



Sharon M. Suzuki
President

June 26, 2012

PUBLIC UTILITIES
COMMISSION

2012 JUN 26 P 3:52

FILED

The Honorable Chair and Members of the
Hawaii Public Utilities Commission
Kekuanaoa Building
465 South King Street, First Floor
Honolulu, Hawaii 96813

Dear Commissioners:

Subject: MECO Annual Service Reliability Report for 2011

Maui Electric Company, Limited respectfully submits a copy of its Annual Service Reliability Report for the year 2011.

Sincerely,

Attachment

c: Division of Consumer Advocacy (with Attachment)



MAUI ELECTRIC COMPANY, LIMITED

ANNUAL SERVICE RELIABILITY REPORT

2011

Prepared By

Transmission and Distribution Department
Operations Division

Introduction

This is the 2011 service reliability report for Maui Electric Company, Limited (MECO). The average number of electric customers increased from 67,405 in 2010 to 68,010 in 2011 (an increase of 0.90%). The peak 2011 demand for the system was 194.1 MW (gross) that occurred on February 17, 2011. The peak 2011 demand was lower than the 2010 peak demand of 203.8 MW (gross) that occurred on December 28, 2010 (a decrease of -4.76%).

The system interruption summary for the past year and the system reliability indices for the five prior years are presented to depict the quality of service to the electrical energy consumer.

The definitions of terms, the explanation and equations of reliability indices are contained on Attachments B-1 through B-3.

The Average Service Availability Index (ASA), the System Average Interruption Frequency Index (SAIFI), the Customer Average Interruption Duration Index (CAIDI), and the System Average Interruption Duration Index (SAIDI) are indicators of service reliability. These indices measure reliability in terms of the overall availability of electrical service (ASA), the frequency or number of times MECO's customers experience an outage during the year (SAIFI), and the average length of time an interrupted customer is out of power (CAIDI). SAIDI is an indication of overall system reliability because it is the product of SAIFI and CAIDI and incorporates the impact of frequency and duration of outages on MECO's total customer base (in this case, 68,010 customers).

Analysis

This analysis of the system reliability for MECO is for the year 2011. To determine the relative level of reliability, the statistics for five prior years, 2006 through 2010, are used for comparison.

The reliability indices are calculated using the data from all sustained¹ system outages, except customer maintenance outages. The data used for calculating the reliability indices for 2006, 2007, 2008, 2009 and 2010 was normalized.

There were 764 outages in 2006. The data used for the 2006 reliability indices for MECO was normalized to exclude the following event:

- October 15 - Earthquake

There were 693 outages in 2007. The data used for the 2007 reliability indices for MECO was normalized to exclude the following events:

- January 29 – Kona Storm
- December 5 - Kona Storm

¹ An Interruption of electrical service of 1 minute or longer

There were 707 outages in 2008. The data used for the 2008 reliability indices for MECO was normalized to exclude the following events:

- Storms on Maui, Molokai and Lanai
- Various equipment failures and faults

There were 880 outages in 2009. The data used for the 2009 reliability indices for MECO was normalized to exclude the following events:

- January 16 – High Winds
- June 19 – High Winds
- Various equipment failures and faults

There were 868 outages in 2010. The data used for the 2010 reliability indices for MECO was normalized to exclude the following events:

- March 28 to April 1 – High Winds
- June 7 - Flashover
- December 9 & 10 – Kona Storm
- Various equipment failures and faults

The data used in calculating the reliability indices was normalized in accordance with the guidelines specified in the report on reliability that was prepared for the Public Utilities Commission, titled "Methodology for Determining Reliability Indices for HECO Utilities," dated December 1990. That report indicates that normalization is allowed for "abnormal" situations such as hurricanes, tsunamis, earthquakes, floods, catastrophic equipment failures, and a single outage that cascades into a loss of load that is greater than 10% of the system peak load. These normalizations are made in calculating the reliability indices, because good engineering design takes into account safety, reliability, utility industry standards, and economics, and cannot always plan for catastrophic events.

Graphs of the ASA (Figure 1), SAIFI (Figure 2), CAIDI (Figure 3), and SAIDI (Figure 4) for the six years are included.

2011 Normalized Results

The 2011 service reliability results were normalized to exclude the effects of various catastrophic equipment failures and large storms on Maui, Molokai and Lanai. There were 916 outages in 2011 and 72 of these outages in 2011 were classified as "abnormal" situations (i.e. catastrophic equipment failures and major storms) that cascaded into a loss of load greater than 10% of the system peak load.

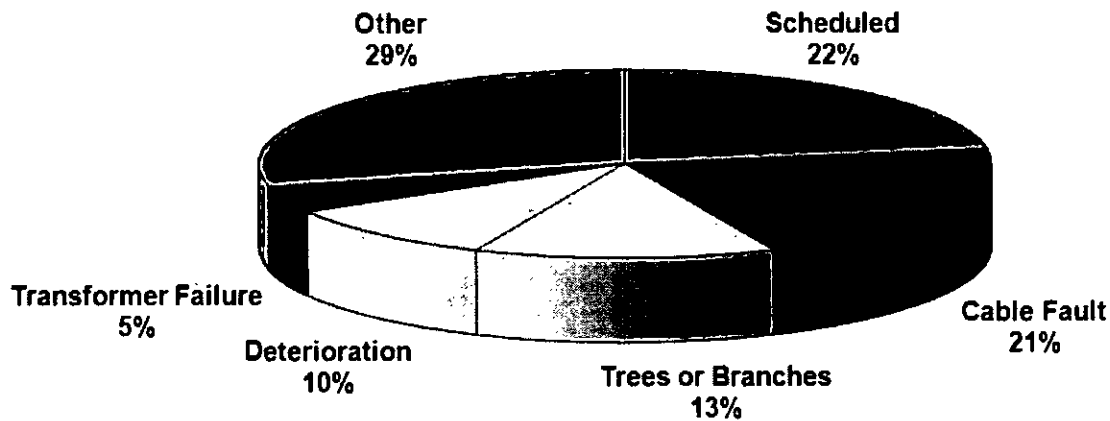
The data used for the 2011 reliability indices for MECO was normalized to exclude the following events:

- January 10 – High Winds
- January 12, 13 & 14 – High Winds and Lightning
- December 24 – High Winds
- Various equipment failures and faults

The 2011 service reliability results (normalized) indicate that MECO did not make improvements in the ASA, SAIFI, CAIDI and SAIDI indices compared to 2010.

- The 2011 ASA index of 99.9755% is a decrease from 2010 and is ranked the third highest ASA index of the last six years. (Higher is better.)
- The 2011 SAIFI index of 1.489 is an increase from 2010 and is ranked the third lowest SAIFI index of the last six years. (Lower is better.)
- The 2011 CAIDI index of 86.33 minutes is an increase from 2010 and is ranked the fourth lowest CAIDI index of the last six years. (Lower is better.)
- The 2011 SAIDI index of 128.55 minutes is an increase from 2010 and is ranked the third lowest SAIDI index of the last six years. (Lower is better.)

2011 Outage Causes



Scheduled outages were the leading cause of outages in 2011, with 167 outages, which accounted for 22.57% of all outages. This was a decrease of 1.76% from 2010 scheduled outages. Outages caused by cable faults were the second leading cause of outages in 2011, with 154 outages and accounted for 20.81% of all outages. This was an increase of 13.24% from 2010 cable faults.

MECO experienced 17 load shed events in 2011. Maui experienced 5 load shed events, Molokai experienced 3 load shed events and Lanai experienced 9 load shed events in 2011. The MECO load shed events for 2006, 2007, 2008, 2009, 2010 and 2011 are shown in the table "Table of Load Shed Events".

