

US EPA ARCHIVE DOCUMENT

# Clean Air Interstate Rule (CAIR)



## Reducing Power Plant Emissions for Cleaner Air, Healthier People, and a Strong America

Office of Air and Radiation  
March 2005



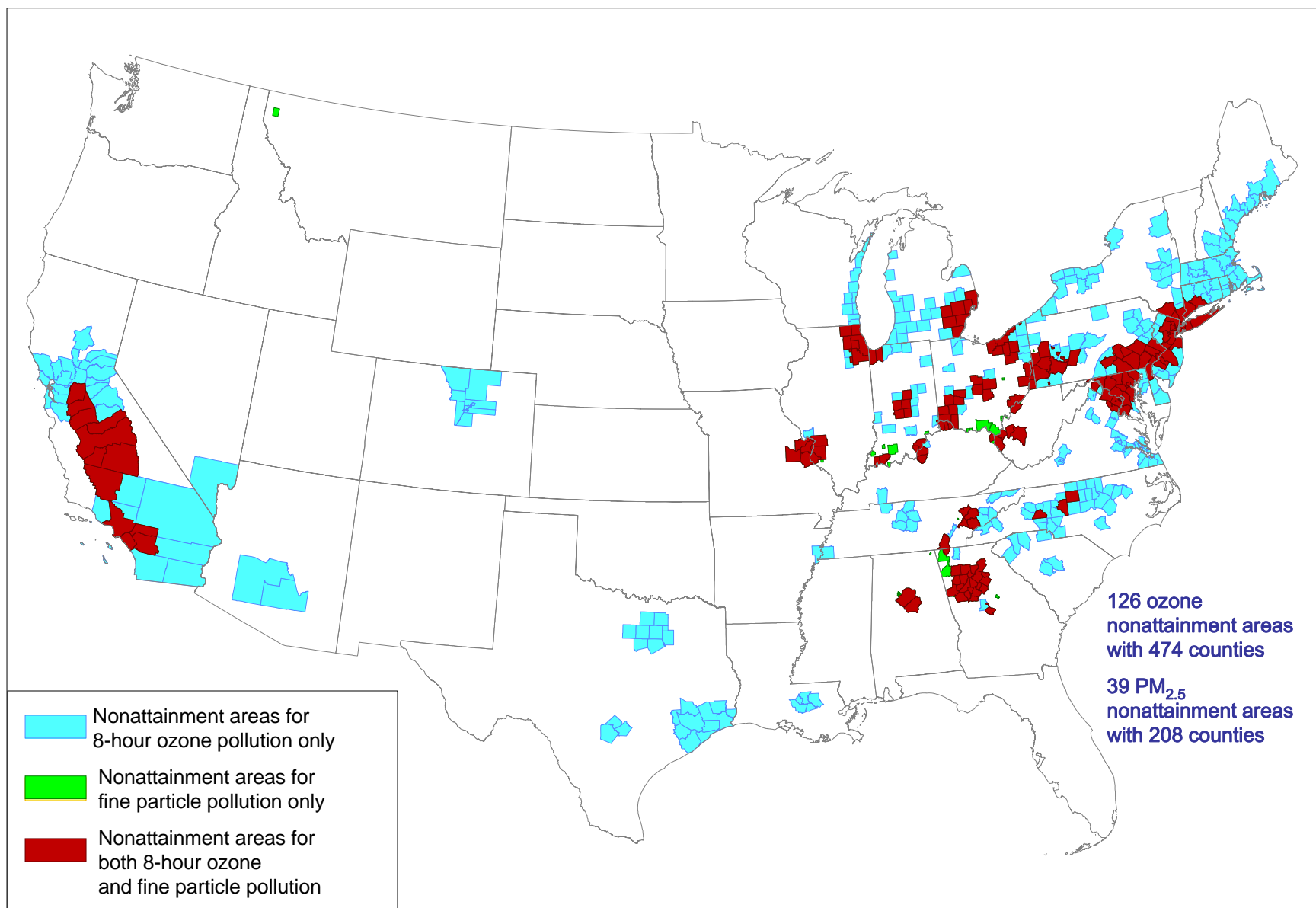
# Benefits of the Clean Air Interstate Rule (CAIR)

- Reduces sulfur dioxide (SO<sub>2</sub>) and nitrogen oxide (NO<sub>x</sub>) emissions which contribute to fine particle pollution (PM<sub>2.5</sub>) and ground level ozone.
- Provides substantial human health and environmental benefits – the largest benefits for any Clean Air Act rule in the last 12 years.
- Helps cities and states in the East meet new, more stringent national ambient air quality standards for ozone and fine particles.
- Emission reductions occur while economic strength is preserved. U.S. maintains both low electricity prices and fuel diversity.

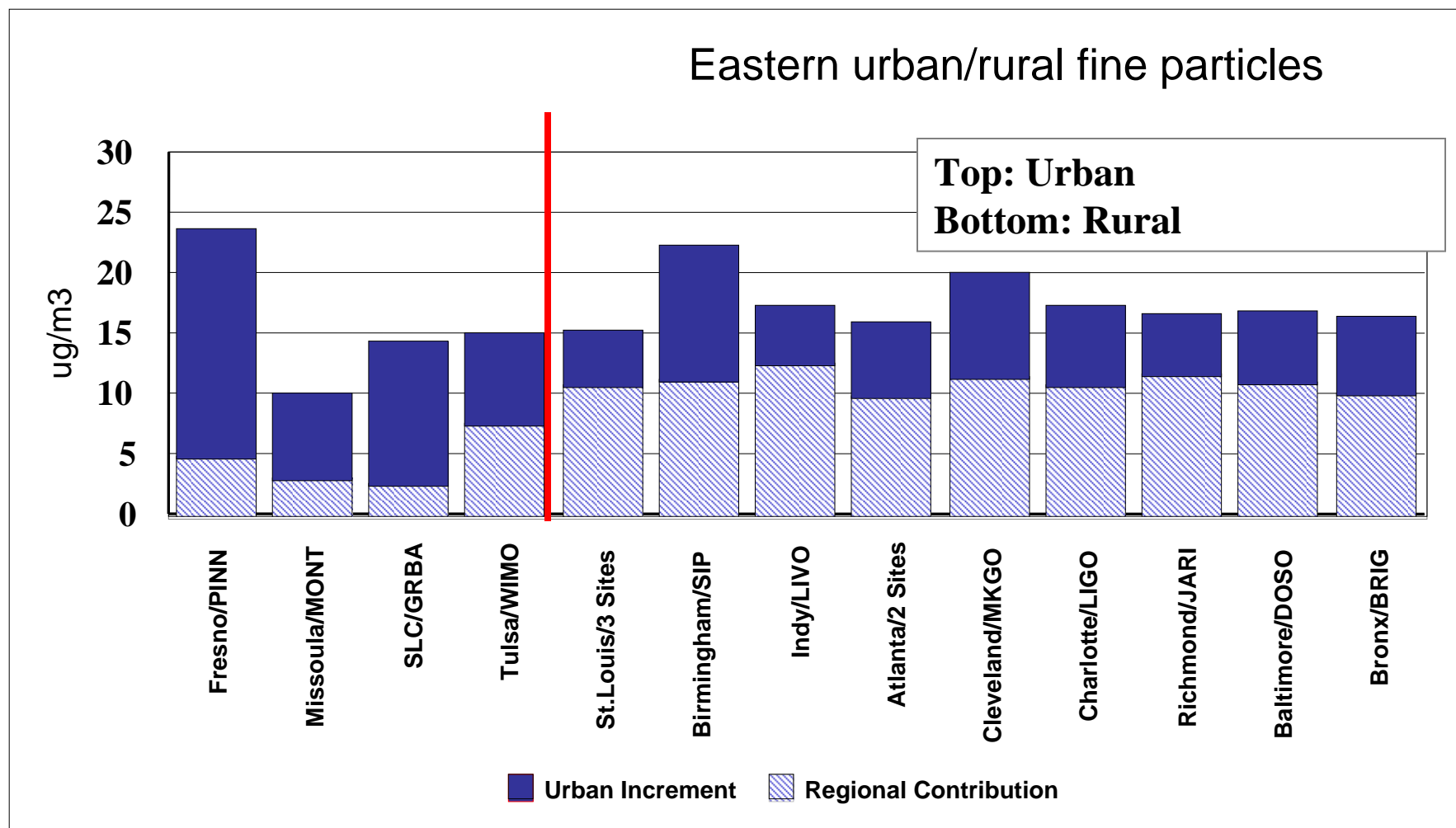
*The most important step EPA can take now to improve air quality.*



