

U.S. Carbon Dioxide Emissions from Energy Sources

2003 Flash Estimate

Energy Information Administration
U.S. Department of Energy
June 2004
Office of Integrated Analysis & Forecasting - EI-81

This flash estimate is based on data published in the May 2004 *Monthly Energy Review*. Petroleum emissions were calculated by using preliminary product-level data. Since monthly data are revised at the end of the year, the emissions data presented here should be considered preliminary.

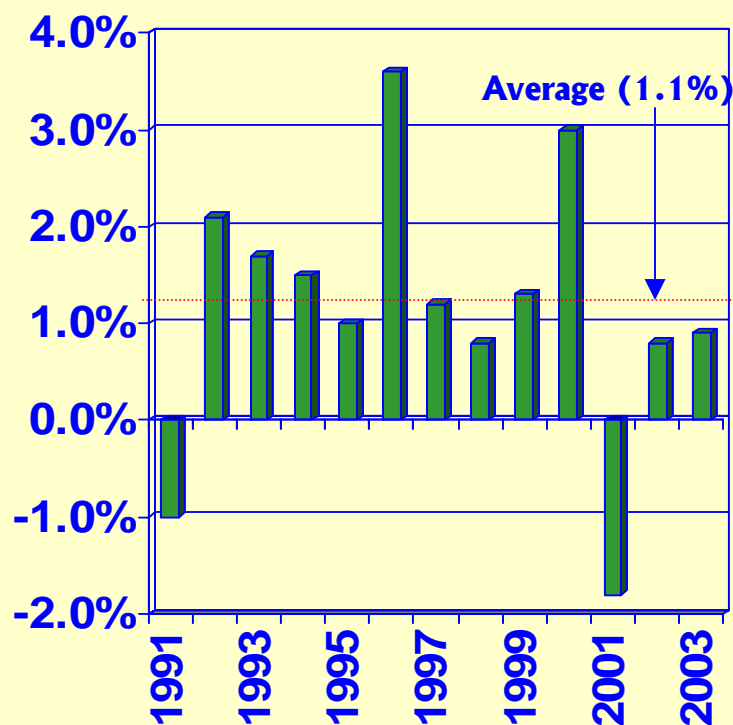
Note: These emission estimates are denominated in millions of metric tons of carbon dioxide (MMTCO₂). To convert to carbon equivalent emissions, multiply by 12/44.

U.S. Energy-Related Carbon Dioxide Emissions Increased in 2003

- U.S. energy-related CO₂ emissions in 2003 were up 0.9 percent from 2002 levels – 5,736 to 5,788 million metric tons (MMT CO₂)
- Between 2002 and 2003, energy demand rose 0.6 percent
- High natural gas prices in 2003 resulted in a shift to higher carbon fuels such as coal and petroleum
- A colder winter than the previous year, with a 3.8-percent increase in heating degree days, required more fuel (primarily natural gas) for home heating
- CO₂ emissions in 2003 were still below the 2000 level having fallen in 2001 by 1.8 percent and having grown by only 0.8 percent in 2002

Energy-Related Carbon Dioxide Emissions (1991-2003)

