Benchmarking Air Emissions

Of the 100 Largest Electric Power Producers in the United States

December 2025

Data Downloads at: www.erm.com

Contributors:

Preface

The 2025 Benchmarking report is the 21st collaborative effort highlighting environmental performance and progress in the U.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. Company-specific data and all associated company metrics are based on 2024 generation and emissions data; aggregate sector-wide trends are presented through 2024 as well, unless otherwise noted. Note that the 2024 Benchmarking report (released Fall 2024) analyzed 2022 data for company-specific insights and 2023 data for sector-wide trends; ERM has not released a report analyzing 2023 data for company-specific insights.

Data on U.S. power plant generation and air emissions are available to the public through several databases maintained by state and federal 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), nitrogen oxides (NOx), carbon dioxide (CO_2), and mercury (Hg) 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.

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Select plant- and company-level data used in this report are available at www.erm.com.

Interactive Analytical Resources

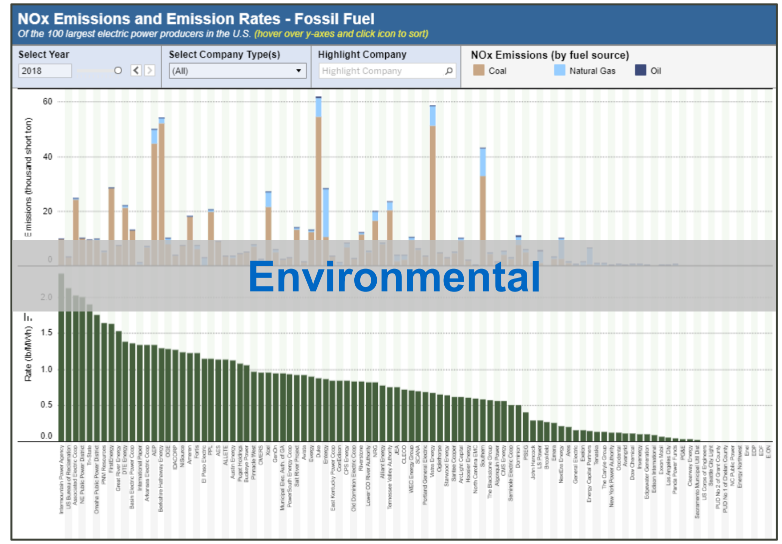
The Benchmarking Report includes a series of interactive, web-based dashboards to further visualize the emissions and electricity generation from power producers in the United States. These tools provide insight into how facility- and company-level emissions and generation are changing over time by utilizing historical Benchmarking data (2008-2024). Data include:

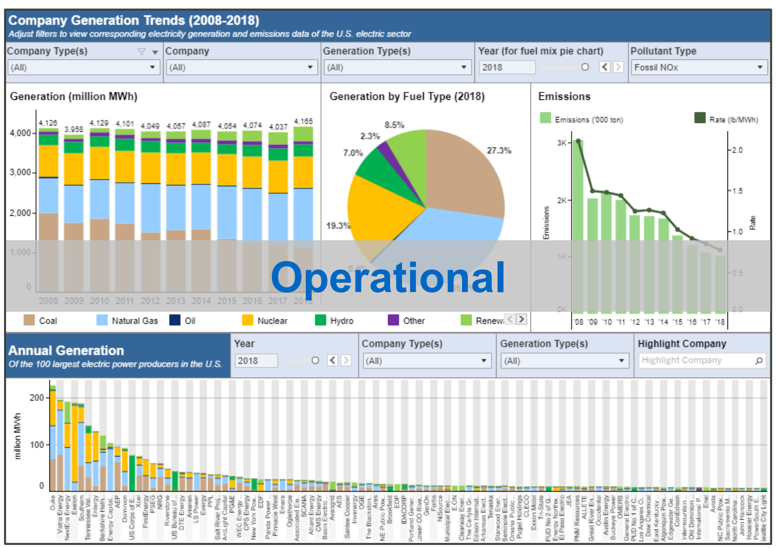
Environmental: Company-specific emissions and emission rates by company type and pollutant

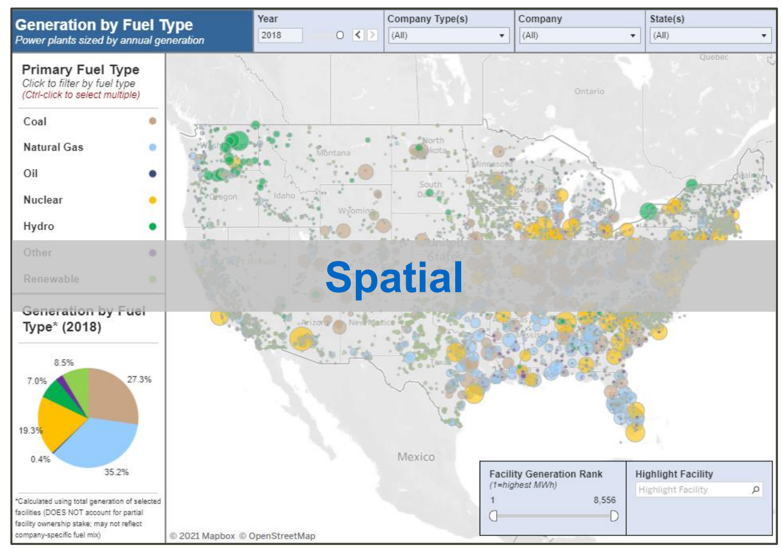
Operational: Electricity generation and relevant data aggregated by company type, company, and other metrics

Spatial: Facility-level emissions and generation visualized by fuel type, company ownership, and other metrics

These tools are available at www.erm.com.







Key Findings

- The 100 largest power producers in the United States own over 4,300 power plants and account for nearly 80 percent of the sector's electric generation and reported air emissions. Their fuel mix, emissions, and emission rates vary widely as summarized throughout this report (based on 2024 data).
- For the electric sector overall, in 2024, power plant SO_2 and NOx emissions were 96% and 90% lower, respectively, than in 1990 when Congress passed major amendments to the Clean Air Act. In 2024, power plant SO_2 and NOx emissions were 28% and 12% lower, respectively, than they were in 2022; however, NOx emissions slightly increased between 2023 and 2024.
- Power sector CO_2 emissions in 2024 were 22% lower than 1990 levels and about 40% lower than their peak in 2007. However, power sector CO_2 emissions slightly increased between 2023 and 2024, and 2024 emissions were only 1% lower than 2020 levels, largely due to the significant increase in natural gas generation as coal generation has declined.
- Mercury air emissions from power plants (as reported to the TRI database) have decreased 94% since 2000. The first-ever federal limits on mercury and other hazardous air pollutants from coal-fired power plants went into effect in 2015.

Download plant-level data from the 2025 Benchmarking Air Emissions report at: www.erm.com

Electricity in the United States

The electricity sector in the United States includes a wide array of companies that produce and distribute electricity to homes and offices, industrial facilities, and other customers. The services it provides are essential to the growth and functioning of the U.S. economy. Electricity is also beginning to serve a growing share of energy consumption in the U.S. with the electrification of transportation and other end-uses.

Section I

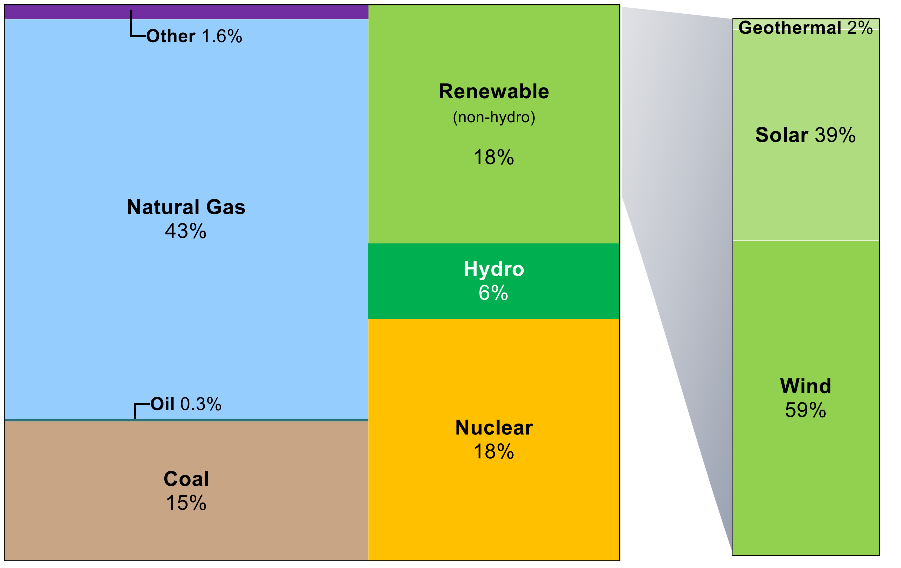
U.S. Electric Sector Highlights

U.S. Electricity Generation

- In 2024, the U.S. electric system continued shifting toward pre-COVID trends associated with zero-emitting generation growth and coal decline. However, natural gas generation continues to grow and was responsible for more generation in 2024 than any preceding year. Fossil sources were responsible for nearly 60% of electricity generation.
- Growth in natural gas generation has exceeded the decline in coal generation since 2021. Natural gas generation has increased by 18% since 2021 and represents the leading source of power generation in the United States.
- Utility-scale solar and wind generation increased by 33% and 7%, respectively, between 2023 and 2024. 2024 was the first year in which solar and wind cumulatively generated more electricity than coal in the U.S.
- Nuclear plants accounted for 18% of total U.S. generation, hydroelectric resources 5%, and other resources (oil, waste, etc.) <3%. Non-hydroelectric renewables (wind, solar, and geothermal) accounted for 18% of total U.S. generation (increasing from 16% in 2023).

Note: See “Data Sources” (page 44) for more information.

U.S. Electricity Generation by Fuel Type (2024)



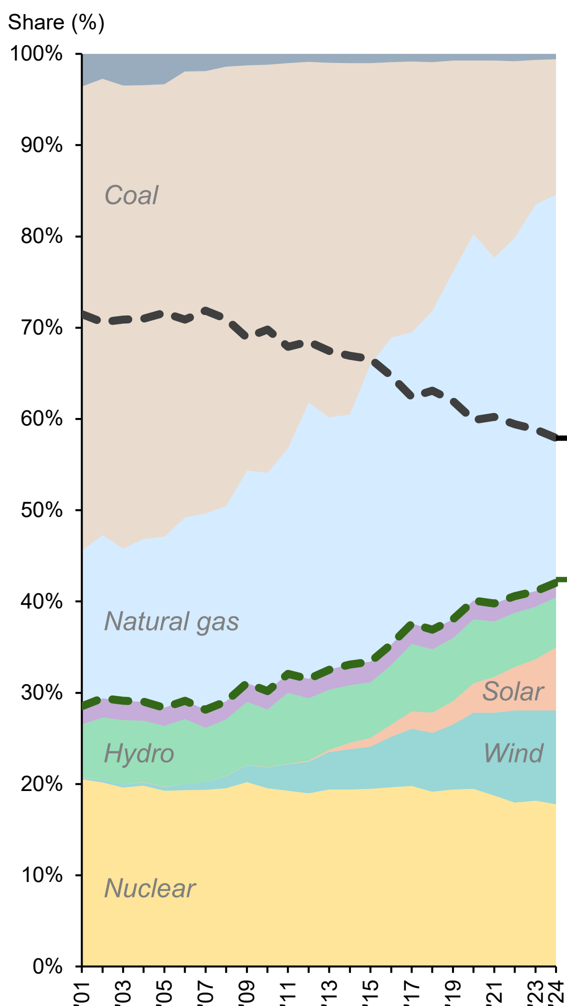
Zero-Carbon Generation in the United States

In 2024, renewables and other zero-carbon resources generated approximately 41% of U.S. electricity; nuclear was responsible for 44% of this generation, renewables 43% (wind, solar, geothermal), and hydro 14%. Combined, these zero-carbon resources represent the second-leading source of power generation in the United States (behind natural gas). For the first time ever, solar was the fastest growing* generating resource.

*Year-over-year, energy basis (i.e., MWh)

U.S. Generation Trends

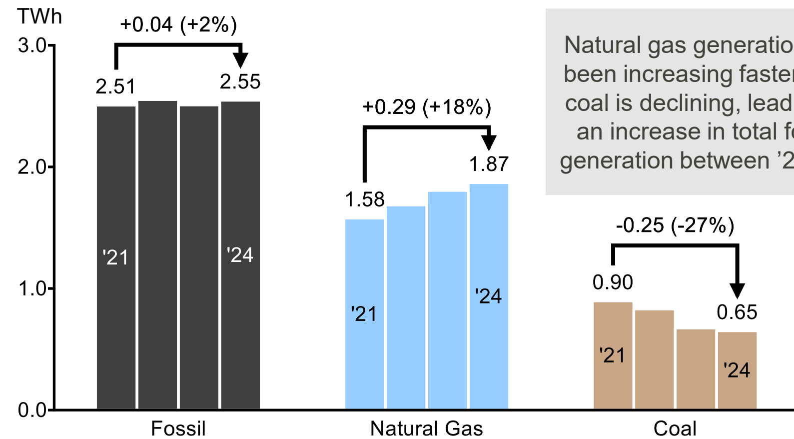
Electricity Generation (2001-2024)
share of generation



Total fossil generation has remained relatively constant over the past 25 years, but natural gas now generates 3x more electricity than coal – a reversal of fossil composition circa 2000.

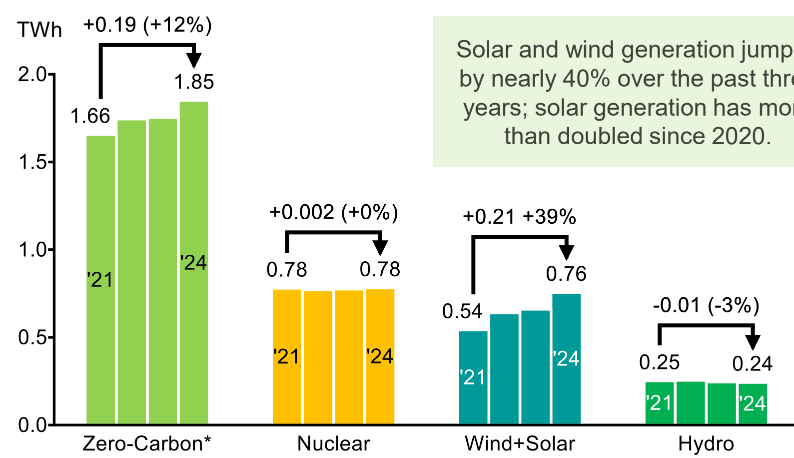
Wind and solar generation have increased significantly over the past decade and – together – will likely overtake nuclear as the largest source of zero-carbon generation in 2025.

Fossil Generation (2021-2024)
TWh



Natural gas generation has been increasing faster than coal is declining, leading to an increase in total fossil generation between '21-'24.

