

U.S. Carbon Dioxide Emissions from Energy Sources 2007 *Flash* Estimate

**Energy Information Administration
U.S. Department of Energy
May 2008**

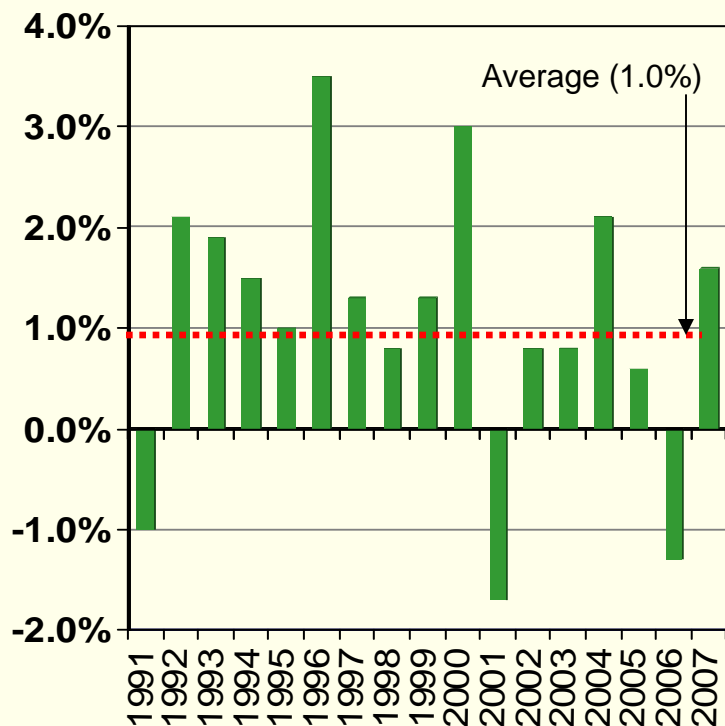
Office of Integrated Analysis & Forecasting, EI-80

This flash estimate is based on data published in the April 2008 *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 2007 data are preliminary. (The full report will be available in the fall of 2008.)

Energy-Related Carbon Dioxide Emissions Grew by 1.6 Percent in 2007

Annual Percent Change in CO₂ Emissions



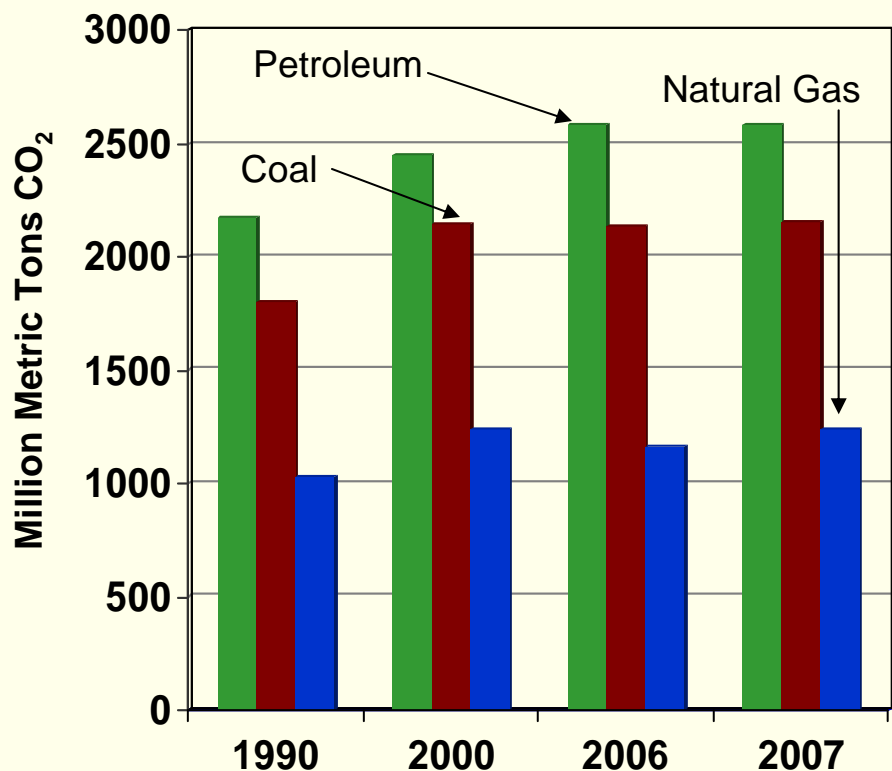
Factors that influenced growth include:

