

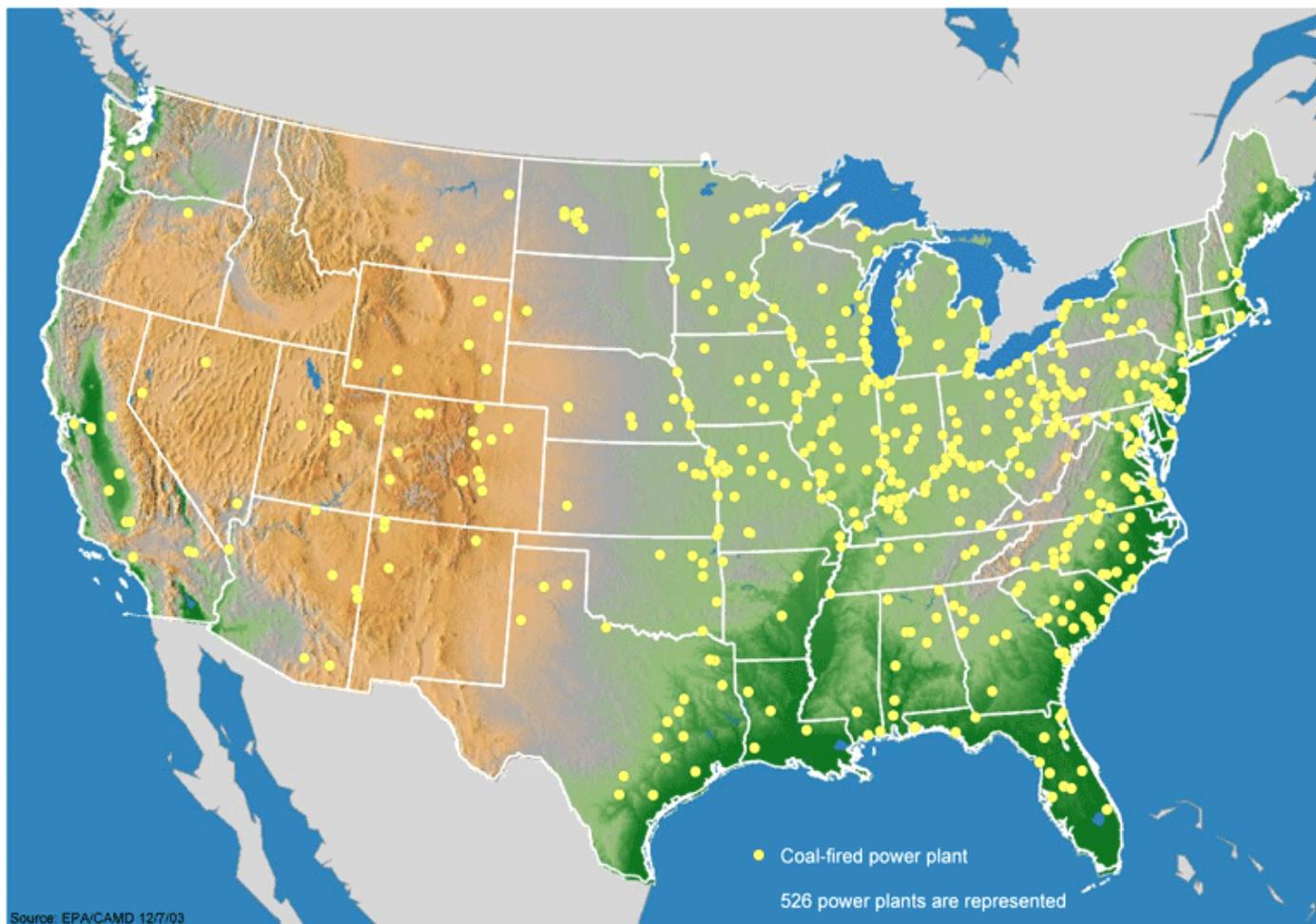
# Experience with Cap and Trade Programs

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May 28, 2008

# Overview

- Cap and trade is one of several regulatory approaches
- If properly designed and applied, it can be
  - Environmentally effective and administratively efficient
  - Reduce emissions quickly and cost-effectively
  - Promote innovation
- Works best in situations where
  - Aggregate impact of emissions is principal concern
  - Costs differ across a range of options
  - Strong regulatory institutions and financial markets exist
- Can work in concert with other regulatory approaches
- Successful US programs include:
  - Acid Rain SO<sub>2</sub> Program (48 states)
  - NO<sub>x</sub> Budget Trading Program (20 states)