Table of Load Shed Events

Island Systems	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>
Maui	30	12	5	2	8	5
Molokai	5	2	12	5	8	3
Lanai	2	12	12	20	8	9
Total	37	26	29	27	24	17

Annual Service Reliability Indices

The normalized results for 2011 and the normalized indices for 2006, 2007, 2008, 2009 and 2010 are shown in the table "MECO – All Islands Annual Service Reliability Indices Table" for all island systems. The following tables also include the annual service reliability indices tables for each island system and by interruptions attributed to T&D or generation. Figures 1 through 4 contain the same data shown in graphical form as well as the 2011 outages listed by cause and associated reliability indices shown on Attachments A1 and A2, (normalized results).

MECO – All Islands
Annual Service Reliability Indices Table

SYSTEM TOTALS	<u>2006*</u>	<u>2007*</u>	<u>2008*</u>	<u>2009*</u>	<u>2010*</u>	<u>2011*</u>
Number of Customers	64,405	65,728	66,810	67,126	67,405	68,010
Customer Hrs. Interrupted	235,186.6	177,607.7	114,000.7	173,602.0	60,006.6	145,710.8
Customer-Interruptions	249,485.0	170,445.0	75,764.0	108,368.0	67,481.0	101,268.0
ASA (Percent)	99.9583	99.9692	99.9805	99.9705	99.9898	99.9755
SAIFI (Occurrence)	3.873	2.593	1.134	1.615	1.001	1.489
CAIDI (Minutes)	56.57	62.53	90.29	96.09	53.35	86.33
SAIDI (Minutes)	219.10	162.13	102.39	155.18	53.41	128.55

* Normalized

MECO – All Islands

Annual Service Reliability Indices Table - T&D Related Outages

SYSTEM TOTALS	<u>2006*</u>	<u>2007*</u>	<u>2008*</u>	<u>2009*</u>	<u>2010*</u>	<u>2011*</u>
Number of Customers	64,405	65,728	66,810	67,126	67,405	68,010
Customer Hrs. Interrupted	163,393.8	146,602.2	111,656.4	162,889.6	53,754.4	139,223.9
Customer-Interruptions	105,126.0	124,179.0	69,556.0	96,773.0	44,699.0	92,997.0
ASA (Percent)	99.9710%	99.9745%	99.9809%	99.9722%	99.9909%	99.9766%
SAIFI (Occurrence)	1.632	1.889	1.041	1.442	0.663	1.367
CAIDI (Minutes)	93.26	70.83	96.32	100.99	72.16	89.82
SAIDI (Minutes)	152.22	133.83	100.28	145.60	47.85	122.83

* Normalized

MECO – All Islands

Annual Service Reliability Indices Table - Generation Related Outages

SYSTEM TOTALS	<u>2006*</u>	<u>2007*</u>	<u>2008*</u>	<u>2009*</u>	<u>2010*</u>	<u>2011*</u>
Number of Customers	64,405	65,728	66,810	67,126	67,405	68,010
Customer Hrs. Interrupted	71,792.8	31,005.5	2,344.3	10,712.4	6,252.2	6,486.9
Customer-Interruptions	144,359.0	46,266.0	6,208.0	11,595.0	22,782.0	8,271.0
ASA (Percent)	99.9872%	99.9946%	99.9996%	99.9982%	99.9989%	99.9989%
SAIFI (Occurrence)	2.241	0.704	0.093	0.173	0.338	0.012
CAIDI (Minutes)	29.84	40.21	22.66	55.43	16.47	47.06
SAIDI (Minutes)	66.88	28.30	2.11	9.58	5.57	5.72

* Normalized

MECO – Maui System

Annual Service Reliability Indices Table

SYSTEM TOTALS	<u>2006*</u>	<u>2007*</u>	<u>2008*</u>	<u>2009*</u>	<u>2010*</u>	<u>2011*</u>
Number of Customers	59,709	60,935	61,981	62,328	62,640	63,225
Customer Hrs. Interrupted	203818.4	162066.0	109806.9	169242.7	55954.1	144,404.5
Customer-Interruptions	235147.0	161215.0	73414.0	106498.0	65654.0	99,729.0
ASA (Percent)	99.9609%	99.9696%	99.9798%	99.9689%	99.9898%	99.9739%
SAIFI (Occurrence)	3.938	2.646	1.184	1.709	1.048	1.577
CAIDI (Minutes)	52.01	60.32	89.74	95.35	51.14	86.88
SAIDI (Minutes)	204.81	159.58	106.30	162.92	53.60	137.04

* Normalized

MECO - Maui System
Annual Service Reliability Indices Table - T&D Related Outages

SYSTEM TOTALS	<u>2006*</u>	<u>2007*</u>	<u>2008*</u>	<u>2009*</u>	<u>2010*</u>	<u>2011*</u>
Number of Customers	59,709	60,935	61,981	62,328	62,640	63,225
Customer Hrs. Interrupted	133,959.9	132,068.6	107,798.7	158,614.5	49,743.3	137,980.4
Customer-Interruptions	97,258.0	116,799.0	68,001.0	95,206.0	42,938.0	91,828.0
ASA (Percent)	99.9743%	99.9752%	99.9801%	99.9709%	99.9909%	99.98%
SAIFI (Occurrence)	1.629	1.917	1.097	1.527	0.685	1.452
CAIDI (Minutes)	82.64	67.84	95.12	99.96	69.51	90.16
SAIDI (Minutes)	134.61	130.04	104.35	152.69	47.65	130.94

* Normalized

MECO - Maui System
Annual Service Reliability Indices Table - Generation Related Outages

SYSTEM TOTALS	<u>2006*</u>	<u>2007*</u>	<u>2008*</u>	<u>2009*</u>	<u>2010*</u>	<u>2011*</u>
Number of Customers	59,709	60,935	61,981	62,328	62,640	63,225
Customer Hrs. Interrupted	69,858.5	29,997.4	2,008.2	10,628.2	6,210.7	6,424.1
Customer-Interruptions	137,889.0	44,416.0	5,413.0	11,292.0	22,716.0	7,901.0
ASA (Percent)	99.9866%	99.9944%	99.9996%	99.9980%	99.9989%	99.9988%
SAIFI (Occurrence)	2.309	0.729	0.087	0.181	0.363	0.125
CAIDI (Minutes)	30.40	40.52	22.26	56.47	16.40	48.78
SAIDI (Minutes)	70.20	29.54	1.94	10.23	5.95	6.10

* Normalized

MECO - Molokai System
Annual Service Reliability Indices Table

SYSTEM TOTALS	<u>2006*</u>	<u>2007*</u>	<u>2008*</u>	<u>2009*</u>	<u>2010*</u>	<u>2011*</u>
Number of Customers	3,094	3,128	3,149	3,151	3,145	3,161
Customer Hrs. Interrupted	30,542.0	14,485.7	3,746.5	3,748.6	3,800.1	1,218.5
Customer-Interruptions	13,628.0	7,773.0	1,393.0	1,284.0	1,498.0	1,252.0
ASA (Percent)	99.8870%	99.9470%	99.9864%	99.9864%	99.9862%	99.9956%
SAIFI (Occurrence)	4.405	2.485	0.442	0.407	0.476	0.396
CAIDI (Minutes)	134.47	111.82	161.37	175.17	152.21	58.39
SAIDI (Minutes)	592.28	277.86	71.38	71.38	72.50	23.13

* Normalized

MECO - Molokai System
Annual Service Reliability Indices Table - T&D Related Outages

