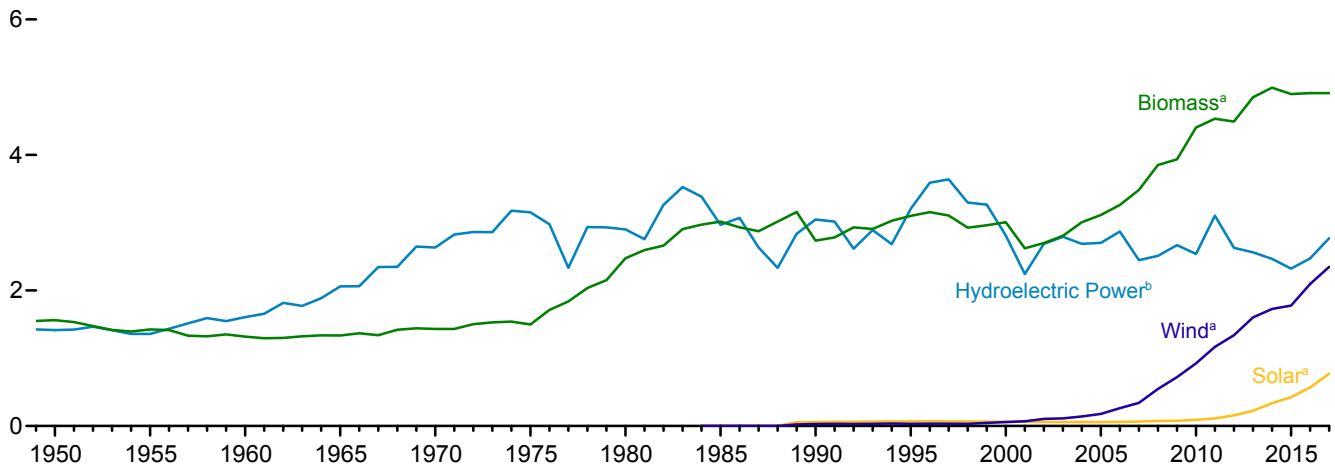


# 10. Renewable Energy

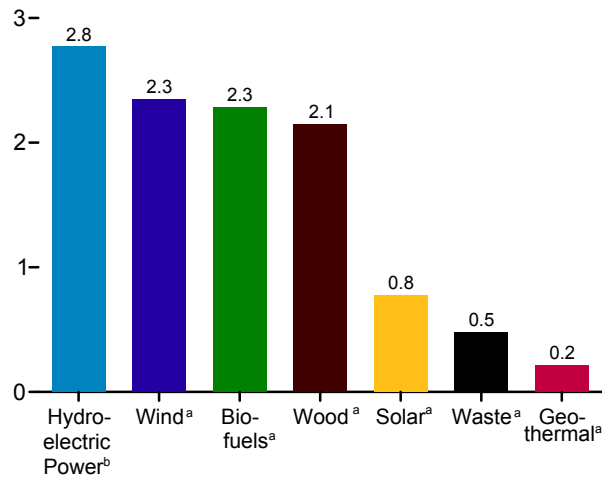
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**Figure 10.1 Renewable Energy Consumption**  
(Quadrillion Btu)

