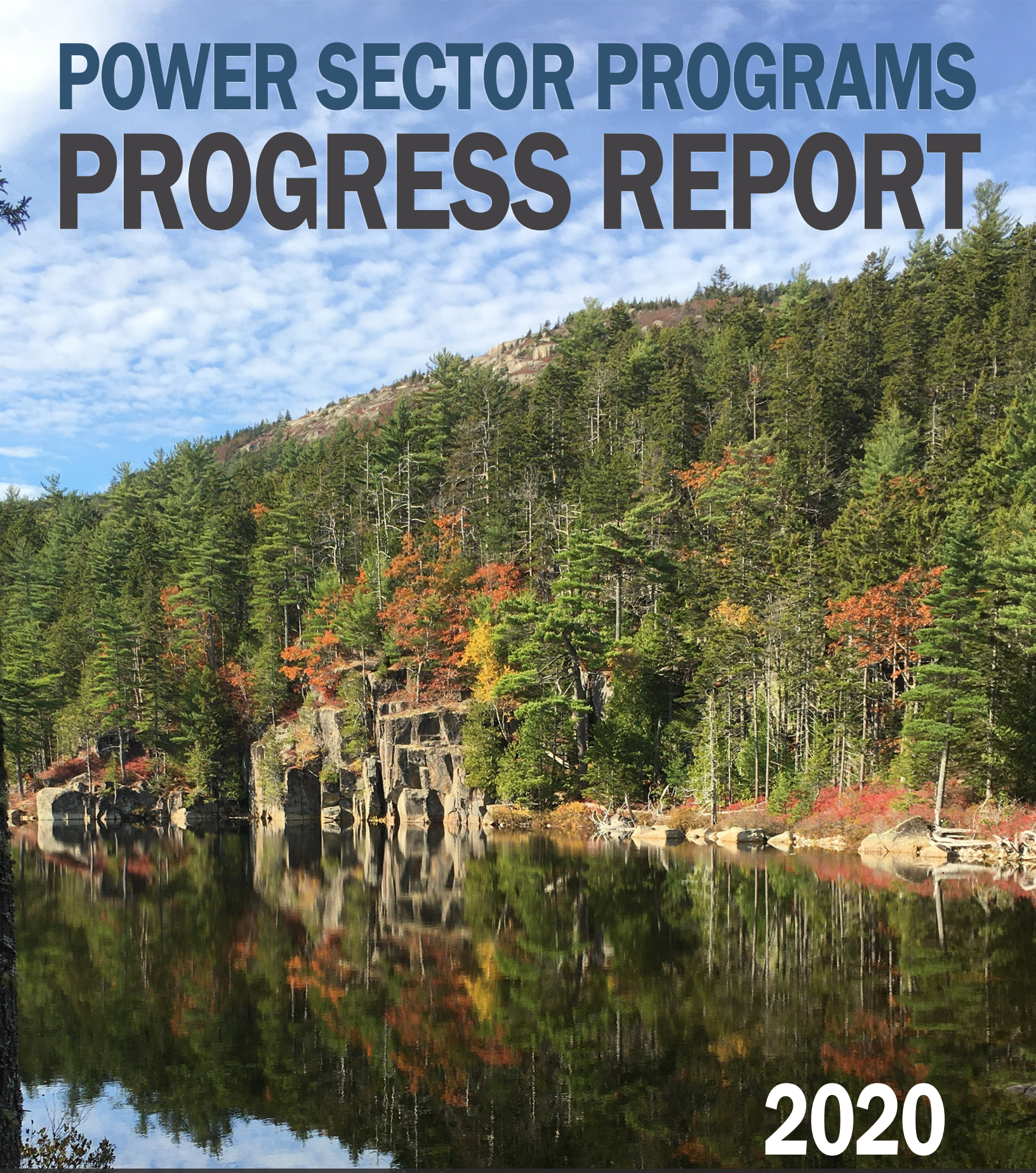
POWER SECTOR PROGRAMS
PROGRESS REPORT



2020

- Program Basics
- Emission Controls & Monitoring
- Affected Units
- Program Compliance
- Emission Reductions
- Market Activity

Photo: Allison Herreid, UNH

Executive Summary

Under the Clean Air Act, EPA implements several regulations that affect power plants, including the Acid Rain Program (ARP), the Cross-State Air Pollution Rule (CSAPR), the CSAPR Update, and the Mercury and Air Toxics Standards (MATS). These programs require fossil fuel-fired electric generating units to reduce emissions of sulfur dioxide (SO_2), nitrogen oxides (NO_X), and hazardous air pollutants including mercury (Hg) to protect human health and the environment. This reporting year marks the sixth year of CSAPR implementation, the fourth year of the CSAPR Update implementation, the twenty-sixth year of the ARP, and the fourth year of MATS implementation in which the majority of sources were required to report emissions for the full year. This report summarizes annual progress through 2020, highlighting data that EPA systematically collects on emissions for all four programs and on compliance for the ARP and CSAPR. Transparency and data availability are a hallmark of these programs and a cornerstone of their success.

SO_2, NO_X, and hazardous air pollutants (HAPs), including mercury, are fossil fuel combustion byproducts that affect public health and the environment. SO_2 and NO_X, and their sulfate and nitrate byproducts, are transported downwind and deposited as acid rain at levels harmful to sensitive ecosystems in many areas of the country. These pollutants also contribute to the formation of fine particles (sulfates and nitrates) and ground-level ozone that are associated with significant human health effects and regional haze. Atmospheric mercury deposition accumulates in fish to levels of concern for human health and the health of fish-eating wildlife.

The ARP, CSAPR, CSAPR Update, and MATS have delivered substantial reductions in power sector emissions of SO_2, NO_X, and hazardous air pollutants, along with significant improvements in air quality and the environment. In addition to the requirements of the power sector emission control programs described in this report, a variety of power industry trends have contributed to further declines of SO_2, NO_X, and hazardous air pollutant emissions.

EPA data in this report are current as of May 2021 and may differ from past or future reports as a result of resubmissions by sources and ongoing data quality assurance activities.

2020 ARP, CSAPR, and MATS at a Glance

- **Annual SO_2 emissions:**
  CSAPR – 497 thousand tons (94 percent below 2005)
  ARP – 778 thousand tons (95 percent below 1990)
- **Annual NO_X emissions:**
  CSAPR – 405 thousand tons (81 percent below 2005)
  ARP – 721 thousand tons (86 percent below 2000)
- **CSAPR ozone season NO_X emissions:** 232 thousand tons (49 percent below 2015)
- **Compliance:** 100 percent compliance for power plants in the market-based ARP and CSAPR allowance trading programs

- **Emissions reported under MATS:**
  Mercury – 2.6 tons (91 percent below 2010)

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Chapter 1: Program Basics

The Acid Rain Program (ARP), the Cross-State Air Pollution Rule (CSAPR), and the CSAPR Update are implemented through cap and trade programs designed to reduce emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_X) from power plants. Established under Title IV of the 1990 Clean Air Act Amendments, the ARP was a landmark nationwide cap and trade program, with a goal of reducing the emissions that cause acid rain. The undisputed success of the program in achieving significant emission reductions in a cost-effective manner led to the application of the market-based cap and trade tool for other regional environmental problems, namely interstate air pollution transport, or pollution from upwind emission sources that impacts air quality in downwind areas. The interstate transport of pollution can make it difficult for downwind states to meet health-based air quality standards for regional pollutants, particularly fine particulates ($PM_{2.5}$) and ozone. EPA first employed trading to address regional pollution in the NO_X Budget Trading Program (NBP), which helped northeastern states address the interstate transport of NO_X emissions causing ozone pollution in northeastern states. Next, the NBP was effectively replaced by the ozone season NO_X program under the Clean Air Interstate Rule (CAIR), which required further summertime NO_X emission reductions from the power sector, and also required annual reductions of NO_X and SO_2 emissions to address $PM_{2.5}$ transport. In response to a court decision on CAIR, CSAPR replaced CAIR beginning in 2015 and continued to reduce annual SO_2 and NO_X emissions, as well as ozone season NO_X emissions, to facilitate attainment of the $PM_{2.5}$ and ozone National Ambient Air Quality Standard (NAAQS). Most recently, implementation of the CSAPR Update began in 2017. The CSAPR Update further reduces ozone season NO_X emissions to help states attain and maintain a newer ozone NAAQS established in 2008.

The Mercury and Air Toxics Standards (MATS) set limits on emissions of hazardous air pollutants from power plants. EPA published the final standards in February 2012, and the compliance requirements generally went into effect in April 2015, with extensions for some plants until April 2016 and a small number until April 2017. As such, 2020 is the fourth full year for which most sources covered by MATS have reported emissions data to the EPA.

Highlights

Acid Rain Program (ARP): 1995 - present

- The ARP began in 1995 and covers fossil fuel-fired power plants across the contiguous United States. The ARP was established under Title IV of the 1990 Clean Air Act Amendments and is designed to reduce SO_2 and NO_X emissions, the primary precursors of acid rain.
- The ARP's market-based SO_2 cap and trade program sets an annual cap on the total amount of SO_2 that may be emitted by electricity generating units (EGUs) throughout the contiguous U.S. The final annual SO_2 emissions cap was set at 8.95 million tons in 2010, a level of about one-half of the emissions from the power sector in 1980.

- NO_X reductions under the ARP are achieved through a rate-based approach that applies to a subset of coal-fired EGUs.

Cross-State Air Pollution Rule (CSAPR): 2015 - present

- CSAPR addresses regional interstate transport of fine particle ($PM_{2.5}$) and ozone pollution for the 1997 ozone and $PM_{2.5}$ NAAQS and the 2006 $PM_{2.5}$ NAAQS. In 2015, CSAPR required a total of 28 eastern states to reduce SO_2 emissions, annual NO_X emissions, and/or ozone season NO_X emissions. Specifically, CSAPR required reductions in annual emissions of SO_2 and NO_X from power plants in 23 eastern states and reductions of NO_X emissions during the ozone season from power plants in 25 eastern states.
- CSAPR includes four separate cap and trade programs to achieve these reductions: the CSAPR SO_2 Group 1 and Group 2 trading programs, the CSAPR NO_X Annual trading program, and the CSAPR NO_X Ozone Season Group 1 trading program.

Cross-State Air Pollution Rule Update (CSAPR Update): 2017 - present

- The CSAPR Update was developed to address regional interstate transport for the 2008 ozone NAAQS and to respond to the July 2015 court remand of certain CSAPR ozone season requirements.
- As of May 2017, the CSAPR Update began further reducing ozone season NO_X emissions from power plants in 22 states in the eastern U.S.
- The CSAPR Update achieves these reductions through the CSAPR NO_X Ozone Season Group 2 trading program.

CSAPR and CSAPR Update Budgets

- The total CSAPR and CSAPR Update budget for each of the five trading programs equals the sum of the individual state budgets for those states affected by each program. In 2017, some original CSAPR budgets tightened, particularly in the SO_2 Group 1 program. Also, the CSAPR Update replaced the original CSAPR ozone season NO_X program for most states. The total budget for each program was set at the following level in 2020:
    - SO_2 Group 1 – 1,372,631 tons
    - SO_2 Group 2 – 597,579 tons
    - NO_X Annual – 1,069,256 tons
    - NO_X Ozone Season Group 1 – 24,041 tons[1]
    - NO_X Ozone Season Group 2 – 313,626 tons

[1] Since the start of CSAPR Update in 2017, the CSAPR NO_X Ozone Season Group 1 program applies only to sources in Georgia.

Revised Cross-State Air Pollution Rule Update (Revised CSAPR Update): 2021 – present

- The Revised CSAPR Update was developed to resolve 21 states' outstanding interstate transport obligations for the 2008 ozone NAAQS and to respond to the September 2019 court remand of the 2016 CSAPR Update.
- Starting June 2021, further emission reductions will be required at power plants in 12 of the 21 states for which the CSAPR Update was previously found to be only a partial remedy. These reductions are based on optimization of existing, already-installed selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR) controls beginning in the 2021 ozone season, and installation or upgrade of enhanced NO_X combustion controls beginning in the 2022 ozone season. EPA will also adjust these 12 states' ozone season emission budgets through 2024 to incentivize the continued use of these control technologies.

Mercury and Air Toxics Standards (MATS)

- EPA announced standards to limit mercury, acid gases, and other toxic pollution from power plants in December 2011 (published in February 2012). EPA provided the maximum 3-year compliance period, so sources were generally required to comply no later than April 16, 2015. Some sources obtained a one-year extension from their state permitting authority, allowed under the CAA, and so, were required to comply with the final rule by April 16, 2016.
- Units subject to MATS must comply with emission rate limits for certain hazardous air pollutants (or surrogates). There are several ways to demonstrate compliance, including the use of continuous monitoring or through periodic measurement of emissions. Some units may choose to demonstrate compliance through periodic performance tests.
- This 2020 progress report only provides data from affected sources that submitted hourly emissions data in 2020. Units not reporting data (e.g., those monitoring using periodic testing) are not included in this report.

Background Information

Power Sector Trends

The widespread and dramatic emission reductions in the power sector over the last few decades have come about from several factors, including changes in markets for fuels and electricity as well as regulatory programs.[1] While most coal-fired electricity generation comes from sources with state-of-the-art emission controls, broad industry shifts from coal-fired generation to gas-fired generation, as well as increases in zero-emitting generation sources, also have reduced power sector emissions. Market factors, modest demand growth, and policy and regulatory efforts have resulted in a notable change in the last decade to the country's overall generation mix as natural gas and renewable energy generation increased while coal-fired generation decreased.

Looking ahead, the price of natural gas is expected to remain low for the foreseeable future as improvements in drilling technologies and techniques continue to reduce the cost of extraction. In

[1] EIA, Annual Energy Outlook 2021.

addition, the existing fleet of coal-fired EGUs continues to age. With a continued (but reduced) tax credit and declining capital costs, solar capacity is projected to grow through 2050, while tax credits that phase out for plants entering service through 2023 provide incentives for new wind capacity in the near-term. Some power generators have announced that they expect to continue to change their generation mix away from coal-fired generation and toward natural-gas fired generation, renewables, and more deployment of energy efficiency measures. All these factors, in total, have resulted in declining power sector emissions in recent years, a trend that is expected to continue going forward.

Acid Rain Program

Title IV of the 1990 Clean Air Act Amendments established the ARP to address acid deposition nationwide by reducing annual SO_2 and NO_X emissions from fossil fuel-fired power plants. In contrast to traditional command and control regulatory methods that establish specific emissions limitations, the ARP SO_2 program introduced a landmark allowance trading system that harnessed the economic incentives of the market to reduce pollution. This market-based cap and trade program was implemented in two phases. Phase I began in 1995 and affected the most polluting coal-fired units in 21 eastern and midwestern states. Phase II began in 2000 and expanded the program to include other units fired by coal, oil, and gas in the contiguous U.S. Under Phase II, Congress also tightened the annual SO_2 emissions cap with a permanent annual cap set at 8.95 million allowances starting in 2010. The NO_X program has a similar results-oriented approach and ensures program integrity through measurement and reporting. However, it does not cap NO_X emissions, nor does it utilize an allowance trading system. Instead, the ARP NO_X program provisions apply boiler-specific NO_X emission limits – or rates – in pounds per million British thermal units (lb/mmBtu) on certain coal-fired boilers. There is a degree of flexibility, however. Units under common control, which are owned or operated by the same company, can comply using emission rate averaging plans, subject to requirements ensuring that the total mass emissions from the units in an averaging plan do not exceed the total mass emissions the units would have emitted at their individual emission rate limits.

NO_X Budget Trading Program

The NBP was a market-based cap and trade program created to reduce NO_X emissions from power plants and other large stationary combustion sources during the summer ozone season to address regional air pollution transport that contributes to the formation of ozone in the eastern United States. The program, which operated during the ozone seasons from 2003 to 2008, was a central component of the NO_X State Implementation Plan (SIP) Call, promulgated in 1998, to help states attain the 1979 ozone NAAQS. All 21 jurisdictions (20 states plus Washington, D.C.) covered by the NO_X SIP Call opted to participate in the NBP. In 2009, the CAIR's NO_X ozone season program began, effectively replacing the NBP to continue achieving ozone season NO_X emission reductions from the power sector.

Clean Air Interstate Rule

CAIR required 25 eastern jurisdictions (24 states plus Washington, D.C.) to limit annual power sector emissions of SO_2 and NO_X to address regional interstate transport of air pollution that contributes to the formation of fine particulates. It also required 26 jurisdictions (25 states plus Washington, D.C.) to limit power sector ozone season NO_X emissions to address regional interstate transport of air pollution that contributes to the formation of ozone during the ozone season. CAIR used three separate market-based

cap and trade programs to achieve emission reductions and to help states meet the 1997 ozone and fine particle NAAQS.