## Areas Designated Nonattainment for Ozone and PM<sub>2.5</sub> Standards – April 2005



# In the East, Transport Is a Major Fraction of PM<sub>2.5</sub> and Ozone (not shown)



12-month average PM<sub>2.5</sub> mass from speciation samplers



## Pollutants and Concerns

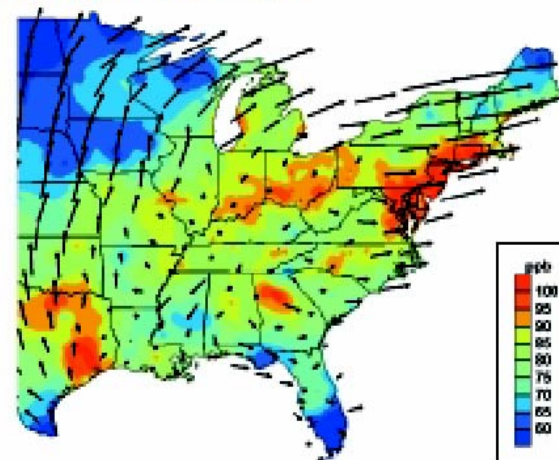
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- Nitrogen Oxides ( $\text{NO}_x$ ) contribute to the formation of  $\text{PM}_{2.5}$  and ground-level ozone.
- Sulfur Dioxide ( $\text{SO}_2$ ) contributes to the formation of  $\text{PM}_{2.5}$ .
- $\text{PM}_{2.5}$  has been linked to premature death, serious illnesses such as chronic bronchitis and heart attacks, and respiratory problems.
- Ozone causes changes in lung function and respiratory symptoms, aggravation of asthma and other respiratory conditions, and may contribute to premature mortality.
- Sulfur deposition acidifies surface waters, damages forest ecosystems and soils, and contributes to decreased visibility.
- Nitrogen deposition acidifies surface waters, damages forest ecosystems and soils, contributes to coastal eutrophication, and impairs visibility.

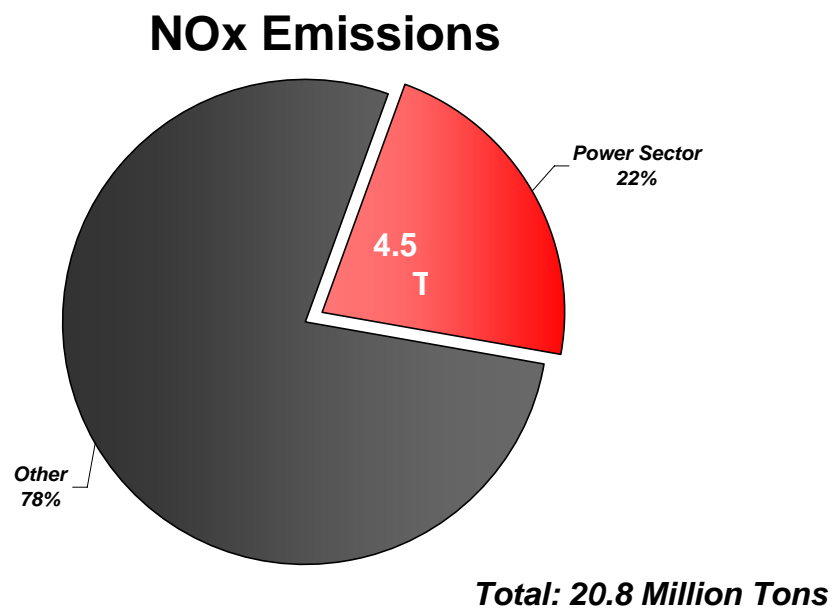
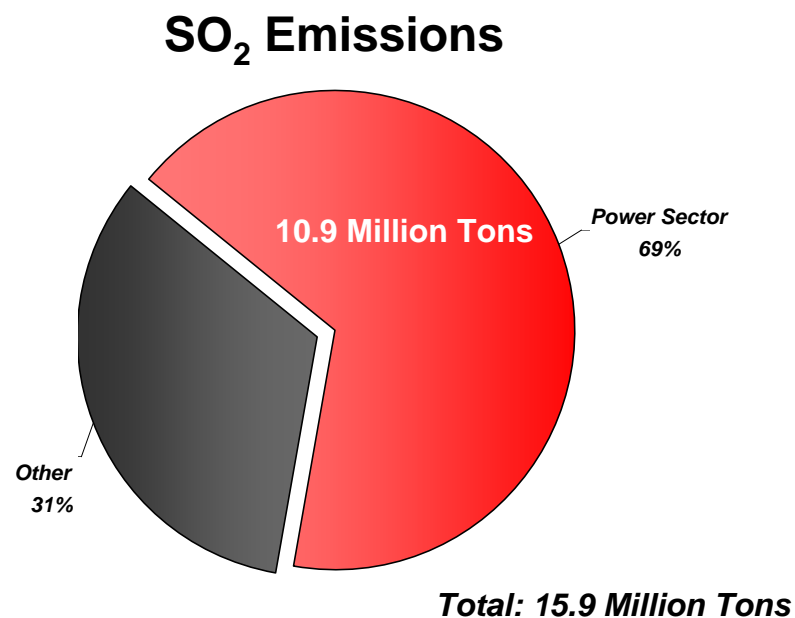
# Long-Range Transport of Air Pollution

- Air pollution can travel hundreds of miles and cause multiple health and environmental problems on regional or national scales.
- Emissions contributing to  $\text{PM}_{2.5}$  and ozone nonattainment often travel across state lines, especially in the eastern U.S.
  - $\text{SO}_2$  and  $\text{NO}_x$ , and other pollutants, contribute to  $\text{PM}_{2.5}$  transport
  - $\text{NO}_x$  and other pollutants contribute to ozone transport.
- Attaining national ambient air quality standards will require some combination of emission reductions from:
  - Sources located in or near nonattainment areas (such as mobile sources) and
  - Sources, such as power plants, located further from the nonattainment area.
- Clean Air Act contains provisions for States and EPA to address interstate pollution transport.
- EPA is also addressing ozone and particle pollution from mobile sources by implementing national fuel and engine standards.

Transport Winds and Ozone Patterns on High Ozone Days



# Electric Power Generation: A Major Source of Emissions



Source: SO<sub>2</sub> and NOx data is from EPA's 2003 National Emissions Inventory. "Other" sources of pollutants include transportation and other mobile sources and industrial sources.



# Two Ways to Address Transported Emissions from Power Plants

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- The President's Clear Skies legislation is the preferred approach to achieving multipollutant emission reductions:
  - Multipollution caps apply to entire country.
  - Legislation can provide more certainty and less complexity.
- Use of existing Clean Air Act authority to address interstate transport of pollution:
  - Until legislation passes, our attainment deadlines and other problems related to power plant emissions demand we act now.
  - CAIR will provide very significant air quality attainment, health, and environmental improvements across the eastern U.S. in a highly cost-effective manner.

# The CAIR Approach

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- Analyze sources of SO<sub>2</sub> (for PM<sub>2.5</sub>) and NO<sub>x</sub> (for PM<sub>2.5</sub> and ozone).
- Determine if a **significant contribution** is projected from individual states on ozone and PM nonattainment in 2010, to define **geographic boundaries** covered by the rule.
- Allow cost-effective approach for regional reductions, propose an **optional cap-and-trade program** similar to current Acid Rain Program for SO<sub>2</sub> (Title IV) and the NO<sub>x</sub> SIP call.
- EPA develops an **emissions budget for each state** based on application of highly effective controls on electric generating units (EGU) in a cap and trade program, that includes all affected states. States have discretion in deciding which sources to control to meet the budget.
- Provide the most timely reductions; propose a **two-phase program** with declining compliance caps for NO<sub>x</sub> in 2009 and 2015, and for SO<sub>2</sub> in 2010 and 2015.

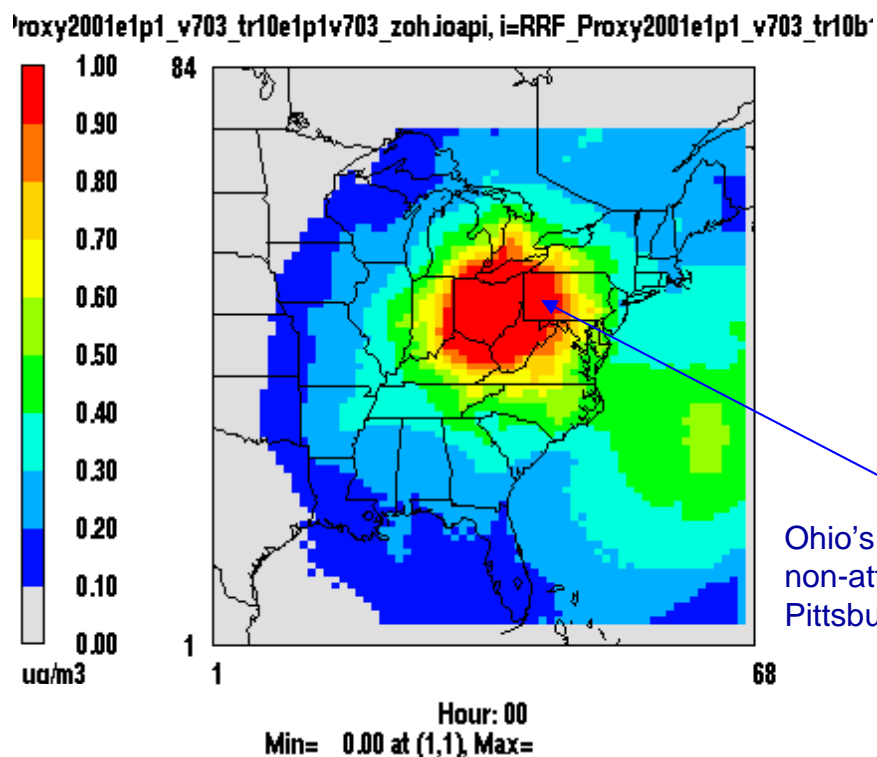
# How EPA Evaluated Significant Air Quality Contributions