SYSTEM TOTALS	<u>2006*</u>	<u>2007*</u>	<u>2008*</u>	<u>2009*</u>	<u>2010*</u>	<u>2011*</u>
Number of Customers	3,094	3,128	3,149	3,151	3,145	3,161
Customer Hrs. Interrupted	29,047.1	14,255.5	3,746.5	3,748.6	3,800.1	1,163.5
Customer-Interruptions	7,600.0	7,159.0	1,393.0	1,284.0	1,498.0	1,102.0
ASA (Percent)	99.8925%	99.9478%	99.9864%	99.9864%	99.9862%	99.9958%
SAIFI (Occurrence)	2.456	2.289	0.442	0.407	0.476	0.349
CAIDI (Minutes)	229.32	119.48	161.37	175.17	152.21	63.35
SAIDI (Minutes)	563.29	273.44	71.38	71.38	72.50	22.08

* Normalized

MECO - Molokai System
Annual Service Reliability Indices Table - Generation Related Outages

SYSTEM TOTALS	<u>2006*</u>	<u>2007*</u>	<u>2008*</u>	<u>2009*</u>	<u>2010*</u>	<u>2011*</u>
Number of Customers	3,094	3,128	3,149	3,151	3,145	3,161
Customer Hrs. Interrupted	1,495.0	230.2	0.0	0.0	0.0	55.0
Customer-Interruptions	6,028.0	614.0	0.0	0.0	0.0	150.0
ASA (Percent)	99.9945%	99.9992%	100%	100%	100%	99.9998%
SAIFI (Occurrence)	1.948	0.196	0.000	0.000	0	0.047
CAIDI (Minutes)	14.88	22.50	0.00	0.00	0.00	22.00
SAIDI (Minutes)	28.99	4.42	0.00	0.00	0.00	1.04

* Normalized

MECO - Lanai System
Annual Service Reliability Indices Table

SYSTEM TOTALS	<u>2006*</u>	<u>2007*</u>	<u>2008*</u>	<u>2009*</u>	<u>2010*</u>	<u>2011*</u>
Number of Customers	1,601	1,665	1,680	1,648	1,621	1,624
Customer Hrs. Interrupted	826.2	1056.1	447.4	610.8	252.4	87.8
Customer-Interruptions	710.0	1457.0	957.0	586.0	329.0	287.0
ASA (Percent)	99.9941%	99.9927%	99.9970%	99.9958%	99.9982%	99.9994%
SAIFI (Occurrence)	0.443	0.875	0.570	0.356	0.203	0.177
CAIDI (Minutes)	69.82	43.49	28.05	62.54	46.04	18.36
SAIDI (Minutes)	30.96	38.06	15.98	22.24	9.34	3.24

* Normalized

MECO - Lanai System
Annual Service Reliability Indices Table - T&D Related Outages

SYSTEM TOTALS	<u>2006*</u>	<u>2007*</u>	<u>2008*</u>	<u>2009*</u>	<u>2010*</u>	<u>2011*</u>
Number of Customers	1,601	1,665	1,680	1,648	1,621	1,624
Customer Hrs. Interrupted	386.9	278.2	111.2	526.5	211.0	80.0
Customer-Interruptions	268.0	221.0	162.0	283.0	263.0	67.0
ASA (Percent)	99.9972%	99.9981%	99.9992%	99.9963%	99.9985%	99.9994%
SAIFI (Occurrence)	0.167	0.133	0.096	0.172	0.162	0.041
CAIDI (Minutes)	86.61	75.52	41.19	111.62	48.13	71.66
SAIDI (Minutes)	14.50	10.02	3.97	19.17	7.81	2.96

* Normalized

MECO - Lanai System
Annual Service Reliability Indices Table - Generation Related Outages

SYSTEM TOTALS	<u>2006*</u>	<u>2007*</u>	<u>2008*</u>	<u>2009*</u>	<u>2010*</u>	<u>2011*</u>
Number of Customers	1,601	1,665	1,680	1,648	1,621	1,624
Customer Hrs. Interrupted	439.4	777.9	336.2	84.3	41.5	7.8
Customer-Interruptions	442.0	1236.0	795.0	303.0	66.0	220.0
ASA (Percent)	99.9969%	99.9947%	99.9977%	99.9994%	99.9997%	99.9999%
SAIFI (Occurrence)	0.276	0.742	0.473	0.184	0.041	0.135
CAIDI (Minutes)	59.64	37.76	25.37	16.69	37.70	2.13
SAIDI (Minutes)	16.47	28.03	12.01	3.07	1.53	0.29

* Normalized

FIGURE 1
MECO AVERAGE SERVICE AVAILABILITY
(ASA)

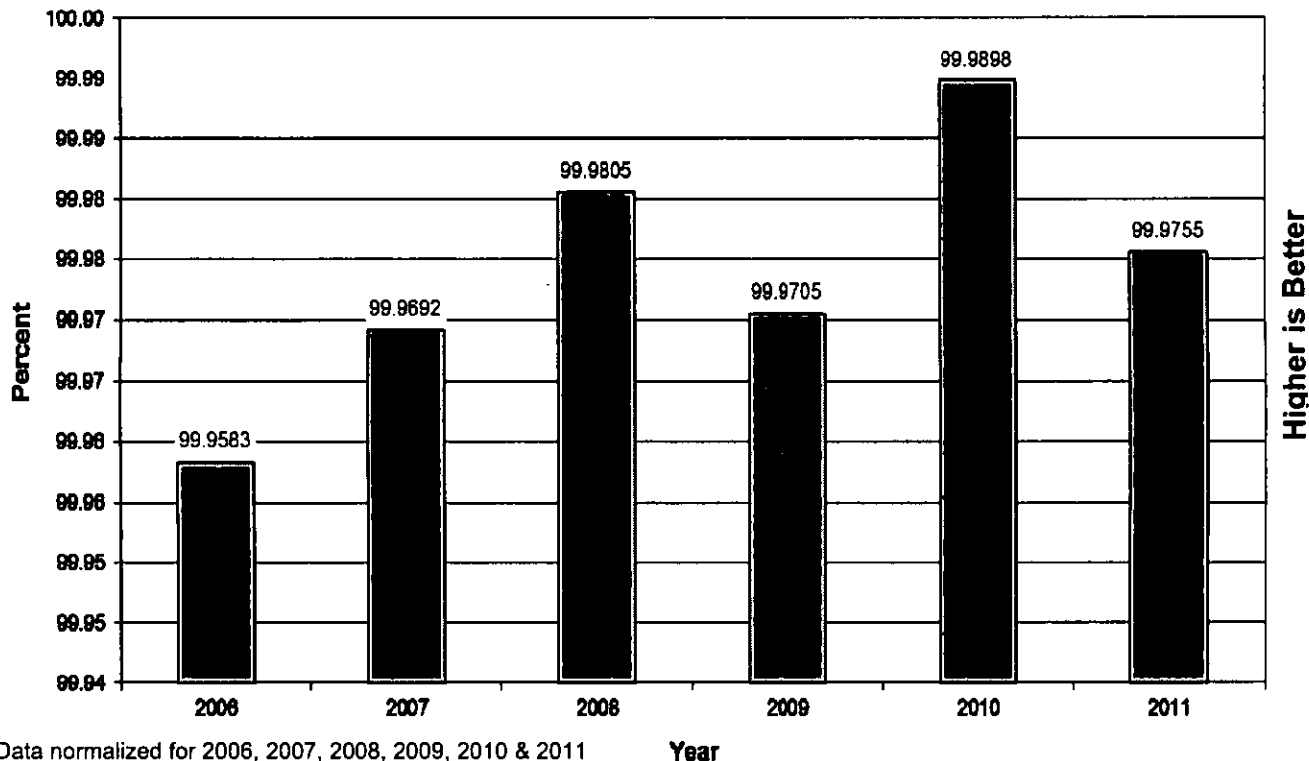


Figure 1 shows that the 2011 Average Service Availability (ASA) index has decreased from the 2010 results of 99.9898% to 99.9755% during 2011. This was a decrease of 0.0143% in the 2011 Average Service Availability compared to the previous year. The 2011 service reliability results (normalized) showed that MECO did not make improvements in the SAIFI, CAIDI or SAIDI indices compared to 2010.