# Coal-Fired Power Plants Are the Dominant Source of Air Emissions

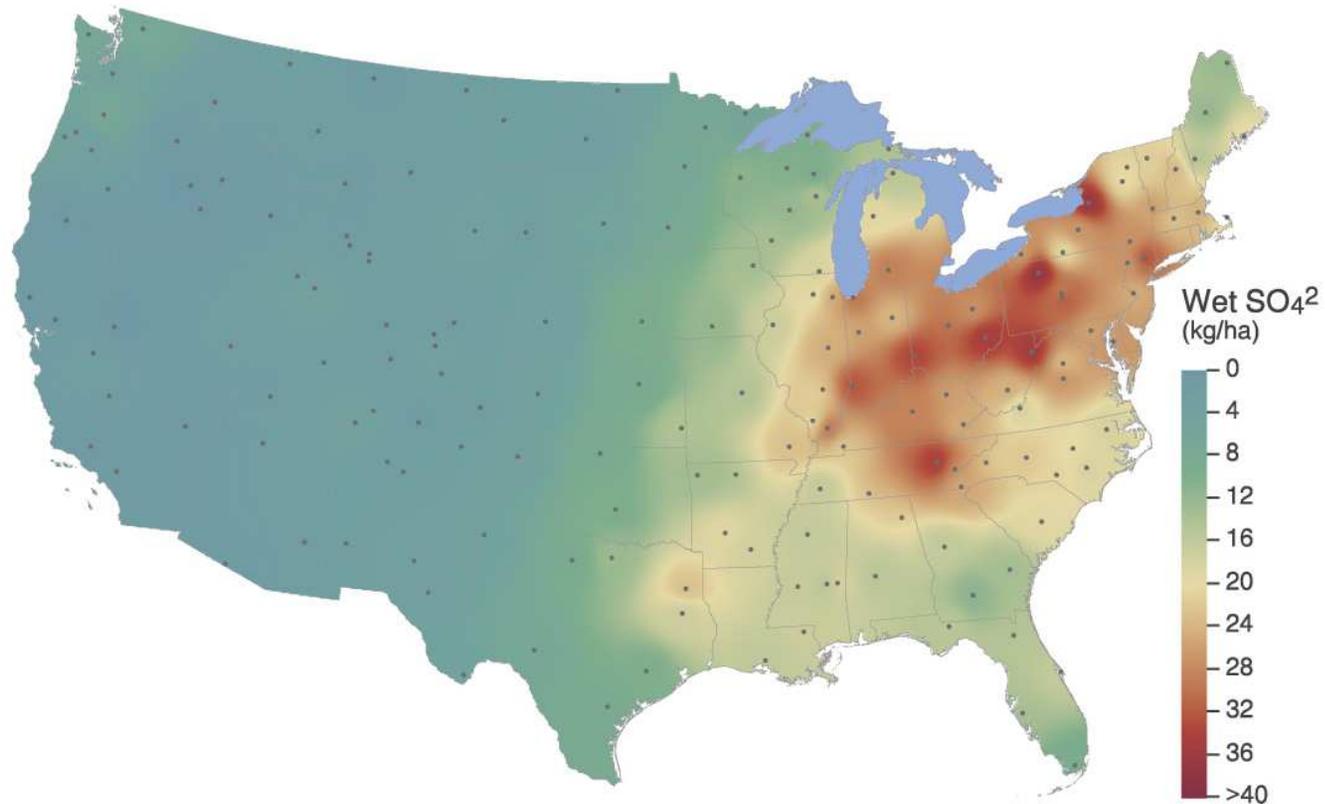


U.S. Coal-Fired Power Plants

- There are about 530 power plants with 305 GW of capacity that consists of about 1,300 units.
- Coal plants generate the vast majority of power sector emissions:
  - 95%  $\text{SO}_2$
  - 90% of  $\text{NO}_x$
  - 83% of  $\text{CO}_2$

# Addressing Acid Rain

Annual Mean Wet Sulfate Deposition,  
1989–1991



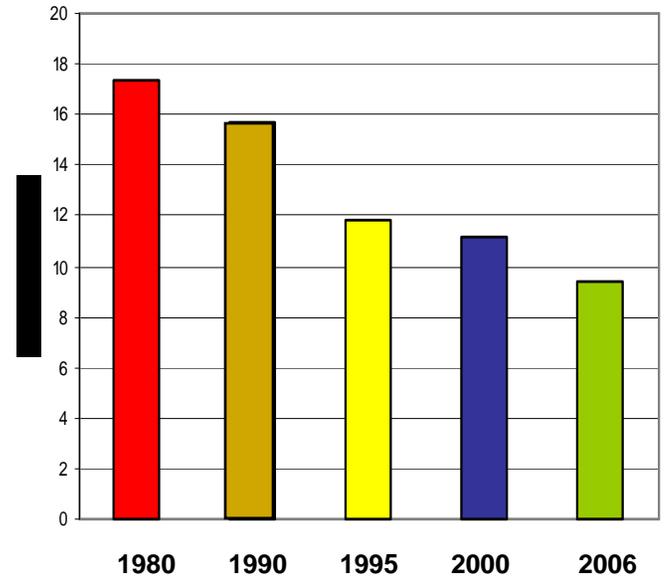
**Source:** National Atmospheric Deposition Program

# SO<sub>2</sub> Emissions Have Fallen



Source: EPA, 2007

### National Power Plant Emissions of SO<sub>2</sub>



Legend:  
■ SO<sub>2</sub> Emissions in 1990  
■ SO<sub>2</sub> Emissions in 1995  
■ SO<sub>2</sub> Emissions in 2000  
■ SO<sub>2</sub> Emissions in 2006

