

Cap and Trade:

Acid Rain Program Results



The Acid Rain Program was established under Title IV of the 1990 Clean Air Act Amendments to reduce acid rain and improve public health by dramatically reducing emissions of SO₂ and NO_x. Using a market-based cap and trade approach, the program sets a permanent cap on the total amount of SO₂ that may be emitted by electric power plants nationwide. The cap is set at about one half of the amount of SO₂ emitted in 1980, and the trading component allows flexibility for sources to select the method of compliance. The program also sets NO_x emission limitations for coal-fired units with some compliance flexibility, representing about a 27 percent reduction from 1990 levels.

Background

Acid deposition, more commonly known as acid rain, occurs when emissions of sulfur dioxide (SO₂) and nitrogen oxides (NO_x) react in the atmosphere (along with water, oxygen, and oxidants) to form various acidic compounds. These compounds fall to earth in either a wet form (rain, snow, and fog) or a dry form (gases and particles). The compounds, including small particles such as sulfates and nitrates, have many detrimental effects on human health and the environment. These pollutants impair air quality, damage public health, acidify lakes and streams, harm sensitive forest and coastal ecosystems, degrade visibility, and accelerate the decay of building materials and cultural artifacts nationwide.

Cap and trade programs are designed to reduce emissions of numerous polluting sources by significant amounts over large geographic areas. The cap and trade mechanism does not replace the requirement to meet the National Ambient Air Quality Standards at the local level, but rather helps achieve the standards through significant reductions in background pollution often transported across state boundaries. Thus, state and local governments continue to have the obligation and the authority under the Clean Air Act to assure that the National Ambient Air Quality Standards are met.

Results

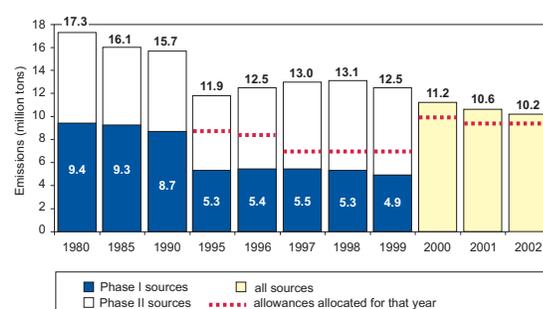
The Acid Rain Program has produced remarkable and demonstrable results. It has reduced SO₂ emissions faster and at far lower costs than anticipated, yielding wide-ranging health and environmental improvements. In fact, a 2003 Office of Management and Budget (OMB) study found that the Acid Rain Program accounted for the largest quantified human health benefits – over \$70 billion annually – of any major federal regulatory program implemented in the last 10 years, with benefits exceeding costs by more than 40:1.

Emission Reductions. In 2002, SO₂ emissions from power plants were 9% lower than the year 2000 and

41% lower than 1980. NO_x emissions from power plants also continue a downward trend, posting a 13% reduction in 2002 from 2000 levels and a 33% decline from 1990 levels.

Air Quality. The Acid Rain Program has reduced human exposure to pollutants that are known to cause chronic bronchitis, asthma, hospitalizations for cardiac and respiratory diseases, and premature death. Ambient concentrations of SO₂ have decreased by as much as 40% since 1990 in the Northeast and Mid-Atlantic. Sulfate concentrations, a major component of fine particulate matter and regional haze, are as much as 30% lower than 1990 levels in most areas of the East.

SO₂ Emissions under the Acid Rain Program



SO₂ emissions have decreased 5.5 million tons from 1990 levels and more than 7 million tons from 1980.

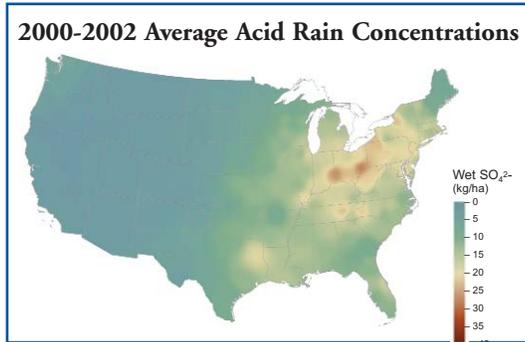
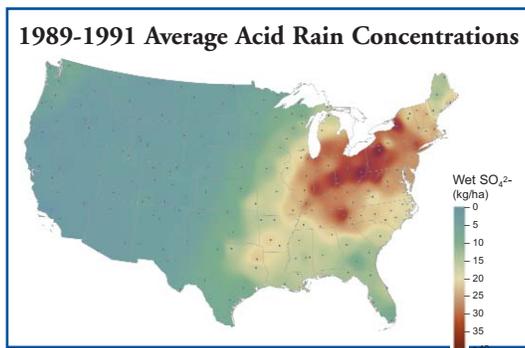
Source: EPA

