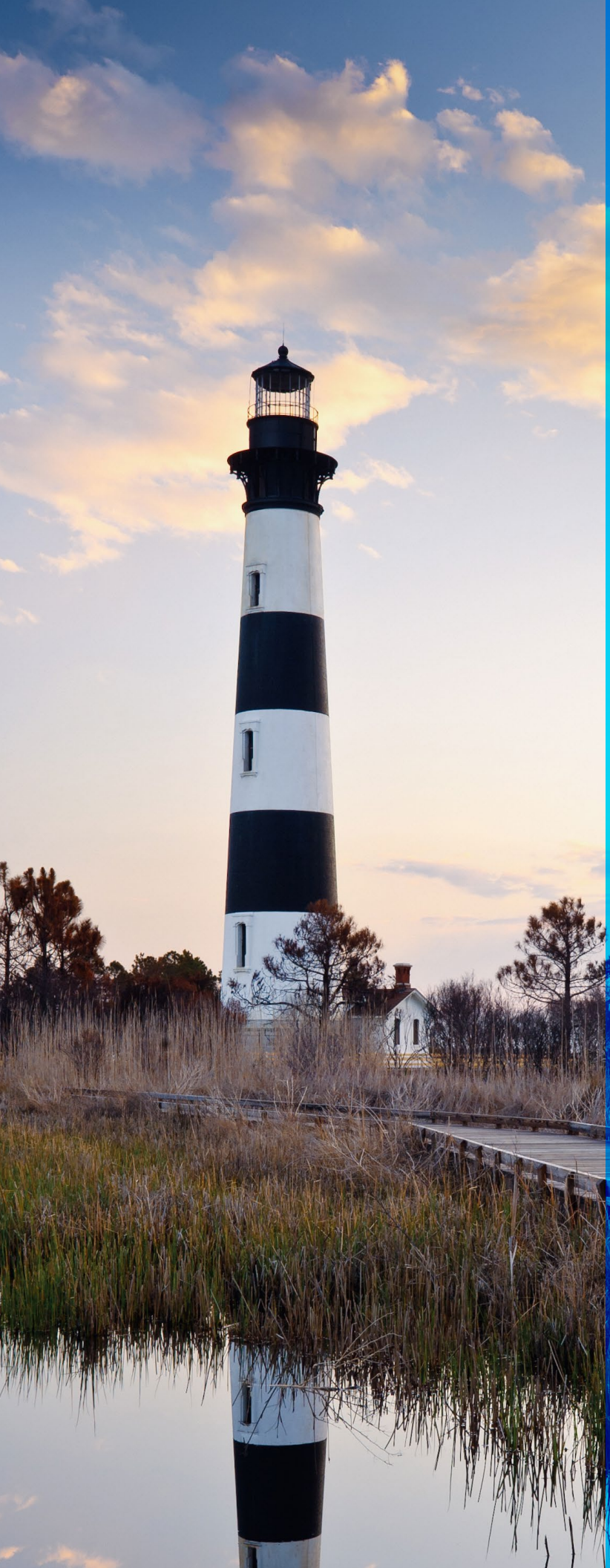


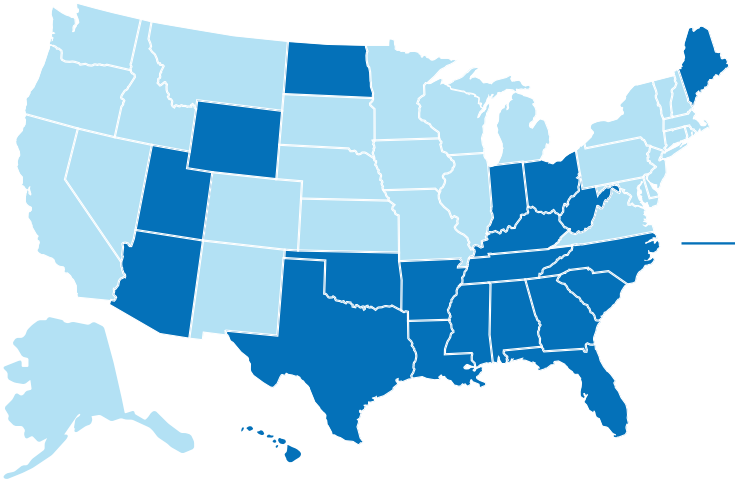
State Air Trends & Successes

THE StATS REPORT
2023 EDITION

AAPCA
THE ASSOCIATION OF AIR POLLUTION CONTROL AGENCIES

AAPCA
THE ASSOCIATION OF AIR POLLUTION CONTROL AGENCIES

State Environmental Agencies Currently Represented on the AAPCA Board of Directors



Alabama
Arizona
Arkansas
Florida
Georgia
Hawaii
Indiana
Kentucky
Louisiana
Maine
Mississippi
North Carolina
North Dakota
Ohio
Oklahoma
South Carolina
Tennessee
Texas
Utah
West Virginia
Wyoming

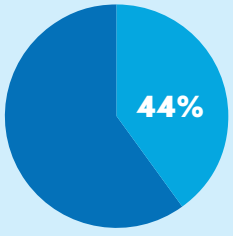
Association of Air Pollution Control Agencies (AAPCA)

The Association of Air Pollution Control Agencies, or AAPCA, is a national, non-profit, consensus-driven organization focused on assisting state and local air quality agencies and personnel with implementation and technical issues associated with the federal Clean Air Act.

Created in 2012, AAPCA represents 48 state and local air pollution control agencies, and senior officials from 21 state environmental agencies currently sit on the AAPCA Board of Directors. AAPCA is housed in Lexington, Kentucky as an affiliate of The Council of State Governments. More information about AAPCA can be found on the Association's website: ***www.cleanairact.org***.

Footprint of AAPCA Member States

State members of the AAPCA Board of Directors have primary responsibility for protecting air quality for a significant portion of the country, as reflected in the following statistics:



An estimated **145.7 MILLION** Americans, about **44%** of the total **U.S. population** in 2022.

From **2012 to 2022**, a **population growth** of

9.4%

compared to national population growth of

6.2%

for the same time period.

38%

38% of **U.S. Gross Domestic Product** (GDP) in 2022.

42%

42% of **U.S. total manufacturing output** and **5.5 MILLION** manufacturing jobs in 2021.

126.6 MILLION motor-vehicles, **45%** of total **motor-vehicles** in the U.S. in 2021.

More than **1.5 MILLION vehicle miles traveled** in 2021, **49%** of the total miles traveled in the U.S.

67% of **U.S. operable petroleum refining capacity** in 2022.

61% of total **U.S. energy production** in 2020, as well as:

- **53%** of **total net electricity generation** in 2022.
- **46%** of **wind generation** in 2022.
- **42%** of **solar generation** in 2022.
- **65%** of **natural gas production** in 2021.
- **70%** of **crude oil production** in 2022.
- **75%** of **coal production** in 2021.

Foreword

Dear Readers,

Today, we're enjoying the best air quality of our lifetimes. Right now, visibility at our greatest natural treasures — our National Parks and Wilderness Areas — is better than we've seen in decades. And we should all be proud of the significant public health benefits resulting from our work. How did we do it? Great federal, state, local and private partnerships and relationships were certainly critical to this success. In my home state of North Carolina, we can see 40 miles further (on the haziest days) than we could 20 years ago in our Class I areas. That's a remarkable improvement!

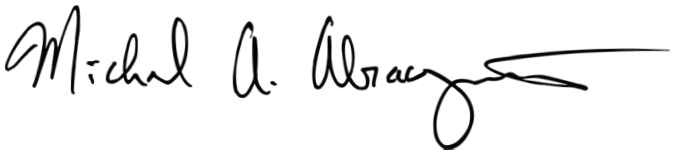
We continue to make progress in the nation's air quality. State, local, and tribal agencies, including the membership of the Association of Air Pollution Control Agencies (AAPCA), have dedicated significant time and resources to fulfilling this important mission. AAPCA is a consensus-driven organization of 48 state and local air agencies focused on assisting members with implementing technical issues associated with the federal Clean Air Act. Comprised of senior officials from 21 state environmental agencies, AAPCA's Board of Directors is geographically diverse, providing a unique forum of perspectives for us to engage as we work to improve air quality for the more than 145 million Americans we represent. AAPCA's Member States also guide the Association on a consensus basis, seeking to engage our federal co-regulator partners on common principles as we implement the Clean Air Act.

I'm pleased to present the Association's 2023 edition of its annual publication, *State Air Trends & Successes: The StATS Report*. Highlights from this year's report include:

- Since 2000, AAPCA Member States have achieved a 52 percent decrease in the combined emissions of the pollutants (or pollutant precursors) for which there are national ambient air quality standards, or NAAQS.
- The United States has reduced aggregate emissions of criteria air pollutants by 78 percent, from 1970 to 2021.
- From 2000 to 2022, AAPCA Member States reduced emissions of sulfur dioxide (SO_2) and oxides of nitrogen (NO_x) from the electricity sector by 92 percent and 84 percent, respectively.
- From 2000 to 2020, energy-related carbon dioxide (CO_2) emissions in AAPCA Member States declined 20 percent, while energy production increased 49 percent.
- Reported toxic air releases decreased nationally by 26 percent from 2012 to 2021. AAPCA Member States were responsible for roughly 66 percent of that reduction.
- From 2000 to 2020, visibility in 156 national parks and wilderness areas across the U.S. has improved by 33 percent on the clearest days and by 28 percent on the most impaired days.

The recipe that led to those successes will have to be repeated as we tackle major challenges ahead, including climate change and emerging contaminants. As the primary implementers of Clean Air Act programs, state, local, and tribal air agencies are well positioned to address those challenges by working directly with communities, regulated entities, and other stakeholders. Again, we have built the necessary relationships, credibility, and trust for interfacing with the public on environmental challenges. We look forward to continuing our important work as we engage federal partners and other stakeholders to improve air quality across the nation.

Thank you for reading.



MICHAEL ABRACZINSKAS

Director, Division of Air Quality

North Carolina Department of Environmental Quality

President, AAPCA

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Introduction

State Air Trends & Successes, or *The StATS Report*, examines the remarkable progress that the United States has achieved in air quality under the Clean Air Act, which places precedence on federal, state, and local cooperation. Through cooperative federalism, state and local governments coordinate with the U.S. Environmental Protection Agency (EPA) to implement national standards that protect public health and the environment. *The StATS Report*, published annually by the Association of Air Pollution Control Agencies (**AAPCA**), looks at the central role of state and local air agencies in improving the nation's air quality.

As primary implementers of Clean Air Act rules, state, local, and tribal air agencies work directly with communities, regulated industries, and other stakeholders in their jurisdiction. In this capacity, air agencies have built the necessary relationships, credibility, and trust for interfacing with the public on environmental challenges.

Polling the Public About the Environment

Gallup's annual **Environment poll** suggests that public perception about the nation's environmental and air quality may be contrary to readily available data. In 2023, only 44 percent of respondents were "Very satisfied" (11 percent) or "Somewhat satisfied" (33 percent) with the "quality of the environment in the nation," while 53 percent were "Somewhat dissatisfied" (30 percent) or "Very dissatisfied" (23 percent). Since 2001, respondents worrying a "Great deal" or "Fair amount" about the environment has never been below 62 percent and often hovers near 70 percent. Over the same period, the percentage of respondents that think the environment is "Getting better" has never been above 42 percent and those that think it is "Getting worse" ranged from 48 to 68 percent.

Gallup has regularly queried the public on air pollution, with polling data on the topic going back to 1989. Consistently, the percentage of respondents worried a "Great deal" or "Fair amount" about air pollution breaches 70 percent. In fact, only in one year did polling data show public worry below 70 percent: 69 percent in 2004.

As *The StATS Report* details, national metrics for air pollution and overall air quality reveal a disconnect in the public's perception of environmental trends. From 1990 through 2021, a period that roughly aligns with Gallup's historical polling data on air pollution, **emissions of all six criteria air pollutants** – carbon monoxide (CO), particulate matter (PM_{10} and $PM_{2.5}$), ground-level ozone (O_3), lead (Pb), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2) – were down at least 33 percent, with **ambient air concentrations** of CO, O_3, Pb, NO_2, and SO_2 reduced at least 21 percent. Polling data is a limited window into public views, but this disconnect presents a unique challenge as air agencies continue to plan for tough-to-find emissions reductions while also responding to public concern about local and sometimes national and global issues.

Gallup Environment Poll Results, 1989–2022

Question: How much do you personally worry about air pollution?					
Date of Poll	Great deal	Fair amount	Only a little	Not at all	No opinion
2022 Mar 1-18	45%	30%	17%	8%	*
2021 Mar 1-15	41%	32%	20%	8%	*
2020 Mar 2-13	48%	28%	16%	9%	*
2019 Mar 1-10	43%	31%	16%	10%	*
2018 Mar 1-8	46%	30%	17%	7%	*
2017 Mar 1-5	47%	31%	15%	7%	*
2016 Mar 2-6	43%	31%	19%	7%	*
2015 Mar 5-8	38%	33%	19%	10%	*
2014 Mar 6-9	46%	27%	21%	7%	*
2013 Mar 7-10	40%	30%	20%	9%	*
2012 Mar 8-11	36%	35%	22%	7%	*
2011 Mar 3-6	36%	36%	20%	8%	*
2010 Mar 4-7	38%	32%	22%	8%	*
2009 Mar 5-8	45%	31%	18%	6%	*
2008 Mar 6-9	43%	35%	17%	6%	*
2007 Mar 11-14	46%	33%	15%	5%	*
2006 Mar 13-16	44%	34%	15%	7%	*
2004 Mar 8-11	39%	30%	23%	8%	*
2003 Mar 3-5	42%	32%	20%	6%	*
2002 Mar 4-7	45%	33%	18%	4%	*
2001 Mar 5-7	48%	34%	14%	4%	*
2000 Apr 3-9	59%	29%	9%	3%	*

Introduction *(continued)*

Question: How much do you personally worry about air pollution?					
Date of Poll	Great deal	Fair amount	Only a little	Not at all	No opinion
1999 Apr 13-14	52%	35%	10%	3%	*
1999 Mar 12-14	47%	33%	16%	4%	*
1997 Oct 27-28	42%	34%	18%	5%	1
1991 Apr 11-14	59%	28%	10%	4%	*
1990 Apr 5-8	58%	29%	9%	4%	*
1989 May 4-7	63%	24%	8%	4%	*

**Less than 0.5 percent*

Source: Gallup Environment poll data available **here**.

Air Quality Data and Trends: A Good Story to Tell

By virtually any metric, the nation's air is cleaner and healthier than five decades ago, when the Clean Air Act was first passed. *The StATS Report* catalogues key trends and indicators using publicly available data from the U.S. EPA and other federal agencies, such as the U.S. Energy Information Administration that is housed in the U.S. Department of Energy (see page 7, "Types of Air Quality Data and Metrics"). These data are important for understanding how air pollution control and planning efforts have improved air quality, including under the national ambient air quality standards (NAAQS) and regional haze programs as well as for hazardous air pollutants and greenhouse gases. When relevant, this report also presents economic and social indicators, such as gross domestic product (GDP) and population growth, to provide context for some air quality metrics (For example: From 1970 through 2021, U.S. GDP rose nearly 300 percent while aggregate emissions of the six criteria air pollutants fell 78 percent).

State Air Trends & Successes: The StATS Report provides these metrics and trends in three sections:

- The first section, "AAPCA Member State Air Trends & Successes," focuses on the 21 AAPCA Member States, which are responsible for protecting air quality for nearly 146 million Americans, about 44 percent of the U.S. population. These states have seen above-average population growth, are home to more than 5.5 million manufacturing jobs, and produced 61 percent of the nation's total energy in 2020.
- The second section, "American Air Quality in an International Context," documents U.S. air quality improvement and economic indicators alongside other nations. The United States is the clear leader in air quality internationally while ranking first in GDP, second in energy production, and third in population.
- The final section, "Air Quality Trends in the United States," presents trends for ambient concentrations and emissions of pollutants under the NAAQS program, toxic air releases, visibility in national parks, and greenhouse gases – data show marked, prolonged improvement in every metric.

As a whole, *The StATS Report* underscores that environmental protection and economic development can both be achieved – indeed, already have been – through the collaborative efforts of state, local, tribal, and federal governments.

Meeting the Mission of State and Local Air Agencies

While air quality has improved substantially, air agencies continue to strive toward their missions of protecting air quality and public health. Core monitoring, modeling, and emissions inventory efforts have become more – not less – complex and technical, as has the development of state implementation plans (SIPs) to attain/maintain federal air quality standards. Located on the ground in their communities, state, local, and tribal air agencies deeply understand how national environmental efforts must intertwine with local priorities, economic strategies, and social needs.

As noted, the policy, technical, and jurisdictional expertise of air agencies is also critical in their role on the frontlines. Citizens and communities now increasingly look to social media and real-time technology like air sensors to become informed, requiring new and innovative outreach methods by agencies that build on their established credibility. Emerging environmental issues like wildfires, per-and polyfluoroalkyl substances (PFAS), and ethylene oxide (EtO) also continue to push the capacity of state and local air agencies.

In short, driving emissions reductions to better air quality has never been more challenging and resource intensive. The increasingly complex work of understanding air quality problems (and solutions) is now coupled with the need to respond to the public faster and more informed than ever. Despite these challenges and level (sometimes reduced) funding and staffing, air agencies have successfully continued to improve air quality because of dedicated public servants, developing best practices, and adopting technology to advance efficient, cost-effective solutions.

The positive air quality trends presented in *The StATS Report* are the result of sustained work and deep coordination among federal, state, tribal, and local agencies, all of which have a common goal of protecting public health. With increased efforts to improve public engagement and implement new federal regulations and legislation, cooperative federalism remains a proven and necessary framework for achieving successful environmental outcomes.

Types of Air Quality Data and Metrics

This report primarily relies on data from the U.S. Environmental Protection Agency (EPA) and other federal agencies, such as the U.S. Energy Information Administration (EIA), to evaluate air quality trends. These trends include metrics for criteria air pollutants, air toxics and hazardous air pollutants, visibility progress in National Parks and wilderness areas, and greenhouse gases, with sources provided below each chart or graph and in the source notes. Also included in this report are case studies and short excerpts from other relevant analyses, which include links to their source and data.

Criteria Air Pollutant Data

Trends and indicators of air quality can be measured in a variety of ways, but an important group of data to analyze is that of the air pollutants that are regulated under the federal Clean Air Act. Section 109 of the Clean Air Act requires U.S. EPA to establish both primary and secondary national ambient air quality standards, or NAAQS. Primary NAAQS are "standards the attainment and maintenance of which in the judgment of the Administrator, based on such criteria and allowing an adequate margin of safety, are requisite to protect the public health," while secondary NAAQS "specify a level of air quality the attainment and maintenance of which… is requisite to protect the public welfare from any known or anticipated adverse effects associated with the presence of such air pollutant in the ambient air."[1]

NAAQS have been set for six "criteria" pollutants: carbon monoxide (CO), sulfur dioxide (SO_2), ground-level ozone (O_3), fine and course particulate matter ($PM_{2.5}$ and PM_{10}), lead (Pb), and nitrogen dioxide (NO_2). Individual NAAQS may differ in form (for example, annual fourth highest daily maximum 8-hour concentration average over three years, for ozone), level[2] (often measured in parts per billion or micrograms per cubic meter), and averaging time (from one hour up to one year).[3] U.S. EPA and the Clean Air Scientific Advisory Committee periodically review the adequacy of the NAAQS according to the statute.[4]

Nationally, ambient air pollution data from thousands of monitors across the United States are collected by U.S. EPA and state, local, and tribal air pollution control agencies and provided to the Air Quality System, or AQS. These data are used to "assess air quality, assist in attainment/non-attainment designations, evaluate State Implementation Plans [SIPs] for non-attainment areas, perform modeling for permit review analysis, and prepare reports for Congress as mandated by the Clean Air Act."[5]

U.S. EPA reports on long-term air quality trends by preparing data analyses that show the overall trend lines for pollutant concentrations and emissions. Primary sources that inform this report include:

- Criteria air pollutant concentration data from U.S. EPA's analysis of the AQS that looks at long-term trends in air quality.[6]
- Data showing emissions trends of the criteria pollutants from U.S. EPA's Air Pollutant Emissions Trends Data,[7] which relies on the National Emissions Inventory (NEI). The NEI is "a comprehensive and detailed estimate of air emissions of criteria pollutants, criteria precursors, and hazardous air pollutants from air emissions sources… released every three years based primarily upon data provided [to the Emissions Inventory System (EIS)] by State, Local, and Tribal air agencies for sources in their jurisdictions and supplemented by data developed by the U.S. EPA."[8]
- Design values that are computed and published annually by U.S. EPA and defined as "a statistic that describes the air quality status of a given location relative to the level of the NAAQS… typically used to designate and classify nonattainment areas, as well as to assess progress towards meeting the NAAQS."[9]

Other Air Quality Data

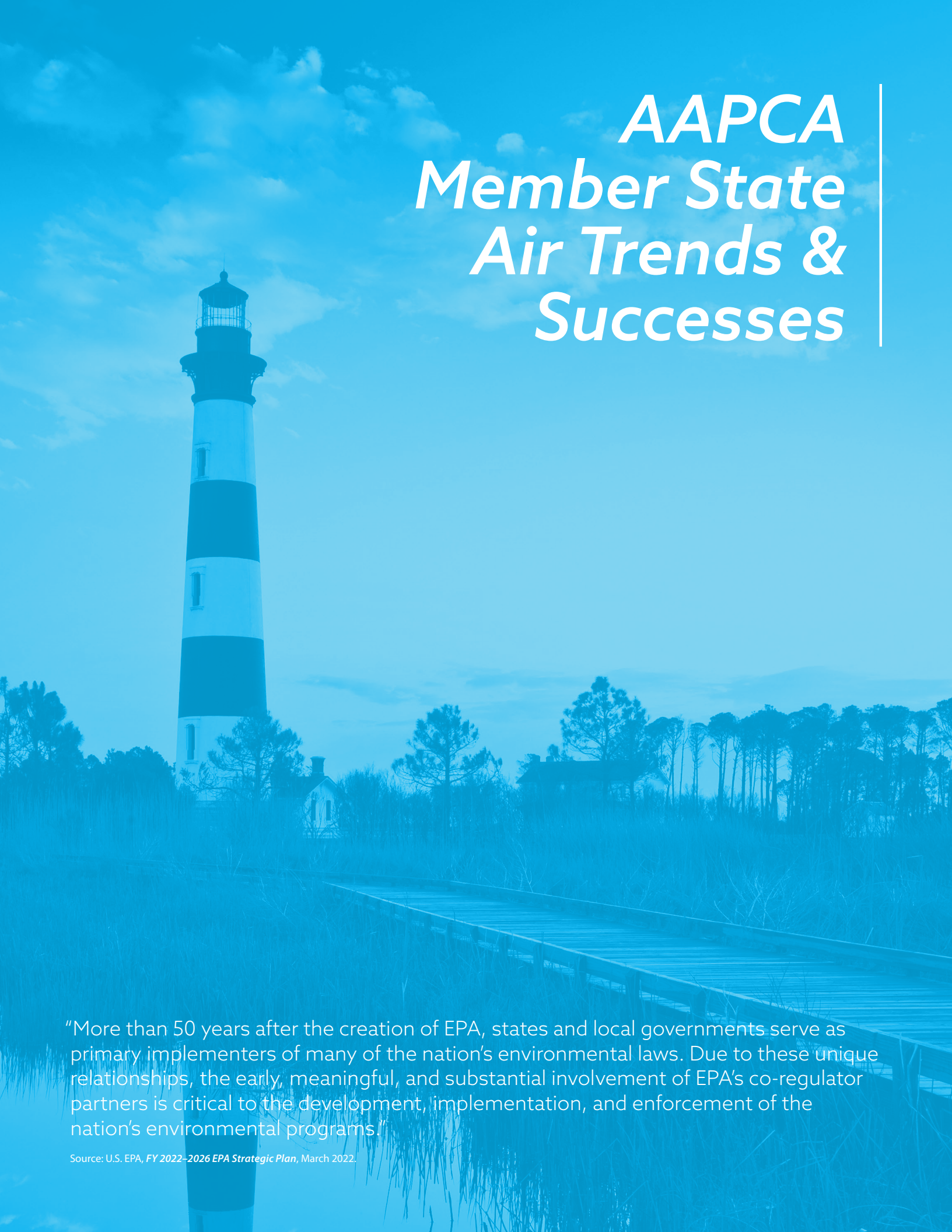
In addition to tracking criteria air pollutants, U.S. EPA also maintains data and develops analyses on multiple other federal air quality programs used to inform this report, including:

