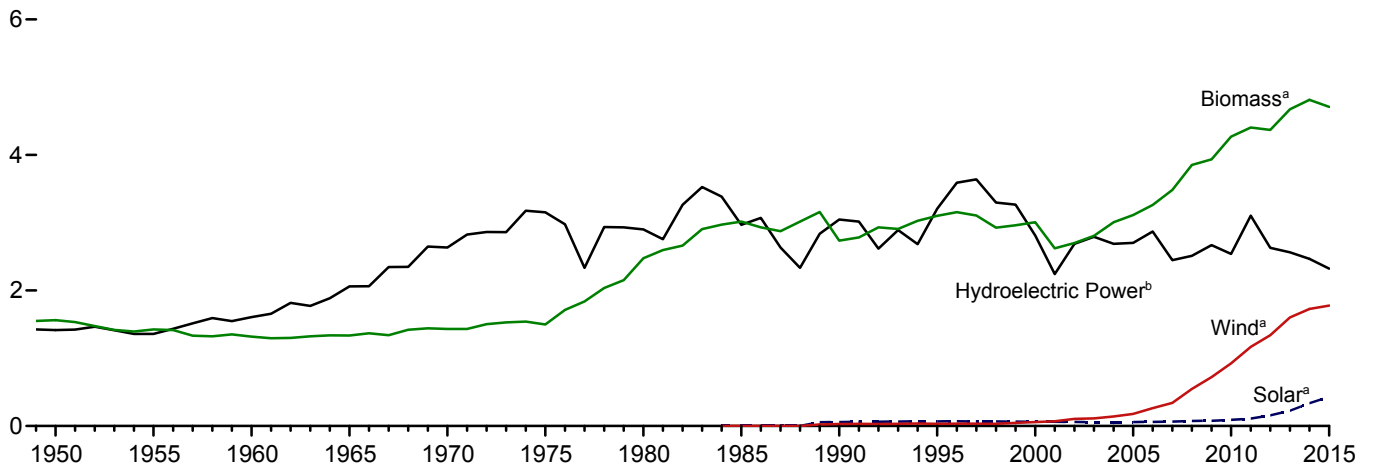


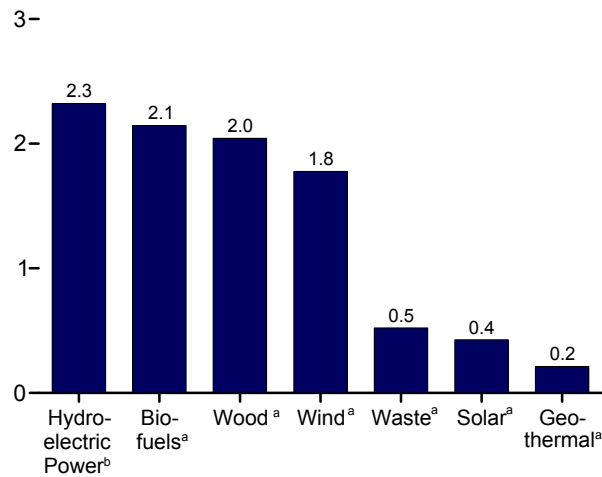
10. Renewable Energy

Figure 10.1 Renewable Energy Consumption
(Quadrillion Btu)

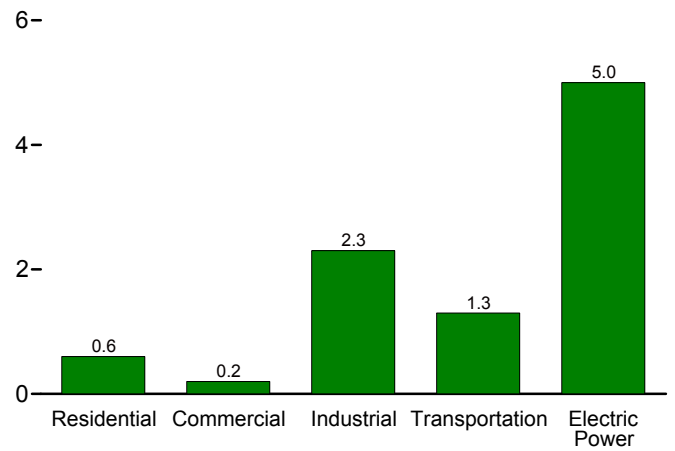
Major Sources, 1949–2015



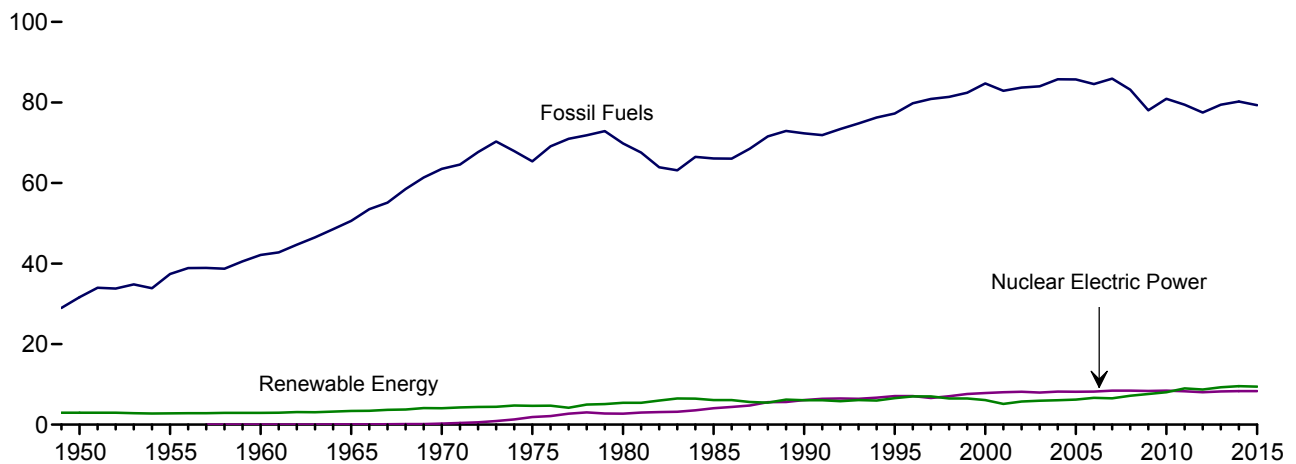
By Source, 2015



By Sector, 2015



Compared With Other Resources, 1949–2015



^a See Table 10.1 for definition.
^b Conventional hydroelectric power.

Web Page: <http://www.eia.gov/totalenergy/data/monthly/#renewable>.
Sources: Tables 1.3 and 10.1–10.2c.

Table 10.1 Renewable Energy Production and Consumption by Source
(Trillion Btu)

	Production ^a			Consumption									
	Biomass		Total Renewable Energy ^d	Hydroelectric Power ^e	Geothermal ^f	Solar ^g	Wind ^h	Biomass				Total Renewable Energy	
	Bio-fuels ^b	Total ^c						Wood ⁱ	Waste ^j	Bio-fuels ^k	Total		
1950 Total	NA	1,562	2,978	1,415	NA	NA	NA	1,562	NA	NA	NA	1,562	2,978
1955 Total	NA	1,424	2,784	1,360	NA	NA	NA	1,424	NA	NA	NA	1,424	2,784
1960 Total	NA	1,320	2,928	1,608	(s)	NA	NA	1,320	NA	NA	NA	1,320	2,928
1965 Total	NA	1,335	3,396	2,059	2	NA	NA	1,335	NA	NA	NA	1,335	3,396
1970 Total	NA	1,431	4,070	2,634	6	NA	NA	1,429	2	NA	NA	1,431	4,070
1975 Total	NA	1,499	4,687	3,155	34	NA	NA	1,497	2	NA	NA	1,499	4,687
1980 Total	NA	2,475	5,428	2,900	53	NA	NA	2,474	2	NA	NA	2,475	5,428
1985 Total	93	3,016	6,084	2,970	97	(s)	(s)	2,687	236	93	3,016	6,084	
1990 Total	111	2,735	6,040	3,046	171	59	29	2,216	408	111	2,735	6,040	
1995 Total	198	3,099	6,557	3,205	152	68	33	2,370	531	200	3,101	6,559	
2000 Total	233	3,006	6,102	2,811	164	63	57	2,262	511	236	3,008	6,104	
2001 Total	254	2,624	5,162	2,242	164	62	70	2,006	364	253	2,622	5,160	
2002 Total	308	2,705	5,731	2,689	171	60	105	1,995	402	303	2,701	5,726	
2003 Total	401	2,805	5,942	2,793	173	58	113	2,002	401	403	2,806	5,944	
2004 Total	486	2,996	6,063	2,688	178	58	142	2,121	389	498	3,008	6,075	
2005 Total	561	3,101	6,221	2,703	181	58	178	2,137	403	574	3,114	6,233	
2006 Total	716	3,212	6,586	2,869	181	61	264	2,099	397	766	3,262	6,637	
2007 Total	970	3,472	6,510	2,446	186	65	341	2,089	413	983	3,485	6,523	
2008 Total	1,374	3,868	7,191	2,511	192	74	546	2,059	435	1,357	3,851	7,174	
2009 Total	1,570	3,953	7,620	2,669	200	78	721	1,931	452	1,553	3,936	7,604	
2010 Total	1,868	4,316	8,077	2,539	208	90	923	1,981	468	1,821	4,270	8,030	
2011 Total	2,029	4,501	9,095	3,103	212	111	1,168	2,010	462	1,933	4,405	8,999	
2012 Total	1,929	4,406	8,743	2,629	212	157	1,340	2,010	467	1,892	4,369	8,706	
2013 Total	1,981	4,647	9,249	2,562	214	225	1,601	2,170	496	R 2,007	R 4,673	R 9,275	
2014 January	170	404	815	206	18	17	170	190	45	163	397	808	
February	153	367	700	165	16	18	133	173	41	150	364	697	
March	173	406	850	231	18	26	169	189	45	167	401	845	
April	170	392	858	242	18	29	177	179	44	167	390	856	
May	178	403	855	252	18	33	148	182	43	176	401	853	
June	177	406	853	245	18	35	150	186	42	173	402	849	
July	183	420	820	232	18	34	116	192	45	180	417	817	
August	179	416	754	188	18	35	97	193	43	182	418	756	
September	173	396	709	153	18	33	110	182	41	172	394	708	
October	179	407	758	163	18	31	138	186	42	180	408	759	
November	177	403	803	177	18	25	179	185	42	173	399	799	
December	191	428	820	212	18	21	140	194	44	183	420	812	
Total	2,103	4,849	9,595	2,467	214	337	1,728	2,230	516	2,067	4,812	9,558	
2015 January	178	R 401	R 806	R 225	R 18	R 21	R 141	R 179	R 43	163	R 386	R 792	
February	162	R 363	R 751	R 208	R 17	R 25	R 139	162	39	158	R 358	R 747	
March	180	R 393	R 815	R 226	R 18	R 35	R 143	R 170	43	176	R 389	R 811	
April	172	R 380	R 812	R 209	R 17	R 40	R 167	R 165	R 42	170	R 378	R 810	
May	183	R 396	R 805	R 188	R 18	R 43	R 160	R 170	R 43	185	R 398	R 807	
June	184	R 395	R 771	R 190	R 17	R 43	R 125	R 168	42	186	R 397	R 773	
July	187	R 410	R 796	R 196	R 18	R 45	R 127	R 177	R 46	189	R 411	R 797	
August	185	R 406	R 770	R 178	R 18	R 45	R 122	R 177	R 44	189	R 411	R 774	
September	175	R 385	R 721	R 150	17	R 39	R 130	R 168	R 42	182	R 392	R 728	
October	183	R 393	R 753	R 155	18	R 34	R 153	R 165	R 45	184	R 394	R 754	
November	182	R 394	R 806	R 180	18	R 30	R 183	R 167	R 45	179	R 391	R 802	
December	190	R 412	R 860	R 216	R 18	R 27	R 187	175	R 47	185	R 406	R 855	
Total	2,161	R 4,727	R 9,466	R 2,321	R 213	R 427	R 1,777	R 2,043	R 522	2,145	R 4,711	R 9,450	
2016 January	184	R 401	R 856	R 236	19	R 27	R 173	171	R 45	172	R 388	R 843	
February	175	R 376	R 845	R 225	18	R 37	R 188	159	41	174	R 375	R 844	
March	189	R 397	R 916	R 252	19	R 45	R 203	163	44	188	R 395	R 914	
April	174	R 372	R 868	R 237	18	R 49	R 192	R 153	R 45	173	R 372	R 868	
May	188	R 391	R 880	R 236	20	R 57	R 175	R 160	R 44	191	R 394	R 883	
June	188	R 394	R 836	R 213	18	R 58	R 152	R 162	R 44	191	R 396	R 838	
July	195	R 407	R 852	R 198	19	R 63	R 164	R 167	R 45	201	R 413	R 858	
August	197	R 410	R 797	R 180	19	R 61	R 126	167	R 45	204	R 417	R 804	
September	186	385	766	152	19	56	153	158	41	192	391	772	
9-Month Total	1,677	3,533	7,614	1,930	170	455	1,526	1,462	394	1,685	3,542	7,623	
2015 9-Month Total	1,607	3,528	7,047	1,770	159	336	1,254	1,536	385	1,598	3,519	7,038	
2014 9-Month Total	1,556	3,610	7,214	1,914	160	260	1,270	1,666	388	1,531	3,585	7,188	

^a Production equals consumption for all renewable energy sources except biofuels.