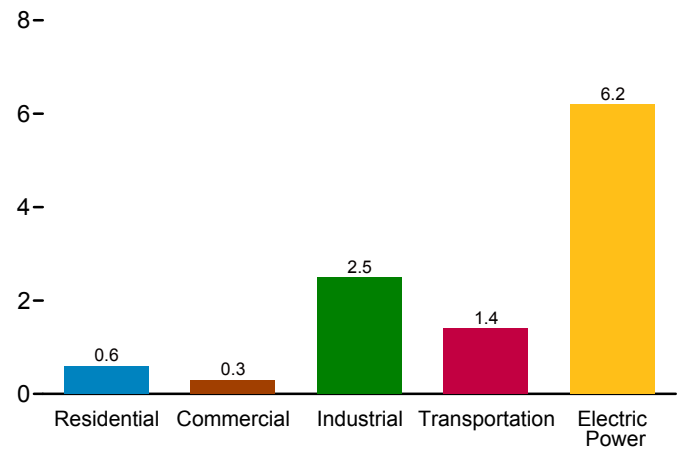
Major Sources, 1949–2017



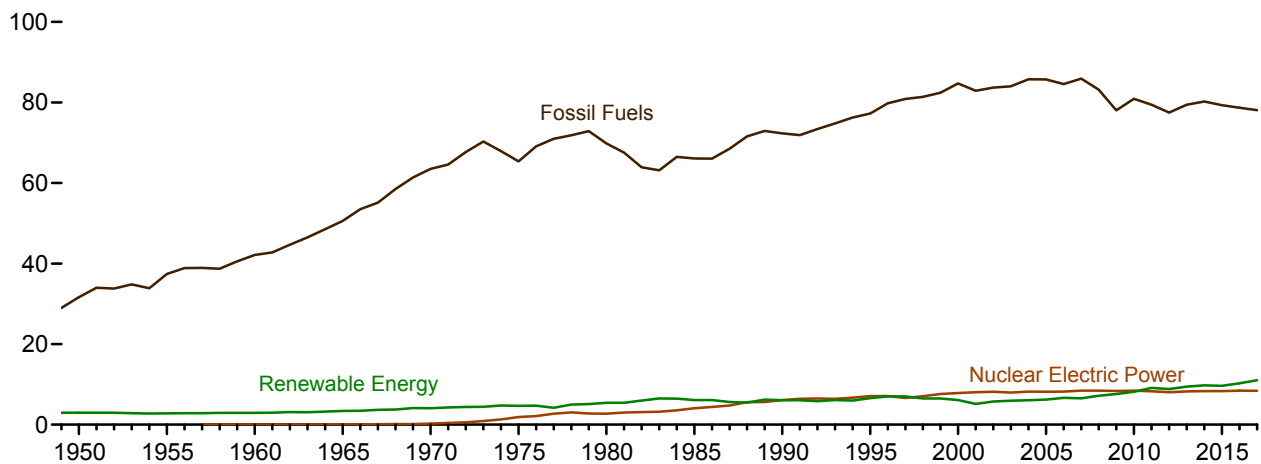
By Source, 2017



By Sector, 2017



Compared With Other Resources, 1949–2017



<sup>a</sup> See Table 10.1 for definition.  
<sup>b</sup> 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 <sup>a</sup>			Consumption								Total Renewable Energy
	Biomass		Total Renewable Energy <sup>d</sup>	Hydroelectric Power <sup>e</sup>	Geothermal <sup>f</sup>	Solar <sup>g</sup>	Wind <sup>h</sup>	Biomass				
	Bio-fuels <sup>b</sup>	Total <sup>c</sup>						Wood <sup>i</sup>	Waste <sup>j</sup>	Bio-fuels <sup>k</sup>	Total	
1950 Total	NA	1,562	2,978	1,415	NA	NA	NA	1,562	NA	NA	1,562	2,978
1955 Total	NA	1,424	2,784	1,360	NA	NA	NA	1,424	NA	NA	1,424	2,784
1960 Total	NA	1,320	2,928	1,608	(s)	NA	NA	1,320	NA	NA	1,320	2,928
1965 Total	NA	1,335	3,396	2,059	2	NA	NA	1,335	NA	NA	1,335	3,396
1970 Total	NA	1,431	4,070	2,634	6	NA	NA	1,429	2	NA	1,431	4,070
1975 Total	NA	1,499	4,687	3,155	34	NA	NA	1,497	2	NA	1,499	4,687
1980 Total	NA	2,475	5,428	2,900	53	NA	NA	2,474	2	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	4,452	8,212	2,539	208	90	923	2,116	468	1,821	4,405	8,166
2011 Total	2,029	4,630	9,224	3,103	212	111	1,168	2,139	462	1,933	4,534	9,128
2012 Total	1,929	4,529	8,866	2,629	212	157	1,340	2,133	467	1,892	4,492	8,829
2013 Total	1,981	4,824	9,426	2,562	214	225	1,601	2,347	496	2,007	4,850	9,452
2014 Total	2,103	5,029	9,774	2,467	214	337	1,728	2,410	516	2,067	4,992	9,738
2015 Total	2,161	4,914	9,650	2,321	212	426	1,777	2,235	518	2,145	4,898	9,634
2016 January	185	417	867	236	18	26	170	184	42	171	398	848
February	176	396	857	223	17	35	186	173	40	173	387	848
March	190	417	933	253	18	43	203	177	44	187	408	924
April	175	388	883	239	16	48	192	166	43	173	382	877
May	189	411	894	235	18	55	174	173	43	192	408	891
June	189	412	850	215	17	56	151	175	40	192	407	845
July	196	422	862	198	17	61	163	181	41	201	423	863
August	198	429	814	181	18	61	125	183	42	204	429	813
September	187	405	780	151	17	55	151	172	39	194	404	780
October	194	412	827	160	18	49	188	172	41	195	407	822
November	192	415	827	174	18	41	179	175	43	195	413	825
December	203	456	933	208	19	37	214	200	45	202	447	924
Total	2,275	4,982	10,328	2,472	210	569	2,096	2,131	503	2,279	4,913	10,260
2017 January	195	430	932	257	18	35	192	184	44	177	405	907
February	176	389	877	227	16	39	205	169	39	166	374	861
March	196	427	1,030	279	18	64	241	181	43	190	414	1,017
April	182	399	995	271	18	70	238	171	39	183	393	990
May	196	417	1,022	297	17	82	209	176	39	200	415	1,020
June	191	413	980	281	17	87	182	177	38	198	414	981
July	195	426	908	238	18	81	146	185	40	198	423	905
August	202	436	850	196	18	79	121	187	40	202	430	844
September	191	407	833	175	17	74	159	171	37	191	399	825
October	200	424	897	159	17	68	229	178	40	196	414	888
November	202	R 427	R 891	183	18	47	215	177	41	193	411	874
December	204	R 443	R 925	208	18	46	210	188	42	191	421	903
Total	2,332	R 5,038	R 11,140	2,770	211	774	2,347	2,145	482	2,286	4,913	11,016
2018 January	198	R 435	R 984	235	18	49	248	188	43	190	421	970
February	182	R 404	R 935	236	17	57	221	173	40	164	377	908
March	200	433	1,016	239	18	75	252	184	43	190	417	1,000
3-Month Total	581	1,272	2,936	710	53	180	721	545	125	544	1,215	2,879
2017 3-Month Total	567	1,246	2,838	763	53	138	638	534	126	533	1,193	2,785
2016 3-Month Total	552	1,230	2,657	712	52	104	559	535	126	532	1,193	2,620

<sup>a</sup> For hydroelectric power, geothermal, solar, wind, and biomass waste, production equals consumption. For biofuels, production equals total biomass inputs to the production of fuel ethanol and biodiesel. For wood, through 2015, production equals consumption; beginning in 2016, production equals consumption plus densified biomass exports.

<sup>b</sup> Total biomass inputs to the production of fuel ethanol and biodiesel.  
<sup>c</sup> Wood and wood-derived fuels, biomass waste, and total biomass inputs to the production of fuel ethanol and biodiesel.

<sup>d</sup> Hydroelectric power, geothermal, solar, wind, and biomass.  
<sup>e</sup> Conventional hydroelectricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6).

<sup>f</sup> 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.

<sup>g</sup> 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.

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

<sup>i</sup> Wood and wood-derived fuels.

<sup>j</sup> 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).

<sup>k</sup> 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: • **Production:** Tables 10.2a–10.4 and U.S. Energy Information Administration, Form EIA-63C, "Densified Biomass Fuel Report."  
• **Consumption:** Tables 10.2a–10.2c.

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

	Residential Sector				Commercial Sector <sup>a</sup>								
	Geo-thermal <sup>b</sup>	Solar <sup>c</sup>	Biomass		Hydro-electric Power <sup>e</sup>	Geo-thermal <sup>b</sup>	Solar <sup>f</sup>	Wind <sup>g</sup>	Biomass			Total	Total
			Wood <sup>d</sup>	Total					Wood <sup>d</sup>	Waste <sup>h</sup>	Fuel Ethanol <sup>i,j</sup>		
1950 Total .....	NA	NA	1,006	1,006	NA	NA	NA	NA	19	NA	NA	19	19
1955 Total .....	NA	NA	775	775	NA	NA	NA	NA	15	NA	NA	15	15
1960 Total .....	NA	NA	627	627	NA	NA	NA	NA	12	NA	NA	12	12
1965 Total .....	NA	NA	468	468	NA	NA	NA	NA	9	NA	NA	9	9
1970 Total .....	NA	NA	401	401	NA	NA	NA	NA	8	NA	NA	8	8
1975 Total .....	NA	NA	425	425	NA	NA	NA	NA	8	NA	NA	8	8
1980 Total .....	NA	NA	850	850	NA	NA	NA	NA	21	NA	NA	21	21
1985 Total .....	NA	NA	1,010	1,010	NA	NA	NA	NA	24	NA	(s)	24	24
1990 Total .....	6	55	580	640	1	3	(s)	-	66	28	(s)	94	98
1995 Total .....	7	63	520	589	1	5	(s)	-	72	40	(s)	113	119
2000 Total .....	9	58	420	486	1	8	1	-	71	47	(s)	119	128
2001 Total .....	9	55	370	435	1	8	1	-	67	25	(s)	92	101
2002 Total .....	10	53	380	443	(s)	9	1	-	69	26	(s)	95	105
2003 Total .....	13	52	400	465	1	11	1	-	71	29	1	101	114
2004 Total .....	14	51	410	475	1	12	1	-	70	34	1	105	120
2005 Total .....	16	50	430	496	1	14	2	-	70	34	1	105	121
2006 Total .....	18	53	380	451	1	14	2	-	65	36	1	103	120
2007 Total .....	22	55	420	497	1	14	4	-	70	31	2	103	121
2008 Total .....	26	58	470	555	1	15	6	-	73	34	2	109	130
2009 Total .....	33	60	500	593	1	17	7	(s)	73	36	3	112	137
2010 Total .....	37	65	440	542	1	19	11	(s)	72	36	3	111	142
2011 Total .....	40	71	450	560	(s)	20	19	(s)	69	43	3	115	154
2012 Total .....	40	79	420	538	(s)	20	32	1	61	45	3	108	161
2013 Total .....	40	91	580	711	(s)	20	41	1	70	47	3	120	182
2014 Total .....	40	109	587	735	(s)	20	52	1	76	47	4	127	200
2015 Total .....	40	127	436	602	(s)	20	57	1	79	47	26	152	230
2016 January .....	3	8	30	41	(s)	2	3	(s)	7	4	2	13	19
February .....	3	10	28	40	(s)	2	4	(s)	7	4	2	12	18
March .....	3	13	30	46	(s)	2	5	(s)	7	4	2	13	20
April .....	3	14	29	46	(s)	2	6	(s)	7	4	2	13	20
May .....	3	16	30	49	(s)	2	6	(s)	7	4	2	13	21
June .....	3	17	29	48	(s)	2	6	(s)	7	4	2	13	21
July .....	3	17	30	50	(s)	2	6	(s)	7	4	2	14	22
August .....	3	17	30	50	(s)	2	6	(s)	7	4	2	14	22
September .....	3	15	29	47	(s)	2	6	(s)	7	4	2	13	20
October .....	3	13	30	46	(s)	2	5	(s)	7	4	2	13	20
November .....	3	11	29	43	(s)	2	4	(s)	7	4	2	13	19
December .....	3	10	30	43	(s)	2	4	(s)	7	4	2	13	19
Total .....	40	160	349	549	2	20	62	1	84	48	26	158	242
2017 January .....	3	10	28	41	(s)	2	4	(s)	7	4	2	13	19
February .....	3	11	26	39	(s)	2	4	(s)	7	4	2	12	18
March .....	3	16	28	47	(s)	2	6	(s)	7	4	2	13	21
April .....	3	18	27	48	(s)	2	7	(s)	7	4	2	13	21
May .....	3	19	28	51	(s)	2	8	(s)	7	4	2	13	23
June .....	3	20	27	51	(s)	2	8	(s)	7	4	2	13	23
July .....	3	20	28	52	(s)	2	8	(s)	7	4	2	13	23
August .....	3	20	28	52	(s)	2	8	(s)	7	4	2	13	23
September .....	3	18	27	48	(s)	2	7	(s)	7	4	2	12	21
October .....	3	16	28	48	(s)	2	6	(s)	7	4	2	13	21
November .....	3	12	27	43	(s)	2	5	(s)	7	4	2	13	20
December .....	3	12	28	43	(s)	2	5	(s)	7	4	2	13	20
Total .....	40	191	334	565	2	20	76	1	84	45	26	155	255
2018 January .....	3	12	33	48	(s)	2	5	(s)	7	4	2	13	20
February .....	3	13	30	45	(s)	2	6	(s)	7	3	2	12	20
March .....	3	18	33	54	(s)	2	8	(s)	7	4	2	13	23
3-Month Total .....	10	43	95	148	1	5	19	(s)	21	11	6	38	63
2017 3-Month Total .....	10	36	82	128	1	5	15	(s)	21	12	6	38	59
2016 3-Month Total .....	10	30	87	127	1	5	13	(s)	21	12	6	39	57

