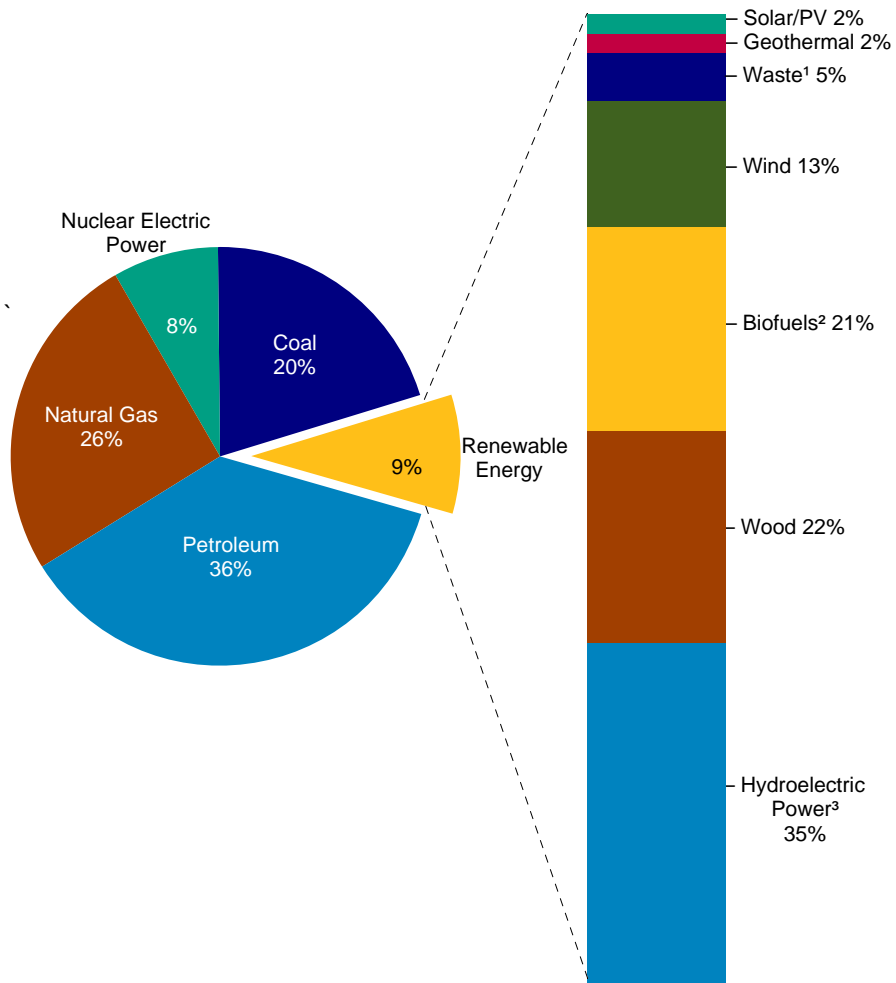


# 10. Renewable Energy

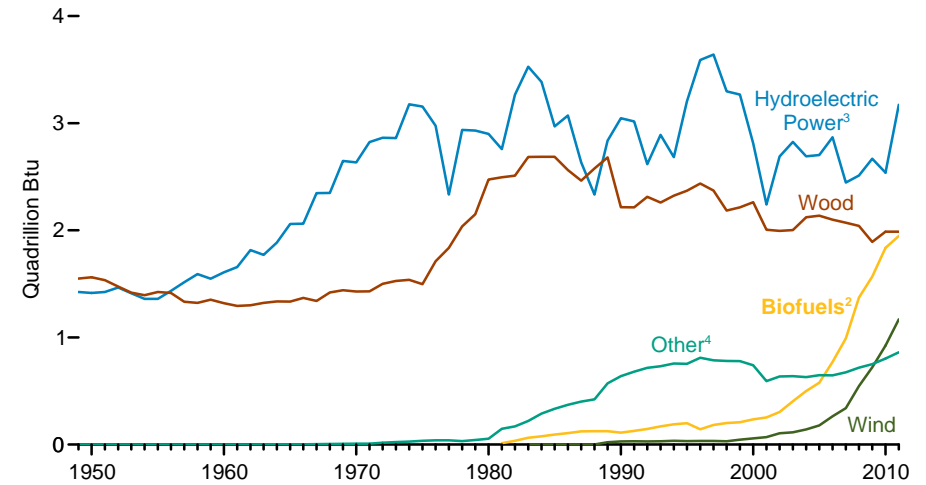
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**Figure 10.1 Renewable Energy Consumption by Major Source**

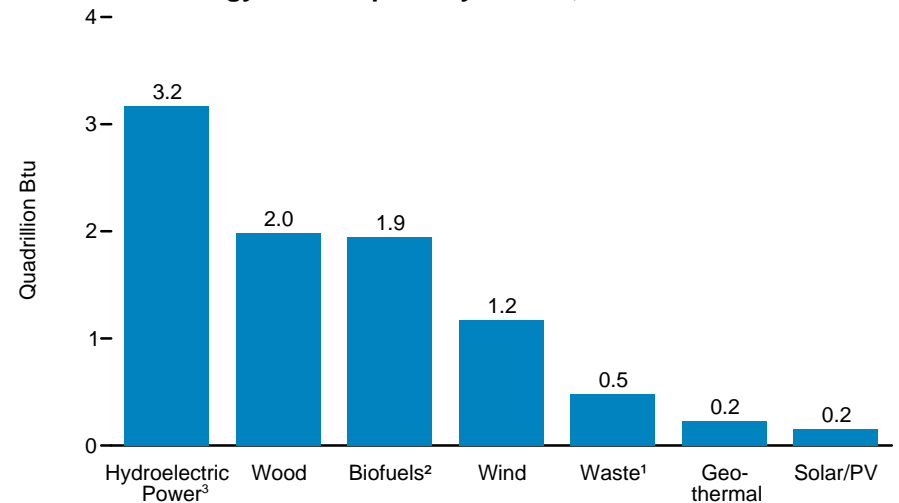
**Renewable Energy as Share of Total Primary Energy Consumption, 2011**



**Renewable Energy Consumption by Source, 1949-2011**



**Renewable Energy Consumption by Source, 2011**



<sup>1</sup> Municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural byproducts, and other biomass.

<sup>2</sup> Fuel ethanol (minus denaturant) and biodiesel consumption, plus losses and co-products from the production of fuel ethanol and biodiesel.

<sup>3</sup> Conventional hydroelectric power.

<sup>4</sup> Geothermal, solar/PV, and waste.

Notes: Sum of components may not equal 100 percent due to independent rounding. Sources: Tables 1.3 and 10.1.

**Table 10.1 Renewable Energy Production and Consumption by Primary Energy Source, Selected Years, 1949-2011**  
(Trillion Btu)

Year	Production <sup>1</sup>			Consumption								Total Renewable Energy
	Biomass		Total Renewable Energy <sup>4</sup>	Hydro-electric Power <sup>5</sup>	Geo-thermal <sup>6</sup>	Solar/PV <sup>7</sup>	Wind <sup>8</sup>	Biomass				
	Biofuels <sup>2</sup>	Total <sup>3</sup>						Wood <sup>9</sup>	Waste <sup>10</sup>	Biofuels <sup>11</sup>	Total	
1949	NA	1,549	2,974	1,425	NA	NA	NA	1,549	NA	NA	1,549	2,974
1950	NA	1,562	2,978	1,415	NA	NA	NA	1,562	NA	NA	1,562	2,978
1955	NA	1,424	2,784	1,360	NA	NA	NA	1,424	NA	NA	1,424	2,784
1960	NA	1,320	2,928	1,608	(s)	NA	NA	1,320	NA	NA	1,320	2,928
1965	NA	1,335	3,396	2,059	2	NA	NA	1,335	NA	NA	1,335	3,396
1970	NA	1,431	4,070	2,634	6	NA	NA	1,429	2	NA	1,431	4,070
1975	NA	1,499	4,687	3,155	34	NA	NA	1,497	2	NA	1,499	4,687
1976	NA	1,713	4,727	2,976	38	NA	NA	1,711	2	NA	1,713	4,727
1977	NA	1,838	4,209	2,333	37	NA	NA	1,837	2	NA	1,838	4,209
1978	NA	2,038	5,005	2,937	31	NA	NA	2,036	1	NA	2,038	5,005
1979	NA	2,152	5,123	2,931	40	NA	NA	2,150	2	NA	2,152	5,123
1980	NA	2,476	5,428	2,900	53	NA	NA	2,474	2	NA	2,476	5,428
1981	13	2,596	5,414	2,758	59	NA	NA	2,496	88	13	2,596	5,414
1982	34	2,663	5,980	3,266	51	NA	NA	2,510	119	34	2,663	5,980
1983	63	2,904	6,496	3,527	64	NA	(s)	2,684	157	63	2,904	6,496
1984	77	2,971	6,438	3,386	81	(s)	(s)	2,686	208	77	2,971	6,438
1985	93	3,016	6,084	2,970	97	(s)	(s)	2,687	236	93	3,016	6,084
1986	107	2,932	6,111	3,071	108	(s)	(s)	2,562	263	107	2,932	6,111
1987	123	2,875	5,622	2,635	112	(s)	(s)	2,463	289	123	2,875	5,622
1988	124	3,016	5,457	2,334	106	(s)	(s)	2,577	315	124	3,016	5,457
1989	125	3,159	6,235	2,837	162	55	22	2,680	354	125	3,159	6,235
1990	111	2,735	6,041	3,046	171	59	29	2,216	408	111	2,735	6,041
1991	128	2,782	6,069	3,016	178	62	31	2,214	440	128	2,782	6,069
1992	145	2,932	5,821	2,617	179	64	30	2,313	473	145	2,932	5,821
1993	169	2,908	6,083	2,892	186	66	31	2,260	479	169	2,908	6,083
1994	188	3,028	5,988	2,683	173	68	36	2,324	515	188	3,028	5,988
1995	198	3,099	6,558	3,205	152	69	33	2,370	531	200	3,101	6,560
1996	141	3,155	7,012	3,590	163	70	33	2,437	577	143	3,157	7,014
1997	186	3,108	7,018	3,640	167	70	34	2,371	551	184	3,105	7,016
1998	202	2,929	6,494	3,297	168	69	31	2,184	542	201	2,927	6,493
1999	211	2,965	6,517	3,268	171	68	46	2,214	540	209	2,963	6,516
2000	233	3,006	6,104	2,811	164	R66	57	2,262	511	236	3,008	6,106
2001	254	2,624	5,164	2,242	164	64	70	2,006	364	253	2,622	5,163
2002	308	2,705	5,734	2,689	171	63	105	1,995	402	303	2,701	5,729
2003	402	2,805	5,982	2,825	175	62	115	2,002	401	404	2,807	5,983
2004	487	2,998	6,070	2,690	178	63	142	2,121	389	499	3,010	6,082
2005	564	3,104	6,229	2,703	181	63	178	R2,137	403	577	R3,117	6,242
2006	720	R3,216	R6,599	2,869	181	68	264	R2,099	397	771	R3,267	R6,649
2007	978	R3,461	R6,509	2,446	186	76	341	R2,070	413	991	R3,474	R6,523
2008	1,387	R3,864	R7,202	2,511	192	89	546	R2,040	436	1,372	R3,849	R7,186
2009	R1,584	R3,928	R7,616	2,669	200	98	721	R1,891	R453	R1,568	R3,912	R7,600
2010	R1,884	R4,341	R8,136	R2,539	R208	R126	R923	R1,988	R469	R1,837	R4,294	R8,090
2011 <sup>P</sup>	2,047	4,511	9,236	3,171	226	158	1,168	1,987	477	1,947	4,411	9,135

<sup>1</sup> Production equals consumption for all renewable energy sources except biofuels.

<sup>2</sup> Total biomass inputs to the production of fuel ethanol and biodiesel.

<sup>3</sup> Wood and wood-derived fuels, biomass waste, and total biomass inputs to the production of fuel ethanol and biodiesel.

<sup>4</sup> Hydroelectric power, geothermal, solar thermal/photovoltaic, wind, and biomass.

<sup>5</sup> Conventional hydroelectricity net generation (converted to Btu using the fossil-fuels heat rate—see Table A6).

<sup>6</sup> Geothermal electricity net generation (converted to Btu using the fossil-fuels heat rate—see Table A6), and geothermal heat pump and direct use energy.

<sup>7</sup> Solar thermal and photovoltaic (PV) electricity net generation (converted to Btu using the fossil-fuels heat rate—see Table A6), and solar thermal direct use energy.

<sup>8</sup> Wind electricity net generation (converted to Btu using the fossil-fuels heat rate—see Table A6).

<sup>9</sup> Wood and wood-derived fuels.

<sup>10</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>11</sup> Fuel ethanol (minus denaturant) and biodiesel consumption, plus losses and co-products from the production of fuel ethanol and biodiesel.

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

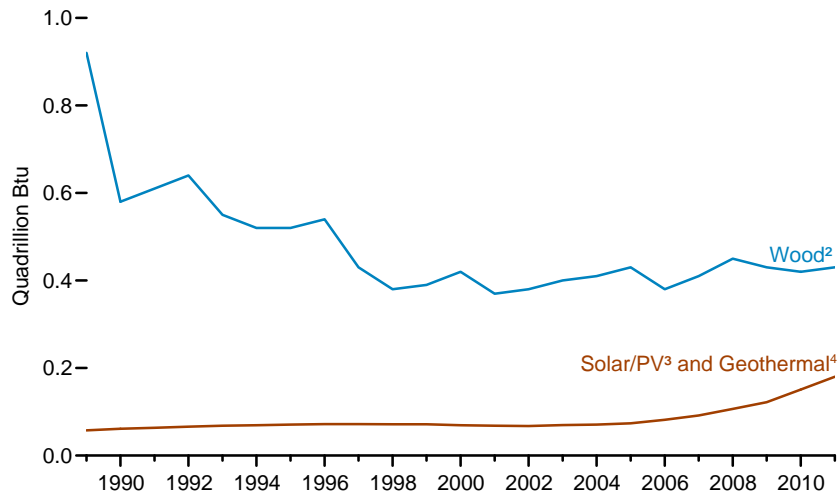
Notes: • Most data for the residential, commercial, industrial, and transportation sectors are estimates. See notes and sources for Tables 10.2a and 10.2b. • See Tables 8.2a–8.2d and 8.3a–8.3c for electricity net generation and useful thermal output from renewable energy sources; Tables 8.4a–8.4c, 8.5a–8.5d, 8.6a–8.6c, and 8.7a–8.7c for renewable energy consumption for electricity generation and useful thermal output; and Tables 8.11a–8.11d for renewable energy electric net summer capacity. • See Note, "Renewable Energy Production and Consumption," at end of section. • See Table E1 for estimated renewable energy consumption for 1635–1945. • Totals may not equal sum of components due to independent rounding.

Web Pages: • See <http://www.eia.gov/totalenergy/data/monthly/#renewable> for updated monthly and annual data. • See <http://www.eia.gov/totalenergy/data/annual/#renewable> for all annual data beginning in 1949. • See <http://www.eia.gov/renewable/> for related information.

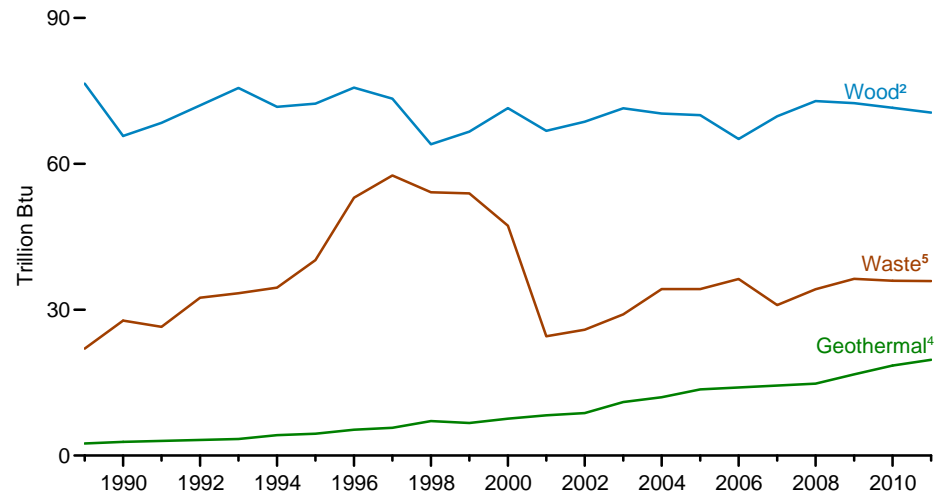
Sources: **Biofuels:** Tables 10.3 and 10.4. **All Other Data:** Tables 10.2a–10.2c.

