

Energy & Science



Section 7

ENERGY & SCIENCE

The increase in Maui County's population has been reflected in the utilities. Consumption and use of electricity, gas, utilities, and water have all increased dramatically over the last decade. Statistics on electricity, gas, water production and consumption are covered. Hawaiian Commercial and Sugar generated about 10.0% of the electric power used on the island of Maui in 2001. Ongoing scientific endeavors include observation of astronomical and man-made space objects from the summit of Mt. Haleakalā.

7.1.1

TELESCOPES AT THE SUMMITS OF MAUNA KE‘A AND HALEAKALĀ: 2003

Facility (mirror diameter in meters)	Capital cost ¹ (\$mil)	Annual operating cost (\$mil)	County based staff	Operational
Mauna Ke‘a observatories:				
UH 0.6-m (Optical)	0.3	-. ²	-. ²	1968
UH 2.2-m (Optical/Infrared)	5	1.3	8	1970
Canada-France-Hawai‘i 3.6-m (Optical/Infrared)	30	6.2	50	1979
NASA IRTF 3.0-m (Infrared)	10	3.2	16	1979
United Kingdom 3.8-m (Infrared)	5	3.0	31	1979
James Clerk Maxwell 15-m Submillimeter	32	5.0	39	1986
Caltech 10.4-m Submillimeter	10	2.6	11	1986
W.M. Keck Observatory (Keck I & II) 10-m x 2 (Optical/Infrared)	170	11.0	115	1992/96
VLBA Antenna 25-m (Radio)	7	0.25	2	1992
Submillimeter Array 8x6-m	80	6.0	36	2003
Subaru (Japan National Large Telescope) 8-m (Optical/Infrared)	170	15.0	70	1999
Fredrick C. Gillett Gemini 8m (Optical/Infrared)	92	8.0	70	1999
Mauna Ke‘a Observatories Support Services	(X)	2.4 ³	28	(X)
Total	611	61.6	476	
Haleakalā observatories:				
Mees Solar Observatory	0.5	0.1	2	1968
Lunar Ranging Facility	3.3	0.7	7	1976/84
Haleakalā Observatories Projects	(NA)	0.5	4	1979
Maui Space Surveillance Site (MSSS) ⁴	200.0	16.0	120	1979
Advanced Electro-Optical System 3.7-m Telescope (AEOS)	50.0	15.0	55	1997
Magnum 2-m Telescope ⁵	5.0	0.25	1	2000
Faulkes 2-m Telescope ⁶	5.0	(NA)	(NA)	2003
Haleakalā Support Facilities	(X)	0.13	6	(NA)
Total	263.8	32.68	195	

NA Not available.

X Not applicable.

¹ Historical cost, not adjusted for inflation.

² Combined budget and staffing with UH 2.2-m telescope.

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

⁴ Formerly Air Force Maui Optical Station (AMOS).

⁵ MAGNUM = Multicolor Active Galactic Nuclei Monitoring.

⁶ Under construction.

SOURCE: University of Hawai‘i at Mānoa, Institute for Astronomy, records.

7.1.2

ELECTRIC UTILITIES, MAUI COUNTY

	2002	2003	2004	2005	2006
CUSTOMERS, DEC. 31					
<i>Total</i>					
Maui Island	55,504	56,880	57,430	59,248	60,218
Moloka'i	2,960	3,017	3,018	3,085	3,099
Lāna'i	1,519	1,526	1,548	1,568	1,620
Maui County	59,983	61,423	61,996	63,901	64,937
<i>Residential¹</i>					
Maui Island	47,253	48,327	48,753	50,281	50,922
Moloka'i	2,416	2,464	2,472	2,504	2,531
Lāna'i	1,310	1,319	1,334	1,350	1,381
Maui County	50,979	52,110	52,559	54,135	54,834
<i>Other</i>					
Maui Island	8,251	8,553	8,677	8,967	9,296
Moloka'i	544	553	546	581	568
Lāna'i	209	207	214	218	239
Maui County	9,004	9,313	9,437	9,766	10,103
GENERATING AND FIRM PURCHASED CAPABILITY, DEC. 31 (MW)					
Maui Island	250.1	245.2	245.2	232.8	248.0
Moloka'i	12.0	11.8	11.8	11.8	11.8
Lāna'i	10.4	10.3	10.3	10.3	10.3
Maui County	272.5	267.3	267.3	254.9	270.1
PEAK DEMAND (MW)²					
Maui Island	193.9	197.7	206.5	202.1	206.4
Moloka'i	6.6	6.5	6.7	6.3	6.2
Lāna'i	4.9	5.0	4.8	5.1	5.5
			218		
POWER SOLD (1,000 kWh)					
<i>Total</i>					
Maui Island	1,096,739	1,142,689	1,184,554	1,188,253	1,202,503
Moloka'i	34,942	35,894	35,344	35,918	35,273
Lāna'i	27,036	28,136	27,802	27,942	28,691
Maui County	1,158,717	1,206,719	1,247,700	1,252,113	1,266,467
<i>Residential</i>					
Maui Island	378,828	398,949	419,276	421,130	424,628
Moloka'i	12,439	13,048	13,413	13,012	12,717
Lāna'i	7,358	7,515	7,688	7,865	8,088
Maui County	398,625	419,512	440,377	442,007	445,433
<i>Other</i>					
Maui Island	717,911	743,741	765,268	767,123	777,875
Moloka'i	22,503	22,846	21,931	22,906	22,556
Lāna'i	19,678	20,621	20,114	20,077	20,603
Maui County	760,092	787,208	807,313	810,106	821,034

