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Emissions of Greenhouse Gases in the United States 2005

Table 1. World Energy-Related Carbon Dioxide Emissions by Region, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History[a]			Projections[a]					Average Annual Percent Change, 2003-2030
	1990	2002	2003	2010	2015	2020	2025	2030	
OECD									
OECD North America	**5,759**	**6,691**	**6,801**	**7,505**	**7,997**	**8,513**	**9,096**	**9,735**	**1.3**
United States[b]	4,985	5,752	5,800	6,365	6,718	7,119	7,587	8,115	1.3
Canada	474	570	596	683	753	799	839	873	1.4
Mexico	300	369	405	457	526	595	670	747	2.3
OECD Europe	**4,089**	**4,203**	**4,264**	**4,474**	**4,632**	**4,741**	**4,909**	**5,123**	**0.7**
OECD Asia	**1,536**	**2,063**	**2,090**	**2,269**	**2,390**	**2,455**	**2,540**	**2,638**	**0.9**
Japan	1,011	1,191	1,206	1,200	1,228	1,218	1,214	1,219	0.0
South Korea	234	462	470	608	675	723	781	843	2.2
Australia/New Zealand	291	410	415	462	487	515	545	576	1.2
Total OECD	**11,384**	**12,957**	**13,155**	**14,248**	**15,019**	**15,709**	**16,545**	**17,496**	**1.1**
Non-OECD									
Non-OECD Europe and Eurasia	**4,193**	**2,634**	**2,725**	**3,113**	**3,444**	**3,758**	**4,047**	**4,352**	**1.7**
Russia	2,334	1,546	1,606	1,799	1,949	2,117	2,246	2,374	1.5
Other	1,859	1,088	1,118	1,314	1,495	1,641	1,801	1,978	2.1
Non-OECD Asia	**3,626**	**5,733**	**6,072**	**9,079**	**10,753**	**12,407**	**14,113**	**15,984**	**3.6**
China	2,241	3,273	3,541	5,857	7,000	8,159	9,349	10,716	4.2
India	578	1,011	1,023	1,369	1,592	1,799	2,008	2,205	2.9
Other Non-OECD Asia	807	1,449	1,508	1,853	2,161	2,449	2,756	3,062	2.7
Middle East	**704**	**1,152**	**1,182**	**1,463**	**1,647**	**1,811**	**1,987**	**2,177**	**2.3**
Africa	**649**	**850**	**893**	**1,188**	**1,363**	**1,477**	**1,593**	**1,733**	**2.5**
Central and South America	**673**	**993**	**1,006**	**1,270**	**1,436**	**1,586**	**1,758**	**1,933**	**2.4**
Brazil	220	347	348	423	469	508	559	610	2.1
Other Central/South America	453	645	659	847	967	1,078	1,199	1,323	2.6
Total Non-OECD	**9,846**	**11,362**	**11,878**	**16,113**	**18,643**	**21,039**	**23,500**	**26,180**	**3.0**
Total World	**21,230**	**24,319**	**25,033**	**30,361**	**33,662**	**36,748**	**40,045**	**43,676**	**2.1**

[a]Values adjusted for nonfuel sequestration.
[b]Includes the 50 States and the District of Columbia.
Note: The U.S. numbers include carbon dioxide emissions attributable to renewable energy sources.
Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2003* (May-July 2005), web site www.eia.doe.gov/iea/; and data presented in this report. **Projections:** EIA, *Annual Energy Outlook 2006*, DOE/EIA-0383(2006) (Washington, DC, February, 2006), Table 1, web site www.eia.doe.gov/oiaf/aeo; and *International Energy Outlook 2006*, DOE/EIA-0484(2006) (Washington, DC, June 2006), Table A10.

