




Cap and Trade Programs for Air Emissions

Presentation for

Louisiana Public Service Commission

Clean Air Markets Division
U.S. Environmental Protection Agency
Office of Air and Radiation
May 29, 2008

CLEAN AIR MARKET PROGRAMS

UNITED STATES • ENVIRONMENTAL PROTECTION AGENCY •

Overview

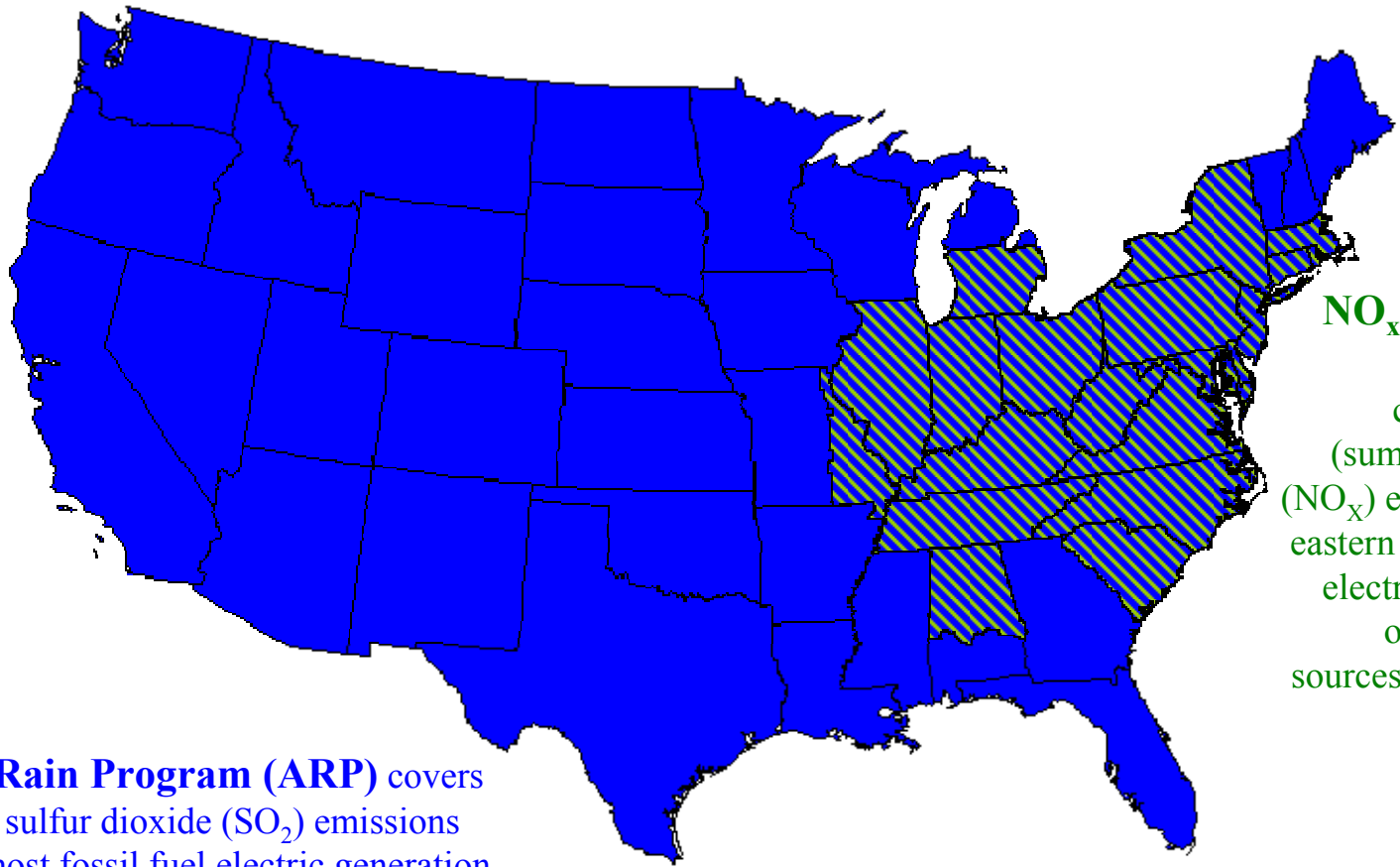
- What is cap and trade?
- Successful U.S. cap and trade programs
  - Acid Rain Program (ARP)
  - NO_X Budget Trading Program (NBP)
- Next generation cap and trade programs
  - Clean Air Interstate Rule (CAIR)
  - Clean Air Visibility Rule (CAVR)
- Why has cap and trade worked for U.S. emissions?
- Key lessons learned
- Emerging cap and trade issues for greenhouse gas programs

What Is Cap and Trade?

- "**Cap and trade**" is a program where the government:
  - Reduces air emissions by setting a mandatory **cap** on aggregate emissions below the existing pollutant levels, **and**
  - Provides covered sources **emission allowances equal to the cap that can be bought or sold (traded)**
    - Unused allowances can be "banked" (saved) from year to year
- The government distributes emission allowances either freely (allocation) or by sale (auction)
- Sources comply with the program by holding enough allowances to cover their emissions. Commonly starting with some allocated level of emission allowances, sources are able to:
  - Lower emissions and free up allowances to trade, bank, or sell
  - Continue emitting at levels higher than their allowance allocation and purchase allowances to cover their excess
- In **"the market,"** parties find each other: those with the lowest cost of reducing emissions generally sell allowances, and those with higher costs generally buy
- Because of the cap, the government does not need to define how or where emission reductions are made. **Government sets the goal** industry collectively must meet – the cap – and **monitors compliance**. **Industry** has the **responsibility** of determining **how to comply** and **gains significant flexibility** in compliance decisions

CLEAN AIR MARKET PROGRAMS

Successful Programs Emerged in the 1990s



NO_x Budget Trading Program (NBP) covers ozone-season (summer) nitrogen oxide (NO_X) emissions in selected eastern states for fossil-fuel electricity generation and other large stationary sources. Program phased in from 2003 to 2007.

Acid Rain Program (ARP) covers annual sulfur dioxide (SO_2) emissions from most fossil fuel electric generation units. Program implemented in two phases: 1995 for largest SO_2 emitters; 2000 for all others.

Programs rely on an emissions <u>cap</u> with air emission allowances that can be <u>traded</u> – cap and trade

CLEAN AIR MARKET PROGRAMS

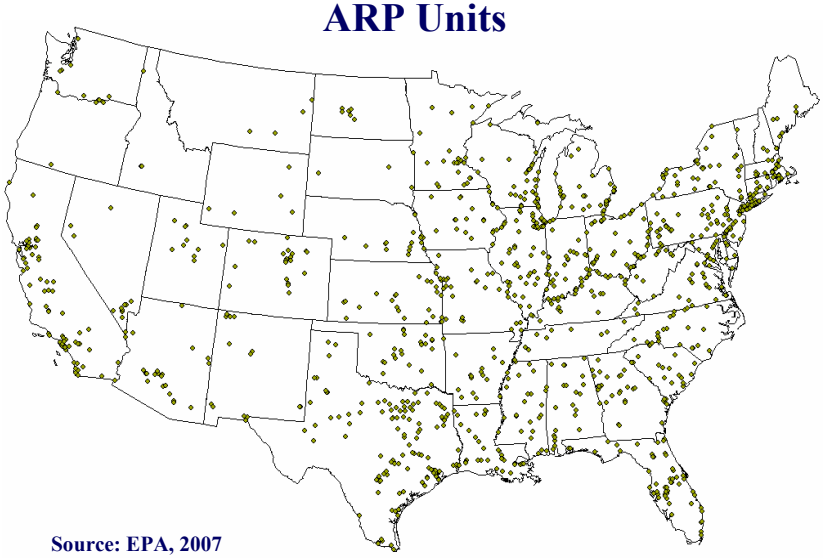
Acid Rain Program for SO_2

Covers about 1,200 facilities with 3,500 units

EPA has phased in the program:

- **1995:** Most fossil fuel electric generation units >25 MW are monitoring emissions. 263 highest, SO_2-emitting, electric generation units have annual emissions cap
- **2000:** Most fossil-fuel electric generation units >25 MW under annual emissions cap of ≈ 10 million tons that dropped to 9.5 million tons after that year
- **2010:** New annual cap = 8.95 million tons

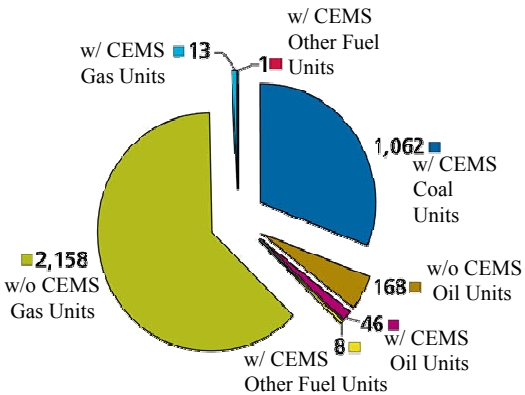
ARP Units



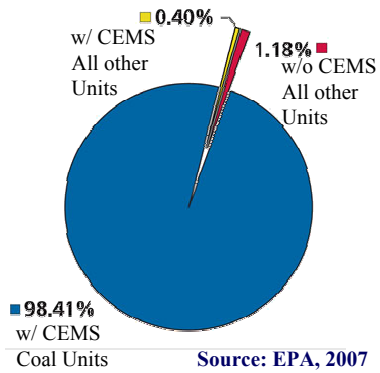
Source: EPA, 2007

- The vast majority of SO_2 emissions (98% in 2006) are from roughly 1,100 coal-fired units (≈420 power plants)
- All coal-fired units and some larger oil and gas units use Continuous Emission Monitor Systems (CEMS) subject to detailed operating and QA requirements
- Other units have monitoring that is less costly, but structured to assure emissions are conservatively estimated and audited

