

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. Haleakala.

7.1.1

TELESCOPES AT THE SUMMITS OF MAUNA KEA AND HALEAKALA: 2003

Facility (mirror diameter in meters)	Capital cost ¹ (\$mil)	Annual operating cost (\$mil)	County based staff	Operational
Mauna Kea observatories:				
UH 0.6-m (Optical)	0.3	- ²	- ²	1968
UH 2.2-m (Optical/Infrared)	5	1.3	8	1970
Canada-France-Hawaii 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 Kea Observatories Support Services	(X)	2.4 ³	28	(X)
Total	611	61.6	476	
Haleakala observatories:				
Mees Solar Observatory	0.5	0.1	2	1968
Lunar Ranging Facility	3.3	0.7	7	1976/84
Haleakala 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
Haleakala 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 Hawaii at Manoa, Institute for Astronomy, records.

7.1.2

ELECTRIC UTILITIES, MAUI COUNTY

	2001	2002	2003	2004	2005
CUSTOMERS, DEC. 31					
<i>Total</i>					
Maui Island	54,405	55,504	56,880	57,430	59,248
Molokai	2,926	2,960	3,017	3,018	3,085
Lanai	1,509	1,519	1,526	1,548	1,568
Maui County	58,840	59,983	61,423	61,996	63,901
<i>Residential¹</i>					
Maui Island	46,320	47,253	48,327	48,753	50,281
Molokai	2,381	2,416	2,464	2,472	2,504
Lanai	1,306	1,310	1,319	1,334	1,350
Maui County	50,007	50,979	52,110	52,559	54,135
<i>Other</i>					
Maui Island	8,085	8,251	8,553	8,677	8,967
Molokai	545	544	553	546	581
Lanai	203	209	207	214	218
Maui County	8,833	9,004	9,313r	9,437	9,766
GENERATING AND FIRM PURCHASED CAPABILITY, DEC. 31 (MW)					
Maui Island	250.1	250.1	245.2	245.2	232.8
Molokai	12.1	12.0	11.8	11.8	11.8
Lanai	10.4	10.4	10.3	10.3	10.3
Maui County	272.6	272.5	267.3	267.3	254.9
PEAK DEMAND (MW)²					
Maui Island	191.0	193.9	197.7	206.5	202.1
Molokai	6.5	6.6	6.5	6.7	6.3
Lanai	5.2	4.9	5.0	4.8	5.1
POWER SOLD (1,000 kWh)					
<i>Total</i>					
Maui Island	1,071,486	1,096,739	1,142,689	1,184,554	1,188,253
Molokai	35,681	34,942	35,894	35,344	35,918
Lanai	26,905	27,036	28,136	27,802	27,942
Maui County	1,134,072	1,158,717	1,206,719	1,247,700	1,252,113
<i>Residential</i>					
Maui Island	360,025	378,828	398,949	419,276	421,130
Molokai	12,348	12,439	13,048	13,413	13,012
Lanai	7,068	7,358	7,515	7,688	7,865
Maui County	379,440	398,625	419,512	440,377	442,007
<i>Other</i>					
Maui Island	711,462	717,911	743,741	765,268	767,123
Molokai	23,333	22,503	22,846	21,931	22,906
Lanai	19,838	19,678	20,621	20,114	20,077
Maui County	754,633	760,092	787,208	807,313	810,106

7.1.2

CONTINUED

	2001	2002	2003	2004	2005
AVERAGE ANNUAL USE (kWh)³					
<i>Residential</i>					
Maui Island	7,773	8,017	8,255	8,600	8,376
Molokai	5,186	5,149	5,296	5,426	5,196
Lanai	5,412	5,617	5,697	5,763	5,826
Maui County	7,588	7,819	8,050	n/a	n/a
<i>Other</i>					
Maui Island	87,998	87,009	86,957	88,195	85,550
Molokai	42,814	41,366	41,312	40,166	39,425
Lanai	97,722	94,152	99,619	93,990	92,096
Maui County	85,433	84,417	84,528	n/a	n/a
AVERAGE RATE (dollars per kWh)					
<i>Residential</i>					
Maui Island	0.18656	0.17119	0.18289	0.20817	0.24687
Molokai	0.23631	0.22173	0.22953	0.25741	0.30111
Lanai	0.24415	0.22445	0.23460	0.25149	0.30019
Maui County	0.18925	0.17375	0.18527	n/a	n/a
<i>Other</i>					
Maui Island	0.17125	0.15684	0.16954	0.19296	0.23321
Molokai	0.22841	0.21110	0.22509	0.25543	0.29621
Lanai	0.24555	0.22480	0.23516	0.23959	0.29003
Maui County	0.17497	0.16020	0.17287	n/a	n/a
REVENUES (\$1,000)					
<i>Total</i>					
Maui Island	189,003	177,446	199,057	234,943	282,868
Molokai	8,247	7,508	8,137	9,054	10,703
Lanai	6,597	6,075	6,612	6,752	8,184
Maui County	203,847	191,030	213,806	250,749	301,755
<i>Residential</i>					
Maui Island	67,166	64,851	72,964	87,281	103,964
Molokai	2,918	2,758	2,995	3,453	3,918
Lanai	1,726	1,652	1,763	1,933	2,361
Maui County	71,809	69,260	77,721	92,667	110,243
<i>Other</i>					
Maui Island	121,837	112,596	126,093	147,662	178,904
Molokai	5,330	4,750	5,142	5,602	6,785
Lanai	4,871	4,424	4,849	4,819	5,823
Maui County	132,038	121,769	136,085	158,083	191,512

