U.S. Energy-Related Carbon Dioxide Emissions, 2024

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Independent Statistics and Analysis
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Executive Summary

This report highlights notable trends in energy-related carbon dioxide (CO_2) emissions in the United States in 2024, based on preliminary data.

U.S. energy-related CO_2 emissions declined overall by less than 1%, or 23 million metric tons (MMmt), in 2024. Among end-use sectors, the most notable decreases occurred in the residential and industrial sectors. Lower residential sector emissions were mostly due to decreases in consumption of natural gas and petroleum products primarily associated with space heating—mainly propane and distillate fuel oil. Decreases in industrial-sector emissions were associated with reduced manufacturing.

Emissions from the commercial, transportation, and electric power sectors remained relatively unchanged but are discussed in greater detail in later sections.

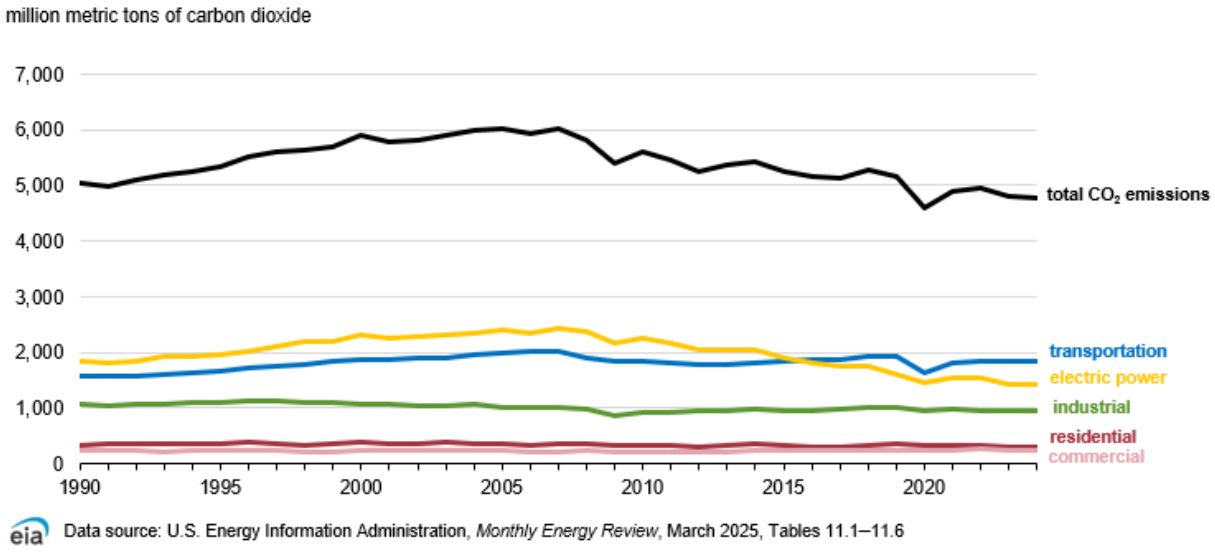
Table 1. Total U.S. energy-related carbon dioxide emissions by sector, 2020–2024

million metric tons of carbon dioxide

Sector	2024	2023	2022	2021	2020
Residential	303	313	340	325	319
Commercial	247	249	260	245	233
Industrial	947	962	960	977	953
Transportation	1,848	1,851	1,842	1,807	1,630
Electric power	1,427	1,421	1,539	1,553	1,450
Total	**4,772**	**4,795**	**4,940**	**4,906**	**4,585**

Data source: U.S. Energy Information Administration, *Monthly Energy Review*, March 2025, Tables 11.1–11.6
Note: Totals may not equal sum of components due to independent rounding.

