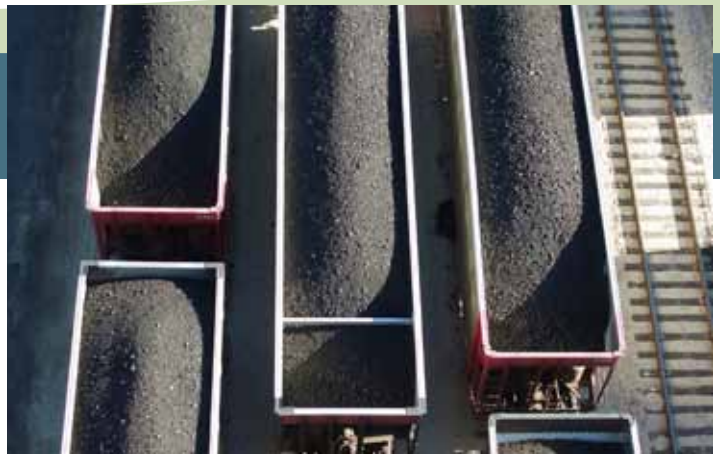
EPA
United States
Environmental Protection
Agency

Clean Air Interstate Rule, Acid Rain Program, and Former NO_x Budget Trading Program

2012 PROGRESS REPORT

SO_2 and NO_x Emissions, Compliance, and Market Analyses



2012 ARP and CAIR at a Glance

CAIR and ARP Annual SO_2 Emissions

3.3 million tons
(68 percent below 2005)

CAIR Ozone Season NO_x Emissions

514,000 tons
(37 percent below 2005)

CAIR and ARP Annual NO_x Emissions

1.7 million tons
(53 percent below 2005)

Perfect compliance

for all facilities reporting to the CAIR and ARP programs

Program Basics

The Clean Air Interstate Rule (CAIR) and the Acid Rain Program (ARP) are both cap and trade programs designed to reduce emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) from power plants.

The ARP, established under Title IV of the 1990 Clean Air Act (CAA) Amendments, requires major emission reductions of SO_2 and NO_x, the primary precursors of acid rain, from the power sector. The SO_2 program sets a permanent cap on the total amount of SO_2 that may be emitted by electric generating units (EGUs) in the contiguous United States. The program is phased in, with the final 2010 SO_2 cap set at 8.95 million tons, 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 program that applies to a subset of coal-fired EGUs and is closer to a traditional, rate-based regulatory system. Since the program began in 1995, the ARP has achieved significant emission reductions. For more information on the ARP, please visit the ARP website at <epa.gov/airmarkets/progsregs/arp/index.html>.

The NO_x Budget Trading Program (NBP) operated from 2003 to 2008. The NBP was a cap and trade program that required NO_x emission reductions from power plants and industrial units in the eastern U.S. during the summer months. For more information on the NBP, please visit the NO_x Budget Trading Program/NO_x SIP Call website at <epa.gov/airmarkets/progsregs/nox/sip.html>.

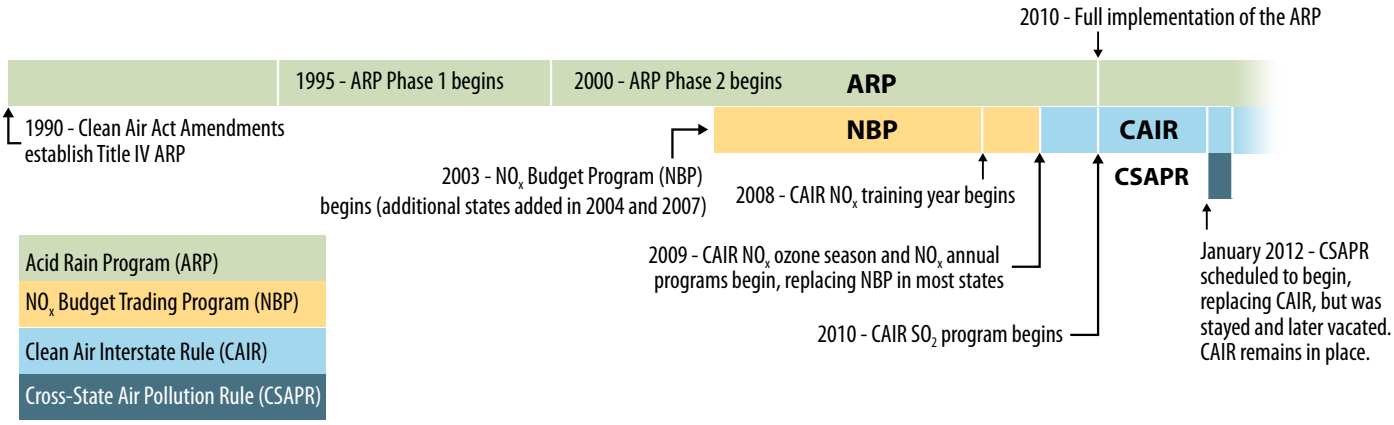
CAIR addresses regional interstate transport of ozone and fine particle pollution. CAIR requires certain eastern states to limit annual emissions of NO_x and SO_2, which contribute to the formation of smog (ground-level ozone) and soot (fine particulate matter). It also requires certain states to limit ozone season NO_x emissions, which contribute to the formation of smog during the summer ozone season (May through September). CAIR includes three separate cap and trade programs to achieve the required reductions: the CAIR NO_x ozone season trading program, the CAIR NO_x annual trading program, and the CAIR SO_2 annual trading program. The CAIR NO_x ozone season and annual programs began in 2009, while the CAIR SO_2 annual program began in 2010. The reduction in ozone and fine particles ($PM_{2.5}$) formation resulting from implementation of CAIR provides health benefits as well as improved visibility in national parks and improvements in freshwater aquatic ecosystems in the eastern U.S. For more information on CAIR, please visit the CAIR website at <epa.gov/airmarkets/progsregs/cair/>.

Cross-State Air Pollution Rule and Litigation

EPA issued the Cross-State Air Pollution Rule (CSAPR) in July 2011, requiring 28 states in the eastern half of the U.S. to significantly improve air quality by reducing power plant emissions that cross state lines and contribute to ozone and fine particle pollution in other states. CSAPR includes three separate cap and trade programs to achieve these reductions: the CSAPR NO_x ozone season trading program, the CSAPR NO_x annual trading program, and the CSAPR SO_2 annual trading program. The CSAPR trading programs were scheduled to replace the CAIR trading programs starting on January 1, 2012. However, on December 30, 2011, the U.S. Court of Appeals for the District of Columbia Circuit (D.C. Circuit Court) stayed CSAPR pending judicial review and on August 21, 2012 the court issued a decision vacating the rule. The U.S. Supreme Court subsequently granted petitions from EPA and several environmental and public health organizations to review the D.C. Circuit Court's decision. EPA anticipates that the Supreme Court will issue its opinion in the first half of 2014. At this time, CAIR remains in place and no immediate action from States or affected sources is expected. For more information on CSAPR, please visit the CSAPR website at <www.epa.gov/airtransport/CSAPR/index.html>.

