

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

Sector and end use	Reference case							Annual growth 2013-2040 (percent)
	2012	2013	2020	2025	2030	2035	2040	
Residential								
Space heating.....	228	293	248	236	228	218	207	-1.3%
Space cooling.....	136	109	124	128	135	141	145	1.1%
Water heating.....	143	144	142	142	143	139	134	-0.3%
Refrigeration.....	60	59	53	51	51	51	52	-0.5%
Cooking.....	30	30	31	32	32	33	34	0.4%
Clothes dryers.....	35	36	36	37	37	38	39	0.3%
Freezers.....	13	13	11	11	10	10	9	-1.1%
Lighting.....	103	96	67	59	52	43	38	-3.3%
Clothes washers ¹	5	5	4	3	3	2	2	-2.4%
Dishwashers ¹	16	15	15	15	17	17	18	0.5%
Televisions and related equipment ²	54	54	50	50	51	53	54	0.0%
Computers and related equipment ³	20	20	15	12	11	9	7	-3.6%
Furnace fans and boiler circulation pumps.....	15	21	18	17	16	14	13	-1.8%
Other uses ⁴	188	211	242	253	267	278	288	1.2%
Discrepancy ⁵	0	0	0	0	0	0	0	--
Total residential.....	1,044	1,105	1,057	1,047	1,051	1,048	1,042	-0.2%
Commercial								
Space heating ⁶	112	136	122	115	111	105	97	-1.2%
Space cooling ⁶	95	82	85	84	84	83	82	0.0%
Water heating ⁶	44	45	44	44	44	44	43	-0.2%
Ventilation.....	82	84	85	85	85	84	83	0.0%
Cooking.....	14	14	15	15	16	16	16	0.4%
Lighting.....	149	148	137	131	127	120	116	-0.9%
Refrigeration.....	61	61	52	48	46	45	45	-1.1%
Office equipment (PC).....	19	17	11	8	6	4	3	-5.9%
Office equipment (non-PC).....	35	35	38	42	47	51	55	1.6%
Other uses ⁷	321	346	392	422	452	484	516	1.5%
Total commercial.....	933	968	979	994	1,016	1,037	1,057	0.3%
Industrial⁸								
Manufacturing								
Refining.....	261	268	252	251	250	255	260	-0.1%
Food products.....	96	96	104	109	113	116	119	0.8%
Paper products.....	69	69	63	59	54	50	49	-1.2%
Bulk chemicals.....	247	247	293	311	309	298	291	0.6%
Glass.....	15	15	16	16	17	16	16	0.1%
Cement and lime.....	29	30	41	42	45	48	52	2.1%
Iron and steel.....	125	123	135	141	135	129	122	0.0%
Aluminum.....	45	46	54	55	51	43	38	-0.7%
Fabricated metal products.....	38	39	42	43	42	43	43	0.3%
Machinery.....	22	22	24	25	27	28	29	1.1%
Computers and electronics.....	47	48	48	49	51	53	52	0.3%
Transportation equipment.....	44	47	50	52	53	58	63	1.1%
Electrical equipment.....	8	8	9	10	10	11	12	1.4%
Wood products.....	15	17	20	20	20	19	18	0.3%
Plastics.....	39	40	44	46	48	49	49	0.8%
Balance of manufacturing.....	154	156	161	164	165	166	169	0.3%
Total manufacturing.....	1,254	1,270	1,355	1,392	1,389	1,383	1,383	0.3%
Nonmanufacturing								
Agriculture.....	66	66	65	64	62	60	58	-0.4%
Construction.....	62	64	77	80	83	85	87	1.1%
Mining.....	101	102	117	115	113	108	108	0.2%
Total nonmanufacturing.....	230	232	259	259	257	253	253	0.3%
Discrepancy ⁵	-8	-16	44	61	73	79	86	--
Total industrial.....	1,476	1,486	1,658	1,711	1,719	1,714	1,723	0.5%

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

Sector and end use	Reference case							Annual growth 2013-2040 (percent)
	2012	2013	2020	2025	2030	2035	2040	
Transportation								
Light-duty vehicles	1,035	1,044	967	892	834	801	777	-1.1%
Commercial light trucks ⁹	36	38	37	36	35	35	36	-0.2%
Bus transportation.....	16	18	18	18	19	19	19	0.2%
Freight trucks	356	389	417	429	440	456	477	0.8%
Rail, passenger.....	5	6	6	6	6	6	7	0.6%
Rail, freight.....	31	36	35	36	34	32	31	-0.5%
Shipping, domestic	7	7	7	6	6	5	5	-1.4%
Shipping, international	52	48	47	47	47	48	48	0.0%
Recreational boats.....	16	17	18	18	19	20	20	0.6%
Air	165	163	180	193	206	214	219	1.1%
Military use.....	50	48	45	45	48	51	54	0.5%
Lubricants	5	5	5	5	5	5	5	0.3%
Pipeline fuel.....	40	47	45	48	50	50	51	0.3%
Discrepancy ⁵	5	-21	-21	-21	-21	-21	-20	--
Total transportation.....	1,819	1,845	1,806	1,759	1,727	1,722	1,728	-0.2%
Biogenic energy combustion¹⁰								
Biomass.....	192	203	205	221	224	229	247	0.7%
Electric power sector	16	17	30	42	47	55	69	5.3%
Other sectors	176	186	175	179	177	174	178	-0.2%
Biogenic waste.....	21	21	24	25	24	24	24	0.6%
Biofuels heat and coproducts	69	68	75	75	75	76	81	0.6%
Ethanol	73	73	74	74	74	77	84	0.5%
Biodiesel	8	14	20	16	16	16	16	0.4%
Liquids from biomass.....	0	0	1	1	1	1	1	22.0%
Renewable diesel and gasoline	0	0	4	8	8	8	8	--
Total	362	379	403	419	422	431	461	0.7%

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 emissions related to (but 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 2012 and 2013 are model results and may differ from official EIA data reports.

Sources: 2012 and 2013 emissions and emission factors: U.S. Energy Information Administration (EIA), *Monthly Energy Review*, DOE/EIA-0035(2014/11) (Washington, DC, November 2014). Projections: EIA, AEO2015 National Energy Modeling System run REF2015.D021915A.