EPA issued CAIR on May 12, 2005, and the CAIR federal implementation plans (FIPs) on April 26, 2006. In 2008, the U.S. Court of Appeals for the DC Circuit remanded CAIR to the Agency, leaving the existing CAIR programs in place while directing EPA to replace them as rapidly as possible with a new rule consistent with the Clean Air Act. The CAIR NO_X ozone season and NO_X annual programs began in 2009, while the CAIR SO_2 program began in 2010. As discussed below, CAIR was replaced by CSAPR in 2015.

Cross-State Air Pollution Rule

EPA issued CSAPR in July 2011, requiring 28 states in the eastern half of the United States to significantly improve air quality by reducing power plant emissions that travel across state lines and contribute to fine particle and summertime ozone pollution in downwind states. CSAPR required 23 states to reduce annual SO_2 and NO_X emissions to help downwind areas attain the 2006 and/or 1997 annual $PM_{2.5}$ NAAQS. CSAPR also required 25 states to reduce ozone season NO_X emissions to help downwind areas attain the 1997 ozone NAAQS. CSAPR divides the states required to reduce SO_2 emissions into two groups (Group 1 and Group 2). Both groups were required to reduce their SO_2 emissions in Phase I. All Group 1 states, as well as some Group 2 states, were required to make additional reductions in SO_2 emissions in Phase II in order to eliminate their significant contribution to air quality problems in downwind areas.

CSAPR was scheduled to replace CAIR starting on January 1, 2012. However, the timing of CSAPR's implementation was affected by D.C. Circuit actions that stayed and then vacated CSAPR before implementation. On April 29, 2014, the U.S. Supreme Court reversed the D.C. Circuit's vacatur, and on October 23, 2014, the D.C. Circuit granted EPA's motion to lift the stay and shift the CSAPR compliance deadlines by three years. Accordingly, the CSAPR Phase I implementation began on January 1, 2015, replacing CAIR, and CSAPR Phase II began January 1, 2017.

Cross-State Air Pollution Rule Update

On September 7, 2016, EPA finalized an update to the CSAPR ozone season program by issuing the CSAPR Update. This rule addresses the summertime ozone pollution in the eastern U.S. that crosses state lines and will help downwind states and communities meet and maintain the 2008 ozone NAAQS. In May 2017, the CSAPR Update began further reducing ozone season NO_X emissions from power plants in 22 states in the eastern U.S. When issuing the CSAPR Update, EPA found that, while the rule would result in meaningful, near-term reductions in ozone pollution that crosses state lines, the rule may not be sufficient to fully address all covered states' good neighbor obligations[2] with respect to the 2008 ozone NAAQS. In December 2018, based on additional analysis conducted after issuance of the rule, EPA published a determination that the emission reductions required by the CSAPR Update in fact would fully address all covered states' good neighbor obligations with respect to this NAAQS.

In September 2019, the D.C. Circuit upheld the CSAPR Update in most respects, but remanded the rule to EPA to address the court's holding that the rule unlawfully allowed upwind states' significant

[2] "Good neighbor" obligations refer to provisions in the Clean Air Act that require upwind states to reduce the emissions that affect downwind states' ability to attain or maintain NAAQS.

contribution to downwind air quality problems to continue beyond downwind states' deadlines for attaining the NAAQS. Relatedly, in October 2019, the court vacated EPA's December 2018 determination that the CSAPR Update fully addressed covered states' good neighbor obligations with respect to the 2008 ozone NAAQS.

Revised Cross-State Air Pollution Rule Update

On March 15, 2021, EPA finalized the Revised CSAPR Update to resolve 21 states' outstanding interstate transport obligations for the 2008 ozone NAAQS. Based on EPA's analysis, the Agency determined that additional emission reductions relative to the CSAPR Update were necessary for 12 of the 21 states. These reductions are based on optimization of existing, already-installed controls beginning in the 2021 ozone season, and installation or upgrade of state-of-the-art NO_X combustion controls beginning in the 2022 ozone season. This rulemaking also adjusts these 12 states' ozone season emission budgets through 2024 to incentivize the continued use of these control technologies. The rule's effective date is June 29, 2021.

Mercury and Air Toxics Standards

On December 16, 2011, the EPA announced final standards to reduce emissions of toxic air pollutants from new and existing coal- and oil-fired electric utility steam generating units (EGUs) in all 50 states and U.S. territories. MATS established technology-based emission rate standards that reflect the level of hazardous air pollutant (HAP) emissions that had been achieved by the best-performing sources. These HAPs include mercury (Hg), non-mercury metals (such as arsenic (As), chromium (Cr), and nickel (Ni)), and acid gases, including hydrochloric acid (HCl) and hydrofluoric acid (HF). EPA provided the maximum 3-year compliance period, so sources were generally required to comply no later than April 16, 2015. Some sources obtained a one-year extension from their state permitting authority, allowed under the CAA so were required to comply with the final rule by April 16, 2016.

More Information

- Acid Rain Program (ARP) https://www.epa.gov/airmarkets/acid-rain-program
- Interstate Air Pollution Transport https://www.epa.gov/airmarkets/interstate-air-pollution-transport
- Cross-State Air Pollution Rule (CSAPR) https://www.epa.gov/csapr
- Cross-State Air Pollution Rule Update (CSAPR Update) https://www.epa.gov/airmarkets/final-cross-state-air-pollution-rule-update
- Clean Air Interstate Rule (CAIR) https://archive.epa.gov/airmarkets/programs/cair/web/html/index.html
- NO_X Budget Trading Program (NBP) / NO_X SIP Call https://www.epa.gov/airmarkets/nox-budget-trading-program
- National Ambient Air Quality Standards (NAAQS) https://www.epa.gov/criteria-air-pollutants
- EPA's Clean Air Market Programs https://www.epa.gov/airmarkets/programs
- Emissions Trading https://www.epa.gov/emissions-trading-resources

- MATS https://www.epa.gov/mats

Figures

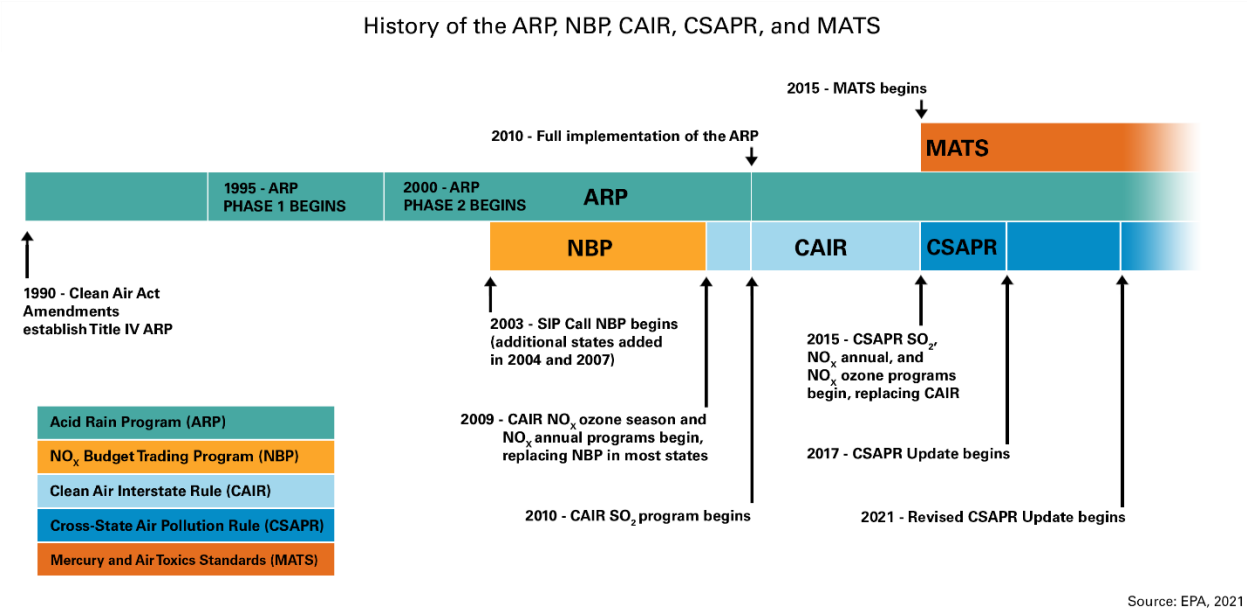


Figure 1. History of the ARP, NBP, CAIR, CSAPR, and MATS

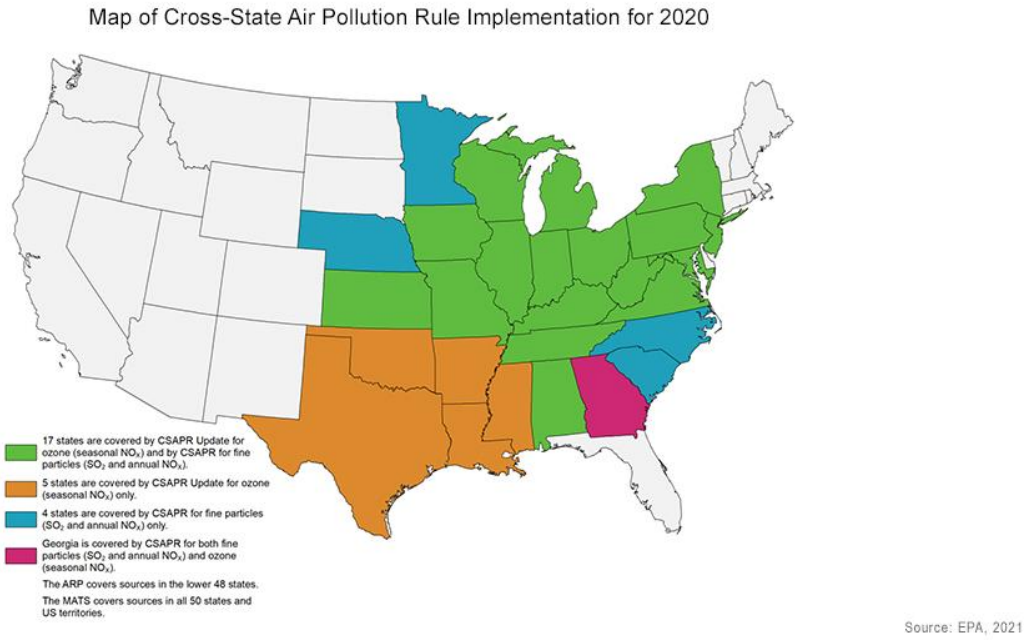


Figure 2. Map of Cross-State Air Pollution Rule Implementation for 2020

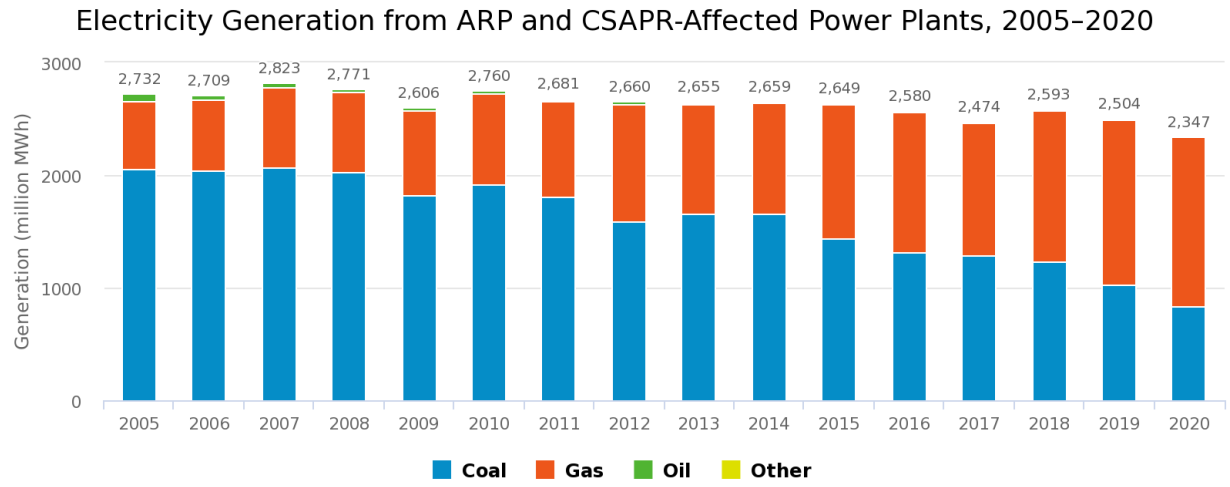


Figure 3. Electricity Generation from ARP- and CSAPR-Affected Power Plants, 2005–2020

Notes:
• There is a small amount of generation from "Oil" or "Other" fuels. The data for these fuels is not easily visible on the full chart. To more clearly see the generation data for these fuels, use the interactive features of the figure: click on the boxes in the legend to turn off the blue and orange categories of fuels (labeled "Coal" and "Gas") and turn on the green and yellow categories of fuels (labeled "Oil" and "Other").

Chapter 2: Affected Units

The Acid Rain Program (ARP) and the Cross-State Air Pollution Rule's (CSAPR) sulfur dioxide (SO_2) and nitrogen oxides (NO_X) emission reduction programs apply to large electricity generating units (EGUs) that burn fossil fuels to generate electricity for sale. The Mercury and Air Toxics Standards (MATS) only cover large EGUs that burn coal or oil to generate electricity for sale and excludes gas-fired units, resulting in fewer units in MATS than in the ARP and CSAPR. This section covers units affected in 2020.

Highlights

Acid Rain Program (ARP)

- In 2020, the ARP SO_2 requirements applied to 3,287 fossil fuel-fired combustion units at 1,159 facilities across the country; 536 units at 246 facilities were subject to the ARP NO_X program.

Cross-State Air Pollution Rule (CSAPR)

- In 2020, there were 2,181 affected EGUs at 678 facilities in the CSAPR SO_2 programs. Of those, 1,747 (80 percent) were also covered by the ARP.
- In 2020, there were 2,181 affected EGUs at 678 facilities in the CSAPR NO_X annual program and 2,527 affected EGUs at 809 facilities in the CSAPR NO_X ozone season programs. Of those, 1,747 (80 percent) and 2,063 (82 percent), respectively, were also covered by the ARP.

Mercury and Air Toxics (MATS)

- The Mercury and Air Toxics Standards (MATS) set limits on the emissions of hazardous air pollutants from coal- and oil-fired electric utility steam generating units in all 50 states and U.S. territories. MATS was issued under section 112 of the Clean Air Act. EPA is including a summary of the mercury data submitted by affected sources in this report.
- In 2020, 428 units at 197 facilities reported hourly mercury emissions to EPA under MATS.

Background Information

In general, the ARP and CSAPR programs apply to large EGUs – boilers, turbines, and combined cycle units – that burn fossil fuel, serve generators with nameplate capacity greater than 25 megawatts, and produce electricity for sale. MATS applies only to coal- and oil-fired steam generating EGUs (i.e., utility boilers). It does not apply to combustion turbines, combined cycle units, or to natural gas-fired utility boilers. The EGUs affected by these programs include a range of unit types, including units that operate year-round to provide baseload power to the electric grid, as well as units that provide power only on peak demand days. The ARP NO_X program applies to a subset of these units that are older and historically coal-fired.

More Information

- Acid Rain Program (ARP) https://www.epa.gov/airmarkets/acid-rain-program
- Cross-State Air Pollution Rule (CSAPR) https://www.epa.gov/csapr

- Mercury and Air Toxics Standards (MATS) https://www.epa.gov/mats

Figures

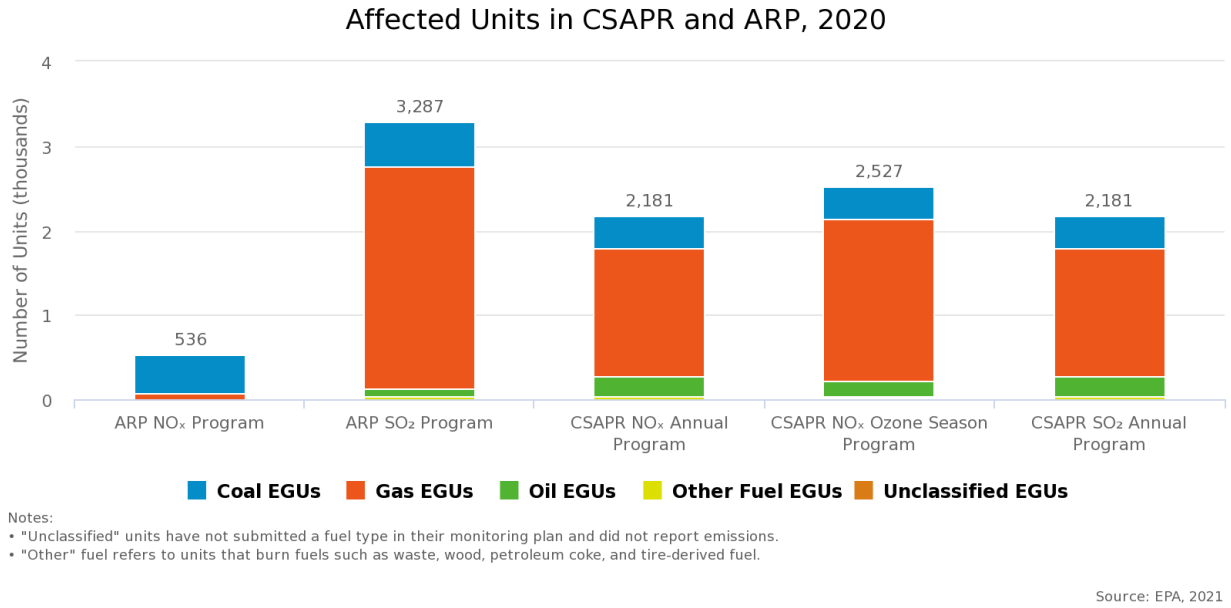


Figure 1. Affected Units in CSAPR and ARP, 2020

Notes:
• "Unclassified" units have not submitted a fuel type in their monitoring plan and did not report emissions.
• "Other fuel units" include units that combusted primarily wood, waste, or other non-fossil fuel (which also boost mercury and HCl removal by ACI and DSI).