^b Total biomass inputs to the production of fuel ethanol and biodiesel.

^c Wood and wood-derived fuels, biomass waste, and total biomass inputs to the production of fuel ethanol and biodiesel.

^d Hydroelectric power, geothermal, solar, wind, and biomass.

^e Conventional hydroelectricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6).

^f Geothermal electricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6), and geothermal heat pump and direct use energy.

^g Solar photovoltaic (PV) and solar thermal electricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6), and solar thermal direct use energy.

^h Wind electricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6).

ⁱ Wood and wood-derived fuels.

^j Municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural byproducts, and other biomass. Through 2000, also includes non-renewable waste (municipal solid waste from non-biogenic sources, and tire-derived fuels).

^k Fuel ethanol (minus denaturant) and biodiesel consumption, plus losses and co-products from the production of fuel ethanol and biodiesel.

R=Revised, NA=Not available, (s)=Less than 0.5 trillion Btu.

Notes: • Most data for the residential, commercial, industrial, and transportation sectors are estimates. See notes and sources for Tables 10.2a and 10.2b. • See Note, "Renewable Energy Production and Consumption," at end of section.

• Totals may not equal sum of components due to independent rounding. • Geographic coverage is the 50 states and the District of Columbia.

Web Page: See <http://www.eia.gov/totalenergy/data/monthly/#renewable> (Excel and CSV files) for all available annual data beginning in 1949 and monthly data beginning in 1973.

Sources: Tables 10.2a–10.5.

Table 10.2a Renewable Energy Consumption: Residential and Commercial Sectors
(Trillion Btu)

	Residential Sector				Commercial Sector ^a									
	Geo-thermal ^b	Solar ^c	Biomass		Hydro-electric Power ^e	Geo-thermal ^b	Solar ^f	Wind ^g	Biomass				Total	
			Wood ^d	Total					Wood ^d	Waste ^h	Fuel Ethanol ⁱ	Total		
1950 Total	NA	NA	1,006	1,006	NA	NA	NA	NA	19	NA	NA	NA	19	19
1955 Total	NA	NA	775	775	NA	NA	NA	NA	15	NA	NA	NA	15	15
1960 Total	NA	NA	627	627	NA	NA	NA	NA	12	NA	NA	NA	12	12
1965 Total	NA	NA	468	468	NA	NA	NA	NA	9	NA	NA	NA	9	9
1970 Total	NA	NA	401	401	NA	NA	NA	NA	8	NA	NA	NA	8	8
1975 Total	NA	NA	425	425	NA	NA	NA	NA	8	NA	NA	NA	8	8
1980 Total	NA	NA	850	850	NA	NA	NA	NA	21	NA	NA	NA	21	21
1985 Total	NA	NA	1,010	1,010	NA	NA	NA	NA	24	NA	(s)	NA	24	24
1990 Total	6	55	580	640	1	3	(s)	–	66	28	(s)	NA	94	98
1995 Total	7	63	520	589	1	5	(s)	–	72	40	(s)	NA	113	119
2000 Total	9	58	420	486	1	8	1	–	71	47	(s)	NA	119	128
2001 Total	9	55	370	435	1	8	1	–	67	25	(s)	NA	92	101
2002 Total	10	53	380	443	(s)	9	1	–	69	26	(s)	NA	95	105
2003 Total	13	52	400	465	1	11	1	–	71	29	1	NA	101	114
2004 Total	14	51	410	475	1	12	1	–	70	34	1	NA	105	120
2005 Total	16	50	430	496	1	14	2	–	70	34	1	NA	105	121
2006 Total	18	52	380	451	1	14	2	–	65	36	1	NA	103	120
2007 Total	22	55	420	497	1	14	3	–	70	31	2	NA	103	121
2008 Total	26	58	470	555	1	15	6	–	73	34	2	NA	109	130
2009 Total	33	60	500	593	1	17	7	(s)	73	36	3	NA	112	137
2010 Total	37	65	440	541	1	19	11	(s)	72	36	3	NA	111	142
2011 Total	40	70	450	560	(s)	20	19	(s)	69	43	3	NA	115	154
2012 Total	40	79	420	538	(s)	20	32	1	61	45	3	NA	108	160
2013 Total	40	92	580	711	(s)	20	41	1	70	47	3	NA	120	182
2014 January	3	6	49	59	(s)	2	3	(s)	6	4	(s)	NA	11	16
February	3	6	44	54	(s)	2	3	(s)	6	3	(s)	NA	9	14
March	3	9	49	61	(s)	2	4	(s)	6	4	(s)	NA	10	17
April	3	9	48	60	(s)	2	5	(s)	6	4	(s)	NA	10	17
May	3	11	49	63	(s)	2	5	(s)	6	4	(s)	NA	11	18
June	3	11	48	62	(s)	2	5	(s)	6	4	(s)	NA	10	17
July	3	11	49	64	(s)	2	5	(s)	6	4	(s)	NA	11	18
August	3	11	49	64	(s)	2	5	(s)	6	4	(s)	NA	11	18
September	3	10	48	61	(s)	2	5	(s)	6	4	(s)	NA	10	17
October	3	10	49	62	(s)	2	4	(s)	6	4	(s)	NA	10	16
November	3	8	48	59	(s)	2	3	(s)	6	4	(s)	NA	10	15
December	3	8	49	60	(s)	2	3	(s)	6	4	(s)	NA	10	15
Total	40	109	580	729	(s)	20	52	1	73	47	4	NA	124	198
2015 January	3	7	37	47	(s)	2	3	(s)	6	4	(s)	NA	10	16
February	3	7	33	43	(s)	2	4	(s)	6	R 3	(s)	NA	9	15
March	3	10	37	50	(s)	2	5	(s)	6	4	(s)	NA	10	R 17
April	3	11	35	50	(s)	2	R 5	(s)	6	R 4	(s)	NA	10	17
May	3	13	37	53	(s)	2	6	(s)	6	R 4	(s)	NA	10	18
June	3	13	35	52	(s)	2	6	(s)	6	R 4	(s)	NA	10	R 18
July	3	14	37	54	(s)	2	6	(s)	6	4	(s)	NA	R 11	R 19
August	3	14	37	54	(s)	2	6	(s)	6	R 4	(s)	NA	R 11	18
September	3	12	35	51	(s)	2	5	(s)	6	R 4	(s)	NA	10	17
October	3	11	37	51	(s)	2	5	(s)	6	4	(s)	NA	10	17
November	3	9	35	48	(s)	2	4	(s)	6	4	(s)	NA	R 10	16
December	3	9	37	49	(s)	2	R 3	(s)	6	4	(s)	NA	11	16
Total	41	R 129	432	R 601	(s)	20	R 57	1	73	R 47	4	NA	R 124	R 202
2016 January	4	8	33	45	(s)	2	4	(s)	6	4	(s)	NA	11	17
February	3	10	31	44	(s)	2	5	(s)	6	4	(s)	NA	10	R 16
March	4	13	33	49	(s)	2	6	(s)	6	5	(s)	NA	11	19
April	4	R 14	32	50	(s)	2	7	(s)	6	4	(s)	NA	R 11	19
May	4	16	33	R 52	(s)	2	7	(s)	6	4	(s)	NA	10	19
June	4	17	32	52	(s)	2	7	(s)	6	R 4	(s)	NA	10	19
July	4	17	33	54	(s)	2	8	(s)	6	4	(s)	NA	R 11	20
August	4	17	33	53	(s)	2	7	(s)	6	4	(s)	NA	R 11	20
September	4	15	32	50	(s)	2	6	(s)	6	4	(s)	NA	10	18
9-Month Total	33	127	289	449	(s)	15	57	1	55	36	3	NA	94	168
2015 9-Month Total	30	100	323	453	(s)	15	45	1	55	35	3	NA	93	154
2014 9-Month Total	30	84	434	548	(s)	15	41	1	55	36	3	NA	94	151

^a Commercial sector, including commercial combined-heat-and-power (CHP) and commercial electricity-only plants. See Note 2, "Classification of Power Plants Into Energy-Use Sectors," at end of Section 7.

^b Geothermal heat pump and direct use energy.

^c Distributed (small-scale) solar photovoltaic (PV) electricity generation in the residential sector (converted to Btu by multiplying by the fossil fuels heat rate factors in Table A6) and distributed solar thermal energy in the residential, commercial, and industrial sectors. See Table 10.5.

^d Wood and wood-derived fuels.

^e Conventional hydroelectricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6).

^f Solar photovoltaic (PV) electricity net generation in the commercial sector (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6), both utility-scale and distributed (small-scale). See Table 10.5.

^g Wind electricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6).

^h Municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural byproducts, and other biomass. Through 2000, also includes non-renewable waste (municipal solid waste from non-biogenic sources, and tire-derived fuels).

ⁱ The fuel ethanol (minus denaturant) portion of motor fuels, such as E10, consumed by the commercial sector.

R=Revised. NA=Not available. –=No data reported. (s)=Less than 0.5 trillion Btu.

Notes: • Data are estimates, except for commercial sector hydroelectric power, wind, and waste. • Totals may not equal sum of components due to independent rounding. • Geographic coverage is the 50 states and the District of Columbia.

Web Page: See <http://www.eia.gov/totalenergy/data/monthly/#renewable> (Excel and CSV files) for all available annual data beginning in 1949 and monthly data beginning in 1973.

Sources: See end of section.