- **Economic growth**
 - 2.2 percent increase in GDP
- **Weather**
 - Heating degree-days were up by 6.7 percent over 2006
 - Cooling degree-days were up by 2.6 percent over 2006
 - More energy was needed for both heating and cooling compared to 2006
- **Power sector electricity generation was up by 2.5 percent**
 - Emissions were up by 3.0 percent indicating a higher carbon intensity of generation in 2007 compared to 2006

Source: Energy Information Administration, preliminary estimate for 2007.

Emissions from Natural Gas and Coal Increased in 2007

U.S. Energy-Related Carbon Dioxide Emissions
by Fuel For Selected Years (Million Metric tons Carbon)

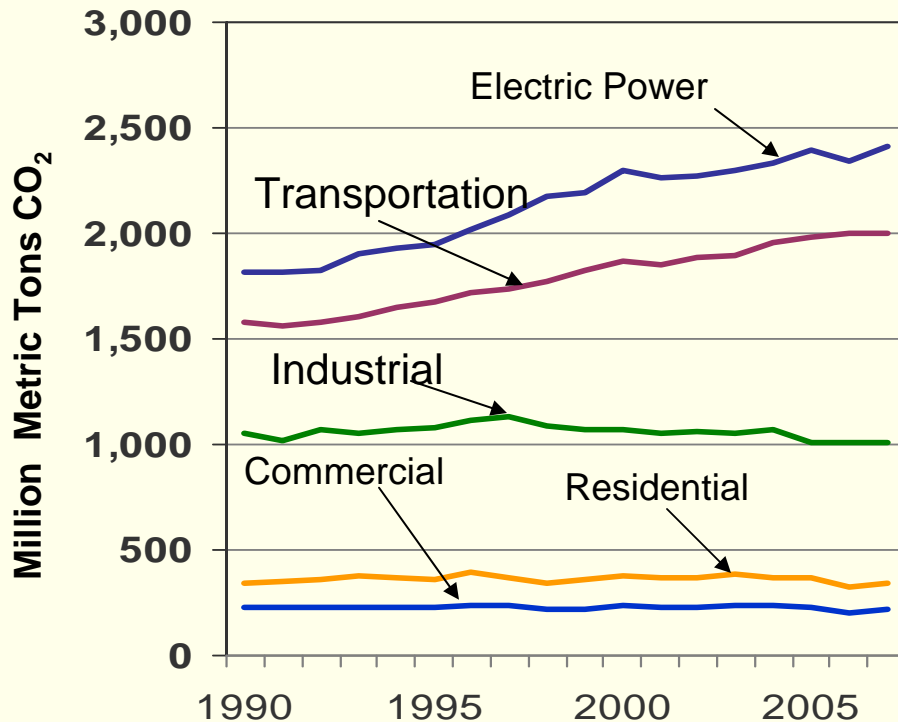


Source: Energy Information Administration, preliminary estimate for 2007.
Totals may not sum due to rounding.

