

Section 17

ENERGY AND SCIENCE

This section presents statistics on fuel resources, energy production and consumption, the electric and gas utility industries, research and development, and scientific, engineering, and technological resources. Related series are cited in Sections 12 (utility employment), 14 (prices), and 18 (gasoline consumption).

Information on energy and science can be obtained from reports and records of the U.S. Department of Energy; U.S. Patent and Trademark Office; U.S. Bureau of Labor Statistics; National Science Foundation; Hawaii State Department of Taxation; Hawaii State Department of Commerce and Consumer Affairs; Hawaii State Department of Business, Economic Development & Tourism, Energy Division; University of Hawaii, Institute of Astronomy; and individual utility companies. *Historical Statistics of Hawaii*, Section 19, presents data for earlier years. Data for the nation as a whole can be found in the *Statistical Abstract of the United States: 2000*, Sections 19 and 20.

**Table 17.01-- CONSUMPTION OF ENERGY, BY SOURCE
(PHYSICAL UNITS): 1960 TO 1999**

Year	Coal 1/ (1,000 short tons)	Natural gas 2/ (billion cubic feet)	Petroleum (1,000 barrels)	Hydroelectric power 3/ (million kWh)	Wood and waste (million kWh)	Other 1/ 4/ (million kWh)	Total 5/
1960	0	0	6/ 16,844	27	(NA)	(NA)	(NA)
1965	0	0	6/ 22,478	105	(NA)	(NA)	(NA)
1970	0	0	6/ 34,105	108	(NA)	(NA)	(NA)
1975	0	0	6/ 37,097	89	(NA)	(NA)	(NA)
1980	0	3	6/ 43,562	86	(NA)	(NA)	(NA)
1985	46	2	6/ 40,091	86	(NA)	(NA)	(NA)
1990	28	3	6/ 48,714	6/ 79	(NA)	(NA)	(NA)
1991	37	3	6/ 45,606	6/ 71	(NA)	(NA)	(NA)
1992	47	3	6/ 44,439	6/ 61	(NA)	(NA)	(NA)
1993	73	3	6/ 38,814	6/ 56	(NA)	(NA)	(NA)
1994	86	3	6/ 41,396	6/ 141	(NA)	(NA)	(NA)
1995	192	3	6/ 40,947	6/ 98	(NA)	(NA)	(NA)
1996	169	3	6/ 38,811	6/ 105	(NA)	(NA)	(NA)
1997	145	3	6/ 37,134	6/ 115	(NA)	(NA)	(NA)
1998	167	3	38,159	121	(NA)	(NA)	(NA)
1999	133	3	37,031	118	(NA)	(NA)	(NA)

NA Not available.

1/ The continuity of these data series estimates may be affected by changing data sources and estimation methodologies.

2/ Includes supplemental gaseous fuels.

3/ If applicable, through 1988, includes all net imports of electricity, and, from 1989, includes only the portion of imports of electricity that is derived from hydroelectric power.

4/ "Other" is geothermal, wind, photovoltaic, and solar thermal energy.

5/ From 1989, "Total" does not equal the sum of the columns. Net imports of electricity generated from nonrenewable energy sources included in the total but not in any other columns.

6/ Revised.

Source: U.S. Department of Energy, Energy Information Administration, *State Energy Data Report 1999*, <http://www.eia.doe.gov/pub/state.data/pdf/hi.pdf>, table 83.

**Table 17.02-- CONSUMPTION OF ENERGY, BY SOURCE
(TRILLION BTU): 1960 TO 1999**

Year	Coal 1/	Natural gas 2/	Petro- leum	Hydro- electric power 3/	Wood and waste	Other 1/ 4/	Total 5/
1960	0.0	0.0	6/ 94.6	0.3	0.0	0.0	6/ 94.9
1965	0.0	0.0	6/ 129.3	1.1	0.2	0.0	6/ 130.6
1970	0.0	0.0	6/ 195.4	1.1	0.4	0.0	6/ 197.0
1975	0.0	0.0	6/ 212.9	0.9	0.6	0.0	6/ 214.4
1980	0.0	3.0	6/ 249.6	0.9	11.9	0.0	6/ 265.4
1985	1.1	2.7	6/ 232.6	0.9	14.2	0.4	6/ 251.9
1990	0.7	3.0	6/ 284.4	6/ 0.8	6/ 6.6	6/ 1.3	6/ 296.8
1991	0.9	2.9	6/ 265.6	6/ 0.7	6/ 6.7	6/ 1.4	6/ 278.3
1992	1.2	2.9	6/ 258.8	0.6	6/ 7.0	6/ 1.3	6/ 271.7
1993	1.8	2.8	6/ 224.0	0.6	6/ 6.8	6/ 4.4	6/ 240.4
1994	1.8	2.9	237.2	1.5	6/ 6.9	6/ 5.4	6/ 255.7
1995	4.1	2.9	6/ 234.7	1.0	6/ 8.0	6.3	6/ 257.0
1996	3.6	2.8	221.4	1.1	6/ 16.0	6/ 6.5	6/ 251.4
1997	3.3	2.7	6/ 213.7	1.2	6/ 14.8	6/ 6.2	6/ 241.8
1998	3.8	2.8	218.9	1.3	13.3	6.5	246.6
1999	3.1	2.9	213.7	1.2	14.6	6.0	241.4

1/ The continuity of these data series estimates may be affected by changing data sources and estimation methodologies.