Zero-Carbon Generation (2021-2024)
TWh



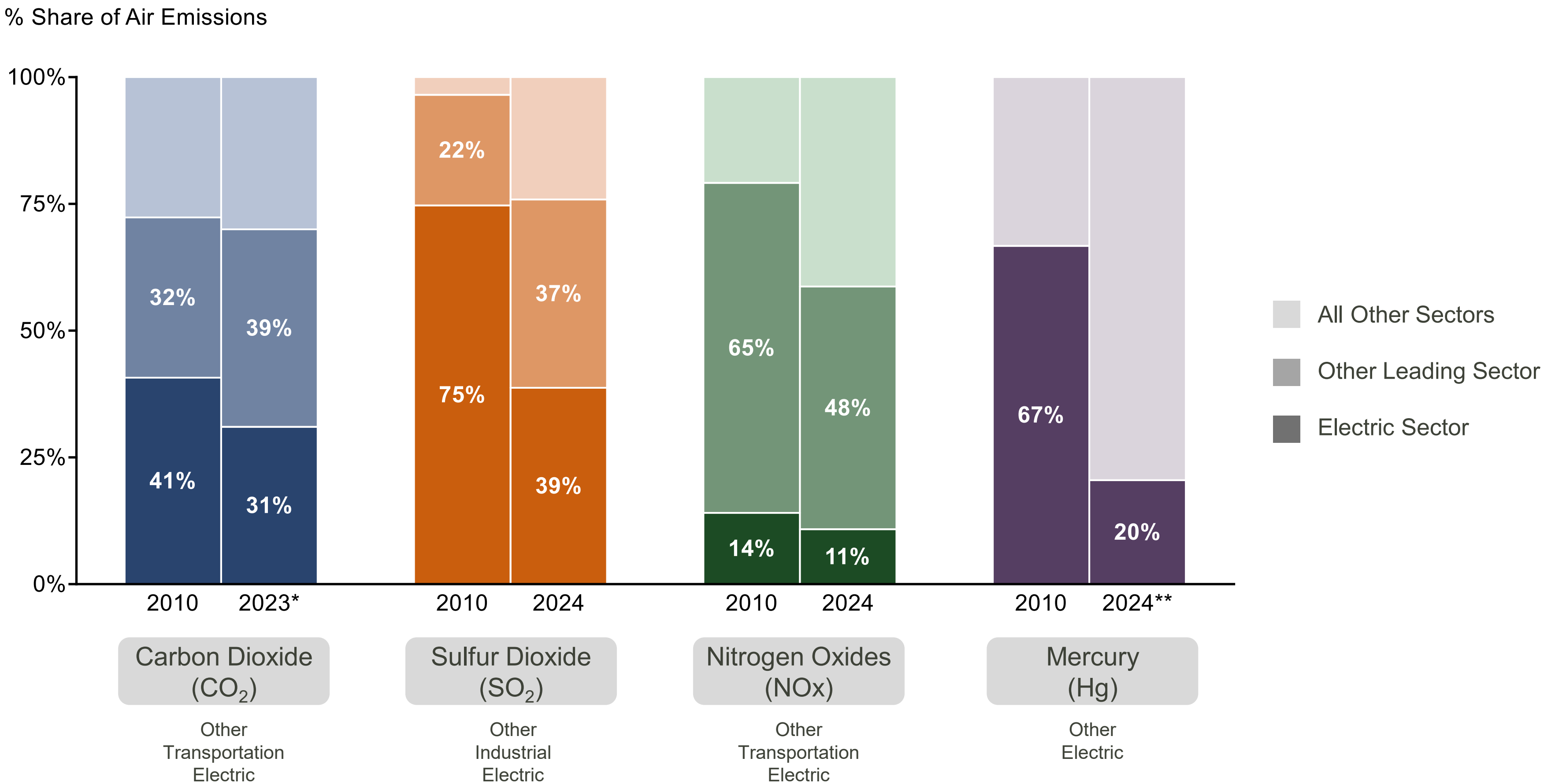
Solar and wind generation jumped by nearly 40% over the past three years; solar generation has more than doubled since 2020.

*Includes biomass for simplicity; biomass not considered zero-carbon resource elsewhere in report

Note: See "Data Sources" (page 44) for more information.

Share of Emissions by Sector

Share of Emissions: U.S. Electric Sector and Other Sectors



* Most recent sector-wide data
** Preliminary 2024 data

Note: See "Data Sources" (page 44) for more information.

Section II

Emissions of the 100 Largest Electric Power Producers

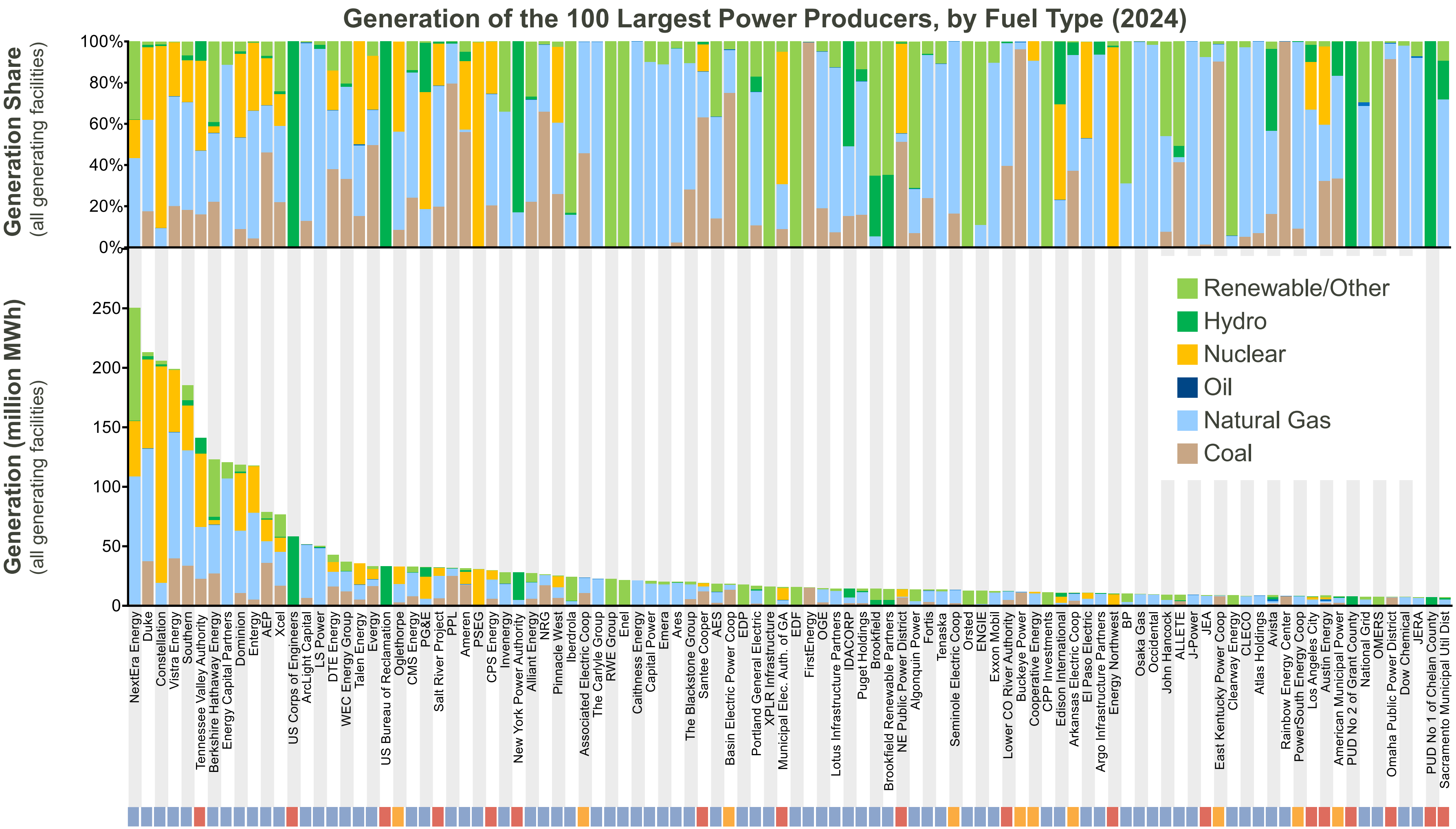
The 100 Largest Electric Power Producers

The report examines and compares the stack air pollutant emissions of the 100 largest power producers in the United States based on their 2024 generation, plant ownership, and emissions data. The table below 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 (collectively referred to as “companies” or “producers” in this report) that own over 4,300 power plants and account for almost 80% of both reported electric generation and CO_2 emissions.

The report focuses on four power plant pollutants for which public emissions data are available: sulfur dioxide (SO_2), nitrogen oxides (NOx), mercury (Hg), and carbon dioxide (CO_2). At sufficient concentrations, these pollutants are associated with significant environmental and/or public health problems, including acid deposition, mercury deposition, nitrogen deposition, global warming, ground-level ozone, regional haze, and/or fine particle air pollution, which can lead to asthma and other respiratory illnesses. The report benchmarks, or ranks, each company’s absolute emissions and its emission rate (determined by dividing emissions by electricity produced) for each pollutant. In 2024, the 100 largest power producers emitted, in aggregate, approximately 0.48 million short tons of SO_2, 0.52 million short tons of NOx, 2.07 short tons of mercury, and 1.27 billion short tons of CO_2.

Rank	Producer Name	TWh
1	NextEra Energy	250.4
2	Duke	213.1
3	Constellation	205.7
4	Vistra Energy	198.9
5	Southern	185.4
6	Tennessee Valley Authority	141.1
7	Berkshire Hathaway Energy	122.9
8	Energy Capital Partners	120.6
9	Dominion	118.5
10	Entergy	117.9
11	AEP	78.8
12	Xcel	76.8
13	US Corps of Engineers	58.1
14	ArcLight Capital	51.7
15	LS Power	50.4
16	DTE Energy	42.9
17	WEC Energy Group	37.0
18	Talen Energy	35.5
19	Evergy	33.3
20	US Bureau of Reclamation	33.1
21	Oglethorpe	32.9
22	CMS Energy	32.9
23	PG&E	32.4
24	Salt River Project	32.2
25	PPL	31.6
26	Ameren	31.6
27	PSEG	30.7
28	CPS Energy	29.8
29	Invenergy	28.1
30	New York Power Authority	27.9
31	Alliant Energy	27.3
32	NRG	26.2
33	Pinnacle West	25.6
34	Iberdrola	24.2
35	Associated Electric Coop	23.7
36	The Carlyle Group	22.6
37	RWE Group	22.5
38	Enel	21.6
39	Caithness Energy	21.4
40	Capital Power	20.9
41	Emera	20.2
42	Ares	20.2
43	The Blackstone Group	20.2
44	Santee Cooper	19.2
45	AES	18.4
46	Basin Electric Power Coop	18.3
47	EDP	17.9
48	Portland General Electric	16.9
49	XPLR Infrastructure	16.1
50	Municipal Elec. Auth. of GA	15.9
51	EDF	15.7
52	FirstEnergy	15.3
53	OGE	14.7
54	Lotus Infrastructure Partners	14.5
55	IDACORP	14.3
56	Puget Holdings	14.2
57	Brookfield	14.2
58	Brookfield Renewable Partners	14.0
59	NE Public Power District	13.9
60	Algonquin Power	13.7
61	Fortis	13.6
62	Tenaska	13.6
63	Seminole Electric Coop	13.4
64	Orsted	12.7
65	ENGIE	12.6
66	Exxon Mobil	12.5
67	Lower CO River Authority	12.3
68	Buckeye Power	11.7
69	Cooperative Energy	11.4
70	CPP Investments	11.2
71	Edison International	11.0
72	Arkansas Electric Coop	11.0
73	El Paso Electric	10.9
74	Argo Infrastructure Partners	10.6
75	Energy Northwest	10.2
76	BP	10.1
77	Osaka Gas	9.9
78	Occidental	9.6
79	John Hancock	9.4
80	ALLETE	9.3
81	J-Power	9.3
82	JEA	9.1
83	East Kentucky Power Coop	8.9
84	Clearway Energy	8.8
85	CLECO	8.4
86	Atlas Holdings	8.4
87	Avista	8.3
88	Rainbow Energy Center	8.3
89	PowerSouth Energy Coop	8.2
90	Los Angeles City	8.0
91	Austin Energy	8.0
92	American Municipal Power	7.9
93	PUD No 2 of Grant County	7.9
94	National Grid	7.6
95	OMERS	7.6
96	Omaha Public Power District	7.5
97	Dow Chemical	7.4
98	JERA	7.3
99	PUD No 1 of Chelan County	7.3
100	Sacramento Municipal Util Dist	7.3

Rankings by Generation

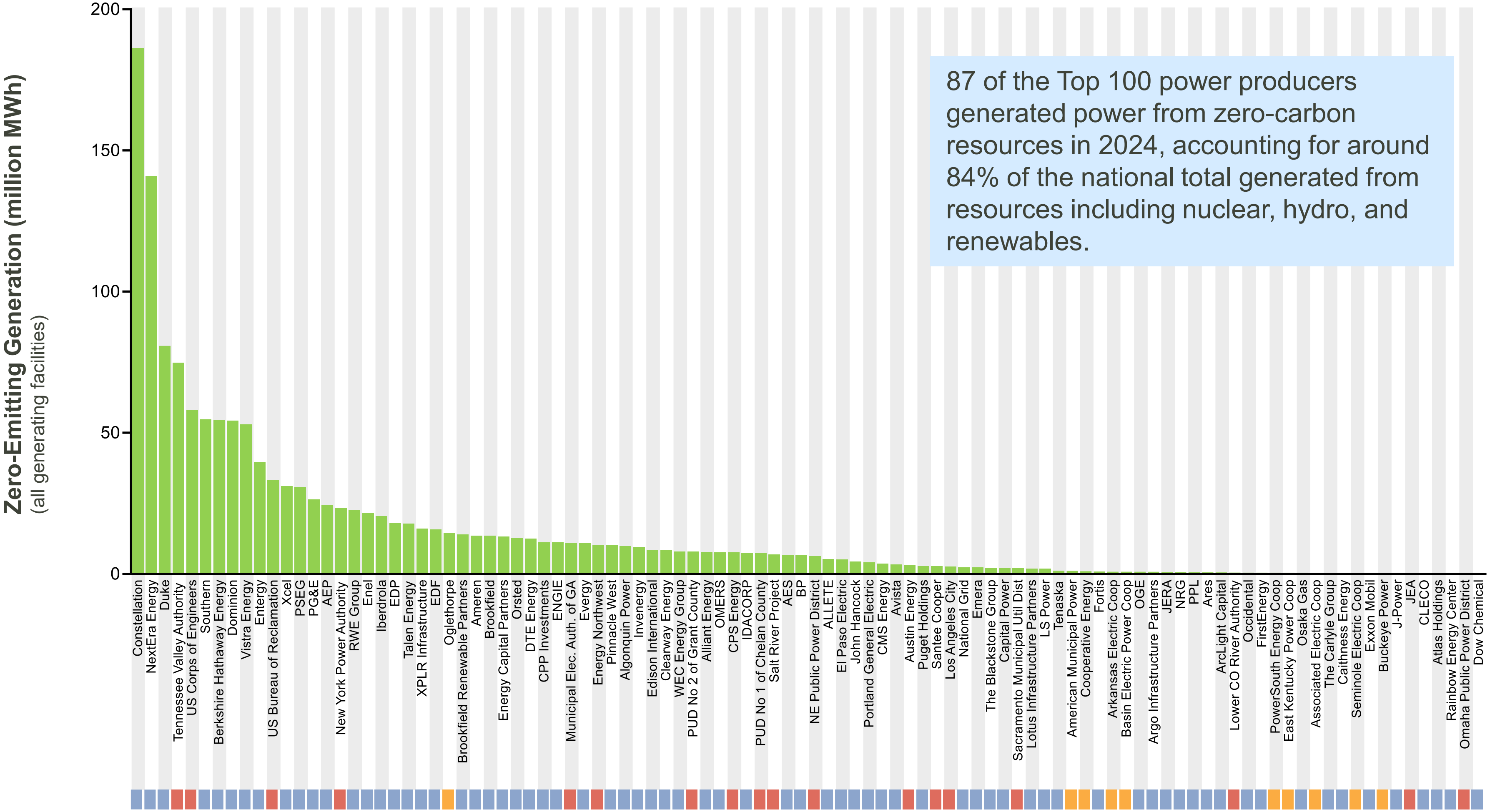


Note: Generation associated with individual fuel types may not be visible due to chart resolution

Breakdown of ownership categories provided in "Methodology" (page 45): privately-/investor-owned public power cooperative

Rankings by Zero-Carbon Generation

Zero-Carbon Generation of the 100 Largest Power Producers (2024)

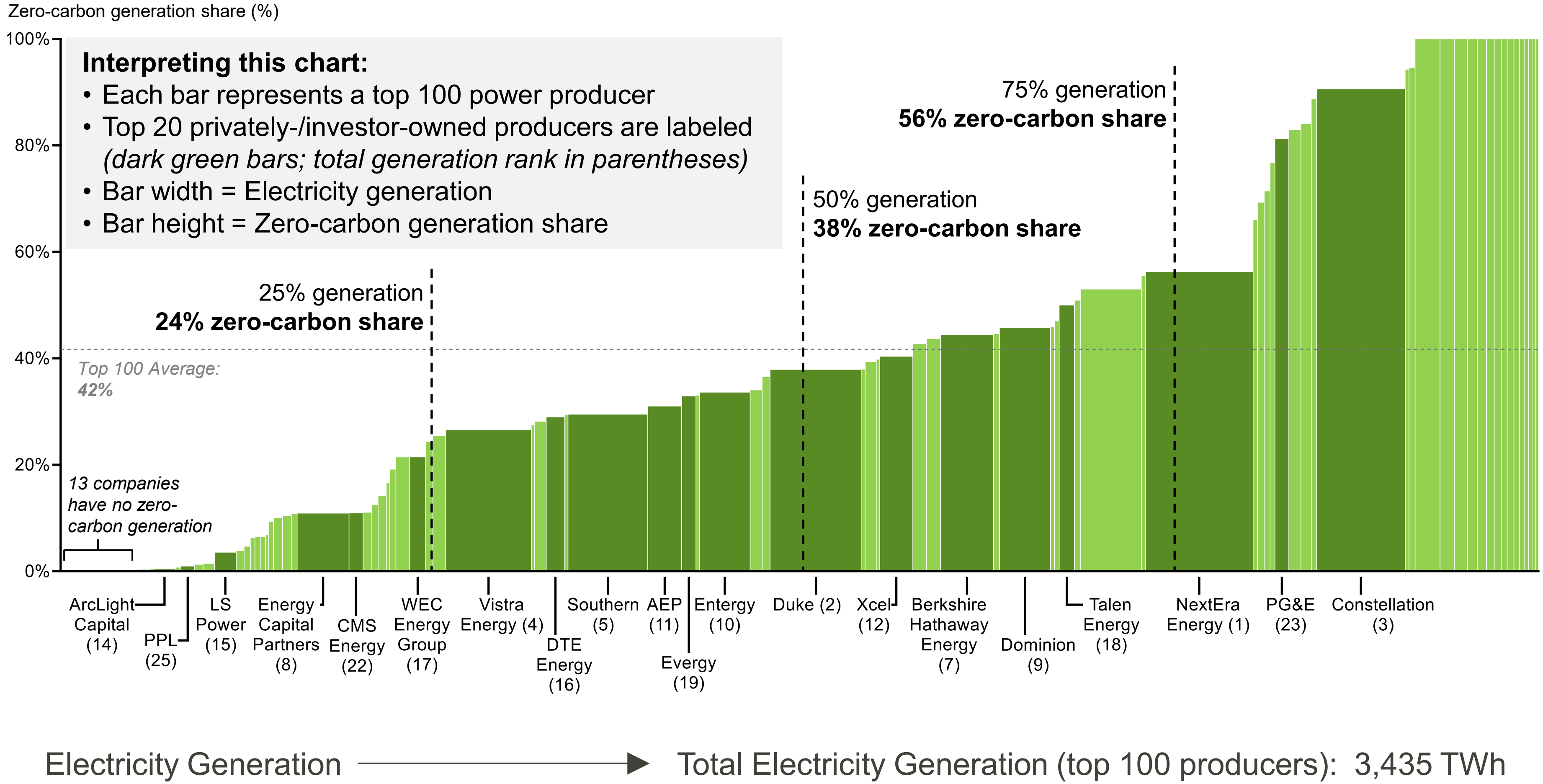


Note: Generation associated with individual fuel types may not be visible due to chart resolution

