

Appendix E

Emissions of Energy-Related Carbon Dioxide in the United States, 1949-1999

This appendix presents estimates of U.S. carbon dioxide emissions for the period 1949-1999. The data were developed originally at the request of the President's Council of Economic Advisors, for inclusion in a graphic that appeared in the 1997 *Economic Report of the President*.¹ U.S. energy data have undergone a number of shifts over the years, and the estimates can be divided into three periods:

- **1980-1999.** The emissions estimates for this period were developed using the methods and sources described in this report. For 1980 through 1997, the energy data on which the emissions estimates are based come from the Energy Information Administration (EIA) data series published in the *State Energy Data Report*.² Estimates for 1998 and 1999 are based on energy data from EIA's *Monthly Energy Review*.
- **1960-1979.** Before 1980, EIA did not maintain a detailed accounting of carbon sequestration due to nonfuel use of fossil fuels. Hence, the data for industrial sector petroleum use, particularly in the category "other petroleum," are not as reliable as those for subsequent years. EIA has also not attempted to develop annual emissions coefficients for fuels in use before 1980, and the estimates do not reflect any changes in fuel quality. The energy data for this period are also drawn from the database of the *State Energy Data Report*.
- **1949-1959.** EIA has made no attempt to distinguish between residential and commercial energy consumption for historical data earlier than 1960. To provide consistent estimates for this appendix, the combined data for residential and commercial energy consumption have been prorated by fuel according to the ratio of consumption in 1960. Composite sectoral petroleum emissions factors are used for this period, based on 1960-weighted petroleum products emissions. The energy data for this period are drawn from the *Annual Energy Review*.³

In future years, EIA hopes to be able to create annual emissions factors for electric utility coal for the period 1949-1979, extend the estimates to cover U.S. territories and non-energy carbon dioxide, estimate sequestration from nonfuel use in somewhat more detail for the period 1974-1979, and to use historical data on consumption of petroleum products by product and sector for the 1949-1959 period, rather than the 1960-based sectoral averages.

¹Council of Economic Advisors, *Economic Report of the President* (Washington DC, February 1998), p. 167.

²Energy Information Administration, *State Energy Data Report 1997*, DOE/EIA-0214(97) (Washington, DC, September 1999), pp. 21-26, web site www.eia.doe.gov/emeu/sep/states.html.

³Energy Information Administration, *Annual Energy Review 1998*, DOE/EIA-0384(98) (Washington, DC, July 1999), pp. 37, web site www.eia.doe.gov/emeu/aer/contents.html.

Table E1. Energy-Related Carbon Dioxide Emissions from the Residential and Commercial Sectors, 1949-1999
(Million Metric Tons of Carbon)

