



**Synapse**  
Energy Economics, Inc.

# Energy Efficiency in Wholesale Markets: ISO-NE, PJM, MISO

**ACEEE 5th National Conference:  
Energy Efficiency as a Resource**

September 29, 2009

Paul Peterson, Vladlena Sabodash

# Topics Covered

- EE in wholesale markets
- New England
- PJM
- MISO
- Analytical tools
- Electric system utilization
- National policy goals

# Demand Resources Defined

- **Demand Response (DR)**
  - a mechanism that manages customer's electricity consumption in response to supply conditions or market prices; can include Emergency Generation.
- **Energy Efficiency (EE)**
  - using less energy to provide the same level of energy service.
- **Distributed Generation (DG)**
  - electricity generation from retail customers (behind the meter).

Main focus of this presentation is EE, but in many respects, DR and DG can be substituted with similar impacts

# ISO-NE Forward Capacity Market

- Demand Resources – including DR, EE, and DG – can qualify as capacity along with supply-side resources both during the Transition Period as well as in the Forward Capacity Auctions (FCA).
- New resources participating in the FCA are eligible to commit to 5-year capacity provision (fixed monthly payments) to encourage investment.
- Demand Resources receive monthly \$/kW payments during the Transition period (until June 2010).
- Demand Resources can receive capacity payments for the entire “measure life” of the investment.

# PJM Reliability Pricing Mechanism

- DR can compete equally with generation in energy and capacity markets, as well as DA scheduling reserve, synchronized reserve and regulation markets.
- EE can compete with generation in capacity market only, starting from 2012/13 delivery year.
- Participation in the capacity market (RPM)
  - DR resource: as long as its ability to reduce demand continues;
  - EE resource: up to four years.

# MISO Voluntary Capacity Auction

- Not a forward capacity market similar to PJM, NY, or New England.
- Residual market for entities to acquire or shed obligations for the next month.
- Implemented in June 2009.
- Five monthly auctions to date.
- DR eligible to meet capacity requirements.
- EE valued only as a load forecast reduction.

# Approaches for analyzing impacts

- Load Forecasts
- Wholesale markets
  - Capacity
  - Energy
- Load Duration Curves (resource utilization)

# ISO-NE: Load Forecast Impacts

Projected Year	50/50 Summer Peak Forecast, MW *	NE ODR, MW *	NE Summer Peak Forecast Net ODR, MW *	Synapse ODR, MW**	Synapse Summer Peak Forecast Net ODR, MW
2009	27875	350	27525	350	27525
2010	28160	350	27810	650	27510
2011	28575	350	28225	925	27650
2012	29020	350	28670	1202	27818
2013	29365	350	29015	1480	27885
2014	29750	350	29400	1759	27991
2015	30115	350	29765	2039	28076
2016	30415	350	30065	2319	28096
2017	30695	350	30345	2600	28095
2018	<b>30960</b>	350	<b>30610</b>	2881	<b>28079</b>

\* Based on 2009 CELT forecast

\*\* Starting from 2011, additional amount of ODR is calculated as 1% of the previous year Net Summer Peak Forecast