Table 10.2b Renewable Energy Consumption: Industrial and Transportation Sectors
(Trillion Btu)

	Industrial Sector ^a									Transportation Sector			
	Hydro-electric Power ^b	Geo-thermal ^c	Solar ^d	Wind ^e	Biomass					Total	Biomass		
					Wood ^f	Waste ^g	Fuel Ethanol ^h	Losses and Co-products ⁱ	Total		Fuel Ethanol ^j	Bio-diesel ^k	Total ^l
1950 Total	69	NA	NA	NA	532	NA	NA	NA	532	602	NA	NA	NA
1955 Total	38	NA	NA	NA	631	NA	NA	NA	631	669	NA	NA	NA
1960 Total	39	NA	NA	NA	680	NA	NA	NA	680	719	NA	NA	NA
1965 Total	33	NA	NA	NA	855	NA	NA	NA	855	888	NA	NA	NA
1970 Total	34	NA	NA	NA	1,019	NA	NA	NA	1,019	1,053	NA	NA	NA
1975 Total	32	NA	NA	NA	1,063	NA	NA	NA	1,063	1,096	NA	NA	NA
1980 Total	33	NA	NA	NA	1,600	NA	NA	NA	1,600	1,633	NA	NA	NA
1985 Total	33	NA	NA	NA	1,645	230	1	42	1,918	1,951	50	NA	50
1990 Total	31	2	(s)	—	1,442	192	1	49	1,684	1,717	60	NA	60
1995 Total	55	3	(s)	—	1,652	195	2	86	1,934	1,992	112	NA	112
2000 Total	42	4	(s)	—	1,636	145	1	99	1,881	1,928	135	NA	135
2001 Total	33	5	(s)	—	1,443	129	3	108	1,681	1,719	141	1	142
2002 Total	39	5	(s)	—	1,396	146	3	130	1,676	1,720	168	2	170
2003 Total	43	3	(s)	—	1,363	142	4	168	1,678	1,725	228	2	230
2004 Total	33	4	(s)	—	1,476	132	6	201	1,815	1,852	286	3	290
2005 Total	32	4	(s)	—	1,452	148	7	227	1,834	1,871	327	12	339
2006 Total	29	4	1	—	1,472	130	10	280	1,892	1,926	442	33	475
2007 Total	16	5	1	—	1,413	145	10	369	1,937	1,958	557	45	602
2008 Total	17	5	1	—	1,339	143	12	519	2,012	2,035	786	39	825
2009 Total	18	4	2	—	1,178	154	13	603	1,948	1,972	894	41	935
2010 Total	16	4	3	—	1,273	168	17	727	2,185	2,208	1,041	33	1,075
2011 Total	17	4	4	(s)	1,309	165	17	756	2,246	2,272	1,045	113	1,158
2012 Total	22	4	7	(s)	1,339	159	17	711	2,226	2,259	1,045	115	1,162
2013 Total	33	4	9	(s)	1,312	187	18	709	2,226	2,272	1,072	^R 182	^R 1,278
2014 January	1	(s)	1	(s)	113	16	1	63	193	195	87	10	99
February	1	(s)	1	(s)	102	15	1	56	175	177	82	10	93
March	1	(s)	1	(s)	112	17	1	62	192	194	88	14	103
April	1	(s)	1	(s)	107	17	1	62	187	189	89	12	104
May	1	(s)	1	(s)	109	15	1	64	190	192	94	15	110
June	1	(s)	1	(s)	111	15	1	64	190	193	92	16	108
July	1	(s)	1	(s)	114	16	1	65	196	199	96	15	113
August	1	(s)	1	(s)	115	15	1	64	195	198	95	19	117
September	1	(s)	1	(s)	107	14	1	62	185	187	89	19	109
October	1	(s)	1	(s)	110	17	1	64	192	194	96	16	115
November	1	(s)	1	(s)	109	16	1	64	190	192	92	17	108
December	1	(s)	1	(s)	116	17	1	68	202	204	94	18	113
Total	12	4	11	1	1,325	190	14	757	2,287	2,314	1,093	181	1,291
2015 January	1	(s)	1	(s)	^R 114	^R 17	1	65	^R 198	^R 200	89	6	96
February	1	(s)	1	(s)	^R 102	^R 15	1	59	^R 177	^R 179	85	11	97
March	1	(s)	1	(s)	106	^R 17	1	65	^R 189	^R 192	94	13	109
April	1	(s)	1	(s)	106	^R 16	1	61	185	188	90	15	107
May	1	(s)	1	(s)	^R 109	^R 16	1	65	192	^R 195	99	18	118
June	1	(s)	1	(s)	106	^R 15	1	65	^R 188	^R 191	96	21	119
July	1	(s)	1	(s)	111	^R 16	1	67	^R 195	^R 198	99	18	120
August	1	(s)	1	(s)	^R 111	16	1	66	^R 194	^R 196	100	20	122
September	1	(s)	1	(s)	^R 106	^R 15	1	63	185	^R 188	96	20	118
October	1	(s)	1	(s)	^R 105	17	1	66	^R 189	^R 192	97	17	116
November	1	(s)	1	(s)	^R 107	^R 17	1	65	^R 190	^R 193	94	14	112
December	1	(s)	1	(s)	110	^R 18	1	68	^R 198	^R 200	95	17	115
Total	13	4	14	^R (s)	^R 1,295	^R 194	15	776	^R 2,280	^R 2,312	1,134	191	1,350
2016 January	1	(s)	1	(s)	^R 112	16	1	66	^R 195	^R 197	90	13	104
February	1	(s)	1	(s)	^R 102	15	1	62	^R 181	^R 184	93	15	110
March	1	(s)	1	(s)	^R 105	16	1	67	^R 190	^R 193	100	16	119
April	1	(s)	2	(s)	^R 101	^R 16	1	61	^R 179	^R 182	92	17	111
May	1	(s)	2	(s)	105	16	1	66	^R 189	192	99	22	123
June	1	(s)	2	(s)	^R 106	16	1	66	^R 189	^R 193	99	21	123
July	1	(s)	2	(s)	^R 108	^R 17	1	68	^R 195	^R 198	102	27	131
August	1	(s)	2	(s)	^R 108	16	1	69	^R 194	^R 197	103	28	133
September	1	(s)	2	(s)	102	15	1	65	184	186	96	26	125
9-Month Total	10	3	14	1	948	143	12	591	1,695	1,721	875	185	1,079
2015 9-Month Total	9	3	11	(s)	973	143	11	577	1,704	1,727	848	143	1,007
2014 9-Month Total	9	3	9	(s)	990	141	11	561	1,703	1,724	811	130	956

^a Industrial sector, including industrial combined-heat-and-power (CHP) and industrial electricity-only plants. See Note 2, "Classification of Power Plants Into Energy-Use Sectors," at end of Section 7.

^b Conventional hydroelectricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6).

^c Geothermal heat pump and direct use energy.

^d Solar photovoltaic (PV) electricity net generation in the industrial sector (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6), both utility-scale and distributed (small-scale). See Table 10.5.

^e Wind electricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6).

^f Wood and wood-derived fuels.

^g Municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural byproducts, and other biomass. Through 2000, also includes non-renewable waste (municipal solid waste from non-biogenic sources, and tire-derived fuels).

^h The fuel ethanol (minus denaturant) portion of motor fuels, such as E10, consumed by the industrial sector.

ⁱ Losses and co-products from the production of fuel ethanol and biodiesel. Does not include natural gas, electricity, and other non-biomass energy used in the

production of fuel ethanol and biodiesel—these are included in the industrial sector consumption statistics for the appropriate energy source.

^j The fuel ethanol (minus denaturant) portion of motor fuels, such as E10 and E85, consumed by the transportation sector.

^k Although there is biodiesel use in other sectors, all biodiesel consumption is assigned to the transportation sector.

^l Beginning in 2009, includes imports minus stock change of other renewable diesel fuel and other renewable fuels. See "Renewable Diesel Fuel (Other)" and "Renewable Fuels (Other)" in Glossary.

^R=Revised. NA=Not available. —=No data reported. (s)=Less than 0.5 trillion Btu.

Notes: • Data are estimates, except for industrial sector hydroelectric power in 1949–1978 and 1989 forward, and wind. • Totals may not equal sum of components due to independent rounding. • Geographic coverage is the 50 states and the District of Columbia.

Web Page: See <http://www.eia.gov/totalenergy/data/monthly/#renewable> (Excel and CSV files) for all available annual data beginning in 1949 and monthly data beginning in 1973.

Sources: See end of section.

Table 10.2c Renewable Energy Consumption: Electric Power Sector
(Trillion Btu)

	Hydro-electric Power ^a	Geo-thermal ^b	Solar ^c	Wind ^d	Biomass			Total
					Wood ^e	Waste ^f	Total	
1950 Total	1,346	NA	NA	NA	5	NA	5	1,351
1955 Total	1,322	NA	NA	NA	3	NA	3	1,325
1960 Total	1,569	(s)	NA	NA	2	NA	2	1,571
1965 Total	2,026	2	NA	NA	3	NA	3	2,031
1970 Total	2,600	6	NA	NA	1	2	4	2,609
1975 Total	3,122	34	NA	NA	(s)	2	2	3,158
1980 Total	2,867	53	NA	NA	3	2	4	2,925
1985 Total	2,937	97	(s)	(s)	8	7	14	3,049
1990 Total ^g	3,014	161	4	29	129	188	317	3,524
1995 Total	3,149	138	5	33	125	296	422	3,747
2000 Total	2,768	144	5	57	134	318	453	3,427
2001 Total	2,209	142	6	70	126	211	337	2,763
2002 Total	2,650	147	6	105	150	230	380	3,288
2003 Total	2,749	146	5	113	167	230	397	3,411
2004 Total	2,655	148	6	142	165	223	388	3,339
2005 Total	2,670	147	6	178	185	221	406	3,406
2006 Total	2,639	145	5	264	182	231	412	3,665
2007 Total	2,430	145	6	341	186	237	423	3,345
2008 Total	2,494	146	9	546	177	258	435	3,630
2009 Total	2,650	146	9	721	180	261	441	3,967
2010 Total	2,521	148	12	923	196	264	459	4,064
2011 Total	3,085	149	17	1,167	182	255	437	4,855
2012 Total	2,606	148	40	1,339	190	262	453	4,586
2013 Total	2,529	151	83	1,600	207	262	470	4,833
2014 January	205	13	7	170	21	24	45	440
February	164	11	8	133	20	22	42	359
March	230	13	12	169	22	24	46	469
April	241	12	14	177	18	23	41	485
May	251	13	16	148	17	24	41	469
June	244	12	18	150	22	24	45	470
July	231	13	17	116	23	25	48	423
August	187	13	17	97	23	24	46	361
September	152	12	17	109	21	22	43	334
October	162	13	16	138	20	22	42	371
November	176	13	13	179	22	22	44	425
December	211	13	10	140	22	23	45	419
Total	2,454	151	165	1,726	251	279	530	5,026
2015 January	R 224	R 13	11	R 141	22	R 23	R 45	R 433
February	R 207	R 12	R 14	R 139	21	R 20	R 41	R 412
March	R 225	R 13	R 19	R 143	R 21	22	R 43	R 443
April	R 208	R 12	R 22	R 166	R 18	22	R 40	R 448
May	R 186	R 13	R 23	R 160	R 18	R 23	41	R 423
June	R 189	R 12	R 23	R 125	21	R 23	R 44	R 393
July	R 195	R 13	R 24	R 127	R 22	R 26	48	R 407
August	R 177	R 13	R 25	R 122	R 23	R 25	R 48	R 384
September	R 149	R 11	R 20	R 130	20	R 23	R 43	R 354
October	R 154	R 12	R 17	R 152	R 17	R 24	41	R 378
November	R 179	R 12	R 16	R 183	R 19	R 25	R 44	R 434
December	R 214	R 13	R 14	R 187	R 21	25	R 47	R 476
Total	R 2,308	R 148	R 228	R 1,776	R 244	R 281	R 525	R 4,985
2016 January	R 235	14	14	R 172	21	R 25	45	R 480
February	R 224	13	R 22	R 188	21	R 23	43	R 490
March	R 250	14	R 24	R 203	20	23	R 43	R 534
April	R 236	12	R 27	R 191	R 15	R 25	R 40	R 506
May	R 235	14	R 32	R 175	R 16	R 24	R 40	R 496
June	R 212	13	R 32	R 152	R 19	R 24	42	R 452
July	R 197	R 13	R 37	R 164	20	24	R 45	R 456
August	R 180	R 13	R 36	R 126	21	R 25	R 46	R 401
September	151	14	33	153	18	23	41	392
9-Month Total	1,920	119	257	1,524	170	215	385	4,206
2015 9-Month Total	1,760	111	180	1,253	186	207	393	3,697
2014 9-Month Total	1,904	112	126	1,269	187	212	399	3,811

^a Conventional hydroelectricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6).

