

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 (on utility employment), 14 (prices), and 18 (gasoline consumption).

Total energy consumption in 1990 amounted to 299 trillion British thermal units, compared with 253 trillion Btu a decade earlier. Fully 98.5 percent in 1990 was provided by petroleum. Transportation, including aviation fuels, accounted for 52 percent of the total. Total expenditures for fuels and electricity in 1991 were \$2.2 billion.

Electricity sales amounted to 8.5 billion kilowatt-hours in 1991, a total that has increased 32 percent since 1981. Manufactured gas sales reached 34 million therms in 1991, five percent above the figure ten years earlier. Residential rates in 1991 averaged 10.5 cents per kilowatt-hour and \$1.79 per therm. Average residential use (7,252 kWh and 184 therms in 1991) has declined since the early 1970s.

The liquid fuel tax base for 1992 was approximately 1.3 billion gallons, compared with 893 million in 1982. The 1992 total included 381 million gallons of gasoline, 711 million of aviation fuel, and 189 million of diesel oil. The average price for automotive gasoline was \$1.56 per gallon during 1991.

The State is well served with scientific resources. Especially noteworthy is the cluster of large astronomical telescopes at the summits of Mauna Kea and Haleakala--twelve major facilities, including the world's most powerful. Federal research and development obligations in Hawaii totaled \$97 million in 1989. Seventy-eight patents were granted to Hawaii residents in 1991.

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 and its Division of Consumer Advocacy, the DBEDT Energy Division, UH Institute for 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: 1992, Sections 19 and 20.

Table 471.-- CONSUMPTION OF ENERGY, BY SOURCE (PHYSICAL UNITS):
1970 TO 1990

Year	Petroleum ^{1/} (1,000 barrels)	Hydro- electric power ^{2/} (million kWh)	Geothermal energy (million kWh)	Coal (1,000 short tons)	Other ^{3/} (million kWh)
1970	34,129	108	0	0	24
1971	36,754	89	0	0	15
1972	37,755	91	0	0	18
1973	38,785	95	0	0	22
1974	36,698	92	0	0	30
1975	37,056	89	0	0	25
1976	37,990	93	0	0	29
1977	40,249	86	0	0	26
1978	40,851	84	0	0	0
1979	44,486	90	0	0	0
1980	43,505	86	0	0	0
1981	38,721	80	0	0	15
1982	35,637	90	0	47	26
1983	36,297	84	0	42	28
1984	37,252	82	21	38	28
1985	40,004	86	19	46	25
1986	38,931	78	18	16	0
1987	40,884	82	13	63	0
1988	47,621	81	16	50	0
1989	49,641	89	14	32	11
1990	50,292	89	0	28	6

^{1/} For data by type of petroleum, see source. Revised data, 1984-1989.

^{2/} Includes industrial and electric utility production.

^{3/} Wood, waste, wind, photovoltaic, and solar thermal energy sources consumed at electric utilities to produce electricity. Excludes natural gas and nuclear electric power.

Source: U.S. Department of Energy, Energy Information Administration, State Energy Data Report, Consumption Estimates, 1960-1990 (May 1992), p. 105.

Table 472.-- CONSUMPTION OF ENERGY, BY SOURCE (TRILLION BTU):
1970 TO 1990

Year	Total energy consumed	Petroleum <u>1/</u>	Hydro-electric power <u>2/</u>	Geo-thermal energy	Coal	Natural gas	Other types <u>3/</u>
1970	196.9	195.5	1.1	0.0	0.0	0.0	0.3
1971	211.6	210.5	0.9	0.0	0.0	0.0	0.2
1972	217.7	216.6	0.9	0.0	0.0	0.0	0.2
1973	223.7	222.5	1.0	0.0	0.0	0.0	0.2
1974	211.6	210.3	1.0	0.0	0.0	0.0	0.3
1975	213.9	212.7	0.9	0.0	0.0	0.0	0.3
1976	219.3	218.0	1.0	0.0	0.0	0.0	0.3
1977	232.6	231.8	0.9	0.0	0.0	0.0	0.3
1978	236.0	235.2	0.9	0.0	0.0	0.0	0.0
1979	255.2	254.3	0.9	0.0	0.0	0.0	0.0
1980	253.2	249.3	0.9	0.0	0.0	3.0	0.0
1981	226.4	222.6	0.8	0.0	0.0	2.8	0.2
1982	208.5	203.3	0.9	0.0	1.1	2.8	0.3
1983	210.3	205.4	0.9	0.0	1.0	2.7	0.3
1984	220.8	215.8	0.8	0.4	0.9	2.4	0.3
1985	237.4	232.1	0.9	0.4	1.1	2.7	0.3
1986	231.2	226.9	0.8	0.4	0.4	2.7	0.0
1987	243.6	238.1	0.8	0.3	1.6	2.8	0.0
1988	283.9	278.7	0.8	0.3	1.3	2.8	0.0
1989	295.3	290.3	0.9	0.3	0.8	2.9	0.1
1990	299.0	294.4	0.9	0.0	0.7	3.0	0.1

1/ For data by type of petroleum, see source. Revised data, 1984-1989.

