Demand Response in Wholesale Electricity Markets

Harvard Electricity Policy Group

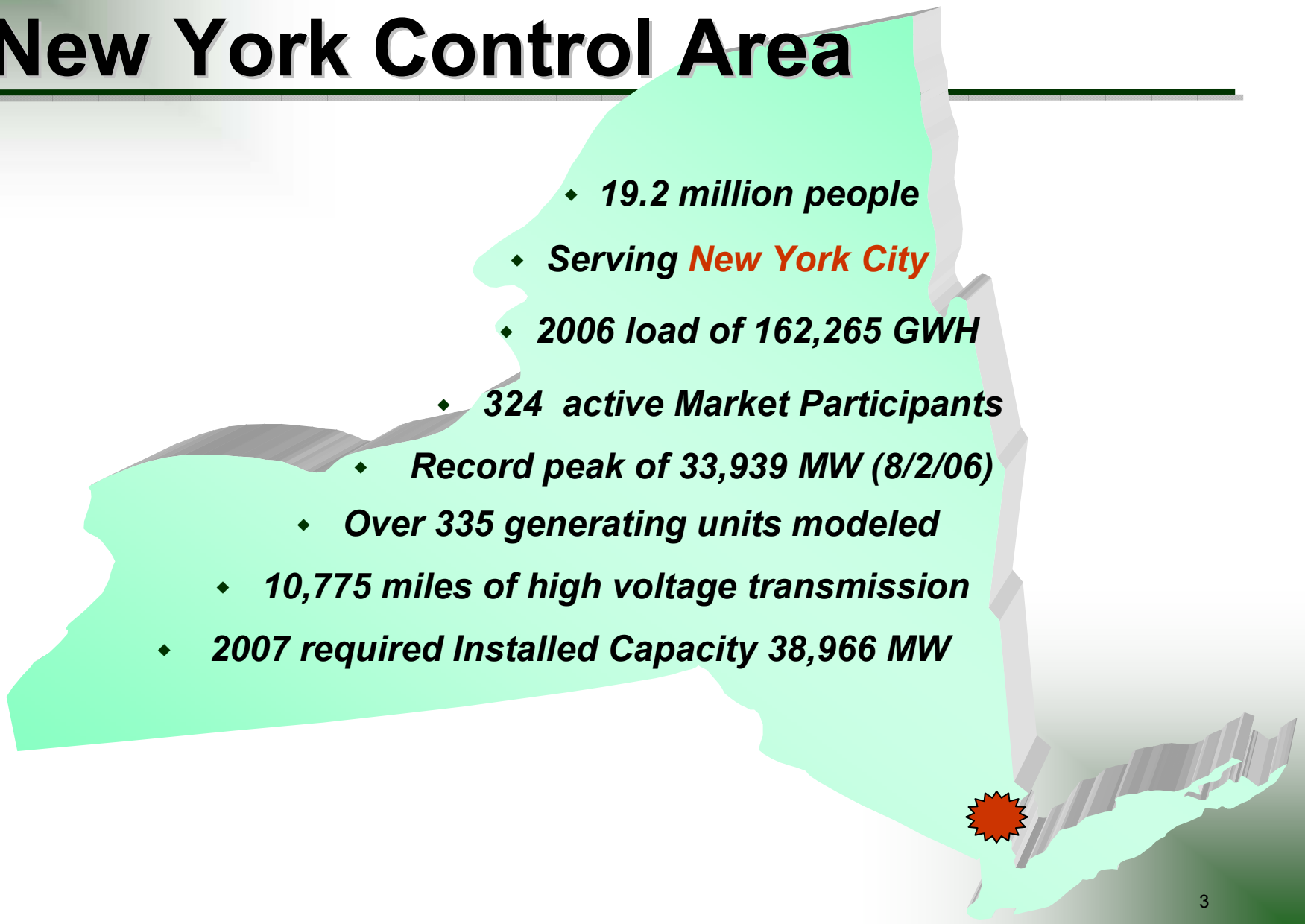
Laguna Beach, California – March 15-16, 2007

Rana Mukerji – Vice President, Market Structures

Introduction

- Why Demand Response is Important
- NYISO's Demand Response Initiatives
- Wholesale & Retail
- Summary