<sup>a</sup> 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.

<sup>b</sup> Geothermal heat pump and direct use energy.  
<sup>c</sup> 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.

<sup>d</sup> Wood and wood-derived fuels.  
<sup>e</sup> Conventional hydroelectricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6).

<sup>f</sup> 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.

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

<sup>h</sup> 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).

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

<sup>j</sup> There is a discontinuity in this time series between 2014 and 2015 due to a change in the method for allocating motor gasoline consumption to the end-use sectors. Beginning in 2015, the commercial and industrial sector shares of fuel ethanol consumption are larger than in 2014, while the transportation sector share is smaller.

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 <sup>a</sup>									Transportation Sector			
	Hydroelectric Power <sup>b</sup>	Geothermal <sup>c</sup>	Solar <sup>d</sup>	Wind <sup>e</sup>	Biomass				Total	Biomass			
					Wood <sup>f</sup>	Waste <sup>g</sup>	Fuel Ethanol <sup>h,i</sup>	Losses and Co-products <sup>j</sup>		Fuel Ethanol <sup>l,k</sup>	Bio-diesel <sup>l</sup>	Total <sup>m</sup>	
<b>1950 Total</b> .....	69	NA	NA	NA	532	NA	NA	NA	532	602	NA	NA	NA
<b>1955 Total</b> .....	38	NA	NA	NA	631	NA	NA	NA	631	669	NA	NA	NA
<b>1960 Total</b> .....	39	NA	NA	NA	680	NA	NA	NA	680	719	NA	NA	NA
<b>1965 Total</b> .....	33	NA	NA	NA	855	NA	NA	NA	855	888	NA	NA	NA
<b>1970 Total</b> .....	34	NA	NA	NA	1,019	NA	NA	NA	1,019	1,053	NA	NA	NA
<b>1975 Total</b> .....	32	NA	NA	NA	1,063	NA	NA	NA	1,063	1,096	NA	NA	NA
<b>1980 Total</b> .....	33	NA	NA	NA	1,600	NA	NA	NA	1,600	1,633	NA	NA	NA
<b>1985 Total</b> .....	33	NA	NA	NA	1,645	230	1	42	1,918	1,951	50	NA	50
<b>1990 Total</b> .....	31	2	(s)	—	1,442	192	1	49	1,684	1,717	60	NA	60
<b>1995 Total</b> .....	55	3	(s)	—	1,652	195	2	86	1,934	1,992	112	NA	112
<b>2000 Total</b> .....	42	4	(s)	—	1,636	145	1	99	1,881	1,928	135	NA	135
<b>2001 Total</b> .....	33	5	(s)	—	1,443	129	3	108	1,681	1,719	141	1	142
<b>2002 Total</b> .....	39	5	(s)	—	1,396	146	3	130	1,676	1,720	168	2	170
<b>2003 Total</b> .....	43	3	(s)	—	1,363	142	4	168	1,678	1,725	228	2	230
<b>2004 Total</b> .....	33	4	(s)	—	1,476	132	6	201	1,815	1,852	286	3	290
<b>2005 Total</b> .....	32	4	(s)	—	1,452	148	7	227	1,834	1,871	327	12	339
<b>2006 Total</b> .....	29	4	1	—	1,472	130	10	280	1,892	1,926	442	33	475
<b>2007 Total</b> .....	16	5	1	—	1,413	145	10	369	1,937	1,958	557	45	602
<b>2008 Total</b> .....	17	5	1	—	1,339	143	12	519	2,012	2,035	786	39	825
<b>2009 Total</b> .....	18	4	2	—	1,178	154	13	603	1,948	1,972	894	41	935
<b>2010 Total</b> .....	16	4	3	—	1,409	168	17	727	2,320	2,343	1,041	33	1,075
<b>2011 Total</b> .....	17	4	4	(s)	1,438	165	17	756	2,375	2,401	1,045	113	1,158
<b>2012 Total</b> .....	22	4	7	(s)	1,462	159	17	711	2,349	2,382	1,045	115	1,162
<b>2013 Total</b> .....	33	4	9	(s)	1,489	187	18	709	2,403	2,449	1,072	182	1,278
<b>2014 Total</b> .....	12	4	11	1	1,495	190	14	757	2,456	2,484	1,093	181	1,292
<b>2015 Total</b> .....	13	4	14	(s)	1,476	190	18	776	2,460	2,491	1,110	191	1,326
<b>2016 January</b> .....	1	(s)	1	(s)	127	15	1	66	209	212	88	13	102
February .....	1	(s)	1	(s)	119	15	1	63	197	200	90	15	107
March .....	1	(s)	2	(s)	121	16	2	67	206	210	96	17	116
April .....	1	(s)	2	(s)	115	15	1	61	193	196	89	18	108
May .....	1	(s)	2	(s)	121	15	2	66	204	207	97	23	122
June .....	1	(s)	2	(s)	121	13	2	66	202	205	97	21	122
July .....	1	(s)	2	(s)	124	14	2	69	208	211	99	27	128
August .....	1	(s)	2	(s)	124	14	2	70	209	213	101	28	131
September .....	1	(s)	2	(s)	117	13	1	66	197	200	94	26	124
October .....	1	(s)	2	(s)	120	15	2	68	204	207	96	25	123
November .....	1	(s)	1	(s)	122	15	1	67	206	208	95	26	124
December .....	1	(s)	1	(s)	143	16	2	71	231	234	100	26	127
<b>Total</b> .....	<b>12</b>	<b>4</b>	<b>19</b>	<b>1</b>	<b>1,474</b>	<b>174</b>	<b>18</b>	<b>801</b>	<b>2,467</b>	<b>2,503</b>	<b>1,143</b>	<b>266</b>	<b>1,434</b>
<b>2017 January</b> .....	1	(s)	1	(s)	128	15	1	70	215	218	89	13	104
February .....	1	(s)	1	(s)	118	14	1	63	196	199	85	13	100
March .....	1	(s)	2	(s)	124	15	1	70	210	213	95	19	117
April .....	1	(s)	2	(s)	119	14	1	64	198	202	93	21	116
May .....	1	(s)	2	(s)	121	13	2	69	204	208	99	25	127
June .....	1	(s)	2	(s)	122	12	2	66	202	206	100	25	128
July .....	1	(s)	3	(s)	127	13	2	68	209	213	98	26	126
August .....	1	(s)	2	(s)	129	13	2	70	214	218	101	25	128
September .....	1	(s)	2	(s)	118	12	2	66	198	201	95	22	121
October .....	1	(s)	2	(s)	122	14	2	69	207	210	100	21	123
November .....	1	(s)	2	(s)	122	15	2	70	209	212	97	21	119
December .....	1	(s)	1	(s)	131	15	2	71	218	221	96	19	117
<b>Total</b> .....	<b>13</b>	<b>4</b>	<b>24</b>	<b>1</b>	<b>1,480</b>	<b>165</b>	<b>18</b>	<b>817</b>	<b>2,480</b>	<b>2,522</b>	<b>1,148</b>	<b>249</b>	<b>1,425</b>
<b>2018 January</b> .....	1	(s)	2	(s)	127	15	2	70	213	216	98	18	117
February .....	1	(s)	2	(s)	118	14	1	63	196	199	81	14	98
March .....	1	(s)	2	(s)	124	15	2	69	210	214	96	20	117
<b>3-Month Total</b> .....	<b>3</b>	<b>1</b>	<b>5</b>	<b>(s)</b>	<b>368</b>	<b>44</b>	<b>4</b>	<b>202</b>	<b>619</b>	<b>629</b>	<b>275</b>	<b>52</b>	<b>331</b>
<b>2017 3-Month Total</b> .....	<b>3</b>	<b>1</b>	<b>5</b>	<b>(s)</b>	<b>370</b>	<b>44</b>	<b>4</b>	<b>203</b>	<b>621</b>	<b>630</b>	<b>269</b>	<b>45</b>	<b>320</b>
<b>2016 3-Month Total</b> .....	<b>4</b>	<b>1</b>	<b>4</b>	<b>(s)</b>	<b>367</b>	<b>45</b>	<b>4</b>	<b>197</b>	<b>613</b>	<b>622</b>	<b>274</b>	<b>45</b>	<b>325</b>