Simulated elimination of all anthropogenic SO<sub>2</sub> and NO<sub>x</sub> emissions from Ohio illustrates influence of interstate transport (proposal model example)

## Steps in determining significant transport

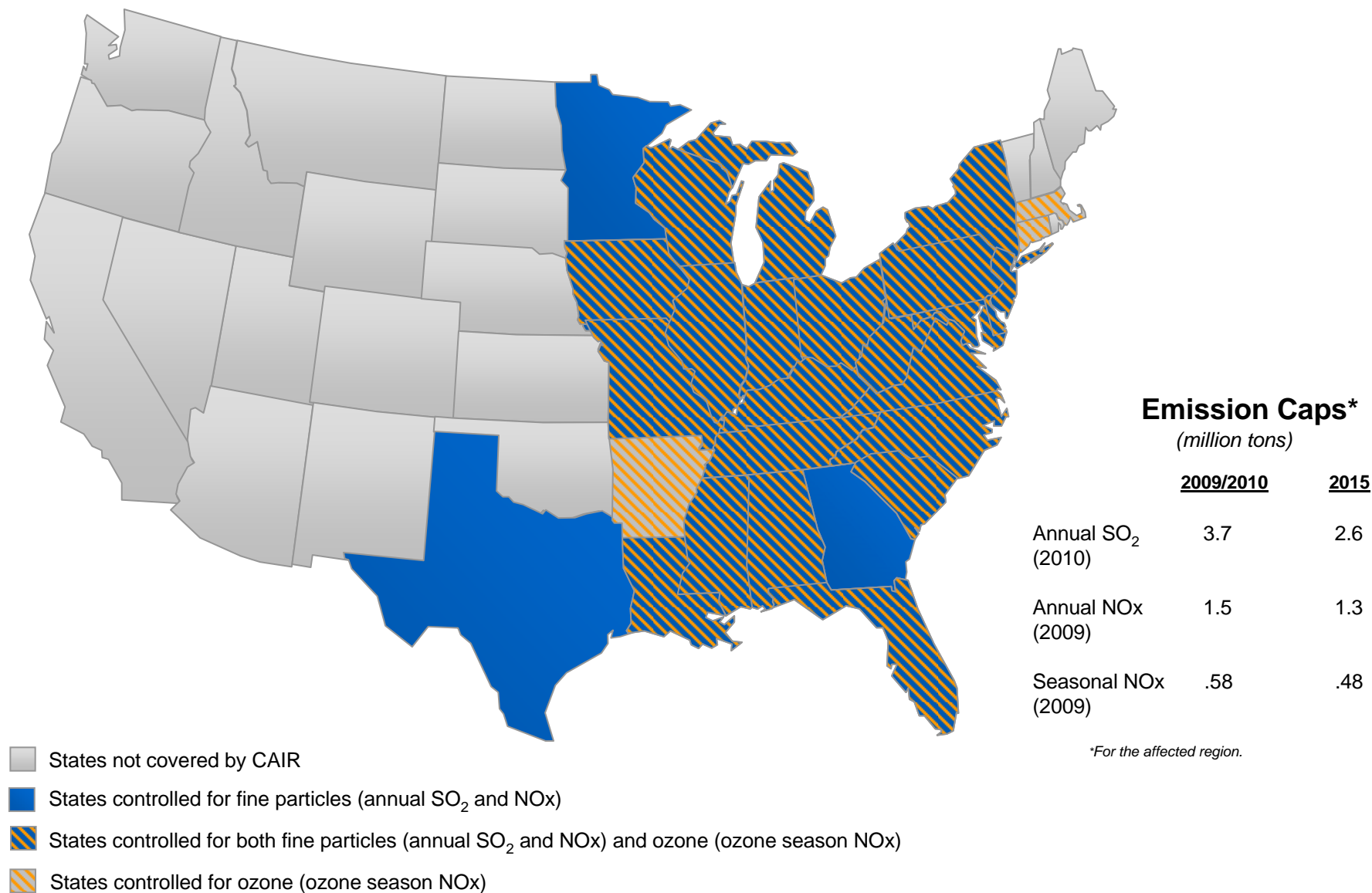
- Forecast areas that would remain nonattainment in 2010 without additional controls
- Zero out upwind states emissions
- Determine contribution to downwind non-attainment
- If >0.2 ug/m<sup>3</sup>, significant

## OH: Impact on PM<sub>2.5</sub> in 2010



Ohio's maximum impact on 2010 non-attainment is 1.67 ug/m<sup>3</sup> in Pittsburgh

# CAIR: Affected Region and Emission Caps



## Key Elements of CAIR

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- **CAIR sets an emission reduction requirement for each State, based on capping power plant emissions collectively at levels that EPA believes are highly cost-effective to achieve.**
- **Provides an optional cap and trade program based on successful Acid Rain and NOx Budget Trading programs as a method to implement the necessary reductions.**
- **Includes a two-phase program with declining power plant emission caps:**
  - **SO<sub>2</sub> annual caps: 3.6 million tons in 2010 and 2.5 million in 2015**
  - **NOx annual caps: 1.5 million tons in 2009 and 1.3 million in 2015**
  - **NOx ozone season caps: 580,000 tons in 2009 and 480,000 tons in 2015**
  - **Emission caps are divided into State SO<sub>2</sub> and NOx budgets.**
- **Allows States flexibility on how to achieve the required reductions, including which sources to control and whether to join the trading program.**

## Cap and Trade Mechanism: Allowance Allocation and Markets

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### EPA ROLE

- Set state budgets
- Establish trading program and market procedures
- Administer tracking systems
- Define allowance allocation parameters

### STATE ROLE

- Identify sources for reduction
- Voluntary trading program
  - Adopt rules/program in 18 months
  - Determine trading program budget
  - Allocate NO<sub>x</sub> allowances (SO<sub>2</sub> already allocated)

- **EPA expects a smooth transition to new trading program**
  - Designed with existing cap and trade programs in mind
  - Reasonable control costs available
  - High number of sources facing different control costs



# CAIR Health and Environmental Benefits: Benefits over 25 Times Greater than Costs

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By 2015, CAIR will result in:

\$85-100 billion in health benefits each year, preventing:

- 17,000 premature deaths
- 22,000 non-fatal heart attacks
- 12,300 hospital admissions
- 1.7 million lost work days
- 500,000 lost school days.

Almost \$2 billion in improved visibility benefits each year.

Other non-monetizable benefits – reductions of mercury emissions, acid rain, nitrification, eutrophication, and more.

In 2015, CAIR will cost about \$3.6 billion a year. Implementation beyond 2015 leads to higher annual benefits and costs.

## CAIR Delivers Considerable Environmental Benefits

In 2015, annual visibility benefits would be almost \$2 billion for improvements in southeastern national parks, such as Great Smoky and Shenandoah, and forests.

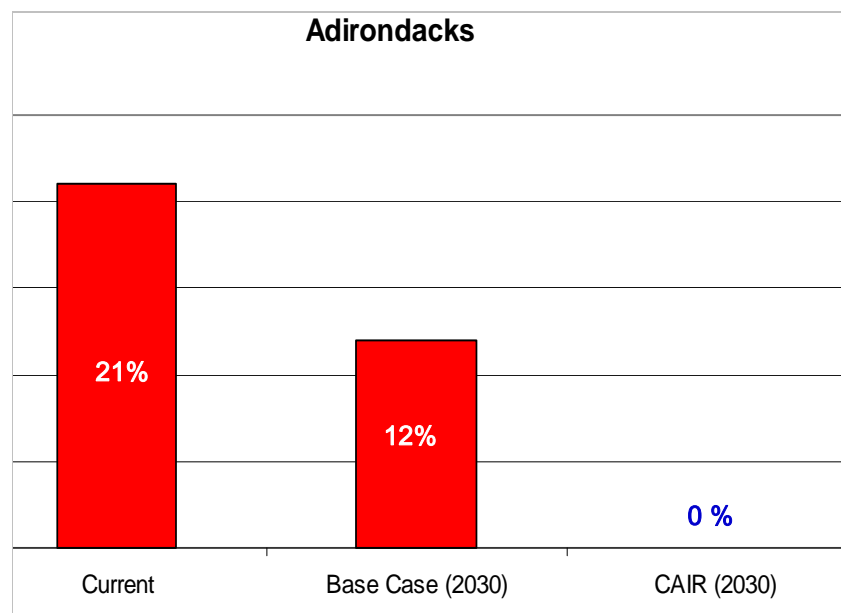
CAIR will reduce the number of acidic lakes — significant regional reductions in sulfur and nitrogen deposition are projected to benefit lakes and streams in the eastern U.S.

