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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, Strategic Industries 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: 2012*, Sections 16 and 19.

**Table 17.01-- CONSUMPTION OF ENERGY, BY SOURCE (PHYSICAL UNITS):
1960 TO 2016**

Year	Coal (1,000 short tons)	Natural gas (billion cubic feet) 1/	Petroleum (1,000 barrels)	Hydroelectric power (million kWh) 2/	Fuel ethanol (1,000 barrels) 3/
1960	-	-	16,844	27	(NA)
1965	-	-	22,478	105	(NA)
1970	-	-	34,105	108	(NA)
1971	-	-	36,734	89	(NA)
1972	-	-	37,753	91	(NA)
1973	-	-	38,826	95	(NA)
1974	-	-	36,739	92	(NA)
1975	-	-	37,097	89	(NA)
1976	-	-	38,047	93	(NA)
1977	-	-	40,326	86	(NA)
1978	-	-	40,945	84	(NA)
1979	-	-	44,660	90	(NA)
1980	-	3	43,562	86	(NA)
1981	-	3	38,811	80	4
1982	47	3	35,706	90	1
1983	42	3	36,291	84	-
1984	38	2	37,297	82	-
1985	46	2	40,006	86	-
1986	16	2	39,044	78	-
1987	63	3	39,389	82	-
1988	50	3	45,902	81	-
1989	32	3	48,021	56	-
1990	29	3	50,015	80	-
1991	45	3	45,758	71	-
1992	303	3	46,655	61	-
1993	691	3	41,392	56	-
1994	704	3	44,843	139	-
1995	895	3	43,842	98	-
1996	930	3	41,631	104	-
1997	933	3	39,829	115	-
1998	822	3	40,493	121	-
1999	801	3	39,662	115	-
2000	816	3	40,591	103	-
2001	829	3	41,479	101	-
2002	748	3	44,772	95	-
2003	784	3	46,861	91	-
2004	797	3	49,098	94	-
2005	740	3	51,267	96	4/ 344
2006	714	3	51,564	120	4/ 392
2007	764	3	52,905	92	4/ 501

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**Table 17.01-- CONSUMPTION OF ENERGY, BY SOURCE (PHYSICAL UNITS):
1960 TO 2016 -- Con.**

Year	Coal (1,000 short tons)	Natural gas (billion cubic feet) 1/	Petroleum (1,000 barrels)	Hydroelectric power (million kWh) 2/	Fuel ethanol (1,000 barrels) 3/
2008	840	3	42,397	84	4/ 930
2009	791	3	42,472	113	4/ 1,065
2010	803	3	4/ 42,754	70	4/ 804
2011	783	3	4/ 44,379	93	4/ 933
2012	803	3	4/ 42,770	115	4/ 847
2013	753	3	4/ 42,336	78	4/ 874
2014	831	3	4/ 41,974	94	4/ 953
2015	747	3	4/ 42,786	121	4/ 1,147
2016	787	3	42,246	91	1,152

NA Not available.

1/ Includes supplemental gaseous fuels.

2/ Conventional hydroelectric power. Does not include pumped-storage hydroelectricity.

3/ Includes denaturant.

4/ Revised from previous *Data Book*.

Source: U.S. Department of Energy, Energy Information Administration, State Energy Data System (SEDS) "Energy Consumption Estimates for Major Energy Sources in Physical Units, Selected Years, 1960-2016, Hawaii" (CT1) <https://www.eia.gov/state/seds/sep_use/notes/use_print.pdf> accessed May 19, 2019.

Table 17.02-- CONSUMPTION OF ENERGY, BY SOURCE: 1970 TO 2016

[Trillion Btu]

Year	Total 1/	Fossil fuels			Renewable energy					Fossil fuels (as commingled)	
		Coal	Natural gas 2/	Petroleum	Hydro-electric power 3/	Biomass	Geo-thermal	Solar/PV 4/	Wind	Natural gas 2/ 5/	Motor gasoline 2/ 6/
1970	197.0	-	-	195.4	1.1	0.4	-	(NA)	(NA)	-	29.9
1971	211.7	-	-	210.4	0.9	0.3	-	(NA)	(NA)	-	30.8
1972	218.1	-	-	216.6	0.9	0.6	-	(NA)	(NA)	-	32.6
1973	224.3	-	-	222.8	1.0	0.5	-	(NA)	(NA)	-	34.7
1974	212.1	-	-	210.6	1.0	0.6	-	(NA)	(NA)	-	34.4
1975	214.4	-	-	212.9	0.9	0.6	-	(NA)	(NA)	-	35.5
1976	220.1	-	-	218.4	1.0	0.7	-	(NA)	(NA)	-	36.9
1977	233.4	-	-	232.0	0.9	0.5	-	(NA)	(NA)	-	38.9
1978	237.0	-	-	235.8	0.9	0.3	-	(NA)	(NA)	-	40.1
1979	256.7	-	-	255.4	0.9	0.3	-	(NA)	(NA)	-	39.4
1980	262.5	-	-	249.6	0.9	11.9	-	(NA)	(NA)	3.0	38.0
1981	236.8	-	-	223.2	0.8	12.7	-	(NA)	(NA)	2.8	37.7
1982	218.3	1.1	-	203.8	0.9	12.4	-	(NA)	(NA)	2.8	38.1
1983	221.3	1.0	-	205.4	0.9	14.0	-	(NA)	-	2.7	38.0
1984	232.4	0.9	-	216.1	0.9	14.3	0.2	-	-	2.4	39.5
1985	248.6	1.1	-	232.1	0.9	14.2	0.2	-	-	2.7	39.9
1986	245.3	0.4	-	227.6	0.8	16.3	0.2	-	-	2.7	41.4
1987	249.5	1.6	0.2	228.9	0.9	17.8	0.2	-	-	2.8	43.0
1988	289.7	1.2	-	268.0	0.8	19.4	0.2	-	-	2.8	44.5
1989	309.8	0.8	-	280.1	0.6	27.0	0.2	0.8	0.3	2.9	46.0
1990	321.4	0.7	-	292.8	0.8	25.9	(7/)	0.9	0.3	3.0	45.5
1991	295.2	1.1	-	266.6	0.7	25.4	(7/)	1.0	0.4	2.9	47.1
1992	306.0	6.8	-	272.5	0.6	24.9	(7/)	1.0	0.2	2.9	46.6

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Table 17.02-- CONSUMPTION OF ENERGY, BY SOURCE: 1970 TO 2016 -- Con.

[Trillion Btu]

