OTC High Electricity Demand Day - Ozone Strategies

Clean Energy Options Analysis

12-05-2006

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Clean EnergyEnvironment
STATE PARTNERSHIP

CLEAN AIR
MARKET PROGRAMS

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Clean Energy Analysis

- EPA Analysis
  - Model,
  - Inputs – PV, EE, DR, Distributed CHP
  - Results
- Clean Energy Options: Best Practice Examples
- Conclusions

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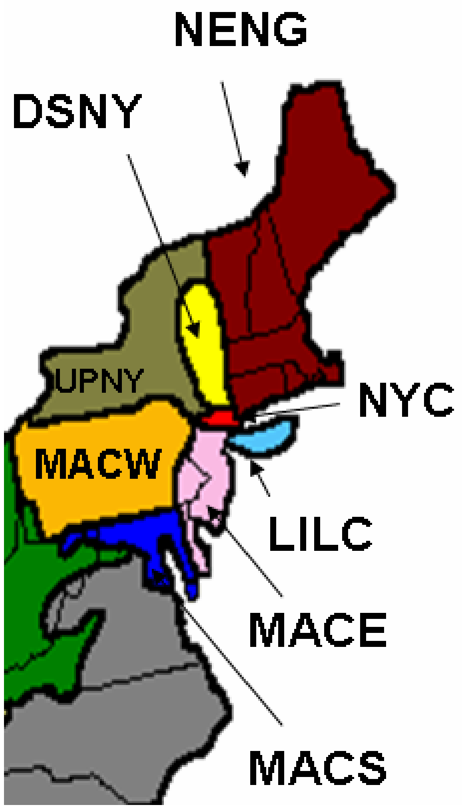
The Technology Retrofit and Updating Model (TRUM)

- Macro-driven spreadsheet model, developed by ICF to supplement the use of its Integrated Planning Model (IPM).
  - Runs quickly but does not provide exact solutions.
- Modeling performed by the Clean Air Markets Division
- Started with 2010 and 2015 CAIR scenarios as base cases
- Reconfigured the modeling exercise to look at episodic period (twelve high electric demand days, based on projected 2010 and 2015 loads)
- Included all units in the NEEDS 2.1.9 database (capped units and smaller units not subject to cap and trade programs).
- 8 IPM Regions encompassing
  - "classic" PJM, NY, and New England



TRUM Inputs: Efficiency, Demand Response, PV, Clean DG

2010 *Measures beginning in 2008*	**Low**	**Medium**	**High**
Energy Efficiency (EE)	1% cumulative reduction in load (1,083 MW at peak)	1.5% cumulative reduction in load (1,624 MW at peak)	2.0% cumulative reduction in load (2,166 MW at peak)
Demand Response (DR)	3% reduction at peak hours (3,216 MW at peak)	4% reduction at peak hours (4,266 MW at peak)	5% reduction at peak hours (5,306 MW at peak)
Solar PV, installed capacity	56 MW	112 MW	168 MW
Clean Distributed Generation (DG) in CHP mode, installed capacity	771 MW	1,884 MW	2,975 MW

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TRUM Inputs: Efficiency, Demand Response, PV, Clean DG

2015 *Measures beginning in 2008*	**Low**	**Medium**	**High**
Energy Efficiency (EE)	3.5% cumulative reduction in load (3,958 MW at peak)	5.25% cumulative reduction in load (5,937 MW at peak)	7.0% cumulative reduction in load (7,917 MW at peak)
Demand Response (DR)	4% reduction at peak hours (4,365 MW at peak)	5.5% reduction at peak hours (5,894 MW at peak)	7% reduction at peak hours (7,362 MW at peak)
Solar PV, installed capacity	169 MW	339 MW	508 MW
Clean Distributed Generation (DG) in CHP mode, installed capacity	2,067 MW	4,617 MW	6,627 MW

TRUM Inputs: Efficiency & Demand Response

- Energy Efficiency
  - Measures starting in 2008 (2010 and 2015 levels are cumulative)
    - Low = 0.5% reduction in load per year
    - Medium = 0.75% reduction in load per year
    - High = 1.0% reduction in load per year
- Demand Response: reduction in grid supplied load during peak hours