Number of Units Monitoring with and without CEMS



Monitoring with and without CEMS: Total SO_2 Mass Coverage



Source: EPA, 2007

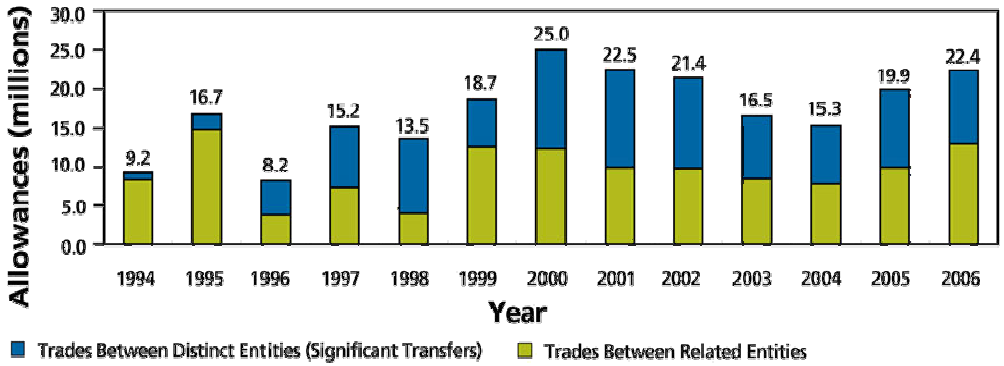
- Quarterly emissions reporting and annual reconciliation of facility emissions and allowances – "true up"
- All data is publicly available. EPA reports progress annually
- "Virtual" 100 percent compliance

CLEAN AIR MARKET PROGRAMS

Acid Rain Program Trading and Banking

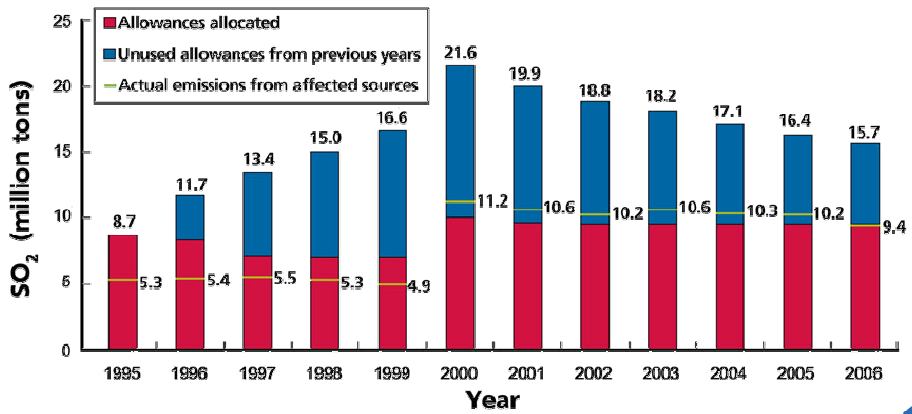
- One allowance covers 1 ton of SO_2
- EPA has allocated all SO_2 emission allowances to facilities and recorded them in electronic accounts
- EPA publishes allowance transfers daily. Anyone can buy or sell allowances
- Each year, EPA auctions 2.8 % of allowances which are taken from affected sources: proceeds are given to these sources
  - Started in 1993 to help with allowance price discovery in emerging market and to ensure new entrants had access to allowances
- Without restriction, all allowances are traded openly, and the market has matured over time
- Since the ARP's outset, there has been considerable "banking" of allowances
  - Provided substantial early environmental gains
  - Led to considerable compliance flexibility for power companies

SO_2 Allowances Transferred under the Acid Rain Program



Source: EPA, 2007

SO_2 Emissions from Acid Rain Sources

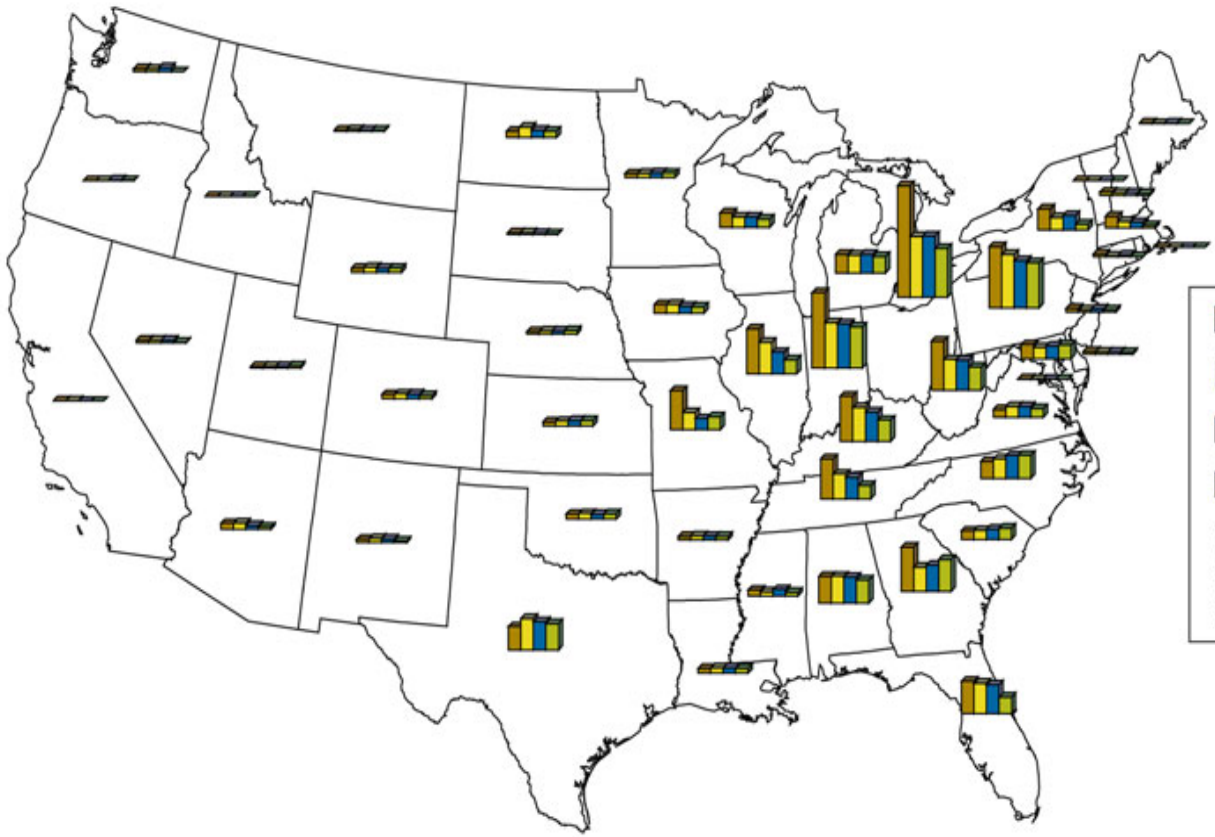


Source: EPA, 2007

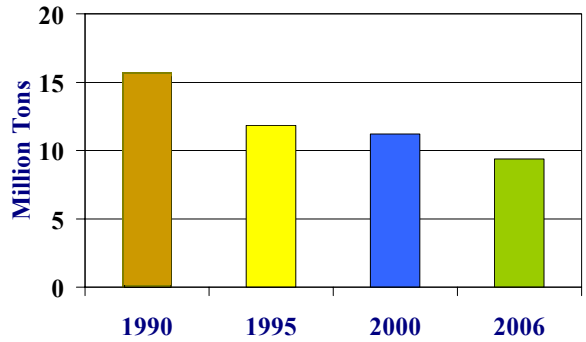
CLEAN AIR MARKET PROGRAMS

SO_2 Emissions Have Fallen in Most States

State-by-state SO_2 Emission Levels from Acid Rain Program-affected Sources (1990-2006)



