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State of Hawaii - Department of Business, Economic Development & Tourism
Research & Economic Analysis Division

Hawaii's Electricity Industry: 2019-2020 Analysis and Recent Trends

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TABLE OF CONTENTS

1. INTRODUCTION 7

2. ELECTRICITY GENERATION BY PRODUCERS 8

3. ELECTRICITY GENERATION BY SOURCES 17

4. FACTORS AFFECTING ELECTRICITY EXPENDITURES IN HAWAII..35

5. ELECTRICITY CONSUMPTION BY SECTOR 45

6. CONCLUSIONS 53

LIST OF TABLES

Table 1 Hawaii Electricity Net Generation by Producer 9
Table 2 Hawaii Electricity Net Generation by Utility 13
Table 3 Hawaii Electricity Sales by Utility 14
Table 4 Share of Utility Station Usage and Loss of Total Electricity Production ...15
Table 5 Share of Total Station Usage and Loss of Total Electricity Production.....16
Table 6 Electricity Net Generation by Source: Total Electric Power Industry.....17
Table 7 Electricity Net Generation by Source: Electric Utilities 19
Table 8 Electricity Net Generation by Source: IPP & CHP 20
Table 9 Power Generating Capacity by Source: Total Electric Power Industry 21
Table 10 Power Generating Capacity by Source: Electric Utilities 22
Table 11 Power Generating Capacity by Source: IPP and CHP.....23
Table 12 Power Generating Capacity by Source in 2020 24
Table 13 Average Operating Hours: Total Electric Power Industry.....25
Table 14 Average Operating Hours: Electric Utilities.....26
Table 15 Average Operating Hours: IPP and CHP.....27
Table 16 Fossil Fuel Consumption: Total Electric Power Industry 28
Table 17 Fossil Fuel Consumption: Electric Utility 30
Table 18 Fossil Fuel Consumption: IPP and CHP.....31
Table 19 Hawaii Utility Fuel Consumption.....32
Table 20 Hawaii Utility Fuel Cost 33
Table 21 Hawaii Utility Average Fuel Cost .....…… …34
Table 22 Hawaii Average Revenue of Electricity by Utility 40
Table 23 Hawaii Average Cost of Fuel and Purchased Power by Utility.....41
Table 24 Utility Fuel Cost and Purchased Power Cost Comparison by Utility.....43
Table 25 Other Major Cost of Electricity by Utility 44
Table 26 Electricity Consumption by Sector and by Utility.....47
Table 27 Number of Retail Customers by Sector in Hawaii 48
Table 28 Annual Electricity Consumption per Customer by Sector.....49
Table 29 Revenue from Retail Electricity Sales by Sector in Hawaii 50
Table 30 Average Electricity Price by County in Hawaii 51
Table 31 Average Electricity Price by Sector in Hawaii 52

LIST OF FIGURES

Figure 1 Electricity Production and Consumption in Hawaii: 2019 10
Figure 2 Changes in Electricity Production and Consumption in Hawaii: 2019-2020 …… 11
Figure 3 Changes in Electricity Production and Consumption in Hawaii: 2005-2019 …… 12
Figure 4 Components of Utility Operating Expense in Hawaii: 2019 35
Figure 5 Changes of Utility Operating Expense in Hawaii: 2019-2020 36
Figure 6 Changes of Utility Operating Expense in Hawaii: 2005-2019 37
Figure 7 Components of HECO Operating Expense: 2019 38
Figure 8 Changes of HECO Operating Expense: 2019-2020 38
Figure 9 Changes of HECO Operating Expense: 2005-2019 39
Figure 10 Electricity Consumption by Sector in Hawaii 45

Executive Summary

This report analyzes the generation, consumption, and cost of Hawaii's electricity using data from the U.S. Energy Information Administration (EIA) and the monthly financial reports (MFR) of Hawaii's electric utilities. The following is a summary of the results identified in this report:

- The importance of Hawaii's non-utility electricity producers has increased over time. The utility companies (HECO, MECO, HELCO, and KIUC) generated 53.9 percent of the total electricity generated by the electric power industry (excluding customer generated electricity) in 2019 and purchased the remainder from independent power producers (IPPs) and combined heat and power (CHPs). This was a 28.5 percentage point decrease from 1990, when utilities generated 82.4 percent of the total electricity sold in Hawaii.
- The gross generation of electricity (including customer generated electricity) in Hawaii was estimated to be about 11,460 GWH in 2019. Of this, 48.3 percent was generated by the utilities, 40.6 percent by the non-utility producers, and 11.1 percent by the customers. Station use accounted for about 4.9 percent of gross generation. Utility loss accounted for about 3.7 percent of gross generation. The 10,473 GWH net consumption in 2019 includes 1,272 GWH generated by customers and 9,200 GWH utility electricity sales.
- From 2019 to 2020, gross generation in Hawaii decreased 366 GWH. Purchased electricity from non-utility producers and utility gross generation both decreased. In 2020, net electricity consumption decreased 445 GWH, purchased electricity decreased 191 GWH, utility gross generation decreased 385 GWH.
- From 2005 to 2019, gross generation in Hawaii decreased by 298 GWH, accounting for about 2.6 percent of gross generation in 2019. Utility gross generation decreased 1,779 GWH, gross generation of non-utility producers increased 211 GWH, and electricity generated by customers increased 1,270 GWH. Since the decrease of utility net generation was more than the increase in purchased electricity and customer generated electricity, gross consumption decreased 228 GWH. Reduced utility loss led to a smaller reduction of net consumption. However, since customer generated electricity increased 1,270 GWH over this period, electricity sold by utilities decreased 1,338 GWH or 14.5 percent of utility sales in 2019.
- Hawaii's dependence on petroleum for electricity generation has decreased over time. According to the data from EIA, about 70.4 percent of the electricity generated by the electric

power industry was generated from petroleum fuel in 2019, and this represented a 19.6 percentage point decrease from the 1990 figure of 90.0 percent. In 2019, electricity generated from renewable sources accounted for 16.2 percent of net generation of electricity by the electric power industry.

- Most of the non-petroleum generated electricity was produced by non-utility producers. Almost all electricity generated from the utilities was from petroleum fuel. From 1990 to 2019, the petroleum generated electricity share of net utility generated electricity decreased only slightly from 99.6 percent to 94.7 percent. The petroleum generated electricity share of non-utility generated electricity decreased from 45.0 percent to 42.1 percent; the share of coal generated electricity increased from 0.1 percent to 28.9 percent; the share of wind generated electricity increased from 1.7 percent to 11.8 percent; the share of solar generated electricity increased from 0.0 percent to 5.1 percent; and the share of biomass decreased from 48.9 percent to 5.2 percent.
- In 2020, the total operating expense of Hawaii's utilities decreased by $275 million from 2019. Of this decrease, about 79.3 percent or $218 million was due to the decreased fuel cost, and about 14.1 percent or $39 million was due to the decreased purchased power cost.
- From 2005 to 2019, the total operating expense of Hawaii utilities increased $674 million. Of this increase, $61 million was due to increased fuel costs, and $215 million was due to increased purchased power costs.
- The average revenue per kWh sold in Hawaii increased almost every year from 18.3 cents in 2005 to 34.0 cents in 2012, an increase of 9.3 percent per year over this period. From 2012 to 2016, however, the average revenue from electricity sales decreased 8.4 percent per year, from 34.0 cents per kWh to 24.0 cents per kWh. From 2016 to 2018, the average revenue from electricity sales increased from 24.0 cents per kWh to 29.4 cents per kWh. In 2019 and 2020, the average electricity revenue decreased to 29.0 cents per kWh and 28.2 cents per kWh, respectively. The average electricity revenue in 2020 was the highest at KIUC at about 40.7 cents per kWh. This was followed by HELCO at 33.6 cents per kWh, MECO at 33.2 cents per kWh, and HECO at 25.8 cents per kWh.
- Before 2015, the average purchased power cost was below the average utility fuel cost in most of the years. Since 2015, average purchased power cost was above the average utility fuel cost.

1. Introduction

Electricity plays an important role in Hawaii's economy. Hawaii's total expenditures on utility sold electricity reached a peak of about $3.3 billion in 2012 due to the state's heavy reliance on imported petroleum and the rapid increase in petroleum prices until 2012. From 2005 to 2012, total expenditures on utility sold electricity in Hawaii increased from $1.9 billion to $3.3 billion, an average annual increase of 7.9 percent. It is important to note that this increase was much higher than the 3.4 percent Honolulu CPI-U increase during the same period, which indicates that energy expenditure growth outpaced inflation during this period. Since 2012, total expenditures on utility sold electricity decreased due to decreased petroleum prices and increase generation of customer-sited solar electricity. In 2020, total expenditures on utility sold electricity decreased $263.1 million or 9.9 percent from 2019. The total fuel and purchased power cost of Hawaii's utilities decreased $256.8 million or 17.9 percent, and the average revenue per kWh of electricity sold decreased 2.8 percent in 2020.

In 2013, the Research and Economic Analysis Division of DBEDT conducted a study to examine Hawaii's electric power industry based on data up to 2012. As an eighth follow up to the 2013 study, this study intends to answer the following research questions:

- Who produces electricity in Hawaii?
- What type of fuels are used to generate electricity in Hawaii?
- What are the main factors that affect electricity prices in Hawaii?
- How have the factors affecting electricity prices changed over time?
- What role does renewable energy play in electricity generation?
- What factors impact the production cost of electricity?
- What are the recent trends in electricity consumption by types of consumers?
- What is the performance of the electricity industry in 2019 and 2020?

The data provided in this report were primarily from three major sources. The first source was the U.S. Energy Information Administration (EIA). The second source of data was each respective Hawaii electric utility's Monthly Financial Reports (MFR). The MFR data provided both annual and monthly data by county utility. The third source of data was the utility Renewable Portfolio Standard Status Report (RPS).

2. Electricity Generation by Producers

Electricity consumed in Hawaii is mainly sold by the four electric utility companies: Hawaiian Electric Company (HECO), serving the island of Oahu; Maui Electric Company (MECO), serving the islands of Maui, Lanai, and Molokai; Hawaii Electric Light Company (HELCO), serving the island of Hawaii; and Kauai Island Utility Cooperative (KIUC), serving the island of Kauai. MECO and HELCO are whole owned subsidiaries of HECO, which is in turn a wholly owned subsidiary of Hawaii Electric Industries, Inc.

Electricity consumed in Hawaii is generated mainly by the electric utilities and non-utility electricity producers. Non-utility producers include independent power producers (IPP), combined heat and power (CHP)-Electric Power, CHP-Industrial Power, and CHP-Commercial Power. Over time, the share of electricity generated by the utilities decreased. As shown in Table 1, from 1990 to 2019, the electric utilities' share of net electricity generation (excluding customer-sited systems) decreased from 82.4 percent to 53.9 percent. Electricity generated by utilities and the four types of non-utility producers are defined as the electricity generated by the electric power industry in the EIA data.

In addition to the electricity generated by the electric power industry, some consumers also generated electricity, such as electricity generated from the photovoltaic (PV) systems owned by residential or commercial users.

Electricity generation data provided by the EIA and the utility MFR are not exactly comparable. According to the MFR, electricity sold by the four utilities includes net generation of the utilities and purchased electricity minus electricity lost in the utility systems (including a small portion of electricity used but not paid for by electricity users). The net electricity generation of the utilities is the total electricity generated minus the total usage by the utility owned power stations. The purchased electricity is the total generation of non-utility producers minus their station use. Since the usage data of non-utility producers is not available, total generation by the non-utility producers is also not available. In 2019, net electricity to the utility system (excluding station use but including purchased electricity) in Hawaii was 9,625 GWH based on the utility MFR, lower than the net electricity generation from the EIA data (9,750 GWH).

Table 1. Hawaii Electricity Net Generation by Producer

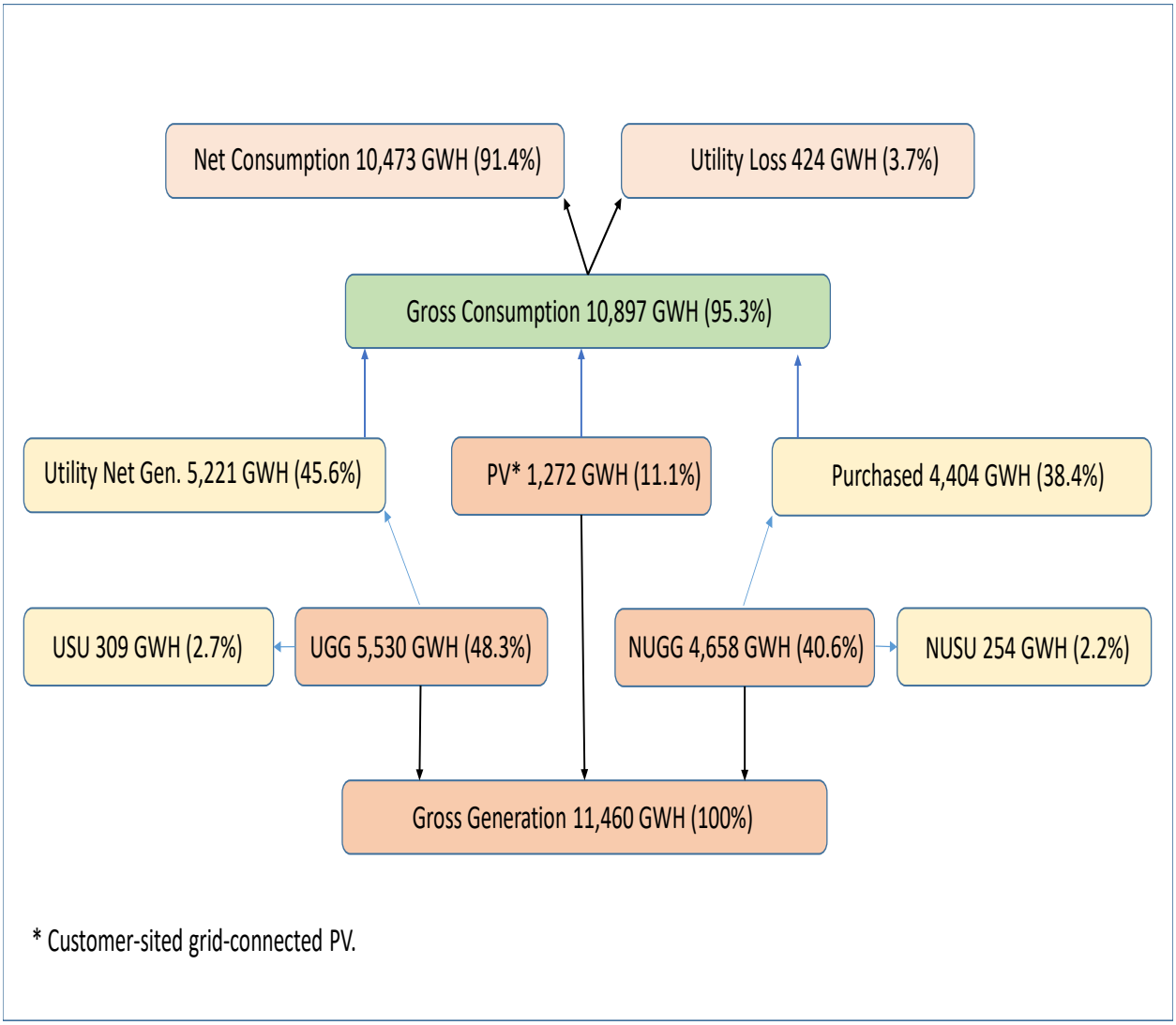
Year	State Total Generation 1/ GWh	% of Total Generation Units: %				
				CHP		
		Utility	IPP	Electric	Industry	Commercial
1990	9,703	82.4	4.0	5.6	8.0	-
1991	8,703	84.3	4.3	1.7	9.7	-
1992	9,844	69.7	4.1	17.9	8.3	-
1993	9,944	61.2	5.2	26.0	7.7	-
1994	10,109	59.9	6.2	26.8	7.1	-
1995	10,304	60.1	6.2	27.3	6.4	-
1996	10,628	60.4	5.7	27.6	6.3	-
1997	10,312	60.2	6.4	27.8	5.6	-
1998	10,228	61.6	6.3	27.3	4.8	-
1999	10,404	62.0	5.8	26.7	5.4	-
2000	10,593	61.7	6.2	27.0	5.1	-
2001	10,633	60.0	4.9	30.3	4.7	-
2002	11,663	64.4	3.4	28.2	4.0	-
2003	10,976	59.2	5.0	33.2	2.7	-
2004	11,410	61.2	2.3	31.3	2.3	2.9
2005	11,523	60.0	2.4	32.7	2.3	2.5
2006	11,559	60.9	3.0	30.9	2.3	2.9
2007	11,533	60.1	4.4	30.6	2.3	2.6
2008	11,376	58.9	7.9	28.0	2.2	2.9
2009	11,011	59.1	7.3	28.4	2.3	2.9
2010	10,836	59.2	7.0	27.2	3.7	2.9
2011	10,723	59.5	7.5	26.4	3.7	3.0
2012	10,469	57.4	8.6	27.0	4.1	2.9
2013	10,267	56.0	9.6	27.2	3.8	3.5
2014	10,204	54.1	10.4	27.4	4.4	3.7
2015	10,120	54.3	11.2	26.6	4.2	3.7
2016	9,949	52.4	11.7	28.2	3.6	4.1
2017	9,813	53.2	12.2	27.8	3.0	3.8
2018	9,797	54.1	12.4	26.6	2.9	4.1
2019	9,750	53.9	12.7	26.4	2.8	4.2

1/ Total generation from EIA is based on survey of electricity producers' net generation (excluding station use).
Source: Energy Information Administration, State Energy Data System

As shown in Figure 1, total gross electricity generation includes utility gross generation (UGG), non-utility gross generation (NUGG), and customer generated electricity (customer-sited grid-connected PV). Utility gross generation includes utility net generation (UNG) and utility station use (USU). Non-utility gross generation includes utility purchased electricity and non-utility station use (NUSU). Gross consumption of electricity is gross generation minus station use. Gross consumption minus utility loss is the net consumption of electricity.

In 2019, based on the utility MFR and RPS, gross generation in Hawaii was about 11,460 GWH, about 48.3 percent was generated by the utilities, 40.6 percent by the non-utility producers, and 11.1 percent by customers. Station use accounted for about 4.9 percent of gross generation. Utility loss accounted for about 3.7 percent of gross generation. The 10,473 GWH net consumption includes 1,272 GWH generated by customers and 9,200 GWH utility electricity sales.

Figure 1. Electricity Production and Consumption in Hawaii: 2019



As shown in Figure 2, from 2019 to 2020, gross generation in Hawaii decreased 366 GWH. Purchased electricity from non-utility producers and utility gross generation both decreased, but customer-sited PV increased. In 2020, net electricity consumption decreased 445 GWH, purchased electricity decreased 191 GWH, utility gross generation decreased 385 GWH.

