High Electricity Demand Day Ozone Attainment Strategies for OTC

Analysis of Select Control Options

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Options Analyzed

- SNCR
- Water Injection
- Fuel-switching

❖ Opportunities for command and control may exist, but may be costly

Analysis Focus: NYC and Philadephia

- 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

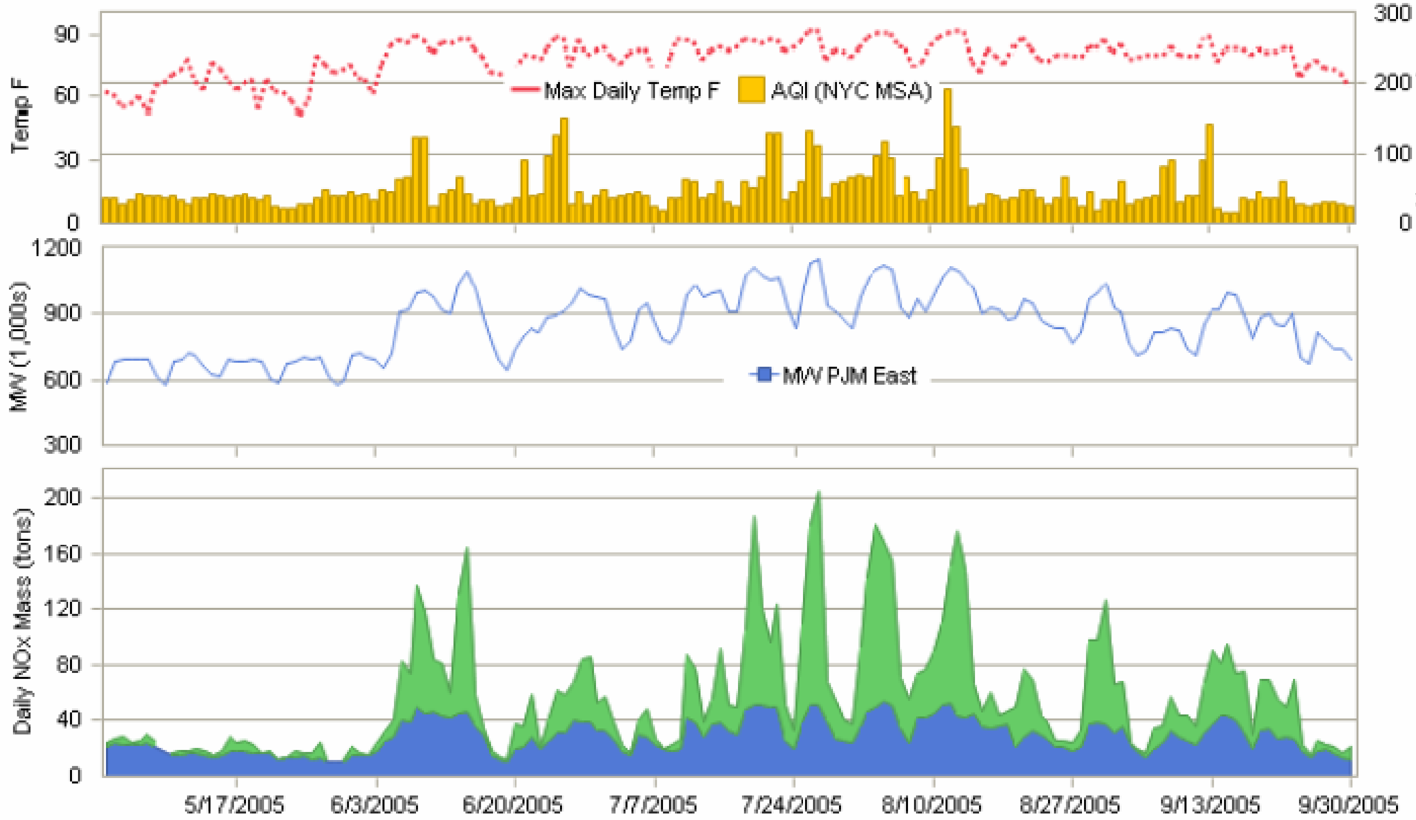
Daily PJM Load, NOx Emissions, CASTNET Met and AQI Ozone Season 2005

NOTES: Daily Max Temperature (F) is at CASTNET site in Washington Crossing, NJ 'WSP144'.
AQI is ozone value only for MSA indicated.
PJM-East Load is aggregated daily total from telemetry data.
Daily NOx Emissions in tons. Analysis considers all electrical generating and large industrial sources in select counties* from the New York City and Philadelphia metropolitan areas which report data to EPA under 40 CFR Part 75.
Peak units defined at <= 1,100 hours of operation in 2005 ozone season. Includes only unit type CT (Combustion Turbines).
Base units defined at > 1,100 hours during the 2005 ozone season. Includes all unit types.