- The Toxic Release Inventory (TRI), which provides a consistent set of data over time for hazardous air pollutants (or air toxics) from source reporting.[10]
- Visibility progress tracked as part of the Regional Haze Program, with long-term trends available in U.S. EPA's annual air quality trends report.[11]
- In an annual progress report, the U.S. EPA publishes power sector emissions data for SO_2, nitrogen oxides (NO_x), and hazardous air pollutants, as well as carbon dioxide (CO_2).[12]

Additionally, greenhouse gas data in this report are primarily from U.S. EPA's annual *Inventory of U.S. Greenhouse Gas Emissions and Sinks*[13] and U.S. EIA reports, such as the *Annual Energy Outlook*, which includes CO_2 emissions data from energy sources.[14]

1 **42 U.S.C. §7409(b)**.
2 U.S. EPA **states**: "Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air (µg/m3)."
3 A chart of the primary and secondary NAAQS by pollutant, which includes averaging time, level, and form, can be found **here**.
4 **42 U.S.C. §7409(d)**.
5 U.S. EPA, **Air Quality System**. U.S. EPA notes that the AQS "also contains meteorological data, descriptive information about each monitoring station (including its geographic location and its operator), and data quality assurance/quality control information."
6 Links to data summary files for national criteria pollutant trends can be found **here**.
7 Data can be found **here**. U.S. EPA notes: "The latest version of the 1970 – 2022 data show the trends for Tier 1 categories which distinguish pollutant emission contributions among major source types… As inventory methods are improved over time, for some emission sources an improved estimation method may be applied 'backwards' to previous year trend estimates."
8 More information on the NEI can be found **here**. U.S. EPA states: "The NEI is built using the Emissions Inventory System (EIS) first to collect the data from State, Local, and Tribal air agencies and then to blend that data with other data sources."
9 U.S. EPA, **Air Quality Design Values**.
10 U.S. EPA, **Toxics Release Inventory (TRI) Program**. Annual TRI National Analysis **here**. U.S. EPA notes that the TRI "is a resource for learning about toxic chemical releases and pollution prevention activities reported by industrial and federal facilities. TRI data support informed decision-making by communities, government agencies, companies, and others. Section 313 of the *Emergency Planning and Community Right-to-Know Act* (EPCRA) created the TRI Program."
11 U.S. EPA, **Air Quality – National Summary**. See also: U.S. EPA, ***Our Nation's Air: Trends Through 2021***, June 2022 (Section: "**Visibility Improves in Scenic Areas**").
12 U.S. EPA, **Power Sector Programs – Progress Report**.
13 U.S. EPA releases the ***Inventory of U.S. Greenhouse Gas Emissions and Sinks*** each April. See also: U.S. EPA, **Greenhouse Gas Inventory Data Explorer**.
14 U.S. EIA, ***Annual Energy Outlook 2023***, March 16, 2023.

AAPCA Member State Air Trends & Successes



"More than 50 years after the creation of EPA, states and local governments serve as primary implementers of many of the nation's environmental laws. Due to these unique relationships, the early, meaningful, and substantial involvement of EPA's co-regulator partners is critical to the development, implementation, and enforcement of the nation's environmental programs."

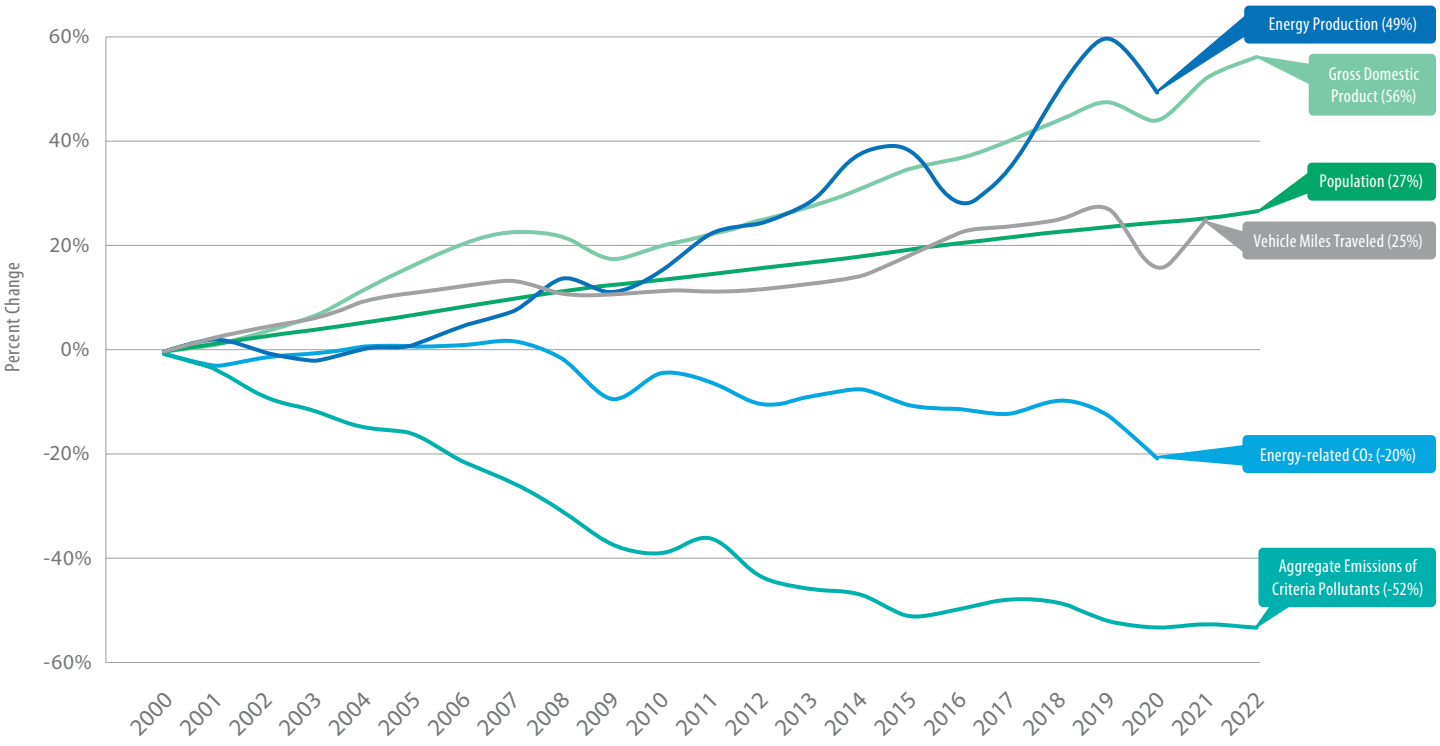
Source: U.S. EPA, ***FY 2022–2026 EPA Strategic Plan***, March 2022.

Economic Growth and Air Quality in AAPCA Member States

Since 2000, AAPCA Member States have overseen a 52 percent decrease in the combined emissions of the pollutants (or pollutant precursors) for which there are national ambient air quality standards, or NAAQS, while also experiencing significant economic and social growth over the last two decades[15]:

- AAPCA Member States saw a total increase in Gross Domestic Product (GDP) of 56 percent from 2000 to 2022, and contributed about 38 percent of the total U.S. GDP in 2022[16];
- States in the Association reported a 25 percent increase in vehicle miles traveled from 2000 to 2021[17];
- By 2022, AAPCA's membership represented more than 145 million people, or 44 percent of the total U.S. population, an increase in population of 27 percent from 2000[18]; and,
- From 2000 to 2020, the 21 states in AAPCA's membership were responsible for a 20 percent reduction in energy-related carbon dioxide (CO_2) emissions.[19] In 2020, energy production in AAPCA Member States grew by 49 percent compared to production levels in 2000. AAPCA's Member States produced 61 percent of total U.S. energy in 2020.[20]

AAPCA Member States | Comparison of Growth Indicators and Emissions Since 2000



Sources: U.S. Bureau of Economic Analysis, data available here; U.S. Energy Information Administration, State Energy Data System (SEDS): 1960–2020; U.S. Federal Highway Administration Office of Highway Policy Information, data available here; U.S. Census Bureau, data available here; U.S. EIA, Energy-Related CO_2 Emission Data Tables, Table 1. State energy-related carbon dioxide emissions by year (1970–2020); U.S. EPA, Air Pollutant Emissions Trends Data (Data file: "State Tier 1 CAPS Trends, Criteria pollutants State Tier 1 for 1990–2022").

Air Quality | Fine Particulate Matter

U.S. EPA's online Green Book "provides detailed information about area National Ambient Air Quality Standards (NAAQS) designations, classifications, and nonattainment status."[21] According to the database, a total of 39 areas were initially designated non-attainment for the 1997 fine particulate matter ($PM_{2.5}$) annual NAAQS of 15.0 micrograms per cubic meter ($\mu g/m^3$), measured by the three-year average annual mean concentration.[22]

U.S. EPA develops design values[23] based on monitoring data from the Agency's Air Quality System (AQS).[24] Of the designated areas, 23 are located partially or completely in AAPCA Member States, with the table below detailing the percent change in design values over two decades, a period in which AAPCA Member States averaged a 47 percent reduction in $PM_{2.5}$ ambient air concentrations.[25] Furthermore, all of the designated areas within AAPCA Member States are now classified as in attainment or maintenance for the current 2012 $PM_{2.5}$ NAAQS of 12.0 $\mu g/m^3$.[26]

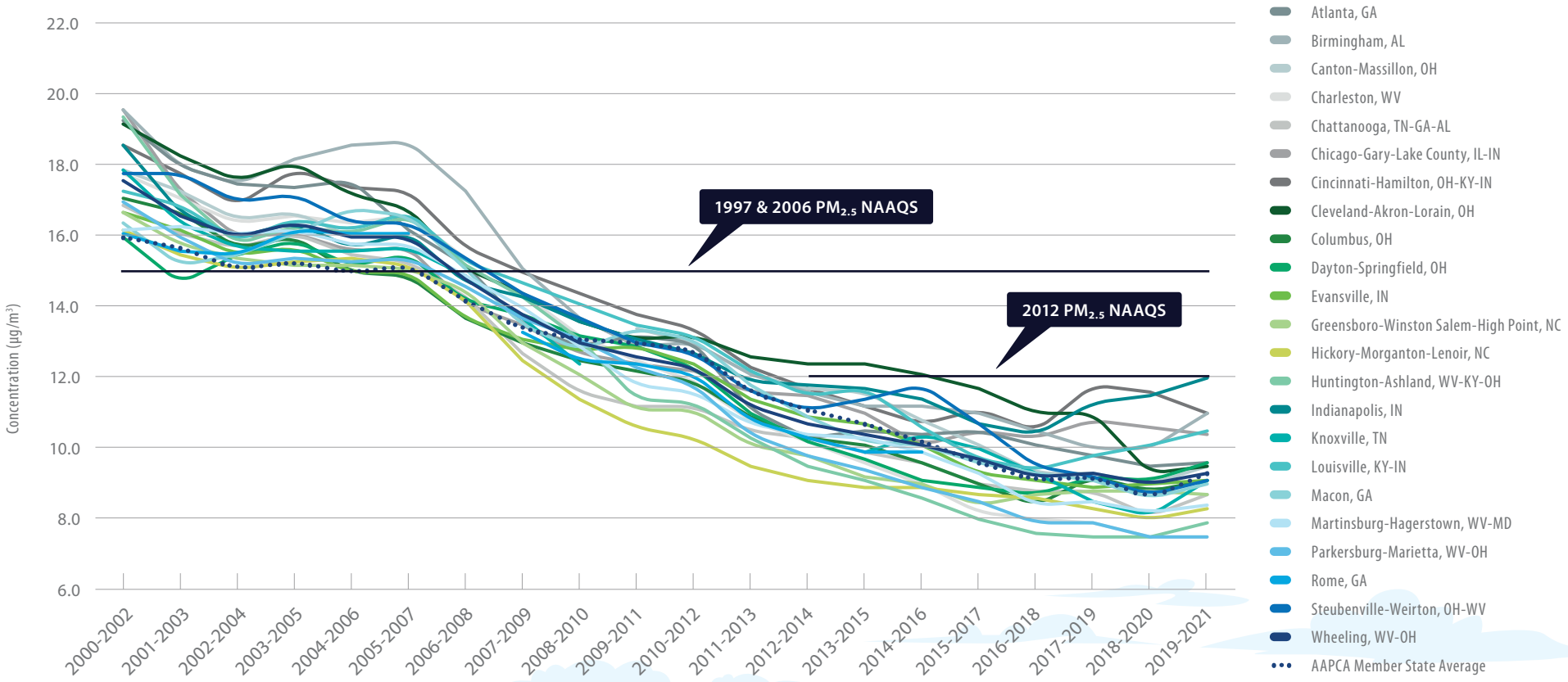
Designated Area	Percent Reduction in $PM_{2.5}$ Concentrations (2000–2002 through 2019–2021 Design Values)
Atlanta, GA	-50.26%
Birmingham, AL	-43.88%
Canton-Massillon, OH	-46.93%
Charleston, WV	-57.87%
Chattanooga, TN-GA-AL	-48.52%
Chicago-Gary-Lake County, IL-IN	-46.94%
Cincinnati-Hamilton, OH-KY-IN	-40.86%
Cleveland-Akron-Lorain, OH	-50.52%
Columbus, OH	-46.78%
Dayton-Springfield, OH	-40.00%
Evansville, IN	-45.51%
Greensboro-Winston Salem-High Point, NC	-47.90%
Hickory-Morganton-Lenoir, NC	-48.77%
Huntington-Ashland, WV-KY-OH	-59.28%
Indianapolis, IN	-35.48%
Knoxville, TN	-49.16%
Louisville, KY-IN	-39.31%
Macon, GA	-45.12%
Martinsburg-Hagerstown, WV-MD	-48.15%
Parkersburg-Marietta, WV-OH	-55.88%
Rome, GA*	-38.51%
Steubenville-Weirton, OH-WV	-48.88%
Wheeling, WV-OH	-41.88%

**Data ends in designation year 2014–2016*

Source: U.S. EPA, **Air Quality Design Values** (Data file: "$PM_{2.5}$ Design Values, 2021").

Air Quality | Fine Particulate Matter

AAPCA Member States | Design Value History for Areas Previously Designated Nonattainment for the 1997 $PM_{2.5}$ Annual NAAQS, 2002–2021



Source: U.S. EPA, **Air Quality Design Values** (Data file: "$PM_{2.5}$ Design Values, 2021").

Air Quality | Ozone

According to U.S. EPA's online Green Book, 47 areas in the United States were previously designated as nonattainment for the 2008 ozone annual national ambient air quality standard (NAAQS) of 0.075 parts per million (ppm), determined using the annual fourth-highest daily maximum 8-hour concentration, averaged over three years.[27]

The table below lists the percent change in design values over the last twenty years for the 13 previously designated nonattainment areas for the 2008 ozone NAAQS that are partially or fully within AAPCA Member States, which averaged over a 26 percent reduction in ambient concentrations of ozone.[28]

Designated Area	Percent Reduction in Ozone Concentrations (2000-2002 through 2019-2021 Design Values)
Atlanta, GA	-31.31%
Baton Rouge, LA	-19.77%
Charlotte-Rock Hill, NC-SC	-35.29%
Chicago-Naperville, IL-IN-WI	-25.00%
Cincinnati, OH-KY-IN	-27.08%
Cleveland-Akron-Lorain, OH	-27.27%
Columbus, OH	-26.67%
Dallas-Fort Worth, TX	-23.23%
Houston-Galveston-Brazoria, TX	-28.04%
Knoxville, TN	-36.73%
Memphis, TN-MS-AR	-27.66%
Phoenix-Mesa, AZ	-5.88%
Upper Green River Basin, WY*	2.78%

**Upper Green River Basin, WY is calculated from the first year that data was available, design value year 2005–2007. This area is excluded from average calculations.*

Source: U.S. EPA, **Air Quality Design Values** (Data file: "Ozone Design Values, 2021").

Implementing the National Ambient Air Quality Standards (NAAQS)

U.S. EPA and delegated programs at state, local, and tribal air agencies work together to implement the NAAQS, as directed by the federal Clean Air Act. U.S. EPA provides the below timeline for designations and implementation following a new or revised standard:

Promulgation of NAAQS

Within 2 years after a final NAAQS With input from the states and tribes, EPA must "designate" areas as meeting (attainment areas) or not meeting (nonattainment areas) the final NAAQS based on the most recent set of air quality monitoring or modeling data characterizing an area.

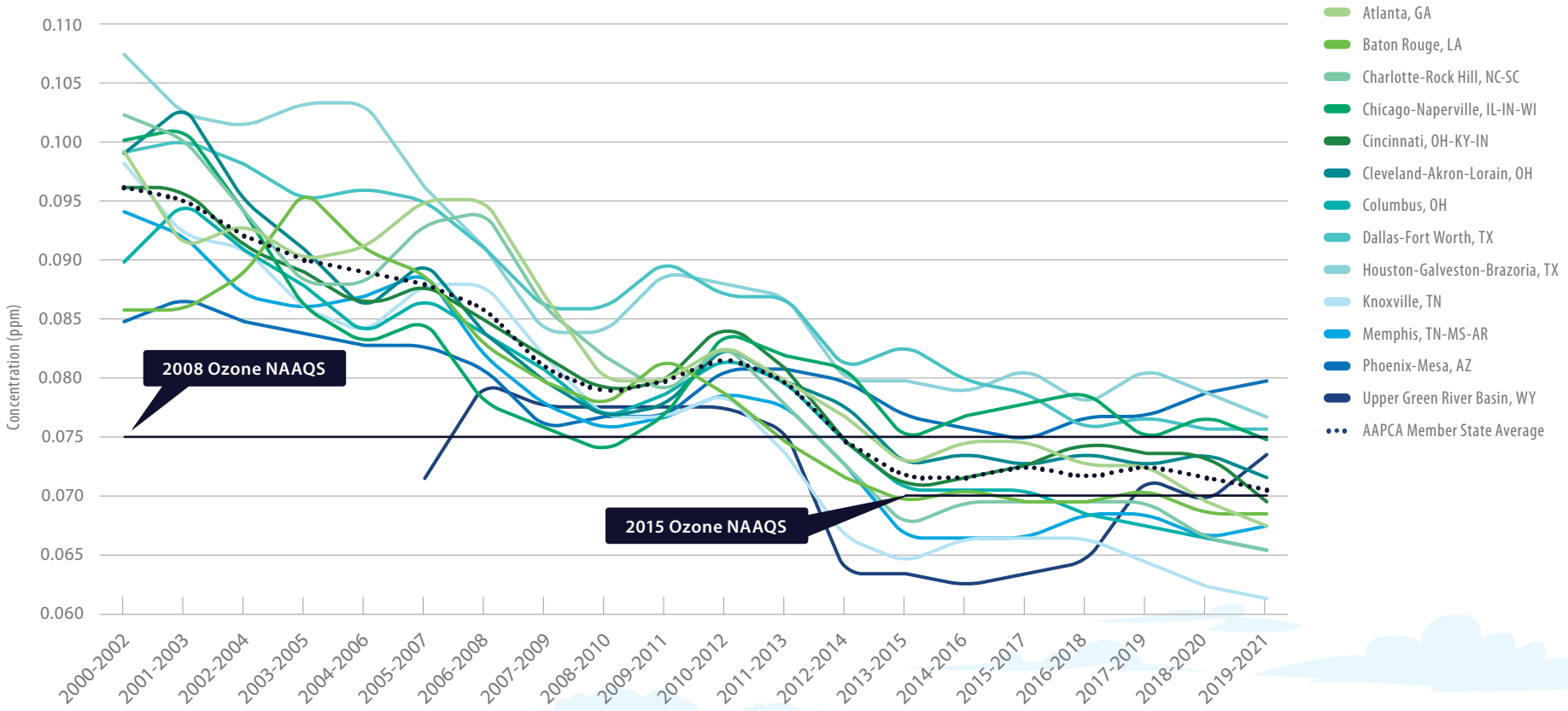
Within 3 years after a final NAAQS Clean Air Act Section 110 requires all states to submit "infrastructure" state implementation plan (SIP) revisions to show they have the basic air quality management program components in place to implement the final NAAQS.

Within 18–24 months after the effective date of designations Nonattainment area SIPs are due.

Source: U.S. EPA, "**NAAQS Implementation Process**," last updated July 8, 2022.

Air Quality | Ozone

AAPCA Member States | Design Value History for Areas Previously Designated Nonattainment for the 2008 Ozone Annual NAAQS, 2002–2021



**Upper Green River Basin, WY is calculated from the first year that data was available, design value year 2005–2007. This area is excluded from average calculations.*

Source: U.S. EPA, **Air Quality Design Values** (Data file: "Ozone Design Values, 2021").