Figure 2. Changes in Electricity Production and Consumption in Hawaii: 2019-2020

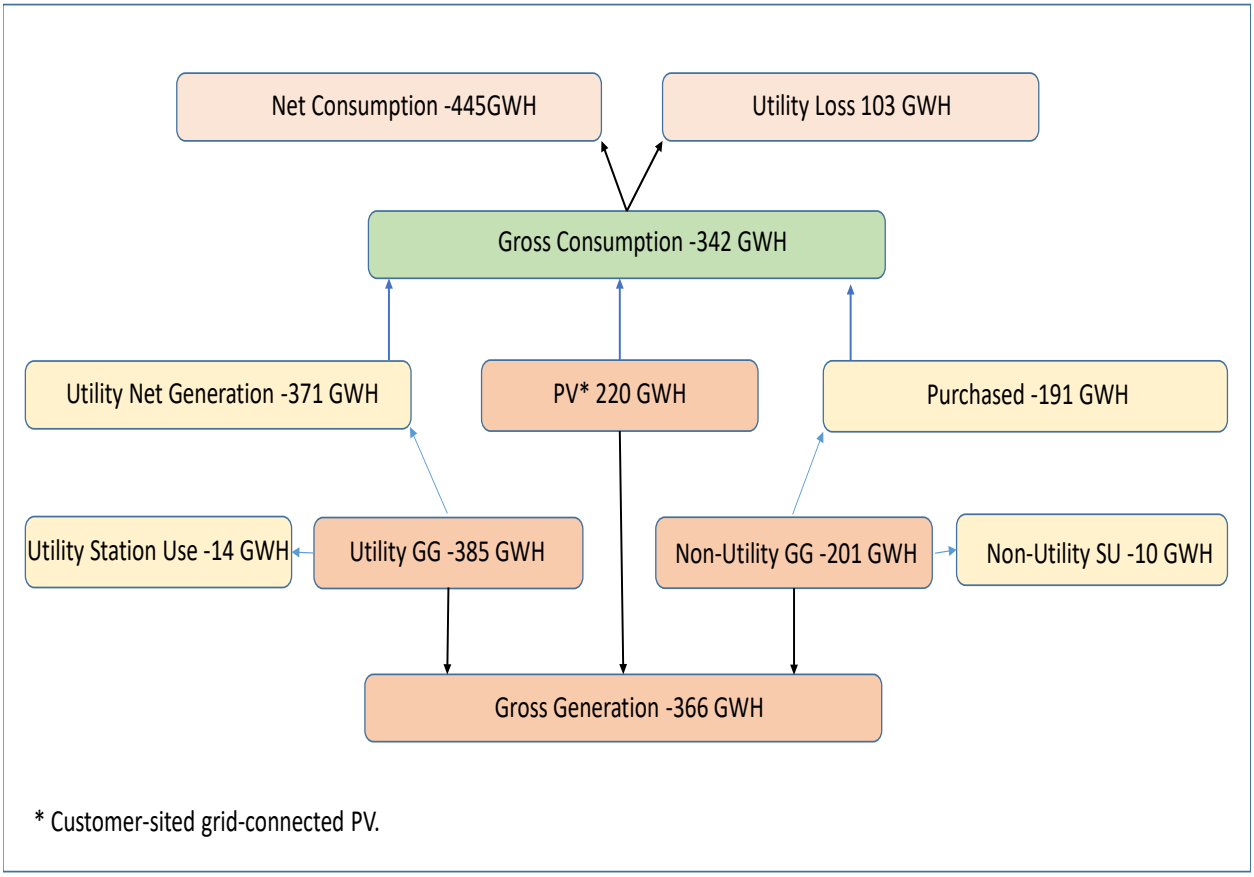
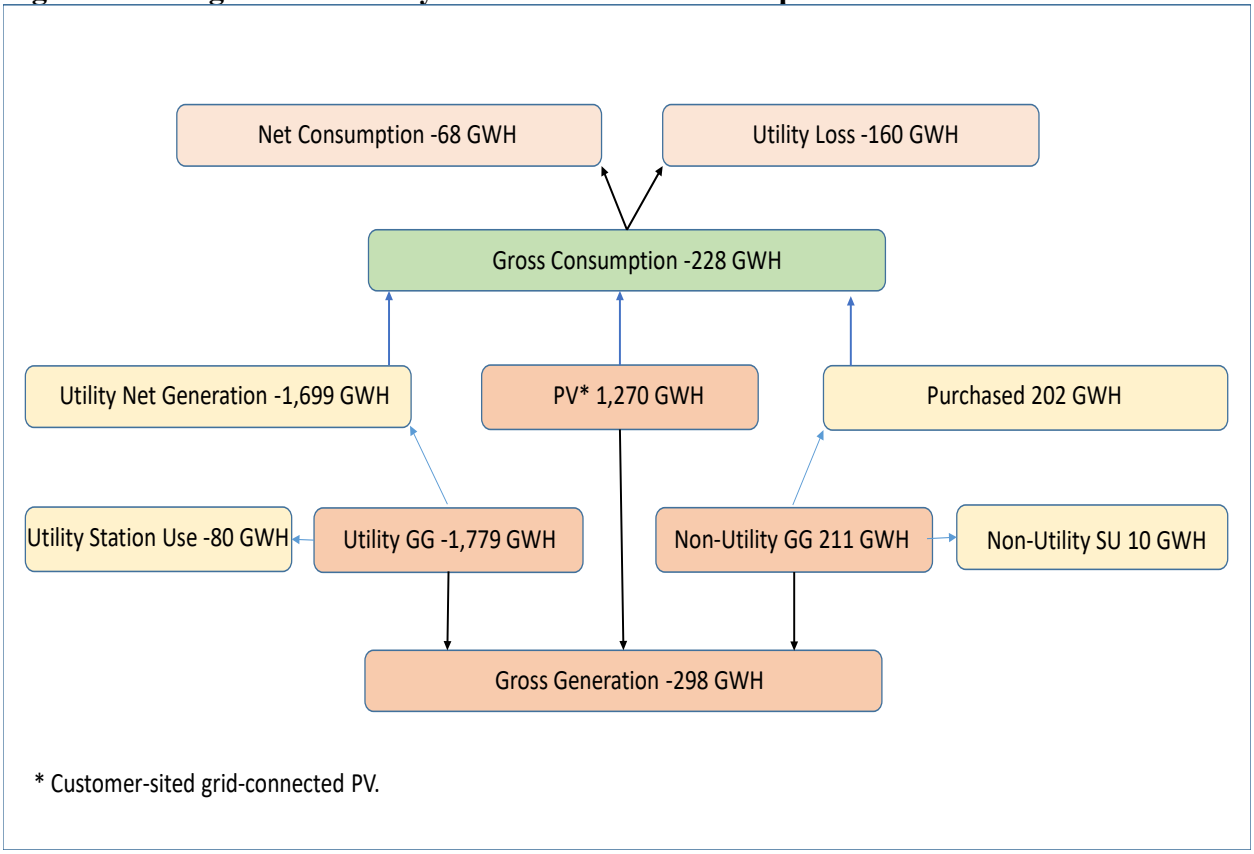


Figure 3 shows the changes in electricity production and consumption from 2005 to 2019. Over the past 14 years, gross generation in Hawaii decreased by 298 GWH, accounting for about 2.6 percent of gross generation in 2019. Utility gross generation decreased 1,779 GWH, gross generation of non-utility producers increased 211 GWH, and electricity generated by customers increased 1,270 GWH.

Since the decrease of utility net generation was more than the increase in purchased electricity and customer generated electricity, gross consumption decreased 228 GWH. Reduced utility loss led to a smaller reduction of net consumption. However, since customer generated electricity increased 1,270 GWH over this period, electricity sold by utilities decreased 1,338 GWH or 14.5 percent of utility sales in 2019.

Figure 3. Changes in Electricity Production and Consumption in Hawaii: 2005-2019



As shown in Table 2, the four electric utilities in Hawaii generated (including station use) about 5,530 GWH of electricity in 2019. From 2005 to 2019, total utility generation decreased 1,779 GWH or about 2.0 percent per year on average. In 2020, total utility generation was 5,145 GWH, decreased 385 GWH or 7.0 percent from the previous year.

Both total generation and station use decreased over time, but station use decreased less than that of the total generation on average. In 2019, station use for the state accounted for about 5.6 percent or 309 GWH of utility total generation. From 2005 to 2019, utility station use decreased 1.6 percent per year, which was less than the 2.0 percent decrease of total generation. As a result, the share of station use increased from 5.3 percent in 2005 to 5.6 percent in 2019. The share of station use was the highest at HECO, followed by HELCO, MECO, and KIUC. From 2005 to 2019, utility net generation decreased 2.0 percent per year on average, from 6,920 GWH in 2005 to 5,221 GWH in 2019. About 66.9 percent of Hawaii's utility net generation in 2019 was produced by HECO, 17.8 percent by MECO, 10.5 percent by HELCO, and 4.8 percent by KIUC.

Table 2. Hawaii Electricity Net Generation by Utility

		2005	2014	2015	2016	2017	2018	2019	2020	Avg. ann. Growth 2005 - 2019
Total utility generation										
State Total	GWh	7,309	5,840	5,799	5,544	5,486	5,588	5,530	5,145	-2.0%
HECO	GWh	5,021	3,970	3,977	3,714	3,677	3,743	3,726	3,489	-2.1%
HELCO	GWh	561	573	536	595	550	600	579	649	0.2%
MECO	GWh	1,279	903	917	927	956	932	971	783	-1.9%
KIUC	GWh	448	394	369	308	304	313	254	224	-4.0%
Utility station use										
State Total	GWh	389	327	317	305	303	318	309	295	-1.6%
HECO	GWh	300	247	243	229	226	239	232	225	-1.8%
HELCO	GWh	31	28	24	27	28	29	29	30	-0.4%
MECO	GWh	45	40	38	39	41	41	41	38	-0.6%
KIUC	GWh	13	12	12	9	9	9	6	3	-5.3%
Utility net generation										
State Total	GWh	6,920	5,513	5,482	5,239	5,183	5,270	5,221	4,850	-2.0%
HECO	GWh	4,721	3,723	3,734	3,485	3,451	3,504	3,494	3,264	-2.1%
HELCO	GWh	530	546	512	567	522	570	550	620	0.3%
MECO	GWh	1,234	863	878	888	915	892	929	745	-2.0%
KIUC	GWh	435	381	358	299	295	304	248	221	-3.9%
Utility share of net generation										
State Total	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
HECO	%	68.2%	67.5%	68.1%	66.5%	66.6%	66.5%	66.9%	67.3%	
HELCO	%	7.7%	9.9%	9.3%	10.8%	10.1%	10.8%	10.5%	12.8%	
MECO	%	17.8%	15.7%	16.0%	17.0%	17.7%	16.9%	17.8%	15.4%	
KIUC	%	6.3%	6.9%	6.5%	5.7%	5.7%	5.8%	4.8%	4.5%	
% of station use of utility generation										
State Total	%	5.3%	5.6%	5.5%	5.5%	5.5%	5.7%	5.6%	5.7%	
HECO	%	6.0%	6.2%	6.1%	6.2%	6.1%	6.4%	6.2%	6.4%	
HELCO	%	5.5%	4.8%	4.4%	4.6%	5.0%	4.9%	5.0%	4.5%	
MECO	%	3.5%	4.4%	4.2%	4.2%	4.3%	4.3%	4.3%	4.8%	
KIUC	%	2.9%	3.1%	3.2%	3.1%	3.0%	3.0%	2.4%	1.5%	

Source: Hawaii Electric Utility Monthly Financial Reports.

Table 3 shows that electricity purchased by the utilities increased from 4,202 GWH in 2005 to 4,404 GWH in 2019, an increase of 202 GWH. In comparison, net utility generation decreased 1,497 GWH during the same period. In 2020, electricity purchased decreased 191 GWH and net utility generation decreased 562 GWH over the previous year. Electricity purchased decreased from 2005 to 2011, increased from 2011 to 2016, and then decreased in 2017 and 2020. Electricity purchased plus utility net generation is defined as the electricity net to system. The share of purchased electricity, as a percentage of the total net to system, increased from 37.8 percent in 2005 to 46.5 percent in 2020.

Table 3. Hawaii Electricity Sales by Utility

		2005	2014	2015	2016	2017	2018	2019	2020	Avg. ann. Growth 2005 - 2019
Electricity purchased										
State Total	GWh	4,202	4,371	4,402	4,508	4,416	4,310	4,404	4,213	0.3%
HECO	GWh	3,383	3,379	3,352	3,478	3,403	3,304	3,340	3,209	-0.1%
HELCO	GWh	688	595	631	578	602	568	572	422	-1.3%
MECO	GWh	97	333	325	292	242	268	256	265	7.2%
KIUC	GWh	35	65	94	159	169	170	235	317	14.6%
Electricity net to system										
State Total	GWh	11,122	9,884	9,884	9,747	9,599	9,580	9,625	9,063	-1.0%
HECO	GWh	8,104	7,102	7,086	6,963	6,855	6,808	6,834	6,474	-1.2%
HELCO	GWh	1,217	1,140	1,143	1,146	1,124	1,138	1,122	1,042	-0.6%
MECO	GWh	1,331	1,196	1,203	1,181	1,157	1,160	1,185	1,010	-0.8%
KIUC	GWh	470	446	452	458	464	474	484	537	0.2%
Utility loss										
State Total	GWh	584	478	496	463	464	440	424	527	-2.3%
HECO	GWh	383	320	332	303	306	282	271	290	-2.4%
HELCO	GWh	101	78	79	78	77	74	73	64	-2.3%
MECO	GWh	79	64	66	63	62	61	58	51	-2.2%
KIUC	GWh	21	16	19	19	19	23	23	122	0.7%
Total electricity sold										
State Total	GWh	10,539	9,406	9,389	9,284	9,136	9,140	9,201	8,536	-1.0%
HECO	GWh	7,721	6,782	6,754	6,660	6,549	6,526	6,563	6,183	-1.2%
HELCO	GWh	1,116	1,063	1,065	1,067	1,047	1,064	1,050	978	-0.4%
MECO	GWh	1,252	1,132	1,138	1,118	1,095	1,099	1,127	959	-0.7%
KIUC	GWh	449	430	432	439	445	451	461	415	0.2%
Share of purchased of net to system										
State Total	%	37.8%	44.2%	44.5%	46.3%	46.0%	45.0%	45.8%	46.5%	
HECO	%	41.7%	47.6%	47.3%	50.0%	49.7%	48.5%	48.9%	49.6%	
HELCO	%	56.5%	52.1%	55.2%	50.5%	53.5%	49.9%	51.0%	40.5%	
MECO	%	7.3%	27.8%	27.0%	24.8%	20.9%	23.1%	21.6%	26.2%	
KIUC	%	7.4%	14.5%	20.8%	34.8%	36.5%	35.9%	48.7%	59.0%	
Share of loss of net to system										
State Total	%	5.2%	4.8%	5.0%	4.7%	4.8%	4.6%	4.4%	5.8%	
HECO	%	4.7%	4.5%	4.7%	4.3%	4.5%	4.1%	4.0%	4.5%	
HELCO	%	8.3%	6.8%	6.9%	6.8%	6.8%	6.5%	6.5%	6.1%	
MECO	%	5.9%	5.4%	5.5%	5.3%	5.4%	5.2%	4.9%	5.1%	
KIUC	%	4.5%	3.6%	4.3%	4.1%	4.0%	4.8%	4.8%	22.7%	

Source: Hawaii Electric Utility Monthly Financial Reports.

It is important to note that not all the electricity sent to the utility systems was sold to consumers; some electricity was lost during the process of transmission and distribution. In Hawaii, about 4.4 percent of the electricity sent to the system was lost in 2019. The percent of utility loss was highest in the HELCO system (6.5 percent), followed by MECO (4.9 percent), KIUC (4.8 percent), and HECO (4.0 percent). Total electricity sold is electricity net to system minus utility lost. From 2005 to 2019, total electricity sold decreased 1.0 percent per year on average from 10,539 GWH to 9,201 GWH. In 2020, total electricity sold decreased 7.2 percent from the previous year.

Table 4 shows that utility station use and loss decreased from 972 GWH in 2005 to 733 GWH in 2019, a decrease of 2.0 percent per year on average. The share of utility station usage and loss as a percentage of total utility generation and purchased electricity decreased from 8.4 percent in 2005 to 7.4 percent in 2019.

Table 4. Share of Utility Station Usage and Loss of Total Electricity Production

		2005	2014	2015	2016	2017	2018	2019	2020	Avg. ann. Growth 2005 - 2019
Total utility generation and purchased 1/										
State Total	GWh	11,511	10,211	10,201	10,052	9,902	9,897	9,934	9,358	-1.0%
HECO	GWh	8,404	7,349	7,328.963	7,192.29	7,080	7,046	7,066	6,698	-1.2%
HELCO	GWh	1,248	1,168	1,166.894	1,173.05	1,151	1,167	1,151	1,072	-0.6%
MECO	GWh	1,376	1,236	1,241.660	1,219.87	1,198	1,200	1,227	1,048	-0.8%
KIUC	GWh	482	458	463.469	467.25	473	483	490	541	0.1%
Station use and loss										
State Total	GWh	972	805	812	768	767	758	733	823	-2.0%
HECO	GWh	683	568	575	532	532	521	503	515	-2.2%
HELCO	GWh	132	105	102	106	104	103	102	93	-1.8%
MECO	GWh	124	104	104	102	103	101	100	89	-1.6%
KIUC	GWh	34	28	31	28	28	32	29	126	-1.1%
% of station use and loss										
State Total	%	8.4%	7.9%	8.0%	7.6%	7.7%	7.7%	7.4%	8.8%	
HECO	%	8.1%	7.7%	7.8%	7.4%	7.5%	7.4%	7.1%	7.7%	
HELCO	%	10.5%	9.0%	8.8%	9.0%	9.1%	8.9%	8.8%	8.7%	
MECO	%	9.0%	8.4%	8.4%	8.4%	8.6%	8.4%	8.1%	8.5%	
KIUC	%	7.0%	6.2%	6.8%	6.0%	5.9%	6.7%	5.9%	23.2%	

1/ Excluding station use of non-utility producers.

Source: Hawaii Electric Utility Monthly Financial Reports.

Data for the station use of non-utility producers is not available. If we assume that the station use's share of the non-utility producers as a percentage of purchased electricity is similar to that of the utility station use share of net generation, the share of total station use and loss in gross generation would be about 9.7 percent for 2019.

Hawaii's gross electricity generation of utility and non-utility electricity producers in 2019 was estimated to be about 10,188 GWH. In 2019, about 71.4 percent of the gross generation of electricity producers was produced by the HECO system (including both utility and non-utility producers). HELCO accounted for about 11.6 percent of gross generation, MECO about 12.1 percent, and KIUC about 4.9 percent. From 2005 to 2019, each respective counties' share of gross generation remained stable.

Table 5. Share of Total Station Usage and Loss of Total Electricity Production

		2005	2014	2015	2016	2017	2018	2019	2020	Avg. ann. Growth 2005 - 2019
Station use of non-utility										
State Total	GWh	244	256	249	258	254	255	254	243	0.3%
HECO	GWh	202	211	205	215	209	211	208	207	0.2%
HELCO	GWh	38	29	28	27	30	28	29	19	-1.9%
MECO	GWh	3	15	14	12	10	12	11	13	8.7%
KIUC	GWh	1	2	3	5	5	5	6	5	13.1%
Total gross generation 1/										
State Total	GWh	11,755	10,467	10,450	10,311	10,157	10,152	10,188	9,601	-1.0%
HECO	GWh	8,606	7,560	7,534	7,407	7,289	7,257	7,274	6,905	-1.2%
HELCO	GWh	1,286	1,197	1,195	1,200	1,182	1,195	1,180	1,091	-0.6%
MECO	GWh	1,379	1,251	1,255	1,232	1,208	1,212	1,238	1,061	-0.8%
KIUC	GWh	484	460	466	472	478	488	495	546	0.2%
Share of gross generation										
State Total	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
HECO	%	73.2%	72.2%	72.1%	71.8%	71.8%	71.5%	71.4%	71.9%	
HELCO	%	10.9%	11.4%	11.4%	11.6%	11.6%	11.8%	11.6%	11.4%	
MECO	%	11.7%	11.9%	12.0%	12.0%	11.9%	11.9%	12.1%	11.0%	
KIUC	%	4.1%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.7%	
Total station use and loss										
State Total	GWh	1,217	1,061	1,061	1,027	1,021	1,013	987	1,066	-1.5%
HECO	GWh	885	778	780	747	741	731	711	721	-1.5%
HELCO	GWh	169	134	130	132	135	131	130	112	-1.8%
MECO	GWh	127	119	118	114	114	113	110	102	-1.0%
KIUC	GWh	35	30	34	33	33	37	35	130	0.0%
% of station use and loss										
State Total	%	10.3%	10.1%	10.2%	10.0%	10.1%	10.0%	9.7%	11.1%	
HECO	%	10.3%	10.3%	10.3%	10.1%	10.2%	10.1%	9.8%	10.4%	
HELCO	%	13.2%	11.2%	10.9%	11.0%	11.4%	11.0%	11.1%	10.3%	
MECO	%	9.2%	9.5%	9.4%	9.3%	9.4%	9.3%	8.9%	9.6%	
KIUC	%	7.2%	6.6%	7.4%	7.0%	6.8%	7.6%	7.0%	23.9%	

1/ Including station use of non-utility producers. Estimated by DBEDT

Source: Hawaii Electric Utility Monthly Financial Reports.

3. Electricity Generation by Sources

Hawaii's electricity generation depends heavily on imported petroleum as the major fuel source. Before 1990, Hawaii's electricity was almost all generated from petroleum products. However, since 1990, electricity generated from waste, coal, wind, and geothermal energy became more significant. Nevertheless, petroleum remains the dominant fuel in Hawaii's electricity generation and is the primary driver for the changes of electricity prices in Hawaii.