Affected Units in CSAPR and ARP, 2020

Fuel	ARP NO_x	ARP SO_2	CSAPR Annual NO_x	CSAPR Ozone Season NO_x	CSAPR Annual SO_2
Coal EGUs	454	535	390	390	390
Gas EGUs	79	2,618	1,526	1,924	1,526
Oil EGUs	1	102	232	179	232
Other Fuel EGUs	2	27	33	24	33
Unclassified EGUs	0	5	0	10	0
Total Units	**536**	**3,287**	**2,181**	**2,527**	**2,181**

Notes:
• "Unclassified" units have not submitted a fuel type in their monitoring plan and did not report emissions.
• "Other" fuel refers to units that burn fuels such as waste, wood, petroleum coke, and tire-derived fuel.

Source: EPA, 2021
Last updated: 05/2021

Figure 2. Affected Units in CSAPR and ARP, 2020

Notes:
• "Unclassified" units have not submitted a fuel type in their monitoring plan and did not report emissions.
• "Other fuel units" include units that combusted primarily wood, waste, or other non-fossil fuel (which also boost mercury and HCl removal by ACI and DSI).

Chapter 3: Emission Reductions

The Acid Rain Program (ARP) and Cross-State Air Pollution Rule (CSAPR) programs significantly reduced sulfur dioxide (SO_2), annual nitrogen oxides (NO_X), and ozone season NO_X emissions from electric generating units (EGUs). The Mercury and Air Toxics Standards (MATS) set limits on the emissions of hazardous air pollutants from coal- and oil-fired electric utility steam generating unit EGUs and have led to reductions in those emissions since 2010. This section covers changes in emissions at units affected by CSAPR, ARP, and MATS between 2020 and previous years.

Sulfur Dioxide (SO_2)

Highlights

Overall Results

- Under the ARP, CAIR, and now CSAPR, power plants have significantly lowered SO_2 emissions while electricity generation has remained relatively stable since 2000.
- These emission reductions are a result of an overall increase in the environmental effectiveness at affected sources as electric generators installed controls, switched to lower emitting fuels, or otherwise reduced their SO_2 emissions. These trends are discussed further in Chapter 1.

SO_2 Emission Trends

- **ARP:** Units in the ARP emitted 778 thousand tons of SO_2 in 2020, well below the ARP's statutory annual cap of 8.95 million tons. The ARP sources reduced emissions by 15.0 million tons (95 percent) from 1990 levels and 16.5 million tons (95 percent) from 1980 levels.
- **CSAPR and ARP:** In 2020, the sixth year of operation of the CSAPR SO_2 program, sources in both the CSAPR SO_2 annual programs and the ARP together reduced SO_2 emissions by 15.0 million tons (95 percent) from 1990 levels (before implementation of the ARP), 10.4 million tons (93 percent) from 2000 levels (ARP Phase II), and 9.5 million tons (92 percent) from 2005 levels (before implementation of the CAIR and the CSAPR). All ARP and CSAPR sources together emitted a total of 788 thousand tons of SO_2 in 2020.
- **CSAPR:** Annual SO_2 emissions from sources in the CSAPR SO_2 programs fell from 7.7 million tons in 2005 to 497 thousand tons in 2020 (94 percent). In 2020, SO_2 emissions were about 1.5 million tons below the regional CSAPR emission budgets (0.94 million in Group 1 and 0.53 million in Group 2); the CSAPR SO_2 annual programs' 2020 regional budgets are 1,372,631 and 597,579 tons for Group 1 and Group 2, respectively.

SO_2 State-by-State Emissions

- **CSAPR and ARP:** From 1990 to 2020, annual SO_2 emissions from sources in the ARP and the CSAPR SO_2 program dropped in 46 states plus Washington, D.C. by a total of 15.0 million tons. In contrast, annual SO_2 emissions increased in two states (Idaho and Vermont) by a combined total of 10 tons from 1990 to 2020.

- **CSAPR:** All 22 states (16 states in Group 1 and 6 states in Group 2) had emissions below their CSAPR allowance budgets, collectively by 1.5 million tons.

SO_2 Emission Rates

- The average SO_2 emission rate for units in the ARP or CSAPR SO_2 program fell to 0.08 pounds per million British thermal units (lb/mmBtu). This indicates a 90 percent reduction from 2005 rates, with most reductions coming from coal-fired units.
- Emissions have decreased dramatically since 2005, due in large part to greater use of control technology on coal-fired units and increased generation at natural gas-fired units that emit very little SO_2 emissions.

Background Information

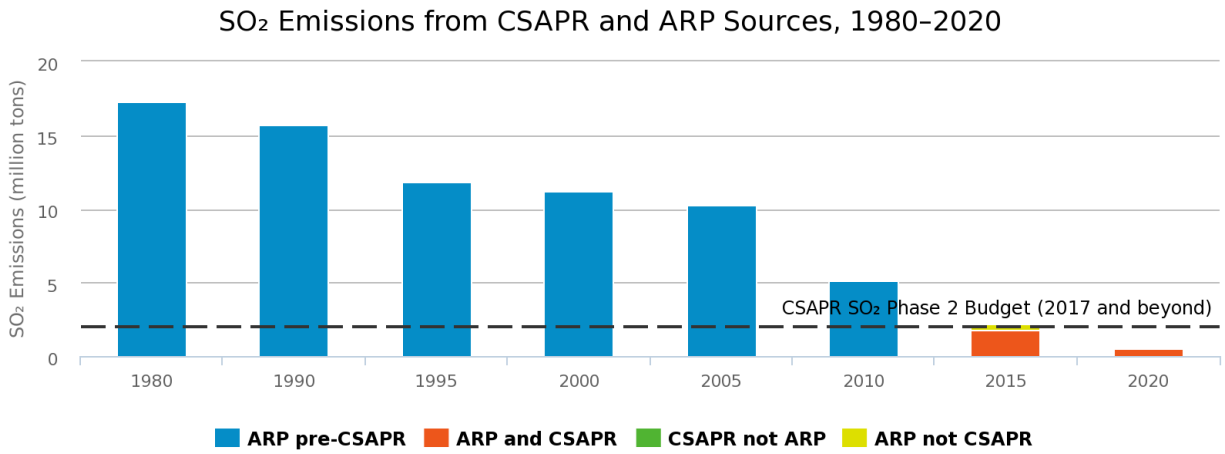
SO_2 is a highly reactive gas that is generated primarily from coal-fired power plants. In addition to contributing to the formation of acid rain and fine particle ($PM_{2.5}$) pollution, SO_2 emissions are linked with a number of adverse effects to human health and ecosystems.

The states with the highest emitting sources in 1990 have generally seen the greatest SO_2 emission reductions under the ARP, and this trend continued under CAIR and CSAPR. Most of these states are in the Ohio River Valley and are upwind of the areas the ARP and CSAPR were designed to protect. Reductions under these programs have provided important environmental and health benefits over a large region.

More Information

- Power Plant Emission Trends https://www.epa.gov/airmarkets/power-plant-emission-trends
- Power Sector Emissions, Operations, and Environmental Data https://www.epa.gov/airmarkets/data-resources
- Acid Rain Program (ARP) https://www.epa.gov/airmarkets/acid-rain-program
- Cross-State Air Pollution Rule (CSAPR) https://www.epa.gov/csapr
- Sulfur Dioxide (SO_2) Pollution https://www.epa.gov/so2-pollution
- Particulate Matter (PM) Pollution https://www.epa.gov/pm-pollution
- Power Profiler https://www.epa.gov/energy/power-profiler

Figures



Notes:
• SO₂ values are shown as millions of tons.
• The data shown here reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR-only SO₂ program units are not included in the SO₂ data prior to 2015.
• There are a small number of sources in CSAPR but not in the ARP. Emissions from these sources comprise about 1 percent of total emissions and are not easily visible on the full chart.

Source: EPA, 2021

Figure 1. SO_2 Emissions from CSAPR and ARP Sources, 1980–2020

Notes:
• SO_2 values are shown as millions of tons.
• The data shown here reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR-only SO_2 program units are not included in the SO_2 data prior to 2015.
• There are a small number of sources in CSAPR but not in the ARP. Emissions from these sources comprise about 1 percent of total emissions and are not easily visible on the full chart.

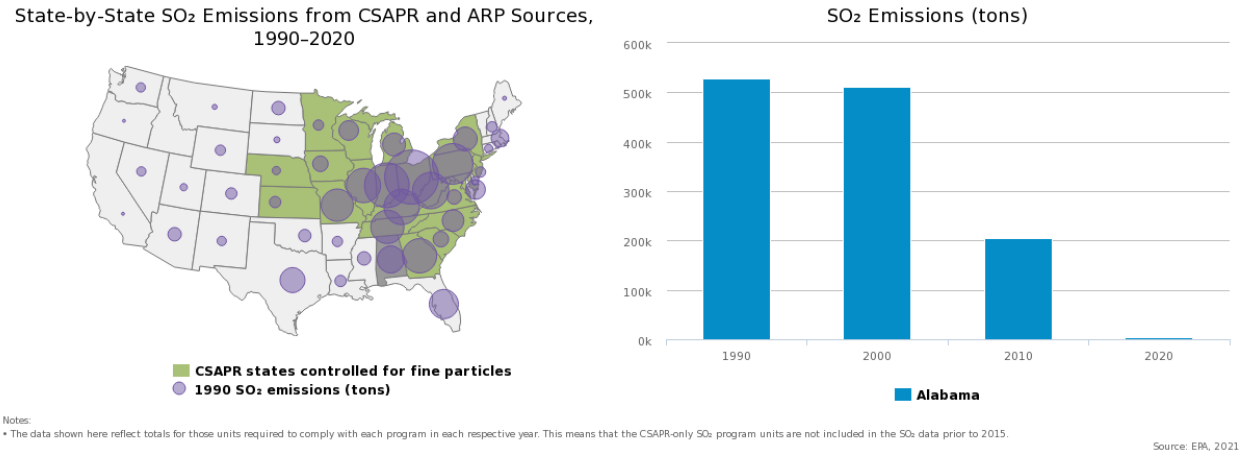


Figure 2. State-by-State SO_2 Emissions from CSAPR and ARP Sources, 1990–2020

Notes:
• The data shown here reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR-only SO_2 program units are not included in the SO_2 data prior to 2015.

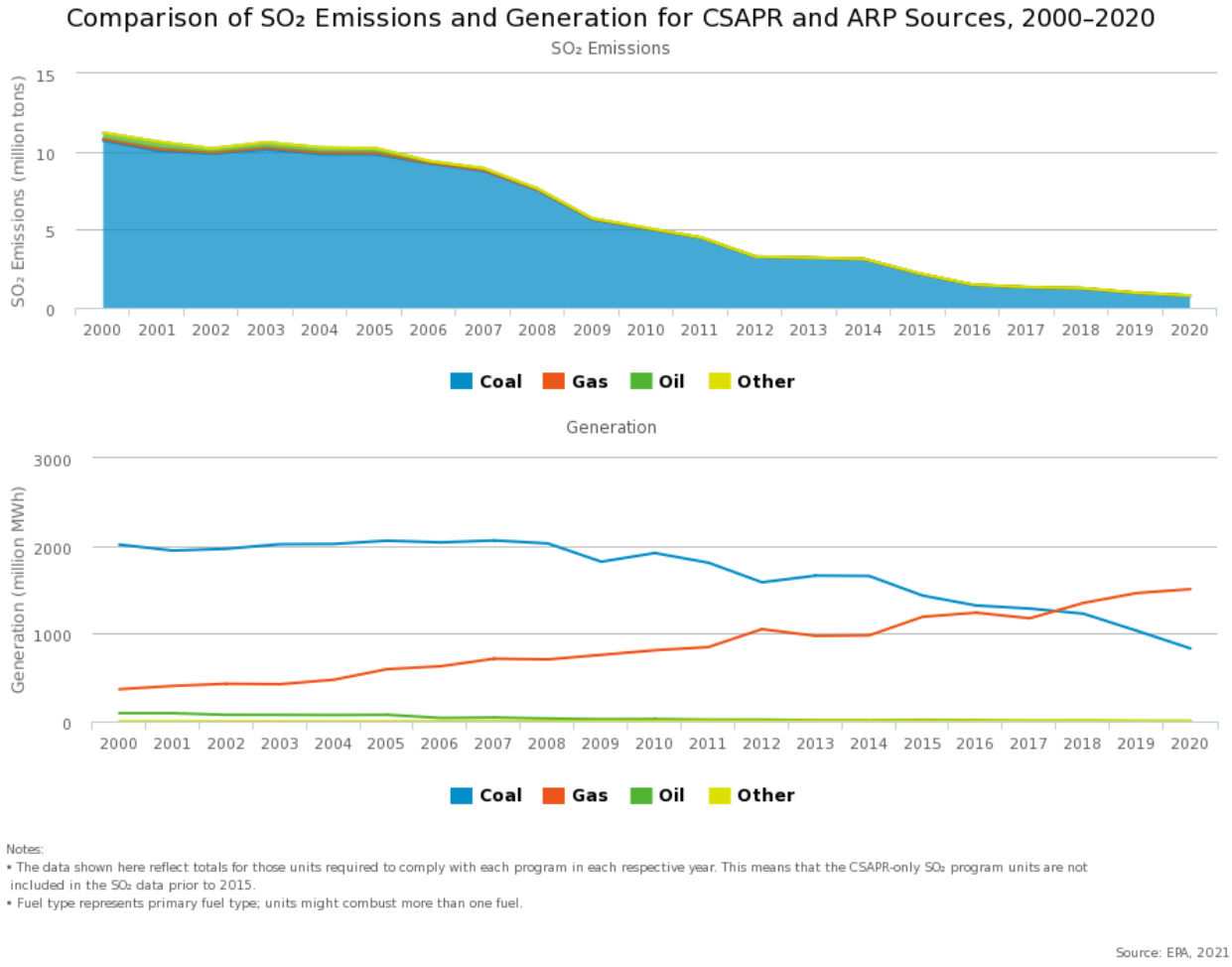


Figure 3. Comparison of SO_2 Emissions and Generation for CSAPR and ARP Sources, 2000–2020

Notes:
• The data shown here reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR-only SO_2 program units are not included in the SO_2 data prior to 2015.
• Fuel type represents primary fuel type; units might combust more than one fuel.

CSAPR and ARP SO_2 Emissions Trends

	SO_2 Emissions (thousand tons)				SO_2 Rate (lb/mmBtu)			
Primary Fuel	**2000**	**2005**	**2010**	**2020**	**2000**	**2005**	**2010**	**2020**
Coal	10,708	9,835	5,052	788	1.04	0.95	0.53	0.18
Gas	108	91	19	5	0.06	0.03	0.01	0.00
Oil	384	292	28	1	0.73	0.70	0.19	0.04
Other	1	4	22	11	0.23	0.27	0.57	0.17
Total / Average	**11,201**	**10,222**	**5,120**	**788**	**0.88**	**0.75**	**0.39**	**0.08**

Notes:
• The data shown here reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR-only SO_2 program units are not included in the SO_2 emissions data prior to 2015.
• Fuel type represents primary fuel type; units might combust more than one fuel.
• Totals may not reflect the sum of individual rows due to rounding.
• The emission rate reflects the emissions (pounds) per unit of heat input (mmBtu) for each fuel category. The total SO_2 emission rate in each column of the table is not cumulative and does not equal the arithmetic mean of the four fuel-specific rates. The total for each year indicates the average rate across all units in the program because each unit influences the annual emission rate in proportion to its heat input, and heat input is unevenly distributed across the fuel categories.