7.1.2

CONTINUED

	2002	2003	2004	2005	2006
AVERAGE ANNUAL USE (kWh)³					
<i>Residential</i>					
Maui Island	8,017	8,255	8,600	8,376	8,339
Moloka'i	5,149	5,296	5,426	5,196	5,024
Lāna'i	5,617	5,697	5,763	5,826	5,857
Maui County	7,819	8,050	n/a	n/a	na
<i>Other</i>					
Maui Island	87,009	86,957	88,195	85,550	83,678
Moloka'i	41,366	41,312	40,166	39,425	39,711
Lāna'i	94,152	99,619	93,990	92,096	86,205
Maui County	84,417	84,528	n/a	n/a	na
AVERAGE RATE (dollars per kWh)					
<i>Residential</i>					
Maui Island	0.17119	0.18289	0.20817	0.24687	0.27784
Moloka'i	0.22173	0.22953	0.25741	0.30111	0.33955
Lāna'i	0.22445	0.23460	0.25149	0.30019	0.32505
Maui County	0.17375	0.18527	na	n/a	na
<i>Other</i>					
Maui Island	0.15684	0.16954	0.19296	0.23321	0.26349
Moloka'i	0.21110	0.22509	0.25543	0.29621	0.33543
Lāna'i	0.22480	0.23516	0.23959	0.29003	0.31364
Maui County	0.16020	0.17287	na	n/a	na
REVENUES (\$1,000)					
<i>Total</i>					
Maui Island	177,446	199,057	234,943	282,868	322,941
Moloka'i	7,508	8,137	9,054	10,703	11,884
Lāna'i	6,075	6,612	6,752	8,184	9,091
Maui County	191,030	213,806	250,749	301,755	343,916
<i>Residential</i>					
Maui Island	64,851	72,964	87,281	103,964	117,980
Moloka'i	2,758	2,995	3,453	3,918	4,318
Lāna'i	1,652	1,763	1,933	2,361	2,629
Maui County	69,260	77,721	92,667	110,243	124,927
<i>Other</i>					
Maui Island	112,596	126,093	147,662	178,904	204,961
Moloka'i	4,750	5,142	5,602	6,785	7,566
Lāna'i	4,424	4,849	4,819	5,823	6,462
Maui County	121,769	136,085	158,083	191,512	218,989

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

² Peak demand is the maximum amount of energy required from the electrical system. The islands' electrical systems are not interconnected, so no peaks are reported for Maui County as a whole.

³ Based on number of customers at end of year. n/a Not Available.

MW: Megawatts kWh: Kilo-watt-hour.

SOURCE: Hawai'i State Department of Commerce and Consumer Affairs, Division of Consumer Advocacy, records; capacity and peak demand: Hawaiian Electric Industries, Inc., Securities and Exchange Commission 10-K filings, 2002-2006.