**Figure 10.2a Renewable Energy Consumption: End-Use Sectors, 1989-2011**

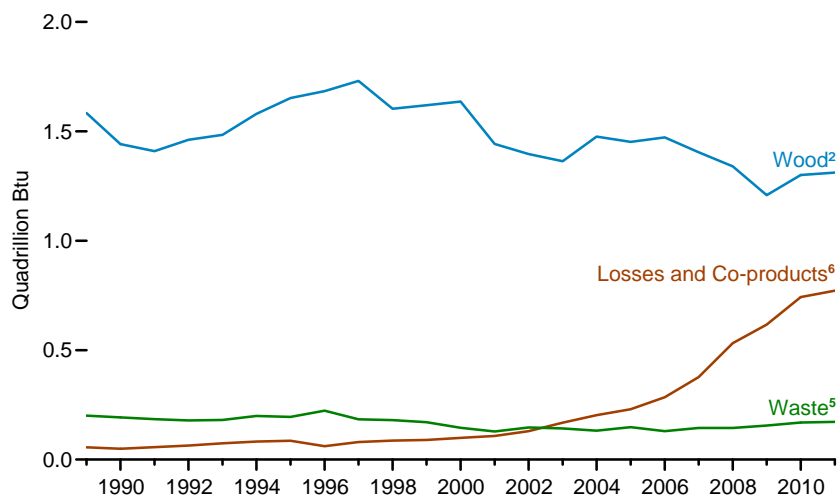
**Residential Sector**



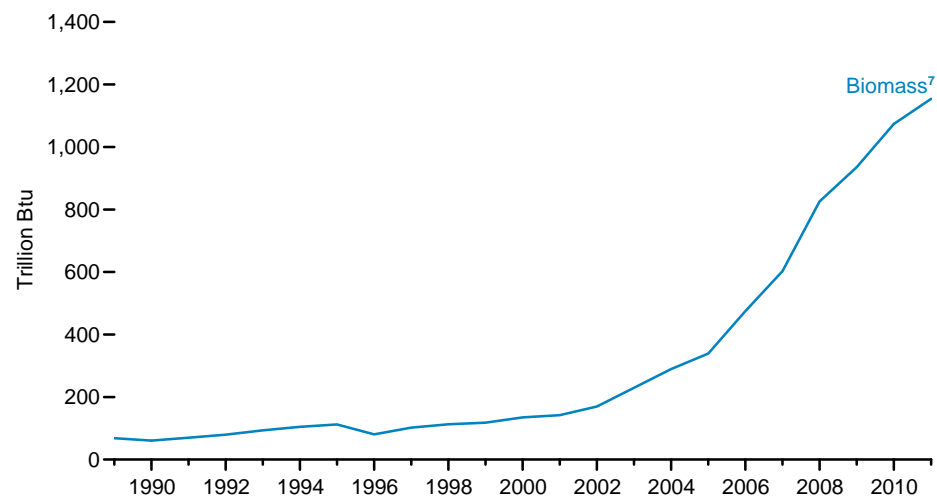
**Commercial¹ Sector, Major Sources**



**Industrial¹ Sector, Major Sources**



**Transportation Sector**



<sup>1</sup> Includes fuel used at combined-heat-and-power (CHP) plants and a small number of electricity-only plants.

<sup>2</sup> Wood and wood-derived fuels.

<sup>3</sup> Solar thermal direct use energy, and photovoltaic (PV) electricity net generation. Includes small amounts of distributed solar thermal and PV energy used in the commercial, industrial, and electric power sectors.

<sup>4</sup> Geothermal heat pump and direct use energy.

<sup>5</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>6</sup> From the production of fuel ethanol and biodiesel.

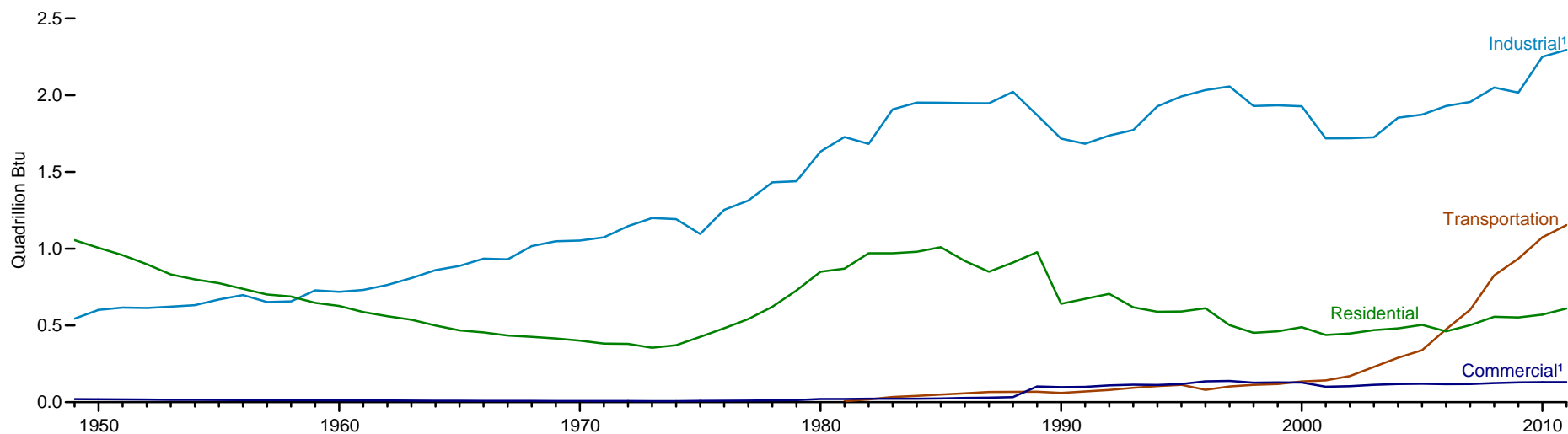
<sup>7</sup> The fuel ethanol (minus denaturant) portion of motor fuels (such as E10 and E85), and biodiesel. See "Biodiesel" in Glossary.

Note: See related Figures 10.2b and 10.2c.

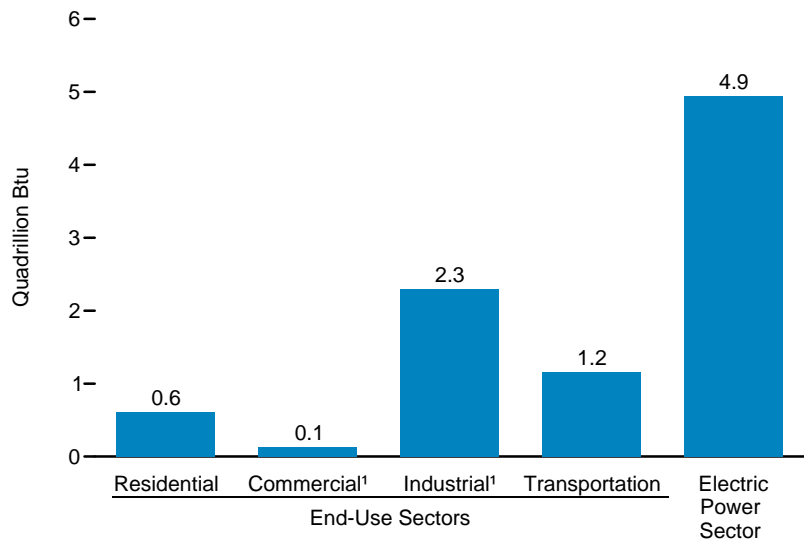
Sources: Tables 10.2a and 10.2b.

**Figure 10.2b Renewable Energy Consumption: End-Use Sectors and Electric Power Sector**

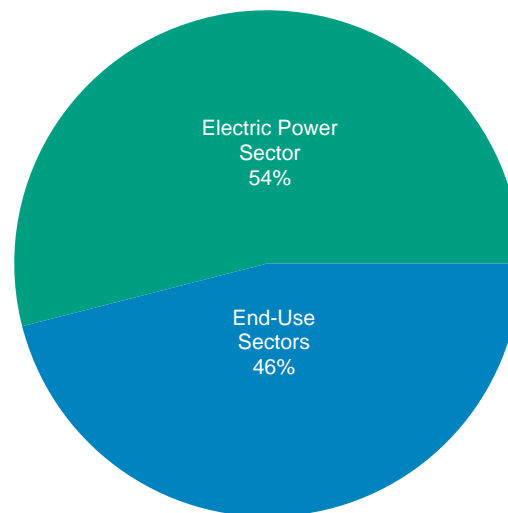
**End-Use Sectors, 1949-2011**



**End-Use Sectors and Electric Power Sector, 2011**



**End-Use Sectors and Electric Power Sector Shares of Total Renewable Energy Consumption, 2011**



<sup>1</sup> Includes fuel use at combined-heat-and-power (CHP) plants and a small number of electricity-only plants.

Note: See related Figures 10.2a and 10.2c.  
Sources: Tables 10.2a-10.2c.

**Table 10.2a Renewable Energy Consumption: Residential and Commercial Sectors, Selected Years, 1949-2011**  
(Trillion Btu)

Year	Residential Sector				Commercial Sector <sup>1</sup>								
	Geo-thermal <sup>2</sup>	Solar/PV <sup>3</sup>	Biomass	Total	Hydro-electric Power <sup>5</sup>	Geo-thermal <sup>2</sup>	Solar/PV <sup>6</sup>	Wind <sup>7</sup>	Biomass			Total	Total
			Wood <sup>4</sup>						Wood <sup>4</sup>	Waste <sup>8</sup>	Fuel Ethanol <sup>9</sup>		
1949	NA	NA	1,055	1,055	NA	NA	NA	NA	20	NA	NA	20	20
1950	NA	NA	1,006	1,006	NA	NA	NA	NA	19	NA	NA	19	19
1955	NA	NA	775	775	NA	NA	NA	NA	15	NA	NA	15	15
1960	NA	NA	627	627	NA	NA	NA	NA	12	NA	NA	12	12
1965	NA	NA	468	468	NA	NA	NA	NA	9	NA	NA	9	9
1970	NA	NA	401	401	NA	NA	NA	NA	8	NA	NA	8	8
1975	NA	NA	425	425	NA	NA	NA	NA	8	NA	NA	8	8
1976	NA	NA	482	482	NA	NA	NA	NA	9	NA	NA	9	9
1977	NA	NA	542	542	NA	NA	NA	NA	10	NA	NA	10	10
1978	NA	NA	622	622	NA	NA	NA	NA	12	NA	NA	12	12
1979	NA	NA	728	728	NA	NA	NA	NA	14	NA	NA	14	14
1980	NA	NA	850	850	NA	NA	NA	NA	21	NA	NA	21	21
1981	NA	NA	870	870	NA	NA	NA	NA	21	NA	(s)	21	21
1982	NA	NA	970	970	NA	NA	NA	NA	22	NA	(s)	22	22
1983	NA	NA	970	970	NA	NA	NA	NA	22	NA	(s)	22	22
1984	NA	NA	980	980	NA	NA	NA	NA	22	NA	(s)	22	22
1985	NA	NA	1,010	1,010	NA	NA	NA	NA	24	NA	(s)	24	24
1986	NA	NA	920	920	NA	NA	NA	NA	27	NA	(s)	27	27
1987	NA	NA	850	850	NA	NA	NA	NA	29	NA	1	30	30
1988	NA	NA	910	910	NA	NA	NA	NA	32	NA	1	33	33
1989	5	52	920	977	1	3	—	—	76	22	1	99	102
1990	6	56	580	641	1	3	—	—	66	28	(s)	94	98
1991	6	57	610	673	1	3	—	—	68	26	(s)	95	100
1992	6	R60	640	706	1	3	—	—	72	32	(s)	105	109
1993	7	61	550	618	1	3	—	—	76	33	(s)	109	114
1994	6	63	520	589	1	4	—	—	72	35	(s)	106	112
1995	7	64	520	591	1	5	—	—	72	40	(s)	113	118
1996	7	65	540	612	1	5	—	—	76	53	(s)	129	135
1997	8	64	430	502	1	6	—	—	73	58	(s)	131	138
1998	8	64	380	452	1	7	—	—	64	54	(s)	118	127
1999	9	63	390	461	1	7	—	—	67	54	(s)	121	129
2000	9	R61	420	489	1	8	—	—	71	47	(s)	119	128
2001	9	59	370	438	1	8	—	—	67	25	(s)	92	101
2002	10	57	380	448	(s)	9	—	—	69	26	(s)	95	104
2003	13	57	400	470	1	11	—	—	71	29	1	101	113
2004	14	57	410	481	1	12	—	—	70	34	1	105	118
2005	16	58	430	504	1	14	—	—	70	34	1	105	R120
2006	18	63	R380	R462	1	14	—	—	65	36	1	R103	R118
2007	22	70	R410	R502	1	14	—	—	R70	31	2	R103	118
2008	26	80	450	R557	1	15	(s)	—	73	34	2	109	125
2009	33	89	430	552	1	17	(s)	(s)	72	36	3	112	129
2010	37	R114	420	R571	1	19	(s)	(s)	R72	R36	3	R111	R130
2011 <sup>P</sup>	40	140	430	610	1	20	(s)	(s)	71	36	3	110	131

<sup>1</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 8.

<sup>2</sup> Geothermal heat pump and direct use energy.

<sup>3</sup> Solar thermal direct use energy, and photovoltaic (PV) electricity net generation (converted to Btu using the fossil-fuels heat rate—see Table A6). Includes distributed solar thermal and PV energy used in the commercial, industrial, and electric power sectors.

<sup>4</sup> Wood and wood-derived fuels.

<sup>5</sup> Conventional hydroelectricity net generation (converted to Btu using the fossil-fuels heat rate—see Table A6).

<sup>6</sup> Photovoltaic (PV) electricity net generation (converted to Btu using the fossil-fuels heat rate—see Table A6) at commercial plants with capacity of 1 megawatt or greater.

<sup>7</sup> Wind electricity net generation (converted to Btu using the fossil-fuels heat rate—see Table A6).

<sup>8</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>9</sup> The fuel ethanol (minus denaturant) portion of motor fuels, such as E10, consumed by the commercial sector.

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

Notes: • Data are estimates, except for commercial sector solar/PV, hydroelectric power, wind, and waste. • See Tables 8.2a–8.2d and 8.3a–8.3c for electricity net generation and useful thermal output from renewable energy sources; Tables 8.4a–8.4c, 8.5a–8.5d, 8.6a–8.6c, and 8.7a–8.7c for renewable energy consumption for electricity generation and useful thermal output; and Tables 8.11a–8.11d for renewable energy electric net summer capacity. • Totals may not equal sum of components due to independent rounding.

Web Pages: • See <http://www.eia.gov/totalenergy/data/monthly/#renewable> for updated monthly and annual data. • See <http://www.eia.gov/totalenergy/data/annual/#renewable> for all annual data beginning in 1949. • See <http://www.eia.gov/renewable/> for related information.

Sources: See end of section.

**Table 10.2b Renewable Energy Consumption: Industrial and Transportation Sectors, Selected Years, 1949-2011**  
(Trillion Btu)

Year	Industrial Sector <sup>1</sup>										Transportation Sector		
	Hydro-electric Power <sup>2</sup>	Geo-thermal <sup>3</sup>	Solar/PV <sup>4</sup>	Wind <sup>5</sup>	Biomass					Total	Biomass		
					Wood <sup>6</sup>	Waste <sup>7</sup>	Fuel Ethanol <sup>8</sup>	Losses and Co-products <sup>9</sup>	Total		Fuel Ethanol <sup>10</sup>	Biodiesel	Total
1949	76	NA	NA	NA	468	NA	NA	NA	468	544	NA	NA	NA
1950	69	NA	NA	NA	532	NA	NA	NA	532	602	NA	NA	NA
1955	38	NA	NA	NA	631	NA	NA	NA	631	669	NA	NA	NA
1960	39	NA	NA	NA	680	NA	NA	NA	680	719	NA	NA	NA
1965	33	NA	NA	NA	855	NA	NA	NA	855	888	NA	NA	NA
1970	34	NA	NA	NA	1,019	NA	NA	NA	1,019	1,053	NA	NA	NA
1975	32	NA	NA	NA	1,063	NA	NA	NA	1,063	1,096	NA	NA	NA
1976	33	NA	NA	NA	1,220	NA	NA	NA	1,220	1,253	NA	NA	NA
1977	33	NA	NA	NA	1,281	NA	NA	NA	1,281	1,314	NA	NA	NA
1978	32	NA	NA	NA	1,400	NA	NA	NA	1,400	1,432	NA	NA	NA
1979	34	NA	NA	NA	1,405	NA	NA	NA	1,405	1,439	NA	NA	NA
1980	33	NA	NA	NA	1,600	NA	NA	NA	1,600	1,633	NA	NA	NA
1981	33	NA	NA	NA	1,602	87	(s)	6	1,695	1,728	7	NA	7
1982	33	NA	NA	NA	1,516	118	(s)	16	1,650	1,683	18	NA	18
1983	33	NA	NA	NA	1,690	155	(s)	29	1,874	1,908	34	NA	34
1984	33	NA	NA	NA	1,679	204	1	35	1,918	1,951	41	NA	41
1985	33	NA	NA	NA	1,645	230	1	42	1,918	1,951	50	NA	50
1986	33	NA	NA	NA	1,610	256	1	48	1,915	1,948	57	NA	57
1987	33	NA	NA	NA	1,576	282	1	55	1,914	1,947	66	NA	66
1988	33	NA	NA	NA	1,625	308	1	55	1,989	2,022	67	NA	67
1989	28	2	—	—	1,584	200	1	56	1,841	1,871	68	NA	68
1990	31	2	—	—	1,442	192	1	49	1,684	1,717	60	NA	60
1991	30	2	—	—	1,410	185	1	56	1,652	1,684	70	NA	70
1992	31	2	—	—	1,461	179	1	64	1,705	1,737	80	NA	80
1993	30	2	—	—	1,484	181	1	74	1,741	1,773	94	NA	94
1994	62	3	—	—	1,580	199	1	82	1,862	1,927	105	NA	105
1995	55	3	—	—	1,652	195	2	86	1,934	1,992	112	NA	112
1996	61	3	—	—	1,683	224	1	61	1,969	2,033	81	NA	81
1997	58	3	—	—	1,731	184	1	80	1,996	2,057	102	NA	102
1998	55	3	—	—	1,603	180	1	86	1,872	1,929	113	NA	113
1999	49	4	—	—	1,620	171	1	90	1,882	1,934	118	NA	118
2000	42	4	—	—	1,636	145	1	99	1,881	1,928	135	NA	135
2001	33	5	—	—	1,443	129	3	108	1,681	1,719	141	1	142
2002	39	5	—	—	1,396	146	3	130	1,676	1,720	168	2	170
2003	43	3	—	—	1,363	142	4	169	1,679	1,726	228	2	230
2004	33	4	—	—	1,476	132	6	203	1,817	1,853	286	3	290
2005	32	4	—	—	1,452	148	7	230	1,837	1,873	327	12	339
2006	29	4	—	—	1,472	130	10	285	1,897	1,930	442	33	475
2007	16	5	—	—	R1,405	144	10	377	R1,936	R1,956	557	46	602
2008	17	5	—	—	R1,340	144	12	532	R2,028	R2,049	786	40	826
2009	18	4	—	—	R1,208	R155	13	617	R1,994	R2,016	894	R42	R935
2010	16	4	(s)	(s)	R1,301	R169	R17	R742	R2,230	R2,250	R1,040	R34	R1,074
2011 <sup>P</sup>	18	4	(s)	(s)	1,311	172	17	772	2,273	2,295	1,042	112	1,154

<sup>1</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 8.