Table 2. Global Atmospheric Concentrations of Selected Greenhouse Gases

Item	Carbon Dioxide	Methane	Nitrous Oxide	Sulfur Hexafluoride	Perfluoro-methane
	(parts per million)			(parts per trillion)	
Pre-industrial (1750) Atmospheric Concentration. .	278	0.700	0.270	0	40
1998 Atmospheric Concentration	365	1.745	0.314	4.2	80
Average Annual Change, 1990-1999	1.5[a]	0.007[a]	0.0008	0.2	1.0
Atmospheric Lifetime (Years)	50–200[b]	12[c]	114[c]	3,200	>50,000

[a]The rate has fluctuated between 0.9 and 2.8 parts per million per year for CO_2 and between 0 and 0.013 parts per million per year for methane over the 1990-1999 period.

[b]No single lifetime can be defined for CO_2 because uptake rates differ for different removal processes.

[c]This lifetime has been defined as an "adjustment time" that takes into account the indirect effect of the gas on its own residence time.

Source: Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis* (Cambridge, UK: Cambridge University Press, 2001), pp. 38 and 244.

Table 3. Global Natural and Anthropogenic Sources and Absorption of Greenhouse Gases in the 1990s

Gas	Sources			Absorption	Annual Increase in Gas in the Atmosphere
	Natural	Human-Made	Total		
Carbon Dioxide (Million Metric Tons of Gas)[a]	770,000	23,100	793,100	781,400	11,700
Methane (Million Metric Tons of Gas)[b]	239	359	598	576	22
Nitrous Oxide (Million Metric Tons of Gas)[c]	9.5	6.9	16.4	12.6	3.8

[a]Carbon dioxide natural source and absorption of 770,000 million metric tons carbon dioxide, based on balanced flux of 40,000 million metric tons between land and atmosphere and 330,000 million metric tons between oceans and atmosphere, from Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis* (Cambridge, UK: Cambridge University Press, 2001), Figure 3.1, p. 188. Human-made emissions of 23,100 million metric tons and distribution of those emissions (atmospheric absorption 11,700 million metric tons, ocean absorption 6,200 million metric tons, and land absorption 5,100 million metric tons), taken from Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis* (Cambridge, UK: Cambridge University Press, 2001), p. 39.

[b]Methane total sources, absorption, and annual atmospheric increases from Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis* (Cambridge, UK: Cambridge University Press, 2001), Table 4.2, p. 250. Distinction between natural and human-made sources based on the assumption that 60 percent of total sources are anthropogenic, from Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis* (Cambridge, UK: Cambridge University Press, 2001), p. 248.

[c]Nitrous oxide total and human-made sources, absorption, and atmospheric increases from Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis* (Cambridge, UK: Cambridge University Press, 2001), Table 4.4, p. 252. Nitrous oxide natural sources (9.5 million metric tons of gas) derived by subtracting human-made sources from total sources.

Source: Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis* (Cambridge, UK: Cambridge University Press, 2001).

Table 4. Numerical Estimates of Global Warming Potentials Compared With Carbon Dioxide
(Kilogram of Gas per Kilogram of Carbon Dioxide)

Gas	Lifetime (Years)	Direct Effect for Time Horizons of		
		20 Years	100 Years	500 Years
Carbon Dioxide	5 – 200[a]	1	1	1
Methane	12	62	23	7
Nitrous Oxide	114	275	296	156
HFCs, PFCs, and Sulfur Hexafluoride				
HFC-23	260	9,400	12,000	10,000
HFC-125	29	5,900	3,400	1,100
HFC-134a	13.8	3,300	1,300	400
HFC-152a	1.4	410	120	37
HFC-227ea	33	5,600	3,500	1,100
Perfluoromethane (CF_4)	50,000	3,900	5,700	8,900
Perfluoroethane (C_2F_6)	10,000	8,000	11,900	18,000
Sulfur Hexafluoride (SF_6)	3,200	15,100	22,200	32,400

[a]No single lifetime can be defined for carbon dioxide due to different rates of uptake by different removal processes.

Note: The typical uncertainty for global warming potentials is estimated by the Intergovernmental Panel on Climate Change at ±35 percent.

Source: Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis* (Cambridge, UK: Cambridge University Press, 2001), pp. 38 and 388-389.