

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

Sector and end use	Reference case							Annual growth 2012-2040 (percent)
	2011	2012	2020	2025	2030	2035	2040	
Residential								
Space heating.....	285.2	235.7	254.0	245.4	236.2	226.7	217.3	-0.3%
Space cooling.....	141.5	139.7	139.1	151.3	162.1	172.5	181.4	0.9%
Water heating.....	146.6	145.2	143.4	144.9	144.1	140.7	137.0	-0.2%
Refrigeration.....	64.1	61.5	58.3	58.0	57.9	58.7	59.6	-0.1%
Cooking.....	30.8	30.1	31.0	31.9	32.7	33.5	34.1	0.4%
Clothes dryers.....	36.3	35.1	35.7	36.9	37.8	38.8	39.5	0.4%
Freezers.....	13.5	13.0	12.4	12.1	11.8	11.5	11.3	-0.5%
Lighting.....	108.3	103.0	67.7	60.1	52.8	44.2	39.8	-3.3%
Clothes washers ¹	5.4	5.1	4.0	3.4	3.2	3.2	3.2	-1.6%
Dishwashers ¹	16.9	16.2	15.2	15.0	15.7	16.5	17.2	0.2%
Televisions and related equipment ²	56.7	54.0	50.8	51.5	52.8	54.9	55.9	0.1%
Computers and related equipment ³	21.7	20.2	15.2	12.9	10.8	9.2	7.6	-3.4%
Furnace fans and boiler circulation pumps.....	20.0	15.3	17.9	17.9	17.8	17.5	17.0	0.4%
Other uses ⁴	203.6	181.4	209.0	222.8	235.9	248.7	260.7	1.3%
Discrepancy ⁵	-0.4	0.3	0.0	0.0	0.0	0.0	0.0	--
Total residential.....	1,150.4	1,055.9	1,053.7	1,064.2	1,071.5	1,076.6	1,081.7	0.1%
Commercial								
Space heating ⁶	131.4	115.4	125.8	122.9	118.7	114.6	110.2	-0.2%
Space cooling ⁶	95.2	92.1	81.5	82.9	82.6	82.9	83.4	-0.4%
Water heating ⁶	42.7	42.8	43.5	44.4	44.5	44.3	44.1	0.1%
Ventilation.....	86.7	83.8	85.1	87.9	88.3	88.5	88.8	0.2%
Cooking.....	14.1	14.2	14.5	14.9	15.3	15.6	15.9	0.4%
Lighting.....	162.2	151.8	136.3	135.4	131.3	125.3	121.2	-0.8%
Refrigeration.....	65.7	62.0	57.0	57.1	57.2	57.8	58.4	-0.2%
Office equipment (PC).....	21.3	18.7	10.5	7.8	5.7	4.3	3.4	-6.0%
Office equipment (non-PC).....	37.8	35.3	37.3	41.7	46.5	51.1	55.1	1.6%
Other uses ⁷	335.4	322.6	360.6	392.2	420.7	453.4	488.2	1.5%
Total commercial.....	992.3	938.6	952.2	987.2	1,010.8	1,037.9	1,068.7	0.5%
Industrial⁸								
Manufacturing								
Refining.....								-0.2%
Food products.....	252.4	257.5	254.7	248.9	245.1	244.6	246.7	0.9%
Paper products.....	96.4	96.8	106.4	111.9	116.2	119.8	123.7	0.1%
Bulk chemicals.....	74.5	71.0	69.9	70.9	70.9	71.6	73.2	0.5%
Glass.....	254.8	247.7	295.6	313.5	310.4	295.8	282.2	0.2%
Cement and lime.....	15.5	15.4	16.1	16.3	17.1	16.7	16.1	1.8%
Iron and steel.....	29.0	29.1	42.2	43.6	45.0	45.7	47.3	-0.4%
Aluminum.....	126.9	124.8	136.5	142.4	133.7	120.9	110.4	-0.8%
Fabricated metal products.....	45.3	45.6	50.3	54.2	49.7	41.2	36.3	0.4%
Machinery.....	37.8	38.2	42.3	44.3	43.8	43.0	42.2	0.9%
Computers and electronics.....	21.4	21.8	25.0	27.1	28.2	28.2	28.2	1.3%
Transportation equipment.....	46.3	46.4	50.5	57.4	61.7	64.6	65.8	1.4%
Electrical equipment.....	41.7	44.3	50.5	53.2	58.2	62.1	65.0	1.1%
Wood products.....	8.3	8.2	9.1	9.9	10.5	10.9	11.1	0.5%
Plastics.....	15.6	15.4	20.7	20.3	19.4	18.2	17.5	0.4%
Balance of manufacturing.....	39.7	38.7	42.4	44.3	44.6	44.0	43.6	0.9%
Total manufacturing.....	159.7	154.0	166.2	174.3	179.4	185.8	195.5	0.4%
Nonmanufacturing								
Agriculture.....								0.6%
Construction.....	71.0	65.5	75.7	76.7	77.3	77.4	77.7	1.5%
Mining.....	59.7	61.0	81.1	83.9	86.6	88.7	91.7	0.0%
Total nonmanufacturing.....	100.5	101.0	113.3	111.5	107.4	103.9	100.1	0.6%
Discrepancy ⁵	231.1	227.5	270.1	272.1	271.3	270.0	269.5	--
Total industrial.....	4.9	-2.6	39.1	47.5	56.2	66.6	74.1	0.6%