Acid Rain Emissions of SO_2



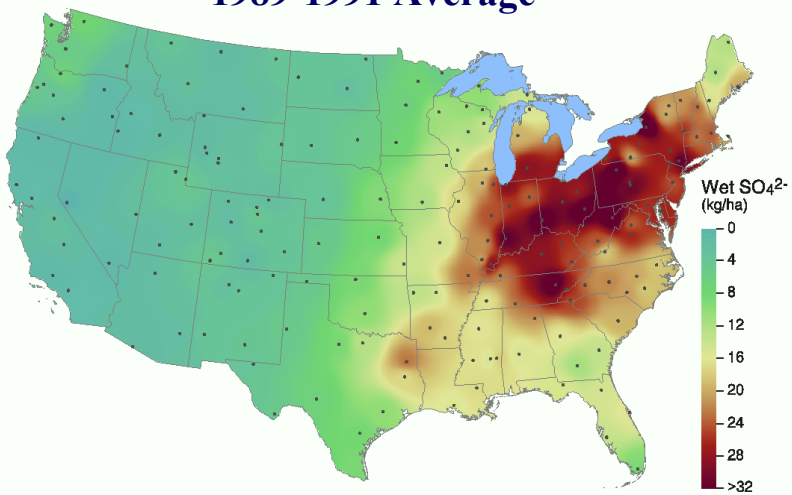
Source: EPA, 2007

CLEAN AIR MARKET PROGRAMS

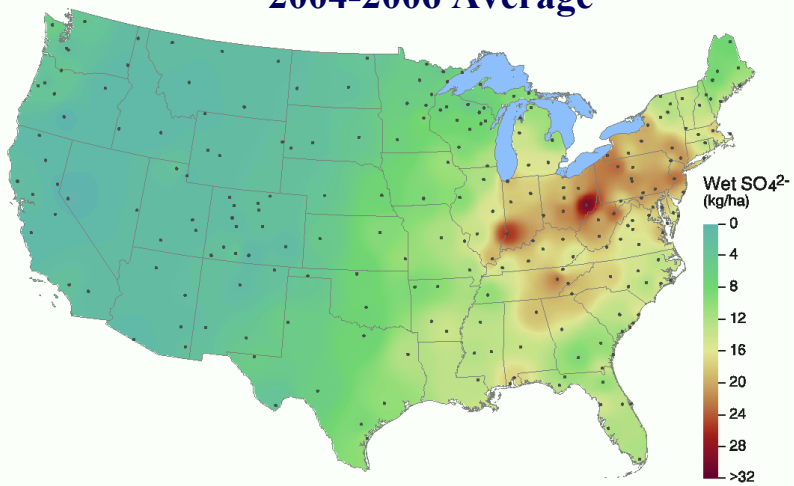
Acid Rain Program Progress

Annual Mean Wet Sulfate Deposition

1989-1991 Average



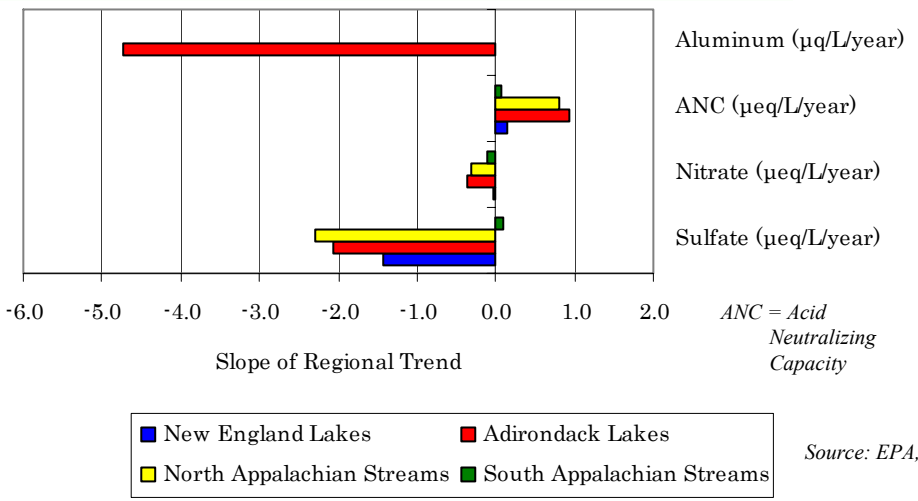
2004-2006 Average



Source: NADP

USEPA/CAMD 07/19/07

Water Quality Improvements, 1990-2005



Source: EPA, 2007

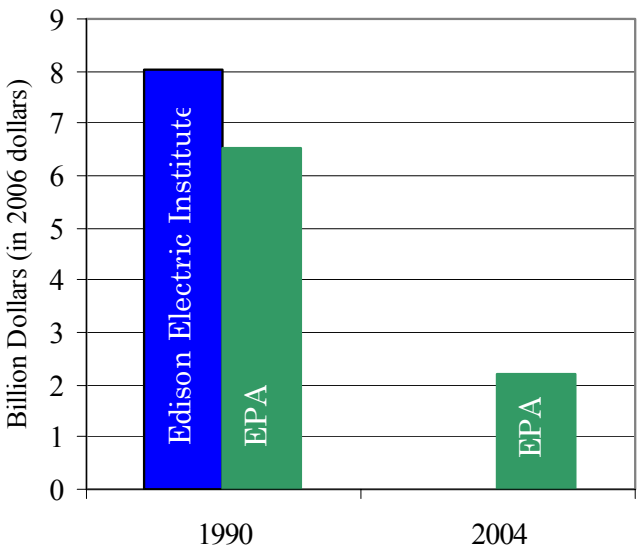
Substantial Gains:

- Reduced "Acid Rain"
- Improved Air and Water Quality
- Improved Health (lives extended and ailments reduced)
- Reduced Regional Haze
- Provided Other Benefits

CLEAN AIR MARKET PROGRAMS

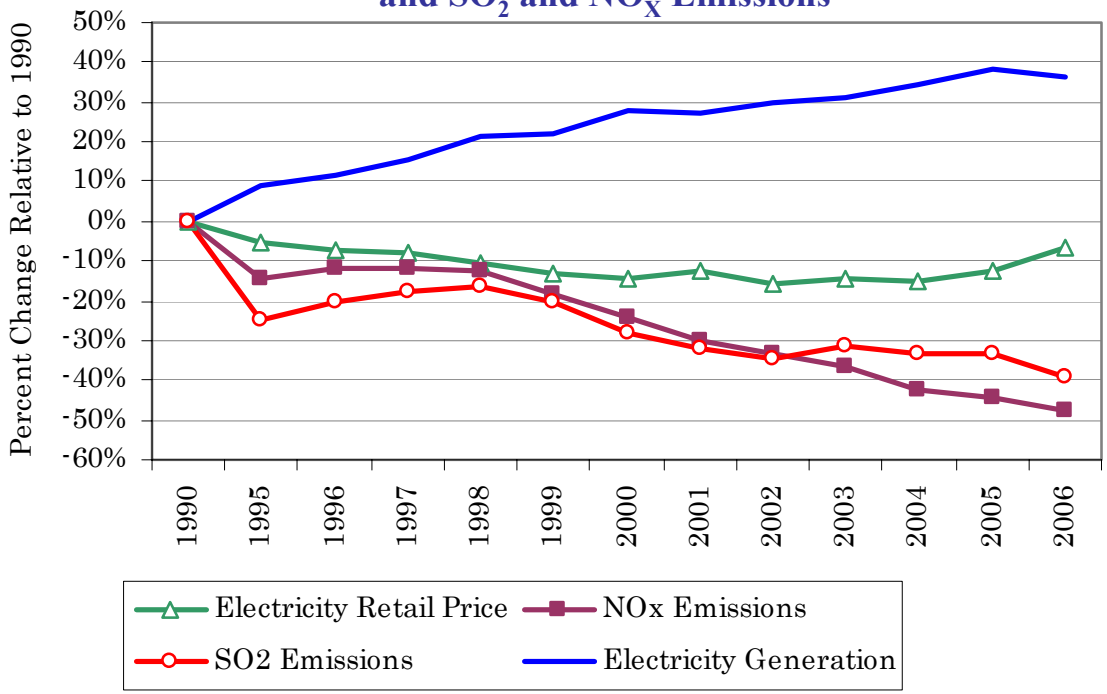
Control Costs: Lower than Predicted

Estimated SO_2 Program Costs in 2010



Source: EPA, 2007

Trends in Electricity Generation, Electric Prices, and SO_2 and NO_X Emissions

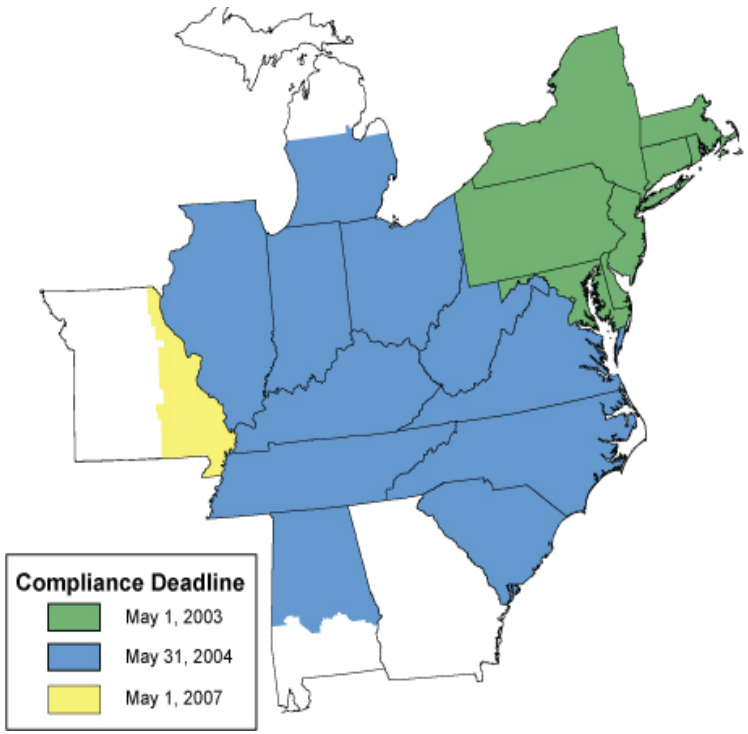


Source: EPA, 2007

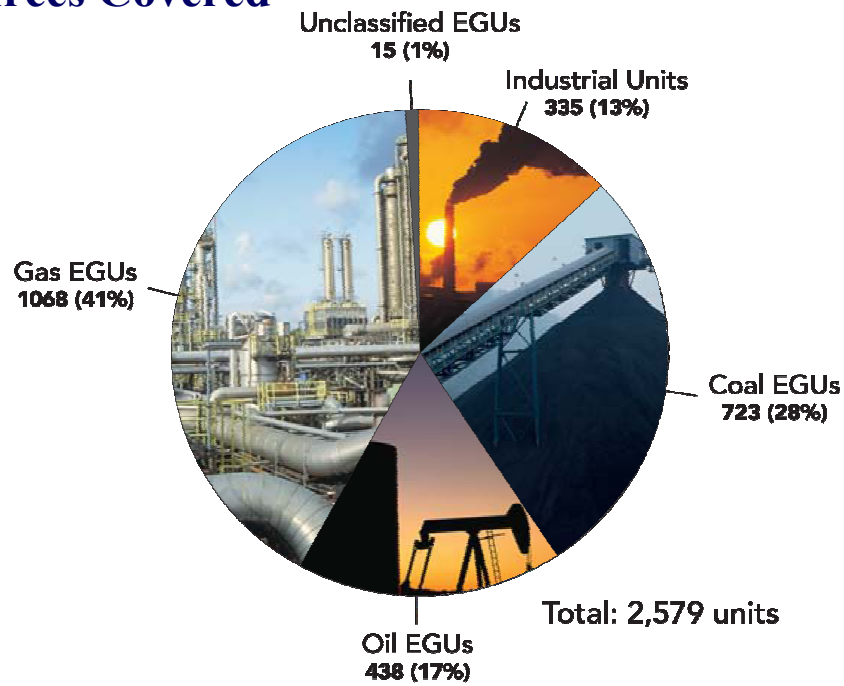
NO_X Budget Trading Program (NBP)

- The NO_X Budget Trading Program (NBP) is a market-based cap and trade program created to reduce seasonal NO_X emissions from electric generating units (EGUs) and large industrial sources in the eastern United States
- The program was designed to address the interstate transport of ozone (and NO_X emissions which combine with volatile organic compounds to produce ozone) across Eastern states
- NBP started in 2003 with phase-in of additional states in 2004 and 2007. Have virtually 100 percent compliance.

