



Metropolitan  
Energy™

# Price Responsive Demand: A Commercial Building Perspective

PJM Symposium on Demand Response  
November 10, 2009

*The Power is Yours™*

# Agenda

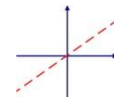
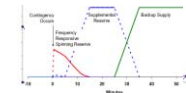
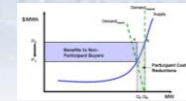
## Integrating Price Responsive Demand (PRD)

- Case Study: The BOMA/Chicago Smart Grid
- Key Features
- Key Assumptions
- Key Risks and Mitigation Factors



# Key Features

- BOMA/Chicago buildings acting in concert can deliver a utility-scale, clean, virtual generator. Its operation simultaneously lowers emissions and the LMP – benefitting all consumers in the region.
- Aggregation and integration of commercial building operations to provide operating reserves, frequency regulation, and over 200 MW of demand response in grid markets.
- Annual societal energy cost reductions of \$82 million and carbon reductions of 300 million pounds.
- The ability to measure and verify regional economic and environmental benefits in a manner unprecedented in scope, scale and granularity.

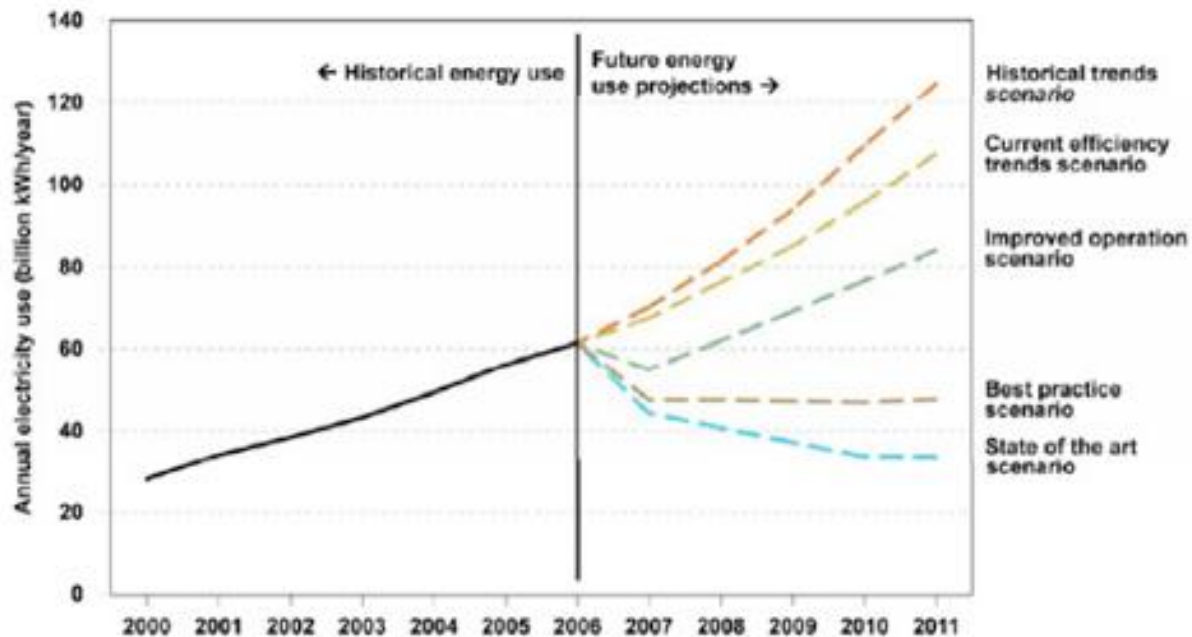


# Buildings as Regulation Resources

- In 2006 PJM added the capability of accepting demand response bids in the frequency regulation market. To date, this remains a dormant program.
- Regulation service corrects for short-term changes in electricity use that might affect the stability of the power system by matching generation and load to maintain the desired frequency.
- Commercial building operations using variable frequency drives, direct digital control and automation capabilities can deliver reliability to the grid.