New York Control Area



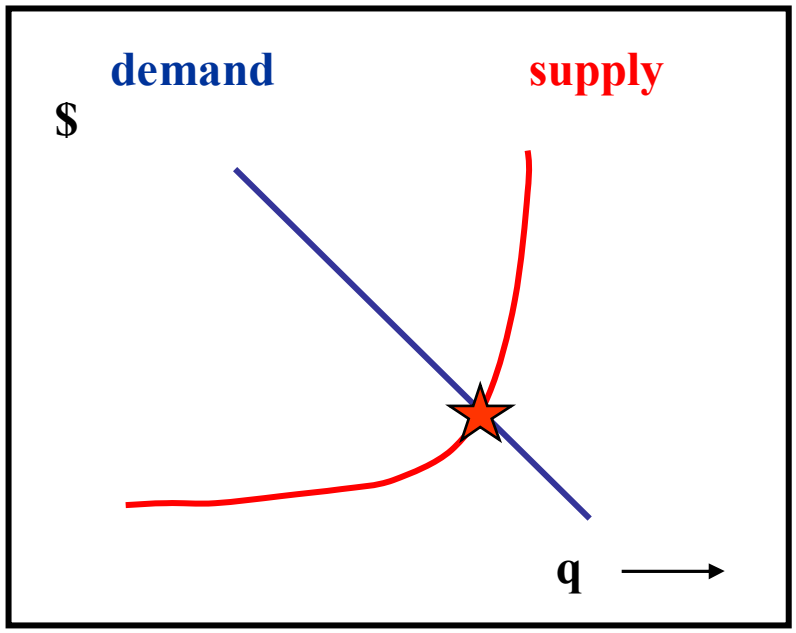
- *19.2 million people*
- *Serving New York City*
- *2006 load of 162,265 GWH*
- *324 active Market Participants*
- *Record peak of 33,939 MW (8/2/06)*
- *Over 335 generating units modeled*
- *10,775 miles of high voltage transmission*
- *2007 required Installed Capacity 38,966 MW*

Elements of NYISO Market Design

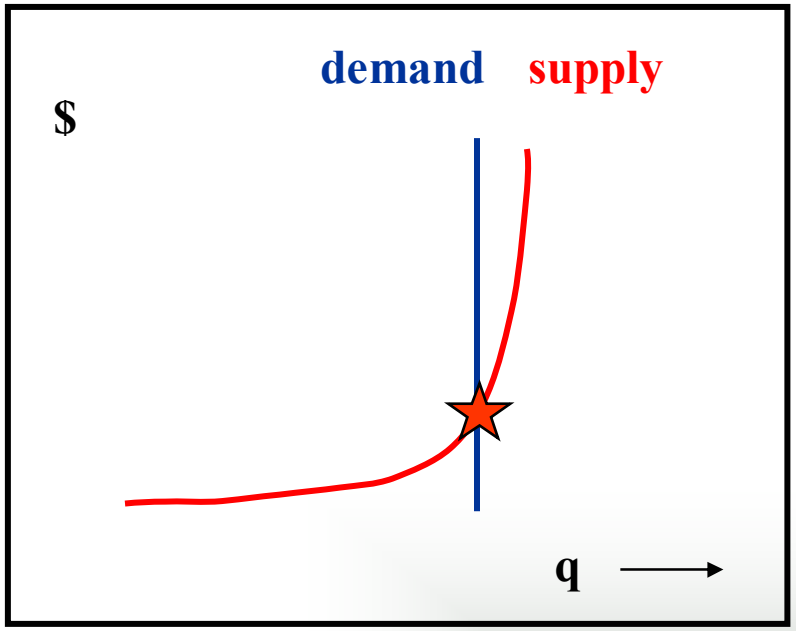
- *Bid-based, security-constrained economic dispatch*
- *Simultaneous clearing of energy and operating reserves*
- *Shortage pricing for operating reserves*
- *Locational energy prices (LBMP)*
- *Market power mitigation with bid caps*
- *Unit commitment and production cost guarantees*
- *Day-ahead market with virtual bidding*
- *Transmission Congestion Contracts*
- *Locational Capacity Markets*
- *Demand Side Participation*