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: Hawaii 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, 2001-2005.

7.1.3

GAS UTILITIES, MAUI COUNTY

Excludes bottled gas

	2000	2001	2002	2003	2004	2005
Island of Maui						
Customers (December 31)						
Residential ¹	333	329	325	321	317	321
Other	78	79	75	76	74	76
Total	411	408	400	397	391	397
Gas Sold (1,000 therms)						
Residential	78	77	68	69	69	74
Other	805	786	771	766	782	755
Total	883	863	839	836	850	829
Average Annual Use (therms)						
Residential	233	234	210	216	217	231
Other	10,320	9,947	10,281	10,081	10,561	9,934
Average Rate (\$ per therm)²						
Residential	2.10372	2.43086	2.71343	2.82044	2.91367	3.14865
Other	1.23916	1.45250	1.36960	1.51092	1.59858	1.87550
Revenues (\$1,000)						
Residential	163	187	185	196	201	233
Other	997	1,141	1,056	1,158	1,249	1,416
Total	1,161	1,329	1,241	1,353	1,450	1,649
Island of Molokai³						
Customers (December 31)						
Total/Residential	78	71	80	72	73	78
Gas Sold (1,000 therms)						
Total/Residential	17	15	14	15	14	14
Average Annual Use (therms)						
Total/Residential	220	205	117	202	185	179
Average Rate (\$ per therm)						
Total/Residential	2.33821	2.62590	2.84208	3.00433	3.15372	3.35714
Revenues (\$1,000)						
Total/Residential	40	38	40	44	43	47

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

7.1.4

HAWAII STATE ENERGY REPORT, ENERGY CONSUMPTION ESTIMATES BY SOURCE

In billion BTU

	1999	2000	2001	2002	2003
Asphalt and road oil	2,340.3	4,009.3	2,271.0	709.9	731.5
Aviation gasoline	293.6	226.3	243.8	88.6	77.4
Distillate fuel	30,951.2	29,672.3	35,180.4	47,099.5	46,782.6
Kerosene-type jet fuel	53,720.0	53,510.8	50,437.3	59,450.4	73,620.8
Naphtha-type jet fuel	0.0	0.0	0.0	0.0	0.0
Kerosene	0.9	1.3	0.9	0.7	0.9
Liquified petroleum gasses	1,358.0	2,027.4	2,102.2	2,782.4	1,786.3
Lubricants	604.8	595.7	545.8	539.3	498.6
Motor gasoline	46,653.8	48,397.8	50,587.3	54,261.1	55,176.6
Residual fuel	81,383.5	85,001.5	83,517.5	80,086.4	75,938.7
Other petroleum products ¹	14,730.3r	13,959.5r	17,188.4r	16,407.9r	17,733.8
Subtotal petroleum products	229,921.1r	235,194.0r	239,834.4r	259,185.8r	270,052.1
Geothermal energy	4,437.1	5,515.6	4,349.9	1,537.2r	3,756.1
Solar thermal and photovoltaic energy	1,353.0	1,364.9	1,343.1r	1,369.8r	1,417.5
Wind energy	168.7	173.4	21.6	16.4r	16.1
Subtotal geothermal, solar thermal, photovoltaic and wind energy	5,958.8	7,053.9	5,715.0r	2,923.4r	5,189.8
Coal	17,691.3r	17,653.7	17,773.8r	16,618.0r	19,255.5
Hydroelectric power	1,175.0	1,041.1r	1,025.0	967.1r	926.9
Natural gas	2,886.5	2,975.0	2,919.4	2,898.1r	2,860.8
Wood and waste	16,980.9r	15,193.5r	11,351.6	9,144.9r	11,321.2
Total energy consumption	274,612.7r	279,125.2r	278,635.5r	291,737.4r	309,606.3

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.