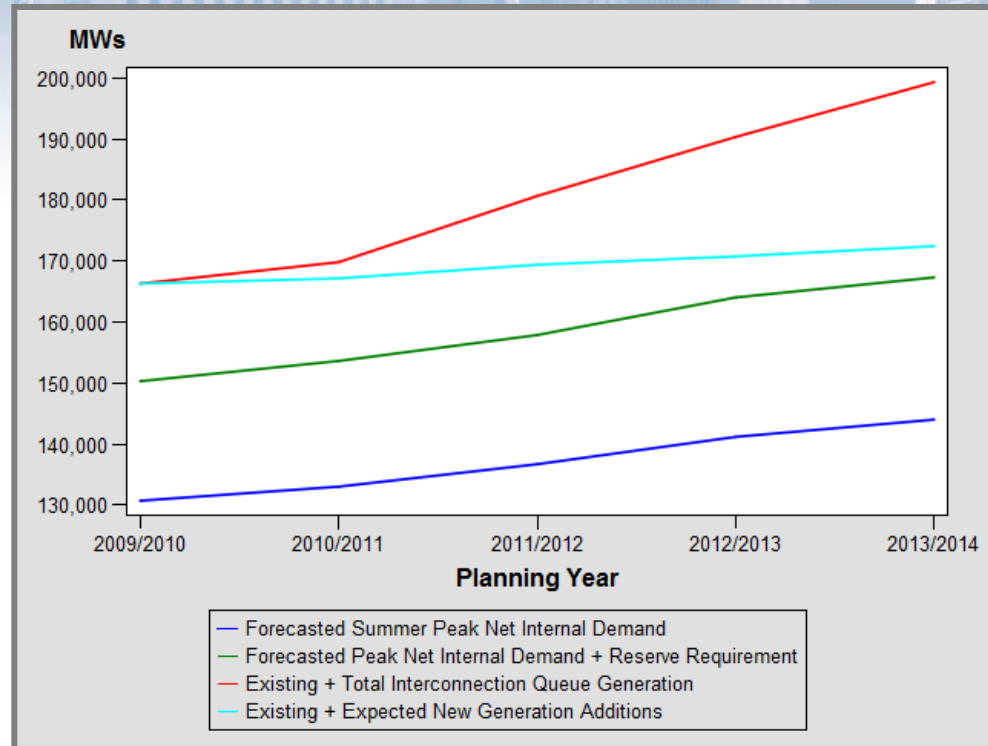
# Energy Efficiency (Demand) Projection

Comparison of Projected Electricity Use, All Scenarios, 2007 to 2011.



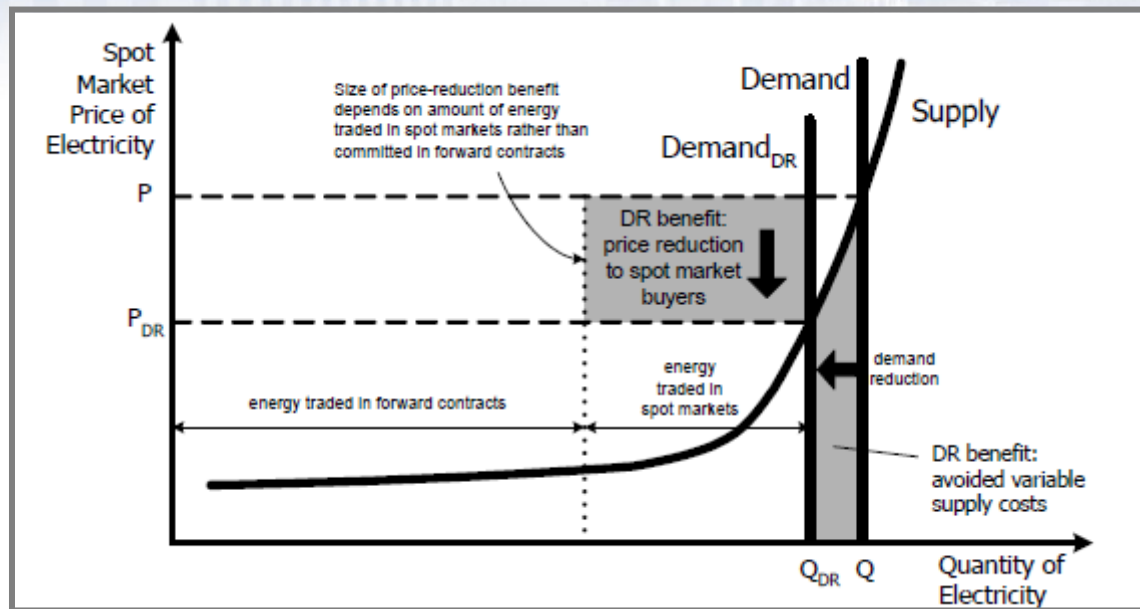
Source: EPA Report to Congress on Server and Data Center Energy Efficiency, 2007.

# Energy Supply Projection



Source: Forecasted Reserve Margin PJM RTO (as of 06/08/2009).