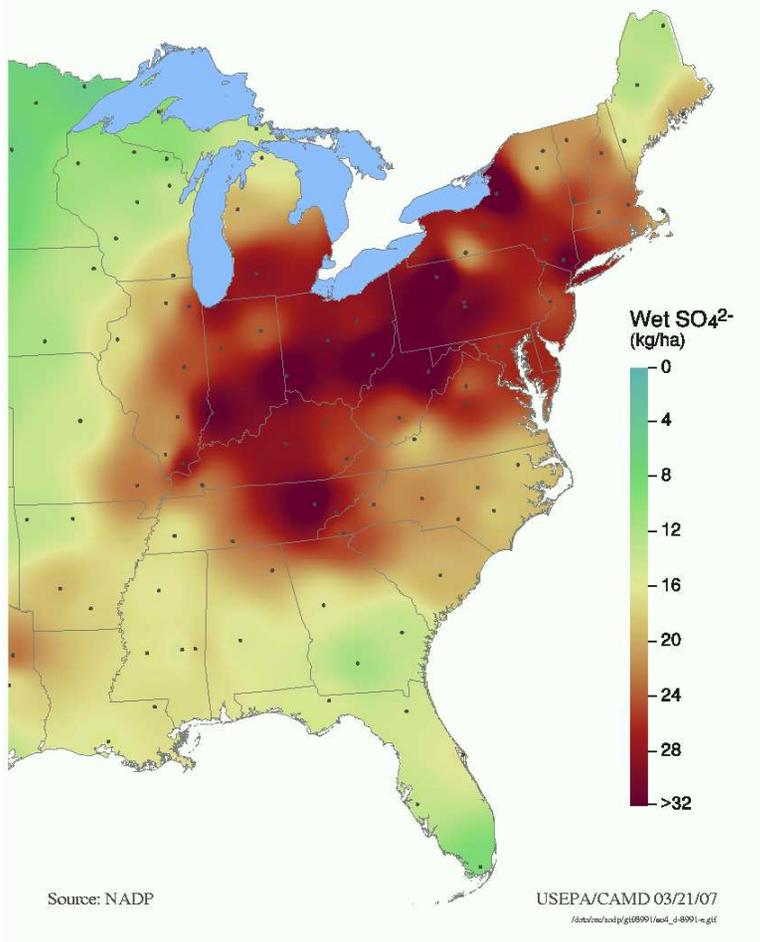
Scale: Largest bar equals 2.2 million tons of SO<sub>2</sub> emissions in Ohio, 1990