Source: EPA, 2021

Figure 4. CSAPR and ARP SO_2 Emissions Trends, 2020

Notes:
• The data shown here reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR-only SO_2 program units are not included in the SO_2 emissions data prior to 2015.
• Fuel type represents primary fuel type; units might combust more than one fuel.
• Totals may not reflect the sum of individual rows due to rounding.
• The emission rate reflects the emissions (pounds) per unit of heat input (mmBtu) for each fuel category. The total SO_2 emission rate in each column of the table is not cumulative and does not equal the arithmetic mean of the four fuel-specific rates. The total for each year indicates the average rate across all units in the program because each unit influences the annual emission rate in proportion to its heat input, and heat input is unevenly distributed across the fuel categories.

Annual Nitrogen Oxides

Highlights

Overall Results

- Annual NO_X emissions have declined dramatically under the ARP, CAIR, and CSAPR programs, with most reductions coming from coal-fired units. These reductions have occurred while electricity generation has remained relatively stable since 2000.
- These emission reductions are a result of an overall increase in the environmental efficiency at affected sources as power generators installed controls, ran their controls year-round, switched to lower emitting fuels, or otherwise reduced their NO_X emissions. These trends are discussed further in Chapter 1.
- Other programs – such as regional and state NO_X emission control programs – also contributed significantly to the annual NO_X emission reductions achieved by sources in 2020.

Annual NO_X Emissions Trends

- **ARP:** Units in the ARP NO_X program emitted 721 thousand tons of NO_X emissions in 2020. Sources reduced emissions by 7.3 million tons from the projected level in 2000 without the ARP, over three times the program's NO_X emission reduction objective.
- **CSAPR and ARP:** In 2020, the sixth year of operation of the CSAPR NO_X annual program, sources in both the CSAPR NO_X annual program and the ARP together emitted 737 thousand tons, a reduction of 5.7 million tons (89 percent reduction) from 1990 levels, 4.4 million tons (86 percent reduction) from 2000, and 2.9 million tons (80 percent reduction) from 2005 levels.
- **CSAPR:** Emissions from the CSAPR NO_X annual program sources were 405 thousand tons in 2020. This is about 1.8 million tons (81 percent) lower than in 2005 and 664 thousand tons (62 percent) below the CSAPR NO_X annual program's 2020 regional budget of 1,069,256 tons.

Annual NO_X State-by-State Emissions

- **CSAPR and ARP:** From 1990 to 2020, annual NO_X emissions in the ARP and the CSAPR NO_X program dropped in 47 states plus Washington, D.C. by a total of approximately 5.7 million tons. In contrast, annual emissions increased in one state (Idaho) by 331 tons from 1990 to 2020.
- **CSAPR:** 21 of 22 states had emissions below their CSAPR 2020 allowance budgets, collectively by 666 thousand tons. One state (Missouri) exceeded their 2020 state level budget by about two thousand tons.

Annual NO_X Emission Rates

- In 2020, the ARP and CSAPR average annual NO_X emission rate was 0.07 lb/mmBtu, a 73 percent reduction from 2005.
- Emissions have decreased dramatically since 2005, due in large part to greater use of control technology, primarily on coal-fired units, and increased generation at natural gas-fired units that emit less NO_X emissions per unit of electricity than coal-fired units.

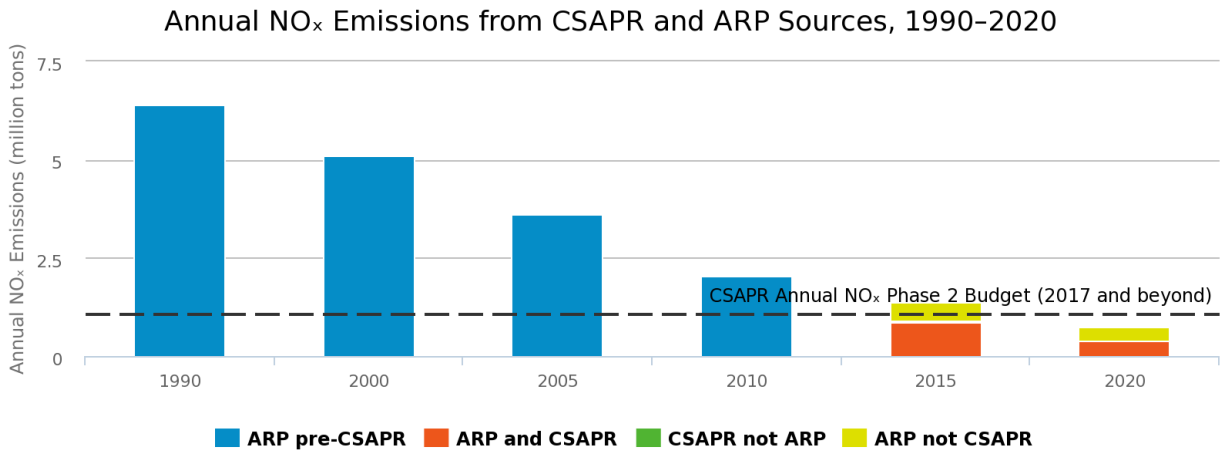
Background Information

Nitrogen oxides (NO_X) are made up of a group of highly reactive gases that are emitted from power plants and motor vehicles, as well as other sources. NO_X emissions contribute to the formation of ground-level ozone and fine particle pollution, which cause a variety of adverse health effects.

More Information

- Power Plant Emission Trends https://www.epa.gov/airmarkets/power-plant-emission-trends
- Power Sector Emissions, Operations, and Environmental Data https://www.epa.gov/airmarkets/data-resources
- Acid Rain Program (ARP) https://www.epa.gov/airmarkets/acid-rain-program
- Cross-State Air Pollution Rule (CSAPR) https://www.epa.gov/csapr
- Nitrogen Oxides (NO_X) Pollution https://www.epa.gov/no2-pollution
- Particulate Matter (PM) Pollution https://www.epa.gov/pm-pollution
- Power Profiler https://www.epa.gov/energy/power-profiler

Figures



Notes:
• NOₓ values are shown as millions of tons.
• The data shown here reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR-only NOₓ program units are not included in the NOₓ data prior to 2015.
• There are a small number of sources in CSAPR but not in the ARP. Emissions from these sources comprise about 1 percent of total emissions and are not easily visible on the full chart.

Source: EPA, 2021

Figure 1. Annual NO_X Emissions from CSAPR and ARP Sources, 1990–2020

Notes:
• NO_x values are shown as millions of tons.
• The data shown here reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR-only NO_x program units are not included in the NO_x data prior to 2015.
• There are a small number of sources in CSAPR but not in the ARP. Emissions from these sources comprise about 1 percent of total emissions and are not easily visible on the full chart.

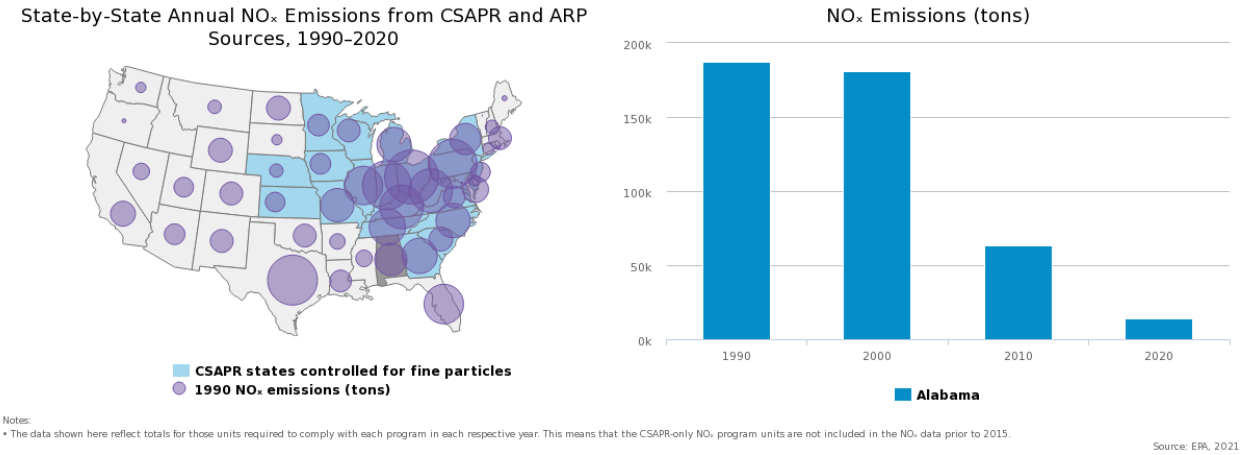


Figure 2. State-by-State Annual NO_X Emissions from CSAPR and ARP Sources, 1990–2020

Notes:
• The data shown here reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR-only NO_x program units are not included in the NO_x data prior to 2015.

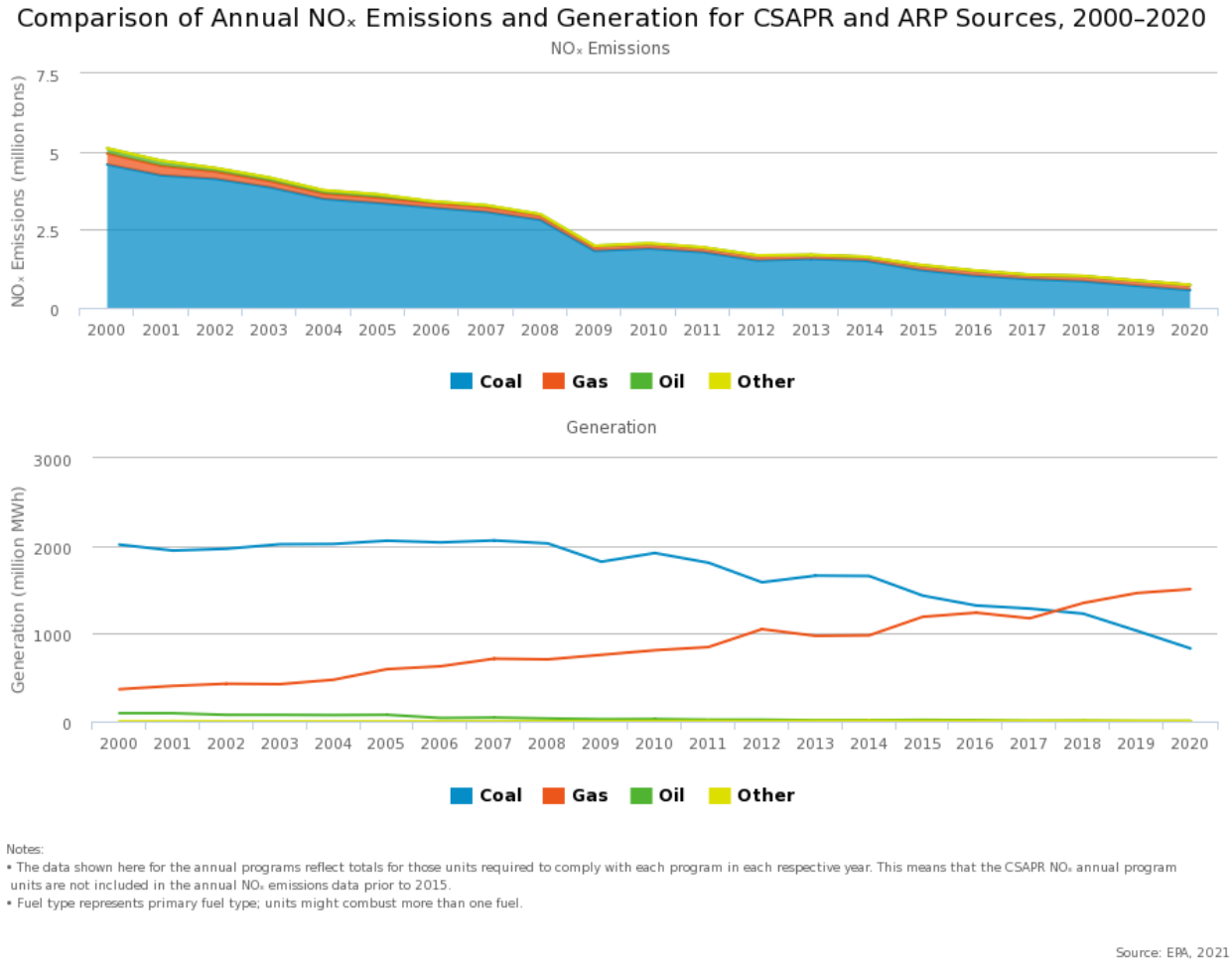


Figure 3. Comparison of Annual NO_X Emissions and Generation for CSAPR and ARP Sources, 2000–2020

Notes:
• The data shown here for the annual programs reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR NO_x annual program units are not included in the annual NO_x emissions data prior to 2015.
• Fuel type represents primary fuel type; units might combust more than one fuel.

CSAPR and ARP Annual NO_x Emissions Trends

	NO_x Emissions (thousand tons)				NO_x Rate (lb/mmBtu)			
Primary Fuel	**2000**	**2005**	**2010**	**2019**	**2000**	**2005**	**2010**	**2020**
Coal	4,587	3,356	1,896	569	0.44	0.32	0.20	0.14
Gas	355	167	142	160	0.18	0.06	0.04	0.03
Oil	162	104	20	2	0.31	0.25	0.13	0.10
Other	2	6	5	6	0.26	0.42	0.14	0.09
Total / Average	**5,104**	**3,633**	**2,063**	**737**	**0.40**	**0.27**	**0.16**	**0.07**

Notes:
• The data shown here reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR-only annual NO_x program units are not included in the NO_x emissions data prior to 2015.
• Fuel type represents primary fuel type; units might combust more than one fuel.
• Totals may not reflect the sum of individual rows due to rounding.
• The emission rate reflects the emissions (pounds) per unit of heat input (mmBtu) for each fuel category. The total annual NO_x emission rate in each column of the table is not cumulative and does not equal the arithmetic mean of the four fuel-specific rates. The total for each year indicates the average rate across all units in the program because each unit influences the annual emission rate in proportion to its heat input, and heat input is unevenly distributed across the fuel categories.

Source: EPA, 2021

Figure 4. CSAPR and ARP Annual NO_X Emissions Trends, 2020

Notes:
• The data shown here reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR-only annual NO_x program units are not included in the NO_x emissions data prior to 2015.
• Fuel type represents primary fuel type; units might combust more than one fuel.
• Totals may not reflect the sum of individual rows due to rounding.
• The emission rate reflects the emissions (pounds) per unit of heat input (mmBtu) for each fuel category. The total annual NO_x emission rate in each column of the table is not cumulative and does not equal the arithmetic mean of the four fuel-specific rates. The total for each year indicates the average rate across all units in the program because each unit influences the annual emission rate in proportion to its heat input, and heat input is unevenly distributed across the fuel categories.

Ozone Season Nitrogen Oxides

Highlights

Overall Results

- Ozone season NO_X emissions have declined dramatically under the ARP, NBP, CAIR, and CSAPR programs.[1]
- States with the highest emitting sources of ozone season NO_X emissions in 2000 have seen the greatest reductions under the CSAPR NO_X ozone season program and CSAPR Update. Most of these states are in the Ohio River Valley and are upwind of the areas CSAPR was designed to protect. Reductions by sources in these states have resulted in important environmental and human health benefits over a large region.
- These reductions have occurred while electricity generation has remained relatively stable since 2000. These trends are discussed further in Chapter 1.
- Other programs – such as regional and state NO_X emission control programs – also contributed significantly to the ozone season NO_X emission reductions achieved by sources in 2020.

Ozone Season NO_X Emissions Trends

- **ARP:** Units in the ARP program emitted 333 thousand tons of ozone season NO_X emissions in 2020. Sources reduced emissions by 1.9 million tons (85 percent) from the 2000 ozone season and 930 thousand tons (74 percent) from the 2005 ozone season.
- **CSAPR:** In 2020, units covered under the CSAPR NO_X ozone season programs (Group 1 and Group 2) emitted 232 thousand tons, a reduction of 220 thousand (49%) since 2015.
- In 2020, the CSAPR NO_X ozone season program emissions were 31 percent below the regional emission budget of 337,667 tons (24,041 tons for Group 1 and 313,626 tons for Group 2).

Ozone Season NO_X State-by-State Emissions

- Between 2005 and 2020, ozone season NO_X emissions from the CSAPR sources fell in every state participating in the CSAPR NO_X ozone season program.
- 21 states had emissions below their CSAPR 2020 allowance budgets, collectively by about 113 thousand tons. Two states (Mississippi and Missouri) exceeded their 2020 state level budget by about 7,400 tons total.

