Demand Response in Wholesale Electricity Markets

Harvard Electricity Policy Group

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Introduction

- Why Demand Response is Important
- NYISO’s Demand Response Initiatives
- Wholesale & Retail
- Summary
New York Control Area

- 19.2 million people
- Serving New York City
- 2006 load of 162,265 GWH
- 324 active Market Participants
  - Record peak of 33,939 MW (8/2/06)
  - Over 335 generating units modeled
- 10,775 miles of high voltage transmission
- 2007 required Installed Capacity 38,966 MW
Elements of NYISO Market Design

- Bid-based, security-constrained economic dispatch
- Simultaneous clearing of energy and operating reserves
- Shortage pricing for operating reserves
- Locational energy prices (LBMP)
- Market power mitigation with bid caps
- Unit commitment and production cost guarantees
- Day-ahead market with virtual bidding
- Transmission Congestion Contracts
- Locational Capacity Markets
- Demand Side Participation
Traditionally, electric utilities have managed supply for an inelastic demand for energy. Demand response products produce an elastic demand curve in an efficient whole-sale electric market.
Benefits of Demand Response

- Reliability benefits
- Consumer savings
- Increases competition
- Reduces market power
- Hedges exposure to price volatility
- Environmental benefits from reduced plant emissions
Markets for Demand Response Products

- **Capacity Market**
  - Assure enough resources, including demand that can be responsive, to assure resource adequacy

- **Reserves Market**
  - Keep sufficient resources, including responsive demand, available in ten or thirty minutes to maintain reliable operation

- **Energy Markets**
  - Schedule and dispatch resources, including price-sensitive demand, economically to meet customers’ demand 24 hours per day, 365 days per year.
NYISO’s Demand Response Products

Two Reliability Products – Controlled by NYISO

- ICAP Special Case Resources (SCR)
- Emergency Demand Response (EDR)

One Economic Products – Controlled by Customer

- Day-Ahead Demand Response (DADR)
ICAP Special Case Resources

- Available to curtailable load & emergency backup generation of at least 100 kW per zone
- Activated for forecasted operating reserve deficiency
- Day-ahead advisory and a 2-hour in-day notification
- Mandatory 4-hour minimum performance – Penalties and derated for non-compliance
- Payment for capacity (kW) reduction plus payment for energy (kWh) reduction at the greater of real-time price or strike price (up to $500/MWh) for at least 4 hours.
- May set real time market price under scarcity pricing rules
Emergency Demand Response

- Available to curtailable load & emergency backup generation of at least 100 kW per zone
- Activated for forecasted operating reserve deficiency
- Providers notified of activation 2 hours ahead, if possible
- Voluntary – no penalties for non-performance
- Payment for energy (kWh) reduction at the greater of real-time price or $500/MWh for at least 4 hours.
- May set real-time energy price at $500/MWh
Day-Ahead Demand Response

- Available to interruptible load only of at least 1 MW / zone
- Loads bid curtailment in Day-Ahead Market with $75/MWh minimum bid
- Providers notified by 11 AM for following day schedule
- Mandatory – Penalties assessed for non-compliance (penalized for buy-through at greater of DAM or RT price)
- Payment for energy (kWh) reduction at the greater of DAM price or bid for actual interruption (also allowed lower credit requirements by curtailment amount)
- May set DAM energy marginal price
Demand Response Participation

- Current Registration – January 2007

<table>
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<tr>
<th>Customers</th>
<th>Megawatts</th>
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<tr>
<td>SCR</td>
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<tr>
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EDR & SCR Growth

Date

MW Registered

# Customers

# Customers (Disaggregated)
# EDR & SCR Activations

- **Summary of Historical Events**

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<th>Year</th>
<th>Days</th>
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<td>6</td>
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Average hours per call: 6.5
Average hours per year: 18.5
NYISO Ancillary Services Demand Response

- Planned for Q3 2007 implementation.
- Operating reserves and regulation products
- Metering and communications requirements are the same as those for generators.
- Offers and scheduling for loads treated same as generation.
## ISO Demand Response Programs

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<th>AESO</th>
<th>CAISO</th>
<th>ERCOT</th>
<th>IESO</th>
<th>ISONE</th>
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NYISO – DR Impacts on 8/2/06

Graph: Comparison of 8/2 NYCA and 8/2 NYCA no DR

MWs

[Graph showing MWs from 12:00 to 20:15 with two lines, one for 8/2 NYCA and another for 8/2 NYCA no DR.]
PJM – DR Impacts on 8/2/06

Hourly DSR Impact

Total: $239,003,549

$8,435,325 $14,161,886 $10,070,045 $43,339,047 $80,448,260 $84,201,280 $86,766,545 $4,571,281

1300 1400 1500 1600 1700 1800 1900 2000

LMP with CSR removed
Hourly Integrated RTU LMP
Link between Retail & Wholesale Markets

- Retail Rate Policies and Metering Infrastructure have limited Real Time Price signals
  - *Retail customers on Fixed Rates and non-interval Metering have no incentive to reduce consumption during high demand.*
  - *Flat Pricing means customers don’t see price signals to reduce use when demand is high and the price is high*
- Demand won’t be fully active in retail markets until retail customers see prices and a linkage exists between retail and wholesale markets.
- Retail and wholesale demand response programs are complementary and mutually reinforcing