BENCHMARKING AIR EMISSIONS

OF THE
100 LARGEST
ELECTRIC POWER
PRODUCERS
IN THE
UNITED STATES

MAY 2014

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Contents

Acknowledgments

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Preface

The 2014 Benchmarking report is the tenth collaborative effort highlighting environmental performance and progress in the nation's electric power sector. The Benchmarking series began in 1997 and uses publicly reported data to compare the emissions performance of the 100 largest power producers in the United States. The current report is based on 2012 generation and emissions data.

Data on U.S. power plant generation and air emissions are available to the public through several databases maintained by federal government agencies. Publicly- and privately-owned electric generating companies are required to report fuel and generation data to the U.S. Energy Information Administration (EIA). Most power producers are also required to report air pollutant emissions data to the U.S. Environmental Protection Agency (EPA). These data are reported and recorded at the boiler, generator, or plant level, and must be combined and presented so that company-level comparisons can be made across the industry.

The Benchmarking report facilitates the comparison of emissions performance by combining generation and fuel consumption data compiled by EIA with emissions data on sulfur dioxide (SO_2), oxides of nitrogen (NOx), carbon dioxide (CO_2) and mercury compiled by EPA; error checking the data; and presenting emissions information for the nation's 100 largest power producers in a graphic format that aids in understanding and evaluating the data. The report is intended for a wide audience, including electric industry executives, environmental advocates, financial analysts, investors, journalists, power plant managers, and public policymakers.

The report is available in PDF format at www.ceres.org and www.nrdc.org. Plant and company level data used in this report are available at www.mjbradley.com.

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Executive Summary

This report examines and compares the stack air pollutant emissions of the 100 largest power producers in the United States based on their 2012 generation, plant ownership, and emissions data. Table ES.1 lists the 100 largest power producers featured in this report ranked by their total electricity generation from fossil fuel, nuclear, and renewable energy facilities. These producers include public and private entities[1] (collectively referred to as "companies" or "producers" in this report) that own more than 2,700 power plants and account for 86 percent of reported electric generation and 87 percent of the industry's reported emissions.

The report focuses on four power plant pollutants for which public emissions data are available: sulfur dioxide (SO_2), oxides of nitrogen (NOx), mercury (Hg), and carbon dioxide (CO_2). These pollutants are associated with significant environmental and public health problems, including acid deposition, global warming, fine particle air pollution, mercury deposition, nitrogen deposition, ozone smog, and regional haze. The report

TABLE ES.1

100 Largest Electric Power Producers in the U.S. (in order of 2012 electric generation)

RANK	PRODUCER NAME	2012 MWh (millions)	RANK	PRODUCER NAME	2012 MWh (millions)	RANK	PRODUCER NAME	2012 MWh (millions)	RANK	PRODUCER NAME	2012 MWh (millions)
1	Duke	231.7	26	Pinnacle West	28.7	51	Riverstone	14.7	76	Intermountain Power Agency	9.8
2	Exelon	192.6	27	General Electric	27.9	52	IDACORP	14.1	77	Energy Northwest	9.7
3	Southern	175.3	28	Great Plains Energy	27.5	53	Los Angeles City	14.0	78	EDP	9.6
4	NextEra Energy	170.3	29	Energy Capital Partners	26.8	54	Occidental	13.4	79	Lower CO River Authority	9.6
5	AEP	163.4	30	San Antonio City	26.6	55	NiSource	13.3	80	El Paso Electric	9.4
6	Tennessee Valley Authority	144.6	31	OGE	26.4	56	Tri-State	13.0	81	Portland General Electric	9.3
7	Entergy	129.5	32	Salt River Project	26.2	57	Omaha Public Power District	12.9	82	Puget Holdings	9.3
8	Calpine	113.1	33	Westar	25.5	58	Dow Chemical	12.9	83	Big Rivers Electric	9.2
9	FirstEnergy	103.3	34	Oglethorpe	25.1	59	JEA	12.7	84	Austin Energy	8.7
10	Dominion	100.4	35	New York Power Authority	25.0	60	Arkansas Electric Coop	12.7	85	ALLETE	8.6
11	NRG	96.7	36	SCANA	24.9	61	Municipal Elec. Auth. of GA	12.6	86	Integrys	8.4
12	MidAmerican	89.1	37	Santee Cooper	23.4	62	Sempra	12.6	87	UniSource	8.3
13	PPL	85.1	38	NV Energy	21.8	63	ArcLight Capital	12.5	88	TransCanada	7.8
14	US Corps of Engineers	76.5	39	CMS Energy	21.2	64	Entegra Power	11.9	89	LS Power	7.7
15	Xcel	73.5	40	Wisconsin Energy	19.9	65	BP	11.6	90	International Paper	7.5
16	Energy Future Holdings	70.5	41	Edison International	19.8	66	NC Public Power	11.5	91	Buckeye Power	7.0
17	Ameren	69.1	42	Basin Electric Power Coop	18.5	67	Exxon Mobil	11.4	92	Seattle City Light	6.9
18	PSEG	53.3	43	TECO	18.3	68	Great River Energy	11.1	93	E.ON	6.9
19	US Bureau of Reclamation	49.8	44	EDF	18.1	69	East Kentucky Power Coop	10.8	94	Grand River Dam Authority	6.7
20	DTE Energy	40.7	45	Alliant Energy	18.1	70	PNM Resources	10.5	95	Avista	6.7
21	Dynegy	40.6	46	Tenaska	18.0	71	Seminole Electric Coop	10.4	96	Brazos Electric Power Coop	6.7
22	AES	38.8	47	Rockland Capital	17.7	72	PUD No 1 of Chelan County	10.3	97	Hoosier Energy	6.7
23	GDF Suez	36.6	48	NE Public Power District	16.3	73	J-Power	10.0	98	Sacramento Municipal Util Dist	6.5
24	Edison Mission Energy	32.2	49	Associated Electric Coop	16.3	74	PUD No 2 of Grant County	9.9	99	Centrica	6.3
25	PG&E	31.8	50	Iberdrola	15.5	75	CLECO	9.9	100	Waste Management	6.3

benchmarks, or ranks, each company's absolute emissions and its emission rate (determined by dividing emissions by electricity produced) for each pollutant against the emissions of the other companies. Appendix A discusses the data sources and methodology used to benchmark the 100 largest power producers.

Major Findings

Industry Trends

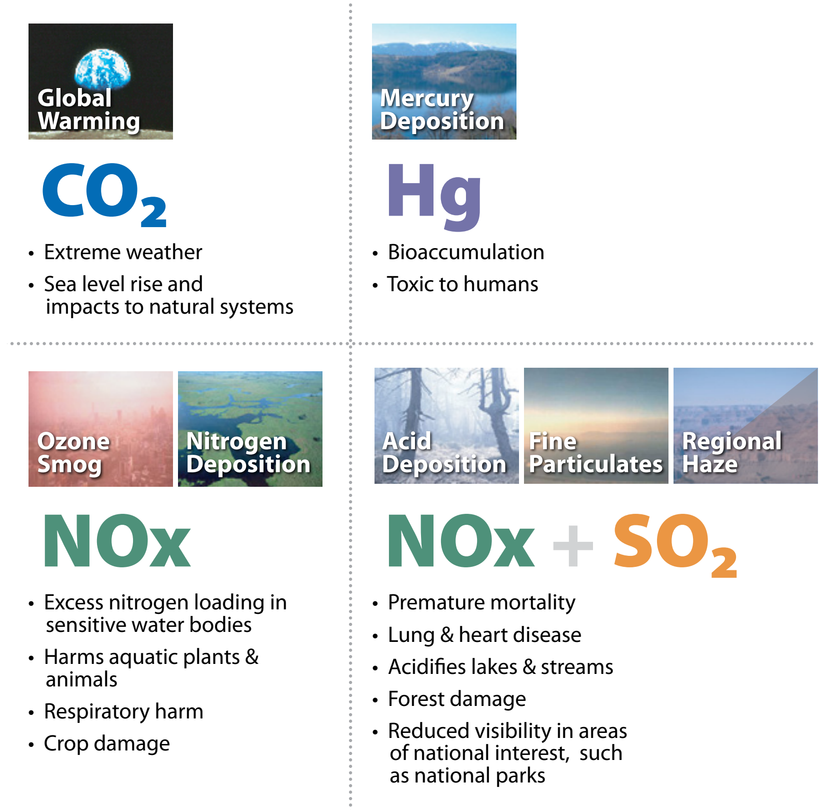
The electric power industry is in a period of transition. In particular, electricity demand growth has been relatively flat and natural gas prices have remained at low levels, leading to increased natural gas use within the electric sector. Companies are retiring aging power plants, including roughly 18 percent of the nation's coal-fired generating fleet and more than 4 gigawatts of nuclear capacity. Renewable energy capacity continues to expand with record growth in wind and solar energy.

Since January 2010, plant owners have announced about 60,000 megawatts of coal plant retirements. This represents roughly 18 percent of the nation's coal-fired generating fleet. About 16,000 megawatts of this capacity has already been shut down, and another 34,000 megawatts is scheduled to do so by year-end 2016. Also, coal plant utilization has declined in recent years; the average annual capacity factor of coal plants in the U.S. dropped from 73 percent in 2008 to 60 percent in 2013.

Since declining to their lowest levels in 10 years in 2012, natural gas prices experienced a modest increase in 2013. Despite this modest increase, natural gas prices have remained relatively low by historic standards and total natural gas consumption in the U.S. reached a record high of over 26 trillion cubic feet in 2013. Natural gas consumption by the electric sector has increased by nearly 60 percent over the past 10 years. Natural gas combined-cycle power plants have been running more often in recent years; average capacity factors have increased from 40 to 47 percent between 2008 and 2013.

FIGURE ES. 1

Environmental Concerns Associated with Power Plant Emissions



In 2012 and 2013, four nuclear power plants announced plans to retire and five major uprates were canceled. In some cases, plant-specific equipment issues have led to early retirement decisions. However, other factors have also been putting significant financial pressures on nuclear plants operating in competitive power markets and these pressures have increased in recent years. Further nuclear plant closures could lead to further CO_2 emissions increases; however, depending on the stringency, some portion of these emission increases could be mitigated by an effective national policy to limit CO_2 emissions.

Renewable energy and energy efficiency have shown increased growth and investment. Although total electricity generation has decreased modestly since 2010, renewable electricity generation (excluding large hydroelectric projects) has increased by over 50 million megawatt hours between 2010 and 2012, a 31 percent increase. Wind energy remains the largest source of non-hydroelectric renewable energy. In 2012, the U.S. wind energy industry experienced record growth, adding over 13,000 megawatts of new wind power capacity, bringing the nation's cumulative total to over 60,000 megawatts. U.S. state budgets for electricity and natural gas efficiency and demand response programs have continued to increase modestly, totaling over $8.2 billion in 2012 compared to $8 billion in 2011.

Electric Industry Emission Trends

Since 1990, power plant emissions of SO_2 and NOx have decreased and CO_2 emissions have increased.

- In 2012, power plant NOx and SO_2 emissions were 74 percent and 79 percent lower, respectively, than they were in 1990 when Congress passed major amendments to the Clean Air Act.
- In 2012, power plant CO_2 emissions were 13 percent higher than they were in 1990. However, emissions have declined in recent years. Between 2008 and 2012, power plant CO_2 emissions decreased by 13 percent, and total U.S. greenhouse gas emissions have decreased by over 8 percent between 2008 and 2012. Some of the factors driving this trend include slow economic growth, energy efficiency improvements, and the displacement of coal generation by natural gas and renewable energy resources.
- Mercury emissions from power plants have decreased 51 percent since 2000, and will decline further as the first-ever federal limits on mercury and other hazardous air pollutants from coal-fired power plants go into effect in 2015.

Overall Emissions from Electricity

The electric industry in the U.S. is a major source of air pollution.

- In 2012, power plants were responsible for about 62 percent of SO_2 emissions, 13 percent of NOx emissions, 61 percent of mercury air emissions (among sources reporting to EPA's Toxics Release Inventory), and 37 percent of CO_2 emissions in the U.S.
- The electric industry accounts for more CO_2 emissions that any other sector, including the transportation and industrial sectors.

Air Pollution Rankings and Comparisons

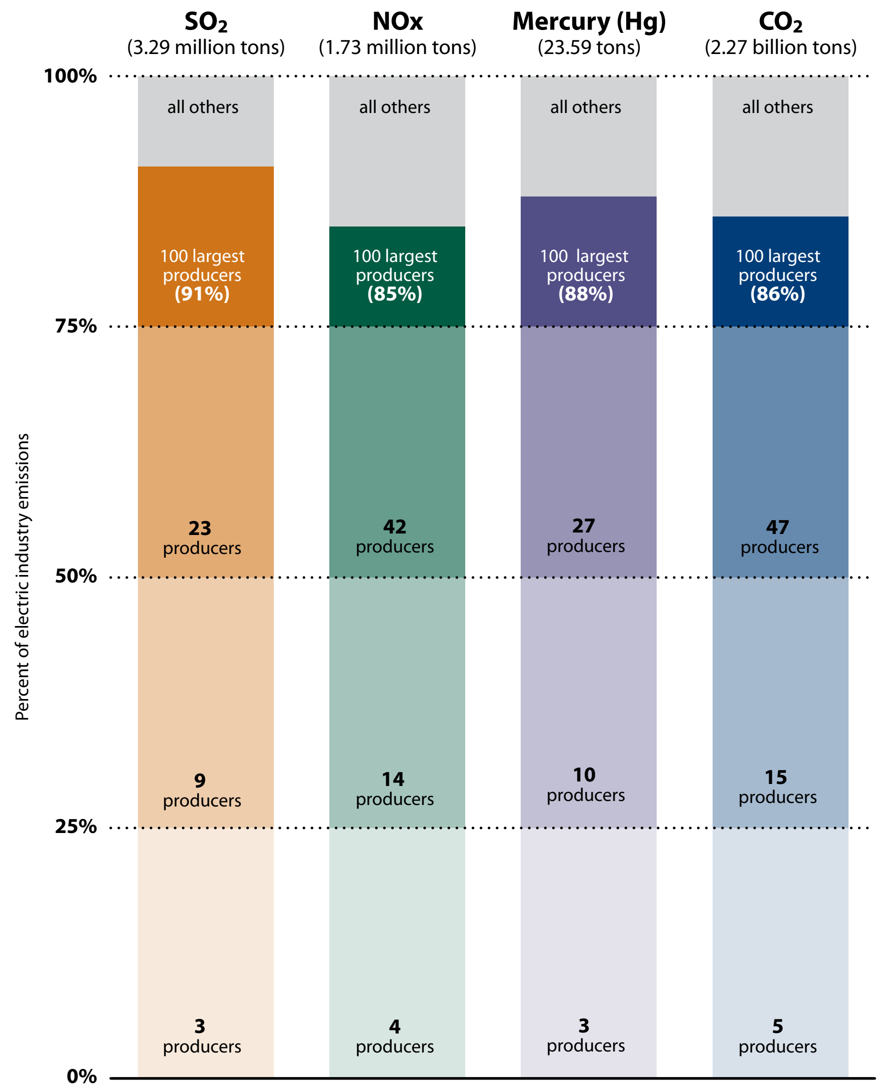
The 100 largest power producers generated 86 percent of electric power in the U.S. in 2012. The 100 largest producers generated 97 percent of all nuclear power, 88 percent of all coal-fired power, 86 percent of all hydroelectric power, 81 percent of all natural gas-fired power, and 71 percent of all non-hydroelectric renewable power.

Air pollution emissions from power plants are highly concentrated among a small number of producers. For example, a quarter of the electric power industry's SO_2 and CO_2 emissions are emitted by just three and five of the top 100 producers, respectively. Figure ES.2 summarizes the distribution of emissions among electric power producers.

Electric power producers' emission levels and emission rates vary significantly due to the amount of power produced, the efficiency of the technology used in producing the power, the fuel used to generate the power, and installed pollution controls.

FIGURE ES.2

Concentration of Air Emissions among All Electric Power Producers



In 2012, total generation among the 100 largest power producers ranged from 6.3 million to 232 million megawatt hours and:

- SO_2 emissions ranged from 0 to 312,683 tons, and SO_2 emission rates ranged from 0 to 7.2 pounds per megawatt hour;
- NOx emissions ranged from 0 to 112,520 tons, and NOx emission rates ranged from 0 to 3.5 pounds per megawatt hour;
- CO_2 emissions ranged from 0 to 141.2 million tons, and CO_2 emission rates ranged from 0 to 2,267.2 pounds per megawatt hour.
- Mercury emissions from producers with coal plants ranged from less than 1 to 4,395 pounds, and mercury emission rates ranged from 0.0002 to 0.089 pounds per gigawatt hours (GWh; a GWh is 1,000 megawatt hours).

Using this Report

The information in this report supports informed decision-making in several areas:

- It can be used by policymakers who are addressing the public health and environmental risks of SO_2, NOx, mercury, and CO_2 emissions.
- It can be used by the investment community to assess the costs and business risks associated with compliance with future additional emission reduction requirements.
- It can be used by electric power companies and the public to assess corporate performance relative to key competitors, prior years, and industry benchmarks.

Electric Industry Overview

Electric power production is essential to the growth and operation of the U.S. economy. The availability, reliability, and price of electricity have significant impacts on national economic output, energy security and quality of life. At the same time, the production of electricity from fossil fuels results in air pollution emissions that affect both public health and the environment.

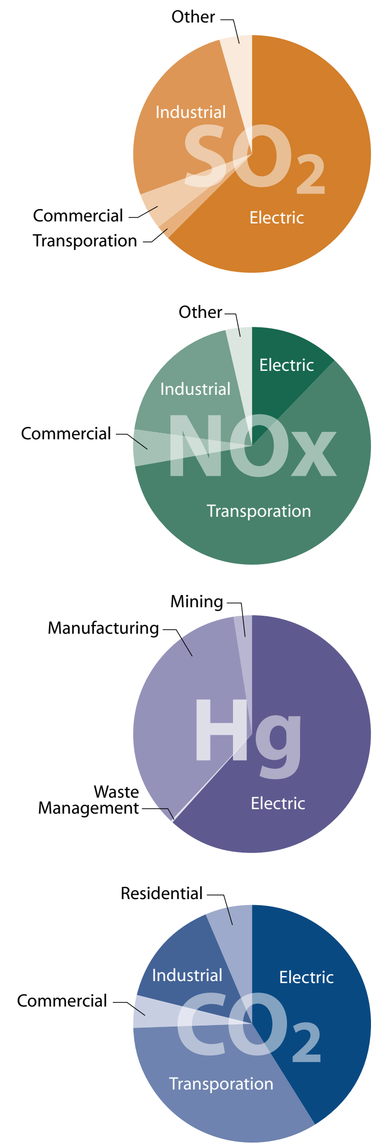
This report focuses on four power plant pollutants for which public emissions data are available: sulfur dioxide (SO_2), nitrogen oxides (NOx), mercury, and carbon dioxide (CO_2). Collectively, power plants are responsible for about 62 percent of SO_2 emissions, 13 percent of NOx emissions, 61 percent of mercury air emissions (among sources reporting to EPA's Toxics Release Inventory), and 37 percent of CO_2 emissions in the U.S.[2] The electric power industry accounts for more CO_2 emissions than any other sector, including the transportation and industrial sectors.

SO_2 and NOx emissions from power plants both contribute to acid rain, regional haze, and fine particle air pollution.[3] Acid rain damages trees and crops, acidifying soils, lakes, and streams. Fine particle air pollution can affect the heart and lungs through inhalation. Exposure to fine particle air pollution is linked to premature death and illness from respiratory disease and other ailments, particularly in children and the elderly. Regional haze impairs visibility, most notably at national parks. NOx emissions are also associated with nitrogen deposition and ground-level ozone. Nitrogen deposition can impair water quality by overloading a water body with nutrients. Ground-level ozone can also trigger serious respiratory problems.

Mercury air emissions from power plants deposited to lakes, ponds, and oceans are converted by certain microorganisms to a highly toxic form of the chemical known as methylmercury. Methylmercury then accumulates in fish, shellfish, as well as birds and mammals that feed on fish. Humans are exposed to mercury when they eat contaminated fish. Exposure to high levels of methlymercury is detrimental to the development of fetuses and young children.[4]

FIGURE 1

U.S. Electric Industry Contribution to Total Emissions



CO_2 is the most prevalent of anthropogenic (or human caused) greenhouse gas emissions. Greenhouse gases (or global warming pollutants) trap heat in the atmosphere and at elevated concentrations lead to global climate change. Climate change threatens public health due to more severe heat waves, exacerbation of ground-level ozone formation, and increases in extreme weather, such as floods and droughts.[5]

Because of their associated public health and environmental risks, SO_2, NOx, mercury, and now greenhouse gases, are regulated under the Clean Air Act

Sources of Power

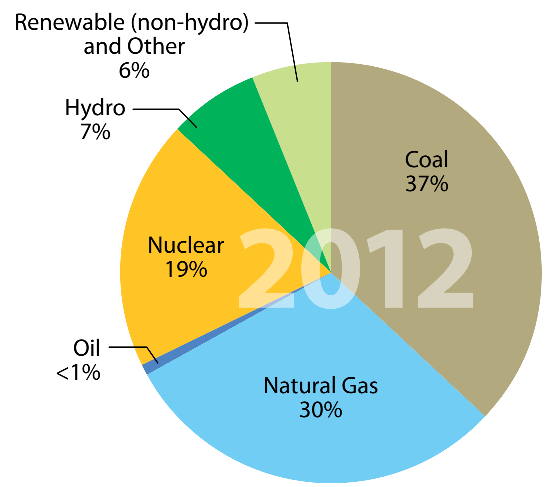
Over 6,400 power plants generate electricity in the U.S. In 2012, these plants generated approximately 4 billion megawatt hours of electricity. About 68 percent of this power was produced by burning fossil fuels (coal, natural gas, and oil) resulting in the release of SO_2, NOx, mercury, and CO_2 into the air. Coal accounted for about 37 percent of total power production, natural gas accounted for 30 percent, and oil's contribution was negligible, less than a third of a percentage point. Nuclear power, the largest non-fossil fuel energy source, generated 19 percent of U.S. electric power. Hydroelectricity accounted for almost 7 percent of total power production and non-hydroelectric renewables (such as wind turbines and solar photovoltaic cells) accounted for 4 percent. A variety of other fuel sources comprised the remaining 2 percent of generation.[6]

Coal-fired power plants are located across the nation, most predominantly in the midwestern and eastern parts of the country, with the heaviest concentrations of coal plants located along the Ohio and Mississippi Rivers. Natural gas plants are generally smaller than coal plants and are also spread across the country. The heaviest concentrations of natural gas-fired power plants are in Texas and Louisiana, near the Gulf of Mexico, and in California. Most large nuclear plants are located in eastern and upper-midwestern states, and most large hydroelectric facilities are in northwestern states.

Figure 3 plots the locations of the nation's major power plants, sized according to their electricity production in 2012 and colored based on their primary fuel type.

FIGURE 2

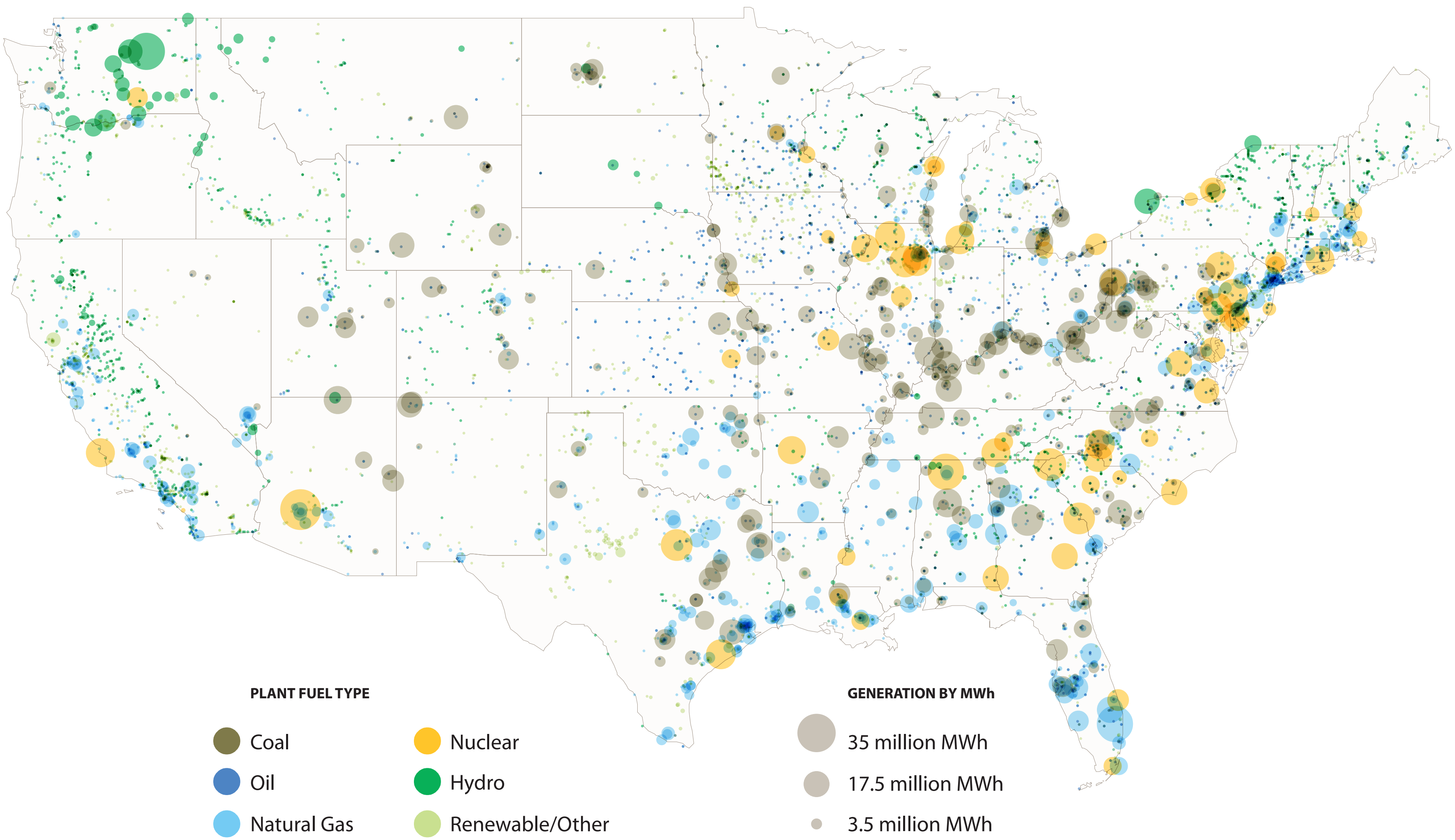
U.S. Electricity Generation by Fuel Type (2012)



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION. EIA-923 MONTHLY GENERATION AND FUEL CONSUMPTION 2012 FINAL RELEASE.