Table 6. Electricity Net Generation by Source: Total Electric Power Industry

	Total Electricity Generation	% of Total Electricity Generation									
Year	GWH	Petroleum	Coal	Other Gases 1/	Biomass	Wood	Geothermal	Hydro	Wind	Solar 2/	Other
1990	9,703	90.0	0.0	0.2	8.7	-	-	0.8	0.3	-	-
1991	8,703	88.6	0.1	0.6	9.5	-	-	0.8	0.4	-	-
1992	9,844	84.7	5.7	0.6	8.2	0.0	0.0	0.6	0.2	-	-
1993	9,944	74.4	14.9	0.6	7.8	0.0	1.5	0.6	0.2	-	-
1994	10,109	75.6	13.1	0.7	7.2	0.0	1.8	1.4	0.2	-	-
1995	10,304	74.5	15.2	0.7	6.2	0.0	2.3	0.9	0.2	-	0.0
1996	10,628	74.9	15.5	0.6	5.6	0.0	2.3	1.0	0.2	-	-
1997	10,312	74.6	15.3	0.6	5.9	0.0	2.4	1.1	0.2	-	-
1998	10,228	76.8	14.0	0.6	4.9	-	2.3	1.2	0.2	-	-
1999	10,404	76.8	13.8	0.5	5.5	-	2.0	1.1	0.2	-	-
2000	10,593	76.0	14.9	0.4	5.1	-	2.5	1.0	0.2	-	-
2001	10,633	77.3	15.1	0.4	2.7	-	1.9	0.9	0.0	-	1.6
2002	11,663	81.2	13.3	0.3	2.5	-	0.6	0.8	0.0	-	1.2
2003	10,976	77.5	15.0	0.4	3.2	-	1.6	0.8	0.0	-	1.6
2004	11,410	78.4	14.1	0.4	2.9	-	1.9	0.8	0.1	-	1.5
2005	11,523	78.7	14.2	0.4	2.7	-	1.9	0.8	0.1	-	1.3
2006	11,559	78.3	13.4	0.4	2.8	-	1.8	1.0	0.7	-	1.5
2007	11,533	77.3	13.7	0.4	2.5	-	2.0	0.8	2.1	-	1.3
2008	11,376	76.2	14.5	0.3	2.7	-	2.1	0.7	2.1	0.0	1.4
2009	11,011	75.3	13.6	0.2	2.6	-	1.5	1.0	2.3	0.0	3.5
2010	10,836	74.6	14.3	0.2	2.6	0.0	1.9	0.6	2.4	0.0	3.4
2011	10,723	73.9	13.3	0.3	2.9	-	2.1	0.9	3.2	0.0	3.4
2012	10,469	71.5	14.7	0.4	2.7	-	2.5	1.1	3.6	0.0	3.5
2013	10,267	70.3	13.7	0.4	3.2	-	2.7	0.8	4.9	0.2	3.8
2014	10,204	67.9	14.8	0.6	3.3	-	2.5	0.9	5.7	0.4	4.0
2015	10,120	69.4	13.2	0.5	3.2	-	2.3	1.2	6.1	0.5	3.6
2016	9,949	66.7	15.1	0.5	3.6	-	2.6	0.9	6.4	0.9	3.2
2017	9,813	67.6	14.0	0.5	3.0	-	3.3	0.7	5.4	1.8	3.7
2018	9,797	68.9	13.4	0.6	3.1	-	1.1	1.0	6.1	1.9	3.9
2019	9,750	70.4	13.4	0.1	3.0	-	-	1.0	5.4	2.8	4.0

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

2/ Does not include customer-sited solar.

Source: Energy Information Administration, State Energy Data System

From 1990 to 2019, the share of petroleum generated electricity in Hawaii (including both utility and non-utility producers) decreased from 90.0 percent to 70.4 percent; the share of coal generated electricity increased from 0.0 percent to 13.4 percent; the share of wind generated electricity increased from 0.3 percent to 5.4 percent; and the share of biomass decreased from 8.7 percent to 3.0 percent (Table 6). In 2019, total renewable electricity (excluding customer-sited solar) accounted for about 16.2 percent of net electricity generation.

Most of the non-petroleum generated electricity was produced by non-utility producers. As shown in Table 7, almost all electricity generated from the utilities was from petroleum fuel. From 1990 to 2019, the petroleum generated electricity share of net utility generated electricity decreased only slightly from 99.6 percent to 94.7 percent. In 2019, only about 5.3 percent of electricity generated by the utilities was from renewable sources. Due to increased generation of non-utility producers and decreased generation of utilities, over the same period, the share of utility petroleum generated electricity of total petroleum generated electricity decreased from 91.2 percent to 72.4 percent.

Non-utility producers depend more on non-petroleum sources of energy to generate electricity, especially coal and wind. As shown in Table 8, from 1990 to 2019, the petroleum generated electricity share of non-utility generated electricity decreased from 45.0 percent to 42.1 percent; the share of coal generated electricity increased from 0.1 percent to 28.9 percent; the share of wind generated electricity increased from 1.7 percent to 11.8 percent; the share of solar generated electricity increased from 0.0 percent to 5.1 percent; and the share of biomass decreased from 48.9 percent to 5.2 percent.

The increased share of non-petroleum generated electricity, especially coal-fired electricity, kept the growth rate of purchased electricity costs low.

Table 7. Electricity Net Generation by Source: Electric Utilities

Year	Total Electricity Generation GWH	% of Total Electricity Generation									
		Petroleum	Coal	Other Gases 1/	Biomass	Wood	Geothermal	Hydro	Wind	Solar 2/	Other
1990	7,996	99.6	-	-	0.1	-	-	0.3	-	-	-
1991	7,333	99.7	-	-	-	-	-	0.3	-	-	-
1992	6,861	99.9	-	-	-	-	-	0.1	-	-	-
1993	6,084	99.8	-	-	-	-	-	0.2	-	-	-
1994	6,055	99.7	-	-	-	-	-	0.3	-	-	-
1995	6,191	99.7	-	-	-	-	-	0.3	-	-	-
1996	6,420	99.7	-	-	-	-	-	0.3	-	-	-
1997	6,213	99.7	-	-	-	-	-	0.3	-	-	-
1998	6,301	99.8	-	-	-	-	-	0.2	0.00	-	-
1999	6,452	99.6	-	-	-	-	-	0.3	0.06	-	-
2000	6,535	99.7	-	-	-	-	-	0.2	0.04	-	-
2001	6,383	99.7	-	-	-	-	-	0.3	0.03	-	-
2002	7,513	99.9	-	-	-	-	-	0.1	0.02	-	-
2003	6,493	99.9	-	-	-	-	-	0.0	0.02	-	-
2004	6,982	99.8	-	-	-	-	-	0.1	0.02	-	-
2005	6,915	99.8	-	-	-	-	-	0.1	0.02	-	-
2006	7,040	99.7	-	-	-	-	-	0.3	0.01	-	-
2007	6,928	99.8	-	-	-	-	-	0.2	0.01	-	-
2008	6,701	99.7	-	-	-	-	-	0.3	0.00	-	-
2009	6,510	96.2	-	-	0.1	-	-	0.4	0.00	-	3.3
2010	6,416	96.3	-	-	0.0	-	-	0.3	-	-	3.4
2011	6,376	95.8	-	-	0.6	-	-	0.3	-	-	3.3
2012	6,013	95.6	-	-	0.4	-	-	0.5	-	-	3.6
2013	5,748	95.6	-	-	0.5	-	-	0.3	-	-	3.6
2014	5,517	94.9	-	-	0.7	-	-	0.4	-	0.2	3.8
2015	5,492	94.9	-	-	1.0	-	-	0.4	-	0.5	3.3
2016	5,218	96.0	-	-	0.7	-	-	0.3	-	0.8	2.2
2017	5,223	94.5	-	-	1.1	-	-	0.2	-	0.8	3.4
2018	5,296	94.3	-	-	1.0	-	-	0.4	-	0.7	3.6
2019	5,252	94.7	-	-	1.1	-	-	0.2	-	0.8	3.3

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

2/ Does not include customer-sited solar.

Source: Energy Information Administration, State Energy Data System

Table 8. Electricity Net Generation by Source: IPP & CHP

Year	Total Electricity Generation GWH	% of Total Electricity Generation									
		Petroleum	Coal	Other Gases 1/	Biomass	Wood	Geothermal	Hydro	Wind	Solar 2/	Other
1990	1,707	45.0	0.1	0.9	48.9	-	-	3.3	1.7	-	-
1991	1,370	29.3	0.6	3.8	60.1	-	-	3.7	2.6	-	-
1992	2,983	49.7	18.7	2.1	27.0	0.0	0.1	1.7	0.8	-	-
1993	3,860	34.3	38.3	1.6	20.1	0.0	3.9	1.1	0.6	-	-
1994	4,054	39.6	32.7	1.6	18.0	0.0	4.6	3.0	0.5	-	-
1995	4,113	36.6	38.0	1.7	15.5	0.0	5.7	2.0	0.5	-	0.1
1996	4,208	37.1	39.0	1.4	14.1	0.0	5.8	2.0	0.5	-	-
1997	4,100	36.5	38.4	1.6	14.8	0.0	6.0	2.4	0.4	-	-
1998	3,927	39.8	36.5	1.5	12.8	-	6.0	2.7	0.5	-	-
1999	3,952	39.6	36.4	1.3	14.6	-	5.3	2.4	0.3	-	-
2000	4,059	37.8	38.9	1.0	13.3	-	6.5	2.2	0.4	-	-
2001	4,250	43.8	37.8	0.9	6.8	-	4.9	1.9	0.0	-	4.0
2002	4,150	47.3	37.2	1.0	7.1	-	1.8	2.1	0.0	-	3.5
2003	4,483	44.9	36.7	0.9	7.7	-	4.0	2.0	0.0	-	3.8
2004	4,428	44.6	36.2	1.1	7.4	-	4.8	1.9	0.1	-	3.9
2005	4,608	47.0	35.4	0.9	6.7	-	4.8	1.9	0.1	-	3.2
2006	4,519	45.1	34.3	0.9	7.2	-	4.7	2.1	1.7	-	3.9
2007	4,605	43.5	34.3	1.0	6.2	-	5.0	1.7	5.2	-	3.2
2008	4,676	42.5	35.2	0.8	6.5	-	5.0	1.4	5.1	0.0	3.4
2009	4,501	45.0	33.3	0.5	6.2	-	3.7	1.9	5.6	0.0	3.7
2010	4,420	43.2	35.0	0.5	6.4	0.0	4.5	1.2	5.9	0.0	3.3
2011	4,347	41.8	32.8	0.8	6.3	-	5.2	1.7	7.8	0.1	3.6
2012	4,457	39.0	34.5	1.1	5.8	-	5.9	1.9	8.5	0.1	3.3
2013	4,519	38.2	31.1	0.9	6.7	-	6.1	1.3	11.1	0.4	4.2
2014	4,687	36.1	32.2	1.3	6.3	-	5.4	1.5	12.3	0.6	4.1
2015	4,627	39.1	28.9	1.1	5.8	-	5.0	2.1	13.2	0.6	4.1
2016	4,731	34.5	31.7	1.1	6.8	-	5.5	1.6	13.5	0.9	4.4
2017	4,590	37.0	30.0	1.1	5.2	-	7.0	1.2	11.6	2.9	4.0
2018	4,501	39.0	29.1	1.2	5.6	-	2.4	1.7	13.4	3.3	4.3
2019	4,498	42.1	28.9	0.1	5.2	-	-	1.8	11.8	5.1	5.0

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

2/ Does not include customer-sited solar.

Source: Energy Information Administration, State Energy Data System

Based on the most recent data available from EIA, the generating capacity for Hawaii's total electric power industry increased from 1,976 MW in 1990 to 3,212 MW in 2019, an increase of 1.7 percent per year on average. Coal-fired capacity increased from 24 MW to 203 MW or 7.7 percent per year over the period, solar capacity increased from 0 MW to 268 MW, wind capacity increased from 23 MW to 206 MW or 7.8 percent per year on average, petroleum generation capacity increased from 1,692 MW to 2,182 MW or an average of 0.9 percent, and biomass capacity decreased from 211 MW to 167 MW or a 0.8 percent average per year (Table 9).

Table 9. Power Generating Capacity by Source: Total Electric Power Industry

	Power Generating Capacity Units: MW									
Year	Petroleum	Coal	Other Gases	Biomass	Geothermal	Hydro	Wind	Solar 1/	Other	Total
1990	1,692	24	9	211	-	18	23	-	-	1,976
1991	1,910	24	9	204	-	18	23	-	-	2,187
1992	1,947	228	9	230	30	18	23	-	-	2,484
1993	1,976	228	9	222	30	18	23	-	-	2,505
1994	1,976	228	9	206	30	28	23	-	-	2,498
1995	1,976	228	9	193	35	29	22	-	-	2,491
1996	1,984	228	9	193	35	29	22	-	-	2,500
1997	1,972	228	9	178	35	29	20	-	-	2,471
1998	1,997	228	9	164	35	29	20	-	-	2,482
1999	2,007	228	9	156	35	28	9	-	-	2,473
2000	2,091	228	9	155	35	27	12	-	-	2,556
2001	2,093	227	9	151	35	26	11	-	-	2,552
2002	2,093	227	9	110	35	25	11	-	-	2,509
2003	2,089	227	9	114	35	23	11	-	-	2,508
2004	2,178	203	9	114	35	23	11	-	-	2,573
2005	2,192	203	9	114	35	25	11	-	-	2,589
2006	2,220	203	9	114	35	25	43	-	-	2,648
2007	2,224	203	9	114	35	25	64	-	-	2,674
2008	2,224	203	9	114	35	25	64	1	-	2,675
2009	2,242	203	9	227	35	25	64	1	-	2,805
2010	2,214	203	9	227	35	25	62	2	-	2,776
2011	2,214	203	12	227	35	25	92	2	-	2,810
2012	2,181	203	6	227	51	26	206	7	75	2,982
2013	2,181	203	6	260	51	26	206	15	60	3,008
2014	2,077	203	6	256	51	26	206	32	60	2,917
2015	2,060	203	9	256	51	26	206	44	66	2,921
2016	2,063	203	6	220	51	27	206	51	68	2,893
2017	2,063	203	6	230	51	27	206	98	84	2,967
2018	2,063	203	6	280	51	27	206	124	102	3,061
2019	2,182	203	-	167	51	34	206	268	102	3,212

1/ Does not include customer-sited solar.

Source: Energy Information Administration, State Energy Data System

Table 10 shows that the generating capacity of the utilities increased from 1,542 MW in 1990 to 1,939 MW in 2019, an increase of 0.8 percent per year on average. The generating capacity added by the utilities from 1990 to 2019 was mainly petroleum, biomass, solar, and other capacity.

Table 10. Power Generating Capacity by Source: Electric Utilities

	Power Generating Capacity Units: MW									
Year	Petroleum	Coal	Other Gases	Biomass	Geothermal	Hydro	Wind	Solar 1/	Other	Total
1990	1,538	-	-	-	-	3	-	-	-	1,542
1991	1,574	-	-	-	-	3	-	-	-	1,577
1992	1,617	-	-	-	-	3	-	-	-	1,621
1993	1,655	-	-	-	-	3	-	-	-	1,659
1994	1,655	-	-	-	-	3	-	-	-	1,659
1995	1,655	-	-	-	-	3	-	-	-	1,659
1996	1,664	-	-	-	-	3	-	-	-	1,667
1997	1,652	-	-	-	-	3	-	-	-	1,655
1998	1,677	-	-	-	-	3	-	-	-	1,680
1999	1,687	-	-	-	-	3	-	-	-	1,690
2000	1,705	-	-	-	-	3	2	-	-	1,711
2001	1,703	-	-	-	-	3	2	-	-	1,708
2002	1,702	-	-	-	-	2	2	-	-	1,706
2003	1,702	-	-	-	-	2	2	-	-	1,706
2004	1,791	-	-	-	-	2	2	-	-	1,795
2005	1,806	-	-	-	-	4	2	-	-	1,812
2006	1,833	-	-	-	-	4	2	-	-	1,840
2007	1,838	-	-	-	-	4	2	-	-	1,845
2008	1,838	-	-	-	-	4	2	-	-	1,845
2009	1,856	-	-	113	-	4	2	-	-	1,976
2010	1,827	-	-	113	-	4	-	-	-	1,945
2011	1,827	-	-	113	-	4	-	-	-	1,945
2012	1,788	-	-	113	-	4	-	-	39	1,945
2013	1,788	-	-	113	-	4	-	-	39	1,945
2014	1,684	-	-	113	-	4	-	12	39	1,852
2015	1,669	-	-	113	-	4	-	24	45	1,855
2016	1,669	-	-	113	-	4	-	24	47	1,857
2017	1,669	-	-	123	-	4	-	24	50	1,870
2018	1,669	-	-	173	-	4	-	24	48	1,919
2019	1,782	-	-	60	-	4	-	44	48	1,939

1/ Does not include customer-sited solar.
Source: Energy Information Administration, State Energy Data System

Table 11 shows that the generating capacity of the non-utility producers in Hawaii increased from 435 MW in 1990 to 1,274 MW in 2019, an increase of 3.8 percent per year on average. The growth rate of wind capacity was the highest during this period at 7.8 percent on average per year. Wind was followed by coal-fired capacity at 7.0 percent per year and petroleum capacity at 3.3 percent per year. Geothermal capacity increased from zero to 51 MW, but the biomass capacity decreased from 211 MW to 107 MW over the period. The figures do not include electricity generation from the customer-sited solar systems.

Table 11. Power Generating Capacity by Source: IPP and CHP

	Power Generating Capacity Units: MW									
Year	Petroleum	Coal	Other Gases	Biomass	Geothermal	Hydro	Wind	Solar 1/	Other	Total
1990	154	24	9	211	-	15	23	-	-	435
1991	337	24	9	204	-	15	23	-	-	610
1992	329	228	9	230	30	15	23	-	-	863
1993	320	228	9	222	30	15	23	-	-	846
1994	320	228	9	206	30	24	23	-	-	839
1995	320	228	9	193	35	26	22	-	-	832
1996	320	228	9	193	35	26	22	-	-	833
1997	320	228	9	178	35	26	20	-	-	816
1998	320	228	9	164	35	26	20	-	-	802
1999	320	228	9	156	35	25	9	-	-	782
2000	386	228	9	155	35	24	10	-	-	845
2001	390	227	9	151	35	23	9	-	-	844
2002	391	227	9	110	35	23	9	-	-	803
2003	387	227	9	114	35	21	9	-	-	802
2004	387	203	9	114	35	21	9	-	-	778
2005	386	203	9	114	35	21	9	-	-	777
2006	387	203	9	114	35	21	41	-	-	808
2007	386	203	9	114	35	21	62	-	-	829
2008	386	203	9	114	35	21	62	1	-	830
2009	386	203	9	114	35	21	62	1	-	829
2010	387	203	9	114	35	21	62	2	-	831
2011	386	203	12	114	35	21	92	2	-	865
2012	393	203	6	114	51	22	206	7	36	1,037
2013	393	203	6	147	51	22	206	15	21	1,064
2014	393	203	6	143	51	22	206	20	21	1,065
2015	391	203	9	143	51	22	206	20	21	1,066
2016	394	203	6	107	51	23	206	27	21	1,037
2017	394	203	6	107	51	23	206	74	34	1,097
2018	394	203	6	107	51	23	206	100	54	1,143
2019	400	203	-	107	51	30	206	224	54	1,274

1/ Does not include customer-sited solar.

Source: Energy Information Administration, State Energy Data System

The detailed power generating capacity by county in 2020 (2019 for Kauai) is provided in Table 12. Currently, the state of Hawaii has about 2,397.9 MW firm capacity (guaranteed available at a given time); 1,794.5 MW in Honolulu, 213.3 MW in Hawaii County, 273.1 MW in Maui County, and 117.0 MW in Kauai County. About 87.2 percent of the firm capacity use petroleum, 7.5 percent use coal, and 5.3 percent use biofuel or waste.

The state also installed about 553.9 MW non-firm capacity, mostly by non-utility producers; 339.3 MW in Honolulu, 47.6 MW in Hawaii County, 79.0 MW in Maui County, and 87.6 MW in Kauai County. Solar accounted for about 46.9 percent of the non-firm capacity; followed by wind at 40.8 percent, hydro at 5.9 percent, and petroleum at 5.1 percent. In addition, about 772.4 MW customer-sited solar was installed in Hawaii; 513.0 MW in Honolulu, 107.0 MW in Hawaii County, 120.2 MW in Maui County, and 32.2 MW in Kauai County.