	2010	2015
Low	3.0%	4.0%
Medium	4.0%	5.5%
High	5.0%	7.0%

  - Responses
    - 65% curtailment/conservation
    - 15% loadshifting
    - 20% Back-up generation

	2010	2015
New units operating at 6.2 lbs/MWh	75%	90%
Old units operating at 23.3 lbs/MWh	25%	10%

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TRUM Input: Solar

- Estimated PV installations
  - Medium case: Based on applying NY&NJ initial installation rates from incentive programs to other OTC States (population weighted) in 2008 and applying a 15% annual increase (recent national average) to new installations
  - Solar PV output based on analysis hourly of solar radiation on August 4, 2005 at several northeastern measurement stations
  - Converted hourly state outputs into TRUM load segments
  - Low case = 50% of medium case
  - High case = 150% of medium case

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TRUM Input: Clean Distributed Generation

- Estimated installations of 4 types of DG technologies in CHP mode:

	NOx Rate (#/MWh)
➢ 150 kW Rich Burn Recip. Engine	-0.9
➢ 1000 kW Lean Burn Recip. Engine	1.7
➢ 250 kW Microturbine	-0.5
➢ 5000 kW Gas Turbine (SS)	-0.6

NOx Rates account for the displaced emissions that would otherwise have been generated to provide the same thermal output from a conventional system (boiler).

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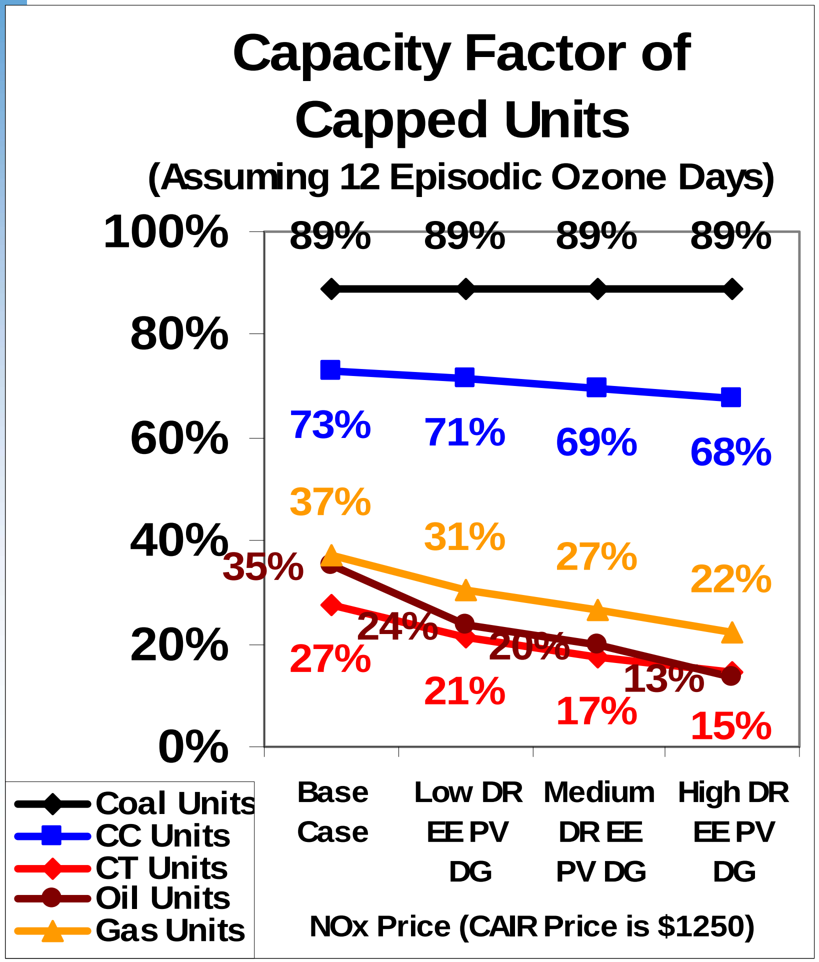
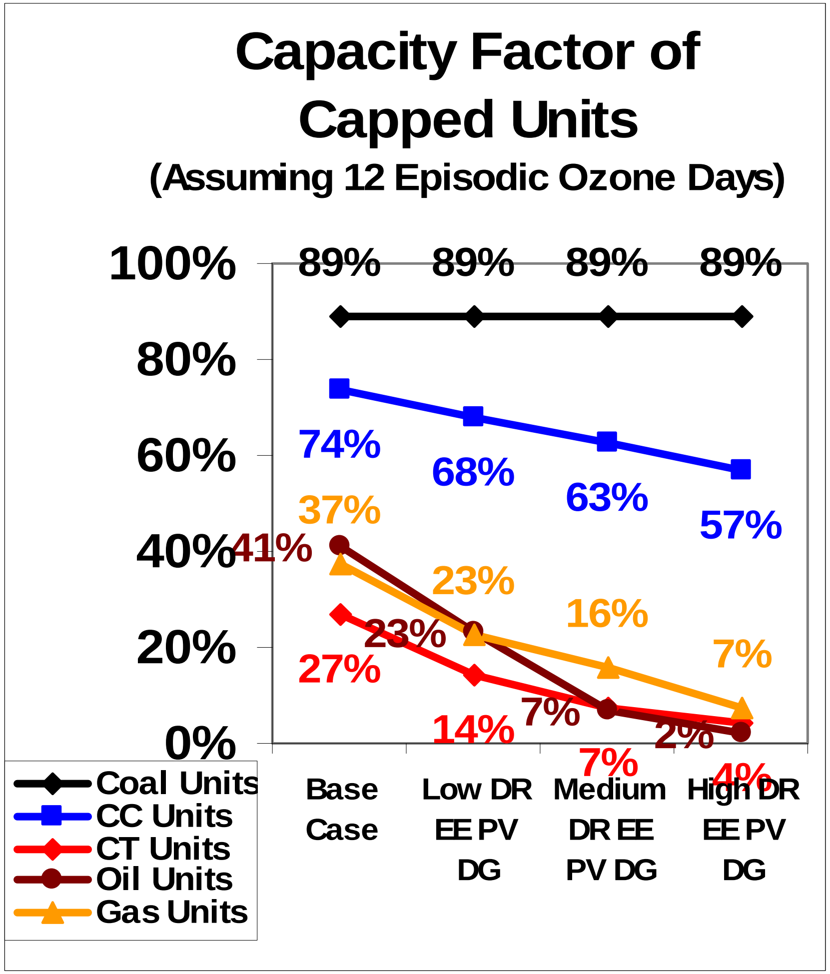
Results: Capacity Factor in Entire Region