AAPCA **Best Practices** in Air Pollution Control

Each year, AAPCA designates **Best Practices** that identify ground-breaking technology, innovative approaches, and exemplary operations in the field of air pollution control, with particular focus on activities that are directly transferable to the operation of an air pollution control agency. Below are recipients of AAPCA's Best Practices in Air Pollution Control since 2018:

2022

Open Burn Permit Program
Arizona Department of Environmental Quality

2022 Air Quality Workshop
Oklahoma Department of Environmental Quality

Environmental Trainee Mentoring Program
Pennsylvania Department of Environmental Protection

Wyoming Environmental Audit Process
Wyoming Department of Environmental Quality

Air Quality Action Partners Program
Louisville Metro Air Pollution Control District (Local Government Best Practice)

Streamlined Communication and Collaboration for Air Monitoring Programs via Microsoft Teams
Mecklenburg County Air Quality (Local Government Best Practice)

Residential Woodsmoke Reduction Strategy
San Joaquin Valley Air Pollution Control District (Local Government Best Practice)

2021

COVID-19 Air Quality Inspection/Compliance Determinations
Arizona Department of Environmental Quality

Efficiencies in the Data Quality Review of Ambient Air Monitoring Data
Georgia Environmental Protection Division

NESHAP 6H Reg Nav Tool
North Carolina Division of Environmental Assistance & Customer Service

Shiny Dashboard for Remote Monitoring of Air Quality Data
Tennessee Department of Environment & Conservation

2020

Georgia PSD Emissions Inventory
Georgia Environmental Protection Division

2019

Data Verification Procedures
Georgia Environmental Protection Division

Ozone Design Value Predictor Tool
North Carolina Division of Air Quality

Louisville Community Workshop Series
Louisville Metro Air Pollution Control District (Local Government Best Practice)

2018

Georgia State Implementation Plan Processing Procedures
Georgia Environmental Protection Division

Toxicity Factors Database
Texas Commission on Environmental Quality

Inventory, Monitoring, Permitting, and Compliance Tracking (IMPACT) Web-based Data System
Wyoming Department of Environmental Quality

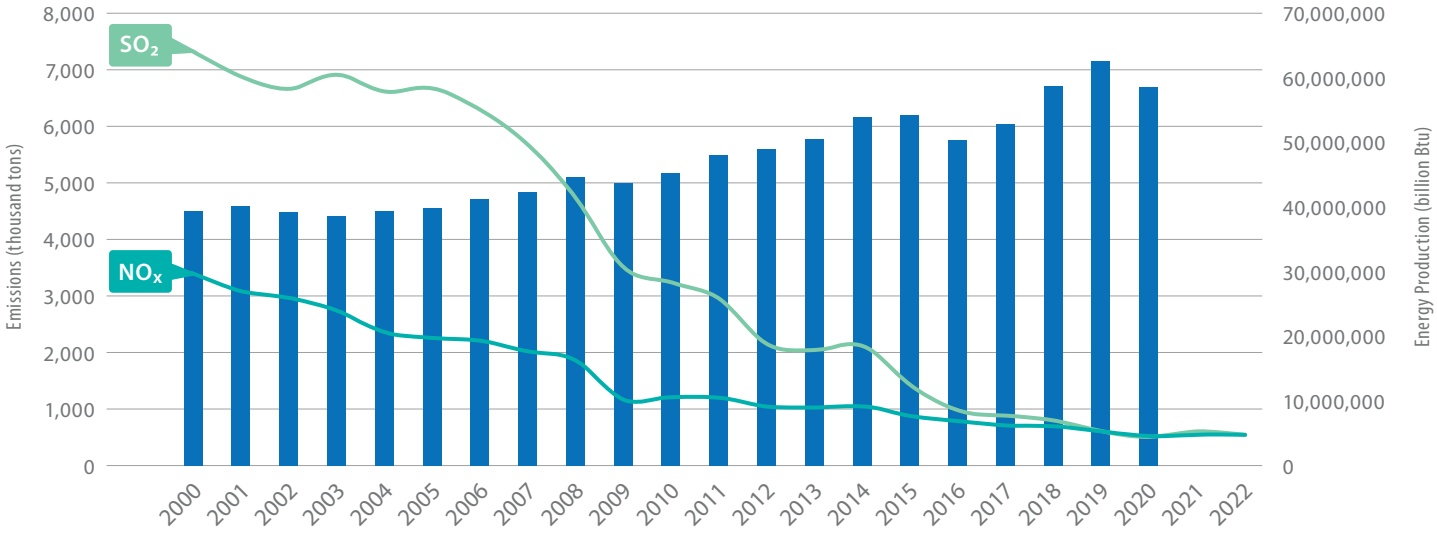
Presentations from all past recipients can be found on AAPCA's website: **www.cleanairact.org**

Emissions Reductions in the Electricity Sector

From 2000 to 2022, AAPCA Member States oversaw significant reductions in the emissions of sulfur dioxide (SO_2) and oxides of nitrogen (NO_x) from the electricity sector. Specifically, SO_2 emissions went from 7,322,232 tons in 2000 to 551,533 tons in 2022, a decline of 92 percent; NO_x emissions went from 3,405,187 tons in 2000 to 544,863 tons in 2022, a decline of 84 percent.[29]

Meanwhile from 2000 to 2020, energy production in AAPCA Member States increased by 49 percent, to a total production in 2020 exceeding 58,500 trillion British thermal units (trillion Btu) of energy.[30]

AAPCA Member States | Energy Production Compared to SO_2 and NO_x Emissions from the Electricity Sector, Since 2000

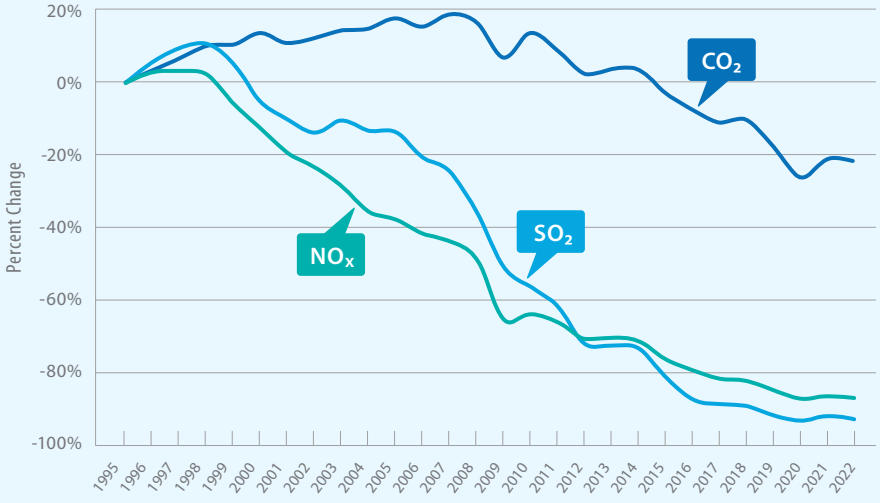


Source: U.S. Energy Information Administration, **State Energy Data System (SEDS): 1960–2020**; U.S. EPA, **Air Pollutant Emissions Trends Data** (Data file: "State Tier 1 CAPS Trends, Criteria pollutants State Tier 1 for 1990–2022").

U.S. Power Plant Emissions Trends | Annual Percent Change of Emissions From Power Plants, 1995–2022

In February 2023, U.S. EPA released the 2022 annual emissions data for power plants across the United States, highlighting the following trends compared to 2021:

- A 10 percent decrease in sulfur dioxide (SO_2) emissions, a 93 percent reduction from 1995 levels;
- A 4 percent decrease in nitrogen oxides (NO_x) emissions, down 87 percent from 1995 levels; and,
- A 1 percent decrease in carbon dioxide (CO_2) emissions, 22 percent below 1995 levels.



Source: U.S. EPA, "**EPA Releases 2022 Power Plant Emissions Data**," February 24, 2023. Data available **here**.

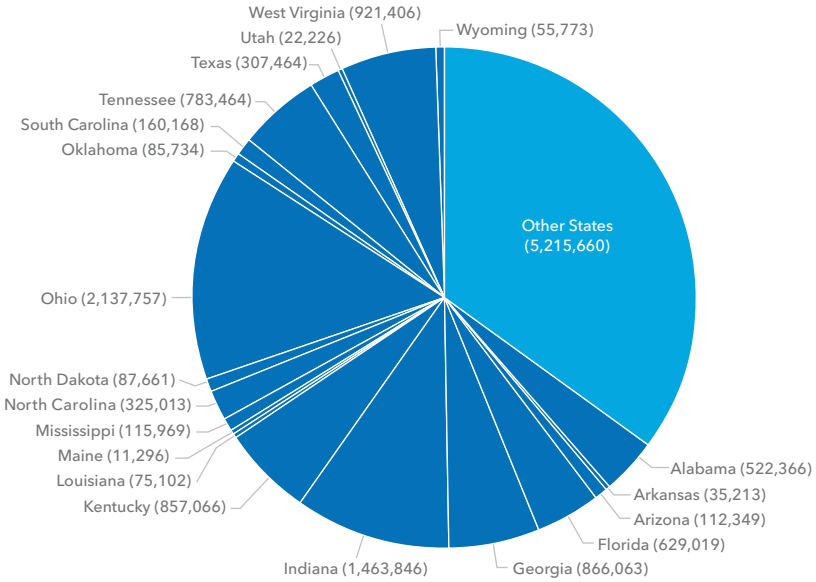
Emissions Reductions in the Electricity Sector

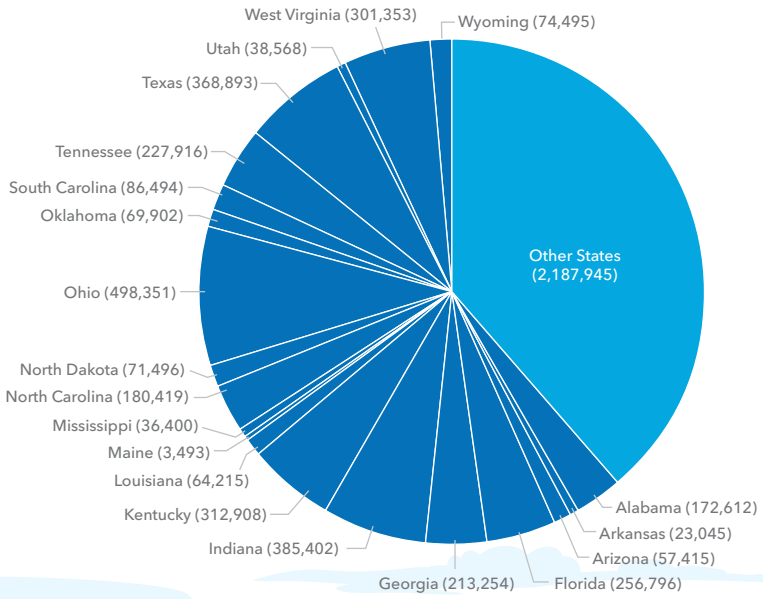
Data from U.S. EPA's Clean Air Markets Programs[31] show that nationally from 1990 to 2021, the United States electricity sector reduced sulfur dioxide (SO_2) emissions by 94 percent — from 15,733,106 tons to 942,491 tons — and nitrogen oxides (NO_x) emissions by 88 percent — from 6,410,541 tons to 779,169 tons.

AAPCA Member States accounted for nearly 65 percent of the total 14,790,615-ton national reduction in SO_2 emissions, lowering SO_2 emissions from 10,152,009 tons in 1990 to 577,054 tons in 2021.[32] Of the national 5,631,372-ton decrease in NO_x emissions, AAPCA Member States accounted for 61 percent, or 3,443,427 tons, reducing emissions from 3,938,966 tons in 1990 to 495,539 tons in 2021.[33]

AAPCA Member States | Share of SO_2 Emissions Reductions in the Electricity Sector (tons of SO_2 reduced)

Source: U.S. EPA, "**State-by-State SO_2 Emissions from CAIR and ARP Sources, 1990–2021**," July 2022.





AAPCA Member States | Share of NO_x Emissions Reductions in the Electricity Sector (tons of NO_x reduced)

Source: U.S. EPA, "**Annual NO_x Emissions from CSAPR and ARP Sources, 1990–2021**," July 2022.

Regional Haze | Breton Wilderness Area

Established in 1904 through executive order of President Theodore Roosevelt, Breton National Wildlife Refuge (NWR) is the second oldest refuge in the National Wildlife Refuge System and the only refuge the president ever visited when he traveled to the islands in June 1915. As Louisiana's only Class I area, Breton NWR is comprised of a sixty-mile-long crescent of barrier islands, including Breton Island and the Chandeleur Islands. Breton NWR is located in the Gulf of Mexico, south of Gulfport, Mississippi and east of New Orleans and is accessible only by boat or seaplane.

Figure: Harvard College Library, Theodore Roosevelt Collection, Breton National Wildlife Refuge, photograph from *www.fws.gov/media/president-teddy-roosevelt-breton-island-1915*

The exposed islands are composed of open sand, shell beaches, and are partially covered with dune grasses and other shrubby vegetation. As nature takes its course, some parts of the islands are washed away while sand is deposited in other areas. Breton NWR also has some of the largest seabird colonies in the nation and has been identified as a Globally Important Bird Area by the American Bird Conservancy and The Nature Conservancy. Twenty-three species of seabirds and shorebirds frequently use the refuge, and thirteen species nest on the islands. The most abundant nesters are brown pelicans, laughing gulls, and royal, Caspian, and sandwich terns. Over 10,000 brown pelicans have been recorded nesting on the refuge. Waterfowl winter nearby and use the shallows, marshes, and sounds for feeding and shelter. Additionally in 2022, Kemp's ridley sea turtle nests have been observed on the islands for the first time in 75 years!

While the birds use the islands as a safe harbor, Louisiana must not become complacent with emissions reductions that push us firmly under the uniform rate of progress (glideslope). Through the collaborative efforts of state, local, and federal entities, visibility has improved and will continue to improve in Breton NWR under the Regional Haze Rule. The rule requires that each Class I area achieve natural conditions for visibility by the year 2064 by steadily improving the number of most impaired days and keeping the number of clearest days from decreasing. Point source sulfur dioxide (SO_2) and nitrogen oxides (NO_X) emissions were collectively reduced some 32 percent (134,965 tpy) from 2011 to 2017. These reductions have allowed Louisiana to exceed the uniform rate progress goals and remain below the glideslope established in the original state implementation plan (SIP) submittal.

More on the Louisiana Department of Environmental Quality can be found at *www.deq.louisiana.gov/subhome/air*.

Figure: U.S. Fish & Wildlife Service, Breton National Wildlife Refuge, photograph from *www.fws.gov/refuge/breton*.

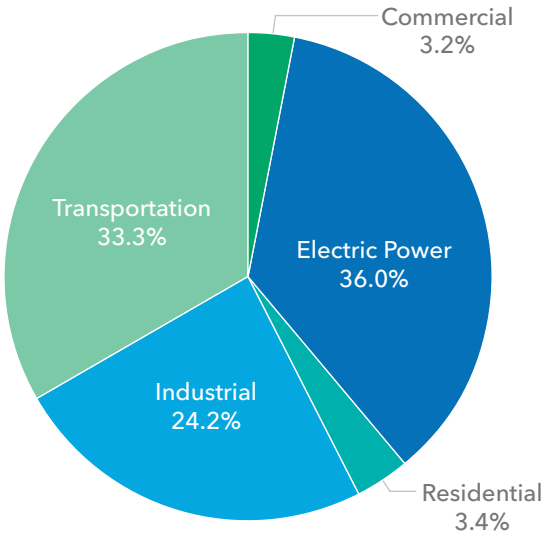
Greenhouse Gases and Energy

AAPCA Member States | Energy-Related Carbon Dioxide Emissions by Sector, 2020

The profile of energy-related carbon dioxide (CO_2) emissions from AAPCA Member States in 2020 was attributable to the following primary economic sectors[34]:

- 36.0 percent from electricity generation;
- 33.3 percent from transportation;
- 24.2 percent from industry;
- 3.4 percent from residential; and,
- 3.2 percent from commercial.

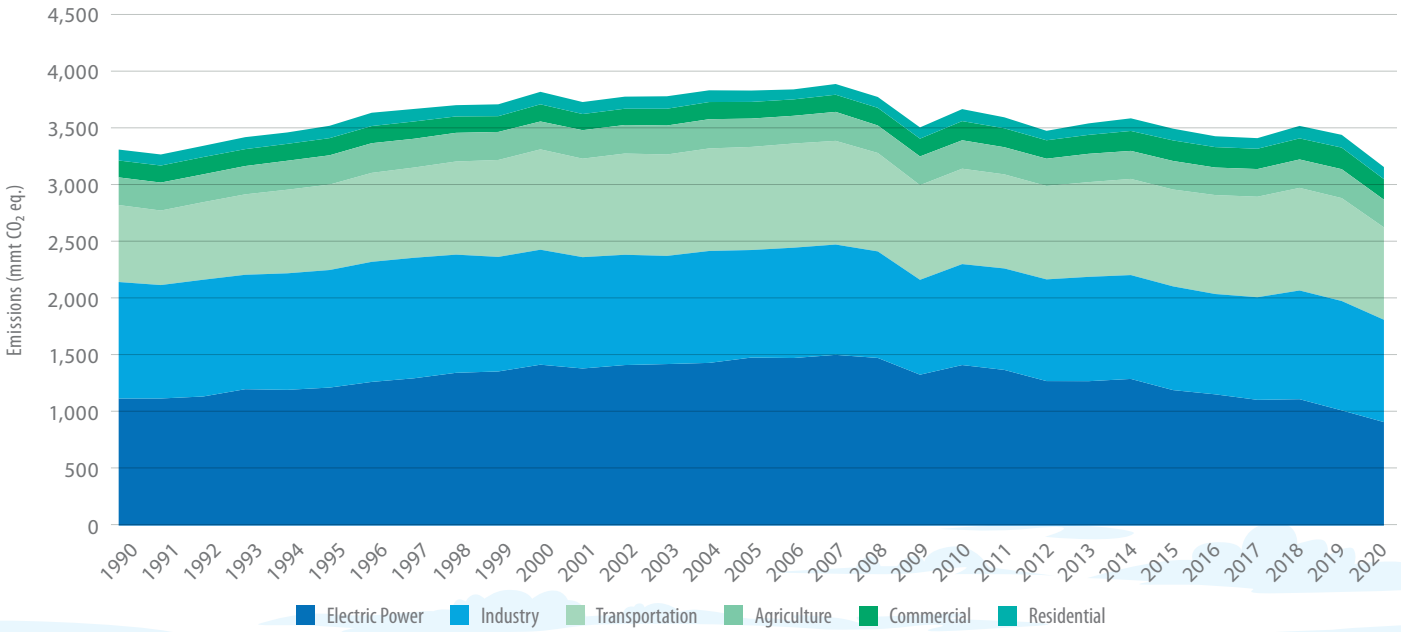
Source: U.S. Energy Information Administration, **Energy-Related CO_2 Emission Data Tables**, Table 3. State energy-related carbon dioxide emissions by sector.



U.S. EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks by State* provides estimated greenhouse gas (GHG) data at the state level, consistent with the national *Inventory of U.S. Greenhouse Gas Emissions and Sinks*.[35] From 1990 to 2020, estimated GHG emissions in AAPCA Member States followed these trends:

- Electric power sector emissions decreased 19 percent;
- Industry sector emissions decreased 12 percent;
- Transportation sector emissions increased 20 percent;
- Agriculture sector emissions decreased 1 percent;
- Commercial sector emissions increased 21 percent; and,
- Residential sector emissions increased 15 percent.

AAPCA Member States | Greenhouse Gas Emissions by Economic Sector, 1990–2020

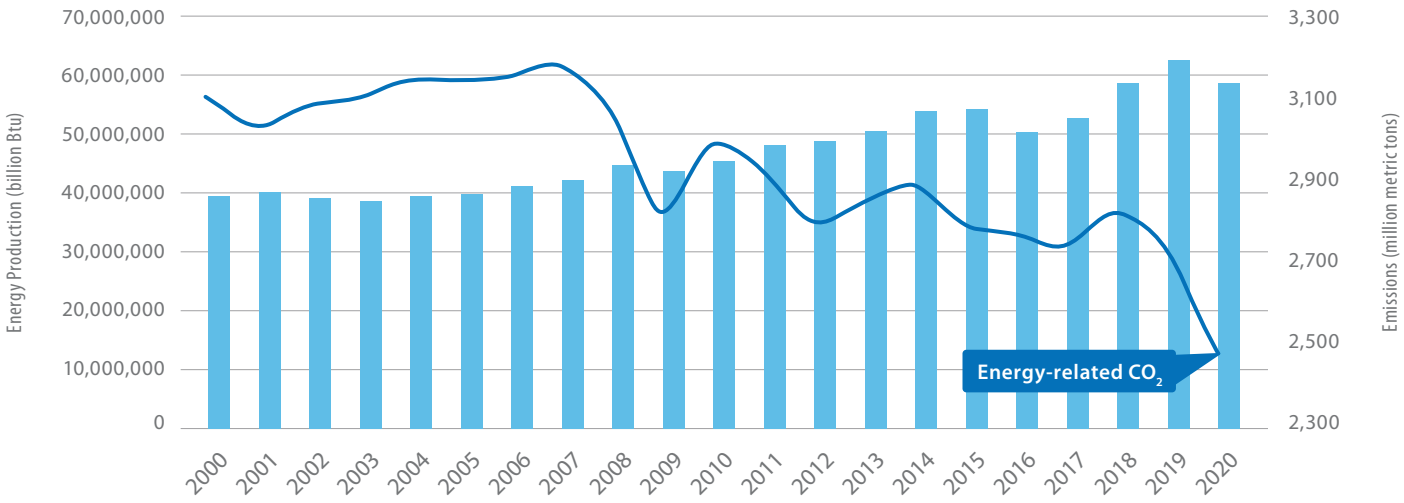


Source: U.S. EPA, ***Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021***, April 2023. See U.S. EPA's **Greenhouse Gas Inventory Data Explorer**.

Greenhouse Gases and Energy

From 2000 to 2020, energy-related carbon dioxide (CO_2) emissions in AAPCA Member States declined 20 percent, from 3,106 million metric tons in 2000 to 2,479 million metric tons in 2020, while energy production increased 49 percent.[36]

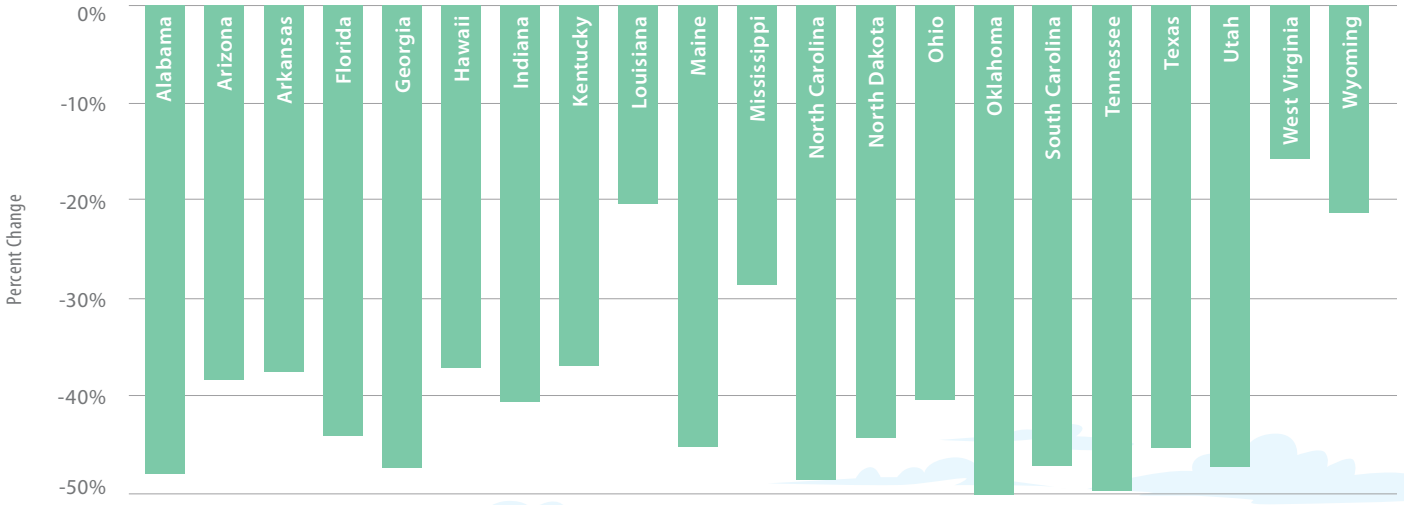
AAPCA Member States | Total Energy Production Compared to Energy-Related Carbon Dioxide Emissions, 2000–2020



Source: U.S. Energy Information Administration (EIA), State Energy Data System (SEDS): 1960–2020; U.S. EIA, Energy-Related CO_2 Emission Data Tables, Table 1. State energy-related carbon dioxide emissions by year (1970–2020).