Environmental Improvements. Acid deposition has been substantially reduced, particularly in the Northeast, allowing lakes and streams to begin recovering from decades of harm from acid rain. Wet sulfate deposition, a major component of acid rain, is 25-50% lower than 1990 levels in most areas of the Northeast and Midwest. The ability of some lakes and streams to buffer acid deposition is improving in the Northeast, including the Adirondacks, a sign that recovery has begun.

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Independent analyses have shown that emissions trading has not resulted in localized high emissions. The Environmental Law Institute, Environmental Defense, and MIT's Center for Energy and Environmental Policy Research have all examined emissions trading under the Acid Rain Program, and all have concluded that the program has not resulted in geographic shifting of emissions due to trading, sometimes referred to as "hot spots." To the contrary, the highest emitting sources have tended to reduce emissions by the greatest amount. Resources for the Future also conducted a similar analysis that modeled air quality and health benefits and drew similar conclusions. This is partly because trading occurs under a nationwide cap that represents a reduction in total emissions and improvements in regional air quality. The Agency agrees that ongoing evaluation of local emission impacts under cap and trade programs is important.



Monitors show significant decreases in wet sulfate deposition in the Eastern U. S. Source: NADP

Compliance. Compliance with the program has been consistently and extraordinarily high (over 99%). Stringent, automatic penalties provide a strong incentive for compliance and require that any excess emissions are offset.

Costs. The cost of compliance with the Acid Rain Program has been substantially lower than estimated. Achievement of the required SO₂ emission reductions (when the program is fully implemented in 2010) is now projected to cost \$1 to \$2 billion per year, just one quarter of original EPA estimates. The price of an allowance, which is the marginal cost of compliance, has been far lower than prices predicted in 1990.

The environmental results observed under the Acid Rain Program show that the combination of a stringent emissions cap with trading results in substantial reductions throughout the affected region, with the greatest reductions achieved in the areas of highest pollution.

Data and Emissions Monitoring. Each source affected is required by the program to install continuous emissions monitoring systems to accurately measure emissions. Hourly data is required to be submitted to EPA each quarter. An enhanced auditing system launched in 2002 provides additional assurance of continued high quality emissions data. The result is accurate, consistent, complete emissions data readily available to the public, sources, and other stakeholders. Additionally, environmental monitoring networks, such as the National Atmospheric Deposition Program (NADP) and the Clean Air Status and Trends network (CASTNET), measure wet and dry deposition and track the impact of emissions reductions on air quality, deposition and water quality across the country. Already, significant environmental results have been documented. The Acid Rain Program's rigorous emissions monitoring and reporting requirements ensure complete accountability, resulting in high quality, completely transparent emissions inventory information. Source emissions, air quality, and deposition data, as well as allowance trading information and annual reports, are available online at www.epa.gov/airmarkets.

Innovations and Incentives. Allowance trading, which places a value on emission reductions, provides an increasing reward for innovation and use of more effective and efficient pollution reducing technologies. Acid Rain Program implementation has been accompanied by reduced costs and improved performance of pollution control technologies, which have led to lower than expected overall program compliance costs.

Next Steps

Nearly ten years of experience with the Acid Rain Program has clearly demonstrated that market-based cap and trade programs are an effective vehicle for achieving broad improvements in air quality by reducing emissions of a regionally transported air pollutant. The environmental results observed under the Acid Rain Program show that the combination of a stringent emissions cap with trading results in substantial reductions throughout the affected region, with the greatest reductions achieved in the areas of highest pollution.

Although these programs have proven highly effective at reducing pollution, recent studies suggest further reductions of SO₂ and NO_x are needed. Improved understanding of complex environmental processes are likely to inform further reduction requirements. The success of the Acid Rain Program has informed development of

other programs including the OTC NO_x Budget Program and various state cap and trade programs to address a range of air quality concerns. Pending national multi-pollutant reduction legislation and proposed regulations would employ the same cap and trade mechanism to further reduce emissions of SO₂ and NO_x, as well as emissions of mercury. Application of the core principles of a cap and trade program are expected to have similarly favorable results for further protection of human health and the environment.