<sup>2</sup> Conventional hydroelectricity net generation (converted to Btu using the fossil-fuels heat rate—see Table A6).

<sup>3</sup> Geothermal heat pump and direct use energy.

<sup>4</sup> Photovoltaic (PV) electricity net generation (converted to Btu using the fossil-fuels heat rate—see Table A6) at industrial plants with capacity of 1 megawatt or greater.

<sup>5</sup> Wind electricity net generation (converted to Btu using the fossil-fuels heat rate—see Table A6).

<sup>6</sup> Wood and wood-derived fuels.

<sup>7</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>8</sup> The fuel ethanol (minus denaturant) portion of motor fuels, such as E10, consumed by the industrial sector.

<sup>9</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>10</sup> The fuel ethanol (minus denaturant) portion of motor fuels, such as E10 and E85, consumed by the transportation sector.

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

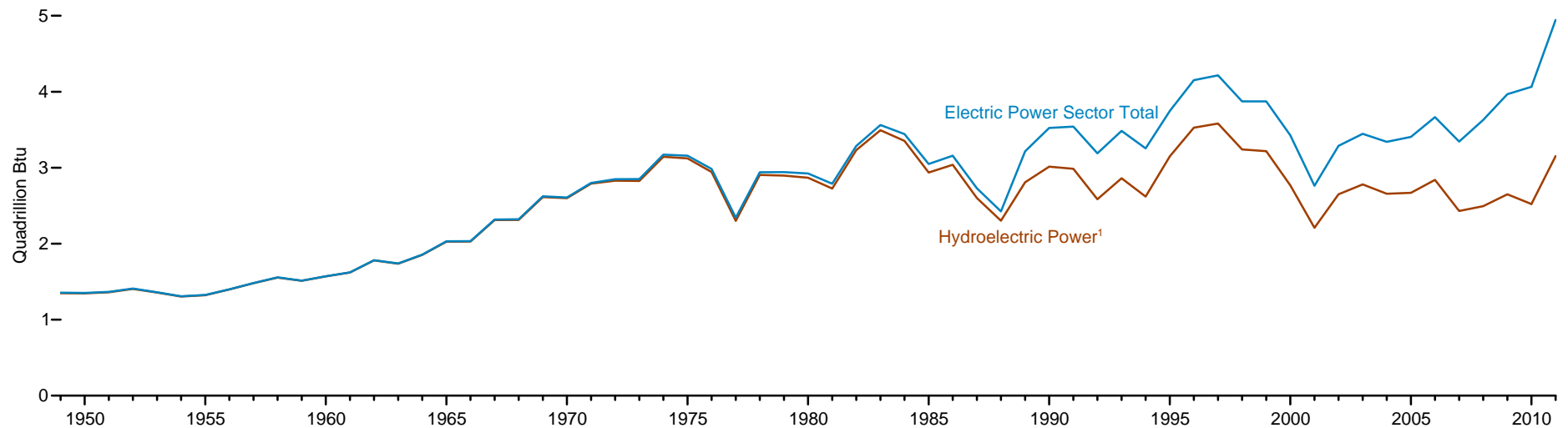
Notes: • Data are estimates, except for industrial sector hydroelectric power in 1949–1978 and 1989 forward, solar/PV, and wind. • See Tables 8.2a–8.2d and 8.3a–8.3c for electricity net generation and useful thermal output from renewable energy sources; Tables 8.4a–8.4c, 8.5a–8.5d, 8.6a–8.6c, and 8.7a–8.7c for renewable energy consumption for electricity generation and useful thermal output; and Tables 8.11a–8.11d for renewable energy electric net summer capacity. • Totals may not equal sum of components due to independent rounding.

Web Pages: • See <http://www.eia.gov/totalenergy/data/monthly/#renewable> for updated monthly and annual data. • See <http://www.eia.gov/totalenergy/data/annual/#renewable> for all annual data beginning in 1949. • See <http://www.eia.gov/renewable/> for related information.

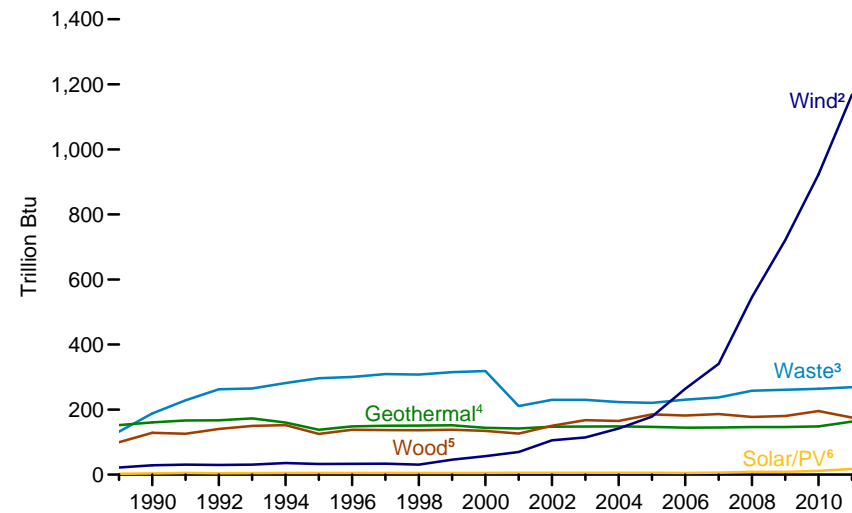
Sources: See end of section.

## Figure 10.2c Renewable Energy Consumption: Electric Power Sector

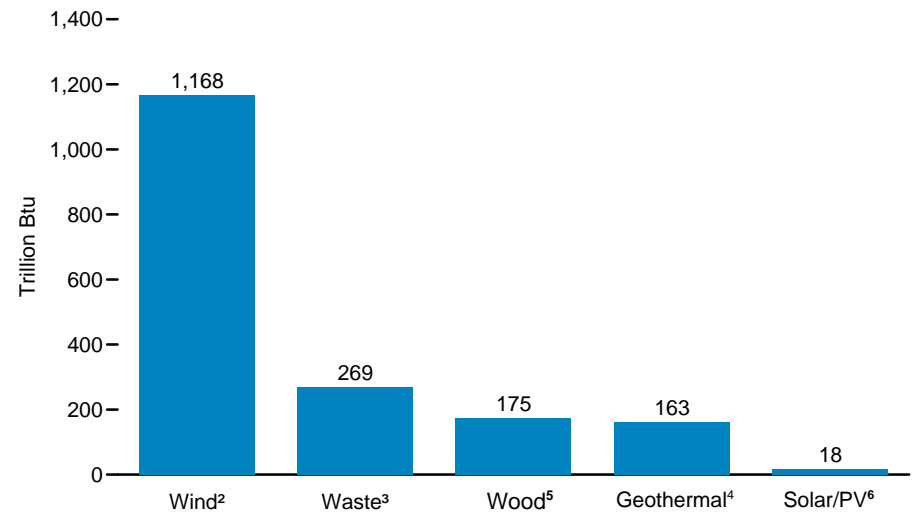
### Electric Power Sector Total and Hydroelectric Power, 1949-2011



### Non-Hydroelectric Power Sources, 1989-2011



### Non-Hydroelectric Power Sources, 2011



<sup>1</sup> Conventional hydroelectricity net generation.

<sup>2</sup> Wind electricity net generation.

<sup>3</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>4</sup> Geothermal electricity net generation.

<sup>5</sup> Wood and wood-derived fuels.

<sup>6</sup> Solar thermal and photovoltaic (PV) electricity net generation.

Note: See related Figures 10.2a and 10.2b on the end-use sectors.

Source: Table 10.2c.



**Table 10.2c Renewable Energy Consumption: Electric Power Sector, Selected Years, 1949-2011**

(Trillion Btu)

Year	Hydroelectric Power <sup>1</sup>	Geothermal <sup>2</sup>	Solar/PV <sup>3</sup>	Wind <sup>4</sup>	Biomass			Total
					Wood <sup>5</sup>	Waste <sup>6</sup>	Total	
1949	1,349	NA	NA	NA	6	NA	6	1,355
1950	1,346	NA	NA	NA	5	NA	5	1,351
1955	1,322	NA	NA	NA	3	NA	3	1,325
1960	1,569	(s)	NA	NA	2	NA	2	1,571
1965	2,026	2	NA	NA	3	NA	3	2,031
1970	2,600	6	NA	NA	1	2	4	2,609
1975	3,122	34	NA	NA	(s)	2	2	3,158
1976	2,943	38	NA	NA	1	2	3	2,983
1977	2,301	37	NA	NA	3	2	5	2,343
1978	2,905	31	NA	NA	2	1	3	2,940
1979	2,897	40	NA	NA	3	2	5	2,942
1980	2,867	53	NA	NA	3	2	5	2,925
1981	2,725	59	NA	NA	3	1	4	2,788
1982	3,233	51	NA	NA	2	1	3	3,286
1983	3,494	64	NA	(s)	2	2	4	3,562
1984	3,353	81	(s)	(s)	5	4	9	3,443
1985	2,937	97	(s)	(s)	8	7	14	3,049
1986	3,038	108	(s)	(s)	5	7	12	3,158
1987	2,602	112	(s)	(s)	8	7	15	2,729
1988	2,302	106	(s)	(s)	10	8	17	2,425
1989 <sup>7</sup>	2,808	152	3	22	100	132	232	3,217
1990	3,014	161	4	29	129	188	317	3,524
1991	2,985	167	5	31	126	229	354	3,542
1992	2,586	167	4	30	140	262	402	3,189
1993	2,861	173	5	31	150	265	415	3,484
1994	2,620	160	5	36	152	282	434	3,255
1995	3,149	138	5	33	125	296	422	3,747
1996	3,528	148	5	33	138	300	438	4,153
1997	3,581	150	5	34	137	309	446	4,216
1998	3,241	151	5	31	137	308	444	3,872
1999	3,218	152	5	46	138	315	453	3,874
2000	2,768	144	5	57	134	318	453	3,427
2001	2,209	142	6	70	126	211	337	2,763
2002	2,650	147	6	105	150	230	380	3,288
2003	2,781	148	5	115	167	230	397	3,445
2004	2,656	148	6	142	165	223	388	3,340
2005	2,670	147	6	178	185	221	406	3,406
2006	2,839	145	5	264	182	231	412	3,665
2007	2,430	145	6	341	186	237	423	3,345
2008	2,494	146	9	546	177	258	435	3,630
2009	2,650	146	9	721	180	261	441	3,967
2010	<sup>R</sup> 2,521	<sup>R</sup> 148	<sup>R</sup> 12	<sup>R</sup> 923	<sup>R</sup> 196	<sup>R</sup> 264	<sup>R</sup> 459	<sup>R</sup> 4,064
2011 <sup>P</sup>	3,153	163	18	1,168	175	269	444	4,945

<sup>1</sup> Conventional hydroelectricity net generation (converted to Btu using the fossil-fuels heat rate—see Table A6).

<sup>2</sup> Geothermal electricity net generation (converted to Btu using the fossil-fuels heat rate—see Table A6).

<sup>3</sup> Solar thermal and photovoltaic (PV) electricity net generation (converted to Btu using the fossil-fuels heat rate—see Table A6).

<sup>4</sup> Wind electricity net generation (converted to Btu using the fossil-fuels heat rate—see Table A6).

<sup>5</sup> Wood and wood-derived fuels.

<sup>6</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>7</sup> Through 1988, data are for electric utilities only. Beginning in 1989, data are for electric utilities and independent power producers.

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

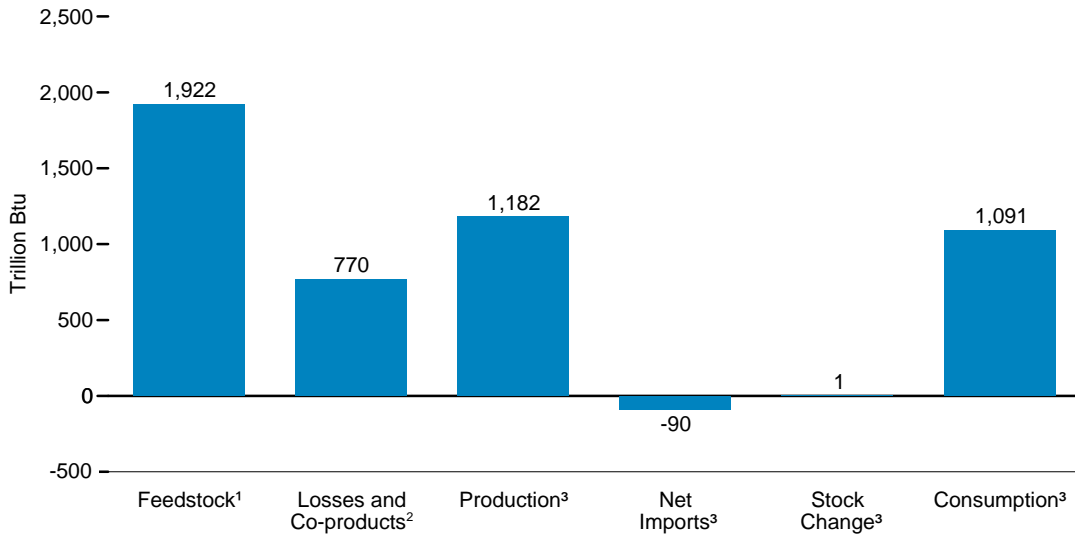
Notes: • The electric power sector comprises electricity-only and combined-heat-and-power (CHP) plants within the NAICS 22 category whose primary business is to sell electricity, or electricity and heat, to the public. • See Tables 8.2a–8.2d and 8.3a–8.3c for electricity net generation and useful thermal output from renewable energy sources; Tables 8.4a–8.4c, 8.5a–8.5d, 8.6a–8.6c, and 8.7a–8.7c for renewable energy consumption for electricity generation and useful thermal output; and Tables 8.11a–8.11d for renewable energy electric net summer capacity. • See Note 3, "Electricity Imports and Exports," at end of Section 8. • Totals may not equal sum of components due to independent rounding.

Web Pages: • See <http://www.eia.gov/totalenergy/data/monthly/#renewable> for updated monthly and annual data. • See <http://www.eia.gov/totalenergy/data/annual/#renewable> for all annual data beginning in 1949. • See <http://www.eia.gov/renewable/> for related information.

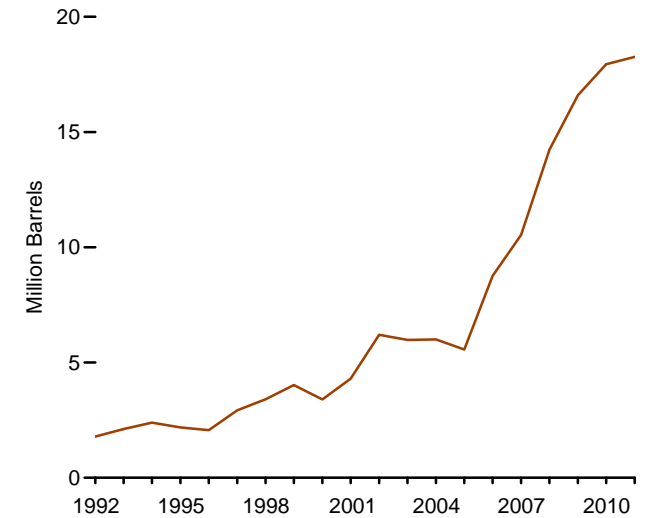
Sources: Tables 8.2b, 8.5b, 8.7b, and A6.

## Figure 10.3 Fuel Ethanol Overview

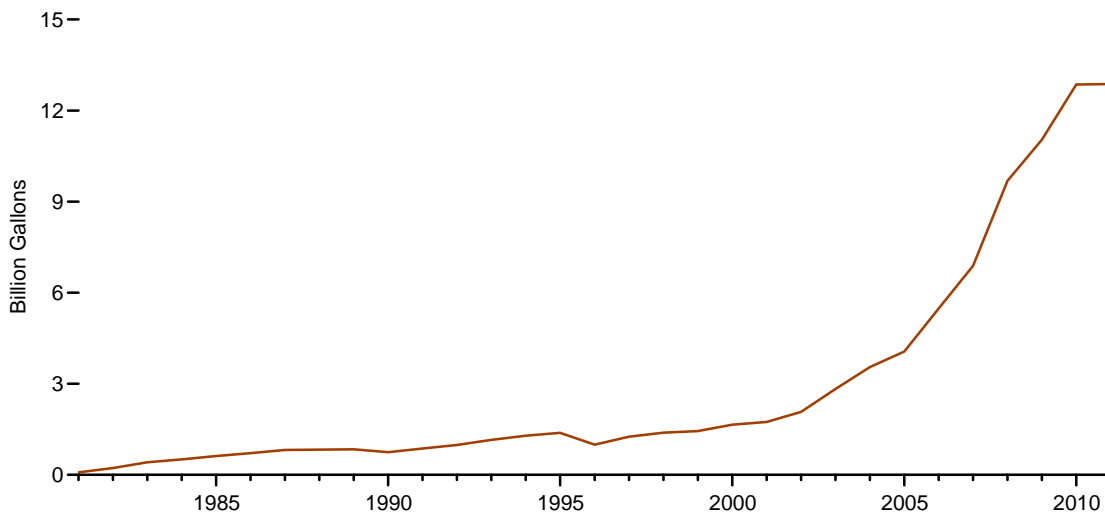
### Overview, 2011



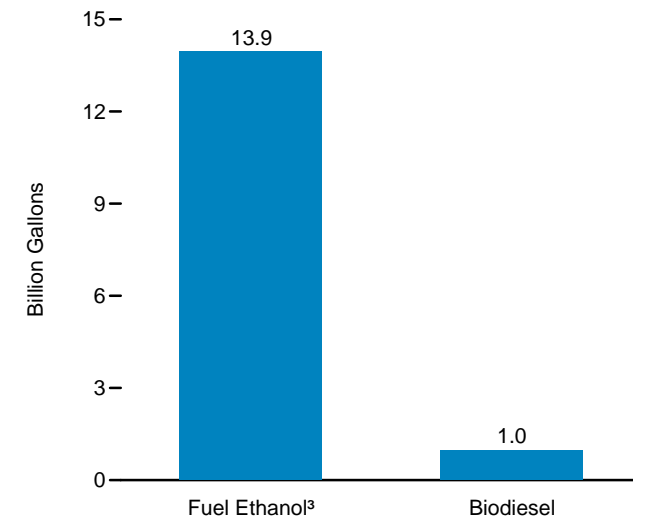
### Stocks,<sup>3</sup> End of Year 1992-2011



### Consumption,<sup>3</sup> 1981-2011



### Fuel Ethanol and Biodiesel Production, 2011



<sup>1</sup> Total corn and other biomass inputs to the production of undenatured ethanol used for fuel ethanol.