Furthermore from 2000 to 2020, states in AAPCA's membership oversaw an average reduction of nearly 40 percent in the carbon intensity of their economies.[37]

AAPCA Member States | Percent Reduction in Carbon Intensity of the Economy, 2000–2020



Source: U.S. Energy Information Administration, Energy-Related CO_2 Emission Data Tables, Table 7. Carbon intensity of the economy by state (1997–2020).

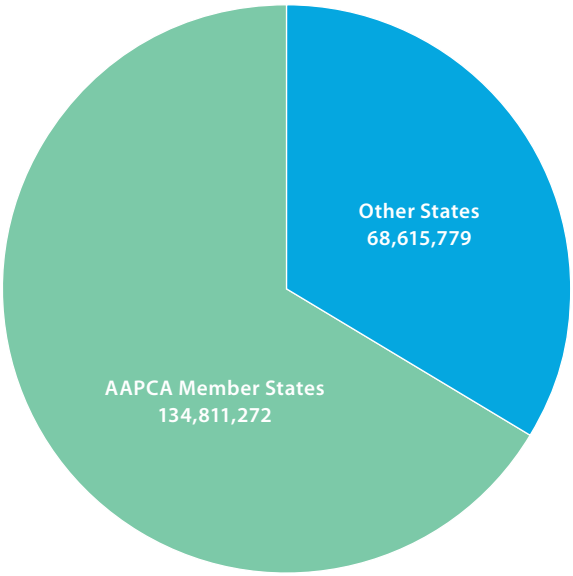
Air Toxics

AAPCA Member States | Share of Total Reduction of Reported Toxic Air Releases, 2012–2021 (pounds reduced)

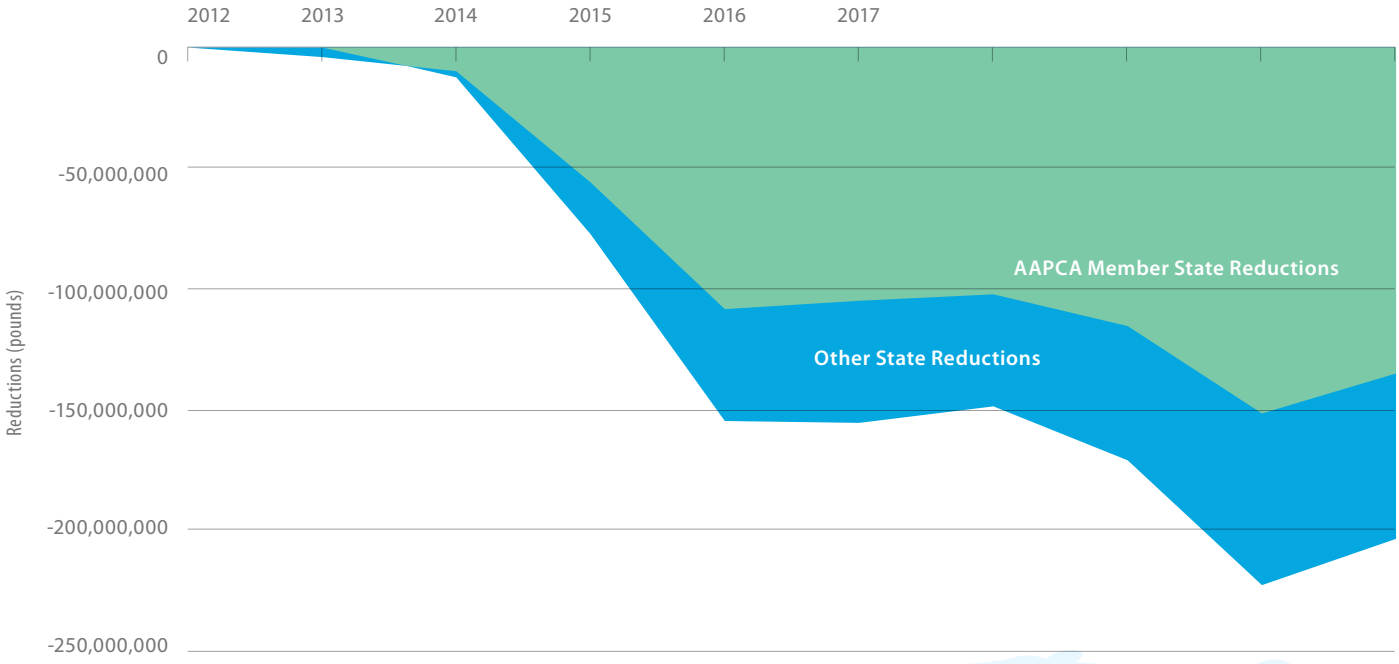
U.S. EPA's *2021 Toxic Release Inventory (TRI) National Analysis* revealed a 26 percent reduction in reported toxic air releases compared to 10 years ago, from 774.6 million pounds in 2012 to 571.2 million pounds in 2021.[38]

Of the 203.4-million-pound decrease in reported releases over the past decade, AAPCA Member States oversaw roughly 66 percent, or 134.8 million pounds.[39]

Source: U.S. EPA Toxic Release Inventory Explorer, **2021 TRI Factsheets**.



AAPCA Member States | Annual Share of National Reduction in Reported Toxic Air Releases, 2012–2021



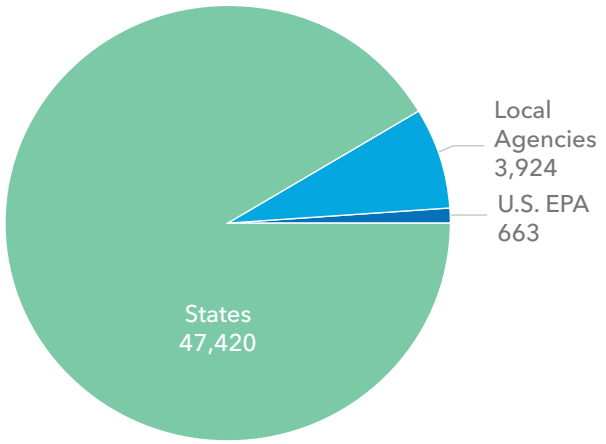
Source: U.S. EPA Toxic Release Inventory Explorer, **2021 TRI Factsheets**.

State Compliance and Enforcement Activity

Number of Facilities Permitted Under Clean Air Act, 2022

U.S. EPA's Enforcement and Compliance History Online (ECHO) documents compliance monitoring activities that are undertaken by state and local air agencies and U.S. EPA, such as compliance evaluations, compliance determinations, and enforcement actions. U.S. EPA's ECHO Dashboard notes that "EPA delegates much of its [Clean Air Act] authority to state, local, and tribal agencies."[40]

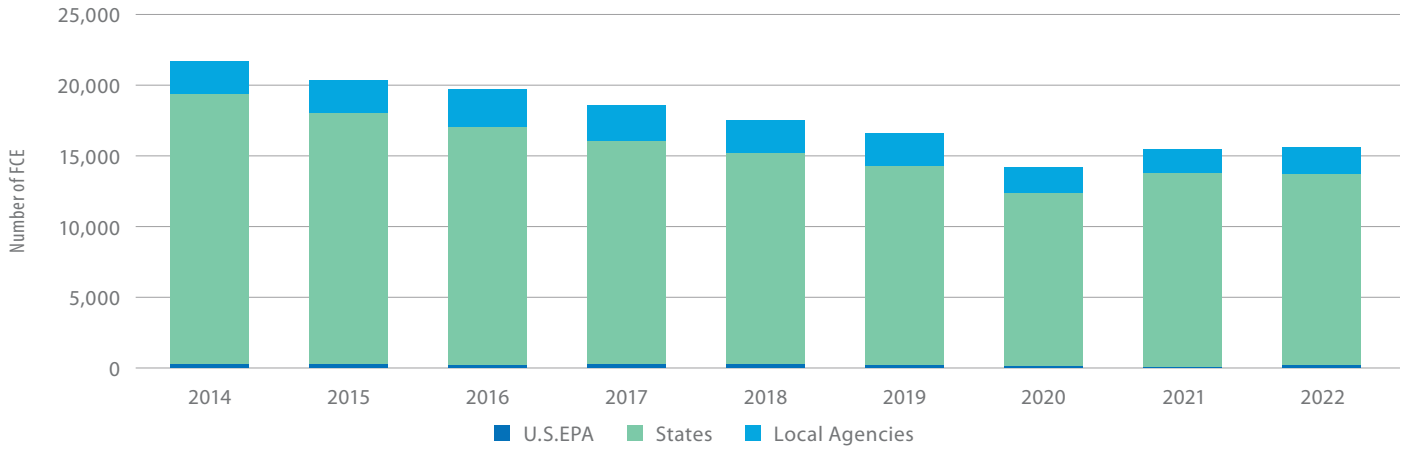
The ECHO Air Dashboard shows that of the 52,007 facilities permitted under the Clean Air Act in federal fiscal year (FY) 2022, states were the permitting agency on 47,420 facilities, local agencies on 3,924, and U.S. EPA for 663 facilities.[41]



The ECHO Air Dashboard also provides data on Full Compliance Evaluations (FCE) performed by U.S. EPA and state and local agencies. U.S. EPA defines an FCE as "a comprehensive evaluation of the compliance status of the facility. It looks for all regulated pollutants at all regulated emission units, and it addresses the compliance status of each unit, as well as the facility's continuing ability to maintain compliance at each emission unit."[42] In federal FY 2022, ECHO details the following FCE lead agency distribution:

- States were the lead agency for 13,551 FCE, averaging more than 15,300 FCE annually from 2014 through 2022;
- Local programs were the lead agency for 1,872 FCE, averaging above 2,200 FCE annually from 2014 through 2022; and,
- U.S. EPA was the lead agency for 178 FCE, averaging about 200 FCE from 2014 through 2022.[43]

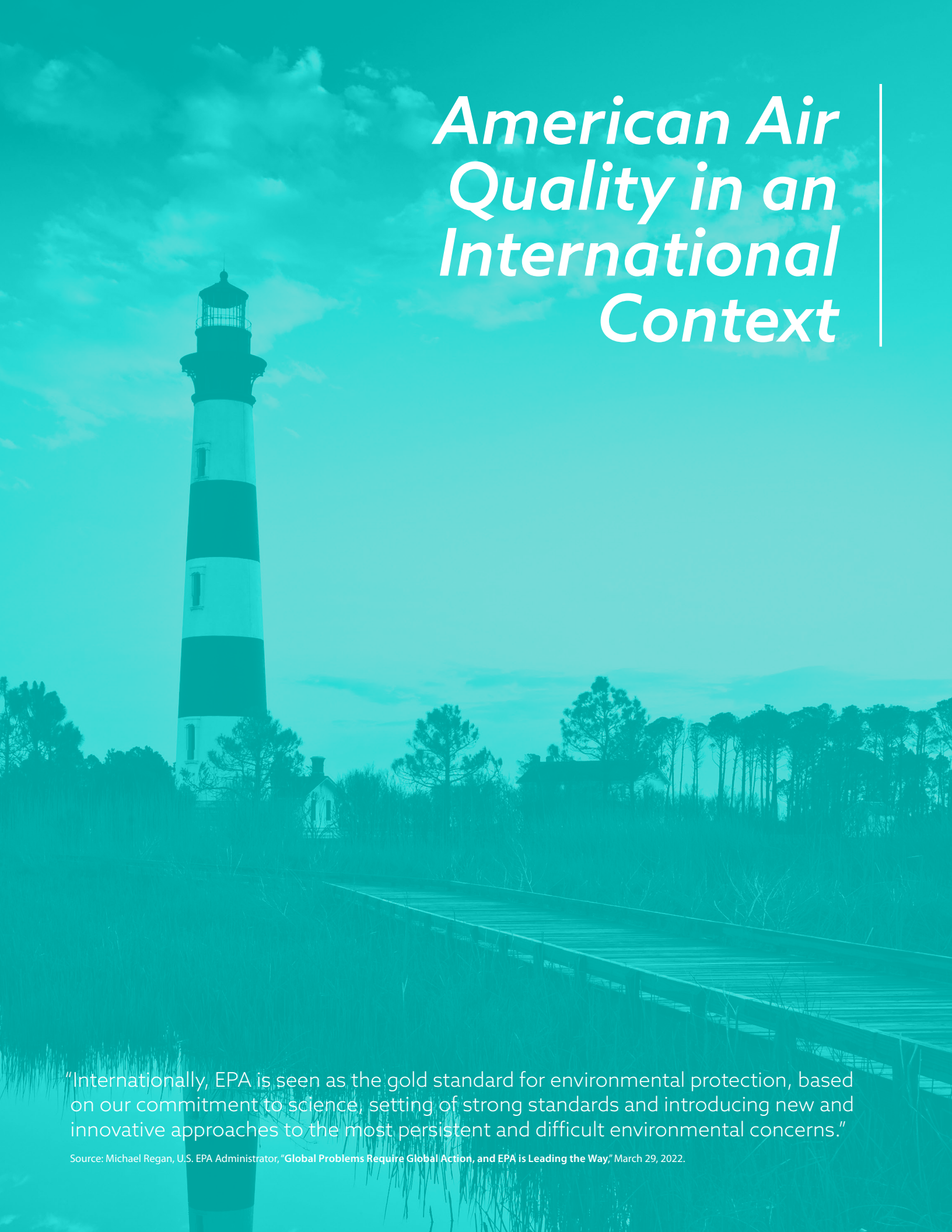
Full Compliance Evaluations under Clean Air Act by Lead Agency, 2014–2022



Source: U.S. EPA, **Analyze Trends: State Air Dashboard**.

Additionally, U.S. EPA's ECHO Air Dashboard also shows that states averaged about 86,200 Clean Air Act compliance monitoring activities per year from 2014 through 2022, while local programs averaged above 22,500 per year from the same period. In 2022, AAPCA Member States were the lead agency for 44,997 out of the 75,678 state-led compliance monitoring activities, or 59 percent of the state lead agency total.[44]

American Air Quality in an International Context



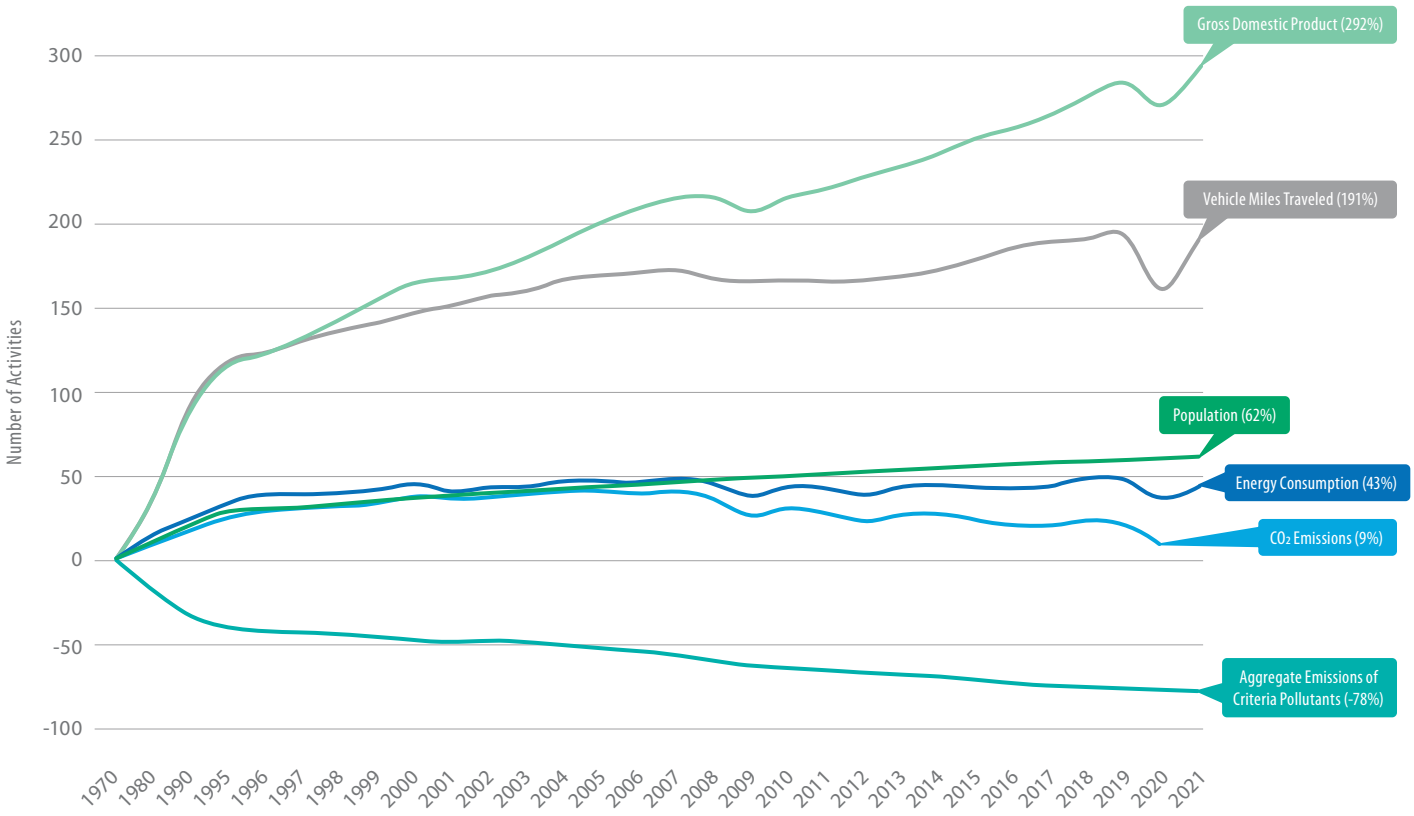
"Internationally, EPA is seen as the gold standard for environmental protection, based on our commitment to science, setting of strong standards and introducing new and innovative approaches to the most persistent and difficult environmental concerns."

Source: Michael Regan, U.S. EPA Administrator, "**Global Problems Require Global Action, and EPA is Leading the Way,**" March 29, 2022.

Air Quality and Growth Indicator Trends in the United States

According to U.S. EPA's June 2022 report, *Our Nation's Air: Trends Through 2021*, the United States has reduced aggregate emissions of the six criteria air pollutants by 78 percent since 1970.[45] The substantial, sustained decline in emissions have led to improved air quality in the United States while Gross Domestic Product (GDP) rose 292 percent, Vehicle Miles Traveled increased 191 percent, population grew 62 percent, and energy consumption went up 43 percent.[46]

Growth Indicators and Emissions Reductions in the United States, 1970–2021



Source: U.S. EPA, ***Our Nation's Air: Trends Through 2021*** (Section: "Economic Strength with Cleaner Air"), June 2022.

Internationally, the United States ranks:

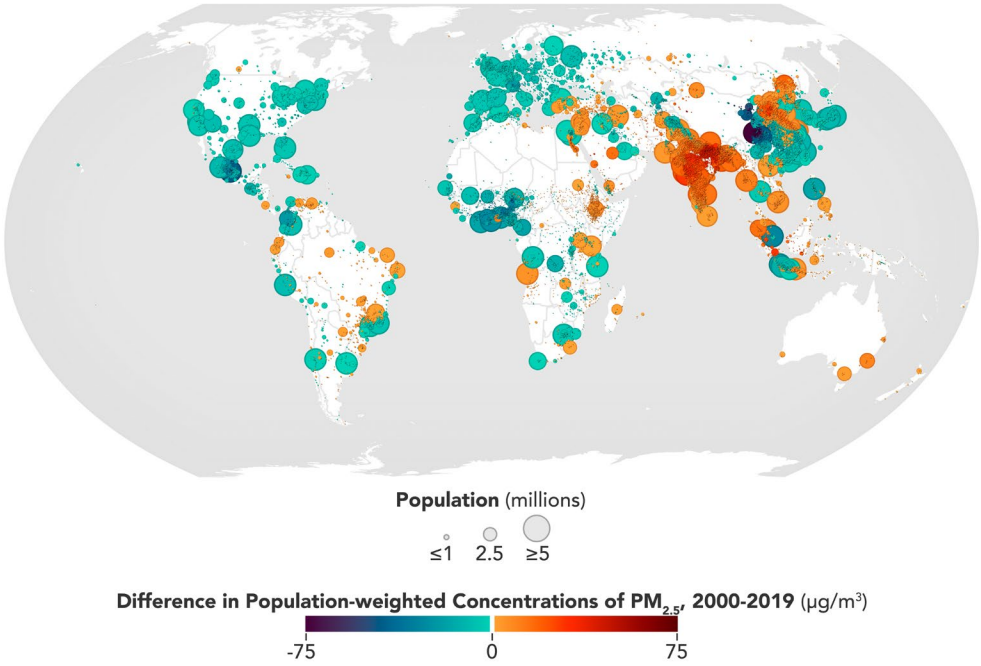
- First in GDP, at $23.32 trillion in 2021, representing 24 percent of gross world product[47] and up by 127 percent from 2000 levels.[48]
- Second in energy production, behind China, according to International Energy Agency (IEA) data.[49] From 1960 to 2020, United States energy production increased from approximately 42,591 trillion British thermal units (Btu) to 95,711 trillion Btu, or 125 percent.[50]
- Third in total population, behind China and India,[51] growing from approximately 203.4 million people in 1970 to 331.9 million people in 2021.[52]

International Trends | Air Quality

Global Change in Population-Weighted Concentrations of $PM_{2.5}$, 2000–2019

Using satellite data,[53] the National Aeronautics and Space Administration's (NASA) Earth Observatory mapped the mean population-weighted ambient fine particulate matter ($PM_{2.5}$) concentration globally across all urban areas. The change in population-weighted $PM_{2.5}$ concentration trends from 2000 to 2019 varied widely between regions, with consistent decreases across North America, including the United States, and Europe while increasing across southeast Asia.[54]

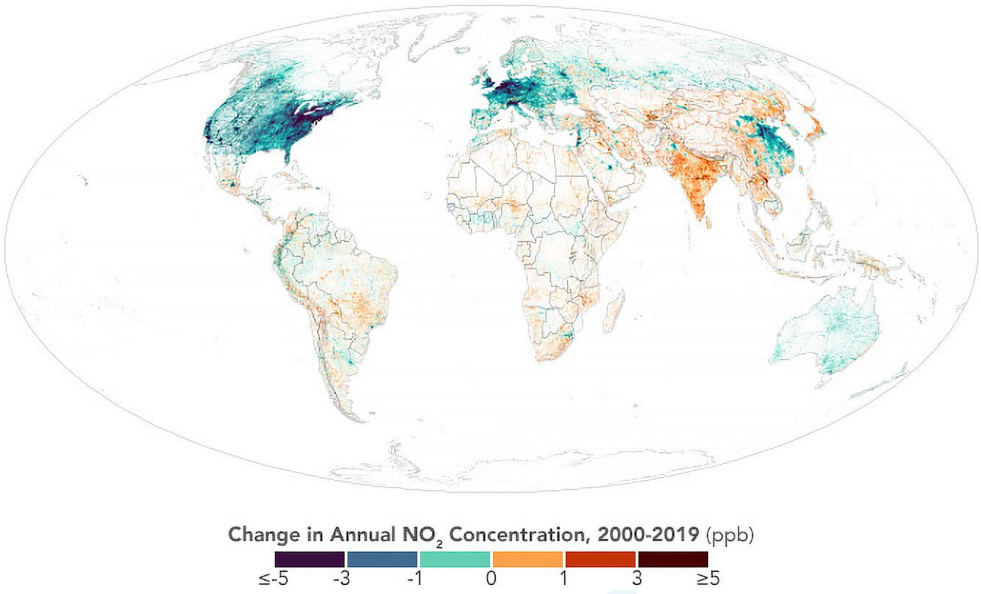
Source: NASA Earth Observatory, "No Breathing Easy for City Dwellers: Particulates," March 15, 2022.