<sup>a</sup> 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.

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

<sup>c</sup> Geothermal heat pump and direct use energy.

<sup>d</sup> 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.

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

<sup>f</sup> Wood and wood-derived fuels.

<sup>g</sup> 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).

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

<sup>i</sup> There is a discontinuity in this time series between 2014 and 2015 due to a change in the method for allocating motor gasoline consumption to the end-use sectors. Beginning in 2015, the commercial and industrial sector shares of fuel ethanol consumption are larger than in 2014, while the transportation sector share

is smaller.

<sup>j</sup> 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.

<sup>k</sup> The fuel ethanol (minus denaturant) portion of motor fuels, such as E10 and E85, consumed by the transportation sector.

<sup>l</sup> Although there is biodiesel use in other sectors, all biodiesel consumption is assigned to the transportation sector.

<sup>m</sup> 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.

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 <sup>a</sup>	Geo-thermal <sup>b</sup>	Solar <sup>c</sup>	Wind <sup>d</sup>	Biomass			Total
					Wood <sup>e</sup>	Waste <sup>f</sup>	Total	
<b>1950 Total</b> .....	1,346	NA	NA	NA	5	NA	5	1,351
<b>1955 Total</b> .....	1,322	NA	NA	NA	3	NA	3	1,325
<b>1960 Total</b> .....	1,569	(s)	NA	NA	2	NA	2	1,571
<b>1965 Total</b> .....	2,026	2	NA	NA	3	NA	3	2,031
<b>1970 Total</b> .....	2,600	6	NA	NA	1	2	4	2,609
<b>1975 Total</b> .....	3,122	34	NA	NA	(s)	2	2	3,158
<b>1980 Total</b> .....	2,867	53	NA	NA	3	2	4	2,925
<b>1985 Total</b> .....	2,937	97	(s)	(s)	8	7	14	3,049
<b>1990 Total</b> <sup>g</sup> .....	3,014	161	4	29	129	188	317	3,524
<b>1995 Total</b> .....	3,149	138	5	33	125	296	422	3,747
<b>2000 Total</b> .....	2,768	144	5	57	134	318	453	3,427
<b>2001 Total</b> .....	2,209	142	6	70	126	211	337	2,763
<b>2002 Total</b> .....	2,650	147	6	105	150	230	380	3,288
<b>2003 Total</b> .....	2,749	146	5	113	167	230	397	3,411
<b>2004 Total</b> .....	2,655	148	6	142	165	223	388	3,339
<b>2005 Total</b> .....	2,670	147	6	178	185	221	406	3,406
<b>2006 Total</b> .....	2,839	145	5	264	182	231	412	3,665
<b>2007 Total</b> .....	2,430	145	6	341	186	237	423	3,345
<b>2008 Total</b> .....	2,494	146	9	546	177	258	435	3,630
<b>2009 Total</b> .....	2,650	146	9	721	180	261	441	3,967
<b>2010 Total</b> .....	2,521	148	12	923	196	264	459	4,064
<b>2011 Total</b> .....	3,085	149	17	1,167	182	255	437	4,855
<b>2012 Total</b> .....	2,606	148	40	1,339	190	262	453	4,586
<b>2013 Total</b> .....	2,529	151	83	1,600	207	262	470	4,833
<b>2014 Total</b> .....	2,454	151	165	1,726	251	279	530	5,026
<b>2015 Total</b> .....	2,308	148	228	1,776	244	281	525	4,985
<b>2016</b> .....								
January .....	235	12	13	170	21	23	44	475
February .....	222	11	20	186	20	22	43	482
March .....	251	12	24	202	19	24	43	533
April .....	238	11	26	192	15	24	39	506
May .....	234	12	31	174	16	24	40	491
June .....	213	12	32	150	18	23	41	448
July .....	197	12	36	163	20	24	44	451
August .....	180	12	36	125	21	24	45	399
September .....	150	12	33	151	19	22	41	388
October .....	159	12	29	188	16	22	37	426
November .....	173	13	25	179	18	24	42	432
December .....	207	13	22	213	21	25	46	501
<b>Total</b> .....	<b>2,459</b>	<b>146</b>	<b>328</b>	<b>2,094</b>	<b>224</b>	<b>281</b>	<b>505</b>	<b>5,531</b>
<b>2017</b> .....								
January .....	256	13	20	191	21	24	45	525
February .....	225	11	23	205	19	22	41	505
March .....	278	13	40	241	22	24	46	618
April .....	269	13	44	238	18	21	40	603
May .....	296	12	53	209	20	22	42	611
June .....	279	12	57	182	21	23	44	573
July .....	236	13	50	145	22	23	46	490
August .....	195	13	49	121	22	23	46	423
September .....	174	12	47	159	19	21	41	433
October .....	158	12	44	229	21	22	43	486
November .....	182	12	28	215	20	22	43	480
December .....	207	13	28	210	21	23	45	502
<b>Total</b> .....	<b>2,755</b>	<b>147</b>	<b>483</b>	<b>2,345</b>	<b>247</b>	<b>272</b>	<b>519</b>	<b>6,249</b>
<b>2018</b> .....								
January .....	233	13	30	248	22	24	45	569
February .....	235	12	37	221	19	22	42	546
March .....	238	13	47	252	20	24	44	593
<b>3-Month Total</b> .....	<b>706</b>	<b>37</b>	<b>113</b>	<b>720</b>	<b>61</b>	<b>70</b>	<b>131</b>	<b>1,708</b>
<b>2017 3-Month Total</b> .....	<b>759</b>	<b>37</b>	<b>83</b>	<b>637</b>	<b>61</b>	<b>70</b>	<b>131</b>	<b>1,648</b>
<b>2016 3-Month Total</b> .....	<b>708</b>	<b>36</b>	<b>58</b>	<b>558</b>	<b>61</b>	<b>69</b>	<b>130</b>	<b>1,490</b>

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

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

<sup>c</sup> 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.