Metro NYC, NY

MSA 5600
Non-Controlled Units

- Selecting 2005 ozone season days with a maximum daily temp of approximately 90 F will capture most AQI ozone days >100 (orange or higher) in MSA 5600.
- There appears to be a close correlation between PJM East load and the dispatch of non-controlled units in metro NYC area. Note that PJM only called the peaking units during periods of warm temperatures. PJM maximum load for 2005 was on July 26.



EDAT

Data Sources: EPA, PJM

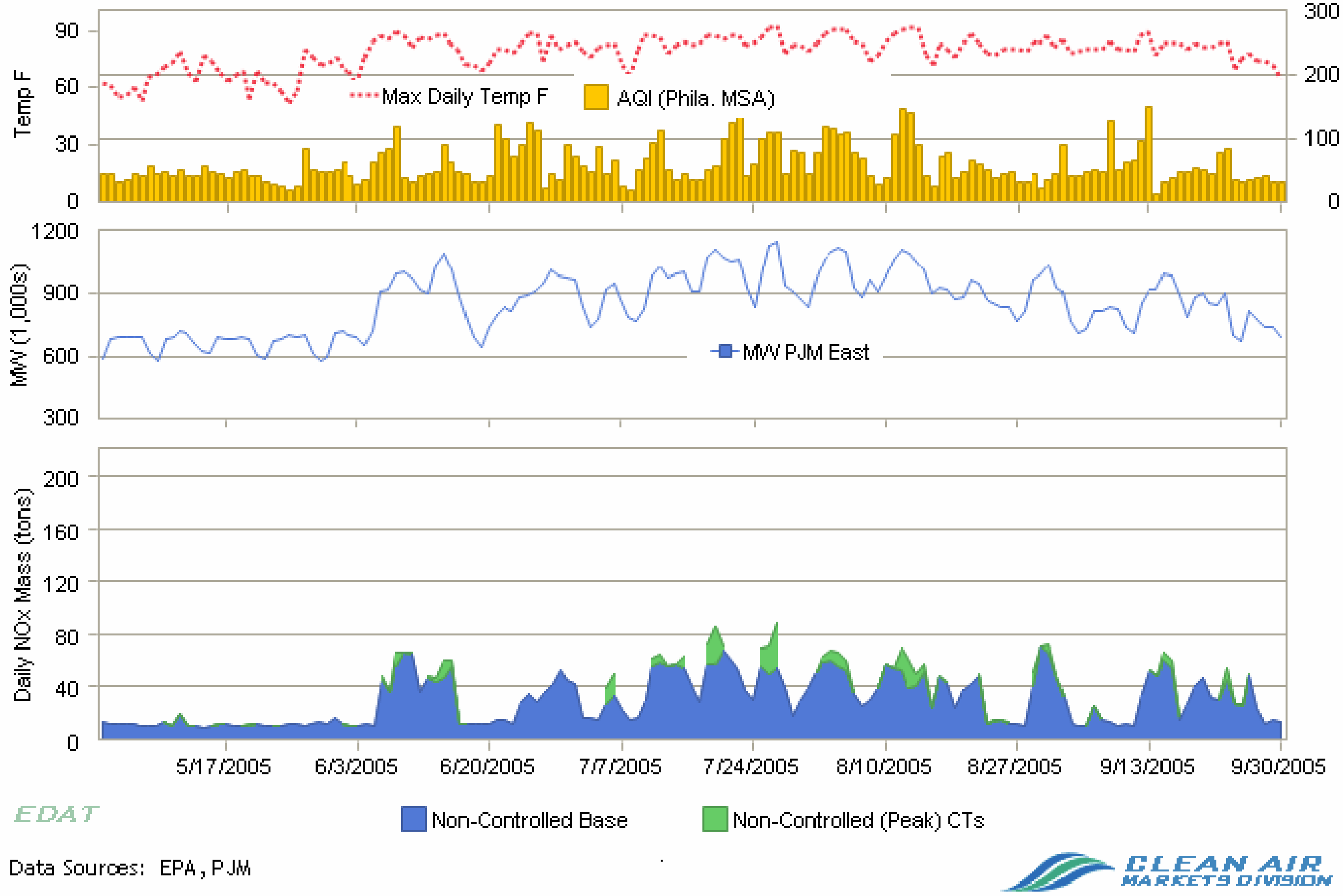
CLEAN AIR MARKETS DIVISION

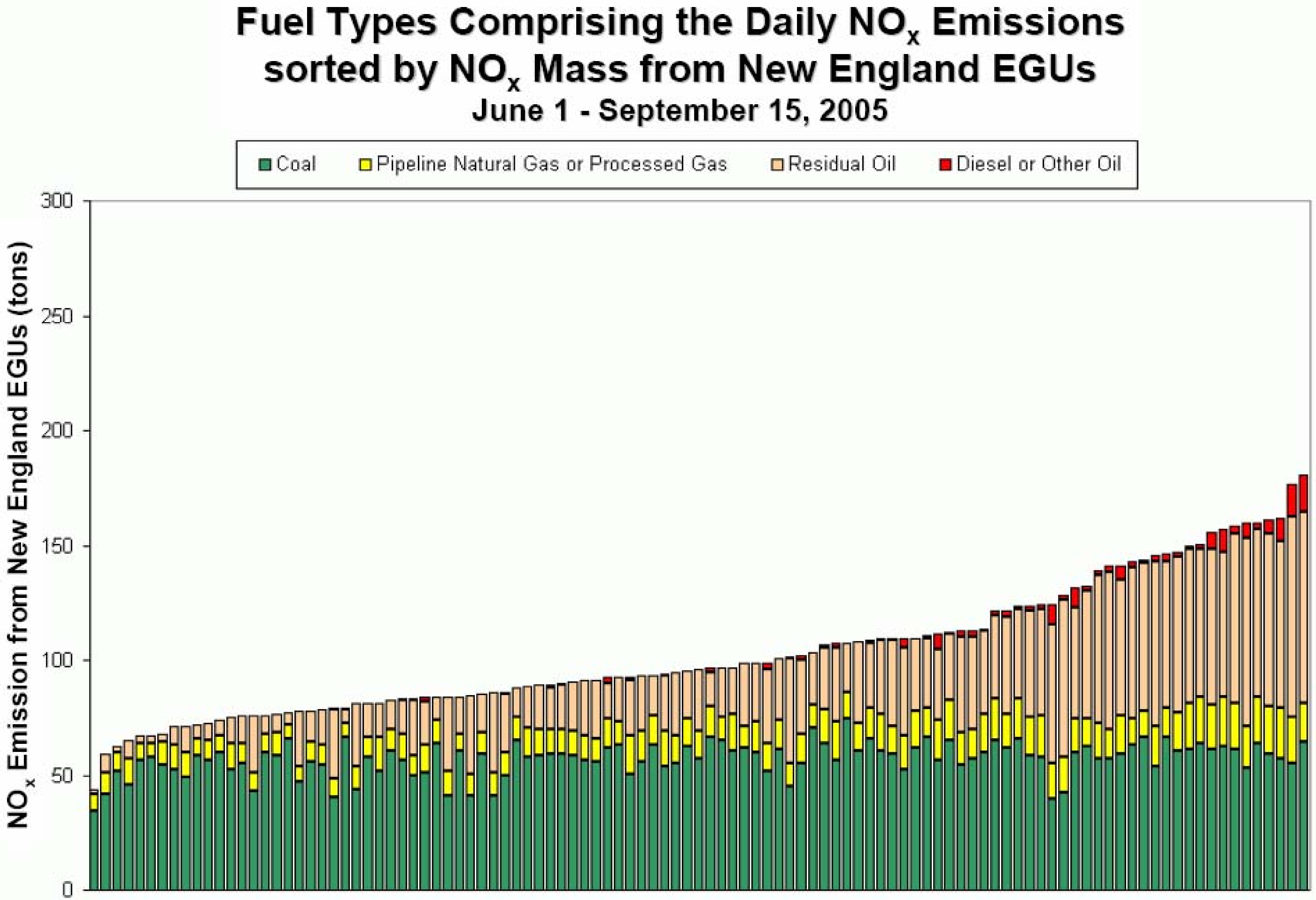
Philadelphia Non-Controlled Units,

Daily PJM Load, NOx Emissions, CASTNET Met and AQI