2/ Includes supplemental gaseous fuels.

3/ If applicable, through 1988, includes all net imports of electricity, and, from 1989, includes only the portion of imports of electricity that is derived from hydroelectric power.

4/ "Other" is geothermal, wind, photovoltaic, and solar thermal energy.

5/ From 1989, "Total" does not equal the sum of the columns. Net imports of electricity generated from nonrenewable energy sources included in the total but not in any other columns.

6/ Revised.

Source: U.S. Department of Energy, Energy Information Administration, *State Energy Data Report 1999*, <http://www.eia.doe.gov/pub/state.data/pdf/hi.pdf>, table 83.

**Table 17.03-- CONSUMPTION OF ENERGY BY END-USE SECTOR
(TRILLION BTU): 1960 TO 1999**

Year	Consumption				Input at electric utilities
	Residential	Commercial	Industrial	Transportation	
1960	7.3	5.2	1/ 20.6	61.8	17.6
1965	10.1	6.8	1/ 34.7	79.0	27.6
1970	16.4	11.6	1/ 43.7	125.3	43.2
1975	19.6	13.8	1/ 50.4	130.5	58.8
1980	23.2	20.8	1/ 74.7	146.7	69.7
1985	20.9	20.3	1/ 67.5	143.3	70.0
1990	1/ 26.1	34.3	1/ 79.4	156.9	86.1
1991	1/ 24.3	28.2	1/ 74.3	151.4	79.2
1992	1/ 24.1	32.8	1/ 71.9	142.9	74.6
1993	1/ 20.9	22.7	1/ 70.0	126.8	66.2
1994	1/ 20.6	25.4	1/ 74.3	1/ 135.3	64.7
1995	1/ 21.0	24.4	1/ 76.2	1/ 135.4	66.5
1996	1/ 21.7	23.8	1/ 85.9	1/ 120.0	68.2
1997	1/ 21.6	1/ 24.2	79.4	1/ 116.6	67.0
1998	23.1	35.4	73.5	114.6	67.3
1999	23.0	24.8	71.3	122.3	69.4

1/ Revised.

Source: U.S. Department of Energy, Energy Information Administration, *State Energy Data Report 1999*, <http://www.eia.doe.gov/pub/state.data/pdf/hi.pdf>, tables 84-88.

Table 17.04-- PRIMARY ENERGY CONSUMPTION AND ELECTRICITY SALES, TOTAL AND PER CAPITA: 1988 TO 1998

Year	Primary energy consumption		Electricity sales by utilities	
	Total (trillion Btu)	Per capita 1/ (million Btu)	Total (1,000 kWh)	Per capita 1/ (kWh)
1988	306.92120	255.682	7,719,029	6,430
1989	315.08420	252.958	7,970,360	6,399
1990	312.13040	2/ 248.339	8,310,537	2/ 6,612
1991	322.95240	2/ 253.686	8,564,032	2/ 6,727
1992	339.09120	2/ 267.495	8,643,562	2/ 6,819
1993	307.74649	2/ 243.573	8,657,905	2/ 6,852
1994	327.47780	2/ 254.829	8,948,458	2/ 6,963
1995	315.11860	2/ 243.982	9,187,429	2/ 7,113
1996	315.94920	2/ 243.562	9,378,962	2/ 7,230
1997	315.99270	2/ 240.414	9,345,281	2/ 7,110
1998 3/	302.87730	229.262	9,261,071	7,010

1/ Based on estimated de facto population.

2/ Revised.

3/ Preliminary.

Source: Hawaii State Department of Business, Economic Development & Tourism, Energy, Resources and Technology Division, records; Hawaii State Department of Commerce and Consumer Affairs, records.

**Table 17.05-- PRIMARY ENERGY CONSUMPTION, BY SOURCE:
1985 TO 1998**

[Trillion Btu]

Year	Total		Petroleum	Biomass	Solar hot water
1985	266.2178		238.6470	23.1430	2.1327
1986	271.0562		242.5857	23.9670	2.1644
1987	284.2042		256.4061	22.1840	2.1914
1988	306.9212		279.1052	22.7080	2.1931
1989	315.0842		289.2301	20.8020	2.3310
1990	312.1304		284.4906	18.1200	2.3400
1991	322.9524		294.6222	17.9000	2.3000
1992	339.0912		305.7758	16.9840	2.3000
1993	307.7465		266.9516	16.8310	2.3000
1994	327.4778		285.5010	16.3660	2.3000
1995	315.1186		273.9590	11.8232	2.8386
1996	315.9492		277.1298	10.3994	3.1225
1997	315.9927		278.3480	8.9527	3.1225
1998 1/	302.8773		269.1272	7.5220	3.1225

Year	Hydroelectric	Coal	Wind	Geothermal	Solid waste
1985	0.9808	0.9560	0.1697	0.1886	-
1986	1.0562	0.4970	0.6036	0.1823	-
1987	0.9670	1.4875	0.8236	0.1446	-
1988	0.9826	1.3509	0.4185	0.1629	-
1989	1.0183	0.8715	0.4189	0.1435	0.2689
1990	1.0700	0.8900	0.2900	-	4.9298
1991	1.0000	0.8000	0.3060	-	6.0242
1992	0.7226	6.9207	0.2573	0.0168	6.1140
1993	0.8024	13.2237	0.2352	1.5988	5.8038
1994	1.5300	13.5599	0.2251	1.8060	6.1898
1995	1.0632	16.5249	0.2364	2.3045	6.3688
1996	1.1332	16.9294	0.2244	2.3566	4.6539
1997	0.9544	16.7772	0.1796	2.3633	5.2950
1998 1/	0.7654	14.7665	0.2159	2.2782	5.0796

1/ Preliminary.