Figure 1 contains important milestones for ARP, NBP, CAIR, and CSAPR.

Figure 1: History of ARP, NBP, CAIR, and CSAPR



Source: EPA, 2013

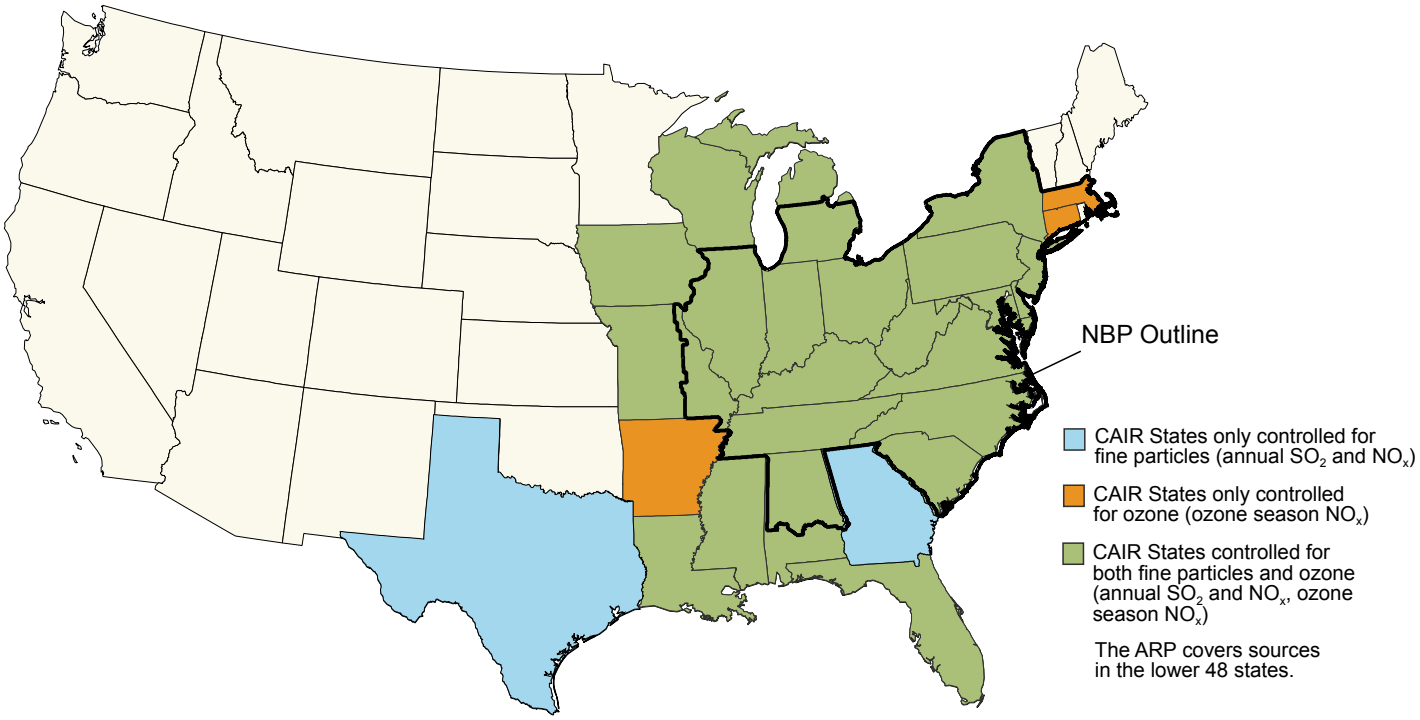
Next Steps in Addressing Interstate Air Pollution Transport

EPA is working with state partners on the next steps to address air pollution that crosses state boundaries—particularly with respect to recently promulgated health-based air quality standards. After considering input from states and other stakeholders, the initial focus will be to define upwind states' obligations under the 2008 ozone standards to address transported air pollution affecting the eastern half of the U.S., resulting in a proposed rulemaking by late summer 2014. In addition, EPA will continue supporting efforts across the U.S. that reduce SO_2 and NO_x emissions by implementing existing programs, finalizing pending rules, and working with regional, state, and local air quality planners to evaluate the need for additional clean air actions.

2012 Progress Reports

Each year EPA releases reports summarizing progress under both CAIR and the ARP. In these 2012 reports, EPA combines data for both CAIR and the ARP in a first report to show reductions in power sector emissions of SO_2 and NO_x and a second report to assess the effect of these regional programs on human health and the environment. This report presents 2012 data on combined emission reductions and compliance results for CAIR and the ARP as well as some historic NBP emissions data; it also analyzes emission reductions and market activity. The second report will evaluate changes in a variety of human health and environmental indicators.

Figure 2: CAIR, ARP, and NBP States



Source: EPA, 2013

CAIR, ARP, and NBP Affected States and Units

Affected States

The ARP is a nationwide program affecting large fossil fuel-fired power plants across the country. CAIR covers 27 eastern states and the District of Columbia (D.C.) and requires reductions in annual emissions of SO_2 and NO_x from 24 states and D.C. (to achieve improvements in fine particle pollution in downwind areas) and emission reductions of NO_x during the ozone season from 25 states and D.C. (to achieve improvements in ozone pollution in downwind areas). The former NBP affected 20 eastern states and D.C. State coverage for CAIR, ARP, and NBP is shown in Figure 2, above.

Affected Units

The CAIR SO_2 and NO_x annual programs generally apply to large electric generating units (EGUs) — boilers, turbines, and combined cycle units that primarily burn fossil fuels to generate electricity for sale. The CAIR NO_x ozone season program includes EGUs as well as, in some states, large industrial units that produce electricity or steam primarily for internal use and that have been carried over from the NBP. Examples of these units are boilers and turbines at heavy manufacturing facilities such as paper mills, petroleum refineries, and iron and steel production facilities. These units also include some steam plants at institutional settings such as large universities or hospitals.

Table 1: Affected Units in CAIR and ARP, 2012

Fuel	ARP SO_2 Program	ARP NO_x Program	CAIR NO_x Ozone Season Program	CAIR NO_x and SO_2 Annual Programs
Coal EGUs	1,003	885	812	869
Gas EGUs	2,430	11	1,719	2,009
Oil EGUs	187	0	514	427
Industrial Units	4	0	198	0
Unclassified EGUs	10	0	1	4
Other Fuel EGUs	18	4	29	27
Total Units	**3,652**	**900**	**3,273**	**3,336**

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 waste, wood, petroleum coke, tire-derived fuel, etc.
Source: EPA, 2013

Photo: EPA, 2005

In 2012, there were 3,336 affected EGUs at 952 facilities in the CAIR SO_2 and NO_x annual programs and 3,273 EGUs and industrial facility units at 949 facilities in the CAIR NO_x ozone season program (see Table 1). The variation in the number of units covered under the programs is due to the difference in states that are included in each program (see Figure 2, above). EGUs in the CAIR programs cover 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 on peak demand days only and may not operate at all during some years.