Global Change in Concentrations of NO_2, 2000–2019

Data from NASA's Ozone Monitoring Instrument on the Aura satellite shows a similar global pattern for the change in annual average nitrogen dioxide (NO_2) concentrations between 2000 and 2019.[55]

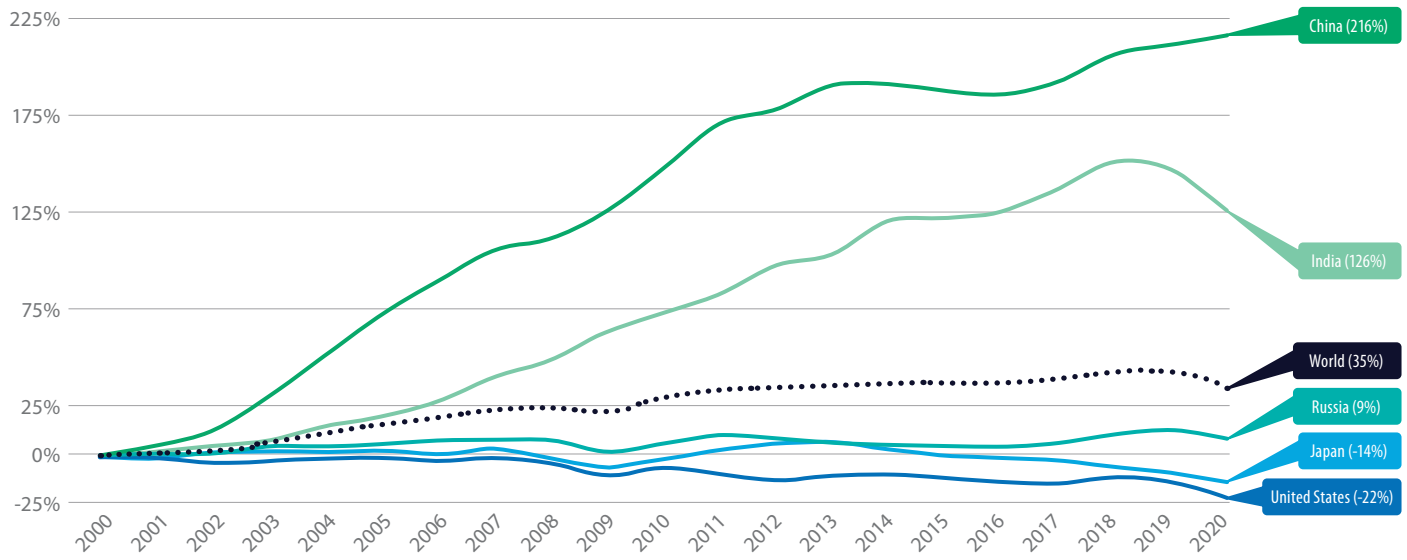
Source: NASA Earth Observatory, "No Breathing Easy for City Dwellers: Nitrogen Dioxide," March 14, 2022.



International Trends | Greenhouse Gas Emissions

The International Energy Agency's (IEA) database, *Greenhouse Gas Emissions from Energy*, includes annual estimates of total greenhouse gas (GHG) emissions from the energy sector for over 190 countries and regions.[56] From 2000 to 2020, the United States achieved the largest reductions among the five highest emitting nations, decreasing energy-related GHG emissions from 6,070 million tonnes of carbon dioxide equivalent (CO_2e) in 2000 to 4,744 million tonnes CO_2e in 2020. Data from IEA shows that GHG emissions from energy in the United States in 2021 were 18 percent lower than 2000 levels.[57]

Annual Percent Change of Greenhouse Gas Emissions from Energy by Country, 2000–2020



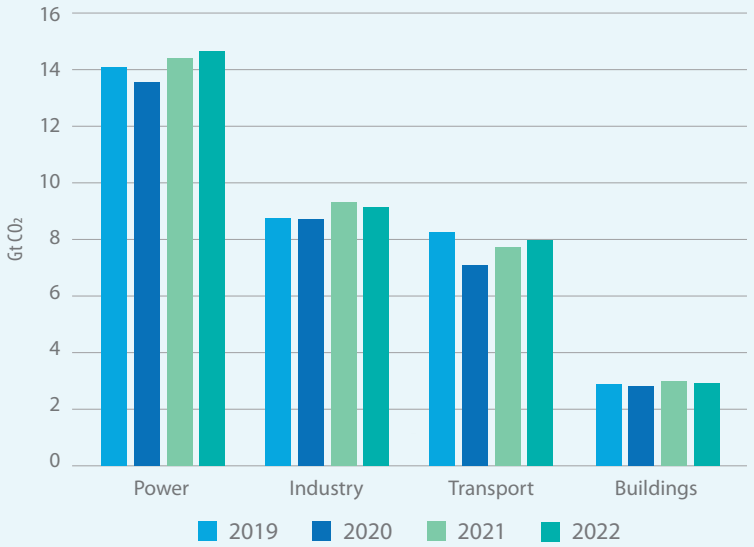
Source: International Energy Agency, ***Greenhouse Gas Emissions from Energy* Highlights**, September 16, 2022.

International Energy Agency | Global CO_2 Emissions by Sector, 2019-2022 (Gt CO_2)

In March 2023, IEA released the report, *CO_2 Emissions in 2022*, highlighting the following global carbon dioxide (CO_2) emissions trends:

- Global energy-related CO_2 emissions reached 36.8 gigatonnes (Gt) in 2022, a 0.9 percent increase from 2021;
- United States emissions grew by 0.8 percent (or 36 megatonnes) from 2021, to total 4.7 Gt in 2022;
- Total energy-related greenhouse gas emissions increased by 1.0 percent from 2021, to an all-time high of 41.3 Gt CO_2-equivalent; and,
- Global electricity demand increased by 2.7 percent, and overall carbon intensity of electricity generation declined by 2.0 percent.

Source: International Energy Agency, ***CO_2 Emissions in 2022***, March 2023.



Air Quality Trends in the United States

"Cleaner air provides important public health benefits, and we commend our state, local, community and industry partners for helping further long-term improvement in our air quality."

Source: U.S. EPA, ***Our Nation's Air: Trends Through 2021*** (Section: "**Introduction**"), June 2022.

Criteria Air Pollutants | Concentration Trends

U.S. EPA's national-level analysis of 2021 monitoring data show the substantial reductions in ambient concentrations of all criteria pollutants over the past several decades. As the below chart indicates, the United States has seen at least a 29 percent decline in the ambient levels of carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), and sulfur dioxide (SO_2) since 1980. Available data show that fine and coarse particulate matter ($PM_{2.5}$ and PM_{10}) ambient concentrations have declined by at least a third of 2000 levels. And more recent data point to a sustained trend of meaningful improvements, with monitored concentrations of all criteria pollutants continuing to decline over the last ten years.[58]

Ambient Concentrations	1980 vs 2021	1990 vs 2021	2000 vs 2021	2010 vs 2021
Carbon Monoxide	-87%	-79%	-65%	-26%
Lead	-98%	-98%	-93%	-85%
Nitrogen Dioxide (annual)	-67%	-61%	-53%	-29%
Nitrogen Dioxide (1-hour)	-64%	-54%	-40%	-22%
Ozone (8-hour)	-29%	-21%	-16%	-5%
PM_{10} (24-hour)	---	-32%	-36%	-5%
$PM_{2.5}$ (annual)	---	---	-37%	-14%
$PM_{2.5}$ (24-hour)	---	---	-33%	-2%
Sulfur Dioxide (1-hour)	-94%	-91%	-85%	-74%

Source: U.S. EPA, **Air Quality—National Summary: Air Quality Trends** (updated June 1, 2022).

Criteria Air Pollutants | Emissions Trends

In coordination with state and local air agencies, tribes, and industry, U.S. EPA develops annual nationwide emissions estimates, which are "based on actual monitored readings or engineering calculations of the amounts and types of pollutants emitted by vehicles, factories, and other sources."[59] U.S. EPA's most recently published estimates, show that the emissions of all criteria pollutants and precursors declined by at least a third (33 percent) from 1990 through 2021, and at least 21 percent since 2010.[60]

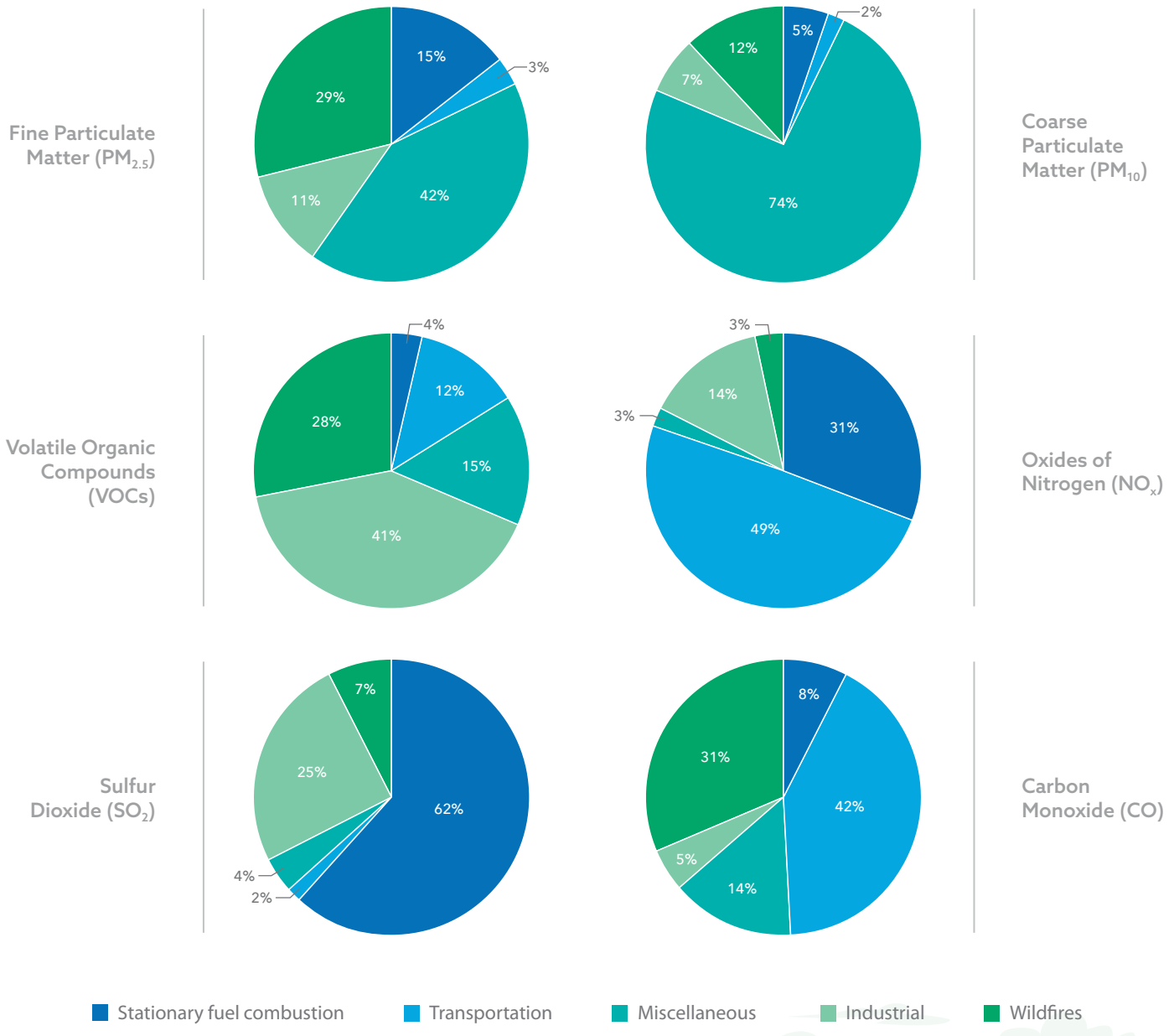
Emissions	1980 vs 2021	1990 vs 2021	2000 vs 2021	2010 vs 2021
Carbon Monoxide	-75%	-70%	-57%	-29%
Lead	-99%	-87%	-76%	-30%
Nitrogen Oxides	-72%	-70%	-66%	-48%
Volatile Organic Compounds	-61%	-49%	-30%	-21%
Direct PM_{10}	-65%	-33%	-30%	-22%
Direct $PM_{2.5}$	---	-40%	-46%	-25%
Sulfur Dioxide	-93%	-92%	-89%	-76%

Source: U.S. EPA, U.S. EPA, **Air Quality—National Summary: Emissions Trends** (updated June 1, 2022).

Criteria Air Pollutants | Emissions Sources

U.S. EPA tracks emissions from the following source categories: Stationary Fuel Combustion, Industrial, Transportation, Wildfires, and Miscellaneous. Included below are the sources of criteria air pollutant and precursor emissions for the year 2022.[61]

Criteria Air Pollutant Sources, 2022

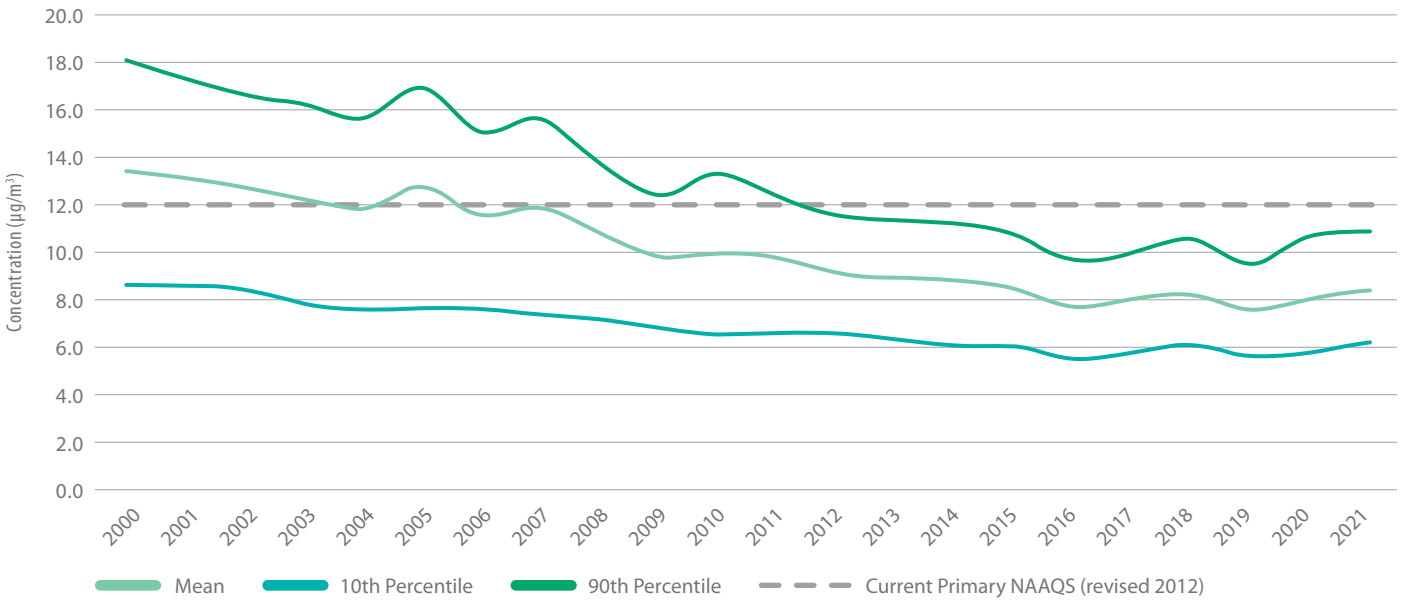


Source: U.S. EPA, **Air Pollutant Emissions Trends** (Data file: "National Tier 1 CAPS Trends, Criteria pollutants National Tier 1 for 1970–2022").

Criteria Air Pollutant Trends | Fine Particulate Matter

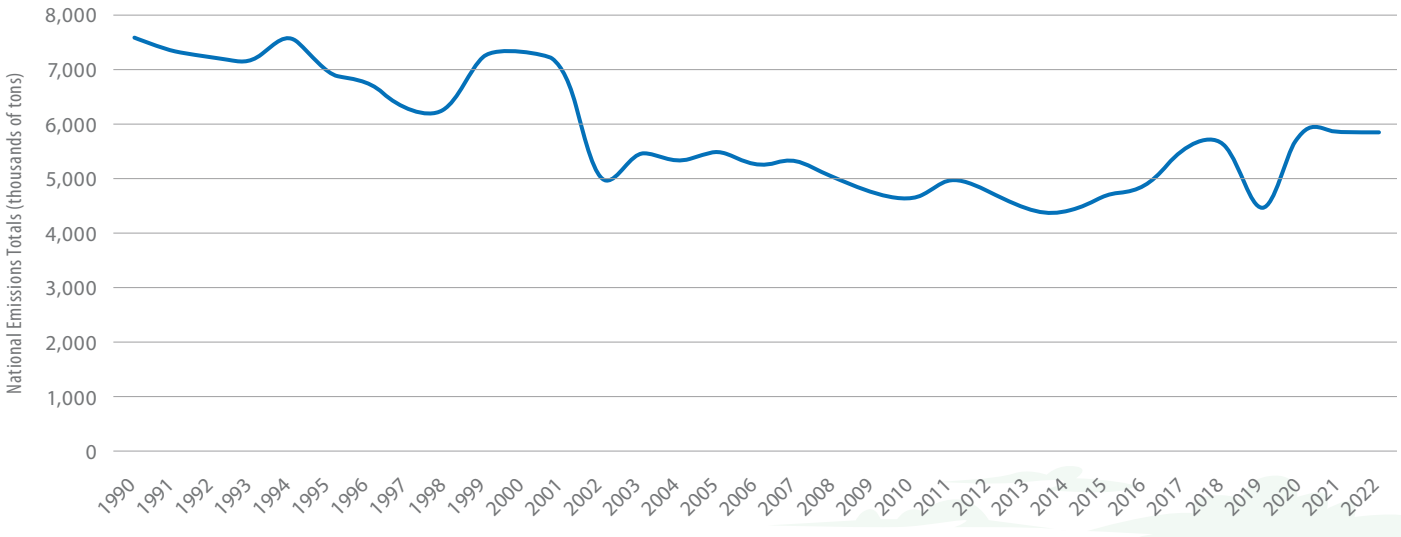
Fine Particulate Matter ($PM_{2.5}$) Air Quality, 2000–2021

(Seasonally Weighted Annual Average) National Trend based on 375 Sites



Source: U.S. EPA, **Particulate Matter ($PM_{2.5}$) Trends**, August 2022.

Fine Particulate Matter ($PM_{2.5}$) Emissions, 1990–2022

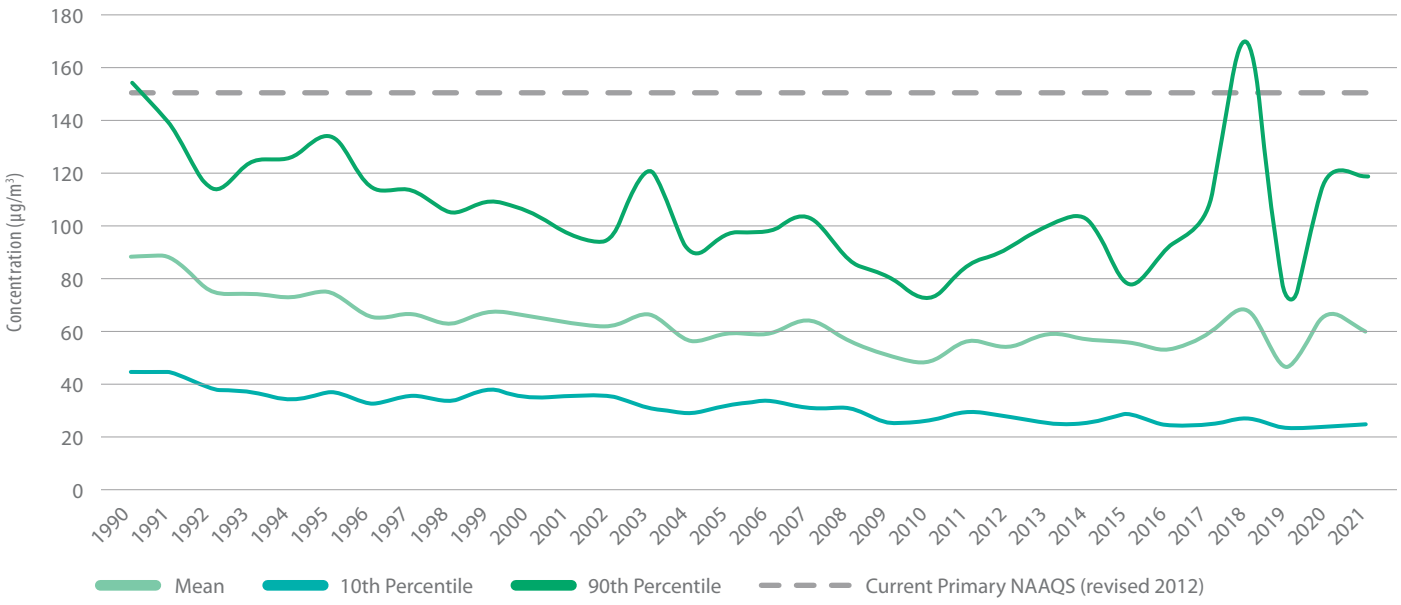


Source: U.S. EPA, **Air Pollutant Emissions Trends** (Data file: "National Tier 1 CAPS Trends, Criteria pollutants National Tier 1 for 1970–2022").