FIGURE 3

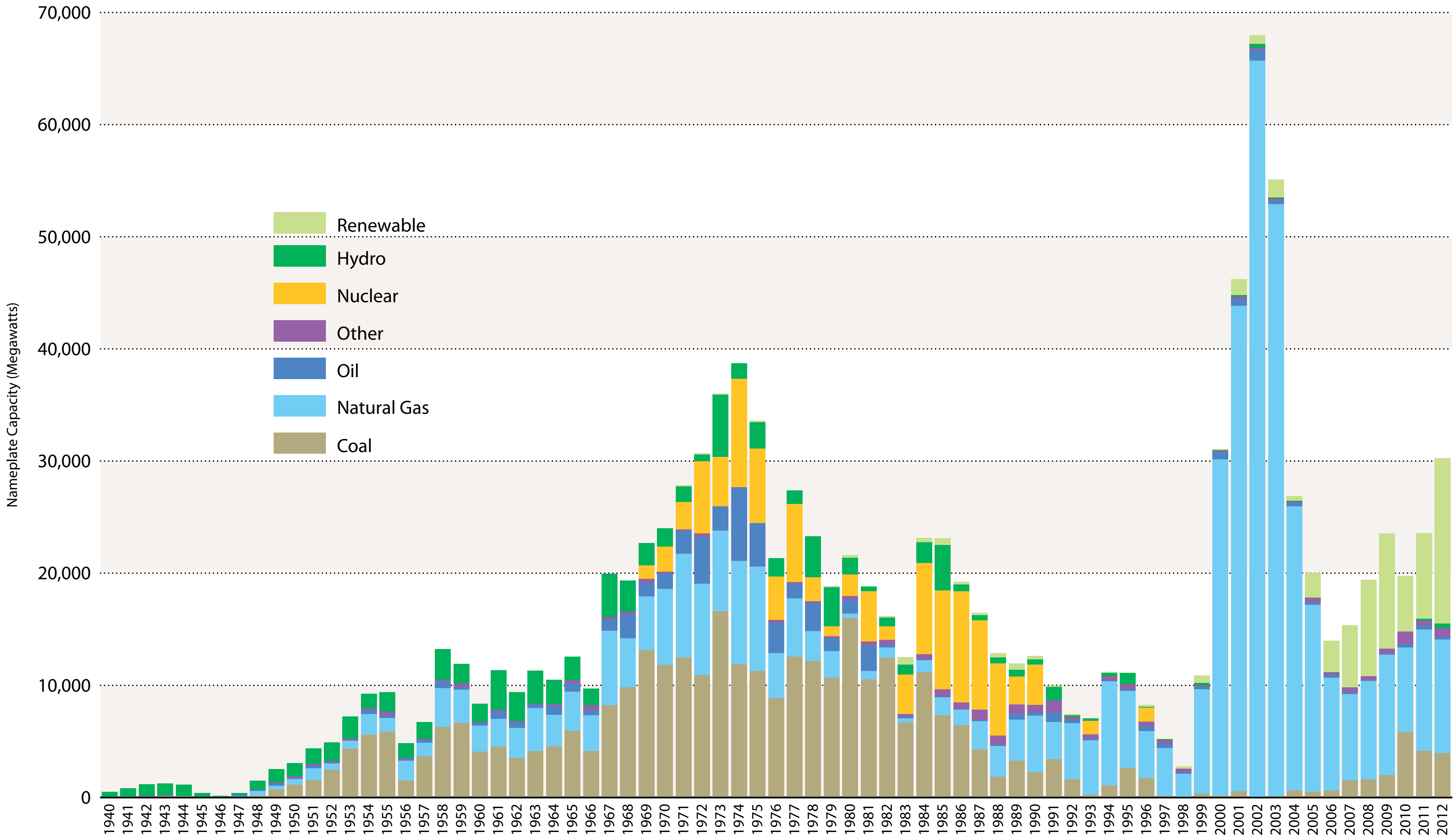
Location and Relative Size of U.S. Power Plants by Fuel Type



SOURCE: MJB&A ANALYSIS; VENTYX VELOCITY SUITE; U.S. ENERGY INFORMATION ADMINISTRATION: FORM EIA-923 (2012).

FIGURE 4

U.S. Electric Generating Capacity by In Service Year



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION. EIA-860 ANNUAL ELECTRIC GENERATOR REPORT. DECEMBER 4, 2013 (CORRECTION).

Power plant development in the U.S. has occurred in cycles with a dramatic spike in natural gas-fired power plant construction in the period from 2000-2005. Most coal-fired power plants were built before 1980. There was a wave of nuclear plant construction from the late 1960s to about 1990. Since 2005 some new coal-fired plants have come on-line, but most new capacity has been natural gas fired, with a significant amount of renewable energy capacity. Figure 4 presents the in-service year and fuel type of the existing electric generating fleet in the U.S.

Market Trends

The electric power industry is in a period of transition. In particular, electricity demand growth has been relatively flat (Figure 5) and natural gas prices have remained at low levels, leading to increased natural gas use within the electric sector. This shift in demand growth and fuel price dynamics is leading to consolidation within the industry and companies are rethinking some of their investment choices.

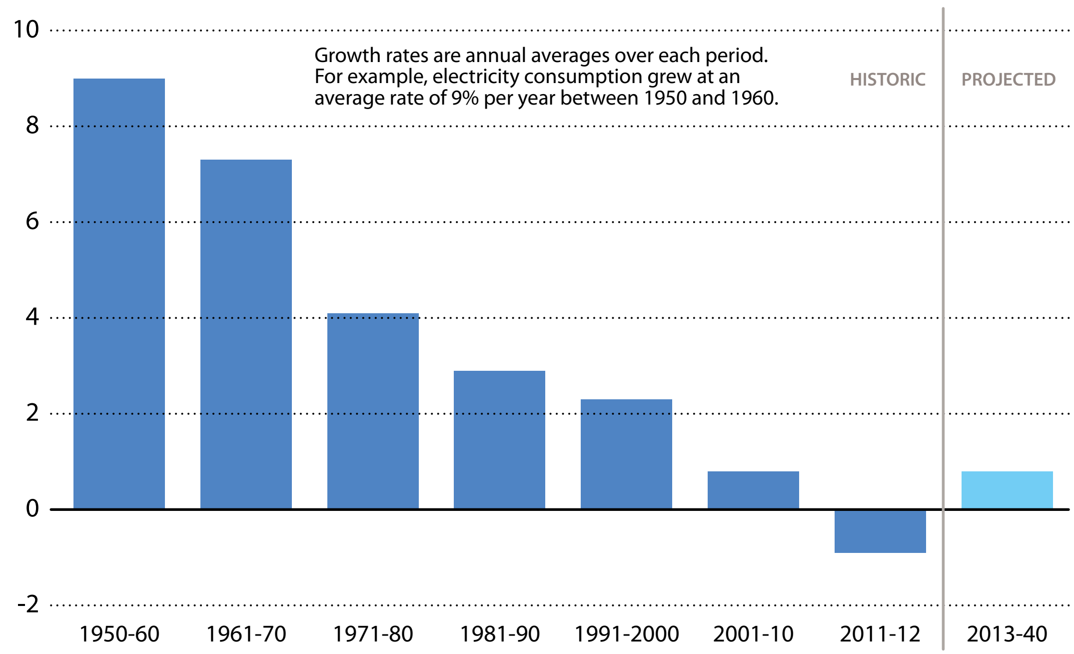
The following discussion highlights some of the key issues facing the electric power sector, including implications for future emissions trends.

Natural Gas Outlook

Electricity prices tend to reflect trends in fuel prices—particularly natural gas prices, because natural gas-fired power plants set the market price of electricity around much of the U.S., and fuel costs account for a majority of generators' variable costs of generation. In 2012, natural gas prices dipped below $2/MMBtu, a level not seen since 2001.

FIGURE 5

Historic and Projected U.S. Electricity Consumption Growth Rates
(% average annual growth rate)



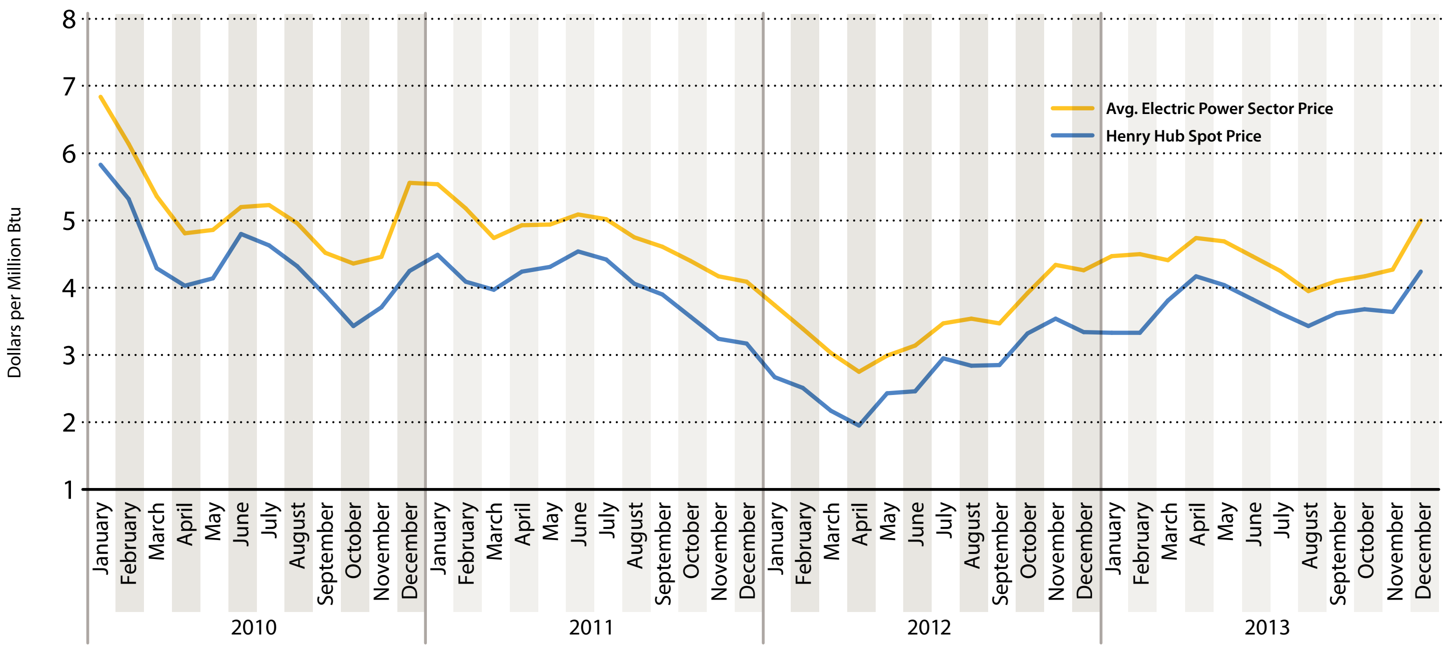
SOURCE: M. J. BRADLEY & ASSOCIATES ANALYSIS BASED ON U.S. ENERGY INFORMATION ADMINISTRATION DATA.

Although last year saw a slight uptick in prices, they remain very low and stable by historical standards. Figure 6 shows the modest recovery in natural gas prices (Henry Hub and delivered electric price) since April 2012. As a result, in 2013 total natural gas consumption in the U.S. reached a record high of over 26 trillion cubic feet.[7] The electric sector, a key driver of demand, has seen annual consumption of natural gas rise by nearly 60 percent over the past 10 years, to more than 8 trillion cubic feet.[8] As shown in Figure 7, natural gas combined-cycle power plants have been running more often in recent years, with average capacity factors increasing 40 to 47 percent between 2008 and 2013.

The United States has large reserves of natural gas and almost 90 percent of the natural gas consumed in the U.S. is produced domestically from both onshore and offshore drilling. Technological advances in horizontal drilling and hydraulic fracturing have allowed access to large volumes of shale gas that were previously

FIGURE 6

U.S. Natural Gas Prices
(dollars per million Btu)



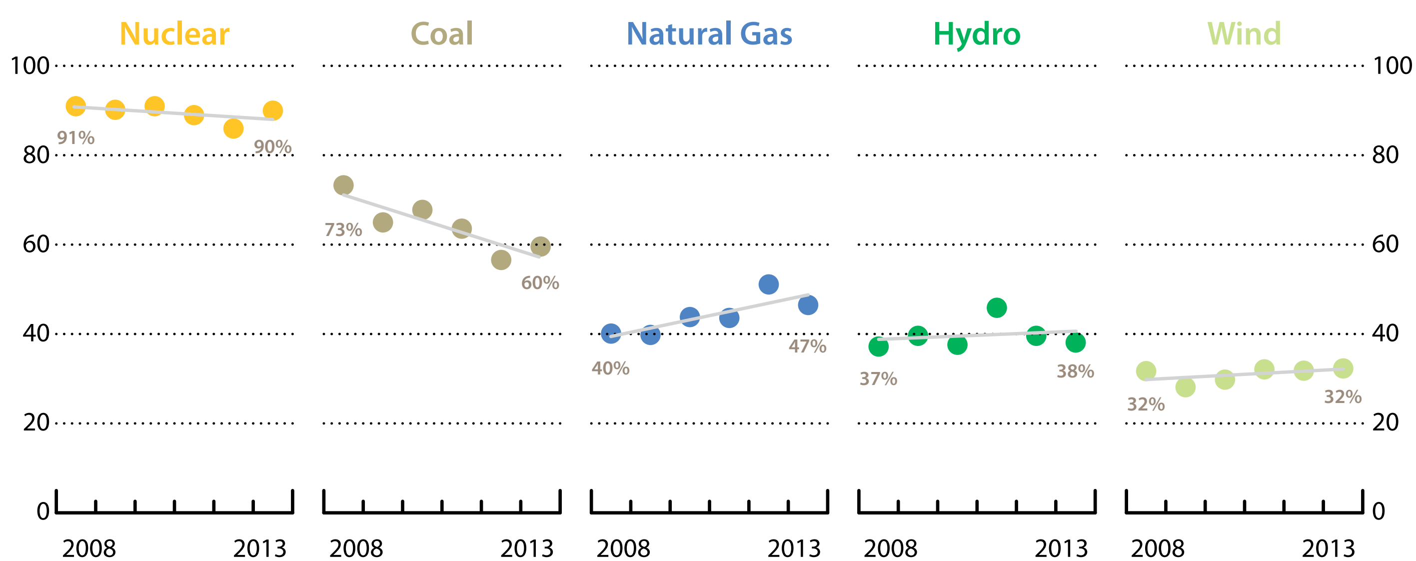
NOTE: ELECTRIC POWER PRICE IS THE DELIVERED PRICE OF GAS USED BY ELECTRICITY GENERATORS (REGULATED UTILITIES AND NON-REGULATED POWER PRODUCERS) WHOSE LINE OF BUSINESS IS THE GENERATION OF POWER.
SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION, U.S. NATURAL GAS ELECTRIC POWER PRICE, RELEASED MARCH 31, 2014 AND HENRY HUB SPOT PRICE, RELEASED APRIL 16, 2014.

uneconomical to produce. Shale gas refers to natural gas that is trapped within shale formations or fine-grained sedimentary rocks. Figure 8 shows the Department of Energy's projection of natural gas production in the U.S. The chart highlights the rapid growth in natural gas production over the past few years and the expectations of further growth over the coming decade. The chart also highlights the expanding role of shale gas in the nation's energy supply mix. States such as Pennsylvania and Arkansas have seen large increases in natural gas production. For example, Pennsylvania's natural gas production more than quadrupled between 2009 and 2011.[9]

Shale gas production through hydraulic fracturing has garnered significant attention due to concerns about potential drinking water contamination, air pollution emissions, and industrialization of areas with no previous history of large scale energy production. In August 2012, EPA finalized the first federal air

FIGURE 7

Annual Capacity Factors for Select Fuels and Technologies
(percent)



Capacity factors measure the extent to which a power plant is utilized over the course of time. The technical definition is the ratio of the electrical energy produced by a generating unit to the electrical energy that could have been produced assuming continuous full power operation. Nuclear plants have high utilization rates, consistently running at a 90 percent average capacity factor. Coal plant utilization has declined in recent years; the average annual capacity factor of coal plants in the U.S. dropped from 73 percent in 2008 to 60 percent in 2013, while over the same time period, natural gas combined-cycle capacity factors rose, from 40 to 47 percent. Hydropower and wind capacity factors are lower, but have also remained relatively constant over the past five years.

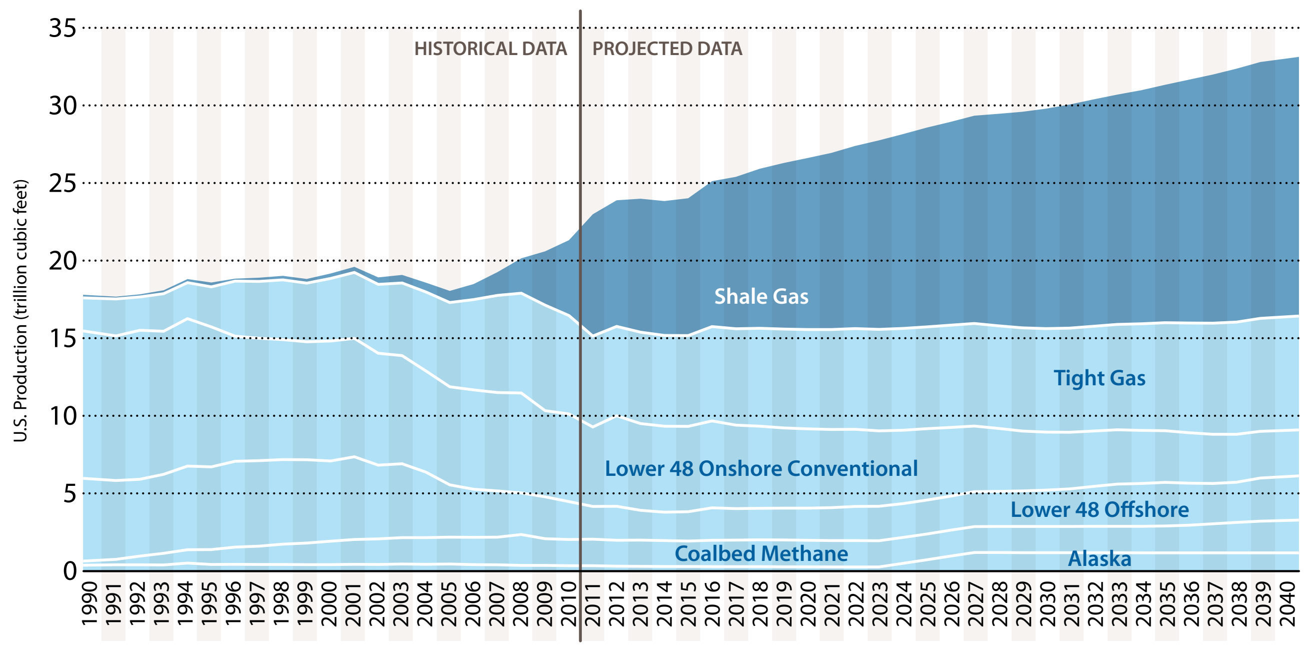
SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION. ELECTRIC POWER MONTHLY, TABLES 6.7A AND 6.7B. JANUARY 2014 standards for hydraulically fractured natural gas wells,[10] which will significantly reduce emission of volatile organic compounds (VOCs) and methane from new wells and other equipment in the oil and gas industry. Separately, the Bureau of Land Management is working to finalize regulations for hydraulic fracturing on federal lands, while EPA is scheduled to release a draft assessment of findings from its study on the impact of hydraulic fracturing on drinking water for public review and comment in December 2014. On March 28, 2014, the White House released the Climate Action Plan - Strategy to Cut Methane Emissions, outlining potential strategies to reduce methane emissions from oil and gas systems and other sources. Several states have also taken action to address concerns related to natural gas production. Colorado, for example, has finalized air pollution rules that regulate methane emissions from the sector.[11]

Coal Outlook

Large coal plants have traditionally supplied much of the U.S. baseload energy needs. These are facilities that run day in and day out on a near continuous basis throughout the year. However, electricity producers have announced a significant number of coal plant retirements over the past several years due to changing market conditions and other factors. Coal plants are also running less in response to lower demand and competition from other generating sources. As shown in Figure 7, the average annual capacity factor of coal plants in the U.S. dropped from 73 percent in 2008 to 60 percent in 2013. This trend is expected to continue creating both opportunities and challenges for the electric power system.

FIGURE 8

U.S. Natural Gas Production: 1990-2040 (Historic and Projected)
(trillion cubic feet)



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION. AEO2013. APRIL 2013.

Since January 2010, plant owners have announced about 60,000 megawatts of coal plant retirements. This represents roughly 18 percent of the nation's coal-fired generating fleet. About 16,000 megawatts of this capacity has already been shut down, and another 34,000 megawatts is scheduled to do so by year-end 2016.[12] Companies cite a variety of factors in their decisions to retire: (1) lower natural gas prices, which in turn translate to lower wholesale electricity prices; (2) rising coal prices; (3) lower demand for electricity; and (4) the costs associated with new environmental requirements.[13] Although most retiring units are smaller and higher emitting, the major retirement announcements of 2013 demonstrate that even larger, better controlled coal-fired power plants are at risk of retirement.

For example, as part of its new energy strategy adopted in 2010, the Tennessee Valley Authority (TVA) announced the retirement of eight coal fired power plants in November 2013.[14] Among these plants were two units at the Paradise Fossil Plant in western Kentucky that featured expensive and new pollution control technologies including cooling towers and wet limestone scrubbers that were updated in 2012. TVA plans to replace the 1,218 megawatts of generating capacity with a new natural gas-fired power plant.[15]

In October 2013, Energy Capital Partners announced the retirement of Brayton Point Power Station in Somerset, Massachusetts, New England's largest coal-fired power plant. Dominion, the previous owner of the plant, had invested $1.1 billion in pollution controls and cooling towers since 2005. Despite these recent investments in updated technology, the plant will retire in 2017.[16] The owner of the facility cites a weakening competitive position in the New England power market due to low natural gas prices among other factors in its decision to close the plant.[17]

In July, 2013, FirstEnergy announced the retirement of 1,728 megawatt Hatfield's Ferry Power Station in Greene County, Pennsylvania. This coal fired power

The Tennessee Valley Authority's (TVA) Paradise Coal Plant. Two of the coal units were announced for retirement in November 2013.
PHOTO CREDIT: TVA, HTTP://CREATIVECOMMONS.ORG/LICENSES/BY/2.0/LEGALCODE

plant uses supercritical technology and had scrubbers installed in 2009 as part of a $1.3 billion project to update pollution control technology at Hatfield's Ferry and another FirstEnergy plant.[18] Despite the investment in state-of-the-art pollution controls, the plant was retired in October of 2013.[19]

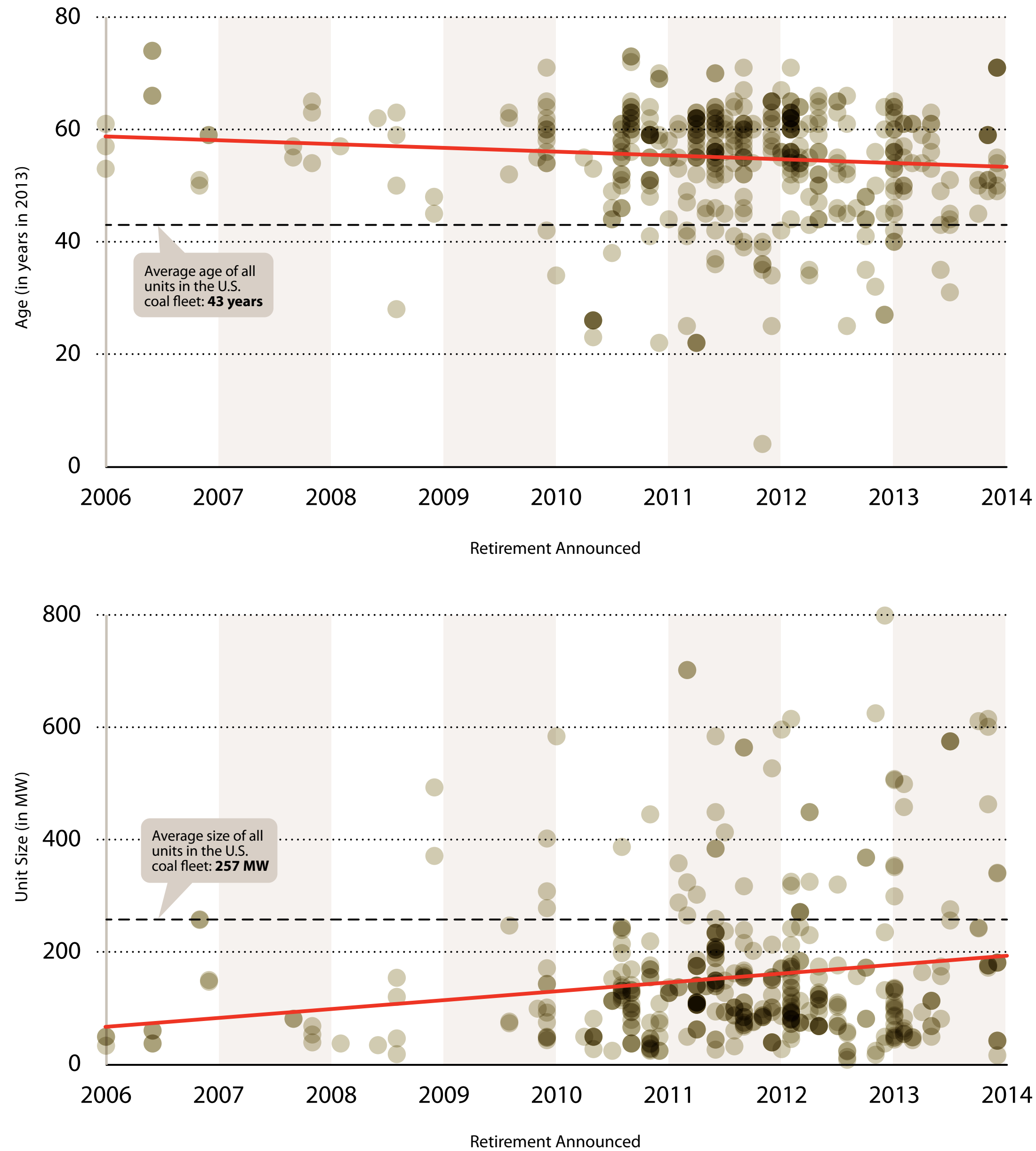
In contrast to the steady increase in natural gas-fired generation, coal-fired generation fell by 12 percent from 2010 to 2013. EIA's Annual Energy Outlook 2014 projects that coal generation will remain fairly constant throughout its forecast (i.e., through 2040), even with 50 gigawatts of coal plant retirements.[20]

Nuclear Outlook

Nuclear power has consistently made up approximately 20 percent of the total U.S. generation output.[21] However, with most nuclear plants built in the 1970s and 1980s, many plants in the U.S. are now close to 40 years old.[22] Assuming a life expectancy of about 60 years, this translates to 20 nuclear plants (around 18,000 megawatts[23]) in the U.S. ending operations in the next 20 years. However, given recent market conditions, industry analysts are projecting that many plants could retire before they reach 60 years of operation because of challenging economic factors.[24] In fact, many nuclear plants in the U.S. are reported to be operating at a net loss. In 2012 and 2013, four nuclear power plants announced plans to retire and five major uprates were cancelled.[25]

FIGURE 9

Average Age and Capacity of Retiring Coal Units
(dots represent existing coal units)



SOURCE: M. J. BRADLEY & ASSOCIATES. COAL RETIREMENT TRACKING DATABASE. MARCH 2014.