2/ Includes industrial and electric utility production.

3/ Wood, waste, wind, photovoltaic, and solar thermal energy sources consumed at electric utilities to produce electricity.

Source: U.S. Department of Energy, Energy Information Administration, State Energy Data Report, Consumption Estimates, 1960-1990 (May 1992), p. 105.

Table 473.-- CONSUMPTION OF ENERGY BY END-USE SECTOR: 1960 TO 1990

[Trillion Btu. Revised data for 1985-1989]

Year	Consumption ^{1/}				Input at electric utilities
	Residential	Commercial	Industrial	Transportation	
1970	16.4	11.6	43.6	125.3	43.2
1971	17.8	11.4	43.5	138.8	47.7
1972	19.6	12.7	48.9	136.5	54.1
1973	20.0	13.5	49.4	140.9	55.6
1974	20.3	13.3	49.4	128.7	57.5
1975	19.6	13.8	49.9	130.5	58.8
1976	21.3	15.3	51.0	131.7	62.5
1977	21.8	16.8	52.7	141.3	65.2
1978	21.8	17.4	52.2	144.6	66.8
1979	22.9	18.1	57.8	156.4	67.7
1980	23.2	20.8	62.4	146.7	69.7
1981	23.0	18.8	60.6	124.1	69.9
1982	21.5	17.6	67.1	102.2	66.9
1983	22.1	17.8	52.6	117.9	68.6
1984	21.0	19.5	50.9	129.3	70.6
1985	20.9	20.3	53.0	143.3	70.0
1986	21.3	22.8	60.2	126.9	72.9
1987	22.8	33.7	62.0	125.1	76.6
1988	23.9	48.6	69.3	142.0	81.9
1989	25.3	48.8	66.8	154.4	85.8
1990	25.1	45.1	72.2	156.6	86.1

^{1/} Excludes small quantities of energy sources for which consistent historical data are not available, such as solar energy obtained by the use of thermal and photovoltaic collectors; wind energy; and geothermal, biomass, and waste energy other than that consumed at the electric utilities.

Source: U.S. Department of Energy, Energy Information Administration, State Energy Data Report, Consumption Estimates, 1960-1990 (May 1992), pp. 106-110.

Table 474.-- ENERGY CONSUMPTION AND ELECTRICITY SALES, TOTAL AND PER CAPITA: 1960 TO 1991

Year	Primary energy consumption		Electricity sales by utilities	
	Total (trillion Btu)	Per capita ^{1/} (million Btu)	Total (1,000 kWh)	Per capita ^{1/} (kWh)
1960	120.49816	185.040	1,602,197	2,460
1961	141.31562	211.487	1,766,031	2,643
1962	137.19339	197.799	1,966,105	2,835
1963	143.86984	207.156	2,077,571	2,991
1964	153.96038	216.480	2,284,275	3,212
1965	160.60139	224.492	2,445,025	3,418
1966	175.59905	242.339	2,639,866	3,643
1967	196.12467	264.105	2,832,469	3,814
1968	214.96128	283.291	3,109,256	4,098
1969	221.93865	284.975	3,426,052	4,399
1970	225.22990	282.031	3,758,094	4,706
1971	241.09159	289.391	4,167,127	5,002
1972	245.12817	281.821	4,562,568	5,246
1973	250.54211	277.979	4,867,850	5,401
1974	237.26587	256.865	5,113,906	5,536
1975	238.35719	252.631	5,334,755	5,654
1976	240.51954	247.882	5,615,210	5,787
1977	254.54840	256.524	5,831,610	5,877
1978	259.11475	255.462	6,004,891	5,920
1979	278.45009	267.047	6,197,426	5,944
1980	273.88094	259.504	6,345,531	6,012
1981	273.32263	257.221	6,424,016	6,046
1982	272.11290	250.888	6,332,707	5,839
1983	279.03031	251.560	6,425,578	5,793
1984	276.36995	244.467	6,606,255	5,844
1985	266.21778	233.976	6,635,158	5,832
1986	271.05620	232.168	7,025,739	6,018
1987	282.71678	238.278	7,298,178	6,151
1988	306.72360	255.518	7,719,029	6,430
1989	314.96310	252.861	7,970,360	6,399
1990 (est.).....	306.70400	243.803	8,310,537	6,606
1991 (est.)	315.50600	247.320	8,524,088	6,682

^{1/} Based on estimated de facto population.