Year	Residential					Commercial				
	Natural Gas	Petroleum	Coal	Electricity	Total	Natural Gas	Petroleum	Coal	Electricity	Total
1949	15.1	23.2	30.2	19.0	87.4	5.0	13.2	42.2	15.0	75.3
1950	17.8	27.6	29.9	20.2	95.4	5.9	15.7	41.7	15.9	79.2
1951	21.8	30.1	26.4	22.5	100.8	7.2	17.1	36.8	17.8	78.8
1952	23.9	30.8	24.0	24.0	102.8	7.9	17.5	33.5	19.0	77.9
1953	24.8	31.3	20.6	26.2	103.0	8.2	17.8	28.8	20.7	75.4
1954	27.8	33.5	17.9	27.5	106.7	9.2	19.0	25.0	21.7	74.9
1955	30.9	36.0	17.8	30.0	114.7	10.2	20.4	24.9	23.7	79.2
1956	34.1	37.6	16.6	32.4	120.7	11.2	21.3	23.1	25.6	81.3
1957	36.7	36.5	12.7	34.7	120.7	12.1	20.7	17.7	27.4	78.0
1958	40.2	39.1	12.4	35.3	127.0	13.2	22.2	17.3	27.9	80.6
1959	43.5	39.9	10.6	39.1	133.1	14.3	22.6	14.8	30.9	82.6
1960	46.2	43.8	10.6	42.3	142.9	15.2	24.9	14.5	33.4	88.0
1961	48.4	45.1	9.6	44.4	147.5	16.0	25.3	13.2	34.6	89.2
1962	51.8	47.1	9.2	47.4	155.5	18.0	25.9	13.0	37.0	93.9
1963	53.2	47.4	8.0	51.9	160.5	18.7	25.5	11.1	41.7	97.0
1964	56.1	45.7	7.1	55.9	164.9	20.3	25.2	9.5	44.5	99.6
1965	57.9	47.8	6.6	60.2	172.5	21.4	28.1	9.0	47.9	106.4
1966	61.3	47.5	6.3	66.6	181.7	24.0	29.1	9.1	52.9	115.1
1967	63.9	49.2	5.4	69.8	188.4	29.0	30.1	7.8	55.7	122.6
1968	65.9	51.6	4.9	79.0	201.5	30.7	30.6	7.0	61.7	130.0
1969	70.0	52.5	4.6	87.1	214.2	33.3	30.7	6.6	66.4	137.0
1970	71.3	52.8	4.0	95.9	224.0	35.3	31.4	5.5	72.5	144.7
1971	73.3	53.3	3.7	100.8	231.1	37.0	30.5	5.2	76.3	149.0
1972	75.7	55.5	2.9	109.0	243.1	38.5	30.9	4.0	83.6	156.9
1973	72.0	54.2	2.7	117.5	246.4	38.3	31.6	3.8	90.3	164.0
1974	70.5	49.4	2.7	114.6	237.1	37.6	28.7	3.8	87.2	157.4
1975	72.3	47.9	2.2	113.1	235.5	36.8	26.3	3.1	90.1	156.3
1976	74.1	52.3	2.1	119.4	247.9	39.1	29.4	3.0	96.8	168.4
1977	70.8	51.8	2.2	129.0	253.7	36.7	30.4	3.1	102.8	173.0
1978	71.8	50.4	2.2	130.8	255.2	38.0	29.1	3.3	103.2	173.6
1979	72.7	40.8	1.9	134.1	249.5	40.8	26.9	2.9	106.7	177.3
1980	69.9	33.6	1.6	143.2	248.2	38.4	26.1	2.3	111.5	178.2
1981	67.0	29.6	1.8	141.3	239.7	37.1	22.0	2.5	116.6	178.2
1982	68.4	27.6	1.9	139.5	237.5	38.5	20.3	2.9	116.4	178.1
1983	65.0	25.9	1.9	143.2	236.1	36.1	22.5	3.0	118.4	179.9
1984	67.5	25.6	2.1	146.0	241.1	37.3	23.8	3.2	124.3	188.7
1985	65.7	28.4	1.8	149.9	245.8	36.0	20.6	2.7	130.2	189.6
1986	63.8	27.9	1.8	150.5	244.0	34.3	21.9	2.7	131.4	190.4
1987	63.9	28.8	1.7	156.6	251.0	36.0	21.5	2.6	137.2	197.2
1988	68.5	29.9	1.7	164.7	264.8	39.5	20.7	2.6	144.8	207.6
1989	70.9	29.7	1.5	165.3	267.5	40.3	19.2	2.3	148.2	209.9
1990	65.1	24.0	1.6	163.5	253.1	38.8	18.0	2.4	148.5	207.7
1991	67.5	24.5	1.4	165.6	257.1	40.4	17.1	2.2	148.3	208.0
1992	69.4	24.9	1.5	162.8	255.9	41.5	16.1	2.2	148.0	207.8
1993	73.4	26.3	1.5	173.1	271.7	42.4	14.9	2.2	154.1	213.6
1994	71.7	25.4	1.4	173.6	268.3	42.9	14.9	2.1	157.2	217.1
1995	71.8	25.8	1.4	174.5	270.3	44.9	14.1	2.1	159.5	220.6
1996	77.6	27.6	1.4	183.0	285.9	46.8	14.6	2.1	165.7	229.2
1997	73.8	27.1	1.5	186.2	284.8	47.7	13.9	2.2	177.7	241.5
1998	67.2	24.7	1.1	195.7	284.5	44.6	13.0	1.7	185.2	244.5
1999	69.5	26.0	1.1	193.4	290.1	45.4	13.7	1.7	182.6	243.5

Sources: **1997-1999**—Estimates documented in this report, based on energy data in the *Monthly Energy Review*. **1980-1996**—Estimates documented in this report, based on energy data in the *State Energy Data Report*. **1960-1979**—Calculated from energy data in the *State Energy Data Report*. **1949-1959**—Calculated from energy data in the *Annual Energy Review*.

