Analysis of NOx Emission Reduction Potential from Demand Side Resources

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Ozone Transport Commission Meeting, Dulles Hilton, 9-15-2006

(final)

Clean EnergyEnvironment STATE PARTNERSHIP

CLEAN AIR MARKET PROGRAMS

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Outline

- EPA Analysis
  - Model, Inputs, Results
- Opportunities
  - What loads are at peak
  - Lessons from established EE & DR programs
- Conclusions
  - Great emission reductions and energy savings from EE & DR

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EPA Analysis

TRUM

- TRUM = The Technology Retrofit and Updating Model (TRUM)
  - Macro-driven spreadsheet model, developed by ICF to supplement the use of its Integrated Planning Model (IPM).
  - Uses a linear programming formulation to select investment options and to dispatch generation and load management resources to meet overall electricity demand and energy requirements (Load duration curve)
  - More simple and streamlined compared to IPM.
  - Runs quickly but does not provide exact solutions.

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TRUM Inputs

- Modeling performed by the Clean Air Markets Division
- Started with 2010 CAIR scenario as a base case
- Reconfigured the modeling exercise to look at episodic period (twelve high electric demand days (based on recent load projected to 2010)
- Included smaller units not subject to cap and trade programs

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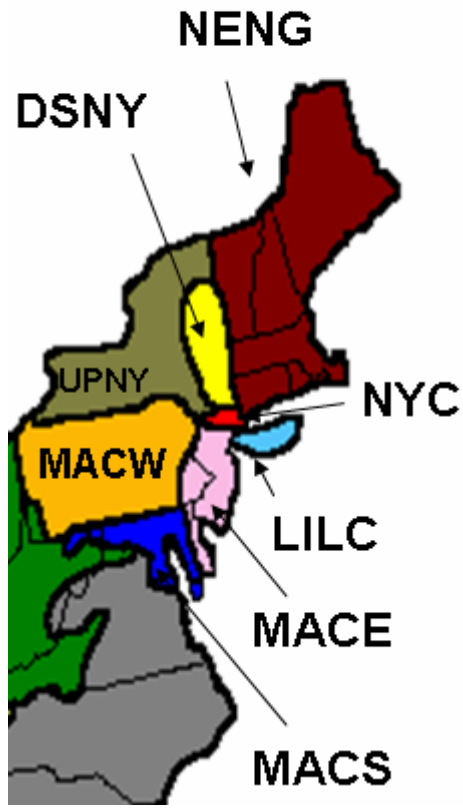
TRUM Inputs: Geographic Extent

- 8 IPM Regions encompassing
  - "classic" PJM,
  - NY, and
  - New England



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TRUM Inputs: Efficiency & Demand Response

- Base case + Three altered load curves
  - Low: 1% overall from energy efficiency (EE), then 3% from demand response (DR) during peak times only
  - Medium: 1.5% EE, 5% DR
  - High: 2% EE, 7% DR
- Other:
  - Load curve represents peak demand
  - No additional policy options adopted

Demand Response Sources:
Assessment of Demand Response and Advanced Metering Staff Report, FERC, August 2006
http://www.ferc.gov/legal/staff-reports/demand-response.pdf

Benefits of Demand Response in Electricity Markets and Recommendations for Achieving Them: A Report to the United States Congress Pursuant to Section 1252 of the Energy Policy Act of 2005, DOE, February 2006
http://eetd.lbl.gov/ea/EMP/reports/congress-1252d.pdf