*Acid Rain and NO<sub>x</sub> Cap and Trade Program Experience*

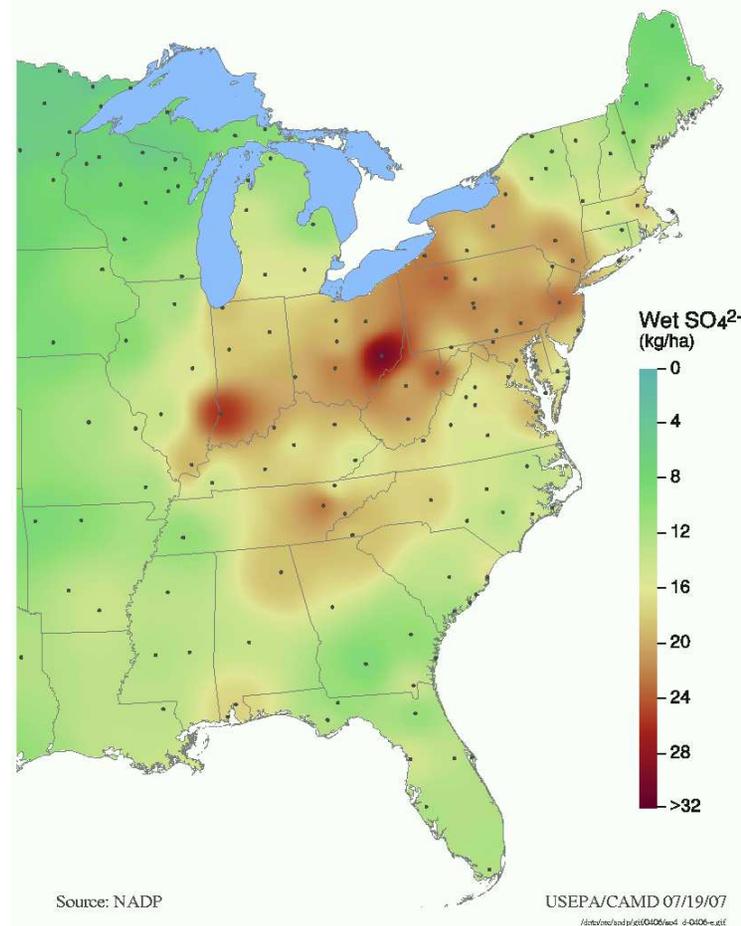
# Acid Rain Levels Have Dropped

## Annual Mean Wet Sulfate Deposition

1989-1991

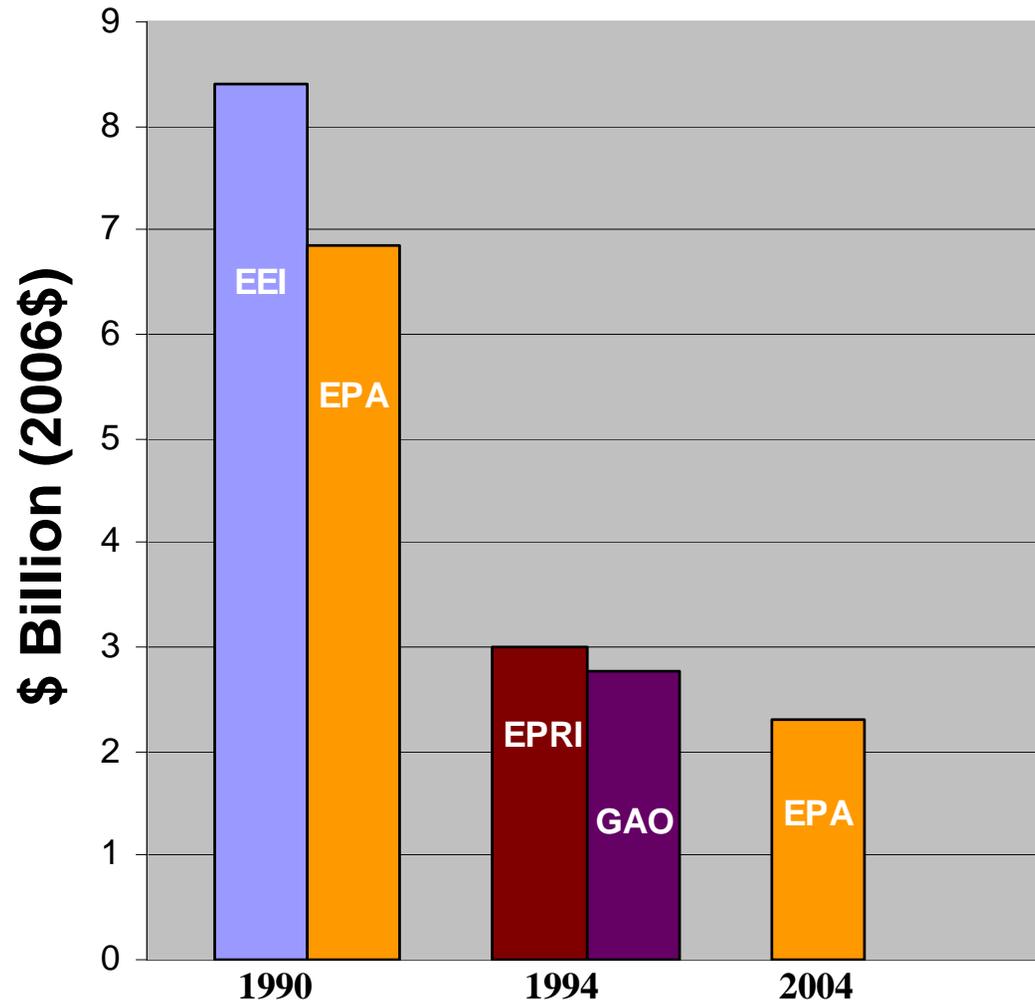


2004-2006



*Acid Rain and NO<sub>x</sub> Cap and Trade Program Experience*

# Acid Rain SO<sub>2</sub> Annual Program Costs: Much Lower than Originally Predicted



Source: EPA, 2006

*Acid Rain and NO<sub>x</sub> Cap and Trade Program Experience*

# Addressing Ozone Transport

- Ozone caused by local and transported emissions of NO<sub>x</sub> and VOC
- More diverse set of sources than acid rain
  - Power generation about 25% of NO<sub>x</sub> emissions
- Problem is seasonal with short term peak concentrations rather than one of total loadings

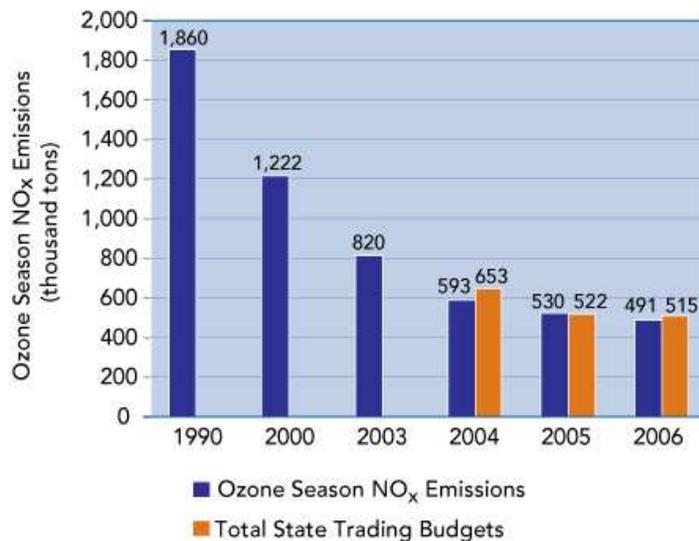


# Summertime NO<sub>x</sub> Emission Reductions

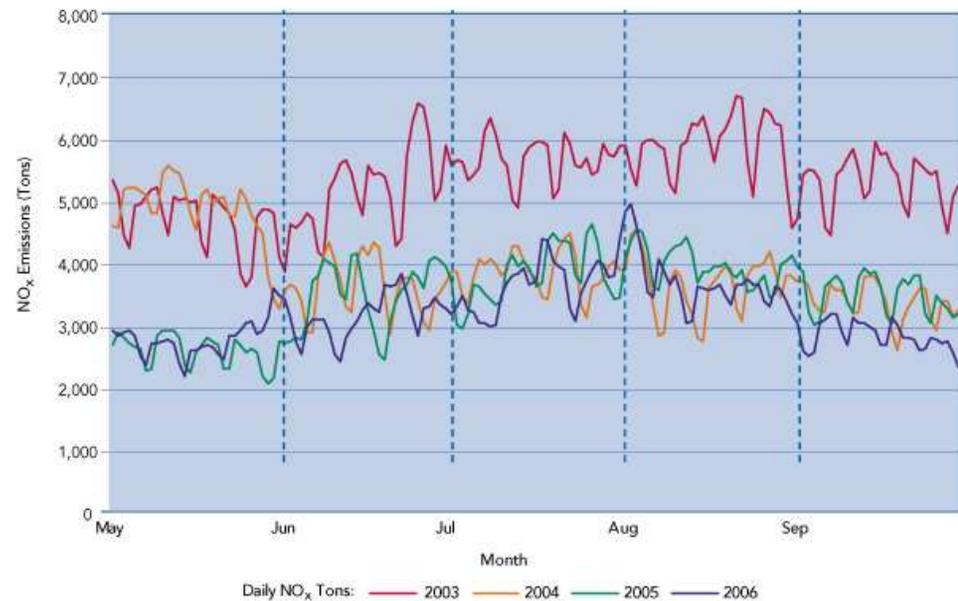
2006 NBP states' ozone season reductions (May 1 – September 30)