Supply vs Demand Curves

Efficient Market



Traditional Market



- Traditionally, electric utilities have managed supply for an in-elastic 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

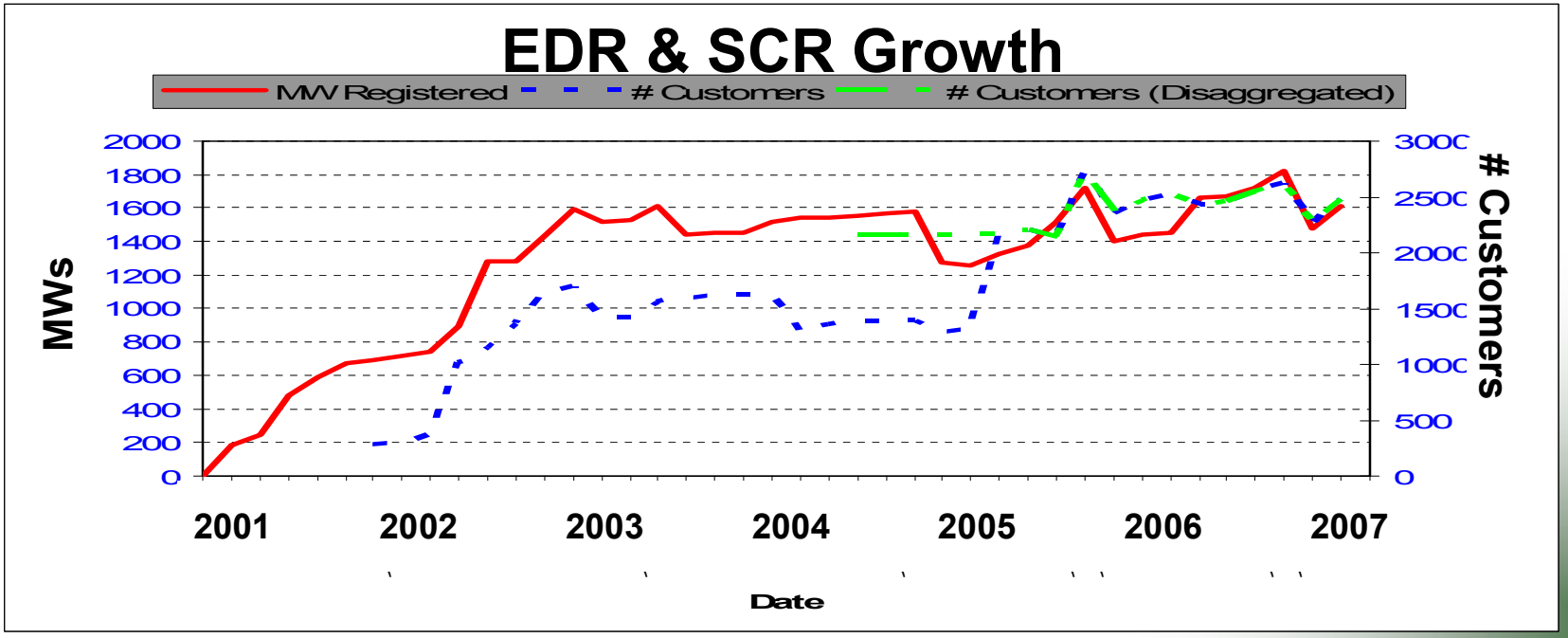
Day-Ahead Demand Response

- 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

	Customers	Megawatts
SCR	1683	1055
EDR	801	553
DADR	19	389



EDR & SCR Activations

- Summary of Historical Events

Year	Days	Hours	Megawatts
2001	4	23	1374
2002	4	22	1389
2003	2	22	1276
2005	1	4	345
2006	6	40	2472