^b Geothermal electricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6).

^c Solar photovoltaic (PV) and solar thermal electricity net generation in the electric power sector (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6). See Table 10.5.

^d Wind electricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6).

^e Wood and wood-derived fuels.

^f Municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural byproducts, and other biomass. Through 2000, also includes non-renewable waste (municipal solid waste from non-biogenic sources, and

tire-derived fuels).

^g Through 1988, data are for electric utilities only. Beginning in 1989, data are for electric utilities and independent power producers.

R=Revised. NA=Not available. (s)=Less than 0.5 trillion Btu.

Notes: • The electric power sector comprises electricity-only and combined-heat-and-power (CHP) plants within the NAICS 22 category whose primary business is to sell electricity, or electricity and heat, to the public. • Totals may not equal sum of components due to independent rounding. • Geographic coverage is the 50 states and the District of Columbia.

Web Page: See <http://www.eia.gov/totalenergy/data/monthly/#renewable> (Excel and CSV files) for all available annual data beginning in 1949 and monthly data beginning in 1973.

Sources: Tables 7.2b, 7.4b, and A6.

Table 10.3 Fuel Ethanol Overview

	Feed-stock ^a	Losses and Co-products ^b	Denaturant ^c	Production ^d			Trade ^d		Stocks ^{d,f}	Stock Change ^{d,g}	Consumption ^d			Consumption Minus Denaturant ^h			
							Net Imports ^e	Mbbbl							Mbbbl	MMgal	Tbtu
Tbtu	Tbtu	Mbbbl	Mbbbl	MMgal	Tbtu	Mbbbl	Mbbbl	Mbbbl	Mbbbl	MMgal	Tbtu	Tbtu					
1981 Total	13	6	40	1,978	83	7	NA	NA	NA	1,978	83	7	7				
1985 Total	93	42	294	14,693	617	52	NA	NA	NA	14,693	617	52	51				
1990 Total	111	49	356	17,802	748	63	NA	NA	NA	17,802	748	63	62				
1995 Total	198	86	647	32,325	1,358	115	387	2,186	-207	32,919	1,383	117	114				
2000 Total	233	99	773	38,627	1,622	138	116	3,400	-624	39,367	1,653	140	137				
2001 Total	253	108	841	42,028	1,765	150	315	4,298	898	41,445	1,741	148	144				
2002 Total	307	130	1,019	50,956	2,140	182	306	6,200	1,902	49,360	2,073	176	171				
2003 Total	400	168	1,335	66,772	2,804	238	292	5,978	-222	67,286	2,826	240	233				
2004 Total	482	201	1,621	81,058	3,404	289	3,542	6,002	24	84,576	3,552	301	293				
2005 Total	550	227	1,859	92,961	3,904	331	3,234	5,563	-439	96,634	4,059	344	335				
2006 Total	683	280	2,326	116,294	4,884	414	17,408	8,760	3,197	130,505	5,481	465	453				
2007 Total	907	368	3,105	155,263	6,521	553	10,457	10,535	1,775	163,945	6,886	584	569				
2008 Total	1,286	518	4,433	221,637	9,309	790	12,610	14,226	3,691	230,556	9,683	821	800				
2009 Total	1,503	602	5,688	260,424	10,938	928	4,720	16,594	2,368	262,776	11,037	936	910				
2010 Total	1,823	726	6,506	316,617	13,298	1,127	-9,115	17,941	1,347	306,155	12,858	1,090	1,061				
2011 Total	1,904	754	6,649	331,646	13,929	1,181	-24,365	18,238	297	306,984	12,893	1,093	1,065				
2012 Total	1,801	709	6,264	314,714	13,218	1,120	-5,891	20,350	2,112	306,711	12,882	1,092	1,064				
2013 Total	1,805	707	6,181	316,493	13,293	1,126	-5,761	16,424	-3,926	314,658	13,216	1,120	1,092				
2014 January	160	62	558	28,194	1,184	100	-2,024	17,153	729	25,441	1,069	91	88				
February	144	56	498	25,269	1,061	90	-1,473	16,865	-288	24,084	1,012	86	84				
March	160	62	544	28,120	1,181	100	-1,985	17,310	445	25,690	1,079	91	89				
April	158	61	551	27,733	1,165	99	-1,202	17,610	300	26,231	1,102	93	91				
May	164	64	565	28,888	1,213	103	-704	18,330	720	27,464	1,153	98	95				
June	163	63	524	28,629	1,202	102	-1,278	18,785	455	26,896	1,130	96	93				
July	167	65	542	29,413	1,235	105	-1,495	18,696	-89	28,007	1,176	100	97				
August	163	64	534	28,665	1,204	102	-1,283	18,218	-478	27,860	1,170	99	97				
September	158	62	509	27,807	1,168	99	-1,346	18,724	506	25,955	1,090	92	90				
October	163	64	502	28,644	1,203	102	-1,919	17,341	-1,383	28,108	1,181	100	98				
November	163	63	540	28,588	1,201	102	-2,081	17,035	-306	26,813	1,126	95	93				
December	175	68	609	30,831	1,295	110	-1,580	18,739	1,704	27,547	1,157	98	96				
Total	1,938	755	6,476	340,781	14,313	1,212	-18,371	18,739	2,315	320,095	13,444	1,139	1,111				
2015 January	169	65	589	29,770	1,250	106	-1,633	20,647	1,908	26,229	1,102	93	91				
February	152	59	534	26,814	1,126	95	-1,623	21,057	410	24,781	1,041	88	86				
March	167	65	567	29,485	1,238	105	-2,050	20,878	-179	27,614	1,160	98	96				
April	158	61	527	27,910	1,172	99	-1,504	20,854	-24	26,430	1,110	94	92				
May	168	65	545	29,666	1,246	106	-1,489	20,154	-700	28,877	1,213	103	100				
June	168	65	528	29,684	1,247	106	-1,490	20,128	-26	28,220	1,185	100	98				
July	172	66	539	30,249	1,270	108	-1,675	19,701	-427	29,001	1,218	103	101				
August	169	65	524	29,762	1,250	106	-905	19,390	-311	29,168	1,225	104	101				
September	162	63	519	28,571	1,200	102	-987	18,944	-446	28,030	1,177	100	97				
October	169	66	560	29,886	1,255	106	-1,579	18,984	40	28,267	1,187	101	98				
November	168	65	580	29,675	1,246	106	-929	20,099	1,115	27,631	1,161	98	96				
December	176	68	624	31,081	1,305	111	-1,767	21,596	1,497	27,817	1,168	99	96				
Total	1,998	774	6,636	352,553	14,807	1,254	-17,632	21,596	2,857	332,064	13,947	1,181	1,153				
2016 January	171	66	615	30,319	1,273	108	-2,073	23,168	ⁱ 1,730	26,516	1,114	94	92				
February	162	62	583	28,678	1,204	102	-1,595	23,004	-164	27,247	1,144	97	94				
March	174	67	600	30,812	1,294	110	-2,268	22,301	-703	29,247	1,228	104	101				
April	158	61	554	28,059	1,178	100	-2,273	20,992	-1,309	27,095	1,138	96	94				
May	171	66	584	30,228	1,270	108	-1,327	20,792	-200	29,101	1,222	104	101				
June	171	66	564	30,258	1,271	108	-858	21,199	407	28,993	1,218	103	101				
July	177	68	565	31,251	1,313	111	-1,338	21,167	-32	29,945	1,258	107	104				
August	179	69	560	31,669	1,330	113	-1,601	21,042	-125	30,193	1,268	107	105				
September	169	65	542	29,876	1,255	106	-2,342	20,605	-437	27,971	1,175	100	97				
9-Month Total	1,531	589	5,167	271,150	11,388	965	-15,676	20,605	-833	256,307	10,765	912	890				
2015 9-Month Total	1,485	575	4,872	261,911	11,000	932	-13,357	18,944	205	248,349	10,431	884	863				
2014 9-Month Total	1,437	560	4,825	252,718	10,614	899	-12,792	18,724	2,300	237,626	9,980	845	825				

^a Total corn and other biomass inputs to the production of undenatured ethanol used for fuel ethanol.

^b Losses and co-products from the production of fuel ethanol. Does not include natural gas, electricity, and other non-biomass energy used in the production of fuel ethanol—these are included in the industrial sector consumption statistics for the appropriate energy source.

^c The amount of denaturant in fuel ethanol produced.

^d Includes denaturant.

^e Through 2009, data are for fuel ethanol imports only; data for fuel ethanol exports are not available. Beginning in 2010, data are for fuel ethanol imports minus fuel ethanol (including industrial alcohol) exports.

^f Stocks are at end of period.

^g A negative value indicates a decrease in stocks and a positive value indicates an increase.

^h Consumption of fuel ethanol minus denaturant. Data for fuel ethanol minus denaturant are used to develop data for "Renewable Energy/Biomass" in Tables 10.1–10.2b, as well as in Sections 1 and 2.

ⁱ Derived from the preliminary 2015 stocks value (21,438 thousand barrels), not the final 2015 value (21,596 thousand barrels) that is shown under "Stocks."

NA=Not available.

Notes: • Mbbbl = thousand barrels. MMgal = million U.S. gallons. Tbtu = trillion Btu. • Fuel ethanol data in thousand barrels are converted to million gallons by multiplying by 0.042, and are converted to Btu by multiplying by the approximate heat content of fuel ethanol—see Table A3. • Through 1980, data are not available. For 1981–1992, data are estimates. For 1993–2008, only data for feedstock, losses and co-products, and denaturant are estimates. Beginning in 2009, only data for feedstock, and losses and co-products, are estimates. • See "Denaturant," "Ethanol," "Fuel Ethanol," and "Fuel Ethanol Minus Denaturant" in Glossary. • Totals may not equal sum of components due to independent rounding. • Geographic coverage is the 50 states and the District of Columbia.

Web Page: See <http://www.eia.gov/totalenergy/data/monthly/#renewable> (Excel and CSV files) for all available annual and monthly data beginning in 1981.

Sources: See end of section.