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

Table 475.-- ENERGY CONSUMPTION, BY SOURCE: 1970 TO 1991

[Trillion Btu]

Year	Total	Petroleum	Biomass <u>1/</u>	Solar water heating	Hydro-electricity	Coal	Wind	Geo-thermal
1970 ...	225.2299	197.2279	26.9020	-	1.1000	-	-	-
1971 ...	241.0916	212.8486	27.3430	-	0.9000	-	-	-
1972 ...	245.1282	218.3842	25.8440	-	0.9000	-	-	-
1973 ...	250.5421	223.7861	25.7560	-	1.0000	-	-	-
1974 ...	237.2659	212.2739	23.9920	-	1.0000	-	-	-
1975 ...	238.3572	213.4572	24.0000	-	0.9000	-	-	-
1976 ...	240.5195	215.5195	24.0000	-	1.0000	-	-	-
1977 ...	254.5484	229.5889	24.0000	0.0595	0.9000	-	-	-
1978 ...	259.1148	233.5357	24.4000	0.2791	0.9000	-	-	-
1979 ...	278.4501	253.0344	24.0000	0.5157	0.9000	-	-	-
1980 ...	273.8809	248.0109	24.2000	0.7700	0.9000	-	-	-
1981 ...	273.3226	245.5086	24.0900	1.1185	0.7356	1.8700	-	-
1982 ...	272.1129	244.3151	23.9200	1.3567	1.0939	1.2700	-	0.1572
1983 ...	279.0303	250.6283	24.8500	1.5269	0.8865	0.9500	-	0.1886
1984 ...	276.3700	248.4026	24.3650	1.7683	0.7796	0.8470	-	0.2075
1985 ...	266.2178	238.6470	23.1430	2.1327	0.9808	0.9560	0.1697	0.1886
1986 ...	271.0562	242.5857	23.9670	2.1644	1.0562	0.4970	0.6036	0.1823
1987 ...	284.2043	256.4061	22.1840	2.1914	0.9670	1.4875	0.8236	0.1446
1988 ...	306.9212	279.1052	22.7080	2.1931	0.9826	1.3509	0.4185	0.1629
1989 <u>2/</u>	314.9631	289.2301	20.9498	2.3310	1.0183	0.8715	0.4189	0.1435
1990 ...	306.704	280.874	21.2400	2.3400	1.0700	0.8900	0.2900	-
1991 <u>3/</u>	315.506	289.900	21.2000	2.3000	1.0000	0.8000	0.3060	-

1/ Beginning 1989, includes solid waste.

2/ Preliminary.

3/ Estimated.

Source: U.S. Energy Information Administration; Hawaii State Department of Business, Economic Development & Tourism, Energy Division, records.

Table 476.-- ELECTRICITY GENERATION BY SOURCE: 1986 TO 1991

[Millions of kWh generated]

Year	Total	Petroleum	Biomass	Hydro-electric	Geo-thermal	Wind	Other <u>1/</u>
1986	8,251	7,412	646	100	18	58	17
1987	8,368	7,577	605	93	14	79	-
1988	8,952	8,115	681	98	16	42	-
1989	9,280	8,511	614	100	14	41	(Z)
1990	9,565	8,589	538	105	-	28	306
1991	9,610	8,664	495	92	-	30	329

Z Less than 500,000 kWh.

1/ Coal, photovoltaic, and solid waste.

Source: Hawaii State Department of Commerce and Consumer Affairs, records; Hawaii State Department of Business, Economic Development & Tourism, Energy Division, records; Hawaiian Sugar Planters' Association, records.

Table 477.-- ELECTRICITY PRODUCTION, BY SOURCE, BY ISLANDS: 1991

[Million kWh]

Island	Total	Petroleum	Biomass <u>1/</u>	Hydro-electric	Wind	Other <u>2/</u>
State total ..	9,609.6	8,664.4	815.7	91.7	29.5	0.8
Hawaii	892.5	686.4	157.3	22.4	19.3	0.7
Maui	1,027.5	861.3	148.7	16.4	-	1.1
Lanai	25.2	25.2	-	-	-	-
Molokai	32.1	32.1	-	-	-	-
Oahu	7,138.6	6,729.1	399.2	-	10.3	-
Kauai	493.7	330.3	110.5	52.9	-	-

1/ Includes generation from Honolulu municipal solid waste plant.2/ Coal, geothermal (ceased operation in 1989), and photovoltaic.

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

Table 478.-- EXPENDITURES FOR FUELS AND ELECTRICITY, BY SOURCE:
1970 TO 1991

[Millions of dollars]

Year	Total energy expend.	Fuel expenditures			Less: electric utility fuel expend.	Plus: electric purch. by end-user
		Total	Electric utility	Other		
1970	282.7	215.9	17.3	198.6	17.3	84.1
1971	320.8	246.8	24.8	222.0	24.8	98.8
1972	332.4	250.4	27.3	223.1	27.3	109.3
1973	391.1	300.9	36.3	264.6	36.3	126.5
1974	534.5	433.2	49.8	383.4	49.8	151.1
1975	669.9	546.1	91.9	454.2	91.9	215.7
1976	735.6	600.0	100.4	499.6	100.4	236.0
1977	844.5	696.5	123.5	573.0	123.5	271.5
1978	932.2	767.8	149.3	618.5	149.3	313.7
1979	1,261.3	1,083.7	177.0	906.7	177.0	354.6
1980	1,721.3	1,529.8	267.8	1,262.0	267.8	459.3
1981	2,195.2	1,947.7	451.5	1,496.2	451.5	699.0
1982	2,153.8	1,869.6	439.4	1,430.2	439.4	723.6
1983	2,019.9	1,730.1	369.3	1,360.8	369.3	659.1
1984	2,048.4	1,724.8	379.3	1,345.5	379.3	702.9
1985	1,921.6	1,586.6	337.6	1,249.0	337.6	672.6
1986	1,564.0	1,147.3	224.6	922.7	224.6	641.3
1987	1,575.1	1,176.2	203.7	972.5	203.7	602.6
1988	1,664.1	1,314.6	238.0	1,076.6	238.0	587.5
1989	1,895.2	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 <u>1/</u> .	2,186.2	1,711.6	304.8	1,406.8	304.8	779.4

1/ Provisional.