Table E2. Energy-Related Carbon Dioxide Emissions from the Industrial and Transportation Sectors, 1949-1999
(Million Metric Tons of Carbon)

Year	Industrial					Transportation				
	Natural Gas	Petroleum	Coal	Electricity	Total	Natural Gas	Petroleum	Coal	Electricity	Total
1949	45.9	57.7	131.6	33.1	268.4	1.9	119.1	42.9	0.5	164.5
1950	51.1	66.0	140.2	38.4	295.7	2.8	129.7	38.9	0.6	172.0
1951	58.3	70.5	149.9	42.6	321.2	3.1	142.7	34.2	0.6	180.6
1952	60.2	71.6	133.5	43.7	309.0	3.4	149.1	24.5	0.6	177.6
1953	61.9	73.5	143.6	49.1	328.1	3.4	156.1	18.2	0.6	178.4
1954	62.2	75.1	114.5	48.5	300.3	3.7	157.8	11.5	0.6	173.6
1955	67.7	82.9	136.0	60.5	347.0	4.5	169.9	10.5	0.7	185.5
1956	70.1	85.1	137.1	65.3	357.7	4.5	176.4	8.5	0.7	190.0
1957	73.6	84.0	133.8	65.4	356.8	4.6	179.8	6.0	0.7	191.2
1958	75.0	85.8	109.7	61.3	331.8	5.2	183.3	2.9	0.7	192.1
1959	81.3	90.3	106.8	67.4	346.0	5.2	190.6	2.2	0.8	198.7
1960	86.0	89.5	110.2	68.1	353.8	5.2	195.5	1.9	0.7	203.2
1961	86.9	89.1	105.3	69.7	350.9	5.6	199.3	0.5	0.7	206.1
1962	90.8	92.0	106.4	73.2	362.4	5.7	207.9	0.4	0.7	214.7
1963	95.2	93.5	111.3	78.1	378.2	6.3	215.5	0.4	0.6	222.8
1964	100.3	98.6	119.1	83.4	401.4	6.5	221.9	0.4	0.6	229.4
1965	103.5	102.1	124.0	88.8	418.3	7.5	228.9	0.4	0.6	237.3
1966	110.0	105.6	125.9	97.4	438.8	8.0	241.1	0.4	0.6	250.0
1967	113.6	105.5	119.4	99.6	438.0	8.5	253.1	0.3	0.6	262.5
1968	121.4	107.2	117.5	107.9	454.0	8.8	274.2	0.3	0.5	283.7
1969	129.8	111.3	113.4	114.1	468.6	9.3	285.7	0.2	0.5	295.8
1970	133.7	111.1	111.5	117.4	473.6	10.7	295.2	0.2	0.5	306.6
1971	138.7	111.3	94.8	119.0	463.8	11.0	307.0	0.1	0.5	318.6
1972	139.1	121.4	96.0	129.8	486.3	11.3	325.5	0.1	0.5	337.4
1973	147.2	128.4	97.7	139.2	512.5	10.7	343.8	0.1	0.5	355.1
1974	141.1	121.2	94.7	135.7	492.7	9.8	335.5	0.0	0.5	345.9
1975	120.7	114.6	88.9	132.3	456.4	8.6	339.6	0.0	0.6	348.8
1976	124.0	127.0	88.2	148.5	487.6	8.0	356.9	0.0	0.6	365.6
1977	122.3	137.8	83.7	157.2	501.0	7.8	371.3	0.0	0.6	379.7
1978	121.2	135.9	83.1	157.0	497.1	7.8	386.8	0.0	0.5	395.1
1979	120.9	143.6	88.3	165.4	518.1	8.8	383.2	0.0	0.6	392.7
1980	118.4	128.2	75.4	162.6	484.6	9.4	368.1	0.0	0.6	378.1
1981	116.3	110.0	75.8	161.6	463.7	9.5	364.0	0.0	0.6	374.1
1982	100.1	104.0	61.2	142.5	407.8	8.8	356.1	0.0	0.6	365.6
1983	95.2	96.0	60.2	148.0	399.3	7.3	359.0	0.0	0.6	366.9
1984	104.1	105.8	69.3	156.8	436.0	7.8	370.5	0.0	0.7	379.0
1985	98.9	99.9	67.8	158.0	424.5	7.5	376.1	0.0	0.7	384.3
1986	93.1	101.8	64.7	152.6	412.2	7.2	391.1	0.0	0.7	399.0
1987	101.8	101.4	66.1	158.0	427.3	7.7	402.6	0.0	0.7	411.0
1988	106.9	104.8	71.1	165.4	448.2	9.1	417.5	0.0	0.7	427.3
1989	112.8	98.9	69.4	169.0	450.1	9.4	422.5	0.0	0.7	432.6
1990	118.3	100.7	68.3	167.3	454.8	9.8	421.2	0.0	0.7	431.8
1991	120.2	95.0	64.5	164.0	444.1	9.0	414.6	0.0	0.7	424.3
1992	125.9	103.9	61.8	169.2	461.6	8.8	421.6	0.0	0.7	431.1
1993	130.9	97.7	61.7	170.0	461.0	9.3	426.4	0.0	0.7	436.4
1994	132.7	101.2	62.0	173.5	471.0	10.2	438.2	0.0	0.9	449.3
1995	140.4	96.0	61.8	169.5	469.2	10.4	446.5	0.0	0.8	457.8
1996	145.3	103.8	59.9	174.2	483.8	10.6	457.4	0.0	0.8	468.9
1997	145.1	104.7	59.9	178.8	489.7	11.3	461.5	0.0	0.8	473.6
1998	141.2	100.9	56.0	180.5	480.2	9.5	471.5	0.0	0.9	481.9
1999	141.6	104.2	54.5	179.5	481.2	9.5	485.8	0.0	0.8	496.1