# N.E. Governors' Blueprint for 2030

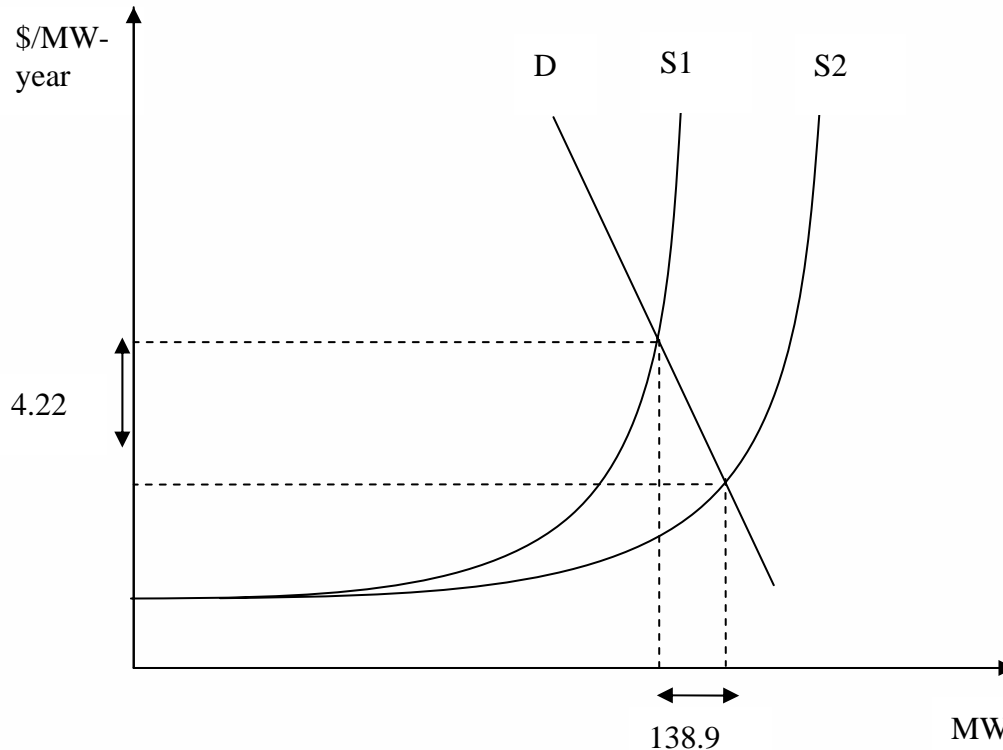
## 2018 and 2030 Net Peak Load Calculation

	ISO-NE Medium Case	Synapse 1% EE Case
2018 Original Peak (Gross MW)	30960	30960
Passive Demand Resources - EE (MW)	350	<b>2881</b>
Active Demand Resources - DR (MW)*	2092	2092
Emergency Generation (MW)	800	800
<b>2018 Net Peak (MW)</b>	<b>27718</b>	<b>25187</b>
2030 Original Peak (Gross MW)	34500	34500
Passive Demand Resources - EE (MW)	3450	6257
Active Demand Resources - DR (MW)	3100	3100
Emergency Generation (MW)	800	800
<b>2030 Net Peak (MW)</b>	<b>27150</b>	<b>24343</b>

# PJM: RPM Supply Curves

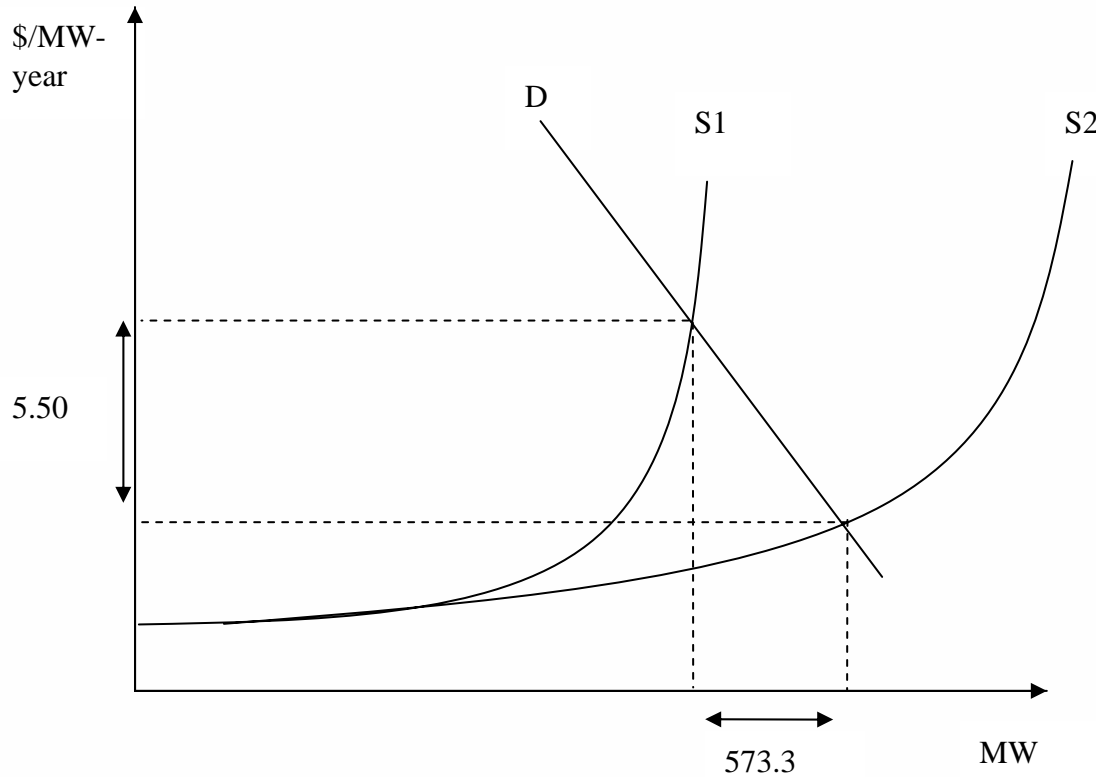
Each annual Reliability Pricing Model capacity auction has a unique supply curve. Two illustrative curves below show how shifts in supply impact auction prices.

