

Issue 13 : Control Action Operating Reserve (CAOR)

MPWG # 52 – October 29, 2008



- To provide MPWG with a review and update on Control Action Operating Reserve (CAOR) use.
- To identify issues with respect to current CAOR procedures and pricing.
- To initiate discussion on identified issues and gather MPWG feedback.
- To present MPWG the possible options for pricing CAOR for their feedback.

- Background on CAOR
- Frequency of CAOR usage
- Issues identified
- Scope of study
- Options for pricing CAOR
- MPWG feedback
- Supplemental information

HISTORY:

- Prior to CAOR introduction in the market, the IESO manually reduced the OR requirements when a shortage of reserve (insufficient OR market offers) in the real time constrained schedule was identified.
- The reduction in the OR requirement allowed market to clear with available OR offers.
- The lowered OR requirement was used for calculating prices (MCP) in the unconstrained schedule.
- Often shortages that exist in the constrained schedule will not exist in the unconstrained schedule.
- These out-of-market actions had following implications:
 - Counter-intuitive price effect: A decrease in market clearing price at times of shortage.
 - RT vs. PD Divergence: Increased difference between Pre-dispatch and Real time prices since manual OR reductions were typically employed in Real-time.

CAOR is the implementation of standing offers in IESO reserve markets for certain out-of-market control actions available to IESO.

- In July 2003, 400 MW of out-of-market control actions were introduced at an offer price of \$30 for 30R and \$30.10 for 10N.
- The prices applied were chosen so that CAOR would be scheduled at roughly same frequency (around 7%) in which out-of-market control actions were scheduled previously.
- The objective behind the pricing structure was to ensure CAOR was typically used first as 30R before being scheduled as 10N.
- CAOR implementation had following effects on the market:
 - Reduced frequency of shortfalls in OR market.
 - Less instances of manual reductions in OR requirements.
 - Reduced non-intuitive pricing outcomes.
- After introduction of CAOR, there were number of concerns raised related to its implementation such as pricing of CAOR and scheduling CAOR in pre-dispatch.
- In November 2005, IESO Board approved additional 400 MW of standing offers for CAOR.

| | Prior to November 23, 2005 | Since November 23, 2005 |
|--|-----------------------------------|---|
| Amount | 400 MW | Additional 400 MW |
| Price | 10N @ 30.1/MWh 30R @ 30.00/MWh | 200MW @ \$75/MWh for 10N 200MW @ \$100/MWh for 10N |
| Timeframe | Pre-dispatch and Real-time | Real -time |
| All CAOR offers have an associated energy offer price of 2,000/MWh | | |

- Rationale for additional 400 MW of CAOR:
 - To further reduce instances of counter-intuitive pricing.
 - Offered only in real-time to reduce likelihood of planning for reliance on Emergency Control Actions.
- Also, eliminated the IESO practice of reducing operating reserve (OR) requirement when a shortage was expected.

Latest Development

- On September 5, 2008, the IESO Board approved the removal of CAOR from Pre-dispatch. The decision was taken to manage the operational impacts and concerns associated with export failures (due to recallable exports).

Current CAOR pricing structure

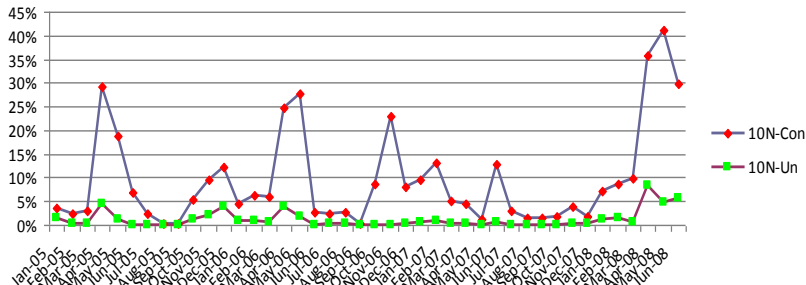
| Resource | Total Quantity (MW) | 30 min OR Price (\$/MW/Hr) | 10 min Non Sync OR Price (\$/MW/Hr) | Resource OR Scheduling Ramp Rate (MW/Min) | Energy Bid (\$/MWh) | Resource Energy Ramp Rate (MW/Min) |
|---------------------|---------------------|----------------------------|-------------------------------------|---|---------------------|------------------------------------|
| RICHVIEW -230.G_3VR | 400 RT | 30.00 | 30.10 | 999 | 2000.00 | 4 up, 999 down |
| RICHVIEW -230.G_5VR | 200 RT | N/A | 75.00 | 999 | 2000.00 | 4 up, 999 down |
| RICHVIEW -230.G_5VR | 200 RT | N/A | 100.00 | 999 | 2000.00 | 4 up, 999 down |