Year	Total 1/	Fossil fuels			Renewable energy					Fossil fuels (as commingled)	
		Coal	Natural gas 2/	Petroleum	Hydro-electric power 3/	Biomass	Geo-thermal	Solar/PV 4/	Wind	Natural gas 2/ 5/	Motor gasoline 2/ 6/
1993	282.9	15.6	-	239.5	0.6	24.4	1.6	1.1	0.2	2.8	47.4
1994	299.3	15.7	-	258.2	1.4	20.7	1.9	1.1	0.2	2.9	48.9
1995	297.0	19.9	-	252.5	1.0	19.8	2.4	1.2	0.2	2.9	49.1
1996	283.3	20.4	-	238.8	1.1	19.1	2.5	1.2	0.2	2.8	48.9
1997	273.6	20.5	-	230.6	1.2	17.4	2.5	1.2	0.2	2.7	48.8
1998	273.5	18.2	-	233.6	1.2	16.5	2.4	1.3	0.2	2.8	48.7
1999	269.4	17.7	-	230.0	1.2	17.0	2.2	1.3	0.2	2.9	46.7
2000	273.4	17.7	0.1	235.3	1.1	15.2	2.7	1.3	0.2	3.0	48.4
2001	270.2	17.8	0.1	239.9	1.0	7.9	2.1	1.2	(7/)	2.9	50.6
2002	284.8	16.6	0.1	257.6	1.0	7.5	0.7	1.2	(7/)	2.9	54.3
2003	301.0	18.0	0.1	269.5	0.9	9.3	1.8	1.3	(7/)	2.9	55.1
2004	314.8	17.9	0.2	282.9	0.9	9.3	2.1	1.3	0.1	2.9	55.9
2005	324.7	16.5	0.2	293.9	1.0	9.6	2.2	1.3	0.1	2.9	57.1
2006	327.2	16.1	0.2	8/ 295.5	1.2	9.9	2.1	1.4	0.8	2.9	59.9
2007	337.7	17.1	0.2	303.7	0.9	9.7	2.3	1.5	2.4	3.0	58.5
2008	276.6	18.1	0.1	239.3	0.8	11.8	2.3	1.8	2.4	2.8	54.7
2009	276.0	17.1	0.2	239.3	1.1	8/ 12.3	1.6	2.0	2.5	2.7	55.3
2010	8/ 277.1	17.1	0.2	8/ 241.9	0.7	8/ 10.5	2.0	2.3	2.5	2.7	50.7
2011	8/ 285.5	16.1	0.2	8/ 249.5	0.9	10.6	2.2	2.8	3.3	2.7	56.5
2012	8/ 277.9	16.6	0.2	8/ 240.1	1.1	9.6	2.5	4.3	3.6	2.8	53.6
2013	8/ 278.5	15.3	0.2	8/ 237.6	0.7	11.2	2.6	6.1	4.8	2.9	54.4
2014	8/ 279.3	17.2	0.2	8/ 234.5	0.9	11.0	2.4	7.5	5.5	2.8	54.8
2015	8/ 283.2	15.6	0.2	8/ 238.5	1.1	11.5	2.2	8/ 8.3	5.7	2.9	8/ 55.9
2016	282.9	16.4	0.2	234.9	0.8	12.5	2.4	9.8	5.9	3.0	56.8

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Table 17.02-- CONSUMPTION OF ENERGY, BY SOURCE: 1970 TO 2016 -- Con.

NA Not available.

1/ Excluding fossil fuels as commingled.

2/ Supplemental gaseous fuels (SGF) and fuel ethanol are consumed with natural gas and motor gasoline, respectively. In this table, natural gas excluding SGF and motor gasoline excluding fuel ethanol are presented so that a fossil fuel total can be calculated. Natural gas including SGF and motor gasoline including fuel ethanol are presented separately for reference.

3/ Conventional hydroelectric power. Does not include pumped-storage hydroelectricity.

4/ Solar thermal and photovoltaic energy.

5/ Including supplemental gaseous fuels.

6/ Including fuel ethanol.

7/ Value less than +0.05 and greater than -0.05.

8/ Revised from previous *Data Book*.

Source: U.S. Department of Energy, Energy Information Administration, State Energy Data System (SEDS) "Primary Energy Consumption Estimates, Selected Years, 1960-2016, Hawaii" (CT2) <https://www.eia.gov/state/seds/sep_use/notes/use_print.pdf> accessed May 19, 2019.

**Table 17.03-- CONSUMPTION OF ENERGY, BY END-USE SECTOR:
1960 TO 2016**

[Trillion Btu]

Year	Residential 1/ 2/	Commercial 1/ 3/ 4/ 5/	Industrial 1/ 4/ 5/	Transportation 1/ 4/	Electric power 1/ 2/
1960	7.1	5.3	20.6	61.8	17.6
1961	7.3	5.6	26.8	74.0	19.4
1962	7.7	5.7	28.7	66.1	21.4
1963	8.7	6.2	29.9	69.5	24.2
1964	9.4	6.9	32.4	74.8	26.7
1965	9.9	7.0	34.7	79.0	27.6
1966	10.5	7.7	35.8	91.5	29.7
1967	11.7	8.4	38.7	105.1	31.3
1968	12.6	9.2	38.9	122.0	35.0
1969	14.1	10.7	41.0	125.1	38.7
1970	15.5	12.5	43.7	125.3	43.2
1971	16.8	12.5	43.6	138.8	47.7
1972	18.6	13.7	49.2	136.5	54.1
1973	19.0	14.5	49.9	140.9	55.6
1974	19.3	14.3	49.9	128.7	57.5
1975	19.0	14.5	50.4	130.5	58.8
1976	20.3	16.4	51.7	131.7	62.5
1977	20.7	18.0	53.3	141.3	65.2
1978	20.8	18.5	53.1	144.6	66.8
1979	21.4	19.7	59.2	156.4	67.7
1980	21.0	20.1	74.7	146.7	69.7
1981	20.9	18.1	73.7	124.1	69.9
1982	19.6	16.9	79.6	102.2	66.9
1983	20.1	17.2	66.2	117.9	68.6
1984	19.7	18.3	65.0	129.4	70.4
1985	19.9	18.4	67.3	142.9	69.8
1986	20.4	20.9	76.9	127.1	72.7
1987	22.0	23.8	79.6	124.1	76.5
1988	23.0	36.9	88.8	140.9	81.7
1989	25.4	36.1	93.8	154.5	86.5
1990	30.7	37.2	98.9	154.5	105.9
1991	26.1	28.8	89.0	151.2	88.7
1992	29.7	38.6	93.6	144.1	99.3
1993	29.6	30.7	92.3	130.4	99.5
1994	30.5	35.0	93.8	140.0	102.3
1995	31.3	34.6	93.0	138.2	105.5
1996	32.0	34.0	95.6	121.6	107.4
1997	32.1	35.5	88.7	117.3	107.3
1998	32.3	45.9	80.7	114.6	105.6

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**Table 17.03-- CONSUMPTION OF ENERGY, BY END-USE SECTOR:
1960 TO 2016 -- Con.**

[Trillion Btu]

Year	Residential 1/ 2/	Commercial 1/ 3/ 4/ 5/	Industrial 1/ 4/ 5/	Transportation 1/ 4/	Electric power 1/ 2/
1999	32.4	36.0	78.0	123.1	106.6
2000	33.0	37.3	78.0	125.2	108.5
2001	32.2	36.6	69.5	132.0	105.3
2002	34.5	39.4	70.8	140.2	110.9
2003	31.8	37.5	68.8	162.9	102.7
2004	32.6	41.3	68.9	172.0	104.4
2005	33.3	39.9	72.4	179.1	104.1
2006	33.7	40.7	71.6	181.3	104.7
2007	34.1	40.2	69.0	194.4	105.7
2008	33.4	40.9	65.8	136.5	102.8
2009	33.3	40.7	69.1	133.0	100.3
2010	32.6	40.1	68.0	6/ 136.4	98.7
2011	6/ 32.5	41.1	6/ 67.5	6/ 144.4	98.9
2012	31.5	6/ 39.1	65.1	6/ 142.2	94.8
2013	30.9	40.6	6/ 65.4	6/ 141.7	92.3
2014	31.4	6/ 41.1	64.5	142.2	92.1
2015	31.8	6/ 41.4	6/ 64.2	6/ 145.8	91.6
2016	32.7	41.5	62.5	146.2	91.8

1/ There is a discontinuity between 1988 and 1989 due to the expanded coverage of renewable energy sources beginning in 1989.

2/ Beginning in 1980, adjusted for the double-counting of supplemental gaseous fuels, which are included in both natural gas and the other fossil fuels from which they are mostly derived, but should be counted only once in net energy and total.

3/ Small amounts of solar thermal and photovoltaic energy consumed in the commercial sector cannot be separately identified and are included in residential consumption.

4/ From 1981 through 1992, includes fuel ethanol blended into motor gasoline that is not included in the motor gasoline column.

5/ Beginning in 1980, adjusted for the double-counting of supplemental gaseous fuels, which are included in both natural gas and the other fossil fuels from which they are mostly derived, but should be counted only once in net energy and total.

6/ Revised from previous *Data Book*.

Source: U.S. Department of Energy, Energy Information Administration, State Energy Data System (SEDS) Consumption Estimates, Selected Years, 1960-2016, Hawaii (CT4-CT8), and earlier editions <https://www.eia.gov/state/seds/sep_use/notes/use_print.pdf> accessed May 19, 2019.