**Northeast Region — Chronic acidity would be dramatically reduced by 2030 (only 1% of lakes would remain chronically acidic).\***

**Adirondack Mountains — Eliminates chronic acidity from lakes in the Adirondacks\***

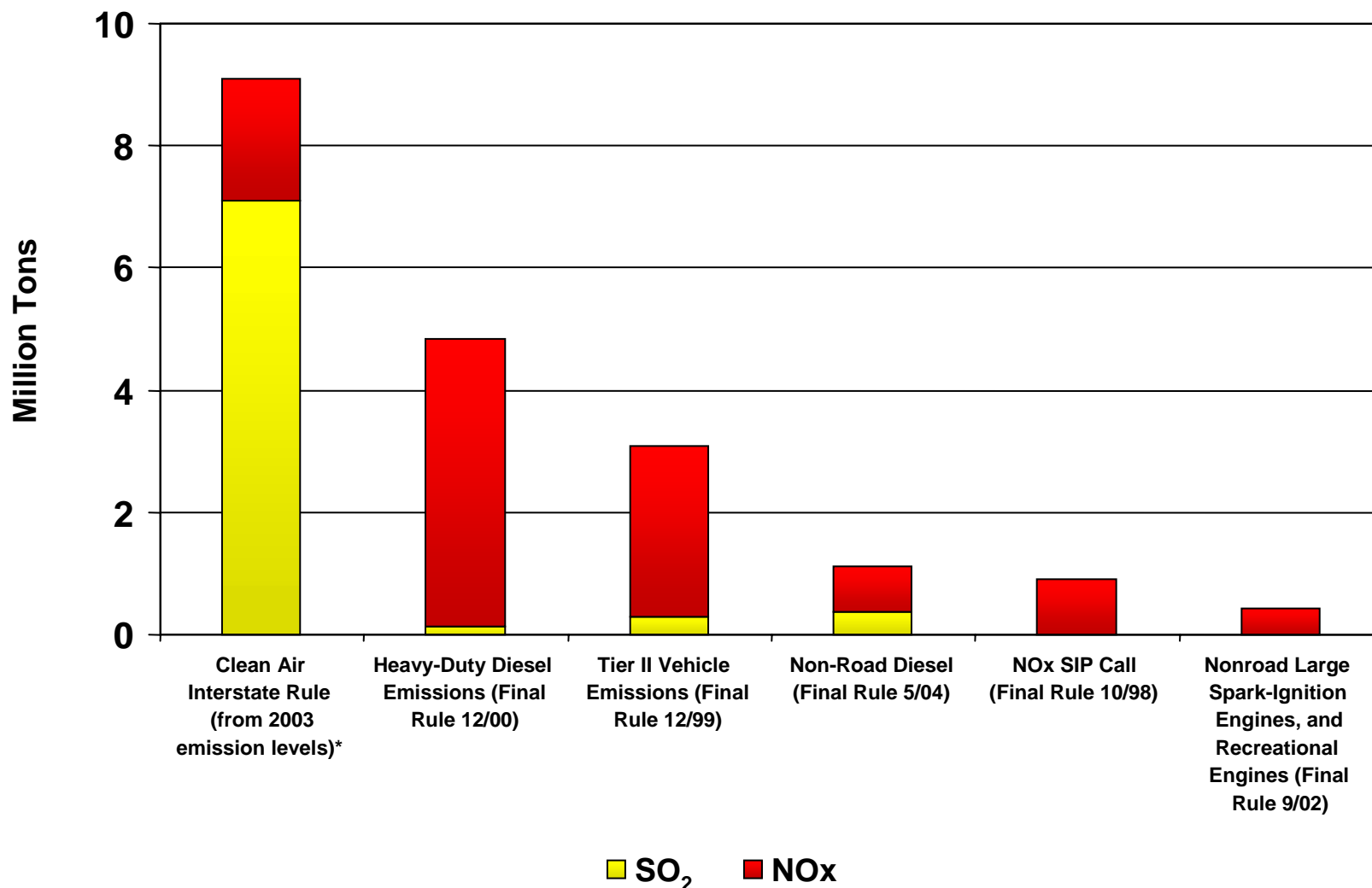
**Southeast Region — Slows the rate of stream acidification.**

**Reductions in nitrogen deposition will benefit sensitive coastal ecosystems.**



\*Note: The figure presents results for chronic acidity only in modeled lakes. As such, model results apply to a subset of lakes in the Adirondacks and cannot be generalized to all waters in that area. These results do not include lakes that experience episodic acidification, or short periods of low Acid Neutralizing Capacity or high acidity, during storms or snowmelt. A significant proportion of Adirondack lakes could still experience episodic acidification at levels potentially harmful to fish and other aquatic species.

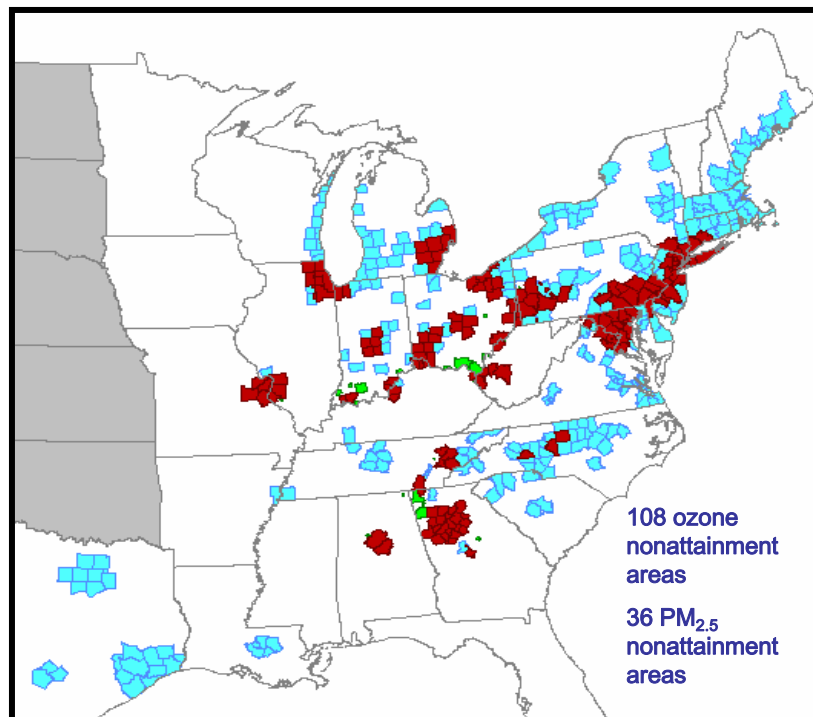
# CAIR and Other Major Air Pollution Rules Since 1990: Annual Emission Reductions at Full Implementation



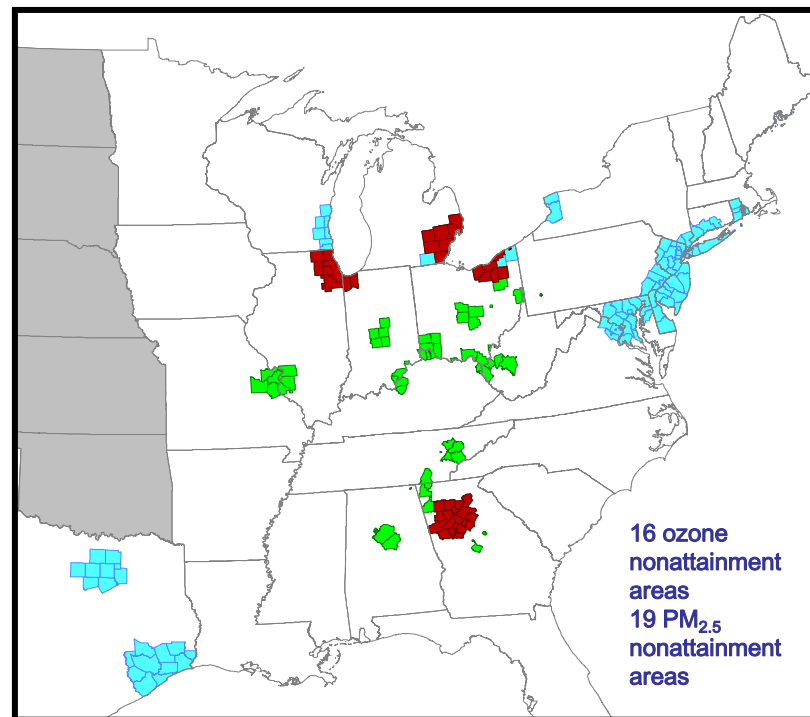
\*These reductions are calculated from 2003 levels and do not reflect the full phase in of the acid rain program. Full implementation for mobile source rules is 2030. Full implementation for the CAIR is between 2020 and 2025.