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

<sup>e</sup> Wood and wood-derived fuels.

<sup>f</sup> 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).

<sup>g</sup> Through 1988, data are for electric utilities only. Beginning in 1989, data are for electric utilities and independent power producers.

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 <sup>a</sup>	Losses and Co-products <sup>b</sup>	Denaturant <sup>c</sup>	Production <sup>d</sup>			Trade <sup>d</sup>	Stocks <sup>d,f</sup>	Stock Change <sup>d,g</sup>	Consumption <sup>d</sup>			Consumption Minus Denaturant <sup>h</sup>
							Net Imports <sup>e</sup>						
							TBtu						
<b>1981 Total</b> .....	13	6	40	1,978	83	7	NA	NA	NA	1,978	83	7	7
<b>1985 Total</b> .....	93	42	294	14,693	617	52	NA	NA	NA	14,693	617	52	51
<b>1990 Total</b> .....	111	49	356	17,802	748	63	NA	NA	NA	17,802	748	63	62
<b>1995 Total</b> .....	198	86	647	32,325	1,358	115	387	2,186	-207	32,919	1,383	117	114
<b>2000 Total</b> .....	233	99	773	38,627	1,622	138	116	3,400	-624	39,367	1,653	140	137
<b>2001 Total</b> .....	253	108	841	42,028	1,765	150	315	4,298	898	41,445	1,741	148	144
<b>2002 Total</b> .....	307	130	1,019	50,956	2,140	182	306	6,200	1,902	49,360	2,073	176	171
<b>2003 Total</b> .....	400	168	1,335	66,772	2,804	238	292	5,978	-222	67,286	2,826	240	233
<b>2004 Total</b> .....	482	201	1,621	81,058	3,404	289	3,542	6,002	24	84,576	3,552	301	293
<b>2005 Total</b> .....	550	227	1,859	92,961	3,904	331	3,234	5,563	-439	96,634	4,059	344	335
<b>2006 Total</b> .....	683	280	2,326	116,294	4,884	414	17,408	8,760	3,197	130,505	5,481	465	453
<b>2007 Total</b> .....	907	368	3,105	155,263	6,521	553	10,457	10,535	1,775	163,945	6,886	584	569
<b>2008 Total</b> .....	1,286	518	4,433	221,637	9,309	790	12,610	14,226	3,691	230,556	9,683	821	800
<b>2009 Total</b> .....	1,503	602	5,688	260,424	10,938	928	4,720	16,594	2,368	262,776	11,037	936	910
<b>2010 Total</b> .....	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
<b>2011 Total</b> .....	1,904	754	6,649	331,646	13,929	1,181	-24,365	18,238	297	306,984	12,893	1,093	1,065
<b>2012 Total</b> .....	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
<b>2013 Total</b> .....	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
<b>2014 Total</b> .....	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
<b>2015 Total</b> .....	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
<b>2016 January</b> .....	172	66	617	30,452	1,279	108	-2,294	23,347	1,751	26,407	1,109	94	92
February .....	162	63	586	28,810	1,210	103	-2,024	23,171	-176	26,962	1,132	96	93
March .....	175	67	601	30,957	1,300	110	-2,612	22,730	-441	28,786	1,209	102	100
April .....	159	61	557	28,208	1,185	100	-2,919	21,336	-1,394	26,683	1,121	95	93
May .....	171	66	586	30,346	1,275	108	-1,627	20,962	-374	29,093	1,222	104	101
June .....	172	66	567	30,443	1,279	108	-1,045	21,284	322	29,076	1,221	103	101
July .....	178	68	570	31,469	1,322	112	-1,641	21,381	97	29,731	1,249	106	103
August .....	180	69	564	31,856	1,338	113	-1,924	21,198	-183	30,115	1,265	107	105
September .....	170	65	544	30,048	1,262	107	-2,315	20,713	-485	28,218	1,185	100	98
October .....	175	67	563	31,006	1,302	110	-2,946	20,113	-600	28,660	1,204	102	100
November .....	173	67	559	30,706	1,290	109	-3,074	19,463	-650	28,282	1,188	101	98
December .....	185	71	606	32,680	1,373	116	-2,583	19,758	295	29,802	1,252	106	104
<b>Total</b> .....	<b>2,072</b>	<b>798</b>	<b>6,920</b>	<b>366,981</b>	<b>15,413</b>	<b>1,306</b>	<b>-27,002</b>	<b>19,758</b>	<b>-1,838</b>	<b>341,817</b>	<b>14,356</b>	<b>1,216</b>	<b>1,187</b>
<b>2017 January</b> .....	183	70	593	32,577	1,368	116	-2,901	22,624	<sup>i</sup> 3,093	26,583	1,116	95	92
February .....	164	63	541	29,052	1,220	103	-3,349	23,015	391	25,312	1,063	90	88
March .....	181	69	597	32,161	1,351	114	-3,044	23,759	744	28,373	1,192	101	99
April .....	166	64	540	29,500	1,239	105	-1,981	23,593	-166	27,685	1,163	98	96
May .....	179	68	558	31,700	1,331	113	-2,809	22,909	-684	29,575	1,242	105	103
June .....	173	66	539	30,667	1,288	109	-1,958	21,763	-1,146	29,855	1,254	106	104
July .....	176	67	551	31,221	1,311	111	-2,512	21,147	-616	29,325	1,232	104	102
August .....	183	70	569	32,447	1,363	115	-2,199	21,197	50	30,198	1,268	107	105
September .....	172	66	531	30,581	1,284	109	-1,809	21,485	288	28,484	1,196	101	99
October .....	181	69	550	32,076	1,347	114	-2,162	21,574	89	29,825	1,253	106	104
November .....	183	70	520	32,469	1,364	115	-2,152	22,863	1,289	29,028	1,219	103	101
December .....	185	71	525	32,809	1,378	117	-4,130	23,048	185	28,494	1,197	101	99
<b>Total</b> .....	<b>2,126</b>	<b>814</b>	<b>6,614</b>	<b>377,260</b>	<b>15,845</b>	<b>1,342</b>	<b>-31,007</b>	<b>23,048</b>	<sup>i</sup> <b>3,517</b>	<b>342,736</b>	<b>14,395</b>	<b>1,219</b>	<b>1,192</b>
<b>2018 January</b> .....	182	69	504	32,428	1,362	115	-2,104	24,229	1,181	29,143	1,224	104	102
February .....	166	63	441	29,519	1,240	105	-5,298	24,335	106	24,115	1,013	86	84
March .....	181	69	484	32,216	1,353	115	-5,122	22,883	-1,452	28,546	1,199	102	100
<b>3-Month Total</b> ...	<b>530</b>	<b>202</b>	<b>1,429</b>	<b>94,163</b>	<b>3,955</b>	<b>335</b>	<b>-12,523</b>	<b>22,883</b>	<b>-165</b>	<b>81,805</b>	<b>3,436</b>	<b>291</b>	<b>285</b>
<b>2017 3-Month Total</b> ...	<b>528</b>	<b>202</b>	<b>1,731</b>	<b>93,790</b>	<b>3,939</b>	<b>334</b>	<b>-9,295</b>	<b>23,759</b>	<b>4,228</b>	<b>80,267</b>	<b>3,371</b>	<b>285</b>	<b>279</b>
<b>2016 3-Month Total</b> ...	<b>509</b>	<b>196</b>	<b>1,804</b>	<b>90,219</b>	<b>3,789</b>	<b>321</b>	<b>-6,930</b>	<b>22,730</b>	<b>1,134</b>	<b>82,155</b>	<b>3,451</b>	<b>292</b>	<b>285</b>

<sup>a</sup> Total corn and other biomass inputs to the production of undenatured ethanol used for fuel ethanol.

