


Clean Air Interstate Rule

2009 Emission, Compliance and Market Analyses

Program Basics

The Clean Air Interstate Rule (CAIR) was designed to address interstate transport of ozone and fine particulate matter ($PM_{2.5}$) pollution. To do so, CAIR required certain states to limit annual emissions of nitrogen oxides (NO_x) and sulfur dioxide (SO_2), which contribute to the formation of ozone and $PM_{2.5}$. It also required certain states to limit ozone season NO_x emissions which contribute to the formation of ozone during the summer ozone season. CAIR developed three separate cap and trade programs that could be used to achieve the required reductions — the CAIR NO_x ozone season trading program, the CAIR annual NO_x trading program, and the CAIR SO_2 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 $PM_{2.5}$ formation resulting from implementation of the CAIR programs provides health benefits as well as improved visibility in national parks and improved stream quality in the eastern U.S.

Litigation and the CAIR Replacement Rule

On July 11, 2008, the U.S. Court of Appeals for the D.C. Circuit issued a ruling vacating CAIR in its entirety. EPA and other parties requested a rehearing, and on December 23, 2008, the Court revised its decision and remanded CAIR to EPA without vacatur. This ruling leaves CAIR and the CAIR Federal Implementation Plans (FIPs) — including the CAIR trading programs — in place until EPA issues new rules to replace CAIR.

EPA is committed to issuing rules to replace CAIR that will help states address the interstate air emissions transport problem in a timely way and that fully comply with the requirements of the Clean Air Act and the opinions of the D.C. Circuit. EPA has developed a proposed Transport Rule which, if finalized as proposed, would replace CAIR in 2012. The proposed rule was signed in July 2010, and is available online at <http://epa.gov/airtransport/>.

2009 Progress Reports

EPA is releasing a series of reports over several months summarizing the first year of CAIR implementation, including the transition from the ozone season NO_x Budget Program (NBP). A previous online report presented 2009 data on NO_x and SO_2 emission reductions and compliance results for both NO_x programs. This report evaluates progress under CAIR by analyzing emission reductions, compliance results, and market activity in 2009. A future report will compare changes in emissions to changes in environmental indicators.

At a Glance: CAIR in 2009

Ozone Season NO_x Emissions: 495,198 tons

- 21 percent below 2009 cap
- 28 percent lower than in 2008 (the CAIR monitoring training year)

Annual NO_x Emissions: 1,311,986 tons

- 21 percent below 2009 cap
- 43 percent lower than in 2008 (the CAIR monitoring training year)

Ozone Season and Annual NO_x Compliance: Nearly 100 percent

- Only one facility exceeded its allowed emissions under each CAIR NO_x program.

SO_2 Program Emissions: 5,000,000 tons

- 2009 was the monitoring training year for the CAIR SO_2 program

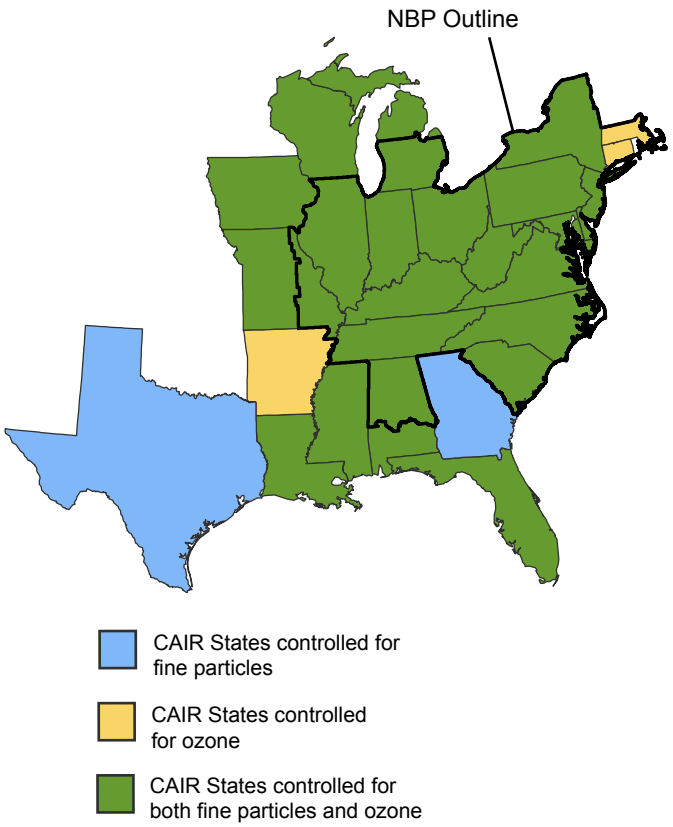
NO_x Annual and Ozone Season Programs

The CAIR NO_x annual program generally applies to large electric generating units (EGUs) — boilers, turbines, and combined cycle units used 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 were 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 steam plants at institutional settings, such as large universities or hospitals.

CAIR States

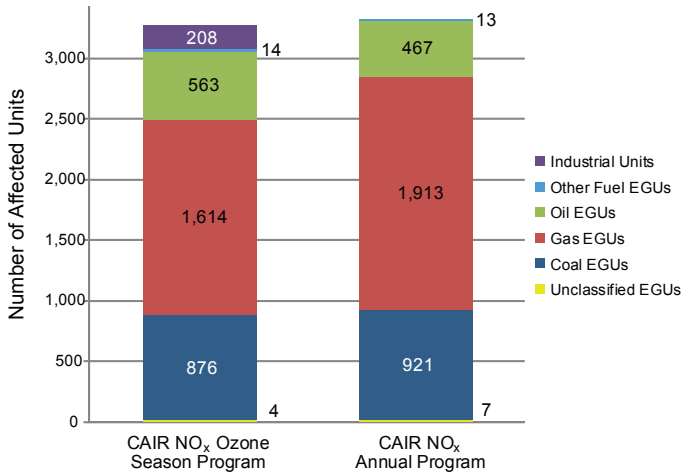
The CAIR NO_X ozone season requirements apply to all states from the former NBP except Rhode Island, and to six additional eastern states (Arkansas, Florida, Iowa, Louisiana, Mississippi, and Wisconsin). In addition, while only parts of Alabama, Michigan, and Missouri were in the NBP, the CAIR NO_X ozone season requirements apply to these states in their entirety. The CAIR NO_X annual and CAIR SO_2 requirements, which address $PM_{2.5}$, apply in all of the CAIR NO_X ozone season states except Connecticut, Massachusetts, and Arkansas, and also in Texas and Georgia. These areas are shown in Figure 1. In a November 2009 rule, EPA stayed the effectiveness of CAIR for Minnesota, which had previously been identified as significantly contributing to nonattainment of $PM_{2.5}$ ambient air quality standards in downwind states. For purposes of the 2009 Progress Reports, EPA is excluding Minnesota sources and emissions.