Sources: **1997-1999**—Estimates documented in this report, based on energy data in the *Monthly Energy Review*. **1980-1996**—Estimates documented in this report, based on energy data in the *State Energy Data Report*. **1960-1979**—Calculated from energy data in the *State Energy Data Report*. **1949-1959**—Calculated from energy data in the *Annual Energy Review*.

Table E3. Energy-Related Carbon Dioxide Emissions from the Electricity Generation Sector, and Total Energy-Related Carbon Dioxide Emissions by End-Use Sector, 1949-1999
(Million Metric Tons of Carbon)

Year	Electricity Utility Sector				End-Use Sectors				
	Natural Gas	Petroleum	Coal	Total	Residential	Commercial	Industrial	Transportation	Total
1949	8.2	8.7	50.7	67.6	87.4	75.3	268.4	164.5	595.6
1950	9.4	10.0	55.7	75.1	95.4	79.2	295.7	172.0	642.2
1951	11.4	8.5	63.6	83.5	100.8	78.8	321.2	180.6	681.5
1952	13.5	8.9	64.9	87.3	102.8	77.9	309.0	177.6	667.3
1953	15.4	10.8	70.4	96.7	103.0	75.4	328.1	178.4	684.9
1954	17.4	8.9	72.0	98.3	106.7	74.9	300.3	173.6	655.6
1955	17.1	10.0	87.7	114.8	114.7	79.2	347.0	185.5	726.3
1956	18.4	9.5	96.0	124.0	120.7	81.3	357.7	190.0	749.7
1957	19.9	10.6	97.8	128.3	120.7	78.0	356.8	191.2	746.6
1958	20.4	10.4	94.3	125.1	127.0	80.6	331.8	192.1	731.4
1959	24.3	11.7	102.1	138.1	133.1	82.6	346.0	198.7	760.3
1960	25.7	11.7	107.1	144.5	142.9	88.0	353.8	203.2	787.9
1961	27.2	11.8	110.3	149.4	147.5	89.2	350.9	206.1	793.7
1962	29.3	11.9	117.1	158.3	155.5	93.9	362.4	214.7	826.6
1963	32.0	12.4	127.9	172.3	160.5	97.0	378.2	222.8	858.6
1964	34.7	13.4	136.3	184.4	164.9	99.6	401.4	229.4	895.2
1965	34.7	15.3	147.5	197.4	172.5	106.4	418.3	237.3	934.5
1966	39.1	18.7	159.6	217.4	181.7	115.1	438.8	250.0	985.7
1967	41.1	21.4	163.2	225.7	188.4	122.6	438.0	262.5	1,011.5
1968	47.0	25.0	177.1	249.2	201.5	130.0	454.0	283.7	1,069.2
1969	52.0	33.3	182.8	268.1	214.2	137.0	468.6	295.8	1,115.6
1970	58.3	45.0	183.0	286.3	224.0	144.7	473.6	306.6	1,149.0
1971	58.9	52.9	184.8	296.6	231.1	149.0	463.8	318.6	1,162.5
1972	58.8	65.5	198.6	322.9	243.1	156.9	486.3	337.4	1,223.7