The contributing factors to the decrease of the ASA index from 2010 were a greater number of customer hour interruptions related to trees or branches in lines, deterioration or rot and automobile accidents. Outages due to trees or branches in lines increased in 2011, which incurred 33,182.7 customer interruption hours, as compared to 14,385.4 customer interruption hours in 2010. Outages due to trees or branches in lines accounted for 22.8% of all customer interruption hours in 2011. Outages due to deterioration or rot increased in 2011, which incurred 19,229.7 customer interruption hours, as compared to 3,737.4 customer interruption hours in 2010. Outages due to deterioration or rot accounted for 13.2% of all customer interruption hours in 2011. Outages due to automobile accidents also increased in 2011, which incurred 13,548.5 customer interruption hours, as compared to 3,047.1 customer interruption hours in 2010. Outages due to automobile accidents accounted for 9.3% of all customer interruption hours in 2011.

FIGURE 2

**MECO SYSTEM AVERAGE INTERRUPTION FREQUENCY
(SAIFI)**

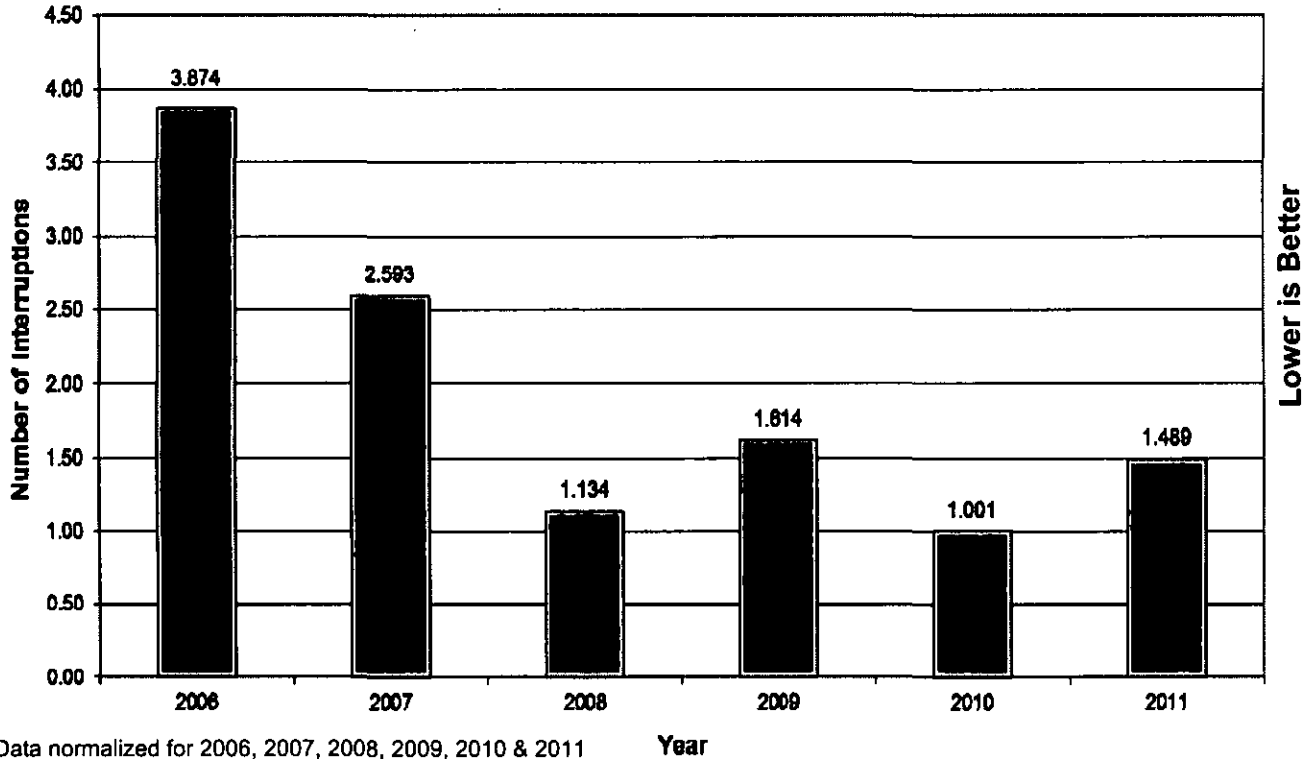


Figure 2 shows the System Average Interruption Frequency Index (SAIFI) for the past six years. It shows that in 2011, the recorded SAIFI index was 1.489 and it had increased from 2010 by 48.75%.

An increase in interruptions caused by trees or branches in lines, corrosion and rot and man or animals in lines or equipment contributed to a higher SAIFI for 2011. The number of interruptions due to trees or branches in lines increased in 2011, which incurred 19,955 customer interruptions, as compared to 7,867 customer interruptions in 2010. Interruptions due to trees or branches in lines accounted for 13.24% of the total number of interruptions in 2011. Outages due to corrosion and rot increased in 2011, which incurred 11,828 customer interruptions, as compared to 2,290 customer interruptions in 2010. Outages due to corrosion and rot accounted for 10.0% of the total number of interruptions in 2011. Outages due to man or animals in lines or equipment also increased in 2011, which incurred 9,033 customer interruptions, as compared to 2,298 customer interruptions in 2010. Outages due to man or animals in lines or equipment accounted for 2.16% of the total number of interruptions in 2011.