- U.S. energy-related CO₂ emissions increased 97 million metric tons (MMT CO₂) – from 5,888 MMT CO₂ in 2006 to 5,984 MMT CO₂ in 2007
- Natural gas emissions increased by 77 MMT CO₂ (6.6 percent) and coal emissions increased by 23 MMT CO₂ (1.1 percent)
- Petroleum emissions were down 3 MMT CO₂ (-0.1 percent)

The Electric Power Sector is the Largest Emissions Source in Terms of Primary Energy Consumption

CO₂ Emissions by Energy-Use Sector (1990 – 2007)

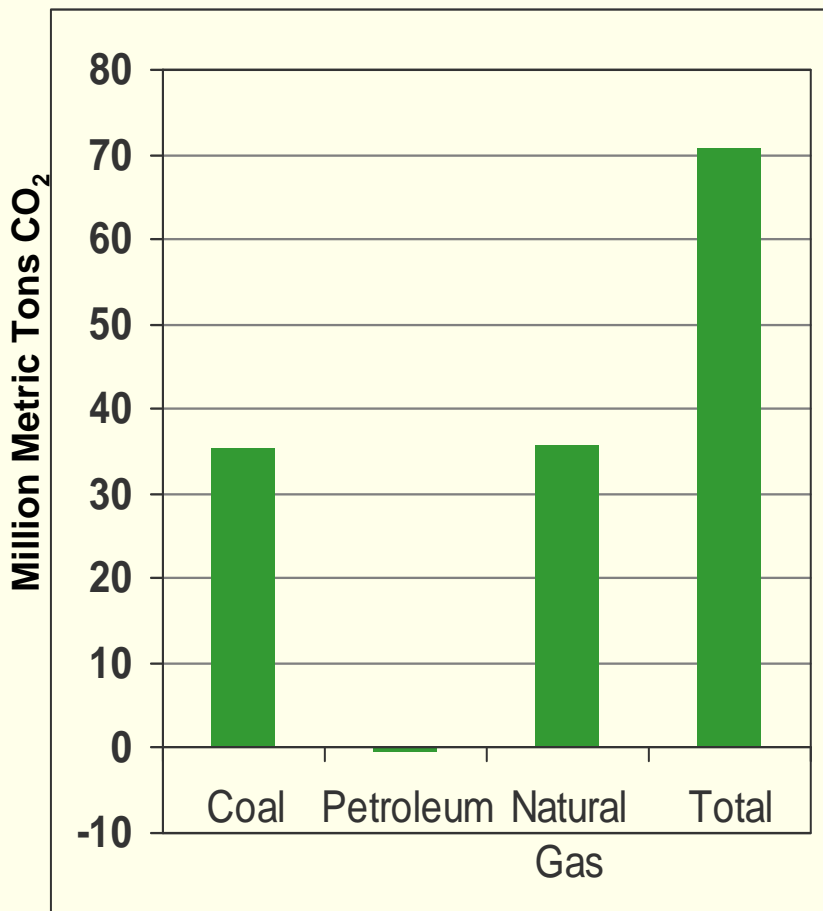


- When electric power sector emissions are considered as a whole rather than being attributed to the sectors that use electricity, they represent the largest source of energy-related CO₂
- Transportation emissions have grown at about the same rate as electric power emissions since 1990
- Direct-use emissions in the residential, commercial and industrial sectors, which do not include the emissions associated with the generation of electric power used by those sectors, have remained relatively flat since 1990

Source: Energy Information Administration, preliminary estimate for 2007.

Growing Electricity Demand and Changes in the Generation Fuel Mix Led to Increased Emissions