The SO_2 requirements under the ARP apply to the 3,652 fossil fuel-fired combustion units at 1,249 facilities across the country that serve a large generator (greater than 25 megawatts) that provides electricity for sale. The vast majority of ARP SO_2 emissions result from coal-fired EGUs, although the program also applies to oil and gas units. Of the 3,336 units in the CAIR SO_2 program, 2,624 (79 percent) were also covered by the ARP in 2012. The other units are largely fossil fuel generation units that entered SO_2 control under the broader applicability requirements of CAIR.

The ARP also requires NO_x emission reductions for older, large coal-fired EGUs by limiting their NO_x emission rate (expressed in pounds of emissions per million British thermal units, or lb/mmBtu). The goal of the NO_x program is to limit NO_x emission levels from affected coal-fired boilers so that their emissions are at least two million tons less than the projected level for the year 2000 without implementation of Title IV. In 2012, 900 units at 368 facilities were subject to the ARP NO_x program.

Emission Reductions

Overall Trends

Table 2 on page 6 shows a large reduction in annual SO_2 and NO_x emissions from CAIR and ARP sources between 2005 and 2012. Tons of SO_2 emitted fell 68 percent from the 2005 level, and annual NO_x emissions dropped 53 percent. During this same period, ozone season NO_x emissions from CAIR sources alone decreased by approximately 37 percent. These reductions occurred while electricity demand (measured as heat input) remained relatively stable, indicating that the reduction in emissions was not driven by decreased electric generation. Instead, there was a significant drop in emission rate for sources in all three programs: 65 percent for SO_2 sources, 50 percent for annual NO_x sources, and 31 percent for ozone season NO_x sources. A drop in emission rate represents an overall increase in the environmental efficiency of these sources as power generators installed controls, ran their NO_x controls year round, switched to different fuels, or otherwise cut their SO_2 and NO_x emissions while meeting relatively steady demand for power. Most of the reductions since 2005 are from early reduction incentives and stricter emission limits under CAIR.

Between 2011 and 2012, CAIR and ARP sources continued to reduce their SO_2 emissions and emission rate. Annual and ozone season NO_x emissions from CAIR and ARP sources also fell in the last year. Overall, facilities were below budgets for all three programs.

Visit EPA's Quarterly Emissions Tracking site at <epa.gov/airmarkets/quarterlytracking.html> for the most up-to-date emissions and control data for sources in CAIR and the ARP.

Milestone Years for Measuring Progress under CAIR and ARP

1980: The Clean Air Act specified that annual SO_2 emissions be cut to 10 million tons below the 1980 level

1990: Baseline emission levels for the ARP

1995: First year of the ARP (Phase 1)

2000: Phase 2 of the ARP

2005: Baseline emission levels for CAIR

2008: Training year for CAIR NO_x monitoring. Units participating in the two CAIR NO_x trading programs were required to monitor and report their emissions, but were not required to hold allowances for compliance

2009: First year of CAIR NO_x annual and CAIR NO_x ozone season programs (Phase 1). Training year for CAIR SO_2 monitoring

2010: First year of CAIR SO_2 annual program (Phase 1)

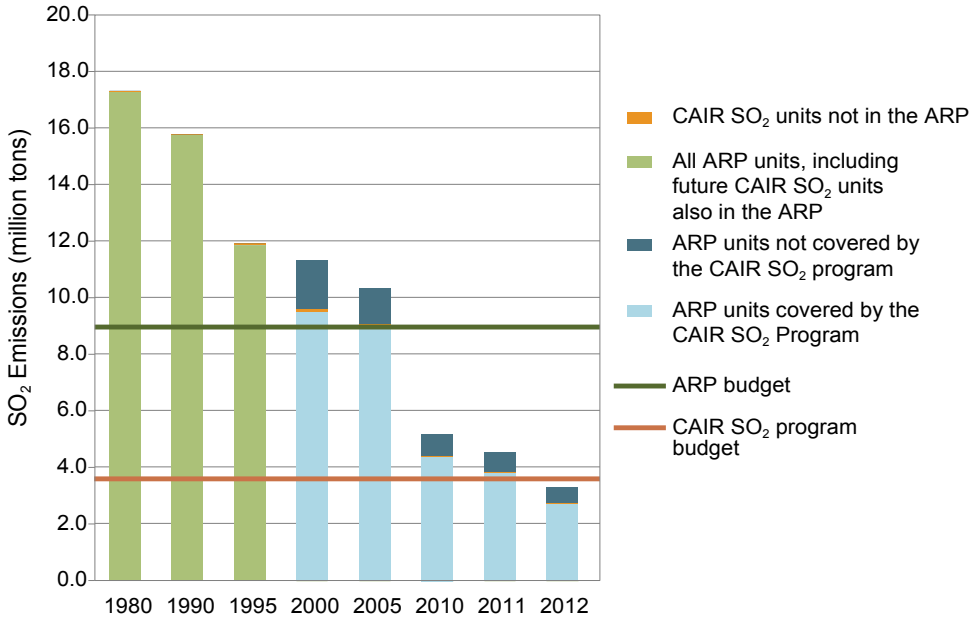
SO_2 Emission Reductions

Figure 3 shows that the CAIR SO_2 program continues and complements the ARP's history of SO_2 emission reductions. In 2012, the third year of operation of the CAIR SO_2 trading program, sources in both the CAIR SO_2 annual program and the ARP together reduced SO_2 emissions by 12.4 million tons (79 percent) from 1990 levels (before implementation of the ARP), 8.0 million tons (71 percent) from 2000 levels (ARP Phase 2), and 7.0 million tons (68 percent) from 2005 levels (before implementation of CAIR). All ARP and CAIR sources together emitted a total of 3.3 million tons of SO_2 in 2012, well below the ARP's statutory annual cap of 8.95 million tons.

Annual SO_2 emissions from sources in the CAIR SO_2 program alone fell from 9.1 million tons in 2005 to 2.8 million tons in 2012, a 69 percent reduction. Between 2011 and 2012, SO_2 emissions fell 1.1 million tons (28 percent).

Units in the ARP emitted 3.3 million tons of SO_2 in 2012, so ARP sources reduced emissions by 12.4 million tons (79 percent) from 1990 levels and 14 million tons (81 percent) from 1980 levels.

