

U.S. Carbon Dioxide Emissions from Energy Sources 2008 *Flash* Estimate

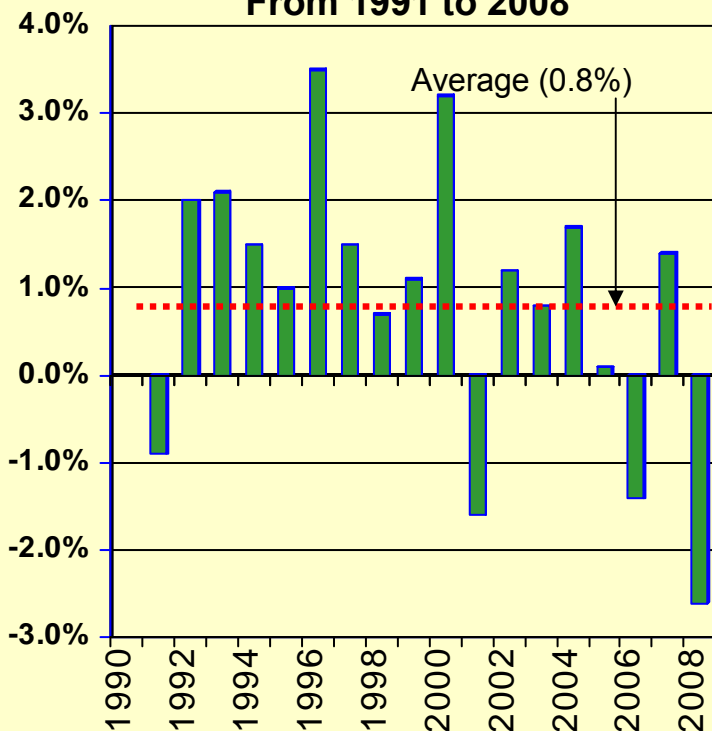
**Energy Information Administration
U.S. Department of Energy
May 2009**

This flash estimate is based on data published in the April 2009 *Monthly Energy Review* (MER).

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. All 2008 data are preliminary. (The full report on all greenhouse gases, *Emissions of Greenhouse Gases in the United States 2008*, will be available in December 2009.)

Energy-Related Carbon Dioxide Emissions Declined by 2.8 Percent in 2008

Annual Percent Change in CO₂ Emissions From 1991 to 2008



Source: Energy Information Administration, preliminary estimate for 2008.

- **Factors that contributed to the decline include:**

- **Energy prices**

- In 2008, gasoline and diesel prices were at their all-time peak level
- Near the end of the year, despite lower energy prices, gasoline and diesel demand was dampened by a drop in consumer income

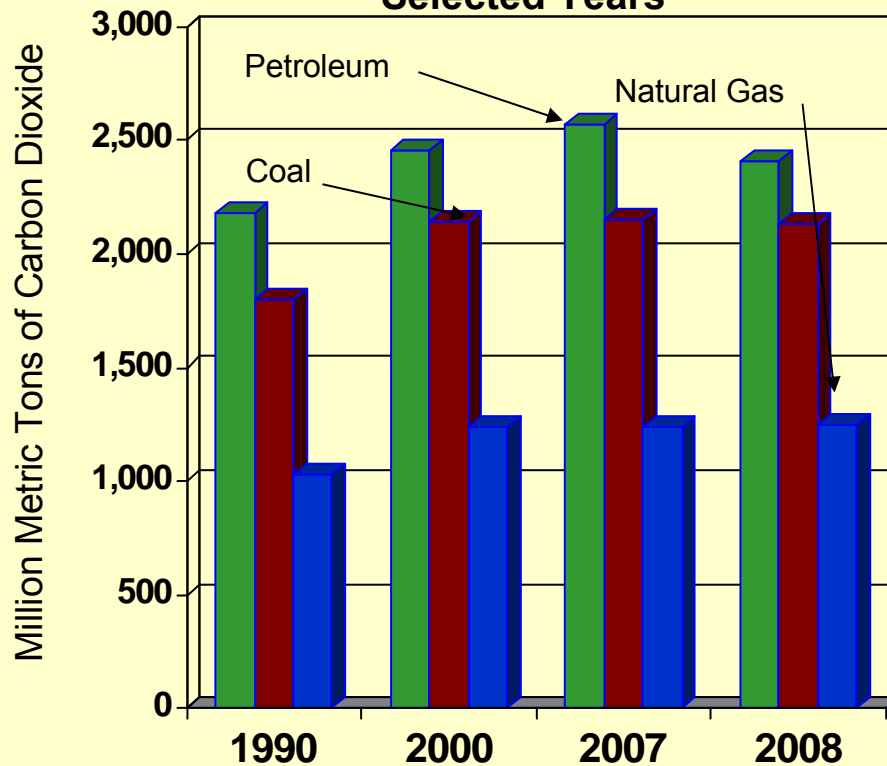
- **Lower economic growth**

- In 2008, GDP growth was a modest 1.1 percent
- In the 4th quarter, GDP fell at an annual rate of 6.3 percent