Change in CO₂ Emissions by Fuel for the Electric Power Sector, 2006 to 2007

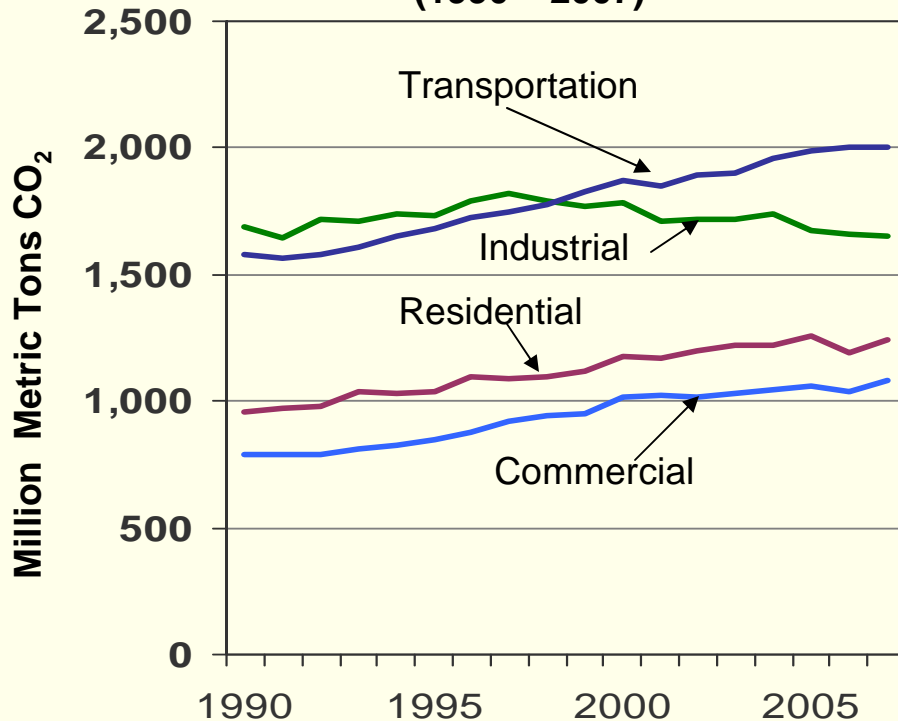


- Emissions from the electric power sector increased by 70.8 MMTCO₂ (3.0 percent) in 2007
- Generation was up by 2.5 percent.
- The resulting increase in carbon intensity of 0.5 percent was driven by a decrease in non-carbon generation:
 - Natural gas-related emissions increased 35.6 MMTCO₂ (10.5 %), they were matched by a coal increase of 35.3 MMTCO₂ (1.8 %) Emissions from petroleum decreased by 0.4 MMTCO₂ (0.7 %)
 - Non-carbon generation decreased by 15 billion kWh, as hydropower fell by 40 billion kWh offsetting wind and nuclear power increases of 6 and 19 billion kWh respectively

Source: Energy Information Administration, preliminary estimate for 2007.

Transportation Is the Largest Emitter Among End-use Sectors, but its Emissions Growth Has Flattened

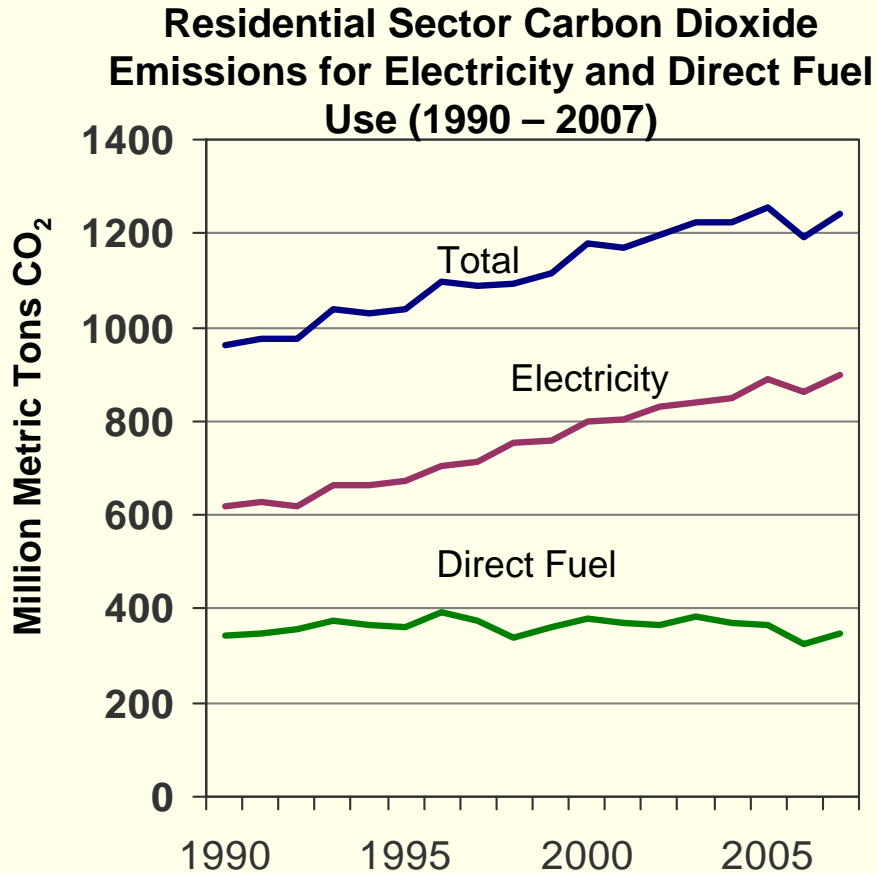
CO₂ Emissions by Energy-Use Sector (1990 – 2007)