Breakdown of ownership categories provided in "Methodology" (page 45): privately-/investor-owned public power cooperative

Generation of Top 100 Producers, by Zero-Carbon Share

Electricity Generation Associated with Zero-Carbon Generation Share (Top 100 Power Producers)



Emission Rankings

Important Note on Emission Rankings

The Benchmarking Report presents generation and emissions information of power producers, not distribution utilities that deliver electricity to customers. In order to apply a uniform methodology to all power producers, the Report assigns electricity generation and associated emissions to power producers according to their known generating asset ownership as of December 31, 2024. Assets retired or sold before this date are not allocated to power producers on a prorated basis. For example, a company which retires a generating unit before this date will not see its generation reflected in the rankings. Similarly, a company which purchases a generating unit from another will take on the unit's full output for the calendar year.

The above is true even when a producer's generating facilities are part of one or more contractual agreements (e.g., power purchase contracts, etc.) with other entities (often utilities). In other words, this Report attributes all generation and emissions to the owner of an asset, not to purchasers of the asset's output or to counterparties to the contracts. Publicly available data do not allow the accurate and exhaustive tracking of such agreements.

There are a host of reasons why a company's generation profile may differ from that of the electricity it delivers to customers. For example, rural cooperatives, which are non-profit entities and are thus generally unable to directly take advantage of renewable tax credits, tend to rely on power purchase agreements and other non-asset owning mechanisms to deliver renewable electricity to their customers.

A vertically integrated utility that owns a large fossil generating fleet, but also delivers purchased renewable electricity to its customers, might have lower average emission rates than the level attributed in this report to the power producer that owns the said fossil fleet, if the renewable energy purchases were factored into the utility's performance. By the same token, the utility's emissions or emission rate would increase if it contracted with a higher emitting facility or relied on market purchases with associated emissions.

The charts in the next few pages 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, CO_2 emissions range from zero to over 95 million short tons per year. The NOx emission rates range from zero to 1.5 pounds per megawatt-hour of generation. A power producer's total emissions are influenced by the amount of generation that the producer owns and by the fuels and technologies that it uses to generate electricity.

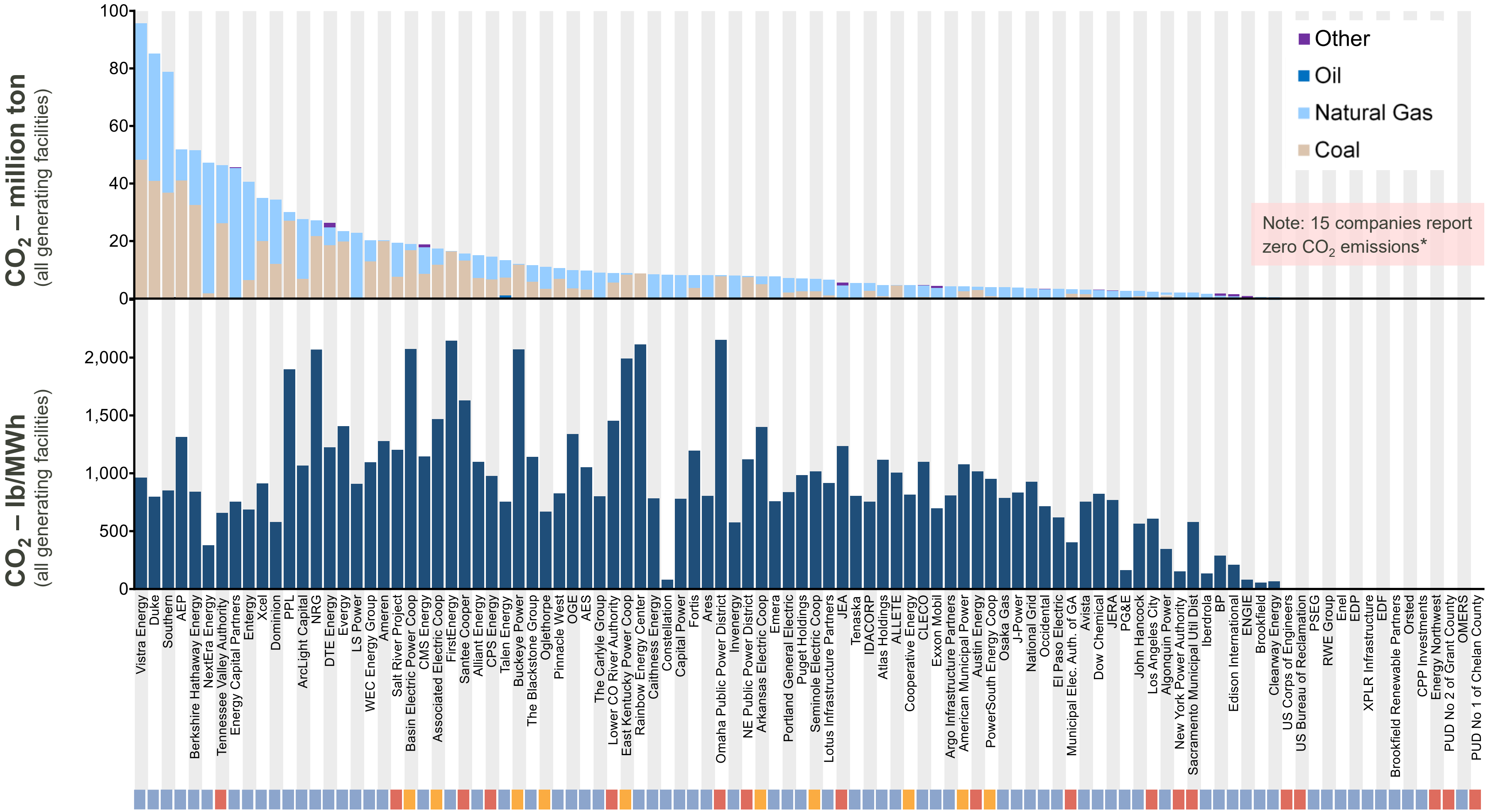
Emission Contributions

Percent of industry emissions	SO_2 (million short ton)	NO_x (million short ton)	Mercury (Hg) (short ton)	CO_2 (billion short ton)
100%	0.60	0.65	2.73	1.61
100 largest producers				
	80%	79%	76%	79%
No. of producers				
75%	29	47	47	59
50%	11	15	11	18
25%	4	4	3	5

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 four and five top 100 producers, respectively.

CO_2: Total Emissions and Emission Rates

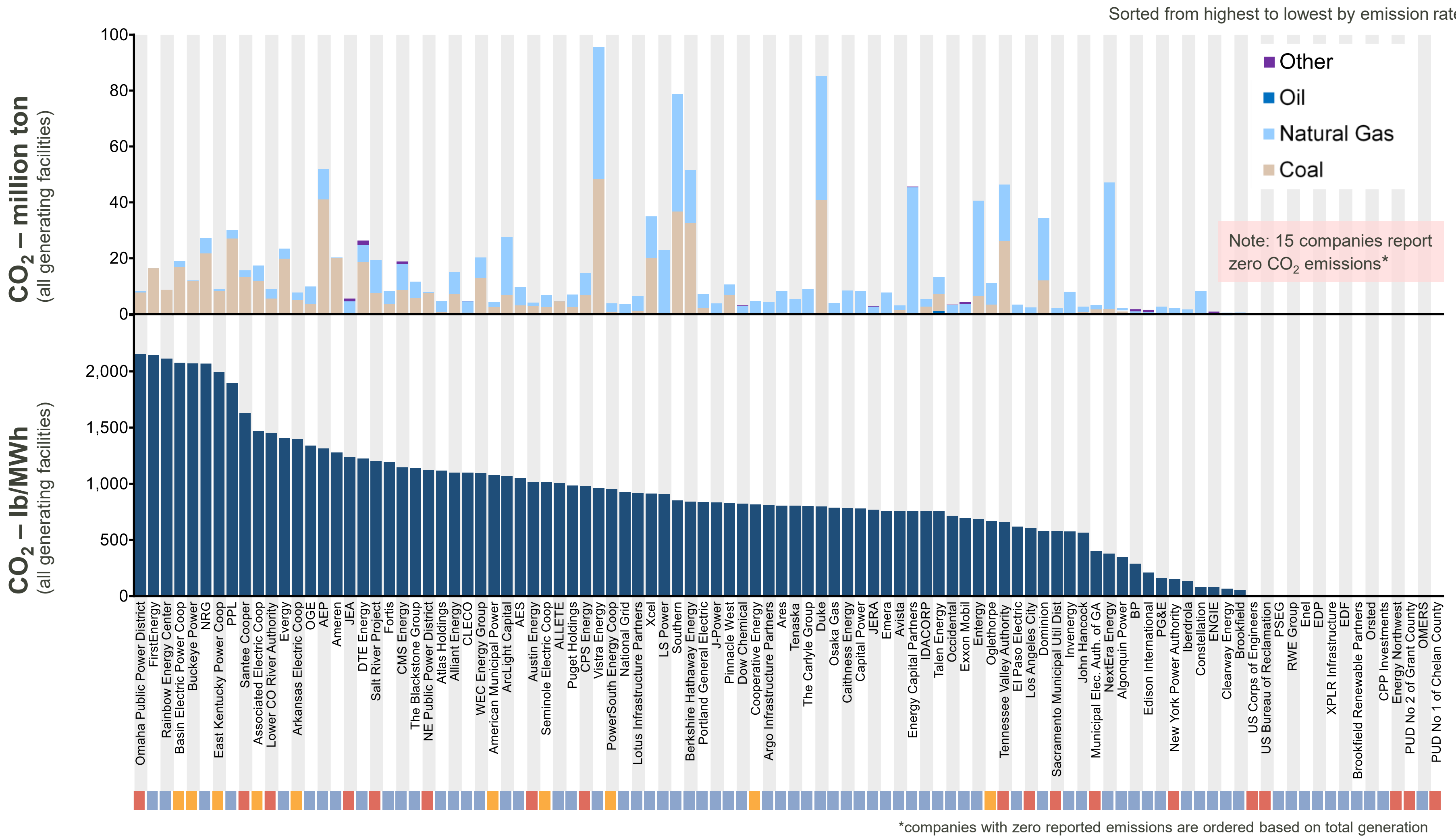
Sorted from highest to lowest by emissions



*companies with zero reported emissions are ordered based on total generation

Breakdown of ownership categories provided in “Methodology” (page 45): privately-/investor-owned public power cooperative

CO_2: Total Emissions and Emission Rates



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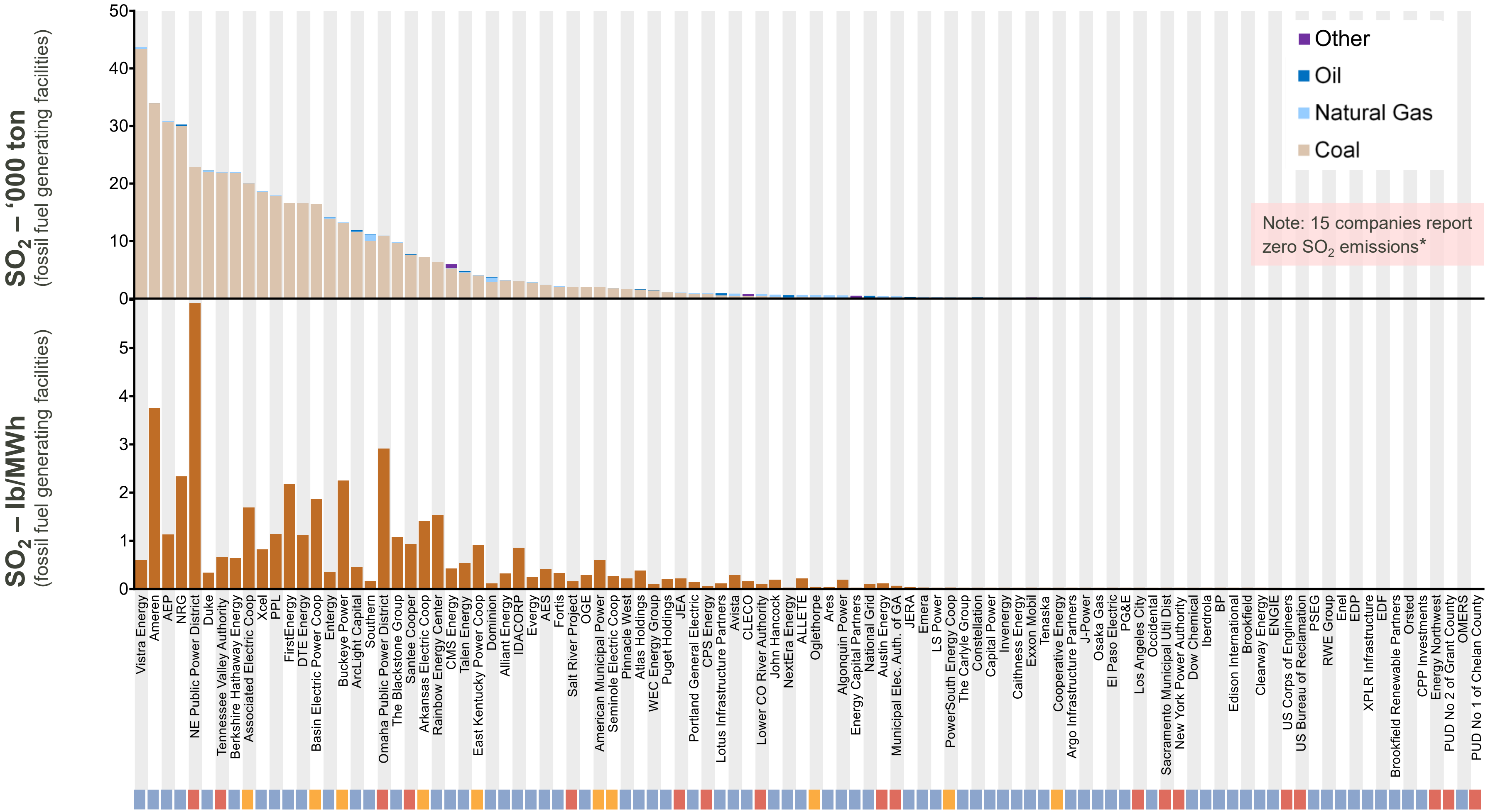
Breakdown of ownership categories provided in "Methodology" (page 45): privately-/investor-owned public power cooperative