Table 12. Power Generating Capacity by Source in 2020

	Petroleum	Coal	Other Gases	Biofuel Waste	Geothermal	Hydro	Wind	Solar	Total
State Total MW With Customer-Sited Solar	2,119.5	180.0	-	133.2	-	32.9	226.0	1,032.2	3,723.8
State Total MW W/O Customer-Sited Solar	2,119.5	180.0	-	133.2	-	32.9	226.0	259.8	2,951.4
State Total Firm MW	2,091.4	180.0	-	126.5	-	-	-	-	2,397.9
State Total Non-Firm MW	28.1	-	-	6.7	-	32.9	226.0	259.8	553.5
State Total Customer-Sited Solar								772.4	772.4
State Total MW W/O Customer-Sited Solar	2,119.5	180.0	-	133.2	-	32.9	226.0	259.8	2,951.4
Honolulu	1,516.1	180.0	-	126.5	-	-	123.0	188.2	2,133.8
Hawaii	213.3	-	-	-	-	16.6	31.0	-	260.9
Maui	273.1	-	-	-	-	-	72.0	7.0	352.1
Kauai 1/	117.0	-	-	6.7	-	16.3	-	64.6	204.6
State Total Firm MW	2,091.4	180.0	-	126.5	-	-	-	-	2,397.9
Honolulu	1,488.0	180.0	-	126.5	-	-	-	-	1,794.5
Hawaii	213.3	-	-	-	-	-	-	-	213.3
Maui	273.1	-	-	-	-	-	-	-	273.1
Kauai	117.0	-	-	-	-	-	-	-	117.0
State Total Non-Firm MW	28.1	-	-	6.7	-	32.9	226.0	259.8	553.5
Honolulu	28.1	-	-	-	-	-	123.0	188.2	339.3
Hawaii	-	-	-	-	-	16.6	31.0	-	47.6
Maui	-	-	-	-	-	-	72.0	7.0	79.0
Kauai	-	-	-	6.7	-	16.3	-	64.6	87.6
State Total Customer-Sited Solar	-	-	-	-	-	-	-	772.4	772.4
Honolulu	-	-	-	-	-	-	-	513.0	513.0
Hawaii	-	-	-	-	-	-	-	107.0	107.0
Maui	-	-	-	-	-	-	-	120.2	120.2
Kauai	-	-	-	-	-	-	-	32.2	32.2

Source: Power Facts provided by HECO and KIUC.

1/ Kauai capacity from Annual Report 2019.

The generating units in the electric power industry have multiple functions. Some generating units are used to serve base load needs, while others are used to serve peak loads. Units serving the base load needs have more average operating hours per year, and the average cost per kWh is normally lower than the average cost of the units serving peak loads. Based on the EIA data of electricity generation and capacity, the average annual operating hours can be calculated.

Table 13. Average Operating Hours: Total Electric Power Industry

	Average Operating Hours Units: Hours/Year									
Year	Petroleum	Coal	Other Gases	Biomass	Geothermal	Hydro	Wind	Solar 1/	Other	Total
1990	5,163	100	1,796	3,990	-	4,418	1,245	-	-	4,909
1991	4,038	320	5,720	4,044	-	3,944	1,580	-	-	3,979
1992	4,281	2,443	6,933	3,508	71	3,396	1,006	-	-	3,964
1993	3,743	6,493	7,008	3,500	5,075	3,125	973	-	-	3,970
1994	3,868	5,824	7,302	3,553	6,177	5,052	902	-	-	4,047
1995	3,887	6,853	7,701	3,308	6,701	3,384	932	-	-	4,136
1996	4,014	7,213	6,707	3,066	6,914	3,600	1,023	-	-	4,252
1997	3,899	6,913	7,265	3,403	7,011	3,950	792	-	-	4,173
1998	3,931	6,299	6,716	3,073	6,774	4,196	952	-	-	4,121
1999	3,983	6,322	5,501	3,696	6,024	4,046	1,783	-	-	4,208
2000	3,851	6,924	4,686	3,473	7,487	3,832	1,417	-	-	4,145
2001	3,929	7,069	4,206	1,905	5,903	3,875	193	-	-	4,167
2002	4,523	6,810	4,535	2,696	2,079	3,803	147	-	-	4,648
2003	4,070	7,243	4,472	3,045	5,094	3,935	143	-	-	4,377
2004	4,107	7,900	5,323	2,884	6,094	4,083	681	-	-	4,435
2005	4,137	8,034	4,570	2,717	6,331	3,848	603	-	-	4,451
2006	4,079	7,629	4,751	2,857	6,065	4,803	1,853	-	-	4,365
2007	4,008	7,778	5,025	2,502	6,568	3,694	3,722	-	-	4,313
2008	3,898	8,116	4,286	2,653	6,695	3,374	3,750	18	-	4,253
2009	3,697	7,390	2,483	1,253	4,788	4,506	3,929	1,390	-	3,925
2010	3,653	7,613	2,435	1,249	5,731	2,817	4,212	885	-	3,903
2011	3,579	7,015	2,889	1,378	6,397	3,741	3,721	1,633	-	3,817
2012	3,431	7,573	7,839	1,239	5,118	4,373	1,840	640	4,830	3,511
2013	3,312	6,915	6,888	1,265	5,389	2,988	2,448	1,281	6,555	3,413
2014	3,335	7,444	10,367	1,303	4,977	3,591	2,814	1,219	6,739	3,498
2015	3,410	6,588	5,573	1,252	4,516	4,625	2,980	1,231	5,585	3,464
2016	3,220	7,376	8,501	1,637	5,100	3,352	3,109	1,746	4,765	3,439
2017	3,216	6,777	8,670	1,275	6,325	2,438	2,588	1,780	4,344	3,308
2018	3,272	6,459	9,287	1,091	2,159	3,562	2,928	1,487	3,744	3,200
2019	3,147	6,414	NA	1,746	-	2,814	2,574	999	3,866	3,035

1/ Does not include customer-sited solar.

Source: Energy Information Administration, State Energy Data System

As shown in Table 13, in 2019, for the total electric power industry, coal-fired units had the highest average annual operating hours, followed by other units, and hydro units. Petroleum units have average annual operating hours of 3,147 hours, similar to the average annual operating hours of all units at 3,035 hours. Biomass units have relatively low average operating hours because the biodiesel units at HECO are used to serve peak loads. The low average operating hours of solar units is due to the lower daily solar generating window.

Table 14. Average Operating Hours: Electric Utilities

	Average Operating Hours Units: Hours/Year									
Year	Petroleum	Coal	Other Gases	Biomass	Geothermal	Hydro	Wind	Solar 1/	Other	Total
1990	5,180	-	-	-	-	6,789	-	-	-	5,187
1991	4,647	-	-	-	-	6,090	-	-	-	4,650
1992	4,236	-	-	-	-	2,932	-	-	-	4,233
1993	3,667	-	-	-	-	4,105	-	-	-	3,668
1994	3,646	-	-	-	-	5,613	-	-	-	3,650
1995	3,730	-	-	-	-	4,763	-	-	-	3,732
1996	3,848	-	-	-	-	5,333	-	-	-	3,851
1997	3,749	-	-	-	-	5,609	-	-	-	3,753
1998	3,749	-	-	-	-	4,104	-	-	-	3,750
1999	3,811	-	-	-	-	5,625	-	-	-	3,817
2000	3,822	-	-	-	-	5,038	1,325	-	-	3,819
2001	3,736	-	-	-	-	6,044	1,055	-	-	3,737
2002	4,408	-	-	-	-	4,267	803	-	-	4,404
2003	3,813	-	-	-	-	1,039	781	-	-	3,806
2004	3,892	-	-	-	-	4,862	743	-	-	3,890
2005	3,823	-	-	-	-	2,292	849	-	-	3,816
2006	3,828	-	-	-	-	5,914	420	-	-	3,826
2007	3,761	-	-	-	-	3,682	219	-	-	3,755
2008	3,636	-	-	-	-	4,468	86	-	-	3,632
2009	3,374	-	-	29	-	7,152	43	-	-	3,294
2010	3,382	-	-	14	-	4,180	-	-	-	3,299
2011	3,342	-	-	343	-	4,878	-	-	-	3,279
2012	3,213	-	-	191	-	7,059	-	-	5,519	3,092
2013	3,073	-	-	252	-	4,625	-	-	5,254	2,956
2014	3,110	-	-	324	-	5,742	-	868	5,389	2,979
2015	3,124	-	-	464	-	5,301	-	1,039	3,982	2,961
2016	3,000	-	-	332	-	4,108	-	1,820	2,423	2,811
2017	2,957	-	-	446	-	2,387	-	1,806	3,632	2,793
2018	2,993	-	-	307	-	4,790	-	1,573	3,948	2,761
2019	2,790	-	-	941	-	2,797	-	915	3,556	2,709

1/ Does not include customer-sited solar.

Source: Energy Information Administration, State Energy Data System

Table 14 and Table 15 compare the average operating hours of utility generating units and non-utility generating units. For all generating units, the average operating hours of utility-based units decreased from 5,187 hours per year in 1990 to 2,709 hours per year in 2019, a decrease of 2.2 percent per year on average. In contrast, the average operating hours of non-utility units decreased from 3,925 hours per year in 1990 to 3,532 hours per year in 2019, a decrease of 0.4 percent per year on average.

Table 15. Average Operating Hours: IPP and CHP

	Average Operating Hours Units: Hours/Year									
Year	Petroleum	Coal	Other Gases	Biomass	Geothermal	Hydro	Wind	Solar 1/	Other	Total
1990	5,000	100	1,796	3,962	-	3,875	1,245	-	-	3,925
1991	1,193	320	5,720	4,044	-	3,453	1,580	-	-	2,245
1992	4,503	2,443	6,933	3,508	71	3,502	1,006	-	-	3,458
1993	4,134	6,493	7,008	3,500	5,075	2,900	973	-	-	4,561
1994	5,011	5,824	7,302	3,553	6,177	4,974	902	-	-	4,830
1995	4,697	6,853	7,701	3,308	6,701	3,204	932	-	-	4,941
1996	4,874	7,213	6,707	3,066	6,914	3,372	1,023	-	-	5,054
1997	4,669	6,913	7,265	3,403	7,011	3,735	792	-	-	5,023
1998	4,884	6,299	6,716	3,073	6,774	4,208	937	-	-	4,897
1999	4,890	6,322	5,501	3,696	6,024	3,835	1,373	-	-	5,051
2000	3,976	6,924	4,686	3,473	7,487	3,681	1,435	-	-	4,803
2001	4,772	7,069	4,206	1,905	5,903	3,592	1	-	-	5,036
2002	5,023	6,810	4,535	2,696	2,079	3,762	1	-	-	5,168
2003	5,202	7,243	4,472	3,045	5,094	4,211	1	-	-	5,590
2004	5,099	7,900	5,323	2,884	6,094	4,008	668	-	-	5,691
2005	5,604	8,034	4,570	2,717	6,331	4,144	548	-	-	5,930
2006	5,267	7,629	4,751	2,857	6,065	4,592	1,923	-	-	5,592
2007	5,184	7,778	5,025	2,502	6,568	3,696	3,835	-	-	5,555
2008	5,149	8,116	4,286	2,653	6,695	3,165	3,869	18	-	5,633
2009	5,251	7,390	2,483	2,466	4,788	4,002	4,054	1,390	-	5,429
2010	4,932	7,613	2,435	2,472	5,731	2,557	4,212	885	-	5,319
2011	4,703	7,015	2,889	2,407	6,397	3,516	3,721	1,633	-	5,025
2012	4,423	7,573	7,839	2,279	5,118	3,875	1,840	640	4,081	4,296
2013	4,400	6,915	6,888	2,041	5,389	2,685	2,448	1,281	8,977	4,247
2014	4,304	7,444	10,367	2,074	4,977	3,192	2,814	1,428	9,253	4,401
2015	4,633	6,588	5,573	1,873	4,516	4,499	2,980	1,458	9,027	4,341
2016	4,149	7,376	8,501	3,020	5,100	3,218	3,109	1,680	9,962	4,564
2017	4,317	6,777	8,670	2,232	6,325	2,447	2,588	1,772	5,382	4,184
2018	4,455	6,459	9,287	2,366	2,159	3,343	2,928	1,467	3,563	3,938
2019	4,735	6,414	NA	2,202	-	2,816	2,574	1,015	4,142	3,532

1/ Does not include customer-sited solar.

Source: Energy Information Administration, State Energy Data System

For petroleum generating capacity, the average operating hours of utility-based units decreased from 5,180 hours per year in 1990 to 2,790 hours per year in 2019, an average decrease of 2.1 percent per year. The average operating hours of non-utility units decreased from 5,000 hours per year in 1990 to 4,735 hours per year in 2019, an average decrease of 0.2 percent per year.

Table 16. Fossil Fuel Consumption: Total Electric Power Industry

	Consumption			Consumption Per MWH		
Year	Petroleum BBL	Coal ST	Other Gases Billion BTU	Petroleum BBL	Coal ST	Other Gases Billion BTU
1990	16,033,262	2,013	211	1.84	0.85	0.01
1993	12,605,395	603,669	1,044	1.70	0.41	0.02
1994	12,933,103	596,431	913	1.69	0.45	0.01
1995	13,034,983	688,499	663	1.70	0.44	0.01
1996	13,451,479	742,026	1,027	1.69	0.45	0.02
1997	13,226,872	754,453	622	1.72	0.48	0.01
1998	13,262,910	638,057	811	1.69	0.44	0.01
1999	13,544,370	646,215	447	1.69	0.45	0.01
2000	13,754,387	691,513	388	1.71	0.44	0.01
2001	13,661,310	717,290	315	1.66	0.45	0.01
2002	15,661,770	706,734	325	1.65	0.46	0.01
2003	13,133,452	751,987	361	1.54	0.46	0.01
2004	13,995,473	702,545	269	1.56	0.44	0.01
2005	14,131,327	703,865	231	1.56	0.43	0.01
2006	14,211,287	674,909	240	1.57	0.44	0.01
2007	13,943,232	689,627	254	1.56	0.44	0.01
2008	13,407,277	746,642	213	1.55	0.45	0.01
2009	12,739,777	663,171	126	1.54	0.44	0.01
2010	12,334,599	733,480	123	1.53	0.47	0.01
2011	12,089,799	709,440	198	1.53	0.50	0.01
2012	11,199,945	756,726	265	1.50	0.49	0.01
2013	10,765,251	701,013	228	1.49	0.50	0.01
2014	10,388,099	743,893	350	1.50	0.49	0.01
2015	10,510,012	653,257	276	1.50	0.49	0.01
2016	10,796,701	779,186	242	1.63	0.52	0.00
2017	10,859,057	759,018	247	1.64	0.55	0.00
2018	11,097,703	734,351	264	1.64	0.56	0.00
2019	11,451,266	716,842	27	1.67	0.55	0.00

Source: Energy Information Administration, State Energy Data System

Fossil fuels used to generate electricity in Hawaii consist mainly of petroleum and coal. As shown in Table 16, for the whole electric power industry, total petroleum used for electricity generation decreased from about 16.0 million barrels (BBLs) in 1990 to 11.5 million BBLs in 2019, an average decrease of 1.2 percent per year. Decreased petroleum consumption for electricity generation was due to both a reduction in electricity generated by petroleum and a reduction in petroleum consumption per kWh of electricity generated. From 1990 to 2019, total electricity generated by petroleum decreased an average of 0.8 percent per year and petroleum consumption per MWH of electricity decreased 0.3 percent per year, from 1.84 BBL per MWH in 1990 to 1.67 BBL per MWH in 2019.

Coal used for electricity generation in Hawaii was very limited before 1993. From 1993 to 2019, total coal used for electricity generation increased from 603,669 short tons (STs) to 716,842 STs, an average increase of 0.7 percent per year. During this period, total coal generated electricity decreased 0.5 percent per year, and coal consumption per MWH generated increased 1.2 percent per year on average, from 0.41 ST per MWH to 0.55 ST per MWH.

The utilities accounted for about 76.8 percent of the petroleum used to generate electricity in Hawaii. As shown in Table 17, petroleum consumption per MWH was stable over the period analyzed for utility units. From 1990 to 2019, petroleum consumption per MWH remained about the same.

The non-utility petroleum units are more energy efficient than the utility units. In addition, the energy efficiency of non-utility units improved over time. From 1990 to 2019, petroleum consumption per MWH for non-utility petroleum units decreased an average of 2.5 percent per year from 2.95 BBL to 1.40 BBL. In 2019, the petroleum consumption per MWH for non-utility producers was only about 79 percent of the per MWH petroleum consumption by utility producers.

Table 17. Fossil Fuel Consumption: Electric Utility

	Consumption			Consumption Per MWH		
Year	Petroleum BBL	Coal ST	Other Gases Billion BTU	Petroleum BBL	Coal ST	Other Gases Billion BTU
1990	13,769,448	-	-	1.73	-	-
1995	10,712,608	-	-	1.73	-	-
1996	10,980,227	-	-	1.72	-	-
1997	10,792,923	-	-	1.74	-	-
1998	10,864,385	-	-	1.73	-	-
1999	11,195,221	-	-	1.74	-	-
2000	11,439,206	-	-	1.76	-	-
2001	11,055,880	-	-	1.74	-	-
2002	12,825,449	-	-	1.71	-	-
2003	11,099,634	-	-	1.71	-	-
2004	12,046,236	-	-	1.73	-	-
2005	12,039,252	-	-	1.74	-	-
2006	12,238,861	-	-	1.74	-	-
2007	12,027,927	-	-	1.74	-	-
2008	11,516,852	-	-	1.72	-	-
2009	10,859,417	-	-	1.73	-	-
2010	10,601,260	-	-	1.72	-	-
2011	10,471,897	-	-	1.71	-	-
2012	9,646,276	-	-	1.68	-	-
2013	9,267,226	-	-	1.69	-	-
2014	8,892,659	-	-	1.70	-	-
2015	8,877,217	-	-	1.70	-	-
2016	8,586,750	-	-	1.71	-	-
2017	8,558,609	-	-	1.73	-	-
2018	8,697,951	-	-	1.74	-	-
2019	8,796,675	-	-	1.77	-	-

Source: Energy Information Administration, State Energy Data System

Table 18. Fossil Fuel Consumption: IPP and CHP

	Consumption			Consumption Per MWH		
Year	Petroleum BBL	Coal ST	Other Gases Billion BTU	Petroleum BBL	Coal ST	Other Gases Billion BTU
1990	2,263,814	2,013	211	2.95	0.85	0.01
1993	1,949,294	603,669	1,044	1.47	0.41	0.02
1994	2,524,020	596,431	913	1.57	0.45	0.01
1995	2,322,375	688,499	663	1.54	0.44	0.01
1996	2,471,252	742,026	1,027	1.58	0.45	0.02
1997	2,433,949	754,453	622	1.63	0.48	0.01
1998	2,398,525	638,057	811	1.53	0.44	0.01
1999	2,349,149	646,215	447	1.50	0.45	0.01
2000	2,315,181	691,513	388	1.51	0.44	0.01
2001	2,605,430	717,290	315	1.40	0.45	0.01
2002	2,836,321	706,734	325	1.44	0.46	0.01
2003	2,033,818	751,987	361	1.01	0.46	0.01
2004	1,949,237	702,545	269	0.99	0.44	0.01
2005	2,092,075	703,865	231	0.97	0.43	0.01
2006	1,972,426	674,909	240	0.97	0.44	0.01
2007	1,915,305	689,627	254	0.96	0.44	0.01
2008	1,890,425	746,642	213	0.95	0.45	0.01
2009	1,880,360	663,171	126	0.93	0.44	0.01
2010	1,733,339	733,480	123	0.91	0.47	0.01
2011	1,617,902	709,440	198	0.89	0.50	0.01
2012	1,553,669	756,726	265	0.89	0.49	0.01
2013	1,498,025	701,013	228	0.87	0.50	0.01
2014	1,495,440	743,893	350	0.89	0.49	0.01
2015	1,632,795	653,257	276	0.90	0.49	0.01
2016	2,209,951	779,186	242	1.35	0.52	0.00
2017	2,300,448	759,018	247	1.35	0.55	0.00
2018	2,399,752	734,351	264	1.37	0.56	0.00
2019	2,654,591	716,842	27	1.40	0.55	0.00

Source: Energy Information Administration, State Energy Data System

Fuel consumption data provided by the EIA is only available at the state level. Conversely, data available from the utility MFR includes fuel consumption by individual utility producers, and the average price of fuel data is also available. The fuel cost of non-utility producers, however, is not available in the utility MFR.

As shown in Table 19, from 2005 to 2019, total petroleum consumption by the four electric utilities in Hawaii decreased an average 1.9 percent per year from about 12.0 million BBLs to about 9.2 million BBLs; fuel oil consumption decreased an average 2.4 percent per year from 9.1 million BBLs to 6.5 million BBLs; diesel oil consumption decreased an average 0.6 percent per year, from 2.9 million BBLs to 2.7 million BBLs. In 2020, petroleum consumption by the utilities decreased 7.6 percent from the previous year; fuel oil decreased 6.3 percent, while diesel decreased 11.4 percent.

