- **Carbon dioxide in geothermal steam.** Geothermal steam at The Geysers in Guerneyville, California, where most U.S. geothermal electric power is generated, contains carbon dioxide dissolved in the steam, which is released into the atmosphere when the steam is brought to the Earth's surface for power production. EIA includes emissions from this source, at a rate of about 0.1 million metric tons of carbon per year.

Carbon Sequestration: Nonfuel Use of Fossil Fuels

Gross emissions can be estimated by multiplying fossil fuel consumption by an emissions factor embodying the estimated carbon content of the fuel. However, portions of the fossil fuels consumed are not actually combusted but are used as chemical feedstocks, construction materials, lubricants, solvents, or reducing agents (Table A2). EIA estimates "nonfuel" use of fossil fuels annually in Table 1.15 of the *Annual Energy Review*.[3] For this report, EIA has estimated the fate of the carbon in fuels used for nonfuel purposes (see Table 5 in Chapter 2), based on the rates of sequestration shown in Table A3. Some but not all of the carbon is emitted to the atmosphere. The principal nonfuel uses of fossil fuels, the methods of estimating nonfuel consumption, and the fate of the carbon are listed below.

Table A2 Fossil Fuel Consumption for Nonfuel Use, 1990-2001 (Quadrillion Btu)

Year	Asphalt & Road Oil	LPG	Pentanes Plus	Lubricants	Petrochem Feedstocks	Petroleum Coke	Special Naphtha	Other Petroleum	Total Petroleum	Natural Gas	Coal	Total Energy
1990	1.17	1.20	0.08	0.36	1.12	0.18	0.11	0.23	4.45	0.59	0.02	5.06
1991	1.08	1.38	0.04	0.32	1.15	0.15	0.09	0.26	4.47	0.59	0.02	5.08
1992	1.10	1.39	0.06	0.33	1.20	0.23	0.10	0.20	4.63	0.61	0.04	5.28
1993	1.15	1.35	0.28	0.34	1.22	0.12	0.10	0.20	4.76	0.61	0.03	5.40
1994	1.17	1.55	0.26	0.35	1.26	0.14	0.08	0.20	5.01	0.69	0.03	5.73
1995	1.18	1.59	0.30	0.35	1.21	0.13	0.07	0.20	5.03	0.67	0.03	5.72
1996	1.18	1.65	0.32	0.34	1.21	0.15	0.07	0.20	5.11	0.68	0.03	5.82
1997	1.22	1.67	0.30	0.35	1.40	0.12	0.07	0.21	5.34	0.70	0.03	6.07
1998	1.26	1.60	0.27	0.37	1.40	0.21	0.11	0.23	5.45	0.79	0.03	6.27
1999	1.32	1.81	0.33	0.37	1.33	0.28	0.15	0.22	5.81	0.69	0.03	6.53
2000	1.28	1.86	0.31	0.37	1.35	0.14	0.10	0.22	5.62	0.71	0.03	6.35
2001	1.26	1.69	0.24	0.34	1.19	0.18	0.08	0.23	5.20	0.67	0.02	5.89

P = preliminary data.
Notes: Data in this table are revised from the data contained in the previous EIA report, *Emissions of Greenhouse Gases in the United States 2000*, DOE/EIA-0573(2000) (Washington, DC, November 2001).
Source: Energy Information Administration, *Annual Energy Review 2001*, DOE/EIA-0384(2001) (Washington, DC, November 2002), Table 1.15, p. 33, and underlying estimates.

- **Natural Gas.** Nonfuel use of natural gas is based on periodic (1985, 1988, 1991, 1994 and 1998) reports in EIA's Manufacturing Energy Consumption Survey (MECS). Based on MECS, nonfuel use is divided into three categories: nitrogenous fertilizers, other chemical use, and all other nonfuel uses. Feedstock use of natural gas to make nitrogenous fertilizers is a nonsequestering use, because the underlying chemical in nitrogenous fertilizers is ammonia (NH_3), which is manufactured by steam reforming of natural gas and reacting the synthesis gas with atmospheric nitrogen, leaving the carbon in the feedstock literally "up in the air." In many cases, the carbon dioxide is recovered to make urea or for industrial use. However, carbon in urea and industrial carbon dioxide are generally only temporarily delayed on their way to the atmosphere. EIA assumes that other nonfuel uses in the chemical industry result in 100-percent carbon sequestration. Natural gas is used as a feedstock for a range of chemical products other than ammonia, particularly methanol. Although the methanol used to make methyl tertiary butyl ether (MTBE) winds up in the gasoline pool and is combusted, EIA already counts the carbon in MTBE in gasoline emissions, and to count it again in the feedstock would be double counting. Future research on the fate of the carbon in feedstocks for other chemical industry uses will probably gradually reduce the 100-percent sequestration share currently assumed.

[3]Energy Information Administration, *Annual Energy Review 2000*, DOE/EIA-0384(2000) (Washington, DC, August 2001), p. 33.