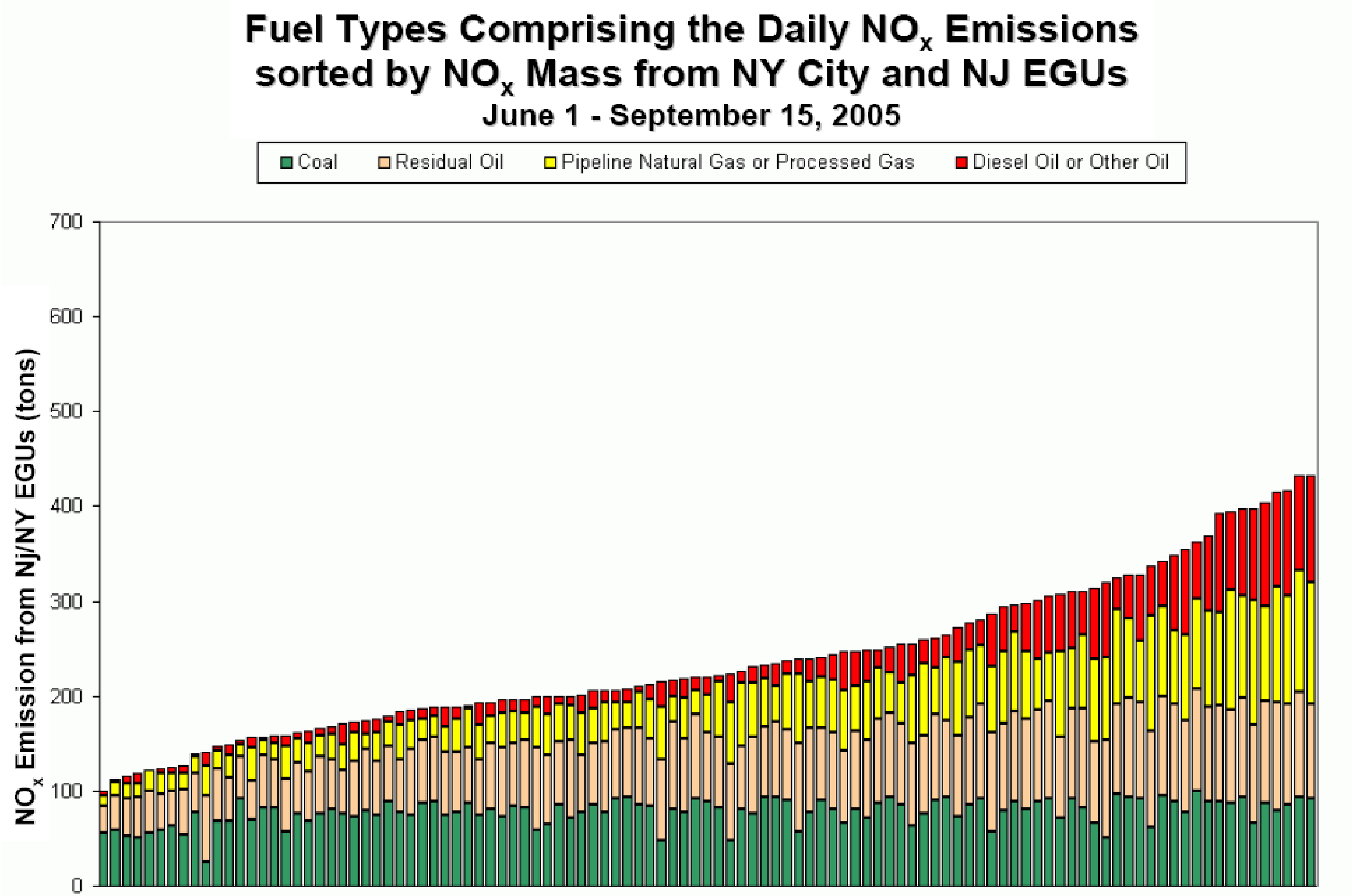
Ozone Season 2005

- More uncontrolled units in Philadelphia area (MSA 6160) are coal than in NYC area





Source: Chris Salmi, NJ DEP



Source: Chris Salmi, NJ DEP

Technology Option 1 - SNCR

Cost Effectiveness for Coal Units with No Post-Combustion Controls to Install SNCR for 12-HEDD Use