Table 19. Hawaii Utility Fuel Consumption

		2005	2012	2015	2016	2017	2018	2019	2020	Growth 2020	Avg. ann. Growth 2005 - 2019
Petroleum											
State Total	BBL	12,046,758	10,101,880	9,389,734	9,019,130	9,049,319	9,177,944	9,203,662	8,500,645	-7.6%	-1.9%
HECO	BBL	7,993,010	6,793,695	6,374,751	5,952,009	6,006,645	6,081,565	6,105,873	5,705,353	-6.6%	-1.9%
HELCO	BBL	1,136,268	904,034	909,157	1,034,292	939,346	1,010,891	1,031,821	1,142,285	10.7%	-0.7%
MECO	BBL	2,170,554	1,697,767	1,477,603	1,515,071	1,600,110	1,560,142	1,633,411	1,331,946	-18.5%	-2.0%
KIUC	BBL	746,926	706,384	628,223	517,758	503,218	525,346	432,557	321,061	-25.8%	-3.8%
Fuel Oil											
State Total	BBL	9,120,687	7,612,236	6,766,206	6,573,322	6,485,587	6,566,897	6,513,044	6,116,177	-6.1%	-2.4%
HECO	BBL	7,874,530	6,703,981	6,139,949	5,768,973	5,709,841	5,813,837	5,671,391	5,348,859	-5.7%	-2.3%
HELCO	BBL	726,866	533,394	387,475	509,691	399,720	393,831	456,545	445,766	-2.4%	-3.3%
MECO	BBL	519,291	374,861	238,782	294,658	376,026	359,229	385,108	321,552	-16.5%	-2.1%
KIUC	BBL	-	-	-	-	-	-	-	-		
Diesel											
State Total	BBL	2,926,071	2,489,644	2,623,528	2,445,808	2,563,732	2,611,047	2,690,618	2,384,468	-11.4%	-0.6%
HECO	BBL	118,480	89,714	234,802	183,036	296,804	267,728	434,482	356,494	-17.9%	9.7%
HELCO	BBL	409,402	370,640	521,682	524,601	539,626	617,060	575,276	696,519	21.1%	2.5%
MECO	BBL	1,651,263	1,322,906	1,238,821	1,220,413	1,224,084	1,200,913	1,248,303	1,010,394	-19.1%	-2.0%
KIUC	BBL	746,926	706,384	628,223	517,758	503,218	525,346	432,557	321,061	-25.8%	-3.8%
% of Fuel Oil											
State Total	%	75.7%	75.4%	72.1%	72.9%	71.7%	71.6%	70.8%	71.9%		
HECO	%	98.5%	98.7%	96.3%	96.9%	95.1%	95.6%	92.9%	93.8%		
HELCO	%	64.0%	59.0%	42.6%	49.3%	42.6%	39.0%	44.2%	39.0%		
MECO	%	23.9%	22.1%	16.2%	19.4%	23.5%	23.0%	23.6%	24.1%		
KIUC	%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
County % of Fuel Oil											
State Total	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%		
HECO	%	86.3%	88.1%	90.7%	87.8%	88.0%	88.5%	87.1%	87.5%		
HELCO	%	8.0%	7.0%	5.7%	7.8%	6.2%	6.0%	7.0%	7.3%		
MECO	%	5.7%	4.9%	3.5%	4.5%	5.8%	5.5%	5.9%	5.3%		
KIUC	%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
County % of Diesel											
State Total	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%		
HECO	%	4.0%	3.6%	8.9%	7.5%	11.6%	10.3%	16.1%	15.0%		
HELCO	%	14.0%	14.9%	19.9%	21.4%	21.0%	23.6%	21.4%	29.2%		
MECO	%	56.4%	53.1%	47.2%	49.9%	47.7%	46.0%	46.4%	42.4%		
KIUC	%	25.5%	28.4%	23.9%	21.2%	19.6%	20.1%	16.1%	13.5%		

Source: Hawaii Electric Utility Monthly Financial Reports.

Table 19 also shows that the fuel oil share of total petroleum consumption for electricity production decreased from 75.7 percent in 2005 to 70.8 percent in 2019. For HECO, almost all the petroleum consumed was fuel oil. In 2019, fuel oil accounted for about 44.2 percent of total petroleum consumption at HELCO, and about 23.6 percent of total petroleum consumption at MECO. All petroleum consumed at KIUC was diesel.

From 2005 to 2012, both total fuel oil cost and total diesel oil cost paid by the utilities in Hawaii increased significantly, although consumption of both fuels decreased. The growth rate of fuel oil costs was significantly higher than the growth rate of diesel costs.

Table 20. Hawaii Utility Fuel Cost

		2005	2012	2015	2016	2017	2018	2019	2020	Growth 2020	Avg. ann. Growth 2005 - 2019
Petroleum											
State Total	$M	694	1,391	706	489	624	806	754	536	-28.9%	0.6%
HECO	$M	421	945	458	305	408	522	495	354	-28.4%	1.2%
HELCO	$M	65	117	72	55	64	91	85	72	-14.6%	1.9%
MECO	$M	154	235	125	94	116	146	141	89	-37.1%	-0.6%
KIUC	$M	54	94	51	35	36	47	34	21	-37.8%	-3.3%
Fuel Oil											
State Total	$M	467	1,033	465	323	418	549	500	365	-27.1%	0.5%
HECO	$M	412	924	428	292	378	497	447	324	-27.5%	0.6%
HELCO	$M	33	65	24	19	21	28	30	24	-20.0%	-0.7%
MECO	$M	22	44	13	11	18	24	24	16	-30.1%	0.4%
KIUC	$M	-	-	-	-	-	-	-	-		
Diesel											
State Total	$M	226	358	241	167	206	257	254	172	-32.4%	0.8%
HECO	$M	9	21	30	13	30	25	48	30	-37.4%	12.7%
HELCO	$M	32	52	48	36	43	63	54	48	-11.6%	3.9%
MECO	$M	132	191	111	83	97	122	118	73	-38.5%	-0.8%
KIUC	$M	54	94	51	35	36	47	34	21	-37.8%	-3.3%
% of Fuel Oil											
State Total	%	67.4%	74.2%	65.9%	65.9%	66.9%	68.1%	66.3%	68.0%		
HECO	%	97.9%	97.8%	93.4%	95.8%	92.7%	95.2%	90.3%	91.5%		
HELCO	%	51.2%	55.4%	32.8%	34.5%	32.8%	31.0%	35.6%	33.4%		
MECO	%	14.5%	18.7%	10.7%	11.8%	15.9%	16.3%	16.6%	18.5%		
KIUC	%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		

Source: Hawaii Electric Utility Monthly Financial Reports.

From 2005 to 2012, total petroleum costs for Hawaii's utilities increased an average 10.5 percent per year, from $694 million to $1,391 million; fuel oil costs increased an average 12.0 percent per year, from $467 million to $1,033 million; and diesel oil costs increased an average 6.8 percent per year, from $226 million to $358 million (Table 20). Due to the faster growth of fuel oil expenditures, the fuel oil share of total utility petroleum expenditures increased from 67.4 percent in 2005 to 74.2 percent in 2012, an increase of 6.9 percentage points.

From 2012 to 2016, the costs of fuel oil and diesel both decreased from each of the previous years. From 2016 to 2018, however, the cost of utility petroleum increased 64.8 percent or $317 million. In 2019 and 2020, the cost of utility petroleum cost decreased $52 million and $218 million, respectively from the previous year.

The average unit cost of petroleum used for utility electricity generation increased rapidly from 2005 to 2012s. In this period, the average unit petroleum cost for the four electric utilities in Hawaii increased an average of 13.3 percent per year, from $57.57 per BBL to $137.74 per BBL (Table 21). Fuel oil costs increased an average 14.9 percent per year, from $51.22 per BBL to $135.72 per BBL, and diesel oil costs increased an average 9.3 percent per year, from $77.36 per BBL to $143.93 per BBL.

From 2012 to 2016, the unit fuel oil cost decreased 22.5 percent per year on average, and the unit diesel cost decreased 17.0 percent per year. From 2016 to 2018, the unit fuel oil cost increased 30.5 percent per year, and the unit diesel cost increased 20.2 percent per year. In 2019 and 2020, the unit petroleum cost increased 6.7 percent and 23.0 percent, respectively from the previous year.

Table 21. Hawaii Utility Average Fuel Cost

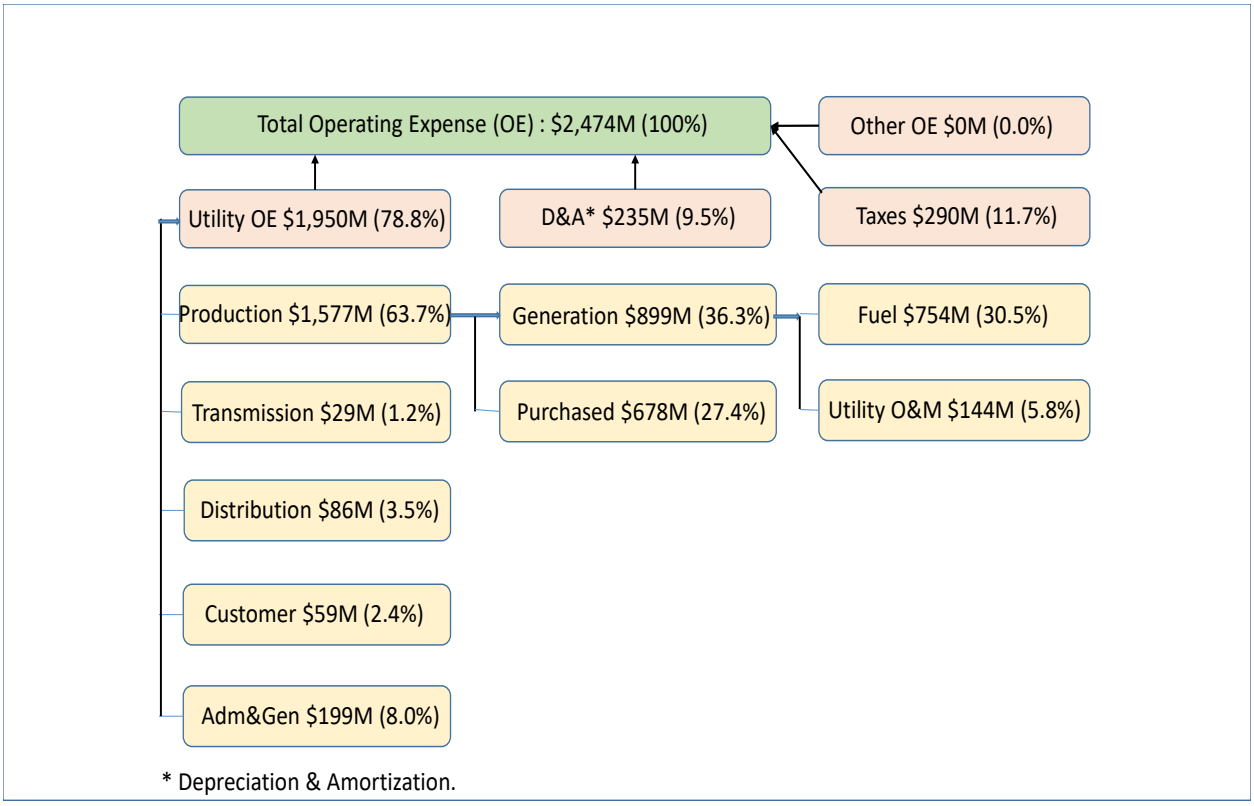
		2005	2012	2015	2016	2017	2018	2019	2020	Growth 2020	Avg. ann. Growth 2005 - 2019
Petroleum											
State Total	$/BBL	57.57	137.74	75.14	54.25	68.96	87.84	81.95	63.07	-23.0%	2.6%
HECO	$/BBL	52.61	139.14	71.86	51.30	67.96	85.83	81.02	62.06	-23.4%	3.1%
HELCO	$/BBL	57.44	129.27	79.03	53.27	68.02	89.81	81.96	63.21	-22.9%	2.6%
MECO	$/BBL	70.88	138.60	84.38	62.21	72.29	93.60	86.58	66.81	-22.8%	1.4%
KIUC	$/BBL	72.19	133.12	81.09	66.75	72.08	90.23	77.62	65.04	-16.2%	0.5%
Fuel Oil											
State Total	$/BBL	51.22	135.72	68.67	49.06	64.41	83.57	76.83	59.61	-22.4%	2.9%
HECO	$/BBL	52.26	137.88	69.65	50.69	66.26	85.47	78.78	60.58	-23.1%	3.0%
HELCO	$/BBL	45.96	121.43	60.89	37.29	52.38	71.38	65.94	54.02	-18.1%	2.6%
MECO	$/BBL	42.93	117.39	55.92	37.67	48.98	66.15	61.03	51.11	-16.3%	2.5%
KIUC	$/BBL										
Diesel											
State Total	$/BBL	77.36	143.93	91.83	68.18	80.48	98.58	94.37	71.96	-23.7%	1.4%
HECO	$/BBL	76.07	232.92	129.46	70.77	100.57	93.58	110.39	84.28	-23.7%	2.7%
HELCO	$/BBL	77.84	140.56	92.51	68.79	79.60	101.57	94.67	69.09	-27.0%	1.4%
MECO	$/BBL	79.67	144.61	89.87	68.13	79.45	101.81	94.46	71.81	-24.0%	1.2%
KIUC	$/BBL	72.19	133.12	81.09	66.75	72.08	90.23	77.62	65.04	-16.2%	0.5%

Source: Hawaii Electric Utility Monthly Financial Reports.

4. Factors Affecting Electricity Expenditures in Hawaii

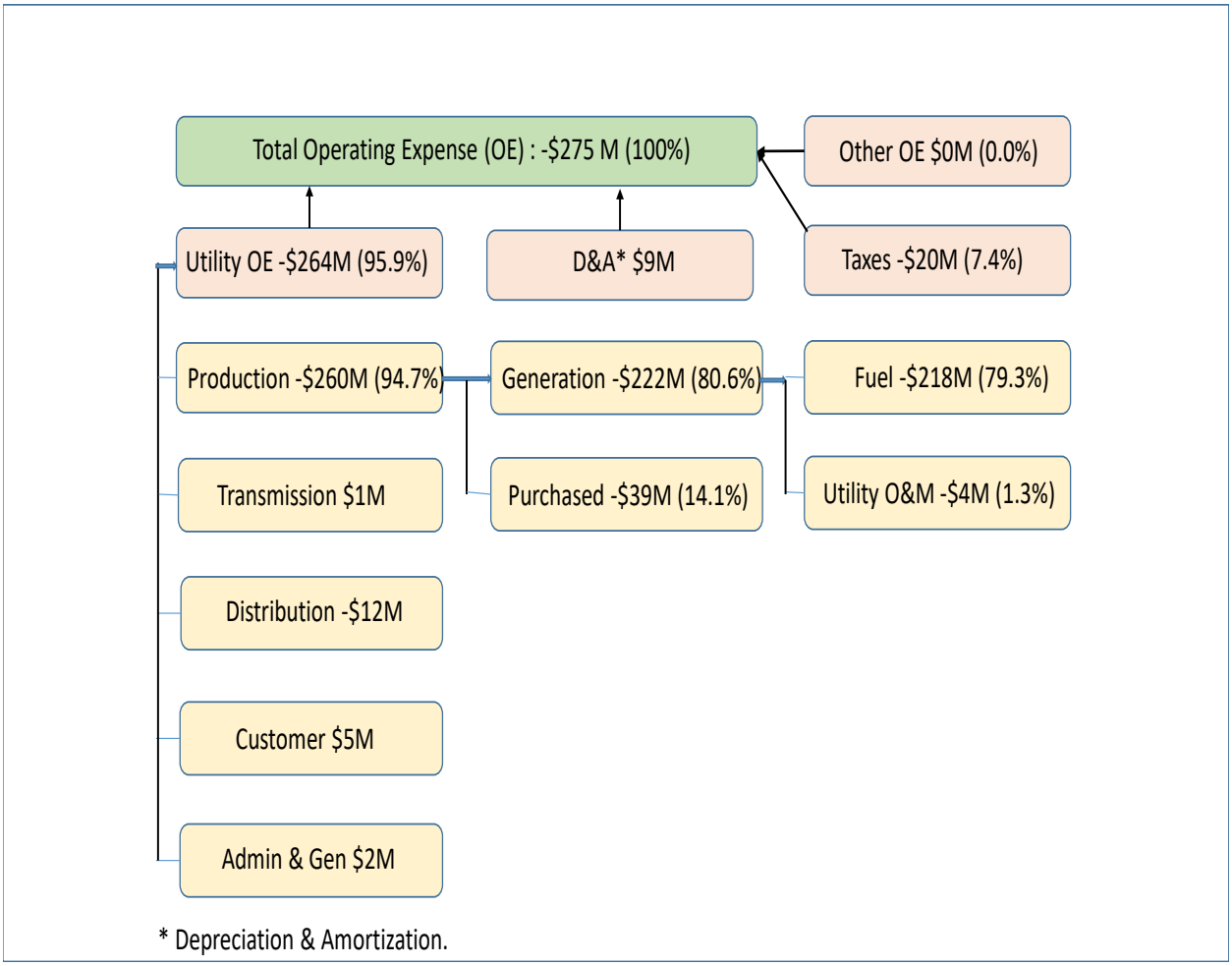
The electricity expenditures of customers in Hawaii, excluding the expenditures of the customer-generated electricity, are determined by the revenues of the utilities in Hawaii. The revenues of the utilities are mainly affected by the operating expense of the utilities. As shown in Figure 4, the total operating expense (OE) includes four components: (1) utility operating expense, (2) depreciation and amortization (D&A), (3) taxes, and (4) other operation expense. In 2019, utility operating expense accounted for about 78.8 percent of total OE, the other three components accounted for about 21.2 percent. Utility OE includes five major components: production cost, transmission cost, distribution cost, customer accounts and service cost, and administration and general cost. The production cost accounted for 63.7 percent of total OE in 2019. The production cost includes mainly fuel cost, purchased power cost, and utility operation and maintenance cost (O&M). In 2019, fuel cost accounted for about 30.5 percent of total OE, purchased power accounted for about 27.4 percent, and utility O&M accounted for about 5.8 percent.

Figure 4. Components of Utility Operating Expense in Hawaii: 2019



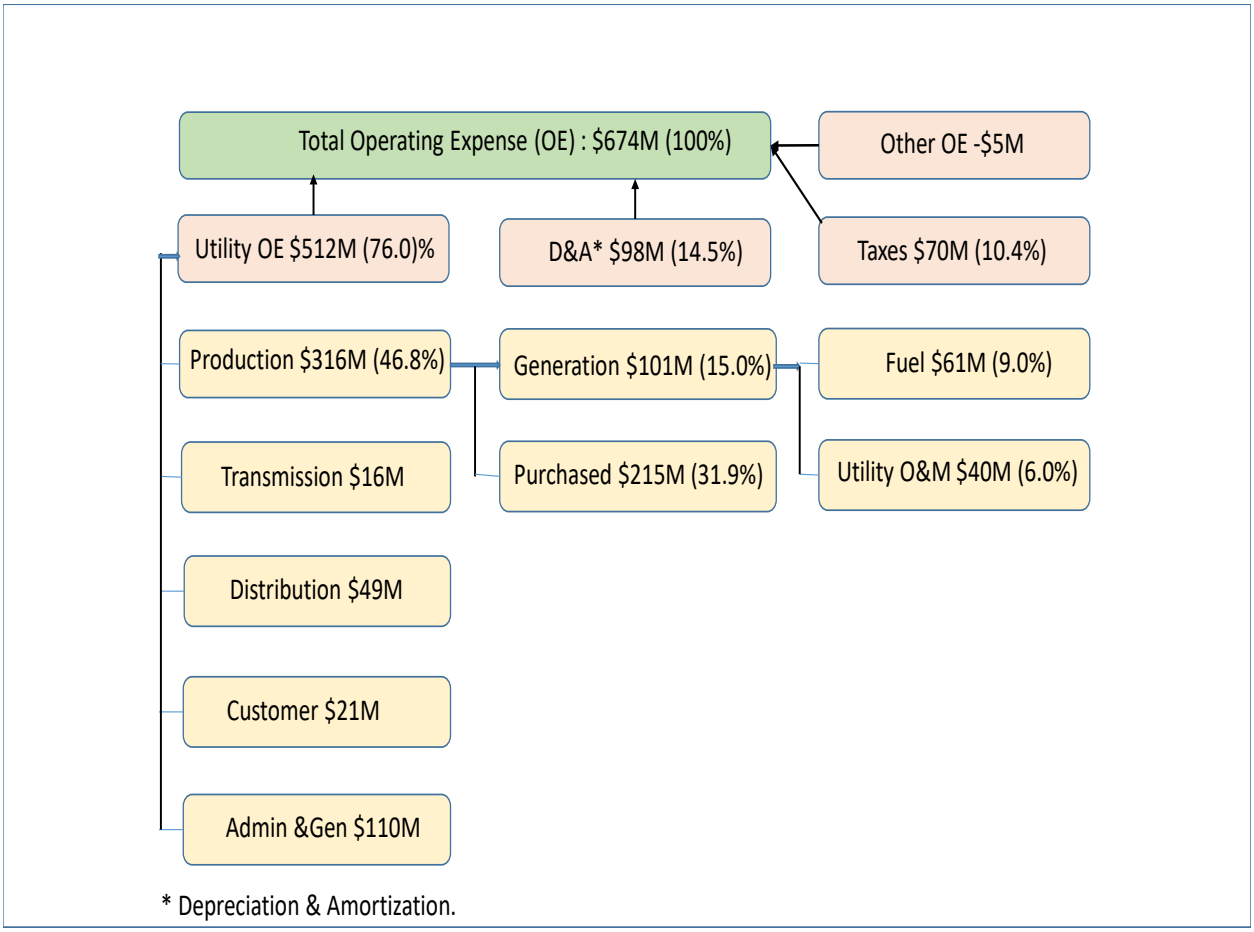
As shown in Figure 5, in 2020, the total operating expense of Hawaii's utilities decreased by $275 million. Of this decrease, about 79.3 percent or $218 million was due to the decreased fuel cost, and about 14.1 percent or $39 million was due to the decreased purchased power cost.