**2009/2010 BRA:** 138.9 MW quantity change leads to \$4.22 price change. A shift of 1 MW changes the price by approximately \$0.03/MW-day or \$11/MW-yr



# PJM: RPM Supply Curves

**20010/2011 BRA:** 573.3 MW quantity change leads to \$5.50 price change. A shift of 1 MW changes the price by approximately \$0.01/MW-day or \$3.50/MW-yr



# PJM: Maryland DSM impacts

**Table 1 - Utility Savings**

INDIRECT CAPACITY SAVINGS - Reductions in Capacity Auction Prices						
Utility	PEPCO	DPL	BGE	AP	SMECO	MD Total
<b>2009/2010 BRA; \$-MW Change</b>	\$ 11.09	\$ 11.09	\$ 11.09	\$ 11.09	\$ 11.09	\$ 11.09
<b>Capacity Price Savings</b>	\$ 16,774,272	\$ 5,347,961	\$ 37,503,849	\$ 3,607,249	\$ 2,077,984	<b>\$ 65,311,315</b>
<b>2011/2012 BRA; \$-MW Change</b>	\$ 3.50	\$ 3.50	\$ 3.50	\$ 3.50	\$ 3.50	\$ 3.50
<b>Capacity Price Savings</b>	\$ 5,296,808	\$ 1,688,724	\$ 11,842,582	\$ 1,139,060	\$ 656,164	<b>\$ 20,623,339</b>

**Table 2 - Utility Savings**

INDIRECT ENERGY SAVINGS - Reductions in Wholesale Market Energy Prices in Peak Hours						
Utility	PEPCO	DPL	BGE	AP	SMECO	MD Total
<b>\$100/MWH Hours case</b>	388	388	388	388	388	388
<b>Energy Price Savings</b>	\$ 22,841,379	\$ 5,686,142	\$ 45,076,039	\$ 4,616,953	\$ 3,353,366	<b>\$ 81,573,878</b>
<b>DR Hours case</b>	147	147	147	147	147	147
<b>Energy Price Savings</b>	\$ 8,653,821	\$ 2,154,286	\$ 17,077,778	\$ 1,749,206	\$ 1,270,476	<b>\$ 30,905,567</b>

# PJM: Maryland DSM impacts

Empower Maryland Act required MD utilities to develop DR and EE programs to meet a 15% reduction in per capita peak demand by 2015

**Table 3 - Summary of Savings**

Capacity Value	2011-2012 BRA - Low		2009-2010 BRA - High	
	DR hrs - Low	\$100/MWhrs - High	DR hrs - Low	\$100/MWhrs - High
<b>Energy Value</b>				
<b>Indirect Capacity Savings</b>	\$ 20,623,339	\$ 20,623,339	\$ 65,311,315	\$ 65,311,315
<b>Indirect Energy Savings</b>	\$ 30,905,567	\$ 81,573,878	\$ 30,905,567	\$ 81,573,878
<b>Total</b>	<b>\$ 51,528,906</b>	<b>\$ 102,197,217</b>	<b>\$ 96,216,883</b>	<b>\$ 146,885,194</b>
<b>2011 DSM Expenditures - All MD Utilities</b>	\$ 95,464,969	\$ 95,464,969	\$ 95,464,969	\$ 95,464,969