<sup>2</sup> Losses and co-products from the production of fuel ethanol.

<sup>3</sup> Includes denaturant.

Sources: Tables 10.3, 10.4, and A3.

**Table 10.3 Fuel Ethanol Overview, 1981-2011**

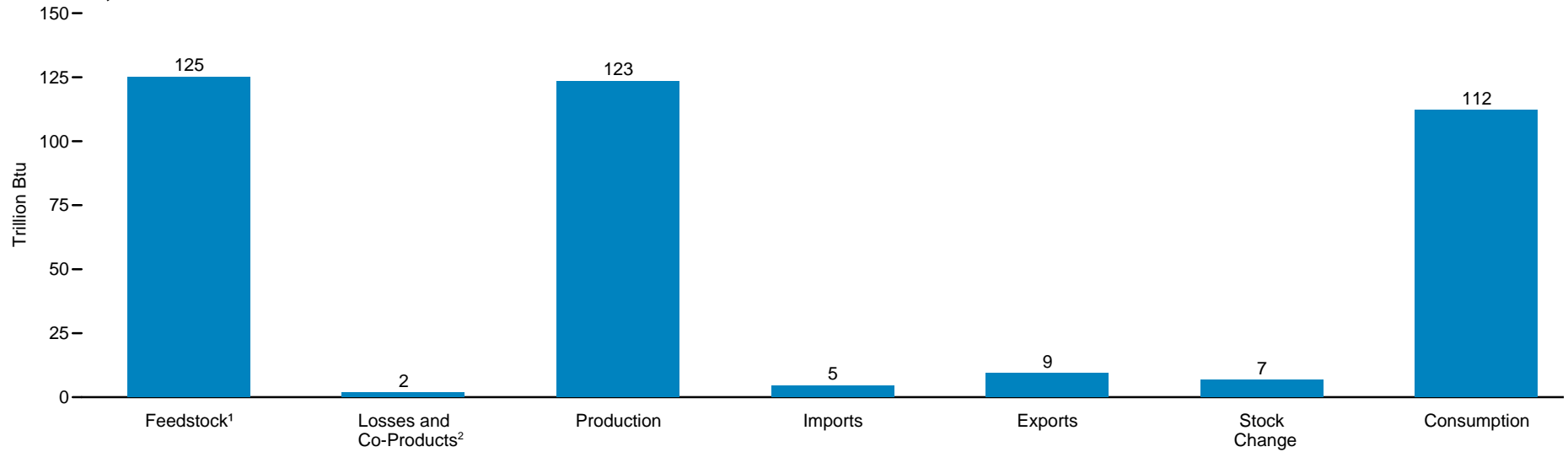
Year	Feed-stock <sup>1</sup> Trillion Btu	Losses and Co-products <sup>2</sup> Trillion Btu	Denaturant <sup>3</sup> Thousand Barrels	Production <sup>4</sup>			Trade <sup>4</sup>			Stocks, <sup>4</sup> End of Year Thousand Barrels	Stock Change <sup>4,6</sup> Thousand Barrels	Consumption <sup>4</sup>			Consumption Minus Denaturant <sup>7</sup> Trillion Btu
				Thousand Barrels	Million Gallons	Trillion Btu	Imports	Exports	Net Imports <sup>5</sup>			Thousand Barrels	Million Gallons	Trillion Btu	
				Thousand Barrels	Million Gallons	Trillion Btu	Thousand Barrels	Thousand Barrels	Thousand Barrels			Thousand Barrels	Million Gallons	Trillion Btu	
1981	13	6	40	1,978	83	7	NA	NA	NA	NA	NA	1,978	83	7	7
1982	34	16	107	5,369	225	19	NA	NA	NA	NA	NA	5,369	225	19	19
1983	63	29	198	9,890	415	35	NA	NA	NA	NA	NA	9,890	415	35	34
1984	77	35	243	12,150	510	43	NA	NA	NA	NA	NA	12,150	510	43	42
1985	93	42	294	14,693	617	52	NA	NA	NA	NA	NA	14,693	617	52	51
1986	107	48	339	16,954	712	60	NA	NA	NA	NA	NA	16,954	712	60	59
1987	123	55	390	19,497	819	69	NA	NA	NA	NA	NA	19,497	819	69	68
1988	124	55	396	19,780	831	70	NA	NA	NA	NA	NA	19,780	831	70	69
1989	125	56	401	20,062	843	71	NA	NA	NA	NA	NA	20,062	843	71	70
1990	111	49	356	17,802	748	63	NA	NA	NA	NA	NA	17,802	748	63	62
1991	128	56	413	20,627	866	73	NA	NA	NA	NA	NA	20,627	866	73	72
1992	145	64	469	23,453	985	84	NA	NA	NA	1,791	NA	23,453	985	84	81
1993	169	74	550	27,484	1,154	98	244	NA	244	2,114	323	27,405	1,151	98	95
1994	188	82	614	30,689	1,289	109	279	NA	279	2,393	279	30,689	1,289	109	106
1995	198	86	647	32,325	1,358	115	387	NA	387	2,186	-207	32,919	1,383	117	114
1996	141	61	464	23,178	973	83	313	NA	313	2,065	-121	23,612	992	84	82
1997	186	80	613	30,674	1,288	109	85	NA	85	2,925	860	29,899	1,256	107	104
1998	202	86	669	33,453	1,405	119	66	NA	66	3,406	481	33,038	1,388	118	115
1999	211	90	698	34,881	1,465	124	87	NA	87	4,024	618	34,350	1,443	122	119
2000	233	99	773	38,627	1,622	138	116	NA	116	3,400	-624	39,367	1,653	140	137
2001	253	108	841	42,028	1,765	150	315	NA	315	4,298	898	41,445	1,741	148	144
2002	307	130	1,019	50,956	2,140	182	306	NA	306	6,200	1,902	49,360	2,073	176	171
2003	400	169	1,335	66,772	2,804	238	292	NA	292	5,978	-222	67,286	2,826	240	233
2004	484	203	1,621	81,058	3,404	289	3,542	NA	3,542	6,002	24	84,576	3,552	301	293
2005	552	230	1,859	92,961	3,904	331	3,234	NA	3,234	5,563	-439	96,634	4,059	344	335
2006	688	285	2,326	116,294	4,884	414	17,408	NA	17,408	8,760	3,197	130,505	5,481	465	453
2007	914	376	3,105	155,263	6,521	553	10,457	NA	10,457	10,535	1,775	163,945	6,886	584	569
2008	1,300	531	4,433	221,637	9,309	790	12,610	NA	12,610	14,226	3,691	230,556	9,683	821	800
2009	1,517	616	5,688	260,424	10,938	928	4,720	NA	4,720	16,594	2,368	262,776	11,037	936	910
2010	R1,839	R742	R6,506	R316,617	R13,298	R1,127	R373	R9,488	R-9,115	R17,941	R1,347	R306,155	R12,858	R1,090	R1,061
2011 <sup>P</sup>	1,922	770	6,636	332,107	13,948	1,182	3,135	28,457	-25,322	18,261	8321	306,464	12,871	1,091	1,063

<sup>1</sup> Total corn and other biomass inputs to the production of undenatured ethanol used for fuel ethanol.  
<sup>2</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>3</sup> The amount of denaturant in fuel ethanol produced.  
<sup>4</sup> Includes denaturant.  
<sup>5</sup> Net imports equal imports minus exports.  
<sup>6</sup> A negative value indicates a decrease in stocks and a positive value indicates an increase.  
<sup>7</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>8</sup> Derived from the preliminary 2010 stocks value (17,940 thousand barrels), not the final 2010 value (17,941 thousand barrels) that is shown under "Stocks."  
R=Revised. P=Preliminary. NA=Not available.  
Notes: • 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.  
Web Pages: • See <http://www.eia.gov/totalenergy/data/monthly/#renewable> for updated monthly and annual data. • See <http://www.eia.gov/petroleum/supply/monthly/> for related information.  
Sources: **Feedstock:** 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:** 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 percent 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 forward—U.S. Energy Information Administration (EIA), *Petroleum Supply Annual (PSA)*, annual

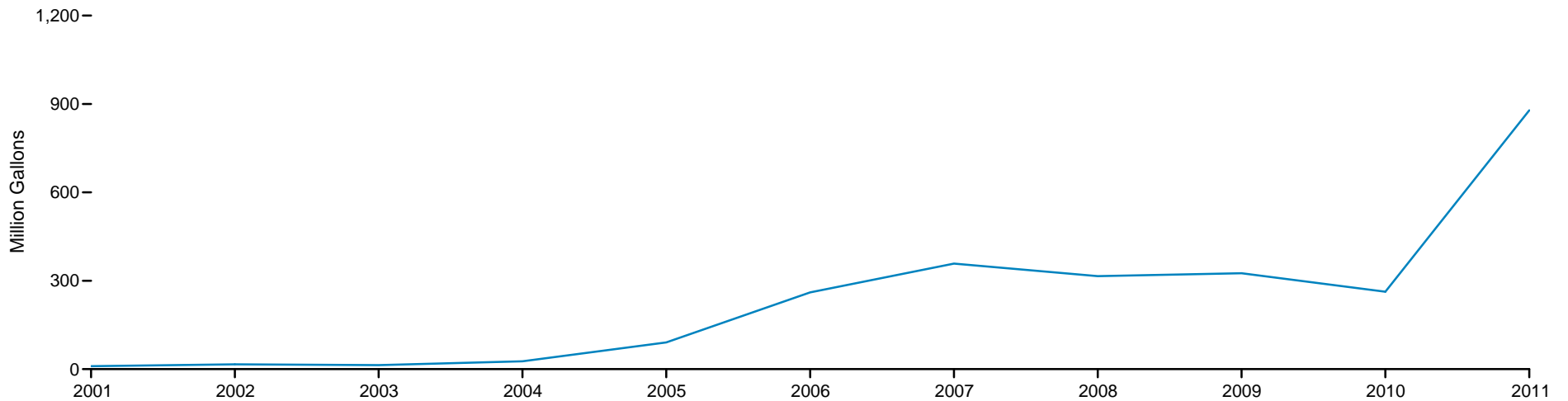
report, Table 1, and *Petroleum Supply Monthly (PSM)*, monthly reports, Table 1. Data in thousand barrels for net production of pentanes plus at renewable fuels and oxygenate plants are multiplied by -1; these data are converted to Btu by multiplying by 4.620 million Btu per barrel (the approximate heat 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 and 2010—EIA, PSA, Table 1, data for net production of fuel ethanol at renewable fuels and oxygenate plants.  
• 2011—EIA, PSM (February 2012), Table 1, data for net production of fuel ethanol at renewable fuels and oxygenate plants. **Trade, Stocks, and Stock Change:** • 1992–2010—EIA, PSA, annual reports, Table 1.  
• 2011—EIA, PSM (February 2012), 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 percent 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 and 2010—EIA, PSA, Table 1. Calculated as fuel ethanol refinery and blender net inputs minus fuel ethanol adjustments. • 2011—EIA, PSM (February 2012), Table 1. Calculated as fuel ethanol refinery and blender net inputs minus fuel ethanol adjustments. **Consumption Minus Denaturant:** 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.

## Figure 10.4 Biodiesel Overview

### Overview, 2011



### Consumption, 2001-2011



<sup>1</sup> Total vegetable oil and other biomass inputs to the production of biodiesel.

<sup>2</sup> Losses and co-products from the production of biodiesel.

Sources: Tables 10.4 and A3.

**Table 10.4 Biodiesel Overview, 2001-2011**

Year	Feedstock <sup>1</sup>	Losses and Co-products <sup>2</sup>	Production			Trade			Stocks, End of Year	Stock Change <sup>4</sup>	Balancing Item <sup>5</sup>	Consumption		
						Imports	Exports	Net Imports <sup>3</sup>						
			Trillion Btu	Trillion Btu	Thousand Barrels	Million Gallons	Trillion Btu	Thousand Barrels	Thousand Barrels	Thousand Barrels	Thousand Barrels	Thousand Barrels	Thousand Barrels	Thousand Barrels
2001	1	(s)	204	9	1	78	39	39	NA	NA	NA	243	10	1
2002	1	(s)	250	10	1	191	56	135	NA	NA	NA	385	16	2
2003	2	(s)	338	14	2	94	110	-16	NA	NA	NA	322	14	2
2004	4	(s)	666	28	4	97	124	-26	NA	NA	NA	640	27	3
2005	12	(s)	2,162	91	12	207	206	1	NA	NA	NA	2,163	91	12
2006	32	(s)	5,963	250	32	1,069	828	242	NA	NA	NA	6,204	261	33
2007	63	1	11,662	490	62	3,342	6,477	-3,135	NA	NA	NA	8,528	358	46
2008	88	1	16,145	678	87	7,502	16,128	-8,626	NA	NA	NA	7,519	316	40
2009	<sup>R</sup> 67	1	<sup>R</sup> 12,281	<sup>R</sup> 516	<sup>R</sup> 66	1,844	6,332	-4,489	711	711	<sup>R</sup> 669	<sup>R</sup> 7,750	<sup>R</sup> 326	<sup>R</sup> 42
2010	<sup>R</sup> 44	1	<sup>R</sup> 8,177	<sup>R</sup> 343	<sup>R</sup> 44	546	2,503	-1,958	<sup>R</sup> 672	<sup>R</sup> -39	0	<sup>R</sup> 6,258	<sup>R</sup> 263	<sup>R</sup> 34
2011 <sup>P</sup>	125	2	23,034	967	123	861	1,740	-879	1,902	<sup>6</sup> 1,240	0	20,915	878	112

<sup>1</sup> Total vegetable oil and other biomass inputs to the production of biodiesel.

<sup>2</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>3</sup> Net imports equal imports minus exports.

<sup>4</sup> A negative value indicates a decrease in stocks and a positive value indicates an increase.

<sup>5</sup> Beginning in 2009, because of incomplete data coverage and different data sources, "Balancing Item" is used to balance biodiesel supply and disposition.

<sup>6</sup> Derived from the preliminary 2010 stocks value (662 thousand barrels), not the final 2010 value (672 thousand barrels) that is shown under "Stocks."

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

Notes: • 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 A3). • 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.

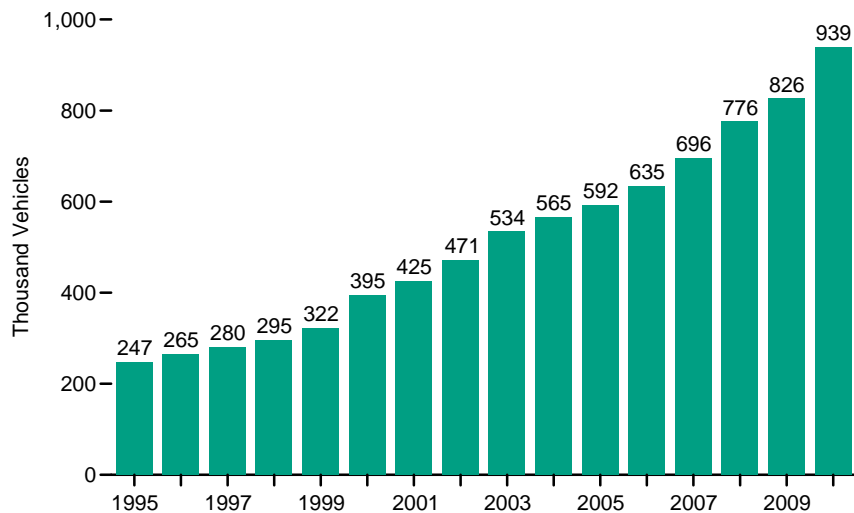
Web Pages: • See <http://www.eia.gov/totalenergy/data/monthly/#renewable> for updated monthly and annual data. • See <http://www.eia.gov/biofuels/biodiesel/production/> for related information.