- **Total energy consumption in 2008 fell by 2.2 percent**

Emissions From Petroleum Fell by 6 Percent in 2008

U.S. Energy-Related Carbon Dioxide Emissions by Fuel for Selected Years

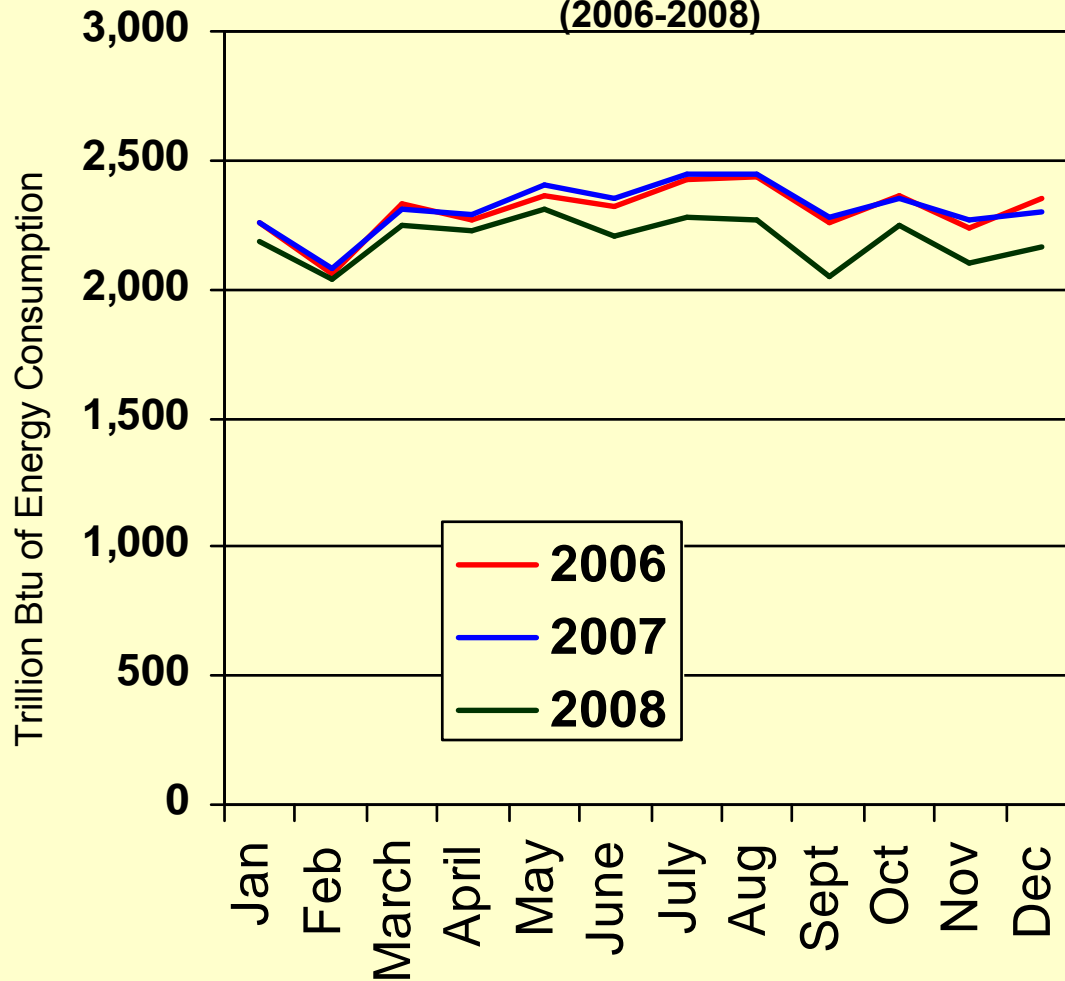


- U.S. energy-related CO₂ emissions decreased 165 million metric tons (MMT_{CO₂}) – from 5,967 MMT_{CO₂} in 2007 to 5,802 MMT_{CO₂} in 2008 (2.8 percent)
- Petroleum emissions were down 155 MMT_{CO₂} (6.0 percent)
- Natural gas emissions increased by 13 MMT_{CO₂} (1.0 percent) while coal emissions decreased by 23 MMT_{CO₂} (1.1 percent)

Source: Energy Information Administration, preliminary estimate for 2008.
Totals may not sum due to rounding.