Average hours per call: 6.5

Average hours per year: 18.5

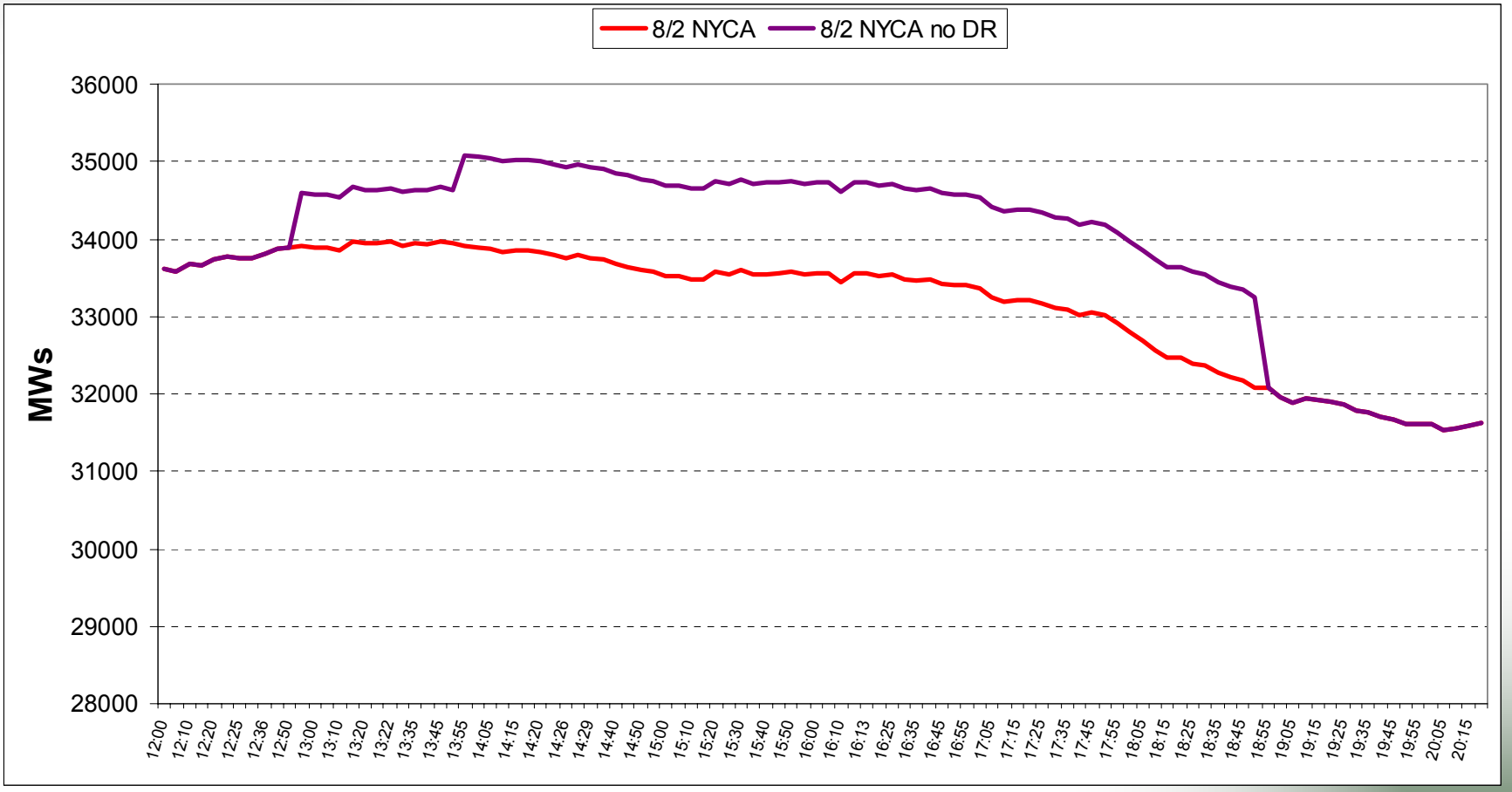
NYISO Ancillary Services Demand Response

- 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.