Table 17.04-- PRIMARY ENERGY CONSUMPTION AND ELECTRICITY SALES, TOTAL AND PER CAPITA: 1995 TO 2017

Year	Primary energy consumption		Electricity sales by utilities	
	Total (billion Btu)	Per capita (million Btu) 2/	Total (1,000 kWh)	Per capita (kWh) 2/
1995 1/	296,774	228.8467	9,188	7,078
1996 1/	283,060	217.2649	9,379	7,193
1997 1/	273,483	206.0455	9,363	7,037
1998 1/	273,387	205.0482	9,261	6,942
1999 1/	269,352	202.2617	9,381	7,040
2000 1/	273,307	204.7111	9,691	7,253
2001 1/	270,115	202.0927	9,785	7,309
2002 1/	284,651	210.5612	9,892	7,360
2003 1/	300,905	221.5970	10,391	7,512
2004 1/	314,701	226.9509	10,732	7,573
2005 1/	324,677	230.0269	10,539	7,461
2006 1/	327,116	228.8608	10,568	7,387
2007 1/	337,594	235.8076	10,585	7,384
2008 1/	276,444	193.4260	10,390	7,252
2009 1/	275,894	191.7964	10,126	7,020
2010 1/	277,125	188.7087	10,017	6,819
2011 1/	285,580	191.6064	9,962	6,691
2012 1/	277,993	183.0864	9,639	6,361
2013 1/	278,467	180.6185	9,503	6,179
2014 1/	279,315	179.1634	9,475	6,073
2015 1/	282,832	179.4748	9,511	6,008
2016 1/	282,609	178.6890	9,445	5,966
2017	283,414	199.0000	9,324	5,851

1/ 'Total' and 'Per capita' for 'Primary energy consumption' revised from previous Data Book.

2/ Based on estimated de facto population.

Source: U.S. Department of Energy, Energy Information Administration, State Energy Data System (SEDS) <<http://www.eia.gov/state/seds/seds-data-fuel.cfm?sid=HI>> accessed June 27, 2019 and calculations by Hawaii State Department of Business, Economic Development and Tourism.

Table 17.05-- PRIMARY ENERGY CONSUMPTION, BY SOURCE: 2001 TO 2017

[Billion Btu. Components may not sum to totals due to rounding]

Year	Total	Petroleum	Coal	Natural gas	Renewable
2001	1/ 270,115	1/ 239,817	17,774	134	12,389
2002	1/ 284,651	1/ 257,441	16,618	140	10,452
2003	1/ 300,905	1/ 269,414	18,044	137	13,310
2004	1/ 314,701	1/ 282,864	17,913	155	13,769
2005	1/ 324,677	1/ 295,039	16,506	195	1/ 14,128
2006	1/ 327,116	1/ 296,835	16,102	179	1/ 15,362
2007	1/ 337,594	1/ 305,278	17,107	173	1/ 16,773
2008	1/ 276,444	1/ 242,279	18,095	148	1/ 19,145
2009	1/ 275,894	1/ 242,829	17,083	167	1/ 19,503
2010	1/ 277,125	1/ 244,593	17,117	161	1/ 18,042
2011	1/ 285,580	1/ 252,695	16,080	158	1/ 19,883
2012	1/ 277,993	1/ 243,028	16,572	187	1/ 21,143
2013	1/ 278,467	1/ 240,572	15,306	197	1/ 25,424
2014	1/ 279,315	1/ 237,826	17,241	167	1/ 27,390
2015	1/ 282,832	1/ 242,434	15,632	196	1/ 28,553
2016	1/ 282,609	1/ 238,881	16,431	1/ 162	1/ 31,136
2017	283,414	241,871	14,948	163	30,471
Year	Biomass	Solar	Wind	Geothermal	Hydro
2001	7,947	1/ 1,237	22	2,143	1,041
2002	7,480	1,240	16	748	967
2003	9,305	1/ 1,260	16	1,813	916
2004	9,336	1/ 1,273	75	2,144	941
2005	9,574	1/ 1,302	66	2,224	962
2006	9,885	1/ 1,382	790	2,114	1,191
2007	9,707	1/ 1,520	2,354	2,280	913
2008	11,834	1/ 1,799	2,365	2,316	831
2009	12,274	1/ 2,033	2,454	1,643	1,099
2010	1/ 10,532	1/ 2,311	2,547	1,964	687
2011	1/ 10,614	1/ 2,870	3,311	2,183	905
2012	1/ 9,629	1/ 4,333	3,599	2,491	1,090
2013	1/ 11,189	6,056	4,802	2,630	747
2014	1/ 11,017	1/ 7,553	5,503	2,422	895
2015	1/ 11,203	1/ 8,356	5,710	2,154	1,129
2016	1/ 12,181	1/ 9,807	5,900	2,409	839
2017	9,411	12,570	4,902	2,980	609

1/ Revised from previous *Data Book*.

Source: U.S. Department of Energy, Energy Information Administration, State Energy Data System (SEDS) <<http://www.eia.gov/state/seds/seds-data-fuel.cfm?sid=HI>> accessed June 27, 2019 and calculations by Hawaii State Department of Business, Economic Development and Tourism.

Table 17.06-- ELECTRICITY GENERATION, BY SOURCE: 2001 TO 2017

[Millions of kWh generated]

Year	Total	Petroleum	Coal	Wind	Biomass
2001	10,633.093	8,223.824	1,604.764	2.122	287.708
2002	11,663.070	9,466.990	1,545.797	1.614	296.543
2003	10,976.371	8,502.550	1,644.137	1.572	347.167
2004	11,410.403	8,944.696	1,603.751	7.495	328.832
2005	11,522.805	9,067.592	1,630.918	6.632	309.740
2006	11,559.174	9,054.474	1,548.595	79.674	325.692
2007	11,533.350	8,914.207	1,578.931	238.184	285.277
2008	11,376.385	8,669.934	1,647.592	240.023	302.423
2009	11,010.533	8,289.107	1,500.166	251.427	284.427
2010	10,836.036	8,087.337	1,545.513	261.120	283.474
2011	10,723.333	7,923.925	1,424.036	340.812	312.627
2012	10,469.269	7,482.760	1,537.340	378.234	280.976
2013	10,267.052	7,222.766	1,403.754	503.310	329.364
2014	10,204.158	6,925.919	1,511.184	578.617	334.030
2015	10,120.000	7,023.000	1,337.000	613.000	320.000
2016	9,948.845	6,640.316	1,497.380	639.127	359.466
2017	9,812.000	6,633.596	1,375.724	532.055	292.762

Year	Geothermal	Hydro	Other gases 1/	Solar	Others
2001	206.592	100.750	37.855	-	169.478
2002	72.761	95.068	40.816	-	143.481
2003	178.292	90.505	40.251	-	171.897
2004	213.288	93.901	47.908	-	170.532
2005	221.597	96.188	41.133	-	149.005
2006	212.276	120.087	42.757	-	175.619
2007	229.886	92.343	45.226	-	149.296
2008	234.333	84.343	38.572	-	159.147
2009	167.591	112.649	22.345	1.390	381.431
2010	200.595	70.423	21.915	1.770	363.889
2011	223.888	93.141	35.250	3.593	366.061
2012	260.997	114.581	47.036	4.608	362.736
2013	274.841	78.295	41.330	19.466	393.927
2014	253.841	94.083	62.204	39.262	405.019
2015	230.000	121.000	55.000	54.400	369.000
2016	260.102	90.849	51.006	88.511	322.089
2017	322.592	66.075	52.022	174.101	363.123

1/ Other gases include blast furnace gas, propane gas, and other manufactured and waste gases derived from fossil fuels.

Source: U.S. Department of Energy, Energy Information Administration, State Energy Data System (SEDS) Detailed State Data 1990-2016 Net Generation by State by Type of Producer by Energy Source (EIA-906, EIA-920, and EIA-923) <<http://www.eia.gov/electricity/data/state/>> accessed June 27, 2019.