- ☹️ 74% from 1990 baseline
- ☹️ 60% from 2000 baseline
- ☹️ 7% from 2005

Ozone Season NO<sub>x</sub> Emissions from All NBP Sources

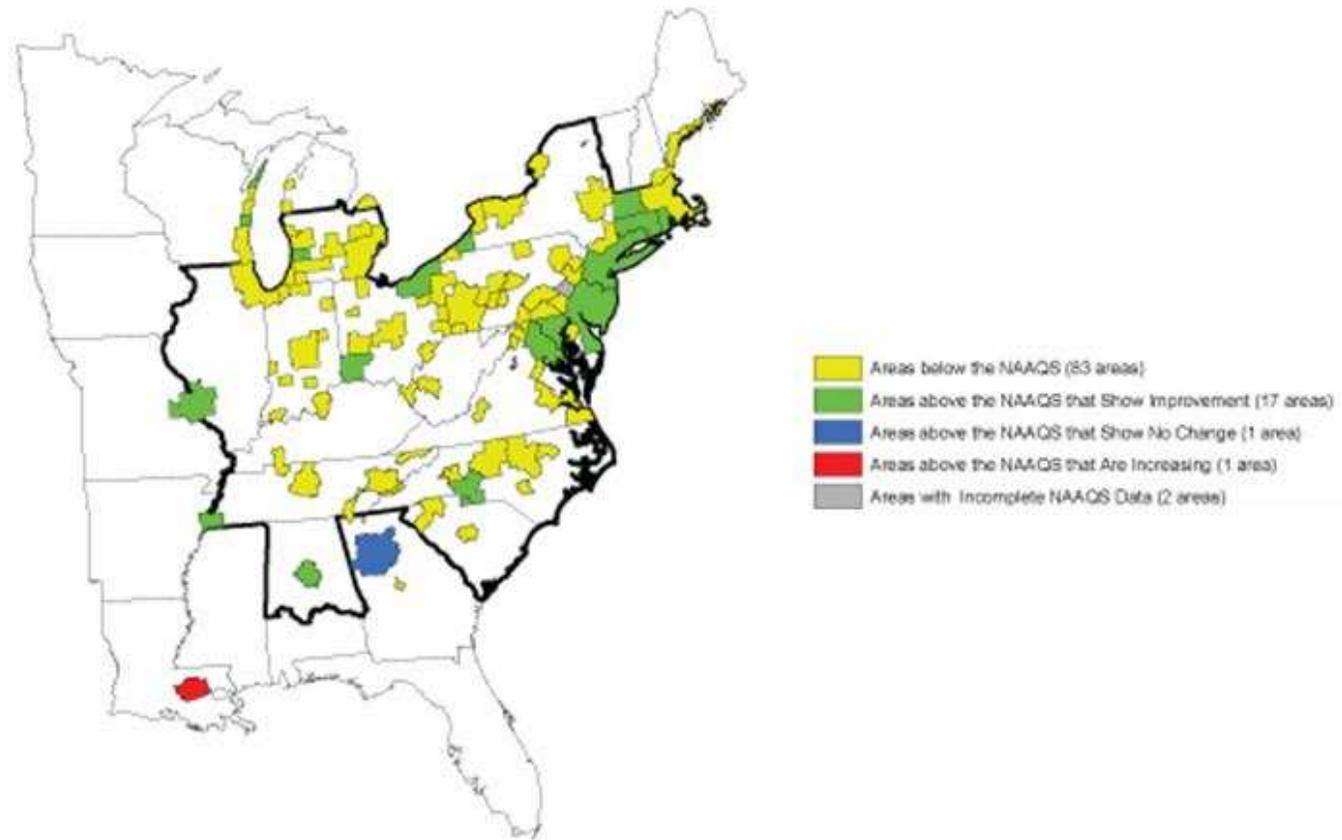


Comparison of Daily Ozone Season NO<sub>x</sub> Emissions from NBP Sources, 2003–2006