- Dominion's Kewaunee Power Station in Wisconsin shut down in May 2013 after almost 40 years in operation.[26]
- In February 2013, Duke Energy announced the retirement of the Crystal River plant in Florida's Gulf Coast.[27]
- Southern California Edison's San Onofre plant, located near San Clemente, California, also announced it would retire.[28] In June 2013, the plant permanently ceased operations and has since begun the decommissioning process.[29]
- In the summer of 2013, Entergy announced the 2014 retirement date of its Vermont Yankee plant which was licensed to operate until 2032.[30]

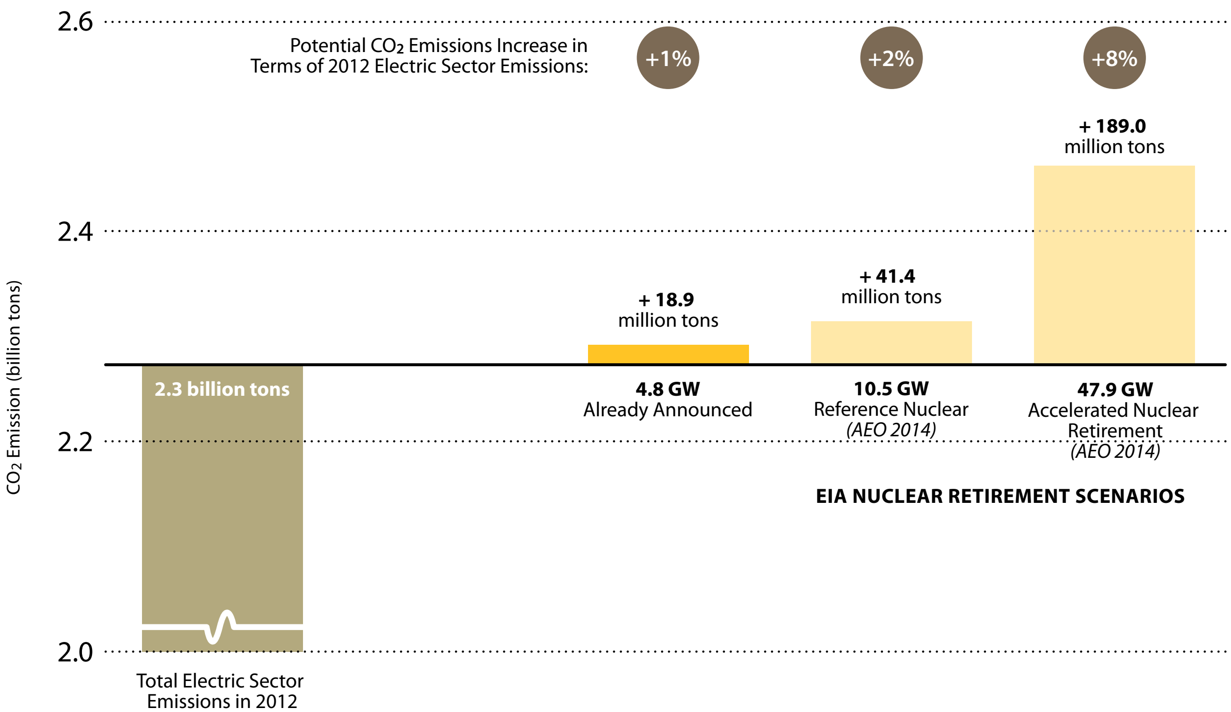
There are multiple factors contributing to the retirement of nuclear power plants. In some cases, plant-specific equipment issues have led to early retirement decisions. However, other factors have also been putting significant financial pressures on nuclear plants operating in competitive power markets and these pressures have increased in recent years.[31] In particular, wholesale energy prices have declined in recent years due to a combination of factors, including reduced electricity demand, lower natural gas prices, and increased penetration of renewable energy.[32] Lower wholesale energy prices can benefit consumers, but can also hurt the economics of all electric power generators. Nuclear plants, which are designed for continuous baseload operation, cannot cycle their electricity output during periods when wholesale power prices decline to levels below their production costs.[33]

As more nuclear plants are at risk of retirement in the coming decade, this could set back efforts to reduce CO_2 emissions within the electric power sector. Nuclear power plants account for about 60 percent of zero carbon emitting sources in the U.S. The four nuclear plants (4.2 gigawatts) that announced plans to retire in 2012 and 2013 together were capable of producing more than 34 million megawatt hours of electricity per year. Replacing this generation output with a natural gas combined cycle facility would increase CO_2 emissions by 17 million tons per year. To the extent that this lost capacity is replaced by zero-emitting resources, these emissions increases can be avoided or mitigated. For example, California's Public Utility Commission issued a plan this spring to replace two-thirds of San Onofre's output with carbon-free efficiency and renewable energy.

Further nuclear plant closures could lead to further CO_2 emissions increases; however, depending on the stringency, some portion of these emission increases could be mitigated by an effective national policy to limit CO_2 emissions. Figure 10, illustrates the potential for emission increases due to recent and future nuclear unit retirements, based on modeling scenarios that do not assume a federal CO_2 policy.

FIGURE 10

Potential Annual CO_2 Emissions Increases from Nuclear Retirements



NOTE: : The nuclear retirement projections are based on EIA scenarios that assume no national emission limits for CO_2 from power plants. The CO_2 emission estimates assume a 90% capacity factor for nuclear plants and that fossil generation with an emission rate of 1,000 lb/MWh (EPA's proposed emission standard for new gas turbine power plants) replaces the lost output. Nuclear capacity retirements are based on already announced retirements (expected to retire by 2020) and two scenarios from EIA's Annual Energy Outlook (AEO 2014). The AEO 2014 scenarios assume incremental nuclear retirements of 5.7 GW under the Reference scenario (projected by the model to occur between 2012 and 2019) and an additional 37.4 GW under the Accelerated Nuclear scenario (projected by the model to occur between 2029 and 2040).

Renewable Energy Outlook

Renewable energy (excluding large hydroelectric projects) accounted for nearly 4 percent of U.S. electricity generation in 2012. Although total electricity generation has decreased modestly since 2010, renewable energy electricity generation has increased by over 50 million megawatt hours, a 31 percent increase between 2010 and 2012.[34]

Wind energy remains the largest source of non-hydroelectric renewable energy. In 2012, the U.S. wind energy industry experienced record growth, adding over 13,000 megawatts of new wind power capacity, bringing the nation's cumulative total to over 60,000 megawatts. Nine states, including top producers Iowa, South Dakota and North Dakota, produced more than 10 percent of their electricity output from wind power in 2012 compared with only one state in 2007.[35] Resource and incentive limitations continue to leave southeast wind penetration levels virtually unchanged. However, all other regions experienced an increase

Winter view of the 377 megawatt (nominal) Ivanpah solar electric generating station in California. The system uses computer-controlled mirrors to track the sun and reflect the sunlight to boilers that sit atop 459 foot tall towers, creating superheated steam for electricity generation.
PHOTO CREDIT: IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

in capacity with the recent capacity additions. High wind capacity in the ERCOT (Texas), Colorado, and the Midwest ISO areas have led to record high contributions by wind to the total grid mix; Xcel Energy, for example, reported greater than 50 percent of its total Colorado load being served by wind for a period of time in April 2012. System operators have been forced to adjust market operations to account for the variability of wind and the prominent role it now plays in these regions.

Solar energy also continues to expand with record growth in 2013. The U.S. installed 4,751 megawatts of solar photovoltaic (PV) capacity in 2013; 41 percent higher than what was added in 2012.[36] The U.S. also added 410 megawatts of concentrating solar (CSP) in 2013.[37] At the end of 2013 there were more than 440,000 operating solar electric systems in the U.S. totaling over 12,000 megawatts of PV and 918 megawatts of CSP. [38]

The key question for the renewable energy sector is what incentives will be available in the U.S. after 2013. The production tax credit (PTC) for renewable energy expired at the end of 2013. However, changes made to the PTC when it was last extended in January 2013 allowed any project that started construction by the expiration date to receive the tax credits (previously, the project had to be producing electricity by the deadline). This means that some projects in progress will continue to benefit from the incentive beyond the deadline. As of June 2013, there were at least 1,132 megawatts of wind energy projects already under construction and requests for new projects due in the second half of 2013 promise 1,300 megawatts of additional new capacity to be constructed.[39] The wind energy industry is projected to continue at least modest expansion even in the absence of federal tax credits due to competitive wind prices in certain regions and projects already under construction that will still receive tax credits.

Energy Efficiency Outlook

Energy efficiency is widely recognized to be a low cost energy resource that reduces emissions by avoiding the need for additional energy production. According to the American Council for an Energy-Efficient Economy, utilities can generate electricity savings at an average cost of 2.5 cents per kilowatt hour.[40] Results from energy efficiency programs have confirmed this. ISO New England reports average costs ranging from 2 to 4 cents per kilowatt hour through energy efficiency programs in the New England states, which have some of the highest levels of spending on energy efficiency.[41] The average retail price of electricity in the U.S. is about 10 cents per kilowatt hour.

Ratepayer-funded energy efficiency program budgets throughout the United States have increased between 2011 and 2012.[42] Utility companies employ programs such as efficiency audits, discounts on energy efficient equipment, rebates to consumers, and financial assistance to companies engaged in energy saving projects in order to encourage energy savings. U.S. state budgets for electricity and natural gas efficiency programs have continued to increase modestly, totaling over $8.2 billion in 2012 compared to $8 billion in 2011.[43] California, New York, Massachusetts, New Jersey, and Florida had the largest budgets in 2012, together accounting for about half of the nation's budget.[44] In June 2013, Connecticut passed a new energy bill which calls for a 100 percent increase in energy efficiency funding.[45] Analysts predict the energy efficiency market will expand in the next decade, featuring growth in the Midwest and Southeast regions which currently have lower budgets for electricity efficiency programs.[46]

Electricity savings due to efficiency programs were estimated to equal 21,478 gigawatt hours in 2012.[47] These savings totaled slightly less than the electricity consumption of the state of New Mexico in 2012.[48]

In competitive power markets, market operators have been encouraging an expanded role for energy efficiency. In PJM and ISO New England, for example, energy efficiency competes with generating facilities to meet the region's future capacity needs. Energy efficiency resources that exceed current building codes or appliance standards are eligible to participate in the region's forward capacity auction. More than 1,000 megawatts of energy efficiency resources cleared the PJM auction in 2013, making them eligible for capacity payments.[49]

State governments have also been encouraging expanded investment in energy efficiency. Twenty-three states and Washington D.C. currently have Energy Efficiency Resource Standards (EERS) or similar requirements for utilities to invest in efficiency, covering 104.6 million electric customers at the end of 2012.[50] Massachusetts ranked first in ACEEE's 2013 State Energy Efficiency Scorecard, with its Green Communities Act serving as a strong influence for investments in energy efficiency. Along with Massachusetts, California, New York, Oregon, and Connecticut had the highest rankings for their strong energy efficiency policies.[51]

At the federal level, appliance efficiency standards have resulted in increasing energy savings. For example, the Energy Independence and Security Act of 2007 strengthened energy efficient product procurement, including new standards for ten appliances. In particular, the Act imposed efficiency standards for general use light bulbs. In 2012 and 2013, 100-watt and 75-watt traditional incandescent bulbs were retired, respectively, and beginning in 2014, 60-watt and 40-watt bulbs are also required to meet new efficiency standards. The legislation will continue to encourage the increased usage of LED lighting and compact florescent bulbs which use approximately 75 percent less energy than traditional incandescent light bulbs.[52]

Environmental Regulatory Trends

The electric generating sector currently faces numerous regulations related to air quality and climate change. As detailed in this report, fossil fuel-fired power plants, particularly coal-fired power plants, are a significant source of SO_2, NOx, CO_2, mercury, and other hazardous air pollutants. These power plant emissions are controlled through several statutory and regulatory programs. As these regulatory programs continue to evolve, they will have important implications for public health, for the mix of U.S. generating resources, and for economic growth by driving investment in new and cleaner technologies and encouraging some of the more inefficient and higher polluting plants to retire. The discussion below provides a snapshot of the major environmental regulatory programs facing the electric generating sector.

Regulation of Greenhouse Gases under the Clean Air Act

On December 7, 2009, EPA signed the greenhouse gas endangerment finding in response to the U.S. Supreme Court's 2007 decision in Massachusetts v. EPA. This finding constituted an official determination by EPA that greenhouse gas emissions endanger public health and welfare, which set the stage for EPA to establish the first-ever federal vehicle emissions standards for greenhouse gases. EPA finalized emissions standards for new light-duty motor vehicles (in coordination with Department of Transportation fuel economy standards) for 2012-2016 model year vehicles in 2010, followed by a rulemaking for 2017-2025 vehicles in 2012, as well as standards for medium- and heavy-duty vehicles in 2011. Additionally, on May 13, 2010, EPA issued its final "Tailoring Rule" setting air permitting requirements for large stationary sources of greenhouse gas emissions under the so-called Prevention of Significant Deterioration (PSD) and Title V permitting requirements of the Clean Air Act. The U.S. Court of Appeals for the D.C. Circuit upheld EPA's authority to regulate greenhouse gases in 2012.

In September 2013, EPA reproposed a New Source Performance Standard limiting greenhouse gas emissions from new fossil-fired power plants, withdrawing its initial proposal from April 2012. The new proposal would establish separate standards for new coal-fired boilers and natural gas combustion turbines, and would require new power plants to meet a greenhouse gas emission rate comparable to a new combined-cycle power plant, a limit that would essentially prevent the construction of new coal-fired power plants without carbon capture and storage technology.

By promulgating the standards for new plants, EPA also triggered a legal obligation to promulgate an additional rule under section 111(d) of the Clean Air Act that would limit greenhouse gas emissions from existing power plants. The President directed EPA to propose such a rule by June 2014, and finalize it by June 2015.

Cross-State Air Pollution Rule

In 2005, EPA issued the Clean Air Interstate Rule (CAIR), building on progress made under the NOx SIP Call to reduce the transport of ozone and fine particulates (PM2.5) in the eastern U.S. CAIR required that 28 eastern states and the District of Columbia that contribute to ozone and/or PM2.5 nonattainment problems in downwind states achieve further reductions in SO_2 and NOx emissions from power plants and/or other sources.

The D.C. Circuit vacated CAIR in 2008, but left the program in place until EPA issued a replacement rule. On July 7, 2011, EPA published its final rule replacing CAIR, called the Cross-State Air Pollution Rule (CSAPR), which would limit SO_2 and/or NOx emissions from power plants in 28 states. In August 2012, the D.C. Circuit vacated the rule, in response to litigation from a number of states, utilities, and industry groups. EPA challenged the ruling, and the Supreme Court agreed to review the decision. On April 29, 2014 the Supreme Court upheld CSAPR, reversing the D.C. Circuit's 2012 decision striking down the rule. The decision is now remanded back to the D.C. Circuit for further proceedings consistent with the Supreme Court's opinion. CAIR remains in place until the D.C. Circuit lifts its vacatur of the rule.

Mercury and Other Hazardous Air Pollutants

Section 112 of the Clean Air Act requires EPA to regulate emissions of hazardous air pollutants, including mercury, nickel, arsenic, acid gases, and other toxic pollutants, through the establishment of maximum achievable control technology (MACT) standards. In December 2011, EPA released the first-ever federal limits on hazardous air pollutants from coal-fired power plants, known as the Mercury and Air Toxics Standards (MATS). These standards replace the 2005 Clean Air Mercury Rule, which was vacated by the D.C. Circuit in 2008, and require overall reductions in mercury emissions of 90 percent, as well as reductions in acid gases and particulate matter. The rule is expected to drive investment in new generation as well as installation of emission control retrofits, such as mercury controls, scrubbers, and particulate filters. Affected facilities are generally required to comply with the standards for hazardous air pollutants by 2015; however, the rule allows for compliance extensions until 2016 on a case-by-case basis. Many plants have already been approved for such extensions, either to provide extra time to install controls or to retire. The rule was challenged in court by multiple states, companies, and industry groups. However, on April 15, 2014, the U.S. Court of Appeals for the D.C. Circuit upheld the rule, denying the petitioners' arguments to change or overturn the rule.

FIGURE 11

Comparison of CAIR Emissions Budgets and Actual Reported Emissions

Annual NOx
('000 ton; 2012)

CAIR Region	Annual NOx (ton)	Deficit Surplus
Observed Emissions	1,245,252	
Budget (2009/10 to 2014)	1,521,707	22% (surplus)
Budget (2015–)	1,268,091	2% (surplus)

Ozone Season NOx
('000 ton; 2012)

CAIR Region	OS NOx (ton)	Deficit Surplus
Observed Emissions	517,954	
Budget (2009/10 to 2014)	565,185	9% (surplus)
Budget (2015–)	481,947	-7% (deficit)

Annual SO_2
('000 ton; 2012)

CAIR Region	Annual SO_2 (ton)	Deficit Surplus
Observed Emissions	2,788,743	
Budget (2009/10 to 2014)	3,619,196	30% (surplus)
Budget (2015–)	2,533.434	-9% (deficit)

SOURCE: ANALYSIS BY M. J. BRADLEY & ASSOCIATES; U.S. EPA CLEAN AIR MARKETS DATA.
NOTE: ON NOVEMBER 3, 2009, EPA STAYED THE EFFECTIVENESS OF CAIR AND THE ASSOCIATED CAIR FIP FOR MINNESOTA ONLY.

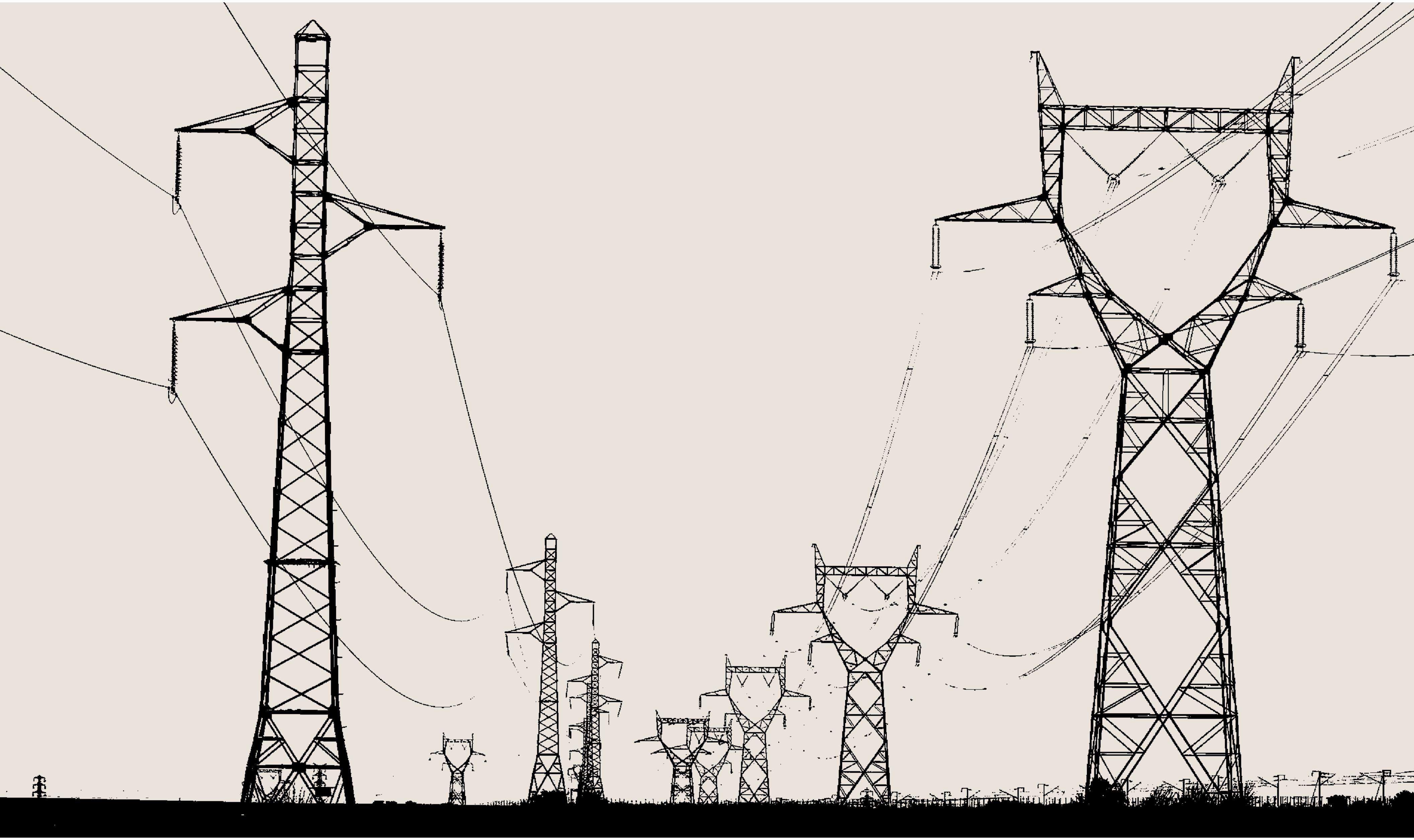
Coal Ash Waste, Cooling Water Intake Structures, and Effluent Limitation Guidelines

In addition to the air quality and climate change regulations that are under consideration at the federal level, the EPA is also considering possible changes to waste and water quality regulations that could have major cost implications for the electric industry.

The large coal ash spill at the Tennessee Valley Authority's Kingston Power Plant in 2008 brought national attention to the challenges associated with the storage and disposal of coal combustion byproducts. On June 21, 2010, EPA proposed two options to regulating coal ash disposal under the Resource Conservation and Recovery Act (which governs solid waste disposal). The options proposed are to regulate coal ash as either hazardous or non-hazardous waste. EPA has not stated when the proposal will be finalized, although the D.C. Circuit has taken steps toward setting a deadline.

Many large power plants, including fossil and nuclear facilities, use water from lakes, rivers, and oceans to dissipate surplus heat generated in the production of electricity. In a "once-through" cooling system, millions of gallons of water are withdrawn each day, run through the plant, and discharged back to the environment. Section 316(b) of the Clean Water Act requires cooling water intake structures to reflect the "best technology available" for minimizing adverse environmental impacts associated with the intake of cooling water. In April 2011, EPA proposed new regulations governing cooling water intake structures at existing power plants. On May 19, 2014, EPA released the final 316(b) regulation.

EPA also sets technology-based standards for discharges into water by the electric generating sector. These effluent limitation guidelines (ELGs) include limits on discharges from various sources within the sector, including coal ash storage ponds and pollution control technologies. These ELGs were last revised in 1982. EPA proposed revisions to the ELGs in April 2013, and they are expected to be finalized in 2014.