Figure 1: Transition from the NBP to CAIR



Note: In a November 2009 rule, EPA stayed the effectiveness of CAIR for Minnesota, which had previously been among the states controlled for fine particles.
Source: EPA, 2010

Figure 2: Affected Units in CAIR NO_x Annual and CAIR NO_x Ozone Season Programs



Notes: "Other" fuel refers to units that burn fuels such as waste, wood, petroleum coke, or tire-derived fuel.
"Unclassified" units have not submitted a fuel type in their monitoring plan and did not report emissions.
Source: EPA, 2010

Affected Units

In 2009, there were 3,279 EGUs and industrial facility units in the CAIR NO_X ozone season program and 3,321 affected units in the CAIR NO_X annual program (see Figure 2). 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 1). This covers a range of unit types, including units that operate every day or nearly every day 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 some years.

Of the units covered by the NBP in 2008, 172 were not subsequently covered by the 2009 CAIR NO_X ozone season program.

As part of CAIR implementation, 2008 was a "training year" for 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. The reported emissions and heat input values from 2008 provide a baseline with which to assess future reductions (see Table 1).

Table 1: Comparison of NO_x Emissions, Heat Input, and NO_x Emission Rates for all CAIR Sources

Fuel	Ozone Season NO_X Mass Emissions (thousand tons)		Ozone Season Heat Input (billion MMBtu, or quads)		Ozone Season NO_X Emission Rate (lb/MMBtu)	
	2008	2009	2008	2009	2008	2009
Coal	625	442	6.14	5.22	0.20	0.17
Gas	34	33	1.40	1.53	0.05	0.04
Oil	28	19	0.28	0.21	0.20	0.18
Other	2	2	0.03	0.02	0.14	0.14
Total	689	495	7.85	6.97	0.18	0.14

Fuel	Annual NO_X Mass Emissions (thousand tons)		Annual Heat Input (billion MMBtu, or quads)		Annual NO_X Emission Rate (lb/MMBtu)	
	2008	2009	2008	2009	2008	2009
Coal	2,154	1,184	16.32	13.94	0.26	0.17
Gas	95	91	4.08	4.37	0.05	0.04
Oil	47	33	0.45	0.36	0.21	0.18
Other	7	4	0.08	0.07	0.16	0.11
Total	2,302	1,312	20.93	18.74	0.22	0.14

Notes:

- Tons are rounded to the nearest 1,000 and the heat input values are rounded to the nearest 10 million MMBtus. Totals in final row may not equal the sum of individual rows due to rounding.
- EPA data in Table 1 and used elsewhere in this report are current as of June 7, 2010, and may differ from past or future reports as a result of resubmissions by sources and ongoing data quality assurance activities.
- The emission rate is based on dividing total reported emissions for each fuel category by the total heat input reported for that category, and then rounding the emission rate to the nearest 0.01 lb/MMBtu. The average emission rate expressed for the total uses the heat input-weighted average for the fuel categories.
- Although fuel type, as shown here, is based on the monitoring plan primary fuel designation submitted to EPA, many units burn multiple fuels. "Other" fuel refers to units that burn fuels such as waste, wood, petroleum coke, or tire-derived fuel.

Source: EPA, 2010

What Is Heat Input?

Heat input, often expressed in million British thermal units (MMBtu), is a measure of the energy content of fuel. It is standardized across fuel sources to allow comparisons among them. For example, a cubic foot of natural gas releases a different amount of energy than a gallon of oil when burned. Heat input also offers an indication of energy demand. For example, high electricity consumption for air conditioning on a hot day will be reflected in high heat input levels at EGUs.

What Is Emission Rate?

Emission rate is the measure of how much pollutant (NO_X) is emitted from a combustion unit compared to the amount of energy (heat input) used. In this report, emission rate is expressed as pounds of NO_X emitted per MMBtu of heat input. Emission rates enable comparison of a combustion unit's environmental efficiency given its fuel type and usage. A lower emission rate represents a cleaner operating unit — one that is emitting fewer pounds of NO_X per unit of fuel consumed.

Emission Reductions

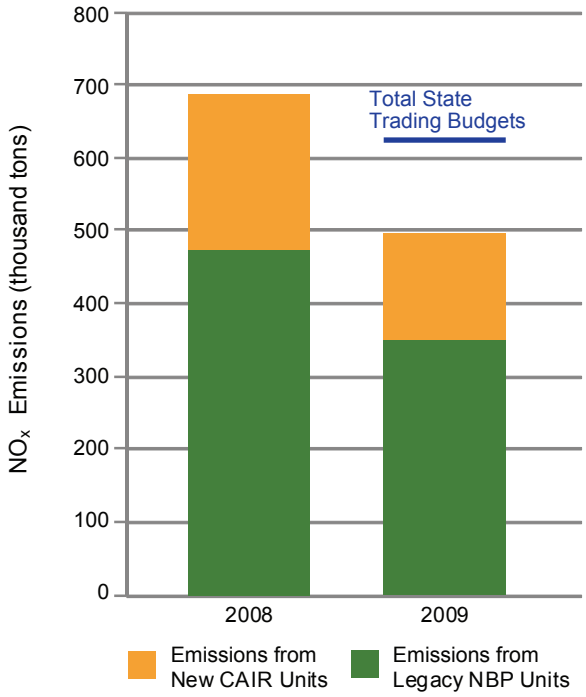
Ozone Season NO_X Reductions

As Figure 3 shows, nearly all the emissions in the NBP region went on to be covered by the CAIR NO_X ozone season program. Figure 4 shows that in the first year of CAIR ozone season compliance, former NBP units (i.e., legacy units) continued to reduce their NO_X emissions.

Improved emission rates at units with previously installed controls were the primary reason for reduced ozone season NO_X emissions in 2009 — the drop in the overall NO_X rate alone would have resulted in a reduction of 69 percent of the actual reduction seen, had power demand remained constant. Nine units operated with new NO_X control equipment during the 2009 ozone season, and although their collective NO_X rate fell by 51 percent, they contributed only 4 percent of the program-wide emission reductions.