Figure 3: SO_2 Emissions from CAIR SO_2 Annual Program and ARP Sources, 1980–2012



Note: For CAIR units not in the ARP, the 2009 annual SO_2 emissions were applied retroactively for each pre-CAIR year following the year in which the unit began operating.
Source: EPA, 2013

Table 2: Comparison of Emissions, Emission Rates, and Heat Input for CAIR and ARP Sources, 2000–2012

CAIR and ARP Annual SO_2 Trends

	SO_2 Emissions (thousand tons)					SO_2 Rate (lb/mmBtu)					Heat Input (billion mmBtu)				
Primary Fuel	**2000**	**2005**	**2009**	**2010**	**2012**	**2000**	**2005**	**2009**	**2010**	**2012**	**2000**	**2005**	**2009**	**2010**	**2012**
Coal	10,708	9,835	5,653	5,090	3,291	1.04	0.95	0.63	0.53	0.41	20.67	20.77	18.02	19.30	15.97
Gas	108	91	22	20	6	0.06	0.03	0.01	0.00	0.00	3.88	5.49	6.59	7.28	8.90
Oil	385	292	38	31	6	0.73	0.70	0.27	0.19	0.04	1.06	0.84	0.29	0.33	0.32
Other	1	4	8	26	16	0.22	0.27	0.27	0.53	0.29	0.01	0.03	0.06	0.10	0.11
Total	**11,201**	**10,223**	**5,722**	**5,168**	**3,319**	**0.88**	**0.75**	**0.46**	**0.38**	**0.26**	**25.61**	**27.13**	**24.96**	**27.00**	**25.31**

CAIR and ARP Annual NO_x Trends

	NO_x Emissions (thousand tons)					NO_x Rate (lb/mmBtu)					Heat Input (billion mmBtu)				
Primary Fuel	**2000**	**2005**	**2009**	**2010**	**2012**	**2000**	**2005**	**2009**	**2010**	**2012**	**2000**	**2005**	**2009**	**2010**	**2012**
Coal	4,587	3,356	1,847	1,923	1,533	0.44	0.32	0.20	0.20	0.19	20.67	20.77	18.27	19.30	15.97
Gas	354	167	143	150	153	0.18	0.06	0.04	0.04	0.03	3.88	5.49	6.80	7.28	8.90
Oil	162	104	25	24	19	0.31	0.25	0.17	0.15	0.12	1.06	0.84	0.29	0.33	0.32
Other	2	6	5	7	7	0.25	0.42	0.12	0.13	0.13	0.01	0.03	0.09	0.10	0.11
Total	**5,104**	**3,633**	**2,020**	**2,103**	**1,712**	**0.40**	**0.27**	**0.16**	**0.16**	**0.14**	**25.61**	**27.13**	**25.45**	**27.00**	**25.31**

CAIR Ozone Season NO_x Trends

	NO_x Emissions (thousand tons)					NO_x Rate (lb/mmBtu)					Heat Input (billion mmBtu)				
Primary Fuel	**2000**	**2005**	**2009**	**2010**	**2012**	**2000**	**2005**	**2009**	**2010**	**2012**	**2000**	**2005**	**2009**	**2010**	**2012**
Coal	1,398	695	442	527	452	0.45	0.22	0.17	0.18	0.18	6.19	6.31	5.21	5.85	4.91
Gas	79	58	39	49	48	0.17	0.08	0.05	0.05	0.04	0.93	1.55	1.58	2.02	2.51
Oil	66	57	13	16	11	0.27	0.25	0.17	0.14	0.12	0.48	0.45	0.15	0.22	0.18
Other	1	2	2	2	3	0.15	0.17	0.14	0.12	0.13	0.02	0.02	0.02	0.04	0.04
Total	**1,545**	**812**	**495**	**594**	**514**	**0.41**	**0.20**	**0.14**	**0.15**	**0.13**	**7.62**	**8.33**	**6.98**	**8.13**	**7.65**

Notes:

- The data shown here for the annual programs reflect totals for those facilities required to comply with each program in each respective year. This means that CAIR NO_x annual program facilities are not included in the annual NO_x data for 2000 and 2005, and CAIR SO_2 annual program facilities are not included in the annual SO_2 data for 2000, 2005, or 2009.
- The CAIR ozone season NO_x table includes emissions and heat input data for 2000 and 2005 that were reported under other programs. For facilities that were not covered by another program and did not report 2005 emissions, their reported emissions for 2008 were substituted.
- 2009 was a monitoring and reporting training year for facilities covered by the CAIR SO_2 annual program.
- 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.
- Each year's total emission rate does not equal the arithmetic mean of the four fuel-specific rates, as each facility influences the annual emission rate in proportion to its heat input, and heat input is unevenly distributed across the fuel categories.
- EPA data in these tables and used elsewhere in this report are current as of June 2013, and may differ from past or future reports as a result of resubmissions by sources and ongoing data quality assurance activities.

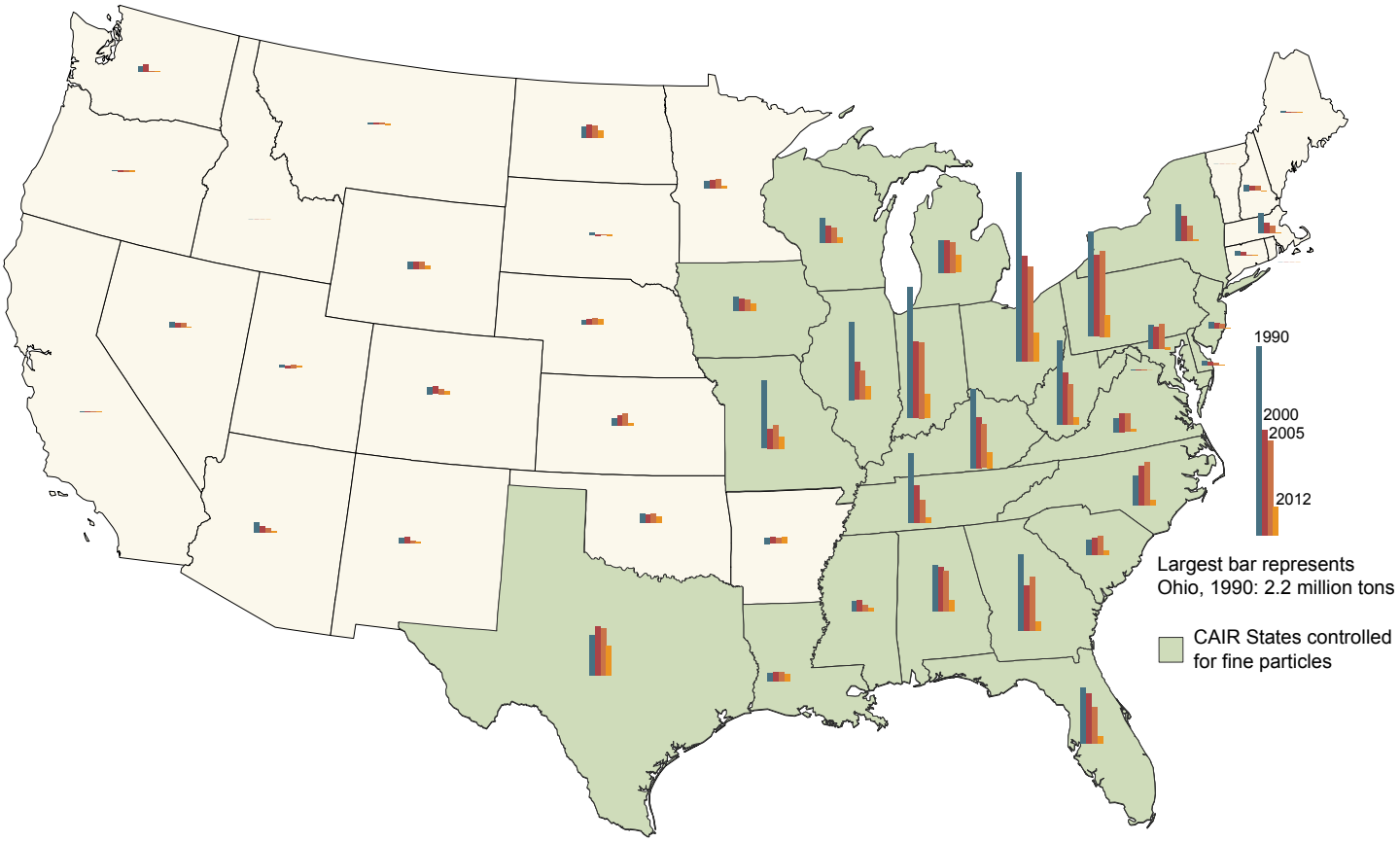
Source: EPA, 2013

The states with the highest emitting sources in 1990 have generally seen the greatest SO_2 reductions under the ARP, and this trend continues under CAIR (see Figure 4). Most of these states are upwind of the areas the ARP and CAIR were designed to protect, and reductions have resulted in important environmental and health benefits over a large region.