Ozone Season NO_X Emission Rates

- In 2020, the average NO_X ozone season emission rate fell to 0.07 lb/mmBtu for the CSAPR ozone season program states and 0.07 lb/mmBtu nationally. This represents a 58 and 66 percent reduction, respectively, from 2005 emission rates, with the majority of reductions coming from coal-fired units.

[1] CSAPR refers to both the CSAPR and the CSAPR Update program since 2017.

- Emissions have decreased dramatically since 2005, due in large part to greater use of control technology, primarily on coal-fired units, and increased generation at natural gas-fired units, which emit less NO_X emissions per unit of electricity than coal-fired units.

Background Information

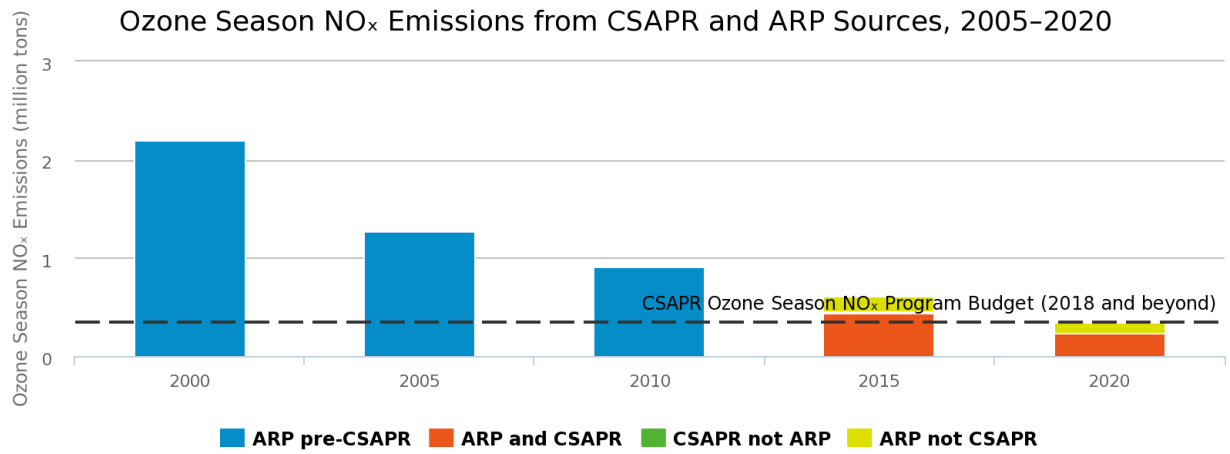
Nitrogen oxides (NO_X) are made up of a group of highly reactive gases that are emitted from power plants and motor vehicles, as well as other sources. NO_X emissions contribute to the formation of ground-level ozone and fine particle pollution, which cause a variety of adverse human health effects.

The CSAPR NO_X ozone season program was established to reduce interstate transport of air pollution during the ozone season (May 1 – September 30), the warm summer months when ozone formation is highest, and to help eastern U.S. counties attain the 1997 ozone standard. The CSAPR Update NO_X ozone season program was similarly established to help eastern U.S. counties attain the 2008 ozone standard.

More Information

- Power Plant Emission Trends https://www.epa.gov/airmarkets/power-plant-emission-trends
- Power Sector Emissions, Operations, and Environmental Data https://www.epa.gov/airmarkets/data-resources
- Cross-State Air Pollution Rule (CSAPR) https://www.epa.gov/csapr
- Pollution from Nitrogen Oxides (NO_X) https://www.epa.gov/no2-pollution
- Pollution from Ozone https://www.epa.gov/ozone-pollution

Figures



Notes:
• NOₓ values are shown as millions of tons.
• The data shown here reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR-only ozone season NOₓ program units are not included in the ozone season NOₓ data prior to 2015.
• There are a small number of sources in CSAPR but not in the ARP. Emissions from these sources comprise about 1 percent of total emissions and are not easily visible on the full chart.

Source: EPA, 2021

Figure 1. Ozone Season NO_X Emissions from CSAPR and ARP Sources, 2005–2020

Notes:
• NO_x values are shown as millions of tons.
• The data shown here reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR-only ozone season NO_x program units are not included in the ozone season NO_x data prior to 2015.
• There are a small number of sources in CSAPR but not in the ARP. Emissions from these sources comprise about 1 percent of total emissions and are not easily visible on the full chart.

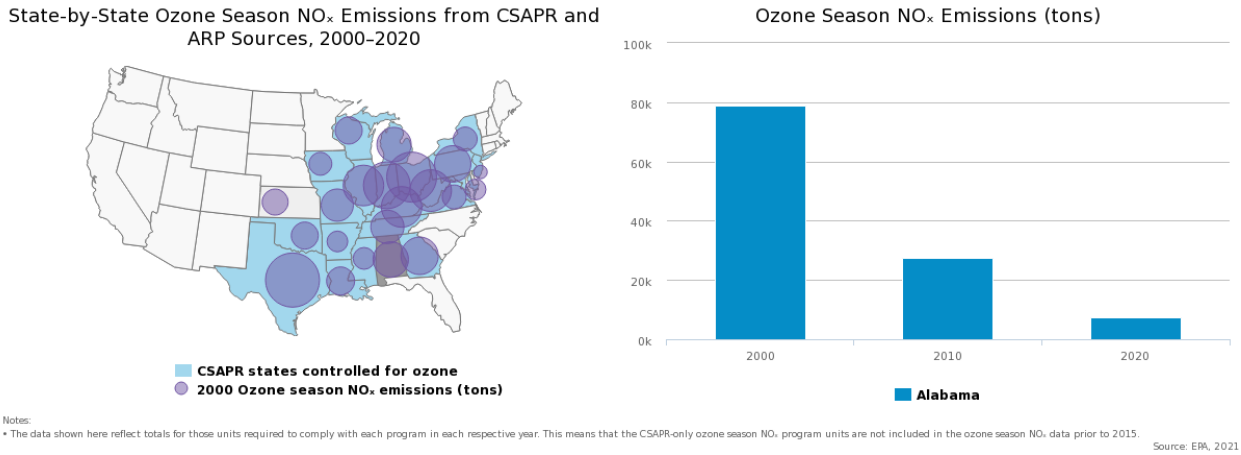


Figure 2. State-by-State Ozone Season NO_X Emissions from CSAPR and ARP Sources, 2000–2020

Notes:
• The data shown here reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR-only ozone season NO_x program units are not included in the ozone season NO_x data prior to 2015.

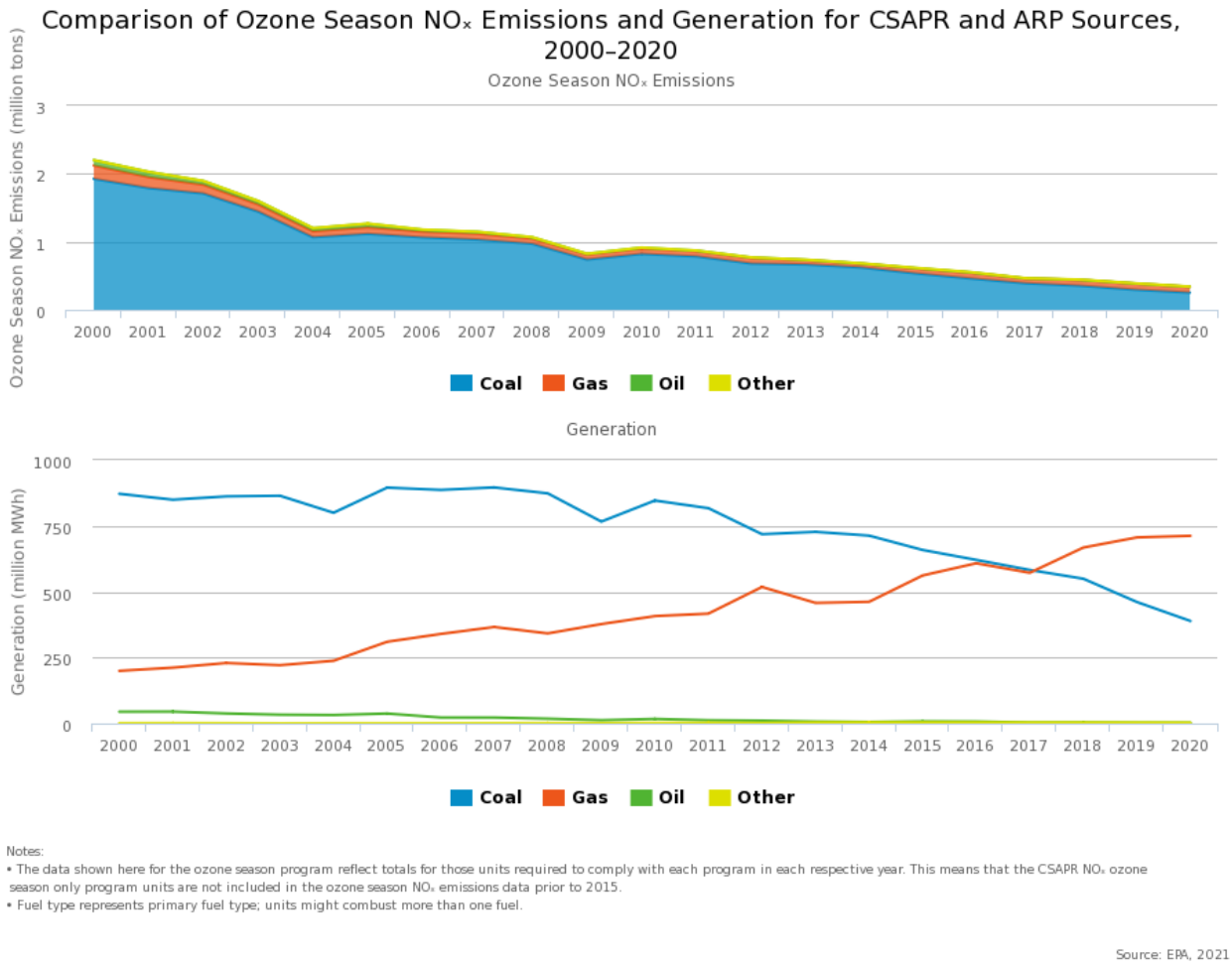


Figure 3. Comparison of Ozone Season NO_X Emissions and Generation for CSAPR and ARP Sources, 2000–2020

Notes:
• The data shown here for the ozone season program reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR NO_x ozone season only program units are not included in the ozone season NO_x emissions data prior to 2015.
• Fuel type represents primary fuel type; units might combust more than one fuel.

CSAPR and ARP Ozone Season NO_x Emissions Trends, 2020

	Ozone Season NO_x Emissions (thousand tons)				Ozone Season NO_x Rate (lb/mmBtu)			
Primary Fuel	**2000**	**2005**	**2010**	**2020**	**2000**	**2005**	**2010**	**2020**
Coal	1,926	1,117	821	253	0.43	0.25	0.19	0.13
Gas	196	96	79	85	0.19	0.07	0.04	0.03
Oil	78	52	12	1	0.31	0.25	0.13	0.09
Other	1	2	2	2	0.25	0.40	0.11	0.08
Total / Average	**2,201**	**1,267**	**914**	**341**	**0.38**	**0.20**	**0.15**	**0.07**

Notes:
• The data shown here reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR NO_x ozone season only program units are not included in the ozone season NO_x emissions data prior to 2015.
• Fuel type represents primary fuel type; units might combust more than one fuel.
• Totals may not reflect the sum of individual rows due to rounding.
• The emission rate reflects the emissions (pounds) per unit of heat input (mmBtu) for each fuel category. The total NO_x ozone season emission rate in each column of the table is not cumulative and does not equal the arithmetic mean of the four fuel-specific rates. The total for each year indicates the average rate across all units in the program because each unit influences the annual emission rate in proportion to its heat input, and heat input is unevenly distributed across the fuel categories.

Source: EPA, 2021

Figure 4. CSAPR Ozone Season NO_X Emissions Trends, 2020

Notes:
• The data shown here reflect totals for those units required to comply with each program in each respective year. This means that the CSAPR NO_x ozone season only program units are not included in the ozone season NO_x emissions data prior to 2015.
• Fuel type represents primary fuel type; units might combust more than one fuel.
• Totals may not reflect the sum of individual rows due to rounding.
• The emission rate reflects the emissions (pounds) per unit of heat input (mmBtu) for each fuel category. The total NO_x ozone season emission rate in each column of the table is not cumulative and does not equal the arithmetic mean of the four fuel-specific rates. The total for each year indicates the average rate across all units in the program because each unit influences the annual emission rate in proportion to its heat input, and heat input is unevenly distributed across the fuel categories.

Mercury

Highlights

Overall Results

- Mercury and other hazardous air pollutant (HAP) emissions have declined significantly since 2010 estimates. These emission reductions were driven by the installation of new pollution controls and enhancements of existing pollution controls that reduce multiple pollutants. Emissions have also decreased due to operational changes, such as fuel switching and increased generation at natural gas-fired units that emit very little mercury and other HAPs. These trends are discussed in Chapter 1.
- Other programs – such as regional and state SO_2 and NO_X emission control programs – also contributed to the mercury and other HAP emission reductions achieved by covered sources in 2020.

Mercury and Hazardous Air Pollutant Emission Trends

- Compared to 2010[1], units covered under MATS in 2020 emitted 26 fewer tons of mercury (91% reduction).

Background Information

Hazardous air pollutants (HAPs) emitted by power plants include mercury, acid gases (e.g., hydrochloric acid, hydrofluoric acid), non-mercury metallic toxics (e.g., arsenic, nickel, and chromium), and organic HAPs (e.g., formaldehyde, dioxin/furan). Exposure to these pollutants at certain concentrations and durations can increase chances of cancer and immune system damage, along with neurological, reproductive, developmental, respiratory, and other health problems.

In 2011, EPA issued MATS, establishing national emission standards for mercury and other hazardous air pollutants for new and existing coal- and oil-fired power plants. The standards were finalized under section 112 of the Clean Air Act. The MATS emission standards were established using data from a 2010 information collection request (ICR) that was sent to selected coal- and oil- fired EGUs.

More Information

- Power Sector Emissions, Operations, and Environmental Data https://www.epa.gov/airmarkets/data-resources
- MATS https://www.epa.gov/mats
- HAPs https://www.epa.gov/haps

[1] Emissions from 2010 are estimated as described in *Memorandum: Emissions Overview: Hazardous Air Pollutants in Support of the Final Mercury and Air Toxics Standard.* EPA-454/R-11-014. November 2011; Docket ID No. EPA-HQ-OAR-2009-0234-19914.

Figures

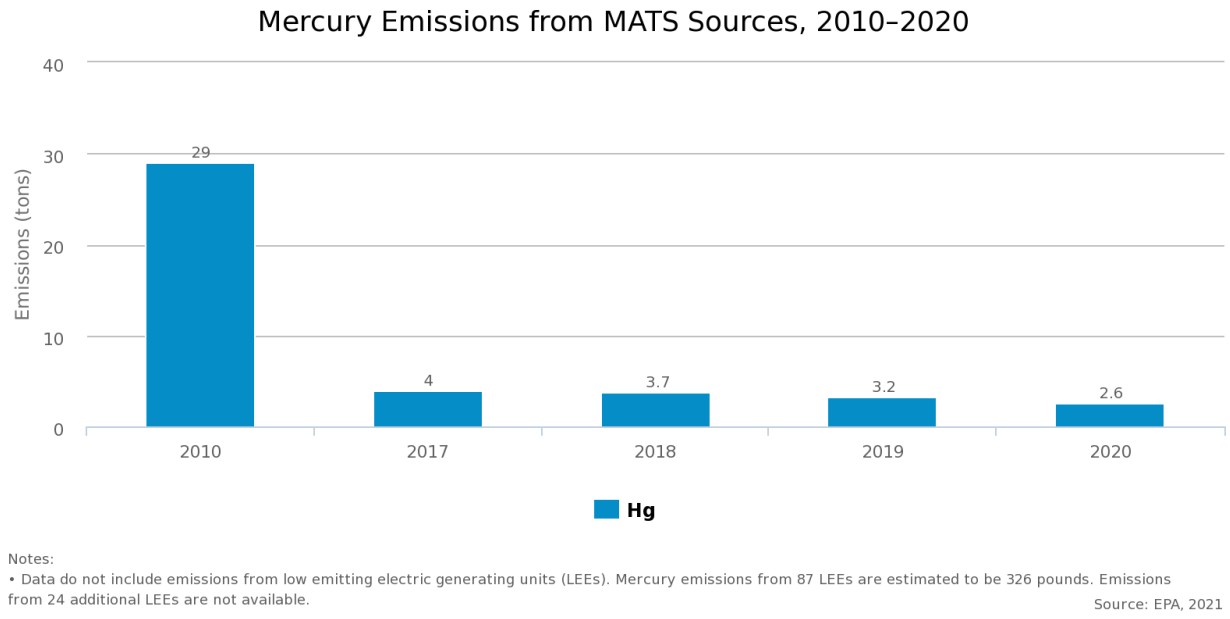


Figure 1. Mercury Emissions from MATS Sources, 2010–2020

Notes:

- Data do not include emissions from low emitting electric generating units (LEEs). Mercury emissions from 87 LEEs are estimated to be 326 pounds. Emissions from 24 additional LEEs are not available.