<sup>b</sup> 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.

<sup>c</sup> The amount of denaturant in fuel ethanol produced.

<sup>d</sup> Includes denaturant.

<sup>e</sup> 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.

<sup>f</sup> Stocks are at end of period.

<sup>g</sup> A negative value indicates a decrease in stocks and a positive value indicates an increase.

<sup>h</sup> 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.

<sup>i</sup> Derived from the preliminary 2016 stocks value (19,531 thousand barrels), not the final 2016 value (19,758 thousand barrels) that is shown under "Stocks."

NA=Not available.

Notes: • Mbbl = 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 <sup>f</sup>
	Feed-stock <sup>a</sup>	Losses and Co-products <sup>b</sup>	Production			Trade			Stocks <sup>d</sup>	Stock Change <sup>e</sup>	Consumption			
						Imports	Exports	Net Imports <sup>c</sup>						
			TBtu	TBtu	Mbbl	MMgal	TBtu	Mbbl			Mbbl	Mbbl	Mbbl	
<b>2001 Total</b> .....	1	(s)	204	9	1	81	41	40	NA	NA	244	10	1	NA
<b>2002 Total</b> .....	1	(s)	250	10	1	197	57	140	NA	NA	390	16	2	NA
<b>2003 Total</b> .....	2	(s)	338	14	2	97	113	-17	NA	NA	322	14	2	NA
<b>2004 Total</b> .....	4	(s)	666	28	4	101	128	-27	NA	NA	639	27	3	NA
<b>2005 Total</b> .....	12	(s)	2,162	91	12	214	213	1	NA	NA	2,163	91	12	NA
<b>2006 Total</b> .....	32	(s)	5,963	250	32	1,105	856	250	NA	NA	6,213	261	33	NA
<b>2007 Total</b> .....	63	1	11,662	490	62	3,455	6,696	-3,241	NA	NA	8,422	354	45	NA
<b>2008 Total</b> .....	88	1	16,145	678	87	7,755	16,673	-8,918	NA	NA	7,228	304	39	NA
<b>2009 Total</b> .....	67	1	12,281	516	66	1,906	6,546	-4,640	711	711	<sup>g</sup> 7,663	322	41	(s)
<b>2010 Total</b> .....	44	1	8,177	343	44	564	2,588	-2,024	672	-39	6,192	260	33	(s)
<b>2011 Total</b> .....	125	2	23,035	967	123	890	1,799	-908	2,005	<sup>h</sup> 1,028	21,099	886	113	(s)
<b>2012 Total</b> .....	128	2	23,588	991	126	853	3,056	-2,203	1,984	-20	21,406	899	115	3
<b>2013 Total</b> .....	176	2	32,368	1,359	173	8,152	4,675	3,477	3,810	1,825	34,020	1,429	182	24
<b>2014 Total</b> .....	165	2	30,452	1,279	163	4,578	1,974	2,604	3,131	-679	33,735	1,417	181	18
<b>2015 Total</b> .....	163	2	30,080	1,263	161	8,399	2,091	6,308	3,943	813	35,575	1,494	191	25
<b>2016 January</b> .....	14	(s)	2,490	105	13	248	42	206	4,222	279	2,416	101	13	1
February .....	14	(s)	2,504	105	13	287	49	238	4,133	-89	2,831	119	15	2
March .....	16	(s)	2,861	120	15	565	234	331	4,167	34	3,159	133	17	3
April .....	16	(s)	2,856	120	15	969	246	723	4,358	192	3,388	142	18	1
May .....	18	(s)	3,222	135	17	1,117	335	782	4,091	-268	4,272	179	23	2
June .....	17	(s)	3,205	135	17	1,630	220	1,410	4,726	635	3,980	167	21	3
July .....	18	(s)	3,331	140	18	1,681	250	1,431	4,443	-283	5,045	212	27	2
August .....	18	(s)	3,385	142	18	1,873	235	1,638	4,265	-177	5,201	218	28	2
September .....	17	(s)	3,206	135	17	1,835	150	1,685	4,227	-38	4,929	207	26	4
October .....	19	(s)	3,433	144	18	1,822	114	1,708	4,690	463	4,678	196	25	2
November .....	19	(s)	3,408	143	18	2,184	143	2,041	5,314	624	4,825	203	26	3
December .....	19	(s)	3,425	144	18	2,668	80	2,588	6,398	1,083	4,929	207	26	1
<b>Total</b> .....	203	3	37,327	1,568	200	16,879	2,098	14,781	6,398	2,455	49,653	2,085	266	25
<b>2017 January</b> .....	12	(s)	2,204	93	12	241	43	198	6,259	<sup>i</sup> 41	2,361	99	13	2
February .....	12	(s)	2,232	94	12	549	57	492	6,466	207	2,516	106	13	1
March .....	15	(s)	2,757	116	15	650	136	514	6,194	-272	3,542	149	19	3
April .....	16	(s)	3,014	127	16	681	283	398	5,713	-481	3,893	163	21	2
May .....	18	(s)	3,237	136	17	948	239	709	4,926	-787	4,734	199	25	3
June .....	18	(s)	3,336	140	18	1,736	226	1,510	5,072	147	4,700	197	25	3
July .....	19	(s)	3,552	149	19	1,670	455	1,215	5,076	3	4,764	200	26	3
August .....	19	(s)	3,551	149	19	1,582	387	1,195	5,172	96	4,650	195	25	2
September .....	19	(s)	3,507	147	19	205	100	105	4,655	-517	4,129	173	22	3
October .....	19	(s)	3,484	146	19	386	217	169	4,397	-258	3,911	164	21	2
November .....	19	(s)	3,523	148	19	222	38	184	4,257	-140	3,847	162	21	1
December .....	19	(s)	3,515	148	19	504	35	469	4,750	493	3,491	147	19	2
<b>Total</b> .....	206	3	37,913	1,592	203	9,374	2,218	7,156	4,750	<sup>i</sup> -1,468	46,537	1,955	249	28
<b>2018 January</b> .....	16	(s)	2,945	124	16	246	102	144	4,557	-193	3,282	138	18	1
February .....	16	(s)	2,996	126	16	146	103	43	4,924	367	2,672	112	14	2
March .....	19	(s)	3,493	147	19	457	255	202	4,916	-8	3,702	155	20	2
<b>3-Month Total</b> .....	51	1	9,434	396	51	849	460	389	4,916	166	9,656	406	52	5
<b>2017 3-Month Total</b> .....	39	1	7,193	302	39	1,440	237	1,203	6,194	-23	8,420	354	45	7
<b>2016 3-Month Total</b> .....	43	1	7,854	330	42	1,100	325	775	4,167	223	8,406	353	45	5

<sup>a</sup> 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.

<sup>b</sup> 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.

<sup>c</sup> Net imports equal imports minus exports.

<sup>d</sup> Stocks are at end of period. Includes biodiesel stocks at (or in) refineries, pipelines, and bulk terminals. Beginning in 2011, also includes stocks at biodiesel production plants.