Eastern States of the NBP



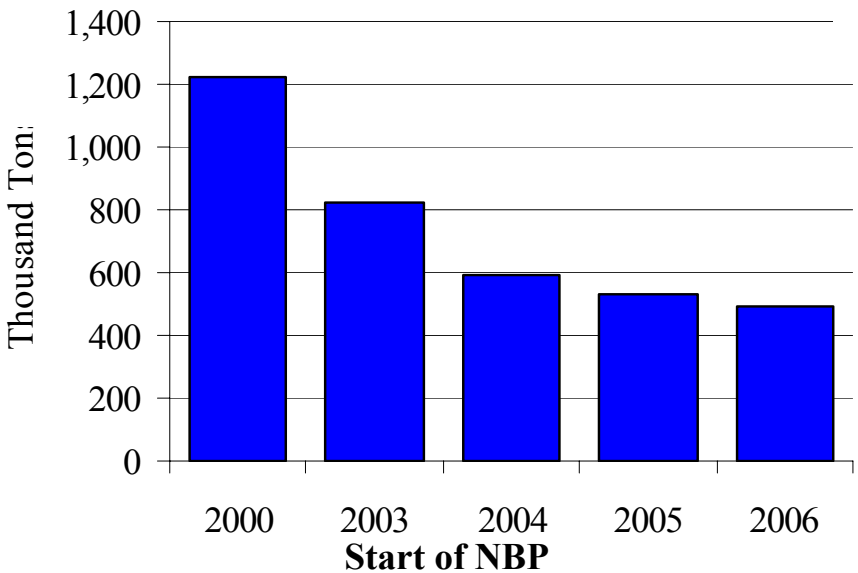
Sources Covered



Source: EPA, 2007

NBP Emissions Reductions

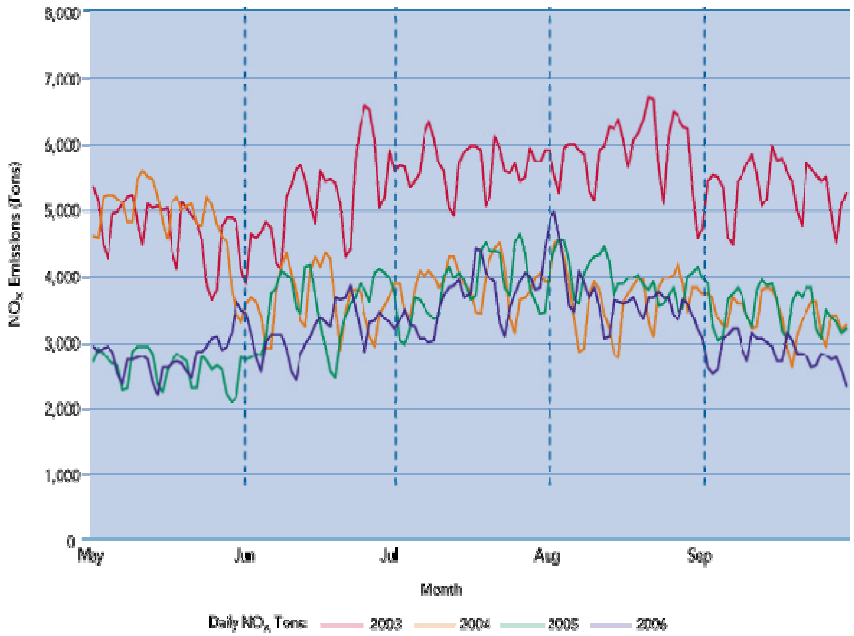
Ozone Season* NO_x Emissions 2000 to 2006



** Ozone season is from May 1 to September 30.*

Source: EPA, 2007

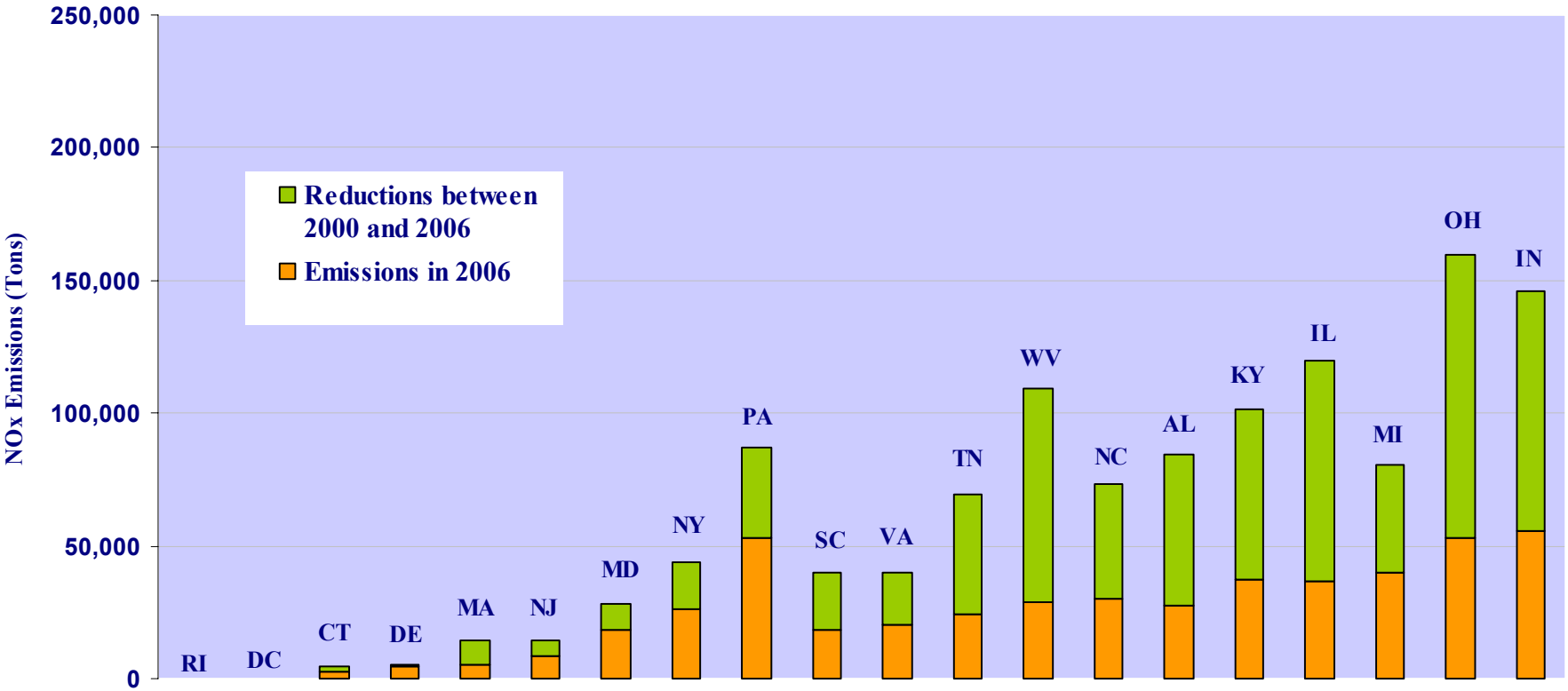
Comparison of Daily Ozone Season NO_x Emissions from NBP Sources, 2003-2006



Source: EPA, 2007

- **Power plants and large industrial sources lowered ozone season NO_x emissions about 60 percent from 2000 levels**

NBP State-by-State Ozone Season NO_x Emission Reductions from 2000 to 2006



- For each state, the total bar (i.e., the sum of the orange and green stacked bars) depicts emissions in 2000 and the orange bar depicts emissions in 2006.
- Results in Alabama and Michigan represent ozone season emissions from only the affected portion of each state.