Prior to implementation of CAOR, the IESO used out-of-market sources of reserve in roughly 7 % (constrained) of 5 min intervals. For the period between Jan. 2005 – Jun. 2008, CAOR has been scheduled:

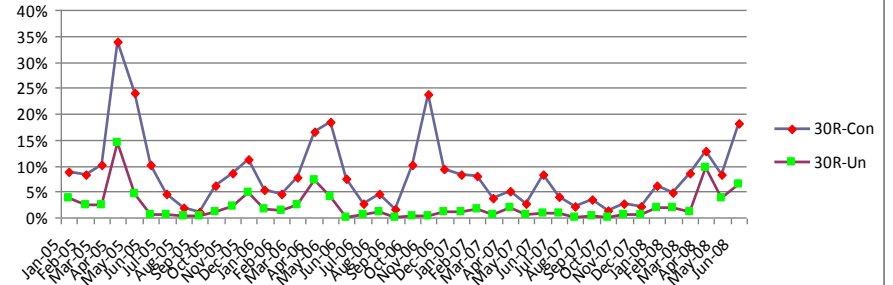
- 9.5% in real-time constrained sequence
- 1.94% in real-time unconstrained sequence
- 10.3% in Pre-dispatch constrained sequence
- 2.7% in Pre-dispatch unconstrained sequence