Table 10.4 Biodiesel and Other Renewable Fuels Overview

	Biodiesel													Other Renewable Fuels ^f
	Feedstock ^a	Losses and Co-products ^b	Production			Trade			Stocks ^d	Stock Change ^e	Consumption			
						Imports	Exports	Net Imports ^c						
			TBtu	TBtu	Mbbl	MMgal	TBtu	Mbbl			Mbbl	Mbbl	Mbbl	
2001 Total	1	(s)	204	9	1	81	41	40	NA	NA	244	10	1	NA
2002 Total	1	(s)	250	10	1	197	57	140	NA	NA	390	16	2	NA
2003 Total	2	(s)	338	14	2	97	113	-17	NA	NA	322	14	2	NA
2004 Total	4	(s)	666	28	4	101	128	-27	NA	NA	639	27	3	NA
2005 Total	12	(s)	2,162	91	12	214	213	1	NA	NA	2,163	91	12	NA
2006 Total	32	(s)	5,963	250	32	1,105	856	250	NA	NA	6,213	261	33	NA
2007 Total	63	1	11,662	490	62	3,455	6,696	-3,241	NA	NA	8,422	354	45	NA
2008 Total	88	1	16,145	678	87	7,755	16,673	-8,918	NA	NA	7,228	304	39	NA
2009 Total	67	1	12,281	516	66	1,906	6,546	-4,640	711	711	^g 7,663	322	41	(s)
2010 Total	44	1	8,177	343	44	564	2,588	-2,024	672	-39	6,192	260	33	(s)
2011 Total	125	2	23,035	967	123	890	1,799	-908	2,005	^h 1,028	21,099	886	113	(s)
2012 Total	128	2	23,588	991	126	853	3,056	-2,203	1,984	-20	21,406	899	115	3
2013 Total	176	2	32,368	1,359	173	8,152	4,675	3,477	3,810	1,825	34,020	1,429	182	24
2014 January	9	(s)	1,727	73	9	222	134	88	3,708	-101	1,916	80	10	2
February	10	(s)	1,801	76	10	161	141	20	3,726	18	1,803	76	10	1
March	13	(s)	2,361	99	13	240	91	149	3,604	-122	2,632	111	14	2
April	12	(s)	2,223	93	12	135	261	-126	3,402	-202	2,299	97	12	3
May	14	(s)	2,531	106	14	133	208	-75	3,135	-267	2,724	114	15	2
June	14	(s)	2,645	111	14	235	263	-28	2,798	-337	2,953	124	16	(s)
July	16	(s)	2,926	123	16	493	320	173	3,089	291	2,808	118	15	2
August	16	(s)	2,987	125	16	571	264	307	2,786	-304	3,597	151	19	2
September	15	(s)	2,754	116	15	352	136	216	2,293	-492	3,462	145	19	1
October	16	(s)	2,928	123	16	507	40	467	2,641	347	3,048	128	16	2
November	14	(s)	2,610	110	14	989	65	924	3,084	444	3,091	130	17	(s)
December	16	(s)	2,958	124	16	540	51	489	3,131	46	3,401	143	18	1
Total	165	2	30,452	1,279	163	4,578	1,974	2,604	3,131	-679	33,735	1,417	181	18
2015 January	9	(s)	1,727	73	9	372	22	350	4,032	902	1,176	49	6	(s)
February	10	(s)	1,851	78	10	526	23	503	4,245	212	2,141	90	11	1
March	13	(s)	2,326	98	12	340	191	149	4,244	(s)	2,475	104	13	2
April	14	(s)	2,568	108	14	330	240	90	4,071	-173	2,831	119	15	2
May	15	(s)	2,784	117	15	336	255	81	3,599	-471	3,337	140	18	2
June	16	(s)	2,901	122	16	673	260	413	3,063	-536	3,850	162	21	2
July	16	(s)	2,883	121	15	1,157	255	902	3,404	341	3,444	145	18	3
August	16	(s)	2,933	123	16	961	275	686	3,333	-71	3,690	155	20	2
September	13	(s)	2,479	104	13	1,062	200	862	3,021	-312	3,652	153	20	3
October	14	(s)	2,535	106	14	863	161	702	3,070	48	3,189	134	17	3
November	14	(s)	2,521	106	14	701	76	625	3,600	530	2,616	110	14	3
December	14	(s)	2,573	108	14	1,078	133	945	3,943	343	3,174	133	17	3
Total	163	2	30,080	1,263	161	8,399	2,091	6,308	3,943	813	35,575	1,494	191	25
2016 January	14	(s)	2,490	105	13	211	42	169	4,036	ⁱ 221	2,437	102	13	1
February	14	(s)	2,503	105	13	287	55	232	3,937	-99	2,834	119	15	2
March	15	(s)	2,829	119	15	437	234	203	3,923	-14	3,046	128	16	3
April	15	(s)	2,827	119	15	891	246	645	4,175	253	3,219	135	17	1
May	17	(s)	3,169	133	17	1,117	334	783	4,062	-113	4,065	171	22	2
June	17	(s)	3,205	135	17	1,575	220	1,355	4,735	672	3,888	163	21	3
July	18	(s)	3,330	140	18	1,681	250	1,431	4,444	-291	5,053	212	27	1
August	18	(s)	3,385	142	18	1,829	234	1,595	4,267	-177	5,157	217	28	2
September	17	(s)	3,131	132	17	1,793	150	1,643	4,212	-54	4,829	203	26	3
9-Month Total	146	2	26,869	1,128	144	9,821	1,765	8,056	4,212	398	34,527	1,450	185	19
2015 9-Month Total	122	2	22,451	943	120	5,757	1,721	4,036	3,021	-109	26,596	1,117	143	16
2014 9-Month Total	119	2	21,955	922	118	2,542	1,819	723	2,293	-1,516	24,194	1,016	130	15

^a Total vegetable oil and other biomass inputs to the production of biodiesel—calculated by multiplying biodiesel production by 5.433 million Btu per barrel. See "Biodiesel Feedstock" entry in the "Thermal Conversion Factor Source Documentation" at the end of Appendix A.

^b Losses and co-products from the production of biodiesel. Does not include natural gas, electricity, and other non-biomass energy used in the production of biodiesel—these are included in the industrial sector consumption statistics for the appropriate energy source.

^c Net imports equal imports minus exports.

^d Stocks are at end of period. Through 2010, includes stocks at bulk terminals only. Beginning in 2011, includes stocks at bulk terminals and biodiesel production plants.

^e A negative value indicates a decrease in stocks and a positive value indicates an increase.

^f Imports minus stock change of other renewable diesel fuel and other renewable fuels. See "Renewable Diesel Fuel (Other)" and "Renewable Fuels (Other)" in Glossary.

^g In 2009, because of incomplete data coverage and differing data sources, a "Balancing Item" amount of 733 thousand barrels (653 thousand barrels in January

2009; 80 thousand barrels in February 2009) is used to balance biodiesel supply and disposition.

^h Derived from the final 2010 stocks value for bulk terminals and biodiesel production plants (977 thousand barrels), not the final 2010 value for bulk terminals only (672 thousand barrels) that is shown under "Stocks."

ⁱ Derived from the preliminary 2015 stocks value (3,815 thousand barrels), not the final 2015 value (3,943 thousand barrels) that is shown under "Stocks."

NA=Not available. (s)=Less than 0.5 trillion Btu and greater than -0.5 trillion Btu. Notes: • Mbbl = thousand barrels. MMgal = million U.S. gallons. TBtu = trillion Btu. • Biodiesel data in thousand barrels are converted to million gallons by multiplying by 0.042, and are converted to Btu by multiplying by 5.359 million Btu per barrel (the approximate heat content of biodiesel—see Table A1). • Through 2000, data are not available. Beginning in 2001, data not from U.S. Energy Information Administration (EIA) surveys are estimates. • Totals may not equal sum of components due to independent rounding. • Geographic coverage is the 50 states and the District of Columbia.

Web Page: See <http://www.eia.gov/totalenergy/data/monthly/#renewable> (Excel and CSV files) for all available annual and monthly data beginning in 2001.

Sources: See end of section.

Table 10.5 Solar Energy Consumption
(Trillion Btu)

	Distributed ^a Solar Energy ^b					Utility-Scale ^c Solar Energy ^d					Total ^k
	Heat ^f	Electricity ^d				Total ^g	Electricity ^e				
		Residential Sector	Commercial Sector	Industrial Sector	Total		Commercial Sector ^h	Industrial Sector ⁱ	Electric Power Sector ^j	Total	
1985 Total	NA	NA	NA	NA	NA	NA	NA	NA	(s)	(s)	(s)
1990 Total	55	(s)	(s)	(s)	55	—	—	4	4	4	59
1995 Total	63	(s)	(s)	(s)	63	—	—	5	5	5	68
2000 Total	57	(s)	1	(s)	58	—	—	5	5	5	63
2001 Total	55	(s)	1	(s)	56	—	—	6	6	6	62
2002 Total	53	1	1	(s)	54	—	—	6	6	6	60
2003 Total	51	1	1	(s)	53	—	—	5	5	5	58
2004 Total	50	1	1	(s)	53	—	—	6	6	6	58
2005 Total	49	1	2	(s)	52	—	—	6	6	6	58
2006 Total	51	2	2	1	56	—	—	5	5	5	61
2007 Total	53	2	3	1	59	—	—	6	6	6	65
2008 Total	54	4	6	1	65	(s)	—	9	9	9	74
2009 Total	55	5	7	2	69	(s)	—	9	9	9	78
2010 Total	56	9	11	3	79	(s)	(s)	12	12	12	90
2011 Total	58	13	19	4	93	1	(s)	17	18	18	111
2012 Total	59	20	30	7	116	1	(s)	40	41	41	157
2013 Total	61	31	38	8	138	3	(s)	83	86	86	225
2014 January	3	2	3	1	6	9	(s)	(s)	7	7	17
February	4	3	3	1	6	10	(s)	(s)	8	8	18
March	5	4	4	1	9	14	(s)	(s)	12	13	26
April	5	4	4	1	9	15	(s)	(s)	14	14	29
May	6	4	5	1	10	16	(s)	(s)	16	17	33
June	6	5	5	1	10	17	(s)	(s)	18	18	35
July	6	5	5	1	11	17	(s)	(s)	17	17	34
August	6	5	5	1	11	17	(s)	(s)	17	18	35
September	6	4	4	1	10	16	(s)	(s)	17	17	33
October	5	4	4	1	9	15	(s)	(s)	16	16	31
November	4	4	3	1	8	12	(s)	(s)	13	13	25
December	4	3	3	1	7	12	(s)	(s)	10	10	21
Total	62	47	49	11	107	169	4	(s)	165	168	337
2015 January	3	3	3	1	7	10	(s)	(s)	11	R 11	R 21
February	4	R 3	R 3	1	8	11	(s)	(s)	R 14	R 14	R 25
March	5	5	R 4	1	11	16	(s)	(s)	R 19	R 19	R 35
April	6	6	5	1	12	R 17	R (s)	(s)	R 22	R 22	R 40
May	6	6	5	1	13	R 19	R (s)	(s)	R 23	R 23	R 43
June	6	R 6	5	1	13	R 19	R (s)	(s)	R 23	R 24	R 43
July	7	7	6	1	14	21	R (s)	(s)	R 24	R 24	R 45
August	7	7	5	1	14	R 20	R (s)	(s)	R 25	R 25	R 45
September	6	6	5	1	R 12	R 18	(s)	(s)	R 20	R 21	R 39
October	5	6	4	1	11	17	(s)	(s)	R 17	R 18	R 34
November	4	5	3	1	9	14	(s)	(s)	R 16	R 16	R 30
December	4	4	3	1	9	13	(s)	(s)	R 14	15	R 27
Total	64	R 65	R 53	14	R 132	R 195	R 4	(s)	R 228	R 232	R 427
2016 January	3	5	4	1	10	13	(s)	(s)	14	R 14	R 27
February	4	6	R 4	1	11	15	(s)	(s)	R 22	R 22	R 37
March	5	8	6	1	15	20	(s)	(s)	R 24	R 25	R 45
April	6	9	6	2	R 16	22	(s)	(s)	R 27	R 27	R 49
May	6	10	7	2	18	R 24	R (s)	(s)	R 32	R 33	R 57
June	6	10	7	2	19	25	1	(s)	R 32	R 33	R 58
July	7	11	7	2	R 19	26	1	(s)	R 37	R 38	R 63
August	7	10	7	2	19	R 25	1	(s)	R 36	R 36	R 61
September	6	9	6	2	17	23	1	(s)	33	34	56
9-Month Total	50	77	53	13	143	193	4	(s)	257	261	455
2015 9-Month Total	50	50	42	11	103	153	3	(s)	180	183	336
2014 9-Month Total	48	36	39	8	83	131	3	(s)	126	129	260

^a Data are estimates for distributed (small-scale) facilities (combined generator nameplate capacity less than 1 megawatt).

^b See "Photovoltaic Energy" and "Solar Thermal Energy" in Glossary.

^c Data are for utility-scale facilities (combined generator nameplate capacity of 1 megawatt or more).

^d Solar photovoltaic (PV) electricity generation at distributed (small-scale) facilities connected to the electric power grid (converted to Btu by multiplying by the fossil fuels heat rate factors in Table A6).

^e Solar photovoltaic (PV) and solar thermal electricity net generation at utility-scale facilities (converted to Btu by multiplying by the fossil fuels heat rate factors in Table A6).

^f Solar thermal direct use energy in the residential, commercial, and industrial sectors for all end uses, such as pool heating, hot water heating, and space heating.

^g Data are the sum of "Distributed Solar Energy Heat" and "Distributed Solar Energy Electricity."

^h Commercial combined-heat-and-power (CHP) and commercial electricity-only plants. See Note 2, "Classification of Power Plants Into Energy-Use Sectors," at end of Section 7.

