

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

Total energy consumption in 1989 amounted to 299 trillion British thermal units, compared with 255 trillion Btu a decade earlier. Fully 98.3 percent in 1989 was provided by petroleum. Transportation, including aviation fuels, accounted for 51 percent of the total. Total expenditures for fuels and electricity in 1988 were \$1.66 billion.

Electricity sales amounted to 8.3 billion kilowatt-hours in 1990, a total that has increased 31 percent since 1980. Manufactured gas sales reached 34 million therms in 1989, four percent below the figure ten years earlier. Residential rates in 1990 averaged 10.3 cents per kilowatt-hour and \$1.63 per therm. Average residential use (7,247 kWh and 192 therms in 1990) has declined since the early 1970s.

The liquid fuel tax base for 1990 was approximately 1.3 billion gallons, compared with 940 million in 1980. The 1990 total included 375 million gallons of gasoline, 751 million of aviation fuel, and 176 million of diesel oil. The average price for automotive gasoline was \$1.48 per gallon during 1990.

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 1990.

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 DBED 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: 1991, Sections 19 and 20.

Table 463.-- CONSUMPTION OF ENERGY, BY SOURCE (PHYSICAL UNITS):
1960 TO 1989

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)
1960	16,864	27	0	0	0
1961	20,094	24	0	0	0
1962	19,040	20	0	0	0
1963	19,946	23	0	0	0
1964	21,298	115	0	0	0
1965	22,507	105	0	0	0
1966	25,140	112	0	0	2
1967	28,321	108	0	0	0
1968	31,483	94	0	0	30
1969	33,054	100	0	0	29
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	36,932	82	21	38	28
1985	39,351	86	19	46	25
1986	38,905	78	18	16	0
1987	39,470	82	13	63	0
1988	44,500	81	16	50	0
1989	50,232	89	14	32	11

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

^{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, 1960-1989 (May 1991), p. 95.

Table 464.-- CONSUMPTION OF ENERGY, BY SOURCE (TRILLION BTU):
1960 TO 1989

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>
1960	95.0	94.7	0.3	0.0	0.0	0.0	0.0
1961	113.9	113.6	0.3	0.0	0.0	0.0	0.0
1962	108.5	108.3	0.2	0.0	0.0	0.0	0.0
1963	114.2	114.0	0.2	0.0	0.0	0.0	0.0
1964	123.5	122.3	1.2	0.0	0.0	0.0	0.0
1965	130.6	129.5	1.1	0.0	0.0	0.0	0.0
1966	145.6	144.4	1.2	0.0	0.0	0.0	(Z)
1967	164.0	162.9	1.1	0.0	0.0	0.0	0.0
1968	182.6	181.3	1.0	0.0	0.0	0.0	0.3
1969	190.7	189.4	1.0	0.0	0.0	0.0	0.3
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	218.7	213.8	0.8	0.4	0.9	2.4	0.3
1985	233.3	227.9	0.9	0.4	1.1	2.7	0.3
1986	230.9	226.7	0.8	0.4	0.4	2.7	0.0
1987	234.7	229.2	0.8	0.3	1.6	2.8	0.0
1988	264.3	259.0	0.8	0.3	1.3	2.8	0.0
1989	299.1	294.0	0.9	0.3	0.8	2.9	0.1

Z Less than 0.05.

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

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, 1960-1989 (May 1991), p. 95.

Table 465.-- CONSUMPTION OF ENERGY BY END-USE SECTOR: 1960 TO 1989

[Trillion Btu]

Year	Consumption ^{1/}				Input at electric utilities
	Residential	Commercial	Industrial	Transportation	
1960	7.3	5.2	20.7	61.8	17.6
1961	7.5	5.4	26.9	74.0	19.4
1962	8.0	5.5	28.9	66.1	21.4
1963	8.9	6.0	29.8	69.5	24.2
1964	9.6	6.6	32.4	74.8	26.7
1965	10.1	6.8	34.7	79.0	27.6
1966	10.8	7.4	35.8	91.5	29.7
1967	12.1	8.0	38.8	105.1	31.3
1968	13.1	8.8	38.7	122.0	35.0
1969	14.9	9.8	40.8	125.1	38.7
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	19.4	46.6	131.7	70.6
1985	20.8	20.2	47.4	144.9	70.0
1986	21.4	22.7	57.4	129.4	72.9
1987	22.9	29.0	57.1	125.7	76.6
1988	24.0	36.1	62.6	141.7	81.9
1989	25.3	52.8	68.6	152.4	85.8

^{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, 1960-1989 (May 1991), pp. 96-100.