Annual Percent Change in CO₂ Emissions

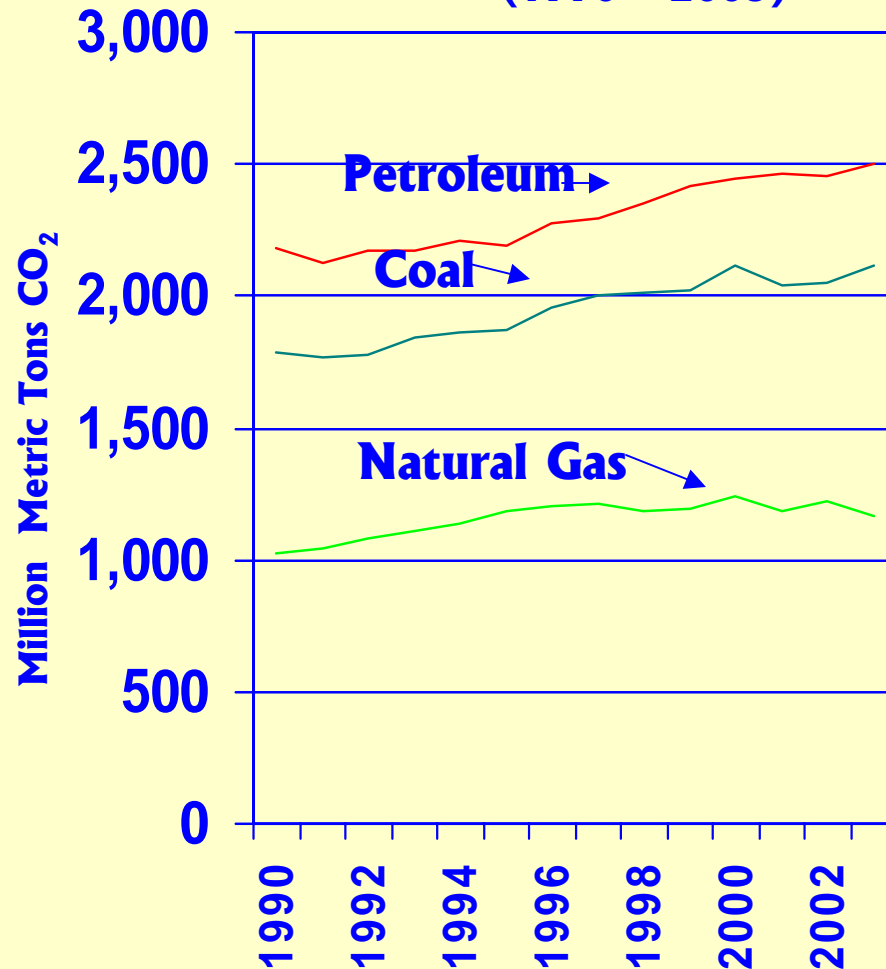


- Long-term growth in energy CO₂ emissions is influenced by:
 - Economic growth
 - Energy intensity of economy
 - Carbon intensity of energy supply
- Short-term, year-to-year variations are affected by:
 - Weather
 - Economic fluctuations
 - Fuel mix, which is influenced by the relative prices of fuels

Source: Energy Information Administration, preliminary estimate for 2003.

Carbon Dioxide Emissions by Fossil Fuel Type

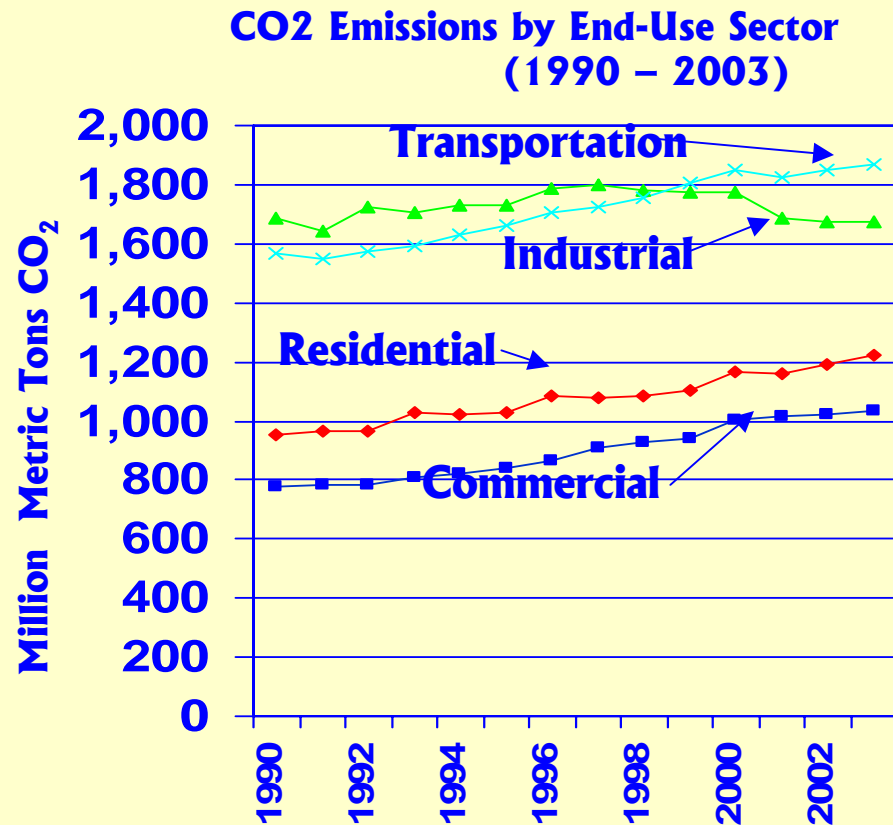
CO₂ Emissions By Fossil Fuel
(1990 – 2003)



- In 2003, petroleum emissions were 2,500, coal 2,116 and natural gas 1,169 MMTCO₂
- While coal produces the most CO₂ per unit of energy, petroleum produces the most CO₂ emissions due to its larger consumption levels
- Annual emissions growth from petroleum sources averaged 1.1 percent (1990 to 2003)
- Annual emissions growth averaged 1.3 % from coal and 1.0% from natural gas

Source: Energy Information Administration, preliminary estimate for 2003.