FREQUENCY OF CAOR USAGE

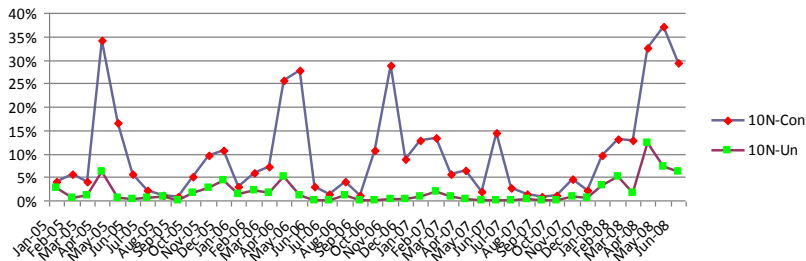
RT Constrained Vs UnConstrained 10N



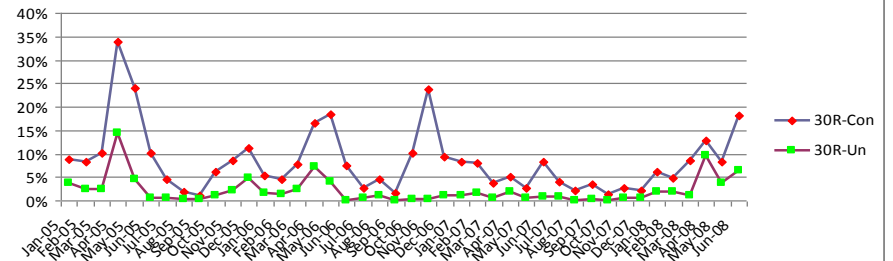
RT Constrained Vs UnConstrained 30R



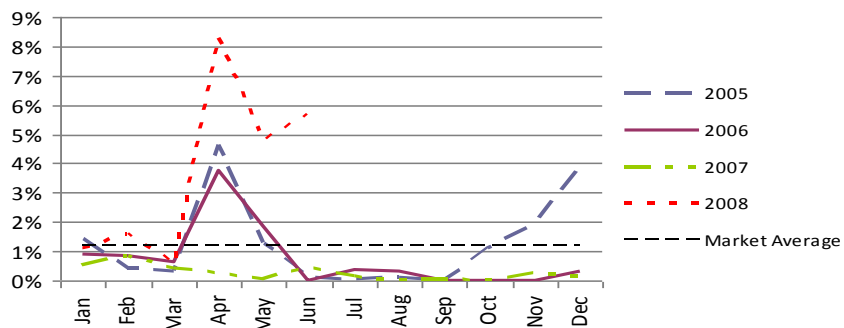
PD Constrained Vs Unconstrained 10N



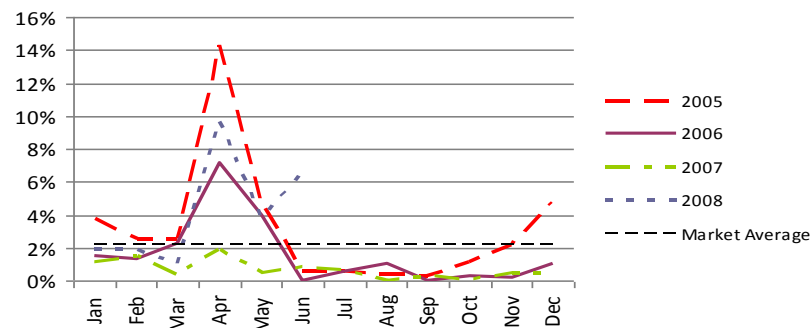
PD Constrained Vs UnConstrained 30R



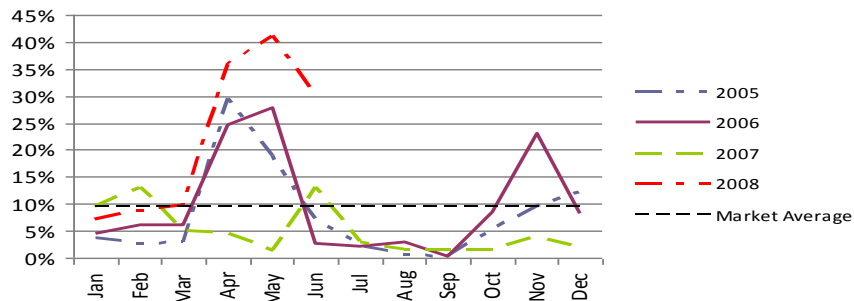
RT Unconstrained 10N



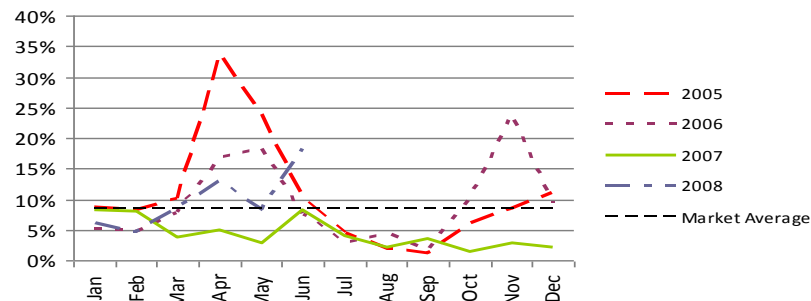
RT Unconstrained 30R



RT Constrained 10N

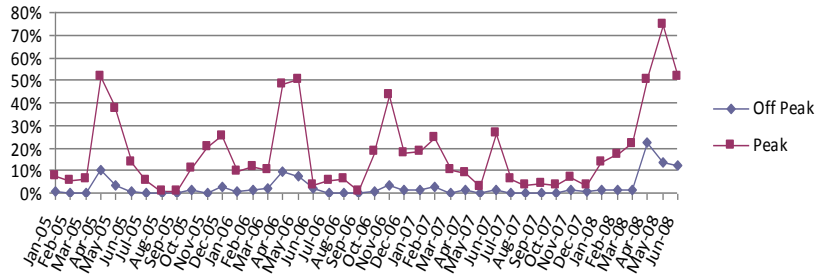


RT Constrained 30R

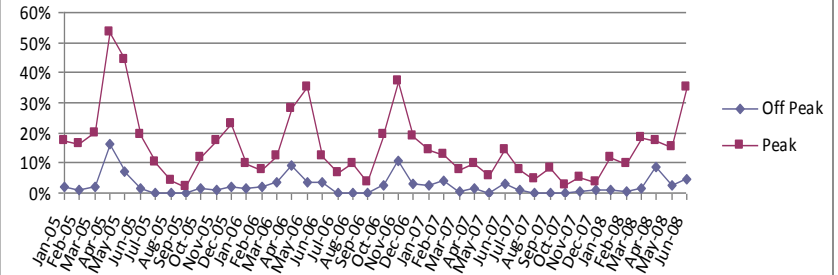


FREQUENCY OF CAOR USAGE

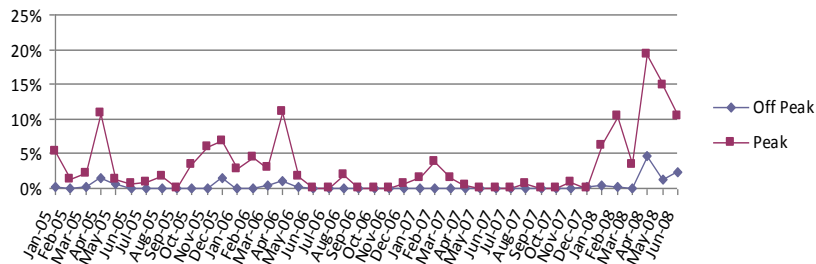
RT Constrained Peak Vs Off Peak 10N



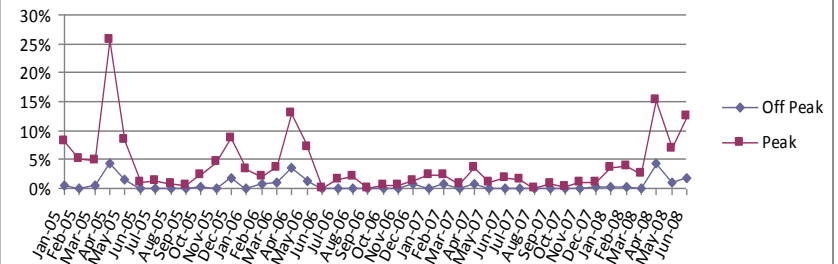
RT Constrained Peak Vs Off Peak 30R



RT Unconstrained Peak Vs Off Peak 10N



RT Unconstrained Peak Vs Off Peak 30R



1. Current Price structure: Do we have the correct price structure of CAOR? Is CAOR displacing potential market OR resources? Is it resulting in inefficient price signals?
2. Since CAOR is removed from pre-dispatch, what will be its market and pricing impacts? Would it cause increased convergence/divergence between RT and PD pricing sequences?

- Neighbouring OR markets
- Research papers based on Pricing of Operating Reserve - William Hogan.
- Examination of Ontario OR curve – analyse the non-strategic market offers being displaced by CAOR.
- Reliability impacts
- Market efficiency impacts – Market efficiency and price impacts due to current CAOR pricing structure and/or procedure.
- Value of Control Actions – To determine the actual social cost of control actions

NYISO model:

Prices of CAOR will be set based on NYSIO methodology to price their OR demand curves.

Motivation – To achieve rational prices when market is short of OR offers.