Source: Hawaii State Department of Business, Economic Development & Tourism, Energy, Resources and Technology Division, records; Hawaii State Department of Commerce and Consumer Affairs, records.

Table 17.06-- ELECTRICITY GENERATION BY SOURCE: 1989 TO 1998

[Millions of kWh generated]

Year	Total	Petroleum	Biomass	MSW 1/	Hydroelectric
1989	9,280	8,511	614	-	100
1990	9,566	8,589	538	-	105
1991	9,610	8,664	495	-	92
1992	10,104	8,556	460	-	67
1993	10,219	7,576	435	349	78
1994	10,341	7,793	423	379	148
1995	10,563	7,853	292	383	103
1996	10,742	8,027	270	326	110
1997	10,424	7,805	226	371	93
1998 4/	10,455	8,009	178	364	87

Year	Geothermal	Wind	Coal	PV 2/	Other 3/
1989	14	41	-	-	(Z)
1990	-	28	-	-	306
1991	-	30	-	-	329
1992	1	21	-	-	999
1993	155	24	1,592	(Z)	10
1994	175	22	1,382	(Z)	19
1995	223	23	1,674	(Z)	12
1996	228	22	1,740	(Z)	19
1997	229	17	1,663	(Z)	20
1998 4/	220	21	1,553	(Z)	20

Z Less than 500,000 kWh.

1/ Electricity generated from Honolulu municipal solid waste plant.

2/ Electricity generated from photovoltaic.

3/ From 1989 to 1992, includes electricity production by coal, geothermal (a test well which ceased operation in 1989), and photovoltaic.

4/ Preliminary

Source: Hawaii State Department of Business, Economic Development & Tourism, Energy, Resources and Technology Division, records; Hawaii State Department of Commerce and Consumer Affairs, records; Hawaii Agriculture Research Center, records.

**Table 17.07-- ELECTRICITY PRODUCTION, BY SOURCE, BY ISLANDS:
1998**

[Million kWh]

Island	Total	Petroleum	Biomass	MSW 1/	Hydroelectric
State total	10,455	8,010	178	364	87
Hawaii	1,040	627	-	-	49
Maui	1,171	1,008	112	-	21
Lanai	28	28	-	-	-
Molokai	38	38	-	-	-
Oahu	7,723	5,937	-	364	-
Kauai	455	372	66	-	17

Island	Wind	Geothermal	Coal	PV 2/	Other
State total	21	220	1,555	(Z)	20
Hawaii	21	220	123	(Z)	-
Maui	-	-	30	(Z)	-
Lanai	-	-	-	-	-
Molokai	-	-	-	-	-
Oahu	-	-	1,402	(Z)	20
Kauai	-	-	-	-	-

Z. Less than 500,000 kWh.

1/ Electricity generated from Honolulu municipal solid waste plant.

2/ Electricity generated from photovoltaic.

Source: Hawaii State Department of Business, Economic Development & Tourism, Energy, Resources and Technology Division, records; Hawaii State Department of Commerce and Consumer Affairs, records.

**Table 17.08-- EXPENDITURES FOR FUELS AND ELECTRICITY, BY
SOURCE: 1988 TO 1998**

[Millions of dollars]

Year	Total energy expenditures	Fuel expenditures			Less: electric utility fuel expenditures	Plus: electricity purchased by end-user
		Total	Electric utility	Other		
1988	1,664.1	1,314.6	238.0	1,076.6	238.0	587.5
1989	1,897.8	1,530.6	277.5	1,253.1	277.5	642.1
1990	2,204.4	1,807.0	352.5	1,454.5	352.5	749.9
1991	2,217.5	1,736.4	304.8	1,431.6	304.8	785.9
1992	2,340.3	1,760.0	238.2	1,521.8	238.2	818.5
1993	2,369.9	1,660.4	213.3	1,447.1	213.3	922.8
1994	2,397.0	1,642.5	201.4	1,441.1	201.4	955.9
1995	2,459.4	1,645.2	223.5	1,421.7	223.5	1,037.7
1996 1/	2,712.0	1,843.9	268.9	1,575.0	268.9	1,137.0
1997	2,756.5	1,863.6	276.2	1,587.4	276.2	1,169.2
1998 2/	2,442.9	1,580.2	210.9	1,369.3	210.9	1,073.6

1/ Revised.

2/ Preliminary.

Source: Hawaii State Department of Business, Economic Development & Tourism, Energy, Resources and Technology Division, records.