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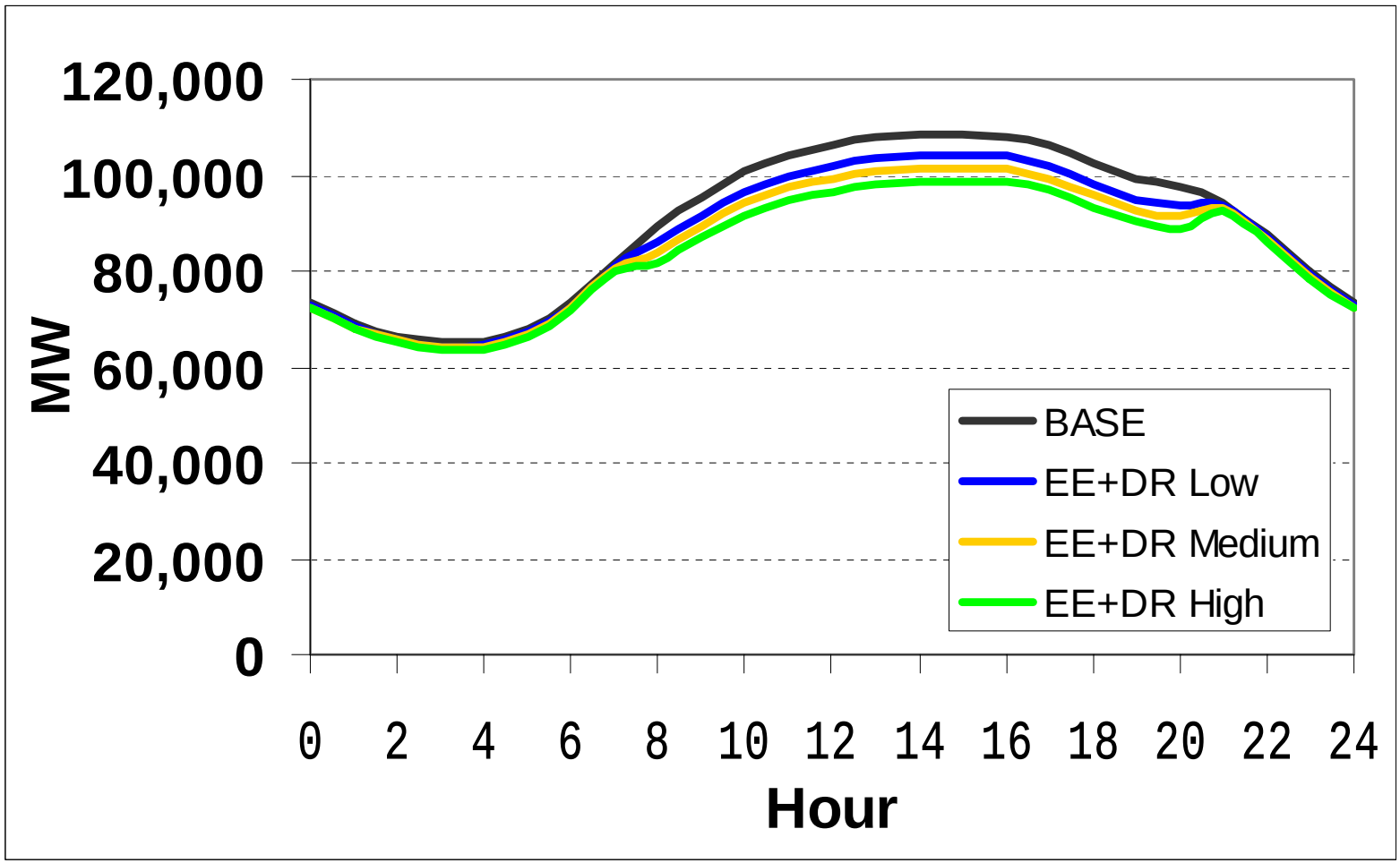
TRUM Inputs: Efficiency & Demand Response