ⁱ Industrial combined-heat-and-power (CHP) and industrial electricity-only plants. See Note 2, "Classification of Power Plants Into Energy-Use Sectors," at end of Section 7.

^j Electricity-only and combined-heat-and-power (CHP) plants within the NAICS 22 category whose primary business is to sell electricity, or electricity and heat, to the public. Through 1988, data are for electric utilities only; beginning in 1989, data are for electric utilities and independent power producers.

^k Data are the sum of "Distributed Solar Energy Total" and "Utility-Scale Solar Energy Total."

R=Revised. NA=Not available. —=No data reported. (s)=Less than 0.5 trillion Btu.

Notes: • Distributed (small-scale) solar energy data for all years, and utility-scale solar energy data for the current two years, are estimates. • Totals may not equal sum of components due to independent rounding. • Geographic coverage is the 50 states and the District of Columbia.

Web Page: See <http://www.eia.gov/totalenergy/data/monthly/#renewable> (Excel and CSV files) for all available annual and monthly data beginning in 1984.

Sources: See end of section.

Table 10.6 Solar Electricity Net Generation
(Million Kilowatthours)

	Distributed ^a Solar Generation ^b				Utility-Scale ^c Solar Generation ^b				Total
	Residential Sector	Commercial Sector	Industrial Sector	Total	Commercial Sector ^d	Industrial Sector ^e	Electric Power Sector ^f	Total	
1985 Total	NA	NA	NA	NA	NA	NA	11	11	11
1990 Total	12	17	4	32	—	—	367	367	399
1995 Total	20	29	6	55	—	—	497	497	552
2000 Total	39	55	12	106	—	—	493	493	600
2001 Total	47	67	15	129	—	—	543	543	671
2002 Total	56	79	18	152	—	—	555	555	707
2003 Total	65	92	20	178	—	—	534	534	712
2004 Total	80	115	25	220	—	—	575	575	796
2005 Total	121	172	38	331	—	—	550	550	881
2006 Total	176	251	56	482	—	—	508	508	990
2007 Total	249	354	78	681	—	—	612	612	1,293
2008 Total	400	569	126	1,094	(s)	—	864	864	1,959
2009 Total	537	764	169	1,471	(s)	—	891	891	2,362
2010 Total	888	1,168	259	2,314	5	2	1,206	1,212	3,526
2011 Total	1,317	1,906	422	3,645	84	7	1,727	1,818	5,463
2012 Total	2,050	3,162	700	5,913	148	14	4,164	4,327	10,239
2013 Total	3,231	4,015	889	8,134	294	17	8,724	9,036	17,170
2014 January	263	300	62	624	16	1	734	751	1,375
February	277	322	65	664	20	1	814	835	1,499
March	382	432	93	907	29	1	1,286	1,317	2,224
April	421	467	101	988	33	2	1,453	1,487	2,476
May	468	512	111	1,092	38	2	1,710	1,750	2,842
June	478	510	113	1,101	39	2	1,883	1,923	3,024
July	502	529	117	1,149	38	2	1,748	1,788	2,936
August	503	520	116	1,139	39	2	1,839	1,879	3,019
September	472	469	106	1,046	35	2	1,795	1,832	2,879
October	445	419	100	965	36	1	1,680	1,717	2,682
November	373	338	81	792	28	1	1,351	1,380	2,171
December	363	329	74	766	20	1	1,011	1,032	1,798
Total	4,947	5,146	1,139	11,233	371	16	17,304	17,691	28,924
2015 January	340	327	80	746	R 20	R 1	R 1,134	R 1,155	R 1,902
February	375	356	85	816	R 23	R 1	R 1,459	R 1,484	R 2,299
March	536	479	119	1,134	R 33	R 2	R 2,037	R 2,072	R 3,206
April	609	525	129	1,264	R 39	R 2	R 2,338	R 2,379	R 3,643
May	676	574	144	1,394	R 46	R 2	R 2,456	R 2,504	R 3,898
June	693	571	144	1,408	R 43	R 2	R 2,512	R 2,558	R 3,966
July	741	596	150	1,487	R 45	R 2	R 2,579	R 2,627	R 4,114
August	746	575	147	1,468	R 46	R 2	R 2,639	R 2,688	R 4,156
September	679	515	135	1,330	R 37	R 2	R 2,178	R 2,217	R 3,547
October	618	455	125	1,198	R 32	2	R 1,875	R 1,910	R 3,107
November	515	367	100	982	R 27	R 1	R 1,702	R 1,730	R 2,712
December	471	349	93	914	R 24	R 1	R 1,545	R 1,570	R 2,484
Total	6,999	5,689	1,451	14,139	R 416	R 21	R 24,456	R 24,893	R 39,032
2016 January	R 515	R 407	R 99	R 1,021	R 23	NM	R 1,469	R 1,492	R 2,514
February	R 615	R 465	R 109	R 1,190	R 44	NM	R 2,357	R 2,404	R 3,593
March	R 826	R 605	R 152	R 1,583	R 46	NM	R 2,618	R 2,667	R 4,250
April	R 942	R 657	R 165	R 1,764	R 44	NM	R 2,851	R 2,897	R 4,661
May	R 1,048	R 715	R 183	R 1,946	R 53	NM	R 3,483	R 3,539	R 5,485
June	R 1,089	R 719	R 184	R 1,993	R 61	NM	R 3,480	R 3,544	R 5,537
July	R 1,137	R 740	R 191	R 2,068	R 68	NM	R 3,953	R 4,024	R 6,092
August	R 1,106	R 714	R 188	R 2,008	R 58	NM	R 3,816	R 3,877	R 5,885
September	981	641	170	1,792	55	3	3,555	3,613	5,405
9-Month Total	8,259	5,665	1,440	15,364	452	24	27,582	28,058	43,422
2015 9-Month Total	5,395	4,518	1,133	11,046	333	17	19,333	19,684	30,729
2014 9-Month Total	3,766	4,059	884	8,710	287	13	13,263	13,563	22,273

^a Data are estimates for solar photovoltaic (PV) electricity generation at small-scale facilities (combined generator nameplate capacity less than 1 megawatt) connected to the electric power grid.

^b See "Photovoltaic Energy" and "Solar Thermal Energy" in Glossary.

^c Solar photovoltaic (PV) and solar thermal electricity net generation at utility-scale facilities (combined generator nameplate capacity of 1 megawatt or more).

^d Commercial combined-heat-and-power (CHP) and commercial electricity-only plants. See Note 2, "Classification of Power Plants Into Energy-Use Sectors," at end of Section 7.

^e Industrial combined-heat-and-power (CHP) and industrial electricity-only plants. See Note 2, "Classification of Power Plants Into Energy-Use Sectors," at end of Section 7.

^f Electricity-only and combined-heat-and-power (CHP) plants within the NAICS 22 category whose primary business is to sell electricity, or electricity and heat, to the public. Through 1988, data are for electric utilities only; beginning in 1989, data are for electric utilities and independent power producers.

R=Revised. NA=Not available. NM=Not meaningful due to large standard error. —=No data reported. (s)=Less than 0.5 million kilowatthours.

Notes: • Distributed (small-scale) solar generation data for all years, and utility-scale solar energy data for the current two years, are estimates. • Totals may not equal sum of components due to independent rounding. • Geographic coverage is the 50 states and the District of Columbia.

Web Page: See <http://www.eia.gov/totalenergy/data/monthly/#renewable> (Excel and CSV files) for all available annual and monthly data beginning in 1984.

Sources: • **Distributed Solar Generation: 1989–2013**—Calculated as distributed solar energy consumption (see Table 10.5) divided by the total fossil fuels heat rate factors (see Table A6). **2014 forward**—U.S. Energy Information Administration (EIA), *Electric Power Monthly*, monthly reports, Tables 1.1, 1.2.C, 1.2.D, and 1.2.E. • **Utility-Scale Solar Generation: 1984–1988**—EIA, Form EIA-759, "Monthly Power Plant Report." **1989–1997**: EIA, Form EIA-759, "Monthly Power Plant Report," and Form EIA-867, "Annual Nonutility Power Producer Report." **1998–2000**: EIA, Form EIA-759, "Monthly Power Plant Report," and Form EIA-860B, "Annual Electric Generator Report—Nonutility." **2001–2003**: EIA, Form EIA-906, "Power Plant Report." **2004–2007**: EIA, Form EIA-906, "Power Plant Report," and Form EIA-920, "Combined Heat and Power Plant Report." **2008 forward**: EIA, Form EIA-923, "Power Plant Operations Report." • **Total**: Calculated as distributed solar generation plus utility-scale solar generation.

Renewable Energy

Note. Renewable Energy Production and Consumption.

In Tables 1.1, 1.3, and 10.1, renewable energy consumption consists of: conventional hydroelectricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6); geothermal electricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6), and geothermal heat pump and geothermal direct use energy; solar thermal and photovoltaic electricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6), and solar thermal direct use energy; wind electricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6); wood and wood-derived fuels consumption; biomass waste (municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural byproducts, and other biomass) consumption; fuel ethanol (minus denaturant) and biodiesel consumption; and losses and co-products from the production of fuel ethanol and biodiesel. In Tables 1.1, 1.2, and 10.1, renewable energy production is assumed to equal consumption for all renewable energy sources except biofuels (biofuels production comprises biomass inputs to the production of fuel ethanol and biodiesel).

Table 10.2a Sources

Residential Sector, Geothermal

1989–2011: Annual estimates by the U.S. Energy Information Administration (EIA) based on data from Oregon Institute of Technology, Geo-Heat Center.

2012–2014: Annual estimates assumed by EIA to be equal to that of 2011.

2015 and 2016: Annual estimates are from EIA, *Short-Term Energy Outlook (STEO)*.

(For 1989 forward, monthly estimates are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month.)

Residential Sector, Solar

1989 forward: Residential sector solar consumption is the sum of the values for “Distributed Solar Energy Consumption: Heat” (which includes solar thermal direct use energy in the residential, commercial, and industrial sectors) from Table 10.5 and “Distributed Solar Energy Consumption: Electricity, Residential Sector” from Table 10.5.

Residential Sector, Wood

1949–1979: Annual estimates are from EIA, *Estimates of U.S. Wood Energy Consumption from 1949 to 1981*, Table A2.

1980–2013: Annual estimates are based on EIA, Form EIA-457, “Residential Energy Consumption Survey”; and National Oceanic and Atmospheric Administration regional heating degree-day data.

2014: Annual estimate assumed by EIA to be equal to that of 2013.

2015 and 2016: Annual estimates are from EIA, STEO. (For 1973 forward, monthly estimates are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month.)

Residential Sector, Total Renewable Energy

1949–1988: Residential sector total renewable energy consumption is equal to residential sector wood consumption.

1989 forward: Residential sector total renewable energy consumption is the sum of the residential sector consumption values for geothermal, solar, and wood.

Commercial Sector, Hydroelectric Power

1989 forward: Commercial sector conventional hydroelectricity net generation data from EIA, Form EIA-923, “Power Plant Operations Report,” and predecessor forms, are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.

Commercial Sector, Geothermal

1989–2011: Annual estimates by EIA based on data from Oregon Institute of Technology, Geo-Heat Center.

2012 forward: Annual estimates assumed by EIA to be equal to that of 2011.

(For 1989 forward, monthly estimates are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month.)

Commercial Sector, Solar

1989 forward: Commercial sector solar consumption is the sum of the values for “Distributed Solar Energy Consumption: Electricity, Commercial Sector” from Table 10.5 and “Utility-Scale Solar Energy Consumption: Electricity, Commercial Sector” from Table 10.5.

Commercial Sector, Wind

2009 forward: Commercial sector wind electricity net generation data from EIA, Form EIA-923, “Power Plant Operations Report,” are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.

Commercial Sector, Wood

1949–1979: Annual estimates are from EIA, *Estimates of U.S. Wood Energy Consumption from 1949 to 1981*, Table A2.