Source: Energy Information Administration, preliminary estimate for 2007.
Electric Power sector emissions are distributed across the end-use sectors.

- Transportation sector emissions of energy-related CO₂, which surpassed emissions from the industrial sector in 1999, have grown by 1.4 percent per year since 1990
- Industrial emissions have declined on average - 0.1 percent per year since 1990
- Residential sector emissions have grown 1.5% per year
- Commercial emissions have averaged the highest growth (1.9 % per year), although they remain the smallest sector for CO₂ emissions
- Emissions from both residential and commercial sectors are dominated by emissions associated with the production of the electricity they use

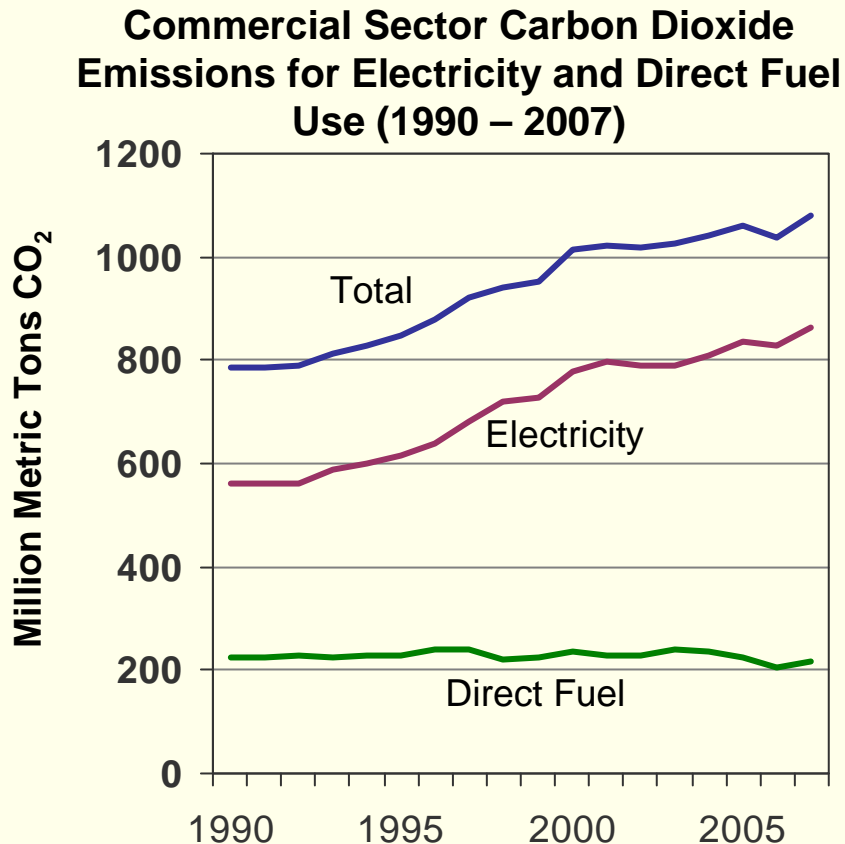
Residential Sector Emissions Grew the Most in 2007



Source: Energy Information Administration, preliminary estimate for 2007.