From 1990 to 2012, annual SO_2 emissions in the nationwide ARP and the regional CAIR SO_2 program dropped in 43 states and D.C. by a total of approximately 12 million tons. In contrast, annual SO_2 emissions increased by a total of only 25,696 tons in five states (Arkansas, Idaho, Nebraska, Oregon, and Vermont) from 1990 to 2012.

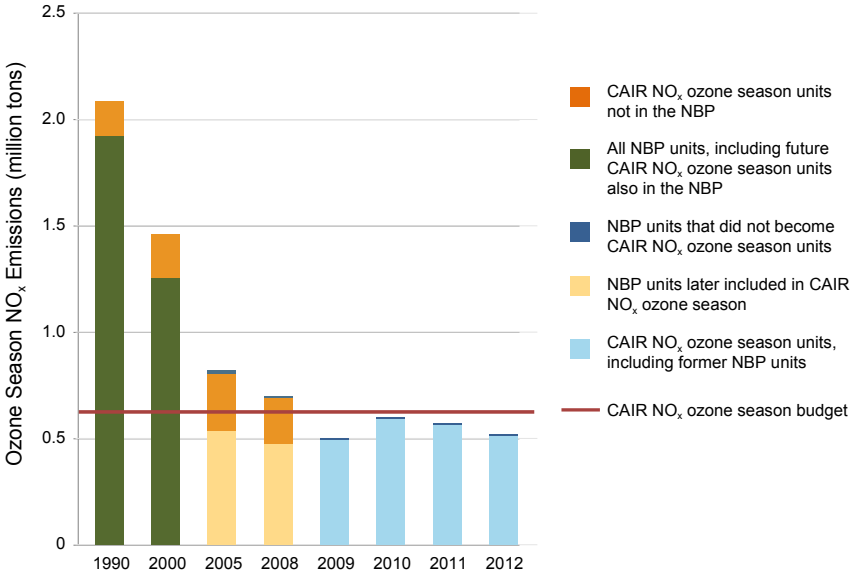
In 2012, the total SO_2 emissions from participating sources were about 855,000 tons below the regional CAIR emission budget. Seventeen states and DC had emissions below their allowance budgets, collectively by about 956,000 tons. Another seven states exceeded their 2012 budgets by a total of about 101,000 tons, indicating that, on an aggregate basis, sources within those states covered a portion of their emissions with allowances banked from earlier years, transferred from an out-of-state account, or purchased from the market.

Figure 4: State-by-State Annual SO_2 Emission Levels for CAIR and ARP Sources, 1990–2012



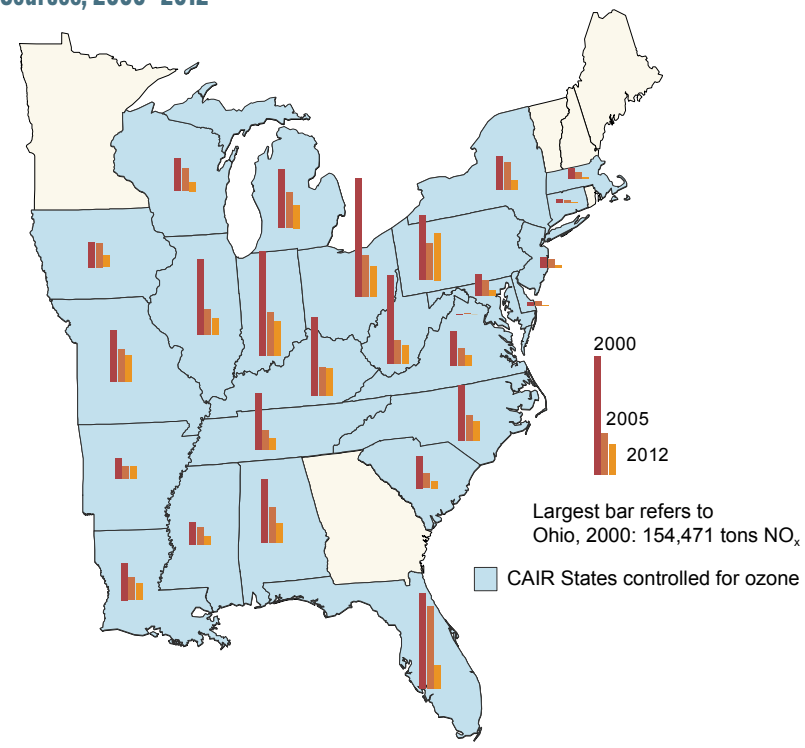
Source: EPA, 2013

Figure 5: Ozone Season NO_x Emissions from CAIR and NBP Sources, 1990–2012



Note: For CAIR units not in the NBP, the 2008 NO_x emissions were applied retroactively to 1990 and 2000 if the unit operated in the previous year's ozone season.
Source: EPA, 2013

Figure 6: State-by-State Ozone Season NO_x Emission Levels from CAIR Sources, 2000–2012



Note: The 2000 and 2005 ozone season values reflect data that were reported under other programs (ARP and NBP). For facilities that were not covered by another program and did not report 2000 or 2005 emissions, their reported emissions for the earliest subsequent year (usually the 2008 training year) were substituted.
Source: EPA, 2013

NO_x Emission Reductions

Ozone Season NO_x Reductions

Figure 5 shows ozone season NO_x emissions from 1990 to 2012 for CAIR and NBP sources. In 2012, the fourth year of the CAIR NO_x ozone season program, sources from both CAIR and the former NBP, together with a small number of sources that were previously in the NBP but did not enter CAIR, reduced their overall NO_x emissions from 819,000 tons in 2005 (before implementation of CAIR) to 519,000 tons in 2012, a decrease of 37 percent. NO_x emissions were 1.6 million tons lower (75 percent) than in 1990 and 940,000 tons lower (64 percent) than in 2000 (before implementation of the NBP).

Between 2005 and 2012, ozone season NO_x emissions from sources in the CAIR program alone have fallen 298,000 tons, a decrease of 37 percent. From 2011 to 2012, ozone season emissions from sources in the CAIR NO_x ozone season program decreased by 52,000 tons (9 percent). Ozone season NO_x emissions totaled 514,000 tons in 2012, 9 percent below the regional emission budget of 567,744 tons.