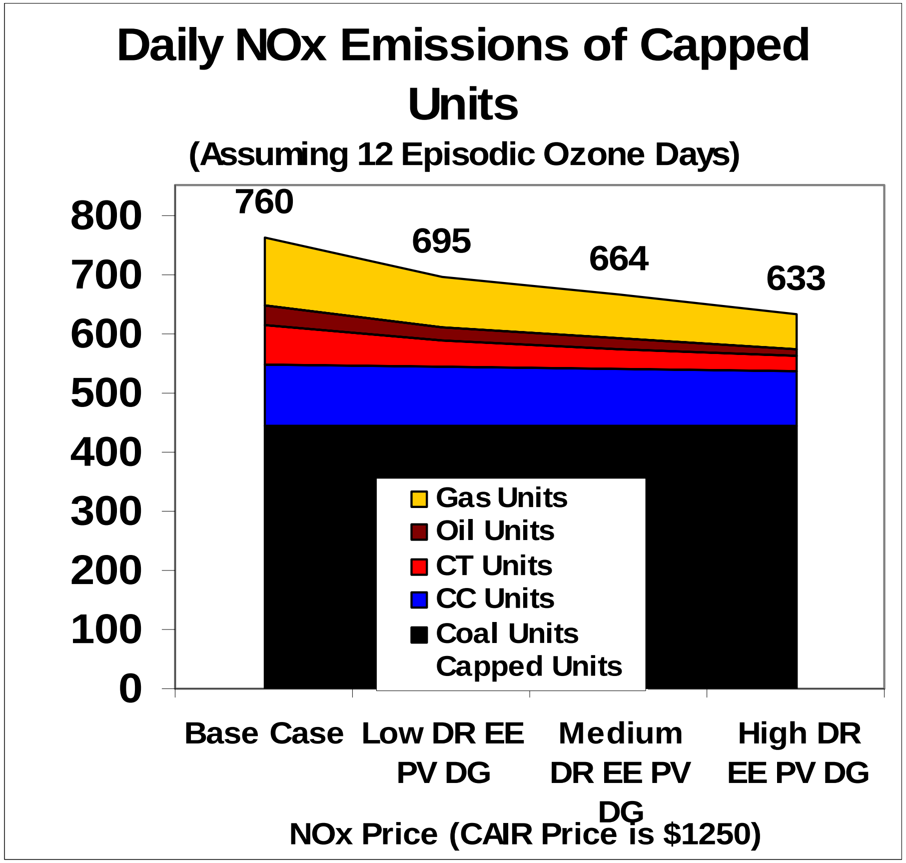
2010



2015

Results: NOx Emissions in Entire Region (2010)

Daily NOx reduced from ***All*** Units	Low	Medium	High
Tons	**29**	**46**	**64**
Percent of total	**-3.6%**	**-5.7%**	**-7.8%**



Daily NOx Decrease from Capped Units

LO	MED	HI
65	96	127

Daily NOx Increase from Back Up Generation

LO	MED	HI
42	55	68

Results: NOx Emissions in Entire Region (2015)

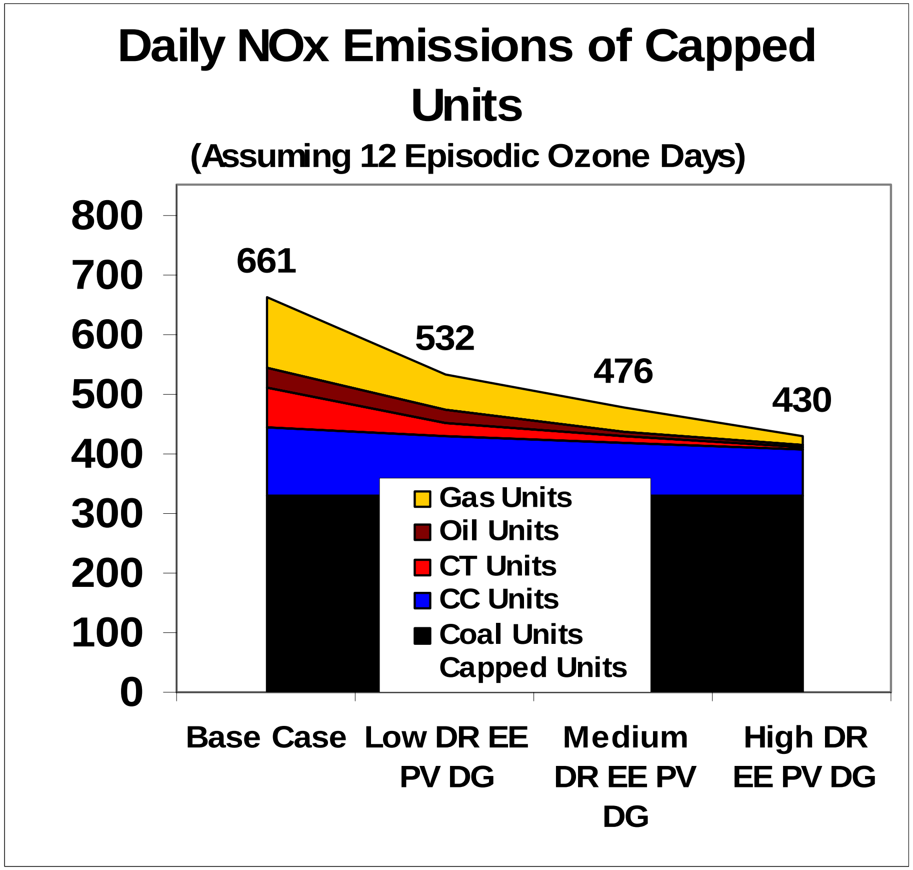
Daily NOx reduced from ***All*** Units	Low	Medium	High
Tons	**94**	**136**	**167**
Percent of total	**-13.2%**	**-19.0%**	**-23.3%**