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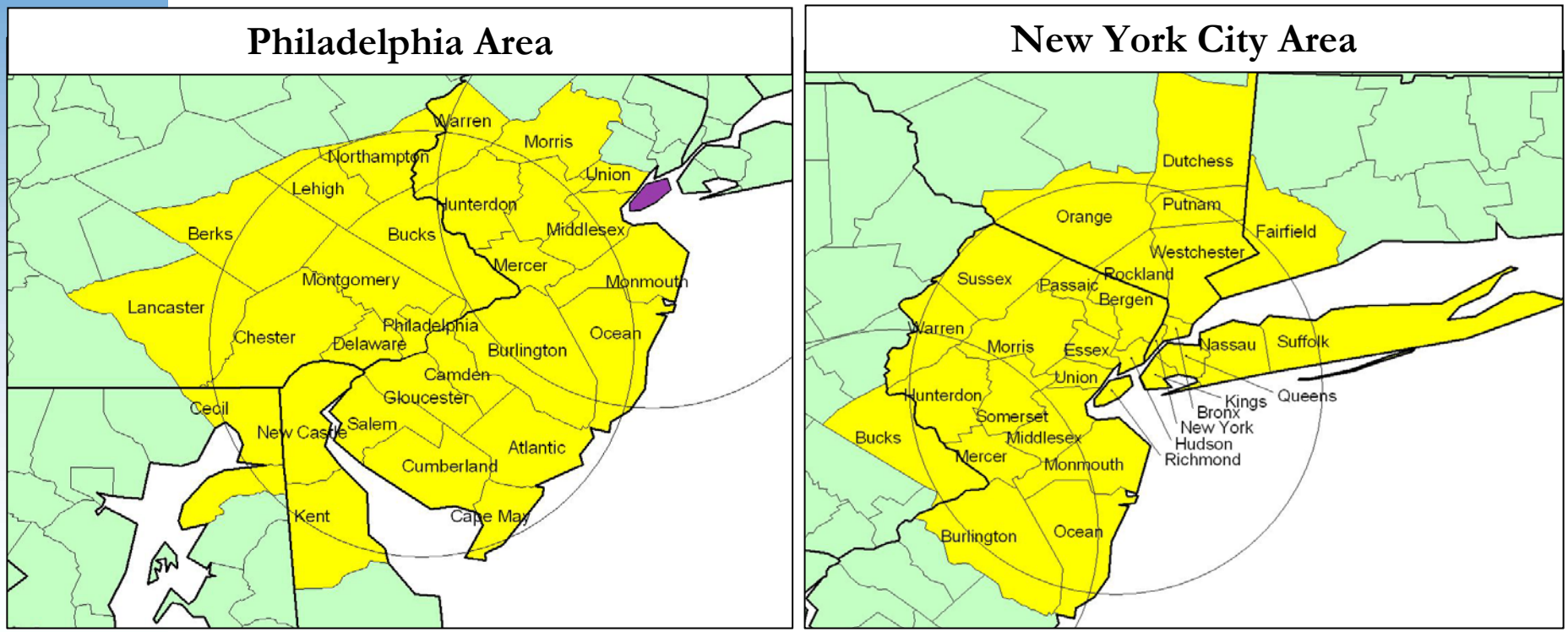
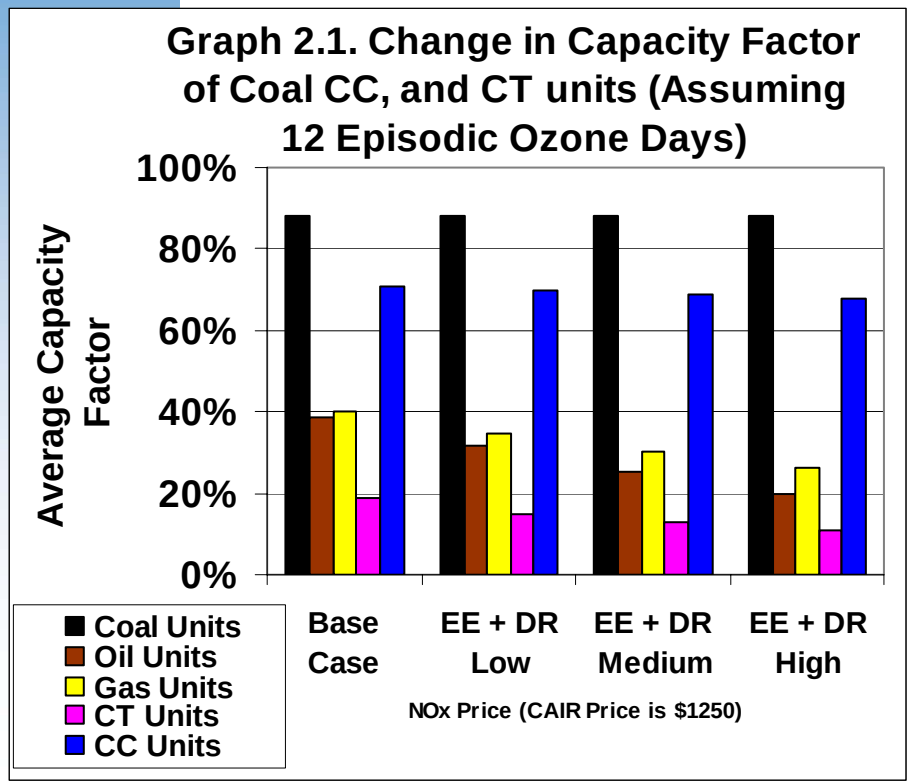
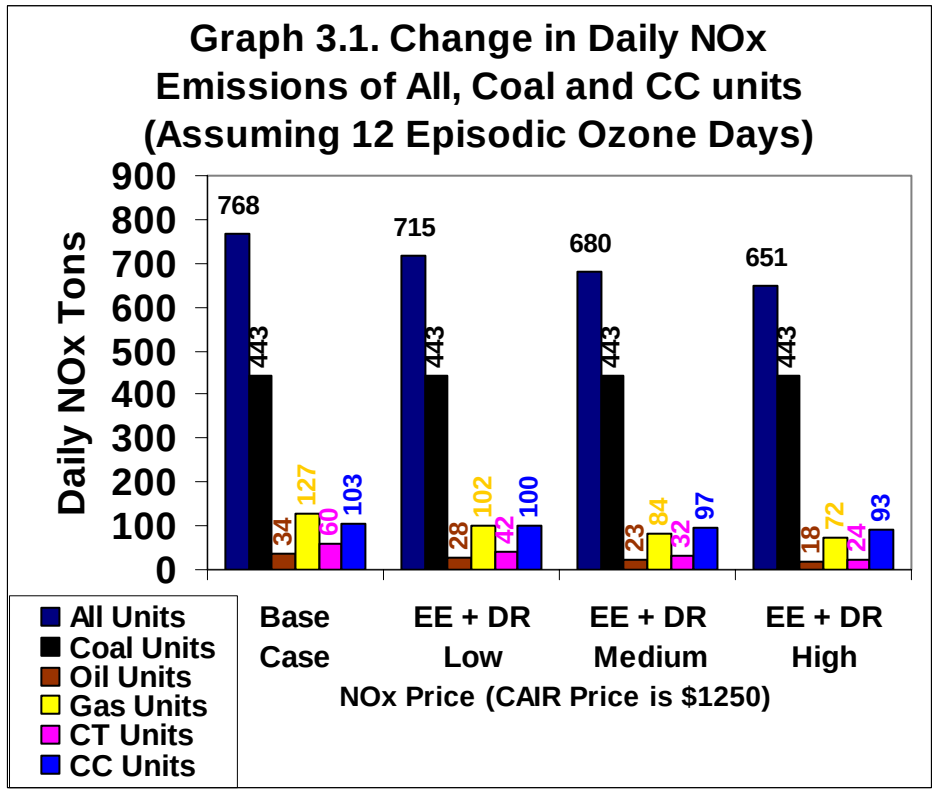
Analysis Focus: NYC and Philadelphia



- Counties chosen as “in the circle”:
  - Were predicted to remain in non-attainment in 2015 with CAIR,
  - Had at least a portion of area within a 50-mile radius of the respective city center or included major EGUs.
  - NOTE: There is some overlap between areas