Source: EPA, 2007

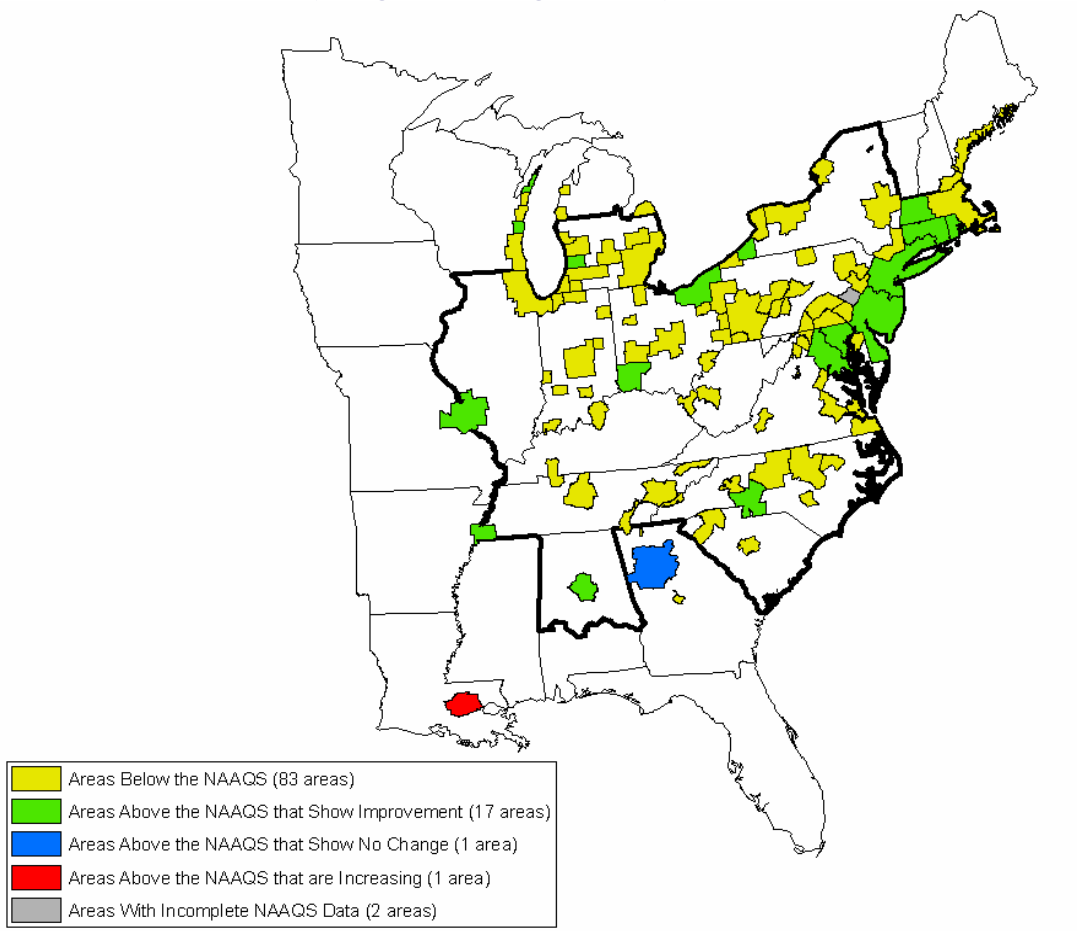
CLEAN AIR MARKET PROGRAMS

Ozone Attainment Has Improved Dramatically

The NO_X Budget Trading Program is the most significant contributor (of EPA and state programs) to ozone improvements in the East

- In 2004, EPA designated 104 areas in the East as 8-hour ozone NAAQS nonattainment areas
- 2004-2006 data show ozone air quality improvements in virtually all of these areas, bringing cleaner air to over 55 million people
- In 2006, four out of five of the original nonattainment areas met the ozone standard

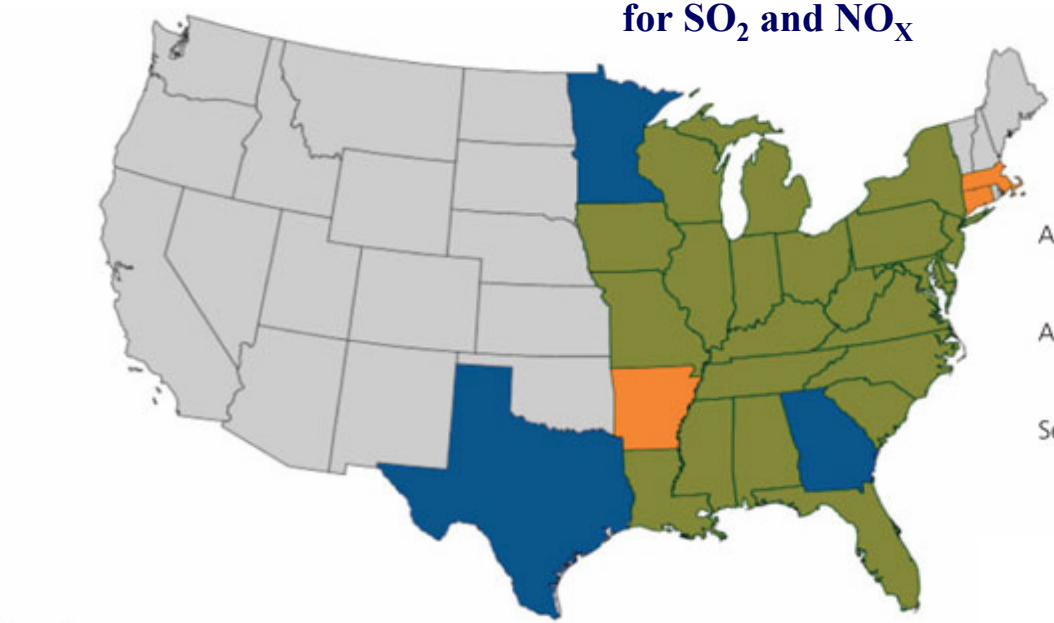
Changes in 8-Hour Ozone Nonattainment Areas in the East 2001-2003 (Original Designations) Versus 2004-2006



CLEAN AIR MARKET PROGRAMS

Next Generation Programs: Clean Air Interstate and Visibility Rules

States Covered in Clean Air Interstate Rule (CAIR) and Clean Air Visibility Rule (CAVR) for SO_2 and NO_X



CAIR Emission Caps*
(million tons)

	2009/2010	2015
Annual SO_2 *(2010)*	3.7	2.6
Annual NO_X *(2009)*	1.5	1.3
Seasonal NO_X *(2009)*	0.6	0.5

**for the affected regions*

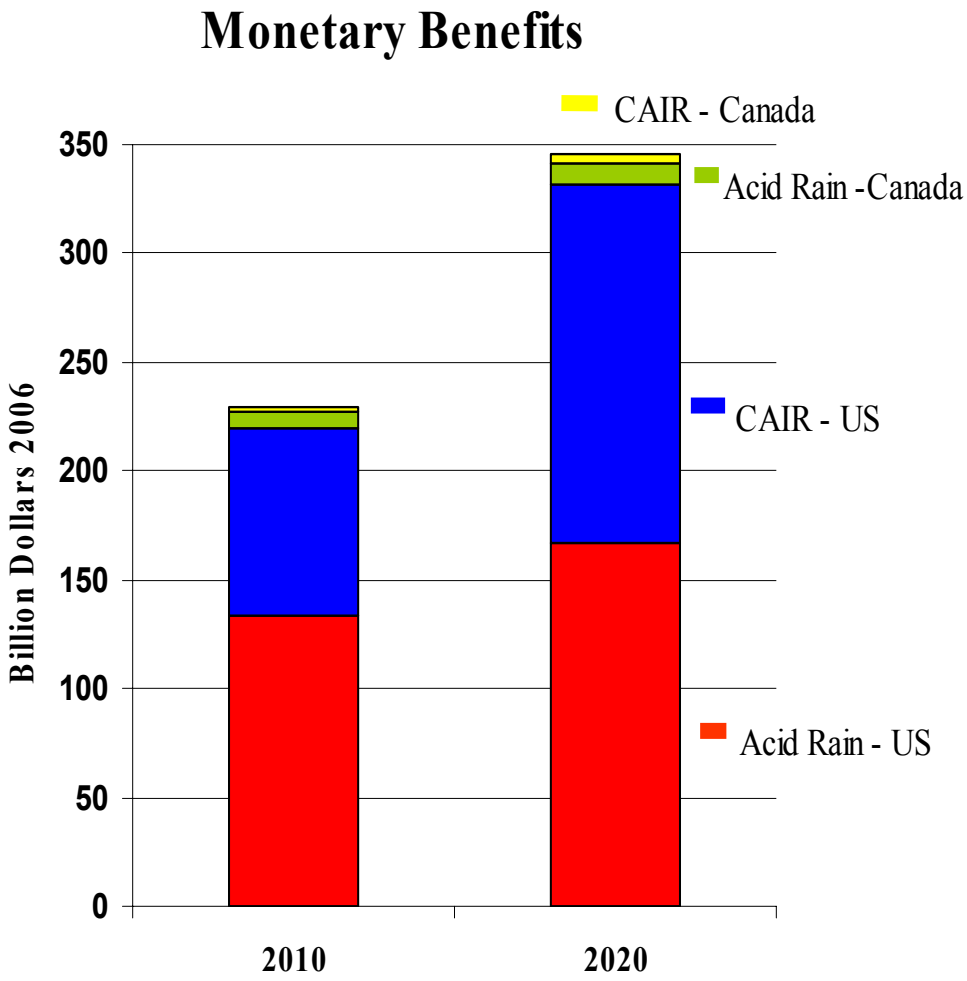
CAVR

Outside of CAIR Region – Best Available Retrofit Technology (BART) controls or States can create trading programs

Source: EPA, 2007

Note: On February 8, 2008, the U.S. Court of Appeals issued a decision vacating the Clean Air Mercury Rule (CAMR) and thereby suspending the program that allowed mercury emissions trading. On May 20, 2008, the Court denied the Department of Justice's request for a rehearing of the case.