Oil Use In Transportation Fell in 2008

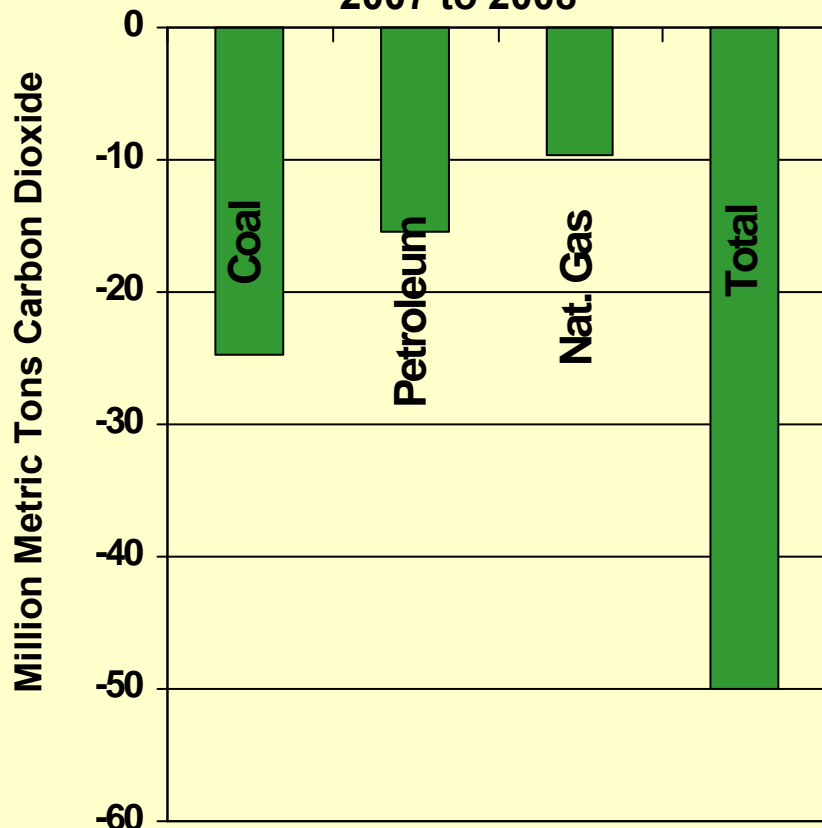
Transportation Petroleum Monthly
Energy Consumption
(2006-2008)



- By mid-year 2008, consumption was running 100 to 200 trillion Btu per month lower than the previous 2 years as gasoline and diesel prices were at an all-time high
- For the year, transportation petroleum consumption was down by 1,434 trillion Btu in 2008 as compared to 2007

Electric Power Sector Emissions Declined Due to Lower Demand and a Decrease in all Fossil-Fuel Generation

Decreased CO₂ Emissions by Fuel for the Electric Power Sector, 2007 to 2008

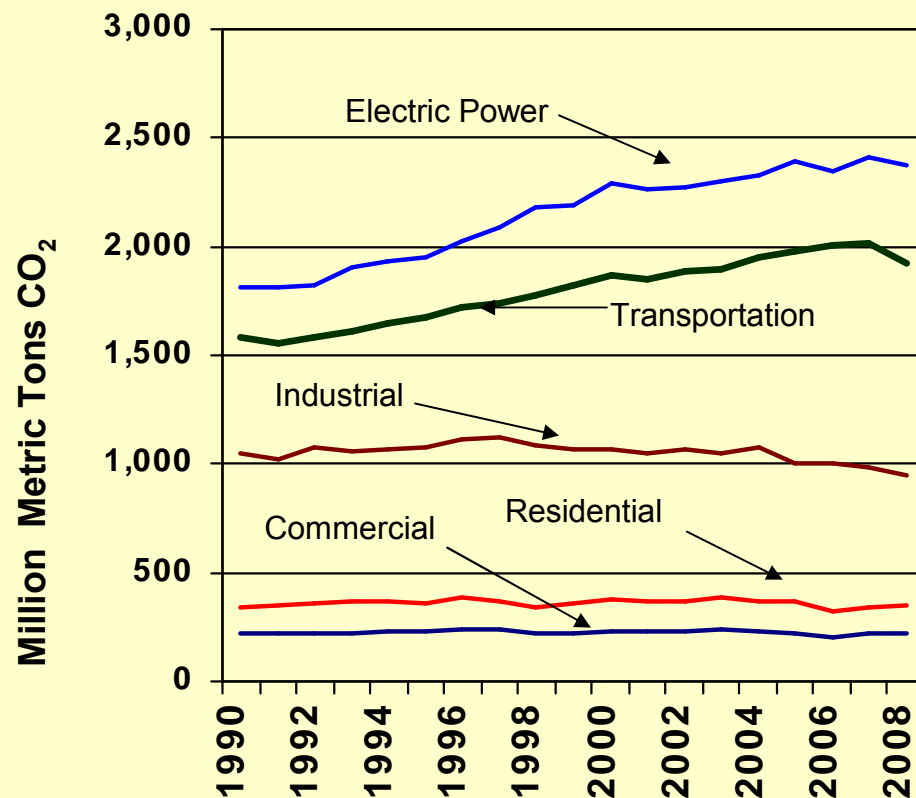


- Emissions from the electric power sector decreased by 50 MMTCO₂ (2.1 percent) in 2008
- Generation declined by 1.0 percent
- The resulting decrease in carbon intensity of 1.1 percent was driven by a decrease in fossil fuel generation
 - Natural gas-related emissions decreased 9.7 MMTCO₂ (2.6 percent), coal decreased 24.7 MMTCO₂ (1.3 percent)
 - Emissions from petroleum decreased by 15.4 MMTCO₂ (28.1 percent)
- Non-carbon generation rose by 18.6 billion kWh (1.7 percent) as the non-carbon share of generation rose from 27.8 percent in 2007 to 28.5 percent in 2008

Source: Energy Information Administration, preliminary estimate for 2008.