SO_2: Total Emissions and Emission Rates

Sorted from highest to lowest by emissions

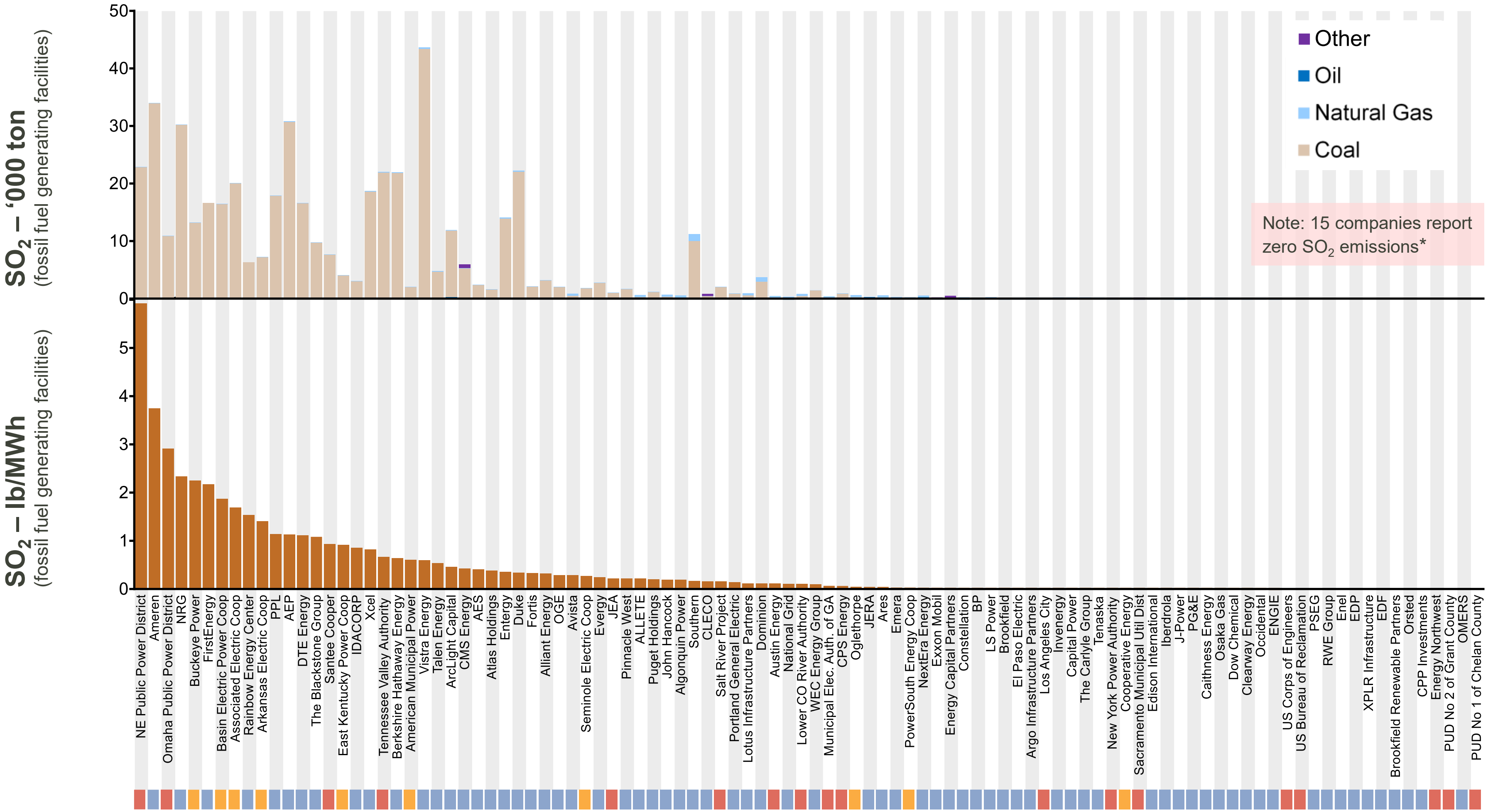


*companies with zero reported emissions are ordered based on total generation

Breakdown of ownership categories provided in "Methodology" (page 45): privately-/investor-owned public power cooperative

SO_2: Total Emissions and Emission Rates

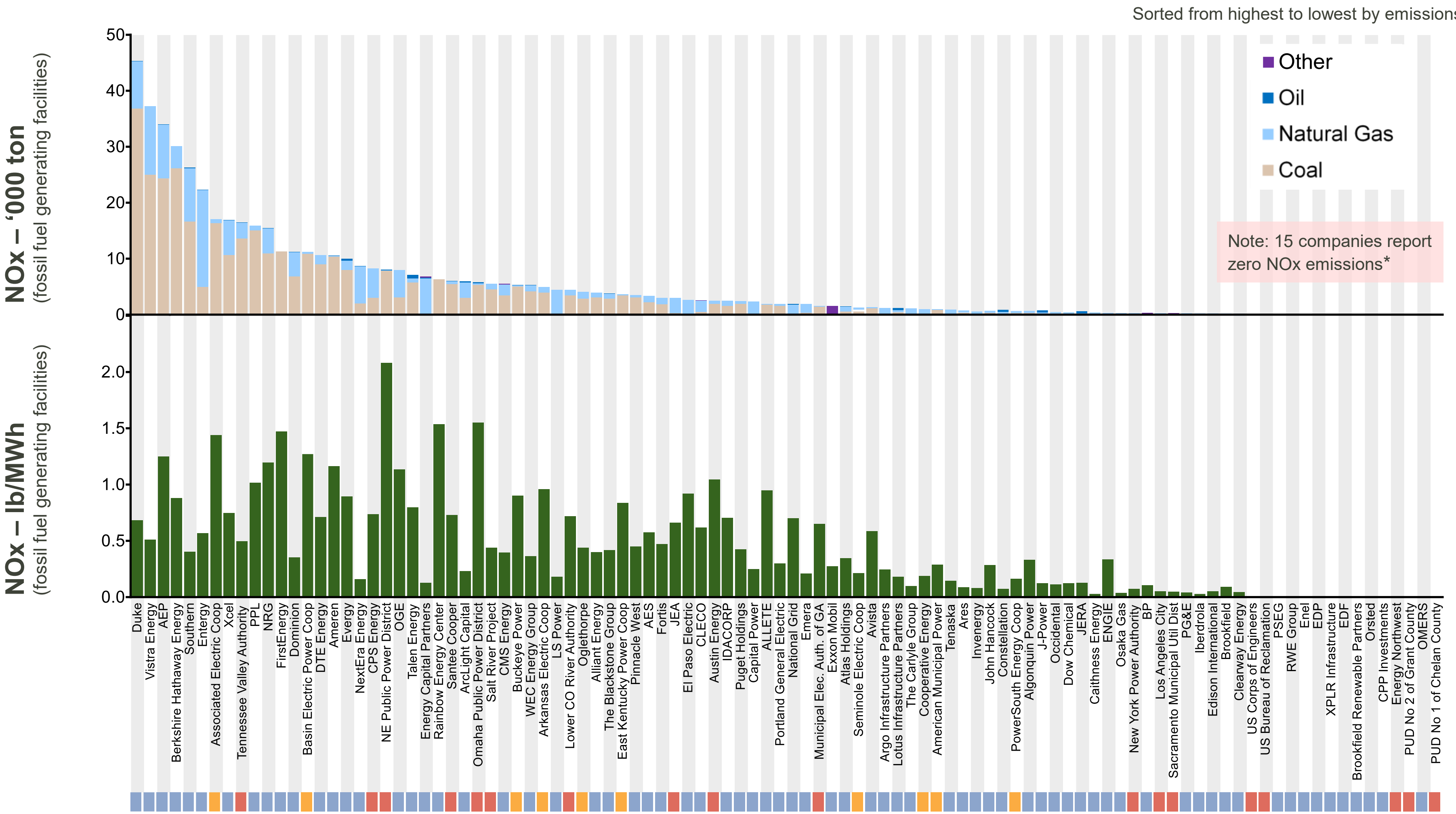
Sorted from highest to lowest by emission rate



*companies with zero reported emissions are ordered based on total generation

Breakdown of ownership categories provided in "Methodology" (page 45): privately-/investor-owned public power cooperative

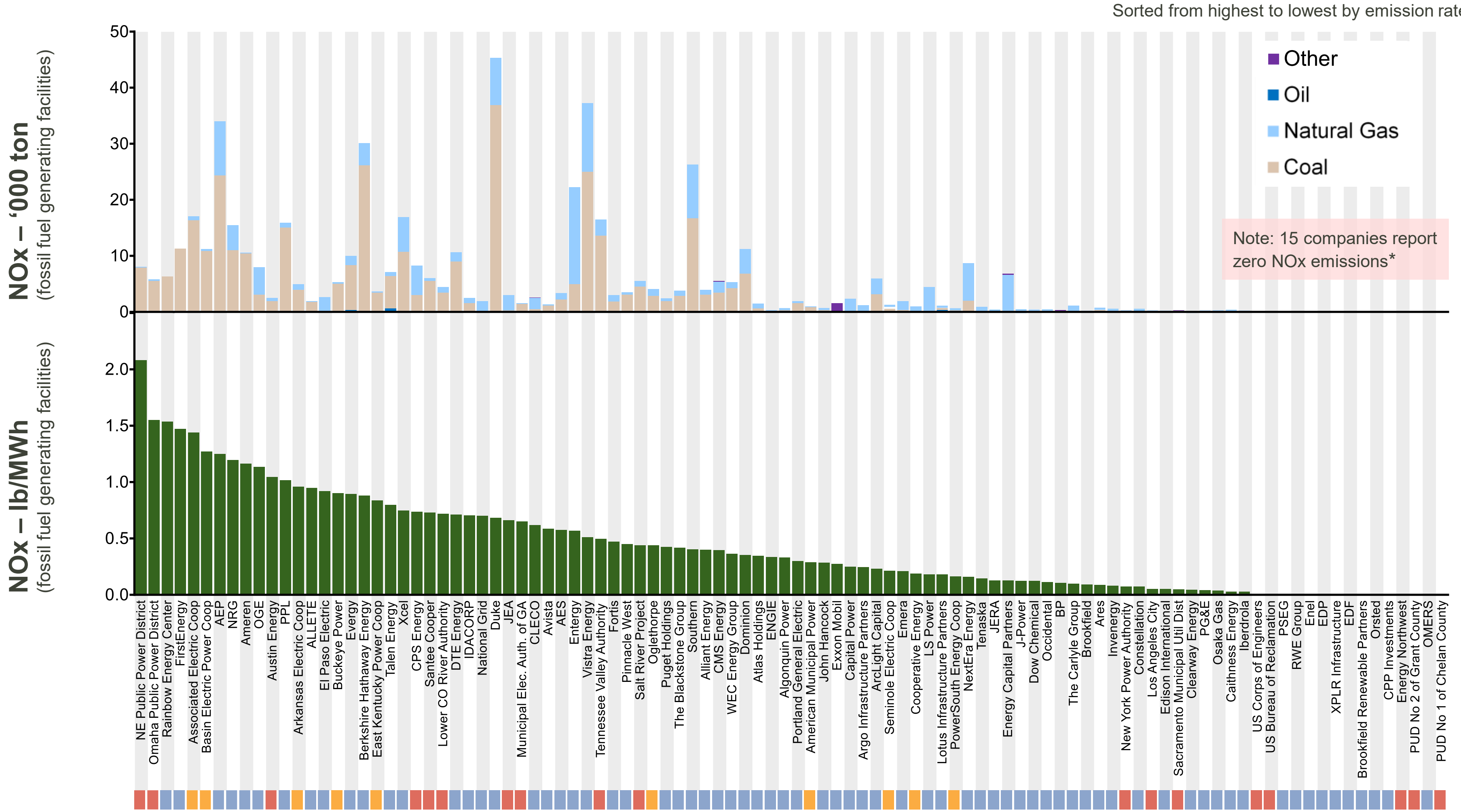
NOx: Total Emissions and Emission Rates



*companies with zero reported emissions are ordered based on total generation

Breakdown of ownership categories provided in "Methodology" (page 45): privately-/investor-owned public power cooperative

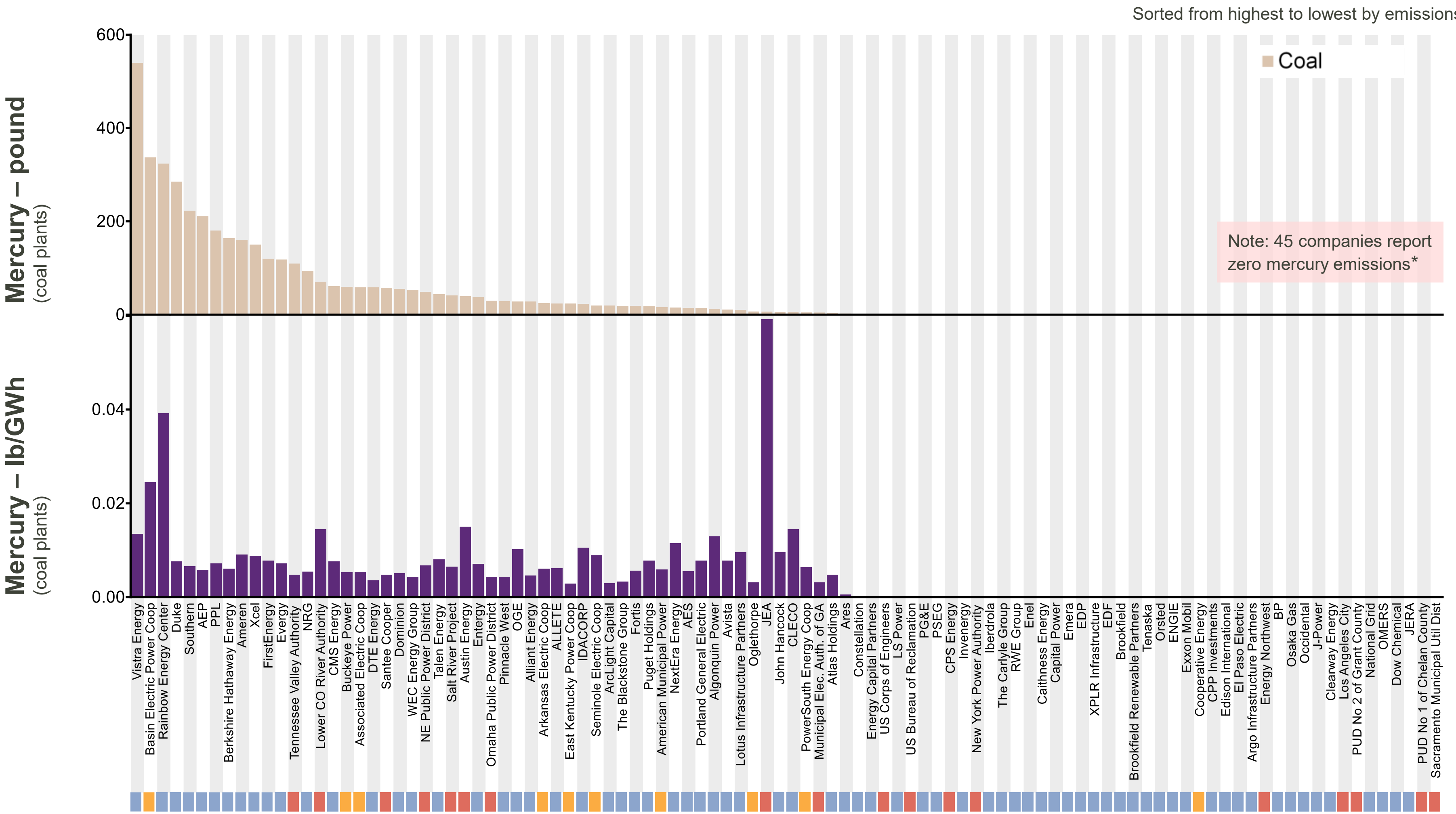
NOx: Total Emissions and Emission Rates



*companies with zero reported emissions are ordered based on total generation

Breakdown of ownership categories provided in "Methodology" (page 45): privately-/investor-owned public power cooperative