7.1.3

GAS UTILITIES, MAUI COUNTY*Excludes bottled gas*

	2001	2002	2003	2004	2005	2006
Island of Maui						
Customers (December 31)						
Residential ¹	329	325	321	317	321	319
Other	79	75	76	74	76	77
Total	408	400	397	391	397	396
Gas Sold (1,000 therms)						
Residential	77	68	69	69	74	76
Other	786	771	766	782	755	726
Total	863	839	836	850	829	802
Average Annual Use (therms)						
Residential	234	210	216	217	231	238
Other	9,947	10,281	10,081	10,561	9,934	9,429
Average Rate (\$ per therm)²						
Residential	2.43086	2.71343	2.82044	2.91367	3.14865	3.34211
Other	1.45250	1.36960	1.51092	1.59858	1.87550	2.05510
Revenues (\$1,000)						
Residential	187	185	196	201	233	254
Other	1,141	1,056	1,158	1,249	1,416	1,492
Total	1,329	1,241	1,353	1,450	1,649	1,746
Island of Moloka'i³						
Customers (December 31)						
Total/Residential	71	80	72	73	78	81
Gas Sold (1,000 therms)						
Total/Residential	15	14	15	14	14	14
Average Annual Use (therms)						
Total/Residential	205	117	202	185	179	173
Average Rate (\$ per therm)						
Total/Residential	2.62590	2.84208	3.00433	3.15372	3.35714	3.71429
Revenues (\$1,000)						
Total/Residential	38	40	44	43	47	52

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

² Based on number of customers at end of year.

³ All Molokai customers are residential.

SOURCE: Hawai'i State Department of Commerce and Consumer Affairs, Division of Consumer Advocacy, records.

7.1.4

HAWAI'I STATE ENERGY REPORT, ENERGY CONSUMPTION ESTIMATES BY SOURCE

In billion BTU

	2000	2001	2002	2003	2004
Asphalt and road oil	4,009.3	2,271.0	709.9	731.5	99.5
Aviation gasoline	226.3	243.8	88.6	77.4	199.7
Distillate fuel	29,672.3	35,180.4	47,099.5	46,782.6	50,293.8
Kerosene-type jet fuel	53,510.8	50,437.3	59,450.4	73,620.8	75,465.8
Naphtha-type jet fuel	0.0	0.0	0.0	0.0	0.0
Kerosene	1.3	0.9	0.7	0.9	0.8
Liquified petroleum gasses	2,027.4	2,102.2	2,782.4	1,786.3	1,672.9
Lubricants	595.7	545.8	539.3	498.6	505.1
Motor gasoline	48,397.8	50,587.3	54,261.1	55,176.6	56,012.2
Residual fuel	85,001.5	83,517.5	80,086.4	75,938.7	82,423.1
Other petroleum products ¹	11751.7r	14948.1r	14167.6r	15438.6r	15,183.8
Subtotal petroleum products	235,194.0	239,834.4	259,185.8	270,052.1	282,556.6
Geothermal energy	5,515.6	4,349.9	1,537.2	3,756.1	4,492.5
Solar thermal and photovoltaic energy	1,364.9	1,343.1	1,369.8	1,417.5	1,467.9
Wind energy	173.4	21.9r	16.4	16.1	75.1
Subtotal geothermal, solar thermal, photovoltaic and wind energy	7,053.9	5,715.0r	2,923.4r	5,189.8	6,035.5
Coal	17,653.7	17,773.8r	16,618.0r	19,255.5	19,253.7
Hydroelectric power	1055.4r	1041.1r	967.1	926.9	941.1
Natural gas	2,975.0	2,919.4	2,898.1	2,860.8	2,905.1
Wood and waste	15,193.5	11690.2r	9531.4r	11706.4r	11,760.9
Total energy consumption	279,125.2	278,974.1r	292,123.8r	309,991.5r	323,452.7

Note: Totals may not equal sum of components due to independent rounding.

¹ Other petroleum products are aviation gasoline blending components, motor gasoline blending components, petroleum coke, still gas, unfinished oils, and petroleum waxes.

r Revised from previous Data Book.

SOURCE: U.S. Department of Energy, Energy Information Administration, Combined State Energy Data System 2004.

7.1.5

WATER SERVICES AND CONSUMPTION, MAUI COUNTY*Years ending June 30*

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	NUMBER OF SERVICES										
State Total	229,989	230,952	233,043	235,799	238,665	242,092	245,397	247,862	254,036	258,790	261,096
Maui County	27,918	28,306	28,720	29,333	29,750	30,414	31,021	31,680	32,344	33,123	33,675
Maui	26,409	26,795	27,205	27,809	28,217	28,872	29,451	30,102	30,751	31,510	32,045
Moloka'i	1,509	1,511	1,515	1,524	1,533	1,542	1,570	1,578	1,593	1,613	1,630
	CONSUMPTION (million gallons)										
State Total	75,389	71,810	73,301	76,631	76,401	78,748	77,868	80,735	78,245	77,171	80,106
Maui County	11,477	11,485	11,729	12,547	12,719	12,883	12,312	12,695	12,436	12,961	13,186
Maui	11,138	11,110	11,399	12,199	12,388	12,546	11,997	12,357	12,105	12,644	12,883
Moloka'i	339	330	369	348	331	337	315	338	331	317	303

SOURCE: County of Maui, Department of Water Supply, *Annual Report FY 2006*.