Carbon Dioxide Emissions by Direct-Fuel Use Energy Consumption in Sectors

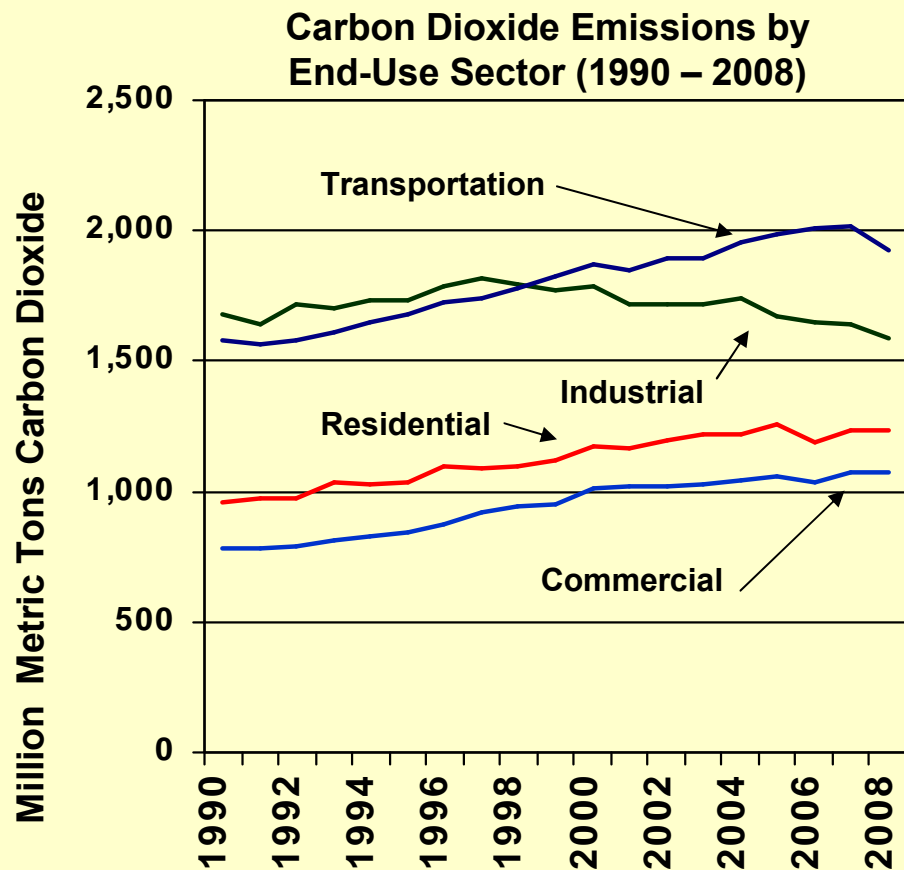
CO₂ Emissions by Direct-Fuel Use Sector (1990 – 2008)



- When the electric power sector is considered by itself, it is the largest sector in terms of energy-related carbon dioxide emissions (41 percent of total emissions)
- Transportation emissions contain very little indirect CO₂ from the electric power sector and they are growing at about the same rate, but both declined in 2008
- Direct-fuel use emissions in the residential and commercial sectors have remained relatively flat since 1990
- Direct-fuel use industrial emissions have declined by about 8 percent since 1990

Source: Energy Information Administration, preliminary estimate for 2008

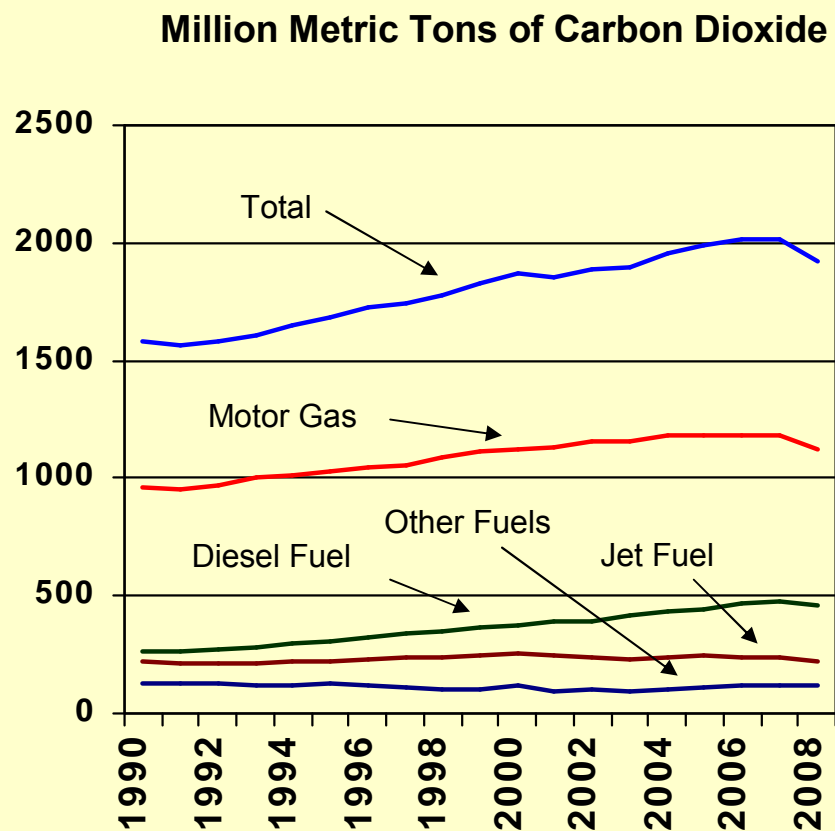
Transportation Remains the Largest Emitter Among End-Use Sectors



