

Table A19. Energy-related carbon dioxide emissions by end use
(million metric tons)

Sector and Source	Reference Case							Annual Growth 2009-2035 (percent)
	2008	2009	2015	2020	2025	2030	2035	
Residential								
Space Heating	292.69	279.60	272.85	270.86	268.47	266.39	263.11	-0.2%
Space Cooling	162.47	147.72	135.39	140.24	150.37	157.54	164.20	0.4%
Water Heating	164.41	160.32	160.36	162.26	163.49	159.75	154.66	-0.1%
Refrigeration	69.77	65.09	58.06	56.92	58.36	60.38	62.88	-0.1%
Cooking	32.95	32.03	32.51	34.07	35.91	37.39	38.70	0.7%
Clothes Dryers	37.79	35.69	33.17	32.37	33.23	34.56	35.96	0.0%
Freezers	14.84	13.90	12.91	13.13	13.71	14.06	14.43	0.1%
Lighting	134.22	125.70	93.51	88.06	87.22	87.55	89.23	-1.3%
Clothes Washers ¹	6.31	5.85	4.91	4.41	4.48	4.70	4.89	-0.7%
Dishwashers ¹	17.17	16.09	14.89	15.25	16.50	17.58	18.65	0.6%
Color Televisions and Set-Top Boxes	62.03	59.44	54.35	55.38	59.93	64.15	68.61	0.6%
Personal Computers and Related Equipment	32.17	31.33	27.80	28.37	29.72	30.85	31.71	0.0%
Furnace Fans and Boiler Circulation Pumps	25.57	24.67	25.43	27.38	30.24	31.49	32.26	1.0%
Other Uses	174.01	165.12	166.34	183.70	208.58	229.34	249.04	1.6%
Discrepancy ²	2.85	3.79	-0.00	0.00	0.00	0.00	0.00	-28.5%
Total Residential	1229.24	1166.35	1092.49	1112.42	1160.21	1195.73	1228.32	0.2%
Commercial								
Space Heating ³	127.32	128.25	128.76	130.33	130.33	130.73	130.54	0.1%
Space Cooling ³	92.96	85.70	88.59	91.17	95.98	99.38	103.41	0.7%
Water Heating ³	42.12	41.58	44.00	46.26	48.12	49.69	50.80	0.8%
Ventilation	92.45	89.19	91.42	98.49	106.96	112.72	118.04	1.1%
Cooking	13.16	13.28	14.38	15.09	15.71	16.30	16.87	0.9%
Lighting	194.26	182.85	171.08	179.04	190.65	198.63	206.01	0.5%
Refrigeration	75.47	70.56	59.86	58.46	60.25	61.96	64.22	-0.4%
Office Equipment (PC)	41.33	38.12	30.95	31.31	32.55	34.14	34.85	-0.3%
Office Equipment (non-PC)	44.27	44.13	51.94	60.16	67.37	73.13	77.41	2.2%
Other Uses ⁴	350.35	324.36	342.43	377.83	422.03	464.68	511.60	1.8%
Total Commercial	1073.69	1018.02	1023.40	1088.13	1169.96	1241.34	1313.74	1.0%
Industrial								
Manufacturing								
Refining								
Food Products	260.03	258.29	288.28	290.06	314.11	356.19	405.68	1.8%
Paper Products	107.09	102.49	105.47	110.03	116.18	119.76	122.70	0.7%
Bulk Chemicals	100.00	89.65	95.56	93.28	90.78	87.05	82.98	-0.3%
Glass	282.56	263.03	296.76	296.24	290.00	269.58	250.33	-0.2%
Cement Manufacturing	24.31	20.02	22.83	24.06	25.94	26.14	26.04	1.0%
Iron and Steel	36.59	28.55	32.98	33.48	33.83	32.75	30.04	0.2%
Aluminum	118.67	75.90	107.58	110.31	107.52	99.37	91.23	0.7%
Fabricated Metal Products	31.20	30.82	29.30	28.22	26.72	24.94	23.17	-1.1%
Machinery	43.03	38.34	45.61	45.86	47.05	45.89	45.03	0.6%
Computers and Electronics	26.22	22.37	28.08	29.54	31.97	31.88	32.02	1.4%
Transportation Equipment	37.33	32.51	39.99	42.57	45.67	47.67	48.93	1.6%
Electrical Equipment	52.05	45.41	63.50	59.55	59.07	61.20	63.60	1.3%
Wood Products	8.42	7.45	9.31	9.15	9.90	10.16	10.49	1.3%
Plastics	19.15	17.64	23.03	22.59	21.92	20.77	19.55	0.4%
Balance of Manufacturing	42.80	37.75	41.50	42.12	42.41	41.02	40.40	0.3%
Total Manufacturing	159.81	143.04	152.19	156.28	153.93	150.44	146.27	0.1%
Nonmanufacturing								
Agriculture	1349.26	1213.26	1381.97	1393.31	1416.98	1424.82	1438.46	0.7%
Construction	76.78	74.57	74.55	74.39	74.88	74.74	74.38	-0.0%
Mining	94.04	78.52	96.81	97.43	96.54	94.14	93.58	0.7%
Total Nonmanufacturing	56.28	49.39	50.85	50.28	50.19	50.26	50.44	0.1%
Discrepancy ²	227.10	202.47	222.21	222.09	221.61	219.13	218.40	0.3%
Total Industrial	21.41	-28.42	39.28	35.75	29.52	29.47	31.76	--
	1597.78	1387.31	1643.46	1651.16	1668.11	1673.42	1688.61	0.8%