FIGURE 3

**MECO CUSTOMER AVERAGE INTERRUPTION DURATION
(CAIDI)**

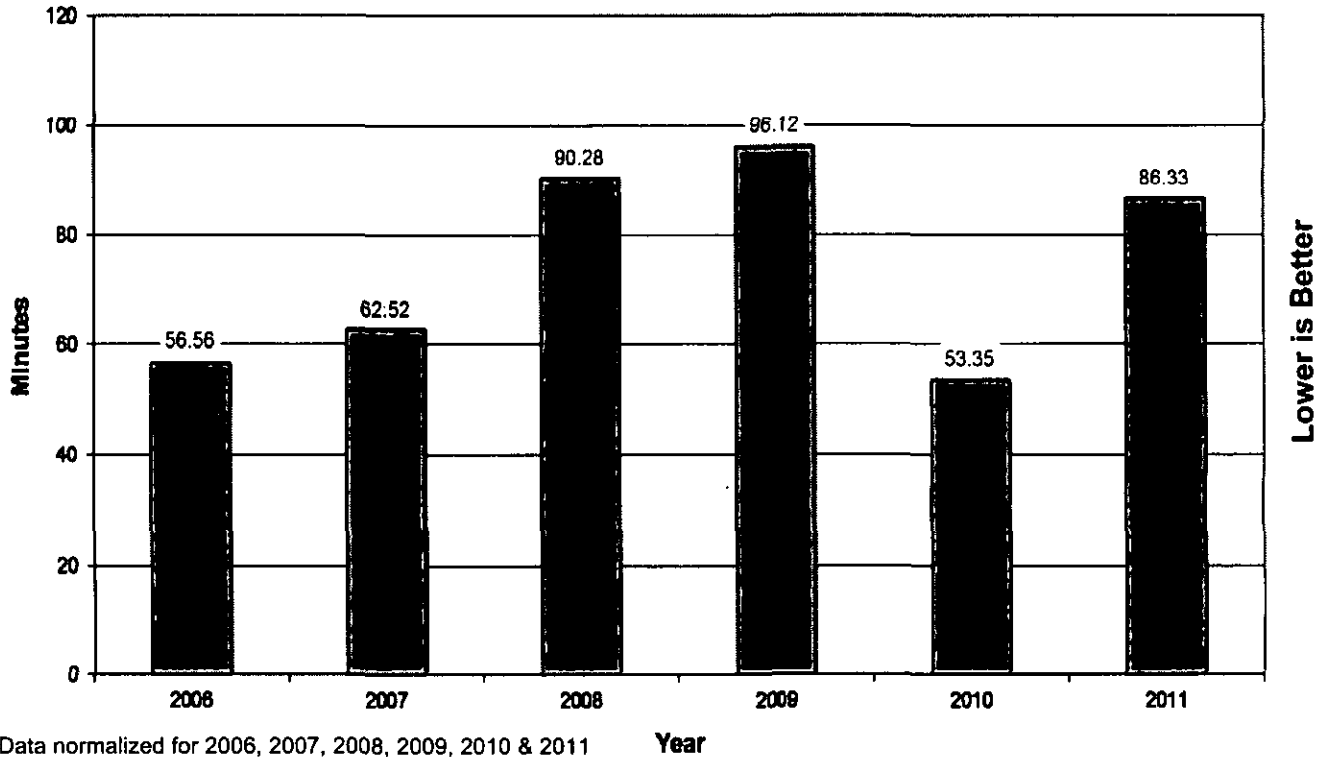


Figure 3 shows the Customer Average Interruption Duration index (CAIDI) for the past six years. The average interruption duration of 86.33 minutes per customer for 2011 is an increase of 61.82% from the previous year.

The contributing factors to the increase of the CAIDI index from 2010 were longer outage durations related to system additions or removals, scheduled maintenance and equipment failure. Outages due to system additions or removals increased in 2011, which incurred 3,288.5 customer interruption hours, as compared to 0 customer interruption hours in 2010. Outages due to system additions or removals accounted for 2.3% of all customer interruption hours in 2011. Outages due to scheduled maintenance increased in 2011, which incurred 9,913.9 customer interruption hours, as compared to 1,403.0 customer interruption hours in 2010. Outages due to scheduled maintenance accounted for 6.8% of all customer interruption hours in 2011. Outages due to equipment failure also increased in 2011, which incurred 17,761.1 customer interruption hours, as compared to 8,112.8 customer interruption hours in 2010. Outages due to equipment failure accounted for 12.2% of all customer interruption hours in 2011.

FIGURE 4
MECO SYSTEM AVERAGE INTERRUPTION DURATION
(SAIDI)

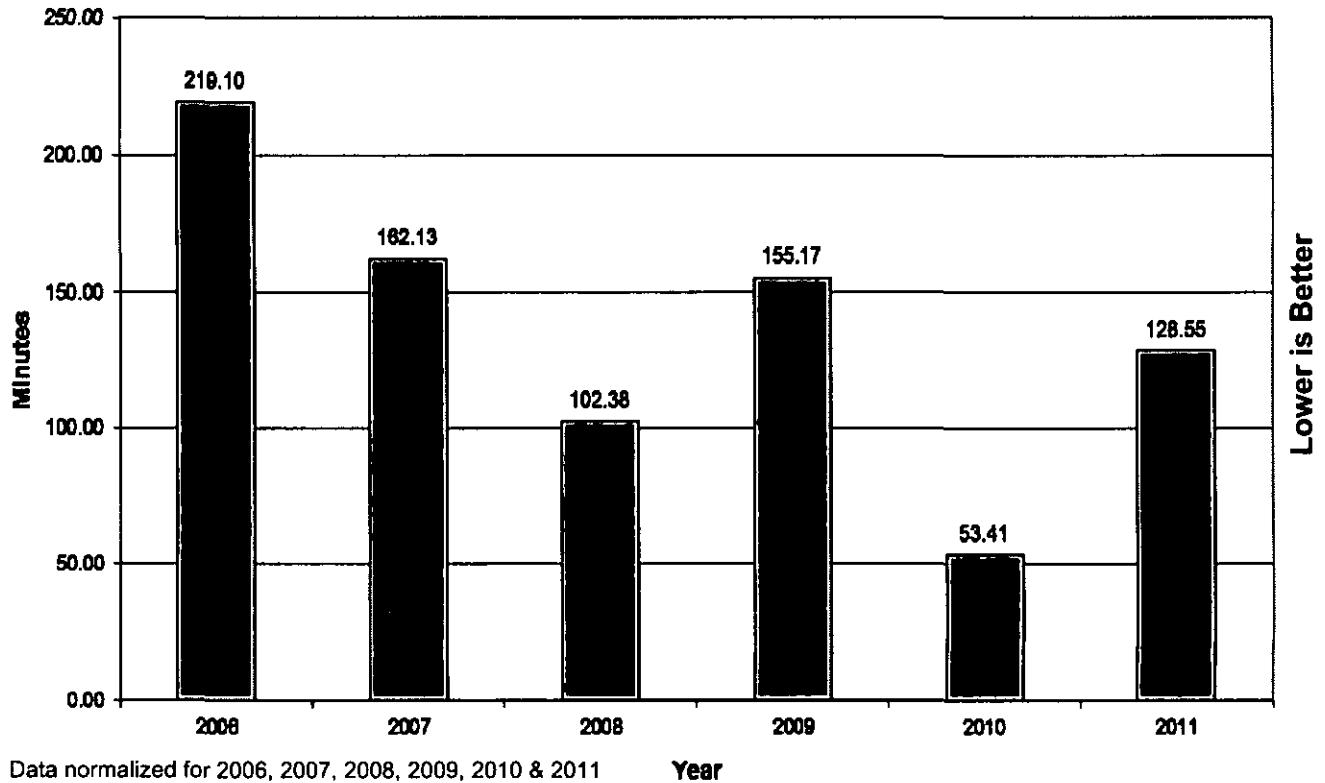


Figure 4 shows the System Average Interruption Duration Index (SAIDI) for the past six years. It shows that in 2011, the recorded SAIDI index was 128.55 and it had increased from 2010 by 140.69%.

The SAIDI is the composite of both the SAIFI and CAIDI indices and produces a broader benchmark of system reliability by combining both the duration and the number of customer interruptions during a given period of time. The higher SAIDI result was due to an increase in the SAIFI and CAIDI statistics as noted previously.