Daily NOx Decrease from Capped Units

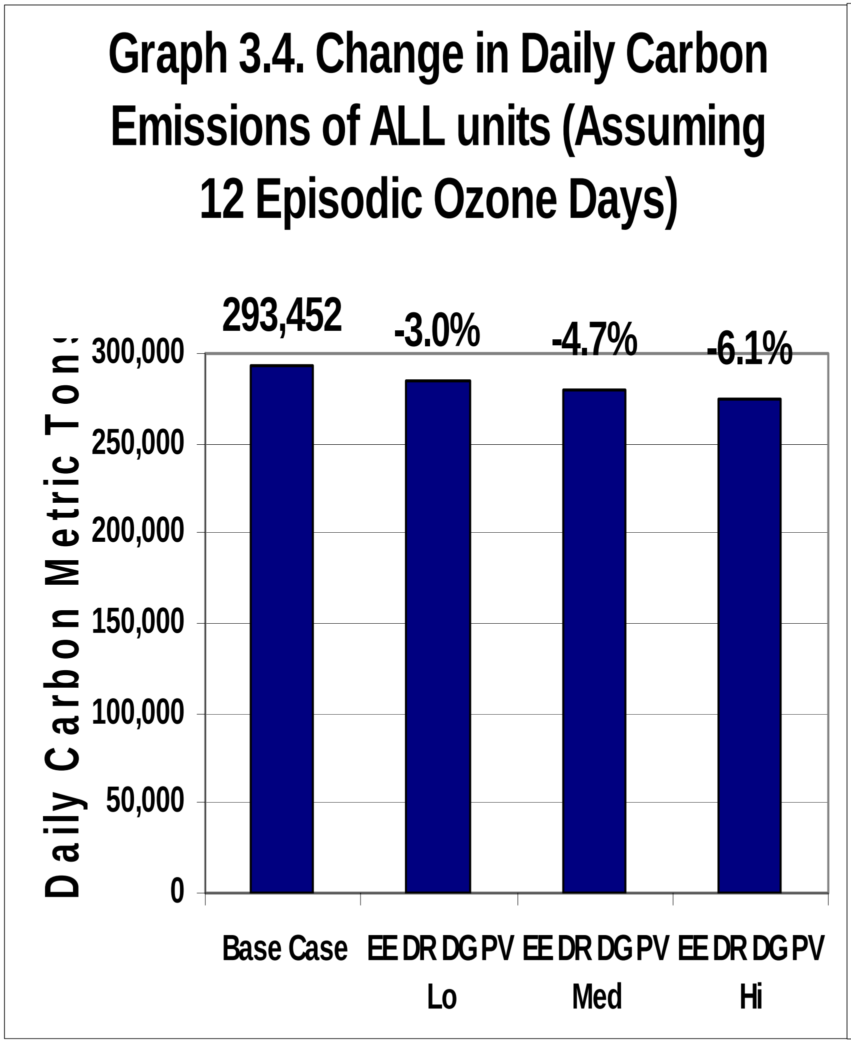
LO	MED	HI
129	185	230

Daily NOx Increase from Back Up Generation

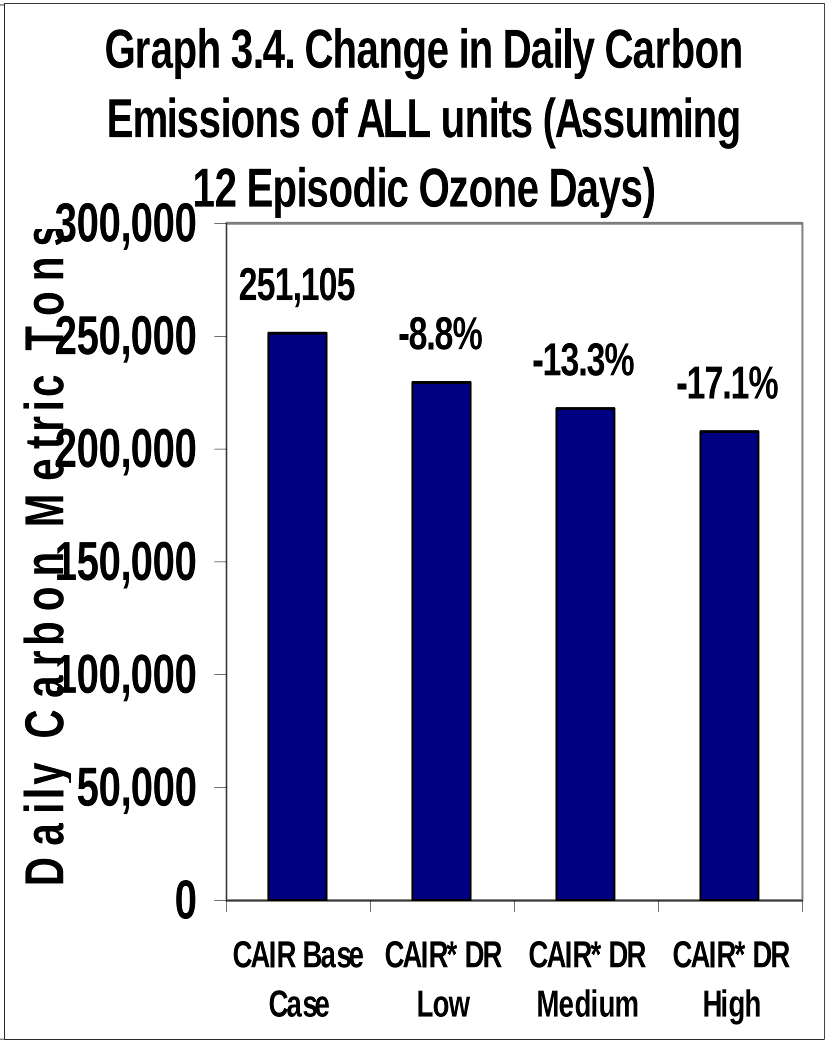
LO	MED	HI
43	57	72



Results: Carbon Emissions Co-Benefits



2010



2015

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Results of Individual Runs

- Ran medium case for individual measures (EE, DR, PV, CHP) for 2010
- Modeled NOx Emission Reductions
  - EE = 24.7 tons per HEDD
  - PV = 0.7 tons per HEDD
  - CHP = 27.5 tons per HEDD
  - DR =

    49.3 tons per HEDD (grid supplied EGU reductions) +

    -54.9 tons per HEDD (back-up generator increases)

    = - 5.6 tons per HEDD
  - net total of individual measures = 47.3 tons per HEDD (for comparison, the model yields 46 tons per HEDD for combined measures)

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Policy Options for Back-up Generators

- Careful policy implementation is needed regarding participation of backup generation in demand response programs

  - Exclude or limit use of Back-up Generation for economic demand response programs
    - (e.g., NYISO's Day Ahead Demand Response Program)
      - "Beginning in 2003, the program will be open only to resources that provide load reduction through interruptible load; load reduction through on-site generation will not be permitted."

  - Require emission limits for generators that participate in Voluntary Demand Response Programs