1973	53.8	74.4	219.3	347.5	246.4	164.0	512.5	355.1	1,277.9
1974	50.6	71.2	216.2	338.0	237.1	157.4	492.7	345.9	1,233.1
1975	46.5	67.0	222.6	336.1	235.5	156.3	456.4	348.8	1,197.0
1976	45.4	73.6	246.4	365.4	247.9	168.4	487.6	365.6	1,269.5
1977	47.3	82.6	259.8	389.6	253.7	173.0	501.0	379.7	1,307.4
1978	47.4	84.5	259.6	391.5	255.2	173.6	497.1	395.1	1,320.9
1979	51.9	69.6	285.3	406.9	249.5	177.3	518.1	392.7	1,337.7
1980	54.8	55.3	307.8	417.9	248.2	178.2	484.6	378.1	1,289.0
1981	54.1	46.3	319.7	420.1	239.7	178.2	463.7	374.1	1,255.7
1982	48.0	33.0	318.0	399.0	237.5	178.1	407.8	365.6	1,188.9
1983	43.1	32.5	334.6	410.2	236.1	179.9	399.3	366.9	1,182.2
1984	46.3	27.0	354.3	427.7	241.1	188.7	436.0	379.0	1,244.8
1985	45.5	22.9	370.3	438.8	245.8	189.6	424.5	384.3	1,244.2
1986	38.7	30.6	365.9	435.2	244.0	190.4	412.2	399.0	1,245.6
1987	42.2	26.4	383.7	452.5	251.0	197.2	427.3	411.0	1,286.5
1988	39.0	32.9	403.7	475.7	264.8	207.6	448.2	427.3	1,347.9
1989	41.2	35.4	406.5	483.2	267.5	209.9	450.1	432.6	1,360.0
1990	41.2	26.4	412.4	480.1	254.2	207.7	454.8	431.8	1,348.6
1991	41.1	24.9	412.6	478.6	259.0	208.0	444.1	424.3	1,335.3
1992	40.7	20.2	419.7	480.6	258.6	207.8	461.6	431.1	1,359.1
1993	39.5	22.3	436.1	497.9	274.3	213.6	461.0	436.4	1,385.3
1994	44.0	20.5	440.7	505.2	272.2	217.1	471.0	449.3	1,409.6
1995	46.8	13.9	443.5	504.3	273.4	220.6	469.2	457.8	1,421.0
1996	39.9	15.3	468.5	523.8	289.6	229.2	483.8	468.9	1,471.5
1997	43.5	17.5	482.5	543.6	288.6	241.5	489.7	473.6	1,493.4
1998	47.9	24.8	489.5	562.2	288.8	244.5	480.2	481.9	1,495.4
1999	45.8	20.0	490.5	556.3	290.1	243.5	481.2	496.1	1,510.8

Note: Emissions from electricity utility sector are prorated across the end-use sectors.

Sources: **1997-1999**—Estimates documented in this report, based on energy data in the *Monthly Energy Review*. **1980-1996**—Estimates documented in this report, based on energy data in the *State Energy Data Report*. **1960-1979**—Calculated from energy data in the *State Energy Data Report*. **1949-1959**—Calculated from energy data in the *Annual Energy Review*.