Table 17.09-- ELECTRIC UTILITIES: 1989 TO 2000

Year	Customers, Dec. 31 1/			Power sold (1,000 kWh)		
	Total	Residen- tial 2/	Other	Total	Residen- tial 2/	Other
1989	362,281	312,347	49,934	7,969,694	2,238,874	5,730,820
1990	370,952	320,215	50,737	8,310,537	2,320,550	5,989,987
1991	380,963	328,899	52,064	8,460,186	2,363,726	6,076,697
1991 3/	380,963	328,899	52,064	8,524,088	2,385,276	6,178,756
1992	385,055	332,863	52,192	8,666,889	2,430,152	6,213,410
1993	395,402	341,471	53,931	8,657,903	2,453,830	6,204,075
1994	403,595	346,977	56,618	8,948,458	2,551,240	6,397,218
1995	409,983	352,589	57,394	9,187,430	2,597,010	6,590,419
1996	413,830	356,205	57,625	9,378,962	2,669,654	6,709,308
1997	415,964	358,683	57,281	9,345,281	2,659,248	6,686,033
1998	418,989	361,429	57,560	9,261,070	2,634,172	6,626,899
1999	424,603	366,273	58,330	9,379,808	2,683,408	6,696,400
2000	430,354	370,928	59,426	9,690,598	2,764,619	6,925,980

Year	Average annual use (kWh 4/)		Average rate (dollars per kWh)		Revenues (\$1,000)		
	Residen- tial 2/	Other	Residen- tial 2/	Other	Total	Residen- tial 2/	Other
1989	7,168	114,772	0.09265	0.07585	642,101	207,436	434,665
1990	7,247	118,060	0.10261	0.08544	749,857	238,103	511,754
1991	7,187	116,716	0.10539	0.08726	779,382	249,104	530,278
1991 3/	7,252	117,524	0.10546	0.08733	785,896	251,553	534,343
1992	7,301	119,049	0.10932	0.08898	818,525	265,667	552,858
1993	7,186	115,037	0.12309	0.10005	922,796	302,054	620,743
1994	7,353	112,989	0.12464	0.09972	955,907	317,984	637,923
1995	7,366	114,828	0.13337	0.10490	1,037,702	346,359	691,343
1996	7,495	116,431	0.14272	0.11268	1,137,045	381,011	756,034
1997	7,414	116,723	0.14839	0.11584	1,169,134	394,603	774,531
1998	7,288	115,130	0.13884	0.10682	1,073,610	365,719	707,891
1999	7,326	114,802	0.14312	0.11037	1,123,126	384,043	739,083
2000	7,453	116,548	0.16409	0.13083	1,359,756	453,650	906,106

Footnotes and source on next page.

Table 17.09-- ELECTRIC UTILITIES: 1989 TO 2000 -- Con.

1/ 1990 based on November data for Oahu.

2/ Residential refers to single-metered residential customers which may include condominiums for visitor use but excludes master-metered apartment and condominium buildings used by residents which are classified as commercial customers.

3/ Includes the effect of a change in the method of estimating unbilled kilowatt hour sales beginning in 1991 which increased power sold and revenues for all islands except Kauai and Molokai for that year.

4/ Based on number of customers at end of year.

Source: Hawaii State Department of Commerce and Consumer Affairs, Division of Consumer Advocacy, records.

Table 17.10-- ELECTRIC UTILITIES, BY ISLANDS: 2000

County or island	Customers, Dec. 31			Gross System Peak 2/	Power sold (1,000 kWh)		
	Total	Residential 1/	Other	(mW)	Total	Residential 1/	Other
State total	430,354	370,928	59,426	(X)	9,690,598	2,764,619	6,925,980
Oahu	278,260	245,027	33,233	1,203	7,211,760	1,897,691	5,314,069
Hawaii	63,778	53,263	10,515	170.8	954,453	355,281	599,172
Kauai	30,715	23,612	7,103	71.8	418,922	137,415	281,506
Maui County	57,601	49,026	8,575	(X)	1,105,463	374,231	731,232
Lanai	1,494	1,296	198	5.0	27,108	6,855	20,253
Maui	53,204	45,379	7,825	185.1	1,042,006	354,689	687,317
Molokai	2,903	2,351	552	6.5	36,349	12,687	23,661
County or island	Average annual use (kWh) 3/		Average rate (dollars per kWh)		Revenues (\$1,000)		
	Residential 1/	Other	Residential 1/	Other	Total	Residential 1/	Other
State total	7,453	116,548	0.16409	0.13083	1,359,756	453,650	906,106
Oahu	7,745	159,903	0.14477	0.11402	880,663	274,733	605,930
Hawaii	6,670	56,983	0.21762	0.19169	192,174	77,316	114,858
Kauai	5,820	39,632	0.23666	0.21874	94,096	32,520	61,575
Maui County	7,633	85,275	0.18459	0.16922	192,823	69,080	123,743
Lanai	5,289	102,288	0.22184	0.22112	5,999	1,521	4,478
Maui	7,816	87,836	0.18232	0.16582	178,638	64,668	113,970
Molokai	5,397	42,865	0.22787	0.22376	8,186	2,891	5,294

X Not applicable.

1/ Residential refers to single-metered residential customers which may include condominiums for visitor use but excludes master-metered apartment and condominium buildings used by residents which are classified as commercial customers.

2/ System peak is the maximum amount of energy required by the electrical system at a point in time. The island electrical systems are not interconnected, therefore, peaks are reported separately for each island. (Hawaii County-net peak).

3/ Based on number of customers at end of year.

Source: Hawaii State Department of Commerce and Consumer Affairs, Division of Consumer Advocacy, records.