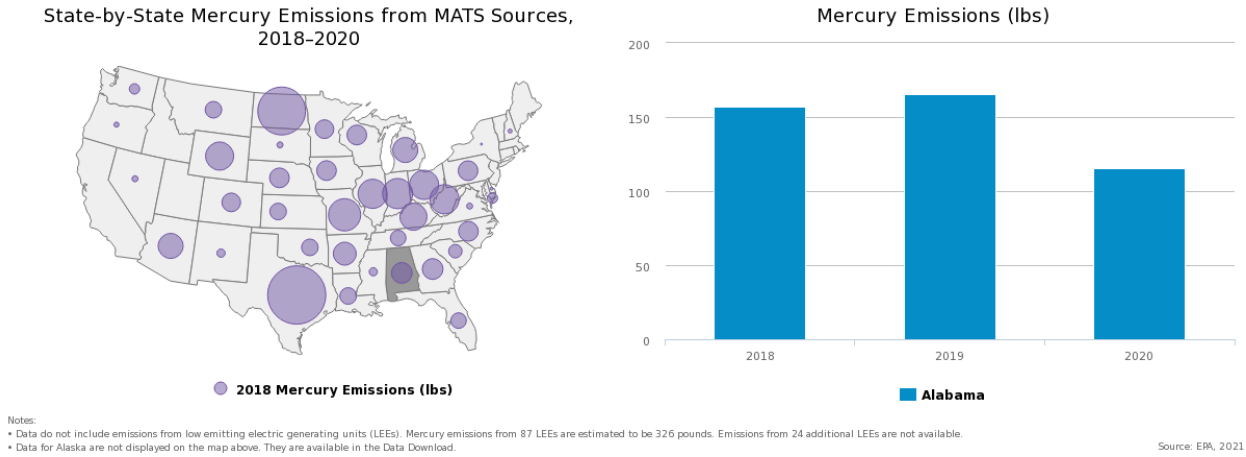


Figure 2. State-by-State Mercury Emissions from MATS Sources, 2020

Notes:

- Data do not include emissions from low emitting electric generating units (LEEs).
- Data for Alaska are not displayed on the map above. They are available in the Data Download.

Chapter 4: Emission Controls and Monitoring

Many sources opted to install control technologies to meet the Acid Rain Program (ARP) and Cross-State Air Pollution Rule (CSAPR) emission reduction targets. A wide range of controls is available to help reduce emissions. Affected units under the Mercury and Air Toxics Standards (MATS) also have several options for reducing hazardous air pollutants and have some flexibility in how they monitor emissions. These programs hold sources to high standards of accountability for emissions. Accurate and consistent emissions monitoring data is critical to ensure program results. Most emissions from affected sources are measured by continuous emission monitoring systems (CEMS).

Highlights

ARP and CSAPR SO_2 Program Controls and Monitoring

- Units with advanced flue gas desulfurization (FGD) controls (also known as scrubbers) accounted for 79 percent of coal-fired units and 86 percent of coal-fired electricity generation, measured in megawatt hours, or MWh, in 2020.
- In 2020, 21 percent of the CSAPR units (including 100 percent of coal-fired units) monitored SO_2 emissions using CEMS. Ninety-nine percent of SO_2 emissions were measured by CEMS.

CSAPR NO_X Annual Program Controls and Monitoring

- Eighty-one percent of fossil fuel-fired generation was produced by units with advanced add-on controls (either selective catalytic reduction [SCR] or selective non-catalytic reduction [SNCR]).
- In 2020, the 258 coal-fired units with advanced add-on controls (either SCRs or SNCRs) generated 78 percent of coal-fired electricity. At oil- and natural gas-fired units, SCR- and SNCR-controlled units produced 84 percent of electricity generation.
- In 2020, 67 percent of the CSAPR units (including 100 percent of coal-fired units) monitored NO_X emissions using CEMS. Ninety-eight percent of NO_X emissions were measured by CEMS.

CSAPR NO_X Ozone Season Program Controls and Monitoring

- Seventy-two percent of all the fossil fuel-fired generation was produced by units with advanced add-on controls (either SCRs or SNCRs).
- In 2020, 233 units with advanced add-on controls (either SCR or SNCR) accounted for 72 percent of coal-fired electricity generation. At oil- and natural gas-fired units, SCR- and SNCR-controlled units produced 72 percent of electricity generation.
- In 2020, 73 percent of the CSAPR units (including 100 percent of coal-fired units) monitored ozone season NO_X emissions using CEMS. Ninety-seven percent of ozone season NO_X emissions were measured by CEMS.

MATS Controls and Monitoring

- In 2020, forty-five percent of the MATS units reporting mercury emissions and 50 percent of the electricity generation at the MATS reporting units used activated carbon injection (ACI), a mercury-specific pollution control method to reduce mercury emissions and SO_2.
- About 82 percent of units that reported continuous mercury emissions data (or 82 percent of the total electricity generation from units that reported data) reported the use of advanced controls, such as wet scrubbers, dry scrubbers, or ACI, to reduce hazardous air pollutant emissions in 2020. These controls also reduce other pollutants, including SO_2. Some oil-fired units can meet the MATS emission limits through the use of particulate matter (PM) controls such as electrostatic precipitators (ESPs) or fabric filters (FFs).

Background Information

Continuous Emission Monitoring Systems (CEMS)

EPA has developed detailed procedures codified in federal regulations (40 CFR Part 75) to ensure that sources monitor and report emissions with a high degree of precision, reliability, accuracy, and timeliness. Sources are required to use CEMS or other approved methods to record and report pollutant emissions data. Sources conduct stringent quality assurance tests of their monitoring systems to ensure the accuracy of emissions data and to provide assurance to market participants that a unit of emissions measured at one facility is equivalent to a quantity measured at a different facility. EPA conducts comprehensive electronic and field data audits to validate the reported data. While some units with low levels of SO_2 or NO_X emissions are allowed to use other approved monitoring methods, the vast majority of SO_2 and NO_X emissions are measured by CEMS.

Under the MATS measurement regulations (40 CFR part 63), affected units can continuously measure emissions using CEMS for mercury, SO_2, hydrochloric acid (HCl), PM, and hydrofluoric acid (HF), or sorbent traps for mercury (Hg). Some qualifying units with low emissions can conduct periodic stack tests in lieu of continuous monitoring.

SO_2 Emission Controls

Sources in the ARP or the CSAPR SO_2 programs have a number of SO_2 emission control options available. These include switching to low sulfur coal or natural gas, employing various types of FGDs, or, in the case of fluidized bed boilers, injecting limestone into the furnace. FGDs – also known as scrubbers – on coal-fired electricity generating units are the principal means of controlling SO_2 emissions and tend to be present on the highest generating coal-fired units.

NO_X Emission Controls

Sources in the ARP or the CSAPR NO_X annual and ozone season programs have a variety of options by which to reduce NO_X emissions, including advanced add-on controls such as SCR or SNCR, and combustion controls, such as low NO_X burners.

Hazardous Air Pollutant Controls

Sources in MATS have a number of options available to reduce hazardous air pollutants (HAPs), including mercury, PM (a surrogate for toxic non-mercury metals), HCl, HF, and other acid gases. Sources can

improve operation of existing controls, add pollution controls, and switch fuels (including coal blending). Specific pollution control devices that reduce mercury and HCl include wet FGDs (scrubbers), activated carbon injection (ACI), dry sorbent injection (DSI), and fabric filters.

More Information

- Power Plant Emission Trends https://www.epa.gov/airmarkets/power-plant-emission-trends
- Power Sector Emissions, Operations, and Environmental Data https://www.epa.gov/airmarkets/data-resources
- Emissions Monitoring https://www.epa.gov/airmarkets/emissions-monitoring-and-reporting
- Plain English guide to 40 CFR Part 75 https://www.epa.gov/airmarkets/plain-english-guide-part-75-rule
- Continuous Emission Monitoring Systems (CEMS) https://www.epa.gov/emc/emc-continuous-emission-monitoring-systems

Figures

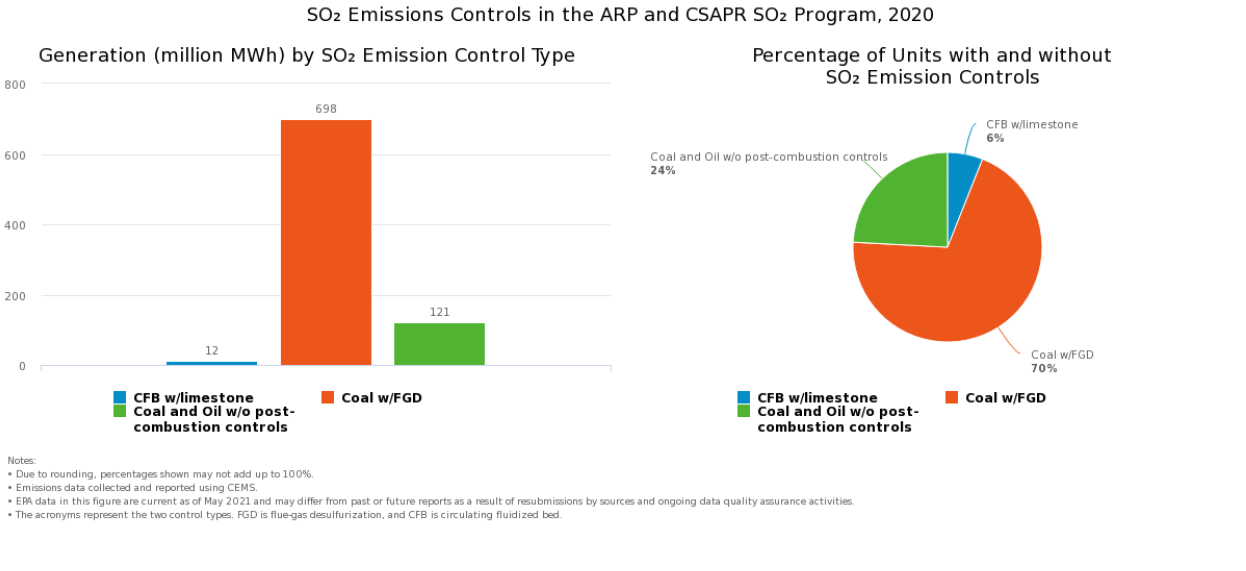


Figure 1. SO_2 Emissions Controls in the ARP and CSAPR SO_2 Program, 2020

Notes:
• Due to rounding, percentages shown may not add up to 100%.
• The acronyms represent the two control types. FGD is flue-gas desulfurization, and CFB is circulating fluidized bed.

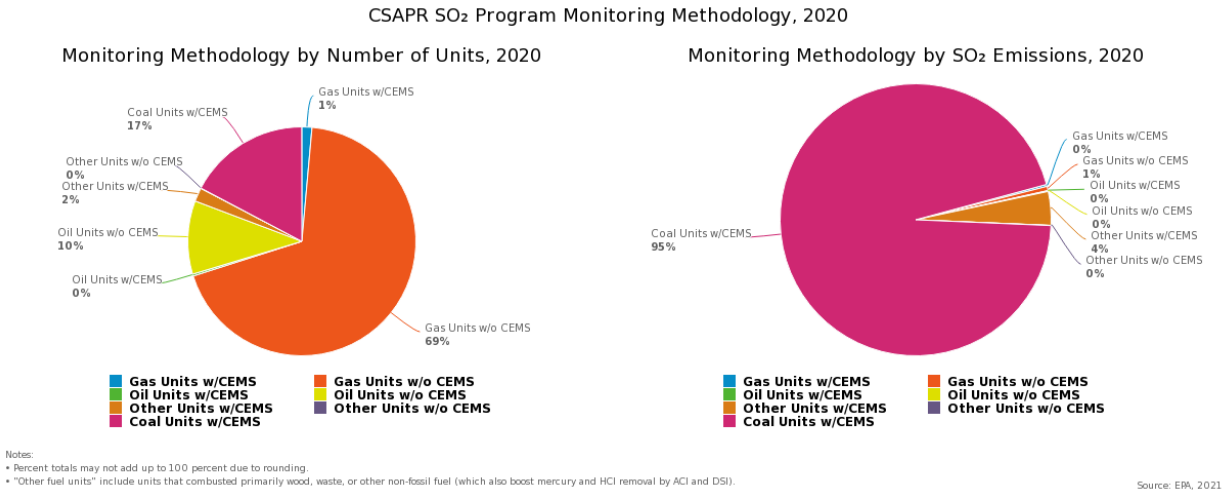


Figure 2. CSAPR SO_2 Program Monitoring Methodology, 2020

Notes:
• Percent totals may not add up to 100 percent due to rounding.
• "Other fuel units" include units that combusted primarily wood, waste, or other non-fossil fuel (which also boost mercury and HCl removal by ACI and DSI).

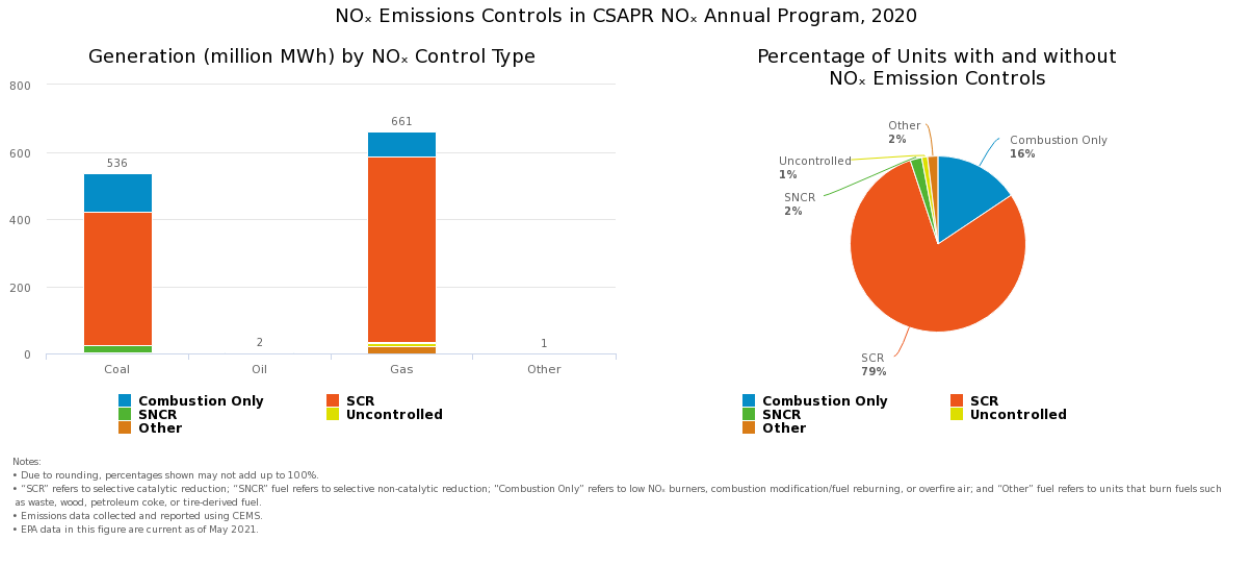


Figure 3. NO_X Emissions Controls in CSAPR NO_X Annual Program, 2020

Notes:
• Due to rounding, percentages shown may not add up to 100%.
• "SCR" refers to selective catalytic reduction; "SNCR" fuel refers to selective non-catalytic reduction; "Combustion Only" refers to low NO_x burners, combustion modification/fuel reburning, and/or overfire air; and "Other" fuel refers to units that burn fuels such as waste, wood, petroleum coke, or tire-derived fuel.
• "Other fuel units" include units that combusted primarily wood, waste, or other non-fossil fuel (which also boost mercury and HCl removal by ACI and DSI).