**Maui Electric Company System Interruption
Service Reliability - System Total**

From: January 1, 2011 To: December 31, 2011

Cause	Cust-Hr	Cust-Int	SAIFI	SAIDI	CAIDI	SAIDI Rank
07. Trees or branches in lines	33182.7	19955.0	0.293	29.27	99.77	1
08. Deterioration, rot, corrosion, termites	19229.7	11828.0	0.174	16.96	97.55	2
12. Flashover	4867.5	10975.0	0.161	4.29	26.61	10
17. Equipment failure	17761.1	10205.0	0.150	15.67	104.43	3
02. Man or animals in lines or equipment	8293.2	9033.0	0.133	7.32	55.09	6
01. Automobile Accident	13548.5	6525.0	0.096	11.95	124.58	4
13. Cable fault	6718.4	4965.0	0.073	5.93	81.19	7
15. Transformer overload	5307.7	4705.0	0.069	4.68	67.69	9
10. High wind	3886.3	4037.0	0.059	3.43	57.76	13
29. Unknown failure	3941.3	3216.0	0.047	3.48	73.53	12
25. Maintenance - scheduled	9914.0	3145.0	0.046	8.75	189.14	5
03. Foreign objects in lines or equipment	1717.5	3032.0	0.045	1.52	33.99	16
26. Maintenance - forced	4085.7	2839.0	0.042	3.60	86.35	11
09. Lightning	5823.8	1971.0	0.029	5.14	177.28	8
16. Equipment overload	1890.7	1336.0	0.020	1.67	84.91	15
27. System additions or removals	3288.5	624.0	0.009	2.90	316.21	14
31. Mylar Balloon	517.4	571.0	0.008	0.46	54.36	18
20. Operator or switching error	453.9	556.0	0.008	0.40	48.98	19
14. Transformer failure other than overload	536.0	367.0	0.005	0.47	87.63	17
18. Vandalism	294.3	324.0	0.005	0.26	54.51	20
23. Nec. Int. to transfer load (out of phase)	4.8	266.0	0.004	0.00	1.09	28
30. Other company personnel error	194.8	242.0	0.004	0.17	48.31	21
21. Failure of customer's electrical equipment	31.7	225.0	0.003	0.03	8.46	25
19. Faulty operation of equipment	69.9	211.0	0.003	0.06	19.89	23
06. Excavation and construction	25.3	42.0	0.001	0.02	36.14	26
04. Fire	76.1	39.0	0.001	0.07	117.05	22
22. Tsunami, earthquake, or flooding	11.7	20.0	0.000	0.01	35.00	27
11. Loose connection	38.3	14.0	0.000	0.03	164.29	24
24. Nec. Int. to balance load or system conv.	0.0	0.0	0.000	0.00	0.00	30
05. Contact by moving equipment	0.0	0.0	0.000	0.00	0.00	29
Total	145710.8	101268.0	1.489	128.55	86.33	

Average System Availability Index (ASA) = 99.9755%

Number of Customers for the Period = 68010

SAIFI = System Average Interruption Frequency Index

SAIDI = System Average Interruption Duration Index (Minutes)

CAIDI = Customer Average Interruption Duration Index (Minutes)

The Outage Causes are Listed in Order of its SAIFI Index

Maui Electric Company System Interruption

Service Reliability - Maui

From: January 1, 2011 To: December 31, 2011

<u>Cause</u>	<u>Cust-Hr</u>	<u>Cust-Int</u>	<u>SAIFI</u>	<u>SAIDI</u>	<u>CAIDI</u>	<u>SAIDI Rank</u>
07. Trees or branches in lines	33182.5	19953.0	0.316	31.49	99.78	1
08. Deterioration, rot, corrosion, termites	19193.4	11774.0	0.186	18.21	97.81	2
12. Flashover	4811.8	10965.0	0.173	4.57	26.33	10
17. Equipment failure	17753.3	9985.0	0.158	16.85	106.68	3
02. Man or animals in lines or equipment	8259.6	9007.0	0.142	7.84	55.02	6
01. Automobile Accident	13480.5	6445.0	0.102	12.79	125.50	4
13. Cable fault	6718.4	4965.0	0.079	6.38	81.19	7
15. Transformer overload	5307.7	4705.0	0.074	5.04	67.69	9
10. High wind	3767.5	3929.0	0.062	3.58	57.53	12
25. Maintenance - scheduled	9883.3	3137.0	0.050	9.38	189.03	5
03. Foreign objects in lines or equipment	1717.5	3032.0	0.048	1.63	33.99	16
29. Unknown failure	3479.8	2987.0	0.047	3.30	69.90	13
26. Maintenance - forced	4085.7	2839.0	0.045	3.88	86.35	11
09. Lightning	5650.0	1781.0	0.028	5.36	190.34	8
16. Equipment overload	1890.7	1336.0	0.021	1.79	84.91	15
27. System additions or removals	3288.5	624.0	0.010	3.12	316.21	14
31. Mylar Balloon	517.4	571.0	0.009	0.49	54.36	17
20. Operator or switching error	453.9	556.0	0.009	0.43	48.98	18
18. Vandalism	294.3	324.0	0.005	0.28	54.51	20
23. Nec. Int. to transfer load (out of phase)	4.8	266.0	0.004	0.00	1.09	27
21. Failure of customer's electrical equipment	31.7	225.0	0.004	0.03	8.46	23
14. Transformer failure other than overload	451.4	135.0	0.002	0.43	200.64	19
19. Faulty operation of equipment	14.9	61.0	0.001	0.01	14.69	25
06. Excavation and construction	25.3	42.0	0.001	0.02	36.14	24
04. Fire	76.1	39.0	0.001	0.07	117.05	21
30. Other company personnel error	48.2	22.0	0.000	0.05	131.36	22
22. Tsunami, earthquake, or flooding	11.7	20.0	0.000	0.01	35.00	26
11. Loose connection	4.7	4.0	0.000	0.00	70.00	28
24. Nec. Int. to balance load or system conv.	0.0	0.0	0.000	0.00	0.00	30
05. Contact by moving equipment	0.0	0.0	0.000	0.00	0.00	29
Total	144404.5	99729.0	1.577	137.04	86.88	

Average System Availability Index (ASA) = 99.9755%

Number of Customers for the Period = 63225

SAIFI = System Average Interruption Frequency Index

SAIDI = System Average Interruption Duration Index (Minutes)

CAIDI = Customer Average Interruption Duration Index (Minutes)

The Outage Causes are Listed in Order of its SAIFI Index

**Maui Electric Company System Interruption
Service Reliability - Molokai
From: January 1, 2011 To: December 31, 2011**

<u>Cause</u>	<u>Cust-Hr</u>	<u>Cust-Int</u>	<u>SAIFI</u>	<u>SAIDI</u>	<u>CAIDI</u>	<u>SAIDI Rank</u>
14. Transformer failure other than overload	84.6	232.0	0.073	1.60	21.87	5
29. Unknown failure	454.8	222.0	0.070	8.63	122.91	1
30. Other company personnel error	146.7	220.0	0.070	2.78	40.00	3
09. Lightning	173.8	190.0	0.060	3.30	54.89	2
19. Faulty operation of equipment	55.0	150.0	0.047	1.04	22.00	8
10. High wind	118.8	108.0	0.034	2.25	66.00	4
01. Automobile Accident	68.0	80.0	0.025	1.29	51.00	6
08. Deterioration, rot, corrosion, termites	27.5	30.0	0.009	0.52	55.00	10
12. Flashover	55.7	10.0	0.003	1.06	334.00	7
11. Loose connection	33.7	10.0	0.003	0.64	202.00	9
31. Mylar Balloon	0.0	0.0	0.000	0.00	0.00	30
27. System additions or removals	0.0	0.0	0.000	0.00	0.00	29
26. Maintenance - forced	0.0	0.0	0.000	0.00	0.00	28
25. Maintenance - scheduled	0.0	0.0	0.000	0.00	0.00	27
24. Nec. Int. to balance load or system conv.	0.0	0.0	0.000	0.00	0.00	26
23. Nec. Int. to transfer load (out of phase)	0.0	0.0	0.000	0.00	0.00	25
22. Tsunami, earthquake, or flooding	0.0	0.0	0.000	0.00	0.00	24
21. Failure of customer's electrical equipment	0.0	0.0	0.000	0.00	0.00	23
20. Operator or switching error	0.0	0.0	0.000	0.00	0.00	22
18. Vandalism	0.0	0.0	0.000	0.00	0.00	21
17. Equipment failure	0.0	0.0	0.000	0.00	0.00	20
16. Equipment overload	0.0	0.0	0.000	0.00	0.00	19
15. Transformer overload	0.0	0.0	0.000	0.00	0.00	18
13. Cable fault	0.0	0.0	0.000	0.00	0.00	17
07. Trees or branches in lines	0.0	0.0	0.000	0.00	0.00	16
06. Excavation and construction	0.0	0.0	0.000	0.00	0.00	15
05. Contact by moving equipment	0.0	0.0	0.000	0.00	0.00	14
04. Fire	0.0	0.0	0.000	0.00	0.00	13
03. Foreign objects in lines or equipment	0.0	0.0	0.000	0.00	0.00	12
02. Man or animals in lines or equipment	0.0	0.0	0.000	0.00	0.00	11
Total	1218.5	1252.0	0.396	23.13	58.39	