Table 17.07-- ELECTRICITY PRODUCTION, BY SOURCE AND BY ISLAND: 2017

[Million kWh]

Island	Total	Petroleum	Coal	Wind	Biomass
State total	9,812.05	6,633.60	1,375.72	532.06	292.76
Hawaii	1,148.54	704.04	-	81.87	-
Maui	1,118.00	915.19	-	189.55	-
Lanai	33.05	33.05	-	-	-
Molokai	31.78	31.78	-	-	-
Oahu	7,006.65	4,583.75	1,375.72	260.63	285.30
Kauai	474.04	365.79	-	-	7.47
Island	Geothermal	Hydro	Other gases 1/	Solar	Others
State total	322.59	66.08	52.02	174.10	363.12
Hawaii	322.59	40.03	-	-	-
Maui	-	1.21	-	12.05	-
Lanai	-	-	-	-	-
Molokai	-	-	-	-	-
Oahu	-	-	52.02	86.10	363.12
Kauai	-	24.84	-	75.94	-

1/ Other gases include blast furnace gas, propane gas, and other manufactured and waste gases derived from fossil fuels.

Source: U.S. Department of Energy, Energy Information Administration, State Energy Data System (SEDS), Detailed State Data 1990-2016 Net Generation: by State, Type of Producer, and Energy Source (EIA-906, EIA-920, and EIA-923) <<http://www.eia.gov/electricity/data/state/>> accessed July 2, 2019 and calculations by Hawaii State Department of Business, Economic Development and Tourism.

**Table 17.08 -- FUEL, ELECTRICITY, AND TOTAL ENERGY EXPENDITURES
BY SOURCE: 1994 TO 2017**

[Millions of dollars]

Year	Total energy expenditures	Primary energy expenditures	Electricity additions	Retail electricity expenditures	Electricity fuel cost
1994	2,122.1	1,441.7	680.4	937.3	256.9
1995	2,202.7	1,470.2	732.5	1,017.7	285.3
1996	2,305.8	1,532.5	773.3	1,119.7	346.3
1997	2,272.6	1,455.8	816.8	1,152.7	336.0
1998	2,092.5	1,296.7	795.8	1,054.4	258.6
1999	2,163.2	1,379.8	783.4	1,106.5	323.1
2000	2,705.1	1,863.0	842.1	1,341.2	499.0
2001	2,779.2	1,891.1	888.1	1,353.4	465.2
2002	2,688.2	1,882.7	805.5	1,300.2	494.7
2003	3,335.9	2,341.4	994.5	1,478.9	484.4
2004	4,024.6	2,886.3	1,138.3	1,654.9	516.6
2005	4,996.9	3,892.2	1,104.7	1,897.8	793.2
2006	5,729.1	4,535.9	1,193.2	2,152.2	959.0
2007	6,177.1	4,994.8	1,182.3	2,213.3	1,031.0
2008	6,828.5	5,297.3	1,531.2	2,978.3	1,447.2
2009	4,804.8	1/ 3,540	1/ 1,264.8	2,111.7	1/ 846.9
2010	1/ 5,865.6	1/ 4,532.6	1,333.0	2,473.3	1,140.3
2011	1/ 7,684.5	1/ 6,186.1	1/ 1,498.4	3,090.5	1/ 1,592.1
2012	1/ 7,846.8	1/ 6,247.6	1/ 1,599.2	3,219.0	1/ 1,619.8
2013	1/ 7,685.5	1/ 6,014.3	1/ 1,671.2	3,153.6	1/ 1,482.4
2014	1/ 7,434.9	1/ 5,648.7	1/ 1,786.2	3,159.3	1/ 1,373.1
2015	1/ 5,707.4	1/ 4,008.7	1/ 1,698.7	2,474.9	1/ 776.2
2016	1/ 5,038.1	3,403.0	1/ 1,635.1	2,242.6	1/ 607.6
2017	5,549.5	3,900.4	1,649.1	2,416.2	767.1

1/ Revised from previous *Data Book*.

Source: U.S. Department of Energy, Energy Information Administration, State Energy Data System (SEDS) <<http://www.eia.gov/state/seds/seds-data-fuel.cfm?sid=HI>> accessed June 26, 2019 and calculations by the Hawaii State Department of Business, Economic Development and Tourism.

Table 17.09-- ELECTRIC UTILITIES: 2003 TO 2018

Year	Customers, Dec. 31			Power sold (1,000 kWh)		
	Total	Residen- tial 1/	Other	Total	Residen- tial 1/	Other
2003	449,354	387,162	62,192	10,206,405	3,024,509	7,181,896
2004	455,278	391,567	63,711	10,508,642	3,156,499	7,352,143
2005	463,088	398,332	64,756	10,538,507	3,164,029	7,374,478
2006	469,013	403,278	65,735	10,567,912	3,182,431	7,385,481
2007	475,104	408,923	66,181	10,585,037	3,200,674	7,384,363
2008	476,124	410,477	65,647	10,390,010	3,085,183	7,304,827
2009	478,588	413,641	64,947	10,125,935	3,055,242	7,070,693
2010	480,918	416,141	64,777	10,013,104	2,989,437	7,023,667
2011	482,498	418,174	64,324	9,961,653	2,928,743	7,032,910
2012	484,716	420,240	64,476	9,639,157	2,739,299	6,899,858
2013	488,456	423,281	65,175	9,496,294	2,606,502	6,889,793
2014	492,358	426,862	65,496	9,406,155	2,538,865	6,867,290
2015	494,632	429,085	65,547	9,388,577	2,558,285	6,830,292
2016	497,292	431,496	65,796	9,284,424	2,496,694	6,787,729
2017	499,664	435,104	64,560	9,135,529	2,503,831	6,631,699
2018	500,794	436,545	64,249	9,139,886	2,585,508	6,554,378

Year	Average annual use (kWh) 2/		Average rate (dollars per kWh)		Revenues (\$1,000)		
	Residen- tial 1/	Other	Residen- tial 1/	Other	Total	Residen- tial 1/	Other
2003	7,812	115,479	0.16743	0.13629	1,485,234	506,399	978,835
2004	8,061	115,398	0.18031	0.14793	1,656,764	569,162	1,087,601
2005	7,943	113,881	0.20656	0.17280	1,927,872	653,568	1,274,304
2006	7,891	112,352	0.23347	0.19595	2,190,152	742,994	1,447,159
2007	7,827	111,578	0.24122	0.20061	2,253,431	772,064	1,481,367
2008	7,516	111,274	0.32497	0.27809	3,033,950	1,002,583	2,031,367
2009	7,386	108,869	0.24202	0.19923	2,148,123	739,416	1,408,707
2010	7,184	108,428	0.28101	0.23857	2,515,731	840,066	1,675,665
2011	7,004	109,336	0.34681	0.30304	3,146,960	1,015,703	2,131,256
2012	6,518	107,014	0.37343	0.32727	3,281,058	1,022,944	2,258,114
2013	6,158	105,712	0.36813	0.31735	3,146,011	959,542	2,186,468
2014	5,948	104,851	0.37342	0.32126	3,154,227	948,062	2,206,164
2015	5,962	104,204	0.29918	0.24909	2,466,759	765,399	1,701,360
2016	5,786	103,163	0.27819	0.22555	2,225,520	694,564	1,530,956
2017	5,755	102,722	0.29967	0.24800	2,394,971	750,316	1,644,655
2018	5,923	102,015	0.33092	0.27923	2,685,761	855,607	1,830,154

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Table 17.09-- ELECTRIC UTILITIES: 2003 TO 2018 -- Con.

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; The Hawaii State Department of Business, Economic Development and Tourism, Strategic Industries Division; *Monthly Financial Reports* issued by utility companies (Hawaiian Electric Company, Maui Electric Company, Hawaii Electric Light Company and Kauai Island Utility Cooperative); calculations by Hawaii State Department of Business, Economic Development and Tourism; and records.