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

Table 479.-- ELECTRIC UTILITIES: 1981 TO 1991

Year	Customers, Dec. 31 <u>1/</u>			Installed capacity, Dec. 31 (kW) <u>2/</u>	Power sold (1,000 kWh)		
	Total	Residential	Other		Total	Residential	Other
1981 ..	305,927	265,042	40,885	1,652,380	6,424,016	1,855,837	4,568,179
1982 ..	313,009	270,712	42,297	1,644,980	6,332,707	1,801,297	4,531,410
1983 ..	319,449	276,194	43,255	1,578,780	6,425,578	1,814,336	4,611,242
1984 ..	324,384	280,518	43,866	1,578,780	6,606,255	1,837,954	4,768,301
1985 ..	330,407	285,117	45,290	1,567,230	6,635,158	1,879,027	4,756,131
1986 ..	337,563	291,222	46,341	1,553,580	7,025,739	1,959,447	5,066,292
1987 ..	347,085	299,758	47,327	1,535,700	7,297,905	2,069,859	5,228,046
1988 ..	354,887	306,375	48,512	1,570,410	7,719,029	2,148,275	5,570,754
1989 ..	362,281	312,347	49,934	1,517,500	7,969,694	2,238,874	5,730,820
1990 <u>4/</u>	370,952	320,215	50,737	1,655,690	8,310,537	2,320,550	5,989,987
1991 ..	380,963	328,899	52,064	1,572,349	8,460,186	2,363,726	6,076,697
1991 <u>5/</u>	380,963	328,899	52,064	1,572,349	8,524,088	2,385,276	6,178,756
Year	Average annual use (kWh) <u>3/</u>		Average rate (dollars per kWh)		Revenues (\$1,000)		
	Residential	Other	Residential	Other	Total	Residential	Other
1981 ..	7,002	111,732	.11563	.10605	699,031	214,584	484,447
1982 ..	6,654	107,133	.12348	.11061	723,622	222,423	501,199
1983 ..	6,569	106,606	.11348	.09828	659,089	205,889	453,200
1984 ..	6,552	108,702	.11831	.10181	702,899	217,447	485,452
1985 ..	6,590	105,015	.11361	.09653	672,600	213,478	459,122
1986 ..	6,728	109,326	.09294	.07505	562,345	182,110	380,234
1987 ..	6,905	110,466	.09431	.07792	602,553	195,198	407,355
1988 ..	7,011	114,832	.08829	.07141	587,528	189,689	397,839
1989 ..	7,168	114,772	.09265	.07585	642,101	207,436	434,665
1990 <u>4/</u>	7,247	118,060	.10261	.08544	749,857	238,103	511,754
1991 ..	7,187	116,716	.10539	.08726	779,382	249,104	530,278
1991 <u>5/</u>	7,252	117,524	.10546	.08733	785,896	251,553	534,343

1/ 1990 based on November data.

2/ Does not include purchased power.

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

4/ Revised.

5/ 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.

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

Table 480.-- ELECTRIC UTILITIES, BY ISLANDS (OLD METHODOLOGY): 1991

[Based on methodology used in previous years. For data based on new methodology, see the following table]

County or island	Customers, Dec. 31			Installed capacity, Dec. 31 (kW)	Power sold (1,000 kWh)		
	Total	Residential	Other		Total	Residential	Other
State total	380,963	328,899	52,064	1,572,349	8,460,185	2,363,725	6,076,697
Oahu	255,176	223,304	31,872	1,188,600	6,508,263	1,679,734	4,828,529
Hawaii	53,351	44,244	9,107	143,850	751,689	289,463	462,226
Kauai	23,917	20,129	3,788	94,360	370,451	119,802	250,649
Maui County	48,519	41,222	7,297	145,539	829,782	274,727	535,293
Lanai	1,173	1,019	154	9,710	19,763	4,942	14,821
Maui	44,627	37,974	6,653	131,029	781,457	263,073	518,385
Molokai	2,719	2,229	490	4,800	28,562	11,654	16,908

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Table 480.-- ELECTRIC UTILITIES, BY ISLANDS (OLD METHODOLOGY): 1991 - Con.