Energy-Related Carbon Dioxide Emissions by End-Use Sector



- In 1999, transportation-related CO₂ emissions overtook industrial emissions and remain the largest source of energy-related CO₂
- Emissions from power sector electricity generation are included in each end-use sector based on their respective shares of electricity use

Source: Energy Information Administration, preliminary estimate for 2003.

Residential Sector

- Between 2002 and 2003, residential CO₂ emissions grew by 2.5 percent as housing stock was up by 1.1 percent and heating degree days were up by 3.8 percent
- Between 1990 and 2003, residential sector CO₂ emissions grew by 28 percent (1.9% per year)
- This increase was driven by population growth of 17 percent (1.2% per year) and residential electricity demand growth of 39 percent (2.6% per year)

Commercial Sector

- Between 2002 and 2003, commercial CO₂ emissions grew 1.3 percent as the economy grew by 3.1 percent and commercial employment rose 0.3 percent
- Between 2002 and 2003, commercial sector electricity sales rose 0.4 percent, but CO₂ emissions rose 1.3 percent due to the higher carbon intensity of generation
- Between 1990 and 2003, commercial sector CO₂ emissions grew by 33 percent (2.2% per year)
- This increase was driven by commercial sector employment growth of 32 percent (2.1% per year) and commercial sector electricity sales growth of 46 percent (2.9% per year)

Industrial Sector

- Between 2002 and 2003, energy-related industrial CO₂ emissions were unchanged; the index of total industrial output increased by only 0.2 percent
- Between 1990 and 2003, energy-related industrial sector CO₂ emissions declined by 0.9 percent (-0.1% per year), while total industrial output grew by 44 percent and manufacturing output grew by 53 percent
- By 2003, energy-intensive primary metals output was 1 percent below 1990 levels, while basic chemicals output was 6 percent below 1990 levels

Transportation Sector

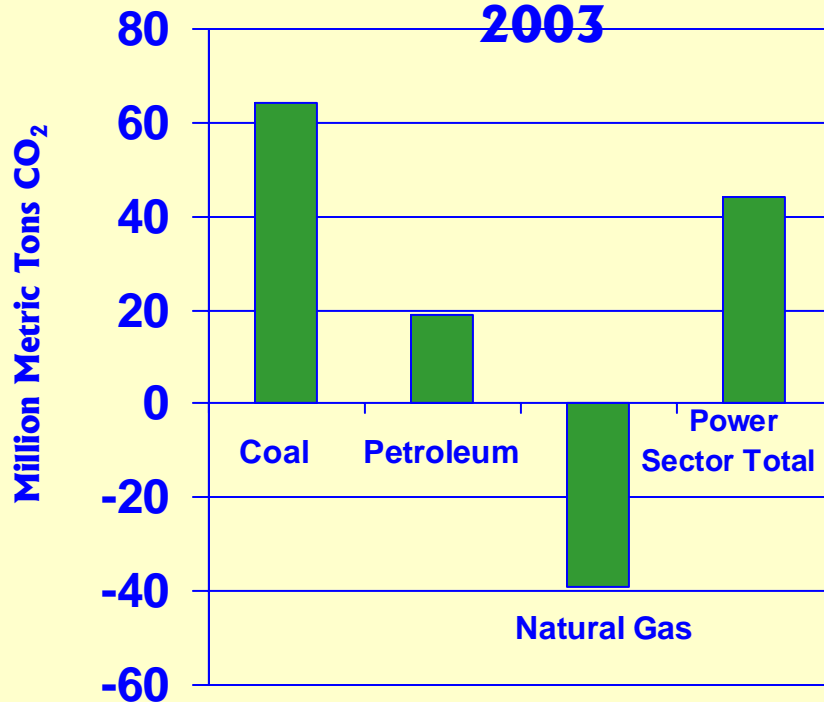
- Between 2002 and 2003, transportation CO₂ emissions grew 0.5 percent
 - gasoline demand was up 1 percent, but a 35-percent increase in ethanol consumption helped to moderate direct emissions in the transportation sector *
- Between 1990 and 2003, transportation CO₂ emissions grew 19 percent (1.3% per year)
- Between 1990 and 2002,** on-highway vehicle miles traveled grew by 32 percent (2.4% per year)