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

Sector and end use	Reference case							Annual growth 2012-2040 (percent)
	2011	2012	2020	2025	2030	2035	2040	
Transportation								
Light-duty vehicles	1,037.7	1,030.7	934.9	845.5	780.7	753.9	743.8	-1.2%
Commercial light trucks ⁹	35.9	35.6	36.1	34.9	34.1	34.4	35.6	0.0%
Bus transportation.....	16.8	16.1	16.0	16.1	16.0	15.9	15.8	-0.1%
Freight trucks.....	369.7	357.7	415.3	438.4	457.1	478.1	502.2	1.2%
Rail, passenger.....	5.5	5.4	5.6	5.9	6.1	6.2	6.5	0.7%
Rail, freight.....	36.9	34.7	31.7	32.0	30.5	28.8	27.2	-0.9%
Shipping, domestic	8.1	7.0	6.8	6.3	5.9	5.6	5.5	-0.9%
Shipping, international	60.0	45.3	46.0	46.6	47.1	47.5	47.9	0.2%
Recreational boats.....	16.1	16.1	17.0	17.7	18.2	18.6	18.8	0.6%
Air	174.4	175.2	184.1	188.1	190.3	190.8	191.4	0.3%
Military use.....	52.5	50.1	45.4	46.1	48.6	51.4	54.4	0.3%
Lubricants	5.0	4.4	4.5	4.5	4.5	4.5	4.6	0.1%
Pipeline fuel	37.1	38.8	39.3	40.6	43.5	44.3	44.9	0.5%
Discrepancy ⁵	-1.4	-1.7	-0.4	0.1	0.6	1.2	1.7	--
Total transportation.....	1,854.1	1,815.4	1,782.4	1,722.6	1,683.2	1,681.3	1,700.4	-0.2%
Biogenic energy combustion¹⁰								
Biomass	200.6	188.7	242.7	277.4	297.0	311.1	326.0	2.0%
Electric power sector	17.3	13.7	44.0	65.6	74.5	77.9	80.3	6.5%
Other sectors	183.3	175.0	198.7	211.8	222.5	233.2	245.7	1.2%
Biogenic waste.....	17.6	19.1	22.5	21.1	21.1	21.9	22.8	0.6%
Biofuels heat and coproducts	43.3	48.6	71.6	73.8	73.9	73.8	73.8	1.5%
Ethanol	74.8	75.5	81.6	83.3	83.3	83.2	86.1	0.5%
Biodiesel	8.5	8.4	12.6	12.5	12.5	12.7	12.7	1.5%
Liquids from biomass.....	0.0	0.0	1.0	1.0	1.0	1.0	1.0	--
Renewable diesel and gasoline	0.0	0.0	0.9	0.9	0.9	0.9	0.9	--
Total	344.8	340.3	432.9	470.1	489.7	504.6	523.3	1.5%

¹Does not include water heating portion of load.

²Includes televisions, set-top boxes, home theater systems, DVD players, and video game consoles.

³Includes desktop and laptop computers, monitors, and networking equipment.

⁴Includes small electric devices, heating elements, outdoor grills, exterior lights, pool heaters, spa heaters, backup electricity generators, and motors not listed above. Electric vehicles are included in the transportation sector.

⁵Represents 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.

⁶Includes emissions related to fuel consumption for district services.

⁷Includes (but is not limited to) miscellaneous uses such as transformers, medical imaging and other medical equipment, elevators, escalators, off-road electric vehicles, laboratory fume hoods, laundry equipment, coffee brewers, water services, pumps, emergency generators, combined heat and power in commercial buildings, manufacturing performed in commercial buildings, and cooking (distillate), plus residual fuel oil, propane, coal, motor gasoline, kerosene, and marketed renewable fuels (biomass).

⁸Includes combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

⁹Commercial trucks 8,501 to 10,000 pounds gross vehicle weight rating.

¹⁰By convention, the direct emissions from biogenic energy sources are excluded from energy-related carbon dioxide 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 2011 and 2012 are model results and may differ from official EIA data reports.

Sources: 2011 and 2012 emissions and emission factors: U.S. Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(2013/09) (Washington, DC, September 2013). Projections: EIA, AEO2014 National Energy Modeling System run REF2014.D102413A.