Figure 5. Changes of Utility Operating Expense in Hawaii: 2019-2020



Due to petroleum price increases from 2005 to 2012, the utilities' fuel cost reached a peak of $1,391 million and purchased electricity increased to $732 million in 2012. From 2012 to 2016, due to reduced petroleum prices and reduced electricity generation from petroleum, the fuel cost decreased substantially. Along with this, purchased electricity costs also decreased to a lesser degree. From 2016 to 2018, the operating expense of Hawaii's utilities increased, but still below the peak value in 2012. As shown in Figure 6, from 2005 to 2019, the total operating expense of Hawaii utilities increased $674 million. Of this increase, $61 million was due to increased fuel costs, and $215 million was due to increased purchased power costs.

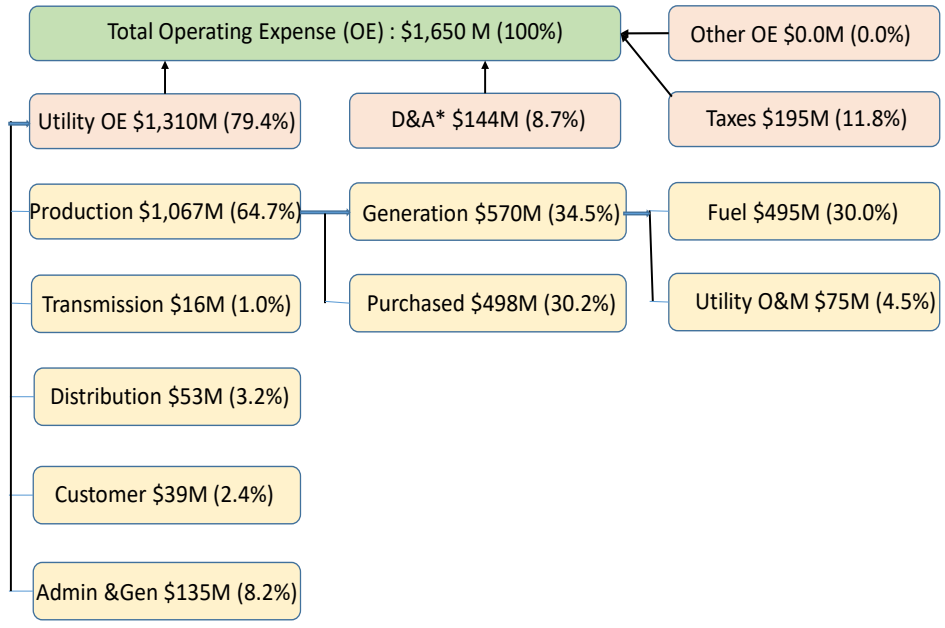
Figure 6. Changes of Utility Operating Expense in Hawaii: 2005-2019



The cost structures of the four utilities in Hawaii are not the same. Compared with the neighbor island utilities, the share of fuel cost in the HECO system was lower, and the share of purchased power was higher. As shown in Figure 7, in 2019, the total operating expense for HECO was $1,650 million; fuel cost accounted for $495 million or 30.0 percent; and purchased electricity accounted for $498 million or 30.2 percent. In comparison, the fuel cost and purchased electricity cost in the neighbor island utilities accounted for 31.5 percent and 21.9 percent of total operating expense, respectively.

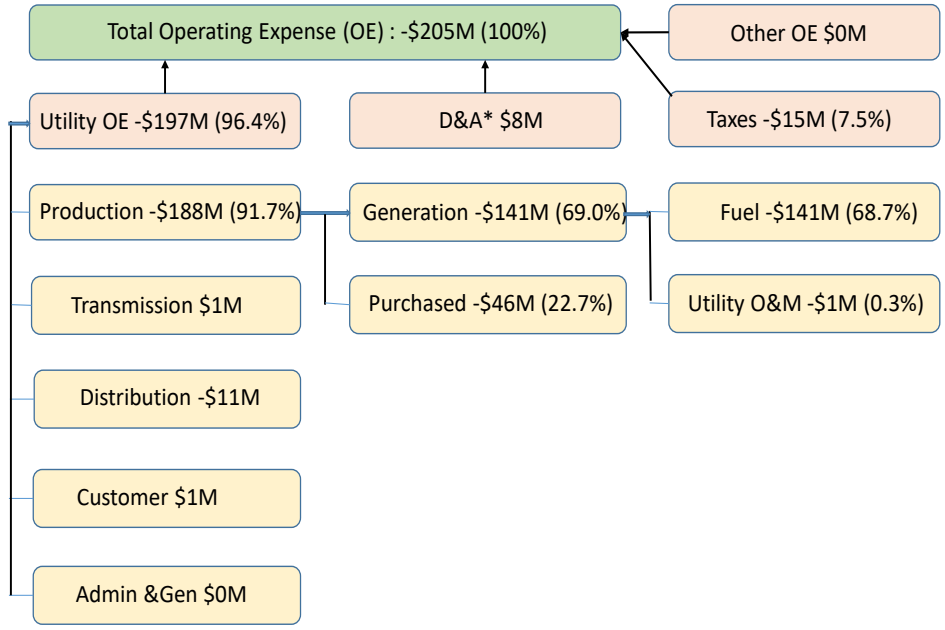
Figure 8 shows the changes of operating expense in the HECO system in 2020. Total operating expense of HECO decreased $205 million. Of this, about 68.7 percent or $141 million of the decrease was due to the decreased fuel cost, and about 22.7 percent or $46 million was due to the decreased purchased power cost.

Figure 7. Components of HECO Operating Expense: 2019



* Depreciation & Amortization.

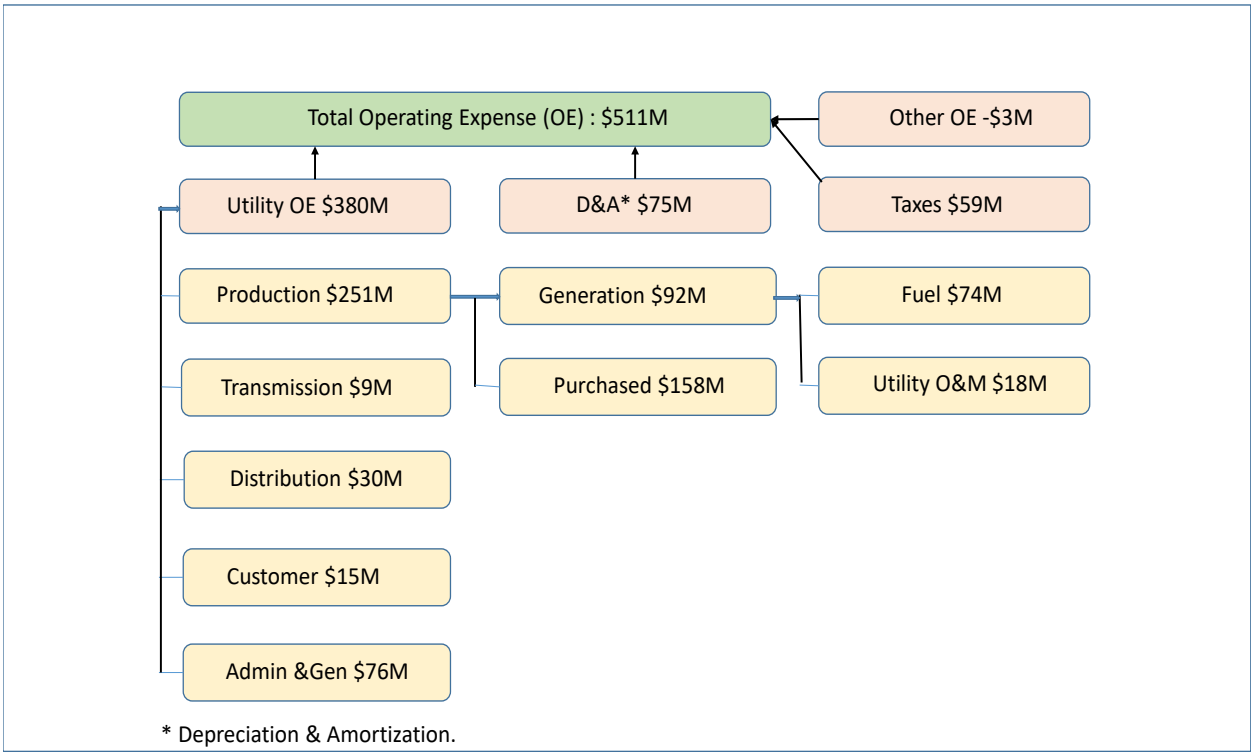
Figure 8. Changes of HECO Operating Expense: 2019-2020



* Depreciation & Amortization.

Figure 9 shows the changes of operating expenses for the HECO system from 2005 to 2019. The total operating expense of HECO increased by $511 million from 2005 to 2019. About $74 million was due to the increased fuel cost, and about $158 million was due to the increased purchased power cost.

Figure 9. Changes of HECO Operating Expense: 2005-2019



The total revenue for the utilities, which reflects the total cost of electricity for customers, increased an average of 7.9 percent per year from $1.9 billion in 2005 to $3.3 billion in 2012. From 2012 to 2016, total revenue from electricity sales decreased an average of 9.2 percent per year to about $2.2 billion. From 2016 to 2018, however, total revenue from electricity sales increased $463 million or 9.9 percent per year to about $2.7 billion. In 2019 and 2020, total revenue from electricity sales decreased 0.6 percent and 9.9 percent, respectively from the previous year.,

Since the consumption of electricity has been relatively stable over time, the fluctuation of the total electricity cost for customers was mainly due to fluctuations in the average price of electricity. As shown in Table 22, the average revenue per kWh sold in Hawaii increased almost every year from 18.3 cents in 2005 to 34.0 cents in 2012, an increase of 9.3 percent per year over this period.

From 2012 to 2016, however, the average revenue from electricity sales decreased 8.4 percent per year, from 34.0 cents per kWh to 24.0 cents per kWh. From 2016 to 2018, the average revenue from electricity sales increased from 24.0 cents per kWh to 29.4 cents per kWh. In 2019 and 2020, the average electricity revenue decreased to 29.0 cents per kWh and 28.2 cents per kWh, respectively. The average electricity revenue in 2020 was the highest at KIUC at about 40.7 cents per kWh. This was followed by HELCO at 33.6 cents per kWh, MECO at 33.2 cents per kWh, and HECO at 25.8 cents per kWh.

Table 22. Hawaii Average Revenue of Electricity by Utility

		2005	2012	2015	2016	2017	2018	2019	2020	Growth 2020	Avg. ann. Growth 2005 - 2019
Revenue from electricity sales											
State Total	$M	1,927	3,281	2,467	2,226	2,395	2,688	2,672	2,408	-9.9%	2.4%
HECO	$M	1,201	2,217	1,636	1,466	1,592	1,790	1,785	1,592	-10.8%	2.9%
HELCO	$M	294	439	344	310	332	372	360	329	-8.6%	1.5%
MECO	$M	302	437	344	307	324	365	372	318	-14.6%	1.5%
KIUC	$M	130	188	143	143	147	162	154	169	9.3%	1.2%
Total electricity sold											
State Total	GWh	10,539	9,639	9,389	9,284	9,136	9,140	9,201	8,536	-7.2%	-1.0%
HECO	GWh	7,721	6,976	6,754	6,660	6,549	6,526	6,563	6,183	-5.8%	-1.2%
HELCO	GWh	1,116	1,085	1,065	1,067	1,047	1,064	1,050	978	-6.8%	-0.4%
MECO	GWh	1,252	1,145	1,138	1,118	1,095	1,099	1,127	959	-15.0%	-0.7%
KIUC	GWh	449	433	432	439	445	451	461	415	-9.9%	0.2%
Average revenue/kWh sold											
State Total	$/kWh	0.183	0.340	0.263	0.240	0.262	0.294	0.290	0.282	-2.8%	3.4%
HECO	$/kWh	0.156	0.318	0.242	0.220	0.243	0.274	0.272	0.258	-5.3%	4.1%
HELCO	$/kWh	0.263	0.405	0.323	0.290	0.317	0.349	0.343	0.336	-1.9%	1.9%
MECO	$/kWh	0.241	0.382	0.302	0.274	0.296	0.332	0.330	0.332	0.5%	2.3%
KIUC	$/kWh	0.291	0.435	0.331	0.326	0.331	0.360	0.335	0.407	21.2%	1.0%

Source: Hawaii Electric Utility Monthly Financial Reports.

The total cost of electricity in Hawaii was mainly affected by two factors, the fuel cost and purchased power cost. The cost of utility fuel and the cost of purchased power were both impacted by fluctuations in petroleum prices. Before 2015, the fuel and purchased power costs accounted for more than 60 percent of the total electricity costs for almost every year. In 2015, 2016, 2017, 2018, 2019, and 2020 the fuel and purchased power share of the total electricity cost decreased to 53.3 percent, 48.5 percent, 51.8 percent, 55.2 percent, 53.6 percent, and 48.8 percent respectively.

From 2005 to 2012, the total fuel cost of the utilities and the cost of purchased electricity increased 9.1 percent per year, from $1,157 million in 2005 to $2,124 million in 2012. From 2005 to 2012, the utility fuel cost increased from $694 million to $1,391 million and the purchased power cost increased from $463 million to $732 million (Table 23).

Table 23. Hawaii Average Cost of Fuel and Purchased Power by Utility

		2005	2012	2015	2016	2017	2018	2019	2020	Growth 2020	Avg. ann. Growth 2005 - 2019
Fuel and purchased power cost											
State Total	$M	1,157	2,124	1,314	1,080	1,241	1,485	1,432	1,175	-17.9%	1.5%
HECO	$M	760	1,486	899	736	862	1,021	992	805	-18.9%	1.9%
HELCO	$M	168	262	169	136	152	189	178	148	-16.9%	0.4%
MECO	$M	170	273	180	145	161	196	190	141	-26.1%	0.8%
KIUC	$M	59	102	65	63	66	79	71	81	14.0%	1.4%
Utility fuel cost											
State Total	$M	694	1,391	706	489	624	808	754	536	-28.9%	0.6%
HECO	$M	421	945	458	305	408	524	495	354	-28.4%	1.2%
HELCO	$M	65	117	72	55	64	91	85	72	-14.6%	1.9%
MECO	$M	154	235	125	94	116	146	141	89	-37.1%	-0.6%
KIUC	$M	54	94	51	35	36	47	34	21	-37.8%	-3.3%
Purchased power cost											
State Total	$M	463	732	608	591	617	677	678	639	-5.7%	2.8%
HECO	$M	339	541	441	431	454	498	498	451	-9.3%	2.8%
HELCO	$M	103	145	98	81	88	98	94	76	-18.9%	-0.7%
MECO	$M	16	38	56	51	46	50	49	52	5.7%	8.2%
KIUC	$M	5	8	14	28	30	32	38	61	60.0%	15.6%
Average fuel and purchased power cost											
State Total	$/kWh	0.110	0.220	0.140	0.116	0.136	0.162	0.156	0.138	-11.5%	2.5%
HECO	$/kWh	0.098	0.213	0.133	0.111	0.132	0.157	0.151	0.130	-13.9%	3.1%
HELCO	$/kWh	0.150	0.242	0.159	0.128	0.145	0.177	0.170	0.152	-10.8%	0.9%
MECO	$/kWh	0.136	0.239	0.158	0.130	0.147	0.178	0.169	0.147	-13.1%	1.6%
KIUC	$/kWh	0.131	0.236	0.151	0.143	0.148	0.175	0.155	0.196	26.5%	1.2%
Share of fuel and purchased power cost											
State Total	%	60.0%	64.7%	53.3%	48.5%	51.8%	55.2%	53.6%	48.8%	-9.0%	-0.8%
HECO	%	63.2%	67.0%	54.9%	50.2%	54.2%	57.1%	55.6%	50.6%	-9.0%	-0.9%
HELCO	%	57.2%	59.7%	49.3%	44.0%	45.7%	50.8%	49.5%	45.0%	-9.1%	-1.0%
MECO	%	56.4%	62.6%	52.5%	47.3%	49.8%	53.7%	51.1%	44.2%	-13.5%	-0.7%
KIUC	%	45.2%	54.3%	45.7%	43.9%	44.8%	48.7%	46.2%	48.2%	4.3%	0.2%

Source: Hawaii Electric Utility Monthly Financial Reports.

In 2020, the average fuel and purchased electricity cost per kWh decreased 11.5 percent, from 15.6 cents to 13.8 cents. The fuel and purchased power cost share, as a percentage of the total cost of electricity sold, decreased from 53.6 percent in 2019 to 48.8 percent in 2020. In 2020, the share of fuel and purchased power cost was the highest for HECO at 50.6 percent, followed by KIUC at 48.2 percent, HELCO at 45.0 percent, and MECO at 44.2 percent.

In comparison, from 2005 to 2012, the average fuel and purchased electricity cost per kWh increased from 11.0 cents to 22.0 cents, an average increase of 10.5 percent per year. The share of fuel and purchased power cost, as a percentage of the total cost of electricity sold, increased from 60.0 percent in 2005 to 64.7 percent in 2012. In 2012, the share of fuel and purchased power cost was the highest in HECO at 67.0 percent, followed by MECO at 62.6 percent, HELCO at 59.7 percent, and KIUC at 54.3 percent.

From 2012 to 2016, both the average fuel cost and average purchased power cost decreased, and the average cost of purchased power decreased at a slower rate. As shown in Table 27, from 2012 to 2016, the average fuel cost to generate one kWh of net electricity (gross generation minus station use) by the utilities decreased 20.3 percent per year from 23.1 cents to 9.3 cents for the state. During the same period, the average cost of purchased electricity decreased only 7.3 percent per year, from 17.7 cents to 13.1 cents. From 2016 to 2018, the average fuel cost increased from 9.3 cents to 15.3 cents, and the average purchased power cost increased from 13.1 cents to 15.7 cents. In 2019 and 2020, the average fuel cost decreased to 14.4 cents and 11.1 cents, respectively, and the average purchased power cost decreased to 15.4 and 15.2 cents, respectively.

In comparison, from 2005 to 2012, the average fuel cost to generate one kWh of net electricity by the utilities increased 12.7 percent per year from 10.0 cents to 23.1 cents for the state. During the same period the average cost of purchased electricity increased only 7.0 percent per year from 11.0 cents to 17.7 cents. In 2005, the average cost of purchased electricity was above the average fuel cost of the utilities. In 2012, the average cost of purchased electricity was about 23.4 percent below the average fuel cost of the utilities in Hawaii. Since 2015, however, the average cost of purchased electricity was above the average fuel cost of the utilities again.