<sup>e</sup> A negative value indicates a decrease in stocks and a positive value indicates an increase.

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

<sup>g</sup> 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.

<sup>h</sup> 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."

<sup>i</sup> Derived from the preliminary 2016 stocks value (6,217 thousand barrels), not the final 2016 value (6,398 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 <sup>a</sup> Solar Energy <sup>b</sup>					Utility-Scale <sup>c</sup> Solar Energy <sup>d</sup>					Total <sup>k</sup>
	Heat <sup>f</sup>	Electricity <sup>d</sup>				Total <sup>g</sup>	Electricity <sup>e</sup>				
		Residential Sector	Commercial Sector	Industrial Sector	Total		Commercial Sector <sup>h</sup>	Industrial Sector <sup>i</sup>	Electric Power Sector <sup>j</sup>	Total	
<b>1985 Total</b> .....	NA	NA	NA	NA	NA	NA	NA	NA	(s)	(s)	(s)
<b>1990 Total</b> .....	55	(s)	(s)	(s)	(s)	55	—	—	4	4	59
<b>1995 Total</b> .....	63	(s)	(s)	(s)	1	63	—	—	5	5	68
<b>2000 Total</b> .....	57	(s)	1	(s)	1	58	—	—	5	5	63
<b>2001 Total</b> .....	55	(s)	1	(s)	1	56	—	—	6	6	62
<b>2002 Total</b> .....	53	1	1	(s)	2	54	—	—	6	6	60
<b>2003 Total</b> .....	51	1	1	(s)	2	53	—	—	5	5	58
<b>2004 Total</b> .....	50	1	1	(s)	2	53	—	—	6	6	58
<b>2005 Total</b> .....	49	1	2	(s)	3	52	—	—	6	6	58
<b>2006 Total</b> .....	51	2	2	1	5	56	—	—	5	5	61
<b>2007 Total</b> .....	53	2	4	1	7	59	—	—	6	6	65
<b>2008 Total</b> .....	54	4	6	1	11	65	(s)	—	9	9	74
<b>2009 Total</b> .....	55	5	7	2	14	69	(s)	—	9	9	78
<b>2010 Total</b> .....	56	9	11	3	23	79	(s)	(s)	12	12	90
<b>2011 Total</b> .....	58	13	19	4	36	93	1	(s)	17	18	111
<b>2012 Total</b> .....	59	20	30	7	56	116	1	(s)	40	41	157
<b>2013 Total</b> .....	61	31	38	9	78	138	3	(s)	83	86	225
<b>2014 Total</b> .....	62	47	49	11	107	169	4	(s)	165	168	337
<b>2015 Total</b> .....	62	65	53	14	132	194	4	(s)	228	232	426
<b>2016 January</b> .....	3	5	3	1	9	12	(s)	(s)	13	14	26
February .....	4	6	4	1	11	14	(s)	(s)	20	21	35
March .....	5	8	5	2	14	19	(s)	(s)	24	24	43
April .....	6	9	5	2	16	21	(s)	(s)	26	27	48
May .....	6	10	6	2	17	24	(s)	(s)	31	32	55
June .....	6	10	6	2	18	24	(s)	(s)	32	32	56
July .....	7	11	6	2	18	25	1	(s)	36	36	61
August .....	6	10	6	2	18	24	1	(s)	36	37	61
September .....	6	9	5	2	16	22	(s)	(s)	33	34	55
October .....	5	8	5	2	14	19	(s)	(s)	29	29	49
November .....	4	7	4	1	12	16	(s)	(s)	25	26	41
December .....	4	6	4	1	11	15	(s)	(s)	22	22	37
<b>Total</b> .....	<b>62</b>	<b>98</b>	<b>57</b>	<b>19</b>	<b>174</b>	<b>236</b>	<b>5</b>	<b>(s)</b>	<b>328</b>	<b>333</b>	<b>569</b>
<b>2017 January</b> .....	3	6	4	1	11	15	(s)	(s)	20	20	35
February .....	4	7	4	1	13	16	(s)	(s)	23	23	39
March .....	5	11	6	2	18	23	(s)	(s)	40	41	64
April .....	6	12	6	2	20	26	(s)	(s)	44	44	70
May .....	6	13	7	2	23	29	1	(s)	53	53	82
June .....	6	14	7	2	23	30	1	(s)	57	58	87
July .....	7	14	8	2	24	30	1	(s)	50	51	81
August .....	6	13	7	2	23	30	1	(s)	49	50	79
September .....	6	12	7	2	21	26	1	(s)	47	48	74
October .....	5	11	6	2	18	24	(s)	(s)	44	45	68
November .....	4	8	5	2	15	19	(s)	(s)	28	29	47
December .....	4	8	4	1	14	17	(s)	(s)	28	28	46
<b>Total</b> .....	<b>63</b>	<b>129</b>	<b>71</b>	<b>23</b>	<b>223</b>	<b>285</b>	<b>5</b>	<b>(s)</b>	<b>483</b>	<b>489</b>	<b>774</b>
<b>2018 January</b> .....	3	9	5	2	15	19	(s)	(s)	30	30	49
February .....	4	9	5	2	16	20	(s)	(s)	37	37	57
March .....	5	13	7	2	22	27	(s)	(s)	47	47	75
<b>3-Month Total</b> .....	<b>12</b>	<b>31</b>	<b>18</b>	<b>5</b>	<b>54</b>	<b>66</b>	<b>1</b>	<b>(s)</b>	<b>113</b>	<b>114</b>	<b>180</b>
<b>2017 3-Month Total</b> .....	<b>12</b>	<b>24</b>	<b>14</b>	<b>5</b>	<b>43</b>	<b>55</b>	<b>1</b>	<b>(s)</b>	<b>83</b>	<b>84</b>	<b>138</b>
<b>2016 3-Month Total</b> .....	<b>12</b>	<b>18</b>	<b>12</b>	<b>4</b>	<b>34</b>	<b>46</b>	<b>1</b>	<b>(s)</b>	<b>58</b>	<b>59</b>	<b>104</b>

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

<sup>b</sup> See "Photovoltaic Energy" and "Solar Thermal Energy" in Glossary.

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

<sup>d</sup> 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).

<sup>e</sup> 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).

<sup>f</sup> 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.

<sup>g</sup> Data are the sum of "Distributed Solar Energy Heat" and "Distributed Solar Energy Electricity."

<sup>h</sup> 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.

<sup>i</sup> 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.

<sup>j</sup> 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.

<sup>k</sup> Data are the sum of "Distributed Solar Energy Total" and "Utility-Scale Solar Energy Total."