- In 1999, transportation-related CO₂ emissions overtook industrial emissions as the largest end-use source of energy-related CO₂
- Since 1990, industrial emissions have declined 0.3 percent per year while transportation emissions have grown 1.1 percent per year
- Residential sector emissions have grown 1.4 percent per year since 1990
- Since 1990, commercial emissions have averaged the highest growth (1.8 percent per year), although they remain the smallest sector for CO₂ emissions
- Both the residential and commercial sectors are dominated by electricity-related emissions

Source: Energy Information Administration, preliminary estimate for 2008.
Electric Power sector emissions are distributed across the end-use sectors.

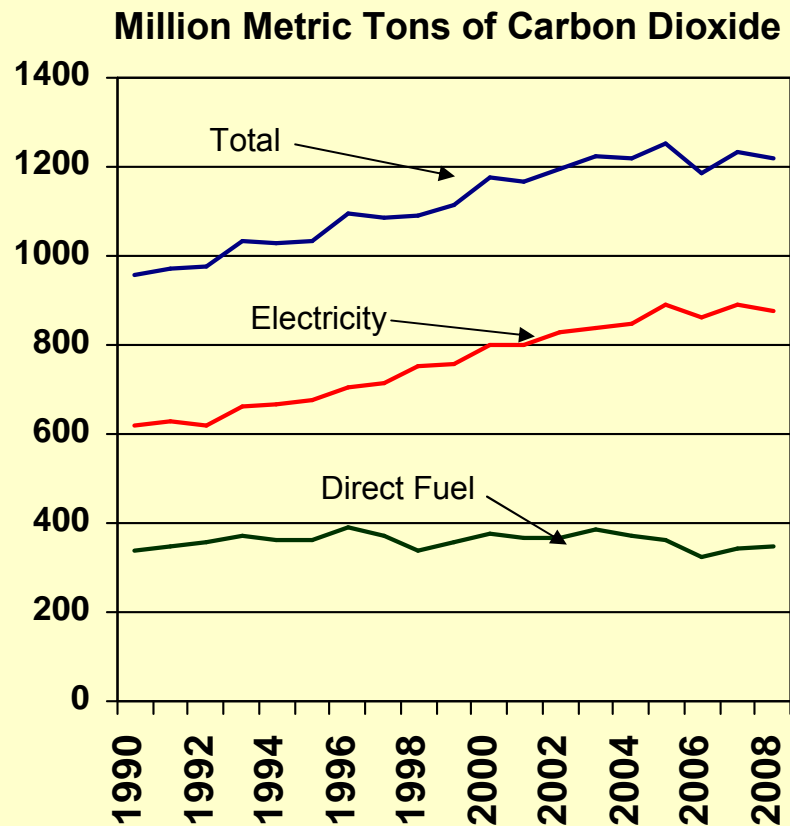
Transportation Sector Carbon Dioxide Emissions by Fuel Types (1990 to 2008)



- In 2008, transportation CO₂ emissions declined by 5.2 percent – the largest annual decline since 1990
- Motor gasoline accounts for 58.7 percent of the sector’s CO₂ emissions
- Diesel fuel accounts for 23.2 percent of the sector’s CO₂ emissions
- Since 1990, transportation sector CO₂ emissions have risen by 21.1 percent – 1.1 percent per year

Source: Energy Information Administration, preliminary estimate for 2008.