1980–1983: Annual estimates are from EIA, *Estimates of U.S. Wood Energy Consumption 1980–1983*, Table ES1.

1984: Annual estimate assumed by EIA to be equal to that of 1983.

1985–1988: Annual estimates interpolated by EIA.

(For 1973–1988, monthly estimates are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month.)

1989 forward: Monthly/annual commercial sector combined-heat-and-power (CHP) wood consumption data are from EIA, Form EIA-923, “Power Plant Operations Report,” and predecessor forms. Annual estimates for commercial sector

non-CHP wood consumption are based on EIA, Form EIA-871, "Commercial Buildings Energy Consumption Survey" (for 2014 forward, the annual estimates are assumed by EIA to be equal to that of 2013). For 1989 forward, monthly estimates for commercial sector non-CHP wood consumption are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month. Commercial sector total wood consumption is the sum of commercial sector CHP and non-CHP wood consumption.

Commercial Sector, Biomass Waste

1989 forward: Table 7.4c.

Commercial Sector, Fuel Ethanol (Minus Denaturant)

1981 forward: The commercial sector share of motor gasoline consumption is equal to commercial sector motor gasoline consumption from Table 3.7a divided by motor gasoline product supplied from Table 3.5. Commercial sector fuel ethanol (minus denaturant) consumption is equal to fuel ethanol (minus denaturant) consumption from Table 10.3 multiplied by the commercial sector share of motor gasoline consumption.

Commercial Sector, Total Biomass

1949–1980: Commercial sector total biomass consumption is equal to commercial sector wood consumption.

1981–1988: Commercial sector total biomass consumption is the sum of the commercial sector consumption values for wood and fuel ethanol (minus denaturant).

1989 forward: Commercial sector total biomass consumption is the sum of the commercial sector consumption values for wood, waste, and fuel ethanol (minus denaturant).

Commercial Sector, Total Renewable Energy

1949–1988: Commercial sector total renewable energy consumption is equal to commercial sector total biomass consumption.

1989–2007: Commercial sector total renewable energy consumption is the sum of the commercial sector consumption values for conventional hydroelectric power, geothermal, and total biomass.

2008: Commercial sector total renewable energy consumption is the sum of the commercial sector consumption values for conventional hydroelectric power, geothermal, solar, and total biomass.

2009 forward: Commercial sector total renewable energy is the sum of the commercial sector consumption values for conventional hydroelectric power, geothermal, solar, wind, and total biomass.

Table 10.2b Sources

Industrial Sector, Hydroelectric Power

1949 forward: Industrial sector conventional hydroelectricity net generation data from Table 7.2c are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.

Industrial Sector, Geothermal

1989–2009: Annual estimates by the U.S. Energy Information Administration (EIA) based on data from Oregon Institute of Technology, Geo-Heat Center.

2010 forward: Annual estimates assumed by EIA to be equal to that of 2009.

(For 1989 forward, monthly estimates are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month.)

Industrial Sector, Solar

1989 forward: Industrial sector solar consumption is the sum of the values for "Distributed Solar Energy Consumption: Electricity, Industrial Sector" from Table 10.5 and "Utility-Scale Solar Energy Consumption: Electricity, Industrial Sector" from Table 10.6.

Industrial Sector, Wind

2011 forward: Industrial sector wind electricity net generation data from EIA, Form EIA-923, "Power Plant Operations Report," are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.

Industrial Sector, Wood

1949–1979: Annual estimates are from EIA, *Estimates of U.S. Wood Energy Consumption from 1949 to 1981*, Table A2.

1980–1983: Annual estimates are from EIA, *Estimates of U.S. Wood Energy Consumption 1980–1983*, Table ES1.

1984: Annual estimate is from EIA, *Estimates of U.S. Biofuels Consumption 1990*, Table 1.

1985 and 1986: Annual estimates interpolated by EIA.

1987: Annual estimate is from EIA, *Estimates of Biofuels Consumption in the United States During 1987*, Table 2.

1988: Annual estimate interpolated by EIA.

(For 1973–1988, monthly estimates are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month.)

1989 forward: Monthly/annual industrial sector combined-heat-and-power (CHP) wood consumption data are from EIA, Form EIA-923, "Power Plant Operations Report," and predecessor forms. Annual estimates for industrial sector non-CHP wood consumption are based on EIA, Form EIA-846, "Manufacturing Energy Consumption Survey" (for 2014, the annual estimate is assumed by EIA to be equal to that of 2013; for 2015, the annual estimate is from EIA, STEO; for 2016, the annual estimate is assumed by EIA to be equal to that of 2015). For 1989 forward, monthly estimates for industrial sector non-CHP wood consumption are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month. Industrial sector total wood consumption is the sum of industrial sector CHP and non-CHP wood consumption.

Industrial Sector, Biomass Waste

1981: Annual estimate is calculated as total waste

consumption (from EIA, *Estimates of U.S. Biofuels Consumption 1990*, Table 8) minus electric power sector waste consumption (from MER Table 10.2c).

1982 and 1983: Annual estimates are calculated as total waste consumption (based on *Estimates of U.S. Biofuels Consumption 1990*, Table 8) minus electric power sector waste consumption (from MER, Table 10.2c).

1984: Annual estimate is calculated as total waste consumption (from EIA, *Estimates of U.S. Biofuels Consumption 1990*, Table 8) minus electric power sector waste consumption (from MER, Table 10.2c).

1985 and 1986: Annual estimates interpolated by EIA.

1987: Annual estimate is calculated as total waste consumption (from EIA, *Estimates of U.S. Biofuels Consumption 1990*, Table 8) minus electric power sector waste consumption (from MER, Table 10.2c).

1988: Annual estimate interpolated by EIA.

(For 1973–1988, monthly estimates are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month.)

1989 forward: Monthly/annual industrial sector combined-heat-and-power (CHP) consumption data are from Table 7.4c. Annual estimates for industrial sector non-CHP waste consumption are based on information presented in Government Advisory Associates, *Resource Recovery Yearbook* and *Methane Recovery Yearbook*, and information provided by the U.S. Environmental Protection Agency, Landfill Methane Outreach Program (for 2014, the annual estimate is assumed by EIA to be equal to that of 2013; for 2015, the annual estimate is from EIA, STEO; for 2016, the annual estimate is assumed by EIA to be equal to that of 2015). For 1989, forward, monthly estimates for industrial sector non-CHP waste consumption are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month. Industrial sector total waste consumption is the sum of industrial sector CHP and non-CHP waste consumption.

Industrial Sector, Fuel Ethanol (Minus Denaturant)

1981 forward: The industrial sector share of motor gasoline consumption is equal to industrial sector motor gasoline consumption from Table 3.7b divided by motor gasoline product supplied from Table 3.5. Industrial sector fuel ethanol (minus denaturant) consumption is equal to fuel ethanol (minus denaturant) consumption from Table 10.3 multiplied by the industrial sector share of motor gasoline consumption.

Industrial Sector, Biomass Losses and Co-products

1981 forward: Calculated as fuel ethanol losses and co-products from Table 10.3 plus biodiesel losses and co-products from Table 10.4.

Industrial Sector, Total Biomass

1949–1980: Industrial sector total biomass consumption is equal to industrial sector wood consumption.

1981 forward: Industrial sector total biomass consumption is the sum of the industrial sector consumption values for

wood, waste, fuel ethanol (minus denaturant), and biomass losses and co-products.

Industrial Sector, Total Renewable Energy

1949–1988: Industrial sector total renewable energy consumption is the sum of the industrial sector consumption values for conventional hydroelectric power and total biomass.

1989–2009: Industrial sector total renewable energy consumption is the sum of the industrial sector consumption values for conventional hydroelectric power, geothermal, and total biomass.

2010: Industrial sector total renewable energy consumption is the sum of the industrial sector consumption values for conventional hydroelectric power, geothermal, solar, and total biomass.

2011 forward: Industrial sector total renewable energy consumption is the sum of the industrial sector consumption values for conventional hydroelectric power, geothermal, solar, wind, and total biomass.

Transportation Sector, Fuel Ethanol (Minus Denaturant)

1981 forward: The transportation sector share of motor gasoline consumption is equal to transportation sector motor gasoline consumption from Table 3.7c divided by motor gasoline product supplied from Table 3.5. Transportation sector fuel ethanol (minus denaturant) consumption is equal to fuel ethanol (minus denaturant) consumption from Table 10.3 multiplied by the transportation sector share of motor gasoline consumption.

Transportation Sector, Biodiesel

2001 forward: Table 10.4. Transportation sector biodiesel consumption is assumed to equal total biodiesel consumption.

Transportation Sector, Other Renewable Fuels

2009 forward: Table 10.4.

Transportation Sector, Total Renewable Energy

1981–2000: Transportation sector total renewable energy consumption is equal to transportation sector fuel ethanol (minus denaturant) consumption.

2001–2008: Transportation sector total renewable energy consumption is the sum of the transportation sector consumption values for fuel ethanol (minus denaturant) and biodiesel.

2009 forward: Transportation sector total renewable energy consumption is the sum of the transportation sector consumption values for fuel ethanol (minus denaturant), biodiesel, and other renewable fuels.

Table 10.3 Sources

Feedstock

1981 forward: Calculated as fuel ethanol production (in thousand barrels) minus denaturant, and then multiplied by the fuel ethanol feedstock factor—see Table A3.

Losses and Co-products

1981 forward: Calculated as fuel ethanol feedstock plus denaturant minus fuel ethanol production.

Denaturant

1981–2008: Data in thousand barrels for petroleum denaturant in fuel ethanol produced are estimated as 2% of fuel ethanol production; these data are converted to Btu by multiplying by 4.645 million Btu per barrel (the estimated quantity-weighted factor of pentanes plus and conventional motor gasoline used as denaturant).

2009–2015: U.S. Energy Information Administration (EIA), *Petroleum Supply Annual (PSA)*, annual reports, Table 1. Data in thousand barrels for net production of pentanes plus at renewable fuels and oxygenate plants are multiplied by -1; these data are converted to Btu by multiplying by 4.620 million Btu per barrel (the approximate heat content of pentanes plus). Data in thousand barrels for net production of conventional motor gasoline and motor gasoline blending components at renewable fuels and oxygenate plants are multiplied by -1; these data are converted to Btu by multiplying by 5.253 million Btu per barrel (the approximate heat content of conventional motor gasoline). Total denaturant is the sum of the values for pentanes plus, conventional motor gasoline, and motor gasoline blending components.

2016: EIA, *Petroleum Supply Monthly (PSM)*, monthly reports, Table 1. Data in thousand barrels for net production of pentanes plus at renewable fuels and oxygenate plants are multiplied by -1; these data are converted to Btu by multiplying by 4.620 million Btu per barrel (the approximate heat content of pentanes plus). Data in thousand barrels for net production of conventional motor gasoline and motor gasoline blending components at renewable fuels and oxygenate plants are multiplied by -1; these data are converted to Btu by multiplying by 5.253 million Btu per barrel (the approximate heat content of conventional motor gasoline). Total denaturant is the sum of the values for pentanes plus, conventional motor gasoline, and motor gasoline blending components.

Production

1981–1992: Fuel ethanol production is assumed to equal fuel ethanol consumption—see sources for "Consumption."

1993–2004: Calculated as fuel ethanol consumption plus fuel ethanol stock change minus fuel ethanol net imports. These data differ slightly from the original production data from EIA, Form EIA-819, "Monthly Oxygenate Report," and predecessor form, which were not reconciled and updated to be consistent with the final balance.

2005–2008: EIA, Form EIA-819, "Monthly Oxygenate Report."

2009–2015: EIA, PSA, annual reports, Table 1, data for net production of fuel ethanol at renewable fuels and oxygenate plants.

2016: EIA, PSM, monthly reports, Table 1, data for net production of fuel ethanol at renewable fuels and oxygenate plants.

Trade, Stocks, and Stock Change

1992–2015: EIA, PSA, annual reports, Table 1.