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 <sup>a</sup> Solar Generation <sup>b</sup>				Utility-Scale <sup>c</sup> Solar Generation <sup>b</sup>				Total
	Residential Sector	Commercial Sector	Industrial Sector	Total	Commercial Sector <sup>d</sup>	Industrial Sector <sup>e</sup>	Electric Power Sector <sup>f</sup>	Total	
<b>1985 Total</b> .....	NA	NA	NA	NA	NA	NA	11	11	11
<b>1990 Total</b> .....	12	17	4	32	—	—	367	367	399
<b>1995 Total</b> .....	20	29	6	56	—	—	497	497	552
<b>2000 Total</b> .....	39	55	12	107	—	—	493	493	600
<b>2001 Total</b> .....	47	67	15	129	—	—	543	543	672
<b>2002 Total</b> .....	56	79	18	153	—	—	555	555	708
<b>2003 Total</b> .....	65	93	21	178	—	—	534	534	712
<b>2004 Total</b> .....	81	115	25	221	—	—	575	575	796
<b>2005 Total</b> .....	121	172	38	332	—	—	550	550	882
<b>2006 Total</b> .....	177	251	56	484	—	—	508	508	991
<b>2007 Total</b> .....	250	355	79	683	—	—	612	612	1,295
<b>2008 Total</b> .....	401	570	126	1,097	(s)	—	864	864	1,962
<b>2009 Total</b> .....	539	766	170	1,475	(s)	—	891	891	2,366
<b>2010 Total</b> .....	900	1,170	259	2,329	5	2	1,206	1,212	3,541
<b>2011 Total</b> .....	1,358	1,911	423	3,692	84	7	1,727	1,818	5,509
<b>2012 Total</b> .....	2,058	3,169	702	5,929	148	14	4,164	4,327	10,256
<b>2013 Total</b> .....	3,217	4,023	891	8,131	294	17	8,724	9,036	17,167
<b>2014 Total</b> .....	4,947	5,146	1,139	11,233	371	16	17,304	17,691	28,924
<b>2015 Total</b> .....	6,999	5,689	1,451	14,139	416	21	24,456	24,893	39,032
<b>2016 January</b> .....	520	346	113	980	26	1	1,458	1,486	2,465
February .....	622	398	124	1,145	39	2	2,201	2,242	3,386
March .....	835	520	171	1,525	44	2	2,571	2,617	4,143
April .....	951	566	186	1,703	46	2	2,831	2,880	4,583
May .....	1,058	616	206	1,879	48	3	3,375	3,425	5,304
June .....	1,099	623	206	1,928	53	3	3,418	3,473	5,401
July .....	1,146	640	214	2,000	55	3	3,886	3,945	5,945
August .....	1,113	620	209	1,942	58	3	3,908	3,969	5,911
September .....	989	556	190	1,735	48	2	3,584	3,635	5,370
October .....	884	493	174	1,552	42	2	3,147	3,191	4,743
November .....	726	393	139	1,257	36	2	2,729	2,767	4,024
December .....	653	387	128	1,167	33	1	2,389	2,424	3,591
<b>Total</b> .....	<b>10,595</b>	<b>6,158</b>	<b>2,060</b>	<b>18,812</b>	<b>529</b>	<b>27</b>	<b>35,497</b>	<b>36,054</b>	<b>54,866</b>
<b>2017 January</b> .....	697	414	133	1,244	22	NM	2,128	2,152	3,396
February .....	783	454	147	1,383	26	NM	2,469	2,497	3,880
March .....	1,147	630	209	1,987	48	NM	4,381	4,433	6,419
April .....	1,284	700	227	2,211	50	NM	4,721	4,774	6,985
May .....	1,415	774	252	2,440	65	4	5,698	5,766	8,207
June .....	1,468	781	254	2,503	71	8	6,174	6,252	8,755
July .....	1,495	818	264	2,578	63	7	5,435	5,505	8,083
August .....	1,446	798	258	2,501	60	7	5,334	5,401	7,903
September .....	1,292	713	235	2,240	58	6	5,103	5,168	7,408
October .....	1,156	633	214	2,002	53	6	4,771	4,830	6,832
November .....	903	501	170	1,574	31	4	3,085	3,120	4,694
December .....	837	485	155	1,476	29	NM	3,027	3,059	4,536
<b>Total</b> .....	<b>13,922</b>	<b>7,700</b>	<b>2,518</b>	<b>24,139</b>	<b>578</b>	<b>54</b>	<b>52,326</b>	<b>52,958</b>	<b>77,097</b>
<b>2018 January</b> .....	951	540	164	1,655	29	NM	3,229	3,262	4,917
February .....	1,008	594	172	1,774	39	5	3,994	4,037	5,812
March .....	1,395	779	241	2,414	46	6	5,047	5,099	7,513
<b>3-Month Total</b> .....	<b>3,354</b>	<b>1,912</b>	<b>578</b>	<b>5,843</b>	<b>114</b>	<b>15</b>	<b>12,270</b>	<b>12,399</b>	<b>18,242</b>
<b>2017 3-Month Total</b> .....	<b>2,627</b>	<b>1,498</b>	<b>489</b>	<b>4,613</b>	<b>97</b>	<b>6</b>	<b>8,979</b>	<b>9,081</b>	<b>13,695</b>
<b>2016 3-Month Total</b> .....	<b>1,976</b>	<b>1,264</b>	<b>409</b>	<b>3,649</b>	<b>110</b>	<b>6</b>	<b>6,229</b>	<b>6,345</b>	<b>9,994</b>

<sup>a</sup> 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.

<sup>b</sup> See "Photovoltaic Energy" and "Solar Thermal Energy" in Glossary.

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

<sup>d</sup> 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.

<sup>e</sup> 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.

<sup>f</sup> 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.

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 and wood. Biofuels production comprises biomass inputs to the production of fuel ethanol and biodiesel. Wood production is the sum of wood consumption and densified biomass exports.

### 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 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.)

#### 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 forward: Annual estimates based on residential wood consumption growth rates from EIA’s *Annual Energy Outlook* data system.

(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 based on commercial sector wood consumption growth rates from EIA’s *Annual Energy Outlook* data system). 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. Note that there is a discontinuity in this time series between 2014 and 2015 due to a change in the method for allocating motor gasoline consumption to the end-use sectors; beginning in 2015, the commercial and industrial sector shares of fuel ethanol consumption are larger than in 2014, while the transportation sector share is smaller.

### **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 2015 forward, the annual estimates are assumed by EIA to be equal to that of 2014). 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 forward, the annual estimates are assumed by EIA to be equal to that of 2013). 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. Note that there is a discontinuity in this time series between 2014 and 2015 due to a change in the method for allocating motor gasoline consumption to the end-use sectors; beginning in 2015, the commercial and industrial sector shares of fuel ethanol consumption are larger than in 2014, while the transportation sector share is smaller.

### **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. Note that there is a discontinuity in this time series between 2014 and 2015 due to a change in the method for allocating motor gasoline consumption to the end-use sectors; beginning in 2015, the commercial and industrial sector shares of fuel ethanol consumption are larger than in 2014, while the transportation sector share is smaller.

### **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 natural gasoline and conventional motor gasoline used as denaturant).

2009–2016: U.S. Energy Information Administration (EIA), *Petroleum Supply Annual (PSA)*, annual reports, Table 1. Data in thousand barrels for net production of natural gasoline 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 natural gasoline). 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 natural gasoline, conventional motor gasoline, and motor gasoline blending components.

2017 and 2018: EIA, *Petroleum Supply Monthly (PSM)*, monthly reports, Table 1. Data in thousand barrels for net production of natural gasoline 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 natural gasoline). 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 natural gasoline,

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."

2009–2016: EIA, PSA, annual reports, Table 1, data for net production of fuel ethanol at renewable fuels and oxygenate plants.

2017 and 2018: EIA, PSM, monthly reports, Table 1, data for net production of fuel ethanol at renewable fuels and oxygenate plants.

### Trade, Stocks, and Stock Change

1992–2016: EIA, PSA, annual reports, Table 1.

2017 and 2018: 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).

2009–2016: EIA, PSA, annual reports, Table 1. Calculated as fuel ethanol refinery and blender net inputs minus fuel ethanol adjustments.

2017 and 2018: 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 “Biodiesel Feedstock” entry in the “Thermal Conversion Factor Source Documentation” at the end of Appendix A).

### **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.

2011–2016: EIA, *Petroleum Supply Annual (PSA)*, annual reports, Table 1, data for renewable fuels except fuel ethanol.

2017 and 2018: 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.

2012–2016: EIA, PSA, annual reports, Tables 25 and 31, data for biomass-based diesel fuel.

2017 and 2018: 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: 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 derive monthly estimates for that year. Initial monthly estimates for the current year use the previous year’s allocators.

### 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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