Benefits of Acid Rain and CAIR Programs



Source: EPA 2007 and 2008

- Majority of benefits result from:
  - Avoidance of premature deaths*
  - Reduced aggravation and incidence of heart and lung ailments
- Other benefits include increased worker productivity, reduced absences from school and work, and visibility improvement in some parks
- Benefits not included in estimates:
  - Acid rain environmental benefits
  - Mercury co-benefits
  - Remaining visibility benefits from parks and urban areas
  - Others

*EPA has estimated that the programs lead to the annual avoidance of about 32,000 and 42,000 premature deaths in 2010 and 2020, respectively.

CLEAN AIR MARKET PROGRAMS

Key Elements of Cap and Trade

- **Emissions Cap**: Establishes a fixed quantity of allowances for each compliance period (year, season, or other)
  - Cap is the mechanism to achieve and maintain the environmental goal
- **Coverage:** Determines which sources and/or sectors are included (existing and new)
  - Coverage should minimize shifting of production and emissions ("leakage") that may reduce the environmental effectiveness of the program
  - Coverage should capture large share of emissions but be administratively manageable
- **Emission Monitoring, Reporting, and Verification:** Requires complete, accurate measurement and timely reporting of emissions to assure accountability and provide public access to data
  - Leads to program integrity and confidence
- **Allowance Distribution:** Provides initial allowances to regulated community and others (based on political decisions) through mechanisms such as government allocation and auctioning
- **Allowance Trading:** Allows companies to choose (and change) compliance options – leads to significant cost savings
- **Stringent, Automatic Penalties:** Ensures the environment is made whole and penalizes non-compliance
- **Assessment:** Determines program effectiveness and whether more actions needed

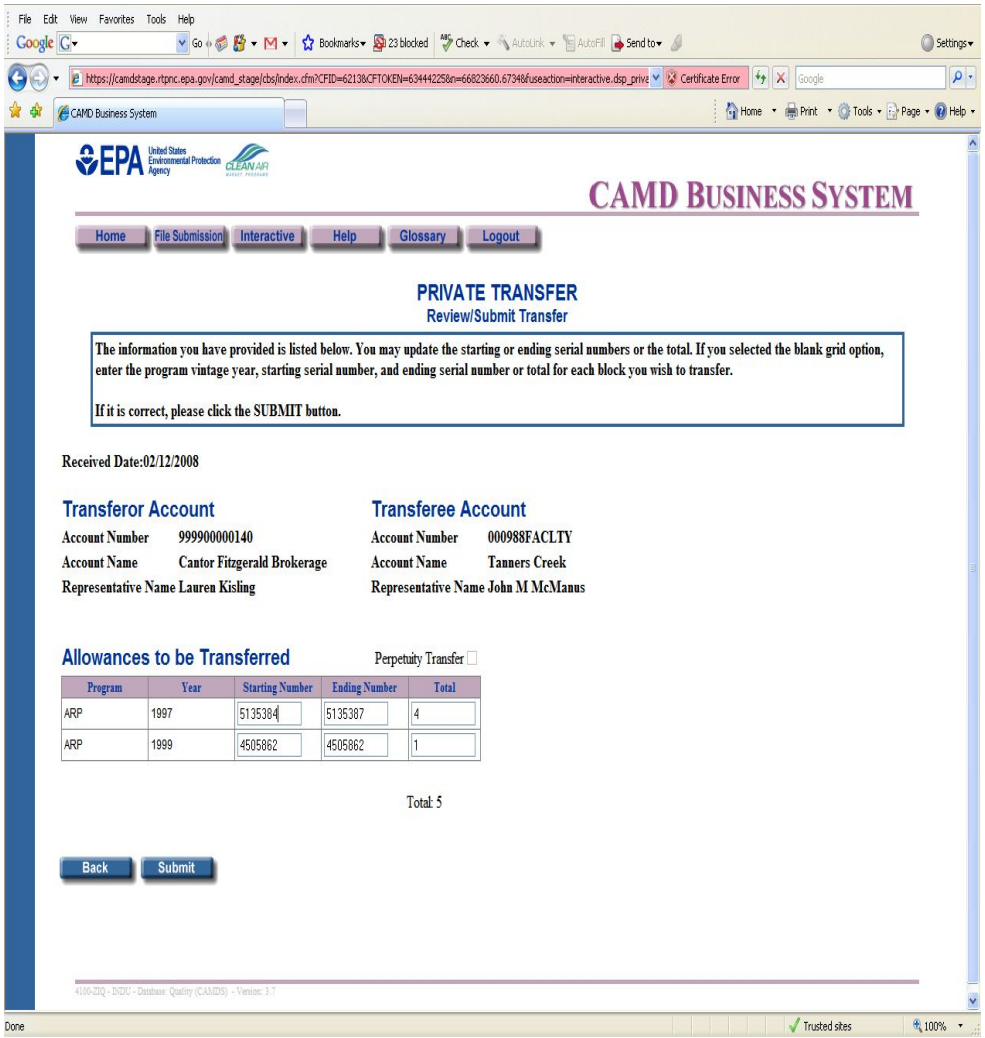
Allowance Distribution

- **Considerations:** Equity, incentives, certainty, efficiency, revenue impacts, price effects, profitability
  - Allowance allocation should balance the need for certainty and changing circumstances
- **Experience:** Generally allocation does not change the environmental outcome. (The emission caps and option for "banking" of allowances over time drive the environmental performance). Allowance allocation can substantially influence compliance expenses by individual firms and the total distributional effects of a program.
- **Approach:** Many options, none are perfect
  - Direct allocation to sources based on historical and/or current emissions, energy use (input), or production (output, e.g. electric generation), with the option of set-asides within the cap for certain sources and/or actions (new sources, renewables, demand side efficiency)
  - Auction
  - Hybrid
  - Auction phase-in following allocation

Monitoring, Reporting, and Verification

- **Considerations:** Equity, incentives, accuracy, timeliness, certainty, transparency, public perception, and confidence in program
- **Experience:** EPA collects high-quality SO_2, NO_X, and CO_2 data from about 3,500 emission sources in the Acid Rain Program
- **Approach:** Focus on complete and accurate emission data
  - Most accurate methods required of largest emitters with **flexibility** through alternative, less-costly measurement approaches for other emitters
  - Built-in **incentives** for greater accuracy and completeness
  - Standardized **quality assurance** tests for every emission value through standardized tests and statistical analyses
  - Petition process to accommodate unexpected situations
  - Heart of process is maintenance of CEMS on major emitters (all coal-fired units and others) that monitor emissions (at high reliability and accuracy levels) hourly and report to EPA every quarter

Some Details of Operations…



Allowance Accounting

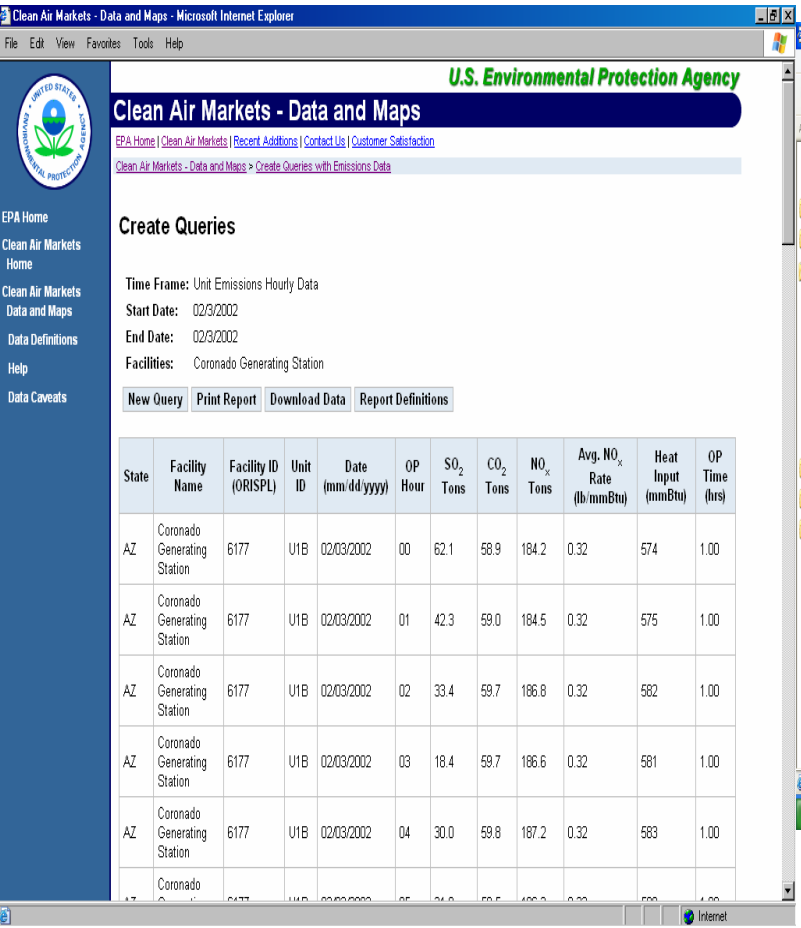
- Official record of allowance transfers and holdings
- Each allowance has a serial number
- Parties reach agreement, then transfer allowances online, or authorize EPA to transfer allowances
- CAMD Business System is not a trading platform