Emissions of the 100 Largest Electric Power Producers

In 2012, the 100 largest power producers in the U.S. generated 86 percent of the nation's electricity supply and 87 percent of the industry's air pollution emissions. Table 1 lists the 100 largest electric power producers in order of their total 2012 electric generation in megawatt hours. The three largest producers were responsible for 17 percent of the 3.5 billion megawatt hours of electricity generated by the 100 largest producers. The 100 largest power producers emitted in aggregate, approximately 3 million tons of SO_2, 1.5 million tons of NOx, 21 tons of mercury, and 2 billion tons of CO_2. The top three producers were responsible for 15 percent of the SO_2, 12 percent of the NOx, 9 percent of the mercury, and 13 percent of the CO_2 emissions of the 100 largest producers.

The average and median emission levels (tons) and emission rates (lb/MWh) shown in Table 1 provide benchmark measures of overall industry emissions that can be used as reference points to evaluate the emissions performance of individual power producers.

Across the industry, power plant emissions of SO_2 and NOx have decreased and CO_2 emissions have increased since 1990. In 2012, power plant SO_2 and NOx emissions were 79 percent and 74 percent lower, respectively, than they were in 1990. In 2012, power plant CO_2 emissions were 13 percent higher than they were in 1990. In recent years, from 2008 through 2012, power plant CO_2 emissions decreased by 13 percent. Mercury emissions from power plants have decreased 51 percent since 2000 (the first year that mercury emissions were reported by the industry under the Toxics Release Inventory).

TABLE 1

Emissions Data for 100 Largest Power Producers
in order of 2012 generation

			2012 Generation (MWh)			2012 Emissions (tons)				Emission Rates (lb/MWh)									
										All Generating Sources			Fossil Fuel Plants †			Coal Plants ††			
Rank	Owner	Ownership Type	Total	Fossil Fuel	Coal	SO_2	NOx	CO_2	Hg*	SO_2	NOx	CO_2	SO_2	NOx	CO_2	SO_2	NOx	CO_2	Hg†††
1	Duke	investor-owned corp.	231,651,968	160,639,617	100,914,257	213,024	99,653	134,277,330	0.67	1.8	0.9	1,159	2.6	1.2	1,672	4.2	1.9	2,119	0.01
2	Exelon	investor-owned corp.	192,607,692	32,551,267	7,774,428	15,296	14,791	19,632,361	0.09	0.2	0.2	204	0.9	0.9	1,206	3.9	3.3	2,012	0.02
3	Southern	investor-owned corp.	175,262,917	140,737,150	65,533,834	213,429	68,543	104,586,955	1.35	2.4	0.8	1,193	3.0	1.0	1,484	6.5	2.0	2,199	0.04
4	NextEra Energy	investor-owned corp.	170,305,651	106,479,642	4,969,297	10,797	19,255	50,603,271	0.04	0.1	0.2	594	0.2	0.4	950	3.2	2.0	2,276	0.02
5	AEP	investor-owned corp.	163,368,015	143,621,070	118,582,788	312,683	112,520	141,226,882	1.96	3.8	1.4	1,729	4.4	1.6	1,967	5.3	1.7	2,136	0.03
6	Tennessee Valley Authority	federal power authority	144,629,635	81,096,895	63,637,611	140,601	54,443	77,354,100	0.68	1.9	0.8	1,070	3.5	1.3	1,908	4.4	1.7	2,179	0.02
7	Entergy	investor-owned corp.	129,473,500	52,237,170	14,198,178	48,832	44,361	38,197,909	0.38	0.8	0.7	590	1.9	1.7	1,460	6.9	2.4	2,291	0.05
8	Calpine	investor-owned corp.	113,100,123	106,539,835	-	303	8,133	46,588,292	-	0.0	0.1	824	0.0	0.2	871	-	-	-	-
9	FirstEnergy	investor-owned corp.	103,305,344	71,756,986	67,144,185	127,886	80,663	74,638,484	1.00	2.5	1.6	1,445	3.6	2.2	2,080	3.7	2.4	2,129	0.03
10	Dominion	investor-owned corp.	100,365,613	51,242,184	24,969,129	49,916	30,078	38,998,412	0.25	1.0	0.6	777	1.9	1.2	1,522	3.9	2.2	2,159	0.02
11	NRG	investor-owned corp.	96,653,635	86,572,457	57,227,121	187,622	58,677	80,117,490	1.14	3.9	1.2	1,658	4.3	1.4	1,851	6.5	1.8	2,219	0.04
12	MidAmerican	privately held corp.	89,090,054	70,101,441	61,773,074	83,796	75,627	72,719,467	0.91	1.9	1.7	1,632	2.4	2.2	2,075	2.7	2.4	2,228	0.03
13	PPL	investor-owned corp.	85,139,682	65,461,096	54,625,698	114,899	70,601	65,002,197	0.76	2.7	1.7	1,527	3.5	2.2	1,986	4.2	2.5	2,178	0.03
14	US Corps of Engineers	federal power authority	76,522,954	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	Xcel	investor-owned corp.	73,518,713	59,380,824	42,479,509	71,809	51,468	56,040,552	0.62	2.0	1.4	1,525	2.4	1.7	1,887	3.4	2.2	2,208	0.03
16	Energy Future Holdings	privately held corp.	70,482,556	50,585,632	49,149,851	166,431	31,430	60,215,174	2.20	4.7	0.9	1,709	6.6	1.2	2,381	6.8	1.2	2,403	0.09
17	Ameren	investor-owned corp.	69,114,135	57,343,473	55,357,646	117,193	32,923	63,229,827	0.83	3.4	1.0	1,830	4.1	1.1	2,205	4.2	1.2	2,242	0.03
18	PSEG	investor-owned corp.	53,332,175	23,536,334	5,183,635	8,715	9,772	13,809,870	0.07	0.3	0.4	518	0.7	0.8	1,173	3.3	3.2	2,051	0.03
19	US Bureau of Reclamation	federal power authority	49,785,503	3,813,136	3,810,257	1,057	3,952	3,936,671	0.07	0.0	0.2	158	0.6	2.1	2,065	0.6	2.1	2,065	0.03
20	DTE Energy	investor-owned corp.	40,658,284	34,321,586	32,534,162	128,919	37,070	37,442,131	0.72	6.3	1.8	1,842	7.5	2.1	2,182	7.9	2.2	2,228	0.04
21	Dynegy	investor-owned corp.	40,563,204	40,563,204	19,843,053	28,725	10,854	31,331,905	0.09	1.4	0.5	1,545	1.4	0.5	1,545	2.9	1.0	2,251	0.01
22	AES	investor-owned corp.	38,835,825	36,027,588	32,251,317	82,222	31,698	37,831,515	0.48	4.2	1.6	1,948	4.6	1.8	2,100	5.1	1.9	2,175	0.03
23	GDF Suez	foreign-owned corp.	36,576,048	35,020,994	8,812,460	22,063	8,463	23,095,465	0.30	1.2	0.5	1,263	1.3	0.5	1,317	5.0	1.4	2,251	0.07
24	Edison Mission Energy	privately held corp.	32,240,099	26,863,086	21,929,134	53,247	12,923	27,869,026	0.11	3.3	0.8	1,729	4.0	1.0	2,070	4.9	1.2	2,390	0.01
25	PG&E	investor-owned corp.	31,842,020	6,307,184	-	13	135	2,731,788	-	0.0	0.0	172	0.0	0.0	866	-	-	-	-
26	Pinnacle West	investor-owned corp.	28,735,733	19,334,819	11,943,396	8,858	23,820	16,429,640	0.23	0.6	1.7	1,143	0.9	2.5	1,699	1.5	3.9	2,198	0.04
27	General Electric	investor-owned corp.	27,906,432	27,619,528	9,982,178	99,909	11,284	18,342,449	0.24	7.2	0.8	1,315	7.2	0.8	1,328	20.0	2.1	2,144	0.05
28	Great Plains Energy	investor-owned corp.	27,540,664	23,199,114	22,578,062	23,816	15,797	24,886,806	0.24	1.7	1.1	1,807	2.1	1.4	2,145	2.1	1.4	2,162	0.02
29	Energy Capital Partners	privately held corp.	26,777,986	26,777,986	-	61	1,499	12,045,879	-	0.0	0.1	900	0.0	0.1	900	-	-	-	-
30	San Antonio City	municipality	26,637,386	19,219,749	13,076,523	10,433	6,723	16,905,591	0.10	0.8	0.5	1,269	1.1	0.7	1,759	1.6	0.8	2,122	0.02
31	OGE	investor-owned corp.	26,375,474	24,781,915	13,650,034	37,706	30,063	22,044,680	0.22	2.9	2.3	1,672	3.0	2.4	1,779	5.5	3.5	2,344	0.03
32	Salt River Project	power district	26,156,031	20,429,375	15,105,910	5,875	22,373	18,861,147	0.18	0.4	1.7	1,442	0.6	2.2	1,846	0.8	2.9	2,206	0.02
33	Westar	investor-owned corp.	25,452,651	21,120,692	18,950,155	15,353	19,549	23,630,640	0.39	1.2	1.5	1,857	1.5	1.9	2,238	1.6	1.9	2,350	0.04
34	Oglethorpe	cooperative	25,109,426	14,926,936	7,549,256	15,149	5,765	11,609,069	0.05	1.2	0.5	925	2.0	0.8	1,555	4.0	1.4	2,184	0.01
35	New York Power Authority	state power authority	25,020,761	4,827,395	-	12	244	2,205,688	-	0.0	0.0	176	0.0	0.1	914	-	-	-	-
36	SCANA	investor-owned corp.	24,879,650	19,526,909	12,019,599	27,891	9,735	15,998,957	0.06	2.2	0.8	1,286	2.9	1.0	1,639	4.6	1.5	2,101	0.01
37	Santee Cooper	state power authority	23,369,755	20,605,923	15,847,224	13,521	6,970	18,661,167	0.09	1.2	0.6	1,597	1.3	0.7	1,811	1.7	0.8	2,052	0.01
38	NV Energy	investor-owned corp.	21,839,064	21,827,135	3,478,529	2,878	5,423	11,723,976	0.06	0.3	0.5	1,074	0.3	0.5	1,074	1.6	2.4	2,252	0.04
39	CMS Energy	investor-owned corp.	21,246,994	20,139,484	14,134,206	45,823	16,850	18,527,325	0.34	4.3	1.6	1,744	4.5	1.6	1,798	6.4	2.2	2,213	0.05
40	Wisconsin Energy	investor-owned corp.	19,922,340	18,911,547	13,648,277	12,501	9,697	18,599,651	0.18	1.3	1.0	1,867	1.3	1.0	1,967	1.8	1.4	2,378	0.03
41	Edison International	investor-owned corp.	19,837,647	11,468,834	4,736,148	3,871	13,751	8,084,204	0.07	0.4	1.4	815	0.7	2.4	1,410	1.6	5.7	2,191	0.03
42	Basin Electric Power Coop	cooperative	18,505,623	17,429,225	17,253,669	56,393	23,423	20,267,828	0.47	6.1	2.5	2,190	6.5	2.7	2,326	6.5	2.7	2,338	0.05
43	TECO	investor-owned corp.	18,307,844	18,307,844	10,677,804	10,058	5,508	15,002,416	0.02	1.1	0.6	1,639	1.0	0.6	1,639	1.7	0.9	2,163	0.00
44	EDF	foreign-owned corp.	18,073,060	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45	Alliant Energy	investor-owned corp.	18,054,859	16,615,030	14,095,636	51,340	15,727	17,686,813	0.41	5.7	1.7	1,959	6.2	1.9	2,128	7.3	2.2	2,327	0.06
46	Tenaska	privately held corp.	18,017,712	17,927,703	-	39	887	7,723,908	-	0.0	0.1	857	0.0	0.1	862	-	-	-	-
47	Rockland Capital	privately held corp.	17,663,729	17,663,729	162,180	1,083	1,280	7,095,254	0.00	0.1	0.1	803	0.1	0.1	803	12.4	4.8	2,526	0.04
48	NE Public Power District	power district	16,294,768	10,213,714	9,859,064	29,203	12,767	11,166,697	0.11	3.6	1.6	1,371	5.7	2.5	2,187	5.9	2.6	2,223	0.02
49	Associated Electric Coop	cooperative	16,254,844	16,254,844	10,972,715	22,601	22,778	14,193,532	0.12	2.8	2.8	1,746	2.8	2.8	1,746	4.1	4.1	2,154	0.02
50	Iberdrola	foreign-owned corp.	15,453,112	854,629	-	2	63	374,482	-	0.0	0.0	48	0.0	0.1	876	-	-	-	-
51	Riverstone	privately held corp.	14,726,182	14,458,622	6,700,085	12,555	8,840	11,564,397	0.03	1.7	1.2	1,571	1.7	1.2	1,600	3.7	2.2	2,296	0.01
52	IDACORP	investor-owned corp.	14,140,926	6,125,557	5,564,378	6,273	6,091	6,486,415	0.11	0.9	0.9	917	2.0	2.0	2,118	2.3	2.2	2,228	0.04

* Mercury emissions are based on 2012 TRI data for coal plants
† Fossil fuel emission rate = pounds of pollution per MWh of electricity produced from fossil fuel
†† Coal emission rate = pounds of pollution per MWh of electricity produced from coal
††† Mercury emissions rate = pounds of mercury per gigawatt hour (GWh) of electricity produced from coal

			2012 Generation (MWh)			2012 Emissions (tons)				Emission Rates (lb/MWh)									
										All Generating Sources			Fossil Fuel Plants †			Coal Plants ††			
Rank	Owner	Ownership Type	Total	Fossil Fuel	Coal	SO_2	NOx	CO_2	Hg*	SO_2	NOx	CO_2	SO_2	NOx	CO_2	SO_2	NOx	CO_2	Hg†††
53	Los Angeles City	municipality	13,967,341	10,719,272	3,333,975	952	3,641	7,407,908	0.06	0.1	0.5	1,061	0.2	0.7	1,382	0.6	2.1	2,065	0.03
54	Occidental	investor-owned corp.	13,408,301	13,324,148	-	9	601	6,182,551	-	0.0	0.1	922	0.0	0.1	920	-	-	-	-
55	NiSource	investor-owned corp.	13,271,037	13,243,465	10,005,951	28,304	8,726	13,124,969	0.16	4.3	1.3	1,978	4.3	1.3	1,982	5.7	1.7	2,343	0.03
56	Tri-State	cooperative	13,012,425	13,012,425	11,964,427	7,713	15,910	13,843,506	0.12	1.2	2.4	2,128	1.2	2.4	2,128	1.3	2.6	2,211	0.02
57	Omaha Public Power District	power district	12,870,103	12,824,020	12,586,437	28,144	11,813	13,763,450	0.25	4.4	1.8	2,139	4.4	1.8	2,147	4.5	1.9	2,160	0.04
58	Dow Chemical	investor-owned corp.	12,866,292	12,001,662	-	9	471	5,483,267	-	0.0	0.1	852	0.0	0.1	847	-	-	-	-
59	JEA	municipality	12,736,599	12,734,543	6,244,926	13,825	13,224	10,408,309	0.06	2.2	2.1	1,634	2.2	2.1	1,634	4.1	3.6	2,148	0.02
60	Arkansas Electric Coop	cooperative	12,688,801	12,256,097	8,896,971	26,863	12,271	11,470,943	0.24	4.2	1.9	1,808	4.4	2.0	1,872	6.0	2.6	2,229	0.05
61	Municipal Elec. Auth. of GA	municipality	12,635,108	5,606,379	3,762,752	6,966	2,640	4,908,974	0.02	1.1	0.4	777	2.5	0.9	1,751	3.7	1.4	2,202	0.01
62	Sempra	investor-owned corp.	12,623,392	11,275,734	-	25	351	4,881,068	-	0.0	0.1	773	0.0	0.1	866	-	-	-	-
63	ArcLight Capital	privately held corp.	12,509,279	8,923,973	592,389	559	732	4,603,115	0.00	0.1	0.1	736	0.1	0.2	1,032	1.8	0.8	2,390	0.00
64	Entegra Power	privately held corp.	11,875,963	11,875,963	-	28	545	5,458,634	-	0.0	0.1	919	0.0	0.1	919	-	-	-	-
65	BP	foreign-owned corp.	11,605,194	7,454,513	-	80	364	3,213,419	-	0.0	0.1	554	0.0	0.1	736	-	-	-	-
66	NC Public Power	municipality	11,501,099	1,102,260	1,091,188	1,476	970	1,223,557	0.01	0.3	0.2	213	2.7	1.8	2,220	2.7	1.8	2,224	0.01
67	Exxon Mobil	investor-owned corp.	11,357,326	10,480,435	-	19	1,129	4,209,707	-	0.0	0.2	741	0.0	0.1	728	-	-	-	-
68	Great River Energy	cooperative	11,116,472	10,987,969	10,466,364	18,653	10,591	12,236,293	0.34	3.4	1.9	2,201	3.4	1.9	2,227	3.6	2.0	2,268	0.06
69	East Kentucky Power Coop	cooperative	10,786,208	10,690,966	9,790,359	14,321	5,453	11,147,393	0.05	2.7	1.0	2,067	2.7	1.0	2,085	2.9	1.1	2,147	0.01
70	PNM Resources	investor-owned corp.	10,479,115	7,239,460	6,009,900	3,184	11,288	7,243,267	0.02	0.6	2.2	1,382	0.9	3.1	2,001	1.1	3.7	2,206	0.01
71	Seminole Electric Coop	cooperative	10,388,620	10,388,620	7,571,945	13,769	2,278	9,210,549	0.05	2.7	0.4	1,773	2.7	0.4	1,773	3.6	0.5	2,080	0.01
72	PUD No 1 of Chelan County	power district	10,276,346	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
73	J-Power	foreign-owned corp.	10,010,973	10,010,973	199,152	119	994	4,645,815	0.00	0.0	0.2	928	0.0	0.2	928	1.0	1.1	2,219	0.00
74	PUD No 2 of Grant County	power district	9,901,175	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
75	CLECO	investor-owned corp.	9,898,725	9,898,725	3,377,575	14,837	5,880	8,146,327	0.08	3.0	1.2	1,646	3.0	1.2	1,646	7.8	1.9	2,399	0.05
76	Intermountain Power Agency	power district	9,763,629	9,763,629	9,755,484	3,551	17,182	10,004,734	0.00	0.7	3.5	2,049	0.7	3.5	2,049	0.7	3.5	2,050	0.00
77	Energy Northwest	municipality	9,707,717	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
78	EDP	foreign-owned corp.	9,646,764	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
79	Lower CO River Authority	state power authority	9,632,677	9,575,337	5,292,226	720	3,653	8,343,861	0.11	0.1	0.8	1,732	0.2	0.8	1,743	0.3	1.1	2,416	0.04
80	El Paso Electric	investor-owned corp.	9,356,666	4,246,359	690,688	574	4,533	3,052,206	0.01	0.1	1.0	652	0.3	2.1	1,438	1.6	5.7	2,191	0.03
81	Portland General Electric	investor-owned corp.	9,333,533	6,276,849	3,388,771	8,806	3,921	5,011,199	0.01	1.9	0.8	1,074	2.8	1.2	1,597	5.2	2.2	2,234	0.01
82	Puget Holdings	privately held corp.	9,261,355	6,698,718	4,024,135	3,217	4,849	5,859,974	0.02	0.7	1.0	1,265	1.0	1.4	1,750	1.6	2.4	2,313	0.01
83	Big Rivers Electric	cooperative	9,150,785	9,150,785	7,702,978	15,933	10,595	10,373,198	0.10	3.5	2.3	2,267	3.5	2.3	2,267	4.1	2.7	2,237	0.03
84	Austin Energy	municipality	8,665,104	5,698,049	3,027,645	422	2,439	5,136,163	0.06	0.1	0.6	1,185	0.1	0.9	1,803	0.3	1.1	2,416	0.04
85	ALLETE	investor-owned corp.	8,591,911	7,780,111	7,767,515	7,243	6,275	9,061,548	0.15	1.7	1.5	2,109	1.8	1.5	2,329	1.8	1.5	2,328	0.04
86	Integrys	investor-owned corp.	8,405,331	7,721,352	7,517,815	16,324	4,862	8,362,329	0.14	3.9	1.2	1,990	4.2	1.3	2,166	4.3	1.3	2,191	0.04
87	UniSource	investor-owned corp.	8,251,780	8,230,660	6,800,391	3,546	8,759	7,926,707	0.08	0.9	2.1	1,921	0.9	2.1	1,926	1.0	2.5	2,167	0.02
88	TransCanada	foreign-owned corp.	7,779,505	6,251,299	-	36	1,626	3,489,770	-	0.0	0.4	897	0.0	0.5	1,116	-	-	-	-
89	LS Power	privately held corp.	7,662,126	7,346,863	-	20	1,150	3,803,186	-	0.0	0.3	993	0.0	0.3	1,035	-	-	-	-
90	International Paper	investor-owned corp.	7,508,457	1,823,299	320,936	-	2,320	809,132	-	-	0.6	216	-	2.5	888	-	7.7	1,529	-
91	Buckeye Power	cooperative	7,021,565	7,021,565	6,839,382	15,889	4,883	7,286,813	0.11	4.5	1.4	2,076	4.5	1.4	2,076	4.6	1.4	2,094	0.03
92	Seattle City Light	municipality	6,934,054	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
93	E.ON	foreign-owned corp.	6,911,004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
94	Grand River Dam Authority	state power authority	6,740,155	6,456,107	4,029,208	11,977	10,111	5,955,050	0.11	3.6	3.0	1,767	3.7	3.1	1,845	5.9	5.0	2,421	0.06
95	Avista	investor-owned corp.	6,711,669	2,414,438	1,257,340	1,001	1,483	1,927,563	0.01	0.3	0.4	574	0.8	1.2	1,597	1.6	2.4	2,313	0.01
96	Brazos Electric Power Coop	cooperative	6,699,582	6,699,582	-	15	607	2,937,460	-	0.0	0.2	877	0.0	0.2	877	-	-	-	-
97	Hoosier Energy	cooperative	6,662,508	6,644,478	6,061,784	11,061	2,859	6,743,227	0.06	3.3	0.9	2,024	3.3	0.9	2,030	3.6	0.9	2,131	0.02
98	Sacramento Municipal Util Dist	municipality	6,534,021	4,882,409	-	11	127	2,133,246	-	0.0	0.0	653	0.0	0.0	874	-	-	-	-
99	Centrica	foreign-owned corp.	6,345,032	6,345,032	-	15	920	2,886,621	-	0.0	0.3	910	0.0	0.3	910	-	-	-	-
100	Waste Management	investor-owned corp.	6,306,811	519,718	357,436	476	446	625,359	0.01	0.2	0.1	198	1.8	1.7	2,407	2.7	2.5	3,038	0.05
		Total (in thousands)	3,462,096	2,340,966	1,335,414	2,993	1,468	1,946,138	0.02										
		Average (mean)	34,620,956	23,409,663	13,354,137	29,934	14,684	19,461,381	0.21	1.7	1.0	1,275	2.0	1.3	1,625	3.9	2.3	2,225	0.03
		Median	15,089,647	11,938,813	6,472,505	8,832	6,499	10,188,966	0.06	1.2	0.8	1,278	1.7	1.2	1,748	3.7	2.1	2,211	0.03

Generation by Fuel Type

The 100 largest power producers in the U.S. accounted for 86 percent of the electricity produced in 2012. Coal accounted for 39 percent of the power produced by the 100 largest companies, followed by natural gas (29 percent), nuclear (22 percent), hydroelectric power (7 percent), non-hydroelectric renewables and other fuel sources (3 and 1 percent, respectively), and oil (less than 0.2 percent). Natural gas was the source of 39 percent of the power produced by smaller companies (i.e., those not within the top 100) followed by coal (30 percent), non-hydroelectric renewables/other (19 percent), hydroelectric power (7 percent), nuclear power (3 percent), and oil (2 percent).

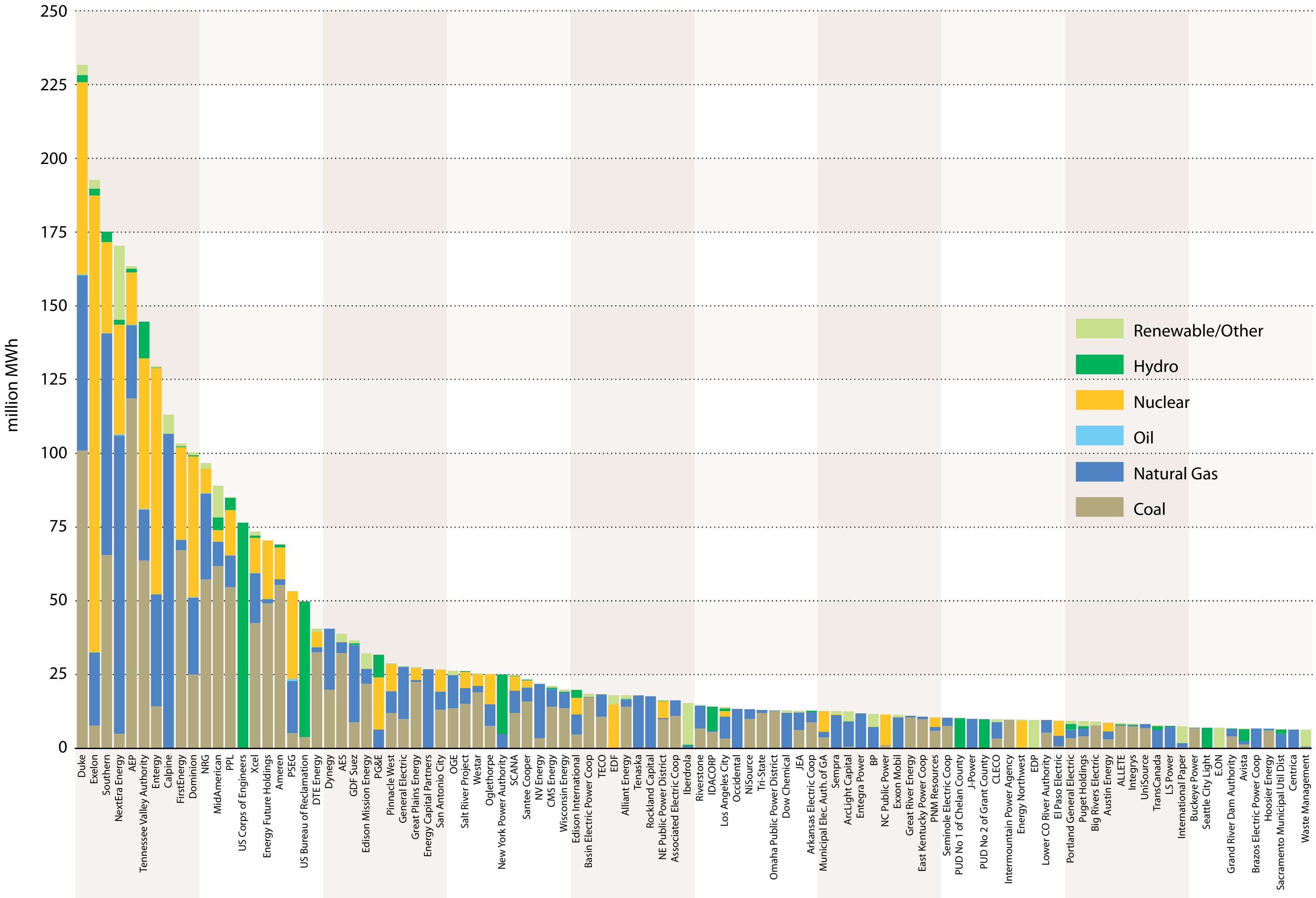
As a portion of total electric power production, the 100 largest producers accounted for 88 percent of all coal-fired power, 81 percent of natural gas-fired power, 31 percent of oil-fired power, 97 percent of nuclear power, 86 percent of hydroelectric power and 71 percent of non-hydroelectric renewable power.