Residential Sector Carbon Dioxide Emissions for Electricity and Direct Fuel Use (1990 – 2008)

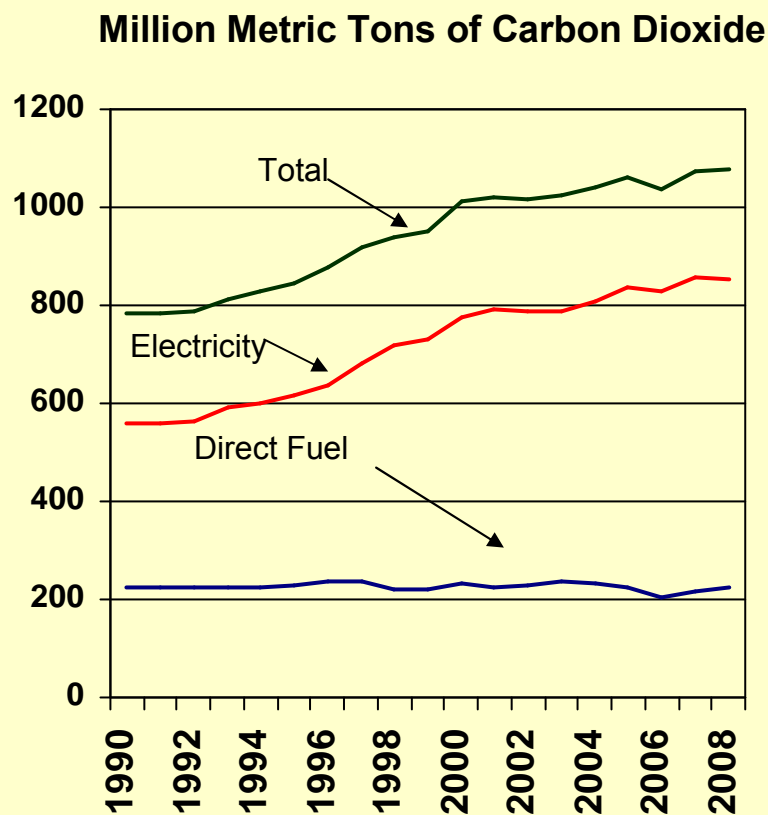


Source: Energy Information Administration, preliminary estimate for 2008.

- In 2008, residential CO₂ emissions fell 13 MMTCO₂ (1.1 percent)
- Heating degree-days were up 5.6 percent, but cooling degree-days fell by 8.7 percent
- About 25 percent of residential energy demand is heating related and 13 percent cooling related*
- Electricity-related emissions are 72 percent of the sector's total emissions so a decline of 1.9 percent offset the heating-related increase
- Between 1990 and 2008, residential sector CO₂ emissions grew by 27.5 percent (1.4 percent per year)
 - CO₂ emissions growth was driven more by electricity-related than direct fuel use emissions (graph)
 - Emissions related to electricity increased by 41.4 percent between 1990 and 2008, while direct use increased by 2.2 percent

*Updated AEO2009 Reference Case, April 2009, Table 4.

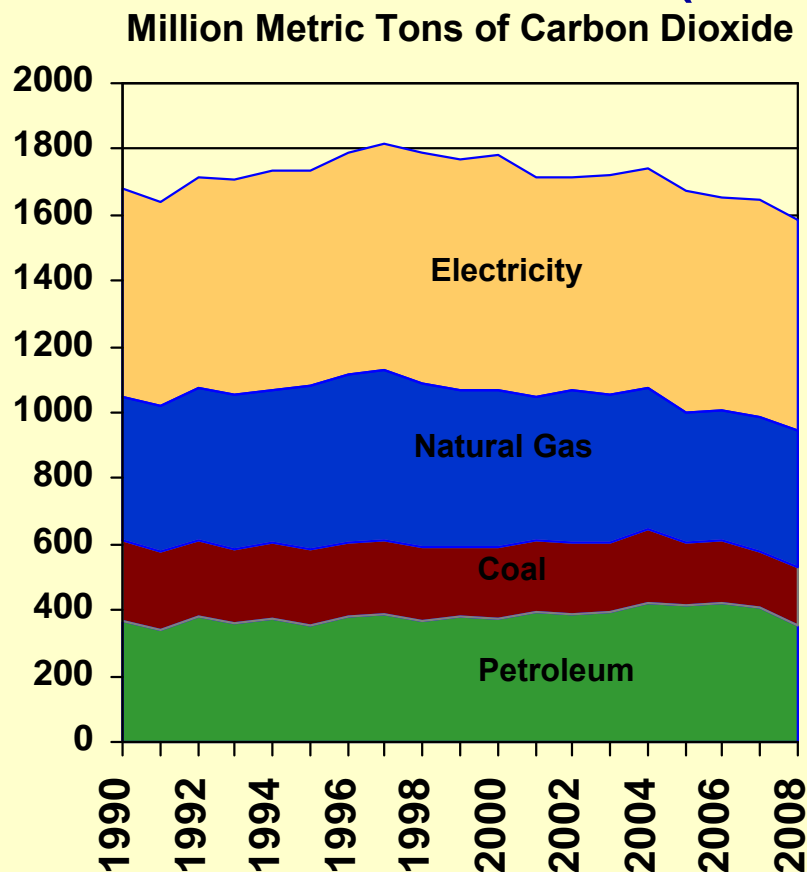
Commercial Sector Carbon Dioxide Emissions for Electricity and Direct Fuel Use (1990 – 2008)



Source: Energy Information Administration, preliminary estimate for 2008.