Expected Implications

- Increase in CAOR prices, as a result upward pressure on market prices.
- Reduction in the amount of CAOR scheduled in PD.
- Less instances of market offers being displaced by CAOR.

Proposed analysis

To establish CAOR prices:

- Simulate shortage pricing
- Ontario OR supply curve
- NYISO prices
- DR programs

To establish impact on stakeholders:

- Analysis of price changes.
- Simulations - Analysis of price impact on the market.

Restructuring CAOR:

| Resource | Total Quantity (MW) | 30 min OR Price (\$/MW/Hr) | 10 min Non Sync OR Price (\$/MW/Hr) | Resource OR Scheduling Ramp Rate (MW/Min) | Energy Bid (\$/MWh) | Resource Energy Ramp Rate (MW/Min) |
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| RICHVIEW-230.G_3VR | 400 PD & RT (Offered in both PD & RT) | 30.00 | N/A (10NS offer removed) | 999 | 2000.00 | 4 up, 999 down |
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Motivation – To resolve the issue of recallable exports.

Expected Implications

- It may lead to improved convergence between PD & RT.
- No recallable exports.

Proposed Analysis

To establish impact on stakeholders:

- Simulations - Analysis of price impact on the market.

Status Quo:

Motivation – To resolve the issue of recallable exports

Expected Implications

- It may lead to increased convergence/divergence between PD & RT
- No recallable exports

Proposed Analysis

To determine if the implementation of the design has lead to any unintended consequences:

- PD vs. RT convergence/divergence
- Price impacts
- Impact on export transactions

Value of Control Actions:

To determine the true social value of latent reserves to the consumers in the form of control actions.

Motivation – To determine the actual social cost of utilizing control actions will lead to most efficient pricing of reserves.