Results: Capacity Factor & NOx in Entire Region





- Most NOx reduction in are from CTs & Oil/Gas Steam Units:
  - Daily NOx tons and capacity factors for coal remain constant
  - Daily NOx tons and capacity factors CCs decline very slightly

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Results: Overall NOx Reductions

	Scenario		
	Low	**Medium**	**High**
Tons of Daily NOx reduced from All Units	**60**	**98**	**130**
Percentage of Daily NOx reduced from All Units	**7%**	**12%**	**16%**
Tons of Daily NOx reduced from CTs	25	38	49
Percentage of Daily NOx reduced from CT Units over base case CT emissions	28%	42%	55%

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Results: NOx Reductions Inside/Outside "Circle"

	Scenario		
	Low	**Medium**	**High**
Tons of Daily NOx reduced with DR in the Circle	33	52	70
Tons of Daily NOx reduced with DR outside the Circle	27	45	60
Percentage of Daily NOx reduced with DR in the Circle	12%	19%	26%
Percentage of Daily NOx reduced with DR outside the Circle	5%	8%	11%
Percentage of Overall Daily NOx reduced	**7%**	**12%**	**16%**
Tons of Daily NOx reduced from CT in the Circle	10	16	21
Tons of Daily NOx reduced from CT outside the Circle	16	21	28
Percentage of Daily NOx reduced from CT over base CT emissions in the Circle	26%	44%	58%
Percentage of Daily NOx reduced from CT over base CT emissions outside the Circle	30%	40%	52%
Percentage of Overall NOx Reductions made by CTs	**43%**	**38%**	**38%**

- See significant reductions in NOx from CTs in immediate Philly & NYC counties
- In circle, ~30% of NOx reduction comes from CTs
- Out of circle, ~50% of NOx reduction comes from CTs
- Most of non-CT reductions from Oil & Gas Steam units

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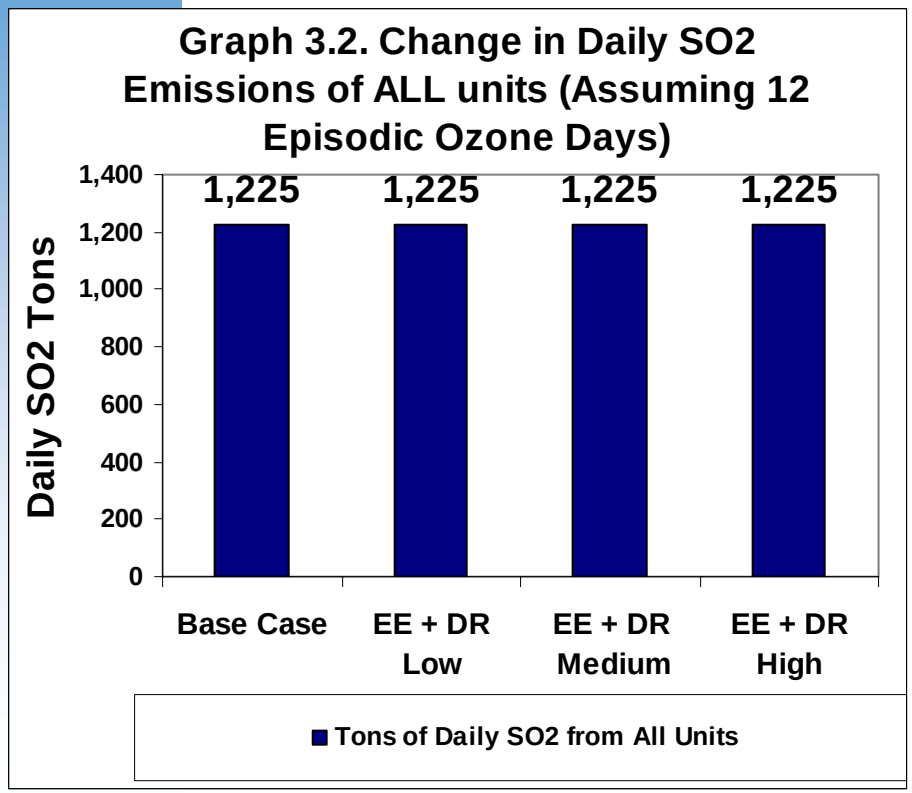
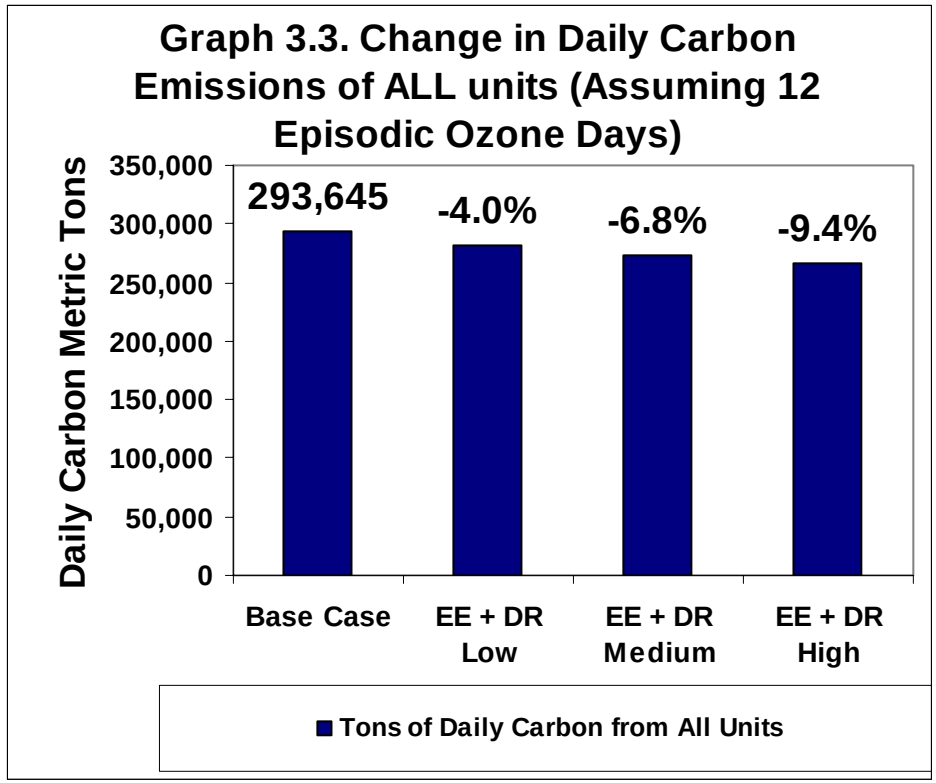
Results: SO2 & Carbon Emissions