County or island	Average annual use (kWh) <u>1/</u>		Average rate (dollars per kWh)		Revenues (\$1,000)		
	Resi- dential	Other	Resi- dential	Other	Total	Resi- dential	Other
State total	7,187	116,716	0.10539	0.08726	779,382	249,104	530,278
Oahu	7,522	151,498	0.09366	0.07768	532,408	157,323	375,085
Hawaii	6,542	50,755	0.13827	0.12365	97,177	40,025	57,152
Kauai	5,952	66,169	0.13571	0.13226	49,409	16,258	33,151
Maui County	6,665	73,358	0.12921	0.12122	100,388	35,498	64,890
Lanai	4,850	96,240	0.16289	0.14513	2,956	805	2,151
Maui	6,928	77,917	0.12379	0.11494	92,147	32,566	59,581
Molokai	5,228	34,506	0.18251	0.18678	5,285	2,127	3,158

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

Source: Hawaii State Department of Commerce and Consumer Affairs, Division of Consumer Advocacy, records; Hawaiian Electric Company, Inc. 1991-1986 Financial and Statistical Data Booklet (July 15, 1992).

Table 481.-- ELECTRIC UTILITIES, BY ISLANDS (NEW METHODOLOGY): 1991

[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]

County or island	Customers, Dec. 31			Installed capacity, Dec. 31 (kW) <u>2/</u>	Power sold (1,000 kWh)		
	Total	Residential	Other		Total	Residential	Other
State total	380,963	328,899	52,064	1,572,349	8,524,088	2,385,276	6,118,756
Oahu	255,176	223,304	31,872	1,188,600	6,538,952	1,688,248	4,850,704
Hawaii	53,351	44,244	9,107	143,850	778,993	300,723	478,270
Kauai	23,917	20,129	3,788	94,360	370,451	119,802	250,649
Maui County	48,519	41,222	7,297	145,539	835,692	276,503	539,133
Lanai	1,173	1,019	154	9,710	20,056	4,978	15,078
Maui	44,627	37,974	6,653	131,029	787,074	264,849	522,225
Molokai	2,719	2,229	490	4,800	28,562	11,654	16,908

Continued on next page.

Table 481.-- ELECTRIC UTILITIES, BY ISLANDS (NEW METHODOLOGY): 1991 - Con.

County or island	Average annual use (kWh)		Average rate (dollars per kWh)		Revenues (\$1,000)		
	Residential	Other	Residential	Other	Total	Residential	Other
State total	7,252	117,524	0.10546	0.08733	785,896	251,553	534,343
Oahu	7,560	152,193	0.09354	0.07763	534,503	157,924	376,579
Hawaii	6,797	52,517	0.13857	0.12401	100,983	41,671	59,312
Kauai	5,952	66,169	0.13571	0.13226	49,409	16,258	33,151
Maui County	6,708	73,884	0.12911	0.12112	101,001	35,700	65,301
Lanai	4,885	97,909	0.16292	0.14485	2,995	811	2,184
Maui	6,974	78,495	0.12370	0.11481	92,721	32,762	59,959
Molokai	5,228	34,506	0.18251	0.18678	5,285	2,127	3,158

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

Source: Hawaii State Department of Commerce and Consumer Affairs, Division of Consumer Advocacy, records; Hawaiian Electric Company, Inc., 1991-1986 Financial and Statistical Data Booklet (July 15, 1992).

Table 482.-- GAS UTILITIES: 1981 TO 1991

[Excludes bottled gas]

Year	Customers, Dec. 31			Gas sold (1,000 therms)			
	Total	Residential	Other	Total	Residential	Other	
1981 ...	32,421	28,343	4,078	32,396	6,422	25,975	
1982 ...	32,905	28,979	3,926	32,224	6,329	25,895	
1983 ...	32,880	28,933	3,947	31,307	6,338	24,970	
1984 ...	32,643	28,859	3,784	30,928	5,853	25,075	
1985 ...	32,988	29,253	3,735	31,203	5,911	25,292	
1986 ...	33,369	29,678	3,691	31,122	5,762	25,360	
1987 ...	33,895	30,198	3,697	32,408	5,880	26,528	
1988 ...	34,103	30,450	3,653	32,733	5,780	26,952	
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	
Year	Average annual use (therms) <u>1/</u>		Average rate (dollars per therm)		Revenues (\$1,000)		
	Residential	Other	Residential	Other	Total	Residential	Other
1981 ...	227	6,369	1.72585	1.50091	50,069	11,083	38,986
1982 ...	218	6,596	1.73311	1.43891	48,229	10,969	37,260
1983 ...	219	6,326	1.79719	1.44022	47,352	11,390	35,962
1984 ...	203	6,627	1.78958	1.37488	44,949	10,474	34,475
1985 ...	202	6,772	1.76934	1.33821	44,305	10,459	33,846
1986 ...	194	6,871	1.57151	1.12027	37,465	9,055	28,410
1987 ...	195	7,176	1.57204	1.10494	38,556	9,244	29,312
1988 ...	189	7,378	1.54961	1.07840	38,023	8,957	29,066
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

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

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

Table 483.-- GAS UTILITIES, BY ISLANDS: 1991

[Excludes bottled gas]