- In 2007, residential CO₂ emissions rose 52 MMT CO₂ (4.4 percent)
- Heating degree-days were up 6.7 percent, cooling degree-days also increased by 2.6 percent – this increased heating fuel demand as well as air-conditioning requirements and the sector’s electricity-related emissions increased by 3.9 percent
- Between 1990 and 2007, residential sector CO₂ emissions grew by 29.4 percent (1.5% per year)
 - As indicated in the graph, growth was driven more by electricity-related CO₂ than direct fuel use.

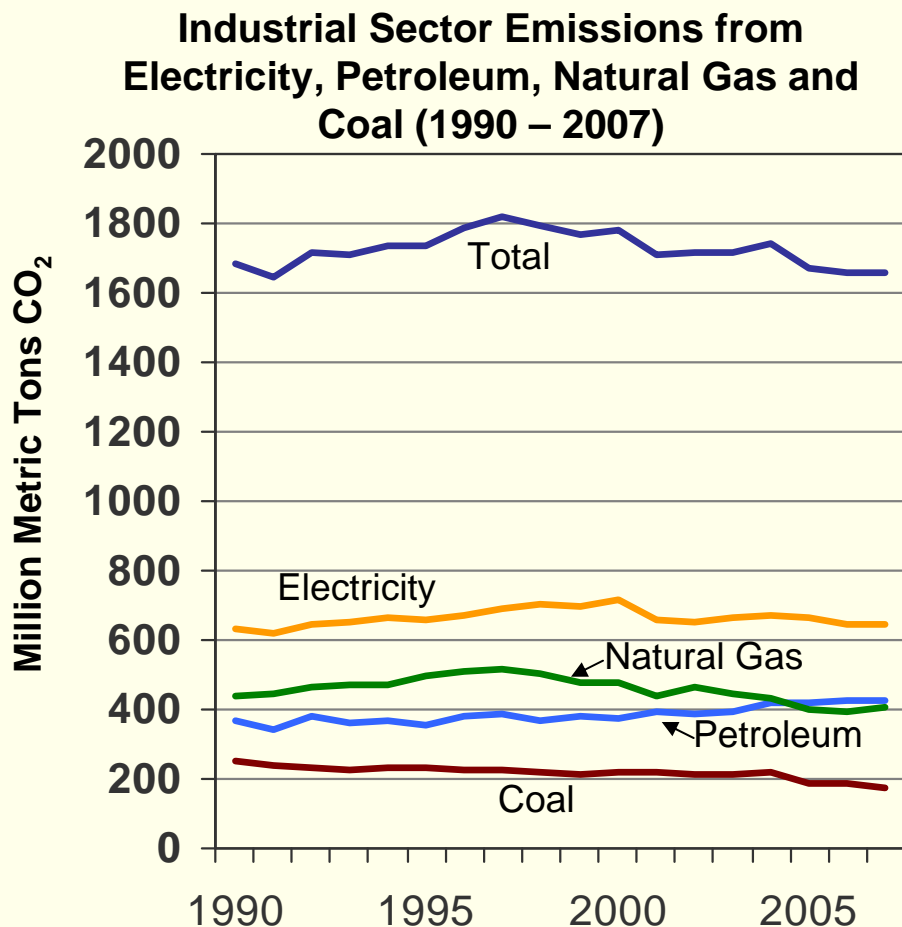
Commercial Sector Emissions Have Grown the Most Since 1990



- In 2007, commercial CO₂ emissions increased 44 MMTCO₂ (4.3 percent) over 2006 levels
- Electricity accounts for 78 percent of CO₂ emissions from the commercial sector
 - Electricity emissions rose 4.2 percent from 2006 to 2007
- Between 1990 and 2007, commercial sector CO₂ emissions grew by 37.4 percent (1.9 percent per year)
 - As in the residential sector, this growth was from electricity-related CO₂ rather than direct fuel use

Source: Energy Information Administration, preliminary estimate for 2007.