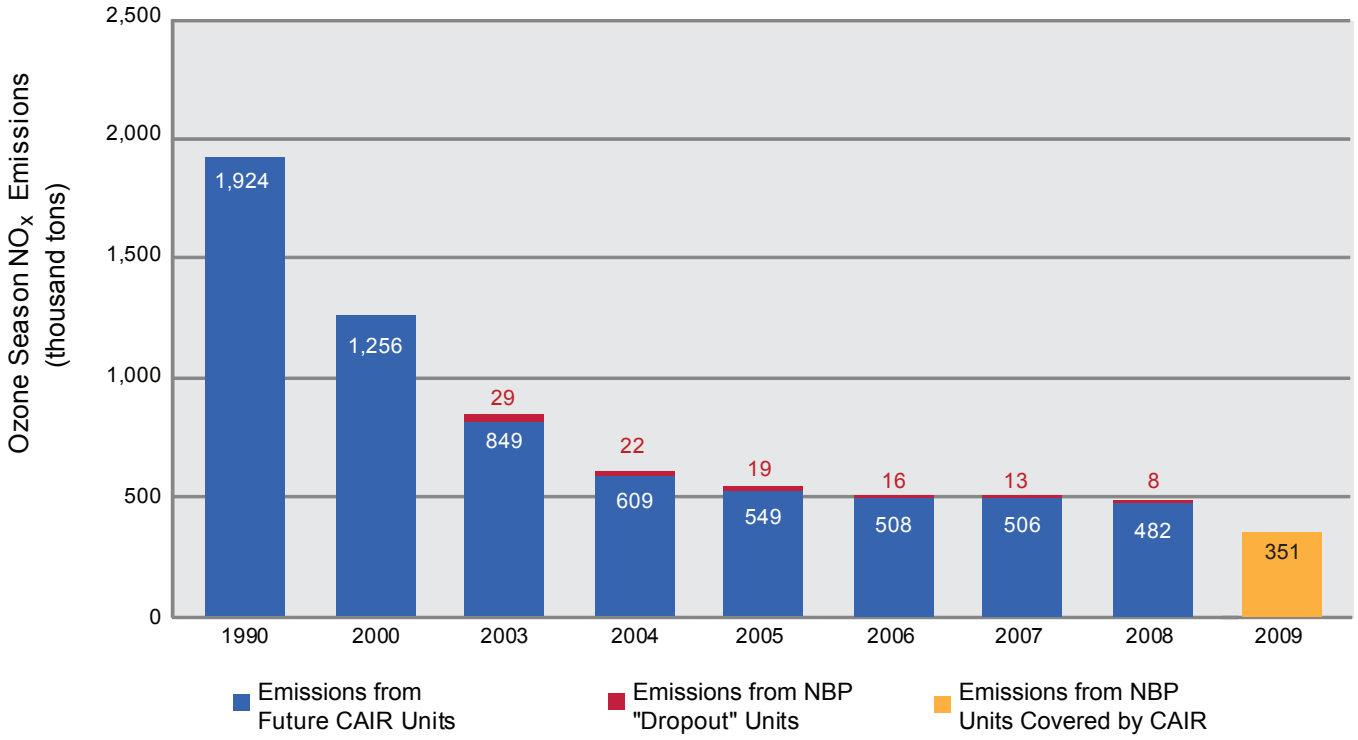
Sources entering the CAIR NO_X ozone season program — units that were not covered by the NBP in 2008 — also accounted for a large share of the overall emission reductions between 2008 and 2009. The 879 new units reduced their collective NO_X rate by 31 percent, from 0.205 lb/MMBtu to 0.142 lb/MMBtu, and their 71 thousand ton reduction in NO_X emissions constituted 37 percent of the program's overall reduction.

Figure 4: Ozone Season Emissions from CAIR NO_X Ozone Season Sources, 2008 – 2009



Source: EPA, 2010

Figure 3: Ozone Season NO_X Emissions from NBP Sources

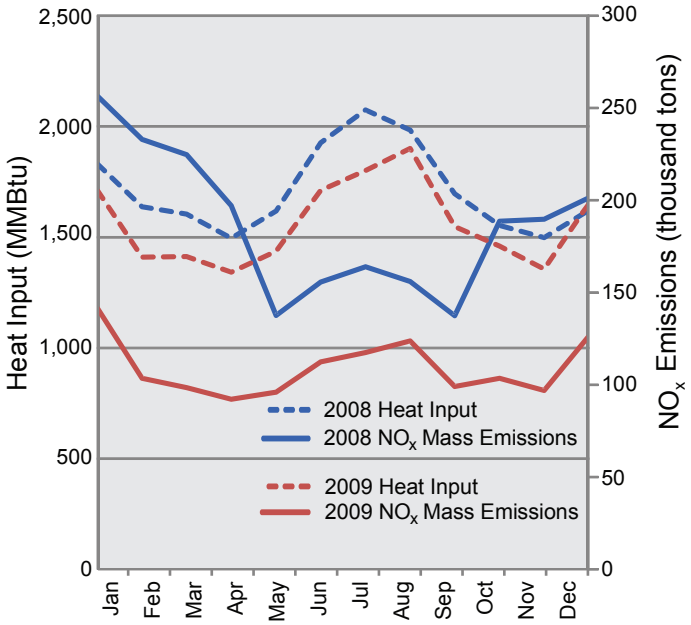


Notes: "Dropout" units are those units that were included in the NBP but did not participate in the 2009 CAIR NO_X ozone season program.
Source: EPA, 2010

Annual NO_X Reductions

As Figure 5 shows, the introduction of the CAIR NO_X annual program reduced year-round emissions in 2009 as program participants operated NO_X control devices on EGUs outside the summer months. From 2008 to 2009, NO_X emissions from units in the CAIR NO_X annual program region fell from 2.3 million tons to 1.3 million tons, reflecting a 43 percent reduction in annual NO_X emissions and a 36 percent improvement in the rate of NO_X emissions. These improvements occurred while power demand (as measured by heat input) from those sources only dropped 10 percent.

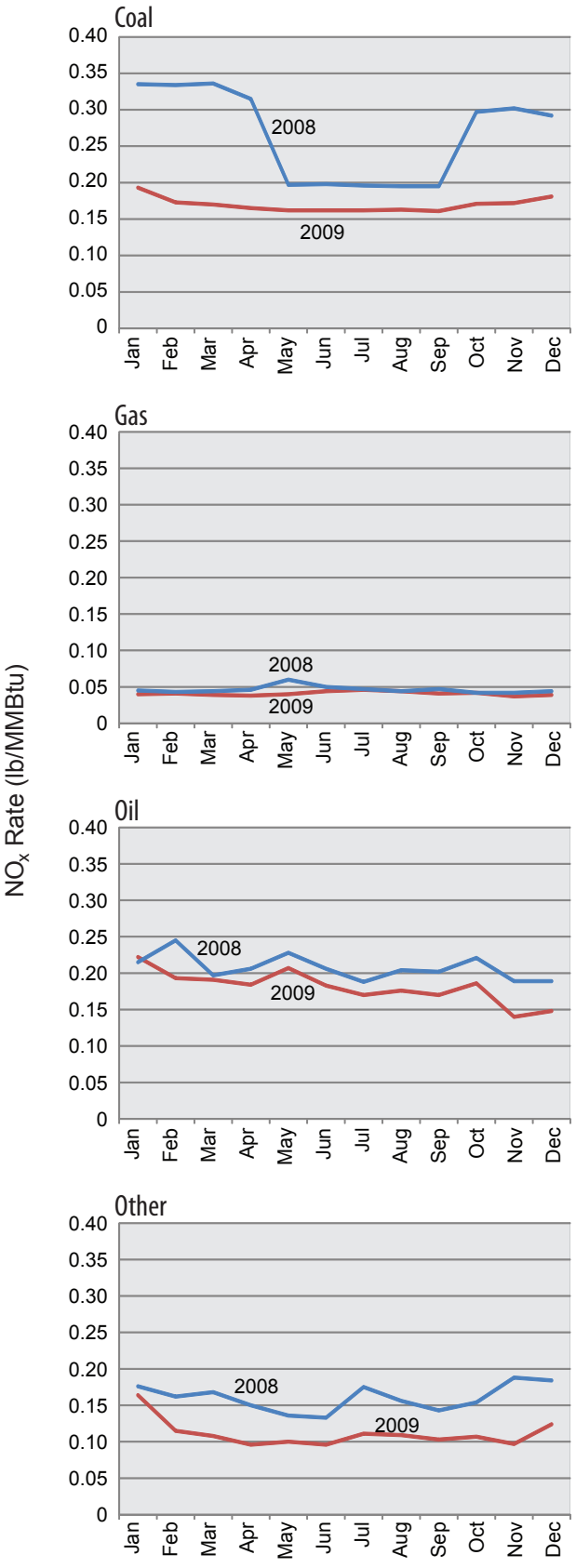
Figure 5: Monthly Emissions and Heat Input from CAIR NO_X Annual Program Sources 2008 – 2009