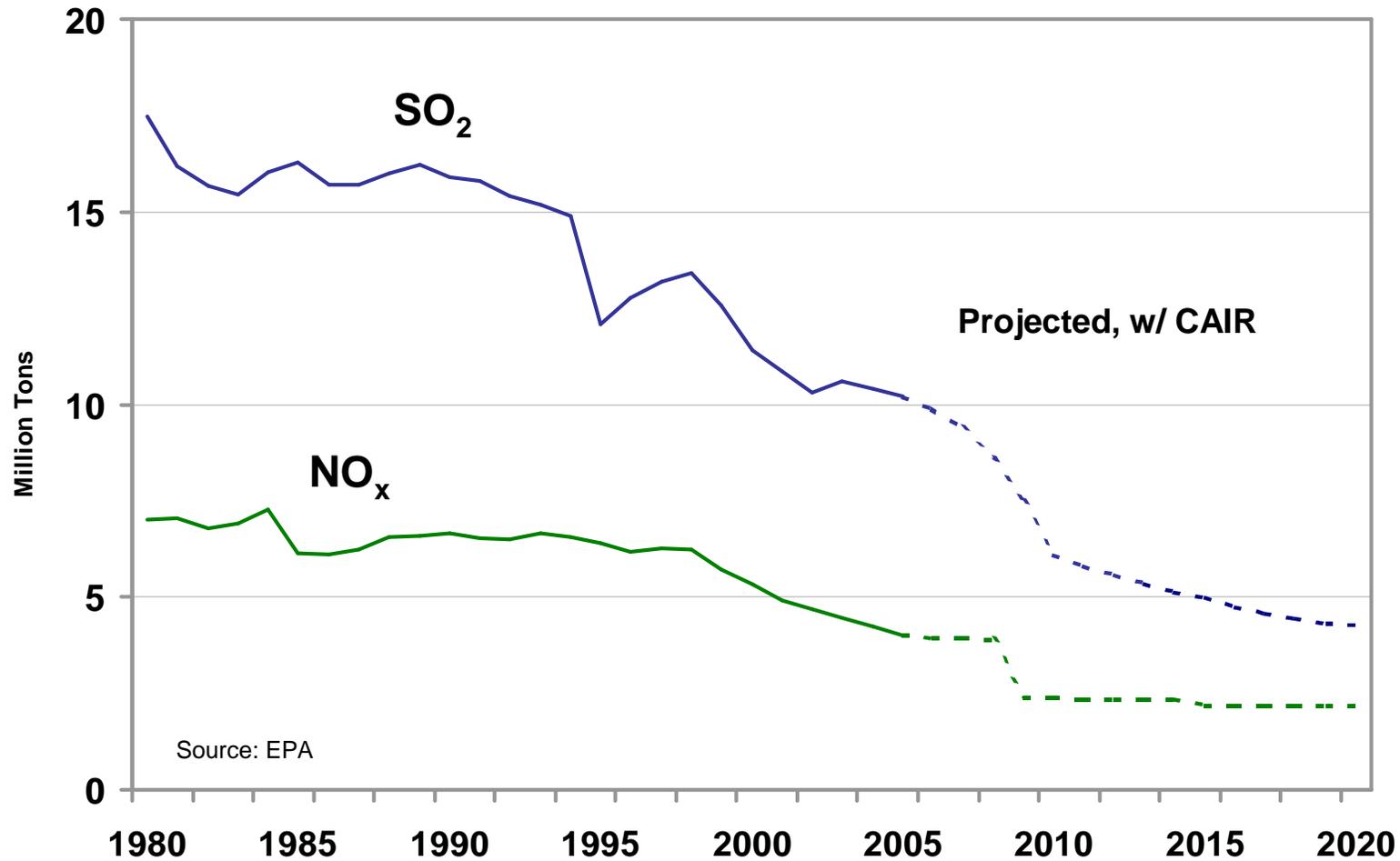
Source: EPA, 2006

# 80% of Areas in the East Designated Nonattainment in 2004 Met Standard in 2006



Changes in 8-hr ozone nonattainment areas in the East, 2001-2003 versus 2004-2006

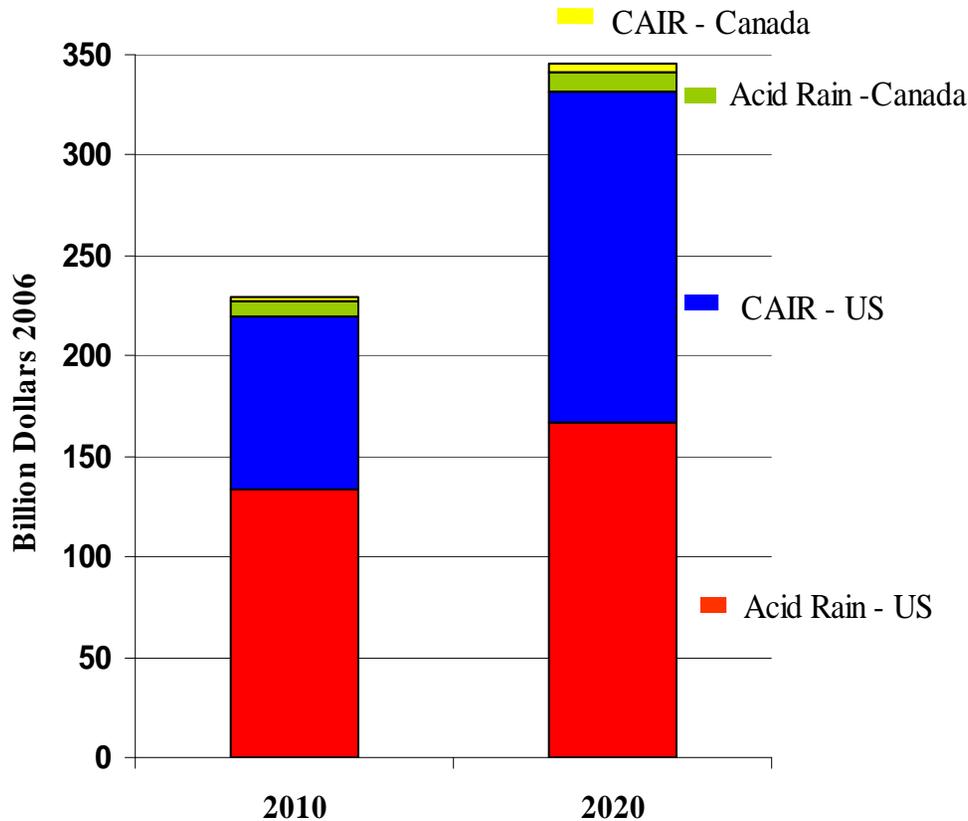
# National SO<sub>2</sub> and NO<sub>x</sub> Power Plant Emissions