Figure 12 illustrates the 2012 electricity generation by fuel for each of the 100 largest power producers. The generation levels, expressed in million megawatt hours, show production from facilities wholly and partially owned by each producer and reported to the EIA. Coal or nuclear accounted for over half the output of 49 out of the top 100 largest producers. Appendix B provides a detailed listing of the fuel mix of the 100 largest power producers.

These data reflect the mix of generating facilities that are directly owned by the 100 largest power producers, not the energy purchases that some utility companies rely on to meet their customers' electricity needs. For example, some utility companies have signed long-term supply contracts for the output of renewable energy projects. In this report, the output of these facilities would be attributed to the owner of the project, not the buyer of the output.

FIGURE 12

Generation of 100 Largest Power Producers by Fuel Type (2012)



Emissions Rankings

Table 2 shows the relative ranking of the 100 largest power producers by several measures—their contribution to total generation (megawatt hours), total emissions and emission rates (emissions per unit of electricity output). These rankings help to evaluate and compare emissions performance.

Figures 13 through 17 illustrate SO_2, NOx, CO_2, and mercury emissions levels (expressed in tons for SO_2, NOx and CO_2, and pounds for mercury) and emission rates for each of the 100 largest producers. These comparisons illustrate the relative emissions performance of each producer based on the company's ownership stake in power plants with reported emissions information. For SO_2 and NOx, the report presents comparisons of total emissions levels and rates for fossil fuel-fired facilities. For CO_2, the report presents comparisons of total emissions levels and rates for all generating sources (e.g., fossil, nuclear, and renewable). For mercury, the report presents comparisons of total emissions levels and rates for coal-fired generating facilities only.

The mercury emissions shown in this report were obtained from EPA's Toxic Release Inventory (TRI). The TRI contains facility-level information on the use and environmental release of chemicals classified as toxic under the Clean Air Act. Because coal plants are the primary source of mercury emissions within the electric industry, the mercury emissions and emission rates presented in this report reflect the emissions associated with each producer's fleet of coal plants only. Other toxic air pollutant emissions, such as hydrogen chloride and hydrogen fluoride (acid gases), are also reported to EPA under the TRI program. However, we have not included these air toxics because of uncertainties about the quality of the data submitted to EPA. We will continue to evaluate whether these pollutants might be included in future benchmarking efforts. In general, there is a strong correlation between SO_2 reductions resulting from FGD installations and co-benefit reductions in acid gas emissions.

The charts present both the total emissions by company as well as their average emission rates. The evaluation of emissions performance by both emission levels and emission rates provides a more complete picture of relative emissions performance than viewing these measures in isolation. Total emission levels are useful for understanding each producer's contribution to overall emissions loading, while emission rates are useful for assessing how electric power producers compare according to emissions per unit of energy produced when size is eliminated as a performance factor.

The charts illustrate significant differences in the total emission levels and emission rates of the 100 largest power producers. For example, the tons of CO_2 emissions range from zero to almost 141 million tons per year. The NOx emission rates range from zero to just over 3.5 pounds of emissions per megawatt hour of generation. The total tons of emissions from any producer are influenced by the total amount of generation that a producer owns and by the fuels and technologies used to generate electricity.

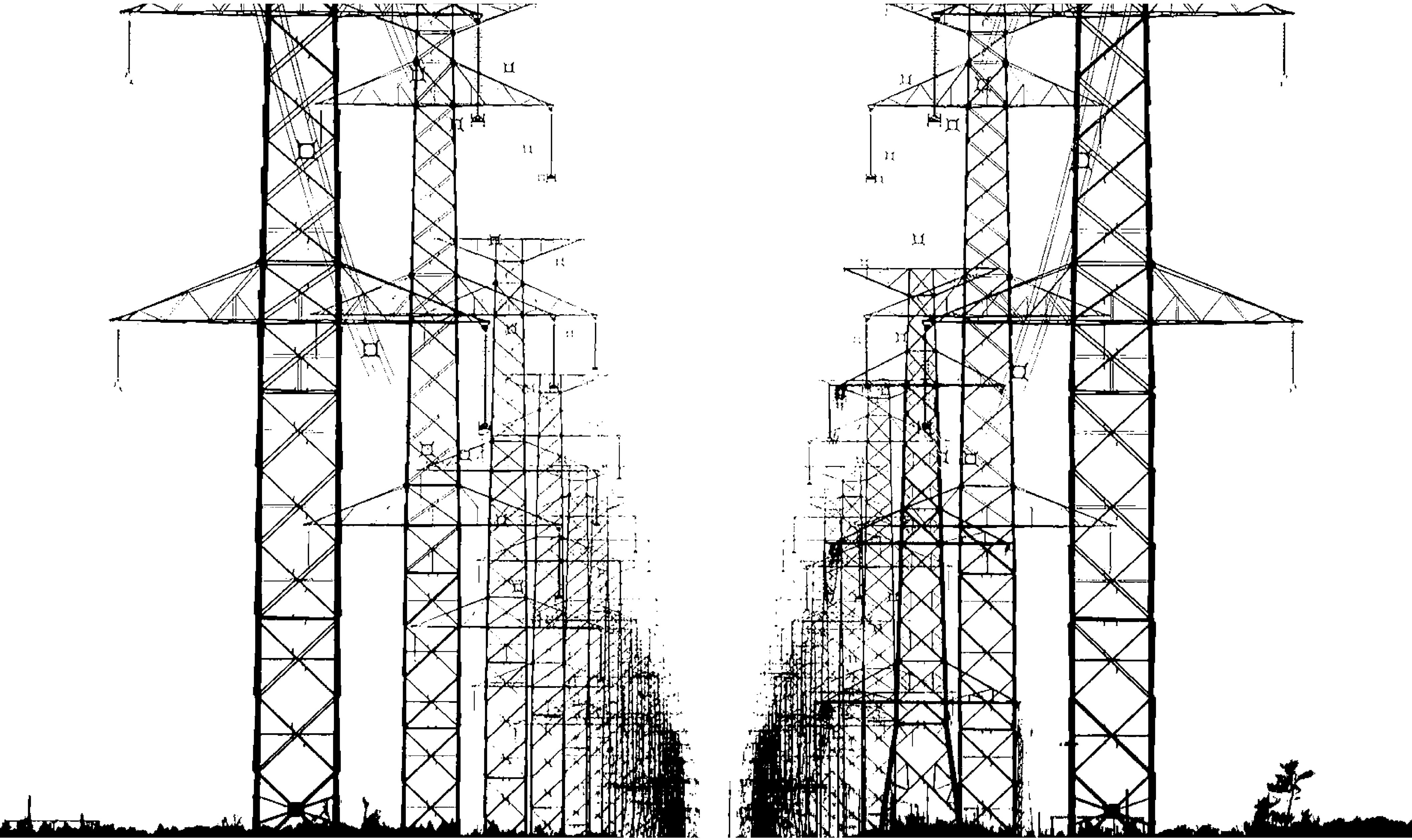
TABLE 2

Company Rankings for 100 Largest Power Producers (2012)
in alphabetical order

		By Generation			By Tons of Emissions				By Emission Rates									
									All Generating Sources			Fossil Fuel Plants			Coal Plants			
Owner	**Ownership Type**	**Total**	**Fossil**	**Coal**	**SO_2**	**NOx**	**CO_2**	**Hg**	**SO_2**	**NOx**	**CO_2**	**SO_2**	**NOx**	**CO_2**	**SO_2**	**NOx**	**CO_2**	**Hg**
AEP	investor-owned corp.	5	2	1	1	1	1	2	14	29	27	12	34	31	17	51	61	29
AES	investor-owned corp.	22	17	13	13	13	16	13	10	20	14	7	29	18	19	43	51	36
ALLETE	investor-owned corp.	85	67	43	54	51	53	31	39	25	6	45	35	3	54	54	15	19
Alliant Energy	investor-owned corp.	45	40	24	17	27	31	15	4	15	13	5	25	15	5	34	16	4
Ameren	investor-owned corp.	17	12	8	9	12	9	7	18	40	19	16	50	9	27	64	26	34
ArcLight Capital	privately held corp.	63	65	71	71	81	76	73	72	81	77	72	78	73	52	74	8	72
Arkansas Electric Coop	cooperative	60	49	40	27	33	46	23	11	11	20	11	22	35	12	17	29	7
Associated Electric Coop	cooperative	49	41	32	29	19	36	34	24	3	24	30	4	47	32	6	57	48
Austin Energy	municipality	84	82	67	73	68	71	52	71	57	51	71	59	40	73	65	4	16
Avista	investor-owned corp.	95	88	68	67	73	88	70	61	64	82	60	46	57	62	27	18	67
Basin Electric Power Coop	cooperative	42	39	19	15	18	24	14	3	4	3	4	5	4	8	16	14	6
Big Rivers Electric	cooperative	83	64	44	33	38	50	42	17	6	1	21	12	5	30	15	27	41
BP	foreign-owned corp.	65	69	-	76	87	81	-	75	87	83	75	87	91	-	-	-	-
Brazos Electric Power Coop	cooperative	96	73	-	84	82	83	-	82	74	67	83	77	82	-	-	-	-
Buckeye Power	cooperative	91	72	48	34	58	61	35	6	27	7	8	37	21	22	56	67	28
Calpine	investor-owned corp.	8	4	-	74	48	13	-	77	79	70	77	79	85	-	-	-	-
Centrica	foreign-owned corp.	99	77	-	85	79	84	-	80	70	64	81	75	79	-	-	-	-
CLECO	investor-owned corp.	75	61	65	38	53	56	46	22	33	32	27	47	51	4	45	7	12
CMS Energy	investor-owned corp.	39	31	23	20	24	29	19	8	21	25	9	33	41	11	32	37	10
Dominion	investor-owned corp.	10	14	14	18	15	14	21	49	55	73	42	48	60	34	36	56	51
Dow Chemical	investor-owned corp.	58	50	-	89	85	69	-	87	86	69	89	89	89	-	-	-	-
DTE Energy	investor-owned corp.	20	19	12	7	11	17	9	2	14	18	1	18	11	3	30	30	13
Duke	investor-owned corp.	1	1	2	3	2	2	11	36	43	52	34	45	50	28	47	65	57
Dynegy	investor-owned corp.	21	16	17	23	37	18	43	40	58	38	48	68	59	46	69	24	64
E.ON	foreign-owned corp.	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Kentucky Power Coop	cooperative	69	56	38	39	56	48	59	26	37	8	31	52	19	45	67	59	65
EDF	foreign-owned corp.	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Edison International	investor-owned corp.	41	52	58	58	29	57	48	59	28	71	63	11	64	58	2	45	32
Edison Mission Energy	privately held corp.	24	22	16	16	31	19	40	21	47	28	17	55	23	21	63	9	63
EDP	foreign-owned corp.	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
El Paso Electric	investor-owned corp.	80	86	70	70	61	82	67	69	39	79	66	17	63	59	2	46	32
Energy Capital Partners	privately held corp.	29	23	-	77	72	42	-	81	82	65	82	82	80	-	-	-	-
Energy Future Holdings	privately held corp.	16	15	10	5	14	10	1	5	41	29	3	44	2	7	62	6	1
Energy Northwest	municipality	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Entegra Power	privately held corp.	64	51	-	80	84	70	-	79	84	62	80	85	77	-	-	-	-
Entergy	investor-owned corp.	7	13	22	19	10	15	17	53	52	81	43	32	62	6	24	20	8
Exelon	investor-owned corp.	2	20	42	36	28	25	45	64	77	87	56	57	68	35	12	74	44
Exxon Mobil	investor-owned corp.	67	57	-	83	76	77	-	85	72	76	88	88	92	-	-	-	-
FirstEnergy	investor-owned corp.	9	8	3	8	3	6	5	28	23	41	19	13	20	36	25	63	35
GDF Suez	foreign-owned corp.	23	18	41	30	47	22	20	43	62	49	51	71	67	20	57	25	2
General Electric	investor-owned corp.	27	21	36	11	36	30	24	1	46	45	2	61	66	1	37	60	9
Grand River Dam Authority	state power authority	94	76	59	45	40	67	37	16	2	23	18	2	38	13	4	3	5
Great Plains Energy	investor-owned corp.	28	26	15	28	26	20	25	37	35	21	39	38	14	51	58	54	49
Great River Energy	cooperative	68	54	34	31	39	41	18	19	12	2	23	24	7	41	40	22	3
Hoosier Energy	cooperative	97	75	52	46	66	64	56	20	44	10	24	58	26	39	70	62	53
Iberdrola	foreign-owned corp.	50	91	-	91	92	92	-	91	92	92	86	80	83	-	-	-	-
IDACORP	investor-owned corp.	52	81	54	56	52	65	38	50	42	63	40	23	17	50	33	31	20
Integrys	investor-owned corp.	86	68	47	32	59	54	32	12	34	11	15	42	12	26	61	47	25
Intermountain Power Agency	power district	76	62	39	59	23	51	72	54	1	9	62	1	25	70	11	73	73
International Paper	investor-owned corp.	90	89	73	-	69	90	-	-	53	85	-	6	81	-	1	75	-

A ranking of 1 indicates the highest absolute number or rate in any column: the highest generation (MWh), highest emissions (tons), or highest emission rate (lb/MWh). A ranking of 100 indicates the lowest absolute number or rate in any column.

		By Generation			By Tons of Emissions				By Emission Rates									
									All Generating Sources			Fossil Fuel Plants			Coal Plants			
Owner	Ownership Type	Total	Fossil	Coal	SO_2	NOx	CO_2	Hg	SO_2	NOx	CO_2	SO_2	NOx	CO_2	SO_2	NOx	CO_2	Hg
JEA	municipality	59	48	51	40	30	49	53	31	10	34	38	20	54	31	9	58	52
J-Power	foreign-owned corp.	73	60	74	75	77	75	74	74	73	59	74	76	75	68	68	36	74
Los Angeles City	municipality	53	55	66	68	65	60	55	67	59	57	69	65	65	71	38	69	26
Lower CO River Authority	state power authority	79	63	55	69	64	55	39	66	50	26	70	63	48	73	65	4	17
LS Power	privately held corp.	89	70	-	82	75	79	-	78	69	58	78	74	72	-	-	-	-
MidAmerican	privately held corp.	12	9	6	12	4	7	6	35	17	35	37	15	22	47	23	32	37
Municipal Elec. Auth. of GA	municipality	61	83	62	55	67	73	62	47	67	74	35	56	45	38	60	42	58
NC Public Power	municipality	66	90	69	64	78	89	69	63	75	86	32	28	8	48	49	33	61
NE Public Power District	power district	48	59	37	22	32	47	36	15	22	44	6	7	10	14	19	34	45
New York Power Authority	state power authority	35	85	-	87	89	86	-	89	90	89	79	83	78	-	-	-	-
NextEra Energy	investor-owned corp.	4	5	57	47	22	12	60	68	71	80	68	73	74	44	42	21	55
NiSource	investor-owned corp.	55	45	35	24	46	40	30	9	30	12	14	41	29	15	50	13	31
NRG	investor-owned corp.	11	6	7	4	7	4	4	13	31	31	13	39	36	9	48	35	18
NV Energy	investor-owned corp.	38	27	63	63	57	43	51	62	61	55	67	70	71	57	26	23	24
Occidental	investor-owned corp.	54	44	-	90	83	66	-	88	85	61	91	86	76	-	-	-	-
OGE	investor-owned corp.	31	24	25	21	16	23	27	23	7	30	25	10	42	16	10	12	30
Oglethorpe	cooperative	34	42	46	37	54	44	58	42	63	60	41	62	58	33	55	48	59
Omaha Public Power District	power district	57	47	28	25	34	39	22	7	13	4	10	27	13	24	46	55	21
PG&E	investor-owned corp.	25	78	-	86	90	85	-	90	91	90	87	91	86	-	-	-	-
Pinnacle West	investor-owned corp.	26	33	31	50	17	33	26	56	19	53	57	8	49	64	7	44	22
PNM Resources	investor-owned corp.	70	71	53	62	35	62	64	57	8	43	58	3	27	66	8	41	70
Portland General Electric	investor-owned corp.	81	79	64	51	63	72	66	34	45	54	29	43	56	18	31	28	69
PPL	investor-owned corp.	13	10	9	10	5	8	8	25	18	39	20	16	28	29	21	50	39
PSEG	investor-owned corp.	18	25	56	52	41	38	50	60	68	84	61	60	69	43	13	72	42
PUD No 1 of Chelan County	power district	72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PUD No 2 of Grant County	power district	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puget Holdings	privately held corp.	82	74	60	61	60	68	65	55	36	48	55	36	46	62	27	17	67
Riverstone	privately held corp.	51	43	50	43	44	45	61	38	32	37	46	49	55	37	29	19	66
Rockland Capital	privately held corp.	47	38	75	65	74	63	71	70	78	72	73	81	90	2	5	2	23
Sacramento Municipal Util Dist	municipality	98	84	-	88	91	87	-	86	89	78	90	92	84	-	-	-	-
Salt River Project	power district	32	30	21	57	20	26	28	58	16	42	64	14	37	69	14	40	43
San Antonio City	municipality	30	34	27	48	50	32	41	52	60	47	53	64	44	61	73	64	54
Santee Cooper	state power authority	37	29	20	42	49	27	44	46	56	36	50	66	39	56	72	71	60
SCANA	investor-owned corp.	36	32	29	26	42	34	54	30	48	46	28	53	53	23	53	66	62
Seattle City Light	municipality	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Seminole Electric Coop	cooperative	71	58	45	41	70	52	57	27	65	22	33	72	43	40	75	68	56
Sempra	investor-owned corp.	62	53	-	81	88	74	-	84	88	75	85	90	87	-	-	-	-
Southern	investor-owned corp.	3	3	4	2	6	3	3	29	49	50	26	54	61	10	41	43	14
TECO	investor-owned corp.	43	36	33	49	55	35	63	48	54	33	54	67	52	55	71	53	71
Tenaska	privately held corp.	46	37	-	78	80	59	-	83	83	68	84	84	88	-	-	-	-
Tennessee Valley Authority	federal power authority	6	7	5	6	8	5	10	33	51	56	22	40	33	25	52	49	47
TransCanada	foreign-owned corp.	88	80	-	79	71	80	-	76	66	66	76	69	70	-	-	-	-
Tri-State	cooperative	56	46	30	53	25	37	33	45	5	5	52	9	16	65	18	38	50
UniSource	investor-owned corp.	87	66	49	60	45	58	47	51	9	15	59	19	32	67	22	52	46
US Bureau of Reclamation	federal power authority	19	87	61	66	62	78	49	73	76	91	65	21	24	72	38	69	26
US Corps of Engineers	federal power authority	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waste Management	investor-owned corp.	100	92	72	72	86	91	68	65	80	88	44	31	1	49	20	1	11
Westar	investor-owned corp.	33	28	18	35	21	21	16	44	24	17	47	26	6	60	44	11	15
Wisconsin Energy	investor-owned corp.	40	35	26	44	43	28	29	41	38	16	49	51	30	53	59	10	40
Xcel	investor-owned corp.	15	11	11	14	9	11	12	32	26	40	36	30	34	42	35	39	38



NOx and SO_2 Emissions Levels and Rates

Figures 13 and 14 display SO_2 and NOx emission levels and emission rates for fossil fuel-fired generating sources owned by each company.

"Fossil only" emission rates are calculated by dividing each company's total NOx and SO_2 emissions from fossil-fired power plants by its total generation from fossil-fired power plants. Companies with significant coal-fired generating capacity have the highest total emissions of SO_2 and NOx because coal contains higher concentrations of sulfur than natural gas and oil and coal plants generally have higher NOx emission rates.

Figures 13 and 14 illustrate wide disparities in the "fossil only" emission levels and emission rates of the 100 largest power producers. Their total fossil generation varies from 0 to 161 million megawatt hours and:

- SO_2 emission rates range from 0 to 7.2 pounds per megawatt hour, and SO_2 emissions range from 0 to 312,683 tons;
- NOx emission rates range from 0 to 3.5 pounds per megawatt hour, and NOx emissions range from 0 to 112,520 tons.

FIGURE 13

Fossil Fuel - NOx Total Emissions and Emission Rates (2012)

Total emissions (thousand tons) and emission rates (lb/MWh) from fossil fuel generating facilities