Island	Customers, Dec. 31			Gas sold (1,000 therms)		
	Total	Residential	Other	Total	Residential	Other
State total ..	34,973	31,378	3,595	33,974	5,775	28,199
Oahu	32,487	29,278	3,209	30,866	5,331	25,535
Hawaii	1,813	1,496	317	2,265	322	1,943
Kauai	277	277	-	56	56	-
Maui	396	327	69	788	66	721
Molokai	-	-	-	-	-	-
Lanai	-	-	-	-	-	-

Island	Average annual use (therms) <u>1/</u>		Average rate (dollars per therm)		Revenues (\$1,000)		
	Residential	Other	Residential	Other	Total	Residential	Other
State total ..	184	7,844	1.78649	1.25285	45,646	10,317	35,329
Oahu	182	7,957	1.80527	1.25816	41,751	9,624	32,127
Hawaii	215	6,129	1.55923	1.21307	2,858	502	2,357
Kauai	202	-	1.61651	-	90	90	-
Maui	203	10,455	1.52226	1.17179	946	101	845
Molokai	-	-	-	-	-	-	-
Lanai	-	-	-	-	-	-	-

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

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

Table 484.-- SERVICE PROVIDED BY HAWAIIAN ELECTRIC CO., INC., ON OAHU:
1986 TO 1991

Year	Number of customers, Dec. 31		Net input ^{1/} (1,000 kWh)	Power sold (1,000 kWh)	Average annual residential use ^{2/} (kWh)	Average residential rate (dollars per kWh)	Generating capability (kW) Dec. 31
	Total	Residential only					
1986 ..	235,742	205,636	5,933,569	5,625,398	7,113	0.08328	1,277,000
1987 ..	241,426	211,277	6,135,382	5,804,298	7,322	0.08591	1,277,000
1988 ..	244,965	214,429	6,439,768	6,095,707	7,386	0.07973	1,258,000
1989 ..	247,120	216,063	6,617,943	6,254,220	7,534	0.08308	1,271,000
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

^{1/} Net generation plus purchased power.

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

Source: Hawaiian Electric Co., Inc., records.

Table 485.-- GAS UTILITY SERVICE BY GASCO, INC., FOR OAHU: 1986 TO 1991

Calendar year	Customers, Dec. 31		Gas sold ^{1/} (1,000 therms)		Average annual residential usage ^{1/} (therms)
	Total	Residential	Total	Residential	
1986 ...	30,831	27,516	28,137	5,318	193
1987 ...	31,398	28,069	29,345	5,435	194
1988 ...	31,613	28,331	29,689	5,342	189
1989 ...	31,812	28,539	30,776	5,446	191
1990 ...	31,974	28,714	31,645	5,469	191
1991 ...	32,487	29,278	30,866	5,331	182

^{1/} Includes liquefied petroleum gas.

Source: Gasco, Inc., records.

Table 486.-- LIQUID FUEL TAX BASE: 1982 TO 1992

[In thousands of gallons]

Year reported ^{1/}	All types		Gasoline	Diesel oil	
	Total	Excluding aviation		Non-hwy.	Hwy. use
1982	893,288	418,811	308,600	88,312	17,303
1983	919,865	418,217	310,085	86,790	16,440
1984	925,871	440,061	322,410	95,956	17,892
1985	970,555	432,500	327,021	83,147	17,636
1986	1,059,180	456,013	336,559	95,022	19,354
1987	1,206,716	512,974	348,474	137,806	21,207
1988	1,216,828	515,273	357,986	131,292	21,057
1989	1,268,597	535,714	369,172	136,465	23,729
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
Year reported ^{1/}	Liquefied petroleum gas		Aviation fuel	Small boats	
	Off-hwy.	Hwy. use		Gasoline	Diesel oil
1982	2,628	960	474,477	207	802
1983	3,013	1,052	501,648	213	624
1984	2,600	873	485,810	114	215
1985	2,804	1,028	538,055	187	676
1986	2,969	1,031	603,167	163	916
1987	3,135	1,142	693,742	123	1,089
1988	3,012	1,071	701,555	63	792
1989	4,301	968	732,883	57	1,022
1990	4,757	834	750,790	78	188
1991	3,575	780	729,378	52	724
1992	3,644	532	711,402	48	102

^{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 ended November 30.

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

Table 487.-- LIQUID FUEL TAX BASE, BY COUNTIES: 1992

[In thousands of gallons]

Type of fuel	State total	City and Co. of Honolulu	County of Maui	County of Hawaii	County of Kauai
Total	1,286,118	1,046,225	90,903	97,171	51,819
Gasoline	381,118	254,097	47,004	56,883	23,134
Diesel oil, non-hwy. ...	162,983	72,558	34,431	29,334	26,659
Diesel oil, hwy. use ...	26,289	18,530	2,441	4,453	863
Liq. pet. gas, off hwy.	3,644	2,319	511	576	237
Liq. pet. gas, hwy. use	532	433	40	31	29
Small boats, gasoline ..	48	48	-	-	-
Small boats, diesel oil	102	13	-	89	-
Aviation fuel	711,402	698,226	6,475	5,805	896

Source: Hawaii State Department of Taxation, "Liquid Fuel Tax Base, Collections & Distributions, Calendar Year Ending December 31, 1992" (annual release).