Table 466.-- ENERGY CONSUMPTION AND ELECTRICITY SALES, TOTAL AND PER CAPITA: 1960 TO 1990

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	250.842	6,332,707	5,838
1983	279.03031	251.379	6,425,578	5,789
1984	276.36995	244.208	6,606,255	5,837
1985	266.21778	233.524	6,635,158	5,820
1986	271.05620	231.751	7,025,739	6,007
1987	282.71678	237.717	7,298,178	6,137
1988	306.72360	254.310	7,719,029	6,400
1989 (prel.) ...	314.96310	252.213	7,970,360	6,382
1990 (prel.) ...	321.23000	255.777	8,310,537	6,617

^{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 467.-- ENERGY CONSUMPTION, BY SOURCE: 1970 TO 1990

[Trillion Btu]

Year	Total <u>1/</u>	Petroleum	Biomass	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	20.8020	2.3310	1.0183	0.8715	0.4189	0.1435
1990 <u>3/</u>	321.2300	295.4000	18.1200	2.3400	1.0700	0.8900	0.2900	-

1/ Beginning 1989, includes solid waste (0.1478 in 1989, 3.1200 in 1990).

2/ Preliminary.

3/ Estimated.

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

Table 468.-- ELECTRICITY GENERATION BY SOURCE: 1985 TO 1990

[Millions of kWh generated]

Year	Total	Petroleum	Biomass	Hydro- electric	Geo- thermal	Wind	Other 1/
1985	7,821	7,001	670	98	19	17	16
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

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 469.-- ELECTRICITY PRODUCTION, BY SOURCE, BY ISLANDS: 1990

[Million kWh]

Island	Total	Petrol- eum	Biomass 1/	Hydro- electric	Wind	Other 2/
State total ...	9,565.4	8,588.8	843.1	104.9	28.1	0.5
Hawaii	875.4	665.9	167.8	25.2	16.4	0.1
Maui	958.0	785.0	146.2	26.3	0.1	0.4
Lanai	17.3	17.3	-	-	-	-
Molokai	31.3	25.3	6.0	-	-	-
Oahu	7,209.7	6,800.1	398.0	-	11.5	-
Kauai	473.7	295.3	125.1	53.4	-	-

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 470.-- EXPENDITURES FOR FUELS AND ELECTRICITY, BY SOURCE:
1970 TO 1988

[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	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	100.4	499.6	100.4	236
1977	844.5	696.5	123.5	573	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	906.7	177	354.6
1980	1,721.3	1,529.8	267.8	1,262	267.8	459.3
1981	2,195.2	1,947.7	451.5	1,496.2	451.5	699
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 <u>1/</u> .	1,664.1	1,314.6	238.0	1,076.6	238.0	587.5

1/ Provisional.

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

Table 471.-- EXPENDITURES FOR FUELS AND ELECTRICITY, BY SECTORS:
1970 TO 1988

[Millions of dollars]

Year	Total fuel	Residential		Commercial and industrial		Transport: fuel	Electric utilities: fuel
		Fuel	Elect.	Fuel	Elect.		
1970	215.9	5.5	34.1	18.9	50.0	174.2	17.3
1971	246.8	8.7	38.8	17.9	60.0	195.4	24.8
1972	250.4	6.1	42.6	20.5	66.7	196.5	27.3
1973	300.9	10.5	48.7	24.4	77.8	229.7	36.3
1974	443.2	10.4	57.1	44.7	94.0	328.3	49.8
1975	546.1	7.4	76.9	45.8	138.8	401.0	91.9
1976	600.0	12.7	84.0	45.9	152.0	441.0	100.4
1977	696.5	13.9	92.9	55.0	178.6	504.1	123.5
1978	767.8	13.3	105.8	52.6	207.9	552.6	149.3
1979	1,083.7	26.2	118.9	102.4	235.7	778.1	177.0
1980	1,529.8	19.5	146.4	135.4	312.9	1,107.1	267.8
1981	1,947.7	20.6	214.6	232.4	484.4	1,243.2	451.5
1982	1,869.6	26.2	222.4	283.6	501.2	1,120.4	439.4
1983	1,730.1	22.9	205.9	288.1	453.2	1,049.8	369.3
1984	1,724.8	20.6	217.4	192.1	485.5	1,132.8	379.3
1985	1,586.6	20.6	213.5	100.8	459.1	1,127.6	337.6
1986	1,147.3	13.8	195.8	65.8	445.6	843.1	224.6
1987	1,176.2	(NA)	(NA)	(NA)	(NA)	(NA)	203.7
1988	1,314.6	(NA)	(NA)	(NA)	(NA)	(NA)	238.0

NA Not available.