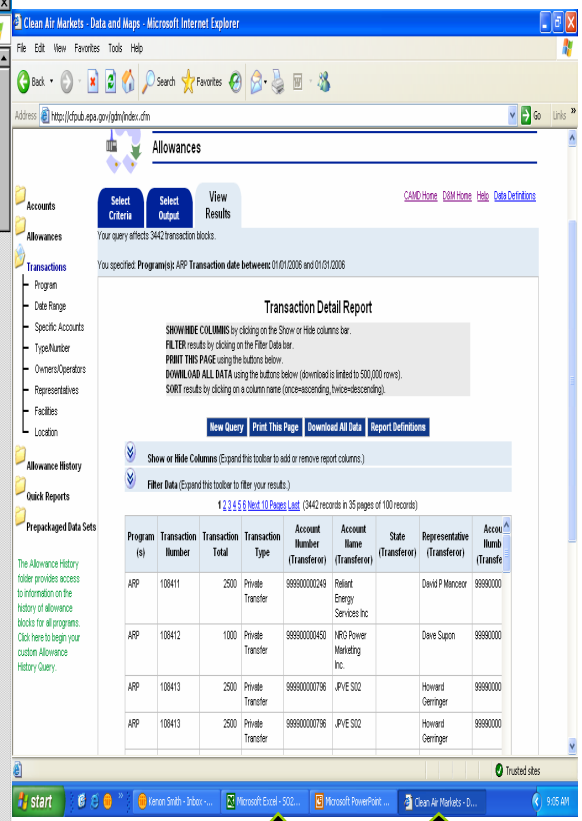
E-government at work…

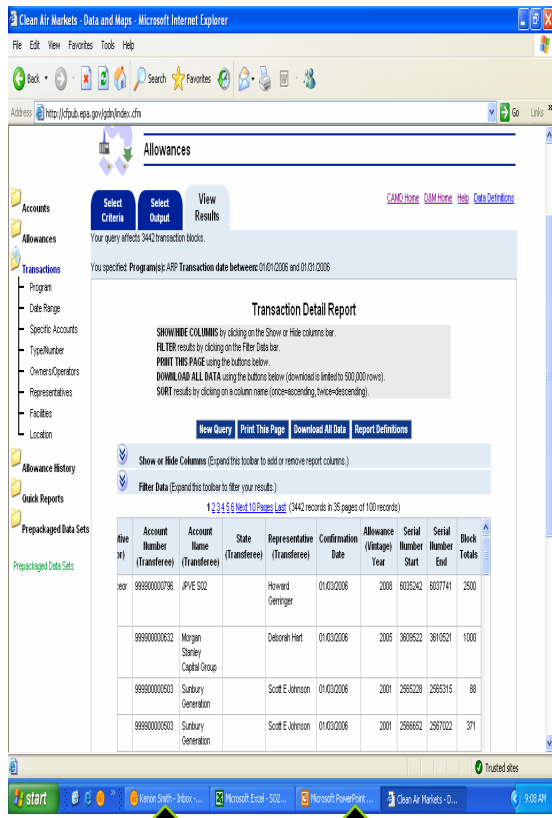
Some Details *continued…*

Routine Public Access to Emissions and Allowance Data

Internet Query Capability







Type of transfer (auction, private)

Seller name and account info

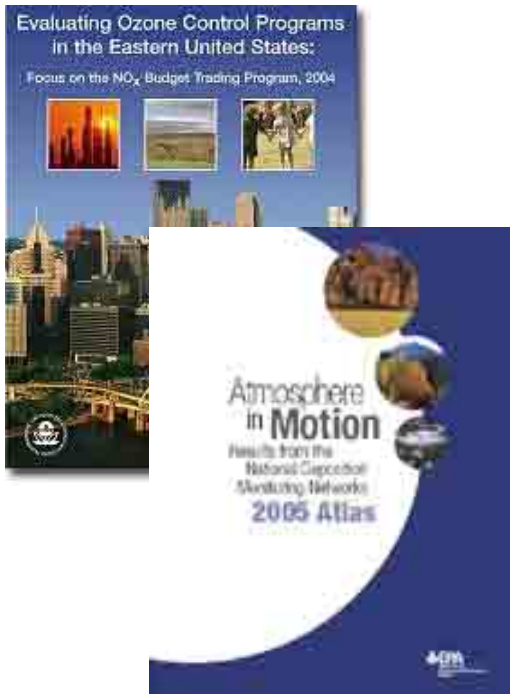
Buyer name and account info

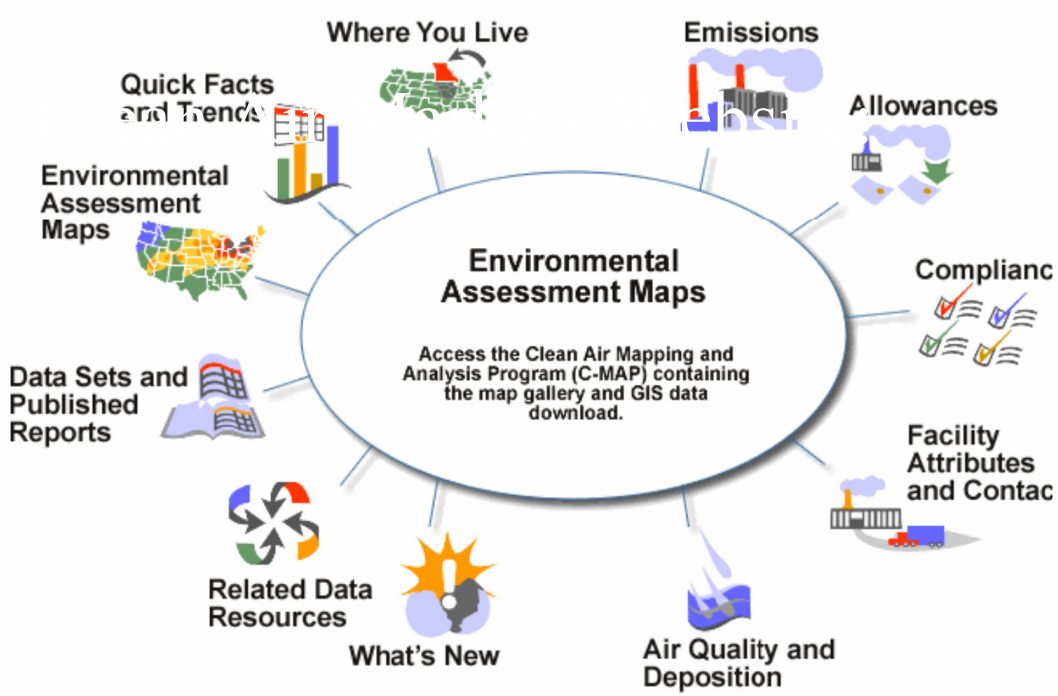
Confirmation date, serial numbers and total allowances transferred

EPA just completed major "reengineering" of systems

Reporting Results

- Annual reports on program results
- Public access to data and reports

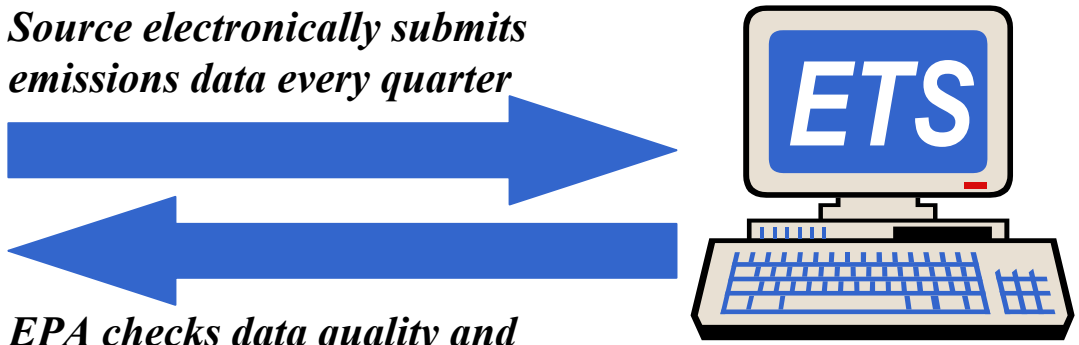




http://cfpub.epa.gov/gdm/

Electronic Reporting and Feedback

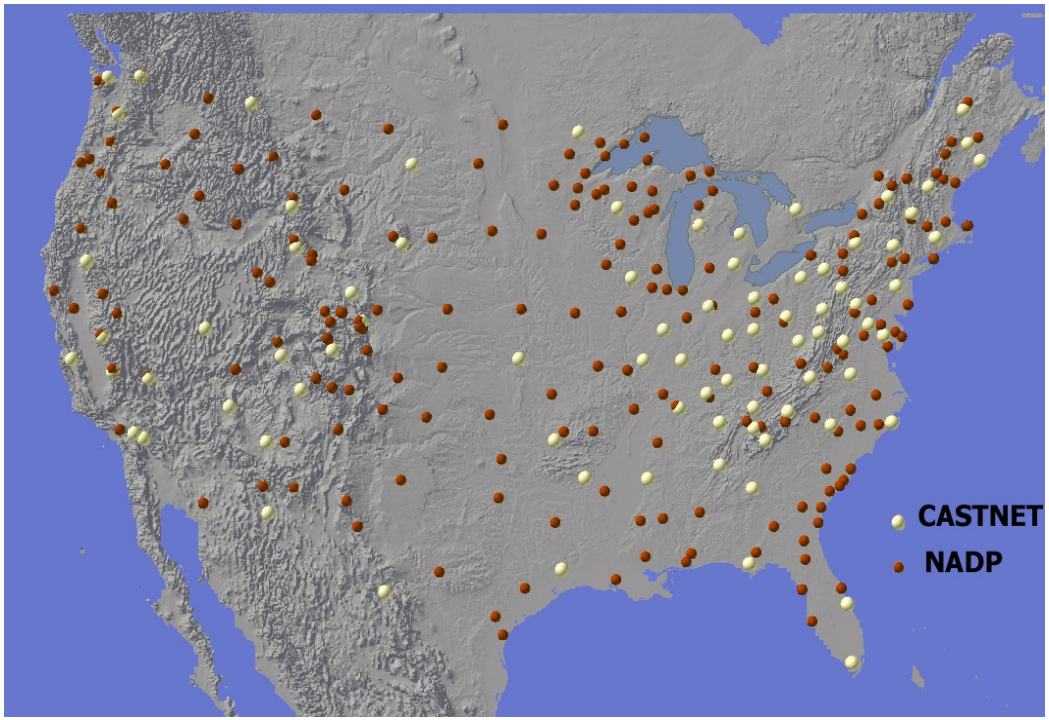
Source electronically submits emissions data every quarter