# Ozone and Particle Pollution: CAIR, together with other Clean Air Programs, Will Bring Cleaner Air to Areas in the East - 2010

**Ozone and Fine Particle Nonattainment Areas (April 2005)**



**Projected Nonattainment Areas in 2010 after Reductions from CAIR and Existing Clean Air Act Programs**

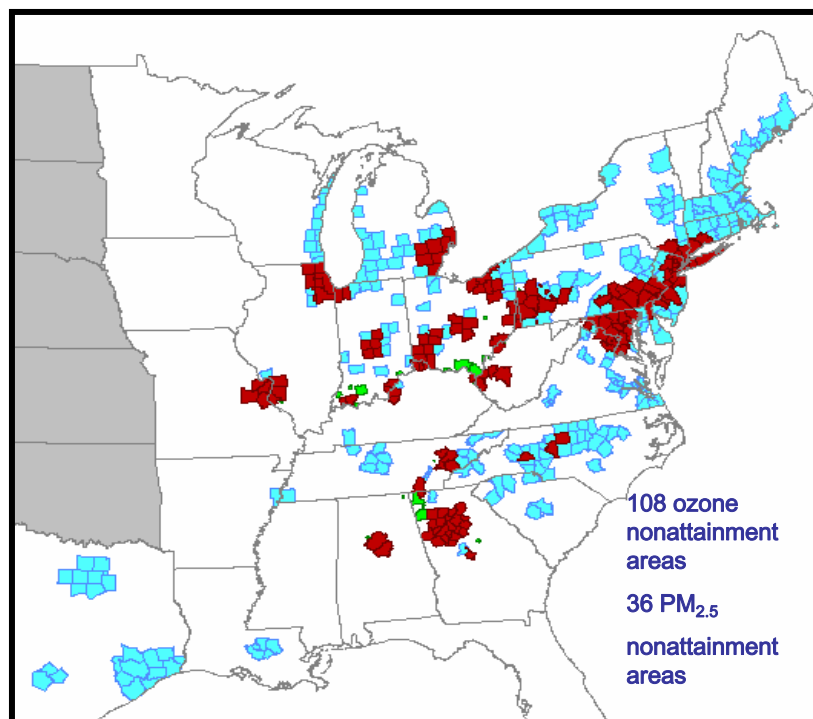


- Nonattainment areas for 8-hour ozone pollution only
- Nonattainment areas for fine particle pollution only .
- Nonattainment areas for both 8-hour ozone and fine particle pollution

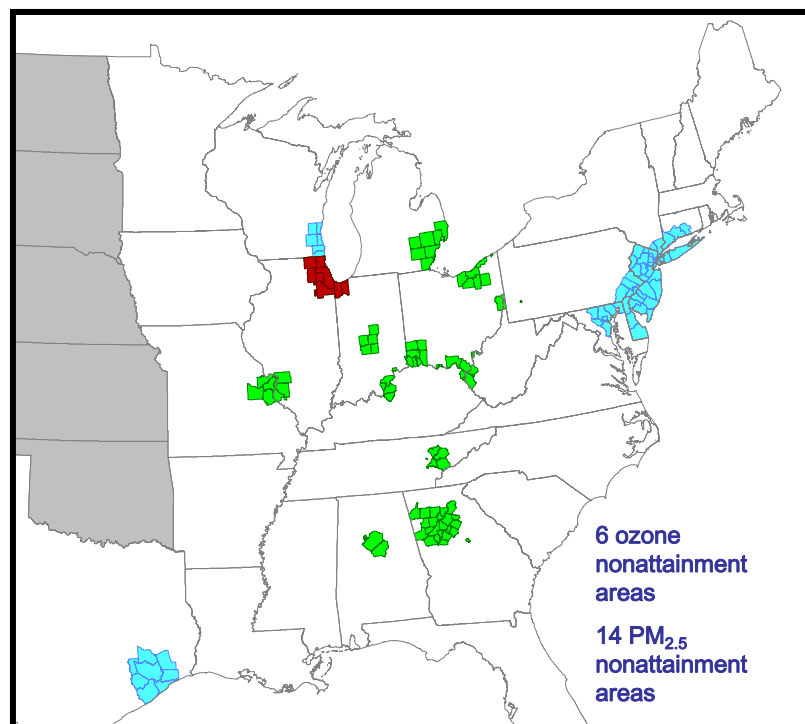
Projections concerning future levels of air pollution in specific geographic locations were estimated using the best scientific models available. They are estimations, however, and should be characterized as such in any description. Actual results may vary significantly if any of the factors that influence air quality differ from the assumed values used in the projections shown here.

# Ozone and Particle Pollution: CAIR, together with other Clean Air Programs, Will Bring Cleaner Air to Areas in the East - 2015

**Ozone and Fine Particle Nonattainment Areas (April 2005)**



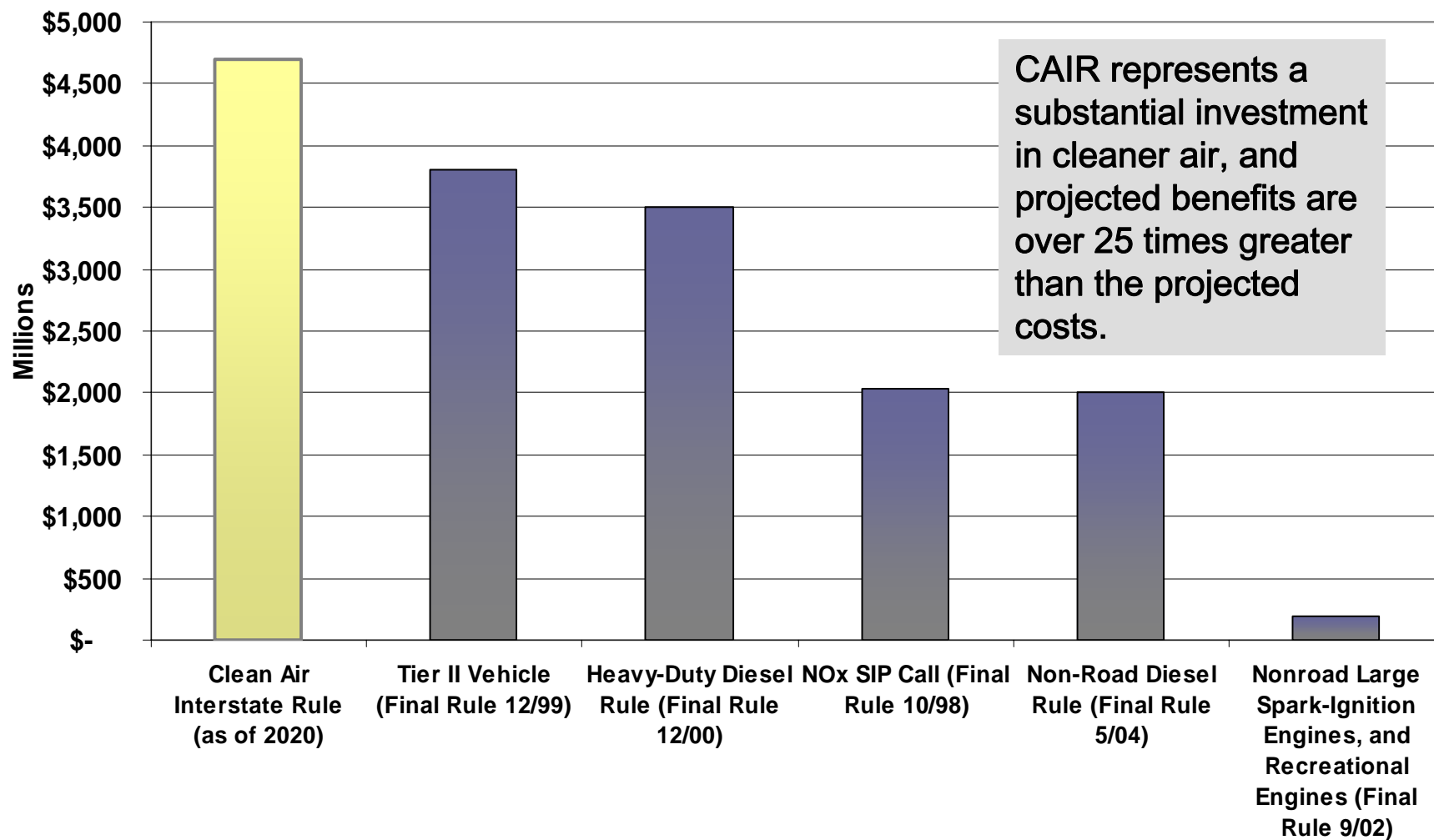
**Projected Nonattainment Areas in 2015 after Reductions from CAIR and Existing Clean Air Act Programs**