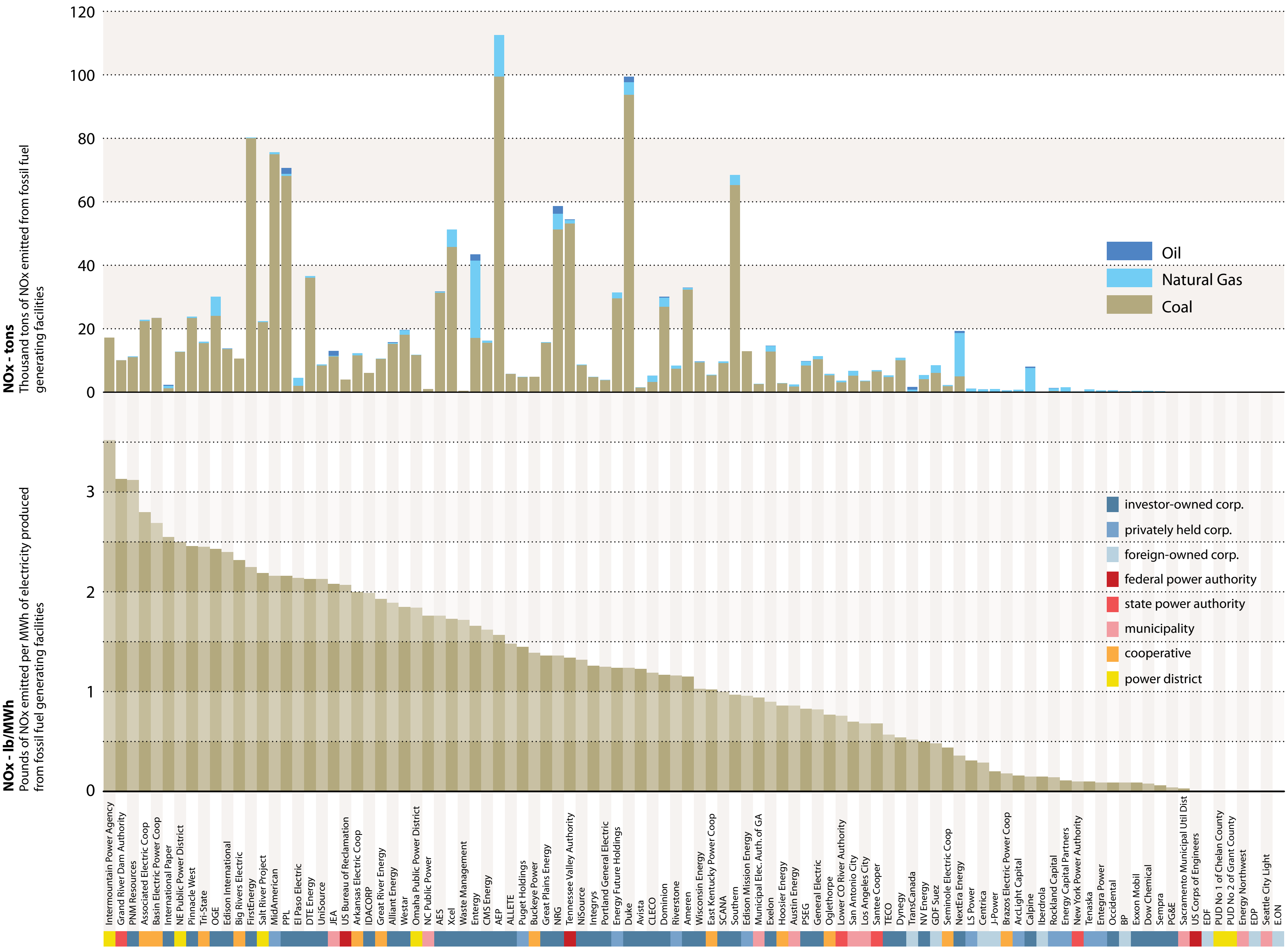
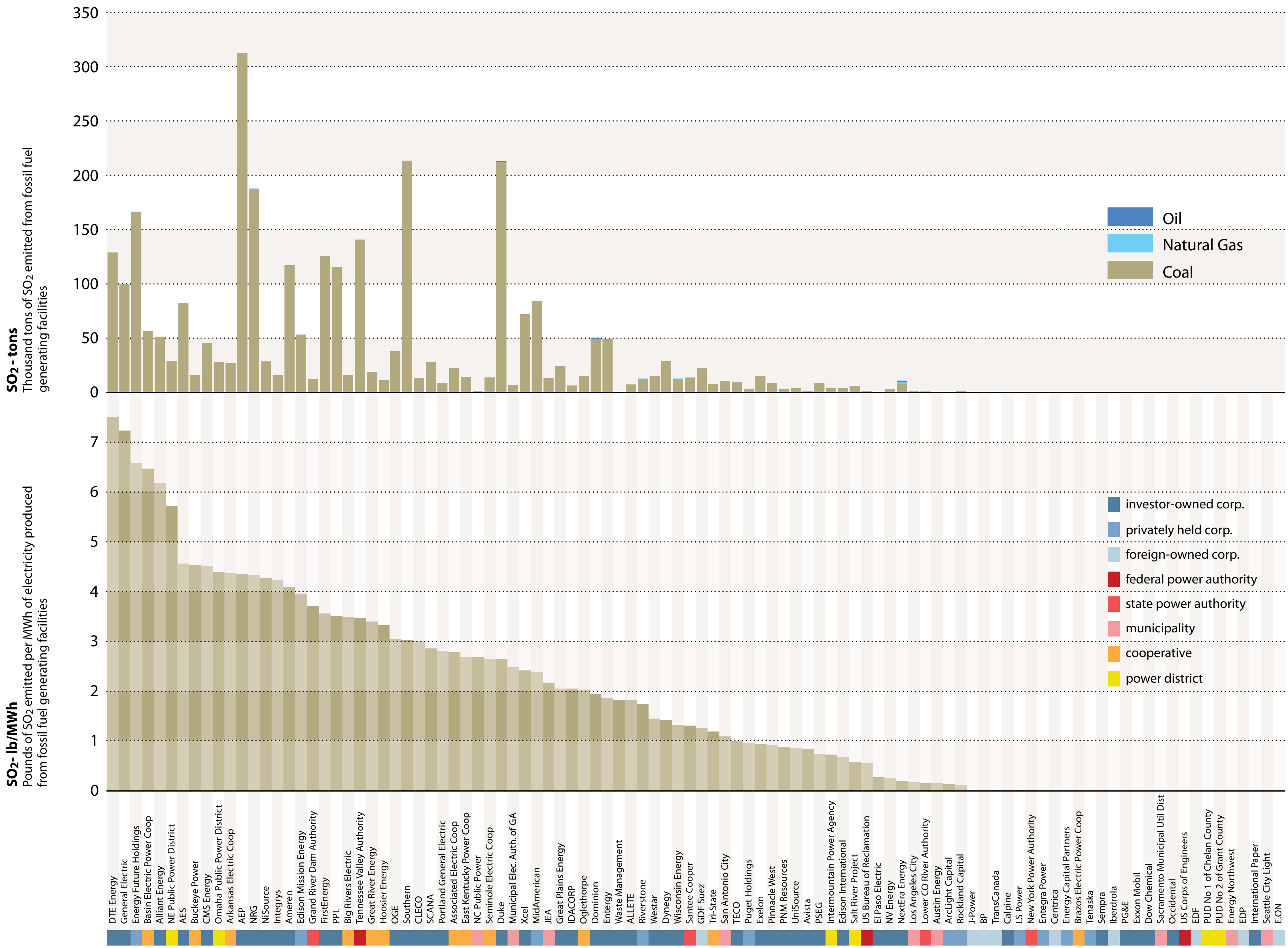
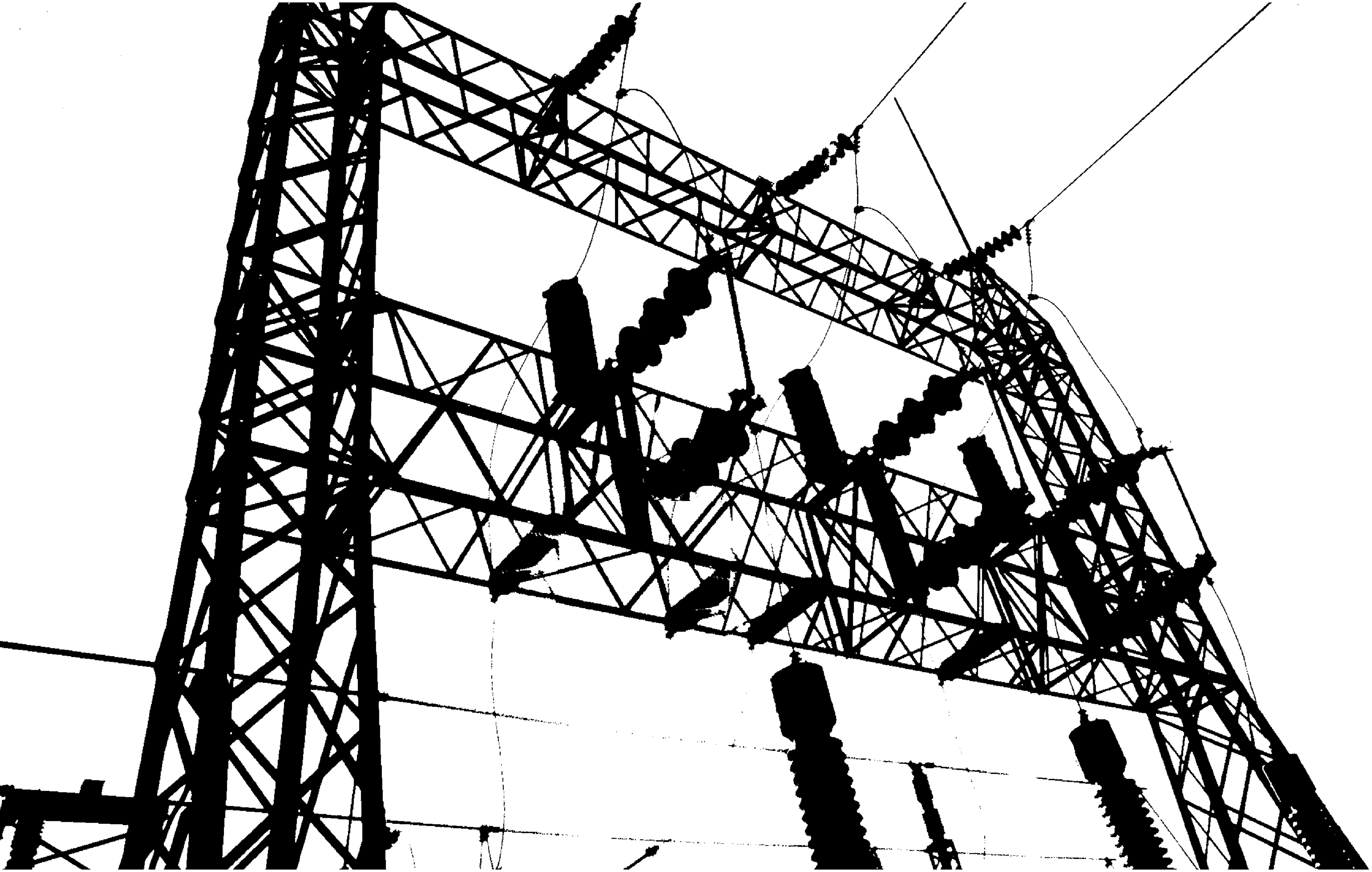


FIGURE 14

Fossil Fuel - SO_2 Total Emissions and Emission Rates (2012)

Total emissions (thousand tons) and emission rates (lb/MWh) from fossil fuel generating facilities





CO_2 Emission Levels and Rates

Figures 15 and 16 display total CO_2 emission levels from coal, oil, and natural gas combustion and emission rates based on all generating sources owned by each company.

"All-source" emission rates are calculated by dividing each company's total CO_2 emissions by its total generation. In most cases, producers with significant non-emitting fuel sources, such as nuclear, hydroelectric and wind power, have lower all-source emission rates than producers owning primarily fossil fuel power plants. Among the 100 largest power producers:

- Coal-fired power plants are responsible for 76 percent of CO_2 emissions.
- Natural gas-fired power plants are responsible for 24 percent of CO_2 emissions.
- Oil-fired power plants are responsible for 0.4 percent of CO_2 emissions.

Figure 15 and 16 illustrate wide disparities in the "all-source" emission levels and emission rates of the 100 largest power producers. Their total electric generation varies from 6.3 million to 231.7 million megawatt hours and their CO_2 emissions range from 0 to 141.2 million tons, and CO_2 emission rates range from 0 to 2,267.2 pounds per megawatt hour.

FIGURE 15

All Source - CO_2 Total Emissions and Emission Rates (2012)

Total emissions (million tons) and emission rates (lb/MWh) from all generating facilities

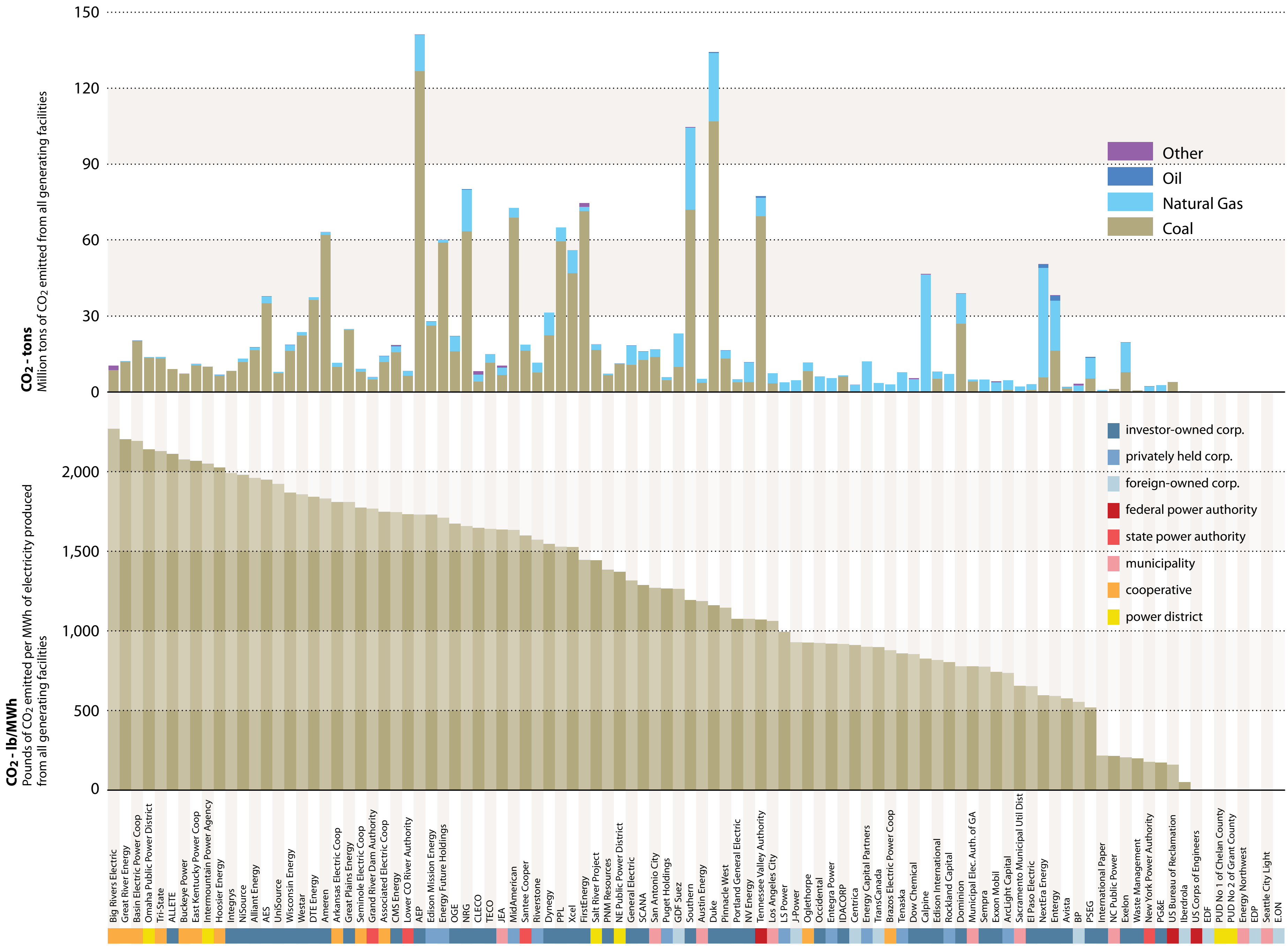
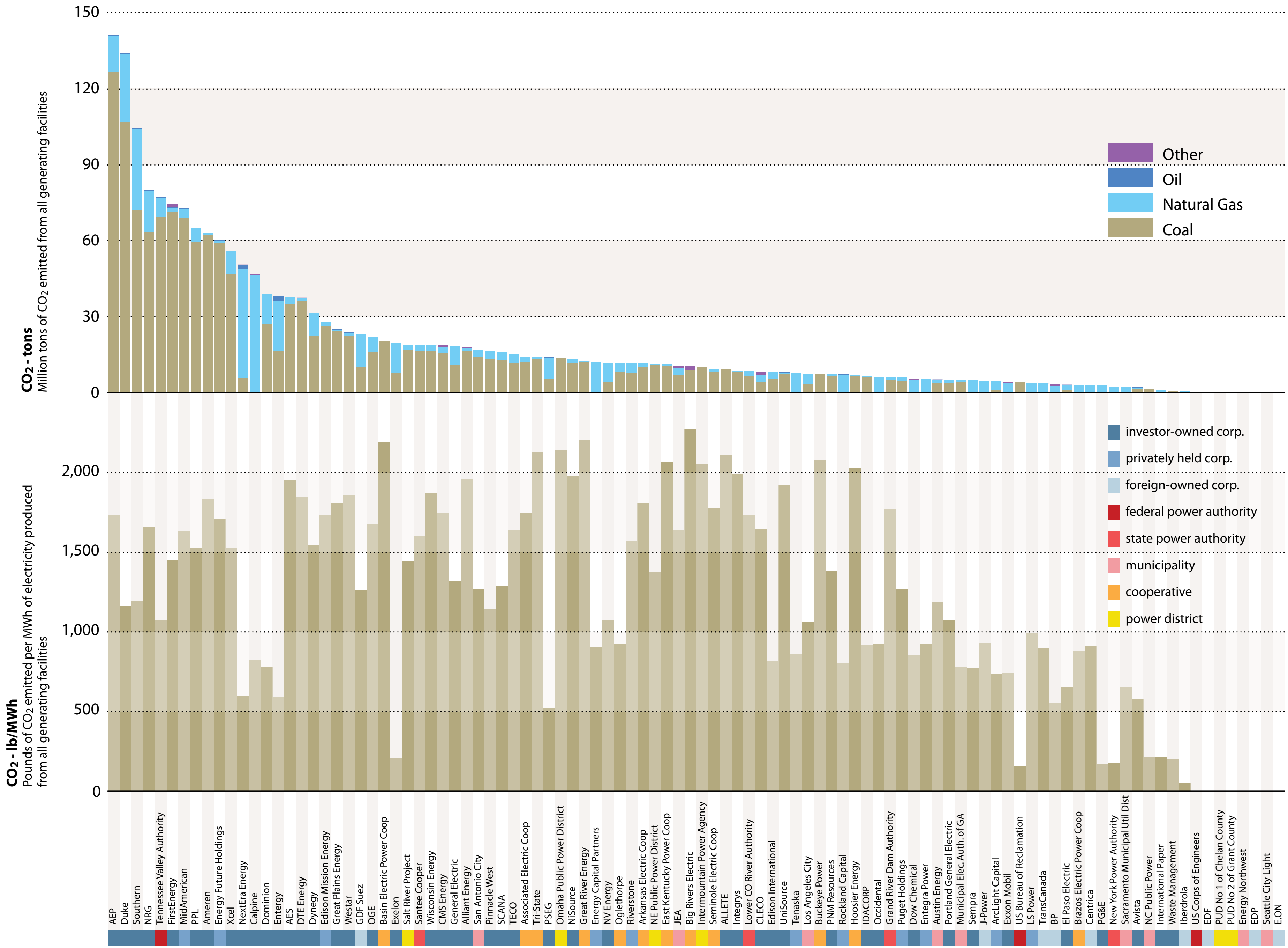


FIGURE 16

All Source - CO_2 Total Emissions and Emission Rates (2012)

Total emissions (million tons) and emission rates (lb/MWh) from all generating facilities



Mercury Emission Levels and Rates

Figure 17 displays total mercury emission levels and emission rates from coal-fired power plants.

In 2005, EPA issued rules regulating mercury emissions from coal-fired power plants. However, in February 2008, the DC Circuit found the rules invalid and they never took effect. EPA has since developed emissions standards for coal- and oil-fired electric generating units to regulate emissions of mercury and other hazardous air pollutants. The standards are scheduled to go into effect in 2015. The differences in mercury emission rates seen in the following figures are largely due to the mercury content and type of coal used, and the effect of control technologies designed to lower SO_2, NOx, and particulate emissions.

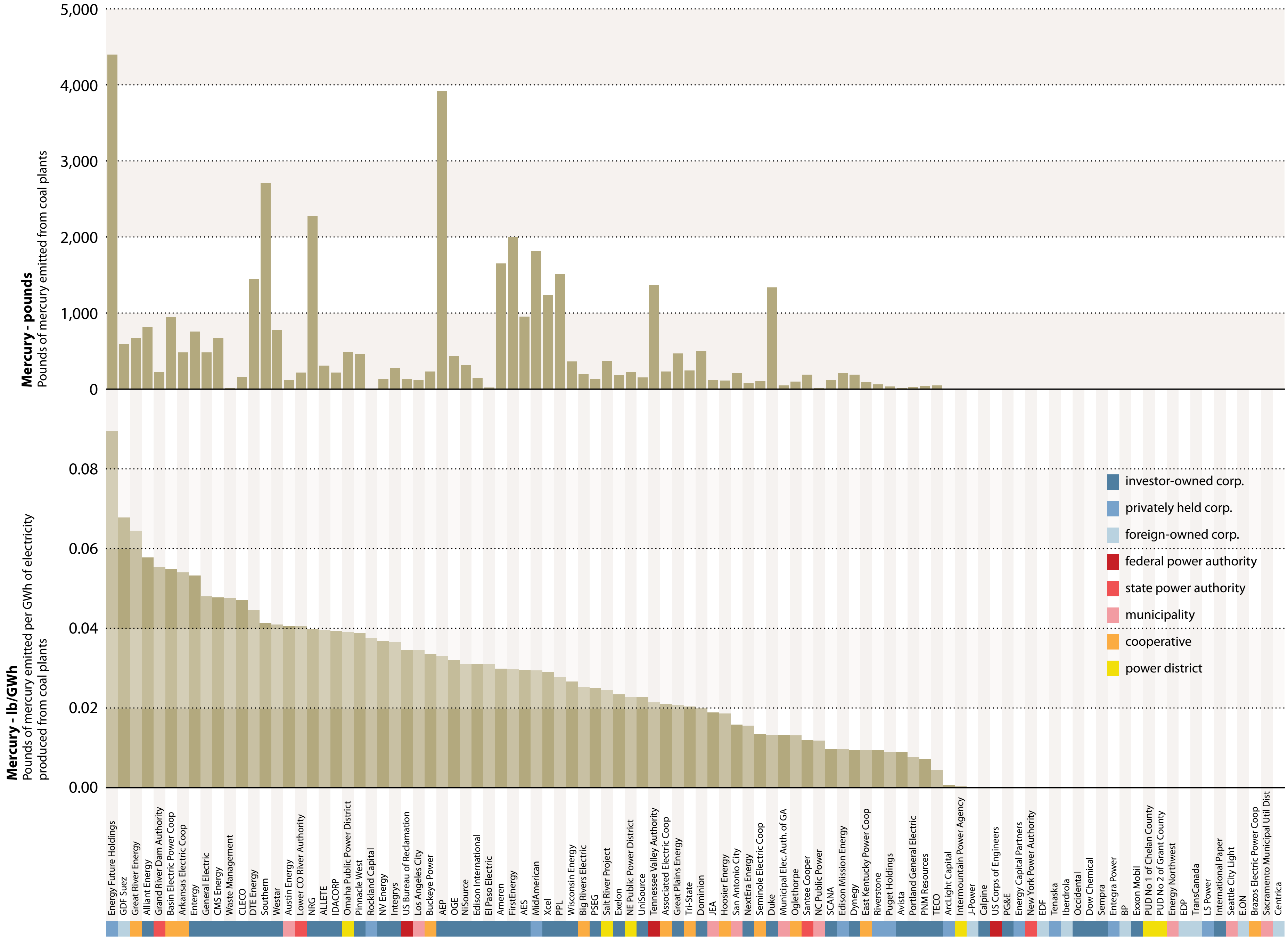
Coal mercury emissions from the top 100 power producers range from less than 1 to 4,395 pounds, and coal mercury emission rates range from 0.0002 to 0.089 pound per gigawatt hour (a gigawatt hour is 1,000 megawatt hours).

FIGURE 17

Coal - Mercury Emission Rates and Total Emissions (2012)

Emission rates (lb/GWh) and total emissions (pounds) from coal plants

1 gigawatt-hour (GWh) = 1,000 MWh

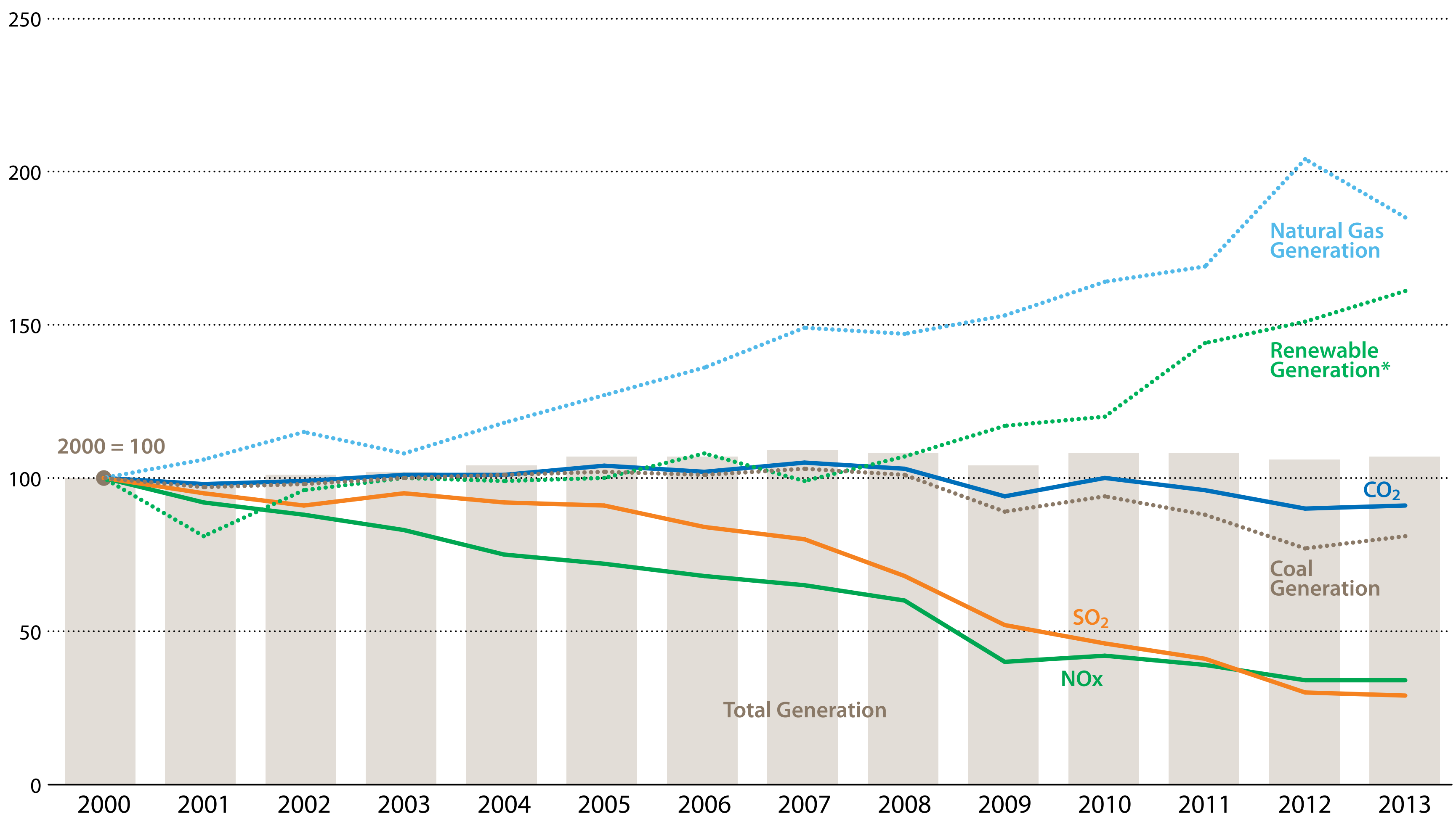


Emissions Trends Analysis

The electric power sector has made significant progress in terms of reducing its NOx and SO_2 emissions over the past several decades. In 2012, power plant NOx and SO_2 emissions were 74 percent and 79 percent lower, respectively, than they were in 1990 when Congress passed major amendments to the Clean Air Act. Less progress has been made in terms of reducing mercury and CO_2 emissions. Since 1990, power plant CO_2 emissions have increased by 13 percent. However, as illustrated in Figure 18, CO_2 emissions have declined in recent years. Figure 18 plots the trends in power plant NOx, SO_2, and CO_2 emissions since 2000 (indexed to 2000 levels). Figure 18 also plots the total electricity generation by fuel type. The electric industry has cut its NOx and SO_2 emissions even as overall electricity generation has increased. In the wake of the recent economic recession, power plant emissions declined significantly, in part due to a decline in overall electricity demand. Emissions then leveled off from 2010 through 2011, and have now resumed their downward trajectory. The major forces driving this recent drop in emissions are low natural gas prices, an increased level of pollution controls installed at coal plants, and coal plant retirements. During spring 2012, natural gas spot prices fell to historically low levels, leading to significant displacement of coal by natural gas for power generation. In 2013, coal recovered some market share as natural gas prices recovered from their record lows.