Table A19. Energy-related carbon dioxide emissions by end use (continued)
(million metric tons)

Sector and Source	Reference Case							Annual Growth 2009-2035 (percent)
	2008	2009	2015	2020	2025	2030	2035	
Transportation								
Light-Duty Vehicles	1100.28	1072.82	1070.91	1040.63	1023.05	1045.89	1094.14	0.1%
Commercial Light Trucks ⁵	44.05	40.28	45.08	44.73	45.06	46.60	48.85	0.7%
Bus Transportation	18.85	18.92	18.92	18.94	18.98	19.08	19.28	0.1%
Freight Trucks	339.28	306.68	362.87	383.43	402.21	423.36	446.65	1.5%
Rail, Passenger	6.19	5.96	6.15	6.49	6.93	7.25	7.55	0.9%
Rail, Freight	41.80	37.09	40.84	43.41	45.53	47.72	49.09	1.1%
Shipping, Domestic	17.11	15.14	15.85	16.32	16.55	16.95	17.35	0.5%
Shipping, International	70.20	60.78	61.39	61.78	62.14	62.52	62.90	0.1%
Recreational Boats	17.54	17.86	18.30	18.65	19.21	19.80	20.47	0.5%
Air	191.53	188.34	191.86	201.45	209.37	214.62	217.94	0.6%
Military Use	50.75	53.27	48.79	49.61	50.96	52.34	53.69	0.0%
Lubricants	5.20	4.75	4.58	4.64	4.72	4.81	4.88	0.1%
Pipeline Fuel	35.31	34.65	35.34	34.73	34.02	34.63	35.42	0.1%
Discrepancy ²	-0.74	-2.69	-0.35	0.20	0.79	1.39	1.96	--
Total Transportation	1937.33	1853.85	1920.52	1924.99	1939.51	1996.96	2080.16	0.4%
Biogenic Energy Combustion⁶								
Biomass	196.75	174.96	227.61	256.86	262.92	255.30	256.31	1.5%
Biogenic Waste	8.26	8.27	8.27	8.27	8.27	8.27	8.27	0.0%
Biofuels Heat and Coproducts	91.62	61.59	79.61	111.90	178.58	218.60	236.59	5.3%
Ethanol	56.60	64.87	91.11	116.47	141.63	154.48	161.98	3.6%
Biodiesel	2.93	3.07	10.88	14.41	17.46	17.96	18.18	7.1%
Liquids from Biomass	0.00	0.00	1.51	6.33	28.66	65.12	80.22	--
Renewable Diesel and Gasoline	0.00	0.00	0.90	1.01	1.12	1.12	1.11	--
Total	356.17	312.75	419.88	515.25	638.65	720.84	762.66	3.5%

¹Does not include water heating portion of load.

²Represents differences between total emissions by end-use and total emissions by fuel as reported in Table A18. Emissions by fuel may reflect benchmarking and other modeling adjustments to energy use and the associated emissions that are not assigned to specific end uses.

³Includes emissions related to fuel consumption for district services.

⁴Includes miscellaneous uses, such as service station equipment, automated teller machines, telecommunications equipment, medical equipment, pumps, emergency generators, combined heat and power in commercial buildings, manufacturing performed in commercial buildings, and cooking (distillate), plus emissions from residual fuel oil, liquefied petroleum gases, coal, motor gasoline, and kerosene.

⁵Commercial trucks 8,500 to 10,000 pounds.

⁶By convention, the direct emissions from biogenic energy sources are excluded from energy-related CO₂ emissions. The release of carbon from these sources is assumed to be balanced by the uptake of carbon when the feedstock is grown, resulting in zero net emissions over some period of time. If, however, increased use of biomass energy results in a decline in terrestrial carbon stocks, a net positive release of carbon may occur. Accordingly, the emissions from biogenic energy sources are reported here as an indication of the potential net release of carbon dioxide in the absence of offsetting sequestration.

-- = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 2008 and 2009 are model results and may differ slightly from official EIA data reports.

Sources: 2008 and 2009 emissions and emission factors: U.S. Energy Information Administration (EIA), *Emissions of Greenhouse Gases in the United States 2009*, DOE/EIA-0573(2009) (Washington, DC, December 2010). Projections: EIA, AEO2011 National Energy Modeling System run REF2011.D020911A.