Mercury: Total Emissions and Emission Rates

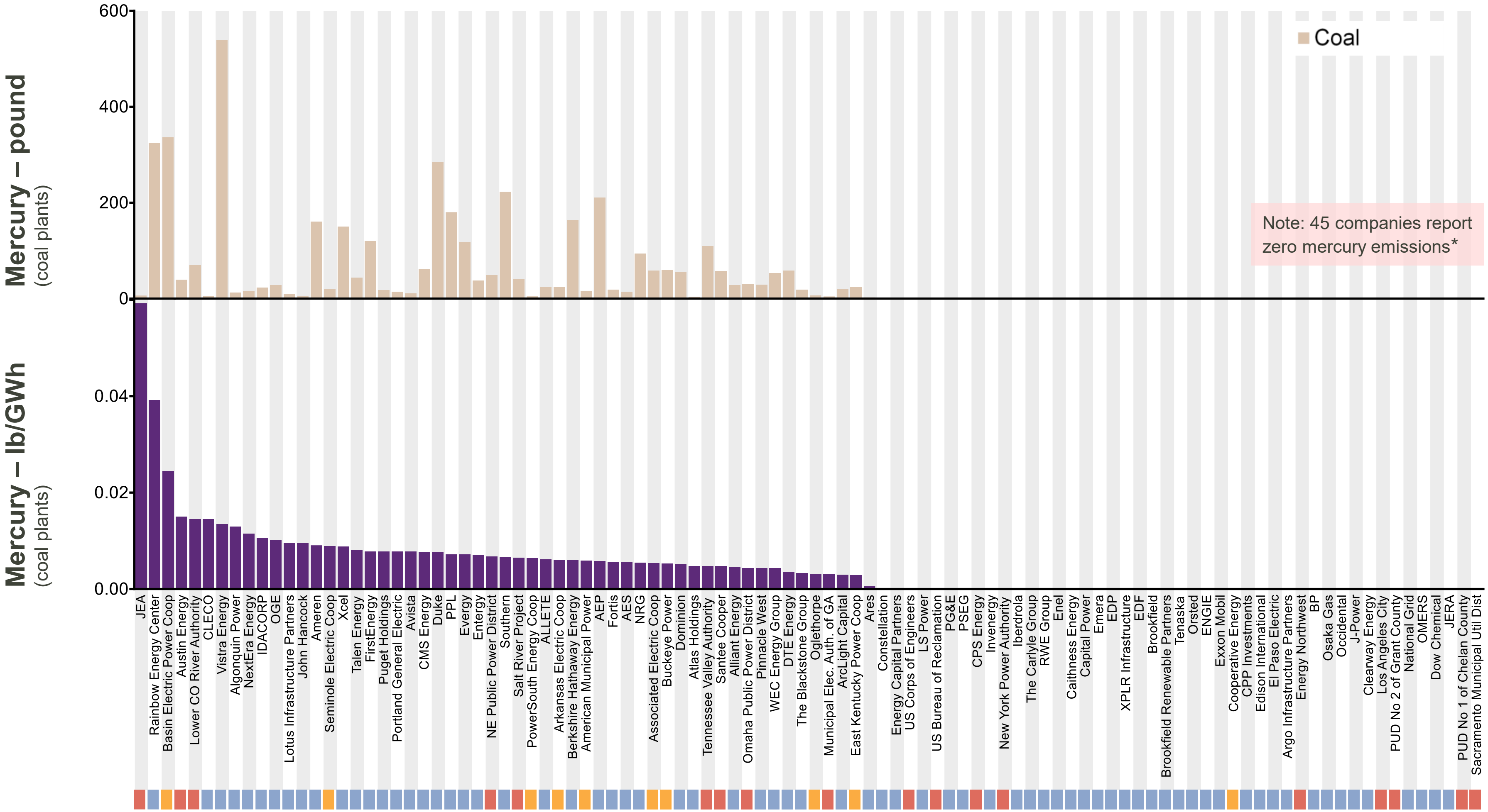


*companies with zero reported emissions are ordered based on total generation

Breakdown of ownership categories provided in “Methodology” (page 45): privately-/investor-owned public power cooperative

Mercury: Total Emissions and Emission Rates

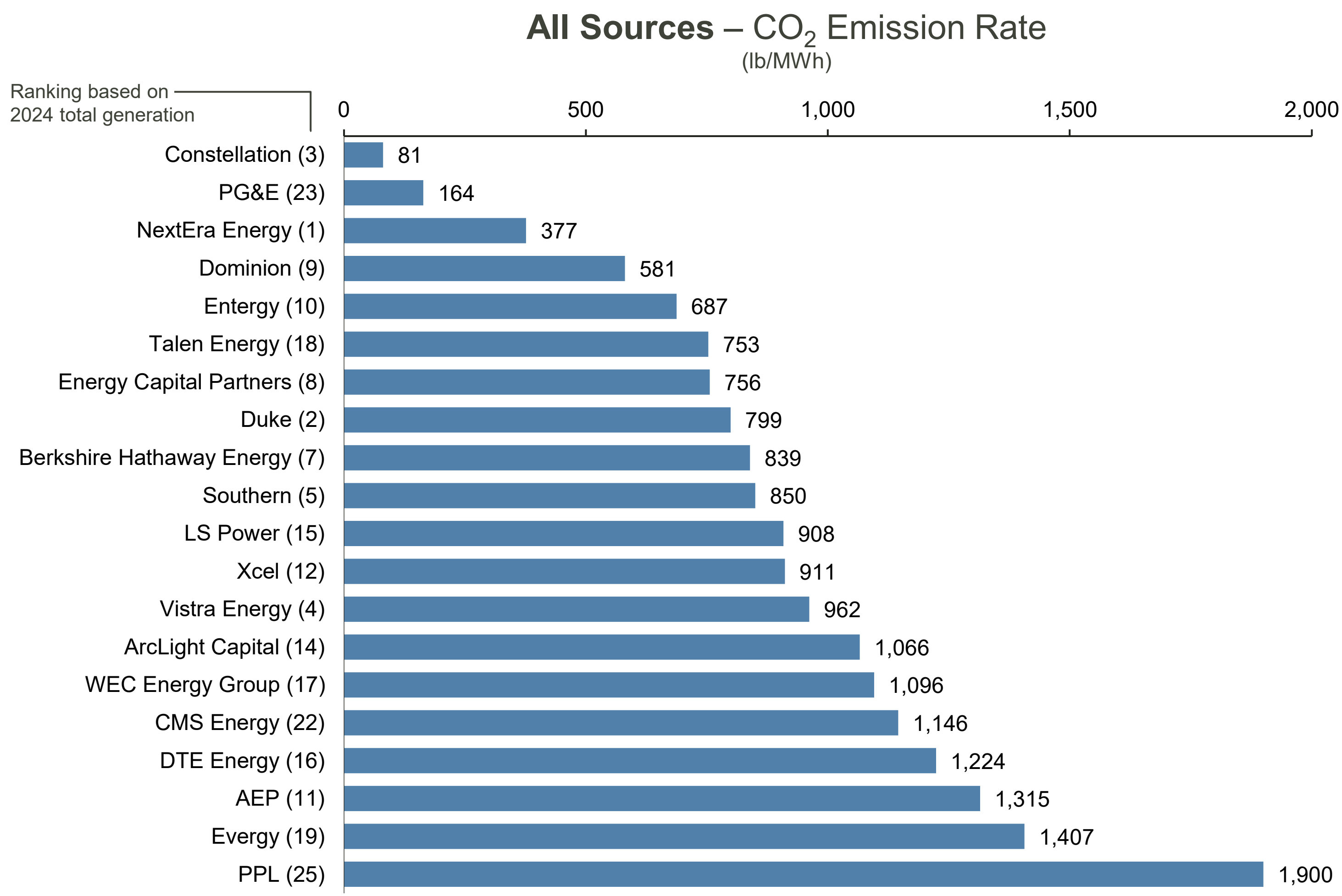
Sorted from highest to lowest by emission rate



*companies with zero reported emissions are ordered based on total generation

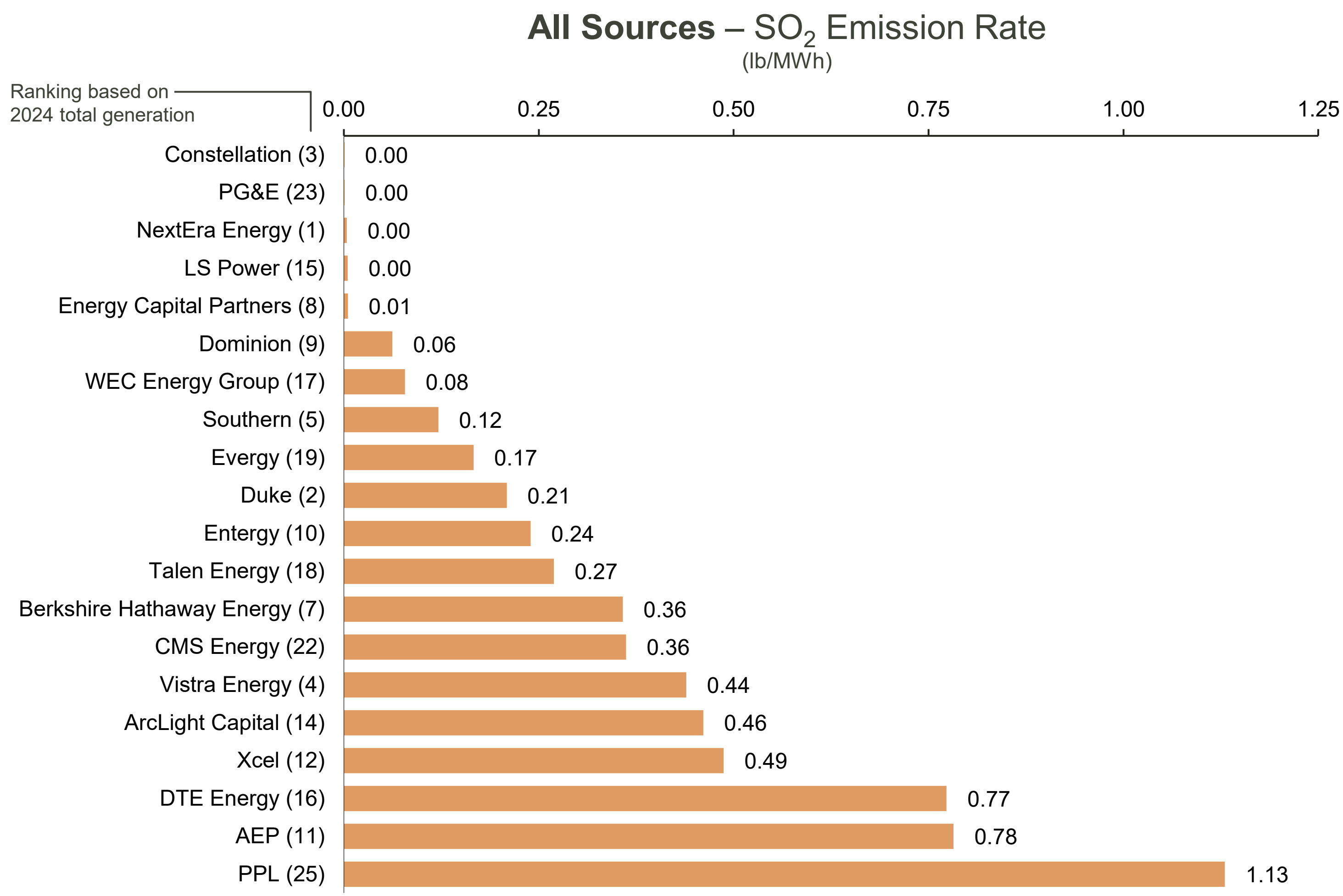
Breakdown of ownership categories provided in “Methodology” (page 45): privately-/investor-owned public power cooperative

Rankings by CO_2 Emission Rate
(Top 20 Privately-/Investor-Owned Power Producers)



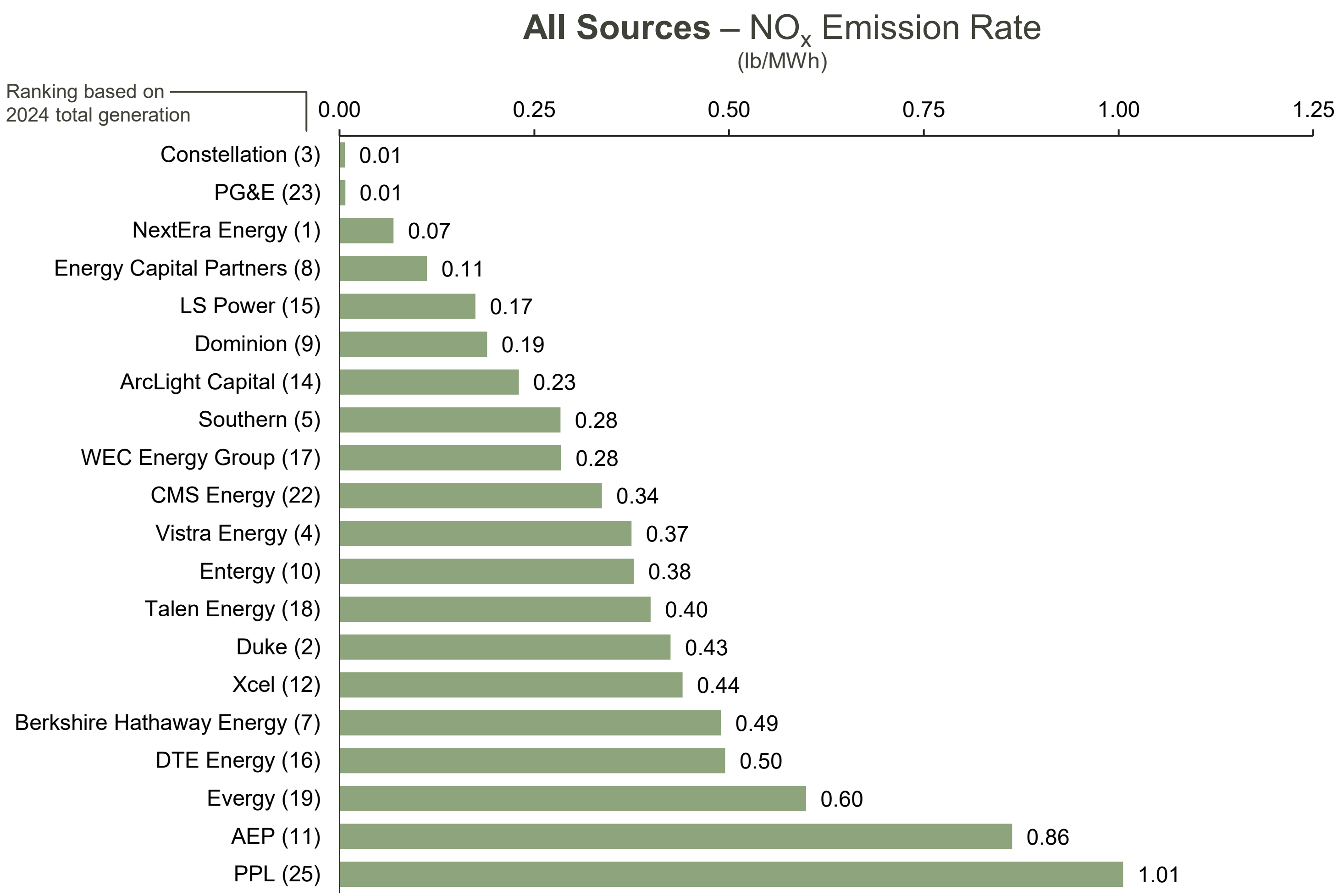
Note: "Privately/investor owned" power producers include investor owned, privately held, and foreign owned corporations. This chart does not show public power producers (federal power authorities, state power authorities, municipalities, power districts) or cooperatives.

Rankings by SO_2 Emission Rate
(Top 20 Privately-/Investor-Owned Power Producers)



Note: "Privately/investor owned" power producers include investor owned, privately held, and foreign owned corporations. This chart does not show public power producers (federal power authorities, state power authorities, municipalities, power districts) or cooperatives.

Rankings by NOx Emission Rate
(Top 20 Privately-/Investor-Owned Power Producers)



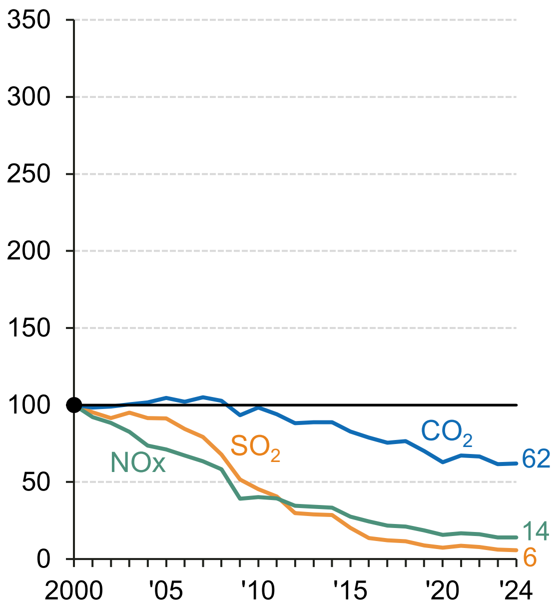
Note: "Privately/investor owned" power producers include investor owned, privately held, and foreign owned corporations. This chart does not show public power producers (federal power authorities, state power authorities, municipalities, power districts) or cooperatives.