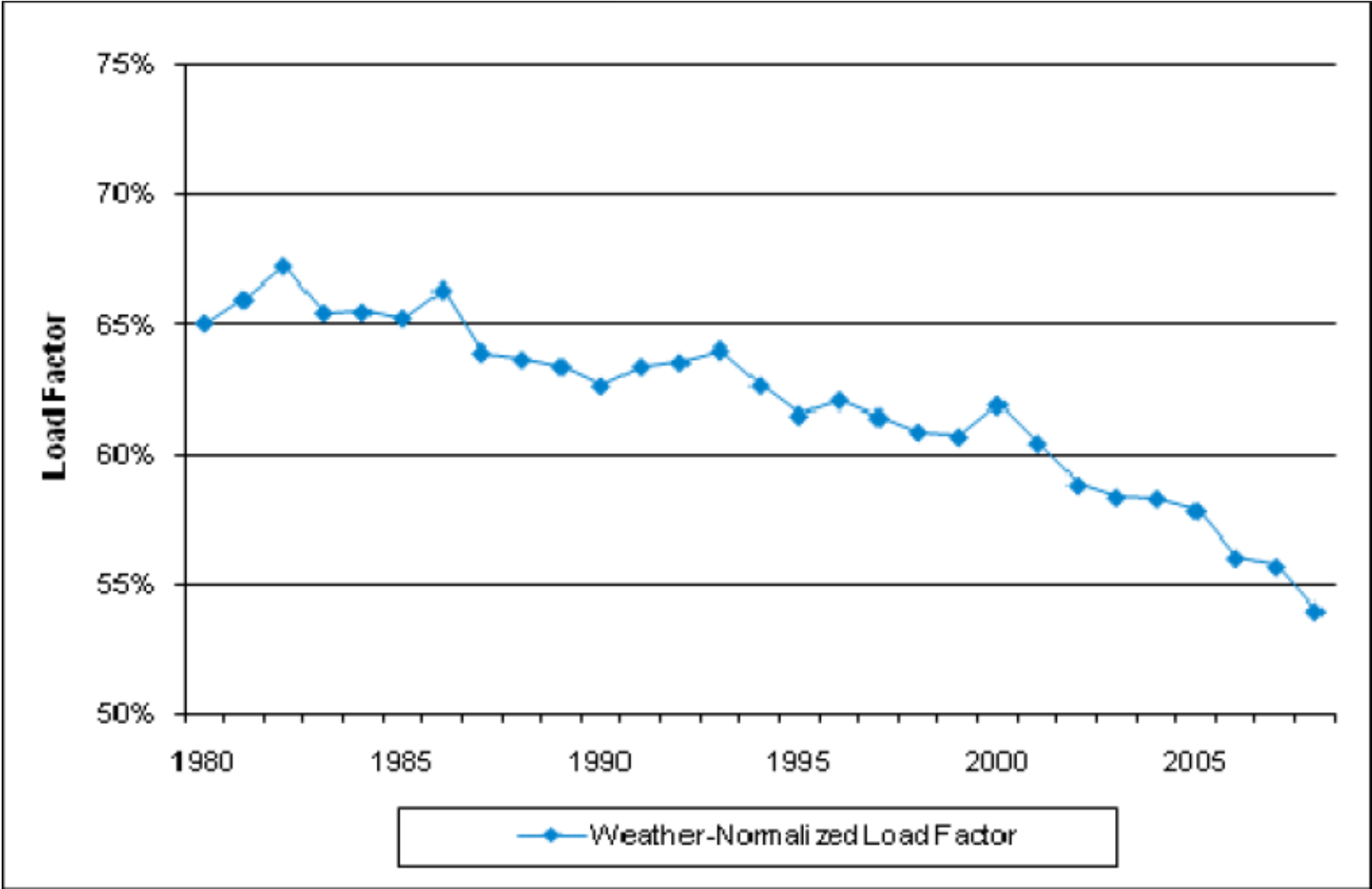
# RPM 2012-13 auction results

## Summary of Monitoring Analytics review

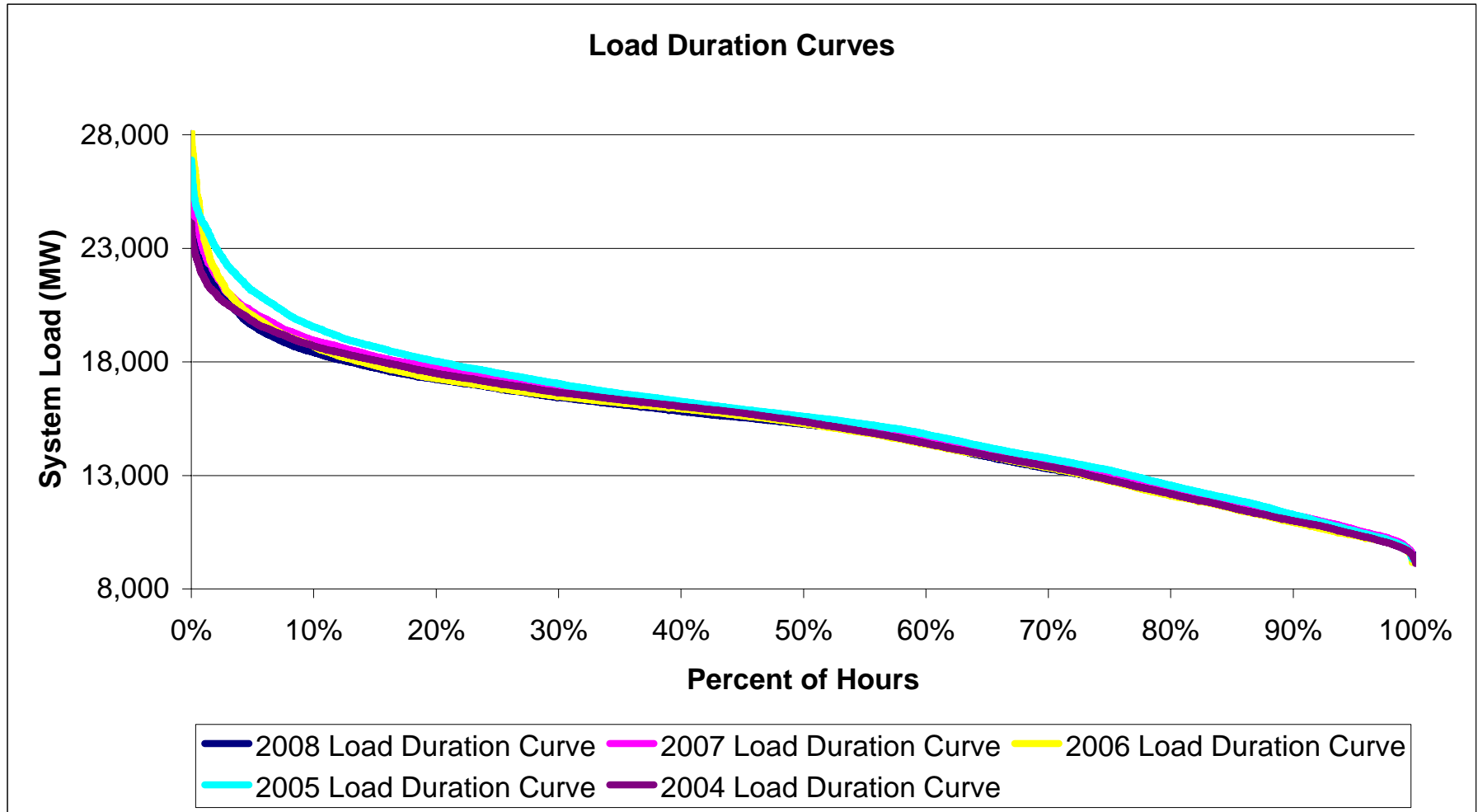
PJM MIC, September 10, 2009

LDA	2012/2013 Auction Clearing Price, \$/MW-day	Clearing Price without DR or EE offers, \$/MW-day	Change in Clearing price, \$/MW-day
DPL South	\$222.30	\$264.66	\$42.36
PSEG North	\$185.00	\$264.66	\$79.66
EMAAC	\$139.73	\$264.66	\$124.93
MAAC	\$133.37	\$264.66	\$131.29
RTO	<b>\$16.46</b>	<b>\$178.78</b>	\$162.32