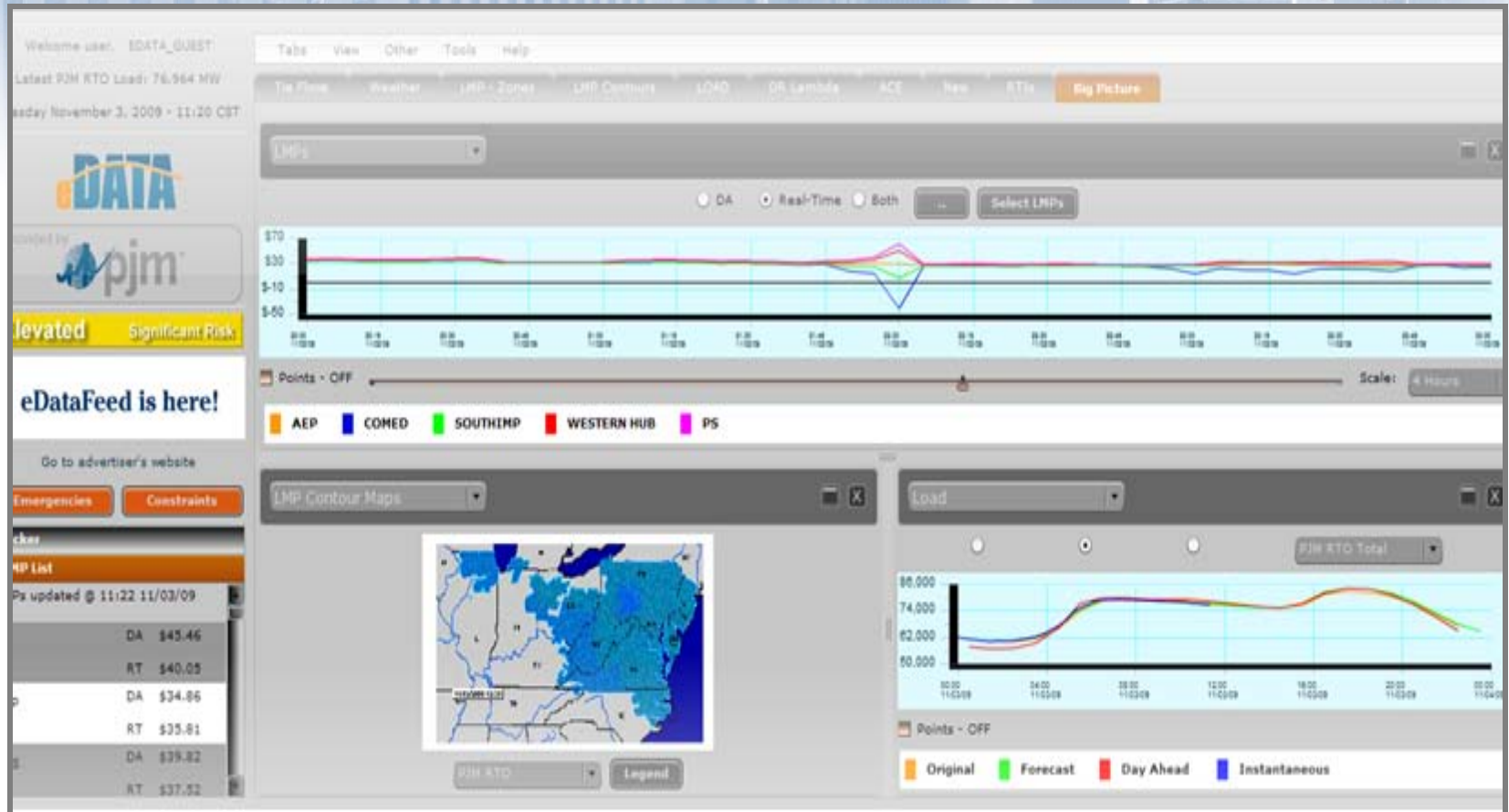
# Integrating Price Responsive Demand



The above graph demonstrates the value of a concentrated DR program to the market as a whole.

Source: U.S. DOE, *Benefits of Demand Response and Recommendations, Appendix B, pg. 69 (Feb. 2006)*.

# PJM Market Data



# Key Risks and Mitigation Factors

- **Information Access**

The relative intelligence of the grid results from informed decisions based on information analyses. Data is simply a tool that allows for greater measurement and verification of various goals and objectives.

All stakeholders contribute to the relative sophistication of the grid.

- **Market Transparency**

Many benefits are identified with PRD; many more are possible that cannot be predicted without data and experience.

Market efficiency dictates transparent market signals for load to effectively respond to price.

- **Market Design**

Price signals to incent load participation require information transfer and take into account the dynamic, not static characteristics of demand resources. Commercial buildings cannot be force-fit into generation market constructs that require periods of sustained dispatch.

Many buildings have sophisticated automation systems with almost unlimited start-stop flexibility. Market design that takes into account load operating characteristics enables PRD.