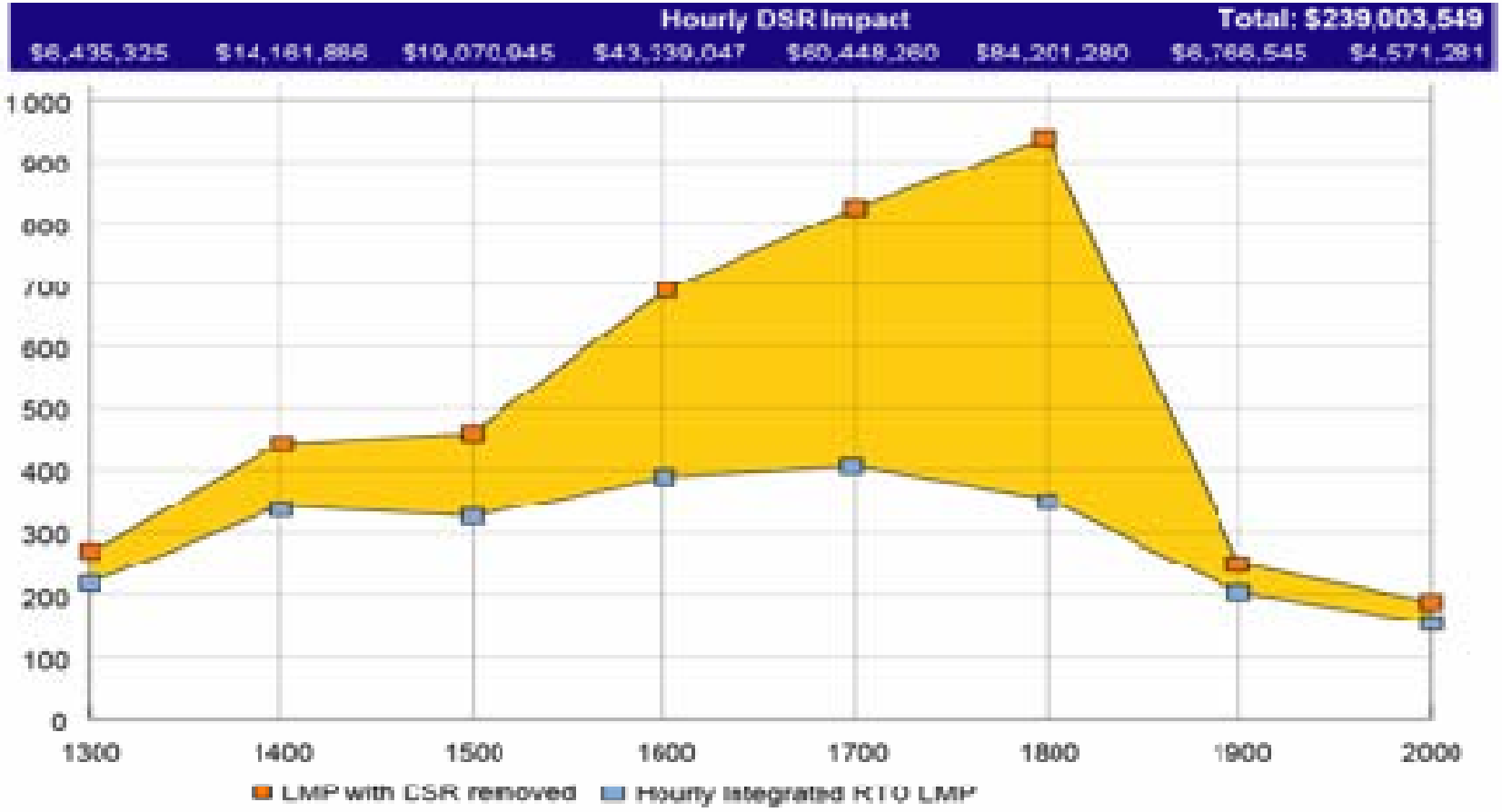
ISO Demand Response Programs

	AESO	CAISO	ERCOT	IESO	ISONE	MISO	NYISO	PJM
Day-Ahead Econonic DR		Q1-08			✓		✓	✓
Day-Ahead Price Sensitive Load		Q1-08			✓	✓	✓	✓
ICAP / Special Case Resource					✓		✓	✓
Emergency / Imbalance DR		✓	✓	✓	✓	✓	✓	✓
Operating Reserves DR	✓	✓	✓		pilot		Q3-07	✓
Regulation DR		Q1-08	✓				Q3-07	✓
Real-Time Dispatchable Load	✓			✓	✓			
Voltage / Load Reduction	✓	✓	✓	✓	✓	✓	✓	✓

NYISO – DR Impacts on 8/2/06



PJM – DR Impacts on 8/2/06



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