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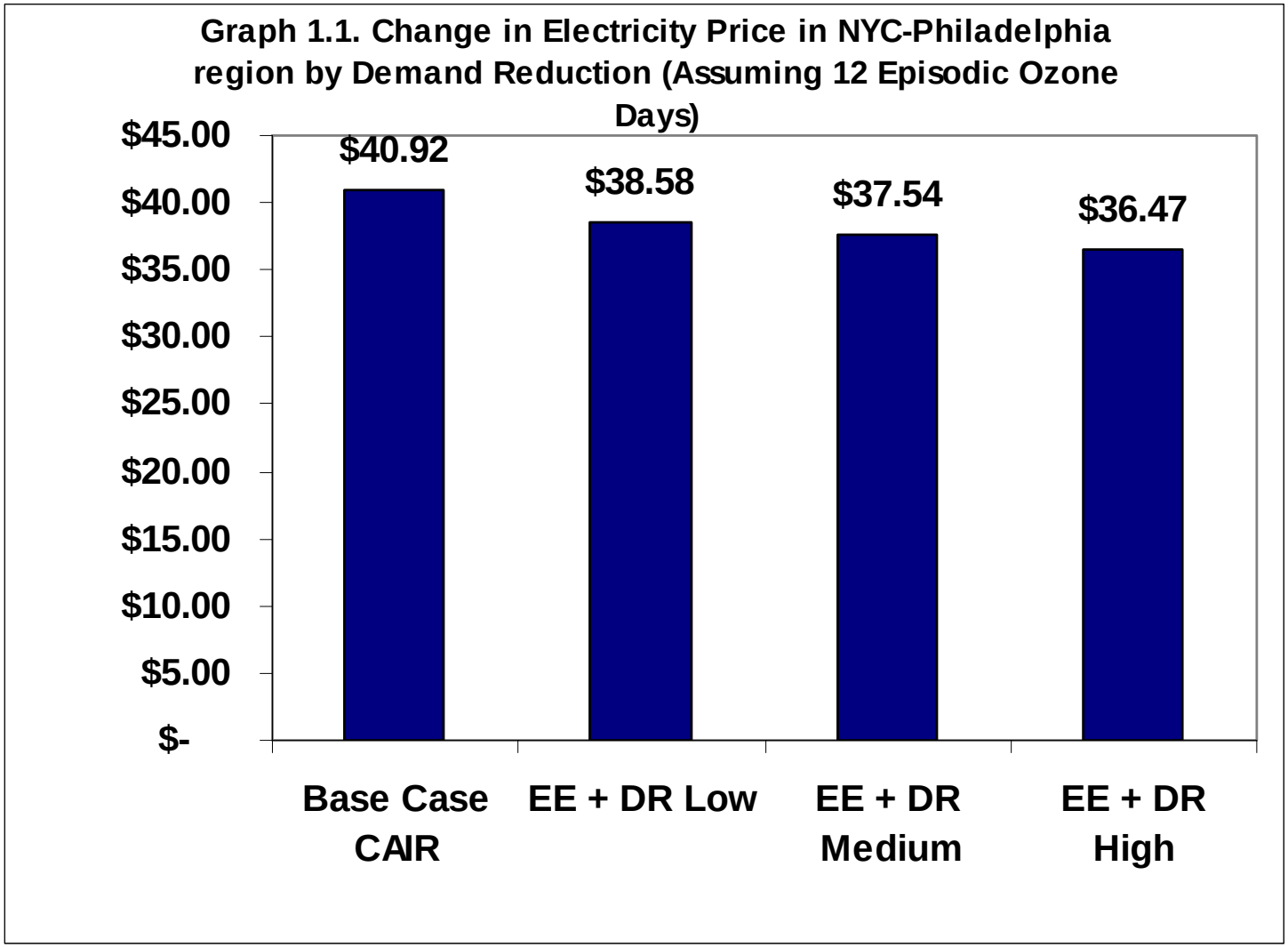
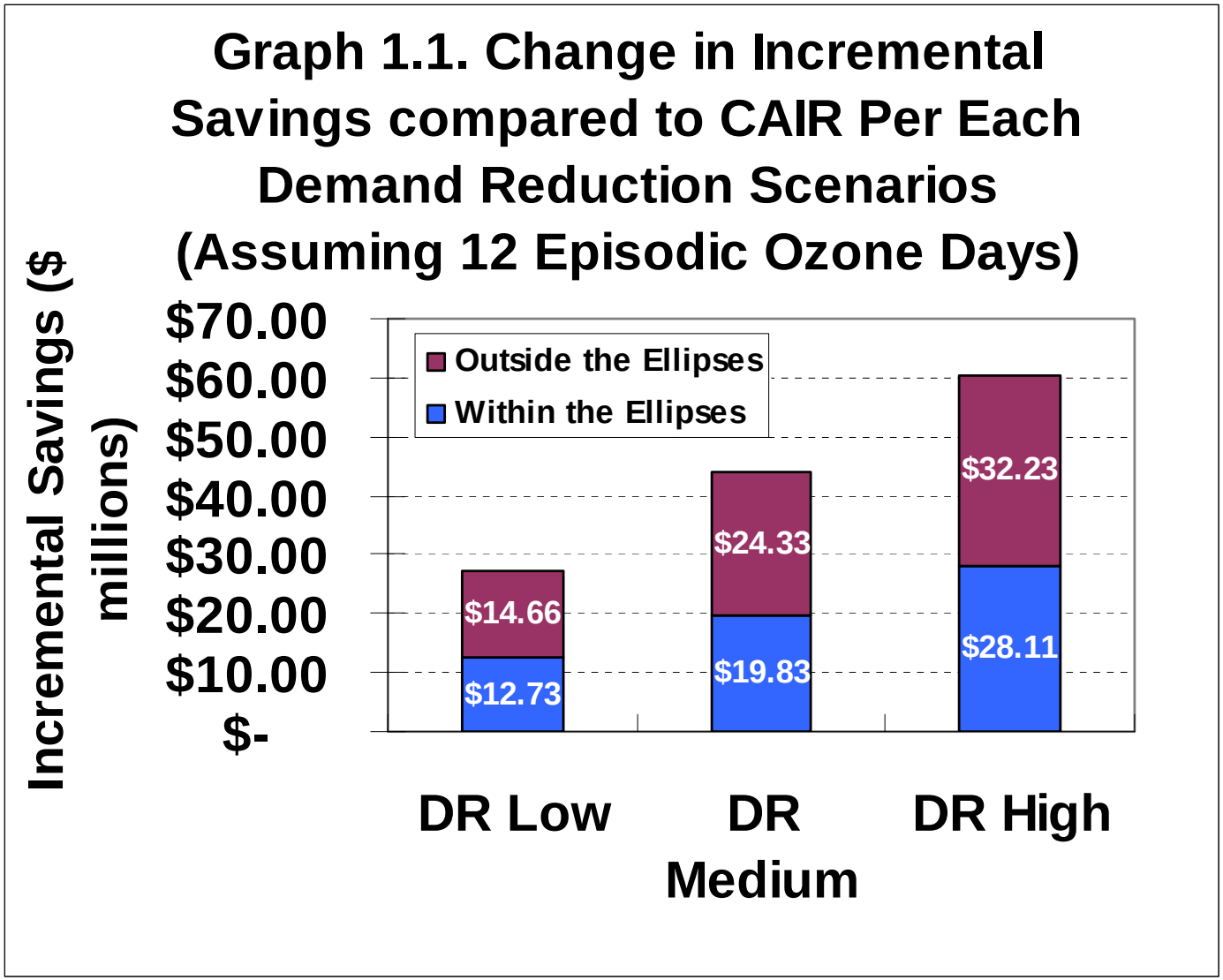
Results: Electricity Price Savings