Table 488.-- IMPORTS AND EXPORTS OF CRUDE OIL AND PETROLEUM PRODUCTS: 1990

[1,000 barrels]

Product	Imports			Exports		
	Total	Domestic	Foreign	Total	Domestic	Foreign
Crude oil	43,719	17,631	26,089	36	-	36
Distillates	849	849	-	4,709	3,972	737
Jet fuel ^{1/}	2,824	1,022	1,802	85	85	-
Residual fuel oil	4,023	2,893	1,129	1,659	633	1,026
Naphtha	10	10	-	1,905	1,333	572
Other	153	153	-	101	101	-

^{1/} Excludes imports of unknown origin (3,686,500 in 1988).

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

Table 489.-- GASOLINE SERVICE STATIONS (SIC 554) WITH PAYROLL,
BY COUNTIES: 1987 AND 1990

Year	State total	City and Co. of Honolulu	Hawaii County	Kauai County	Maui County		
					Lanai	Maui	Molokai
1987	355	241	52	26	1	34	1
1990	324	213	53	22	(1/)	36	(1/)

1/ Included with Maui.

Source: U.S. Bureau of the Census, 1987 Census of Retail Trade, Hawaii RC87-A-12 (May 1989), table 5, and County Business Patterns 1990, Hawaii, CBP-90-13 (November 1992), tables 1b and 2.

Table 490.-- CHARACTERISTICS OF GASOLINE SERVICE STATIONS WITH
PAYROLL: 1987

Subject	State total	Oahu
Number of establishments in business--		
Any time during the year	355	241
Offering self-service	173	129
At end of year	341	232
Sales (\$1,000)	427,232	296,341
Gallon sales of gasoline (1,000)	261,738	186,633
Through self-service	128,298	95,633
Gallon sales of other automotive fuels	3,853	2,501
Gasoline pumps, December 31	2,909	2,020
Self-service	1,284	914
Other automotive fuel pumps, December 31	114	73
Total storage capacity of all fuels, December 31 (1,000 gallons)	7,625	5,097

Source: U.S. Bureau of the Census, 1987 Census of Retail Trade, Miscellaneous Subjects, RC87-S-4 (October 1990), tables 2-5.

Table 491.-- GASOLINE AVERAGE PRICES PER GALLON, FOR ALL U.S. CITIES AND OAHU: ANNUAL AVERAGES, 1984 TO 1991

[In dollars. Average prices include all applicable federal, state, and county taxes. For earlier years, 1903-1983, see Robert C. Schmitt, What People Paid to Travel (Hawaiian Historical Society, 1991), p. 33]

Year	U.S.	Oahu	Year	U.S.	Oahu
1984	1.198	1.450	1988	0.964	1.293
1985	1.196	1.392	1989	1.060	1.365
1986	0.931	1.206	1990	1.217	1.479
1987	0.957	1.233	1991	1.196	1.560

Source: Based on data in the U.S. Bureau of Labor Statistics, CPI Detailed Report (monthly). The 1984-1986 Honolulu prices and all U.S. averages are actual values; the 1987-1991 Honolulu prices are estimates based on actual prices for the last half of 1986 and CPI(U) changes for gasoline for subsequent years.

Table 492.-- BOILERS AND PRESSURE VESSELS: 1990 AND 1991

Date	Total	Power boilers	Heating boilers	Pressure vessels
1990: Dec. 31 ...	8,581	581	2,479	5,521
1991: Dec. 31 ...	8,885	598	2,554	5,733

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

Table 493.-- ENERGY GENERATED, PURCHASED, SOLD, AND USED BY SUGAR PLANTATIONS, BY ISLANDS: 1991

Subject	State total	Hawaii	Kauai	Maui	Oahu
Electricity (millions of kilowatt-hours)					
Generated <u>1/</u>	819	251	187	259	123
Purchased	21.13	1.29	7.33	2.00	10.51
Sold	431.23	180.98	100.12	104.68	45.45
Used <u>2/</u>	409.24	71.23	93.87	156.14	87.99
Gross heat values of boiler fuels (billions of Btu's)					
All fuels	23,685	7,693	4,821	7,293	3,877
Bagasse	17,332	5,765	4,167	4,774	2,627
Fuel oil	5,744	1,927	655	2,294	868
Other fuels	608	-	-	225	383

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

2/ Includes transmission losses and electricity used to operate power plant auxiliaries.

Source: Hawaiian Sugar Planters' Association, Energy Inventory of Hawaiian Sugar Plantations - 1991 (Energy Report 31, October 1992), pp. 7-10.