Source: EPA, 2010

Figure 6 demonstrates that the introduction of the CAIR NO_X annual program caused a large drop in non-ozone season NO_X emission rates as coal-burning units began operating their NO_X control equipment year-round. Coal-fired plants, which account for 74 percent of the 2009 heat input, achieved NO_X emission rates below 0.20 lb/MMBtu for the entire year. Oil and unconventional units also reduced their emission rates, but if non-coal burning units had kept their 2008 emission rates constant through 2009, annual NO_X emissions would still have fallen by 42 percent due to the change in coal-burning plants alone.

Figure 6: CAIR NO_X Annual Program Monthly Emission Rates by Fuel Type



Source: EPA, 2010

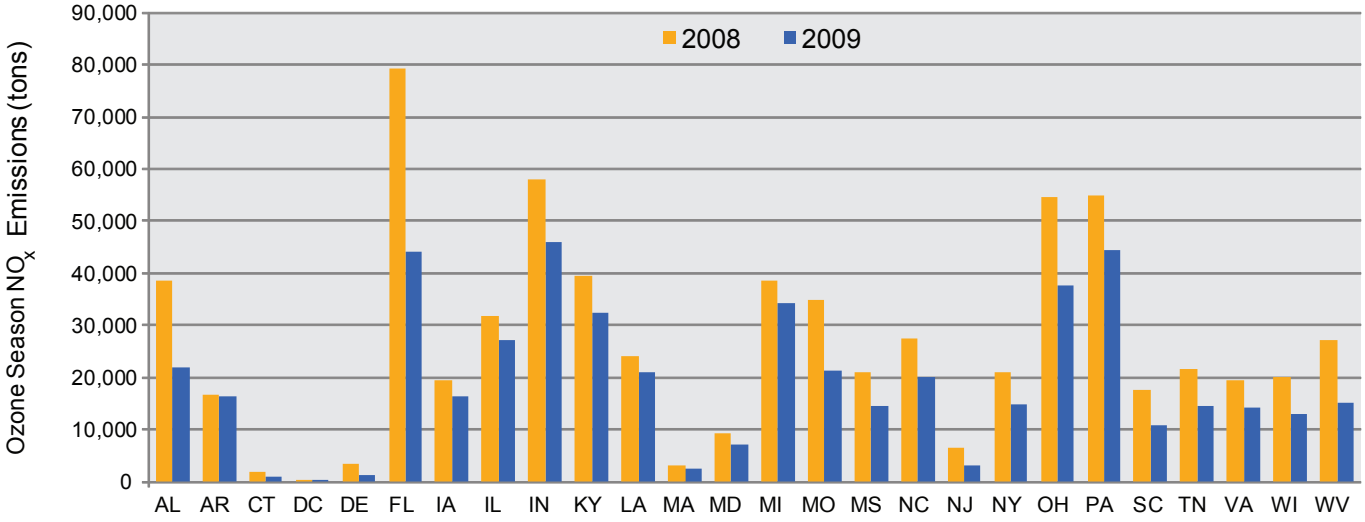
State-Level NO_X Reductions

Between the CAIR monitoring training year in 2008 and 2009, when compliance became mandatory, ozone season NO_X emissions fell in every state participating in the CAIR NO_X ozone season program (see Figure 7). Units in the seasonal program reduced their overall NO_X emissions from 689,000 tons to 495,000 tons. An 11 percent drop in heat input and a 22 percent improvement in NO_X rate accounted for this reduction in total summer NO_X emissions.

In the 2009 ozone season, the total emissions from participating sources were about 130,000 tons (21 percent) below the regional emission cap. Nineteen states and the District of Columbia had emissions below their allowance budgets, collectively by about 155,000 tons. Another six states (Arkansas, Iowa, Louisiana, Michigan, Mississippi, and Pennsylvania) exceeded their 2009 budgets by a total of about 22,000 tons, indicating that, on an aggregate basis, sources within those states covered a portion of their emissions with allowances either banked from earlier years under the NBP, transferred from an out-of-state account, or purchased from the market.

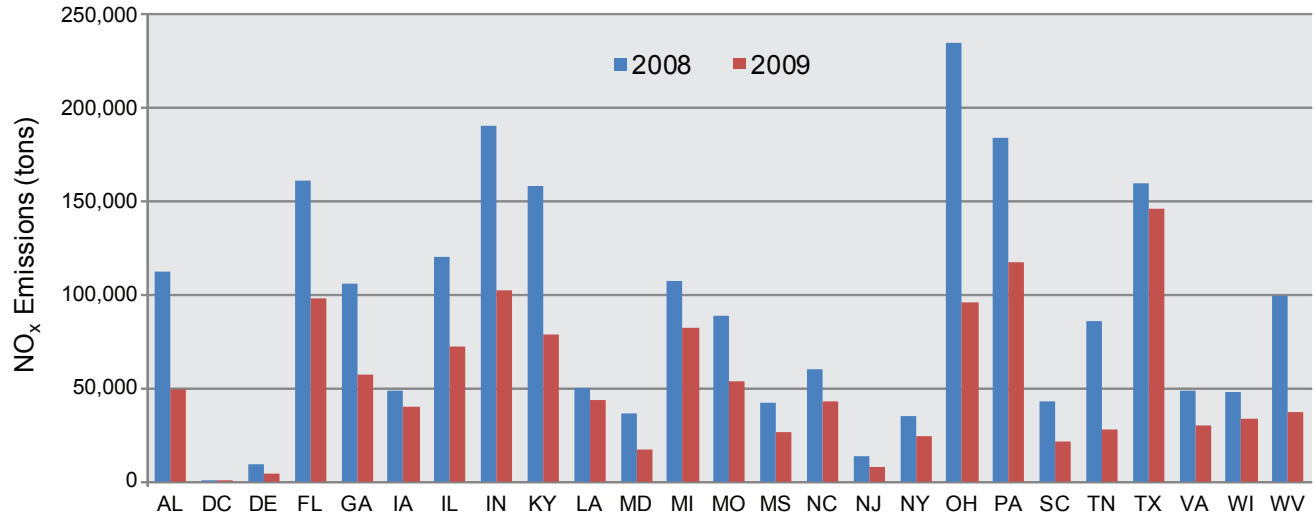
In 2009, the total emissions from sources in the annual NO_X region were about 350,000 tons (also 21 percent) below the regional budget of 1,655,362 tons. All states participating in the program reduced emissions from 2008 levels (see Figure 8). Eighteen states and the District of Columbia had emissions below their allowance budgets, collectively by about 191,000 tons. Another six states (Delaware, Iowa, Louisiana, Michigan, Mississippi, and Pennsylvania) exceeded their 2009 budgets by a total of about 37,000 tons.