Section III

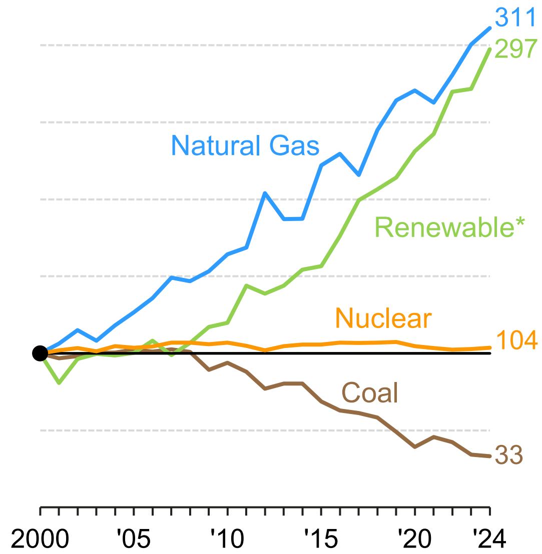
Emissions Trends Analysis

Annual Trends: U.S. Electric Sector

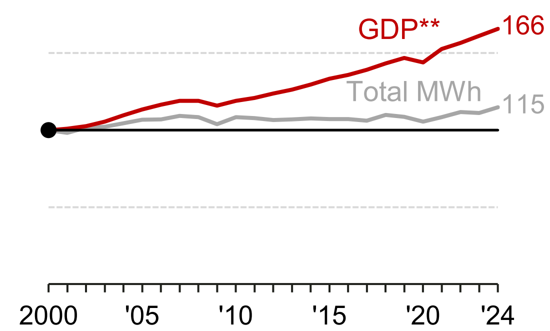
Electric Sector Emissions
(Indexed; 2000 = 100)



Generation Fuel Mix
(Indexed; 2000 = 100)



Macroeconomic Indicators
(Indexed; 2000 = 100)

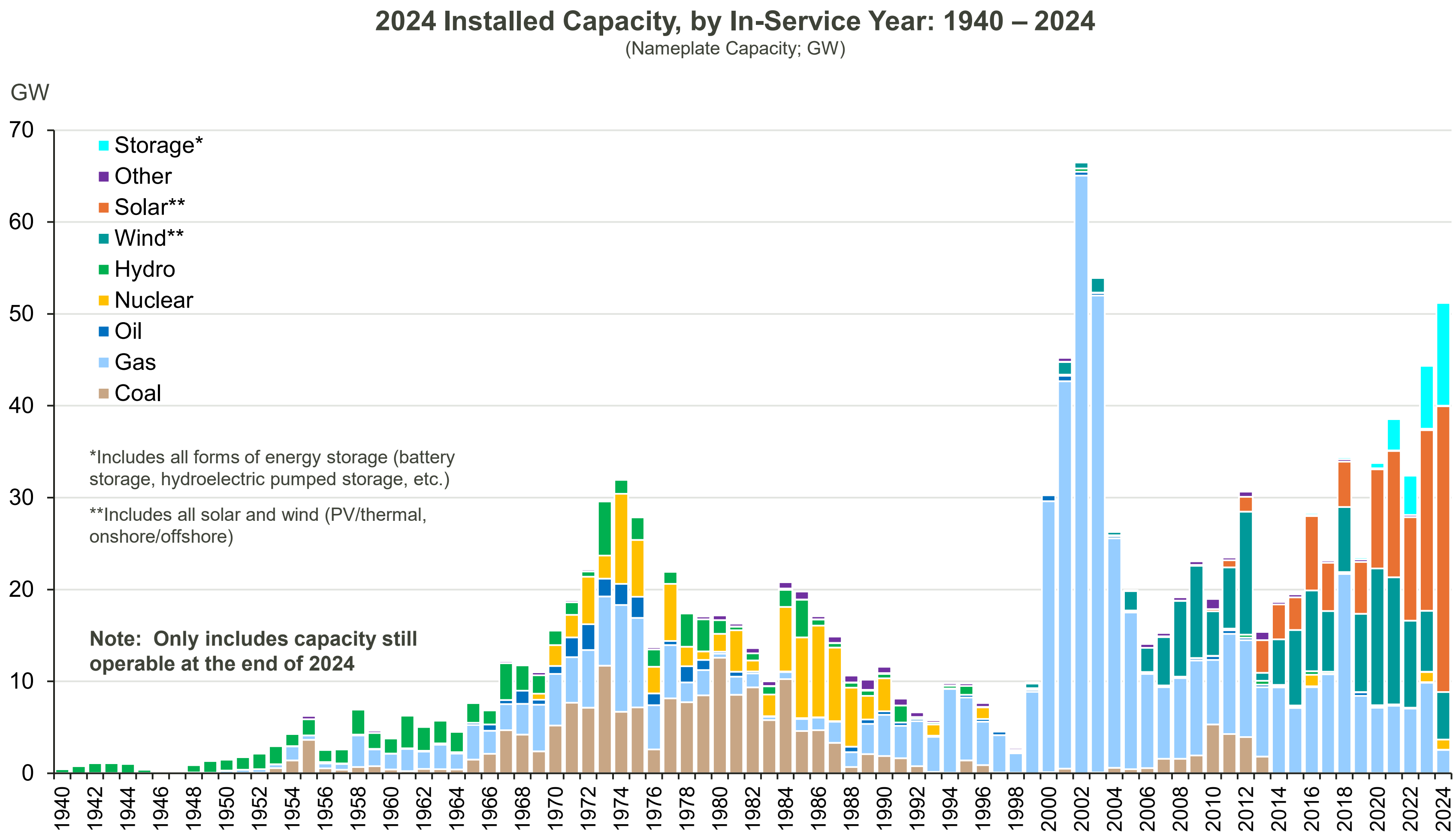


*Includes hydroelectric, wind, solar, biomass, geothermal, and other renewable sources.
**GDP in chained 2017 dollars.

The electric power sector has made significant progress in terms of reducing its NOx and SO_2 emissions. From 2000 through 2024, SO_2 and NOx emissions decreased 94% and 86%, respectively. From 2000 to 2024, CO_2 emissions decreased 38% while GDP grew 66%. Over the same period, generation from renewables increased by nearly 200%.

Note: See “Data Sources” (page 44) for more information.

Incremental Capacity



Most existing coal and nuclear generating capacity came online in the 1970s and 1980s, while most natural gas capacity has been installed since 2000. Effectively all non-hydro renewable capacity came online in the last fifteen years.

Average Capacity Factors

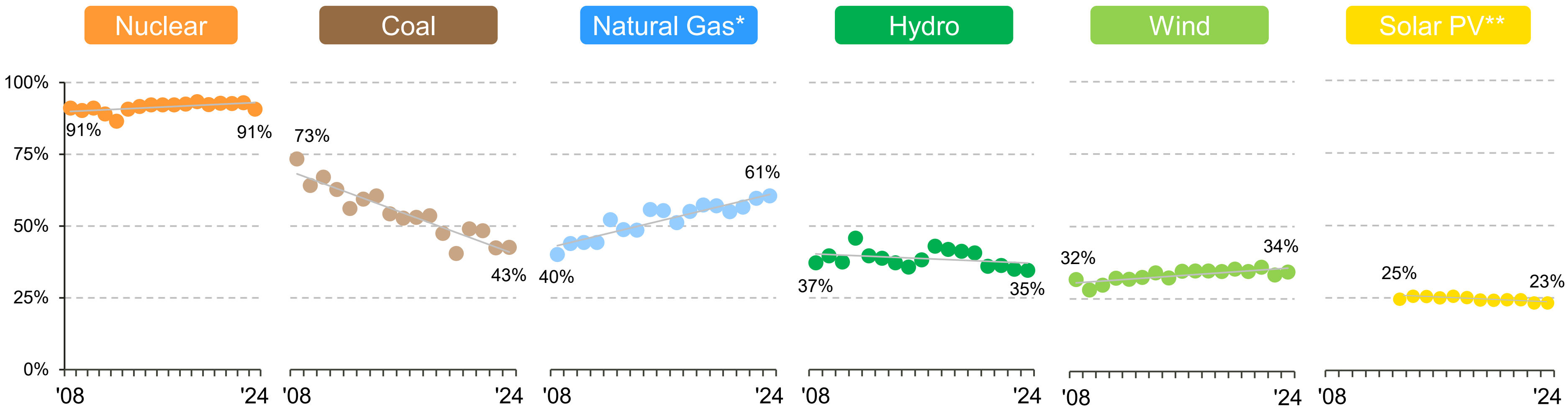
Annual Capacity Factors for Select Fuels and Technologies

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.

Coal plant utilization declined over the last decade, but capacity factors increased from a low of 41% in 2020 to 48% in 2022 before falling back to 43% in 2024. Natural gas combined-cycle capacity factors rose from 40% to 56% from 2008-2015 and has marginally increased since 2021.

Nuclear plants have high utilization rates, consistently running at above 90% average capacity factor. Hydropower capacity factors have remained relatively constant over the past decade.

Wind capacity factors have consistently been around 34-35% since 2016. Since EIA began publishing data for utility-scale solar projects in 2014, annual capacity factors have remained steady at around 25%.



*Combined Cycle

**Utility-Scale, data first available in 2013

Note: See “Data Sources” (page 44) for more information.

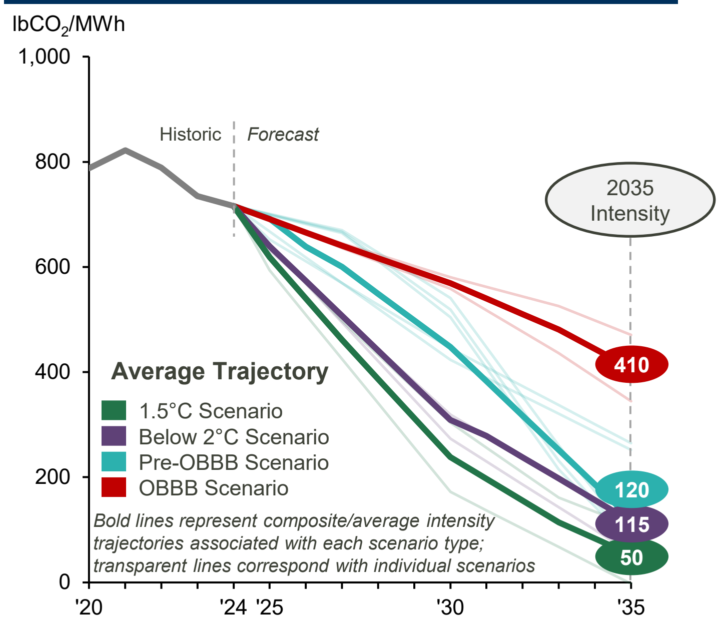
Power Sector in Low-Carbon Scenarios

Over the last several years, organizations have released detailed low-carbon scenario models that provide data on the emission and energy pathways different sectors could follow to limit global warming to specific levels. Scenarios are often categorized as those that limit warming to 1.5°C (generally aligned with net zero by 2050) or 2°C by 2100. Because of its significant contribution to total GHG emissions and potential opportunities for emission reductions, models show the power sector decarbonizing faster than other areas of the economy. Furthermore, the U.S. and other advanced economies – which have the technical and financial resources necessary to support prompt transition to lower-carbon resources – play a particularly important role in near-term decarbonization.

Although low-carbon scenarios show rapid decarbonization of the U.S. power sector, with CO_2 intensity declining by 85-90% between 2020 and 2035, U.S. alignment with 1.5°C and 2°C scenario forecasts is increasingly in doubt. Passage of the One Big Beautiful Bill (OBBB) repealed and weakened key clean energy incentives and programs administered through the 2022 Inflation Reduction Act (IRA), likely slowing the pace of renewable deployment and displacement of fossil generation. Recent analysis shows that the 2030 CO_2 intensity of the U.S. power sector is now projected to be twice as high as low-carbon scenario targets, with the gap further widening through 2035.

Electricity CO_2 Intensity: United States

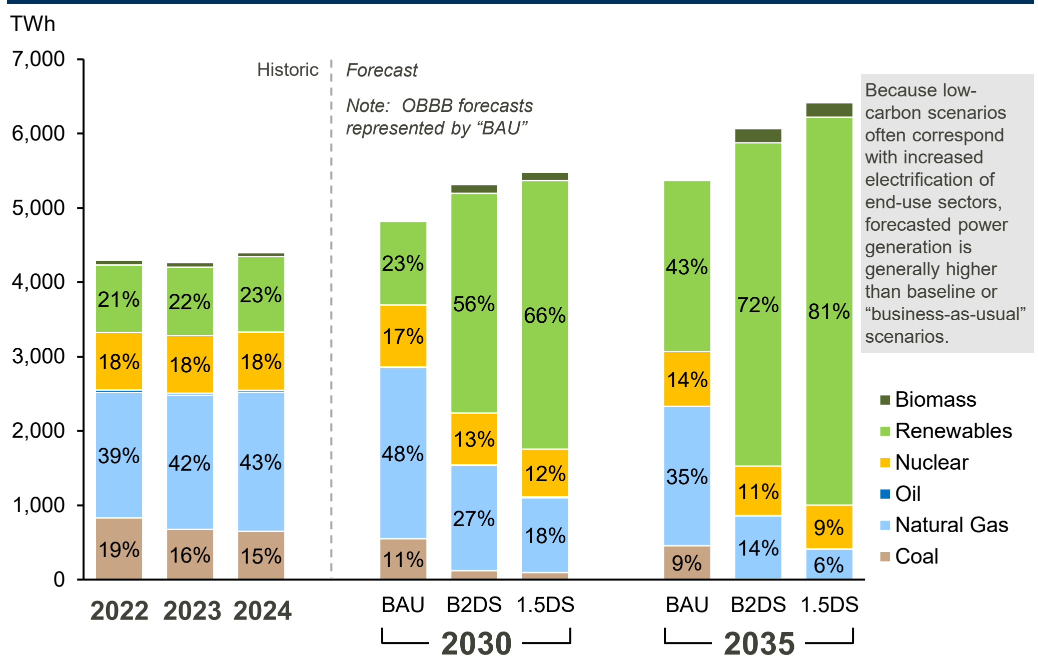
pound CO_2 per megawatt-hour ($lbCO_2/MWh$)



Note: See "Data Sources" (page 44) for more information.

Electricity Generation: United States

terawatt-hour (TWh)



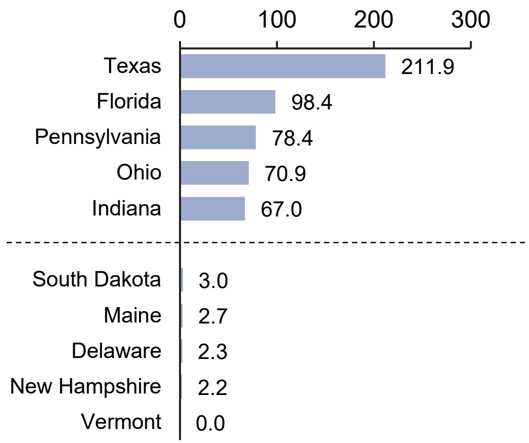
Section IV

State-by-State Emissions Summary

State-by-State CO_2 Emissions: U.S. Electric Sector, 2024

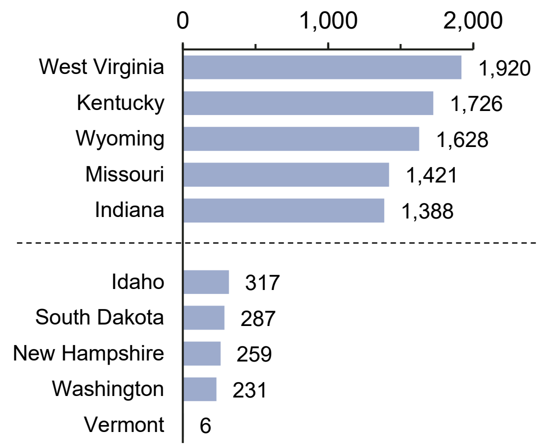
Total CO_2 Emissions by State

(million ton; top 5 and bottom 5 are shown)



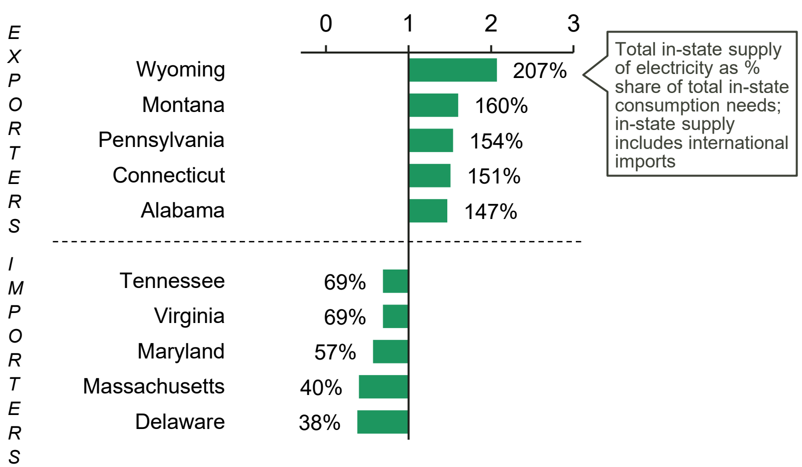
All Generating Sources – CO_2 Emission Rate

(lb/MWh; top 5 and bottom 5 are shown)