- Nonattainment areas for 8-hour ozone pollution only
- Nonattainment areas for fine particle pollution only
- Nonattainment areas for both 8-hour ozone and fine particle pollution

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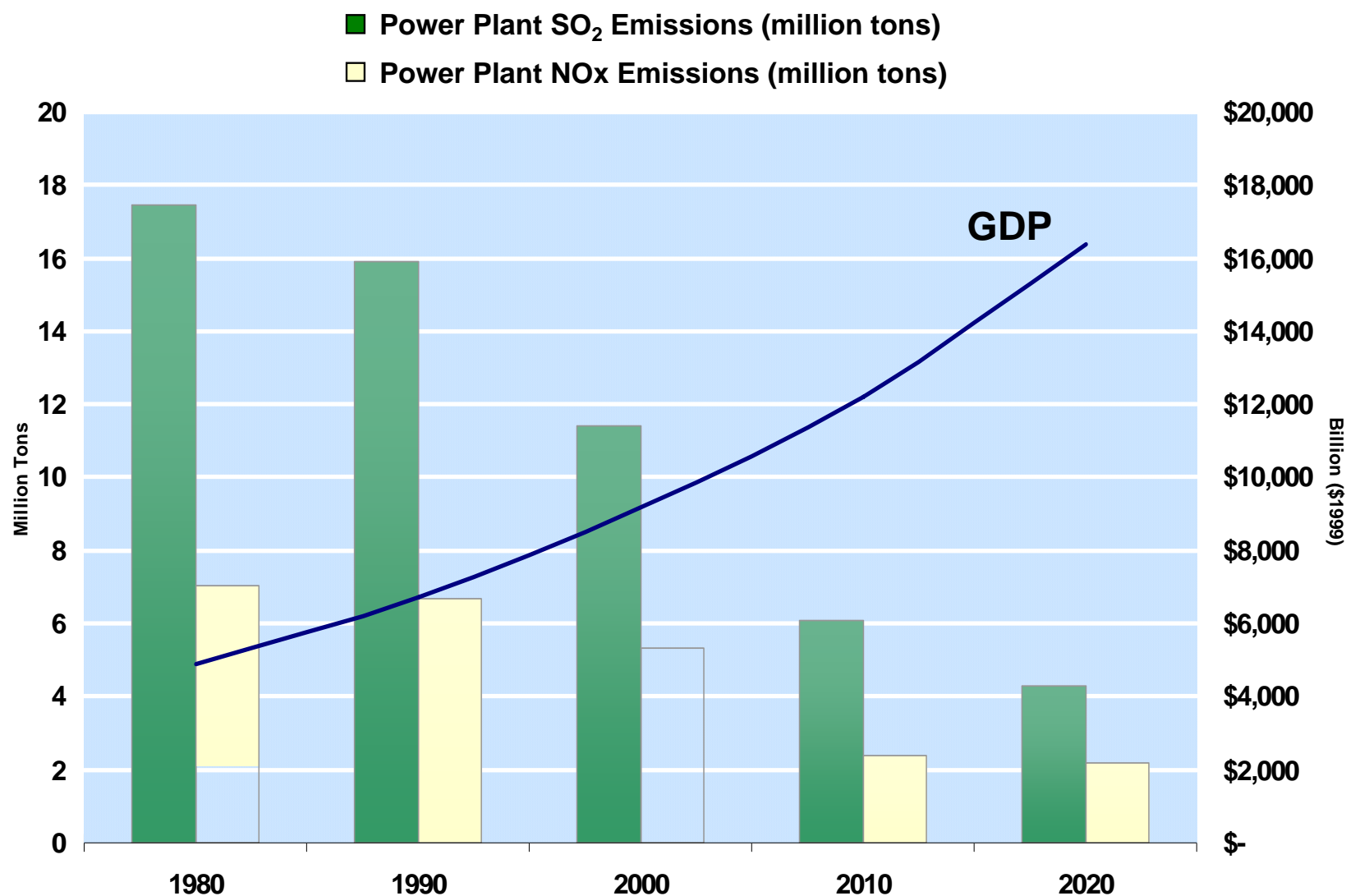
# CAIR and Other Major Air Pollution Rules Since 1990: Annual Private Compliance Costs at Full Implementation



Notes: Annual Costs are EPA projections. NOx SIP Call costs were inflated from 1990 dollars. Full implementation for mobile source rules is 2030.



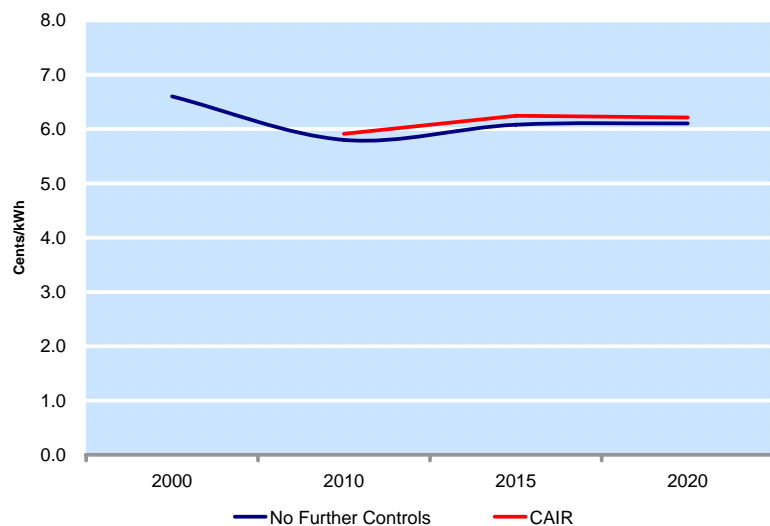
# Economic Growth & Environmental Improvement



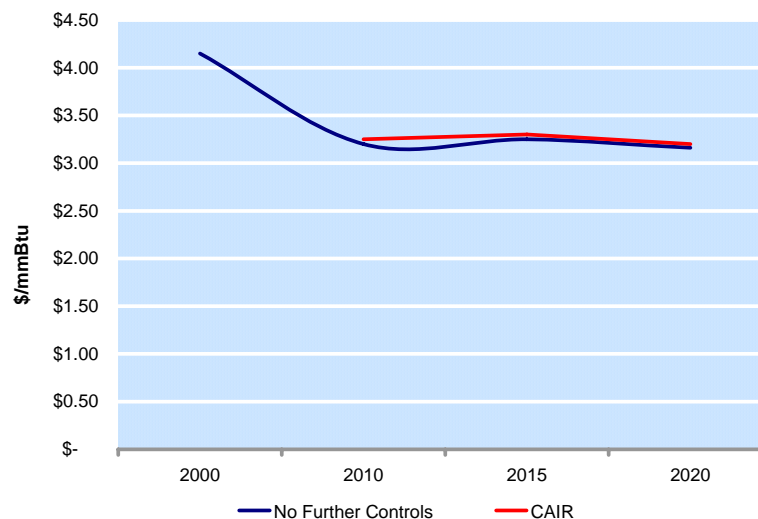
Sources: 1980 - 1999 emissions data are from the National Air Pollutant Emissions Trend Report (EPA, March 2000). Projections for SO<sub>2</sub>, NO<sub>x</sub> and mercury are derived from the Integrated Planning Model (IPM). GDP data for 1980 - 2000 is from the Bureau of Economic Analysis, U.S. Department of Commerce. The GDP projection for 2010 is from OMB's Analytical Perspectives Report for 2003, Table 2-1. The 2010 to 2020 projection follows EIA's assumptions in AEO 2001 of 3% growth per year.