Sources: **Feedstock:** Calculated as biodiesel production in thousand barrels multiplied by 5.433 million Btu per barrel (the biodiesel feedstock factor—see Table A3). **Losses and Co-products:** Calculated as biodiesel feedstock minus biodiesel production. **Production:** • 2001-2005—U.S. Department of Agriculture, Commodity Credit Corporation, Bioenergy Program records. Annual data are derived from quarterly data. • 2006—U.S. Department of Commerce, Bureau of the Census, "M311K - Fats and Oils:

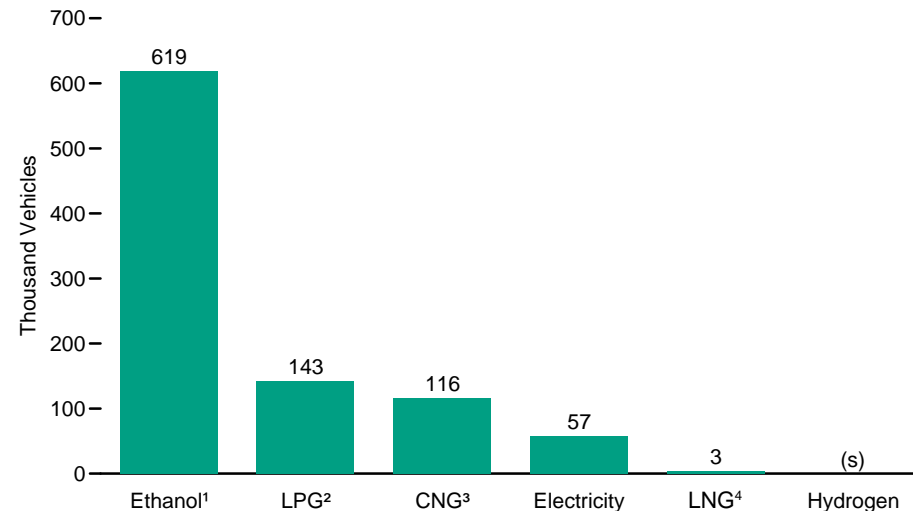
Production, Consumption, and Stocks," data for soybean oil consumed in methyl esters (biodiesel). In addition, EIA estimates that 14.4 million gallons of yellow grease were consumed in methyl esters (biodiesel). • 2007—U.S. Department of Commerce, Bureau of the Census, "M311K - Fats and Oils: Production, 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. • 2009 forward—EIA, *Monthly Biodiesel Production Report* (May 2012), Table 1. **Trade:** U.S. Department of Agriculture, imports data for Harmonized Tariff Schedule codes 3824.90.40.20, "Fatty Esters Animal/Vegetable/Mixture" (for data through June 2010), and 3824.90.40.30, "Biodiesel/Mixes" (for data beginning in July 2010); and exports data for Schedule B code 3824.90.40.00, "Fatty Substances Animal/Vegetable/Mixture" (for data through 2010), and 3824.90.40.30, "Biodiesel <70%" (for data for 2011). Although these categories include products other than biodiesel (such as those 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 estimates. **Stocks and Stock Change:** • 2009 and 2010—EIA, *Petroleum Supply Annual*, annual reports, Table 1, data for renewable fuels except fuel ethanol. • 2011—EIA, *Petroleum Supply Monthly (PSM)*, monthly reports, Table 1, data for renewable fuels except fuel ethanol. **Balancing Item:** • 2009 forward—Calculated as biodiesel consumption and biodiesel stock change minus biodiesel production and biodiesel net imports. **Consumption:** • 2001-2008—Calculated as biodiesel production plus biodiesel net imports. • 2009—Calculated as the sum of the monthly consumption data. Data for January and February 2009 are from EIA, PSM, monthly reports, Table 1, refinery and blender net inputs of renewable fuels except fuel ethanol. Data for March-December 2009 are calculated as biodiesel production plus biodiesel net imports minus biodiesel stock change. • 2010 and 2011—Calculated as biodiesel production plus biodiesel net imports minus biodiesel stock change.

**Figure 10.5 Estimated Number of Alternative-Fueled Vehicles in Use and Alternative Fuel Consumption**

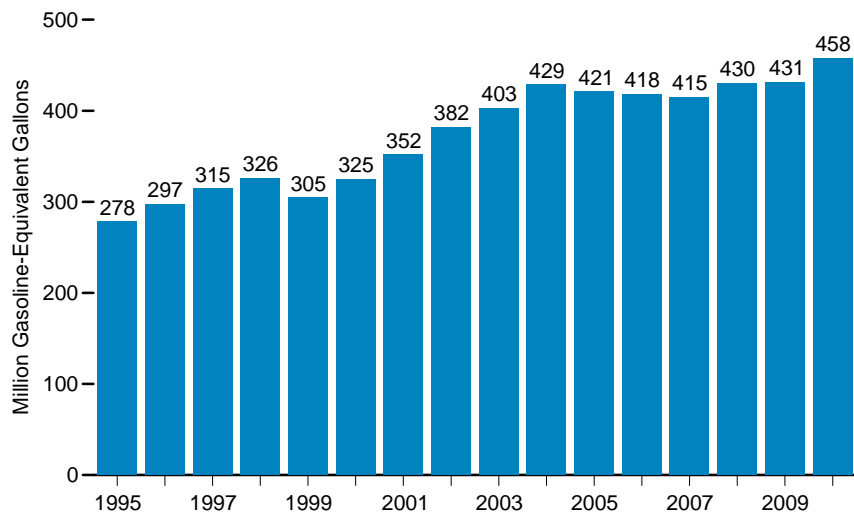
**Vehicles in Use, 1995-2010**



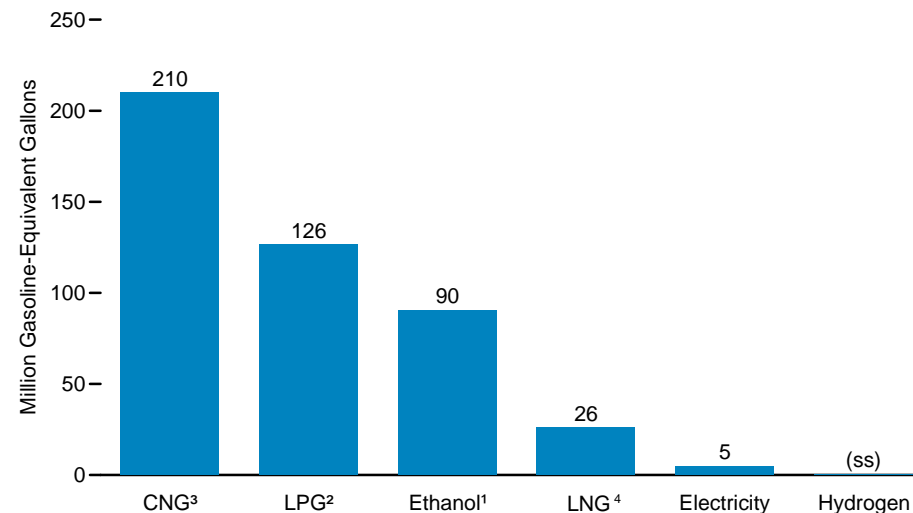
**Vehicles in Use by Fuel Type, 2010**



**Fuel Consumption,⁵ 1995-2010**



**Fuel Consumption by Type, 2010**



<sup>1</sup> Ethanol, 85 percent (E85). Includes only those E85 vehicles believed to be used as alternative-fueled vehicles, primarily fleet-operated vehicles; excludes other vehicles with E85-fueling capability.

<sup>2</sup> Liquefied petroleum gases.

<sup>3</sup> Compressed natural gas.

<sup>4</sup> Liquefied natural gas.

<sup>5</sup> Excludes oxygenates and biodiesel.

(s)=Fewer than 0.5 thousand vehicles.

(ss)=Less than 0.5 million gasoline-equivalent gallons.

Source: Table 10.5.

**Table 10.5 Estimated Number of Alternative-Fueled Vehicles in Use and Fuel Consumption, 1992-2010**

Year	Alternative and Replacement Fuels <sup>1</sup>											Oxygenates <sup>2</sup>			Bio-diesel <sup>10</sup>	Total
	Liquefied Petroleum Gases	Compressed Natural Gas	Liquefied Natural Gas	Methanol, 85 Percent (M85) <sup>3</sup>	Methanol, Neat (M100) <sup>4</sup>	Ethanol, 85 Percent (E85) <sup>3,5</sup>	Ethanol, 95 Percent (E95) <sup>3</sup>	Electricity <sup>6</sup>	Hydrogen	Other Fuels <sup>7</sup>	Subtotal	Methyl Tertiary Butyl Ether <sup>8</sup>	Ethanol in Gasohol <sup>9</sup>	Total		
	Alternative-Fueled Vehicles in Use <sup>11</sup> (number)															
1992	NA	23,191	90	4,850	404	172	38	1,607	NA	NA	NA	NA	NA	NA	NA	NA
1993	NA	32,714	299	10,263	414	441	27	1,690	NA	NA	NA	NA	NA	NA	NA	NA
1994	NA	41,227	484	15,484	415	605	33	2,224	NA	NA	NA	NA	NA	NA	NA	NA
1995	172,806	50,218	603	18,319	386	1,527	136	2,860	0	0	246,855	NA	NA	NA	NA	NA
1996	175,585	60,144	663	20,265	172	4,536	361	3,280	0	0	265,006	NA	NA	NA	NA	NA
1997	175,679	68,571	813	21,040	172	9,130	347	4,453	0	0	280,205	NA	NA	NA	NA	NA
1998	177,183	78,782	1,172	19,648	200	12,788	14	5,243	0	0	295,030	NA	NA	NA	NA	NA
1999	178,610	91,267	1,681	18,964	198	24,604	14	6,964	0	0	322,302	NA	NA	NA	NA	NA
2000	181,994	100,750	2,090	10,426	0	87,570	4	11,830	0	0	394,664	NA	NA	NA	NA	NA
2001	185,053	111,851	2,576	7,827	0	100,303	0	17,847	0	0	425,457	NA	NA	NA	NA	NA
2002	187,680	120,839	2,708	5,873	0	120,951	0	33,047	0	0	471,098	NA	NA	NA	NA	NA
2003	190,369	114,406	2,640	0	0	179,090	0	47,485	9	0	533,999	NA	NA	NA	NA	NA
2004	182,864	118,532	2,717	0	0	211,800	0	49,536	43	0	565,492	NA	NA	NA	NA	NA
2005	173,795	117,699	2,748	0	0	246,363	0	51,398	119	3	592,125	NA	NA	NA	NA	NA
2006	164,846	116,131	2,798	0	0	297,099	0	53,526	159	3	634,562	NA	NA	NA	NA	NA
2007	158,254	114,391	2,781	0	0	364,384	0	55,730	223	3	695,766	NA	NA	NA	NA	NA
2008	151,049	113,973	3,101	0	0	450,327	0	56,901	313	3	775,667	NA	NA	NA	NA	NA
2009	147,030	114,270	3,176	0	0	504,297	0	57,185	357	3	826,318	NA	NA	NA	NA	NA
2010	143,037	115,863	3,354	0	0	618,505	0	57,462	421	0	938,643	NA	NA	NA	NA	NA
Fuel Consumption <sup>12</sup> (thousand gasoline-equivalent gallons)																
1992	NA	17,159	598	1,121	2,672	22	87	359	NA	NA	NA	1,175,964	719,408	1,895,372	NA	NA
1993	NA	22,035	1,944	1,671	3,321	49	82	288	NA	NA	NA	2,070,897	779,958	2,850,854	NA	NA
1994	NA	24,643	2,398	2,455	3,347	82	144	430	NA	NA	NA	2,020,455	868,113	2,888,569	NA	NA
1995	233,178	35,865	2,821	2,122	2,255	195	1,021	663	0	0	278,121	2,693,407	934,615	3,628,022	NA	3,906,142
1996	239,648	47,861	3,320	1,862	364	712	2,770	773	0	0	297,310	2,751,955	677,537	3,429,492	NA	3,726,802
1997	238,845	66,495	3,798	1,630	364	1,314	1,166	1,010	0	0	314,621	3,106,745	852,514	3,959,260	NA	4,273,880
1998	241,881	73,859	5,463	1,271	471	1,772	61	1,202	0	0	325,980	2,905,781	912,858	3,818,639	NA	4,144,620
1999	210,247	81,211	5,959	1,126	469	4,019	64	1,524	0	0	304,618	3,405,390	975,255	4,380,645	NA	4,685,263
2000	213,012	88,478	7,423	614	0	12,388	13	3,058	0	0	324,986	3,298,803	1,114,313	4,413,116	6,828	4,744,930
2001	216,319	106,584	9,122	461	0	15,007	0	4,066	0	0	351,558	3,354,949	1,173,323	4,528,272	10,627	4,890,457
2002	223,600	123,081	9,593	354	0	18,250	0	7,274	0	0	382,152	3,122,859	1,450,721	4,573,580	16,824	4,972,556
2003	224,697	133,222	13,503	0	0	26,376	0	5,141	2	0	402,941	2,368,400	1,919,572	4,287,972	14,082	4,704,995
2004	211,883	158,903	20,888	0	0	31,581	0	5,269	8	0	428,532	1,877,300	2,414,167	4,291,467	27,616	4,747,615
2005	188,171	166,878	22,409	0	0	38,074	0	5,219	25	2	420,778	1,654,500	2,756,663	4,411,163	93,281	4,925,222
2006	173,130	172,011	23,474	0	0	44,041	0	5,104	41	2	417,803	435,000	3,729,168	4,164,168	267,623	4,849,594
2007	152,360	178,565	24,594	0	0	54,091	0	5,037	66	2	414,715	0	4,694,304	4,694,304	367,764	5,476,783
2008	147,784	189,358	25,554	0	0	62,644	0	5,050	117	2	430,329	0	6,442,781	6,442,781	324,329	7,197,439
2009	129,631	199,513	25,652	0	0	71,213	0	4,956	140	2	431,107	0	7,343,133	7,343,133	325,102	8,099,342
2010	126,354	210,007	26,072	0	0	90,323	0	4,847	152	0	457,755	0	8,527,431	8,527,431	235,188	9,220,374

<sup>1</sup> See "Alternative Fuel" and "Replacement Fuel" in Glossary.

<sup>2</sup> See "Oxygenates" in Glossary.

<sup>3</sup> Remaining portion is motor gasoline. Consumption data include the motor gasoline portion of the fuel.

<sup>4</sup> One hundred percent methanol.

<sup>5</sup> Includes only those E85 vehicles believed to be used as alternative-fuels vehicles (AFVs), primarily fleet-operated vehicles; excludes other vehicles with E85-fueling capability. In 1997, some vehicle manufacturers began including E85-fueling capability in certain model lines of vehicles. For 2010, the U.S. Energy Information Administration (EIA) estimates that the number of E85 vehicles that are capable of operating on E85, motor gasoline, or both, is about 10 million. Many of these AFVs are sold and used as traditional gasoline-powered vehicles.

<sup>6</sup> Excludes gasoline-electric hybrids.

<sup>7</sup> May include P-Series fuel or any other fuel designated by the Secretary of Energy as an alternative fuel in accordance with the Energy Policy Act of 1995.

<sup>8</sup> In addition to methyl tertiary butyl ether (MTBE), includes a very small amount of other ethers, primarily tertiary amyl methyl ether (TAME) and ethyl tertiary butyl ether (ETBE).

<sup>9</sup> Data do not include the motor gasoline portion of the fuel.

<sup>10</sup> "Biodiesel" may be used as a diesel fuel substitute or diesel fuel additive or extender. See "Biodiesel" in Glossary.

<sup>11</sup> "Vehicles in Use" data represent accumulated acquisitions, less retirements, as of the end of each calendar year; data do not include concept and demonstration vehicles that are not ready for delivery to

end users. See "Alternative-Fuel Vehicle" in Glossary.

<sup>12</sup> Fuel consumption quantities are expressed in a common base unit of gasoline-equivalent gallons to allow comparisons of different fuel types. Gasoline-equivalent gallons do not represent gasoline displacement. Gasoline equivalent is computed by dividing the gross heat content of the replacement fuel by the gross heat content of gasoline (using an approximate heat content of 122,619 Btu per gallon) and multiplying the result by the replacement fuel consumption value. See "Heat Content" in Glossary.

NA=Not available.

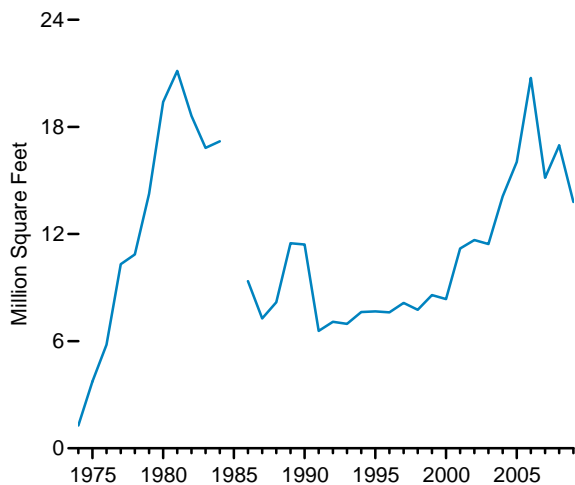
Note: Totals may not equal sum of components due to independent rounding.

Web Page: For related information, see <http://www.eia.gov/renewable/>.

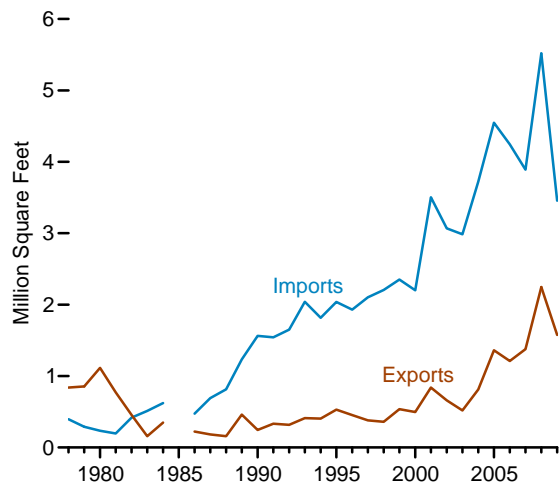
Sources: • 1992-1994—Science Applications International Corporation, "Alternative Transportation Fuels and Vehicles Data Development," unpublished final report prepared for the EIA, (McLean, VA, July 1996), and U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. Data were revised by using gross instead of net heat contents. For a table of gross and net heat contents, see EIA, *Alternatives to Traditional Transportation Fuels: An Overview* (June 1994), Table 22. • 1995-2002—EIA, "Alternatives to Traditional Transportation Fuels 2003 Estimated Data" (February 2004), Tables 1 and 10. Data were revised by using gross instead of net heat contents. • 2003 forward—EIA, Alternative-Fuel Vehicle Interactive Data Viewer (see [http://www.eia.gov/renewable/afv/users.cfm#tabs\\_charts-2](http://www.eia.gov/renewable/afv/users.cfm#tabs_charts-2) and <http://www.eia.gov/renewable/afv/xls/New%20C1%20GEGs.xls>); and "Alternatives to Traditional Transportation Fuels," annual reports, Table C1.