NA: Not Available.

SOURCE: U.S. Department of Energy, Energy Information Administration, Combined State Energy Data System 2003.

7.1.5

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

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
	NUMBER OF SERVICES										
State Total	226,998	229,989	230,952	233,043	235,799	238,665	242,092	245,397	247,862	254,036	258,790
Maui County	27,460	27,918	28,306	28,720	29,333	29,750	30,414	31,021	31,680	32,344	33,123
Maui	25,960	26,409	26,795	27,205	27,809	28,217	28,872	29,451	30,102	30,751	31,510
Molokai	1,500	1,509	1,511	1,515	1,524	1,533	1,542	1,570	1,578	1,593	1,613
	CONSUMPTION (million gallons)										
State Total	74,990	75,389	71,810	73,301	76,631	76,401	78,748	77,868	80,735	78,345	77,171
Maui County	11,494	11,477	11,485	11,729	12,547	12,719	12,883	12,312	12,695	12,436	12,961
Maui	11,150	11,138	11,110	11,399	12,199	12,388	12,546	11,997	12,357	12,105	12,644
Molokai	344	339	330	369	348	331	337	315	338	331	317

Source: County of Maui, Department of Water Supply, Annual Report FY 2005.

7.1.6

DAILY AVERAGES FOR WATER PRODUCTION BY AREA, MAUI COUNTY

in thousands of gallons

Area	06/05	07/05	08/05	09/05	10/05	11/05	12/05	01/06	02/06	03/06	04/06	05/06	Prev. 12 months
Central Maui													
Groundwater-Iao	18,402	18,389	19,240	18,723	18,171	18,341	16,436	17,351	16,838	16,158	16,495	17,354	17,672
Iao Tunnel	2,102	1,729	1,680	1,655	1,682	1,692	1,692	1,697	1,620	1,611	1,632	1,742	1,746
Groundwater-Waihee	4,794	5,208	5,405	5,363	5,189	4,153	4,716	4,421	3,993	3,526	4,419	4,954	4,655
Surface Water	981	1,021	1,009	530	297	0	0	508	735	842	870	863	646
Upcountry Maui													
Surface Water	7,181	7,491	7,961	7,157	6,351	6,130	5,912	6,253	4,868	4,913	5,884	6,087	6,539
Groundwater	1,200	1,060	1,081	1,034	988	971	1,005	961	1,000	973	996	1,066	1,050
West Maui													
Surface Water	3,284	3,365	3,798	3,807	3,808	3,852	3,893	3,887	3,811	3,716	3,732	3,564	3,713
Groundwater	2,553	2,625	2,550	2,301	2,185	1,942	1,996	2,050	1,970	1,902	1,959	2,225	2,172
East Maui													
Groundwater	330	308	345	364	329	352	364	348	334	256	282	276	333
Molokai													
Groundwater	1,377	1,301	1,395	1,276	1,184	1,144	983	1,060	1,013	945	943	1,368	1,170
TOTAL WATER PRODUCTION	42,206	42,496	44,464	42,209	40,185	38,575	36,997	38,536	36,181	34,842	37,212	39,499	39,695

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.

SOURCE: County of Maui, Department of Water Supply, *Annual Report FY 2005*.

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	15,761	965	498	388	372	66	24	3	1	18,078
Makawao	8,397	291	158	75	23	11	4	1	0	8,960
Lahaina	2,634	142	121	127	119	25	6	1	0	3,175
Hana	479	8	8	4	3	0	0	0	0	502
Molokai	1,500	38	31	14	18	2	0	1	0	1,604
Subtotal	28,771	1,444	816	608	535	104	34	6	1	32,319
Agricultural Service Meters										
Wailuku	13	9	7	3	1	0	0	0	0	33
Makawao	433	69	106	95	37	1	2	0	0	743
Lahaina	-1	4	1	0	0	-1	0	0	0	3
Hana	13	0	3	0	0	0	0	0	0	16
Molokai	5	2	1	1	0	0	0	0	0	9
Subtotal	463	84	118	99	38	0	2	0	0	804
Total	29,234	1,528	934	707	573	104	36	6	1	33,123

SOURCE: County of Maui, Department of Water Supply, *Annual Report FY 2005*.