Criteria Air Pollutant Trends | Coarse Particulate Matter

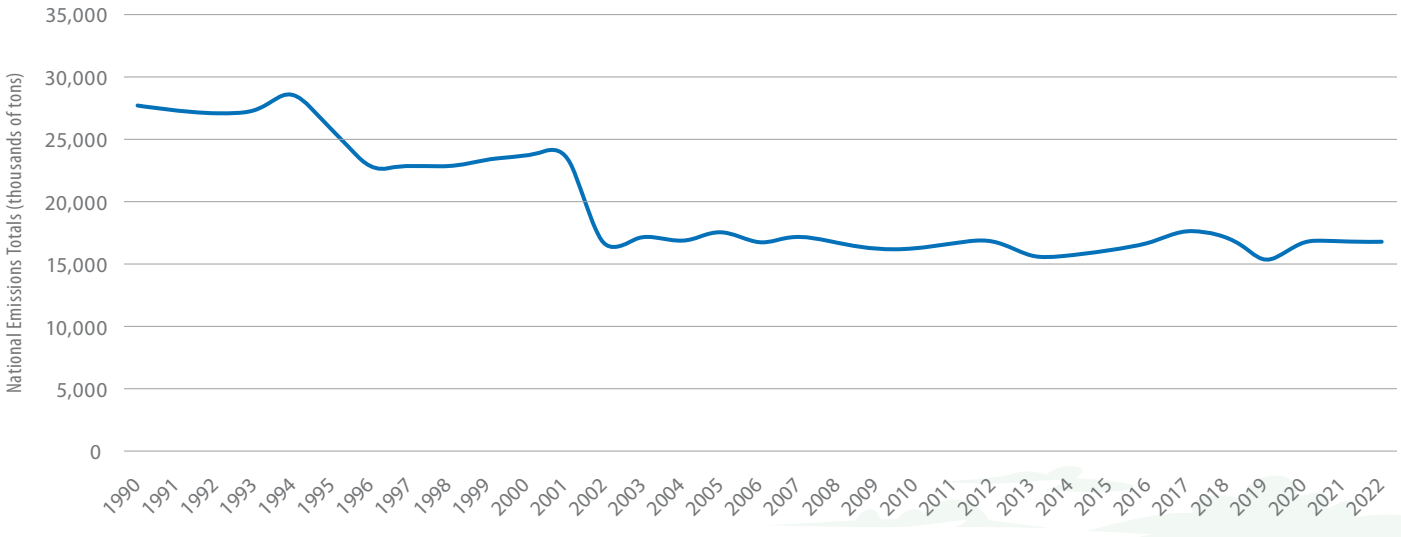
Coarse Particulate Matter (PM_{10}) Air Quality, 1990–2021

(Annual 2nd Maximum 24-Hour Average) Nation Trend Based on 90 Sites



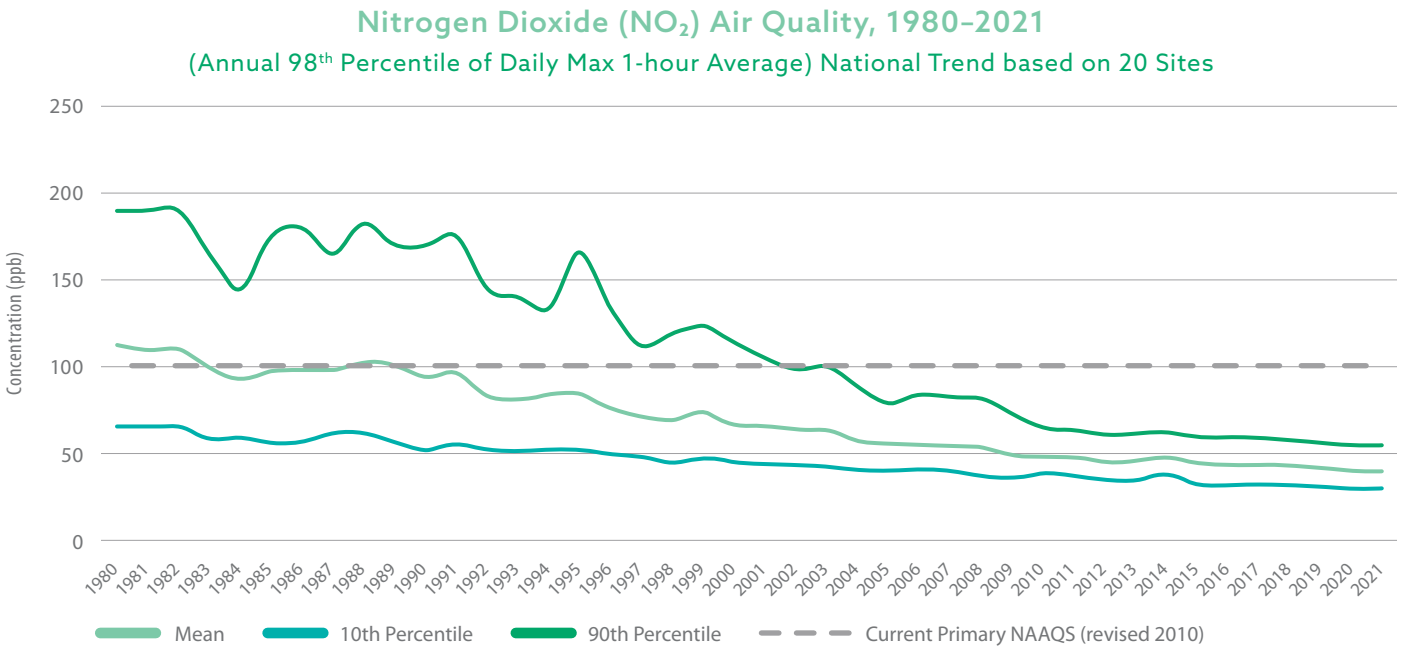
Source: U.S. EPA, **Particulate Matter (PM_{10}) Trends**, August 2022.

Coarse Particulate Matter (PM_{10}) Emissions, 1990–2022



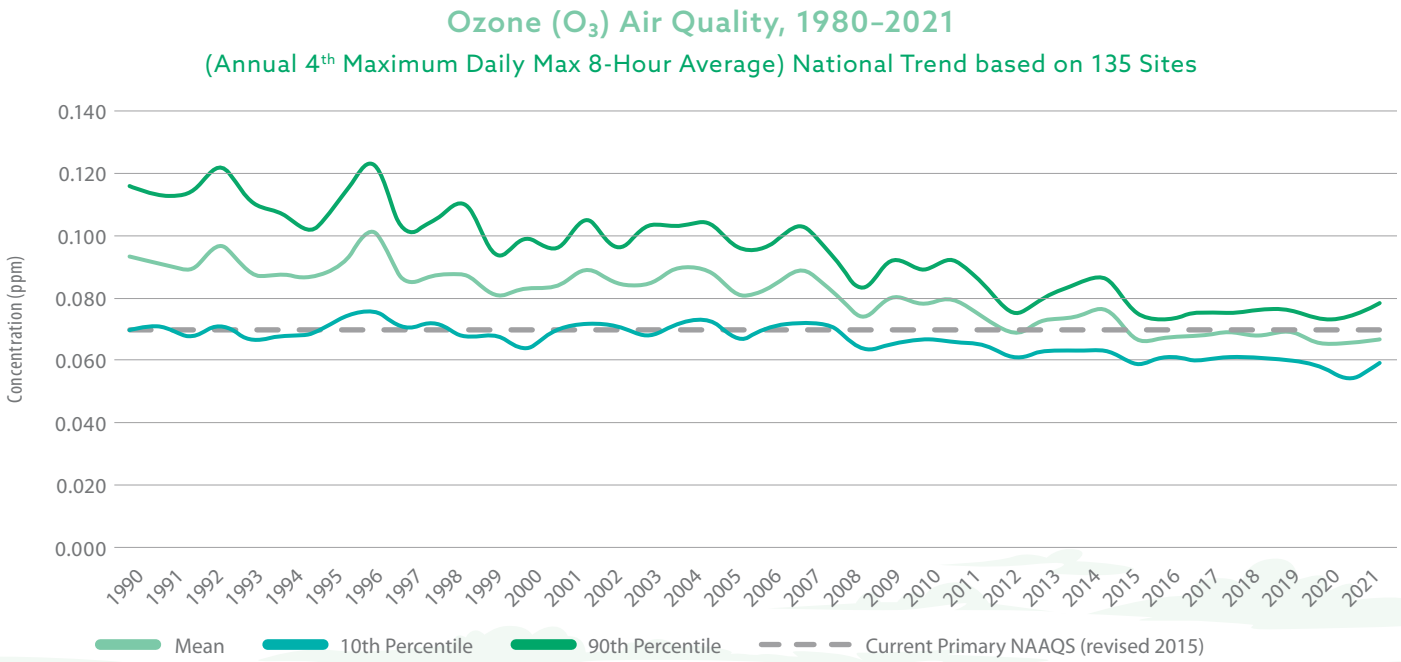
Source: U.S. EPA, **Air Pollutant Emissions Trends** (Data file: "National Tier 1 CAPS Trends, Criteria pollutants National Tier 1 for 1970–2022").

Criteria Air Pollutant Trends | Nitrogen Dioxide



Source: U.S. EPA, **Nitrogen Dioxide Trends**, August 2022.

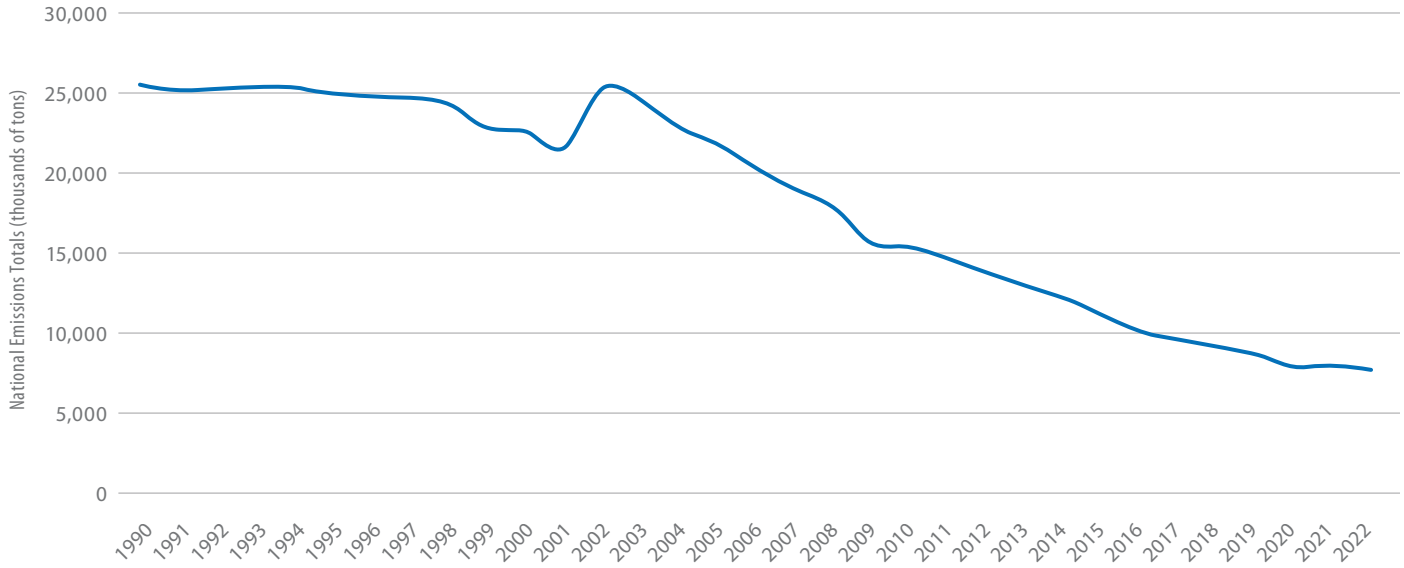
Criteria Air Pollutant Trends | Ozone



Source: U.S. EPA, **Ozone Trends**, August 2022.

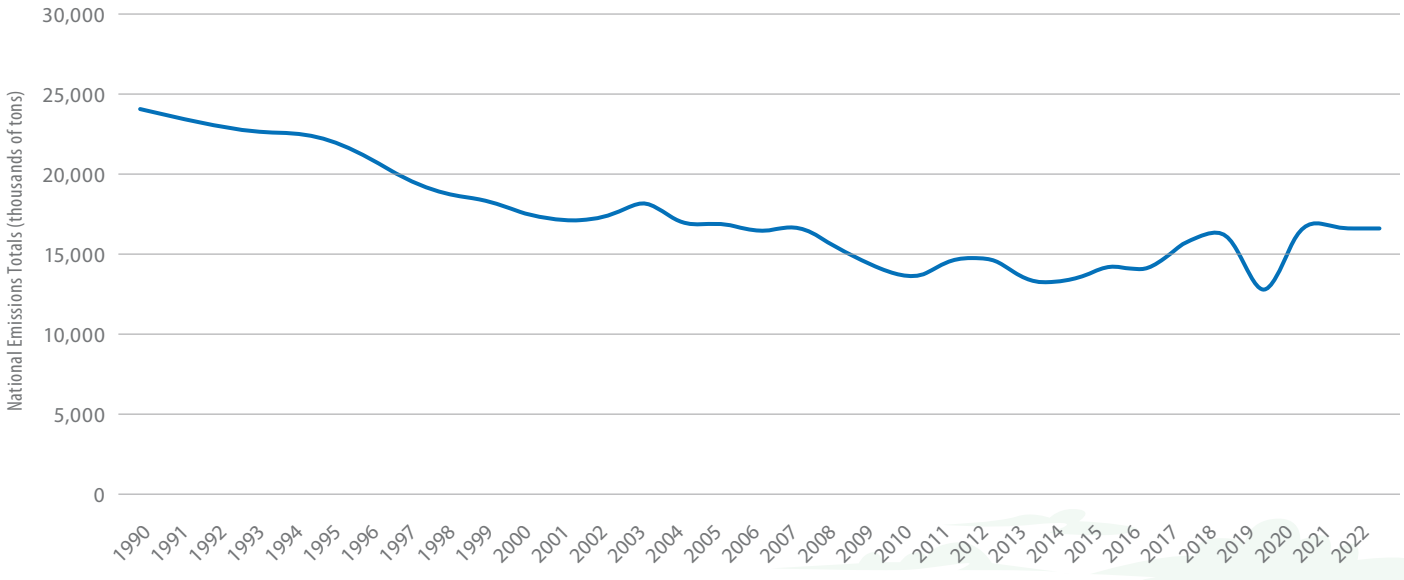
Criteria Air Pollutant Trends | Ozone Precursor Emissions

Oxides of Nitrogen (NO_X) Emissions, 1990–2022



Source: U.S. EPA, **Air Pollutant Emissions Trends** (Data file: "National Tier 1 CAPS Trends, Criteria pollutants National Tier 1 for 1970–2022").

Volatile Organic Compound (VOC) Emissions, 1990–2022

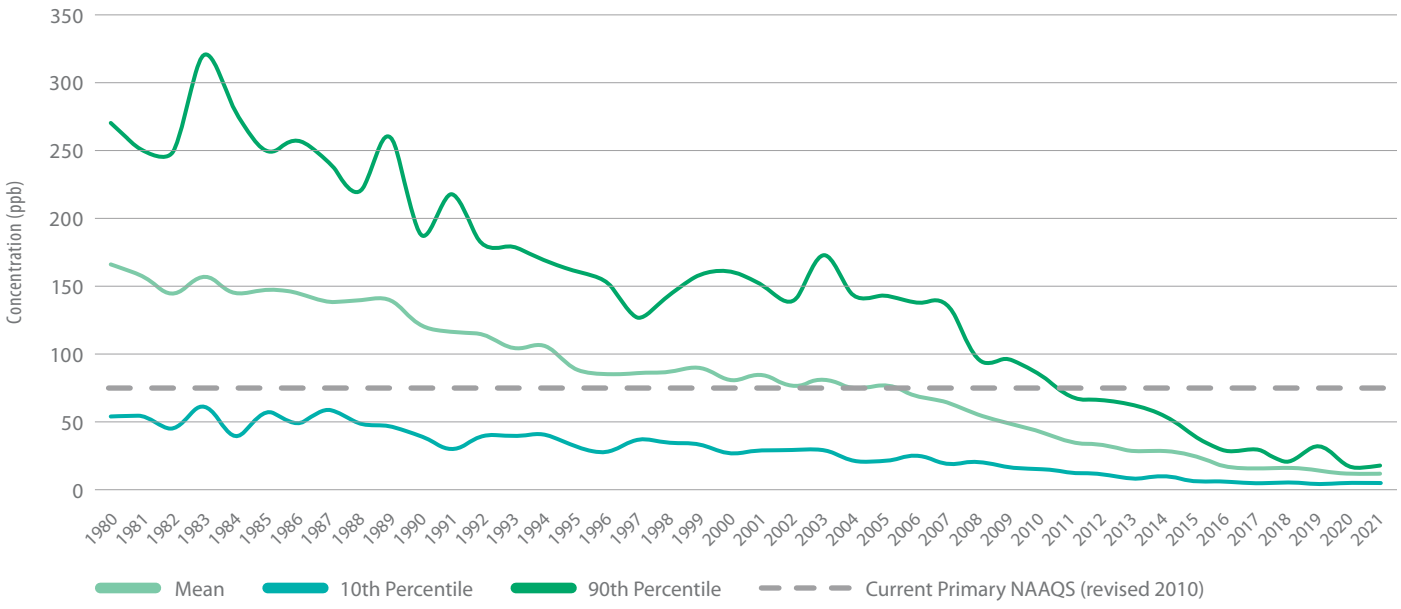


Source: U.S. EPA, **Air Pollutant Emissions Trends** (Data file: "National Tier 1 CAPS Trends, Criteria pollutants National Tier 1 for 1970–2022").

Criteria Air Pollutant Trends | Sulfur Dioxide

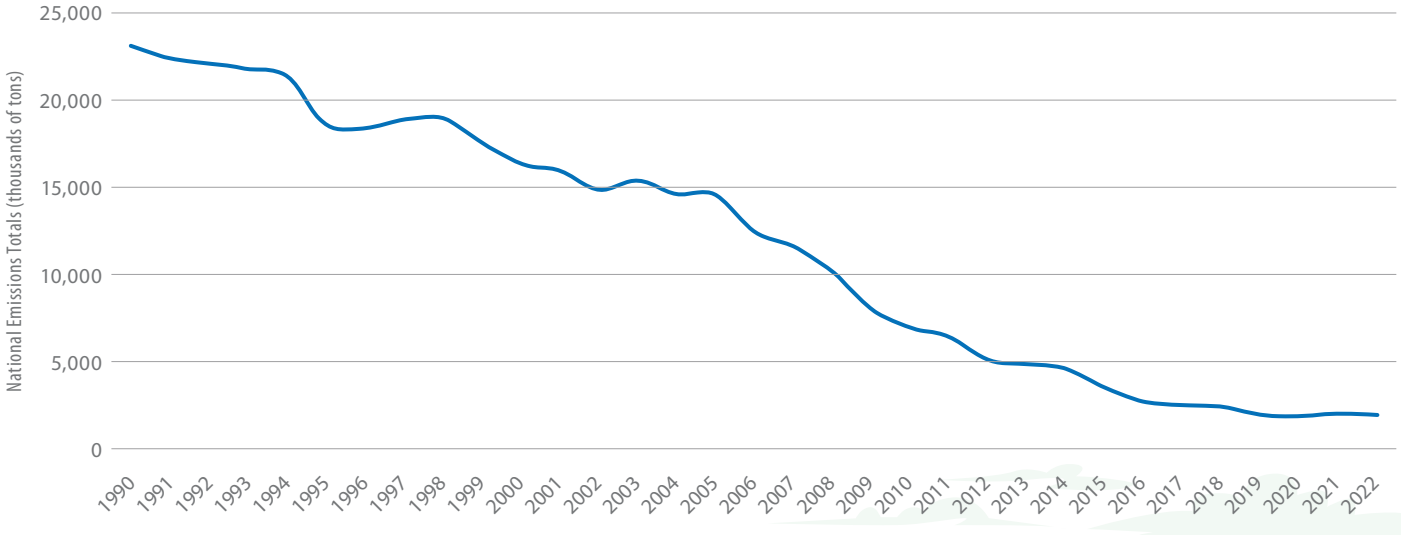
Sulfur Dioxide (SO_2) Air Quality, 1980–2021

(Annual 99th Percentile of Daily Max 1-Hour Average) National Trend based on 31 Sites



Source: U.S. EPA, **Sulfur Dioxide Trends**, August 2022.

Sulfur Dioxide (SO_2) Emissions, 1990–2022

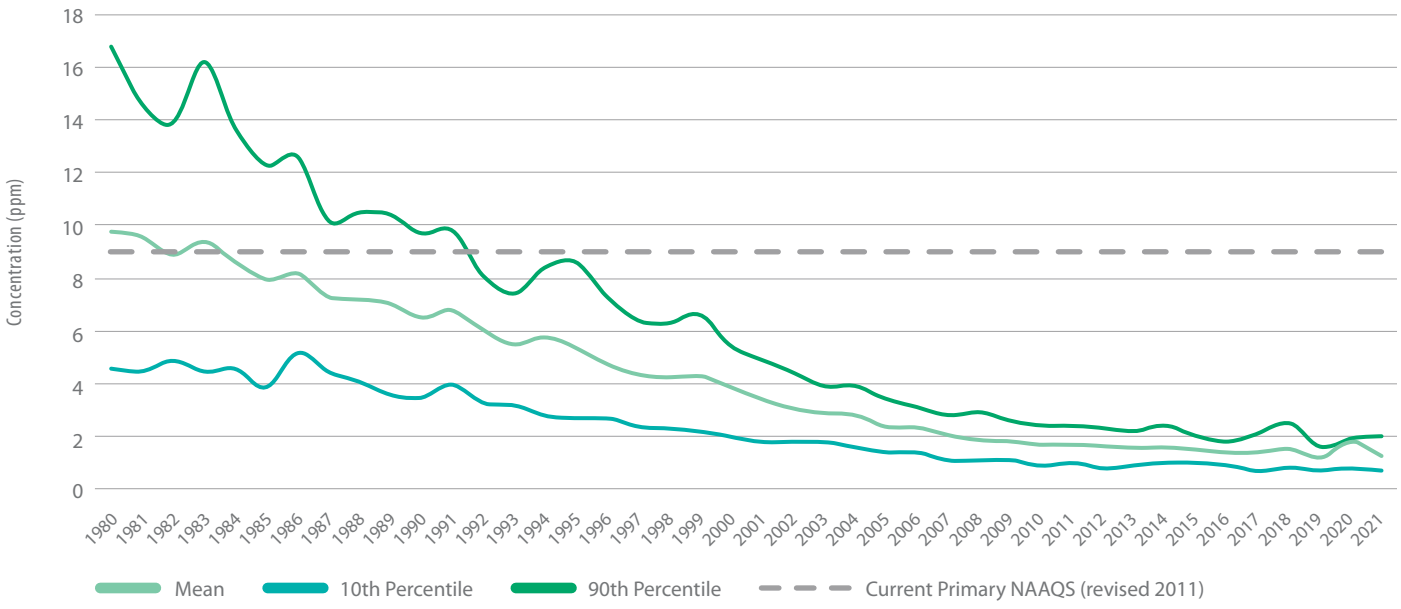


Source: U.S. EPA, **Air Pollutant Emissions Trends** (Data file: "National Tier 1 CAPS Trends, Criteria pollutants National Tier 1 for 1970–2022").