# Other Projected Impacts

## Regional Retail Electricity Prices



## Natural Gas Prices

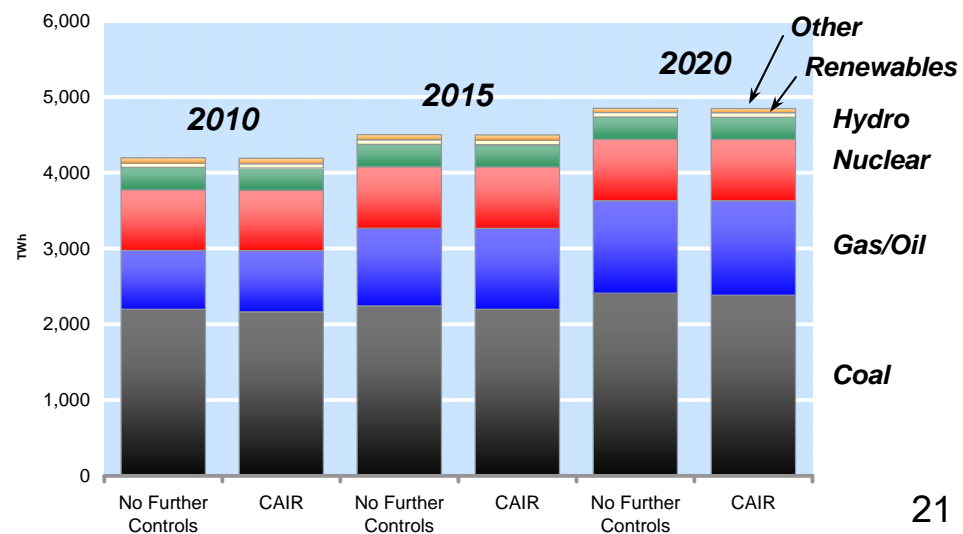


Note: Henry Hub prices

## Coal Production for Electricity Generation (million tons)

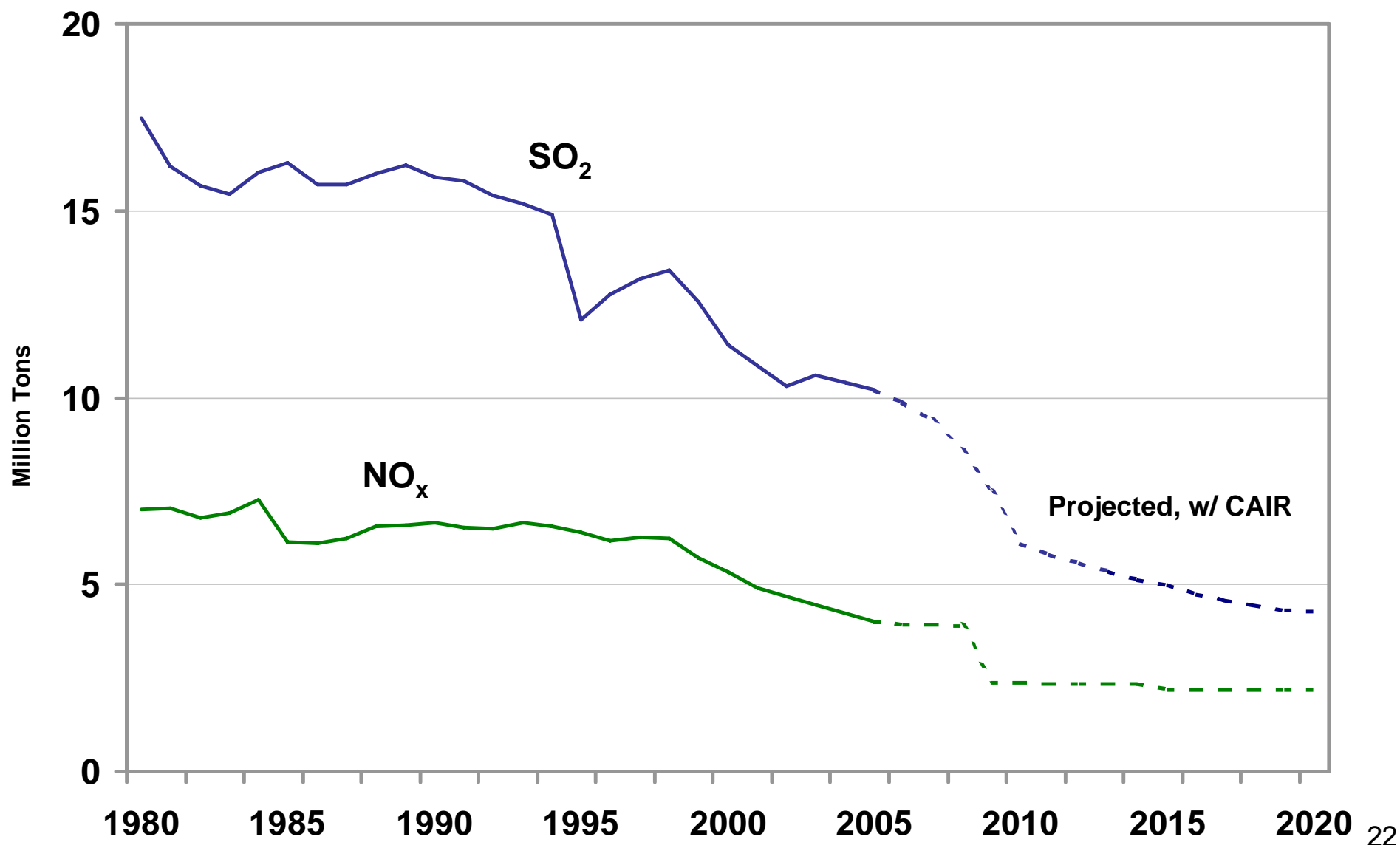
	2000	2003	CAIR	
			2010	2015
Appalachia	299	275	306	306
Interior	131	135	165	191
West	475	526	607	586
National	905	936	1,078	1,083

## Generation Mix



Note: Retail prices for 2000 are from AEO2003. Natural Gas prices for 2000 are from Platts GASdat. All other data is from EPA's Integrated Planning Model.

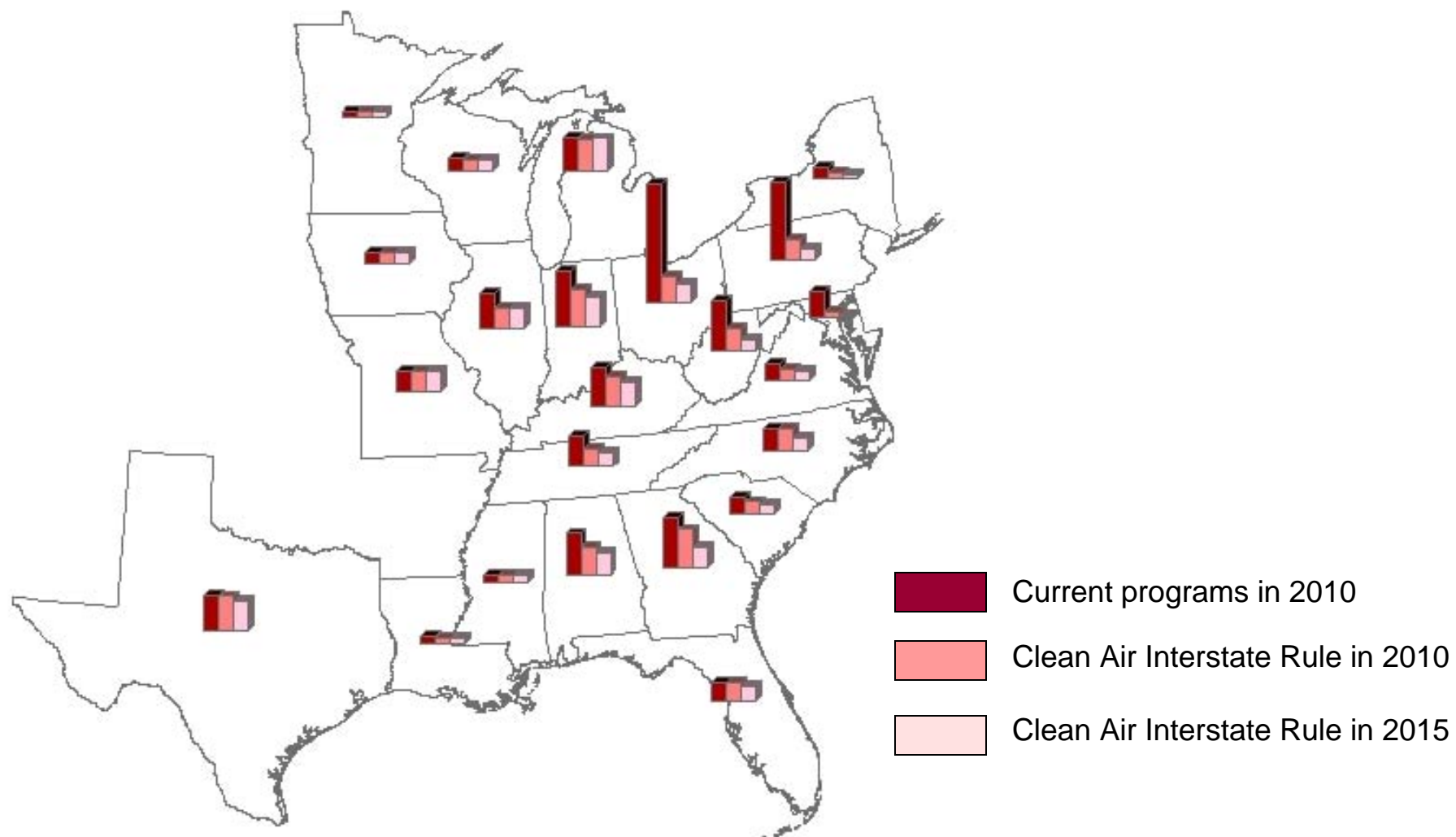
# National NO<sub>x</sub> and SO<sub>2</sub> Power Plant Emissions: Historic and Projected with CAIR