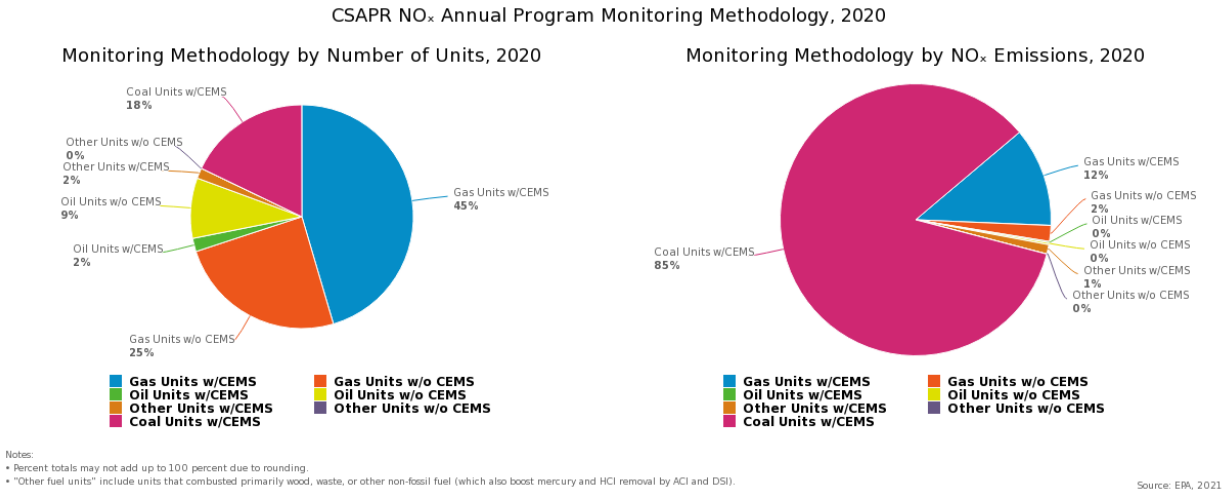


Figure 4. CSAPR NO_X Annual Program Monitoring Methodology, 2020

Notes:
• Percent totals may not add up to 100 percent due to rounding.
• "Other fuel units" include units that combusted primarily wood, waste, or other non-fossil fuel (which also boost mercury and HCl removal by ACI and DSI).

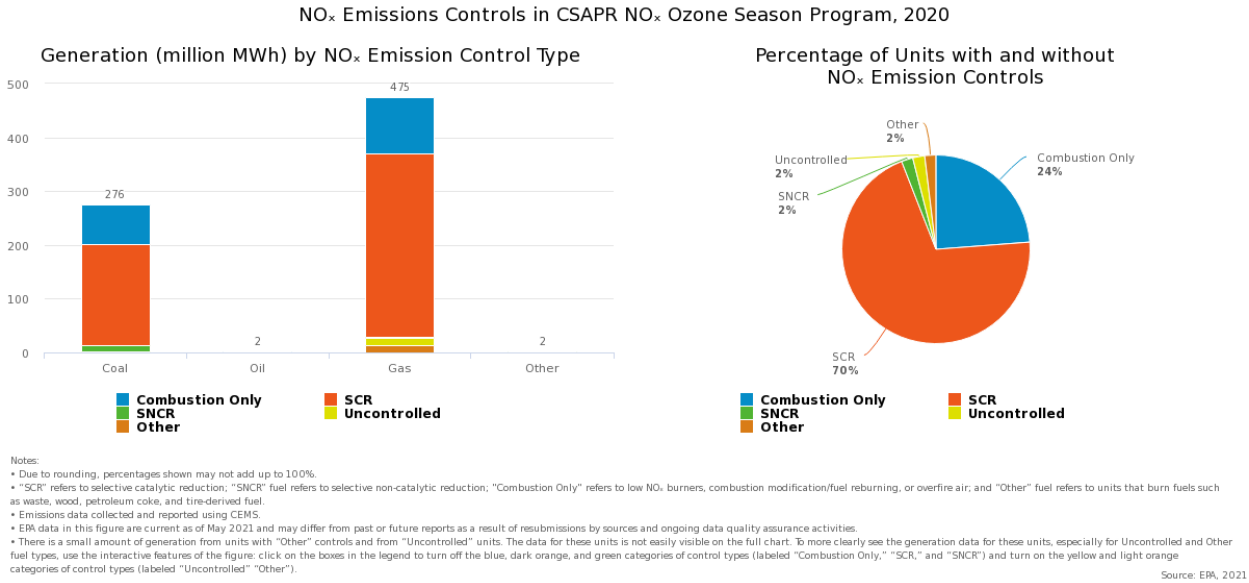


Figure 5. NO_X Emissions Controls in the CSAPR NO_X Ozone Season Program, 2020

Notes:
• Due to rounding, percentages shown may not add up to 100%.
• “SCR” refers to selective catalytic reduction; “SNCR” fuel refers to selective non-catalytic reduction; "Combustion Only" refers to low NO_x burners, combustion modification/fuel reburning, and/or overfire air; and “Other” fuel refers to units that burn fuels such as waste, wood, petroleum coke, and tire-derived fuel.
• "Other fuel units" include units that combusted primarily wood, waste, or other non-fossil fuel (which also boost mercury and HCl removal by ACI and DSI).• There is a small amount of generation from units with “Other” controls and from “Uncontrolled” units. The data for these units is not easily visible on the full chart. To more clearly see the generation data for these units, especially for Uncontrolled and Other fuel types, use the interactive features of the figure: click on the boxes in the legend to turn off the blue, dark orange, and green categories of control types (labeled “Combustion Only,” “SCR,” and “SNCR”) and turn on the yellow and light orange categories of control types (labeled “Uncontrolled” “Other”).

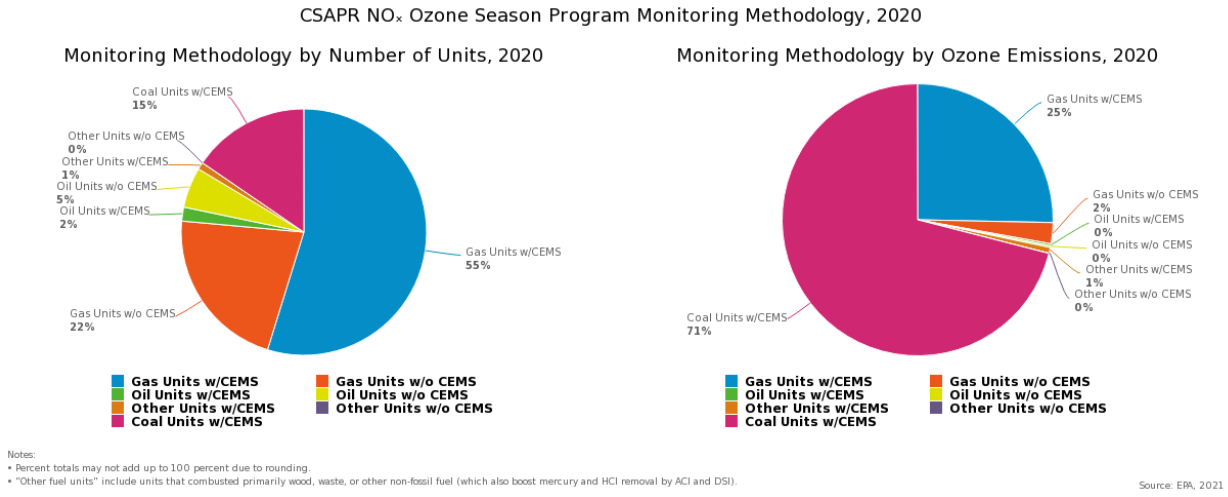


Figure 6. CSAPR NO_X Ozone Season Program Monitoring Methodology, 2020

Notes:
• Percent totals may not add up to 100 percent due to rounding.
• "Other fuel units" include units that combusted primarily wood, waste, or other non-fossil fuel (which also boost mercury and HCl removal by ACI and DSI).

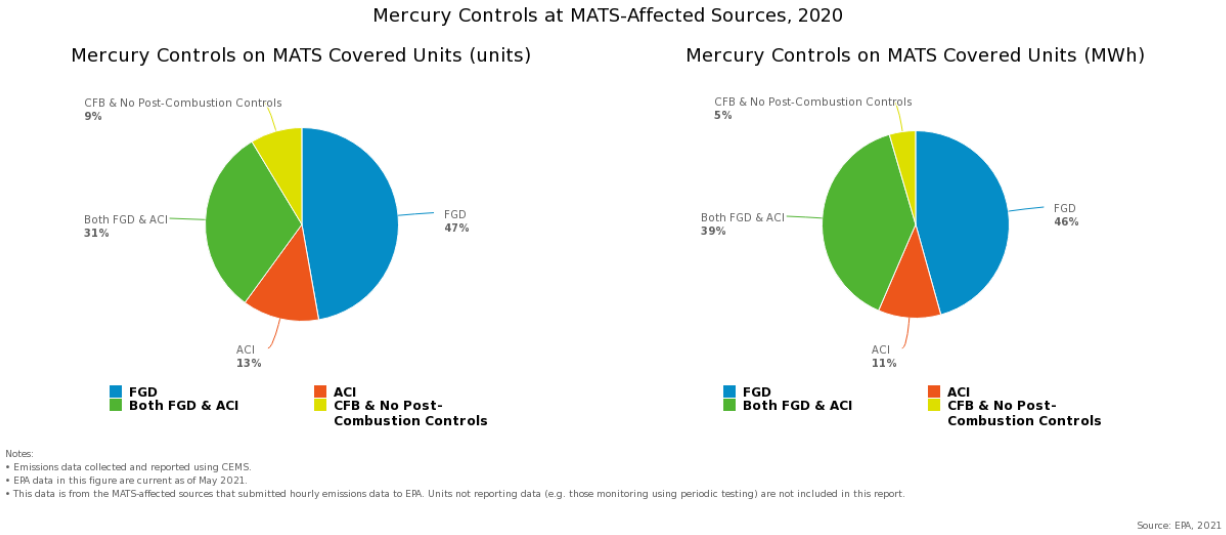


Figure 7. Mercury Controls at MATS-Affected Sources, 2020

Notes:

• Percent totals may not add up to 100 percent due to rounding.
• This data is from the MATS-affected sources that submitted hourly emissions data to EPA. Units not reporting data (e.g. those monitoring using periodic testing) are not included in this report.

Mercury Compliance and Monitoring Methods used by Units Reporting Hourly Data under MATS, 2020

Reporting Hourly Data		Compliance Method (# of Units)		Monitoring Method		
Number of reporting units	Number of reporting facilities	Electrical Output	Heat Input	Sorbent Trap	CEMS	CEMS and Sorbent Trap
463	211	142	321	204	212	47

Notes:
• Emissions data collected and reported using CEMS.
• EPA data in this figure are current as of May 2021.
• This data is from the MATS-affected sources that submitted hourly emissions data to EPA and does not show complete data from all the MATS-affected sources because many sources received compliance extensions or chose to demonstrate compliance through methods other than continuously monitored emissions.

Source: EPA, 2021
Last updated: 05/2021

Figure 8. Mercury Compliance and Monitoring Methods used by Units Reporting Hourly Data under MATS, 2020

Notes:

• This data is from the MATS-affected sources that submitted hourly emissions data to EPA and does not show complete data from all the MATS-affected sources because many sources received compliance extensions or chose to demonstrate compliance through methods other than continuously monitored emissions.

Chapter 5: Program Compliance

This section shows how the Acid Rain Program (ARP) and Cross-State Air Pollution Rule (CSAPR) allowances were used for compliance under the allowance trading programs in 2020. In contrast to the ARP and CSAPR, MATS is issued under section 112 of the Clean Air Act and is not an allowance trading program.

Highlights

ARP SO_2 Program

- The reported 2020 SO_2 emissions by the ARP sources totaled 778,120 tons.
- About 66 million SO_2 allowances were available for compliance (9 million vintage 2020 and nearly 57 million banked from prior years).
- EPA deducted over 775,000 allowances for the ARP compliance. After reconciliation, just about 65 million ARP SO_2 allowances were banked and carried forward to the 2021 ARP compliance year.
- All ARP SO_2 facilities were in compliance in 2020 (holding sufficient allowances to cover their SO_2 emissions).

CSAPR SO_2 Group 1 Program

- The reported 2020 SO_2 emissions by the CSAPR Group 1 sources totaled 432,224 tons.
- Over 6.3 million SO_2 Group 1 allowances were available for compliance.
- EPA deducted over 432,000 allowances for the CSAPR SO_2 Group 1 compliance. After reconciliation, about 6 million CSAPR SO_2 Group 1 allowances were banked and carried forward to the 2021 compliance year.
- All CSAPR SO_2 Group 1 facilities were in compliance in 2020 (holding sufficient allowances to cover their SO_2 emissions).

CSAPR SO_2 Group 2 Program

- The reported 2020 SO_2 emissions by the CSAPR Group 2 sources totaled 64,688 tons.
- Over 3 million SO_2 Group 2 allowances were available for compliance.
- EPA deducted almost 65,000 allowances for the CSAPR SO_2 Group 2 compliance. After reconciliation, about 3 million CSAPR SO_2 Group 2 allowances were banked and carried forward to the 2021 compliance year.
- All CSAPR SO_2 Group 2 facilities were in compliance in 2020 (holding sufficient allowances to cover their SO_2 emissions).

CSAPR NO_X Annual Program

- The reported 2020 annual NO_X emissions by the CSAPR sources totaled 405,334 tons.

- Over 3.2 million NO_X Annual allowances were available for compliance.
- EPA deducted over 405,000 allowances for the CSAPR NO_X Annual Program compliance. After reconciliation, about 3 million CSAPR NO_X Annual Program allowances were banked and carried forward to the 2021 compliance year.
- All CSAPR NO_X Annual Program facilities were in compliance in 2020 (holding sufficient allowances to cover their NO_X emissions).

CSAPR NO_X Ozone Season Group 1 Program

- The reported 2020 ozone season NO_X emissions by the CSAPR sources totaled 5,164 tons.
- Over 93,000 NO_X Ozone Season Group 1 allowances were available for compliance.
- EPA deducted over 5,100 allowances for the CSAPR NO_X Ozone Season Group 1 compliance. After reconciliation, almost 88,000 CSAPR NO_X Ozone Season Group 1 allowances were banked.
- All CSAPR NO_X Ozone Season Group 1 facilities were in compliance (holding sufficient allowances to cover their NO_X emissions).

CSAPR NO_X Ozone Season Group 2 Program

- The reported 2020 ozone season NO_X emissions by the CSAPR sources totaled 227,255 tons.
- Over 492,000 NO_X Ozone Season Group 2 allowances were available for compliance.
- EPA deducted over 227,000 allowances for the CSAPR NO_X Ozone Season Group 2 compliance. After reconciliation, over 265,000 CSAPR NO_X Ozone Season Group 2 allowances were banked.
- All CSAPR NO_X Ozone Season Group 2 facilities were in compliance (holding sufficient allowances to cover their NO_X emissions).
- In 2020, Mississippi and Missouri units covered by the CSAPR Ozone Season NO_X Group 2 Program reported emissions exceeding the respective states' assurance levels, triggering the assurance provisions. Emissions in Mississippi and Missouri exceeded each state's assurance levels by 260 and 2,448 tons, respectively, resulting in the surrender of 5,416 additional allowances.[1]

Background Information

The year 2020 was the sixth year of compliance for the CSAPR SO_2 (Group 1 and Group 2), NO_X Annual and NO_X Ozone Season Group 1 programs, while it was the fourth year of compliance for both the CSAPR NO_X Ozone Season Group 2 program and CSAPR Update. Each program has its own distinct set of allowances, which cannot be used for compliance with the other programs (e.g., CSAPR SO_2 Group 1 allowances cannot be used to comply with the CSAPR SO_2 Group 2 Program). Each CSAPR trading program contains "assurance provisions" to guarantee that each covered state achieves the required emissions reductions. If a state's covered units exceed the state's assurance level under the specific trading program, then the state must surrender two allowances for each ton of emissions exceeding the assurance level.

[1]See 86 Fed. Reg. 26720.

The compliance summary emissions number cited in "Highlights" may differ slightly from the sums of emissions used for reconciliation purposes shown in the "Allowance Reconciliation Summary" figures because of variation in rounding conventions, changes due to resubmissions by sources, and compliance issues at certain units. Therefore, the allowance totals deducted for actual emissions in those figures differ slightly from the number of emissions shown elsewhere in this report.

More Information

- Allowance Markets https://www.epa.gov/airmarkets/allowance-markets
- Air Markets Business Center https://www.epa.gov/airmarkets/business-center
- Air Markets Program Data (AMPD) https://ampd.epa.gov/ampd/
- Emissions Trading https://www.epa.gov/emissions-trading-resources

Figures

Acid Rain Program SO_2 Program Allowance Reconciliation Summary, 2020

Total Allowance Held (1995 - 2020 Vintage)	**65,822,753**	Held by Affected Facility Accounts	**40,297,580**
		Held by Other Accounts (General and Non-Affected Facility Accounts)	**25,525,173**
Allowances Deducted for Acid Rain Compliance*	775,291		
Penalty Allowance Deductions	0		
Banked Allowances	**65,047,462**	Held by Affected Facility Accounts	**39,522,289**
		Held by Other Accounts (General and Non-Affected Facility Accounts)	**25,525,173**

* Includes allowances deducted from opt-in for reduced utilization.