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

Table 472.-- ELECTRIC UTILITIES: 1980 TO 1990

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
1980 ..	301,544	260,358	41,186	1,514,180	6,345,531	1,852,984	4,492,547
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 ..	370,952	320,215	50,737	1,655,690	8,311,537	2,320,550	5,990,987
Year	Average annual use (kWh) <u>3/</u>		Average rate (dollars per kWh)		Revenues (\$1,000)		
	Residential	Other	Residential	Other	Total	Residential	Other
1980 ..	7,117	109,079	.07901	.06964	459,251	146,397	312,854
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 ..	7,247	118,079	.10261	.08542	749,857	238,103	511,754

1/ 1990 based partly on November data.

2/ Does not include purchased power.

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 473.-- ELECTRIC UTILITIES, BY ISLANDS: 1989

[Revised]

County or island	Customers, Dec. 31			Installed capacity, Dec. 31 (kW)	Power sold (1,000 kWh)		
	Total	Residential	Other		Total	Residential	Other
State total	362,281	312,347	49,934	1,517,500	7,969,694	2,238,874	5,730,820
Oahu	247,120	216,063	31,057	1,189,000	6,254,220	1,620,439	4,633,781
Hawaii	48,312	40,012	8,300	128,000	663,512	259,304	404,208
Kauai	22,442	18,779	3,663	59,800	321,259	110,036	211,223
Maui County	44,407	37,493	6,914	140,700	730,703	249,095	481,608
Lanai	1,043	907	136	4,700	12,028	4,095	7,933
Maui	40,712	34,418	6,294	131,000	692,351	233,952	458,400
Molokai	2,652	2,168	484	5,000	26,323	11,048	15,275
	Average annual use (kWh) <u>1/</u>		Average rate (dollars per kWh)		Revenues (\$1,000)		
County or island	Residential	Other	Residential	Other	Total	Residential	Other
State total	7,168	114,772	0.09265	0.07585	642,101	207,436	434,665
Oahu	7,500	149,202	0.08308	0.06785	449,046	134,729	314,317
Hawaii	6,481	48,700	0.11847	0.10764	74,229	30,720	43,509
Kauai	5,860	57,664	0.12661	0.12489	40,312	13,932	26,380
Maui County	6,644	69,657	0.11225	0.10401	78,514	28,055	50,459
Lanai	4,515	58,333	0.15345	0.13840	1,743	634	1,109
Maui	6,797	72,831	0.10735	0.10020	71,521	25,304	46,217
Molokai	5,096	31,560	0.19716	0.19923	5,250	2,117	3,133

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 474.-- ELECTRIC UTILITIES, BY ISLANDS: 1990

County or island	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
State total	370,952	320,215	50,737	1,655,690	8,311,537	2,320,550	5,990,987
Oahu	249,810	218,799	31,011	1,290,000	6,471,587	1,657,105	4,814,482
Hawaii	50,957	42,165	8,792	138,750	715,751	277,468	438,283
Kauai	23,417	19,624	3,793	77,080	342,857	116,361	226,496
Maui County	46,768	39,627	7,141	149,860	781,342	269,616	511,726
Lanai	1,062	918	144	10,760	15,496	4,646	10,850
Maui	43,010	36,505	6,505	130,100	738,220	253,508	484,711
Molokai	2,696	2,204	492	9,000	27,627	11,461	16,165
	Average annual use (kWh) <u>3/</u>		Average rate (dollars per kWh)		Revenues (\$1,000)		
County or island	Residential	Other	Residential	Other	Total	Residential	Other
State total	7,247	118,079	0.10261	0.08542	749,857	238,103	511,754
Oahu	7,574	155,251	0.09228	0.07686	522,962	152,924	370,038
Hawaii	6,581	49,850	0.12963	0.11861	87,954	35,967	51,987
Kauai	5,930	59,714	0.14096	0.13989	48,087	16,402	31,685
Maui County	6,804	71,660	0.12169	0.11343	90,854	32,810	58,044
Lanai	5,061	75,345	0.15422	0.14166	2,254	717	1,537
Maui	6,944	74,514	0.11825	0.11033	83,457	29,977	53,480
Molokai	5,200	32,856	0.18472	0.18721	5,143	2,117	3,026

1/ Oahu based on November data.

2/ Does not include purchased power.