- In 2008, commercial CO₂ emissions increased 5 MMTCO₂ (0.5 percent) from 2007 levels
- Electricity accounts for 79.7 percent of CO₂ emissions from the commercial sector
 - Electricity-related emissions increased 0.3 percent from 2007 to 2008
- Between 1990 and 2008, commercial sector CO₂ emissions grew by 37.2 percent (1.8 percent per year)
- This growth was from electricity-related CO₂ rather than direct fuel use
- Commercial sector electricity-related emissions grew 52.9 percent or 2.4 percent per year between 1990 and 2008

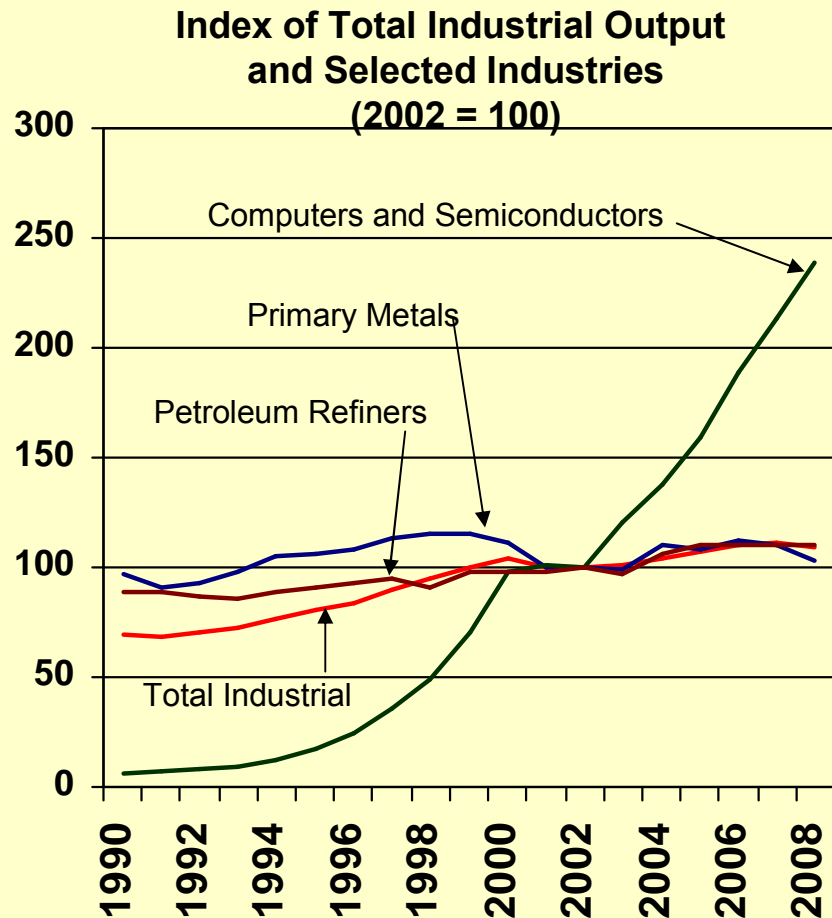
Industrial Sector Emissions from Electricity, Petroleum, Natural Gas and Coal (1990 to 2008)



- In 2008, energy-related industrial CO₂ emissions declined by 3.2 percent
- Between 1990 and 2008, energy-related industrial sector CO₂ emissions declined 95 MMTCO₂ from 1,683 to 1,588 MMTCO₂
- Total petroleum and coke imports increased by 9.1 and 4.0 MMTCO₂ respectively over the 1990 to 2008 time period while coal and natural gas emissions decreased by 77.5 and 20.5 MMTCO₂ over the same time period
- Many energy-intensive industries such as steel have moved overseas and have been replaced with less energy-intensive, higher-value industries such as computer chips

Source: Energy Information Administration, preliminary estimate for 2008.

Industrial Sector (Continued)