FIGURE 18

Annual Electricity Generation and Emission Trends
(Indexed: 2000 = 100)



* INCLUDES HYDROELECTRIC, WIND, SOLAR, BIOMASS, GEOTHERMAL AND OTHER RENEWABLE SOURCES

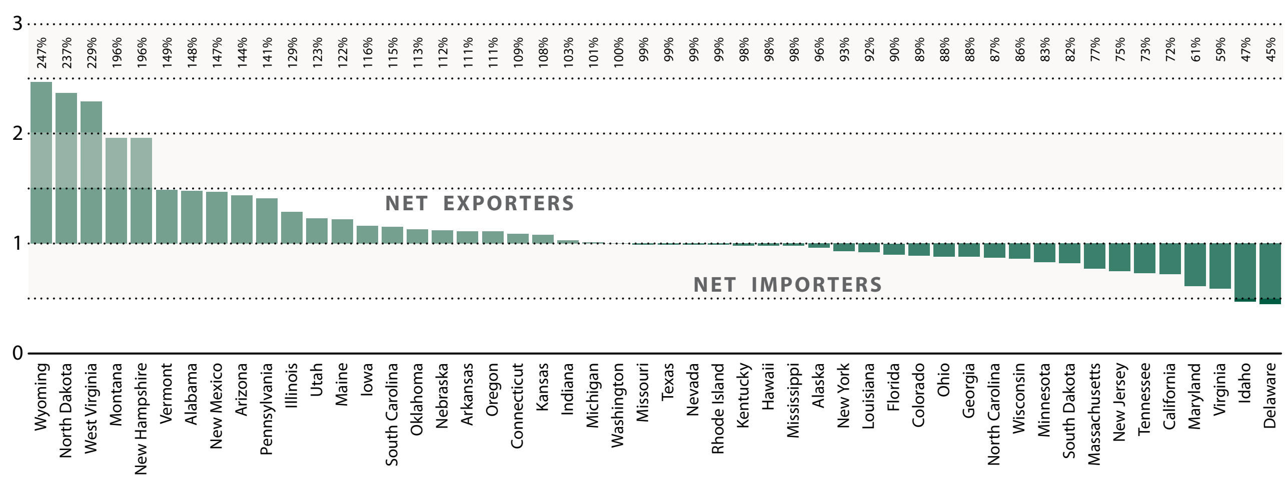
State-by-State Emissions Summary

Power plants are the largest source of CO_2 emissions in the U.S., and consistent with the U.S. Supreme Court's decision in Massachusetts v. EPA, the Agency has determined that greenhouse gas emissions endanger public health and welfare by causing long lasting changes in the global climate. As a result, EPA is planning to implement emissions standards for new and existing power plants. On March 28, 2012, EPA released its proposal for a New Source Performance Standard (NSPS) limiting greenhouse gas emissions from new fossil-fired power plants, and President Obama has directed EPA to issue proposed standards for existing power plants by June 2014. One of the challenges in developing a policy to regulate power plant CO_2 emissions will be to design an approach that recognizes the wide variability in the carbon intensity of the electric generating fleet. As illustrated in Figure 20, average CO_2 emission rates can vary significantly by state. A standard that would be easily achievable, in a state like Rhode Island, would be very difficult to achieve in a coal-dependent state like Michigan. Ironically, a state with relatively low emissions may find it more challenging to achieve further emissions reductions.

Also, states vary in terms of their import and export of electricity. Florida, for example, produces virtually all of the electricity that it generates with limited imports. West Virginia, in contrast, is a large exporter of electricity. Figure 19 summarizes the net imports or exports of electricity by state.

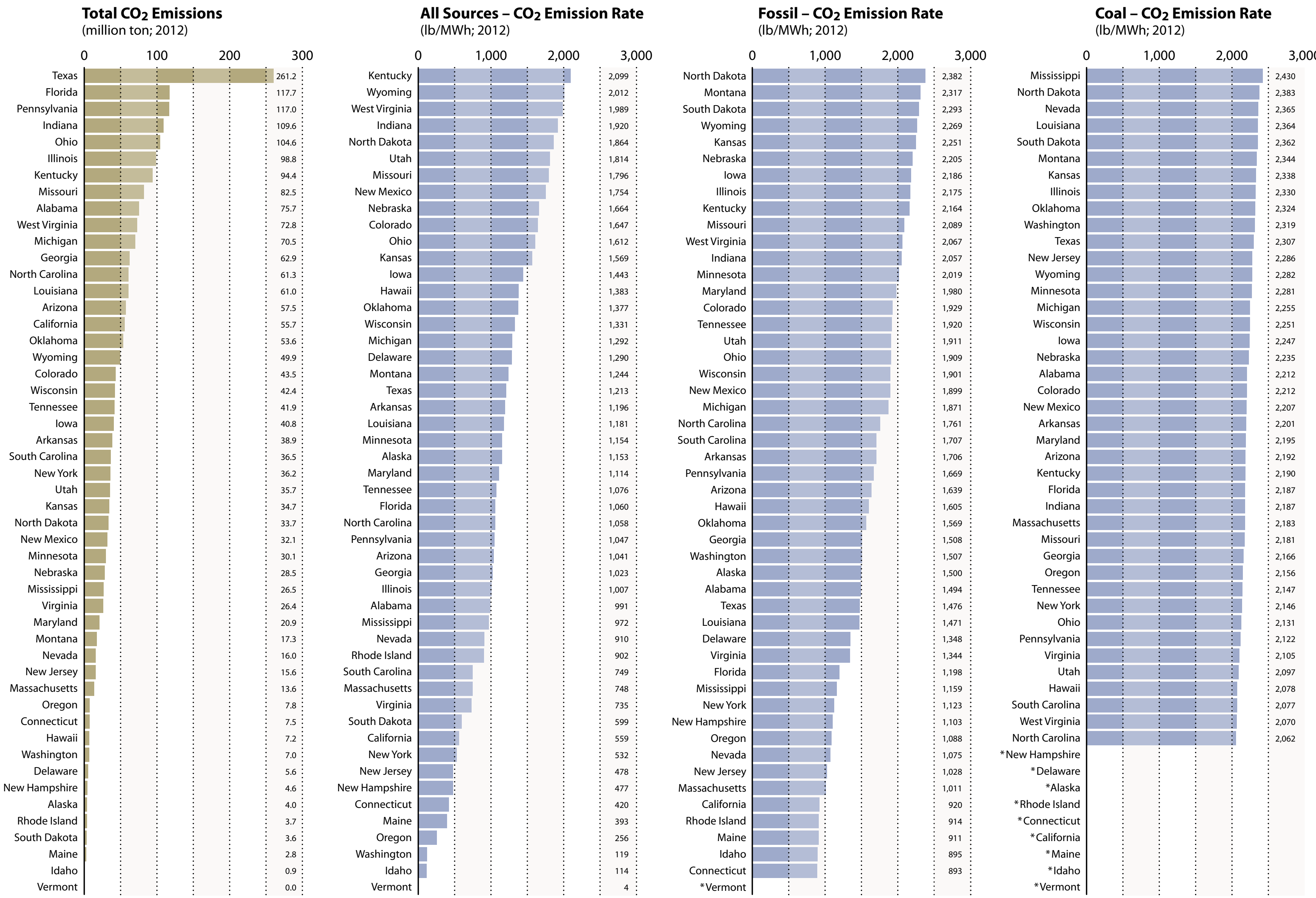
FIGURE 19

Electricity Exporters/Importers
(Net Trade Index; 2010)



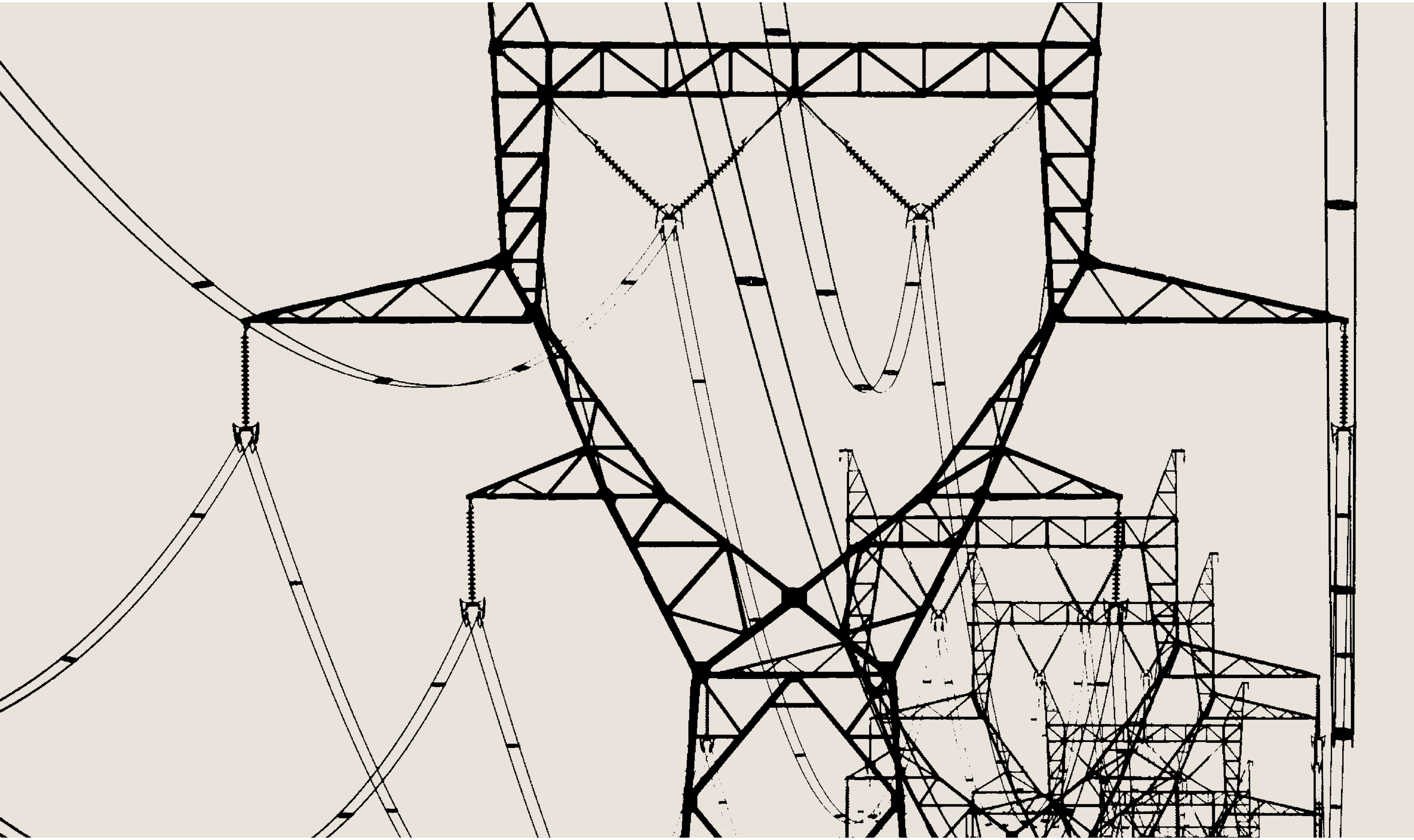
% : TOTAL IN-STATE SUPPLY OF ELECTRICITY AS % SHARE OF TOTAL IN-STATE CONSUMPTION NEEDS.

FIGURE 20



* FOSSIL-FIRED GENERATION OUTPUT IN THE STATE OF VERMONT IS TOO LOW TO CALCULATE A MEANINGFUL EMISSION RATE.

* COAL-FIRED GENERATION OUTPUT IN THESE STATES IS TOO LOW TO CALCULATE A MEANINGFUL EMISSION RATE.



Use of the Benchmarking Data

This report provides public information that can be used to evaluate electric power producers' emissions performance and risk exposure. Transparent information on emissions performance is useful to a wide range of decision-makers, including electric companies, financial analysts, investors, policymakers, and consumers.

Electric Companies

This provision of transparent information supports corporate self-evaluation and business planning by providing a useful "reality check" that companies can use to assess their performance relative to key competitors, prior years and industry benchmarks. By understanding and tracking their performance, companies can evaluate how different business decisions may affect emissions performance over time, and how they may more appropriately consider environmental issues in their corporate policies and business planning.

This report is also useful for highlighting the opportunities and risks companies may face from environmental concerns and potential changes in environmental regulations. Business opportunities may include increasing the competitive advantage of existing assets, the chance to generate or enhance revenues from emission trading mechanisms, and opportunities to increase market share by pursuing diversification into clean energy. Corporate risks that could have severe financial implications include a loss of competitive advantage or decrease in asset value due to policy changes, risks to corporate reputation, and the risk of exposure to litigation arising from potential violations of future environmental laws and regulations. Becoming aware of a company's exposure to these opportunities and risks is the first step in developing effective corporate environmental strategies.

Investors

The financial community and investors in the electric industry need accurate information concerning environmental performance in order to evaluate the financial risks associated with their investments and to assess their overall value. Air emissions information is material to investors and can be an important indicator of a company's management.

Evaluation of financial risks associated with SO_2, NOx, and mercury has become a relatively routine corporate practice. Increasingly, the disclosure of business impacts related to CO_2 is also gaining corporate attention. A turning point in corporate disclosure of CO_2 impacts occurred with the U.S. Securities and Exchange Commission's (SEC) issuance, in January 2010, of interpretive guidance concerning corporate climate risk. Since the issuance, all publicly-traded companies in the U.S. are required to disclose climate-related "material" effects on business operations – whether from new emissions management policies, the physical impacts of changing weather or business opportunities associated with the growing clean energy economy – in their annual SEC filings. Despite the SEC's guidance, some publically traded companies still fail to mention climate change in their most recent annual Form 10-K filings. As a result, some have concluded that SEC requirements must be strengthened to ensure companies meet the expectations of their investors to disclose climate-related risks.

Numerous studies have pointed to the growing financial risks of climate change issues for all firms, especially those within the electric industry. Changing environmental requirements can have important implications for long-term share value, depending on how the changes affect a company's assets relative to its competitors. Especially in the context of climate change, which poses considerable uncertainty and different economic impacts for different types of power plants, a company's current environmental performance can shed light on its prospects for sustained value.

As the risks associated with climate change have become clearer and regulation of carbon pollution moves ahead through the Environmental Protection Agency's New Source Performance Standards, the financial implications of climate change for the electric industry have drawn the attention of Wall Street. Ratings agencies such as Moody's Investors Service and Standard and Poor's have issued reports analyzing the credit impacts of climate change for the power sector. In a December 2013 report, Moody's Investor Service predicted a stable outlook for public power utilities in 2014, noting however that rising costs tied to environmental compliance and the transition to cleaner power sources create longer term risks.[53] In an October 2013 news release, Moody's noted that the completion of generation and environmental projects will drive capital investing of U.S. regulated utilities to peak in 2013 or 2014, and then fall in 2015. New environmental standards including rules for carbon emissions could cause capital spending to rise again after 2016.[54] In March 2013, Standard and Poor's (S&P) rating services declared that future carbon constraints need to be factored in to credit assessments for the oil sector. "By analyzing the potential impact of future carbon constraints driven by global climate change policies, a deterioration in the financial risk profiles for smaller oil companies that could lead to negative outlooks and downgrades."[55] Furthermore, S&P noted that U.S. utilities are responding to EPA's rules to limit greenhouse gas emissions by "closing coal-fired plants, installing new pollution-control equipment, building gas-fired units, or retooling older, coal-dependent sites to use different fuels". According to S&P, "Regulated utilities can generally pass these costs on to customers. Plans to meet stricter standards could weigh on credit quality if a utility lacks adequate cost-recovery regulatory mechanisms". Mainstream financial firms such as Citigroup and Sanford C. Bernstein have issued reports evaluating the company-specific financial impacts of different regulatory scenarios on electric power companies and their shareholders.[56,57]

Shareholder concern about the financial impacts of climate change has increased significantly over the past decade. Much of this concern is directed toward encouraging electric companies to disclose the financial risks associated with climate change, particularly the risks associated with the future regulation of CO_2. The Carbon Disclosure Project (CDP) was launched in 2000 and annually requests climate change information from companies. CDP now represents 722 institutional investors with combined assets of over $87 trillion under management, and, as of 2013, requests climate strategy and greenhouse gas emissions data from over 3,000 of the world's largest companies. In addition to its original Climate Change Program, CDP also recently introduced Supply Chain and Water Disclosure Programs. Over 60 companies currently work with CDP on their corporate supply chain, and 593 companies responded to CDP's Water Disclosure Program, a 59 percent increase since 2012. Since 2011, CDP has moved towards scoring companies not only on the comprehensiveness of their carbon disclosure, but also on their performance to combat climate change through mitigation, adaptation, and transparency. CDP notes that the performance score is a developing metric.

In 2003, the Investor Network on Climate Risk (INCR) was launched to promote better understanding of the risks of climate change among institutional investors. INCR, which now numbers 100 institutional investors representing assets of $13 trillion, encourages companies in which its members invest to address and disclose material risks and opportunities to their businesses associated with climate change and a shift to a lower carbon economy. In October 2013, a group of 70 global investors managing more than $3 trillion of collective assets launched a coordinated effort to spur 45 of the world's top oil and gas, coal and electric power companies to assess the financial risks that climate change poses to their business plans.

Shareholders have demonstrated increasing support for proxy resolutions requesting improved analysis and disclosure of the financial risks companies face from CO_2 emissions and their strategies for addressing these risks. According to the Investor Network on Climate Risk, a near record 110 shareholder resolutions relating to climate and environmental issues at more than 94 oil, coal and electric power companies were filed in the 2013 proxy season, and more than a dozen of the largest U.S. electric power companies have issued reports for investors detailing their climate-related business risks and strategies. In early 2014, FirstEnergy Corporation, one of the largest electric utilities in the U.S., reached an agreement with shareholders to report its plan for reducing greenhouse gas emissions by 2020. The company plans to cut its carbon dioxide emissions 25 percent below 2005 levels by 2015 through plant closures and the installation of additional emissions-control equipment. The decision comes in response to a shareholder resolution filed in the fall of 2013, and could encourage other energy companies to seriously consider the threat of climate change.[58] Shareholders continue to file resolutions with electric power companies that have not yet disclosed this information. According to the Investor Network on Climate Risk, a near record 110 shareholder resolutions relating to climate and environmental issues at more than 94 oil, coal and electric power companies were filed in the 2013 proxy season.

Policymakers

The information on emissions contained in this report is useful to policymakers who are working to develop long-term solutions to the public health and environmental effects of air pollutant emissions. The outcomes of federal policy debates concerning various regulatory and legislative proposals to improve power plant emissions performance will impact the electric industry, either in regard to the types of technologies or fuels that will be used at new power plant facilities or the types of environmental controls that will be installed at existing facilities.

Information about emissions performance helps policymakers by indicating which pollution control policies have been effective (e.g., SO_2 reductions under the Clean Air Act's Acid Rain Program), where opportunities may exist for performance and environmental improvements (e.g.,EPA's Carbon Pollution rules), and where policy action is required to achieve further environmental gains (e.g., the environmental and financial risks associated with climate change).

Electricity Consumers

Finally, the information in this report is valuable to electricity consumers. Accurate and understandable information on emissions promotes public awareness of the difference in environmental performance and risk exposure. In jurisdictions that allow consumers to choose their electricity supplier, this information enables consumers to consider environmental performance in power purchasing decisions. This knowledge also enables consumers to hold companies accountable for decisions and activities that affect the environment and/or public health and welfare.

The information in this report can also help the public verify that companies are meeting their environmental commitments and claims. For example, some electric companies are establishing voluntary emissions reduction goals for CO_2 and other pollutants, and many companies are reporting significant CO_2 emission reductions from voluntary actions. Public information is necessary to verify the legitimacy of these claims. Public awareness of companies' environmental performance supports informed public policymaking by promoting the understanding of the economic and environmental tradeoffs of different generating technologies and policy approaches.

Appendix A
Data Sources, Methodology and Quality Assurance

This report examines the air pollutant emissions of the 100 largest electricity generating companies in the United States based on 2012 electricity generation, emissions, and ownership data. The report relies on publicly-available information reported by the U.S. Energy Information Administration (EIA), U.S. Environmental Protection Agency (EPA), Securities and Exchange Commission (SEC), state environmental agencies, company websites, and media articles.

Data Sources

The following public data sources were used to develop this report:

EPA AIR MARKETS PROGRAM DATA (AMP): EPA's Air Markets Program Data account for almost all of the SO_2 and NOx emissions, and part of the CO_2 emissions analyzed in this report. These emissions were compiled using EPA's on-line emissions database available at http://ampd.epa.gov/ampd/.

EPA TOXIC RELEASE INVENTORY (TRI): Power plants and other facilities are required to submit reports on the use and release of certain toxic chemicals to the TRI. The 2012 mercury emissions used in this report are based on TRI reports submitted by facility managers and which are available at http://iaspub.epa.gov/triexplorer/tri_release.chemical.

EIA FORMS 923 POWER PLANT DATABASES (2012): EIA Form 923 is the source of nearly all generation data analyzed in this report. EIA Form 923 provides data on the electric generation and heat input by fuel type for utility and non-utility power plants. The heat input data was used to calculate the majority share of CO_2 emissions analyzed in this report. The form is available at http://www.eia.doe.gov/cneaf/electricity/page/eia906_920.html.

EIA FORM 860 ANNUAL ELECTRIC GENERATOR REPORT (2012): EIA Form 860 was used as the primary source of power plant ownership data for this report. EIA Form 860 is a generating unit level database that includes, among other things, capacity and ownership information about generators at electric power plants. The form is available at http://www.eia.doe.gov/cneaf/electricity/page/eia860.html.

EPA U.S. INVENTORY OF GREENHOUSE GAS EMISSIONS AND SINKS (2012): EPA's U.S. Inventory of Greenhouse Gas Emissions and Sinks report provides in Annex 2 estimated heat contents and carbon content coefficients of various fuel types. These coefficients are used in conjunction with EIA Form 923 to calculate the majority share of CO_2 emissions analyzed in this report. Annex 2 is available http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2014-Annex-2-Emissions-Fossil-Fuel-Combustion.pdf

Plant Ownership

This report aims to reflect power plant ownership as of December 31, 2012. Plant ownership data used in this report are primarily based on the EIA-860 database from the year 2012. EIA-860 includes ownership information on generators at electric power plants owned or operated by electric utilities and non-utilities, which include independent power producers, combined heat and power producers, and other industrial organizations. It is published annually by EIA.

For the largest 100 power producers, plant ownership is further checked against self-reported data from the producer's 10-K form filed with the SEC, listings on their website, news articles about mergers and acquisitions in the power sector, and other media sources. Ownership of plants is updated based on the most recent information available as a result of this process. The assigned owner of a plant in this report, as a result, may differ from EIA-860's reported ownership. This can happen when the plant in question falls in one or more of the categories listed below:

1. It is owned by a limited liability partnership, shareholders of which are among the 100 largest power producers.
2. The owner of the plant as listed in EIA-860 is a subsidiary of a company that is among the 100 largest power producers.
3. It changed hands during the year 2012. Because form 10-K for a particular year is usually filed in the first quarter of the following year, this report assumes that ownership as reported in form 10-K is more accurate.

Ownership information in this report reflects wholly- or partially-owned physical generating assets. The information does not include power purchase agreements or leased power plants.

Identifying "who owns what" in the dynamic electricity generation industry is probably the single most difficult and complex part of this report. Shares of power plants are regularly traded and producers merge, reorganize, or cease operations altogether. While considerable effort was expended in ensuring the accuracy of ownership information reflected in this report, there may be inadvertent errors in the assignment of ownership for some plants where public information was either not current or could not be verified.

Generation Data and Cogeneration Facilities

Plant generation data used in this report come from EIA Form 923.

Cogeneration facilities produce both electricity and steam or some other form of useful energy. Because electricity is only a partial output of these plants, their reported emissions data generally overstate the emissions associated with electricity generation. Generation and emissions data included in this report for cogeneration facilities have been adjusted to reflect only their electricity generation. For all cogeneration facilities emissions data were calculated on the basis of heat input of fuel associated with electricity generation only.

NOx and SO_2 Emissions

The EPA AMP database collects and reports SO_2 and NOx emissions data for nearly all major power plants in the U.S. Emissions information reported in the AMP database is collected from continuous emission monitoring (CEM) systems. SO_2 and NOx emissions data reported to the AMP account for virtually all of the SO_2 and NOx emissions assigned to the 100 largest power producers in this report. For a handful of mostly very small plants, additional emissions information was procured directly from their owners.

The AMP database collects and reports SO_2 and NOx emissions data by fuel type at the boiler level. This report consolidates this data at the generating unit and plant levels. In the case of jointly owned plants, because joint ownership is determined by producer's share of installed capacity, assignment of SO_2 and NOx emissions to the producers on this basis implicitly assumes that emission rates are uniform across the different units. This may cause producers to be assigned emissions that are slightly higher or lower than their actual shares.

The apportionment of NOx emissions between coal and natural gas at boilers that can burn both fuels may in certain instances slightly overstate coal's share of the emissions. This situation is likely to arise when a dual-fuel boiler that is classified as "coal-fired" within AMP burns natural gas to produce electricity in substantial amounts. In most years there would be very little economic reason to make this switch in a boiler that is not part of a combined cycle setup. But record low natural gas prices in 2012 led to a small number of boilers switching to natural gas for most or a large part of their electricity output. Because AMP datasets do not make this distinction, apportioning emissions based on the fuel-type of the boiler would increase coal's share of the emissions.