In addition to the CAIR NO_x ozone season program and the former NBP, current regional and state NO_x emission control programs have also contributed significantly to the ozone season NO_x reductions achieved by sources in 2012.

Between 2005 and 2012, ozone season NO_x emissions from CAIR and former NBP sources fell in every state participating in the CAIR NO_x ozone season program except Arkansas and Pennsylvania (see Figure 6), where emissions increased by a total of 14,000 tons. In the 2012 ozone season, the total emissions from participating sources were about 111,000 tons below the regional emission budget. Eighteen states and D.C. had emissions below their allowance budgets, collectively by about 95,000 tons. Another seven states exceeded their 2012 budgets by a total of about 41,000 tons, indicating that, on an aggregate basis, sources within those states covered a portion of their emissions with allowances banked from earlier years, transferred from an out-of-state account, or purchased from the market.

Annual NO_x Reductions

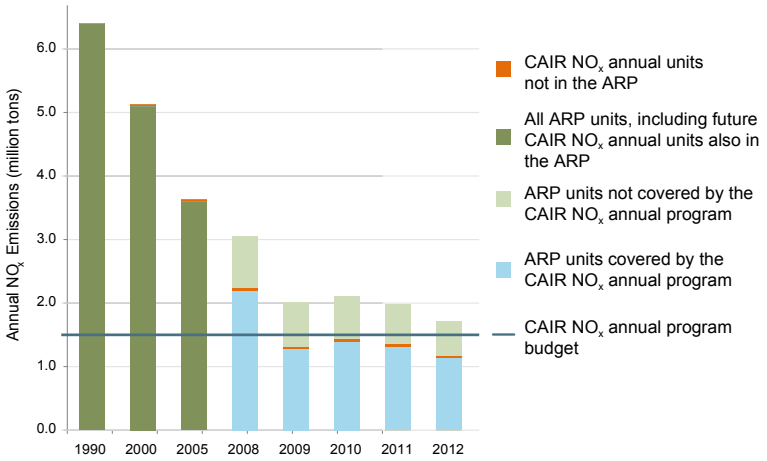
Figure 7 shows that from 1990 to 2012, annual NO_x emissions from CAIR and ARP units together dropped by about 4.7 million tons to 1.7 million tons, a decrease of 73 percent. In 2012, the fourth year of the CAIR NO_x annual program, NO_x emissions from all ARP and CAIR units were 1.9 million tons lower (53 percent) than in 2005 and 3.4 million tons lower (67 percent) than in 2000.

Emissions from CAIR NO_x annual program sources alone were 1.17 million tons in 2012, 330,000 tons (22 percent) below the 2012 CAIR NO_x annual program's regional budget of 1.5 million tons. Annual NO_x emissions were 1.5 million tons (56 percent) lower than in 2005, and 184,000 tons lower (13 percent) than in 2011.

All ARP sources emitted 1.7 million tons of NO_x in 2012. This level is 6.4 million tons less than the projected level in 2000 without the ARP, and over three times the Title IV NO_x emission reduction objective.

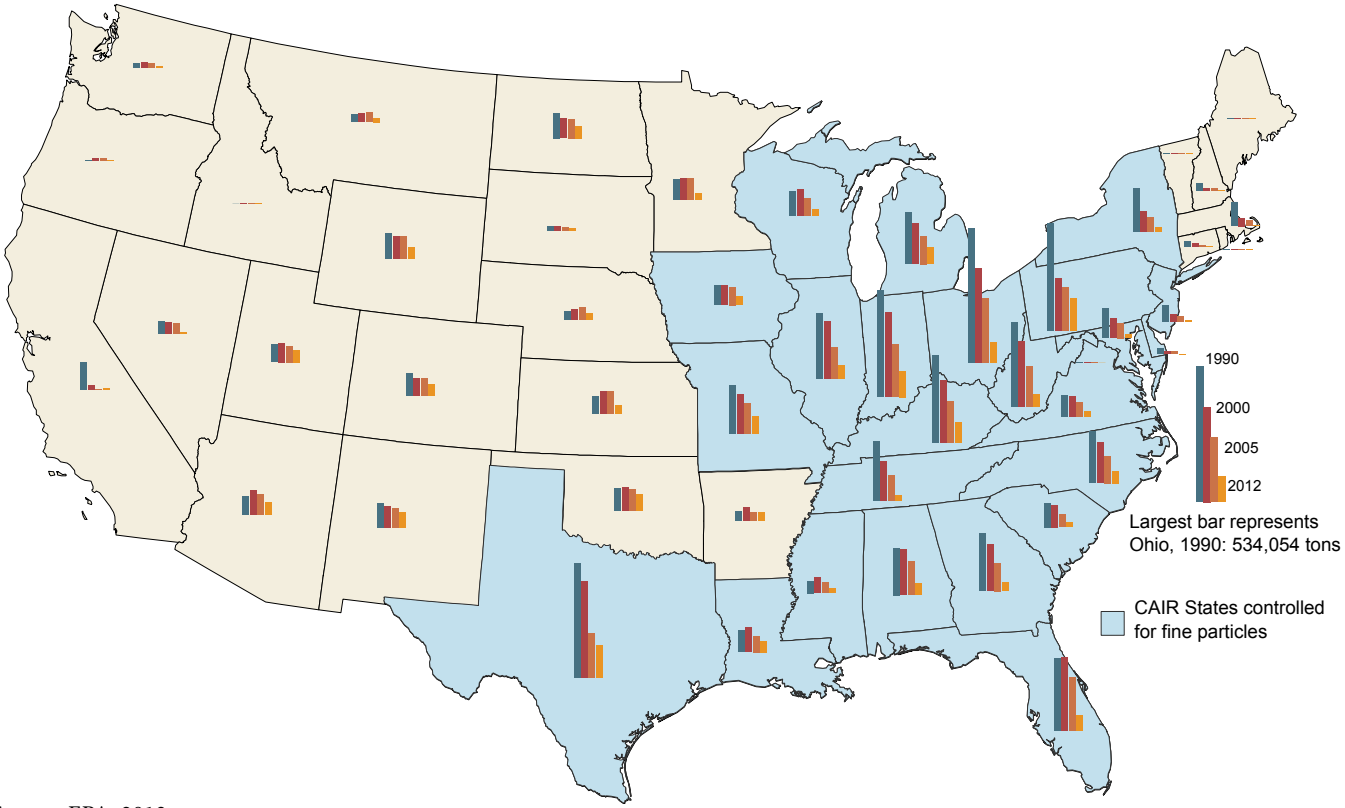
Although the ARP and CAIR NO_x programs were responsible for a large portion of these annual NO_x reductions, other programs—such as regional and state NO_x emission control programs—also contributed significantly to the annual NO_x reductions achieved by sources in 2012.