Industrial Sector Emissions Have Continued to Decline Since 2004

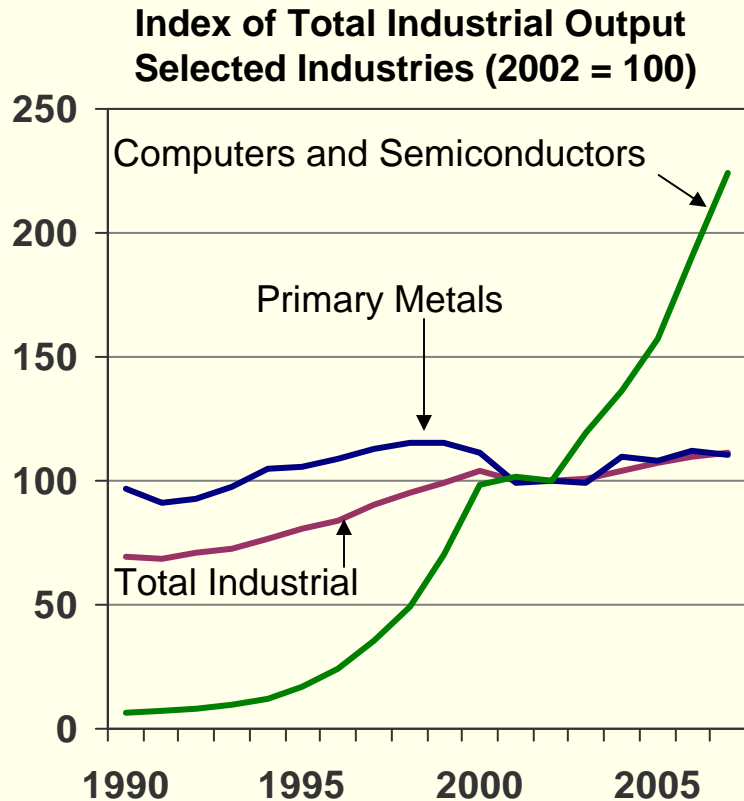


- In 2007, energy-related industrial CO₂ emissions declined slightly (- 0.1 percent)
- Between 1990 and 2007, energy-related industrial sector CO₂ emissions declined 30 MMTCO₂ from 1,685 to 1,655 MMTCO₂
- Increases in petroleum and electricity emissions from 1990 to 2007 were more than offset by reductions from natural gas and especially coal emissions (-30 percent)
- Based on early estimates, total industrial output increased 1.7 percent in 2007*

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

Source: Energy Information Administration, preliminary estimate for 2007.

Industrial Sector (Continued)