Table 17.11-- GAS UTILITIES: 1989 TO 2000

[Excludes bottled gas]

Year	Customers, Dec. 31			Gas sold (1,000 therms)		
	Total	Residential 1/	Other	Total	Residential 1/	Other
1989	34,304	30,661	3,643	33,865	5,896	27,969
1990	34,477	30,840	3,637	34,806	5,924	28,882
1991	34,973	31,378	3,595	33,974	5,775	28,199
1992	35,236	31,625	3,611	33,662	5,733	27,929
1993	35,908	32,293	3,615	33,268	5,750	27,518
1994	36,403	32,753	3,650	34,010	5,851	28,159
1995	36,619	32,950	3,669	33,740	5,793	27,948
1996	36,641	33,020	3,621	33,531	5,642	27,888
1997	36,575	32,977	3,598	32,980	5,603	27,377
1998	36,225	32,630	3,595	33,095	5,702	27,393
1999	36,363	32,757	3,606	34,099	5,577	28,522
2000	36,404	32,804	3,600	34,820	5,477	29,343

Year	Average annual use (therms) 2/		Average rate (dollars per therm)		Revenues (\$1,000)		
	Residential 1/	Other	Residential 1/	Other	Total	Residential 1/	Other
1989	192	7,677	1.54200	1.06487	38,876	9,092	29,783
1990	192	7,941	1.62847	1.14834	42,813	9,646	33,167
1991	184	7,844	1.78649	1.25285	45,646	10,317	35,329
1992	181	7,735	1.79054	1.25466	45,307	10,265	35,042
1993	178	7,612	1.75962	1.22594	43,853	10,117	33,735
1994	179	7,715	1.71994	1.19455	43,700	10,064	33,637
1995	176	7,617	1.79670	1.25158	45,386	10,407	34,979
1996	171	7,702	2.10399	1.33578	49,124	11,872	37,252
1997	170	7,609	2.29075	1.40013	51,167	12,835	38,332
1998	175	7,620	2.16236	1.25934	46,826	12,329	34,497
1999	170	7,910	2.17266	1.24026	47,491	12,116	35,375
2000	167	8,151	2.45358	1.48560	57,031	13,439	43,592

1/ Residential refers to single-metered residential customers which may include condominiums for visitor use but excludes master-metered apartment and condominium buildings used by residents which are classified as commercial customers.

2/ Based on number of customers at end of year.

Source: Hawaii State Department of Commerce and Consumer Affairs, Division of Consumer Advocacy, records.

Table 17.12-- GAS UTILITIES, BY ISLANDS: 2000

[Excludes bottled gas]

County or island	Customers, December 31			Gas sold (1,000 therms)		
	Total	Residential 1/	Other	Total	Residential 1/	Other
State total	36,404	32,804	3,600	34,820	5,477	29,343
Oahu	33,613	30,383	3,230	31,619	5,054	26,565
Hawaii	1,652	1,360	292	2,214	241	1,974
Kauai	650	650	-	88	88	-
Maui	411	333	78	883	78	805
Molokai	78	78	-	17	17	-
Lanai	-	-	-	-	-	-

County or island	Average annual use (therms) 2/		Average rate (dollars per therm)		Revenues (\$1,000)		
	Residential 1/	Other	Residential 1/	Other	Total	Residential 1/	Other
State total	167	8,151	2.45358	1.48560	57,031	13,439	43,592
Oahu	166	8,224	2.42966	1.50748	52,326	12,280	40,046
Hawaii	177	6,759	2.98311	1.29151	3,267	718	2,549
Kauai	135	-	2.71167	-	238	238	-
Maui	233	10,320	2.10372	1.23916	1,161	163	997
Molokai	220	-	2.33821	-	40	40	-
Lanai	-	-	-	-	-	-	-

1/ Residential refers to single-metered residential customers which may include condominiums for visitor use but excludes master-metered apartment and condominium buildings used by residents which are classified as commercial customers.

2/ Based on number of customers at end of year.

Source: Hawaii State Department of Commerce and Consumer Affairs, Division of Consumer Advocacy, records.

**Table 17.13-- SERVICE PROVIDED BY HAWAIIAN ELECTRIC COMPANY, INC.,
ON OAHU: 1990 TO 2000**

Year	Number of customers, Dec. 31		Net input 1/ (1,000 kWh)	Electricity sales (1,000 kWh)	Average annual residential use 2/ (kWh)	Average residential rate (dollars per kWh)	Generating capability Dec. 31 3/ (kW)
	Total	Residential only					
1990	248,692	217,681	6,835,025	6,470,587	7,620	0.09228	1,262,000
1991	255,176	223,304	6,876,964	6,538,952	7,610	0.09354	1,440,000
1992	257,442	225,229	7,061,157	6,650,449	7,711	0.09925	1,666,000
1993	263,478	230,192	7,029,839	6,607,424	7,581	0.11414	1,669,000
1994	264,992	232,115	7,222,978	6,797,364	7,681	0.11342	1,669,000
1995	269,307	235,905	7,359,195	6,962,794	7,732	0.12302	1,669,000
1996	271,602	237,860	7,499,202	7,091,147	7,868	0.12944	1,669,000
1997	271,801	238,825	7,424,259	7,040,291	7,773	0.13360	1,669,000
1998	272,675	239,945	7,299,149	6,938,326	7,603	0.12556	1,669,000
1999	275,467	242,579	7,356,725	6,997,936	7,654	0.12741	1,669,000
2000	278,260	245,027	7,589,409	7,211,760	7,793	0.14477	1,669,000

1/ Net generation plus purchased power.

2/ Based on average number of customers during the year.

3/ Includes firm purchase power.

Source: Hawaiian Electric Company, Inc., records.