Average System Availability Index (ASA) = 99.9956%

Number of Customers for the Period = 3161

SAIFI = System Average Interruption Frequency Index

SAIDI = System Average Interruption Duration Index (Minutes)

CAIDI = Customer Average Interruption Duration Index (Minutes)

The Outage Causes are Listed in Order of its SAIFI Index

**Maui Electric Company System Interruption
Service Reliability - Lanai
From: January 1, 2011 To: December 31, 2011**

Cause	Cust-Hr	Cust-Int	SAIFI	SAIDI	CAIDI	SAIDI Rank
17. Equipment failure	7.8	220.0	0.135	0.29	2.13	4
02. Man or animals in lines or equipment	33.6	26.0	0.016	1.24	77.54	1
08. Deterioration, rot, corrosion, termites	8.8	24.0	0.015	0.33	22.00	3
25. Maintenance - scheduled	30.7	8.0	0.005	1.13	229.88	2
29. Unknown failure	6.8	7.0	0.004	0.25	58.00	5
07. Trees or branches in lines	0.2	2.0	0.001	0.01	6.00	6
31. Mylar Balloon	0.0	0.0	0.000	0.00	0.00	30
30. Other company personnel error	0.0	0.0	0.000	0.00	0.00	29
27. System additions or removals	0.0	0.0	0.000	0.00	0.00	28
26. Maintenance - forced	0.0	0.0	0.000	0.00	0.00	27
24. Nec. Int. to balance load or system conv.	0.0	0.0	0.000	0.00	0.00	26
23. Nec. Int. to transfer load (out of phase)	0.0	0.0	0.000	0.00	0.00	25
22. Tsunami, earthquake, or flooding	0.0	0.0	0.000	0.00	0.00	24
21. Failure of customer's electrical equipment	0.0	0.0	0.000	0.00	0.00	23
20. Operator or switching error	0.0	0.0	0.000	0.00	0.00	22
19. Faulty operation of equipment	0.0	0.0	0.000	0.00	0.00	21
18. Vandalism	0.0	0.0	0.000	0.00	0.00	20
16. Equipment overload	0.0	0.0	0.000	0.00	0.00	19
15. Transformer overload	0.0	0.0	0.000	0.00	0.00	18
14. Transformer failure other than overload	0.0	0.0	0.000	0.00	0.00	17
13. Cable fault	0.0	0.0	0.000	0.00	0.00	16
12. Flashover	0.0	0.0	0.000	0.00	0.00	15
11. Loose connection	0.0	0.0	0.000	0.00	0.00	14
10. High wind	0.0	0.0	0.000	0.00	0.00	13
09. Lightning	0.0	0.0	0.000	0.00	0.00	7
06. Excavation and construction	0.0	0.0	0.000	0.00	0.00	12
05. Contact by moving equipment	0.0	0.0	0.000	0.00	0.00	11
04. Fire	0.0	0.0	0.000	0.00	0.00	10
03. Foreign objects in lines or equipment	0.0	0.0	0.000	0.00	0.00	9
01. Automobile Accident	0.0	0.0	0.000	0.00	0.00	8
Total	87.8	287.0	0.177	3.24	18.36	

Average System Availability Index (ASA) = 99.9994%

Number of Customers for the Period = 1624

SAIFI = System Average Interruption Frequency Index

SAIDI = System Average Interruption Duration Index (Minutes)

CAIDI = Customer Average Interruption Duration Index (Minutes)

The Outage Causes are Listed in Order of its SAIFI Index

Maui Electric Company System Interruption System Total

From: January 1, 2011 To: December 31, 2011

<u>Cause</u>	<u>Interruptions</u>		<u>Customer Hours</u>	
	<u>Number</u>	<u>% of Total</u>	<u>Hours</u>	<u>% of Total</u>
<u>Non-Connected System Emergency</u>	142	19.19%	57686.7	39.6%
Foreign Objects in Lines	3	0.41%	1717.5	1.2%
Contact by Moving Equipment	0	0.00%	0.0	0.0%
Excavation and Construction	3	0.41%	25.3	0.0%
Fire	3	0.41%	76.1	0.1%
Auto Accident	12	1.62%	13548.5	9.3%
Man or Animal in Lines	16	2.16%	8293.2	5.7%
Trees or Branches in Lines	98	13.24%	33182.7	22.8%
Vandalism	1	0.14%	294.3	0.2%
Customer Equip. Failure	4	0.54%	31.7	0.0%
Mylar Balloon	2	0.27%	517.4	0.4%
<u>Error</u>	10	1.35%	648.7	0.4%
Operator or Switching Error	5	0.68%	453.9	0.3%
Other Company Personnel Error	5	0.68%	194.8	0.1%
<u>Weather</u>	49	6.62%	9721.7	6.7%
Lightning	27	3.65%	5823.8	4.0%
High Wind	21	2.84%	3886.3	2.7%
Tsunami, Earthquake or flooding	1	0.14%	11.7	0.0%
<u>Non-Transformer Equipment</u>	272	36.76%	50575.6	34.7%
Loose Connection	2	0.27%	38.3	0.0%
Flashover	15	2.03%	4867.5	3.3%
Equipment Failure	20	2.70%	17761.1	12.2%
Cable Fault	154	20.81%	6718.4	4.6%
Equipment Overload	4	0.54%	1890.7	1.3%
Deterioration, Rot, Corrosion, Termites	74	10.00%	19229.7	13.2%
Faulty Operation of Equipment	3	0.41%	69.9	0.0%
<u>Transformer</u>	35	4.73%	5843.7	4.0%
Transformer Overload	1	0.14%	5307.7	3.6%
Transformer Failure Other Than Overload	34	4.59%	536.0	0.4%
<u>Switching</u>	2	0.27%	4.8	0.0%
NEC Int. to Transfer Load (Out of Phase)	2	0.27%	4.8	0.0%
NEC Int. to Balance Load or Conversion	0	0.00%	0.0	0.0%
<u>Unknown</u>	31	4.19%	3941.3	2.7%
<u>Maintenance</u>	193	26.08%	13999.6	9.6%
Scheduled	167	22.57%	9913.9	6.8%
Forced	26	3.51%	4085.7	2.8%
<u>System Additions Or Removals</u>	6	0.81%	3288.5	2.3%
<u>TOTALS</u>	740		145710.8	