Figure 7: Annual NO_x Emissions from CAIR and ARP Sources, 1990–2012



Note: For CAIR units not in the ARP in 1990, 2000, and 2005, the 2008 annual NO_x emissions were applied retroactively for each pre-CAIR year following the year in which the unit began operating.
Source: EPA, 2013

Figure 8: State-by-State Annual NO_x Emission Levels for CAIR and ARP Sources, 1990–2012



Source: EPA, 2013

Compliance Results

As of June 2013, the reported 2012 SO_2 emissions by CAIR and ARP sources totaled 3,281,981 tons. Because of variation in rounding conventions, changes due to resubmissions by sources, and allowance compliance issues at certain units, this number is lower than the sums of emissions used for reconciliation purposes shown in Table 3, below. Therefore, the allowance totals deducted for actual emissions in Table 3 differ from the number of emissions shown elsewhere in this report.

CAIR and ARP SO_2 Programs

Reported emissions (tons):	3,281,981
Compliance issues, rounding, and report resubmission adjustments (tons):	–1,449
Emissions not covered by allowances (tons):	0
Additional vintage 2010 to 2012 allowances deducted for CAIR:	+1,946,579
Total allowances deducted for emissions (includes some 2 for 1 CAIR deductions):	**5,227,111**

From 1990 to 2012, all states participating in the CAIR NO_x annual program decreased their emissions, as indicated in Figure 8 on page 9. Comparing 2005 to 2012, all states in the CAIR region emitted less NO_x. The total NO_x emissions from participating sources in 2012 were about 311,000 tons below the regional emission budget of 1,490,264 tons. Eighteen states and D.C. had emissions below their 2012 allowance budgets, collectively by about 365,000 tons. Six states exceeded their 2012 budgets by a total of about 54,000 tons, indicating that, on an aggregate basis, sources within those states covered a portion of their emissions with allowances banked from earlier years, transferred from an out-of-state account, or purchased from the market.

CAIR and ARP Program Compliance

SO_2 Programs

Because SO_2 allowances from the ARP are used by sources to comply with the CAIR SO_2 annual program, compliance results for both programs are displayed together in this report. Table 3 shows how ARP allowances are used for compliance under both programs. All ARP and CAIR SO_2 facilities reporting were in compliance with both programs in 2012 and held enough allowances to cover their SO_2 emissions.

2012 was the third year for compliance with the CAIR SO_2 program. Under this program, allowances are used to cover emissions based on the vintage year of the allowances, with pre–2010 vintage allowances used at one allowance for one ton of SO_2 emissions, and 2010–2012 vintage allowances used at two allowances for one ton. For facilities covered by both CAIR and the ARP, reconciliation is a two-step process. First, ARP deductions are made. Then, any additional deductions to comply with the CAIR SO_2 program are made. The additional deductions under CAIR could be to cover the two for one use of 2010–2012 allowances or to cover emissions for units that are subject to CAIR, but not the ARP.

In 2012, over 26.6 million SO_2 allowances were available for compliance under both programs (9 million vintage 2012 and over 17.6 million banked from prior years). Almost 3.3 million allowances were deducted for ARP compliance and approximately 2 million allowances were deducted to complete reconciliation for CAIR. After reconciliation for both programs, over 21.3 million ARP SO_2 allowances were banked and carried forward to the 2013 compliance year.

Table 3: CAIR and ARP SO_2 Allowance Reconciliation Summary, 2012

Total Allowances Held (1995–2012 Vintage)	**26,605,632**	Held by Affected Facility Accounts	18,445,333
		Held by Other Accounts (General and Non-Affected Facilities)	8,160,299
Allowances Deducted for Acid Rain Compliance*	-3,289,425		
Penalty Allowance Deductions (2012 Vintage)	0		
Banked Allowances (after ARP Compliance)	**23,316,207**	Held by Affected Facility Accounts	15,155,908
		Held by Other Accounts (General and Non-Affected Facilities)	8,160,299
Acid Rain Program Allowances Deducted for CAIR SO_2 Compliance	-1,946,579		
Banked Allowances (after ARP and CAIR SO_2 Compliance)	**21,369,628**	Held by Affected Facility Accounts	13,209,329
		Held by Other Accounts (General and Non-Affected Facilities)	8,160,299

*Includes 8,893 allowances deducted from opt-ins for reduced utilization.

Source: EPA, 2013

NO_x Programs

CAIR NO_x Compliance Results

Tables 4 and 5 show how NO_x allowances were used in 2012. All covered facilities reporting were in compliance with the CAIR NO_x ozone season and CAIR NO_x annual programs in 2012 and held enough allowances to cover their NO_x emissions.

ARP NO_x Compliance Results

The ARP NO_x Program does not impose a cap on NO_x emissions and does not rely on allowance trading. The program allows affected sources to comply either by meeting a unit-specific emission rate or by including two or more units in an emission rate averaging plan. These options provide affected sources with the flexibility to meet the NO_x emission reduction requirements in a cost-effective manner. All 900 units subject to ARP NO_x emissions limitations in 2012 were in compliance.

Table 4: CAIR NO_x Ozone Season Allowance Reconciliation Summary, 2012

Total Allowances Held (2003–2012 Vintage)	**1,058,492**	Held by Affected Facility Accounts	885,114
		Held by Other Accounts (General and Non-Affected Facilities)	173,378
Allowances Deducted for CAIR NO_x Ozone Season Trading Program	-513,836		
Penalty Allowance Deductions (2012 Vintage)	0		
Banked Allowances	**544,656**	Held by Affected Facility Accounts	371,278
		Held by Other Accounts (General, State Holding, and Non-Affected Facilities)	173,378

Source: EPA, 2013

Table 5: CAIR NO_x Annual Allowance Reconciliation Summary, 2012

Total Allowances Held (2009–2012 Vintage)	**2,009,111**	Held by Affected Facility Accounts	1,784,242
		Held by Other Accounts (General and Non-Affected Facilities)	224,869
Allowances Deducted for CAIR NO_x Annual Trading Program	-1,169,534		
Penalty Allowance Deductions	0		
Banked Allowances	**839,577**	Held by Affected Facility Accounts	614,708
		Held by Other Accounts (General, State Holding, and Non-Affected Facilities)	224,869

Source: EPA, 2013

Compliance Results

As of June 2013, the reported 2012 ozone season NO_x emissions by CAIR sources totaled 513,813 tons, and annual emissions totaled 1,170,282 tons. Because of variation in rounding conventions, changes due to resubmissions by sources, and allowance compliance issues at certain units, these numbers are different from the sums of emissions used for reconciliation purposes shown in Table 4 (ozone season reconciliation) and Table 5 (annual reconciliation). Therefore, the allowance totals deducted for actual emissions in Tables 4 and 5 differ from the number of emissions shown elsewhere in this report.

CAIR NO_x Ozone Season

Reported emissions (tons)	513,813
Compliance issues, rounding, and report resubmission adjustments (tons)	+23
Emissions not covered by allowances (tons)	0
Total allowances deducted for emissions	**513,836**

CAIR NO_x Annual Program

Reported emissions (tons)	1,170,282
Compliance issues, rounding, and report resubmission adjustments (tons)	-748
Emissions not covered by allowances (tons)	0
Total allowances deducted for emissions	**1,169,534**

Photo: EPA, 2010

Controls and Monitoring

To meet the ARP and CAIR emission reduction targets, some sources opt to install control technologies. A wide set of controls are available to help reduce emissions. The following is an analysis of controls on ARP and CAIR program coal-fired units and CAIR NO_x program combined cycle units in 2012.