Figure 1. U.S. energy-related carbon dioxide emissions by sector, 1990–2024



Key Findings

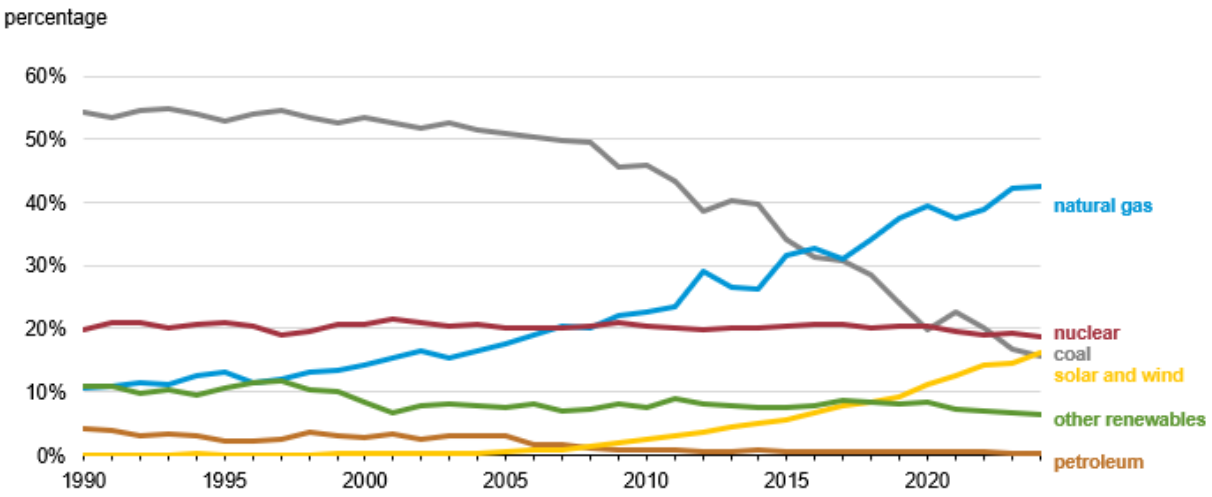
Electric power emissions remained flat as decreasing CO_2 from coal generation offset increasing CO_2 from natural gas

CO_2 emissions from the electric power sector remained mostly flat in 2024, increasing by less than 1% (6 MMmt). Although overall electricity generation increased by 3%, or 122 terawatthours (TWh), in 2024, changes in generation sources resulted in sectoral CO_2 emissions remaining near 2023 levels. Specifically:

- CO_2 emissions from coal-fired generation decreased by 3% (24 MMmt), but:
  - CO_2 emissions from natural gas-fired generation increased by 4% (31 MMmt)
- Coal-fired electricity generation fell by 3% (22 TWh), but:
  - Natural gas generation increased by 3% (59 TWh)
  - Solar generation increased by 32% (53 TWh)
  - Wind generation increased by 8% (32 TWh)

Although growth in natural gas-fired generation exceeded reductions in coal-fired generation, CO_2 emissions did not increase as much because natural gas emits less CO_2 per kilowatthour than coal when combusted.

Figure 2. Share of U.S. electric power sector generation by fuel source, 1990–2024



Warmer late-winter and early-spring weather led to lower residential sector emissions

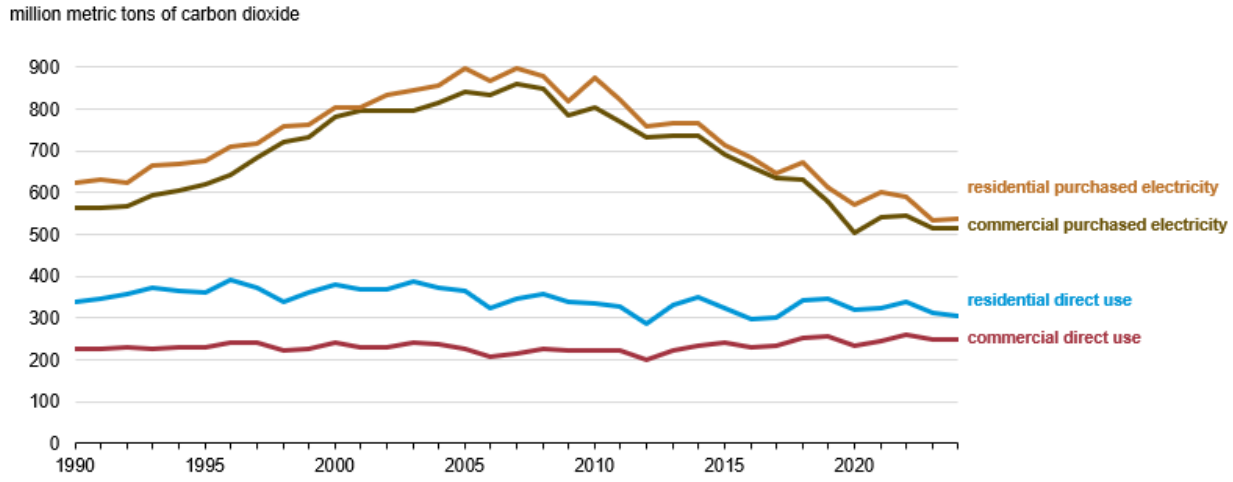
Residential sector CO_2 emissions declined 3% (10 MMmt) in 2024, as demand for heating decreased with relatively warm weather during late-winter and early-spring months. U.S. population-weighted heating degree days (HDDs), a measure of how cold a location is, decreased by 3% last year. Consequently,

consumption of natural gas, propane, and distillate fuel oil declined, which are all key fuels in residential space heating.