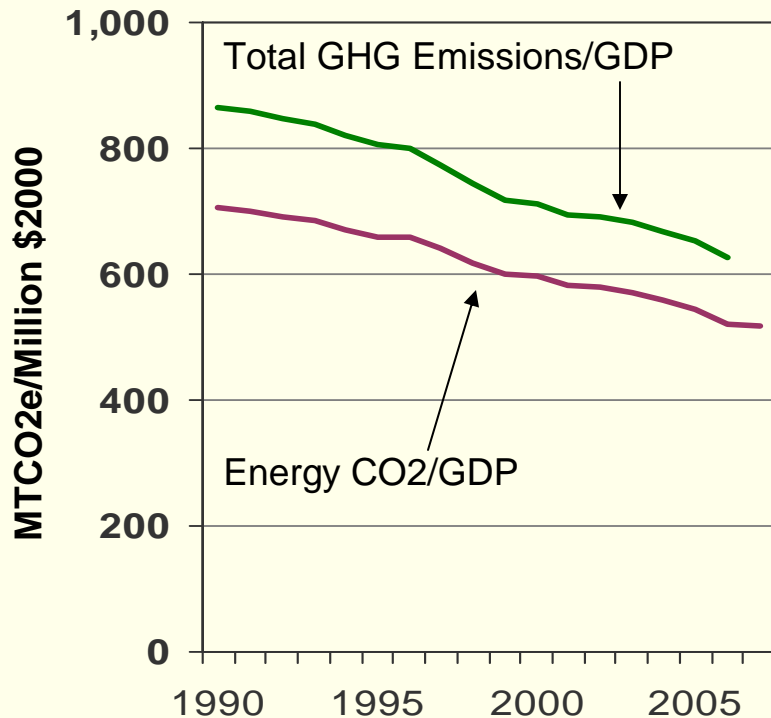


- The food and chemical industries each had growth of 3.2 percent, while the paper industry grew by 1.5 percent
- Output from other energy-intensive industries, such as primary metals, non-metallic minerals, and petroleum refiners decreased 1.8, 1.5, and 0.1 percent, respectively in 2007
- Since 1990 the output of energy-intensive industries such as pig iron for steel and aluminum have declined and have been replaced with less energy-intensive, higher-value industries such as computers and electronic products
- Between 1990 and 2007 the index of total industrial output grew by 60 percent or 2.8 percent per year
 - Primary metals grew by 14 percent or 0.8 percent per year on average
 - Computers and semiconductors grew by 3,385 percent or 23 percent per year on average

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

Carbon Dioxide Intensity Continues to Improve

Greenhouse Gas (1990 – 2006) and Energy CO₂ Intensities (1990 – 2007)



- In 2007, energy CO₂ intensity (carbon dioxide emissions per unit of economic output) fell by about 0.5 percent
- Energy CO₂ rose by 1.6 percent and the economy grew by 2.2
- Between 1990 and 2007, energy CO₂ per unit of GDP declined by 26.6 percent (-1.8% per year)
- Between 1990 and 2006, total greenhouse gas emissions per unit of GDP declined by 27.7 percent (-2.0% per year)

Source: Energy Information Administration, preliminary estimate for 2007. Totals may not sum due to rounding.

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

	Petroleum	Coal	Natural Gas	Total*
1990	2178	1796	1033	5013
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1995	2206	1893	1192	5301
1996	2287	1976	1215	5489
1997	2309	2025	1225	5570
1998	2352	2045	1198	5607
1999	2414	2046	1198	5669
2000	2458	2140	1239	5848
2001	2469	2084	1190	5754
2002	2468	2093	1245	5820
2003	2513	2130	1216	5872
2004	2604	2155	1196	5966
2005	2621	2163	1179	5974
2006	2586	2132	1158	5888
2007	2583	2154	1234	5984

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

Primary Energy	Total	Annual Average		
	Percentage Change	Percentage Growth		
	1990 - 2007	1990 - 2007	2005 - 2006	2006 - 2007
Petroleum	18.6%	1.0%	-1.3%	-0.1%
Coal	19.9%	1.1%	-1.4%	1.1%
Natural Gas	19.5%	1.1%	-1.8%	6.6%
Total Fossil Fuels	19.4%	1.0%	-1.4%	1.6%

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

	Residential	Commercial	Industrial	Transport
1990	960	786	1685	1583
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1995	1037	846	1735	1682
1996	1097	877	1789	1725
1997	1088	921	1817	1744
1998	1095	941	1791	1779
1999	1118	953	1770	1823
2000	1179	1013	1783	1873
2001	1170	1023	1710	1851
2002	1196	1018	1714	1891
2003	1224	1027	1719	1901
2004	1222	1043	1742	1959
2005	1254	1059	1673	1988
2006	1190	1036	1657	2005
2007P	1242	1080	1655	2006

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

Energy Sector	Total Percentage Change	Annual Average Percentage Growth		
	1990 – 2007	1990 - 2007	2005 - 2006	2006 - 2007
Residential	29.4%	1.5%	-5.1%	4.4%
Commercial	37.4%	1.9%	-2.2%	4.3%
Industrial	-1.8%	-0.1%	-0.9%	-0.1%
Transportation	26.8%	1.4%	0.8%	0.1%
Total Energy	19.4%	1.0%	-1.4%	1.6%