7.1.6

DAILY AVERAGES FOR WATER PRODUCTION BY AREA, MAUI COUNTY

in thousands of gallons

Area	07/06	08/06	09/06	10/06	11/06	12/06	01/07	02/07	03/07	04/07	05/07	06/07	Prev. 12 months
Central Maui													
Groundwater-Īao	19,428	19,516	19,394	17,503	15,662	17,525	17,853	16,517	17,216	19,140	19,369	19,919	18,266
Īao Tunnel	1,704	1,808	1,749	1,733	1,906	1,857	1,918	1,812	1,786	1,737	1,717	1,686	1,784
Groundwater-Waihe'e	5,200	5,406	5,385	4,695	4,521	3,403	3,098	3,719	3,358	4,003	5,100	5,201	4,426
Surface Water	1,584	1,591	1,055	952	1,113	605	1,000	1,157	1,130	691	1,222	1,573	1,139
Upcountry Maui													
Surface Water	8,788	8,851	7,854	6,293	5,408	5,667	6,637	6,114	5,906	7,478	8,666	8,551	7,192
Groundwater	1,153	1,181	1,185	1,219	1,126	1,023	1,033	1,080	1,108	481	817	425	987
West Maui													
Surface Water	3,533	3,302	3,679	3,639	3,779	3,552	3,420	3,398	3,419	3,286	3,220	3,159	3,449
Groundwater	2,942	3,191	2,813	2,655	2,356	2,387	2,501	2,634	2,416	2,639	3,005	3,306	2,737
East Maui													
Groundwater	304	280	261	259	237	273	285	282	261	294	321	336	283
Moloka'i													
Groundwater	1,528	1,463	1,365	1,255	1,037	1,137	1,118	1,171	1,121	1,259	1,427	1,513	1,284
TOTAL WATER PRODUCTION	46,165	46,588	44,741	40,202	37,143	37,428	38,863	37,884	37,720	41,008	44,864	45,669	41,547

SOURCE: County of Maui, Department of Water Supply, Water Quality Report.

7.1.7

WATER SYSTEM DEVELOPMENT FEE SCHEDULE

Effective July 29, 2002

Meter Size	Total Fee
5/8 inch	\$6,030
3/4 inch	8,442
1 inch	15,678
1 1/2 inch	34,974
2 inch	61,506
3 inch	138,690
4 inch	247,230
6 inch	555,966
8 inch	987,714
10 inch	1,543,680
12 inch	2,222,658

Note: Fees do not include installation charges.

7.1.8

WATER SERVICES BY METER SIZE, MAUI COUNTY

District	5/8"	3/4"	1"	1-1/2"	2"	3"	4"	6"	8"	Total
Regular Rates										
Wailuku	16,009	1,087	498	394	376	65	23	4	1	18,457
Makawao	8,530	308	169	74	27	14	3	1	0	9,126
Lahaina	2,609	185	124	122	120	26	6	1	0	3,193
Hāna	486	8	8	4	4	0	0	0	0	510
Moloka'i	1,517	40	31	15	18	2	0	1	0	1,624
Subtotal	29,151	1,628	830	609	545	107	32	7	1	32,910
Agricultural Service Meters										
Wailuku	24	5	9	2	2	2	1	0	0	45
Makawao	393	72	99	95	34	1	3	0	0	697
Lahaina	5	3	0	0	0	0	1	0	0	9
Hāna	6	0	2	0	0	0	0	0	0	8
Moloka'i	4	0	2	0	0	0	0	0	0	6
Subtotal	432	80	112	97	36	3	5	0	0	765
Total	29,583	1,708	942	706	581	110	37	7	1	33,675

SOURCE: County of Maui, Department of WaterSupply, *Annual Report FY 2006*.

7.1.9

**OUTSIDE WATER DELIVERIES
TO DEPARTMENT OF WATER SUPPLY,
MAUI COUNTY**

Purchased From	1,000 Gallons	Amount	Cost Per 1,000 Gallons
East Maui Irrigation	2,601,122	\$156,848	\$0.060
Wailuku Agribusiness	509,781	235,924	0.463
Maui Land & Pine	779,097	46,566	0.060
Hawaiian Home Lands	13,736	30,673	2.233
R.W. Meyers	247	99	0.401
HC&S	0		
Total	3,903,983	\$470,110	\$0.120
District			
Wailuku	509,781	\$235,924	\$0.463
Kula	1,937,579	116,836	0.060
Makawao	645,895	38,948	0.060
Lahaina	779,097	46,566	0.060
Hāna	17,648	1,064	0.060
Moloka'i	13,983	30,772	2.201
Total	3,903,983	\$470,110	\$0.120
Other Water			
Wailuku - Wailuku Agri-business	391,974		
Wailuku - Hawaii Land & Farming	1,766,382		
Total	2,158,356		

SOURCE: County of Maui, Department of Water Supply, *Annual Report FY 2006*.