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Best Practice Cases

Clean Energy Options: Best Practice Examples

- To complement the modeling effort, EPA is developing a set of clean energy program "best practices" descriptions.
  - Demonstrate how states are achieving cost-effective peak energy and emissions savings
  - Make more tangible the OTC options of "accelerated" energy efficiency, demand response and distributed generation, and "increase[d]" solar energy capacity
  - Link to EPA technical and policy support through ENERGY STAR and other programs

Clean Energy Best Practices: Programs

- Spotlights proven programs to achieve cost-effective peak reductions with multiple, long term benefits:
  - ENERGY STAR: Qualified (New) Homes, (Existing) Home Performance, HVAC Proper Installation, Retrocommissioning (Commercial Buildings), Roofs
  - Demand Response: Incentive and Dynamic Pricing Programs
  - Combined Heat and Power Incentives
  - Solar Energy Incentives
- Descriptions include:
  - Examples of results
  - Important program features and key actors
  - Implementation and related policy issues
  - Where to go for more information, assistance

Conclusions

- Clean Energy programs should be part of the solution:
  - Meaningful emission reductions
  - Cumulative benefits over life of programs
  - Cost effective
  - Established policy mechanisms and technologies
  - Careful policy implementation is needed regarding participation of backup generation in demand response programs

EPA