EPA checks data quality and provides automated feedback to source

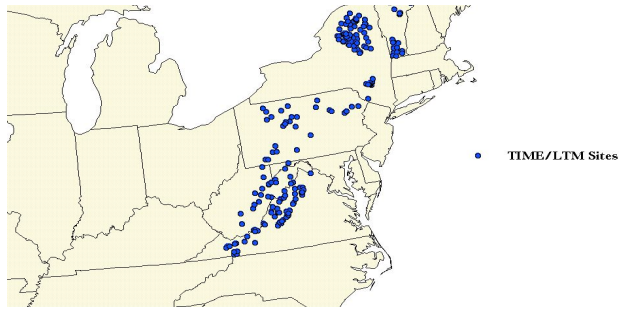
	Reporting Period or Quarterly	Cumulative Annual or Cumulative Ozone Season	EPA Accepted
SO2	2633.4	5629.1	2633.4
CO2	230774.0	601228.0	230774.0
Heat Input	2249279.0	5013635.0	2249279.0
NOx Rate	0.3	0.3	0.3

Assessment



- There are annual program assessments
- EPA considers results from multiple sources; an urban monitoring network and a rural network developed for ARP

Temporary Integrated Monitoring of Ecosystems/ Long Term Monitoring System (Surface Water Monitoring)



- Measure results through broad monitoring networks
  - *Changes to deposition, water quality, ambient air quality*
- Compare to program goals; assess need for further action

Advantages of Cap and Trade

- Offers alternative to traditional regulation and credit trading
  - ***Not simply a trading feature added to existing regulation***
- Provides certainty that a specific emission level is achieved and maintained
- Leads to regulatory certainty, compliance flexibility, and lower permitting and transaction costs for emission sources
- Requires fewer administrative resources from industry and government (if program design is kept simple)
  - ***Government can focus on setting goals & assuring results, not on approving individual compliance actions***
- Creates incentives for innovation and early reductions
- Operates compatibly with other mechanisms
- Makes greater improvements feasible through lower costs

Why Has Cap and Trade Worked?

- Cap on emissions
  - Ensures environmental goal
  - Provides predictability for allowance trading market
- Full-sector coverage of existing and new emission sources
  - Focuses on sources with heterogeneous compliance options and costs
  - Focuses on sources with capability to monitor and report emissions reliably and accurately
  - Limits ability to shift generation and emissions to non-covered sources
  - Eliminates need to conduct case-by-case review of emission reductions
- Complete and accurate emission measurement and reporting
  - Assures accountability and program credibility
  - Provides transparency and public access to data
- Limited restrictions on trading and banking complemented by source-specific limits where needed to protect local air quality
  - Allows companies to choose compliance options
  - Addresses “hotspots” through local requirements for direct controls, if necessary
  - Reduces costs

CLEAN AIR MARKET PROGRAMS

Key Lessons Learned

- Greatest reductions occurred where the highest emissions existed
- Trading provides regional emissions reductions, which can (and are) augmented with local direct controls
- Caps protect the environment, not the allowance allocation
- "Banking" leads to early emission reductions that provide early benefits and flexibility for sources to contain and lower compliance costs
- Implementation should be kept in mind when designing programs
    - Setting the goal
    - Verifying emission data
    - Administering and enforcing the program
    - Helping affected sources understand their options and obligations
- Good legislation makes the job much easier
- Virtually 100% compliance can result
- Start and pace of control matters, especially to gain cost advantages

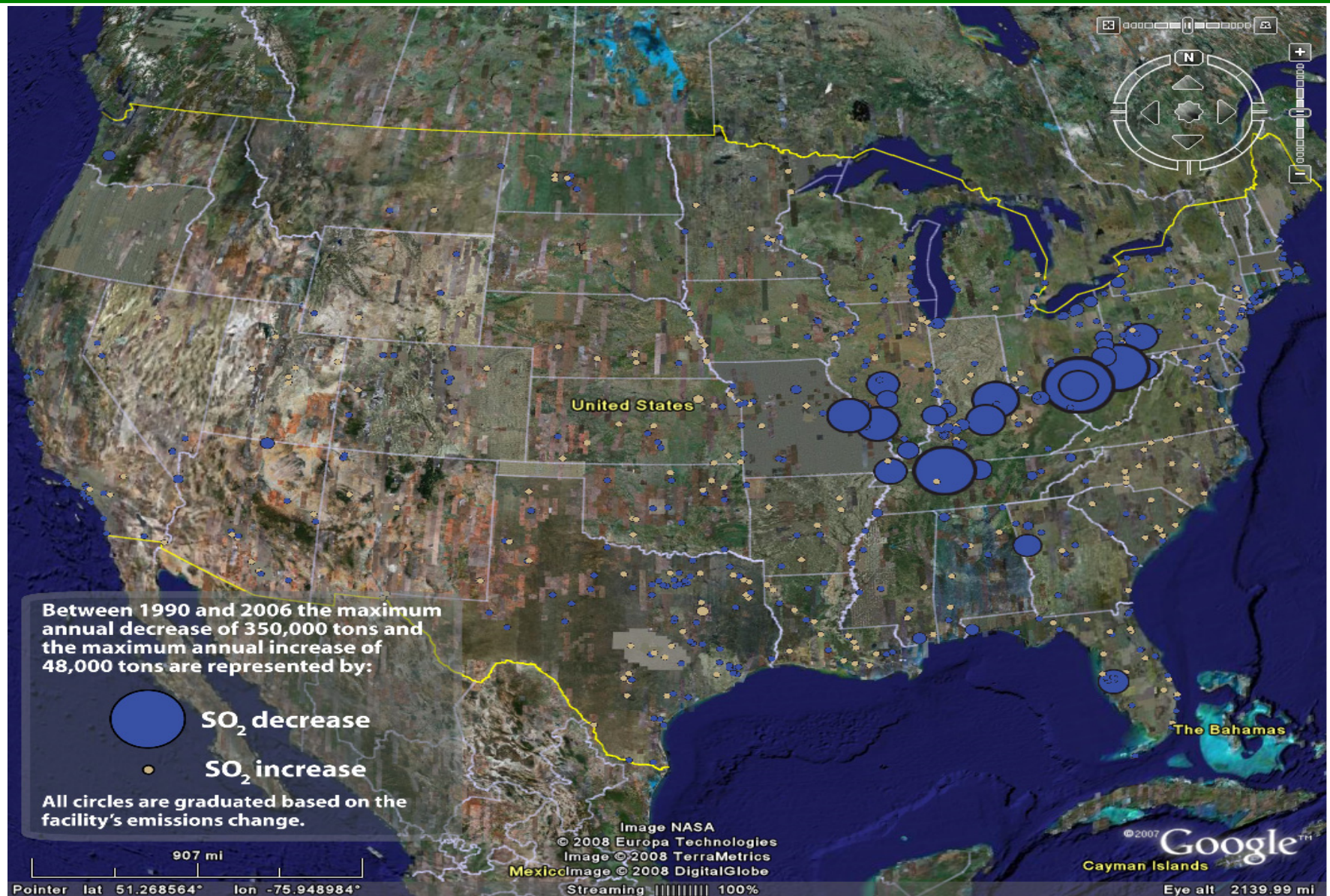
Key Lessons Learned *continued*

- Accountability and transparency essential to program integrity
  - Requires accurate, complete emissions measurement
  - Provides transparent emission and allowance data
  - Creates predictable and, preferably, automatic consequences for noncompliance
- Simple and effective design and operation focused on key objectives reduces administrative burden and costs, and improves compliance and timeliness
  - Establishes a minimal, but effective role for government
  - Provides industry compliance flexibility with accountability – this unleashes incentives for better, cost-effective controls
  - Facilitates market development to maximize flexibility and cost savings
  - Ensures environmental results through clear objectives, strong monitoring and predictable penalties
  - Requires a relatively small number of government staff to produce results (especially when advanced information management technology is used)

Key Lessons Learned *continued*

- Accurate baseline emissions inventory critical to effective design
- Valuable to have a program structure that is readily adaptable
- Advanced computers, software, and the internet allow a transparent, "user friendly" set of large data management systems to support the program's objectives
- Cap and trade can work outside of the power sector
- Assessment routinely enables programs to stay environmentally on track
- Industry having the responsibility to determine how to comply under a flexible program that has clear pollution reduction goals laid out in the air emissions caps unleashes innovation and leads to lower compliance costs

A Better Look at a Lesson Learned: The Biggest Emitters Achieved the Steepest Annual Reductions



Emerging Issues for GHG Programs

- Levels and timing of control
  - Cost containment
- Scope and scale
- Point of regulation
- Federal and state roles
- Technology development and deployment
- Distribution of allowances
- Equity
- Linkage to cheaper GHG tons
  - Energy efficiency
  - International programs
  - International and domestic offsets
- Cap and trade vs. tax

To Learn More…..

Visit EPA's

Clean Air Markets Division Website at:

http://www.epa.gov/airmarkets/

CLEAN AIR
MARKET PROGRAMS

To Learn a lot More…

Office of Atmospheric Programs: http://epa.gov/air/oap.html

- Clean Air Markets Division: http://epa.gov/airmarkets/
- Climate Change Division: http://epa.gov/air/ccd.html
- Climate Protection Partnership Division: http://epa.gov/cppd/
- Stratospheric Protection Division: http://epa.gov/ozone/