Results: Electricity Cost Savings



Opportunities

Many OTC States Already Looking to EE to Meet 1% or More of Load

Examples of State "Energy Efficiency as a Resource" Goals in OTC		
	Goal	Notes
CT - Renewable Portfolio Standard (Class III)	**4% of total load by 2010** and thereafter (program starts in 2007)	includes EE and CHP
NJ -- Public Benefit Program and Energy Efficiency Resource Standard	PBF: 1814 GWh total from 2005-08 EERS: **1% per year of total load** through 2016 (starting in 2005)	EERS goals not yet adopted, cited in conceptual draft
PA -- Alternative Energy Portfolio Standard (Tier 2)	**4.2% of total load from 2006-2010**; 6.2% from 2011-15; 10% in 2021 and thereafter	eligible sources include hydropower, waste coal generation, and municipal solid waste (these sources already account for 8%), plus EE
VT -- Efficiency Vermont and SPEED	**EV:1% of total load from 2006-2008;** SPEED: No net load growth.	Act 61 established the Sustainably Priced Energy Enterprise Development (SPEED) - no net load growth. Renewables and efficiency required to meet all new load growth.
New England Governor's Conference -- Climate Change Action Plan	By 2025, increase the amount of energy saved through conservation programs within the region by 20%	

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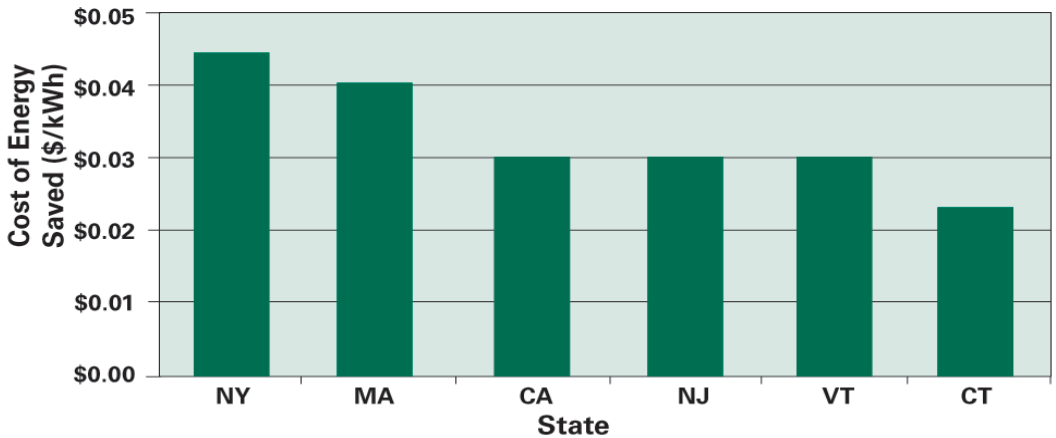
PBF Programs Yielding Cost-Effective Reductions -- with More Possible

- $500 million in EE spending across OTC in 2004
- On average, .87% of revenue -- but leading programs at 1-2% of revenue -- still a gap to fill
- New England "Economic EE" potential estimated at 3,108 MW by 2013 -- enough to maintain peak demand at 2003 levels

Figure 4.2.1: Cost of Energy Saved ($/kWh) for Six State Public Benefits Funds



Source: ACEEE 2004b.

- NY "Economic"EE potential up to 13,000 MW summer peak in 2012 -- less than 1,000 MW planned -- with up to 2,000 MW economically viable from RE

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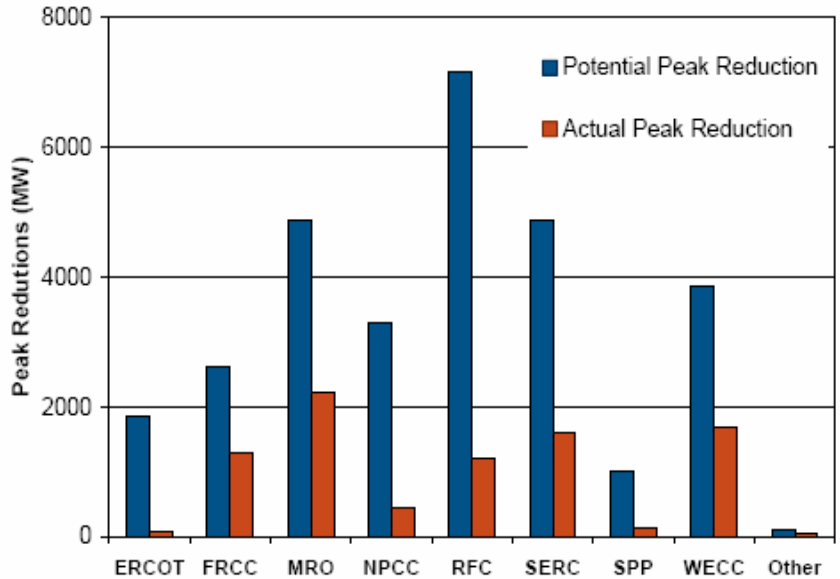
Demand Response also Delivering Results-- with Great Potential

•**NY** -- In 2003, over 1,400 commercial, industrial, and multifamily residential customers reduced their peak electricity consumption by 700 MW in response to more than $7.2 million from NYSERDA. Responding to record peak loads in early August 2006, NYISO activated businesses participating in the state's peak load reduction programs, resulting in load reductions of 416 MW in New York City, 226 MW on Long Island, and 450 MW in Western New York.

•**CT** -- The United Illuminating Company's (UI) Energy Independence Load Response Program offers incentives to area businesses and institutional customers who are willing to reduce their electrical loads or operate generators during an electrical grid emergency. In addition to the more than 100 companies from UI's service area already signed up for the program this summer, 2006 marks the first year that Home Depot and Wal-Mart will participate. Companies qualify for the program by reducing electrical demand by at least 100 kW through load reduction or the operation of backup generation.

Figure V-5. Demand response resource potential versus actual deployed demand response resources by region



Source: FERC Survey
Notes: Other reliability region includes Alaska and Hawaii

•**NE-ISO** -- ISO-NE issued an RFP for reliability resources in SWCT. The resources selected by ISO-NE began providing approximately 125 MW of reliability capacity beginning June 1, 2004, and is expected to provide up to 255 MW during the summer of 2007. These demand response resources include emergency generation, load control, load response, and conservation resources.