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	2,616,640	\$157,783	\$0.060
Wailuku Agribusiness	468,815	163,575	0.349
Maui Land & Pine	707,454	36,222	0.051
Hawaiian Home Lands	11,357	25,542	2.249
R.W. Meyers	497	199	0.400
HC&S	90,212	16,479	0.183
Total	3,894,975	\$399,800	\$0.103
District			
Wailuku	559,027	\$180,054	\$0.322
Kula	1,744,808	105,212	0.060
Makawao	859,488	51,827	0.060
Lahaina	707,454	36,222	0.051
Hana	12,344	744	0.060
Molokai	11,854	25,741	2.172
Total	3,894,975	\$399,800	\$0.103

SOURCE: County of Maui, Department of Water Supply, *Annual Report FY 2005*.

7.1.10

**WATER SALES TO GENERAL AND AGRICULTURAL
CONSUMERS BY DISTRICT & SYSTEMS,
MAUI COUNTY FY JULY 2004 - JUNE 2005**

System	Services	Change from FY 2004	Consumption (1,000 gallons)	Change from FY 2004 (1,000 gallons)
Wailuku District				
Wailuku	5,393	243	1,301,950	99,729
Waihee	191	2	26,752	2,552
Waikapu	328	1	55,294	7,380
Wailuku Heights	485	13	80,765	2,300
Kahului	4,719	189	1,710,232	176,523
Puunene	12	2	24,011	(5,875)
Kihei	5,670	105	4,057,198	111,167
Maalaea	45	0	75,752	(5,041)
Makena	198	34	231,555	13,365
Paia-Kuau	891	5	168,313	5,042
Spreckelsville	172	1	80,298	2,778
Subtotal	18,104	595	7,812,120	409,920
Makawao District				
Kokomo-Kaupakalua	1,164	85	185,173	7,100
Kuiaha	296	(7)	59,338	1,205
Haiku-Pauwela	836	(1)	147,638	964
Makawao	2,005	25	397,844	49,127
Pukalani	2,065	25	362,849	(7,807)
Hailiimaile	205	4	39,344	1,043
Upper Kula	1,935	15	488,050	48,346
Lower Kula	1,081	(3)	805,756	47,364
Ulupalakua	82	3	57,248	1,994
Kula Agr. Park	39	(1)	236,187	43,979
Subtotal	9,708	145	2,779,427	193,315
Lahaina District				
Lahaina	1,974	1	810,192	(81,563)
Honokowai	436	6	686,581	44,236
Alaeloa	756	11	494,394	(9,661)
Honokohau	13	0	1,299	(305)
Subtotal	3,179	18	1,992,466	(47,293)
Molokai District				
Kawela-Kaunakakai	1,132	2	238,496	6,894
Ualapue	367	17	66,127	(17,595)
Kalae	108	1	11,915	(3,875)
Halawa	8	0	418	293
Subtotal	1,615	20	316,956	(14,283)
Hana District				
Hana	381	0	46,283	(10,734)
Nahiku	37	2	4,540	(230)
Keanae	82	2	7,668	(5,416)
Kaupo	17	(3)	1,126	(331)
Subtotal	517	1	59,617	(16,711)
Total	33,123	779	12,960,586	524,948

SOURCE: County of Maui, Department of Water Supply, *Annual Report FY 2005*.

7.1.11

**WATER CONSUMPTION BY DISTRICT,
MAUI COUNTY FY JULY 2004 - JUNE 2005**

1,000 GALLONS

Months	Total	Wailuku	Makawao	Kula	Lahaina	Molokai	Hana
General							
July-August	2,241,480	1,373,380	196,461	112,478	482,640	68,131	8,390
September-October	2,094,115	1,405,462	200,274	119,275	303,237	54,606	11,261
November-December	1,901,030	1,285,580	191,304	93,930	262,478	66,085	1,653
January-February	1,720,105	1,180,288	159,983	72,664	271,814	26,386	8,970
March-April	1,689,464	1,095,901	156,156	85,350	293,910	40,464	17,683
May-June	2,008,764	1,303,597	175,586	94,784	370,915	53,179	10,703
Total	11,654,958	7,644,208	1,079,764	578,481	1,984,994	308,851	58,660
Agricultural							
July-August	243,300	30,926	20,930	188,542	1,198	1,606	98
September-October	268,406	27,235	21,933	216,033	1,605	1,540	60
November-December	240,149	29,430	26,340	181,732	1,202	1,159	286
January-February	160,684	29,754	15,764	113,778	844	438	106
March-April	167,678	24,904	14,180	126,114	771	1,455	254
May-June	225,411	25,663	13,275	182,561	1,852	1,907	153
Total	1,305,628	167,912	112,422	1,008,760	7,472	8,105	957
Grand Total	12,960,586	7,812,120	1,192,186	1,587,241	1,992,466	316,956	59,617

SOURCE: County of Maui, Department of Water Supply, *Annual Report FY 2005*.