Criteria Air Pollutant Trends | Carbon Monoxide

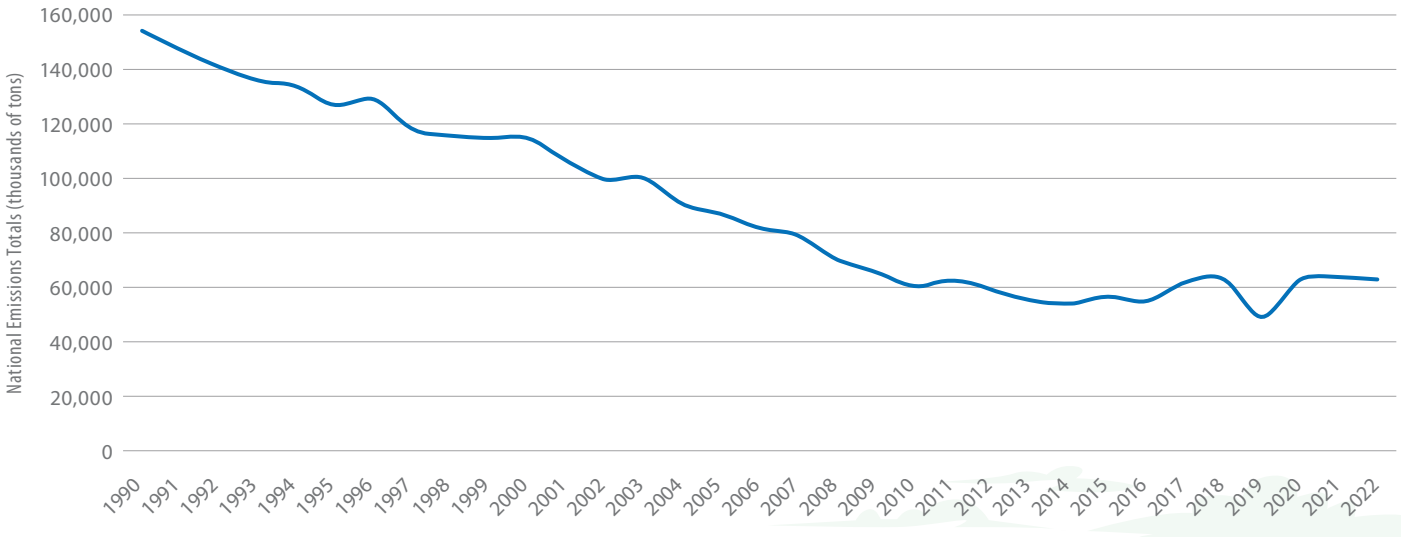
Carbon Monoxide (CO) Air Quality, 1980–2021

(Annual 2nd Maximum 8-hour Average) National Trend based on 33 Sites



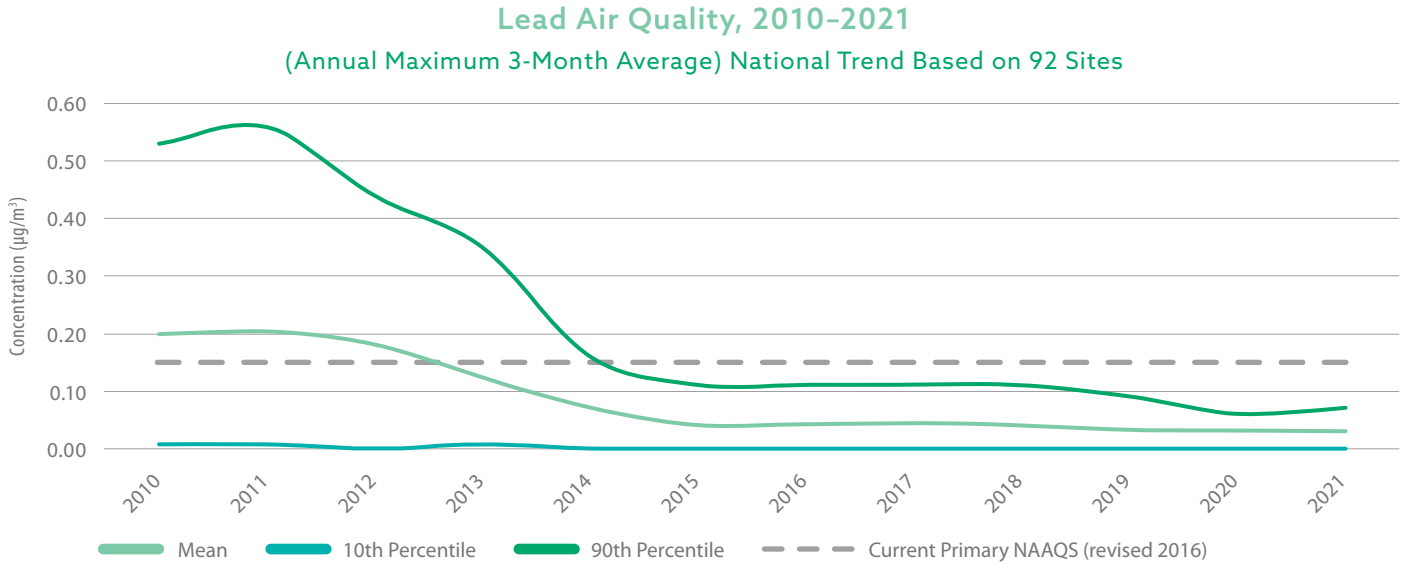
Source: U.S. EPA, **Carbon Monoxide Trends**, August 2022.

Carbon Monoxide (CO) Emissions, 1990–2022



Source: U.S. EPA, **Air Pollutant Emissions Trends** (Data file: "National Tier 1 CAPS Trends, Criteria pollutants National Tier 1 for 1970–2022").

Criteria Air Pollutant Trends | Lead

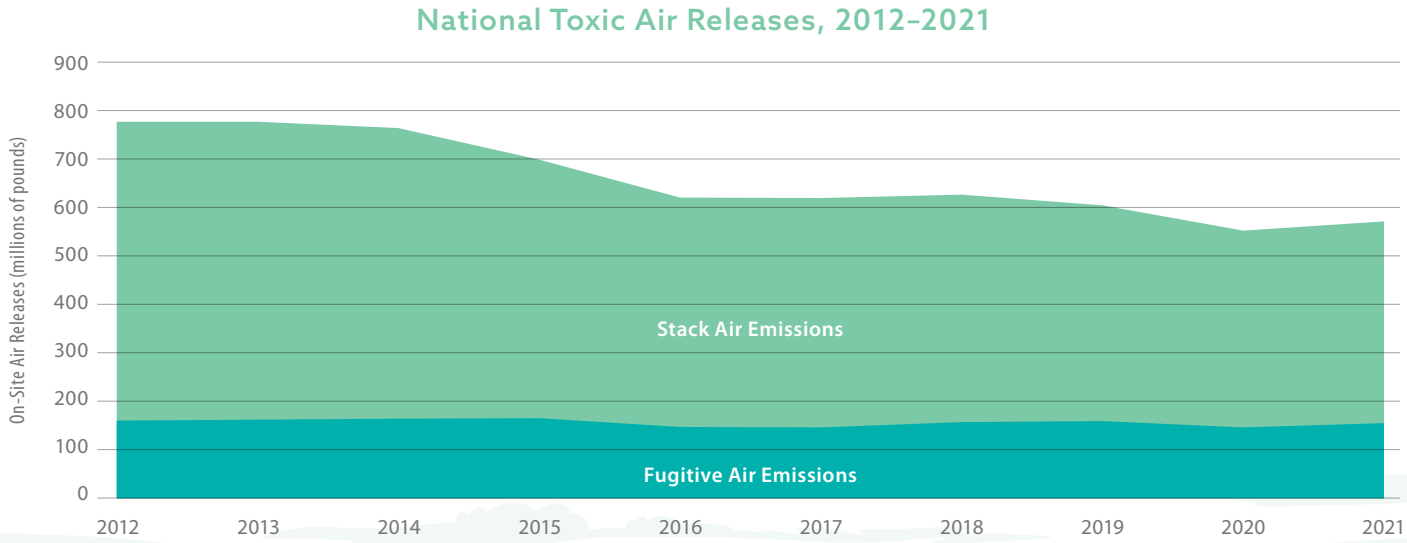


Source: U.S. EPA, Lead Trends, August 2022.

Hazardous Air Pollutants

As reported to U.S. EPA's *2021 Toxic Release Inventory National Analysis*, emissions of hazardous air pollutants, or air toxics, have continued to trend downward over the past decade. From 2012 to 2021, reported on-site toxic air releases decreased by 26 percent, from approximately 774.6 million pounds in 2012 to 571.2 million pounds in 2021, for a total reduction of about 203.4 million pounds.

Compared to 2020, national toxic air releases increased in 2021 by 3 percent. Sectors contributing the largest quantities of air releases during 2021 included chemical manufacturing (168.0 million pounds, or 29 percent), paper manufacturing (115.8 million pounds, or 20 percent), and electric utilities (64.5 million pounds, or 11 percent).[62]

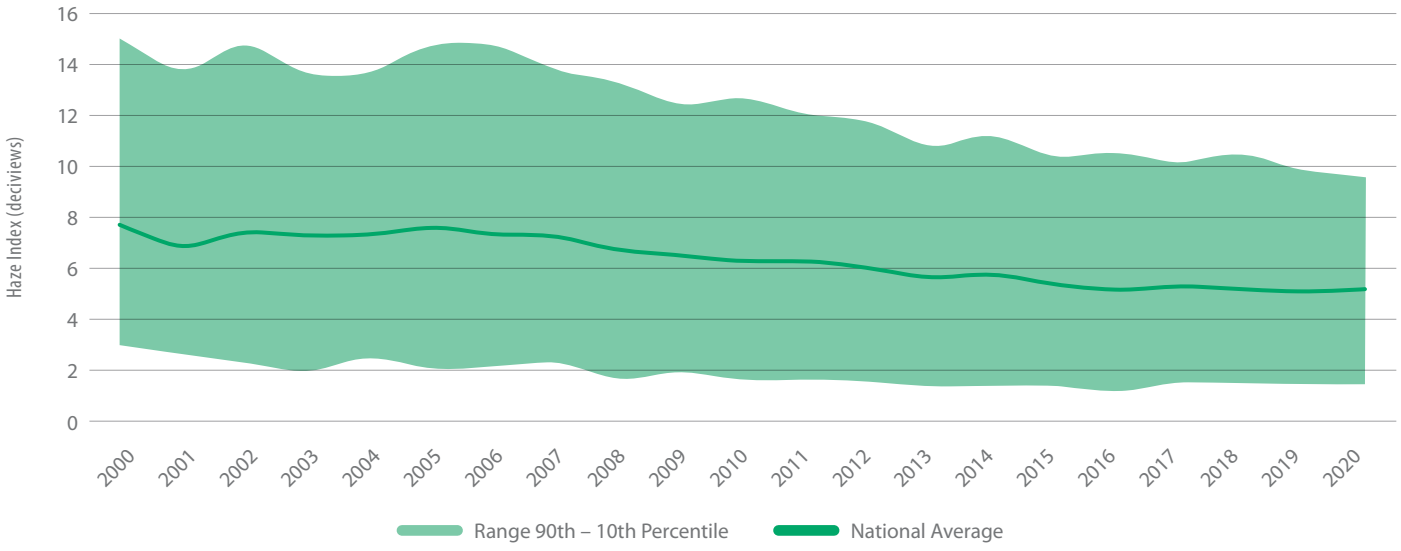


U.S. EPA, *2021 Toxic Release Inventory National Analysis*, March 16, 2023.

Visibility Improvements

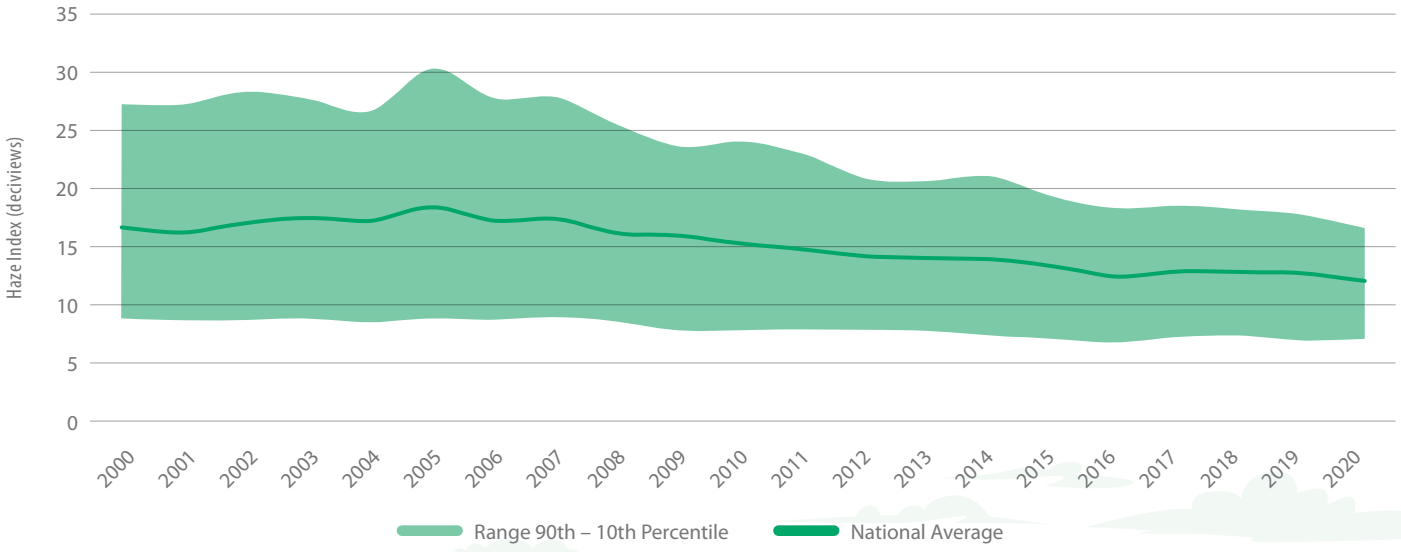
Under the Regional Haze Program, state and federal agencies monitor visibility in 156 national parks and wilderness areas, or Class I areas. U.S. EPA's 2021 report on air trends provides visibility data for Class I areas through 2020. Since 2000, visibility on the 20 percent clearest days has improved by nearly 33 percent, while there has been a 28 percent improvement in visibility during the 20 percent most impaired days.[63]

National Visibility Trends on Clearest Days, 2000–2020



Source: U.S. EPA, *Our Nation's Air: Trends Through 2021* (Section: "Visibility Improves in Scenic Areas"), June 2022.

National Visibility Trends on Most Impaired Days, 2000–2020



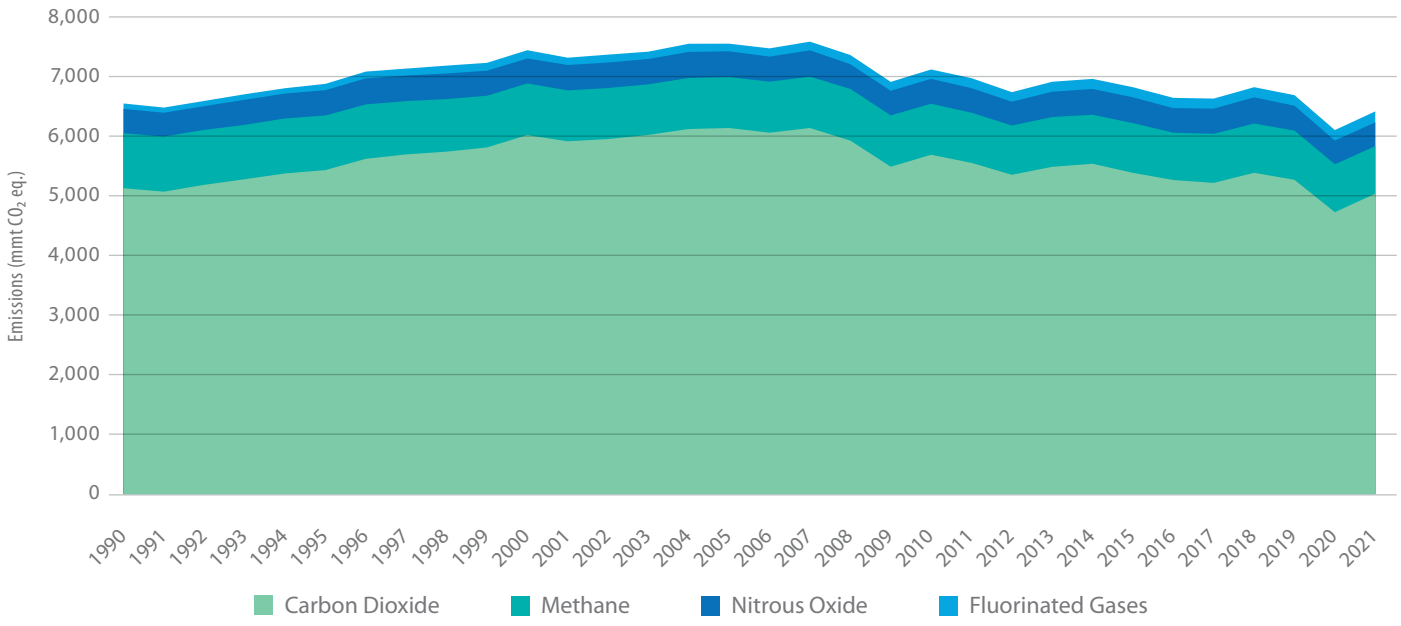
Source: U.S. EPA, Our Nation's Air: Trends Through 2021 (Section: "Visibility Improves in Scenic Areas"), June 2022.

Greenhouse Gas Trends

Released in April 2023, U.S. EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2021* documents that gross greenhouse gas emissions in the United States totaled 6,340.2 million metric tons of carbon dioxide equivalents (mmt CO_2 eq.) in 2021, a 2.3 percent decrease from 1990 levels.

In 2021, after accounting for sequestration from the land sector, U.S. EPA's *Inventory* finds that the nation's greenhouse gas emissions totaled 5,586.0 mmt CO_2 eq., an increase of 6 percent from the prior year and 17 percent below 2005 levels.[64]

U.S. Greenhouse Gas Emissions by Gas, 1990–2021

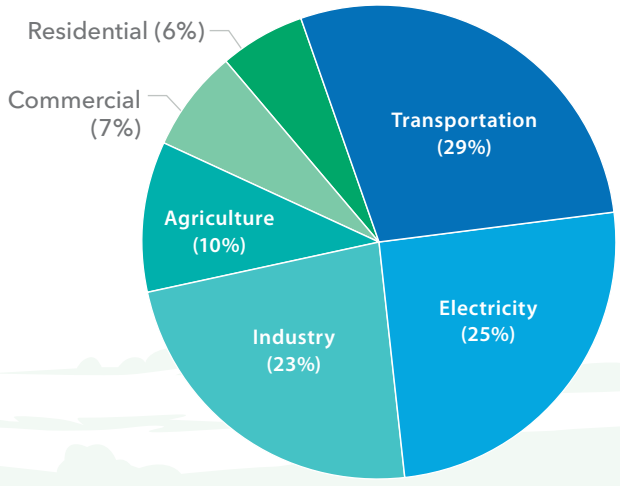


Source: U.S. EPA, ***Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2021***, April 2023. See U.S. EPA's **Greenhouse Gas Inventory Data Explorer**.

U.S. Greenhouse Gas Emissions by Economic Sector, 2021

Greenhouse gas (GHG) emissions in 2021 were from the following primary economic sectors:

- 29 percent from transportation, up 18.6 percent from 1990;
- 25 percent from electricity generation, down 15.7 percent from 1990;
- 23 percent from industry, down 11.3 percent since 1990;
- 10 percent from agriculture, up 7.2 percent since 1990;
- 7 percent from commercial, down 1.8 percent from 1990; and,
- 6 percent from residential, up 5.8 percent from 1990.

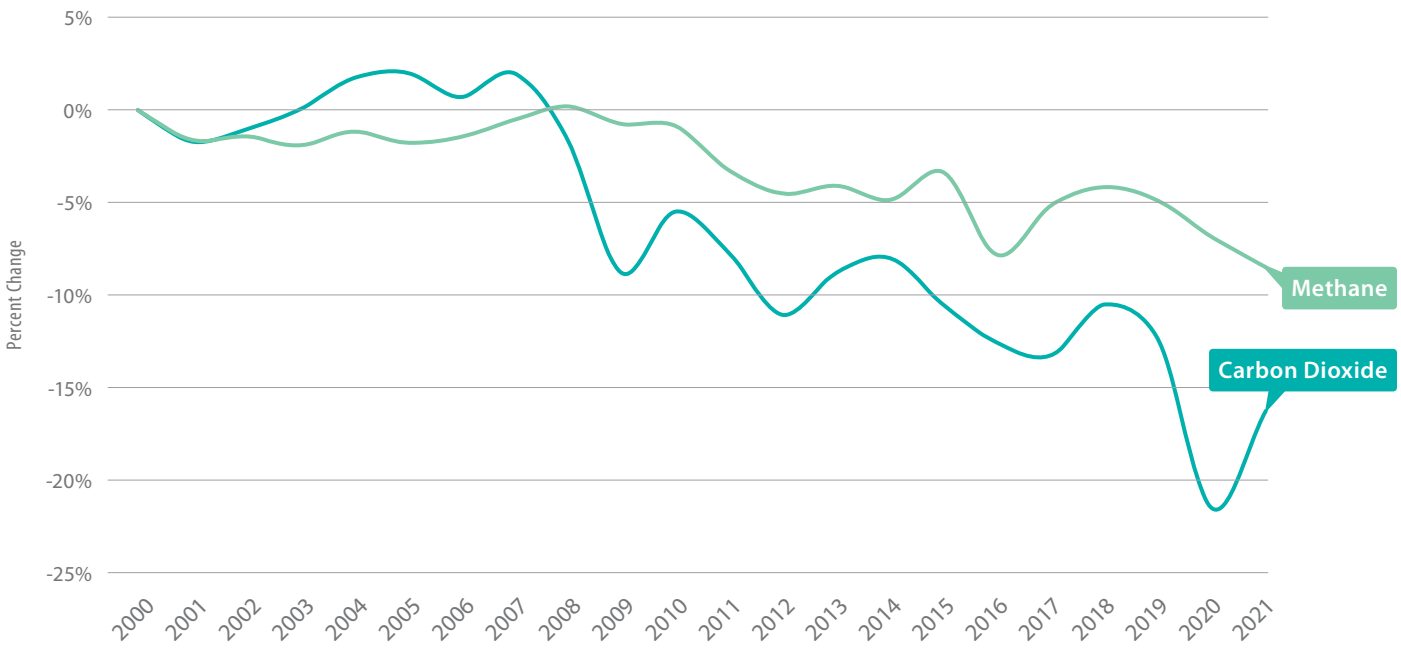


Source: U.S. EPA, ***Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2021***, April 2023. See U.S. EPA's **Greenhouse Gas Inventory Data Explorer**.