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 475.-- GAS UTILITIES: 1980 TO 1990

[Excludes bottled gas]

Year	Customers, Dec. 31			Gas sold (1,000 therms)		
	Total	Residential	Other	Total	Residential	Other
1980 ...	33,019	28,825	4,194	34,705	7,030	27,675
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

Year	Average annual use (therms) <u>1/</u>		Average rate (dollars per therm)		Revenues (\$1,000)		
	Residential	Other	Residential	Other	Total	Residential	Other
1980 ...	244	6,599	1.46583	1.25951	45,162	10,305	34,857
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

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 476.-- GAS UTILITIES, BY ISLANDS: 1990

[Excludes bottled gas]

Island	Customers, Dec. 31			Gas sold (1,000 therms)		
	Total	Residential	Other	Total	Residential	Other
State total ..	34,477	30,840	3,637	34,806	5,924	28,882
Oahu	31,974	28,714	3,260	31,645	5,469	26,176
Hawaii	1,842	1,531	311	2,297	331	1,966
Kauai	279	279	-	58	58	-
Maui	382	316	66	806	66	740
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 ..	192	7,941	1.62847	1.14834	42,813	9,646	33,167
Oahu	190	8,030	1.65421	1.16464	39,532	9,046	30,486
Hawaii	216	6,321	1.31864	1.00341	2,409	436	1,972
Kauai	207	-	1.36066	-	78	78	-
Maui	210	11,212	1.28517	0.95695	793	85	708
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 477.-- SERVICE PROVIDED BY HAWAIIAN ELECTRIC CO., INC., ON OAHU:
1985 TO 1990

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					
1985 ..	231,912	202,222	5,637,678	5,336,262	6,997	0.10417	1,283,000
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

^{1/} Net generation plus purchased power.

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

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

Table 478.-- GAS UTILITY SERVICE BY GASCO, INC., FOR OAHU: 1985 TO 1990

Calendar year	Customers, Dec. 31		Gas sold ^{1/} (1,000 therms)		Average annual residential usage ^{1/} (therms)
	Total	Residential	Total	Residential	
1985 ...	30,442	27,085	28,255	5,436	201
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

^{1/} Includes liquefied petroleum gas.

Source: Gasco, Inc., records.

Table 479.-- LIQUID FUEL TAX BASE: 1980 TO 1990

[In thousands of gallons]

Year reported ^{1/}	All types		Gasoline	Diesel oil	
	Total	Excluding aviation		Non-hwy.	Hwy. use
1980	939,766	437,222	312,896	101,719	17,765
1981	918,437	428,886	305,886	101,212	15,771
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
Year reported ^{1/}	Liquefied petroleum gas		Aviation fuel	Small boats	
	Off-hwy.	Hwy. use		Gasoline	Diesel oil
1980	2,448	1,140	502,544	338	917
1981	2,378	1,136	489,551	424	2,079
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

^{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 Distribution" (annual report).

Table 480.-- LIQUID FUEL TAX BASE, BY COUNTIES: 1990

[In thousands of gallons]

Type of fuel	State total	City and Co. of Honolulu	County of Maui	County of Hawaii	County of Kauai
Total	1,307,887	1,065,323	102,152	90,573	49,839
Gasoline	375,382	250,800	45,696	55,303	23,584
Diesel oil, non-hwy. ...	151,095	56,631	46,446	24,570	23,488
Diesel oil, hwy. use ...	24,763	16,549	2,623	4,766	824
Liq. pet. gas, off hwy.	4,757	2,047	416	535	1,759
Liq. pet. gas, hwy. use	834	671	63	46	55
Small boats, gasoline ..	78	78	-	-	-
Small boats, diesel oil	188	125	-	64	-
Aviation fuel	750,790	738,424	6,909	5,289	168

Source: Hawaii State Department of Taxation, "Liquid Fuel Tax Base, Collections & Distribution, Calendar Year Ending December 31, 1990" (annual release).

Table 481.-- 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 482.-- GASOLINE SERVICE STATIONS (SIC 554) WITH PAYROLL,
BY COUNTIES: 1987 AND 1989

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
1989	331	225	50	22	(1/)	34	(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 1989, Hawaii, CBP-89-13 (October 1991), tables 1b and 2.

Table 483.-- 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 484.-- GASOLINE AVERAGE PRICES PER GALLON, FOR OAHU:
ANNUAL AVERAGES, 1984 TO 1990

[In dollars. Average prices include all applicable federal, state, and county taxes. For earlier years, 1903-1983, see Data Book 1984, tables 497 and 498]

Period	All types <u>1/</u>	Leaded regular	Unleaded regular	Unleaded premium
1984	1.450	1.367	1.443	(NA)
1985	1.392	1.274	1.396	(NA)
1986	1.206	1.077	1.221	1.346
1987	1.233	1.099	1.254	1.372
1988	1.293	1.204	1.273	1.413
1989	1.365	(NA)	1.404	1.460
1990	<u>2/</u> 1.479	(NA)	1.538	1.551

NA Not available.