**Table 17.14-- SERVICE PROVIDED BY THE GAS COMPANY, INC.,
ON OAHU: 1990 TO 2000**

Calendar year	Customers, Dec. 31		Gas sold 1/ (1,000 therms)		Average annual residential usage 1/ (therms)
	Total	Residential	Total	Residential	
1990	31,974	28,714	2/ 31,952	5,469	2/ 190
1991	32,487	29,278	30,866	5,331	182
1992	32,598	29,375	30,528	5,285	180
1993	33,206	29,984	2/ 30,027	5,287	176
1994	33,597	30,344	2/ 30,762	5,372	177
1995	33,472	30,492	30,582	5,332	175
1996	33,914	30,668	30,339	5,203	170
1997	33,800	30,574	29,836	5,176	169
1998	33,705	30,497	29,930	5,284	173
1999	33,614	30,384	30,830	5,154	170
2000	33,613	30,383	31,619	5,054	166

1/ Includes liquefied petroleum gas.

2/ Revised.

Source: The Gas Company, records.

Table 17.15-- LIQUID FUEL TAX BASE: 1990 TO 2000

[In thousands of gallons]

Year reported 1/	All types		Gasoline	Diesel oil	
	Total	Excluding aviation		Non-hwy.	Hwy. use
1990	1,307,887	557,097	375,382	151,095	24,763
1991	1,299,455	570,077	376,182	163,773	24,991
1992	1,286,118	574,716	381,118	162,983	26,289
1993	1,173,458	573,767	384,444	160,121	24,997
1994	1,240,366	578,758	392,404	152,628	29,692
1995	1,286,038	600,596	396,446	172,684	27,411
1996	1,147,866	588,896	394,989	160,102	29,864
1997	955,834	585,400	400,435	150,737	30,109
1998	954,860	597,410	394,674	169,930	28,983
1999	969,434	621,832	384,260	201,664	32,098
2000	1,053,114	684,247	400,920	246,426	33,282

Year reported 1/	Liquefied petroleum gas		Aviation fuel	Small boats	
	Off-hwy.	Hwy. use		Gasoline	Diesel oil
1990	4,757	834	750,790	78	188
1991	3,575	780	729,378	52	724
1992	3,644	532	711,402	48	102
1993	3,343	477	599,691	35	349
1994	3,210	566	661,608	60	198
1995	3,096	514	685,443	50	395
1996	3,249	413	558,969	50	228
1997	3,587	328	370,433	41	164
1998	3,280	383	357,450	9	151
1999	3,326	360	347,602	4	119
2000	3,250	332	368,867	2	35

1/ Liquid fuel sold in a given month is usually reported the following month. Annual totals accordingly refer to fuel sold during a 12-month period ending November 30.

Source: Hawaii State Department of Taxation, "Liquid Fuel Tax Base and Tax Collections" (annual report).

Table 17.16-- LIQUID FUEL TAX BASE, BY COUNTIES: 2000

[In thousands of gallons. Liquid fuel sold in a given month is usually reported the following month. Annual totals accordingly refer to fuel sold during a 12-month period ending November 30]

Type of fuel	State total	City and Co. of Honolulu	County of Maui	County of Hawaii	County of Kauai
Total	1,053,114	755,947	127,738	113,441	55,987
Gasoline	400,920	251,860	57,861	65,310	25,889
Diesel oil, non-hwy.	246,426	173,421	28,289	23,101	21,614
Diesel oil, hwy. use	33,282	19,227	4,097	7,920	2,038
Liq. pet. gas, off hwy.	3,250	1,803	634	503	310
Liq. pet. gas, hwy. use	332	301	14	4	13
Small boats, gasoline	2	2	-	-	-
Small boats, diesel oil	35	3	-	32	-
Aviation fuel	368,867	309,330	36,842	16,572	6,123

Source: Hawaii State Department of Taxation, "Liquid Fuel Tax Base and Tax Collections, Calendar Year Ending December 31, 2000" (annual release).

Table 17.17-- GASOLINE SERVICE STATIONS WITH PAYROLL, BY COUNTIES: 1987, 1992, AND 1997

Year	State total	City and County of Honolulu	Hawaii County	Kauai County	Maui County
1987 1/	355	241	52	26	36
1992 1/	326	212	57	21	36
1997 2/	360	230	67	19	44

1/ Data are for Gasoline Service Stations (SIC 554).

2/ NAICS 447 includes Gasoline Service Stations (SIC 554) and Convenience Stores with gas (SIC 5411 pt.).

Source: U.S. Bureau of the Census, *1987 Census of Retail Trade, Hawaii*, RC87-A-12 (May 1989), table 5; *1992 Census of Retail Trade, Hawaii*, RC92-A-12 (October 1994), table 4; and *1997 Economic Census, Retail Trade, Hawaii*, EC97R44A-HI (November 1999), tables 1 and 3.

**Table 17.18-- BOILERS AND PRESSURE VESSELS, BY ISLANDS:
DECEMBER 31, 2000**

Island	Total	Power boilers	Heating boilers	Pressure vessels
State total	9,921	605	3,067	6,249
Hawaii	1,053	96	287	670
Maui	1,414	91	356	967
Lanai	50	4	10	36
Molokai	65	6	23	36
Oahu	6,829	367	2,291	4,171
Kauai	510	41	100	369

Source: Hawaii State Department of Labor and Industrial Relations, Division of Occupational Safety and Health, Boiler and Elevator Inspection Branch, records.