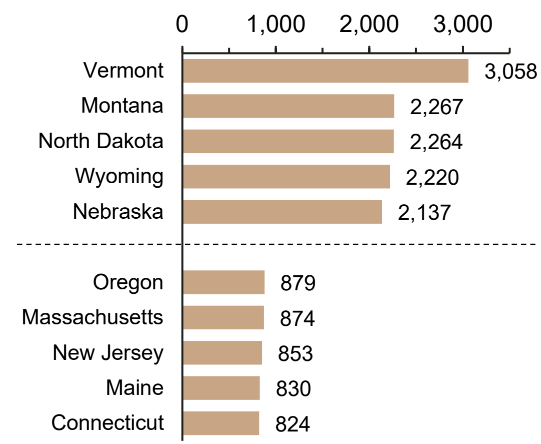
Electricity Exporters/Importers

(2024 Net Trade Index; top 5 exporters and importers are shown)



Fossil Generators – CO_2 Emission Rate

(lb/MWh; top 5 and bottom 5 are shown)



Section V

Fuel Mix of 100 Largest Power Producers in 2024

Fuel Mix of 100 Largest Power Producers, 2024

Rank	Holding Company	Total (million MWh)	Share of Total					
			Coal	Gas	Oil	Nuclear	Hydro	Renew able / Other
1	NextEra Energy	250.4	0.5%	42.9%	0.0%	18.6%	0.0%	37.9%
2	Duke	213.1	17.5%	44.5%	0.1%	35.1%	1.3%	1.5%
3	Constellation	205.7	0.0%	9.4%	0.0%	88.4%	0.9%	1.3%
4	Vistra Energy	198.9	20.1%	53.3%	0.1%	26.2%	0.0%	0.4%
5	Southern	185.4	18.2%	52.3%	0.0%	20.3%	2.5%	6.7%
6	Tennessee Valley Authority	141.1	16.1%	30.8%	0.1%	43.6%	9.4%	0.0%
7	Berkshire Hathaw ay Energy	122.9	22.1%	33.4%	0.0%	3.2%	2.1%	39.1%
8	Energy Capital Partners	120.6	0.0%	88.7%	0.1%	0.0%	0.0%	11.2%
9	Dominion	118.5	9.0%	44.2%	0.2%	40.7%	1.1%	4.7%
10	Entergy	117.9	4.4%	61.9%	0.0%	33.1%	0.1%	0.4%
11	AEP	78.8	46.2%	22.6%	0.2%	22.9%	1.2%	6.9%
12	Xcel	76.8	22.1%	36.8%	0.0%	15.4%	1.3%	24.2%
13	US Corps of Engineers	58.1	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%
14	ArcLight Capital	51.7	12.8%	86.5%	0.3%	0.0%	0.0%	0.4%
15	LS Pow er	50.4	0.0%	96.4%	0.1%	0.0%	1.9%	1.7%
16	DTE Energy	42.9	38.0%	28.5%	0.1%	19.2%	0.0%	14.1%
17	WEC Energy Group	37.0	33.4%	44.6%	0.1%	0.0%	1.4%	20.5%
18	Talen Energy	35.5	15.2%	34.2%	0.6%	50.0%	0.0%	0.0%
19	Evergy	33.3	49.7%	17.0%	0.4%	26.0%	0.0%	7.0%
20	US Bureau of Reclamation	33.1	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%
21	Oglethorpe	32.9	8.5%	47.8%	0.0%	43.7%	0.0%	0.0%
22	CMS Energy	32.9	24.3%	60.6%	0.1%	0.0%	1.1%	13.9%
23	PG&E	32.4	0.0%	18.7%	0.0%	56.7%	23.9%	0.6%
24	Salt River Project	32.2	19.9%	58.6%	0.0%	20.5%	0.9%	0.0%
25	PPL	31.6	79.6%	19.4%	0.0%	0.0%	0.9%	0.0%
26	Ameren	31.6	56.1%	1.2%	0.1%	33.3%	4.4%	5.1%
27	PSEG	30.7	0.0%	0.0%	0.0%	99.6%	0.0%	0.4%
28	CPS Energy	29.8	20.5%	54.1%	0.0%	25.4%	0.0%	0.0%
29	Invenergy	28.1	0.0%	65.9%	0.0%	0.0%	0.0%	34.1%
30	New York Pow er Authority	27.9	0.0%	17.0%	0.0%	0.0%	83.0%	0.0%

Fuel Mix of 100 Largest Power Producers, 2024

			Share of Total					
Rank	Holding Company	Total (million MWh)	Coal	Gas	Oil	Nuclear	Hydro	Renew able / Other
31	Alliant Energy	27.3	22.3%	49.5%	0.0%	0.0%	1.5%	26.7%
32	NRG	26.2	65.9%	32.6%	0.0%	0.0%	0.0%	1.5%
33	Pinnacle West	25.6	25.9%	34.7%	0.0%	36.8%	0.0%	2.5%
34	Iberdrola	24.2	0.0%	15.9%	0.0%	0.0%	0.9%	83.2%
35	Associated Electric Coop	23.7	45.8%	54.0%	0.2%	0.0%	0.0%	0.0%
36	The Carlyle Group	22.6	0.0%	99.9%	0.1%	0.0%	0.0%	0.0%
37	RWE Group	22.5	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
38	Enel	21.6	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
39	Caithness Energy	21.4	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
40	Capital Pow er	20.9	0.0%	90.0%	0.0%	0.0%	0.0%	10.0%
41	Emera	20.2	0.2%	88.6%	0.0%	0.0%	0.1%	11.0%
42	Ares	20.2	2.4%	94.3%	0.0%	0.0%	0.1%	3.3%
43	The Blackstone Group	20.2	28.1%	61.3%	0.1%	0.0%	0.0%	10.4%
44	Santee Cooper	19.2	63.2%	22.2%	0.3%	12.9%	1.3%	0.2%
45	AES	18.4	14.0%	49.4%	0.0%	0.0%	0.0%	36.5%
46	Basin Electric Pow er Coop	18.3	75.1%	20.9%	0.2%	0.0%	0.0%	3.9%
47	EDP	17.9	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
48	Portland General Electric	16.9	10.7%	64.8%	0.1%	0.0%	7.3%	17.1%
49	XPLR Infrastructure	16.1	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
50	Municipal Elec. Auth. of GA	15.9	8.9%	21.8%	0.0%	64.2%	0.0%	5.1%
51	EDF	15.7	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
52	FirstEnergy	15.3	99.6%	0.1%	0.2%	0.0%	0.0%	0.2%
53	OGE	14.7	19.0%	76.0%	0.1%	0.0%	0.0%	4.9%
54	Lotus Infrastructure Partners	14.5	7.3%	80.1%	0.1%	0.0%	0.0%	12.5%
55	IDACORP	14.3	15.3%	33.8%	0.0%	0.0%	50.9%	0.0%
56	Puget Holdings	14.2	15.8%	64.8%	0.3%	0.0%	5.8%	13.4%
57	Brookfield	14.2	0.0%	5.4%	0.0%	0.0%	29.5%	65.1%
58	Brookfield Renew able Partners	14.0	0.0%	0.0%	0.0%	0.0%	35.3%	64.7%
59	NE Public Pow er District	13.9	51.3%	4.0%	0.1%	43.7%	0.5%	0.4%
60	Algonquin Pow er	13.7	7.0%	21.4%	0.2%	0.0%	0.4%	71.0%

Fuel Mix of 100 Largest Power Producers, 2024

Rank	Holding Company	Total (million MWh)	Share of Total					
			Coal	Gas	Oil	Nuclear	Hydro	Renew able / Other
61	Fortis	13.6	24.1%	69.4%	0.1%	0.0%	0.4%	6.1%
62	Tenaska	13.6	0.0%	89.2%	0.0%	0.0%	0.0%	10.8%
63	Seminole Electric Coop	13.4	16.5%	83.4%	0.1%	0.0%	0.0%	0.0%
64	Orsted	12.7	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
65	ENGIE	12.6	0.0%	11.0%	0.0%	0.0%	0.0%	89.0%
66	Exxon Mobil	12.5	0.0%	89.6%	0.0%	0.0%	0.0%	10.4%
67	Low er CO River Authority	12.3	39.6%	59.6%	0.1%	0.0%	0.7%	0.0%
68	Buckeye Pow er	11.7	96.1%	3.5%	0.3%	0.0%	0.0%	0.0%
69	Cooperative Energy	11.4	0.0%	90.7%	0.0%	9.3%	0.0%	0.0%
70	CPP Investments	11.2	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
71	Edison International	11.0	0.0%	23.0%	0.3%	46.4%	30.3%	0.1%
72	Arkansas Electric Coop	11.0	37.3%	56.0%	0.1%	0.0%	6.1%	0.4%
73	El Paso Electric	10.9	0.0%	53.0%	0.0%	46.8%	0.0%	0.1%
74	Argo Infrastructure Partners	10.6	0.0%	93.7%	0.0%	0.0%	6.3%	0.0%
75	Energy Northw est	10.2	0.0%	0.0%	0.0%	97.3%	0.6%	2.1%
76	BP	10.1	0.0%	31.1%	0.0%	0.0%	0.0%	68.9%
77	Osaka Gas	9.9	0.0%	99.9%	0.0%	0.0%	0.0%	0.1%
78	Occidental	9.6	0.0%	98.4%	0.0%	0.0%	0.0%	1.6%
79	John Hancock	9.4	7.6%	46.5%	0.1%	0.0%	0.0%	45.9%
80	ALLETE	9.3	41.5%	2.3%	0.0%	0.0%	5.5%	50.7%
81	J-Pow er	9.3	0.0%	99.9%	0.1%	0.0%	0.0%	0.0%
82	JEA	9.1	1.5%	90.9%	0.1%	0.0%	0.0%	7.5%
83	East Kentucky Pow er Coop	8.9	90.3%	8.3%	0.2%	0.0%	0.0%	1.2%
84	Clearw ay Energy	8.8	0.0%	5.7%	0.0%	0.0%	0.0%	94.3%
85	CLECO	8.4	5.2%	92.0%	0.0%	0.0%	0.0%	2.8%
86	Atlas Holdings	8.4	7.1%	92.8%	0.1%	0.0%	0.0%	0.0%
87	Avista	8.3	16.4%	40.3%	0.0%	0.0%	39.8%	3.5%
88	Rainbow Energy Center	8.3	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
89	Pow erSouth Energy Coop	8.2	9.2%	90.6%	0.0%	0.0%	0.2%	0.0%
90	Los Angeles City	8.0	0.0%	66.9%	0.0%	23.1%	8.3%	1.6%

Fuel Mix of 100 Largest Power Producers, 2024

Rank	Holding Company	Total (million MWh)	Share of Total					
			Coal	Gas	Oil	Nuclear	Hydro	Renew able / Other
91	Austin Energy	8.0	32.4%	27.2%	0.1%	38.0%	0.0%	2.4%
92	American Municipal Pow er	7.9	33.4%	49.8%	0.1%	0.0%	16.5%	0.1%
93	PUD No 2 of Grant County	7.9	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%
94	National Grid	7.6	0.0%	68.6%	2.0%	0.0%	0.0%	29.5%
95	OMERS	7.6	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
96	Omaha Public Pow er District	7.5	91.5%	7.6%	0.3%	0.0%	0.0%	0.6%
97	Dow Chemical	7.4	0.0%	97.9%	0.0%	0.0%	0.0%	2.1%
98	JERA	7.3	0.0%	92.0%	1.0%	0.0%	0.0%	7.1%
99	PUD No 1 of Chelan County	7.3	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%
100	Sacramento Municipal Util Dist	7.3	0.0%	71.9%	0.0%	0.0%	18.6%	9.4%
	Total (top 100 producers)	**3,434.9**	**15.4%**	**42.6%**	**0.1%**	**21.9%**	**5.9%**	**14.2%**
	Total (all U.S. producers)	**4,307.4**	**15.1%**	**43.3%**	**0.3%**	**18.2%**	**5.7%**	**17.5%**

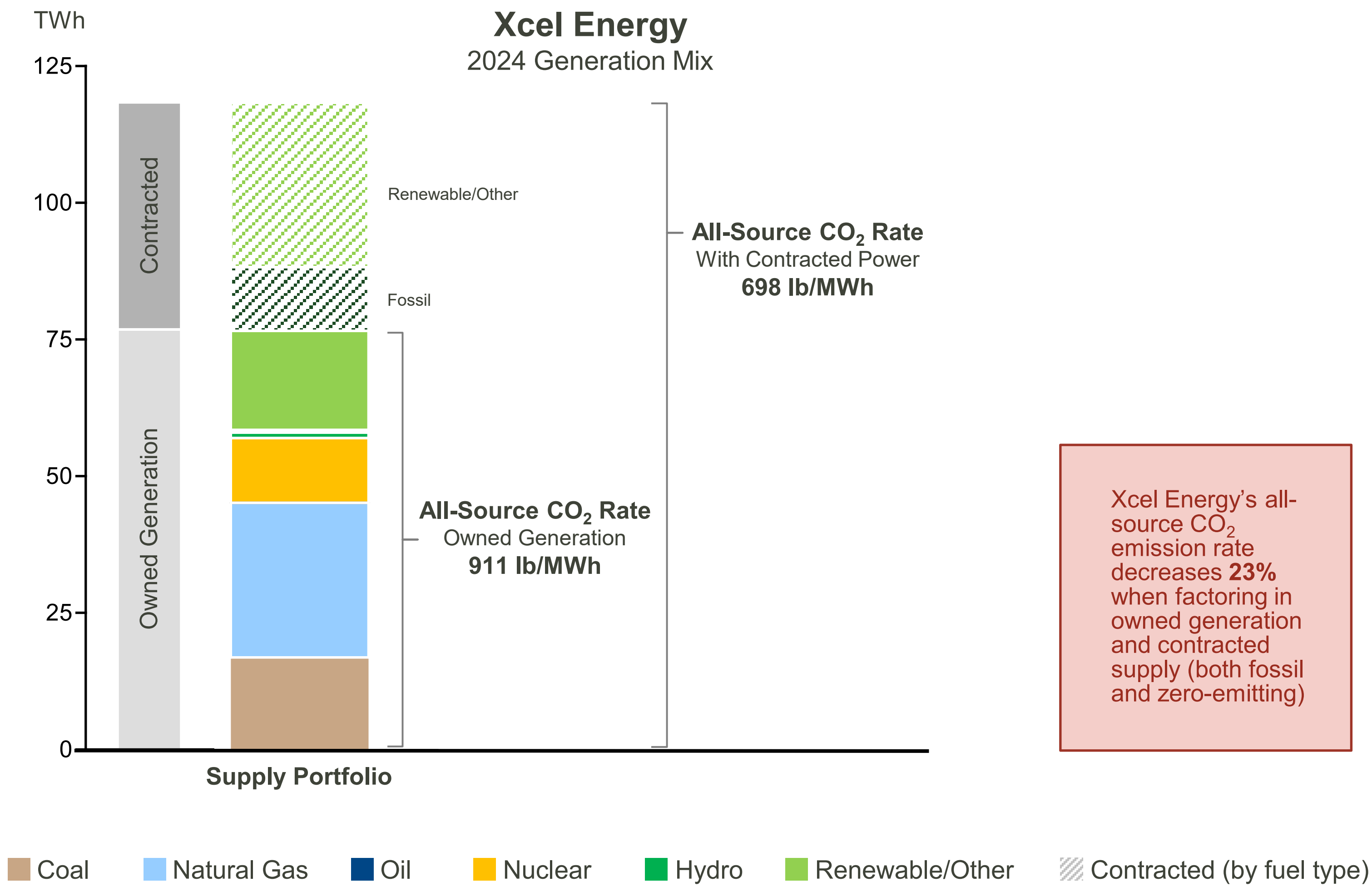
Section VI

Appendix

Ranking Utility Portfolios

- As described above, the Benchmarking Report presents generation and emissions information of power producers, not utility companies with obligations to deliver electricity to customers. In order to apply a uniform methodology to all power producers, the Report assigns electricity generation and associated emissions to power producers according to their known generating asset ownership as of December 31, 2024.
- If a power producer is also a distribution utility, the fuel mix and emissions associated with the utility's total supply portfolio may differ substantially from its owned generation, depending on the nature and extent of any power purchase agreements and other contractual agreements to which the utility may be party. The distribution utility might also rely on market purchases to supply its customers (e.g., purchases from the PJM or MISO markets). A power producer might also sell excess supply to the market or to other utilities.
- To highlight the potential implications of these two different approaches, the following page presents the generation mix and all-source CO_2 emission rate for an investor-owned utility (Xcel). The graph also reports the CO_2 emission rate associated with part of the company's supply portfolio (owned generation and long-term contracts); the supply portfolio emission rate does not reflect the emissions associated with market purchases, which may be fossil-fired, renewables, or other sources.
- In the example shown, the CO_2 emission rate associated with supply is lower because the company contracts for non-emitting, renewable resources in addition to owned wind or solar projects.
- Both approaches—generation and supply—can be helpful in evaluating a company's performance. Unfortunately, there is no publicly available source for the data that would be required to benchmark utility resource portfolios in the same way that we can benchmark owned-generation assets.
- The following page illustrates the all-source CO_2 emissions rates for Xcel, which voluntarily supplied the information displayed. The chart include the emission rate for owned generation only (consistent with the focus and methodology of the Benchmarking report) as well as the all-source emission rate associated with the combination of owned generation and long-term contract purchases.