Due to the slower growth of purchased electricity costs from 2005 to 2012, the ratio of average purchased power cost to average utility fuel cost decreased from 110 percent in 2005 to 77 percent in 2012. In 2020, the ratio of average purchased power cost to average utility fuel cost increased to 137 percent. In 2020, the purchased electricity was cheapest at HECO (14.1 cents/kWh), followed by HELCO (18.0 cents/kWh), KIUC (19.1 cents/kWh), and MECO (19.5 cents/kWh).

Table 24. Utility Fuel Cost and Purchased Power Cost Comparison by Utility

		2005	2012	2015	2016	2017	2018	2019	2020	Growth 2020	Avg. ann. Growth 2005 - 2019
Average fuel cost of utility net generation											
State Total	$/kWh	0.100	0.231	0.129	0.093	0.120	0.153	0.144	0.111	-23.5%	2.6%
HECO	$/kWh	0.089	0.229	0.123	0.088	0.118	0.149	0.142	0.108	-23.4%	3.4%
HELCO	$/kWh	0.123	0.239	0.140	0.097	0.122	0.159	0.154	0.116	-24.3%	1.6%
MECO	$/kWh	0.125	0.237	0.142	0.106	0.126	0.164	0.152	0.119	-21.5%	1.4%
KIUC	$/kWh	0.124	0.227	0.142	0.116	0.123	0.156	0.135	0.095	-30.0%	0.6%
Average cost of purchased electricity											
State Total	$/kWh	0.110	0.177	0.138	0.131	0.140	0.157	0.154	0.152	-1.4%	2.4%
HECO	$/kWh	0.100	0.170	0.132	0.124	0.133	0.151	0.149	0.141	-5.6%	2.9%
HELCO	$/kWh	0.149	0.213	0.154	0.140	0.146	0.172	0.164	0.180	10.0%	0.7%
MECO	$/kWh	0.167	0.172	0.171	0.173	0.188	0.187	0.191	0.195	2.2%	0.9%
KIUC	$/kWh	0.144	0.214	0.152	0.177	0.176	0.185	0.161	0.191	18.9%	0.8%
Ratio of purchased cost/fuel cost											
State Total	%	110%	77%	107%	140%	116%	103%	107%	137%	28.8%	-0.2%
HECO	%	113%	74%	107%	141%	113%	101%	105%	130%	23.2%	-0.5%
HELCO	%	121%	89%	110%	144%	119%	108%	106%	155%	45.2%	-0.9%
MECO	%	134%	72%	120%	163%	149%	114%	125%	163%	30.2%	-0.5%
KIUC	%	116%	94%	107%	153%	143%	119%	119%	202%	69.9%	0.2%
Ratio of fuel cost and average revenue											
State Total	%	55%	68%	49%	39%	46%	52%	50%	39%	-21.3%	-0.7%
HECO	%	57%	72%	51%	40%	49%	54%	52%	42%	-19.1%	-0.7%
HELCO	%	47%	59%	43%	33%	39%	46%	45%	35%	-22.8%	-0.3%
MECO	%	52%	62%	47%	39%	43%	49%	46%	36%	-21.9%	-0.8%
KIUC	%	43%	52%	43%	36%	37%	43%	40%	23%	-42.3%	-0.4%
Ratio of purchased power cost and average revenue											
State Total	%	60%	52%	53%	55%	53%	53%	53%	54%	1.4%	-0.9%
HECO	%	64%	53%	54%	56%	55%	55%	55%	55%	-0.4%	-1.2%
HELCO	%	57%	53%	48%	48%	46%	49%	48%	54%	12.1%	-1.2%
MECO	%	69%	45%	57%	63%	64%	56%	58%	59%	1.7%	-1.3%
KIUC	%	49%	49%	46%	54%	53%	52%	48%	47%	-2.0%	-0.2%

Source: Hawaii Electric Utility Monthly Financial Reports.

In addition to fuel and purchased power costs, the cost of electricity is also affected by four other components. As shown in Table 25, the operating income of the utilities accounted for about 10.2 percent, taxes accounted for about 11.2 percent, depreciation and amortization accounted for about 10.1 percent, and other utility operating expenses accounted for about 21.2 percent of the total electricity cost paid by consumers in 2020.

Table 25. Other Major Costs of Electricity by Utility

		2005	2012	2015	2016	2017	2018	2019	2020	Growth 2020	Avg. ann. Growth 2005 - 2019
Operating income											
State Total	$M	134	191	203	207	182	215	224	245	9.2%	3.7%
HECO	$M	65	117	129	133	110	138	152	162	6.7%	6.2%
HELCO	$M	22	31	31	32	32	36	31	37	21.1%	2.6%
MECO	$M	27	24	31	29	27	29	31	29	-5.6%	1.0%
KIUC	$M	21	19	12	13	14	13	11	17	50.3%	-4.3%
Taxes											
State Total	$M	220	379	316	301	314	287	290	269	-7.0%	2.0%
HECO	$M	137	260	213	204	214	192	195	180	-7.9%	2.6%
HELCO	$M	33	53	45	42	45	41	40	39	-0.8%	1.3%
MECO	$M	39	51	47	43	43	40	42	34	-17.2%	0.4%
KIUC	$M	11	16	12	12	12	14	13	16	20.0%	1.4%
Depreciation and amortization											
State Total	$M	137	156	192	205	210	224	235	244	3.8%	3.9%
HECO	$M	70	90	116	126	132	138	144	152	5.6%	5.4%
HELCO	$M	27	33	37	38	39	40	42	39	-6.6%	3.3%
MECO	$M	25	20	22	23	23	26	31	32	5.8%	1.6%
KIUC	$M	16	13	17	18	15	19	18	20	10.0%	0.6%
Other utility operating expenses											
State Total	$M	286	440	451	442	456	495	517	511	-1.3%	4.3%
HECO	$M	173	269	286	273	279	312	318	308	-3.2%	4.4%
HELCO	$M	45	61	63	64	66	69	73	70	-4.4%	3.6%
MECO	$M	43	72	65	68	71	77	85	86	1.5%	5.1%
KIUC	$M	25	38	37	37	40	38	41	46	12.5%	3.5%
All others											
State Total	$M	777	1,167	1,163	1,155	1,163	1,222	1,266	1,269	0.2%	3.5%
HECO	$M	445	736	744	736	735	780	809	802	-0.9%	4.4%
HELCO	$M	126	178	176	175	181	186	186	186	0.1%	2.8%
MECO	$M	133	166	165	164	164	172	188	182	-3.1%	2.5%
KIUC	$M	73	86	78	81	82	84	83	99	18.2%	0.9%
% of operating income											
State Total	%	7.0%	5.8%	8.2%	9.3%	7.6%	8.0%	8.4%	10.2%		
HECO	%	5.4%	5.3%	7.9%	9.0%	6.9%	7.7%	8.5%	10.2%		
HELCO	%	7.3%	7.0%	9.0%	10.2%	9.5%	9.6%	8.6%	11.3%		
MECO	%	8.8%	5.5%	9.1%	9.5%	8.2%	7.9%	8.2%	9.1%		
KIUC	%	15.8%	9.9%	8.5%	9.4%	9.4%	8.0%	7.2%	9.9%		
% of taxes											
State Total	%	11.4%	11.6%	12.8%	13.5%	13.1%	10.7%	10.8%	11.2%		
HECO	%	11.4%	11.7%	13.0%	13.9%	13.4%	10.7%	10.9%	11.3%		
HELCO	%	11.3%	12.1%	13.0%	13.4%	13.4%	11.1%	11.0%	11.9%		
MECO	%	13.0%	11.6%	13.6%	14.0%	13.3%	11.0%	11.2%	10.8%		
KIUC	%	8.3%	8.4%	8.5%	8.4%	8.4%	8.5%	8.5%	9.3%		
% of depreciation and amortization											
State Total	%	7.1%	4.8%	7.8%	9.2%	8.8%	8.3%	8.8%	10.1%		
HECO	%	5.8%	4.1%	7.1%	8.6%	8.3%	7.7%	8.1%	9.6%		
HELCO	%	9.1%	7.5%	10.7%	12.2%	11.8%	10.9%	11.7%	11.9%		
MECO	%	8.1%	4.6%	6.4%	7.6%	7.3%	7.2%	8.3%	10.2%		
KIUC	%	12.6%	7.1%	11.9%	12.9%	10.4%	11.9%	11.6%	11.7%		
% of other utility operating expenses											
State Total	%	14.9%	13.4%	18.3%	19.8%	19.1%	18.4%	19.4%	21.2%		
HECO	%	14.4%	12.2%	17.5%	18.6%	17.5%	17.4%	17.8%	19.3%		
HELCO	%	15.3%	13.9%	18.4%	20.6%	20.0%	18.5%	20.4%	21.3%		
MECO	%	14.1%	16.4%	18.9%	22.3%	22.0%	21.1%	22.8%	27.1%		
KIUC	%	19.5%	20.4%	25.8%	25.7%	27.4%	23.2%	26.7%	27.5%		

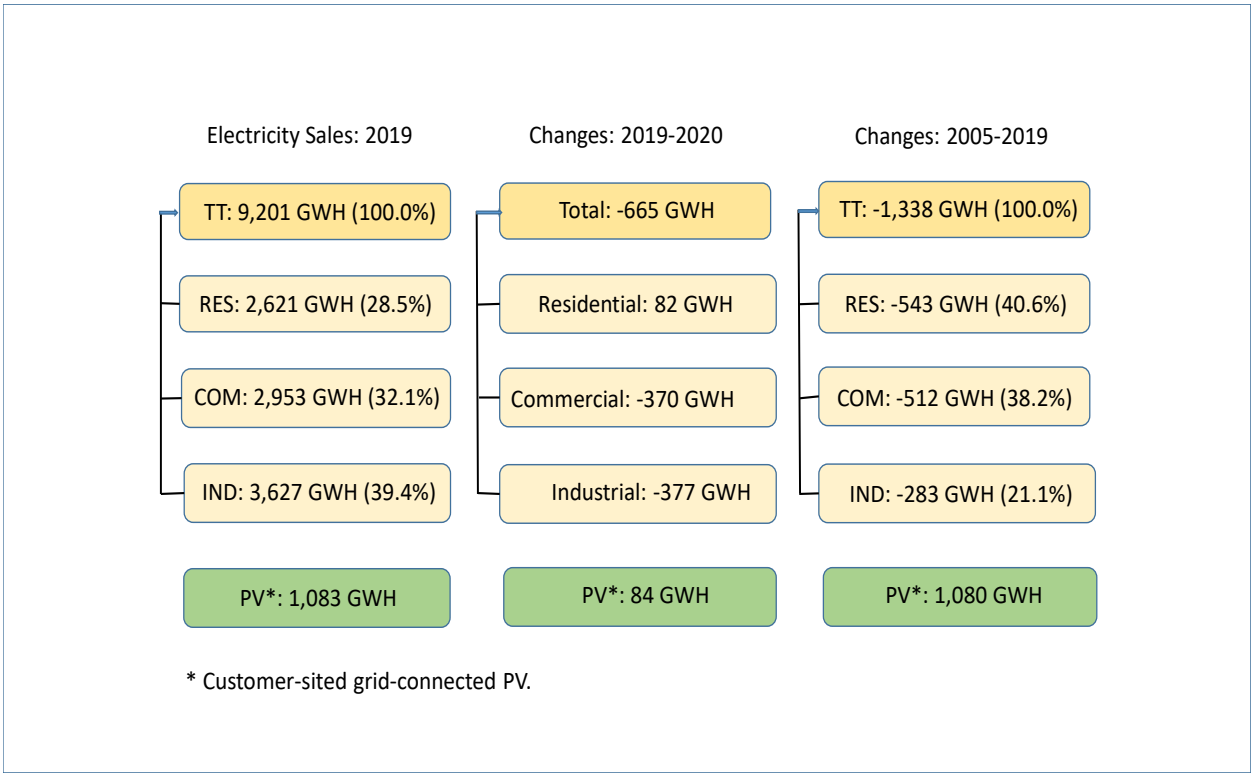
Source: Hawaii Electric Utility Monthly Financial Reports.

5. Electricity Consumption by Sector

Electricity sold by the utilities can be classified into three sectors. First is the residential sector, which includes all residential customers' and utility employees' accounts. Second is the industrial sector, which includes the large power customers. Third is the commercial sector, which includes all other customers.

As shown in Figure 10, total electricity sold by the utilities in Hawaii was about 9,201 GWH in 2019, 2,621 GWH or 28.5 percent was sold to the residential sector, 2,953 GWH or 32.1 percent was sold to the commercial sector, and 3,627 GWH or 39.4 percent was sold to the industrial sector. In 2020, total electricity sold by the utilities decreased 665 GWH; sales to the residential sector increased 82 GWH, sales to the commercial sector decreased 370 GWH, and sales to the industrial sector decreased 377 GWH. From 2005 to 2019, total electricity sold by the utilities decreased 1,338 GWH; sales to the residential sector decreased 543 GWH or 40.6 percent of the reduced sales, sales to the commercial sector decreased 512 GWH or 38.2 percent, and sales to the industrial sector decreased 283 GWH or 21.1 percent.

Figure 10. Electricity Consumption by Sector in Hawaii



The larger decrease in residential electricity sales was due to the installation of customer-sited solar systems. Since most of the customer-sited solar systems were installed by residential customers, electricity sold to residential customers decreased more than that of the other sectors. As shown in Table 26, from 2005 to 2019, total electricity sold decreased an average 1.0 percent per year in Hawaii, while electricity sold to the residential sector decreased an average 1.3 percent per year from 3,164 GWH to 2,621 GWH. In comparison, electricity sold to the commercial sector and the industrial sector decreased an average 1.1 percent and 0.5 percent per year, respectively, over the same period. In 2020, the residential sector's electricity sales increased 3.1 percent, the commercial and industrial sectors' electricity sales decreased 12.5 percent and 10.4 percent, respectively over the previous year.

At the county level, from 2005 to 2019, residential sales in the HECO system decreased the most at 1.9 percent per year; followed by MECO (decreased 0.8 percent per year), and HELCO (decreased 0.2 percent per year). Residential sales of KIUC increased 1.1 percent per year during the same period.

It appears that the decrease in electricity sales in recent years was due to decreased electricity sales per customer, rather than a decrease in the number of customers. As shown in Table 27, from 2005 to 2019, total utility customers for the state increased an average 0.6 percent per year. The number of residential customers increased 0.7 percent per year from 398,332 customers to 439,022 customers, the number of commercial customers decreased 0.04 percent per year from 64,072 to 63,504, and the number of industrial customers increased 1.3 percent per year from 684 to 800.

At the county utility level, the number of customers increased slower at HECO compared with the other utilities. From 2005 to 2019, the share of HECO customers as a percentage of total statewide utility customers decreased 2.2 percentage points, from 63.0 percent to 60.8 percent.

Table 26. Electricity Consumption by Sector and by Utility

		2005	2012	2015	2016	2017	2018	2019	2020	Growth 2020	Avg. ann. Growth 2005 - 2019
Total											
State Total	GWH	10,539	9,639	9,389	9,284	9,136	9,140	9,201	8,536	-7.2%	-1.0%
HECO	GWH	7,721	6,976	6,754	6,660	6,549	6,526	6,563	6,183	-5.8%	-1.2%
HELCO	GWH	1,116	1,085	1,065	1,067	1,047	1,064	1,050	978	-6.8%	-0.4%
MECO	GWH	1,252	1,145	1,138	1,118	1,095	1,099	1,127	959	-15.0%	-0.7%
KIUC	GWH	449	433	432	439	445	451	461	415	-9.9%	0.2%
Residential											
State Total	GWH	3,164	2,739	2,558	2,497	2,504	2,586	2,621	2,703	3.1%	-1.3%
HECO	GWH	2,143	1,777	1,627	1,580	1,579	1,608	1,635	1,736	6.2%	-1.9%
HELCO	GWH	423	410	388	386	392	420	409	411	0.5%	-0.2%
MECO	GWH	442	395	381	366	364	383	395	378	-4.3%	-0.8%
KIUC	GWH	156	157	162	164	169	175	181	177	-2.3%	1.1%
Commercial											
State Total	GWH	3,465	3,238	3,143	3,073	3,028	2,971	2,953	2,583	-12.5%	-1.1%
HECO	GWH	2,480	2,320	2,221	2,171	2,146	2,111	2,103	1,854	-11.9%	-1.2%
HELCO	GWH	453	430	432	423	404	393	381	336	-11.9%	-1.2%
MECO	GWH	406	374	374	364	362	349	349	287	-17.8%	-1.1%
KIUC	GWH	125	114	116	116	115	118	120	107	-11.1%	-0.3%
Industrial											
State Total	GWH	3,909	3,662	3,687	3,714	3,604	3,584	3,627	3,249	-10.4%	-0.5%
HECO	GWH	3,098	2,879	2,906	2,909	2,824	2,807	2,825	2,593	-8.2%	-0.7%
HELCO	GWH	240	245	244	259	251	251	259	231	-10.8%	0.6%
MECO	GWH	404	375	383	388	369	367	383	294	-23.4%	-0.4%
KIUC	GWH	167	162	155	159	161	159	159	131	-17.6%	-0.3%
% of Residential											
State Total	%	30.0%	28.4%	27.2%	26.9%	27.4%	28.3%	28.5%	31.7%		
HECO	%	27.7%	25.5%	24.1%	23.7%	24.1%	24.6%	24.9%	28.1%		
HELCO	%	37.9%	37.8%	36.5%	36.2%	37.4%	39.5%	39.0%	42.0%		
MECO	%	35.3%	34.5%	33.5%	32.8%	33.2%	34.9%	35.1%	39.5%		
KIUC	%	34.8%	36.3%	37.5%	37.3%	38.0%	38.7%	39.3%	42.7%		
% of Commercial											
State Total	%	32.9%	33.6%	33.5%	33.1%	33.1%	32.5%	32.1%	30.3%		
HECO	%	32.1%	33.3%	32.9%	32.6%	32.8%	32.3%	32.0%	30.0%		
HELCO	%	40.6%	39.6%	40.6%	39.6%	38.6%	36.9%	36.3%	34.3%		
MECO	%	32.4%	32.7%	32.9%	32.6%	33.1%	31.8%	30.9%	29.9%		
KIUC	%	27.9%	26.4%	26.8%	26.4%	25.8%	26.1%	26.0%	25.7%		
County % of Total											
State Total	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%		
HECO	%	73.3%	72.4%	71.9%	71.7%	71.7%	71.4%	71.3%	72.4%		
HELCO	%	10.6%	11.3%	11.3%	11.5%	11.5%	11.6%	11.4%	11.5%		
MECO	%	11.9%	11.9%	12.1%	12.0%	12.0%	12.0%	12.3%	11.2%		
KIUC	%	4.3%	4.5%	4.6%	4.7%	4.9%	4.9%	5.0%	4.9%		
County % of Residential											
State Total	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%		
HECO	%	67.7%	64.9%	63.6%	63.3%	63.1%	62.2%	62.4%	64.2%		
HELCO	%	13.4%	15.0%	15.2%	15.5%	15.7%	16.2%	15.6%	15.2%		
MECO	%	14.0%	14.4%	14.9%	14.7%	14.5%	14.8%	15.1%	14.0%		
KIUC	%	4.9%	5.7%	6.3%	6.6%	6.8%	6.8%	6.9%	6.6%		

Source: Hawaii Electric Utility Monthly Financial Reports.