**Table 17.19-- ENERGY GENERATED, PURCHASED, SOLD, AND USED BY
SUGAR PLANTATIONS, BY ISLANDS: 1997**

Subject	State total	Hawaii	Kauai	Maui	Oahu
1997					
Electricity (millions of kilowatt-hours)					
Generated 1/	347.88	-	103.53	244.34	-
Purchased	9.81	-	5.18	4.13	-
Sold	138.91	-	50.66	88.25	-
Used	218.78	-	58.06	160.72	-
Gross heat values of boiler fuels (billions of Btu's)					
All fuels	11,089	-	3,685	7,405	-
Bagasse 2/	8,363	-	3,473	4,890	-
Fossil fuels	2,726	-	211	2,515	-
Other fuels	-	-	-	-	-

1/ Includes electricity generated by steam, hydroelectric and diesel engine.

2/ Includes bagasse transferred between factories.

Source: Hawaii Agriculture Research Center, *Energy Inventory of Hawaiian Sugar Plantations-1997* (Energy Report 37, July 1998), pp. 10-11.

Table 17.20-- ESTIMATED EMPLOYMENT AND REVENUE IN HIGH TECHNOLOGY AND SUPPORT INDUSTRIES IN THE STATE OF HAWAII: 2000

	Number of employees working 20+ hours including contract employees in 2000		Gross Hawaii sales or technology-related revenues for 2000					
	Number of organizations providing information	Estimated number of organizations statewide	Average for organizations providing information	State-wide estimate 1/	Number of organizations providing information 2/	Estimated number of organizations statewide	Average for organizations providing information (dollars)	State-wide estimate (mil. dol.) 1/ 3/
High technology organizations								
Information technologies, telecommunications	156	454	22	9,761	106	454	3,999,005	1,816
Bio sciences	22	64	38	2,400	16	64	1,036,684	66
Earth, ocean, space sciences	33	96	17	1,632	25	96	2,046,160	196
Energy related (excluding traditional)	20	58	15	841	16	58	4,325,290	251
Medical, healthcare; dual-use; distance learning	16	47	68	3,201	9	47	3,996,222	188
Total	247	719		17,835	172	719		2,517

1/ Average times estimated number of organizations statewide

2/ Four firms with revenues of \$150 million or more were excluded from the calculations.

3/ Data rounded to nearest million dollars.

Source: High Technology Development Corporation, 2001 High Tech Business Survey

**Table 17.21-- FEDERAL OBLIGATIONS FOR RESEARCH AND DEVELOPMENT
AND R&D PLANT IN HAWAII: 1993 TO 1998**

[Millions of dollars. For fiscal years ended September 30]

Type of obligation	1993	1994	1995	1996	1997	1998
Obligations for R&D	113.0	140.3	139.3	147.6	150.7	160.8
Obligations for R&D plant	19.3	14.3	0.5	1.7	3.0	3.9

Source: National Science Foundation/Division of Science Resources Studies, *Survey of Federal Funds for Research and Development: Fiscal Years 1998, 1999 and 2000*. Internet site <http://www.nsf.gov/sbe/srs/nsf00317/pdf/sectc.pdf>. Tables C-110a and C-111a.

**Table 17.22-- CHARACTERISTICS OF THE PRIVATE TECHNOLOGY SECTOR:
1996 AND 1999**

Subject	Total private sector	Private technology				
		All categories	Bio-technology	Information technology	Research development, education	Tele-communications
Operating units: 1/						
1996	31,253	738	16	415	140	167
1999	31,257	879	25	527	146	181
Percent change	0.0	19.1	56.3	27.0	4.3	8.4
Employment: 2/						
1996	427,676	10,589	122	2,372	1,772	6,323
1999	429,179	12,421	604	3,584	1,636	6,598
Percent change	0.4	17.3	395.2	51.1	-7.7	4.3
Total wages: 3/						
1996	11,208	434.7	3.9	97.3	63.5	270.0
1999	12,084	583	16.4	188.4	69.6	308.1
Percent change	7.8	34.0	323.6	93.5	9.6	14.1
Wages per employee: 4/						
1996	26,207	41,055	31,742	41,034	35,839	42,705
1999	28,155	46,893	27,148	52,565	42,540	46,700
Percent change	7.4	14.2	-14.5	28.1	18.7	9.4

1/ May include multiple sites of individual companies.

2/ Annual average. Excludes self-employed and proprietors.

3/ Annual totals in millions of dollars.

4/ In dollars.

Source: Hawaii State Department of Business, Economic Development & Tourism, "Hawaii's Expanding Tech Sector," dbedt e-reports, May 2001; <http://www.hawaii.gov/dbedt/hets/types.html>.

**Table 17.23-- PRIVATE TECHNOLOGY SECTOR, DISTRIBUTION
AND JOB GROWTH, BY COUNTIES**

Subject	State total	Hawaii	Maui	Honolulu	Kauai	County unknown
Percent distribution, 1999	100	7	8	80	4	1
Percent change, 1996-1999	17.3	18.1	30.6	15.4	12.4	...

Source: Hawaii State Department of Business, Economic Development & Tourism, "Hawaii's Expanding Tech Sector," dbedt e-reports, May 2001; <http://www.hawaii.gov/dbedt/hets/types.html>.