*** Emissions from ethanol production, not consumption, are counted in the agricultural component of the industrial sector.**

**** 2003 data for on-highway vehicle miles traveled will not be available until December 2004.**

Electric Power Sector

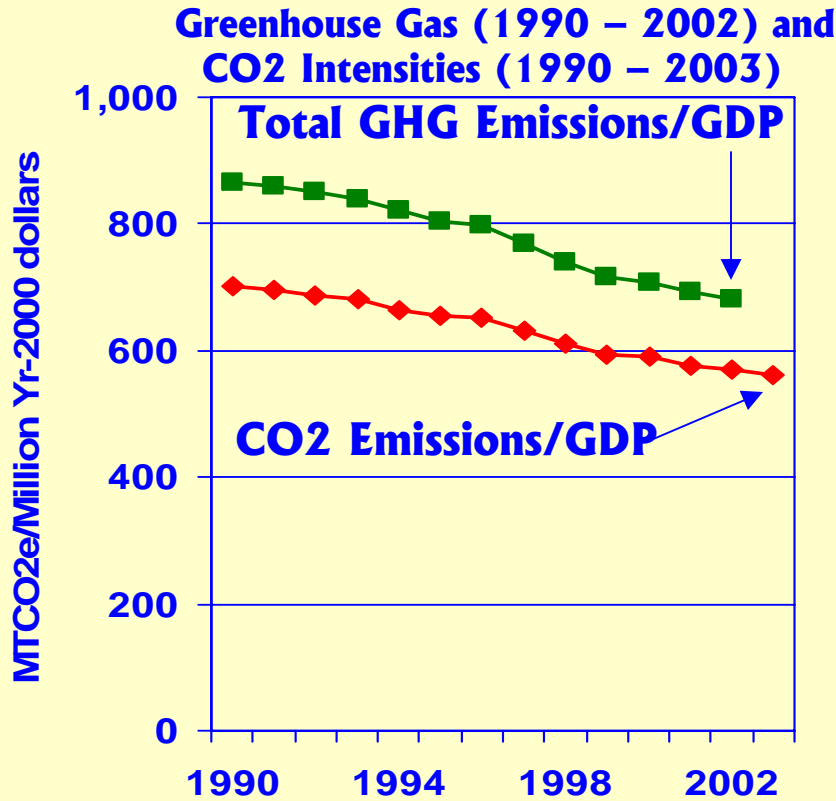
Change in Electric Power CO₂ Emissions by Fuel and for the Total Power Sector, 2002 to 2003



- Despite a 0.2 percent decline in generation, emissions increased by 44 MMTCO₂ (2.0 percent) in 2003.
- Higher natural gas prices caused generators to switch to other, higher carbon fuels:
 - Coal-powered emissions increased by 64 MMTCO₂ (3.5 %), while emissions from petroleum increased by 19 MMTCO₂ (24.7 %)
 - Natural gas-powered emissions fell by 39 MMTCO₂ (12.8 %).

Source: Energy Information Administration, preliminary estimate for 2003.

Intensity Measures



- Between 1990 and 2003, CO₂ emissions per unit of GDP declined by 20.6 percent (-1.8% per year)
- Between 1990 and 2002, greenhouse gas emissions per unit of GDP declined by 21.3 percent (-2.0% per year), and CO₂ emissions per unit of GDP declined by 18.9 percent (-1.7% per year)

Source: Energy Information Administration, preliminary estimate for 2003.

U.S. Energy-Related Carbon Dioxide Emissions by Fossil Fuel

(Million Metric Tons Carbon Dioxide)

	Petroleum	Coal	Natural Gas	Total
1990	2,178	1,784	1,027	4,989
1991	2,123	1,768	1,048	4,941
1992	2,174	1,781	1,086	5,043
1993	2,168	1,847	1,111	5,128
1994	2,211	1,858	1,134	5,205
1995	2,194	1,876	1,183	5,255
1996	2,278	1,959	1,205	5,442
1997	2,296	2,003	1,211	5,510
1998	2,347	2,016	1,188	5,553
1999	2,415	2,019	1,191	5,626
2000	2,444	2,113	1,239	5,798
2001	2,461	2,043	1,184	5,691
2002	2,456	2,050	1,226	5,736
P2003	2,500	2,116	1,169	5,788

Source: Energy Information Administration, preliminary estimate for 2003.