Warmer weather also led to increased demand for space cooling during warmer months. Cooling degree days (CDDs), a measure of how hot a location is, increased by 10% in 2024. However, unlike space heating, space cooling relies on electricity rather than direct use of fuels. As summer temperatures increased relative to 2023, residential sector electricity use rose. Annual purchases of electricity increased by 3%, and emissions associated with residential electricity consumption increased by 1% (5 MMmt). Overall, total residential sector emissions were lower because the decline in CO_2 emissions from lower heating fuel consumption outweighed increases associated with cooling demand.

Weather-related impacts on energy consumption and CO_2 emissions in the commercial sector mirrored the residential sector but to a lesser extent. Commercial sector emissions remained effectively flat in 2024, decreasing by only 2 MMmt, as a result of lower natural gas and petroleum consumption.

Figure 3. U.S. carbon dioxide emissions associated with the residential and commercial sectors, 1990–2024

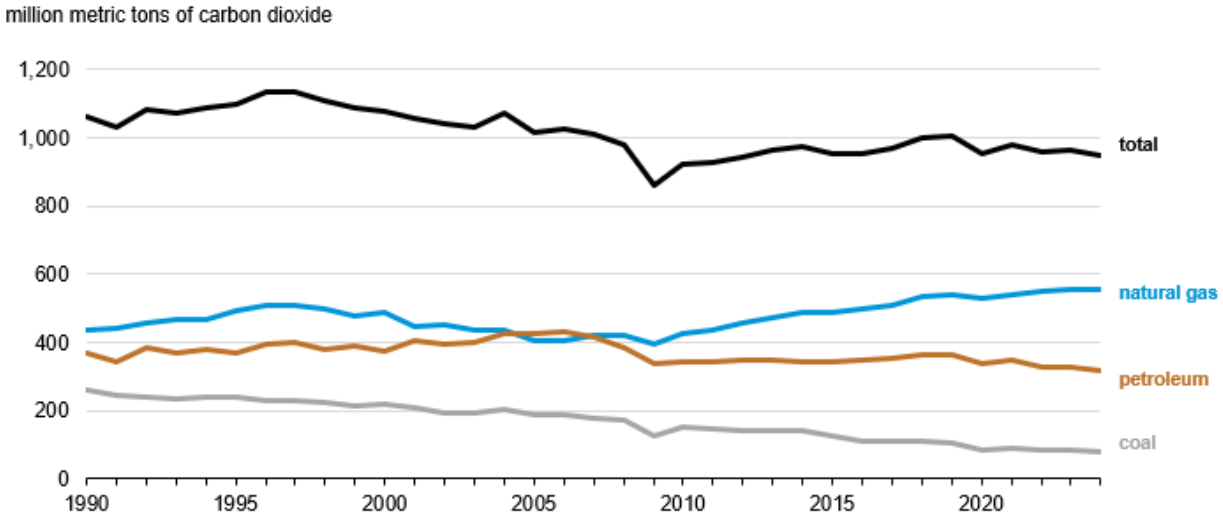


eia Data source: U.S. Energy Information Administration, *Monthly Energy Review*, March 2025, Tables 11.2 and 11.3

Industrial CO_2 emissions decreased in 2024 as industrial production growth slowed

CO_2 emissions from the U.S. industrial sector decreased by 1% (14 MMmt) in 2024. Decreased emissions were mostly related to a 15% (7 MMmt) decrease in petroleum coke consumption and a 6% (5 MMmt) decrease in coal consumption. Declining emissions from these fuels is associated with minor declines in industrial activity, such as manufacturing of primary metals.

Figure 4. U.S. industrial sector direct carbon dioxide emissions by fuel source, 1990–2024



Data source: U.S. Energy Information Administration, *Monthly Energy Review*, March 2025, Tables 11.4, Carbon Dioxide Emissions from Energy Consumption: Industrial Sector
Note: Total represents only direct emissions from the industrial sector and does not include emissions associated with the use of utility-scale electric power.