Table 17.10-- ELECTRIC UTILITIES, BY ISLAND: 2018

Island	Customers, Dec. 31			Net peak demand (mW)	Power sold (1,000 kWh)		
	Total	Residential 1/	Other		Total	Residential 1/	Other
State total	500,794	436,545	64,249	1,551.5	9,139,886	2,585,508	6,554,378
Oahu	305,456	271,807	33,649	1,090.6	6,525,670	1,607,867	4,917,803
Hawaii	85,758	74,288	11,470	180.5	1,064,082	419,892	644,190
Kauai	37,705	29,040	8,665	73.8	451,114	174,726	276,388
Lanai	1,737	1,485	252	5.3	29,263	7,979	21,284
Maui	66,902	57,232	9,670	195.7	1,040,743	364,501	676,241
Molokai	3,236	2,693	543	5.6	29,014	10,542	18,472
Island	Average annual use (kWh) 2/		Average rate (dollars per kWh)		Revenues (\$1,000)		
	Residential 1/	Other	Residential 1/	Other	Total	Residential 1/	Other
State total	5,923	102,015	0.29020	0.25092	2,394,971	750,316	1,644,655
Oahu	5,915	146,150	0.31329	0.26092	1,786,888	503,736	1,283,153
Hawaii	5,652	56,163	0.37075	0.33536	371,713	155,676	216,037
Kauai	6,017	31,897	0.37298	0.35104	162,193	65,170	97,023
Lanai	5,373	84,462	0.40137	0.40499	11,822	3,202	8,620
Maui	6,369	69,932	0.33907	0.32257	341,723	123,590	218,133
Molokai	3,915	34,018	0.40156	0.38917	11,422	4,233	7,189

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: *Monthly Financial Reports* issued by utility companies (Hawaiian Electric Company, Maui Electric Company, Hawaii Electric Light Company and Kauai Island Utility Cooperative) and calculations by the Hawaii State Department of Business, Economic Development and Tourism.

Table 17.11-- GAS UTILITIES: 2003 TO 2018

[Excludes bottled gas]

Year	Customers, Dec. 31			Gas sold (million therms)		
	Total	Residen- tial 1/	Other	Total	Residen- tial 1/	Other
2003	36,046	32,415	3,631	33.6	5.2	28.4
2004	36,049	32,413	3,636	34.2	5.1	29.2
2005	35,850	32,229	3,621	34.2	5.0	29.2
2006	35,793	32,164	3,629	34.3	5.0	29.4
2007	35,692	32,078	3,614	34.7	4.9	29.8
2008	35,364	31,752	3,612	33.1	4.8	28.3
2009	35,449	31,821	3,628	31.9	4.7	27.2
2010	35,317	31,656	3,661	32.3	4.7	27.5
2011	35,226	31,552	3,674	32.4	4.5	27.9
2012	35,183	31,478	3,705	32.3	4.6	27.7
2013	35,116	31,412	3,704	33.1	4.4	28.7
2014	35,186	31,463	3,723	33.1	4.3	28.8
2015	35,248	31,482	3,766	34.1	4.3	29.8
2016	35,408	31,574	3,834	35.5	4.3	31.2
2017	35,494	31,638	3,856	36.2	4.3	31.8
2018	35,694	31,794	3,900	37.6	4.4	33.2

Year	Average annual use (therms) 2/		Average rate (dollars per therm)		Revenues (\$1,000,000)		
	Residen- tial 1/	Other	Residen- tial 1/	Other	Total	Residen- tial 1/	Other
2003	159	7,818	3.06	1.71	64.4	15.8	48.6
2004	157	8,018	3.23	1.88	71.2	16.5	54.8
2005	156	8,066	3.64	2.27	84.5	18.4	66.2
2006	155	8,090	3.87	2.46	91.6	19.3	72.3
2007	154	8,232	3.94	2.53	94.5	19.4	75.1
2008	151	7,833	4.89	3.47	121.7	23.5	98.2
2009	149	7,491	4.19	2.68	92.7	19.9	72.9
2010	150	7,522	4.99	3.27	113.8	23.6	90.2
2011	144	7,585	6.05	4.02	139.5	27.5	112.0
2012	146	7,481	5.61	4.28	144.5	25.8	118.7
2013	141	7,737	5.45	3.91	136.3	24.2	112.1
2014	137	7,738	5.48	3.89	135.8	23.6	112.2
2015	136	7,909	4.68	2.94	107.6	20.1	87.5
2016	138	8,129	4.31	2.50	96.8	18.7	78.0
2017	137	8,306	4.53	2.74	107.1	19.7	87.4
2018	138	8,511	5.09	3.13	126.1	22.3	103.9

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Table 17.11-- GAS UTILITIES: 2003 TO 2018 -- Con.

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; The Hawaii State Department of Business, Economic Development and Tourism, Strategic Industries Division; Hawai'i Gas The Clean Energy Company, *Hawaii Gas Utility Monthly Financial Reports*; calculations by Hawaii State Department of Business, Economic Development and Tourism; and records.

Table 17.12-- GAS UTILITIES, BY ISLAND: 2018

[Excludes bottled gas]

Island	Customers, December 31			Gas sold (1,000 therms)		
	Total	Residen- tial 1/	Other	Total	Residen- tial 1/	Other
State total	35,694	31,794	3,900	37,571	4,377	33,195
Oahu	31,861	28,413	3,448	33,766	3,745	30,021
Hawaii	2,013	1,676	337	2,689	379	2,310
Kauai	1,030	1,010	20	208	132	76
Lanai	22	22	-	3	3	-
Maui	695	600	95	892	104	788
Molokai	73	73	-	13	13	-

Island	Average annual use (therms) 2/		Average rate (dollars per therm)		Revenues (\$1,000)		
	Residen- tial 1/	Other	Residen- tial 1/	Other	Total	Residen- tial 1/	Other
State total	138	8,511	5.09021	3.12893	126,142	22,278	103,864
Oahu	132	8,707	5.25713	3.24052	116,971	19,686	97,285
Hawaii	226	6,855	4.15123	2.07622	6,369	1,573	4,796
Kauai	131	3,776	4.22526	2.04974	714	559	155
Lanai	153	-	4.49091	-	15	15	-
Maui	173	8,292	3.75579	2.06648	2,018	390	1,628
Molokai	184	-	4.04874	-	54	54	-

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: Hawai'i Gas The Clean Energy Company, *Hawaii Gas Utility Monthly Financial Reports*, calculations by the Hawaii State Department of Business, Economic Development and Tourism, and records.

**Table 17.13-- SERVICE PROVIDED BY HAWAIIAN ELECTRIC COMPANY, INC.
ON OAHU: 1991 TO 2018**

Year	Number of customers, Dec. 31		Net input (1,000 kWh) 1/	Electricity sales (1,000 kWh)	Average annual residential use (kWh) 2/	Average residential rate (dollars per kWh)	Generating capability Dec. 31 (1,000 kW) 3/
	Total	Residen- tial only					
1991	255,176	223,304	6,876,964	6,538,952	7,610	0.09354	1,440
1992	257,442	225,229	7,061,157	6,650,449	7,711	0.09925	1,666
1993	263,478	230,192	7,029,839	6,607,424	7,581	0.11414	1,669
1994	264,992	232,115	7,222,978	6,797,364	7,681	0.11342	1,669
1995	269,307	235,905	7,359,195	6,962,794	7,732	0.12302	1,669
1996	271,602	237,860	7,499,202	7,091,147	7,868	0.12944	1,669
1997	271,801	238,825	7,424,259	7,040,291	7,773	0.13360	1,669
1998	272,675	239,945	7,299,149	6,938,326	7,603	0.12556	1,669
1999	275,467	242,579	7,356,725	6,997,936	7,654	0.12741	1,669
2000	278,260	245,027	7,589,409	7,211,760	7,793	0.14477	1,669
2001	280,911	247,672	7,643,288	7,276,681	7,816	0.14255	1,669
2002	283,161	249,896	7,757,699	7,390,367	8,050	0.13859	1,669
2003	286,677	253,033	7,908,957	7,522,230	8,224	0.14888	1,669
2004	288,456	254,797	8,126,998	7,732,834	8,481	0.15690	1,669
2005	291,580	257,804	8,104,303	7,721,296	8,360	0.17673	1,712
2006	292,988	259,098	8,104,872	7,700,605	8,248	0.20063	1,722
2007	294,591	260,583	8,089,115	7,675,355	8,214	0.20519	1,727
2008	293,740	259,929	7,950,649	7,555,962	7,868	0.28892	1,727
2009	295,282	261,630	7,761,597	7,377,537	7,759	0.21533	1,847
2010	296,422	262,635	7,657,018	7,277,229	7,540	0.25474	1,817
2011	296,800	263,384	7,593,813	7,242,311	7,319	0.32041	1,817
2012	297,529	264,047	7,310,995	6,975,996	6,729	0.35101	1,817
2013	299,528	265,772	7,187,329	6,858,536	6,283	0.34625	1,840
2014	301,953	268,056	7,101,879	6,781,665	6,036	0.35479	1,848
2015	302,958	269,207	7,086,141	6,754,083	6,052	0.28019	1,735
2016	304,261	270,451	6,963,058	6,660,195	5,856	0.26069	1,735
2017	304,948	271,065	6,854,689	6,548,697	5,829	0.28215	1,735
2018	305,456	269,981	6,807,785	6,525,670	5,917	0.31194	1,794

1/ Net generation plus purchased power.