# New England Electric System Utilization 1980-2008



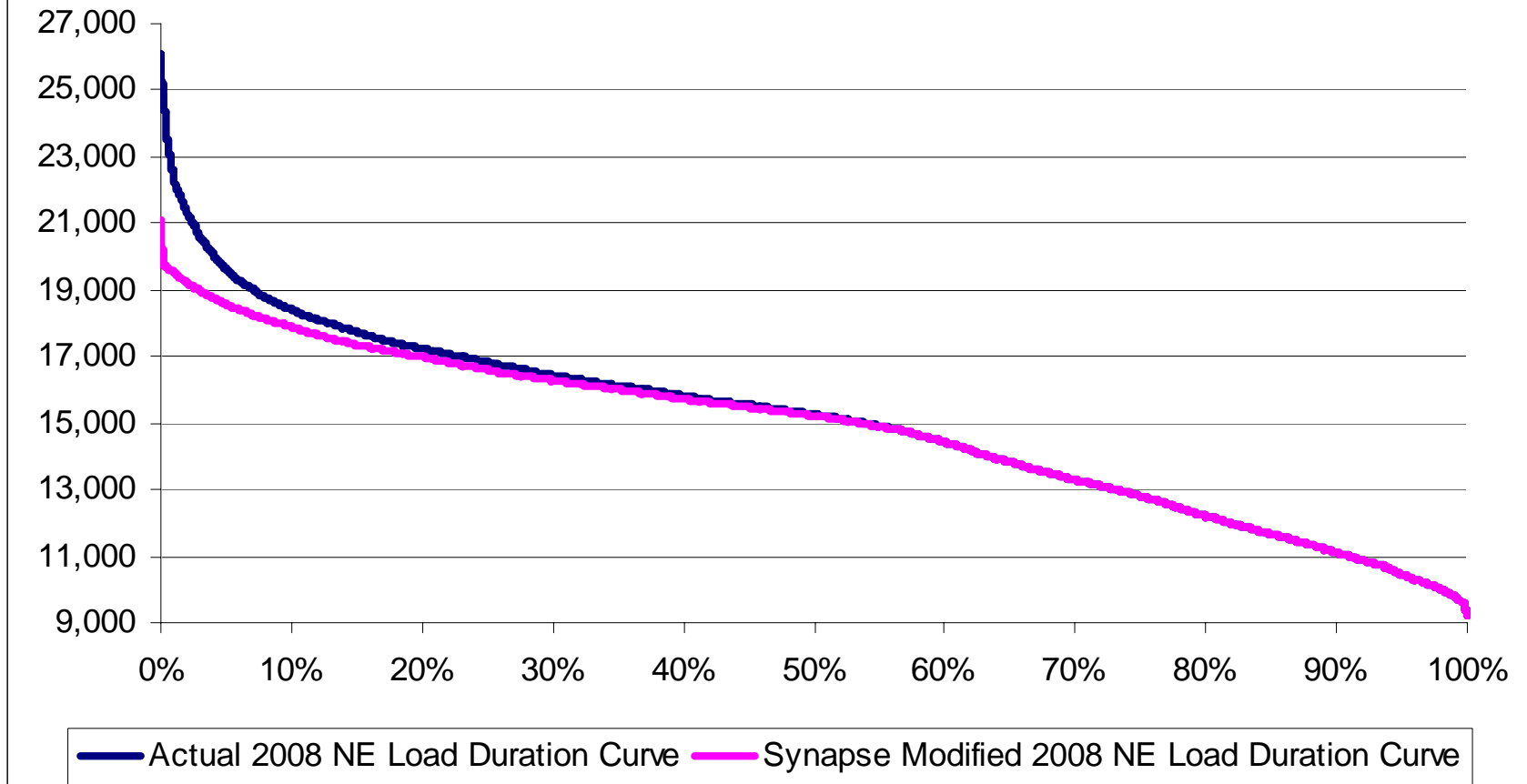
# NE Load Duration Curves





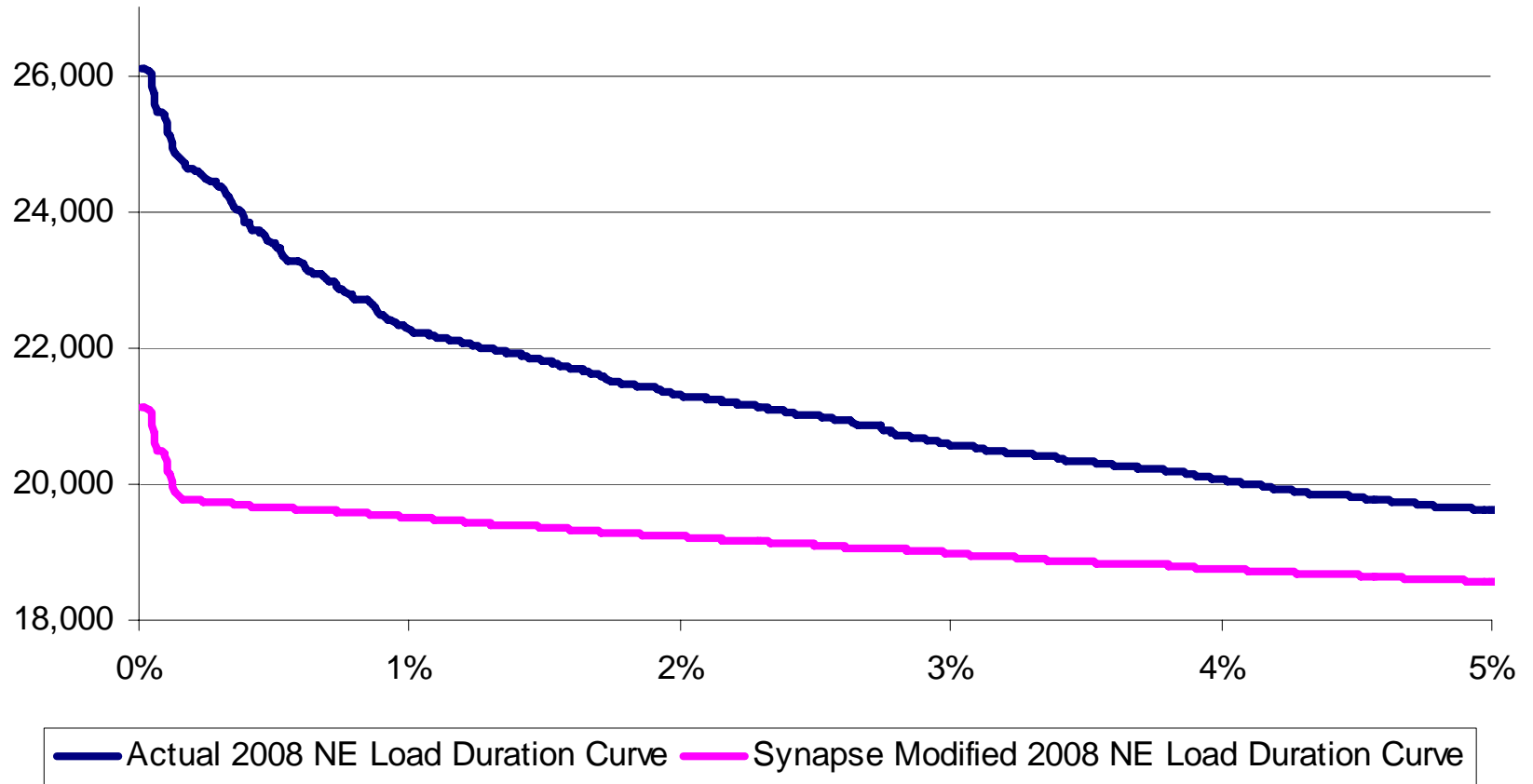
# NE Load Duration Curve

## Actual vs Modified 2008 NE Load Duration Curve



# NE Load Duration Curve

## Actual vs Modified 2008 NE Load Duration Curve, Top 5% of Hours



Smart Grid

Carbon reductions

National RPS

EE resource investment

Small scale DG