

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

Sector and source	Reference case							Annual growth 2010-2035 (percent)
	2009	2010	2015	2020	2025	2030	2035	
Residential								
Space heating	280.90	298.54	278.95	274.16	269.42	266.51	262.14	-0.5%
Space cooling	142.87	191.47	161.07	167.16	177.20	186.54	194.50	0.1%
Water heating	160.15	159.68	153.12	156.60	159.90	159.11	156.70	-0.1%
Refrigeration	66.17	66.06	58.42	59.58	62.17	64.93	67.63	0.1%
Cooking	32.01	32.25	31.13	32.58	34.16	35.59	36.95	0.5%
Clothes dryers	36.78	37.23	34.11	32.65	31.76	31.47	32.32	-0.6%
Freezers	14.50	14.62	13.26	13.39	13.65	13.74	13.91	-0.2%
Lighting	123.36	122.27	83.69	76.89	74.13	73.66	74.31	-2.0%
Clothes washers ¹	5.87	5.79	5.01	4.26	3.92	3.67	3.76	-1.7%
Dishwashers ¹	17.70	17.75	15.61	15.57	15.53	16.29	17.37	-0.1%
Color televisions and set-top boxes	56.62	58.21	52.01	54.53	58.75	63.33	68.10	0.6%
Personal computers and related equipment	29.75	30.47	29.97	34.15	37.56	40.12	41.89	1.3%
Furnace fans and boiler circulation pumps	23.80	23.93	22.07	22.45	22.86	22.97	23.11	-0.1%
Other uses	167.23	173.12	159.95	178.22	201.51	223.61	243.72	1.4%
Discrepancy ²	1.73	0.16	0.00	0.00	0.00	0.00	-0.00	--
Total residential	1159.44	1231.57	1098.37	1122.20	1162.53	1201.53	1236.41	0.0%
Commercial								
Space heating ³	129.15	129.69	125.28	125.04	122.78	121.79	119.49	-0.3%
Space cooling ³	84.29	100.86	81.90	82.06	83.27	84.65	85.77	-0.6%
Water heating ³	41.32	41.44	41.79	43.04	43.76	44.53	44.68	0.3%
Ventilation	88.64	90.04	85.02	89.60	94.41	98.17	100.70	0.4%
Cooking	13.27	13.58	13.75	14.23	14.51	14.91	15.22	0.5%
Lighting	181.96	180.12	160.03	164.72	171.22	176.24	179.63	-0.0%
Refrigeration	70.13	69.16	55.84	53.69	53.66	54.35	55.56	-0.9%
Office equipment (PC)	38.00	37.69	29.98	30.36	31.22	32.51	33.58	-0.5%
Office equipment (non-PC)	43.86	46.44	49.91	57.60	63.83	68.61	72.32	1.8%
Other uses ⁴	317.99	325.62	321.18	349.80	382.79	415.67	452.48	1.3%
Total commercial	1008.62	1034.63	964.68	1010.15	1061.44	1111.42	1159.43	0.5%
Industrial								
Manufacturing								
Refining	261.44	265.88	268.74	284.65	291.20	303.67	323.07	0.8%
Food products	100.97	105.04	99.58	105.29	110.20	113.93	116.48	0.4%
Paper products	77.15	76.69	72.73	73.68	73.48	72.01	70.91	-0.3%
Bulk chemicals	221.74	234.55	220.50	237.85	237.77	229.63	220.71	-0.2%
Glass	18.92	18.59	19.34	21.11	21.51	20.86	19.91	0.3%
Cement manufacturing	21.19	20.95	25.28	28.49	28.83	28.97	29.09	1.3%
Iron and steel	91.87	116.74	120.52	120.72	114.74	104.89	96.55	-0.8%
Aluminum	27.63	30.90	29.05	28.26	26.76	25.18	23.33	-1.1%
Fabricated metal products	36.69	36.14	36.92	38.43	38.62	35.83	33.60	-0.3%
Machinery	22.80	23.76	25.71	27.18	27.59	25.56	23.65	-0.0%
Computers and electronics	30.68	33.08	33.52	35.92	36.33	36.49	37.09	0.5%
Transportation equipment	43.76	45.62	57.23	56.46	55.52	57.62	59.24	1.1%
Electrical equipment	7.86	8.17	8.60	9.08	9.18	8.71	8.62	0.2%
Wood products	16.74	16.90	19.92	20.46	20.36	19.19	18.67	0.4%
Plastics	37.47	38.26	35.32	36.21	35.54	34.91	34.07	-0.5%
Balance of manufacturing	142.01	142.62	136.24	140.38	138.68	132.64	127.12	-0.5%
Total manufacturing	1158.92	1213.88	1209.22	1264.20	1266.32	1250.08	1242.09	0.1%
Nonmanufacturing								
Agriculture	73.75	73.70	69.26	68.06	67.32	65.95	66.60	-0.4%
Construction	76.16	69.67	84.33	91.77	91.73	92.22	93.41	1.2%
Mining	43.45	46.04	45.11	45.41	43.78	42.93	42.44	-0.3%
Total nonmanufacturing	193.36	189.41	198.70	205.24	202.83	201.10	202.46	0.3%
Discrepancy ²	48.64	88.24	85.56	82.38	78.26	80.52	84.95	-0.2%
Total industrial	1400.92	1491.53	1493.48	1551.81	1547.41	1531.70	1529.50	0.1%