2016: EIA, PSM, monthly reports, Table 1.

Consumption

1981–1989: EIA, *Estimates of U.S. Biofuels Consumption 1990*, Table 10; and interpolated values for 1982, 1983, 1985, 1986, and 1988.

1990–1992: EIA, *Estimates of U.S. Biomass Energy Consumption 1992*, Table D2; and interpolated value for 1991.

1993–2004: EIA, PSA, annual reports, Tables 2 and 16. Calculated as 10% of oxygenated finished motor gasoline field production (Table 2), plus fuel ethanol refinery input (Table 16).

2005–2008: EIA, PSA, annual reports, Tables 1 and 15. Calculated as motor gasoline blending components adjustments (Table 1), plus finished motor gasoline adjustments (Table 1), plus fuel ethanol refinery and blender net inputs (Table 15).

2009–2015: EIA, PSA, annual reports, Table 1. Calculated as fuel ethanol refinery and blender net inputs minus fuel ethanol adjustments.

2016: EIA, PSM, monthly reports, Table 1. Calculated as fuel ethanol refinery and blender net inputs minus fuel ethanol adjustments.

Consumption Minus Denaturant

1981 forward: Calculated as fuel ethanol consumption minus the amount of denaturant in fuel ethanol consumed. Denaturant in fuel ethanol consumed is estimated by multiplying denaturant in fuel ethanol produced by the fuel ethanol consumption-to-production ratio.

Table 10.4 Sources

Biodiesel Feedstock

2001 forward: Calculated as biodiesel production in thousand barrels multiplied by 5.433 million Btu per barrel (the biodiesel feedstock factor—see Table A3).

Biodiesel Losses and Co-products

2001 forward: Calculated as biodiesel feedstock minus biodiesel production.

Biodiesel Production

2001–2005: U.S. Department of Agriculture, Commodity Credit Corporation, Bioenergy Program records. Annual data are derived from quarterly data. Monthly data are estimated by dividing the annual data by the number of days in the year and then multiplying by the number of days in the month.

2006: U.S. Department of Commerce, U.S. Census Bureau, "M311K—Fats and Oils: Production, Consumption, and Stocks," data for soybean oil consumed in methyl esters (biodiesel). In addition, the U.S. Energy Information Administration (EIA) estimates that 14.4 million gallons of yellow grease were consumed in methyl esters (biodiesel).

2007: U.S. Department of Commerce, U.S. Census Bureau, “M311K—Fats and Oils: Production, Consumption, and Stocks,” data for all fats and oils consumed in methyl esters (biodiesel).

2008: EIA, *Monthly Biodiesel Production Report*, December 2009 (release date October 2010), Table 11. Monthly data for 2008 are estimated based on U.S. Department of Commerce, U.S. Census Bureau, M311K data, multiplied by the EIA 2008 annual value’s share of the M311K 2008 annual value.

2009 and 2010: EIA, *Monthly Biodiesel Production Report*, monthly reports, Table 1.

2011–2015: EIA, *Petroleum Supply Annual (PSA)*, annual reports, Table 1, data for renewable fuels except fuel ethanol.

2016: EIA, *Petroleum Supply Monthly (PSM)*, monthly reports, Table 1, data for renewable fuels except fuel ethanol.

Biodiesel Trade

2001–2011: For imports, U.S. Department of Agriculture, data for the following Harmonized Tariff Schedule codes: 3824.90.40.20, “Fatty Esters Animal/Vegetable Mixture” (data through June 2010); and 3824.90.40.30, “Biodiesel/Mixes” (data for July 2010–2011). For exports, U.S. Department of Agriculture, data for the following Schedule B codes: 3824.90.40.00, “Fatty Substances Animal/Vegetable/Mixture” (data through 2010); and 3824.90.40.30, “Biodiesel <70%” (data for 2011). (The data above are converted from pounds to gallons by dividing by 7.4.) Although these categories include products other than biodiesel (such as biodiesel coprocessed with petroleum feedstocks; and products destined for soaps, cosmetics, and other items), biodiesel is the largest component. In the absence of other reliable data for biodiesel trade, EIA sees these data as good substitutes.

2012–2015: EIA, PSA, annual reports, Tables 25 and 31, data for biomass-based diesel fuel.

2016: EIA, PSM, monthly reports, Tables 37 and 49, data for biomass-based diesel fuel.

Biodiesel Stocks and Stock Change

2009 forward: EIA, biodiesel data from EIA-22M, “Monthly Biodiesel Production Survey”; and biomass-based diesel fuel data from EIA-810, “Monthly Refinery Report,” EIA-812, “Monthly Product Pipeline Report,” and EIA-815, “Monthly Bulk Terminal and Blender Report.”

Biodiesel Consumption

2001–2008: Calculated as biodiesel production plus biodiesel net imports.

January and February 2009: EIA, PSA, Table 1, data for refinery and blender net inputs of renewable fuels except fuel ethanol.

March 2009 forward: Calculated as biodiesel production plus biodiesel net imports minus biodiesel stock change.

Other Renewable Fuels

2009 forward: Imports data for “Other Renewable Diesel Fuel” are from EIA, PSA Table 25 and PSM Table 37 (data are converted to Btu by multiplying by the other renewable diesel fuel heat content factor in Table A1). Imports data for “Other Renewable Fuels” are from EIA, PSA Table 25 and PSM Table 37 (data are converted to Btu by multiplying by the biodiesel heat content factor in Table A1). Stock change data for “Other Renewable Diesel Fuel” are from EIA, EIA-810, “Monthly Refinery Report,” EIA-812, “Monthly Product Pipeline Report,” and EIA-815, “Monthly Bulk Terminal and Blender Report” (data are converted to Btu by multiplying by the other renewable diesel heat content factor in Table A1). “Other Renewable Fuels” in Table 10.4 is calculated as other renewable diesel fuel imports plus other renewable fuels imports minus other renewable diesel fuel stock change.

Table 10.5 Sources

Distributed Solar Energy Consumption: Heat Annual Data

1989–2009: Annual estimates by the U.S. Energy Information Administration (EIA) based on EIA, Form EIA-63A, “Annual Solar Thermal Collector/Reflector Shipments Report.” Solar energy consumption by solar thermal non-electric applications (mainly in the residential sector, but with some in the commercial and industrial sectors) is based on assumptions about the stock of equipment in place and other factors.

2010 forward: Annual estimates based on commercial sector solar thermal growth rates from EIA’s *Annual Energy Outlook (AEO)* data system. (Annual estimates are subject to revision when a new AEO is released.)

Monthly Data

1989–2013: Monthly estimates for each year are obtained by allocating a given year’s annual value to the months in that year. Each month’s allocator is the average of that month’s “Distributed Solar Energy Consumption: Electricity, Total” values in 2014 and 2015. The allocators, when rounded, are as follows: January—5%; February—6%; March—8%; April—9%; May—10%; June—10%; July—10%; August—10%; September—9%; October—9%; November—7%; and December—7%.

2014 forward: Initial monthly estimates for each year are obtained as described above. Once all 12 months of “Distributed Solar Energy Consumption: Electricity, Total” data are available for a given year, they are used as allocators and applied to the annual estimate in order to revise the initial monthly estimates.

Distributed Solar Energy Consumption: Electricity, Residential Sector

Beginning in 2014, monthly and annual data for residential sector distributed (small-scale) solar photovoltaic generation

are from EIA, *Electric Power Monthly*, Table 1.2.E. Those data are converted to consumption data in Btu by multiplying by the total fossil fuels heat rate factors in MER Table A6.

Backcasts for earlier periods are developed as follows:

Annual Data

1989–2003: Annual growth rates are calculated based on distributed (small-scale) solar electricity consumption in all sectors. Consumption is estimated using information on shipments of solar panels from EIA, Form EIA-63B, “Annual Photovoltaic Cell/Module Shipments Report,” and assumptions about the stock of equipment in place and other factors. The growth rates are applied to more recent data to create historical annual estimates.

2004–2008: Annual growth rates based on commercial sector solar photovoltaic growth rates from EIA’s *Annual Energy Outlook (AEO)* data system are applied to more recent data to create historical annual estimates. (Annual estimates are subject to revision when a new AEO is released.)

2009–2013: Annual growth rates based on residential sector solar photovoltaic growth rates from EIA’s *Annual Energy Outlook (AEO)* data system are applied to more recent data to create historical annual estimates. (Annual estimates are subject to revision when a new AEO is released.)

Monthly Data

1989–2013: See “Distributed Solar Energy Consumption: Heat, Monthly Data.”

Distributed Solar Energy Consumption: Electricity, Commercial Sector

Beginning in 2014, monthly and annual data for commercial sector distributed (small-scale) solar photovoltaic generation are from EIA, *Electric Power Monthly*, Table 1.2.C. Those data are converted to consumption data in Btu by multiplying by the total fossil fuels heat rate factors in MER Table A6.

Backcasts for earlier periods are developed as follows:

Annual Data

1989–2003: Annual growth rates based on EIA, Form EIA-63B, “Annual Photovoltaic Cell/Module Shipments Report,” are applied to more recent data to create historical annual estimates. (See “Distributed Solar Energy Consumption: Electricity, Residential Sector” sources above for details.)

2004–2013: Annual growth rates based on commercial sector solar photovoltaic growth rates from EIA’s *Annual Energy Outlook (AEO)* data system are applied to more recent data to create historical annual estimates. (Annual estimates are subject to revision when a new AEO is released.)

Monthly Data

1989–2013: See “Distributed Solar Energy Consumption: Heat, Monthly Data.”

Distributed Solar Energy Consumption: Electricity, Industrial Sector

Beginning in 2014, monthly and annual data for industrial sector distributed (small-scale) solar photovoltaic generation

are from EIA, *Electric Power Monthly*, Table 1.2.D. Those data are converted to consumption data in Btu by multiplying by the total fossil fuels heat rate factors in MER Table A6.

Backcasts for earlier periods are developed as follows:

Annual Data

1989–2003: Annual growth rates based on EIA, Form EIA-63B, “Annual Photovoltaic Cell/Module Shipments Report,” are applied to more recent data to create historical annual estimates. (See “Distributed Solar Energy Consumption: Electricity, Residential Sector” sources above for details.)

2004–2013: Annual growth rates based on commercial sector solar photovoltaic growth rates from EIA’s *Annual Energy Outlook (AEO)* data system are applied to more recent data to create historical annual estimates. (Annual estimates are subject to revision when a new AEO is released.)

Monthly Data

1989–2013: See “Distributed Solar Energy Consumption: Heat, Monthly Data.”

Distributed Solar Energy Consumption: Electricity, Total

1989 forward: Distributed (small-scale) solar energy consumption for total electricity is the sum of the distributed solar energy consumption (for electricity) values for the residential, commercial, and industrial sectors.

Distributed Solar Energy Consumption: Total

1989 forward: Distributed (small-scale) solar energy consumption total is the sum of distributed solar energy consumption values for heat and total electricity.

Utility-Scale Solar Energy Consumption: Electricity, Commercial Sector

2008 forward: Commercial sector solar photovoltaic and solar thermal electricity net generation data from EIA, Form EIA-923, “Power Plant Operations Report,” are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.

Utility-Scale Solar Energy Consumption: Electricity, Industrial Sector

2010 forward: Industrial sector solar photovoltaic and solar thermal electricity net generation data from EIA, Form EIA-923, “Power Plant Operations Report,” are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.

Utility-Scale Solar Energy Consumption: Electricity, Electric Power Sector

1984 forward: Electric power sector solar photovoltaic and solar thermal electricity net generation data from Table 7.2b are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.

Utility-Scale Solar Energy Consumption: Electricity, Total

1984 forward: Utility-scale solar energy consumption for total electricity is the sum of the utility-scale solar energy consumption (for electricity) values for the commercial, industrial, and electric power sectors.

Solar Energy Consumption: Total

1984 forward: Total solar energy consumption is the sum of the values for total distributed solar energy consumption and total utility-scale solar energy consumption.

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