Figure 7: Ozone Season Emissions by States Participating in the CAIR NO_x Ozone Season Program, 2008 – 2009



Source: EPA, 2010

Figure 8: Annual Emissions by States Participating in the CAIR NO_x Annual Program, 2008 – 2009



Source: EPA, 2010

CAIR NO_x Program Compliance

Tables 2 and 3 show how NO_x allowances were used in 2009. Only one facility did not hold enough allowances to cover its emissions for both the ozone season and annual program. That facility automatically surrendered a 3 for 1 penalty deduction from next year's allowances for each program.

Banking in 2009

In general, under cap and trade programs, banking allows sources that decrease emissions below the number of allowances they are allocated to save the unused allowances for future use. Banking can produce environmental and health benefits earlier than required and provides an available pool of allowances that could be used to address unexpected events or smooth the transition into deeper emission reductions in future years.

On May 1, 2009, the NBP transitioned to the CAIR NO_x ozone season program. As part of this process, EPA transferred the bank of NBP allowances to CAIR NO_x ozone season accounts for use under CAIR. In addition, EPA transferred 2,159 allowances from the primary reserve accounts of two states. In total, EPA transferred 275,367 allowances from the NBP to the CAIR NO_x ozone season program.

In the 2009 ozone season, CAIR participants were able to bank additional allowances (see Figure 9 on page 8). This continues the NBP's five consecutive years in which sources achieved greater reductions than the program required.

Compliance Results

As of June 3, 2010, the reported 2009 ozone season NO_x emissions by CAIR sources totaled 495,198 tons and annual emissions totaled 1,311,986 tons. Because of variation in rounding conventions, changes due to resubmissions by sources, and allowance compliance issues at certain units, these numbers are higher than the sums of emissions used for reconciliation purposes shown in Tables 2 (ozone season reconciliation) and 3 (annual reconciliation). Therefore, the allowance totals deducted for actual emissions in Tables 2 and 3 differ from the number of emissions shown elsewhere in this report.

CAIR NO_x Ozone Season

Reported emissions (tons):	495,198
Rounding and report resubmission adjustments (tons):	-199
Emissions not covered by allowances (tons):	-12
Total allowances deducted for emissions:	494,987

CAIR NO_x Annual Program

Reported emissions (tons):	1,311,986
Rounding and report resubmission adjustments (tons):	-1,666
Emissions not covered by allowances (tons):	-21
Total allowances deducted for emissions:	1,310,299

Table 2: CAIR Ozone Season Allowance Reconciliation Summary, 2009

Total Allowances Held (2003 – 2009 vintages)	887,786
Affected Facility Accounts	752,378
Other (State Holding, General, and Non-Affected Facility Accounts)	135,408
Allowances Deducted	494,987
Banked Allowances	392,799
Affected Facility Accounts	257,391
Other (State Holding, General, and Non-Affected Facility Accounts)	135,408
Penalty Allowance Deductions (2010 Vintage)	12

Note: This table does not include information for sources with ongoing monitoring petitions or applicability issues. The calculations will change as these facilities are reconciled.

Source: EPA, 2010

Table 3: CAIR NO_x Annual Allowance Reconciliation Summary, 2009

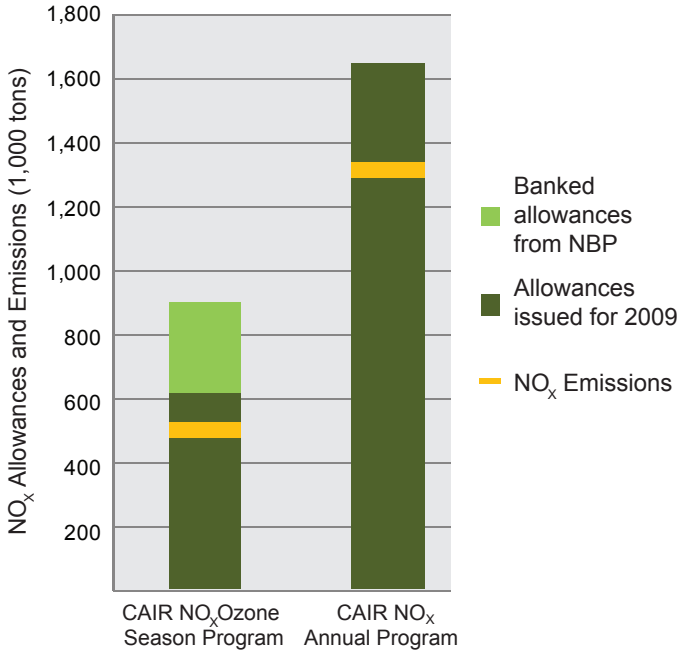
Total Allowances Held (2009 vintage)	1,653,274
Affected Facility Accounts	1,576,393
Other (State Holding, General, and Non-Affected Facility Accounts)	76,881
Allowances Deducted	1,310,299
Banked Allowances	342,975
Affected Facility Accounts	266,094
Other (State Holding, General, and Non-Affected Facility Accounts)	76,881
Penalty Allowance Deductions (2010 Vintage)	21

Note: This table does not include information for sources with ongoing monitoring petitions or applicability issues. The numbers will change as these facilities are reconciled.

Source: EPA, 2010

Under the CAIR NO_X annual program 1,653,274 allowances were issued in 2009. As Figure 9 indicates, after reconciliation, 345,249 allowances remained in the bank to be carried over into 2010.

Figure 9: 2009 NO_x Allowance Allocations and the Allowance Bank



Notes:
Allowances allocated may include those issued by states from the base budget, compliance supplement pool (CSP) (available only for the first two years of compliance), and opt-in allowances. Not all budgeted allowances were necessarily issued by the states each year.
Source: EPA, 2010

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.

Although many CAIR units with low levels of emissions did not have to use CEMS, the vast majority — over 99 percent of the NO_X emissions under CAIR — were measured by CEMS. Coal-fired units were required to use CEMS for NO_X concentration and stack gas flow rate (and if needed, a diluent carbon dioxide or oxygen gas monitor and stack gas moisture measurement) 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 flowmeter 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 for CAIR sources to conservatively estimate NO_X mass emissions.

In all, about 70 percent of CAIR NO_X ozone season program units used CEMS in 2009, including 100 percent of coal-fired units, 66 percent of gas-fired units, and 29 percent of oil-fired units. In the NO_X annual program, 73 percent of units used CEMS, including 100 percent of coal-fired units, 70 percent of gas-fired units, and 29 percent of oil-fired units. The relatively low percentage for oil-fired units was consistent with the decline in oil-fired heat input, as most of these units were used infrequently and qualified for reduced monitoring.

Compliance Options

Sources could select from a variety of compliance options to meet the emission reduction targets of CAIR in ways that best fit their own circumstances. Compliance options included:

- Installing NO_X combustion controls, such as low NO_X burners;
- Installing add-on emission controls, such as Selective Catalytic Reduction (SCR) or Selective Non-Catalytic Reduction (SNCR);
- Using banked allowances or purchasing additional allowances from other market participants that reduced emissions below their allocations;
- Decreasing or stopping generation from units with high NO_X emission rates, or shifting to lower emitting units, during the ozone season; and
- Using combinations of the above options.