**Figure 10.6 Solar Thermal Collector Shipments by Type, Price, and Trade**

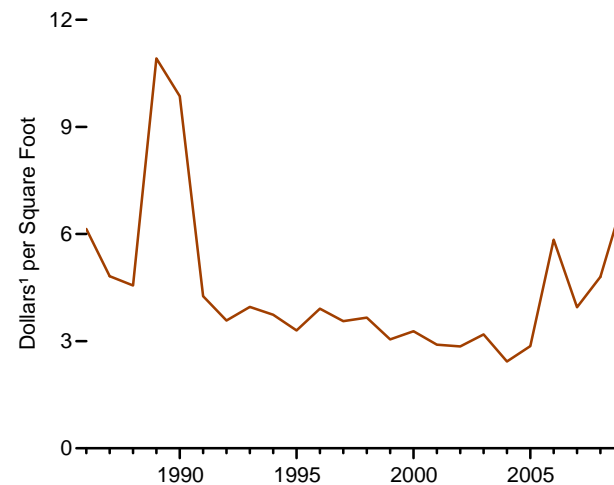
**Total Shipments, 1974-2009**



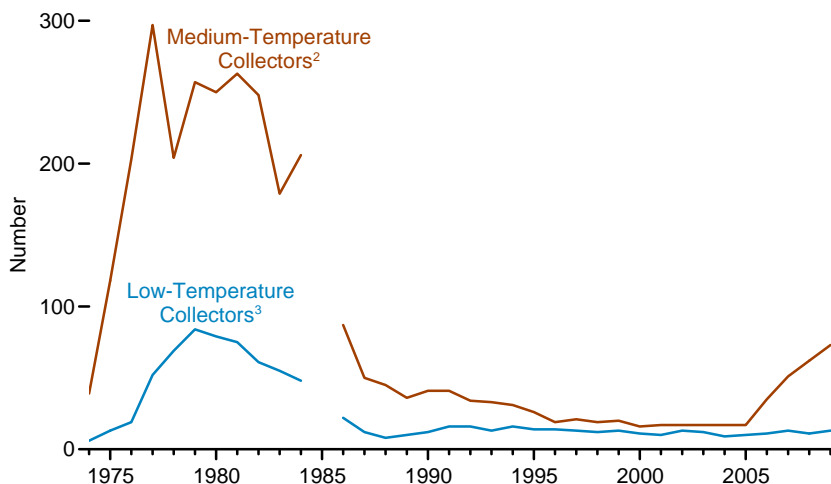
**Trade, 1978-2009**



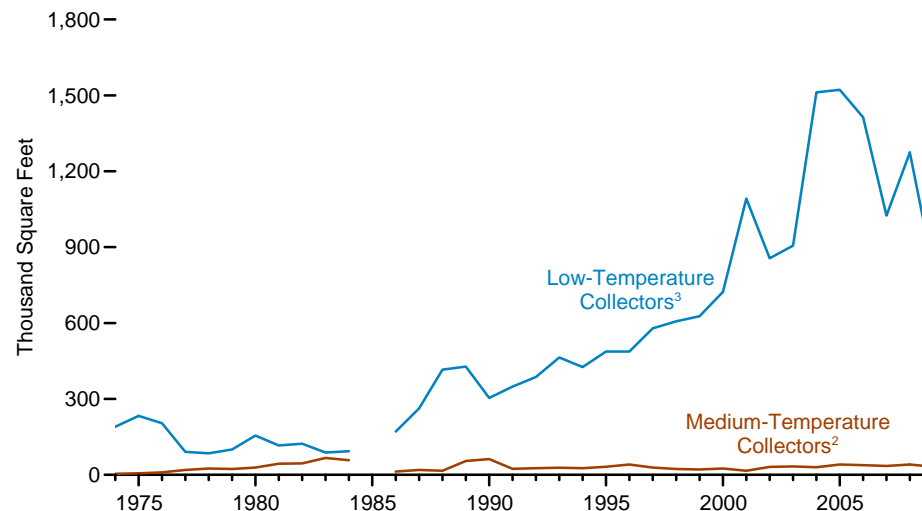
**Price of Total Shipments, 1986-2009**



**Number of U.S. Manufacturers by Type of Collector, 1974-2009**



**Average Annual Shipments per Manufacturer, 1974-2009**



<sup>1</sup> Prices are not adjusted for inflation. See "Nominal Dollars" in Glossary.

<sup>2</sup> Collectors that generally operate in the temperature range of 140 degrees Fahrenheit to 180 degrees Fahrenheit but can also operate at temperatures as low as 110 degrees Fahrenheit. Special collectors—evacuated tube collectors or concentrating (focusing) collectors—are included in the medium-temperature category.

<sup>3</sup> Collectors that generally operate at temperatures below 110 degrees Fahrenheit.

Notes: • Shipments are for domestic and export shipments, and may include imports that subsequently were shipped to domestic or foreign customers. • Data were not collected for 1985.

Source: Table 10.6.



**Table 10.6 Solar Thermal Collector Shipments by Type, Price, and Trade, 1974-2009**

(Thousand Square Feet, Except as Noted)

Year	Low-Temperature Collectors <sup>1</sup>				Medium-Temperature Collectors <sup>2</sup>				High-Temperature Collectors <sup>3</sup>		Total Shipments		Trade	
	Number of U.S. Manufacturers	Quantity Shipped	Shipments per Manufacturer	Price <sup>4</sup> (dollars <sup>5</sup> per square foot)	Number of U.S. Manufacturers	Quantity Shipped	Shipments per Manufacturer	Price <sup>4</sup> (dollars <sup>5</sup> per square foot)	Quantity Shipped	Price <sup>4</sup> (dollars <sup>5</sup> per square foot)	Quantity Shipped	Price <sup>4</sup> (dollars <sup>5</sup> per square foot)	Imports	Exports
1974	6	1,137	190	NA	39	137	4	NA	NA	NA	1,274	NA	NA	NA
1975	13	3,026	233	NA	118	717	6	NA	NA	NA	3,743	NA	NA	NA
1976	19	3,876	204	NA	203	1,925	10	NA	NA	NA	5,801	NA	NA	NA
1977	52	4,743	91	NA	297	5,569	19	NA	NA	NA	10,312	NA	NA	NA
1978	69	5,872	85	NA	204	4,988	25	NA	NA	NA	10,860	NA	396	840
1979	84	8,394	100	NA	257	5,856	23	NA	NA	NA	14,251	NA	290	855
1980	79	12,233	155	NA	250	7,165	29	NA	NA	NA	19,398	NA	235	1,115
1981	75	8,677	116	NA	263	11,456	44	NA	NA	NA	21,133	NA	196	771
1982	61	7,476	123	NA	248	11,145	45	NA	NA	NA	18,621	NA	418	455
1983	55	4,853	88	NA	179	11,975	67	NA	NA	NA	16,828	NA	511	159
1984	48	4,479	93	NA	206	11,939	58	NA	773	NA	17,191	NA	621	348
1985 <sup>6</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1986	22	3,751	171	2.30	87	1,111	13	18.30	4,498	NA	9,360	6.14	473	224
1987	12	3,157	263	2.18	50	957	19	13.50	3,155	NA	7,269	4.82	691	182
1988	8	3,326	416	2.24	45	732	16	14.88	4,116	NA	8,174	4.56	814	158
1989	10	4,283	428	2.60	36	1,989	55	11.74	5,209	17.76	11,482	10.92	1,233	461
1990	12	3,645	304	2.90	41	2,527	62	7.68	5,237	15.74	11,409	9.86	1,562	245
1991	16	5,585	349	2.90	41	989	24	11.94	1	31.94	6,574	4.26	1,543	332
1992	16	6,187	387	2.50	34	897	26	10.96	2	75.66	7,086	3.58	1,650	316
1993	13	6,025	464	2.80	33	931	28	11.74	12	22.12	6,968	3.96	2,039	411
1994	16	6,823	426	2.54	31	803	26	13.54	2	177.00	7,627	3.74	1,815	405
1995	14	6,813	487	2.32	26	840	32	10.48	13	53.26	7,666	3.30	2,037	530
1996	14	6,821	487	2.67	19	785	41	14.48	10	18.75	7,616	3.91	1,930	454
1997	13	7,524	579	2.60	21	606	29	15.17	7	25.00	8,138	3.56	2,102	379
1998	12	7,292	607	2.83	19	443	23	15.17	21	53.21	7,756	3.66	2,206	360
1999	13	8,152	627	2.08	20	427	21	19.12	4	286.49	8,583	3.05	2,352	537
2000	11	7,948	723	2.09	16	400	25	W	5	W	8,354	3.28	2,201	496
2001	10	10,919	1,092	2.15	17	268	16	W	2	W	11,189	2.90	3,502	840
2002	13	11,126	856	1.97	17	535	31	W	2	W	11,663	2.85	3,068	659
2003	12	10,877	906	2.08	17	560	33	W	7	W	11,444	3.19	2,986	518
2004	9	13,608	1,512	1.80	17	506	30	19.30	-	-	14,114	2.43	3,723	813
2005	10	15,224	1,522	2.00	17	702	41	W	115	W	16,041	2.86	4,546	1,361
2006	11	15,546	1,413	1.95	35	1,346	38	W	3,852	W	20,744	5.84	4,244	1,211
2007	13	13,323	1,025	1.97	51	1,797	35	W	33	W	15,153	3.95	3,891	1,376
2008	11	14,015	1,274	1.89	62	2,560	41	19.57	388	11.96	16,963	4.80	5,517	2,247
2009	13	10,511	809	1.94	73	2,307	32	27.32	980	25.32	13,798	7.01	3,456	1,577

<sup>1</sup> Low-temperature collectors are solar thermal collectors that generally operate at temperatures below 110° F.

<sup>2</sup> Medium-temperature collectors are solar thermal collectors that generally operate in the temperature range of 140° F to 180° F but can also operate at temperatures as low as 110° F. Special collectors are included in this category. Special collectors are evacuated tube collectors or concentrating (focusing) collectors. They operate in the temperature range from just above ambient temperature (low concentration for pool heating) to several hundred degrees Fahrenheit (high concentration for air conditioning and specialized industrial processes).

<sup>3</sup> High-temperature collectors are solar thermal collectors that generally operate at temperatures above 180° F. High-temperature collector shipments are dominated by one manufacturer, and the collectors are used by the electric power sector to build new central station solar thermal power plants and generate electricity. Year-to-year fluctuations depend on how much new capacity is brought online.

<sup>4</sup> Prices equal shipment value divided by quantity shipped. Value includes charges for advertising and warranties. Excluded are excise taxes and the cost of freight or transportation for the shipments.

<sup>5</sup> Prices are not adjusted for inflation. See "Nominal Dollars" in Glossary.

<sup>6</sup> No data are available for 1985.

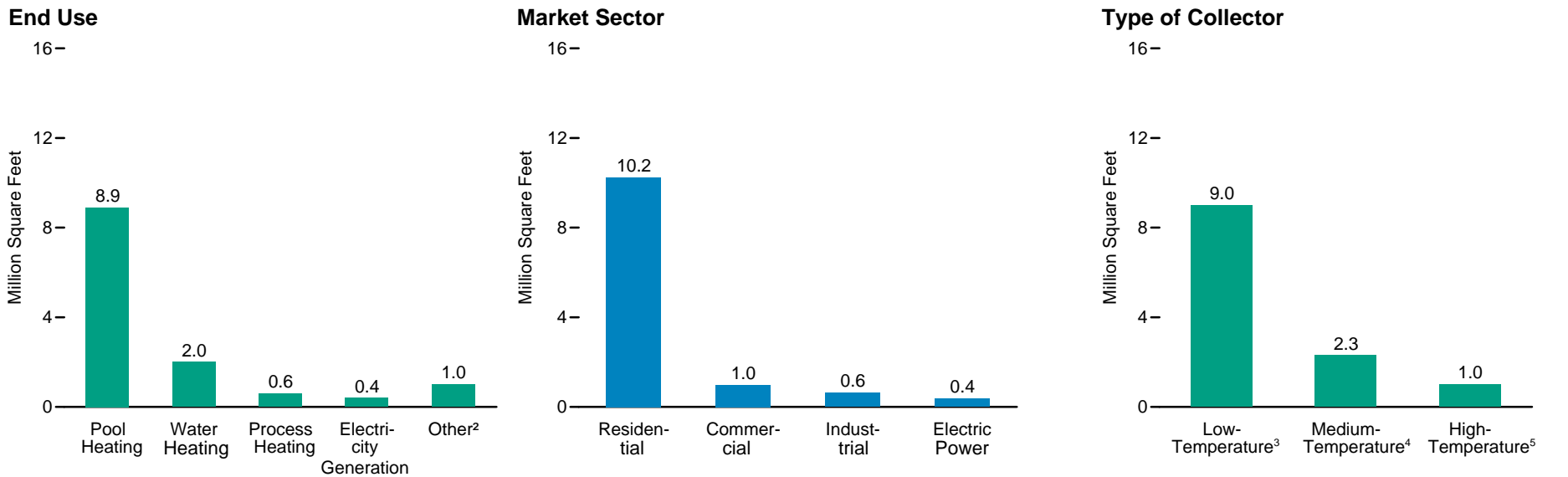
NA=Not available. --=No data reported. --=Not applicable. W=Value withheld to avoid disclosure of proprietary company data.

Notes: • Data for this table are not available for 2010. • Shipments data are for domestic and export shipments, and may include imports that subsequently were shipped to domestic or foreign customers. • Manufacturers producing more than one type of collector are accounted for in both groups.

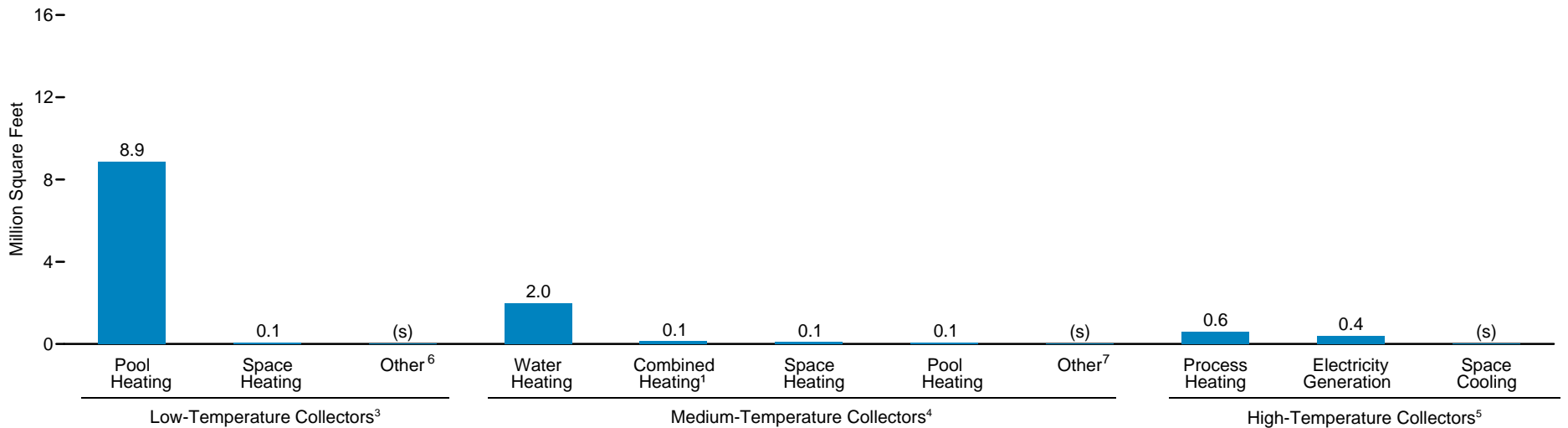
Web Page: For related information, see <http://www.eia.gov/renewable/>.

Sources: • 1974-1992—U.S. Energy Information Administration (EIA), *Solar Collector Manufacturing Activity*, annual reports, and Form CE-63A, "Annual Solar Thermal Collector Manufacturers Survey," and predecessor forms. • 1993-2002—EIA, *Renewable Energy Annual*, annual reports, and Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey," and predecessor form. • 2003 forward—EIA, *Solar Thermal Collector Manufacturing Activities* (and predecessor reports), annual reports, and Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

**Figure 10.7 Solar Thermal Collector Domestic Shipments by Market Sector, End-Use, and Type, 2009**



**End Use by Type of Collector**



<sup>1</sup> Combined space and water heating.

<sup>2</sup> Space heating, combined heating, and space cooling.

<sup>3</sup> Collectors that generally operate at temperatures below 110 degrees Fahrenheit.

<sup>4</sup> Collectors that generally operate in the temperature range of 140 degrees Fahrenheit to 180 degrees Fahrenheit but can also operate at temperatures as low as 110 degrees Fahrenheit.

<sup>5</sup> Collectors that generally operate at temperatures above 180 degrees Fahrenheit.

<sup>6</sup> Water heating and combined heating.

<sup>7</sup> Space cooling, process heating, and electricity generation.

(s)=Less than 0.05 million square feet.

Source: Table 10.7.