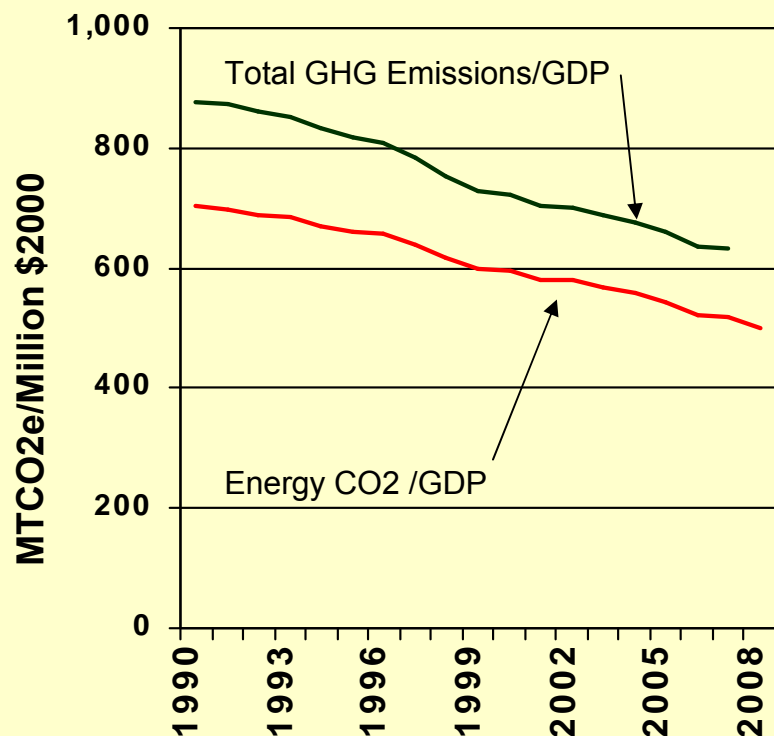


- Based on early estimates, total industrial output decreased 2.2 percent in 2008
 - Output from energy-intensive industries, such as chemicals, primary metals, and non-metallic minerals, decreased 7.8, 6.8, and 5.8 percent, respectively
 - Output from petroleum refineries was flat
 - The food industry grew 1.5 percent while the paper industry fell by 2.4 percent
- Between 1990 and 2008 the index of total industrial output grew by 56 percent or 2.5 percent per year

Source: http://www.federalreserve.gov/releases/G17/ipdisk/ip_nsa.txt

Energy CO₂ Intensity (Energy CO₂ per GDP)

Greenhouse Gas (1990 – 2007) and Energy CO₂ Intensities (1990 – 2008)



- Energy-related CO₂ per unit of GDP dropped 3.8 percent in 2008
 - Energy per GDP (Btu/GDP) declined 3.3 percent
 - The CO₂ intensity of the energy supply (CO₂/Btu) declined 0.6 percent
- Between 1990 and 2008, energy CO₂ per unit of GDP declined by 29.3 percent (1.9 percent per year)
 - Most of this decline was from a 28.4-percent decrease in energy intensity
 - The remainder was from a 1.2-percent decrease in the carbon intensity of the energy supply
- Between 1990 and 2007, energy CO₂ per unit of GDP declined by 26.4 percent (1.8 percent per year)
- Between 1990 and 2007, total greenhouse gas emissions per unit of GDP declined by 28.0 percent (1.9 percent per year)

Source: Energy Information Administration, preliminary estimate for 2008.
Totals may not sum due to rounding.

**U.S. Energy-Related Carbon Dioxide Emissions
by Fossil Fuel
(Million Metric Tons Carbon Dioxide)**

	<u>Petroleum</u>	<u>Coal</u>	<u>Natural Gas</u>	<u>Total*</u>
1990	2,178	1,797	1,026	5,007
1995	2,206	1,894	1,186	5,296
2000	2,458	2,141	1,234	5,844
2001	2,469	2,084	1,185	5,750
2002	2,468	2,094	1,242	5,817
2003	2,513	2,131	1,209	5,864
2004	2,603	2,158	1,191	5,963
2005	2,620	2,161	1,179	5,972
2006	2,585	2,131	1,158	5,885
2007	2,568	2,154	1,234	5,967
2008P	2,413	2,130	1,247	5,802

Source: Energy Information Administration, preliminary estimate for 2008.

*The total includes small amounts of CO2 from municipal solid waste and geothermal energy.

P= Preliminary

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

Primary Energy	Total Percent Change		Annual Average Percentage Growth	
	1990 - 2008	1990 - 2008	2006 - 2007	2007 - 2008
Petroleum	10.8%	0.6%	-0.7%	-6.0%
Coal	18.6%	1.0%	1.1%	-1.1%
Natural Gas	21.5%	1.1%	6.6%	1.0%
Total Fossil Fuels	15.9%	0.8%	1.4%	-2.8%

Source: Energy Information Administration, preliminary estimate for 2008.

**U.S. Energy-Related Carbon Dioxide Emissions
by End-Use Sector
(Million Metric Tons Carbon Dioxide)**

	<u>Residential</u>	<u>Commercial</u>	<u>Industrial</u>	<u>Transport</u>
1990	957	784	1,683	1,583
1995	1,035	845	1,734	1,682
2000	1,177	1,012	1,783	1,873
2001	1,166	1,019	1,714	1,851
2002	1,195	1,017	1,714	1,891
2003	1,223	1,026	1,718	1,897
2004	1,220	1,042	1,743	1,959
2005	1,254	1,059	1,671	1,988
2006	1,186	1,035	1,652	2,012
2007	1,234	1,070	1,641	2,022
2008P	1,221	1,076	1,588	1,917

Source: Energy Information Administration, preliminary estimate for 2008.

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

Energy Sector	Total Percent Change	Annual Average Percent Growth		
	1990 – 2008	1990 - 2008	2006 - 2007	2007 - 2008
Residential	27.5%	1.4%	4.1%	-1.1%
Commercial	37.2%	1.8%	3.4%	0.5%
Industrial	-5.6%	-0.3%	-0.7%	-3.2%
Transportation	21.1%	1.1%	0.5%	-5.2%
Total Energy	15.9%	0.8%	1.4%	-2.8%

Source: Energy Information Administration, preliminary estimate for 2008.