NO_X Controls in 2009

Of the 3,279 units in the CAIR NO_X ozone season program, approximately 31 percent were non-controlled (see Table 4 on page 9), a share that is similar to that of the NBP in 2008. Nine units from the NBP added controls since 2008, and the new CAIR region included 39 units with controls. Of the 3,321 units in the CAIR NO_X annual program, 25 percent were non-controlled (see Table 5 on page 9).

Table 4: Ozone Season Program Operating Units by Control Type, 2009

Control Type	Number of Units	Percent of Total
Combustion	978	30%
Non-controlled	1,015	31%
Other Control	562	17%
SCR	587	18%
SNCR	137	4%

Source: EPA, 2010

Table 5 : Annual Program Operating Units by Control Type, 2009

Control Type	Number of Units	Percent of Total
Combustion	1,093	33%
Non-controlled	824	25%
Other Control	603	18%
SCR	670	20%
SNCR	131	4%

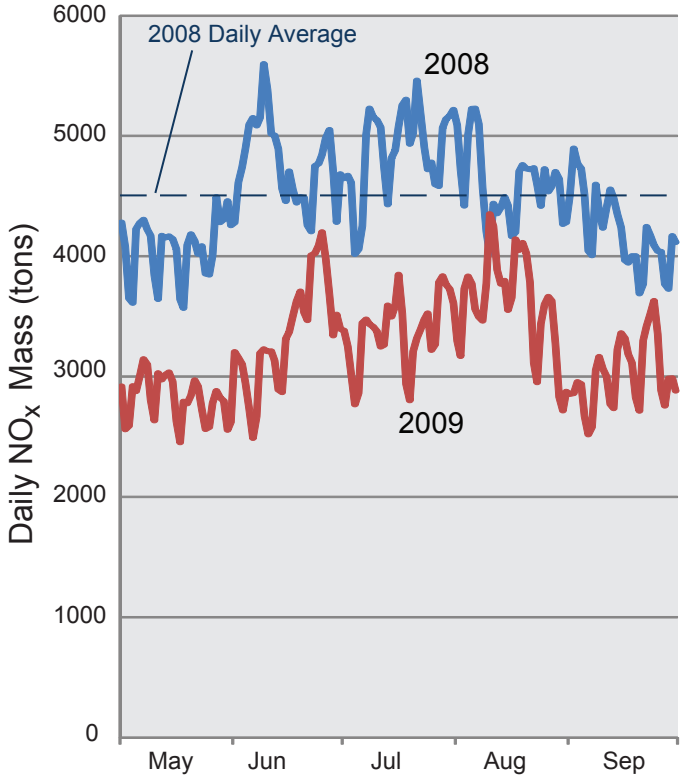
Source: EPA, 2010

Ozone Season High Electric Demand Days

High demand for electricity is closely related to meteorology and is driven primarily by the use of air conditioning on hot days. Periods of hot weather and related high electricity demand often drive peak NO_x emissions on a given day. In the 2009 ozone season, emission levels on peak demand days (as measured by megawatt hours of generation) dropped considerably when compared to 2008 (see Figure 10). The average daily NO_x emissions during ozone season 2008 was 4,506 tons. In ozone season 2009, the maximum emissions of 4,351 tons occurred on August 10. Not a single day in the 2009 season exceeded the average daily NO_x emissions in the 2008 season. Part of the decrease in emissions from 2008 to 2009 is attributable to the decline in demand due to economic conditions.

During high demand days peaking units are called into service. On a typical day during the 2009 ozone season some 1,300 units generated electricity. On the top 10 demand days the average number of units in operation jumped to over 1,800. The average NO_x emission rate for the 10 highest ozone season electric demand days in 2009 fell over 10% from 2008. This continues a steady trend of declining emission rates on peak demand days that began in 2003 under the NBP.

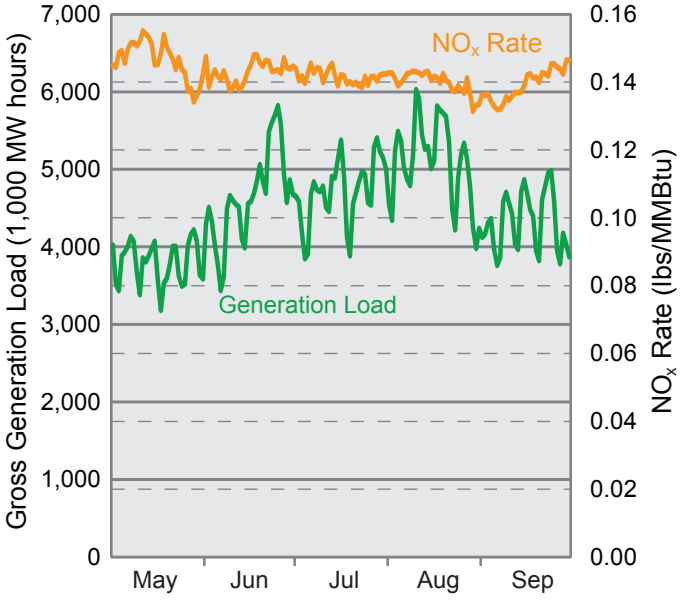
Figure 10: Comparison of Daily NO_x Emission Levels in CAIR States, 2008 – 2009



Source: EPA, 2010

Figure 11 illustrates the considerable variation in generation during the 2009 season while the NO_x emission rate remains nearly constant. There are several reasons for this behavior. Examining daily megawatt hour output by fuel

Figure 11: Daily Ozone Season NO_x Emission Rate and Generation in CAIR States, 2009