To correct for this potential distortion, this report compares AMP data with EIA 923, which provides heat input data broken down by fuel type, to identify boilers that are likely to be most affected. Emissions are reassigned in cases where the differences in heat input between the two sources are greater than 10 percent.

SO_2 and CO_2 emissions are mostly not affected by this issue. Natural gas emits virtually no SO_2. CO_2 emissions can be calculated from the heat input data report in EIA 923, which allows for the correct apportionment of emissions between coal and natural gas.

CO_2 Emissions

A majority of CO_2 emissions reported in this report were calculated using heat input data from EIA form 923 and carbon content coefficient of various fuel types provided by EPA. Table A.1 shows the carbon coefficients used in this procedure. Non-emitting fuel types, whose carbon coefficients are zero, are not shown in the table. CO_2 emissions reported through the EPA AMP account a small share of the CO_2 emissions used in this report.

The datasets report heat input and emissions data by fuel type at either the prime mover or boiler level. This report consolidates that data at the generating unit and plant levels. In the case of jointly owned plants, because joint ownership is determined by producer's share of installed capacity, assignment of CO_2 emissions to the producers on this basis implicitly assumes that emission rates are uniform across the different units. This may cause producers to be assigned emission figures that are slightly higher or lower than their actual shares.

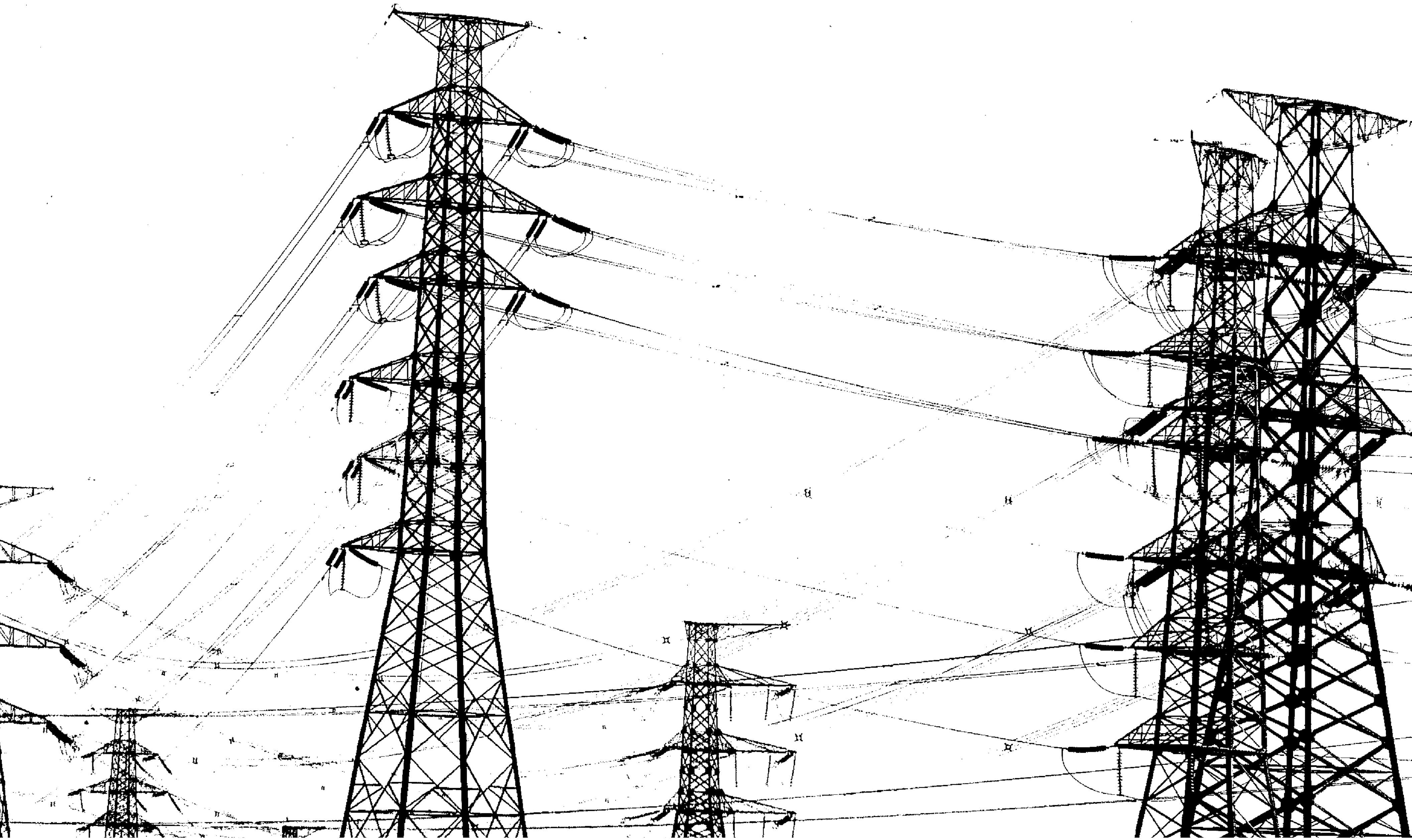
Mercury Emissions

Mercury emissions data for coal power plants presented in this report were obtained from EPA's Toxic Release Inventory (TRI). Mercury emissions reported to the TRI are based on emission factors, mass balance calculations, or data monitoring. The TRI contains facility-level information on the use and environmental release of chemicals classified as toxic under the Clean Air Act. Because coal plants are the primary source of mercury emissions within the electric industry, the mercury emissions and emission rates presented in this report reflect the emissions associated with each producer's fleet of coal plants only.

TABLE A.1

Carbon Content Co-efficients by Fuel Type

FUEL TYPE	CARBON CONTENT COEFFICIENTS (Tg Carbon/Qbtu)
COAL	
Anthracite Coal and Bituminous Coal	25.44
Lignite Coal	26.65
Sub-bituminous Coal	26.50
Waste/Other Coal (includes anthracite culm, bituminous gob, fine coal, lignite waste, waste coal)	26.05
Coal-based Synfuel (including briquettes, pellets, or extrusions, which are formed by binding materials or processes that recycle materials)	25.34
OIL	
Distillate Fuel Oil (Diesel, No. 1, No. 2, and No. 4 Fuel Oils)	20.17
Jet Fuel	19.70
Kerosene	19.96
Residual Fuel Oil (No. 5, No. 6 Fuel Oils, and Bunker C Fuel Oil)	20.48
Waste/Other Oil (including Crude Oil, Liquid Butane, Liquid Propane, Oil Waste, Re-Refined Motor Oil, Sludge Oil, Tar Oil, or other petroleum-based liquid wastes)	20.55
Petroleum Coke	27.85
GAS	
Natural Gas	14.46
Blast Furnace Gas	18.55
Other Gas	18.55
Gaseous Propane	14.46



Appendix B
Fuel Mix of the
Top-100 Power Producers

Table B.1 shows the 2012 fuel-mix for each of the 100 largest power producers. The share of each major fuel type –coal, gas, oil, nuclear, hydro, and renewable / other – is shown as a percentage share of total generation from facilities wholly and partially owned by each producer and reported to the EIA.

"Renewable / Other" comprises mostly generation from wind, solar, biomass, and geothermal, along with some small contributions from other miscellaneous fuel sources not classifiable into the main categories listed in the table. These include non-biogenic municipal solid waste, tire-derived fuel, manufactured and waste gases, etc.

TABLE B.1

Fuel Mix of 100 Largest Power Producers
in order of 2012 generation

Rank	Owner	Ownership Type	Total (million MWh)	Coal	Natural Gas	Oil	Nuclear	Hydro	Renewable / Other
1	Duke	investor-owned corp.	231.7	44%	26%	0.2%	28%	1%	2%
2	Exelon	investor-owned corp.	192.6	4%	13%	0.0%	80%	1%	2%
3	Southern	investor-owned corp.	175.3	37%	43%	0.0%	18%	2%	0%
4	NextEra Energy	investor-owned corp.	170.3	3%	59%	0.3%	22%	1%	15%
5	AEP	investor-owned corp.	163.4	73%	15%	0.2%	11%	1%	1%
6	Tennessee Valley Authority	federal power authority	144.6	44%	12%	0.1%	35%	9%	0%
7	Entergy	investor-owned corp.	129.5	11%	29%	0.0%	59%	0%	0%
8	Calpine	investor-owned corp.	113.1	0%	94%	0.0%	0%	0%	6%
9	FirstEnergy	investor-owned corp.	103.3	65%	3%	0.1%	30%	0%	1%
10	Dominion	investor-owned corp.	100.4	25%	26%	0.2%	48%	0%	1%
11	NRG	investor-owned corp.	96.7	59%	30%	0.3%	8%	0%	2%
12	MidAmerican	privately held corp.	89.1	69%	9%	0.1%	4%	5%	12%
13	PPL	investor-owned corp.	85.1	64%	13%	0.1%	18%	5%	0%
14	US Corps of Engineers	federal power authority	76.5	0%	0%	0.0%	0%	100%	0%
15	Xcel	investor-owned corp.	73.5	58%	23%	0.0%	16%	1%	2%
16	Energy Future Holdings	privately held corp.	70.5	70%	2%	0.1%	28%	0%	0%
17	Ameren	investor-owned corp.	69.1	80%	3%	0.1%	16%	2%	0%
18	PSEG	investor-owned corp.	53.3	10%	33%	1.3%	56%	0%	0%
19	US Bureau of Reclamation	federal power authority	49.8	8%	0%	0.0%	0%	92%	0%
20	DTE Energy	investor-owned corp.	40.7	80%	4%	0.2%	13%	0%	3%
21	Dynegy	investor-owned corp.	40.6	49%	51%	0.1%	0%	0%	0%
22	AES	investor-owned corp.	38.8	83%	9%	0.2%	0%	0%	7%
23	GDF Suez	foreign-owned corp.	36.6	24%	72%	0.0%	0%	2%	3%
24	Edison Mission Energy	privately held corp.	32.2	68%	15%	0.0%	0%	0%	17%
25	PG&E	investor-owned corp.	31.8	0%	20%	0.0%	56%	24%	1%
26	Pinnacle West	investor-owned corp.	28.7	42%	26%	0.0%	32%	0%	0%
27	General Electric	investor-owned corp.	27.9	36%	63%	0.1%	0%	0%	1%
28	Great Plains Energy	investor-owned corp.	27.5	82%	2%	0.1%	14%	0%	2%
29	Energy Capital Partners	privately held corp.	26.8	0%	100%	0.0%	0%	0%	0%
30	San Antonio City	municipality	26.6	49%	23%	0.0%	28%	0%	0%
31	OGE	investor-owned corp.	26.4	52%	42%	0.0%	0%	0%	6%
32	Salt River Project	power district	26.2	58%	20%	0.0%	21%	1%	0%
33	Westar	investor-owned corp.	25.5	74%	8%	0.1%	15%	0%	2%
34	Oglethorpe	cooperative	25.1	30%	29%	0.0%	41%	0%	0%
35	New York Power Authority	state power authority	25.0	0%	19%	0.0%	0%	81%	0%
36	SCANA	investor-owned corp.	24.9	48%	30%	0.2%	20%	1%	1%
37	Santee Cooper	state power authority	23.4	68%	20%	0.2%	10%	1%	0%
38	NV Energy	investor-owned corp.	21.8	16%	84%	0.0%	0%	0%	0%
39	CMS Energy	investor-owned corp.	21.2	67%	28%	0.2%	0%	2%	4%
40	Wisconsin Energy	investor-owned corp.	19.9	69%	26%	0.1%	0%	1%	4%
41	Edison International	investor-owned corp.	19.8	24%	34%	0.1%	29%	13%	0%
42	Basin Electric Power Coop	cooperative	18.5	93%	1%	0.1%	0%	0%	6%
43	TECO	investor-owned corp.	18.3	58%	41%	0.3%	0%	0%	0%
44	EDF	foreign-owned corp.	18.1	0%	0%	0.0%	82%	0%	18%
45	Alliant Energy	investor-owned corp.	18.1	78%	14%	0.3%	0%	1%	7%
46	Tenaska	privately held corp.	18.0	0%	100%	0.0%	0%	0%	0%
47	Rockland Capital	privately held corp.	17.7	1%	99%	0.1%	0%	0%	0%
48	NE Public Power District	power district	16.3	61%	2%	0.0%	36%	1%	1%
49	Associated Electric Coop	cooperative	16.3	68%	32%	0.0%	0%	0%	0%
50	Iberdrola	foreign-owned corp.	15.5	0%	6%	0.0%	0%	2%	93%
51	Riverstone	privately held corp.	14.7	45%	52%	0.3%	0%	0%	2%
52	IDACORP	investor-owned corp.	14.1	39%	4%	0.1%	0%	57%	0%

Rank	Owner	Ownership Type	Total (million MWh)	Coal	Natural Gas	Oil	Nuclear	Hydro	Renewable / Other
53	Los Angeles City	municipality	14.0	24%	53%	0.0%	14%	6%	3%
54	Occidental	investor-owned corp.	13.4	0%	99%	0.0%	0%	0%	1%
55	NiSource	investor-owned corp.	13.3	75%	24%	0.0%	0%	0%	0%
56	Tri-State	cooperative	13.0	92%	8%	0.1%	0%	0%	0%
57	Omaha Public Power District	power district	12.9	98%	2%	0.1%	0%	0%	0%
58	Dow Chemical	investor-owned corp.	12.9	0%	93%	0.0%	0%	0%	7%
59	JEA	municipality	12.7	49%	46%	0.1%	0%	0%	5%
60	Arkansas Electric Coop	cooperative	12.7	70%	26%	0.1%	0%	3%	0%
61	Municipal Elec. Auth. of GA	municipality	12.6	30%	15%	0.0%	56%	0%	0%
62	Sempra	investor-owned corp.	12.6	0%	89%	0.0%	1%	0%	9%
63	ArcLight Capital	privately held corp.	12.5	5%	67%	0.0%	0%	2%	27%
64	Entegra Power	privately held corp.	11.9	0%	100%	0.0%	0%	0%	0%
65	BP	foreign-owned corp.	11.6	0%	62%	0.0%	0%	1%	37%
66	NC Public Power	municipality	11.5	9%	0%	0.0%	90%	0%	0%
67	Exxon Mobil	investor-owned corp.	11.4	0%	92%	0.0%	0%	0%	8%
68	Great River Energy	cooperative	11.1	94%	5%	0.1%	0%	0%	1%
69	East Kentucky Power Coop	cooperative	10.8	91%	8%	0.1%	0%	0%	1%
70	PNM Resources	investor-owned corp.	10.5	57%	12%	0.2%	30%	0%	0%
71	Seminole Electric Coop	cooperative	10.4	73%	27%	0.2%	0%	0%	0%
72	PUD No 1 of Chelan County	power district	10.3	0%	0%	0.0%	0%	100%	0%
73	J-Power	foreign-owned corp.	10.0	2%	98%	0.3%	0%	0%	0%
74	PUD No 2 of Grant County	power district	9.9	0%	0%	0.0%	0%	100%	0%
75	CLECO	investor-owned corp.	9.9	34%	55%	0.0%	0%	0%	10%
76	Intermountain Power Agency	power district	9.8	100%	0%	0.1%	0%	0%	0%
77	Energy Northwest	municipality	9.7	0%	0%	0.0%	96%	1%	3%
78	EDP	foreign-owned corp.	9.6	0%	0%	0.0%	0%	0%	100%
79	Lower CO River Authority	state power authority	9.6	55%	44%	0.0%	0%	1%	0%
80	El Paso Electric	investor-owned corp.	9.4	7%	38%	0.0%	55%	0%	0%
81	Portland General Electric	investor-owned corp.	9.3	36%	31%	0.1%	0%	21%	12%
82	Puget Holdings	privately held corp.	9.3	43%	29%	0.1%	0%	8%	20%
83	Big Rivers Electric	cooperative	9.2	84%	0%	0.1%	0%	0%	16%
84	Austin Energy	municipality	8.7	35%	31%	0.0%	34%	0%	0%
85	ALLETE	investor-owned corp.	8.6	90%	0%	0.0%	0%	3%	6%
86	Integrys	investor-owned corp.	8.4	89%	2%	0.1%	0%	4%	4%
87	UniSource	investor-owned corp.	8.3	82%	17%	0.1%	0%	0%	0%
88	TransCanada	foreign-owned corp.	7.8	0%	80%	0.1%	0%	16%	3%
89	LS Power	privately held corp.	7.7	0%	96%	0.0%	0%	4%	0%
90	International Paper	investor-owned corp.	7.5	4%	19%	1.4%	0%	0%	76%
91	Buckeye Power	cooperative	7.0	97%	2%	0.5%	0%	0%	0%
92	Seattle City Light	municipality	6.9	0%	0%	0.0%	0%	100%	0%
93	E.ON	foreign-owned corp.	6.9	0%	0%	0.0%	0%	0%	100%
94	Grand River Dam Authority	state power authority	6.7	60%	36%	0.0%	0%	4%	0%
95	Avista	investor-owned corp.	6.7	19%	17%	0.0%	0%	61%	3%
96	Brazos Electric Power Coop	cooperative	6.7	0%	100%	0.0%	0%	0%	0%
97	Hoosier Energy	cooperative	6.7	91%	9%	0.2%	0%	0%	0%
98	Sacramento Municipal Util Dist	municipality	6.5	0%	75%	0.0%	0%	22%	3%
99	Centrica	foreign-owned corp.	6.3	0%	100%	0.0%	0%	0%	0%
100	Waste Management	investor-owned corp.	6.3	6%	3%	0.0%	0%	0%	92%
		Total (top-100 producers)	3,462.1	39%	29%	0.1%	22%	7%	4%
		Total (all U.S. producers)	4,049.0	37%	30%	0.3%	19%	7%	6%

Endnotes

1. Private entities include investor-owned and privately held utilities and non-utility power producers (e.g., independent power producers). Cooperative electric utilities are owned by their members (i.e., the consumers they serve). Publicly-owned electric utilities are nonprofit government entities that are organized at either the local or State level. There are also several Federal electric utilities in the United States, such as the Tennessee Valley Authority.

2. SO_2 and NOx emissions data from U.S. Environmental Protection Agency (EPA)EPA, "1970 - 2011 Average annual emissions, all criteria pollutants in MS Excel." National Emissions Inventory (NEI) Air Pollutant Emissions Trends Data, December 2013. http://www.epa.gov/ttnchie1/trends/, (accessed January 15, 2014)

   CO_2 emissions data from EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011, at p. ES-10, April 2013. http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2013-Main-Text.pdf (accessed January 16, 2014)

   Mercury emissions data from, EPA, U.S. EPA Toxics Release Inventory Reporting Year 2010 National Analysis: Overview at p. 8. January 2014. http://www.epa.gov/tri/tridata/tri10/nationalanalysis/overview/2010TRINAOverview.pdf (accessed January 15, 2014)

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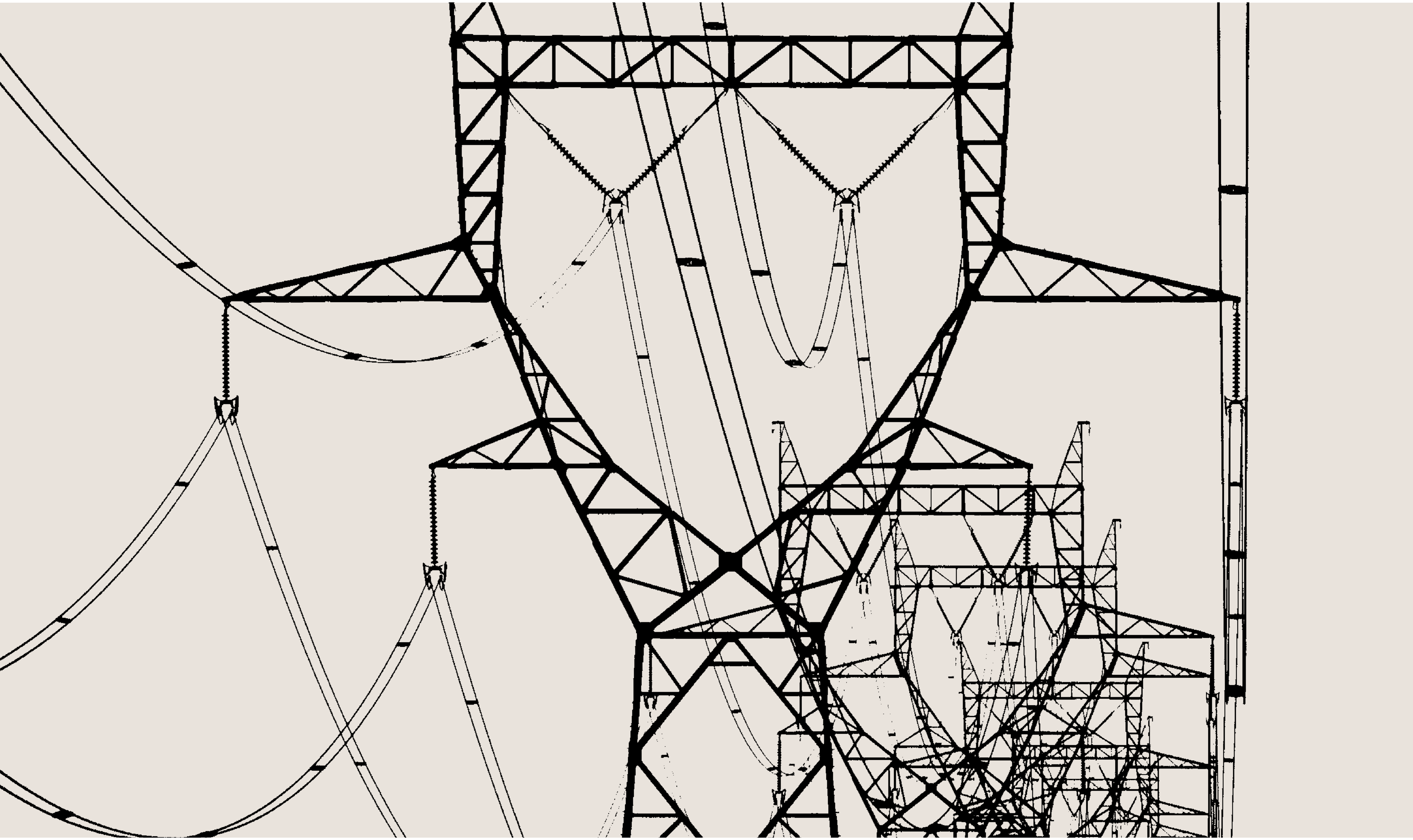

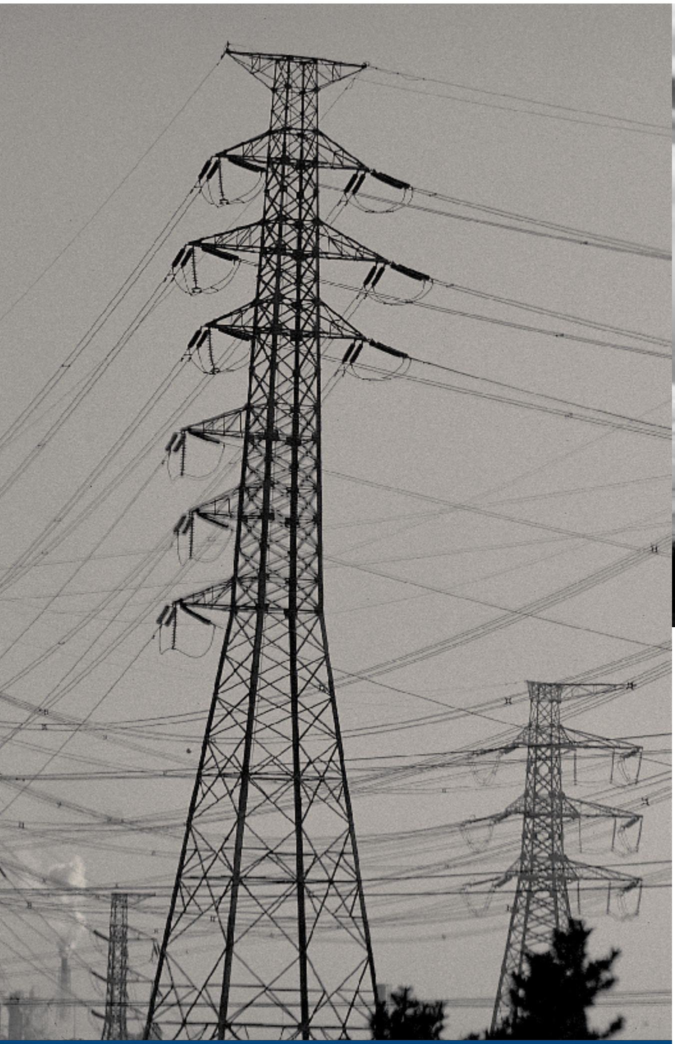

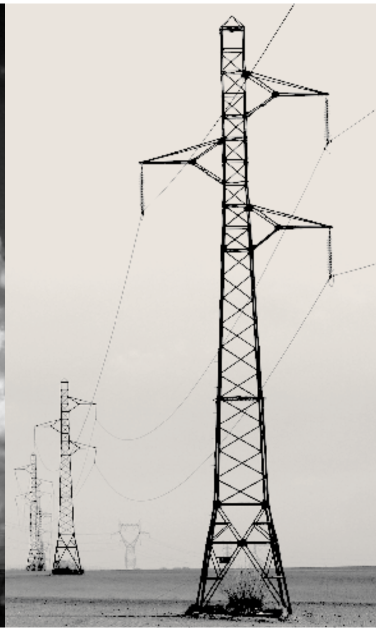

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