Greenhouse Gas Trends

U.S. EPA's *Inventory* also shows that, from 2000 to 2021, the United States reduced annual carbon dioxide emissions from 6,010.1 million metric tons of carbon dioxide equivalents (mmt CO_2 eq.) to 5,032.2 mmt CO_2 eq., a 16 percent decline.[65] Annual U.S. emissions of methane went from 867.8 mmt CO_2 eq. in 2000 down to 793.4 mmt CO_2 eq. in 2021, equivalent to a 9 percent decline.[66]

Percent Change of U.S. Emissions of Carbon Dioxide and Methane, 2000–2021



Source: U.S. EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2021*, April 2023.

Recent Headlines from the U.S. Energy Information Administration (EIA)

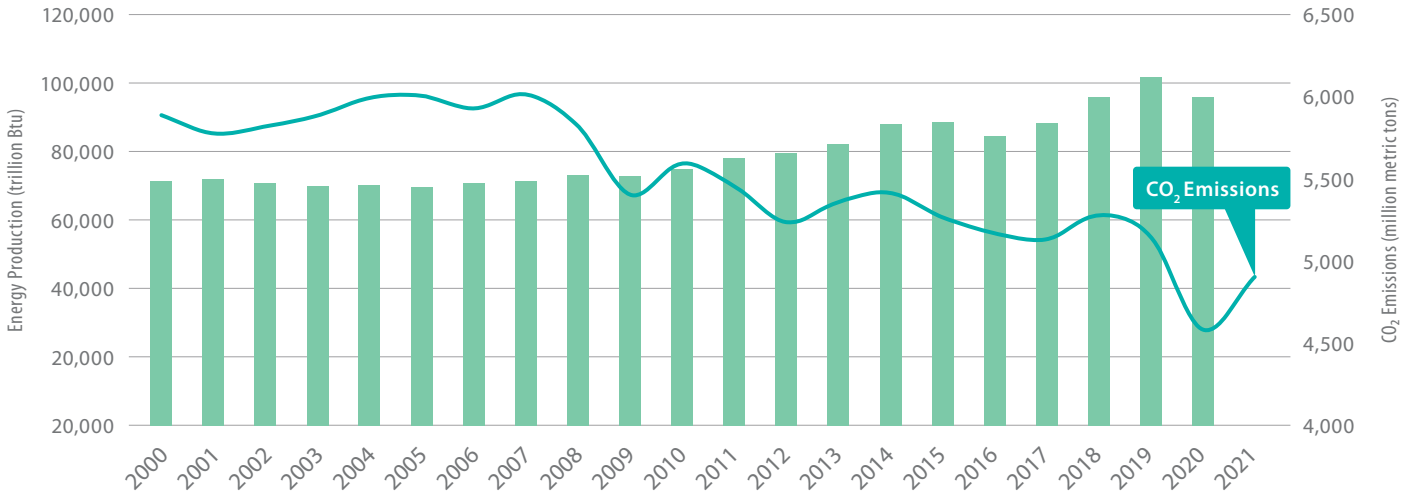
U.S. coal shipments increased slightly in 2022 as power plants replenished stockpiles | April 26, 2023
U.S. natural gas production grew by 4% in 2022 | March 29, 2023
Renewable generation surpassed coal and nuclear in the U.S. electric power sector in 2022 | March 27, 2023
Coal was the largest source of electricity generation for 15 states in 2021 | December 7, 2022
Nearly a quarter of the operating U.S. coal-fired fleet scheduled to retire by 2029 | November 7, 2022
U.S. natural gas production set a new record in 2021 | October 12, 2022
Carbon intensity of U.S. power generation continues to fall but varies widely by state | September 13, 2022
In the first half of 2022, 24% of U.S. electricity generation came from renewable sources | September 9, 2022
Energy production declined by record amounts in several states in 2020 | August 8, 2022
Energy use fell during 2020 in all U.S. states except Alaska | July 21, 2022
Fossil fuel sources accounted for 79% of U.S. consumption of primary energy in 2021 | July 1, 2022
U.S. energy-related CO2 emissions rose 6% in 2021 | May 13, 2022

Greenhouse Gas Trends | Energy-Related Carbon Dioxide Emissions

According to recent data from the U.S. Energy Information Administration, or EIA, United States energy-related carbon dioxide (CO_2) emissions fell by almost 17 percent from 2000 to 2021, from 5,888.6 million metric tons in 2000 to 4,902.5 million metric tons in 2021.[67]

U.S. EIA data also shows that total U.S. energy production increased by 34 percent from 2000 to 2020, from 71,238 trillion British thermal units (Btu) in 2000 to 95,711 trillion Btu in 2020.[68]

U.S. Total Energy Production Compared to Energy-Related CO_2 Emissions, 2000–2021

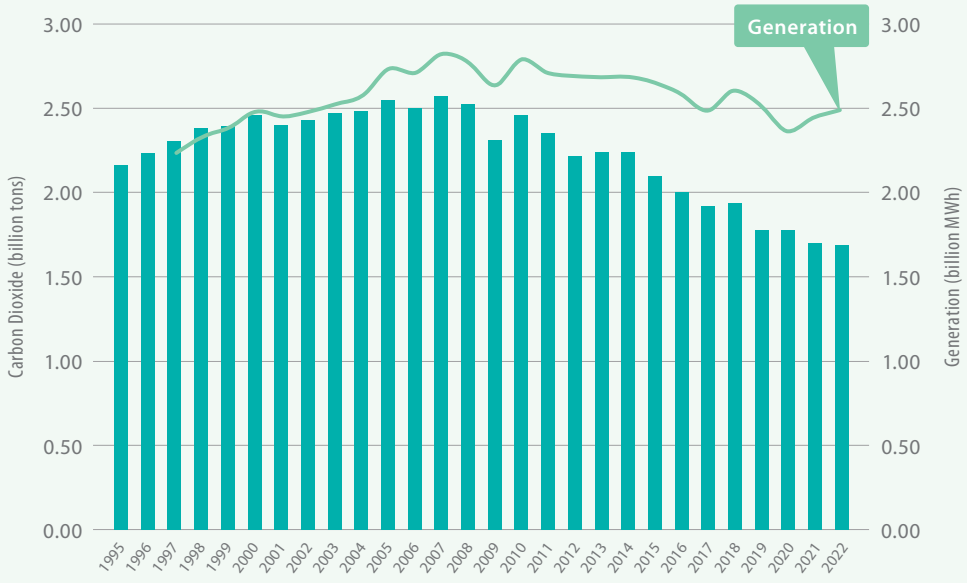


Source: U.S. EIA, **Annual Energy Outlook 2023** (Section: "Emissions"), March 16, 2023; U.S. EIA, **State Energy Data System (SEDS): 1960–2020**.

U.S. Power Plant Emissions Trends | Annual CO_2 Emissions, 1995–2022

U.S. EPA's annual progress report on emissions from the power sector documents that CO_2 emissions from electricity generation declined by 21 percent from 1995 to 2021, during which time gross generation grew nearly 7 percent. From 2021 to 2022, U.S. CO_2 emissions decreased slight by 1 percent, while generation rose by 2 percent.

Source: U.S. EPA, **Power Plant Emission Trends**, February 2023.



Sources

Types of Air Quality Data and Metrics

[1] 42 U.S.C. §7409(b).

[2] U.S. EPA states: "Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air (μg/m^3)."

[3] A chart of the primary and secondary NAAQS by pollutant, which includes averaging time, level, and form, can be found here.

[4] 42 U.S.C. §7409(d).

[5] U.S. EPA, Air Quality System. U.S. EPA notes that the AQS "also contains meteorological data, descriptive information about each monitoring station (including its geographic location and its operator), and data quality assurance/quality control information."

[6] Links to data summary files for national criteria pollutant trends can be found here.

[7] Data can be found here. U.S. EPA notes: "The latest version of the 1970 – 2022 data show the trends for Tier 1 categories which distinguish pollutant emission contributions among major source types… As inventory methods are improved over time, for some emission sources an improved estimation method may be applied 'backwards' to previous year trend estimates."

[8] More information on the NEI can be found here. U.S. EPA states: "The NEI is built using the Emissions Inventory System (EIS) first to collect the data from State, Local, and Tribal air agencies and then to blend that data with other data sources."

[9] U.S. EPA, Air Quality Design Values.

[10] U.S. EPA, Toxics Release Inventory (TRI) Program. Annual TRI National Analysis here. U.S. EPA notes that the TRI "is a resource for learning about toxic chemical releases and pollution prevention activities reported by industrial and federal facilities. TRI data support informed decision-making by communities, government agencies, companies, and others. Section 313 of the *Emergency Planning and Community Right-to-Know Act* (EPCRA) created the TRI Program."

[11] U.S. EPA, Air Quality – National Summary. See also: U.S. EPA, *Our Nation's Air: Trends Through 2021*, June 2022 (Section: "Visibility Improves in Scenic Areas").

[12] U.S. EPA, Power Sector Programs – Progress Report.

[13] U.S. EPA releases the Inventory of *U.S. Greenhouse Gas Emissions and Sinks* each April. See also: U.S. EPA, Greenhouse Gas Inventory Data Explorer.

[14] U.S. EIA, *Annual Energy Outlook 2023*, March 16, 2023.

AAPCA Member State Air Trends & Successes

[15] U.S. EPA, Air Pollutant Emissions Trends Data (Data file: "State Tier 1 CAPS Trends," Criteria pollutants State Tier 1 for 1990–2022).

[16] U.S. Bureau of Economic Analysis, "Gross Domestic Product by State, 4th Quarter 2022 and Year 2022 (Preliminary)," released March 31, 2023.

[17] U.S. Office of Highway Policy Information, data available here.

[18] U.S. Census Bureau, data available here.

[19] U.S. EIA, Energy-Related CO_2 Emission Data Tables. Table 1. State energy-related carbon dioxide emissions by year.

[20] U.S. EIA, State Energy Data Systems (SEDS): 1960–2020.

[21] U.S. EPA's Green Book can be found here.

[22] U.S. EPA's listing of areas designated nonattainment or maintenance for the 1997 annual $PM_{2.5}$ NAAQS can be found here. In 2012, the NAAQS for $PM_{2.5}$ was lowered to 12.0 μg/m^3, based on an annual arithmetic mean averaged over three years (the 2006 review maintained the 1997 NAAQS). In 2020, U.S. EPA retained the 2012 standard of 12.0 μg/m^3. In June 2021, U.S. EPA announced the reconsideration of the 2020 decision to retain the 2012 $PM_{2.5}$ standards. On January 6, 2023, U.S. EPA announced the proposed decision for the reconsideration of the NAAQS for PM.

[23] U.S. EPA defines a design value as "a statistic that describes the air quality status of a given location relative to the level of the [NAAQS]." More information is available here.

[24] U.S. EPA's Air Quality System "contains ambient air pollution data collected by EPA, state, local, and tribal air pollution control agencies from over thousands of monitors."

[25] U.S. EPA, Air Quality Design Values (Data file: "$PM_{2.5}$ Design Values, 2021"). Data for this chart is based on overlapping three-year averages beginning with 2000–2002 and ending with 2019–2021.

[26] U.S. EPA's listing of areas designated nonattainment or maintenance for the 2012 $PM_{2.5}$ NAAQS can be found here.

[27] U.S. EPA's listing of areas designated nonattainment or maintenance for the 2008 ozone NAAQS can be found here. In 2015, U.S. EPA lowered the NAAQS for ozone to 0.070 parts per million (ppm), based on the annual fourth-highest daily maximum 8-hour average concentration, averaged over three years. In 2020, U.S. EPA retained the 2015 standard of 0.070 ppm. In October 2021, U.S. EPA announced the reconsideration of the 2020 decision to retain the 2015 ozone standards.

[28] U.S. EPA, Air Quality Design Values (Data file: "Ozone Design Values, 2021"). Data for this chart is based on overlapping three-year averages beginning with 2000–2002 and ending with 2019–2021.

Sources *(continued)*

[29] U.S. Energy Information Administration, **State Energy Data System (SEDS): 1960–2020**.

[30] U.S. EPA, **Air Pollutant Emissions Trends Data** (Data file: "State Tier 1 CAPS Trends," Criteria pollutants State Tier 1 for 1990–2022).

[31] More information on U.S. EPA Clean Air Markets Programs can be found **here**, and include the **Acid Rain Program** (ARP), the **Cross-State Air Pollution Rule** (CSAPR), and the **CSAPR Update**.

[32] U.S. EPA, "**State-by-State SO_2 Emissions from CSAPR and ARP Sources, 1990–2021**," July 2022.

[33] U.S. EPA, "**State-by-State NO_x Emissions from CSAPR and ARP Sources, 1990–2021**," July 2022.

[34] U.S. Energy Information Administration, **Energy-Related CO_2 Emission Data Tables**. Table 3. State energy-related carbon dioxide emissions by sector.

[35] U.S. EPA recognizes that there will be differences between the EPA's state-level GHG estimates and some inventory estimates developed independently by individual state governments. Inventory data presented **here** should not be viewed as official data of any state government. More information is available here, including official state greenhouse gas inventories **here**.

[36] U.S. Energy Information Administration (EIA), **State Energy Data System (SEDS) 1960–2020**; U.S. EIA, **Energy-Related CO_2 Emission Data Tables**. Table 1. State energy-related carbon dioxide emissions by year.

[37] U.S. Energy Information Administration, **Energy-Related CO_2 Emission Data Tables**. Table 7. Carbon intensity of the economy by state.

[38] U.S. EPA, ***2021 Toxic Release Inventory (TRI) National Analysis***, March 2023.

[39] U.S. EPA Toxic Release Inventory Explorer, **2021 TRI Factsheets**.

[40] See U.S. EPA's **State Air Dashboard**, part of **Enforcement and Compliance History Online (ECHO)**.

[41] See U.S. EPA's **State Air Dashboard**, part of **Enforcement and Compliance History Online (ECHO)**. Data accessed April 27, 2023.

[42] U.S. EPA's ECHO **Air Dashboard** reports the following as Clean Air Act compliance monitoring activities: Full Compliance Evaluation (FCE), Partial Compliance Evaluation (PCE), Stack Test, and Title V Annual Compliance Certification (TVACC) Reviews.

[43] See U.S. EPA's **State Air Dashboard**, part of **Enforcement and Compliance History Online (ECHO)**. Data accessed April 27, 2023.

[44] See U.S. EPA's **State Air Dashboard**, part of **Enforcement and Compliance History Online (ECHO)**. Data accessed April 27, 2023.

American Air Quality in an International Context

[45] U.S. EPA, ***Our Nation's Air: Trends Through 2021***, June 2022.

[46] U.S. EPA, ***Our Nation's Air: Trends Through 2021***, June 2022.

[47] World Bank, **GDP Listings by Country**, March 30, 2023.

[48] World Bank, **GDP Listings by Country**, March 30, 2023.

[49] IEA maintains country profiles on key energy statistics, including energy production. More information on the United States can be found **here**, and China **here**.

[50] U.S. Energy Information Administration, **State Energy Data System (SEDS): 1960–2020**, June 24, 2022.

[51] U.S. Census Bureau, **Current Population**.

[52] U.S. Census Bureau, **Population and Housing Estimates**.

[53] Synthesized measurements of aerosol optical depth acquired by the National Aeronautics and Space Administration (NASA) **Moderate Resolution Imaging Spectroradiometer** (MODIS), **Multi-angle Imaging SpectroRadiometer** (MISR), and **Sea-viewing Wide Field-of-view Sensor** (SeaWiFS).

[54] Southerland, V. et al., "Global urban temporal trends in fine particulate matter ($PM_{2.5}$) and attributable health burdens: estimates from global datasets," *The Lancet Planetary Health*, January 05, 2022. Available at: **https://doi.org/10.1016/S2542-5196(21)00350-8**.

[55] Anenberg, S. et al., "Long-term trends in urban NO_2 concentrations and associated pediatric asthma incidence: estimates from global datasets," *The Lancet Planetary Health*, January 2022. Available at: **https://doi.org/10.1016/S2542-5196(21)00255-2**.

[56] More information on IEA's *Greenhouse Gas Emissions from Energy* database and methodology can be found **here**.

[57] International Energy Agency, ***Greenhouse Gas Emissions from Energy Highlights***, September 2022.

Air Quality Trends in the United States

[58] U.S. EPA, **Air Quality—National Summary: Air Quality Trends** (updated June 1, 2022).

[59] U.S. EPA, **Air Quality—National Summary: Emissions Trends** (updated June 1, 2022). Note: "EPA estimates nationwide emissions of ambient air pollutants and the pollutants they are formed from (their precursors). These estimates are based on actual monitored readings or engineering calculations of the amounts and types of pollutants emitted by vehicles, factories, and other sources. Emission estimates are based on many factors, including levels of industrial activity, technological developments, fuel consumption, vehicle miles traveled, and other activities that cause air pollution."

Sources *(continued)*

[60] U.S. EPA, **Air Quality—National Summary: Emissions Trends** (updated June 1, 2022).

[61] U.S. EPA, **Air Pollutant Emissions Trends Data** (Data file: "National Tier 1 CAPS Trends," Criteria pollutants National Tier 1 for 1970–2022).

[62] U.S. EPA, ***2021 Toxic Release Inventory National Analysis***, March 2023.

[63] U.S. EPA, ***Our Nation's Air: Trends Through 2021***, June 2022 (Section: "**Visibility Improves in Scenic Areas**"). A full listing of Class I Areas under U.S. EPA's Regional Haze program can be found **here**.

[64] U.S. EPA, ***Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2021***, April 2023. U.S. EPA's *Inventory* "provides a comprehensive accounting of total greenhouse gas emissions for all man-made sources in the United States."

[65] U.S. EPA, ***Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2021***, April 2023.

[66] U.S. EPA, ***Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2021***, April 2023.

[67] U.S. EIA, **State Energy Data System (SEDS): 1960–2020**, June 24, 2022.

[68] U.S. Energy Information Administration, ***Annual Energy Outlook 2023***, March 16, 2023 (Section: "Emissions"). Includes the following sectors: transportation, industrial, electric power, residential, and commercial.

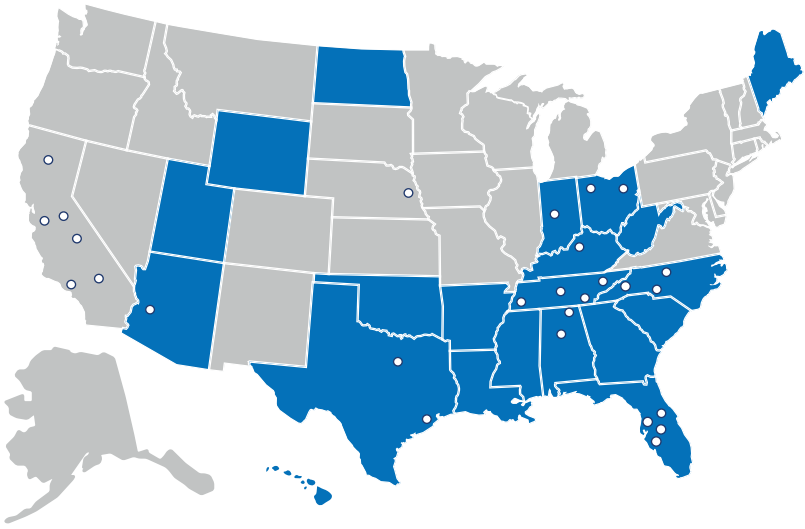
Air Quality Resources

AAPCA State Agencies

- Alabama Department of Environmental Management
- Arizona Department of Environmental Quality
- Arkansas Division of Environmental Quality
- Florida Department of Environmental Protection
- Georgia Environmental Protection Division
- Hawaii Department of Health
- Indiana Department of Environmental Management
- Kentucky Division for Air Quality
- Louisiana Department of Environmental Quality
- Maine Department of Environmental Protection
- Mississippi Department of Environmental Quality
- North Carolina Department of Environmental Quality
- North Dakota Department of Environmental Quality
- Ohio Environmental Protection Agency
- Oklahoma Department of Environmental Quality
- South Carolina Department of Health & Environmental Control
- Tennessee Department of Environment & Conservation
- Texas Commission on Environmental Quality
- Utah Department of Environmental Quality
- West Virginia Department of Environmental Protection
- Wyoming Department of Environmental Quality

AAPCA Local Agencies

- Asheville-Buncombe Air Quality Agency (NC)
- Butte County Air Quality Management District (CA)
- Canton City Health Department Air Pollution Control Division (OH)
- Chattanooga-Hamilton County Air Pollution Control Bureau (TN)
- City of Fort Worth Environmental Quality Division (TX)
- City of Huntsville Natural Resources Office (AL)
- City of Indianapolis (IN)
- El Dorado County Air Pollution Control District (CA)
- Environmental Protection Commission of Hillsborough County (FL)
- Forsyth County Office of Environmental Assistance & Protection (NC)
- Galveston County Health District, Air & Water Pollution Services (TX)
- Jefferson County Department of Health, Air & Radiation Protection Division (AL)
- Knox County Air Quality Management (TN)
- Louisville Metro Air Pollution Control District (KY)
- Manatee County Environmental Protection Division (FL)
- Maricopa County Air Quality Department (AZ)
- Mecklenburg County Air Quality (NC)



- Mojave Desert Air Quality Management District (CA)
- Nashville-Davidson Metro Public Health Department (TN)
- Omaha Air Quality Control Division (NE)
- Orange County Air Quality Management (FL)
- Pinellas County Air Quality Monitoring Program (FL)
- San Joaquin Valley Air Pollution Control District (CA)
- Shelby County Health Department (TN)
- Toledo Division of Environmental Services (OH)
- Ventura County Air Pollution Control District (CA)
- Yolo-Solano Air Quality Management District (CA)

Additional Air Quality Resources

- U.S. EPA Air Quality Trends Website
- U.S. EPA Nonattainment Areas for Criteria Pollutants (Green Book)
- U.S. EPA Report on the Environment (ROE)
- U.S. EPA Air Quality Index (AQI)
- U.S. EPA Power Plant Emissions Trends
- Environmental Council of the States ECOS Results
- Western Regional Air Partnership (WRAP) Regional Haze Storyboard

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