Table 27. Number of Retail Customers by Sector in Hawaii

		2005	2012	2015	2016	2017	2018	2019	2020	Growth 2020	Avg. ann. Growth 2005 - 2019
Total											
State Total		463,088	484,716	494,631	497,292	499,664	500,794	503,515	506,484	0.6%	0.6%
HECO		291,580	297,529	302,958	304,261	304,948	305,456	306,368	307,378	0.3%	0.4%
HELCO		73,835	81,792	84,308	85,029	85,925	85,758	86,566	87,357	0.9%	1.1%
MECO		63,901	68,922	70,533	70,872	71,352	71,875	72,522	73,304	1.1%	0.9%
KIUC		33,772	36,473	36,832	37,130	37,439	37,705	38,059	38,445	1.0%	0.9%
Residential											
State Total		398,332	420,240	429,084	431,496	435,104	436,545	439,022	442,170	0.7%	0.7%
HECO		257,804	264,047	269,207	270,451	271,065	271,807	272,590	273,777	0.4%	0.4%
HELCO		60,699	69,099	71,216	71,892	74,274	74,288	75,142	75,958	1.1%	1.5%
MECO		54,135	58,879	60,231	60,475	60,902	61,410	61,957	62,749	1.3%	1.0%
KIUC		25,694	28,215	28,430	28,678	28,863	29,040	29,333	29,686	1.2%	1.0%
Commercial											
State Total		64,072	63,772	64,769	65,005	63,783	63,434	63,676	63,504	-0.3%	0.0%
HECO		33,416	33,116	33,333	33,373	33,453	33,201	33,325	33,150	-0.5%	0.0%
HELCO		13,071	12,617	13,001	13,046	11,564	11,374	11,328	11,302	-0.2%	-1.0%
MECO		9,632	9,908	10,152	10,255	10,311	10,313	10,414	10,409	0.0%	0.6%
KIUC		7,953	8,131	8,283	8,331	8,455	8,546	8,609	8,643	0.4%	0.6%
Industrial											
State Total		684	704	778	791	777	815	817	810	-0.9%	1.3%
HECO		360	366	418	437	430	448	453	451	-0.4%	1.7%
HELCO		65	76	91	91	87	96	96	97	1.0%	2.8%
MECO		134	135	150	142	139	152	151	146	-3.3%	0.9%
KIUC		125	127	119	121	121	119	117	116	-0.9%	-0.5%
% of Residential											
State Total	%	86.0%	86.7%	86.7%	86.8%	87.1%	87.2%	87.2%	87.3%		
HECO	%	88.4%	88.7%	88.9%	88.9%	88.9%	89.0%	89.0%	89.1%		
HELCO	%	82.2%	84.5%	84.5%	84.5%	86.4%	86.6%	86.8%	87.0%		
MECO	%	84.7%	85.4%	85.4%	85.3%	85.4%	85.4%	85.4%	85.6%		
KIUC	%	76.1%	77.4%	77.2%	77.2%	77.1%	77.0%	77.1%	77.2%		
% of Commercial											
State Total	%	13.8%	13.2%	13.1%	13.1%	12.8%	12.7%	12.6%	12.5%		
HECO	%	11.5%	11.1%	11.0%	11.0%	11.0%	10.9%	10.9%	10.8%		
HELCO	%	17.7%	15.4%	15.4%	15.3%	13.5%	13.3%	13.1%	12.9%		
MECO	%	15.1%	14.4%	14.4%	14.5%	14.5%	14.3%	14.4%	14.2%		
KIUC	%	23.5%	22.3%	22.5%	22.4%	22.6%	22.7%	22.6%	22.5%		
County % of Total											
State Total	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%		
HECO	%	63.0%	61.4%	61.2%	61.2%	61.0%	61.0%	60.8%	60.7%		
HELCO	%	15.9%	16.9%	17.0%	17.1%	17.2%	17.1%	17.2%	17.2%		
MECO	%	13.8%	14.2%	14.3%	14.3%	14.3%	14.4%	14.4%	14.5%		
KIUC	%	7.3%	7.5%	7.4%	7.5%	7.5%	7.5%	7.6%	7.6%		

Source: Hawaii Electric Utility Monthly Financial Reports.

From 2005 to 2019, electricity sales per customer in Hawaii decreased an annual average of 1.6 percent from 22,757 kWh to 18,273 kWh (Table 28). Annual electricity sales per residential customer decreased an average 2.0 percent per year, from 7,943 kWh to 5,969 kWh; annual electricity sales per commercial customer decreased an average 1.1 percent per year, from 54,081 kWh to 46,382 kWh; and annual electricity sales by industrial customers decreased 1.8 percent per year, from 5,715,476 kWh to 4,439,059 kWh.

At the county level, HECO had the highest annual electricity consumption per residential customer in 2020 at 6,340 kWh. This was followed by MECO at 6,028 kWh, KIUC at 5,969 kWh, and HELCO at 5,416 kWh. However, the difference between the utilities' average residential electricity consumption per customer has been decreasing over time, with HECO's residential consumption per customer decreasing faster than others. From 2005 to 2019, residential consumption per customer decreased an average 2.3 percent per year at HECO, decreased 1.8 percent per year at HELCO, decreased 1.7 percent per year at MECO, and increased 0.1 percent per year at KIUC.

Table 28. Annual Electricity Consumption per Customer by Sector

		2005	2012	2015	2016	2017	2018	2019	2020	Growth 2020	Avg. ann. Growth 2005 - 2019
Total											
State Total	kWh/C	22,757	19,886	18,981	18,670	18,283	18,251	18,273	16,852	-7.8%	-1.6%
HECO	kWh/C	26,481	23,446	22,294	21,890	21,475	21,364	21,422	20,116	-6.1%	-1.5%
HELCO	kWh/C	15,121	13,267	12,630	12,553	12,184	12,408	12,124	11,200	-7.6%	-1.6%
MECO	kWh/C	19,595	16,611	16,129	15,771	15,343	15,291	15,545	13,078	-15.9%	-1.6%
KIUC	kWh/C	13,284	11,876	11,731	11,826	11,889	11,964	12,105	10,802	-10.8%	-0.7%
Residential											
State Total	kWh/C	7,943	6,518	5,962	5,786	5,755	5,923	5,969	6,112	2.4%	-2.0%
HECO	kWh/C	8,311	6,729	6,043	5,844	5,824	5,915	5,998	6,340	5.7%	-2.3%
HELCO	kWh/C	6,977	5,931	5,453	5,369	5,278	5,652	5,445	5,416	-0.5%	-1.8%
MECO	kWh/C	8,165	6,715	6,328	6,058	5,972	6,237	6,378	6,028	-5.5%	-1.7%
KIUC	kWh/C	6,072	5,574	5,692	5,717	5,867	6,017	6,180	5,969	-3.4%	0.1%
Commercial											
State Total	kWh/C	54,081	50,780	48,524	47,279	47,466	46,832	46,382	40,682	-12.3%	-1.1%
HECO	kWh/C	74,227	70,053	66,641	65,044	64,153	63,573	63,117	55,930	-11.4%	-1.2%
HELCO	kWh/C	34,685	34,095	33,234	32,417	34,954	34,559	33,671	29,731	-11.7%	-0.2%
MECO	kWh/C	42,163	37,758	36,816	35,480	35,140	33,852	33,481	27,545	-17.7%	-1.6%
KIUC	kWh/C	15,749	14,046	13,967	13,911	13,587	13,794	13,935	12,337	-11.5%	-0.9%
Industrial											
State Total	kWh/C	5,715,476	5,201,000	4,739,613	4,695,780	4,638,570	4,397,099	4,439,059	4,011,706	-9.6%	-1.8%
HECO	kWh/C	8,606,672	7,866,900	6,951,690	6,656,945	6,567,020	6,265,913	6,235,636	5,749,926	-7.8%	-2.3%
HELCO	kWh/C	3,686,703	3,225,790	2,685,072	2,840,736	2,881,831	2,615,831	2,697,867	2,381,936	-11.7%	-2.2%
MECO	kWh/C	3,014,884	2,780,620	2,551,411	2,729,124	2,652,958	2,413,680	2,539,678	2,011,899	-20.8%	-1.2%
KIUC	kWh/C	1,338,824	1,273,029	1,298,817	1,315,987	1,329,504	1,332,000	1,363,084	1,133,453	-16.8%	0.1%

Source: Hawaii Electric Utility Monthly Financial Reports.

Due to rapid growth of electricity prices from 2005 to 2012, total revenue from retail electricity increased substantially. This occurred in spite of a decrease in the kWh of electricity sold over the same period. From 2005 to 2012, the total revenue generated from retail electricity sales increased an average 7.9 percent per year for the state, revenue from residential sales increased an average 6.6 percent per year from $653 million to $1,023 million, and revenue from commercial and industrial sales (separate revenues from the commercial sector and the industrial sector are not available in the MFR) increased an average 8.5 percent per year from $1,274 million to $2,258 million.

Table 29. Revenue from Retail Electricity Sales by Sector in Hawaii

		2005	2012	2015	2016	2017	2018	2019	2020	Growth 2020	Avg. ann. Growth 2005 - 2019
Total											
State Total	$M	1,927	3,281	2,467	2,226	2,395	2,688	2,672	2,408	-9.9%	2.4%
HECO	$M	1,201	2,217	1,636	1,466	1,592	1,790	1,785	1,592	-10.8%	2.9%
HELCO	$M	294	439	344	310	332	372	360	329	-8.6%	1.5%
MECO	$M	302	437	344	307	324	365	372	318	-14.6%	1.5%
KIUC	$M	130	188	143	143	147	162	154	169	9.3%	1.2%
Residential											
State Total	$M	653	1,023	765	695	750	853	855	845	-1.2%	1.9%
HECO	$M	379	624	456	412	445	501	508	499	-1.7%	2.1%
HELCO	$M	118	174	135	122	134	156	149	145	-3.2%	1.7%
MECO	$M	110	154	119	105	112	131	134	127	-5.9%	1.4%
KIUC	$M	46	71	56	56	58	65	63	75	18.0%	2.3%
Others											
State Total	$M	1,274	2,258	1,701	1,531	1,645	1,835	1,817	1,564	-13.9%	2.6%
HECO	$M	823	1,593	1,180	1,054	1,147	1,288	1,277	1,094	-14.4%	3.2%
HELCO	$M	176	265	209	188	198	216	211	185	-12.4%	1.3%
MECO	$M	192	282	224	202	212	234	238	191	-19.5%	1.6%
KIUC	$M	84	118	87	87	89	97	91	94	3.3%	0.6%
% of Residential											
State Total	%	33.9%	31.2%	31.0%	31.2%	31.3%	31.7%	32.0%	35.1%		
HECO	%	31.5%	28.1%	27.9%	28.1%	28.0%	28.0%	28.4%	31.3%		
HELCO	%	40.2%	39.6%	39.1%	39.3%	40.4%	41.9%	41.5%	43.9%		
MECO	%	36.5%	35.3%	34.8%	34.3%	34.7%	35.9%	36.1%	39.8%		
KIUC	%	35.5%	37.6%	38.8%	39.0%	39.7%	40.2%	40.9%	44.2%		
County % of Total											
State Total	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%		
HECO	%	62.3%	67.6%	66.3%	65.9%	66.5%	66.6%	66.8%	66.1%		
HELCO	%	15.2%	13.4%	13.9%	13.9%	13.8%	13.8%	13.5%	13.7%		
MECO	%	15.7%	13.3%	13.9%	13.8%	13.5%	13.6%	13.9%	13.2%		
KIUC	%	6.8%	5.7%	5.8%	6.4%	6.2%	6.0%	5.8%	7.0%		

Source: Hawaii Electric Utility Monthly Financial Reports.

The higher growth in commercial and industrial electricity revenue, compared with residential revenue from 2005 to 2012, was due to the higher growth in commercial and industrial electricity prices. From 2005 to 2012, the average electricity price increased an average of 9.3 percent per year, from 18.3 cents per kWh to 34.0 cents per kWh. For the 2005 to 2012 period, the average residential electricity price increased 8.8 percent per year, from 20.6 cents per kWh to 37.3 cents per kWh, and the average commercial and industrial electricity price increased 9.6 percent per year, from 17.3 cents per kWh to 32.7 cents per kWh (Table 30).

From 2012 to 2016, total revenue from electricity sales decreased 9.2 percent per year. During the same period, the average residential electricity price decreased 7.1 percent and the average commercial and industrial electricity price decreased 8.9 percent.

From 2016 to 2018, total revenue from electricity sales increased 9.9 percent per year, revenue from residential sales increased 10.8 percent per year, and revenue from commercial and industrial sales increased 9.5 percent per year.

In 2019, total revenue from electricity sales decreased slightly. In 2020, total revenue from electricity sales decreased 13.9 percent, revenue from residential sales decreased 1.2 percent per year, and revenue from commercial and industrial sales decreased 13.9 percent per year.

Table 30. Average Electricity Price by County in Hawaii

		2005	2012	2015	2016	2017	2018	2019	2020	Growth 2020	Avg. ann. Growth 2005 - 2019
Total											
State Total	$/kWh	0.183	0.340	0.263	0.240	0.262	0.294	0.290	0.282	-2.8%	3.4%
HECO	$/kWh	0.156	0.318	0.242	0.220	0.243	0.274	0.272	0.258	-5.3%	4.1%
HELCO	$/kWh	0.263	0.405	0.323	0.290	0.317	0.349	0.343	0.336	-1.9%	1.9%
MECO	$/kWh	0.241	0.382	0.302	0.274	0.296	0.332	0.330	0.332	0.5%	2.3%
KIUC	$/kWh	0.291	0.435	0.331	0.326	0.331	0.360	0.335	0.407	21.2%	1.0%
Residential											
State Total	$/kWh	0.206	0.373	0.299	0.278	0.300	0.330	0.326	0.313	-4.2%	3.3%
HECO	$/kWh	0.177	0.351	0.280	0.261	0.282	0.312	0.310	0.287	-7.4%	4.1%
HELCO	$/kWh	0.279	0.425	0.346	0.315	0.342	0.371	0.365	0.352	-3.7%	1.9%
MECO	$/kWh	0.249	0.391	0.313	0.287	0.309	0.342	0.340	0.335	-1.6%	2.2%
KIUC	$/kWh	0.297	0.450	0.343	0.340	0.345	0.373	0.349	0.421	20.7%	1.2%
Others											
State Total	$/kWh	0.173	0.327	0.249	0.226	0.248	0.280	0.276	0.268	-2.9%	3.4%
HECO	$/kWh	0.147	0.306	0.230	0.208	0.231	0.262	0.259	0.246	-5.1%	4.1%
HELCO	$/kWh	0.253	0.393	0.309	0.276	0.302	0.335	0.329	0.325	-1.0%	1.9%
MECO	$/kWh	0.236	0.377	0.296	0.268	0.289	0.327	0.325	0.330	1.6%	2.3%
KIUC	$/kWh	0.287	0.426	0.324	0.317	0.322	0.351	0.327	0.396	21.2%	0.9%

Source: Hawaii Electric Utility Monthly Financial Reports.

Table 31 shows the statewide average electricity price by sector in Hawaii, sourced from EIA data. The data shows prices by sector from 1990 to 2019 are provided.

Table 31. Average Electricity Price by Sector in Hawaii

Year	Residential Cents/kWh	Commercial Cents/kWh	Industrial Cents/kWh	Other Cents/kWh	Total Cents/kWh
1990	10.26	10.18	7.57	9.40	9.02
1991	10.52	10.33	7.71	9.56	9.22
1992	10.90	10.53	7.83	9.71	9.44
1993	12.28	11.68	8.95	11.26	10.66
1994	12.45	11.67	8.82	11.21	10.68
1995	13.32	12.16	9.27	12.11	11.29
1996	14.26	12.99	10.03	12.91	12.12
1997	14.80	13.26	10.32	13.20	12.49
1998	13.82	12.31	9.41	12.28	11.56
1999	14.30	12.74	9.70	12.66	11.97
2000	16.41	14.81	11.69	14.76	14.03
2001	16.34	14.81	11.68	16.81	14.05
2002	15.63	14.11	11.02	16.85	13.39
2003	16.73	15.02	12.20	NA	14.47
2004	18.06	16.19	13.35	NA	15.70
2005	20.70	19.04	15.79	NA	18.33
2006	23.35	21.42	17.96	NA	20.72
2007	24.12	21.91	18.38	NA	21.29
2008	32.50	29.72	26.05	NA	29.20
2009	24.20	21.86	18.14	NA	21.21
2010	28.10	25.93	21.94	NA	25.12
2011	34.68	32.37	28.40	NA	31.59
2012	37.34	34.88	30.82	NA	34.04
2013	36.98	34.05	29.87	NA	33.26
2014	37.04	34.21	30.22	NA	33.43
2015	29.60	26.93	23.06	NA	26.17
2016	27.47	24.64	20.69	NA	23.87
2017	29.50	26.77	22.92	NA	26.05
2018	32.47	29.90	26.10	NA	29.18
2019	32.06	29.23	25.76	NA	28.72

Source: Energy Information Administration, State Energy Data System

6. Conclusions

In recent years, electricity generated by utilities as a percentage of the total electricity generated by the electric power industry has decreased significantly. From 1990 to 2019, the share of utility generated electricity decreased 28.5 percentage points, from 82.4 percent to 53.9 percent. Before 2015, the average cost of electricity purchased by the utility was below the average fuel cost of utility generated electricity in most of the years, the increased share of purchased electricity has helped reduce the cost of electricity sold by the utility. Since 2015, however, the average cost of electricity purchased by the utility was above the average fuel cost of utility generated electricity due to decreased petroleum prices.

In 2019, gross generation in Hawaii was estimated to be about 11,273 GWH. Not all the electricity generated was sold to the utility customers. In 2019, about 5.0 percent of the gross generation in Hawaii was consumed by the power stations. In addition, about 3.8 percent of gross generation was lost during electricity transmission and distribution, and about 9.6 percent of gross generation was generated and consumed by the customers. Therefore, only about 9,200 GWH or 82.0 percent of the gross generation was sold to utility customers.

From 2005 to 2012, the average fuel cost to generate one kWh of net electricity by the utilities increased 12.7 percent per year from 10.0 cents to 23.1 cents for the state. During the same period the average cost of purchased electricity increased only 7.0 percent per year, from 11.0 cents to 17.7 cents. In 2005, the average cost of purchased electricity was above the average fuel cost of the utilities. In 2012, the average cost of purchased electricity was about 23.4 percent below the average fuel cost of the utilities in Hawaii. Since 2015, however, the average cost of purchased electricity was above the average fuel cost of the utilities again. In 2019 and 2020, the average cost of purchased electricity was 6.6 percent and 37.3 percent above the average fuel cost of the utility generated electricity, respectively.

Among the four utility companies, the average cost of purchased electricity in 2020 was the lowest at HECO at about 14.1 cents/kWh. The lower average cost of purchased power at HECO was partially due to the lower purchased power cost from coal generated electricity.

The relatively slower growth of purchased power prices from 2005 to 2012 was due to the rapid growth of petroleum prices and a higher share of electricity being generated from non-petroleum sources including coal and renewable energy by non-utility producers. In 2012, about

95.6 percent of utility generated electricity was from petroleum; in contrast, only 39.0 percent of non-utility generated electricity was from petroleum.

The average unit cost of petroleum used for utility electricity generation increased rapidly from 2005 to 2012, with the growth rate being significantly higher than the growth rate of crude oil prices. In this period, the average unit petroleum cost for the four electric utilities in Hawaii increased an average of 13.3 percent per year from $57.57 per BBL to $137.74 per BBL. Fuel oil costs increased an average 14.9 percent per year from $51.22 per BBL to $135.72 per BBL, and diesel oil costs increased an average 9.3 percent per year from $77.36 per BBL to $143.93 per BBL. In comparison, the average crude oil price increased an average 7.6 percent per year during the same period. From 2012 to 2016, the unit fuel oil cost decreased 22.5 percent per year on average, and the unit diesel cost decreased 17.0 percent per year. From 2016 to 2018, however, the unit fuel oil cost increased 30.5 percent per year, and the unit diesel cost increased 20.2 percent per year. In 2019 and 2020, the unit petroleum cost increased 6.7 percent and 23.0 percent, respectively from the previous year.

In addition to fuel and purchased power costs, the cost of electricity is also affected by four other components. The operating income of the utilities accounted for about 10.2 percent, taxes accounted for about 11.2 percent, depreciation and amortization accounted for about 10.1 percent, and other utility operating expenses accounted for about 21.2 percent of the total electricity cost paid by consumers in 2020.

Total electricity sold by utilities decreased over the period analyzed. A large part of this decrease was due to reduced utility electricity sales caused by the installation of customer-sited solar systems. From 2005 to 2019, total electricity sold by the utilities decreased 1,338 GWH; sales to the residential sector decreased 543 GWH or 40.6 percent of the reduced sales, sales to the commercial sector decreased 512 GWH or 38.2 percent, and sales to the industrial sector decreased 283 GWH or 21.1 percent.

The analysis showed that the decrease in electricity sales was due to a decrease in electricity sales per customer, rather than a decrease in the number of customers. This is a statement appearing in preceding reports and is generally true to apply to the year of 2019 and 2020. However, the electricity sales were further decreased by the pandemic in 2020, due to the reduced activities in the commercial and industrial sectors.

In 2020, total utility generation decreased by 7.0% from 2019, compared to the annual average 2.0% decrease of utility generation from 2005 to 2019. In 2020, the electricity purchased by utilities decreased by 4.3% from 2019, which went against the trend that the purchased electricity grew at an annual rate of 0.3% from 2005 to 2019. Compared to 2019, in 2020, total electricity sold decreased by 7.2%; revenues from electricity sales decreased by 9.9%; fuel and purchased power cost reduced by 17.9%; electricity sold to the residential sector increased by 3.1%; and electricity sold to the commercial and industrial sectors decreased by 12.5% and 10.4%, respectively.