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

3/ Gross capability including firm purchase power.

Source: Hawaiian Electric Company, Inc., records.

**Table 17.14-- UTILITY SERVICE PROVIDED BY THE GAS COMPANY ON OAHU:
1991 TO 2018**

Year	Customers, Dec. 31		Sales (1,000 therms) 1/		Average annual residential usage (therms) 1/
	Total	Residential	Total	Residential	
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	30,027	5,287	176
1994	33,597	30,344	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
2001	33,625	30,403	31,071	4,990	164
2002	33,446	30,202	30,852	4,962	164
2003	33,252	29,990	30,470	4,781	159
2004	33,231	29,964	31,011	4,701	157
2005	32,991	29,744	30,965	4,641	156
2006	32,776	29,519	30,935	4,530	153
2007	32,673	29,434	31,219	4,447	151
2008	32,358	29,123	29,930	4,320	148
2009	32,179	28,951	28,957	4,263	147
2010	32,109	28,867	28,823	4,197	145
2011	32,121	28,872	29,266	4,059	141
2012	31,875	28,622	29,563	4,036	2/ 141
2013	31,730	28,481	29,711	3,923	2/ 138
2014	31,766	28,504	29,703	3,790	133
2015	31,772	28,475	30,642	3,768	132
2016	31,829	28,469	32,109	3,807	134
2017 2/	35,494	31,668	36,292	4,349	137
2018	35,694	31,825	37,445	4,358	137

1/ Includes liquefied petroleum gas.

2/ Revised from previous *Data Book*.

Source: The Gas Company LLC, formerly The Gas Company, Inc., records.

Table 17.15-- LIQUID FUEL TAX BASE: 2004 TO 2018

[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]

Year reported	All types		Gasoline	Diesel oil		
	Total	Excluding aviation		Non-hwy.	Hwy. use	
2004	1,066,808	727,943	459,321	220,562	43,223	
2005	972,642	647,843	454,115	146,922	43,440	
2006	869,789	657,355	472,658	131,665	50,065	
2007	1,018,233	782,580	480,632	230,812	52,826	
2008	920,042	710,863	443,918	158,894	57,613	
2009	898,720	713,534	438,849	166,209	53,437	
2010	820,268	638,300	416,134	132,451	51,512	
2011	881,047	671,169	449,606	133,480	47,237	
2012	900,993	673,513	444,638	151,509	47,674	
2013	866,768	635,587	446,571	107,415	51,235	
2014	902,720	665,707	447,267	137,449	45,921	
2015	899,923	698,487	457,535	157,018	45,248	
2016	844,235	671,751	461,719	136,249	46,245	
2017	945,406	697,345	476,901	139,233	48,092	
2018	930,729	665,805	463,671	116,955	47,573	

Year reported	Liquefied petroleum gas		Aviation fuel	Small boats		Other fuel 1/
	Off hwy.	Hwy. use		Gasoline	Diesel oil	
2004	3,368	246	338,866	8	16	1,200
2005	1,222	300	324,799	15	42	1,786
2006	1	142	212,434	23	45	2,756
2007	-	108	235,653	262	626	17,314
2008	-	96	209,179	452	5,004	44,886
2009	-	66	185,185	1,215	1,324	52,434
2010	-	62	181,968	787	947	36,406
2011	-	50	209,878	1,103	4,022	35,672
2012	-	35	227,480	1,144	399	28,113
2013	-	23	231,181	1,390	1,257	27,696
2014	-	22	237,012	1,565	2,763	30,721
2015	-	16	201,435	1,571	2,658	34,442
2016	-	12	172,483	541	3,221	23,765
2017	-	7	248,061	1,034	3,422	28,656
2018	-	26	264,923	1,567	2,625	33,387

1/ Includes ethanol, methanol, biodiesel, naphtha, nompresed natural gas, and liquefied natural gas.

Source: Hawaii State Department of Taxation, Tax Research & Planning, "Liquid Fuel Tax Base & Tax Collections" (annual) <http://tax.hawaii.gov/stats/a5_3txcolrpt/> accessed May 20, 2019.

Table 17.16-- LIQUID FUEL TAX BASE, BY COUNTY: 2018

[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	930,729	499,773	170,293	171,869	88,793
Gasoline	463,671	286,560	65,077	81,284	30,750
Diesel oil, non-hwy.	116,955	78,611	16,085	11,693	10,566
Diesel oil, hwy. use	47,573	26,622	6,029	11,675	3,247
Liq. pet. gas, hwy. use	26	23	(1/)	3	1
Small boats, gasoline	1,567	1,137	121	309	-
Small boats, diesel oil	2,625	2,625	-	-	-
Aviation fuel	264,923	102,665	82,625	49,396	30,238
Other fuel 2/	33,387	1,530	358	17,509	13,991

1/ Value rounds to zero.

2/ Includes Ethanol, Methanol, Biodiesel, Naphtha, Compressed Natural Gas, and Liquefied Natural Gas.

Source: Hawaii State Department of Taxation, Tax Research & Planning, "Liquid Fuel Tax Base & Tax Collections - CY Ending December 31, 2018" <<http://files.hawaii.gov/tax/stats/monthly/2018cy-fuels-base.pdf>> accessed May 20, 2019.

**Table 17.17-- GASOLINE STATIONS (NAICS 447), BY COUNTY:
1998 TO 2016**

[Excludes most government employees, railroad employees, and self-employed persons]

Year	State total	City and County of Honolulu	Hawaii County	Kauai County	Maui County
1998	350	219	67	19	45
1999	334	206	63	19	46
2000	328	207	61	20	40
2001	322	204	61	17	40
2002	321	200	62	19	40
2003	314	194	63	19	38
2004	294	181	60	18	35
2005	301	188	59	19	35
2006	305	190	63	17	35
2007	289	179	58	14	38
2008	281	177	57	14	33
2009	277	169	58	15	35
2010	283	168	58	17	40
2011	283	168	61	16	38
2012	283	174	58	14	37
2013	286	176	58	15	37
2014	284	171	57	17	39
2015	284	166	57	23	38
2016	264	153	54	20	37

Source: U.S. Census Bureau, *County Business Patterns* "Geography Area Series: County Business Patterns" (CB1600A11) (annual) <<http://factfinder.census.gov/>> accessed May 21, 2019.

Table 17.18-- BOILERS AND PRESSURE VESSELS, BY ISLAND: 2018

[As of December 31]

Island	Total	Power boilers	Heating boilers	Pressure vessels
State total	10,367	423	2,600	7,344
Hawaii	1,472	79	342	1,051
Maui	1,188	54	346	788
Lanai	49	2	17	30
Molokai	42	2	6	34
Oahu	7,059	261	1,739	5,059
Kauai	557	25	150	382

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

Table 17.19-- FEDERAL OBLIGATIONS FOR RESEARCH AND DEVELOPMENT AND FOR R&D PLANT IN HAWAII: 2000 TO 2016

[Millions of dollars. For fiscal year ending September 30]

Year	Total	R&D	R&D plant
2000	236.1	234.3	1.8
2001	438.5	435.7	2.8
2002	434.7	428.3	6.4
2003	415.8	413.9	1.9
2004	495.2	488.2	7.0
2005	644.1	600.3	43.8
2006	385.9	380.3	5.6
2007	387.2	379.2	8.0
2008	350.9	347.8	3.1
2009	412.8	387.5	25.3
2010	427.5	389.4	38.1
2011	426.9	403.6	23.3
2012	397.9	382.5	15.4
2013	361.0	348.0	13.0
2014	341.7	326.5	15.2
2015	319.6	305.4	14.2
2016	298.6	283.8	14.8

Source: National Science Foundation/Division of Science Resources Statistics, *Federal Funds for Research and Development*, tables 88, 128-131 <<https://ncesdata.nsf.gov/fedfunds>> accessed May 21, 2019; and calculations by Hawaii State Department of Business, Economic Development & Tourism.