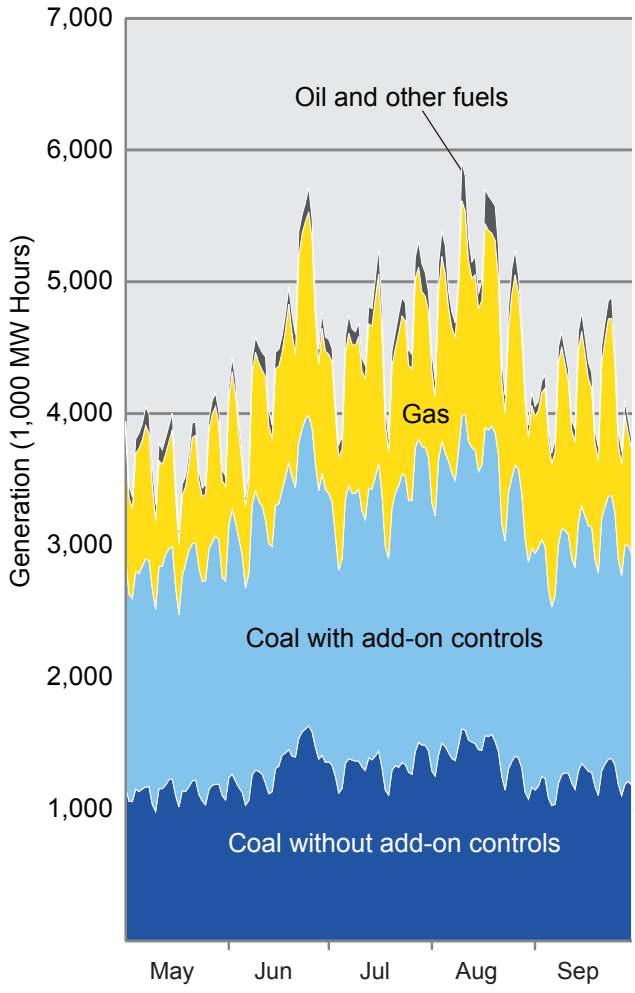


Source: EPA, 2010

type (see Figure 12) reveals that the response to increased demand is primarily met by coal-fired units with add on controls and by gas-fired units. The coal-fired units with SCRs and SNCRs have much lower NO_x emission rates than those without add-on controls. Similarly, units fired by gas, in general emit at lower rates than units consuming other fuels. By comparison, the coal units without add-on controls show a more level response curve. Units fired by other fuels, such as oil, produced such a small share of generation that they had little effect on the aggregate daily emissions rate in the 2009 season.

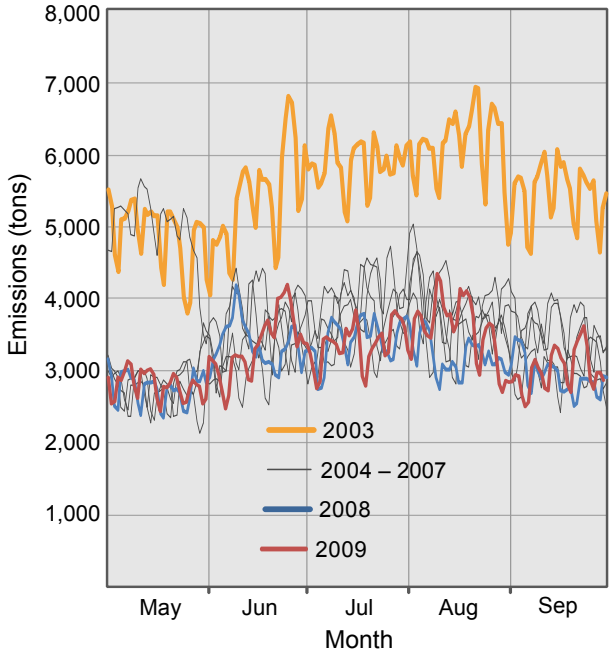
Figure 13 compares daily NO_x mass emissions beginning with the NBP 2003-2008 program and extending to the first year of CAIR. Even with the addition of over 700 new CAIR units, ozone season emissions remained nearly level with past years.

Figure 12: Daily Ozone Season Generation in CAIR States by Fuel, 2009



Source: EPA, 2010

Figure 13: Comparison of Daily NO_x Emission Levels in NBP/CAIR States, 2003 – 2009



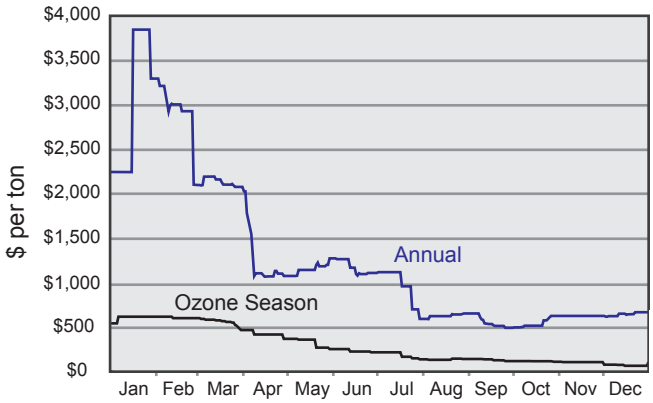
Source: EPA, 2010

Market Activity

NO_x Allowance Trading in 2009

The 2009 CAIR NO_x ozone season allowance market experienced an 87 percent price decline, beginning at $550 per ton in January and falling to a period-end closing price in December of $73 per ton (see Figure 14). The NO_x annual allowance price began 2009 at $2,250 and quickly rose to

Figure 14: NO_x Annual and Ozone Season Allowance Spot Price (Prompt Vintage), January – December 2009



Note: Prompt vintage is the vintage for the "current" compliance year. For example, 2009 vintage allowances were considered the prompt vintage until the true-up period closed at the end of November 2009.
Source: CANTOR CO_2e's Market Price Indicator (MPI), 2010; see <www.emissionstrading.com>

a high of $3,850, before sharply declining for the remainder of the year to close at $675 per ton.

In 2009, the first year of the CAIR ozone season and annual NO_x programs, CAIR sources emitted about 495,000 tons of NO_x during the ozone season (May through September), a 28 percent decrease from 2008 levels, and 21 percent below the overall budget. During the ozone season, CAIR sources emitted about 130,000 tons less than their overall budget—resulting in over 392,000 banked allowances. Not surprisingly, the downward tendency of ozone season allowance prices that occurred from 2003 to 2008 continued into 2009. NO_x emissions from CAIR annual program sources were 1.3 million tons, about 345,000 tons less than the overall budget.

In a cap and trade program, several emission reduction alternatives are available to sources, as part of their compliance strategy, including allowance trading. Because abatement costs are not the same for all sources, the overall market can achieve emission targets at a lower cost through trading than through a command and control program. A market for emission allowances will emerge, and the allowance price will reflect the marginal cost of emission reductions. Emission control decisions will be based on the cost of control options relative to the market price of allowances. The allowance price will motivate those who have relatively low cost opportunities for emission reductions to make those investments and sell their surplus allowances to those with higher marginal abatement costs. Assessing the CAIR NO_x ozone season allowance market, EPA's expectation has been that the CAIR annual NO_x cap would be the binding constraint and would absorb most of the capital costs of controls (e.g., SCRs), while NO_x ozone season allowance prices would primarily be driven by operating costs. As expected, the current CAIR NO_x allowance prices are below the total expected control cost and continue to reflect the variable costs of SCR operation.

Transaction Types and Volumes

NO_x 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 (see Table 6).

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 which excludes parent-subsidiary types of relationships. These transfers are categorized broadly as "economically significant trades."
- 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).

Although all transactions are important to proper market operation, EPA follows trends in the economically significant transaction category with particular interest because these transactions represent an actual exchange of assets between unaffiliated participants.

Table 6: Allowance Transactions

CAIR NO_x Ozone Season Program	Distinct Entities	99,639	26%
	Related Entities	289,851	74%
CAIR NO_x Annual Program	Distinct Entities	335,137	57%
	Related Entities	253,509	43%

Source: EPA, 2010

Role of Brokers and Their Fees

Brokers play an important role in the emissions allowance markets. They primarily facilitate and conduct trades between willing buyers and sellers, undertaking the direct costs of identifying trading partners and transacting sales at a price acceptable to both parties. In the allowance trading market, the fees charged by brokerage firms are often considered to be transaction costs. These fees are the direct costs associated with buying and selling allowances.

