs
  - import/export transactions
- The results show that shifting the Day-Ahead window will have:
  - Marginal impact in energy marginal costs, unit commitment, and production costs
  - Significant impact in import/export transactions across successive days
  - Generators with long minimum run times would be incentivized to change their bidding behavior.
Background

❖ Fundamental question
  - Given the resource mix and the NY electricity market’s traditional load pattern, what is the ideal window of operation in order to optimize dispatch?

❖ Potential benefits
  - Better market efficiency in terms of optimum use of generating resources
  - Optimal production minimization
  - Benefits of better alignment between gas market and electricity market
Typical Load Profiles

PJM

Actual Load (MWh)

Typical Winter day (1/22/14)  Typical Summer day (7/19/14)

ISO-NE

Actual Load (MWh)

Typical Winter day (1/22/14)  Typical Summer day (7/19/14)

MISO

Actual Load (MWh)

Typical Winter day (1/22/14)  Typical Summer day (7/19/14)

NYISO

Actual Load (MWh)

Typical Winter day (1/22/14)  Typical Summer day (7/19/14)
In New York

Typical NY Load Pattern

- Typical Summer day
- Typical Winter day

Key Points:
- Morning Pick-up
- Evening Peak
- Lowest demand level
- Evening Ramp Down

MW

(hours)
Alternative NY electric days

Summer

- Alternative electric day: 04:00 – 03:00

- Alternative electric day: 10:00 – 09:00

- Alternative electric day: 15:00 – 14:00

Winter

- Alternative electric day: 04:00 – 03:00

- Alternative electric day: 10:00 – 09:00

- Alternative electric day: 15:00 – 14:00
Study Framework

Start

Retrieve market results from Day 1

Retrieve market results from Day 2

Merge generator bids and other market parameters from Day 1 & 2 to create a new market day

Adjust other parameters (i.e., outages, PAR schedules, intra-day transaction flows, etc)

Rerun Day-Ahead market

Save copy of Day 1 results

Collect results

Save copy of Day 2 results

Process all results
Study Setup

- Create an alternative electric market day by merging bids and other market data from two consecutive days
- No market parameters are changed, only shifted by start time interval
- Bidding behavior is not simulated
- Only Day-Ahead market is studied, no Real-Time impacts are evaluated
Case Studies

- **Independent days:**
  - Case 1: alternative electric day of 04:00 – 03:00 (EST)
  - Case 2: alternative electric day of 10:00 – 09:00 (EST)
  - Case 3: alternative electric day of 15:00 – 14:00 (EST)

- **Consecutive days:**
  - Case 4: 1 week of consecutive alternative electric days of 10:00 – 09:00 (EST)

- 3 Summer Days (May 8–9, May 15–16 and May 26–27)
- 2 Winter Days (Nov 27–28, Dec 6–7)
- 1 summer week: May 8–14
Study Results
Minimal production cost impact

Percent Change in Production Cost

- May 8-9
- May 15-16
- May 26-27
- Nov 27-28
- Dec 6-7

%chg ProdCost [15-15]
%chg ProdCost [10-10]
%chg ProdCost [4-4]
Minimal energy marginal cost impact

Percent Change in Energy Marginal Cost

- Case 3: [15-15]
- Case 2: [10-10]
- Case 1: [4-4]

May 8-9  May 15-16  May 26-27  Nov 27-28  Dec 6-7
Case Study – Continuous Days

Load Profile May 8 - 15 with Continuous Case for alternative [10 - 10] electric days shown in colors

- Alternative Electric Day May 9-10
- Alternative Electric Day May 10-11
- Alternative Electric Day May 11-12
- Alternative Electric Day May 12-13
- Current Electric Day
Minimal system production cost impact

% Change in Production Cost

- May08-09
- May09-10
- May10-11
- May11-12
- May12-13
- May13-14

- 0.00%
- 0.50%
- 1.00%
- 1.50%
- 2.00%
- 2.50%
Unit Commitment

- Shifting the Day-Ahead window has a significant impact on generator commitment and maintenance schedules, especially units with long minimum run time.
- Currently, these units tend to avoid late starts by bidding higher costs toward the end of the electric day.
- In the Day-Ahead window 10am – 10am scenario, these units are expected to bid higher costs during the morning pickup to avoid starting late in the electric day.
- As a result, the potential savings from changing the electric day may be understated because the study strictly enforced unit commitment parameters but could not account for changes that unit owners could have made in response to the changed timing of the electric day.
Example of Unit with long minimum run time

- **Baseload unit**
  - Operating Max MW: 1.5 MW
  - Min Gen: -$100,000
  - Minimum Run Time: 24 Hours, Minimum Down Time: 1 Hour
- **Unit Available:** 05/08/14-05/11/14
- **Unit on maintenance:** 05/12/14 06:00-15:00 and 05/13/14 06:00-15:00
Import/Export Transactions

- Day-Ahead transactions roll over to Real-time
- Transaction IDs change across two days
- RTC windows near the end of the day span across 2 days
- Comparatively higher volume of transactions at the end of the Day-Ahead window in 10am – 10am scenario may impact RTC performance

<table>
<thead>
<tr>
<th>RTC Transaction Schedules @ Transition Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
</tr>
<tr>
<td>Electric</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>May8-9</td>
</tr>
<tr>
<td>May9-10</td>
</tr>
<tr>
<td>May10-11</td>
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<tr>
<td>May11-12</td>
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<tr>
<td>May12-13</td>
</tr>
<tr>
<td>Average</td>
</tr>
</tbody>
</table>
Conclusions

- This study explores the impact on the NY Day-Ahead market of various electric day start times
- The findings show that:
  - *The load profile ‘seen’ by the optimization is different (peaks and valleys)*
  - *Overall, there is not a significant impact in terms of production cost, energy marginal prices, and generator commitments, if bidding behavior remains unchanged.*
  - *Generators with long minimum run time are most impacted*
  - *The number of import/export transactions will increase in the transition periods. This will have a potential impact on the performance of the Real-Time market*
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