Percentage Change in U.S. Energy-Related Carbon Dioxide Emissions by Fuel Type

<i>Primary Energy</i>	<i>Total Percentage Change</i>		<i>Annual Average Percentage Growth</i>	
	1990 - 2003	1990 - 2003	2001 - 2002	2002 - 2003
<i>Petroleum</i>	14.8	1.1	-0.2	1.8
<i>Coal</i>	18.6	1.3	1.3	3.2
<i>Natural Gas</i>	13.9	1.0	2.9	-4.7
<i>Total Fossil Fuels</i>	16.0	1.1	0.8	0.9

Source: Energy Information Administration, preliminary estimate for 2003.

U.S. Energy-Related Carbon Dioxide Emissions by End-Use Sector

(Million Metric Tons Carbon Dioxide)

	Residential	Commercial	Industrial	Transport
1990	951	779	1,689	1,570
1991	967	781	1,644	1,549
1992	968	781	1,723	1,571
1993	1,027	806	1,705	1,591
1994	1,020	820	1,733	1,632
1995	1,026	837	1,731	1,661
1996	1,085	868	1,784	1,705
1997	1,077	911	1,799	1,723
1998	1,082	929	1,783	1,758
1999	1,106	943	1,772	1,806
2000	1,169	1,004	1,775	1,849
2001	1,161	1,018	1,686	1,827
2002	1,191	1,019	1,675	1,851
P2003	1,220	1,033	1,675	1,860

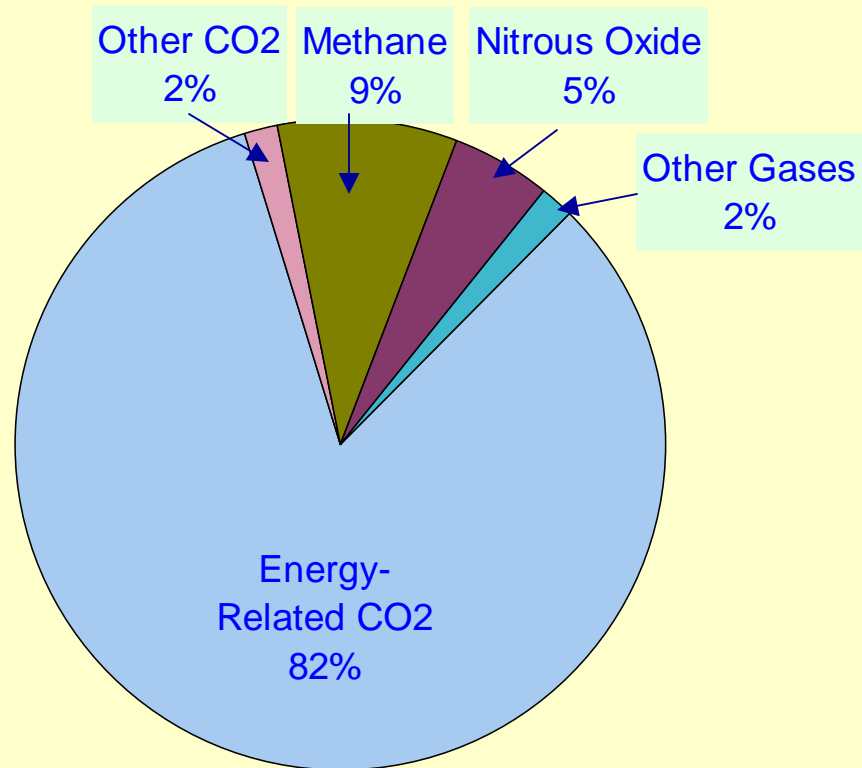
Source: Energy Information Administration, preliminary estimate for 2003.

Percentage Change In U.S. Energy-Related Carbon Dioxide Emissions By End-Use Sector

<i>Energy Sector</i>	<i>Total Percentage Change</i>		<i>Annual Average Percentage Growth</i>	
	1990 – 2003	1990 - 2003	2001 - 2002	2002 - 2003
<i>Residential</i>	28.4	1.9	2.6	2.5
<i>Commercial</i>	32.5	2.2	0.1	1.3
<i>Industrial</i>	-0.9	-0.1	-0.6	0.0
<i>Transportation</i>	18.5	1.3	1.3	0.5
<i>Total Energy</i>	16.0	1.1	0.8	0.9

Source: Energy Information Administration, preliminary estimate for 2003.

Energy-Related Carbon Dioxide Emissions are the Predominant Source of U.S. Greenhouse Gas Emissions 2002



Source: EIA, *Emissions of Greenhouse Gases in the United States 2002*