Table 494.-- HIGH TECHNOLOGY INDUSTRY EMPLOYMENT AS A PERCENT OF ALL EMPLOYMENT, FOR THE UNITED STATES AND HAWAII: 1989

Subject	Value
United States (percent)	11.3
Hawaii (percent)	2.6
Rank among 50 States and D.C.	51

Source: U.S. Bureau of Labor Statistics, "High technology employment: another view," Monthly Labor Review, July 1991, pp. 26-30.

Table 495.-- HIGH-TECHNOLOGY COMPANIES, EMPLOYEES, AND REVENUES:
1990-1991

Characteristics	Compa- nies <u>1/</u>	Employ- ees <u>1/</u>	Revenues <u>2/</u> (\$1,000)
All companies	300	12,204	988,112
Excluding GTE Hawaiian Tel	299	8,004	448,829
Type of company:			
Products	91	3,946	192,581
Services	137	6,549	725,344
Support	72	1,709	70,187
Year established:			
Before 1984	166	10,512	902,411
1984 to 1987	84	1,156	49,107
1988 to 1990	50	536	36,594

1/ As of late 1990 or early 1991.

2/ Annual total for 1990. Excludes 82 companies not reporting revenues.

Source: High Technology Development Corporation, The Hawaii High Technology Business Directory 1991 (1991), and records.

Table 496.-- FEDERAL OBLIGATIONS FOR RESEARCH AND DEVELOPMENT AND
R&D PLANT IN HAWAII: 1985 TO 1990

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

Type of obligation	1985	1986	1987	1988	1989	1990
Obligations for R&D	58.2	54.7	63.9	82.2	97.4	100.0
Obligations for R&D plant	0.9	0.6	0.6	6.9	0.4	1.4

Source: National Science Foundation, Federal Funds for Research and Development: Fiscal Years 1990, 1991, and 1992, Volume XL, NSF 92-322 (July 1992), pp. 283-284.

Table 497.-- RESEARCH AND NON-RESEARCH EXTRAMURAL FUNDING,
FOR THE UNIVERSITY OF HAWAII: 1987-88 TO 1991-92

[Research and non-research awards received through the Office
of Research Administration, University of Hawaii]

Fiscal year	Total		Research		Non-research	
	Awards	Amount (dollars)	Awards	Amount (dollars)	Awards	Amount (dollars)
1987-88 ...	678	61,476,926	417	39,410,637	261	22,066,289
1988-89 ...	777	71,898,382	466	46,990,238	311	24,908,144
1989-90 ...	851	83,689,450	488	49,362,792	363	34,326,658
1990-91 ...	910	106,095,750	510	58,058,097	400	48,037,653
1991-92 ...	1,108	120,150,263	595	61,725,694	513	58,424,569

Source: Office of Research Administration, University of Hawaii,
1991-1992 Extramural Awards (1992), p. i.

Table 498.-- RESEARCH AND DEVELOPMENT EXPENDITURES AT DOCTORATE-GRANTING
INSTITUTIONS: 1986 TO 1990

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

Type of expenditure	1986	1987	1988	1989	1990
Total R&D expenditures	57,383	57,345	64,278	70,733	76,525
Federally financed	35,322	34,472	38,560	40,574	42,665

Source: National Science Foundation, Academic Science/Engineering:
R & D Expenditures, Fiscal Year 1990, NSF 92-321, Detailed Statistical
Tables (July 1992), tables B-23 and B-24.

Table 499.-- TELESCOPES AT THE SUMMITS OF MAUNA KEA AND HALEAKALA: 1991

Location and facility	Mirror size (meters)	Year completed	Primary use	Local staff <u>1/</u>
Mauna Kea:				
UH 24-inch Telescope #1	0.61	1968	Optical	} 12
UH 24-inch Telescope #2	0.61	1969	Optical	
UH 88-inch Telescope	2.24	1970	Optical/infrared	
NASA Infrared Telescope Facility	3.0	1979	Infrared	15
Canada-France-Hawaii Telescope	3.6	1979	Optical/infrared	51
United Kingdom Infrared Telescope	3.8	1979	Infrared	29
Caltech Submillimeter Observatory	10.4	1986	mm/submm	11
James Clerk Maxwell Telescope	15.0	1986	mm/submm	37
W.M. Keck Observatory	10.0	1991	Optical/infrared	40
Haleakala (on UH land):				
Mees Solar Observatory	1956	...	9
Lunar Ranging Facility	1976/84	...	8
Gamma Ray Facility	1985	...	1

1/ Based in same county as observatory.

Source: University of Hawaii at Manoa, Institute for Astronomy, Fact Sheet--1991-92 (July 1991).

Table 500.-- PATENTS ISSUED TO HAWAII
RESIDENTS: 1984 TO 1991

[Fiscal years ended September 30. Data include
design, plant, and reissue patents]

Fiscal year	Patents	Fiscal year	Patents
1984	43	1988	62
1985	33	1989	74
1986	37	1990	78
1987	52	1991	<u>1/</u> 78

1/ Hawaii ranked 46th among the 50 States.

Source: U.S. Department of Commerce, Patent and
Trademark Office, Commissioner of Patents and
Trademarks Annual Report, Fiscal Year '90, pp. 64-65,
and earlier editions.