**Table 10.7 Solar Thermal Collector Shipments by Market Sector, End Use, and Type, 2001-2009**  
(Thousand Square Feet)

Year and Type	By Market Sector					By End Use							Total
	Residential	Commercial <sup>1</sup>	Industrial <sup>2</sup>	Electric Power <sup>3</sup>	Other <sup>4</sup>	Pool Heating	Water Heating	Space Heating	Space Cooling	Combined Heating <sup>5</sup>	Process Heating	Electricity Generation	
<b>Total Shipments <sup>6</sup></b>													
<b>2001 Total</b> ....	<b>10,125</b>	<b>1,012</b>	<b>17</b>	<b>1</b>	<b>35</b>	<b>10,797</b>	<b>274</b>	<b>70</b>	<b>0</b>	<b>12</b>	<b>34</b>	<b>2</b>	<b>11,189</b>
Low <sup>7</sup> .....	9,885	987	12	0	34	10,782	42	61	0	0	34	0	10,919
Medium <sup>8</sup> .....	240	24	5	0	1	16	232	9	0	12	0	0	268
High <sup>9</sup> .....	0	1	0	1	0	0	0	0	0	0	0	2	2
<b>2002 Total</b> ....	<b>11,000</b>	<b>595</b>	<b>62</b>	<b>4</b>	<b>1</b>	<b>11,073</b>	<b>423</b>	<b>146</b>	<b>(s)</b>	<b>17</b>	<b>4</b>	<b>0</b>	<b>11,663</b>
Low <sup>7</sup> .....	10,519	524	2	0	0	11,045	1	0	0	0	0	0	11,046
Medium <sup>8</sup> .....	481	69	60	4	1	28	422	146	(s)	15	4	0	615
High <sup>9</sup> .....	0	2	0	0	0	0	0	0	0	2	0	0	2
<b>2003 Total</b> ....	<b>10,506</b>	<b>864</b>	<b>71</b>	<b>0</b>	<b>2</b>	<b>10,800</b>	<b>511</b>	<b>76</b>	<b>(s)</b>	<b>23</b>	<b>34</b>	<b>0</b>	<b>11,444</b>
Low <sup>7</sup> .....	9,993	813	71	0	0	10,778	0	65	0	0	34	0	10,877
Medium <sup>8</sup> .....	513	44	0	0	2	22	511	11	(s)	16	0	0	560
High <sup>9</sup> .....	0	7	0	0	0	0	0	0	0	7	0	0	7
<b>2004 Total</b> ....	<b>12,864</b>	<b>1,178</b>	<b>70</b>	<b>0</b>	<b>3</b>	<b>13,634</b>	<b>452</b>	<b>13</b>	<b>0</b>	<b>16</b>	<b>0</b>	<b>0</b>	<b>14,115</b>
Low <sup>7</sup> .....	12,386	1,178	44	0	0	13,600	0	8	0	0	0	0	13,608
Medium <sup>8</sup> .....	478	0	26	0	3	33	452	5	0	16	0	0	506
High <sup>9</sup> .....	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>2005 Total</b> ....	<b>14,681</b>	<b>1,160</b>	<b>31</b>	<b>114</b>	<b>56</b>	<b>15,041</b>	<b>640</b>	<b>228</b>	<b>2</b>	<b>16</b>	<b>0</b>	<b>114</b>	<b>16,041</b>
Low <sup>7</sup> .....	14,045	1,099	30	0	50	15,022	12	190	0	0	0	0	15,224
Medium <sup>8</sup> .....	636	58	1	0	6	20	628	38	0	16	0	0	702
High <sup>9</sup> .....	0	2	0	114	0	0	0	0	2	0	0	114	115
<b>2006 Total</b> ....	<b>15,123</b>	<b>1,626</b>	<b>42</b>	<b>3,845</b>	<b>107</b>	<b>15,362</b>	<b>1,136</b>	<b>330</b>	<b>3</b>	<b>66</b>	<b>0</b>	<b>3,847</b>	<b>20,744</b>
Low <sup>7</sup> .....	13,906	1,500	40	0	100	15,225	10	290	0	21	0	0	15,546
Medium <sup>8</sup> .....	1,217	120	2	0	7	137	1,126	40	3	38	0	2	1,346
High <sup>9</sup> .....	0	7	0	3,845	0	0	0	0	0	7	0	3,845	3,852
<b>Domestic Shipments <sup>6</sup></b>													
<b>2007 Total</b> ....	<b>12,799</b>	<b>931</b>	<b>46</b>	<b>1</b>	<b>-</b>	<b>12,076</b>	<b>1,393</b>	<b>189</b>	<b>13</b>	<b>73</b>	<b>27</b>	<b>6</b>	<b>13,777</b>
Low <sup>7</sup> .....	11,352	633	-	1	-	11,917	4	63	-	-	-	1	11,986
Medium <sup>8</sup> .....	1,447	298	18	-	-	158	1,389	126	13	73	-	5	1,764
High <sup>9</sup> .....	-	(s)	27	-	-	-	(s)	-	-	-	27	-	27
<b>2008 Total</b> ....	<b>13,000</b>	<b>1,294</b>	<b>128</b>	<b>294</b>	<b>-</b>	<b>11,973</b>	<b>1,978</b>	<b>186</b>	<b>18</b>	<b>148</b>	<b>50</b>	<b>361</b>	<b>14,716</b>
Low <sup>7</sup> .....	10,983	918	-	-	-	11,880	8	10	-	2	-	-	11,900
Medium <sup>8</sup> .....	2,017	376	33	6	-	93	1,971	176	18	141	21	12	2,432
High <sup>9</sup> .....	-	-	95	289	-	-	-	-	-	5	29	349	383
<b>2009 Total</b> ....	<b>10,239</b>	<b>974</b>	<b>634</b>	<b>374</b>	<b>-</b>	<b>8,934</b>	<b>1,992</b>	<b>150</b>	<b>10</b>	<b>137</b>	<b>608</b>	<b>389</b>	<b>12,221</b>
Low <sup>7</sup> .....	8,423	526	11	-	-	8,882	7	61	-	9	-	-	8,959
Medium <sup>8</sup> .....	1,816	439	29	-	-	52	1,985	89	(s)	128	14	15	2,284
High <sup>9</sup> .....	-	10	594	374	-	-	-	-	10	-	594	374	978

<sup>1</sup> Through 2006, data are for the commercial sector, excluding government, which is included in "Other." Beginning in 2007, data are for the commercial sector, including government.

<sup>2</sup> Through 2006, data are for the industrial sector and independent power producers. Beginning in 2007, data are for the industrial sector only; independent power producers are included in "Electric Power."

<sup>3</sup> Through 2006, data are for electric utilities only; independent power producers are included in "Industrial." Beginning in 2007, data are for electric utilities and independent power producers.

<sup>4</sup> Through 2006, data are for other sectors such as government, including the military, but excluding space applications. Beginning in 2007, data are for the transportation sector.

<sup>5</sup> Combined space and water heating.

<sup>6</sup> Through 2006, data are for domestic and export shipments, and may include imports that subsequently were shipped to domestic or foreign customers. Beginning in 2007, data are for domestic shipments only.

<sup>7</sup> Low-temperature collectors are solar thermal collectors that generally operate at temperatures below 110° F.

<sup>8</sup> Medium-temperature collectors are solar thermal collectors that generally operate in the temperature range of 140° F to 180° F, but can also operate at temperatures as low as 110° F. Special collectors are

included in this category. Special collectors are evacuated tube collectors or concentrating (focusing) collectors. They operate in the temperature range from just above ambient temperature (low concentration for pool heating) to several hundred degrees Fahrenheit (high concentration for air conditioning and specialized industrial processes).

<sup>9</sup> High-temperature collectors are solar thermal collectors that generally operate at temperatures above 180° F. These are parabolic dish/trough collectors used primarily by the electric power sector to generate electricity for the electric grid.

- =No data reported. (s)=Less than 0.5 thousand square feet.

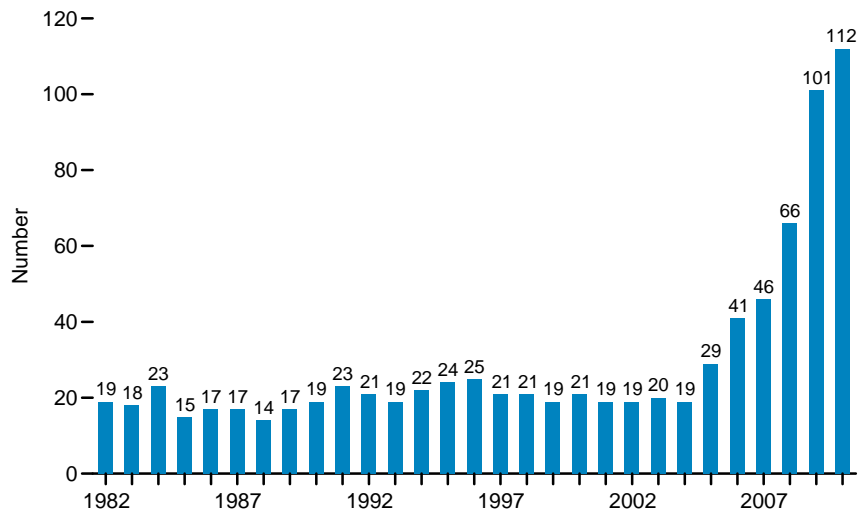
Notes: • Data for this table are not available for 2010. • Totals may not equal sum of components due to independent rounding.

Web Page: For related information, see <http://www.eia.gov/renewable/>.

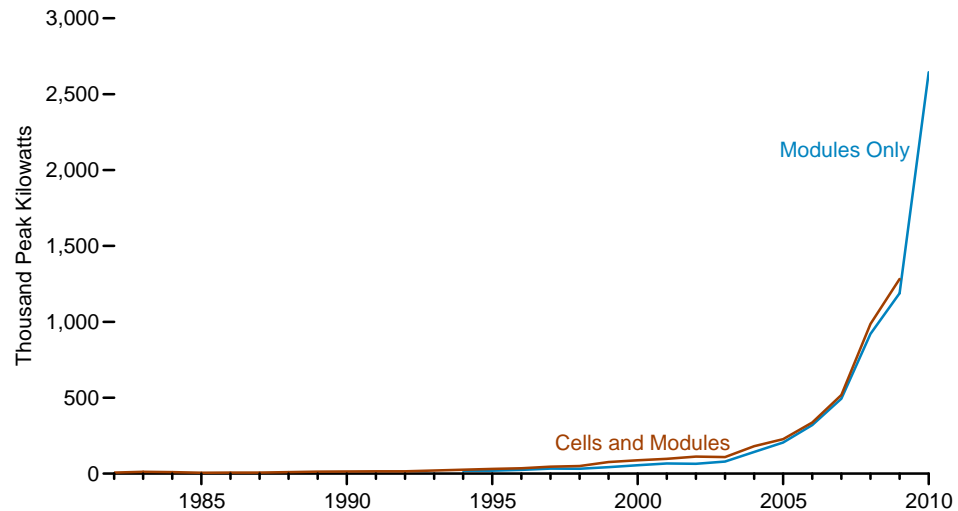
Sources: • 2001-2002—U.S. Energy Information Administration (EIA), *Renewable Energy Annual*, annual reports, and Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey." • 2003 forward—EIA, *Solar Thermal Collector Manufacturing Activities* (and predecessor reports), annual reports, and Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

**Figure 10.8 Photovoltaic Cell and Module Shipments, Trade, and Prices**

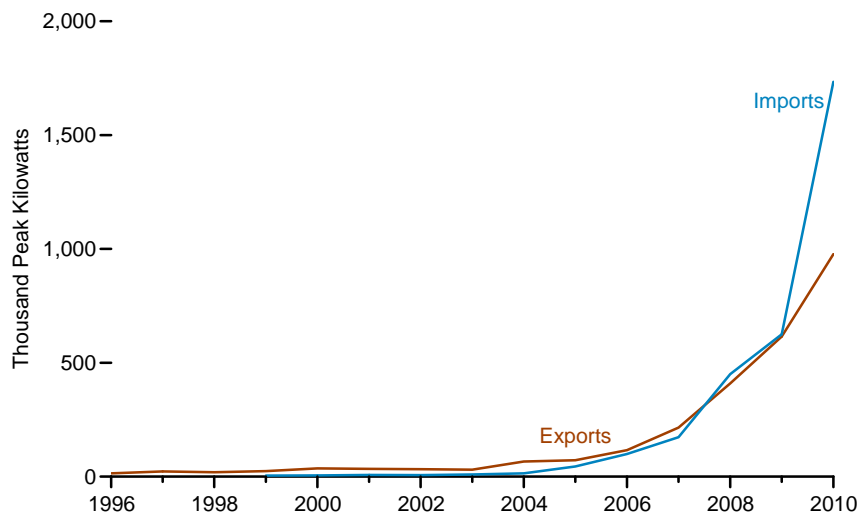
**Number of U.S. Companies Reporting Shipments, 1982-2010**



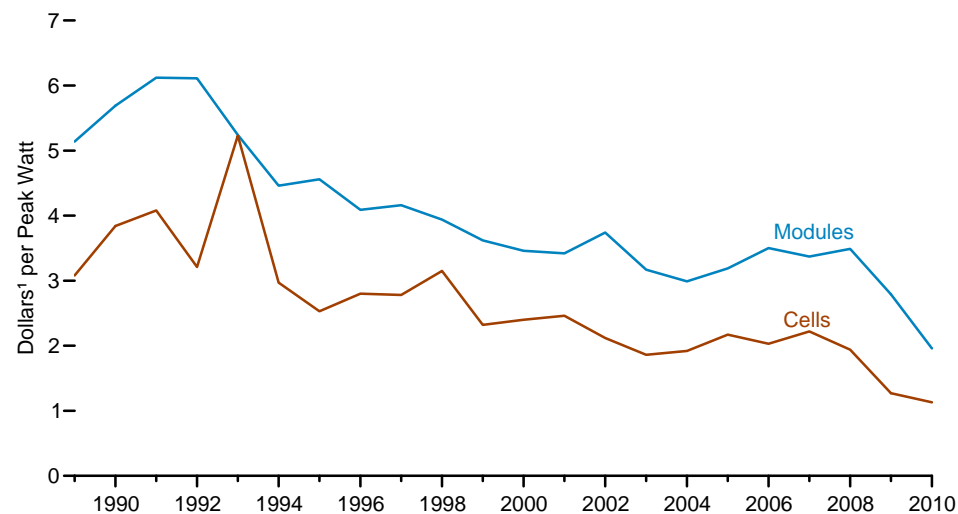
**Total Shipments, 1982-2010**



**Trade, Modules Only, 1996-2010**



**Prices, 1989-2010**



<sup>1</sup> Prices are not adjusted for inflation. See "Nominal Dollars" in Glossary.

Note: Shipments are for domestic and export shipments, and may include imports that subsequently were shipped to domestic or foreign customers.

Source: Table 10.8.

**Table 10.8 Photovoltaic Cell and Module Shipments by Type, Trade, and Prices, 1982-2010**

Year	U.S. Companies Reporting Shipments Number	Shipments						Trade				Prices <sup>1</sup>	
		Crystalline Silicon		Thin-Film		Total <sup>2</sup>		Imports		Exports		Cells	Modules
		Cells and Modules	Modules Only	Cells and Modules	Modules Only	Cells and Modules	Modules Only	Cells and Modules	Modules Only	Cells and Modules	Modules Only		
Peak Kilowatts <sup>3</sup>											Dollars <sup>4</sup> per Peak Watt <sup>3</sup>		
1982	19	NA	NA	NA	NA	6,897	NA	NA	NA	NA	NA	NA	NA
1983	18	NA	NA	NA	NA	12,620	NA	NA	NA	1,903	NA	NA	NA
1984	23	NA	NA	NA	NA	9,912	NA	NA	NA	2,153	NA	NA	NA
1985	15	5,461	NA	303	NA	5,769	NA	285	NA	1,670	NA	NA	NA
1986	17	5,806	NA	516	NA	6,333	NA	678	NA	3,109	NA	NA	NA
1987	17	5,613	NA	1,230	NA	6,850	NA	921	NA	3,821	NA	NA	NA
1988	14	7,364	NA	1,895	NA	9,676	NA	1,453	NA	5,358	NA	NA	NA
1989	17	10,747	NA	1,628	NA	12,825	NA	826	NA	7,363	NA	3.08	5.14
1990	<sup>5</sup> 19	12,492	NA	1,321	NA	<sup>5</sup> 13,837	NA	1,398	NA	7,544	NA	3.84	5.69
1991	23	14,205	NA	723	NA	14,939	NA	2,059	NA	8,905	NA	4.08	6.12
1992	21	14,457	NA	1,075	NA	15,583	NA	1,602	NA	9,823	NA	3.21	6.11
1993	19	20,146	NA	782	NA	20,951	NA	1,767	NA	14,814	NA	5.23	5.24
1994	22	24,785	NA	1,061	NA	26,077	19,064	1,960	NA	17,714	NA	2.97	4.46
1995	24	29,740	NA	1,266	NA	31,059	19,627	1,337	NA	19,871	NA	2.53	4.56
1996	25	33,996	NA	1,445	NA	35,464	24,534	1,864	NA	22,448	14,128	2.80	4.09
1997	21	44,314	NA	1,886	NA	46,354	33,645	1,853	NA	33,793	22,956	2.78	4.16
1998	21	47,186	NA	3,318	NA	50,562	32,313	1,931	NA	35,493	19,015	3.15	3.94
1999	19	73,461	NA	3,269	NA	76,787	43,073	4,784	4,630	55,585	24,545	2.32	3.62
2000	21	85,155	NA	2,736	NA	88,221	55,007	8,821	5,016	68,382	36,277	2.40	3.46
2001	19	84,651	NA	12,541	NA	97,666	67,033	10,204	7,029	61,356	34,282	2.46	3.42
2002	19	104,123	NA	7,396	NA	112,090	64,413	7,297	6,378	66,778	32,559	2.12	3.74
2003	20	97,940	NA	10,966	NA	109,357	80,062	9,731	9,289	60,693	30,229	1.86	3.17
2004	19	159,138	NA	21,978	NA	181,116	143,274	47,703	14,096	102,770	66,278	1.92	2.99
2005	29	172,965	NA	53,826	NA	226,916	204,996	90,981	44,443	92,451	72,017	2.17	3.19
2006	41	233,518	NA	101,766	NA	337,268	320,208	173,977	99,687	130,757	116,561	2.03	3.50
2007	46	310,330	NA	202,519	NA	517,684	494,148	238,018	173,165	237,209	215,364	2.22	3.37
2008	66	665,795	NA	293,182	NA	986,504	920,693	586,558	449,813	462,252	409,261	1.94	3.49
2009	101	984,161	NA	266,547	NA	1,282,560	1,188,879	743,414	625,182	681,427	615,094	1.27	2.79
2010	112	( <sup>6</sup> )	2,114,881	( <sup>6</sup> )	519,516	( <sup>6</sup> )	2,644,498	( <sup>6</sup> )	1,734,149	( <sup>6</sup> )	976,955	1.13	1.96

<sup>1</sup> Prices equal shipment value divided by quantity shipped. Value includes charges for advertising and warranties. Excluded are excise taxes and the cost of freight or transportation for the shipments.

<sup>2</sup> Includes all types of photovoltaic cells and modules (single-crystal silicon, cast silicon, ribbon silicon, thin-film silicon, and concentrator silicon). Excludes cells and modules for space and satellite applications.

<sup>3</sup> See "Peak Kilowatt" and "Peak Watt" in Glossary.

<sup>4</sup> Prices are not adjusted for inflation. See "Nominal Dollars" in Glossary.

<sup>5</sup> Data were imputed for one nonrespondent who exited the industry during 1990.