1/ Includes types not shown separately.

2/ The U.S. city average for 1990 was \$1.217.

Source: Based on data in the U.S. Bureau of Labor Statistics, CPI Detailed Report (monthly). The 1984-1986 Honolulu prices and 1990 U.S. average are actual values; the 1987-1990 Honolulu prices are estimates based on actual prices for the last half of 1986 and CPI(U) changes for gasoline for subsequent years.

Table 485.-- BOILERS AND PRESSURE VESSELS: 1989 AND 1990

Date	Total	Power boilers	Heating boilers	Pressure vessels
1989: Dec. 31 ...	8,519	574	2,441	5,504
1990: Dec. 31 ...	8,581	581	2,479	5,521

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

Table 486.-- ENERGY GENERATED, PURCHASED, SOLD, AND USED BY SUGAR PLANTATIONS, BY ISLANDS: 1989

Subject	State total	Hawaii	Kauai	Maui	Oahu
Electricity (millions of kilowatt-hours)					
Generated <u>1/</u>	844	248	213	247	136
Purchased	38.18	1.51	4.07	24.56	8.05
Sold	440.47	177.12	113.69	99.72	49.94
Used <u>2/</u>	441.89	72.16	103.53	172.19	94.00
Gross heat values of boiler fuels (billions of Btu's)					
All fuels	25,830	8,546	5,706	7,366	4,212
Bagasse	20,513	6,632	5,148	5,448	3,285
Fuel oil	5,028	1,914	559	1,629	927
Other fuels	289	-	-	289	-

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 - 1989 (Energy Report 29, September, 1990), pp. 7-10.

Table 487.-- 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 488.-- FEDERAL OBLIGATIONS FOR RESEARCH AND DEVELOPMENT AND
R&D PLANT IN HAWAII: 1984 TO 1989

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

Type of obligation	1984	1985	1986	1987	1988	1989
Obligations for R&D	52.9	58.2	54.7	63.9	82.2	97.4
Obligations for R&D plant	0.6	0.9	0.6	0.6	6.9	0.4

Source: National Science Foundation, Federal Funds for Research and Development: Fiscal Years 1989, 1990, and 1991, Volume XXXIX, NSF 90-327 final (1991), pp. 285-286.

Table 489.-- RESEARCH AND NON-RESEARCH EXTRAMURAL FUNDING,
FOR THE UNIVERSITY OF HAWAII: 1986-87 TO 1990-91

[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)
1986-87 ...	643	52,360,382	378	35,787,240	265	16,573,142
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

Source: Office of Research Administration, University of Hawaii,
1990-1991 Extramural Awards (1991), p. i.

Table 490.-- RESEARCH AND DEVELOPMENT EXPENDITURES AT
DOCTORATE-GRANTING INSTITUTIONS: 1985 TO 1989

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

Type of expenditure	1985	1986	1987	1988	1989
Total R&D expenditures	54,025	57,383	57,345	64,278	<u>1/</u> 70,733
Federally financed	34,886	35,322	34,472	38,560	40,574

1/ U.S. total was \$14.7 billion. Hawaii ranked 37th of the 50th States.

Source: National Science Foundation, Academic Science/Engineering: R & D Funds, Fiscal Year 1989, NSF 90-321 final (1991), tables B-22 and B-23.

Table 491.-- 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 492.-- PATENTS ISSUED TO HAWAII
RESIDENTS: 1983 TO 1990

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

Fiscal year	Patents	Fiscal year	Patents
1983	30	1987	52
1984	43	1988	62
1985	33	1989	74
1986	37	1990	78

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.

Table 493.-- COMPUTER USE BY OAHU RESIDENTS EMPLOYED OUTSIDE
THEIR HOMES: 1988 AND 1989

[Percent. As of March]

Subject	1988	1989
Use of personal computer at place of work	100	100
Always	22	27
Frequently	14	13
Occasionally	15	16
Never	50	44
Facsimile machine (FAX) at place of work	100	100
Yes	41	52
No	46	44
Don't know	13	5
Own a personal computer for use at home	100	100
Yes	25	33
No	75	67

Source: Omnitrak/Hawaii Inc. Polls (400 telephone interviews each) reported in Honolulu Star-Bulletin, May 23, 1989 (p. C-1), May 30, 1989 (p. D-1), and June 6, 1989 (p. D-1).