**Table 17.24-- RESEARCH AND NON-RESEARCH EXTRAMURAL FUNDING,
FOR THE UNIVERSITY OF HAWAII: 1991-92 TO 1999-00**

[Research and non-research awards received through the Office of Research Services, University of Hawaii, and non-competitive awards from the U.S. Department of Agriculture]

Fiscal year	Total		Research		Non-research	
	Awards	Amount (dollars)	Awards	Amount (dollars)	Awards	Amount (dollars)
1991-92	1,221	124,876,638	703	65,791,624	518	59,085,014
1992-93	1,146	131,075,215	636	61,059,928	510	70,015,287
1993-94	1,322	142,563,794	755	77,763,782	567	64,800,012
1994-95	1,147	139,199,221	616	70,222,653	531	68,976,568
1995-96	1,191	134,469,155	697	76,698,552	494	57,770,603
1996-97	1,255	160,859,800	724	89,131,636	531	71,728,164
1997-98	1,300	159,948,612	763	91,746,988	537	68,201,624
1998-99	1,254	164,168,101	707	92,737,645	547	71,430,456
1999-00	1,379	180,629,855	767	102,845,010	612	77,784,845

Source: Office of Research Services, University of Hawaii, *1999-2000 Extramural Awards* (2000), p. i.

Table 17.25-- RESEARCH AND DEVELOPMENT EXPENDITURES AT DOCTORATE-GRANTING INSTITUTIONS: FISCAL YEARS 1991 TO 1999

	Total	Federally financed	State and local government financed	Industry financed	Institutionally financed	All other sources
1991	78,166	44,857	27,321	856	3,391	1,741
1992	80,258	47,684	26,775	337	3,319	2,143
1993	73,961	41,362	27,099	151	3,109	2,240
1994	70,079	39,392	25,204	434	3,290	1,759
1995	78,429	44,238	26,789	299	3,738	3,365
1996	111,202	86,902	31,826	8,088	4,386	-
1997	120,107	72,421	28,440	5,944	13,297	5
1998	148,007	86,886	37,002	10,949	13,170	-
1999	156,810	93,418	35,111	13,021	15,260	-

Source: National Science Foundation/SRS, Survey of Research and Development Expenditures at Universities and Colleges, Fiscal Year 1998. <http://www.nsf.gov/sbe/srs/nsf00330/sectb.pdf>.
<http://www.nsf.gov/sbe/srs/srs01407/Tables/b23.xls> to [b28.xls](http://www.nsf.gov/sbe/srs/srs01407/Tables/b28.xls)

Table 17.26-- PATENTS ISSUED TO HAWAII RESIDENTS: 1980 TO 2000

Calendar year	Patents	Calendar year	Patents
1980	35	1991	80
1981	44	1992	81
1982	30	1993	106
1983	34	1994	99
1984	39	1995	84
1985	38	1996	104
1986	46	1997	93
1987	46	1998	93
1988	62	1999	97
1989	71	2000	93
1990	85		

Source: U.S. Patent and Trademark Office, Information Products Division/TAF Branch, *Patent Counts by Country/State and Year, All Patents, All Types, January 1, 1977 -- December 31, 2000* (March 2001) at http://www.uspto.gov/web/offices/ac/ido/oeip/taf/est_all.pdf.

**Table 17.27-- ASTRONOMY AND RELATED FACILITIES AT
THE SUMMITS OF MAUNA KEA AND HALEAKALA: 1999**

Facility (mirror diameter in meters)	Capital cost (\$ mil)	Annual operating cost (\$ mil)	Hawaii County based staff	Operational
Mauna Kea:				
UH 0.6-m (Optical)	0.3	(X)	(X)	1969
UH 2.2-m (Optical/Infrared)	5	0.75	8	1970
Canada-France-Hawaii 3.6-m (Optical/Infrared)	30	6.2	50	1979
NASA IRTF 3.0-m (Infrared)	10	3.0	12	1979
United Kingdom Infrared 3.8-m	5	2.7	31	1979
James Clerk Maxwell 15-m Submillimeter	32	3.5	43	1986
Caltech 10.4-m Submillimeter	10	2.1	10	1986
W.M. Keck Observatory (Keck I & II) 10-m x 2 (Optical/Infrared)	170	11.0	85	1992/96
VLBA Antenna 25-m (Radio)	7	0.25	2	1992
Submillimeter Array 8x6-m 1/	80	6.0	2/ 26	1999
Subaru (Japan National Large Telescope) 8-m (Optical/Infrared)	170	8.0	2/ 30	1999
Gemini Northern 8-m (Optical/Infrared)	100	5.0	2/ 30	1999
Mauna Kea Observatories Support Services	(NA)	3/ 1.9	24	
Total	619	48.5	351	
Haleakala:				
Mees Solar Observatory	0.5	0.1	2	1964
Lunar Ranging Facility	3.3	0.7	7	1976/84
Haleakala Observatories Projects	(NA)	0.5	4	
Maui Space Surveillance Site (MSSS) 4/ Advanced Electro-Optical System 3.7-m Telescope (AEOS)	200.0	16.0	120	
Haleakala Support Facilities	50.0	15.0	55	1997
	(NA)	0.13	6	
Total	253.8	32.43	194	

NA Not available.

X Not applicable.

1/ Under construction.

2/ Approximate expected number when in operation.

3/ Not included in the total since derived from facility operating funds.

4/ Formerly Air Force Maui Optical Station (AMOS).

Source: University of Hawaii at Manoa, Institute for Astronomy, *Fact Sheet*.