<sup>6</sup> Beginning in 2010, because of changes to survey methodology, survey data for cells and modules cannot be summed.

NA=Not available.

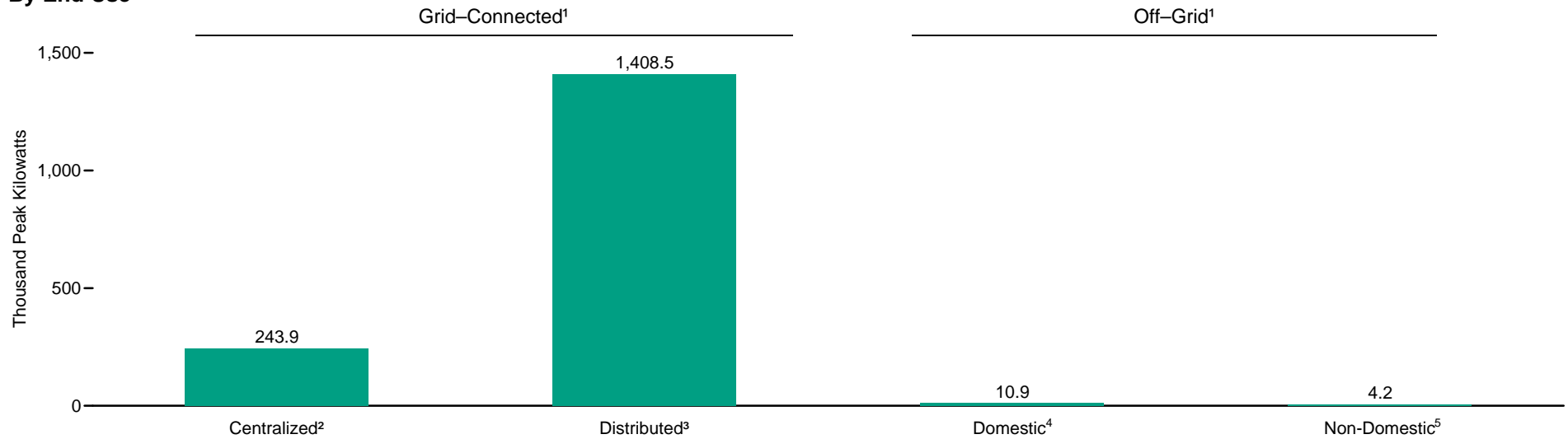
Note: Shipments data are for domestic and export shipments, and may include imports that subsequently were shipped to domestic or foreign customers.

Web Page: For related information, see <http://www.eia.gov/renewable/>.

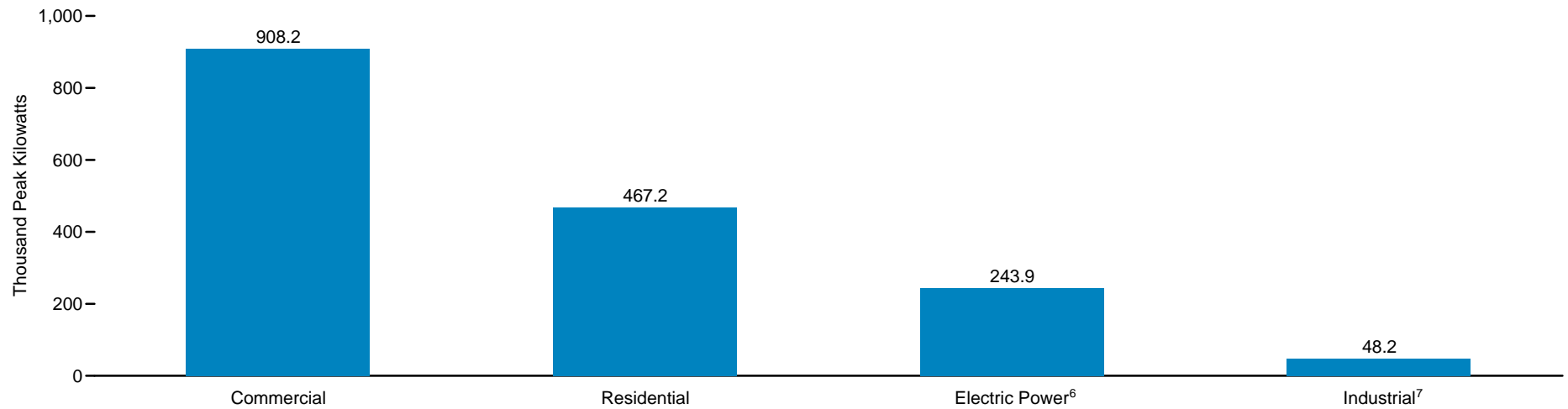
Sources: • 1982-1992—U.S. Energy Information Administration (EIA), *Solar Collector Manufacturing Activity*, annual reports. • 1993-2002—EIA, *Renewable Energy Annual*, annual reports. • 2003 forward—EIA, *Solar Photovoltaic Cell/Module Shipments Report* (and predecessor reports), annual reports.

**Figure 10.9 U.S. Shipments of Photovoltaic Modules Only by Sector and End Use, 2010**

**By End Use**



**By Sector**



<sup>1</sup> See "Electric Power Grid" in Glossary.

<sup>2</sup> Photovoltaic modules that are connected to the electric power grid, and whose output is fed directly into the grid.

<sup>3</sup> Photovoltaic modules that are connected to the electric power grid, and whose output is consumed mainly onsite.

<sup>4</sup> Photovoltaic modules that are not connected to the electric power grid, and that are used to provide electric power to remote households or communities.

<sup>5</sup> Photovoltaic modules that are not connected to the electric power grid, and that are used to provide electric power for a variety of non-domestic applications.

<sup>6</sup> Electric utilities and independent power producers.

<sup>7</sup> Industrial sector only; independent power producers are included in "Electric Power."

Source: Table 10.9.

**Table 10.9 Photovoltaic Cell and Module Shipments by Sector and End Use, 1989-2010**

(Peak Kilowatts <sup>1</sup>)

Year	By Sector					By End Use				Total
	Residential	Commercial <sup>3</sup>	Industrial <sup>4</sup>	Electric Power <sup>5</sup>	Other <sup>6</sup>	Grid-Connected <sup>2</sup>		Off-Grid <sup>2</sup>		
						Centralized <sup>7</sup>	Distributed <sup>8</sup>	Domestic <sup>9</sup>	Non-Domestic <sup>10</sup>	
<b>Total Shipments of Photovoltaic Cells and Modules <sup>11</sup></b>										
1989	1,439	R6,057	3,993	785	551	( <sup>12</sup> )	<sup>12</sup> 1,251	2,620	8,954	12,825
1990	1,701	R8,062	2,817	826	432	( <sup>12</sup> )	<sup>12</sup> 469	3,097	10,271	13,837
1991	3,624	R5,715	3,947	1,275	377	( <sup>12</sup> )	<sup>12</sup> 856	3,594	10,489	14,939
1992	4,154	R5,122	4,279	1,553	477	( <sup>12</sup> )	<sup>12</sup> 1,227	4,238	10,118	15,583
1993	5,237	R8,004	5,352	1,503	856	( <sup>12</sup> )	<sup>12</sup> 1,096	5,761	14,094	20,951
1994	6,632	R9,717	6,855	2,364	510	( <sup>12</sup> )	<sup>12</sup> 2,296	9,253	14,528	26,077
1995	6,272	R12,483	7,198	3,759	1,347	( <sup>12</sup> )	<sup>12</sup> 4,585	8,233	18,241	31,059
1996	8,475	R12,297	8,300	4,753	1,639	( <sup>12</sup> )	<sup>12</sup> 4,844	10,884	19,736	35,464
1997	10,993	R15,594	11,748	5,651	2,367	( <sup>12</sup> )	<sup>12</sup> 8,273	8,630	29,451	46,354
1998	15,936	R14,708	13,232	3,965	2,720	( <sup>12</sup> )	<sup>12</sup> 14,193	8,634	27,735	50,562
1999	19,817	R24,731	24,972	5,876	1,392	( <sup>12</sup> )	<sup>12</sup> 24,782	10,829	41,176	76,787
2000	24,814	R23,611	28,808	6,298	4,690	( <sup>12</sup> )	<sup>12</sup> 21,713	14,997	51,511	88,221
2001	33,262	R29,924	28,063	5,846	571	( <sup>12</sup> )	<sup>12</sup> 27,226	21,447	48,993	97,666
2002	29,315	R42,075	32,218	7,640	841	( <sup>12</sup> )	<sup>12</sup> 33,983	21,693	56,414	112,090
2003	23,389	R49,231	27,951	8,474	313	( <sup>12</sup> )	<sup>12</sup> 42,485	15,025	51,847	109,357
2004	53,928	R79,146	30,493	3,233	14,316	( <sup>12</sup> )	<sup>12</sup> 129,265	18,371	33,480	181,116
2005	75,040	R119,763	22,199	143	9,772	( <sup>12</sup> )	<sup>12</sup> 168,474	24,958	33,484	226,916
2006	95,815	R190,998	28,618	3,981	17,857	( <sup>12</sup> )	<sup>12</sup> 274,197	18,003	45,068	337,268
<b>U.S. Shipments of Photovoltaic Cells and Modules <sup>11</sup></b>										
2007	68,417	R144,061	32,702	35,294	--	( <sup>12</sup> )	<sup>12</sup> 253,101	10,867	16,507	280,475
2008	173,989	R262,952	51,493	35,819	--	( <sup>12</sup> )	<sup>12</sup> 500,854	15,527	7,871	524,252
2009	221,245	R282,807	43,445	53,636	--	( <sup>12</sup> )	<sup>12</sup> 585,189	8,119	7,825	601,133
<b>U.S. Shipments of Photovoltaic Modules Only <sup>11</sup></b>										
2010	467,165	908,224	48,208	243,947	--	243,947	1,408,462	10,941	4,193	1,667,543

<sup>1</sup> See "Peak Kilowatt" in Glossary.

<sup>2</sup> See "Electric Power Grid" in Glossary.

<sup>3</sup> Includes data that were previously shown in the "Commercial," "Government," and "Transportation" sector categories.

<sup>4</sup> Through 2006, data are for the industrial sector and independent power producers. Beginning in 2007, data are for the industrial sector only; independent power producers are included in "Electric Power."

<sup>5</sup> Through 2006, data are for electric utilities only; independent power producers are included in "Industrial." Beginning in 2007, data are for electric utilities and independent power producers.

<sup>6</sup> Through 2006, data are for specialty purposes such as research.

<sup>7</sup> Photovoltaic cells/modules that are connected to the electric power grid, and whose output is fed directly into the grid.

<sup>8</sup> Photovoltaic cells/modules that are connected to the electric power grid, and whose output is consumed mainly onsite.

<sup>9</sup> Photovoltaic cells/modules that are not connected to the electric power grid, and that are used to provide electric power to remote households or communities. Includes data that were previously shown in the "Remote" end-use category.

<sup>10</sup> Photovoltaic cells/modules that are not connected to the electric power grid, and that are used to provide electric power for a variety of non-domestic applications. Includes data that were previously shown

in the following end-use categories: "Communications," "Consumer Goods," "Health," "Original Equipment Manufacturers" (non-photovoltaic manufacturers that combine photovoltaic technology into existing or newly developed product lines), "Transportation," "Water Pumping," and "Other" (applications such as cooking food, desalination, and distilling).

<sup>11</sup> Through 2006, data are for domestic and export shipments of photovoltaic cells and modules, and may include imports that subsequently were shipped to domestic or foreign customers. For 2007-2009, data are for domestic shipments of photovoltaic cells and modules. For 2010, data are for domestic shipments of photovoltaic modules only.

<sup>12</sup> Through 2009, data for "Centralized" are included in "Distributed."

R=Revised. -- = Not applicable.

Notes: • See "Photovoltaic Cell (PVC)" and "Photovoltaic Module" in Glossary. • Totals may not equal sum of components due to independent rounding.

Web Page: For related information, see <http://www.eia.gov/fuelrenewable.html>.

Sources: • 1989-1992—U.S. Energy Information Administration (EIA), *Solar Collector Manufacturing Activity*, annual reports. • 1993-2002—EIA, *Renewable Energy Annual*, annual reports. • 2003 forward—EIA, *Solar Photovoltaic Cell/Module Shipments Report* (and predecessor reports), annual reports.

## 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 using the fossil-fuels heat rate—see Table A6); geothermal electricity net generation (converted to Btu using the fossil-fuels heat rate—see Table A6), and geothermal heat pump and geothermal direct use energy; solar thermal and photovoltaic electricity net generation (converted to Btu using the fossil-fuels heat rate—see Table A6), and solar thermal direct use energy; wind electricity net generation (converted to Btu using the fossil-fuels heat rate—see 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:** Oregon Institute of Technology, Geo-Heat Center.  
**Residential Sector, Solar/PV:** • 1989–2009: U.S. Energy Information Administration (EIA) estimates based on Form EIA-63A, “Annual Solar Thermal Collector Manufacturers Survey,” and Form EIA-63B, “Annual Photovoltaic Cell/Module Shipments Report.” • 2010 and 2011: EIA estimates based on Form EIA-63B, “Annual Photovoltaic Cell/Module Shipments Report”; Form EIA-63A, “Annual Solar Thermal Collector Manufacturers Survey” (pre-2010 data); and SEIA/GTM Research, *U.S. Solar Market Insight: 2010 Year in Review*.  
**Residential Sector, Wood:** • 1949–1979: EIA, *Estimates of U.S. Wood Energy Consumption from 1949 to 1981*, Table A2. • 1980 forward: EIA, Form EIA-457, “Residential Energy Consumption Survey”; and EIA estimates based on Form EIA-457 and regional heating degree-day data.  
**Commercial Sector, Hydroelectric Power:** EIA, *Annual Energy Review (AER)*, Tables 8.2d and A6.  
**Commercial Sector, Geothermal:** Oregon Institute of Technology, Geo-Heat Center.  
**Commercial Sector, Solar/PV:** EIA, AER, Tables 8.2d and A6.  
**Commercial Sector, Wind:** 2009 forward: EIA, AER, Tables 8.2d and A6.  
**Commercial Sector, Wood:** • 1949–1979: EIA, *Estimates of U.S. Wood Energy Consumption from 1949 to 1981*, Table A2. • 1980–1983: EIA, *Estimates of U.S. Wood Energy Consumption 1980-1983*, Table ES1. • 1984: EIA estimate based on the 1983 value. • 1985–1988: Values interpolated. • 1989 forward: EIA, AER, Table 8.7c; and EIA estimates based on Form EIA-871, “Commercial Buildings Energy Consumption Survey.”  
**Commercial Sector, Biomass Waste:** EIA, AER, Table 8.7c.

**Commercial Sector, Fuel Ethanol (Minus Denaturant):** EIA, AER, Tables 5.11, 5.13a, and 10.3. Calculated as commercial sector motor gasoline consumption (Table 5.13a) divided by total motor gasoline product supplied (Table 5.11), and then multiplied by fuel ethanol (minus denaturant) consumption (Table 10.3).

### Table 10.2b Sources

**Industrial Sector, Hydroelectric Power:** • 1949–1988: U.S. Energy Information Administration (EIA), *Annual Energy Review (AER)*, Tables 8.1 and A6. • 1989 forward: EIA, AER, Tables 8.2d and A6.  
**Industrial Sector, Geothermal:** Oregon Institute of Technology, Geo-Heat Center.  
**Industrial Sector, Solar/PV:** 2010 and 2011: EIA, AER, Tables 8.2d and A6.  
**Industrial Sector, Wind:** 2011: EIA, AER, Tables 8.2d and A6.  
**Industrial Sector, Wood:** • 1949–1979: EIA, *Estimates of U.S. Wood Energy Consumption from 1949 to 1981*, Table A2. • 1980–1983: EIA, *Estimates of U.S. Wood Energy Consumption 1980-1983*, Table ES1. • 1984: EIA, *Estimates of U.S. Biofuels Consumption 1990*, Table 1. • 1985 and 1986: Values interpolated. • 1987: EIA, *Estimates of Biofuels Consumption in the United States During 1987*, Table 2. • 1988: Value interpolated. • 1989 forward: EIA, AER, Table 8.7c; and EIA estimates based on Form EIA-846, “Manufacturing Energy Consumption Survey.”  
**Industrial Sector, Biomass Waste:** • 1981: EIA, *Estimates of U.S. Biofuels Consumption 1990*, Table 8, total waste consumption minus electric power sector waste consumption (see AER, Table 10.2c). • 1982 and 1983: EIA estimates for total waste consumption based on *Estimates of U.S. Biofuels Consumption 1990*, Table 8, minus electric power waste consumption (see AER, Table 10.2c). • 1984: EIA, *Estimates of U.S. Biofuels Consumption 1990*, Table 8, total waste consumption minus electric power sector waste consumption (see AER, Table 10.2c). • 1985 and 1986: Values interpolated. • 1987: EIA, *Estimates of U.S. Biofuels Consumption 1990*, Table 8, total waste consumption minus electric power sector waste consumption (see AER, Table 10.2c). • 1988: Value interpolated. • 1989 forward: EIA, AER, Table 8.7c; and EIA estimates 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.  
**Industrial Sector, Fuel Ethanol (Minus Denaturant):** EIA, AER, Tables 5.11, 5.13b, and 10.3. Calculated as industrial sector motor gasoline consumption (Table 5.13b) divided by total motor gasoline product supplied (Table 5.11), and then multiplied by fuel ethanol (minus denaturant) consumption (Table 10.3).  
**Industrial Sector, Losses and Co-products:** EIA, AER, Tables 10.3 and 10.4. Calculated as fuel ethanol losses and co-products (Table 10.3) plus biodiesel losses and co-products (Table 10.4).  
**Transportation Sector, Fuel Ethanol (Minus Denaturant):** EIA, AER, Tables 5.11, 5.13c, and 10.3. Calculated as transportation sector motor gasoline consumption (Table 5.13c) divided by total motor gasoline product supplied (Table 5.11), and then multiplied by fuel ethanol (minus denaturant) consumption (Table 10.3).  
**Transportation Sector, Biodiesel:** EIA, AER, Table 10.4.