Expected Implications

- Social cost may vary for each control action.
- It may require considerable time and may not be IESO's expertise.

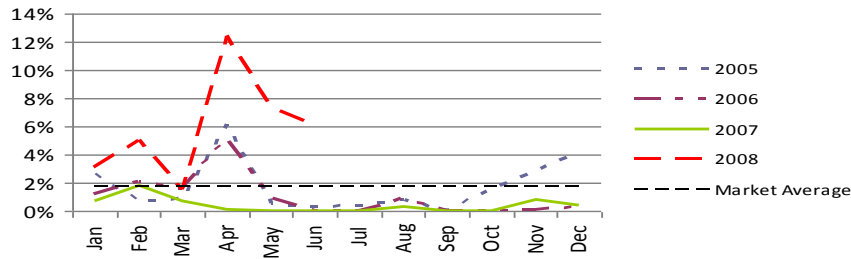
Proposed Analysis

- Reviewing the literature.

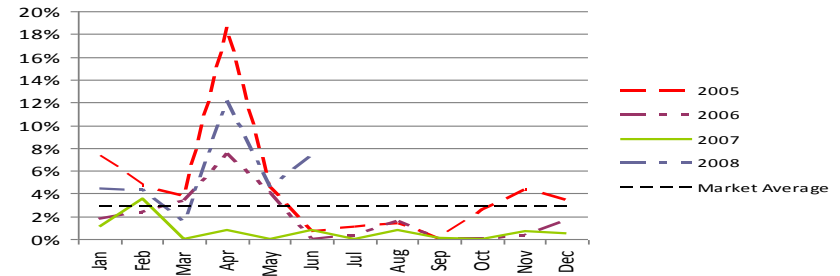
- Solicit MPWG Feedback on issue with written comments on discussion paper, pricing options and proposed analysis.
- MPWG written comments by November 14th, 2008.
- Develop work plan and Stakeholder engagement (SE-72) plan. Report back to MPWG on December 2nd, 2008.