	SNCR on Coal
$/Ton Removed	**$18,320**
$/kW	$19.18
Incremental Annualized Capital Cost	$443,254
Incremental Variable Cost	$42,557
Total Incremental Cost	$485,811
Total Tons Removed per Unit Over 12 Days	26.5

NOTES:

1. Costs for an example unit based on average characteristics (capacity, NOx rate, heat rate) of capped, operating coal steam units with no post-combustion controls in OTR. Example unit has capacity of 188.67MW, NOx rate of 0.29 lbs/MMbtu, and heat rate of 10.9 MMBtu/MWh, and generation of 48,361 MWh/12-day-period to install SNCR with 35% removal efficiency. Costs may vary if applying to all uncontrolled coal units using other metrics (e.g. those with most air quality impact, all units of certain size/capacity factor/emission rate).
2. Unit data based on US EPA NEEDS 2004 and CAMD database; controls data from IPM v.2.1.9 CAIR 2010 projection.
3. Costs per ton are for targeted, HEDD/high ozone day reductions and, thus, are higher than costs averaged over a longer time period such as ozone season or annually.

Technology Option 2 – Water Injection

Cost Effectiveness for Uncontrolled CTs to Install Water Injection for 12-High Electric Demand Day Use

	Water Injection
$/Ton Removed	**$158,148**
$/kW	$43.33
Incremental Annualized Capital Cost	$426,741
Incremental Variable Cost	$2,056
Total Incremental Cost	$428,798
Total Tons Removed per Unit Over 12 Days	2.71

NOTES:

1. Uncontrolled units include only those without water injection or SNCR as projected in IPM v.2.1.9 CAIR 2010 run.
2. Costs for an example unit, based on average characteristics of capacity (82.07MW), NOx rate (0.28 lbs/MMbtu), and heat rate (12.28 MMBtu/MWh), and generation of 3,546 MWh/12-day-period, to install water injection with removal efficiency of 45%. Costs may vary if applying to all uncontrolled CTs using other metrics (e.g. those with most air quality impact, all units of certain size/capacity factor/emission rate).
3. Unit data based on US EPA NEEDS 2004 and CAMD database.
4. Costs per ton are for targeted, HEDD/high ozone day reductions and, thus, are higher than costs averaged over a longer time period such as ozone season or annually.

Fuel-Switching

Costs/Savings for Dual-Fuel Units Switching Entirely to Gas (Over Entire O_3 Season)

	All Dual-fuel Units	Residual Oil Dual-fuel Units	Diesel Oil Dual-fuel Units
$/Ton	$ 74,337	$ 77,138	$ (50,883)
Ozone Season Cost	$ 113,294,664	$ 114,991,385	$ (1,696,721)
Ozone Season Tons Reduced	1524	1491	33
% Ozone Season Nox Reduction (from 16,300 tons)	9.4%	9.1%	0.2%
Number of Dual-fuel Units	69	40	29
Number of All Oil Units (dual- & single-fuel)	183	183	183
Dual-fuel Oil Units as % of All Oil Units	38%	22%	16%
Dual-fuel Oil Units % of All OTR Peaking Units (333)	21%	12%	9%
$/Unit	$ 1,641,952	$ 2,874,785	$ (58,508)

NOTES:

1. Based on 2005 data as reported to CAMD. This analysis includes only electricity generating units (CTs, CCs and boilers) that could sell to grid, operated <= 1,100 hours in 2005 ozone season (“peaking unit” definition) and had no NOx controls (assumed the units with NOx controls would not switch its fuel) as of 2005.
2. Dual-fuel units are those that have reported some hours burning oil to EPA in 2005, and also reported to CAMD gas as a primary or secondary fuel.
3. Average gas rate = 0.20 lbs/MMBtu. Average oil rate = 0.24 lbs/MMBtu.
4. Fuel prices are in 1999 dollars and are based on the prices from IPM 3.0 Base Case.

2010 Gas Price ($/MMBtu)= 6.12 Distillate Price ($/MMBtu)= 8.92 Residual Oil Price ($/MMBtu) = 4.60

Conclusions

- Opportunities for command and control may exist, but may be costly
- Use of CAIR allowances to encourage additional HEDD reductions raises concerns
- Clean energy options (including enhanced energy efficiency, demand response, combined heat and power and solar energy) provide significant benefits