Table 17.20-- PRIVATE SECTOR TECHNOLOGY JOBS AND AVERAGE EARNINGS: 2009 TO 2018

[Jobs includes paid employees and proprietors. 2009-2017 revised from previous *Data Book*]

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Average earnings in 2018 1/
Technology sector	23,676	23,460	23,436	23,829	23,976	23,602	23,843	23,464	23,556	23,963	83,234
Computer services	6,532	6,376	6,279	6,409	6,489	6,413	6,578	6,401	6,544	6,497	88,802
Engineering and related services	6,000	5,910	5,968	6,081	6,076	6,164	6,274	6,253	6,276	6,437	96,866
Technical consulting services	3,939	4,086	4,115	4,287	4,481	4,443	4,550	4,590	4,759	4,950	64,953
Research & development services	2,623	2,570	2,530	2,495	2,413	2,056	1,902	1,865	1,638	1,516	89,211
Research & devel. in biotech.	676	658	693	688	609	555	519	513	413	355	85,871
Information & telecoms tech.	1,295	1,286	1,238	1,285	1,409	1,439	1,423	1,373	1,384	1,427	59,413
Medical labs and imaging centers	1,688	1,697	1,742	1,701	1,689	1,743	1,779	1,754	1,741	1,796	65,733
Technology equipment distribution	853	801	775	776	740	731	753	680	678	810	114,317
Technology manufacturing	746	734	789	794	679	614	583	548	535	531	78,989
Alternate power generation	47	50	24	47	42	15	2	5	-	-	-
Chemical & pharm. manufacturing	99	91	92	106	157	171	95	73	83	77	161,247
Other technology manufacturing	94	86	125	157	127	89	114	76	76	65	57,666
Medical device manufacturing	506	507	548	485	354	339	372	394	376	389	66,371

1/ Average earnings include wages and salaries, supplements to wages and salaries, and proprietors' income.

Source: Hawaii State Department of Business, Economic Development and Tourism, records; see also *Hawaii's Targeted & Emerging Industries Report* (annual) <http://dbedt.hawaii.gov/economic/reports_studies/emerging-industries/>.

Table 17.21-- TECHNOLOGY AND SCIENCE INDEX, BY STATE: 2018

[The State Technology and Science Index observes 79 unique indicators that are categorized into the five major components shown below]

State	Average score	Ranking					
		Overall	Human capital invest.	Risk capital & entrepreneurial infrast.	Research & dev't inputs	Tech. concentration & dynamism	Tech. & science workforce
Massachusetts	86.25	1	1	1	1	3	3
Colorado	80.08	2	3	2	3	5	4
Maryland	79.24	3	2	6	2	11	1
California	78.08	4	10	4	4	2	6
Utah	75.27	5	5	3	11	1	9
Washington	74.60	6	14	5	10	4	2
Delaware	66.13	7	12	15	9	21	5
Minnesota	63.11	8	4	21	21	18	7
New Hampshire	62.34	9	15	23	5	19	11
Oregon	61.76	10	20	16	13	13	10
North Carolina	61.24	11	22	9	14	10	19
Virginia	60.28	12	8	34	16	7	8
Pennsylvania	59.58	13	13	14	8	31	15
Connecticut	59.50	14	7	25	6	25	18
Illinois	58.35	15	6	10	15	24	26
New York	57.52	16	9	6	18	16	38
Arizona	56.73	17	27	30	17	9	14
Michigan	56.37	18	23	12	12	20	31
Rhode Island	56.34	19	11	13	7	38	21
Texas	55.60	20	36	11	28	8	17
New Jersey	55.12	21	21	20	25	14	20
Georgia	53.25	22	30	19	32	6	28
Vermont	53.24	23	16	31	30	23	16
New Mexico	52.06	24	31	18	20	35	22
Wisconsin	51.96	25	25	16	19	28	30
Idaho	50.99	26	41	28	31	17	12
Ohio	50.88	27	26	24	26	33	23
Montana	49.22	28	35	32	23	26	24
Indiana	46.10	29	24	21	22	34	41
Missouri	46.03	30	29	27	36	27	27
Kansas	45.29	31	33	37	38	15	32
Alabama	43.40	32	38	39	24	29	33
Florida	42.39	33	43	8	42	12	45
Nebraska	40.84	34	19	33	33	43	29
Hawaii	39.21	35	32	47	29	36	34
Iowa	38.82	36	18	41	27	41	44
South Carolina	38.00	37	47	26	40	32	36
North Dakota	36.37	38	17	44	37	47	35

Continued on next page.

Table 17.21-- TECHNOLOGY AND SCIENCE INDEX, BY STATE: 2018 -- Con.

State	Average score	Ranking					
		Overall	Human capital invest.	Risk capital & entrepreneurial infrast.	Research & dev't inputs	Tech. concen- tration & dynamism	Tech. & science workforce
Tennessee	36.23	39	40	38	39	29	42
Maine	35.77	40	37	29	43	39	39
Alaska	35.70	41	39	48	35	45	13
Wyoming	35.13	42	34	46	34	46	25
South Dakota	31.86	43	28	45	41	44	37
Nevada	30.45	44	49	34	49	22	50
Louisiana	25.53	45	44	40	47	40	49
Kentucky	25.48	46	45	42	44	37	47
Oklahoma	25.01	47	50	43	45	41	40
Arkansas	23.32	48	48	36	48	49	46
West Virginia	19.96	49	42	50	50	50	43
Mississippi	19.78	50	45	49	46	47	48

Source: Milken Institute *State Technology and Science Index: Sustaining America's Innovation Economy 2018* <<http://statetechandscience.org/statetech.taf?page=state-ranking>> accessed May 22, 2019.

**Table 17.22-- RESEARCH AND NON-RESEARCH EXTRAMURAL FUNDING,
FOR THE UNIVERSITY OF HAWAII: 1992 TO 2018**

[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 ending June 30]

Year	Total		Research		Non-research	
	Awards	Amount (dollars)	Awards	Amount (dollars)	Awards	Amount (dollars)
1992	1,221	124,876,638	703	65,791,624	518	59,085,014
1993	1,146	131,075,215	636	61,059,928	510	70,015,287
1994	1,322	142,563,794	755	77,763,782	567	64,800,012
1995	1,147	139,199,221	616	70,222,653	531	68,976,568
1996	1,191	134,469,155	697	76,698,552	494	57,770,603
1997	1,255	160,859,800	724	89,131,636	531	71,728,164
1998	1,300	159,948,612	763	91,746,988	537	68,201,624
1999	1,254	164,168,101	707	92,737,645	547	71,430,456
2000	1,379	180,629,855	767	102,845,010	612	77,784,845
2001	1,405	216,233,918	835	132,833,308	570	83,400,610
2002	1,629	252,370,477	971	141,875,022	658	110,495,455
2003	1,646	323,868,218	976	190,374,465	670	133,493,753
2004	1,675	328,982,431	1,002	199,944,709	673	129,037,722
2005	1,742	354,127,142	1,022	209,196,531	720	144,930,611
2006	1,785	433,360,395	1,068	236,708,881	717	196,651,514
2007	1,778	354,031,667	1,081	209,909,883	697	144,121,784
2008	1,758	367,580,150	1,093	211,778,184	665	155,801,966
2009	1,990	413,963,739	1,147	246,546,713	843	167,417,026
2010	1,944	452,408,669	1,161	255,734,059	783	196,674,610
2011	1,799	488,597,908	1,070	281,745,764	729	206,852,144
2012	1,727	435,874,967	1,039	256,980,266	688	178,894,701
2013	1,801	409,783,318	1,006	222,207,539	795	187,575,779
2014	1,774	392,314,955	1,081	238,286,786	693	154,028,169
2015	1,823	425,650,338	1,080	236,114,373	743	189,535,965
2016	1,855	391,334,528	1,025	199,840,628	830	191,493,900
2017	1,886	387,001,705	1,077	209,249,788	809	177,751,917
2018	1,879	386,311,703	1,072	215,982,321	807	170,329,382

Source: University of Hawaii, Office of Research Services, *2017-2018 Online Executive Managerial Report* <<http://http://www.ors.hawaii.edu/index.php/reports/annual-executive-managerial-reports/111-reports/annual-reports/391-2017-2018-annual-report>> accessed May 22, 2019 and previous reports.