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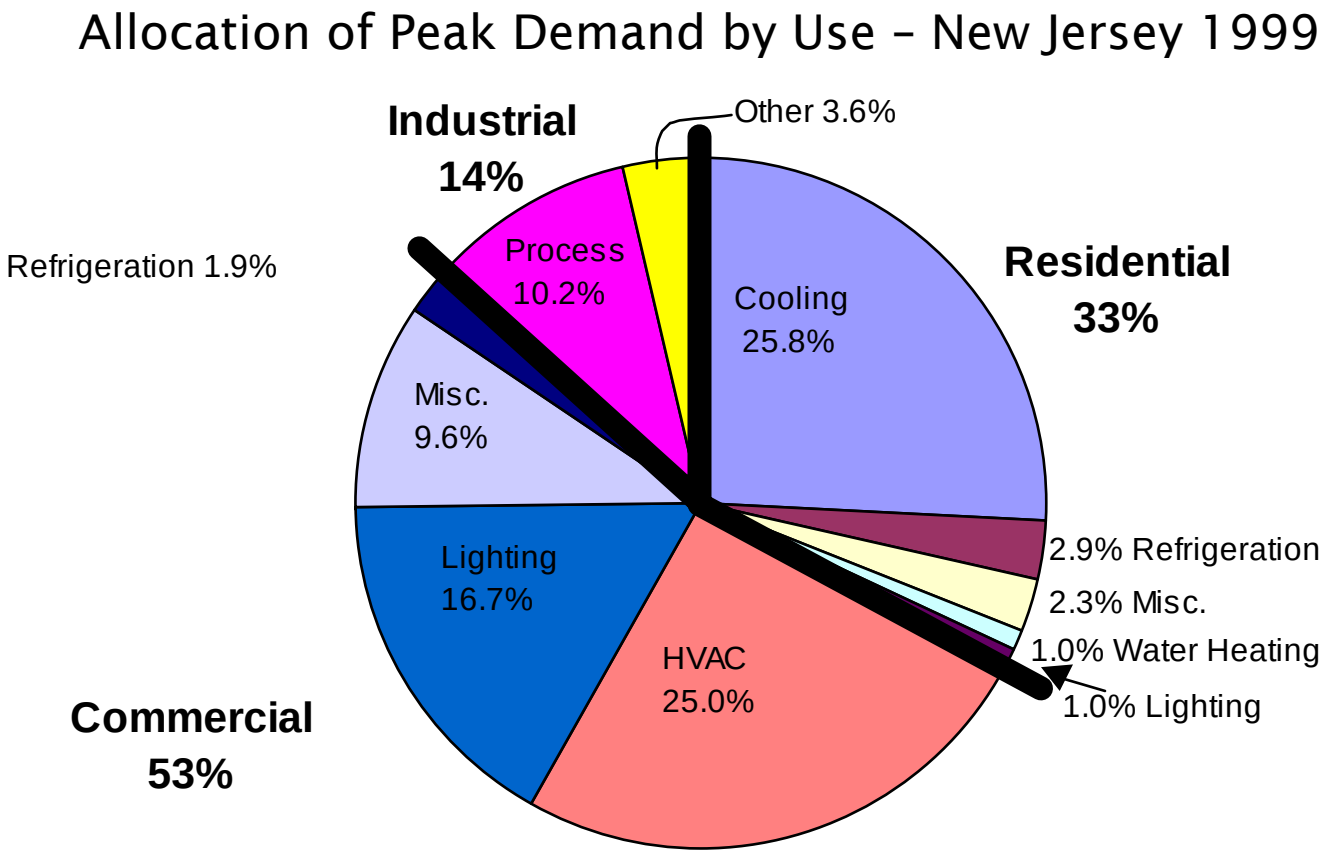
Sample Reservoirs of Peak Summer Demand Reductions



Source: Xenergy study for N.J. utilities.

One Estimate of Savings Potential from Peak Reduction Programs (US-Wide)

"Using Targeted Energy Efficiency Programs to Reduce Peak Electricity Demand and Address Electric System Reliability Problems" (ACEEE, 2000)

Program	Available Peak Savings in 2010 (MW)
New Residential Air Conditioning	28,777
Residential air conditioning repair	6,900
Commercial HVAC equipment	3,900
Commercial retrocommissioning	11,000
Commercial Lighting Upgrades	9,200
Commercial Lighting Designs	4,900
Total	63,000 (adjusted to include double-counting)

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- Savings are approximately 40% of expected demand growth over the next decade

Many Places to Look for More Information and Assistance

Clean EnergyEnvironment STATE PARTNERSHIP

ENERGY STAR

CHP EPA COMBINED HEAT AND POWER PARTNERSHIP

EPA GREEN POWER PARTNERSHIP

http://www.epa.gov/cleanenergy/

US EPA, US DOE, ISOs, PUCs, Energy Offices, National and Regional Organizations,

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Conclusions

Conclusions

- EE & DR programs should be part of the solution
  - Meaningful emission reductions
  - Cost effective
  - Established policy mechanisms and technologies
- EPA is willing to refine analysis to:
  - Identify best opportunities at lowest costs
    - Could add Clean DG/CHP & Solar technologies
  - Estimate regional benefits from recommendations

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