• Additional Graphs

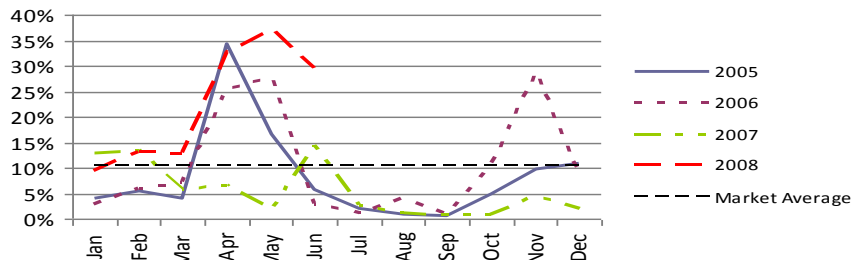
PD Unconstrained 10N



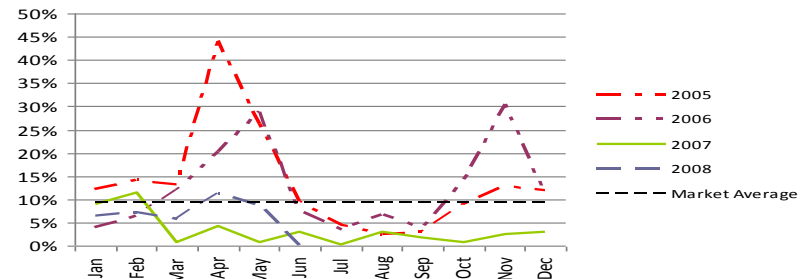
PD Unconstrained 30R



PD Constrained 10N

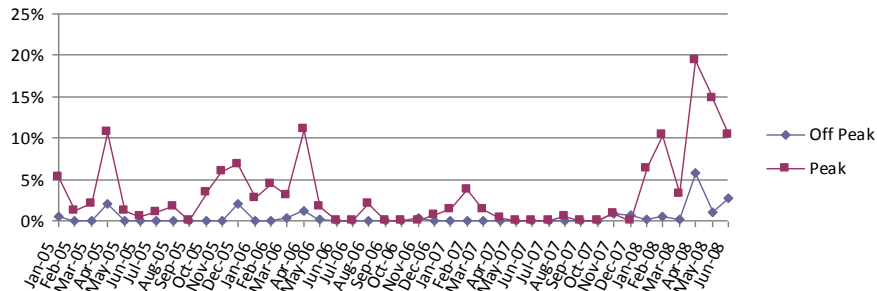


PD Constrained 30R

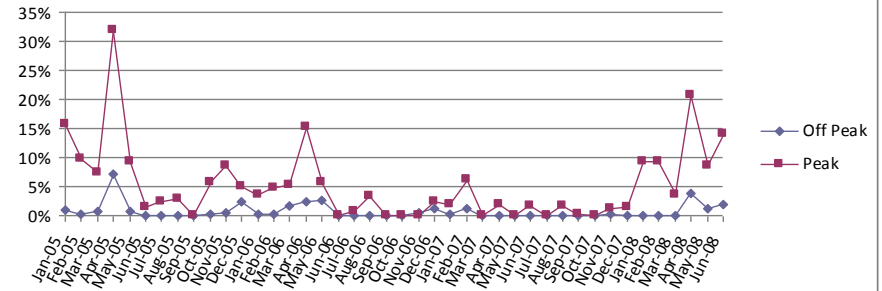


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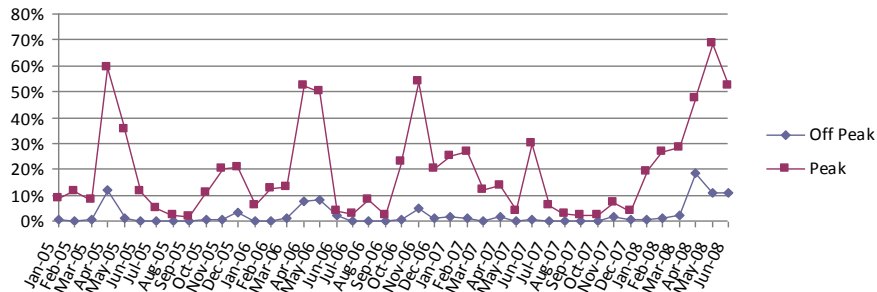
PD Unconstrained Peak Vs Off Peak 10N



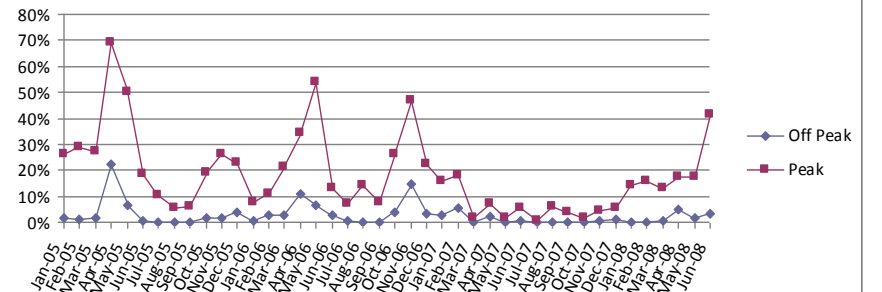
PD Unconstrained Peak Vs Off Peak 30R



PD Constrained Peak Vs Off Peak 10N



PD Constrained Peak Vs Off Peak 30R



Neighbouring OR Markets

NYISO OR Market:

The key elements of NY OR markets can be summarized as follows:

- Co-optimization of operating reserve with energy and regulation in both the day-ahead and real-time markets.
- Use of OR demand curves in price determination of operating reserves to reflect the value of OR and energy in shortage conditions.
- Operating reserve prices are based on the marginal cost of providing the service to the system, which equals the sum of the marginal OR provider's:
 - (i) Availability offer price, and
 - (ii) Opportunity cost of not providing another product, such as energy
- In real-time, all dispatchable on-line generators are at a \$0/MWh availability offer.
- A two-settlement system for OR, whereby day-ahead schedules must either be provided in RT or purchased back from the RT market at RT clearing prices.

PJM OR Market:

- PJM reserve market exists in both the real time and day-ahead timeframes.
- It operates 2 tiered reserve market:
Tier 1 OR – It is an excess capacity of online generators priced higher than \$0 only in case of reserve pick-up.

Tier 2 OR– It includes resource offers in the OR market with an offer cap of \$7.50 over their cost and only gets scheduled into the OR market if reserve requirement is not satisfied by Tier 1.

The price cap remains active unless scarcity pricing is called into effect, during which the price goes to the highest offer of a unit running for PJM within the zone.