Acid Rain Program Compliance Results

Reported Emissions (tons)	778,120
Compliance issues, rounding, and report resubmission adjustments (tons)	-2,829
Emissions not covered by allowances (tons)	0
Total allowances deducted for emissions	775,291

Notes:
- Compliance emissions data may vary from other report sections as a result of variation in rounding conventions, changes due to resubmissions by sources, or allowance compliance issues at certain units.
- Reconciliation and compliance data are current as of May 2021 and subsequent allowance deduction adjustments and penalties are not reflected.

Source: EPA, 2021

Figure 1. Acid Rain Program SO_2 Program Allowance Reconciliation Summary, 2020

Notes:
• Compliance emissions data may vary from other report sections as a result of variation in rounding conventions, changes due to resubmission by sources, or allowance compliance issues at certain units.
• Reconciliation and compliance data are current as of May 2021 and subsequent allowance deduction adjustments and penalties are not reflected.

Cross-State Air Pollution Rule SO_2 Group 1 Program Allowance Reconciliation Summary, 2020

Total Allowance Held (2015 - 2020 Vintage)	**6,357,857**	Held by Affected Facility Accounts	**4,989,947**
		Held by Other Accounts (General, State Holding and Non-Affected Facility Accounts)	**1,367,910**
Allowances Deducted for Cross-State Air Pollution Rule SO_2 Group 1 Program	432,185		
Penalty Allowance Deductions	0		
Banked Allowances	**5,925,672**	Held by Affected Facility Accounts	**4,557,762**
		Held by Other Accounts (General, State Holding and Non-Affected Facility Accounts)	**1,367,910**

CSAPR SO_2 Group 1 Program Compliance Results

Reported Emissions (tons)	432,224
Compliance issues, rounding, and report resubmission adjustments (tons)	-39
Emissions not covered by allowances (tons)	0
Total allowances deducted for emissions	432,185

Notes:
- Compliance emissions data may vary from other report sections as a result of variation in rounding conventions, changes due to resubmissions by sources, or allowance compliance issues at certain units.
- Reconciliation and compliance data are current as of May 2021 and subsequent allowance deduction adjustments and penalties are not reflected.

Source: EPA, 2021

Figure 2. Cross-State Air Pollution Rule SO_2 Group 1 Program Allowance Reconciliation Summary, 2020

Notes:
• Compliance emissions data may vary from other report sections as a result of variation in rounding conventions, changes due to resubmission by sources, or allowance compliance issues at certain units.
• Reconciliation and compliance data are current as of May 2021 and subsequent allowance deduction adjustments and penalties are not reflected.

Cross-State Air Pollution Rule SO_2 Group 2 Program Allowance Reconciliation Summary, 2020

Total Allowance Held (2015 - 2020 Vintage)	**3,023,540**	Held by Affected Facility Accounts	**2,366,664**
		Held by Other Accounts (General, State Holding and Non-Affected Facility Accounts)	**656,876**
Allowances Deducted for Cross-State Air Pollution Rule SO_2 Group 2 Program	64,685		
Penalty Allowance Deductions	0		
Banked Allowances	**2,958,855**	Held by Affected Facility Accounts	**2,301,979**
		Held by Other Accounts (General, State Holding and Non-Affected Facility Accounts)	**656,876**

CSAPR SO_2 Group 2 Program Compliance Results

Reported Emissions (tons)	64,688
Compliance issues, rounding, and report resubmission adjustments (tons)	-3
Emissions not covered by allowances (tons)	0
Total allowances deducted for emissions	64,685

Notes:
- Compliance emissions data may vary from other report sections as a result of variation in rounding conventions, changes due to resubmissions by sources, or allowance compliance issues at certain units.
- Reconciliation and compliance data are current as of May 2021 and subsequent allowance deduction adjustments and penalties are not reflected.

Source: EPA, 2021

Figure 3. Cross-State Air Pollution Rule SO_2 Group 2 Program Allowance Reconciliation Summary, 2020

Notes:
• Compliance emissions data may vary from other report sections as a result of variation in rounding conventions, changes due to resubmission by sources, or allowance compliance issues at certain units.
• Reconciliation and compliance data are current as of May 2021 and subsequent allowance deduction adjustments and penalties are not reflected.

Cross-State Air Pollution Rule NO_x Annual Program Allowance Reconciliation Summary, 2020

Total Allowance Held (2015 - 2020 Vintage)	**3,294,773**	Held by Affected Facility Accounts	**2,624,608**
		Held by Other Accounts (General, State Holding and Non-Affected Facility Accounts)	**670,165**
Allowances Deducted for Cross-State Air Pollution Rule NO_x Annual Program	405,415		
Penalty Allowance Deductions	0		
Banked Allowances	**2,889,358**	Held by Affected Facility Accounts	**2,219,193**
		Held by Other Accounts (General, State Holding and Non-Affected Facility Accounts)	**670,165**

CSAPR NO_x Annual Program Compliance Results	
Reported Emissions (tons)	405,334
Compliance issues, rounding, and report resubmission adjustments (tons)	81
Emissions not covered by allowances (tons)	0
Total allowances deducted for emissions	405,415

Notes:
- Compliance emissions data may vary from other report sections as a result of variation in rounding conventions, changes due to resubmissions by sources, or allowance compliance issues at certain units.
- Reconciliation and compliance data are current as of May 2021 and subsequent allowance deduction adjustments and penalties are not reflected.

Source: EPA, 2021

Figure 4. Cross-State Air Pollution Rule NO_X Annual Program Allowance Reconciliation Summary, 2020

Notes:
• Compliance emissions data may vary from other report sections as a result of variation in rounding conventions, changes due to resubmission by sources, or allowance compliance issues at certain units.
• Reconciliation and compliance data are current as of May 2021 and subsequent allowance deduction adjustments and penalties are not reflected.

Cross-State Air Pollution Rule NO_x Ozone Season Program Group 1 Allowance Reconciliation Summary, 2020

Total Allowance Held (2015 - 2020 Vintage)	**93,155**	Held by Affected Facility Accounts	**40,214**
		Held by Other Accounts (General, State Holding and Non-Affected Facility Accounts)	**52,941**
Allowances Deducted for Cross-State Air Pollution Rule NO_x Ozone Season Program Group 1	5,172		
Penalty Allowance Deductions	0		
Banked Allowances	**87,983**	Held by Affected Facility Accounts	**35,042**
		Held by Other Accounts (General, State Holding and Non-Affected Facility Accounts)	**52,941**

CSAPR NO_x Ozone Season Program Group 1 Compliance Results

Reported Emissions (tons)	5,164
Compliance issues, rounding, and report resubmission adjustments (tons)	8
Emissions not covered by allowances (tons)	0
Total allowances deducted for emissions	5,172

Notes:
- Compliance emissions data may vary from other report sections as a result of variation in rounding conventions, changes due to resubmissions by sources, or allowance compliance issues at certain units.
- Reconciliation and compliance data are current as of May 2021 and subsequent allowance deduction adjustments and penalties are not reflected.

Source: EPA, 2021

Figure 5. Cross-State Air Pollution Rule NO_X Ozone Season Program Group 1 Allowance Reconciliation Summary, 2020

Notes:
• Compliance emissions data may vary from other report sections as a result of variation in rounding conventions, changes due to resubmission by sources, or allowance compliance issues at certain units.
• Reconciliation and compliance data are current as of May 2021 and subsequent allowance deduction adjustments and penalties are not reflected.

Cross-State Air Pollution Rule NO_x Ozone Season Program Group 2 Allowance Reconciliation Summary, 2020

Total Allowance Held (2017 - 2020 Vintage)	**492,574**	Held by Affected Facility Accounts	**428,725**
		Held by Other Accounts (General, State Holding and Non-Affected Facility Accounts)	**63,849**
Allowances Deducted for Cross-State Air Pollution Rule NO_x Ozone Season Program Group 2	227,479		
Penalty Allowance Deductions	0		
Banked Allowances	**265,095**	Held by Affected Facility Accounts	**201,246**
		Held by Other Accounts (General, State Holding and Non-Affected Facility Accounts)	**63,849**

CSAPR NO_x Ozone Season Program Group 2 Compliance Results

Reported Emissions (tons)	227,255
Compliance issues, rounding, and report resubmission adjustments (tons)	224
Emissions not covered by allowances (tons)	0
Total allowances deducted for emissions	227,479

Notes:
- Compliance emissions data may vary from other report sections as a result of variation in rounding conventions, changes due to resubmissions by sources, or allowance compliance issues at certain units.
- Reconciliation and compliance data are current as of May 2021 and subsequent allowance deduction adjustments and penalties are not reflected.

Source: EPA, 2021

Figure 6. Cross-State Air Pollution Rule NO_X Ozone Season Program Group 2 Allowance Reconciliation Summary, 2020

Notes:
• Compliance emissions data may vary from other report sections as a result of variation in rounding conventions, changes due to resubmission by sources, or allowance compliance issues at certain units.
• Reconciliation and compliance data are current as of May 2021 and subsequent allowance deduction adjustments and penalties are not reflected.

Chapter 6: Market Activity

Cap and trade programs allow participants to independently determine their best compliance strategy. Participants that reduce their emissions below the number of allowances they hold may trade allowances, sell them, or bank them for use in future years. While the ARP and CSAPR are cap and trade programs, MATS is not a market-based program; therefore, this section does not discuss MATS.

Highlights

Transaction Types and Volumes

- In 2020, more than 1.3 million allowances were traded across all five of the CSAPR trading programs.
- Thirty-nine percent of the transactions within the CSAPR programs were between distinct organizations.
- In 2020, over 1.8 million ARP allowances were traded.
- Twenty percent of the transactions within the ARP program were between distinct organizations.

2020 Allowance Prices[1]

- The ARP SO_2 allowance prices averaged less than $1 per ton in 2020.
- The CSAPR SO_2 Group 1 allowance prices started 2020 at $2.31 per ton and ended 2020 at $1.56 per ton.
- The CSAPR SO_2 Group 2 allowance prices started 2020 at $2.56 per ton and ended 2020 at $2.31 per ton.
- The CSAPR NO_X annual program allowances started 2020 at $2.75 per ton and ended 2020 at $2 per ton.
- The CSAPR NO_X ozone season program allowances started 2020 at $93.75 per ton and ended 2020 at $200 per ton.[2]

Background Information

Transaction Types and Volumes

Allowance transfer activity includes two types of transfers: EPA transfers to accounts and private transactions. EPA transfers to accounts include the initial allocation of allowances by states or EPA, as

[1] Allowance prices as reported by S&P Global Market Intelligence, 2021.

[2] These prices reflect the CSAPR Update ozone season NO_X allowances. In October 2016, EPA published an update to the CSAPR ozone season allowance trading programs. On October 26th, 2016, most CSAPR ozone season NO_X allowances were converted to the CSAPR Update ozone season NO_X allowances. On April 30th, 2021, EPA published an update to the CSAPR Update ozone season allowance trading program, the Revised CSAPR Update Rule.

well as transfers into accounts related to set-asides. This category does not include transfers due to allowance retirements. Private transactions include all transfers initiated by authorized account representatives for any compliance or general account purposes.

To better understand the trends in market performance and transfer history, EPA classifies private transfers of allowance transactions into two categories:

- Transfers between separate and unrelated parties (distinct organizations), which may include companies with contractual relationships (such as power purchase agreements) but excludes parent-subsidiary types of relationships.
- Transfers within a company or between related entities (e.g., holding company transfers between a facility compliance account and any account held by a company with an ownership interest in the facility).

While all transactions are important to proper market operation, EPA follows trends in transactions between distinct economic entities with particular interest. These transactions represent an actual exchange of assets between unaffiliated participants, which reflect companies making the most of the cost-minimizing flexibility of emission trading programs. Companies accomplish this by finding the cheapest emission reductions not only among their own generating assets, but across the entire marketplace of power generators.

Allowance Markets

The 2020 emissions were below emission budgets for the Acid Rain Program (ARP) and for all five Cross-State Air Pollution Rule (CSAPR) programs. As a result, the CSAPR allowance prices were well below the marginal cost for reductions projected at the time of the final rule, and are subject, in part, to downward pressure from the available banks of allowances.

More Information

- Allowance Markets https://www.epa.gov/airmarkets/allowance-markets
- Air Markets Business Center https://www.epa.gov/airmarkets/business-center
- Air Markets Program Data (AMPD) https://ampd.epa.gov/ampd/
- Emissions Trading https://www.epa.gov/emissions-trading-resources

Figures

2020 Allowance Transfers under CSAPR and ARP

	Transactions Conducted	Allowances Transferred	Share of Program's Allowances Transferred	
			Related (%)	Distinct (%)
ARP SO_2	544	1,837,918	93%	7%
CSAPR SO_2 Group 1	204	249,754	40%	60%
CSAPR SO_2 Group 2	57	634,495	99%	1%
CSAPR NO_x Annual	400	326,533	80%	20%
CSAPR NO_x Ozone Season Group 1	26	17,032	98%	2%
CSAPR NO_x Ozone Season Group 2	802	122,871	52%	48%

Notes:
• The breakout between distinct and related organizations is not an exact value as relationships are often difficult to categorize in a simple bifurcated manner. EPA's analysis is conservative and the "Distinct Organizations" percentage is likely higher.
• Percentages may not add up to 100% due to rounding.

Source: EPA, 2021
Last updated: 05/2021

Figure 1. 2020 Allowance Transfers under CSAPR and ARP

Notes:
• The breakout between distinct and related organizations is not an exact value as relationships are often difficult to categorize in a simple bifurcated manner. EPA's analysis is conservative and the "Distinct Organizations" percentage is likely higher.
• Percentages may not add up to 100% due to rounding.

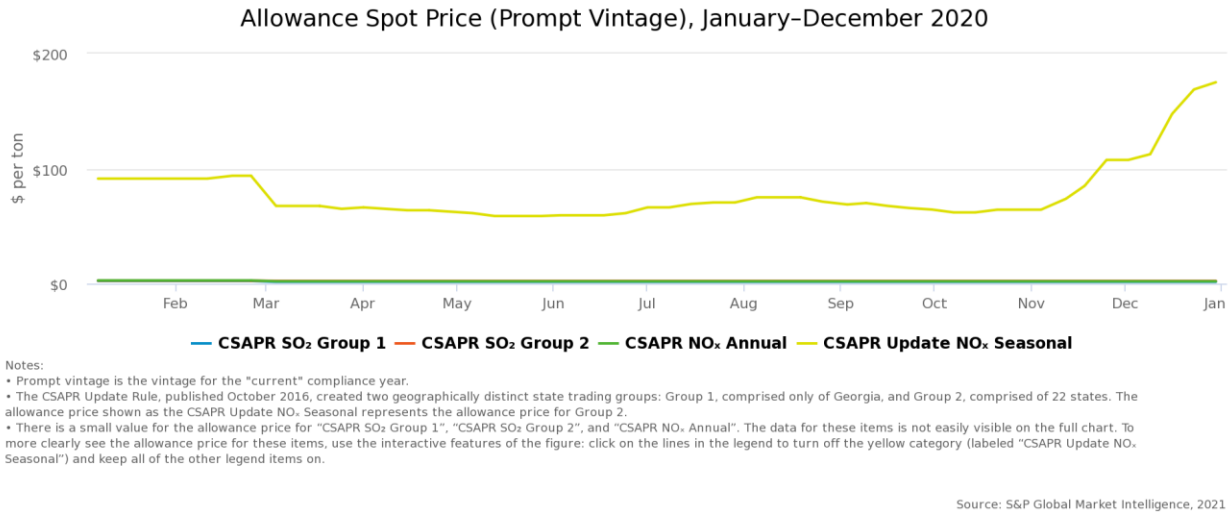


Figure 2. Allowance Spot Price (Prompt Vintage), January–December 2020

Notes:
• Prompt vintage is the vintage for the "current" compliance year.
• The CSAPR Update Rule, published October 2016, created two geographically distinct state trading groups: Group 1, comprised only of Georgia, and Group 2, comprised of 22 states. The allowance price shown as the CSAPR Update NO_x Seasonal represents the allowance price for Group 2.
• There is a small value for the allowance price for "CSAPR SO_2 Group 1", "CSAPR SO_2 Group 2", and "CSAPR NO_x Annual". The data for these items is not easily visible on the full chart. To more clearly see the allowance price for these items, use the interactive features of the figure: click on the lines in the legend to turn off the yellow category (labeled "CSAPR Update NO_x Seasonal") and keep all of the other legend items on.