Costs for services are fairly standardized and are generally low compared to the value of allowances, usually within the 1 to 2 percent range of allowance values typically cited in the economics literature.* Because there is sufficient competition among the brokerage houses any attempt at charging fees in excess of market standards would likely be bid down through either existing competition or entry of more businesses able to provide brokerage services. In many instances, larger clients can negotiate fees even lower than market averages. In addition, if a company needs some expert analysis or opinions to maximize the value of its allowances, it may agree to pay additional fees unrelated to the actual execution of the trades.

Emissions allowances and derivatives (i.e., futures contracts) may also be traded on exchanges such as the New York Mer-

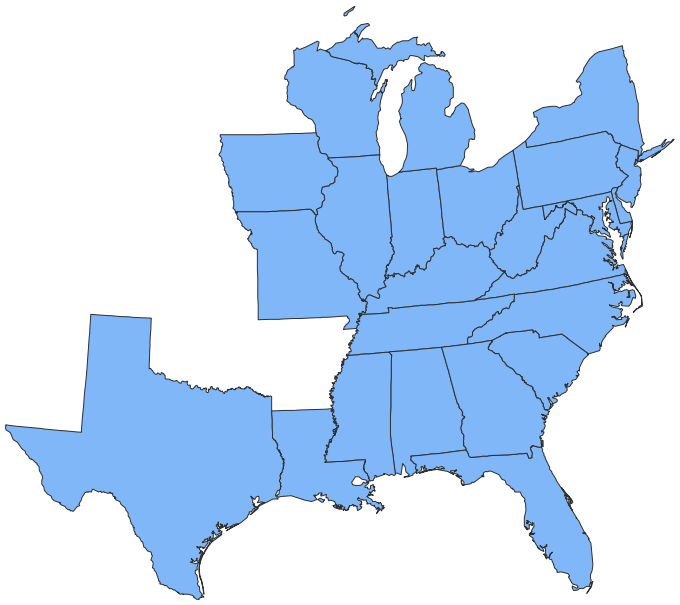
*Personal communication with Gary Hart, ICAP-United, June 25, 2007 as quoted in Napolitano, S., J. Schreifels, G. Stevens, M. Witt, M. LaCount, R. Forte, & K. Smith. 2007. "The U.S. Acid Rain Program: Key Insights from the Design, Operation, and Assessment of a Cap-and-Trade Program." *Electricity Journal*. Aug./Sept. 2007, Vol. 20, Issue 7.

cantile Exchange (NYMEX) and the Chicago Climate Exchange. The fees charged for conducting business on exchanges appear to be markedly lower than the fees charged by brokerage firms. On a per ton basis, these exchange fees range from less than $1.00 per ton for seasonal NO_x to $2.50 per ton for annual NO_x. These fees are below the broker fees charged for transactions between two parties.

The CAIR SO_2 Program

The CAIR SO_2 trading program is intended to reduce ambient SO_2 levels in downwind states by capping emissions in participating eastern states (see Figure 15). The program applies to the same EGUs as the CAIR NO_x annual program (see Figure 16). Of the 3,321 units in the CAIR SO_2 program, 2,595 (78 percent) were also covered by the Acid Rain Program (ARP) in 2009. The other units are largely fossil generation units that entered SO_2 control under the broader applicability requirements of CAIR. All the CAIR SO_2 program facilities participated in a monitoring and reporting training year in 2009. In 2010, the first year of operation of the CAIR SO_2 trading program, facilities were obligated to hold SO_2 allowances. Since SO_2 allowances from the ARP are used in CAIR, there has been an incentive from 2005–2009 for units to lower SO_2 emissions in order to have allowances under CAIR. Except for a small number of facilities with pending applicability questions, all participating units reported data in 2009. Their total SO_2 emissions were 5.0 million tons.

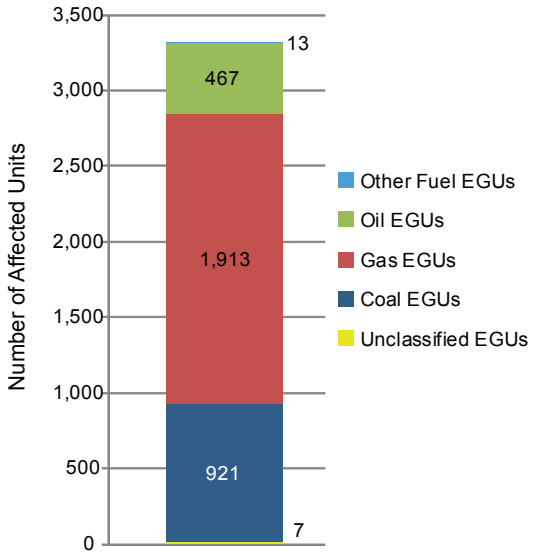
Figure 15: The CAIR SO_2 Region



Source: EPA, 2010

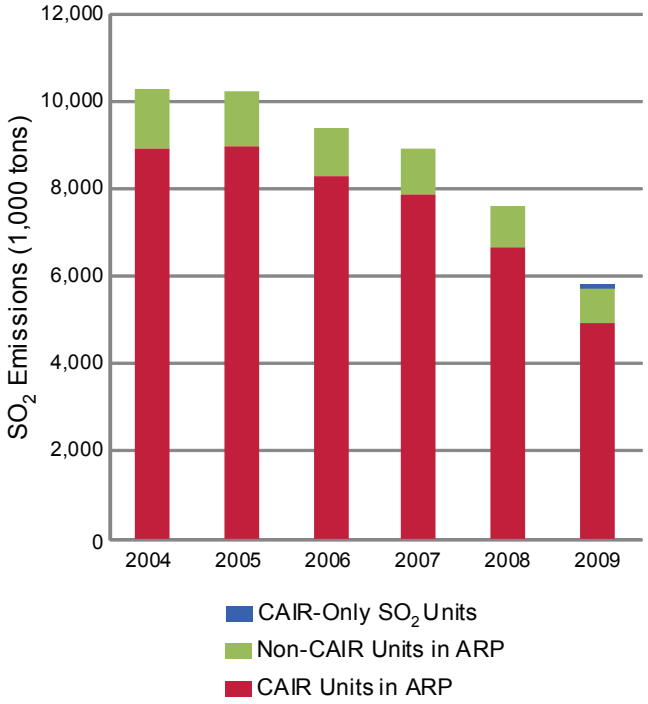
Figure 17 shows that most of the SO_2 emissions under the ARP are also subject to CAIR, and that the CAIR SO_2 program continues and complements the ARP's history of SO_2 emission reductions.

Figure 16: Affected Electric Generating Units in the CAIR SO_2 Program



Notes: "Other" fuel refers to units that burn fuels such as waste, wood, petroleum coke, or tire-derived fuel.
"Unclassified" units have not submitted a fuel type in their monitoring plan and did not report emissions.
Source: EPA, 2010

Figure 17: SO_2 Emissions from Sources in the ARP and in the CAIR Annual SO_2 Program Region, 2004 – 2009



Source: EPA, 2010