SO_2 Controls in 2012

SO_2 control options available to sources include switching to low sulfur coal, employing various types of flue gas desulfurization (FGDs), or utilizing fluidized bed limestone units. FGDs on coal-fired generators are the principal means of controlling SO_2. The share of coal-fired generation, measured in megawatt hours (MWh), at controlled units in the ARP and the CAIR SO_2 annual program grew to 66 percent in 2012 (see Table 6).

Table 6: SO_2 Controls in 2012 on Coal-Fired Units in the ARP and CAIR Annual SO_2 Program

SO_2 Control Type	Number of Units	Share of Units	Share of MWh Generation
FGD	468	44%	66%
Other	43	4%	1%
Uncontrolled	545	52%	33%

Note: Due to rounding, percentages shown may not add up to 100%.
Source: EPA, 2013

NO_x Controls in 2012

NO_x Ozone Season Program

Sources have a variety of options by which to reduce NO_x emissions. Units with add-on controls—selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR)—accounted for 64 percent of coal-fired generation and 84 percent of generation at combined cycle units (gas- or oil-fired). Although 91 coal-fired units and 15 combined cycle units remain uncontrolled, they represent only one percent of coal-fired generation and one percent of combined cycle generation under the CAIR NO_x ozone season program (see Table 7).

Table 7: NO_x Controls in 2012 CAIR NO_x Ozone Season Program

NO_x Control Type	Number of Coal-Fired Units	Share of Coal-Fired MWh Generation	Number of Combined Cycle Units (Gas- or Oil-Fired)	Share of Combined Cycle (Gas- or Oil-Fired) MWh Generation
Combustion	385	33%	63	10%
Non-Controlled	91	1%	15	1%
Other Control	34	1%	94	5%
SCR	225	57%	363	84%
SNCR	138	7%	0	0%

Note: Due to rounding, percentages shown may not add up to 100%.
Source: EPA, 2013

NO_x Annual Program

The 373 coal-fired units with add-on controls (either SCRs or SNCRs) generated 62 percent of annual generation, and the 425 combined cycle units with SCRs generated 78 percent of annual generation (see Table 8). Similar to the CAIR NO_x ozone season program, uncontrolled units represent one percent of coal-fired generation and one percent of combined cycle generation under the CAIR NO_x annual program.

Table 8: NO_x Controls in 2012 CAIR NO_x Annual Program

NO_x Control Type	Number of Coal-Fired Units	Share of Coal-Fired MWh Generation	Number of Combined Cycle Units (Gas- or Oil-Fired)	Share of Combined Cycle (Gas- or Oil-Fired) MWh Generation
Combustion	385	34%	121	17%
Non-Controlled	72	1%	19	1%
Other Control	39	2%	91	4%
SCR	241	54%	425	78%
SNCR	132	8%	0	0%

Note: Due to rounding, percentages shown may not add up to 100%.
Source: EPA, 2013

Continuous Emission Monitoring Systems

Accurate and consistent emissions monitoring is the foundation of a cap and trade system. EPA has developed detailed procedures (40 CFR Part 75) to ensure that sources monitor and report emissions with a high degree of precision, accuracy, reliability, and consistency. Sources use continuous emission monitoring systems (CEMS) or other approved methods. Part 75 requires sources to conduct stringent quality assurance tests of their monitoring systems, such as daily and quarterly calibration tests and a semiannual or annual relative accuracy test audit. These tests ensure that sources report accurate data and provide assurance to market participants that a ton of emissions measured at one facility is equivalent to a ton measured at a different facility.

While some CAIR units with low levels of emissions do not have to use CEMS, the vast majority of NO_x emissions—over 99 percent—were measured by CEMS. Coal-fired units were required to use CEMS for NO_x concentration and stack gas flow rate to calculate and record their NO_x mass emissions. Oil-fired and gas-fired units could use a NO_x CEMS in conjunction with a fuel flow meter to determine NO_x mass emissions. Alternatively, for oil-fired and gas-fired units that either operated infrequently or had very low NO_x emissions, Part 75 provided low-cost alternatives to conservatively estimate NO_x mass emissions.

Similarly, CEMS monitored over 99 percent of SO_2 emissions from CAIR sources, including 100 percent from coal-fired units and 24 percent from oil-fired units. The relatively low percentage for oil-fired units is consistent with the decline in oil-fired heat input, as most of these units were used infrequently and qualified for reduced monitoring.

Market Activity

In a cap and trade program, sources may consider several emission reduction alternatives, and are allowed to trade allowances as part of their compliance strategy. Through trading, the overall market can achieve emission targets at a lower cost than through a command and control program because abatement costs are not the same for all sources. A market for emission allowances will emerge, and the allowance price will reflect the marginal cost of emission reductions, allowing emission control decisions to be made based on the cost of control options relative to the market price of allowances. The allowance price motivates those who have relatively low cost opportunities for emission reductions to make those investments and then sell any surplus allowances to those with higher marginal abatement costs.

Allowance Market Price Trends in 2012

In this third year of CAIR SO_2 compliance, prices for pre-CAIR and CAIR ARP allowance vintages were below $3 per ton. NO_x allowance prices declined throughout the year, with annual NO_x prices staying below $80 per ton and ozone season NO_x prices staying below $30 per ton. Availability of banked allowances (see CAIR and ARP Program Compliance for banked allowance volumes) along with decreases in emission levels put downward pressure on allowance prices. An overall trend of decreasing traded prices was evident in all markets. Current annual allowance prices are well below the marginal cost for reductions projected at the time of the final rule.[1]

[1] U.S. EPA, *Regulatory Impact Analysis for the Final Clean Air Interstate Rule*, Docket No. EPA-HQ-OAR-2003-0053-2158, 7-9.

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 well as transfers into accounts related to special 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.

Table 9: 2012 Allowance Transfers under CAIR and ARP

	Transactions Conducted in 2012	Allowances Transferred in 2012	Share of Program's 2012 Allowances Transferred	
CAIR NO_x Ozone Season Program	1,095	318,299	Distinct Organizations	27%
			Related Organizations	73%
CAIR NO_x Annual Program	1,514	758,588	Distinct Organizations	26%
			Related Organizations	74%
ARP and CAIR SO_2 Annual Program	1,497	8,446,197	Distinct Organizations	22%
			Related Organizations	78%

Notes:
- Most, but not all, of the transactions were characterized. The actual percentage shares may vary by less than 1% of the total allowances transferred for each program.
- Percentages may not add up to 100% due to rounding.

Source: EPA, 2013

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

- Transfers between separate and distinct economic entities, 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 unit compliance account and any account held by a company with an ownership interest in the unit).

While all transactions are important to proper market operation, EPA follows trends in the distinct economic entities transaction category with particular interest because these transactions represent an actual exchange of assets between unaffiliated participants. In 2012, about a quarter of each program's traded allowances were exchanged between unrelated parties, often with a broker facilitating the trade (see Table 9). This proportion is smaller than in 2011.