*Acid Rain and NO<sub>x</sub> Cap and Trade Program Experience*

# Benefits of Acid Rain and CAIR Program

## Monetary Benefits



Source: EPA 2007 and 2008

- Benefits driven by:
  - Reduced premature deaths
  - Lowering aggravation and incidence of heart and lung ailments
- Other benefits:
  - Increased worker productivity
  - Reduced absences from school and work
  - Visibility improvement in some parks
- Benefits not included:
  - Acid rain environmental benefits
  - Mercury co-benefits
  - Remaining visibility benefits from parks and urban areas

# Key Elements of Cap and Trade

- **Full sector coverage** – All sources (existing and new) included
  - Minimizes shifting of production and emissions (“leakage”)
  - Assures achievement of emission reduction goal without case-by-case review
  - Reduces administrative costs to government and industry
- **Cap on emissions** – Government issues fixed quantity of allowances
  - Limits emissions to achieve and maintain environmental goal
  - Limits creation of “paper credits” and “anyway tons”
  - Provides certainty to allowance market
- **Monitoring** – Accurate measurement and reporting of all emissions
  - Assures accountability and results
  - Establishes integrity of allowances and confidence in the market
- **Trading** – Unrestricted trading and banking (with source-specific limits allowed to protect local air quality)
  - Allows companies to choose (and change) compliance options
  - Minimizes compliance cost
  - Ensures that trading will not cause “hotspots”
- **Certainty of penalties for noncompliance** – Automatic emissions offsets make environment whole and penalties deter noncompliance

# Emissions Monitoring and Reporting

- Complete and accurate accounting of every hour of emissions with no underestimation
- Regulatory incentives for accuracy and completeness
- National consistency to support national trading
- Flexibility for small sources
  - 36% of units must use Continuous Emissions Monitors (CEMS)
  - Accounts for 96% of total SO<sub>2</sub> emissions
- Electronic reporting, feedback, and auditing for speed and accuracy
- Public access to all SO<sub>2</sub>, NO<sub>x</sub>, and CO<sub>2</sub> data

# Setting the Cap and Distributing Allowances

- Legislation (for SO<sub>2</sub>) and regulation (for NO<sub>x</sub>) established
  - cap level
  - timing of reductions
  - allowance distributions
- Distribution was addressed after cap was set and was a “zero sum game”
- Considerations: Equity, incentives, certainty, efficiency, cost impacts
- Distribution of allowances generally do not change the level and distribution of emissions reductions --- cap levels and timing do

# Distributing Allowances

- Many ways to distribute allowances; none are perfect:
  - Direct allocation to sources based on historical and/or current emissions, energy use (input), or production (output, e.g. MWH)
    - Set asides (e.g., new sources, renewables, demand side efficiency, technology incentives)
  - Auction (and distribute revenues for similar purposes as set asides)
  - Hybrid (some direct allocations, some auction)
- Acid Rain Program distributed allowances based on historic use of plant (heat input) and performance standards (most commonly 1.2 lbs/mmBtu) and used a small auction
  - Cost burden fell on highest emitting plants
  - Low emitting plants often had “growth” allowances
- Allowance distribution should balance need for certainty with need to address changing circumstances
  - Acid Rain Program allocations were “permanent”, but are being adjusted under CAIR, while NO<sub>x</sub> allocations were for several years

# Public Access to Emissions and Allowance Data

## Internet Query Capability

**U.S. Environmental Protection Agency**  
**Clean Air Markets - Data and Maps**

EPA Home | Clean Air Markets | Recent Additions | Contact Us | Customer Satisfaction  
 Clean Air Markets - Data and Maps > Create Queries with Emissions Data

**Create Queries**

Time Frame: Unit Emissions Hourly Data  
 Start Date: 02/3/2002  
 End Date: 02/3/2002  
 Facilities: Coronado Generating Station

[New Query](#) [Print Report](#) [Download Data](#) [Report Definitions](#)

State	Facility Name	Facility ID (ORISPL)	Unit ID	Date (mm/dd/yyyy)	OP Hour	SO <sub>2</sub> Tons	CO <sub>2</sub> Tons	NO <sub>x</sub> Tons	Avg. NO <sub>x</sub> Rate (lb/mmBtu)	Heat Input (mmBtu)	OP Time (hrs)
AZ	Coronado Generating Station	6177	U1B	02/03/2002	00	62.1	58.9	184.2	0.32	574	1.00
AZ	Coronado Generating Station	6177	U1B	02/03/2002	01	42.3	59.0	184.5	0.32	575	1.00
AZ	Coronado Generating Station	6177	U1B	02/03/2002	02	33.4	59.7	186.8	0.32	582	1.00
AZ	Coronado Generating Station	6177	U1B	02/03/2002	03	18.4	59.7	186.6	0.32	581	1.00
AZ	Coronado Generating Station	6177	U1B	02/03/2002	04	30.0	59.8	187.2	0.32	583	1.00
AZ	Coronado Generating Station	6177	U1B	02/03/2002	05	24.0	59.5	186.3	0.32	580	1.00

**Allowances**

Select Criteria | Select Output | View Results

Your query affects 3442 transaction blocks.

You specified Program(s): ARP Transaction date between: 01/01/2008 and 01/31/2008

**Transaction Detail Report**

SHOW/HIDE COLUMNS by clicking on the Show or Hide columns bar.  
 FILTER results by clicking on the Filter Data bar.  
 PRINT THIS PAGE using the buttons below.  
 DOWNLOAD ALL DATA using the buttons below (download is limited to 500,000 rows).  
 SORT results by clicking on a column name (once=ascending, twice=descending).