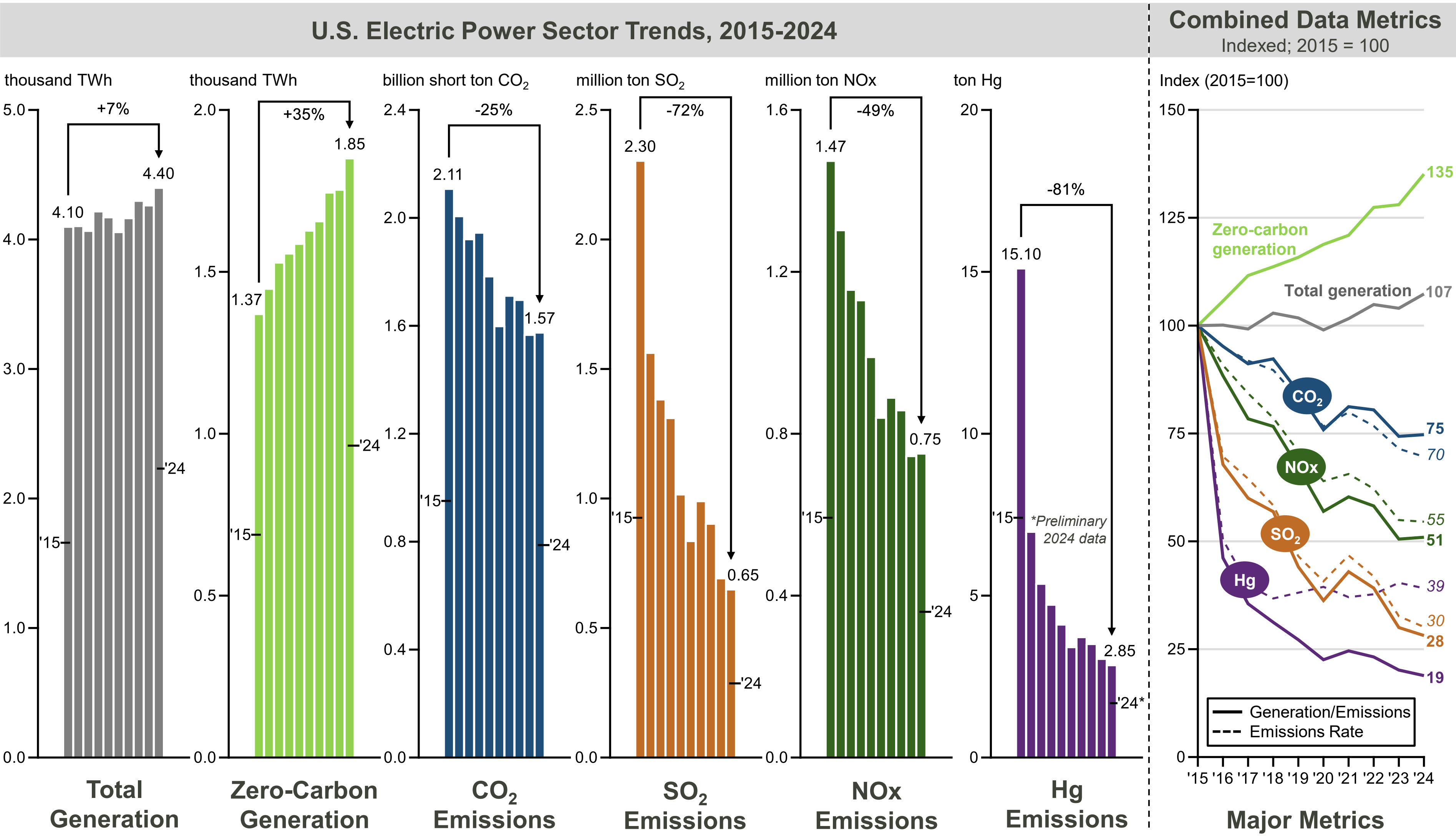
Case Study: Owned Generation and Contracted Supply



Xcel Energy's all-source CO_2 emission rate decreases **23%** when factoring in owned generation and contracted supply (both fossil and zero-emitting)

Note: Contracted power includes long-term PPAs and market purchases

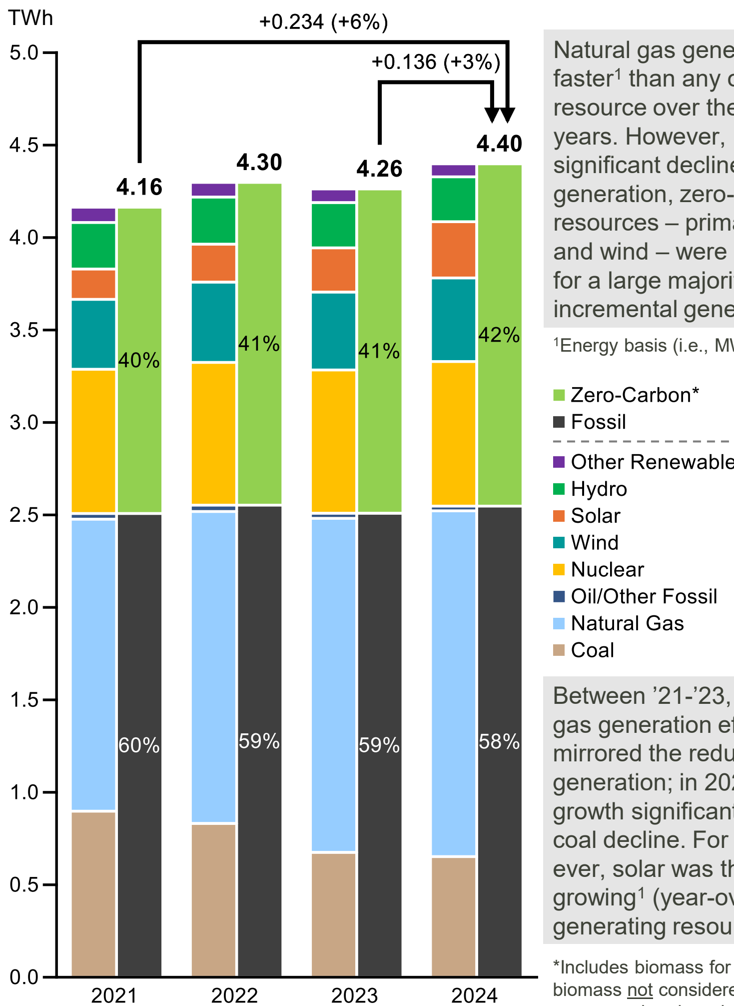
U.S. Generation & Emissions Trends



Note: See "Data Sources" (page 44) for more information.

Recent Changes in U.S. Generation, by Fuel Type

Electricity Generation (2021-2024)
TWh, by resource



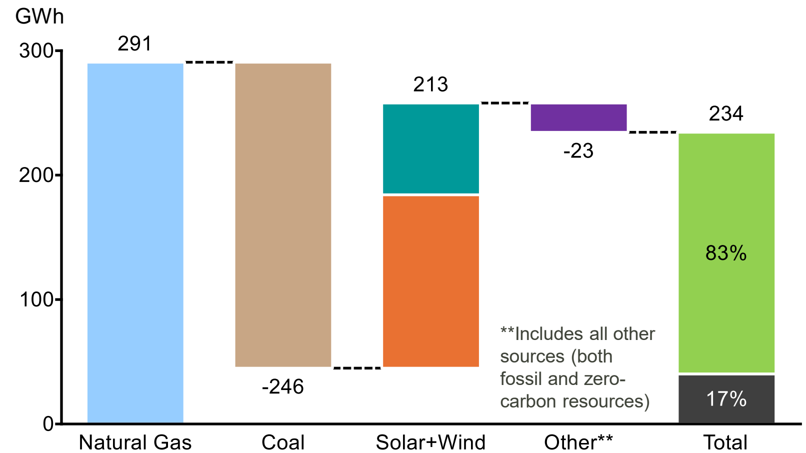
Natural gas generation grew faster[1] than any other resource over the past three years. However, because of a significant decline in coal generation, zero-carbon resources – primarily solar and wind – were responsible for a large majority (83%) of incremental generation.

[1]Energy basis (i.e., MWh)

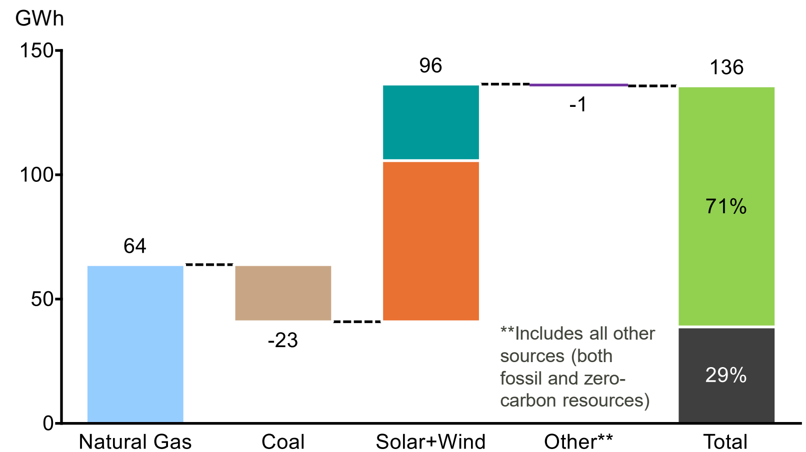
Between '21-'23, new natural gas generation effectively mirrored the reduction in coal generation; in 2024, gas growth significantly exceeded coal decline. For the first time ever, solar was the fastest growing[1] (year-over-year) generating resource.

*Includes biomass for simplicity; biomass not considered zero-carbon resource elsewhere in report

Incremental Generation (2021-2024)
GWh



Incremental Generation (2023-2024)
GWh



Note: See "Data Sources" (page 44) for more information.

Data Sources

The following public data sources were used to develop company-specific 2024 data for this report:

EPA Clean Air Markets Program Data (CAMPD): EPA's Clean Air Markets Program Data account for effectively all SO_2 and NOx emissions, and about 30 percent of the CO_2 emissions analyzed in this report.

EPA Toxic Release Inventory (TRI): 2024 mercury emissions used in this report are based on TRI reports submitted by facility managers.

EIA Form 923 (2024): EIA Form 923 provides data on the electric generation and heat input by fuel type for utility and non-utility power plants. Heat input data are used to calculate approximately 70 percent of the CO_2 emissions analyzed in this report.

EIA Form 860 (2024): EIA Form 860 is a generating unit level data source that includes information about generators at electric power plants, including information about generator ownership.

EPA U.S. Inventory of Greenhouse Gas Emissions and Sinks (2024): EPA's U.S. Inventory of Greenhouse Gas Emissions and Sinks report provides in Annex 2 heat contents and carbon content coefficients of various fuel types. These data are used in conjunction with EIA Form 923 to calculate approximately 70 percent of the CO_2 emissions analyzed in this report.

The following public data sources were used to develop sector-wide 2023 data for this report:

EIA Electric Power Monthly: Sector-wide 2024 data (page 6, 7, 42, 43) and "Average Capacity Factors" (page 30)

EPA Air Pollutant Emissions Trends Data & TRI: Sector-wide 2024 data (page 8, 42)

EPA Clean Air Markets Program Data: "Electric Sector Emissions" (page 28)

EIA Monthly Energy Review: "Generation Fuel Mix" (page 28)

U.S. Bureau of Economic Analysis (GDP): "Macroeconomic Indicators" (page 28)

The following data resources were used to inform low-carbon scenario pathways:

EPA (Electricity Sector Emissions Impact of the Inflation Reduction Act report)

International Energy Agency (IEA) World Energy Outlook (WEO)

Network for Greening the Financial System (NGFS)

Principles for Responsible Investment (PRI) Inevitable Policy Response (IPR)

Princeton ZERO Lab

Methodology

Plant Ownership

This report aims to reflect power plant ownership as of December 31, 2024. Plant ownership data used in this report are primarily based on the EIA-860 database from the year 2024. 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, and other media sources. Ownership of plants is updated based on the most recent data available. Consequently, in a number of instances, ultimate assignment of plant ownership in this report differs from EIA-860's reported ownership. This primarily happens when the plant in question falls in one or more of the categories listed below:

1. It is owned by a limited liability partnership of 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 was sold or bought during the year 2022. Because form 10-K for a particular year is usually filed by the producer in the first quarter of the following year, this report assumes that ownership as reported in form 10-K is more accurate.

Publicly available data do not provide a straightforward means to accurately track lease arrangements and power purchase agreements. Therefore, to apply a standardized methodology to all companies, this report allocates generation and emissions according to reported asset ownership as of December 31, 2024.

Identifying "who owns what" in the dynamic electricity generation industry is probably the single most difficult and complex part of this report. In addition to the categories listed above, 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.

Power producers are ultimately divided into three categories, or company types: 1) privately-/investor-owned (privately-, investor-, and/or foreign-owned corporations), 2) public power (federal power authorities, state power authorities, municipalities, power districts), and 3) cooperative. Private entities include privately-held utilities and non-utility power producers (e.g., independent power producers). 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. Cooperative electric utilities are owned by their members (i.e., the consumers they serve).

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 such cogeneration facilities emissions data were calculated on the basis of heat input of fuel associated with electricity generation only. Consequently, for all such facilities EIA Form 923, which report a plant's total heat input as well as that which is associated with electricity production only, was used to calculate their emissions.

Methodology (continued)

NOx and SO_2 Emissions

The EPA CAMPD 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 CAMPD database is collected from continuous emission monitoring (CEM) systems. SO_2 and NOx emissions data reported to the CAMPD account for all of the SO_2 and NOx emissions assigned to the 100 largest power producers in this report.

The CAMPD 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 emission figures that are slightly higher or lower than their actual shares.

The appointment 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 CAMPD burns natural gas to produce electricity in substantial amounts. Because CAMPD datasets do not make this distinction, apportioning emissions based on the fuel-type of the boiler would increase coal's share of emissions.

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 reported in EIA Form 923, which allows for the correct apportionment of emissions between coal and natural gas.

CO_2 Emissions

A majority of CO_2 emissions used in this report were calculated using heat input data from EIA form 923 and carbon content coefficients of various fuel types provided by EPA. The table on the following page 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 CAMPD account for the remaining share of the CO_2 emissions used in this report, unless data are otherwise provided by companies.

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. The TRI contains information on all toxic releases from a facility; mercury emissions in this report are based on air releases only. 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.

Carbon Content Coefficients by Fuel Type

From Annex 2 of EPA GHG Inventory 2025 (2023 data)

Fuel Type	Carbon Content Coefficients (Tg Carbon/Qbtu)
Coal	
Anthracite Coal	28.28
Bituminous Coal	25.43
Sub-bituminous Coal	26.48
Lignite Coal	26.82
Waste/Other Coal (includes anthracite culm, bituminous gob, fine coal, lignite waste, waste coal)	26.15
Coal-based Synfuel, including briquettes, pellets, or extrusions, which are formed by binding materials or processes that recycle materials	25.34
Coal-based Synthetic Gas	18.55
Oil	
Distillate Fuel Oil (Diesel, No. 1, No. 2, and No. 4 Fuel Oils)	20.22
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	14.43
Blast Furnace Gas	74.81
Other Gas	18.55
Gaseous Propane	17.15

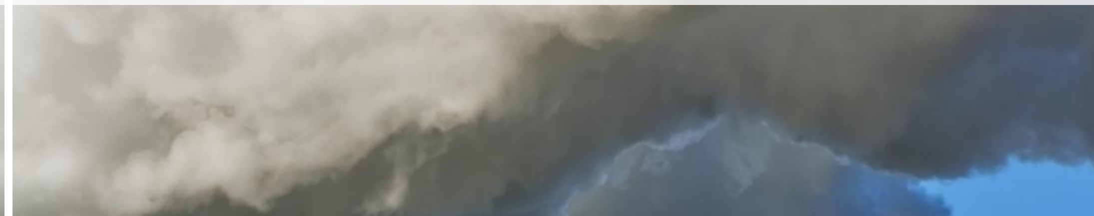
Quality Assurance

This report examines the air pollutant emissions of the 100 largest electricity generating companies in the United States based on 2024 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. Emission data may include revisions to 2024 data that companies were in the process of submitting or have already submitted to EPA at the time of publication of this report.

This report relies almost entirely on publicly available information. Data sets published by EIA and EPA are the primary source of the generation and emissions data used in this report. The organizations that fund this report believe maintaining public access to this information is essential to tracking the industry's performance and making accurate and informed analyses and policy decisions.

Benchmarking Air Emissions

Of the 100 Largest Electric Power Producers in the United States



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