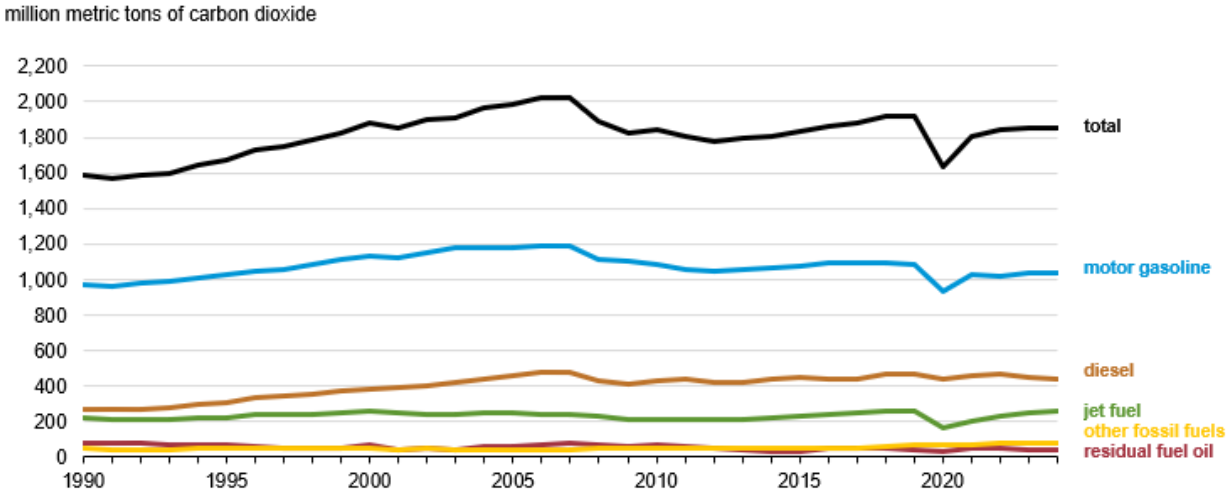
Transportation sector emissions remain unchanged as increased consumption of some petroleum products offset decreases in others

U.S. transportation sector emissions remained virtually unchanged in 2024. CO_2 emissions from motor gasoline and jet fuel increased slightly, following the trend from 2023, but were more than offset by decreases in CO_2 emissions from distillate fuel oil.

CO_2 emissions from motor gasoline increased by less than 1% (3 MMmt) in 2024. Despite steady increases in vehicle miles traveled, motor gasoline emissions have generally declined modestly over the last 20 years (Figure 5). These decreases in motor gasoline emissions are mostly due to higher vehicle fuel economy standards and, to a lesser extent, increased deployment of electric vehicles. Jet fuel emissions increased by 3% (7 MMmt) in 2024, mostly associated with increased air travel.

Higher motor gasoline and jet fuel emissions were more than offset by declining emissions from distillate fuel oil, which fell by 3% (15 MMmt) in 2024. Distillate consumption declined because on-road diesel vehicles consumed less and, to a lesser extent, conventional diesel fuel was substituted for renewable diesel.

Figure 5. U.S. transportation sector carbon dioxide emissions by fuel source, 1990–2024



Data source: U.S. Energy Information Administration, *Monthly Energy Review*, March 2025, Tables 11.5, Carbon Dioxide Emissions from Energy Consumption: Transportation Sector
Note: Total represents only direct emissions from the transportation sector and does not include emissions associated with the use of electric power.

Background and Data

We based our analysis of U.S. energy-related CO_2 emissions in this report on data published in our *Monthly Energy Review* (MER). This initial analysis is based on preliminary 2024 data first published in the March 2025 edition of the MER. These values are subject to change as final data are published from underlying sources, according to source data revision policies and publication schedules. We expect relatively minor differences between the preliminary and revised estimates based on past years (Table 2). Supplemental analysis, figures from past reports, and a discussion of the methodology and terminology used in this report are available in the Appendix.

Table 2. Preliminary and revised U.S. energy-related carbon dioxide emissions estimates, 2018–2023

Year	Preliminary CO_2 estimates (million metric tons)	Revised CO_2 estimates (million metric tons)	Difference (million metric tons)	Percentage difference
2018	5,274	5,269	-5	-0.1%
2019	5,138	5,149	11	0.2%
2020	4,571	4,575	4	0.1%
2021	4,870	4,904	34	0.7%
2022	4,970	4,941	-29	-0.6%
2023	4,807	4,791	-16	-0.3%

Data source: U.S. Energy Information Administration, *Monthly Energy Review*, Tables 11.1–11.6, March and September editions, 2019-2024

Emissions values and analysis presented in this report pertain only to U.S. CO_2 emissions associated with fossil-fuel combustion and non-combustion applications of energy products (for example, as industrial feedstocks). We do not include estimates of CO_2 emissions outside this scope or other greenhouse gas emissions burned or released in production, extraction, or distribution of energy products. Our approach

may result in discrepancies between our emissions estimates and those of other organizations, including other U.S. government agencies.

In addition to historical estimates, we also offer short-term forecasts and long-term projections of U.S. energy-related CO_2 emissions in several other data products. You can find a short-term forecast of U.S. energy-related CO_2 emissions and key drivers in our monthly *Short-Term Energy Outlook*, which includes monthly forecasts by fuel source currently through the end of 2026 and the latest estimates of the effects of recent events on energy markets and energy-related CO_2 emissions. We publish long-term U.S. emissions projections in our *Annual Energy Outlook*, which provides annual projections of energy-related CO_2 emissions by fuel source, sector, and end use through 2050. Projections of international energy-related CO_2 emissions through 2050 are available in our *International Energy Outlook*.