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Show or Hide Columns (Expand this toolbar to add or remove report columns.)  
 Filter Data (Expand this toolbar to filter your results.)

1 2 3 4 5 6 Next 10 Pages Last (3442 records in 35 pages of 100 records)

Program (s)	Transaction Number	Transaction Total	Transaction Type	Account Number (Transferor)	Account Name (Transferee)	State (Transferor)	Representative (Transferor)	Account Number (Transferee)
ARP	108411	2500	Private Transfer	999900002048	Robert Energy Services Inc.	David P Marcor	99990000	
ARP	108412	1000	Private Transfer	999900000450	NRG Power Marketing Inc.	Dave Sapon	99990000	
ARP	108413	2500	Private Transfer	999900000796	IPVE 302	Howard Gerringer	99990000	
ARP	108413	2500	Private Transfer	999900000796	IPVE 302	Howard Gerringer	99990000	

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 Filter Data (Expand this toolbar to filter your results.)

1 2 3 4 5 6 Next 10 Pages Last (3442 records in 35 pages of 100 records)

Account Number (Transferor)	Account Name (Transferor)	State (Transferor)	Representative (Transferor)	Confirmation Date	Allowance (Vintage) Year	Serial Number Start	Serial Number End	Block Totals
999900000796	IPVE 302		Howard Gerringer	01/03/2006	2008	6035242	6037741	2500
999900000532	Morgan Stanley Capital Group		Deborah Hart	01/03/2006	2005	3809522	3810521	1000
999900000593	Sunbury Generation		Scott E Johnson	01/03/2006	2001	2563209	2565315	88
999900000593	Sunbury Generation		Scott E Johnson	01/03/2006	2001	2569652	2567022	371

Type of transfer (auction, private)

Seller name and account info

Buyer name and account info

Confirmation date, serial numbers and total allowances transferred

EPA just completed major "reengineering" of systems

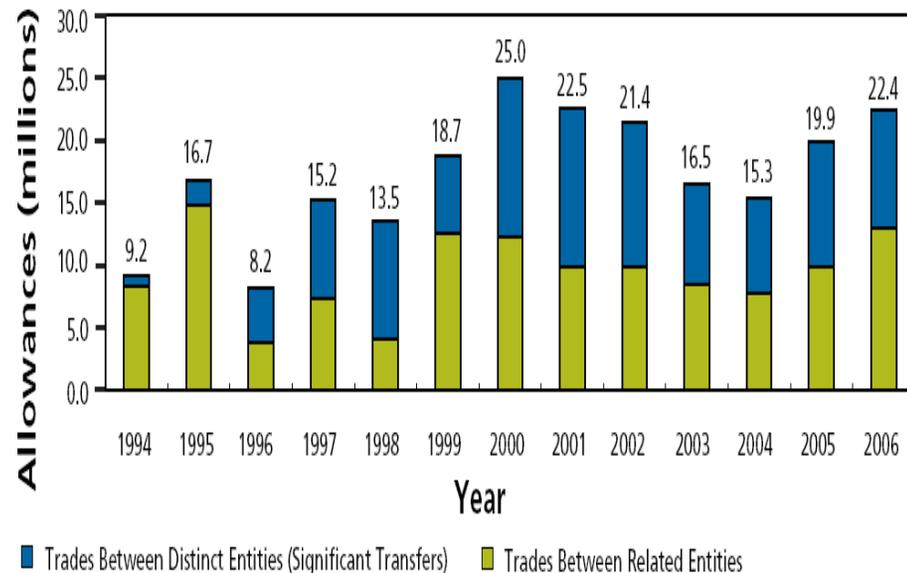
*Acid Rain and NOx Cap and Trade Program Experience*

# Active Allowance Market

- Over 224 million\* allowances privately transferred since 1994 through 43,731 transactions
- Approximately 45% of transfers are arm's length trades
- Over 98% of transfers are handled online
- Low transaction costs

\*excludes EPA transfers

## SO<sub>2</sub> Allowances Transferred under the Acid Rain Program



Source: EPA, 2007

# Summary: Why Cap and Trade

- Offers an alternative to traditional regulation and credit trading—not simply a trading feature added to existing regulation
- Provides environmental certainty that a specific emission level is achieved and maintained
- Provides regulatory certainty, compliance flexibility, and lower permitting and transaction costs for sources
- Requires fewer administrative resources from industry and government—if program is kept simple
- Creates incentives for innovation and early reductions
- Can be compatible with other mechanisms—source-specific requirements, taxes, voluntary measures
- Drives costs down making further environmental improvements feasible

# Lesson Learned: Government Focus

- Achieving the environmental goal (not developing or reviewing source-specific actions)
  - Reducing and capping emissions
  - Ensuring 100% compliance
- Supporting the allowance market (not participating in it)
  - Providing certainty--in allocations, rules, and consequences for noncompliance
  - Ensuring the integrity of the allowance--the authorization to emit
  - Providing transparency of data and decisions
  - Minimizing administrative costs for industry and government

## For more information

- Office of Atmospheric Programs:  
<http://www.epa.gov/air/oap.html>
- Clean Air Markets Division:  
<http://www.epa.gov/airmarkets/>
- Climate Change Division:  
<http://www.epa.gov/air/ccd.html>
- Climate Protection Partnership Division:  
<http://www.epa.gov/cppd/>
- Stratospheric Protection Division:  
<http://www.epa.gov/ozone/>