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

Sector and source	Reference case							Annual growth 2010-2035 (percent)
	2009	2010	2015	2020	2025	2030	2035	
Transportation								
Light-duty vehicles	1071.12	1056.84	1019.26	984.78	965.40	959.78	970.93	-0.3%
Commercial light trucks ⁵	36.81	38.00	40.07	39.96	38.97	39.57	41.12	0.3%
Bus transportation	17.00	17.84	17.50	17.43	17.34	17.36	17.49	-0.1%
Freight trucks	341.29	351.41	390.92	400.89	394.03	395.06	404.63	0.6%
Rail, passenger	5.65	5.86	5.82	6.15	6.49	6.78	7.04	0.7%
Rail, freight	30.64	33.38	31.70	35.55	37.00	37.64	38.44	0.6%
Shipping, domestic	14.41	16.44	16.97	17.98	17.98	18.12	18.31	0.4%
Shipping, international	61.04	67.55	67.99	68.42	68.83	69.23	69.63	0.1%
Recreational boats	16.63	17.03	17.22	17.51	17.83	18.29	18.83	0.4%
Air	172.79	178.28	181.46	187.65	192.85	195.89	197.83	0.4%
Military use	52.41	54.83	46.93	45.98	47.34	49.89	52.84	-0.1%
Lubricants	4.71	5.19	5.00	5.11	5.15	5.20	5.25	0.0%
Pipeline fuel	32.53	34.34	36.51	36.52	35.84	35.75	36.06	0.2%
Discrepancy ²	-1.23	-1.14	-0.22	0.44	1.12	1.77	2.38	--
Total transportation	1855.81	1875.88	1877.14	1864.37	1846.18	1850.34	1880.77	0.0%
Biogenic energy combustion⁶								
Biomass	178.16	190.68	204.76	257.63	290.67	288.97	292.18	1.7%
Electric power sector	15.83	18.00	25.97	66.66	89.93	82.05	76.63	6.0%
Other sectors	162.33	172.68	178.78	190.97	200.74	206.92	215.55	0.9%
Biogenic waste	6.56	7.10	8.20	8.21	8.21	8.21	8.21	0.6%
Biofuels heat and coproducts	77.07	79.14	75.88	93.85	133.49	207.38	256.66	4.8%
Ethanol	65.18	75.71	84.07	100.23	112.05	132.86	152.43	2.8%
Biodiesel	3.07	2.11	12.52	14.35	17.17	18.16	19.07	9.2%
Liquids from biomass	0.00	0.00	2.51	9.10	27.89	66.87	104.20	--
Renewable diesel and gasoline	0.00	0.50	2.54	2.53	2.54	2.52	2.52	6.7%
Total	330.03	355.24	390.49	485.90	592.03	724.98	835.28	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 8,501 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 2009 and 2010 are model results and may differ slightly from official EIA data reports.

Sources: 2009 and 2010 emissions and emission factors: U.S. Energy Information Administration (EIA), *Monthly Energy Review, October 2011* DOE/EIA-0035(2011/10) (Washington, DC, October 2011). Projections: EIA, AEO2012 National Energy Modeling System run REF2012.D121011B.