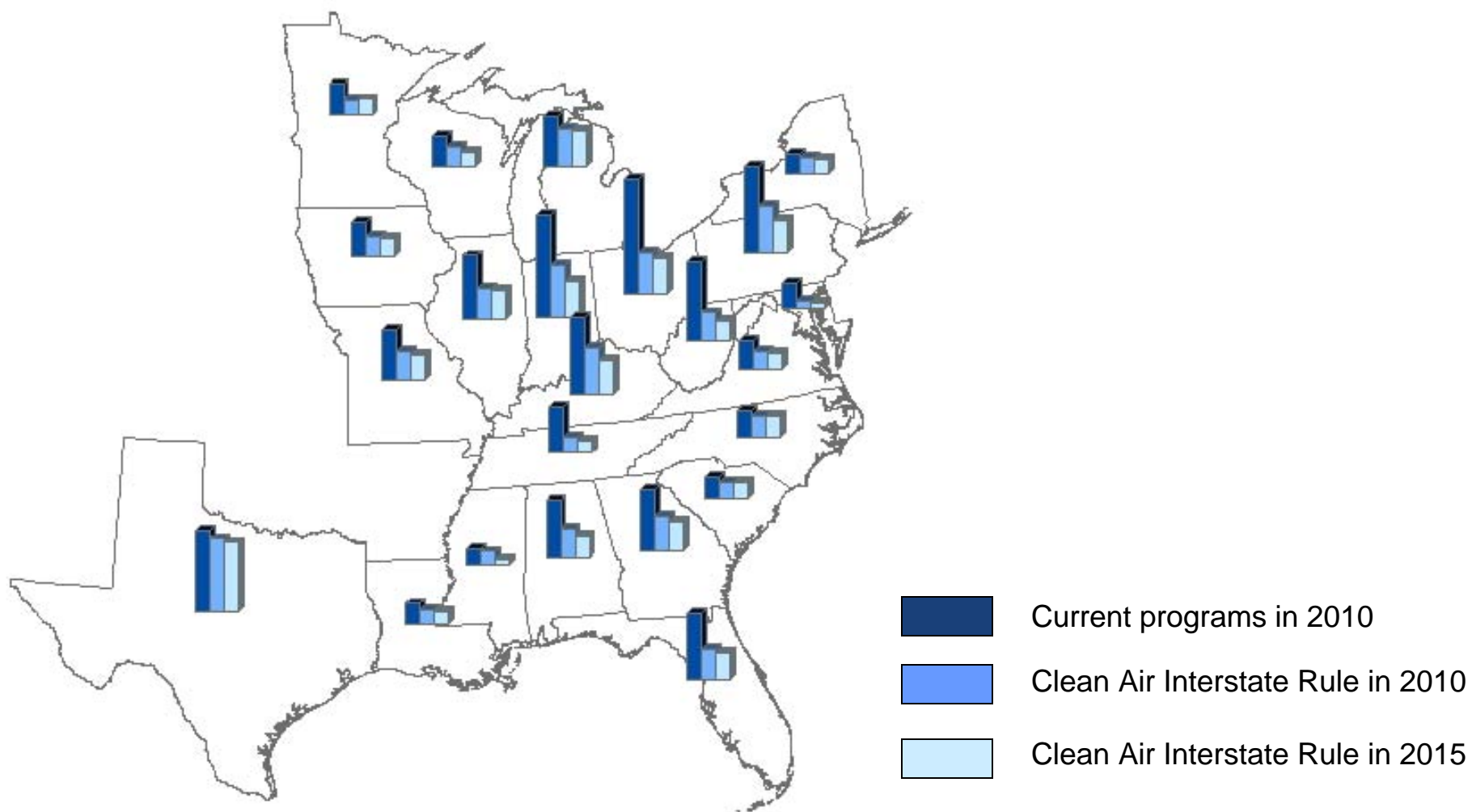
Source: EPA

## Projected Annual SO<sub>2</sub> Emissions for Power Plants Under CAIR

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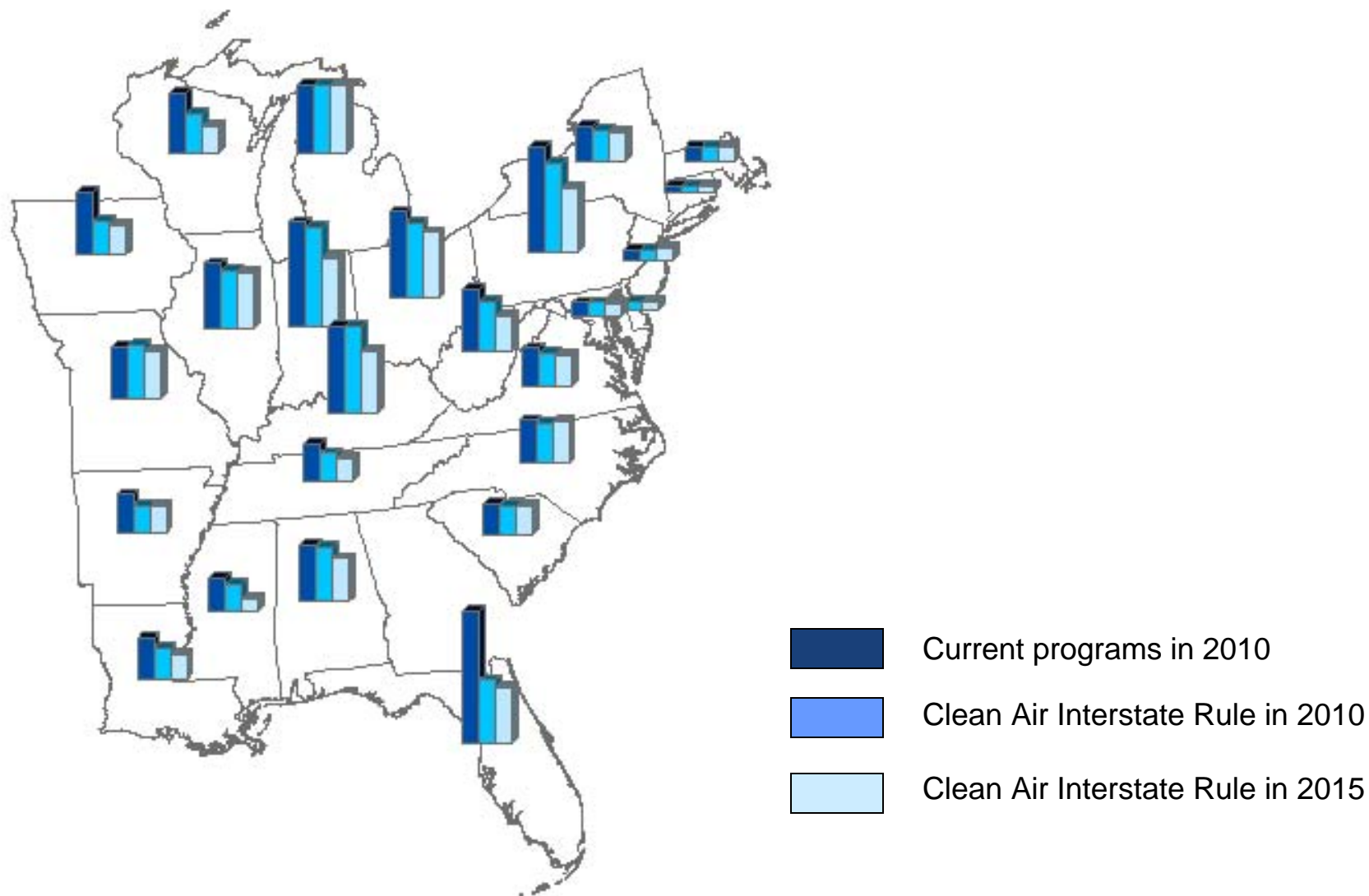


## Projected Annual NO<sub>x</sub> Emissions for Power Plants under CAIR



## Projected Ozone Season NO<sub>x</sub> Emissions for Power Plants under CAIR

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## Summary

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**CAIR will significantly cut emissions of SO<sub>2</sub> and NO<sub>x</sub> from power plants and:**

- Helps cities and States in the East meet new, more stringent national ambient air quality standards (NAAQS) for ozone and fine particles.**
- Guarantees substantial benefits for public health and the environment.**
- Achieves the largest reduction in air pollution in more than a decade (since the highly successful Acid Rain Program).**
- Provides one of the largest investments in pollution control technology in history.**
- Serves as the single most important step to take now to improve air quality in the U.S.**

## To Learn More...

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### Clean Air Interstate Rule

[www.epa.gov/cleanairinterstaterule](http://www.epa.gov/cleanairinterstaterule)