7.1.10

**WATER SALES TO GENERAL AND AGRICULTURAL
CONSUMERS BY DISTRICT & SYSTEMS,
MAUI COUNTY, FISCAL YEAR**

System	Services	Change from FY 2005	Consumption (1,000 gallons)	Change from FY 2005 (1,000 gallons)
Wailuku District				
Wailuku	5,689	296	1,303,985	2,035
Waihe'e	190	(1)	29,451	2,699
Waikapū	334	6	54,308	(986)
Wailuku Heights	487	2	86,437	5,672
Kahului	4,752	33	1,809,576	99,344
Pu'unēnē	11	(1)	37,249	13,238
Kihei	5,725	55	4,321,126	263,928
Mā'alaea	45	0	85,455	9,703
Mākena	195	(3)	224,534	(7,021)
Pā'ia-Kū'au	904	13	154,687	(13,626)
Spreckelsville	170	(2)	78,433	(1,865)
Subtotal	18,502	398	8,185,241	373,121
Makawao District				
Kokomo-Kaupakalua	1,235	71	176,445	(8,728)
Kuiaha	296	0	57,339	(1,999)
Ha'ikū-Pa'uwela	836	0	140,101	(7,537)
Makawao	2,015	10	347,767	(50,077)
Pukalani	2,072	7	364,340	1,491
Hāili'imaile	200	(5)	38,594	(750)
Upper Kula	1,956	21	490,633	2,583
Lower Kula	1,092	11	809,058	3,302
'Ulupalakua	82	0	60,706	3,458
Kula Agr. Park	39	0	220,901	(15,286)
Subtotal	9,823	115	2,705,884	(73,543)
Lahaina District				
Lahaina	1,980	6	849,042	38,850
Honokōwai	441	5	575,581	(111,000)
'Alaeloa	768	12	502,252	7,858
Honokōhau	13	0	1,098	(201)
Subtotal	3,202	23	1,927,973	(64,493)
Moloka'i District				
Kawela-Kaunakakai	1,146	14	226,897	(11,599)
'Ualapu'e	366	(1)	64,482	(1,645)
Kala'e	110	2	11,114	(801)
Hālawa	8	0	159	(259)
Subtotal	1,630	15	302,652	(14,304)
Hāna District				
Hāna	382	1	50,836	4,553
Nāhiku	37	0	4,183	(357)
Ke'anae	82	0	7,462	(206)
Kaupō	17	0	1,900	774
Subtotal	518	1	64,381	4,764

SOURCE: County of Maui, Department of Water Supply, *Annual Report FY 2006*.

7.1.11

**WATER CONSUMPTION BY DISTRICT,
MAUI COUNTY, FISCAL YEAR**

1,000 gallons

Months	Total	Wailuku	Makawao	Kula	Lahaina	Moloka'i	Hāna
General							
July-August	2,185,758	1,454,469	213,649	114,280	354,045	47,413	1,902
September-October	2,073,172	1,416,688	159,018	106,055	340,171	39,863	11,377
November-December	2,001,270	1,359,752	168,887	92,741	293,478	76,065	10,347
January-February	1,938,694	1,317,161	166,806	89,055	311,659	44,711	9,302
March-April	1,822,929	1,262,278	150,663	75,113	282,308	43,420	9,147
May-June	1,883,973	1,209,473	178,654	92,876	336,875	45,511	20,584
Total	11,905,796	8,019,821	1,037,677	570,120	1,918,536	296,983	62,659
Agricultural							
July-August	286,285	28,197	24,564	230,836	1,952	736	0
September-October	244,630	26,468	13,162	201,687	1,695	1,257	361
November-December	206,398	28,707	13,809	160,601	1,351	1,304	626
January-February	213,471	37,021	12,331	160,945	1,735	1,094	345
March-April	136,482	20,611	10,699	103,137	1,351	530	154
May-June	193,069	24,416	12,344	153,636	1,689	751	233
Total	1,280,335	165,420	86,909	1,010,842	9,773	5,672	1,719
Grand Total	13,186,131	8,185,241	1,124,586	1,580,962	1,928,309	302,655	64,378

SOURCE: County of Maui, Department of Water Supply, *Annual Report FY 2006*.