Table 17.23-- RESEARCH AND DEVELOPMENT EXPENDITURES AT HIGHER EDUCATION INSTITUTIONS: 1994 TO 2017

[In thousands of dollars. For fiscal year ending June 30]

Year	Total	Federally financed	State and local government financed	Business 1/	Nonprofit	Institutionally financed	All other sources
1994 2/	70,079	39,392	25,204	434	(NA)	3,290	1,759
1995 2/	78,429	44,238	26,789	299	(NA)	3,738	3,365
1996 2/	111,202	66,902	31,826	8,088	(NA)	4,386	-
1997 2/	120,107	72,421	28,440	5,944	(NA)	13,297	5
1998 3/	148,007	86,886	37,002	10,949	(NA)	13,170	-
1999 3/	156,810	93,418	35,111	13,021	(NA)	15,260	-
2000 3/	161,300	95,419	35,474	11,158	(NA)	19,249	-
2001 3/	156,976	97,716	33,125	7,232	(NA)	18,903	-
2002 3/	172,664	119,381	31,062	9,971	(NA)	12,232	18
2003 3/	184,602	148,662	11,822	6,931	(NA)	17,171	16
2004 4/	241,346	191,252	8,815	21,234	(NA)	19,892	153
2005 4/	240,247	199,135	7,077	12,155	(NA)	21,282	598
2006 4/	257,478	210,097	8,933	12,551	(NA)	25,888	9
2007 4/	274,373	215,806	15,534	22,080	(NA)	16,352	4,601
2008 4/	278,751	200,385	18,192	26,928	(NA)	28,132	5,114
2009 4/	300,302	211,256	17,479	30,357	(NA)	32,198	9,012
2010 5/	317,942	208,540	23,669	24,315	7,989	45,016	8,413
2011 5/	363,887	241,686	22,399	23,362	11,019	57,502	7,919
2012 5/	335,704	215,593	16,406	21,389	6,642	67,934	7,740
2013 5/	343,802	241,600	11,812	73,645	3,863	6,270	6,612
2014 5/	330,897	212,525	8,115	3,436	6,759	89,409	10,653
2015 5/	332,233	213,763	14,140	6,702	9,748	85,793	2,087
2016 5/	318,134	201,809	15,402	5,834	12,110	80,463	2,516
2017 5/	301,204	189,719	14,660	2,084	13,013	77,502	4,226

NA Not available.

1/ Category called 'industry financed' before 2010.

2/ Survey includes a sample of institutions with doctoral programs in S&E, are HBCUs with R&D expenditures in S&E, and/or are other institutions that expend at least \$50,000 in separately budgeted R&D in S&E.

3/ Survey includes institutions with doctoral programs in S&E, are HBCUs with R&D expenditures in S&E, or are master's or bachelor's degree-granting institutions that expend at least \$150,000 in separate R&D in S&E.

4/ Survey includes S&E bachelor's and higher degree-granting institutions that reported at least \$150,000 in separately budgeted R&D expenditures in S&E.

5/ Survey includes institutions which grant a bachelor's degree or higher, expend at least \$150,000 in separately budgeted R&D, and were geographically separate campuses headed by a president, chancellor, or equivalent.

Source: National Science Foundation, Division of Science Resources Statistics, *Academic Research and Development Expenditures: Fiscal Year* (annual) <<http://www.nsf.gov/statistics/rdexpenditures/>> accessed May 22, 2019 and *Higher Education Research and Development Survey: Fiscal Year* (annual) <<https://ncesdata.nsf.gov/herd/2017/>> accessed May 22, 2019.

Table 17.24-- PATENTS ISSUED TO HAWAII RESIDENTS: 1992 TO 2018

Year	Patents	Year	Patents	Year	Patents
1992	81	2001	107	2010	144
1993	106	2002	91	2011	128
1994	99	2003	96	2012	131
1995	84	2004	86	2013	146
1996	104	2005	58	2014	160
1997	93	2006	101	2015	166
1998	93	2007	82	2016	178
1999	97	2008	101	2017	153
2000	93	2009	96	2018	136

Source: U.S. Patent and Trademark Office, Electronic Information Products Division / PTMT, *Patent Counts by Country/State and Year, All Patents, All Types, January 1, 1977 -- December 31, 2015* (December 2015) <http://www.uspto.gov/web/offices/ac/ido/oeip/taf/cst_all.htm> accessed May 8, 2017 and records.

Table 17.25-- ASTRONOMY AND RELATED FACILITIES AT THE SUMMITS OF MAUNAKEA FOR 2016 AND HALEAKALA FOR 2017

[Categories may not sum to totals due to rounding]

Facility and year (mirror diameter in meters)	Capital cost (\$ mil) 1/	Annual operating cost (\$ mil)	County based staff	Opera- tional
Maunakea observatories, 2016				
Total	601	72.4	501	(X)
UH 2.2-m (Optical/Infrared)	5	1.0	6	1970
Canada-France-Hawaii 3.6-m (Optical/Infrared) 2/	30	7.5	49	1979
NASA IRTF 3.0-m (Infrared)	10	5.1	19	1979
UKIRT 3.8-m (Infrared)	5	2.2	6	1979
James Clerk Maxwell 15-m Submillimeter 2/	32	4.5	36	1986
VLBA Antenna 25-m (Radio)	7	0.4	2	1992
W.M. Keck Observatory (Keck I & II) 10-m x 2 (Optical/Infrared) 2/	170	14.2	125	1992/1996
Subaru 8-m (Optical/Infrared)	170	17.0	101	1999
Fredrick C. Gillett Gemini 8-m (Optical/Infrared) 2/	92	15.0	83	1999
Submillimeter Array 8x6-m	80	5.5	23	2003
Maunakea Observatories Support Services 2/	(X)	3/ 5.4	51	1980
Haleakala observatories, 2017				
Total	749	40.7	202	(X)
Mees Solar Observatory	1	0.2	1	1963
Haleakala Observatories Projects	(X)	0.2	2	(X)
Maui Space Surveillance Site (MSSS) 4/	250	26.3	117	1965
Ground-Based Electro-Optical Deep Space Surveillance (GEODSS)	25	6.1	16	1983
Faulkes 2-m Telescope	10	0.6	2	2003
Transportable Laser Ranging System (TLRS4)	1	0.8	5	2005
Panoramic Survey Telescope And Rapid Response System (Pan-STARRS)	110	5.6	11	2009
UH Haleakala Support Facilities	9	1.2	15	1962/2008
Daniel K. Inouye Solar Telescope (DKIST)	344	5/ 18.0	35	(6/)

X Not applicable.

1/ Historical cost, not adjusted for inflation, and not including subsequent capital improvements for Maunakea Observatories.

2/ 'Annual operating cost' and 'County based staff' revised from previous *Data Book*.

3/ Only \$1.9 million are included in total, as the other \$3.5 million are part of facility operating costs.

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

5/ Operational cost of 18 million not included in the total.

6/ Daniel K. Inouye Solar Telescope scheduled to be operational by 2020.

Source: University of Hawaii at Manoa, Institute for Astronomy, records.