Maui Electric Company System Interruption

Maui System

From: January 1, 2011 To: December 31, 2011

<u>Cause</u>	<u>Interruptions</u>		<u>Customer Hours</u>	
	<u>Number</u>	<u>% of Total</u>	<u>Hours</u>	<u>% of Total</u>
<u>Non-Connected System Emergency</u>	133	18.81%	57584.9	39.9%
Foreign Objects in Lines	3	0.42%	1717.5	1.2%
Contact by Moving Equipment	0	0.00%	0.0	0.0%
Excavation and Construction	3	0.42%	25.3	0.0%
Fire	3	0.42%	76.1	0.1%
Auto Accident	11	1.56%	13480.5	9.3%
Man or Animal In Lines	9	1.27%	8259.6	5.7%
Trees or Branches in Lines	97	13.72%	33182.5	23.0%
Vandalism	1	0.14%	294.3	0.2%
Customer Equip. Failure	4	0.57%	31.7	0.0%
Mylar Balloon	2	0.28%	517.4	0.4%
<u>Error</u>	9	1.27%	502.1	0.3%
Operator or Switching Error	5	0.71%	453.9	0.3%
Other Company Personnel Error	4	0.57%	48.2	0.0%
<u>Weather</u>	46	6.51%	9429.1	6.5%
Lightning	25	3.54%	5650.0	3.9%
High Wind	20	2.83%	3767.5	2.6%
Tsunami, Earthquake or Flooding	1	0.14%	11.7	0.0%
<u>Non-Transformer Equipment</u>	265	37.48%	50387.2	34.9%
Loose Connection	1	0.14%	4.7	0.0%
Flashover	14	1.98%	4811.8	3.3%
Equipment Failure	19	2.69%	17753.3	12.3%
Cable	154	21.78%	6718.4	4.7%
Equipment Overload	4	0.57%	1890.7	1.3%
Deterioration, Rot, Corrosion or Termites	71	10.04%	19193.4	13.3%
Faulty Operation of Equipment	2	0.28%	14.9	0.0%
<u>Transformer</u>	33	4.67%	5759.1	4.0%
Transformer Overload	-1	0.14%	5307.7	3.7%
Transformer Failure Other Than Overload	32	4.53%	451.4	0.3%
<u>Switching</u>	2	0.28%	4.8	0.0%
NEC Int. to Transfer Load (Out of Phase)	2	0.28%	4.8	0.0%
NEC Int. to Balance Load or Conversion	0	0.00%	0.0	0.0%
<u>Unknown</u>	25	3.54%	3479.8	2.4%
<u>Maintenance</u>	188	26.59%	13969.0	9.7%
Scheduled	162	22.91%	9883.3	6.8%
Forced	26	3.68%	4085.7	2.8%
<u>System Additions Or Removals</u>	6	0.85%	3288.5	2.3%
<u>TOTALS</u>	707		144404.5	

Maui Electric Company System Interruption

Molokai System

From: January 1, 2011 To: December 31, 2011

<u>Cause</u>	<u>Interruptions</u>		<u>Customer Hours</u>	
	<u>Number</u>	<u>% of Total</u>	<u>Hours</u>	<u>% of Total</u>
<u>Non-Connected System Emergency</u>	1	6.25%	68.0	5.6%
Foreign Objects in Lines	0	0.00%	0.0	0.0%
Contact by Moving Equipment	0	0.00%	0.0	0.0%
Excavation and Construction	0	0.00%	0.0	0.0%
Fire	0	0.00%	0.0	0.0%
Auto Accident	1	6.25%	68.0	5.6%
Man or Animal In Lines	0	0.00%	0.0	0.0%
Trees or Branches in Lines	0	0.00%	0.0	0.0%
Vandalism	0	0.00%	0.0	0.0%
Customer Equip. Failure	0	0.00%	0.0	0.0%
Mylar Balloon	0	0.00%	0.0	0.0%
<u>Error</u>	1	6.25%	146.7	12.0%
Operator or Switching Error	0	0.00%	0.0	0.0%
Other Company Personnel Error	1	6.25%	146.7	12.0%
<u>Weather</u>	3	18.75%	292.6	24.0%
Lightning	2	12.50%	173.8	14.3%
High Wind	1	6.25%	118.8	9.7%
Tsunami, Earthquake or Flooding	0	0.00%	0.0	0.0%
<u>Non-Transformer Equipment</u>	4	25.00%	171.8	14.1%
Loose Connection	1	6.25%	33.7	2.8%
Flashover	1	6.25%	55.7	4.6%
Equipment Failure	0	0.00%	0.0	0.0%
Cable	0	0.00%	0.0	0.0%
Equipment Overload	0	0.00%	0.0	0.0%
Deterioration, Rot, Corrosion or Termites	1	6.25%	27.5	2.3%
Faulty Operation of Equipment	1	6.25%	55.0	4.5%
<u>Transformer</u>	2	12.50%	84.6	6.9%
Transformer Overload	0	0.00%	0.0	0.0%
Transformer Failure Other Than Overload	2	12.50%	84.6	6.9%
<u>Switching</u>	0	0.00%	0.0	0.0%
NEC Int. to Transfer Load (Out of Phase)	0	0.00%	0.0	0.0%
NEC Int. to Balance Load or Conversion	0	0.00%	0.0	0.0%
<u>Unknown</u>	5	31.25%	454.8	37.3%
<u>Maintenance</u>	0	0.00%	0.0	0.0%
Scheduled	0	0.00%	0.0	0.0%
Forced	0	0.00%	0.0	0.0%
<u>System Additions Or Removals</u>	0	0.00%	0.0	0.0%
<u>TOTALS</u>	16		1218.5	

Maui Electric Company System Interruption

Lanai System

From: January 1, 2011 To: December 31, 2011

<u>Cause</u>	<u>Interruptions</u>		<u>Customer Hours</u>	
	<u>Number</u>	<u>% of Total</u>	<u>Hours</u>	<u>% of Total</u>
<u>Non-Connected System Emergency</u>	8	47.06%	33.8	38.5%
Foreign Objects in Lines	0	0.00%	0.0	0.0%
Contact by Moving Equipment	0	0.00%	0.0	0.0%
Excavation and Construction	0	0.00%	0.0	0.0%
Fire	0	0.00%	0.0	0.0%
Auto Accident	0	0.00%	0.0	0.0%
Man or Animal In Lines	7	41.18%	33.6	38.3%
Trees or Branches in Lines	1	5.88%	0.2	0.2%
Vandalism	0	0.00%	0.0	0.0%
Customer Equip. Failure	0	0.00%	0.0	0.0%
Mylar Balloon	0	0.00%	0.0	0.0%
<u>Error</u>	0	0.00%	0.0	0.0%
Operator or Switching Error	0	0.00%	0.0	0.0%
Other Company Personnel Error	0	0.00%	0.0	0.0%
<u>Weather</u>	0	0.00%	0.0	0.0%
Lightning	0	0.00%	0.0	0.0%
High Wind	0	0.00%	0.0	0.0%
Tsunami, Earthquake or Flooding	0	0.00%	0.0	0.0%
<u>Non-Transformer Equipment</u>	3	17.65%	16.6	18.9%
Loose Connection	0	0.00%	0.0	0.0%
Flashover	0	0.00%	0.0	0.0%
Equipment Failure	1	5.88%	7.8	8.9%
Cable	0	0.00%	0.0	0.0%
Equipment Overload	0	0.00%	0.0	0.0%
Deterioration, Rot, Corrosion or Termites	2	11.76%	8.8	10.0%
Faulty Operation of Equipment	0	0.00%	0.0	0.0%
<u>Transformer</u>	0	0.00%	0.0	0.0%
Transformer Overload	0	0.00%	0.0	0.0%
Transformer Failure Other Than Overload	0	0.00%	0.0	0.0%
<u>Switching</u>	0	0.00%	0.0	0.0%
NEC Int. to Transfer Load (Out of Phase)	0	0.00%	0.0	0.0%
NEC Int. to Balance Load or Conversion	0	0.00%	0.0	0.0%
<u>Unknown</u>	1	5.88%	6.8	7.7%
<u>Maintenance</u>	5	29.41%	30.7	34.9%
Scheduled	5	29.41%	30.7	34.9%
Forced	0	0.00%	0.0	0.0%
<u>System Additions Or Removals</u>	0	0.00%	0.0	0.0%
<u>TOTALS</u>	17		87.8	

DEFINITION OF TERMS

OUTAGE

The state of a component when it is not available to perform its intended function due to some event directly associated with that component. An outage may or may not cause an interruption of service to consumers depending on system configuration.

INTERRUPTION

The loss of service to one or more customers and is a result of one or more component outages.

INTERRUPTION DURATION

The period from the initiation of an interruption to a customer until service has been restored to that customer.

MOMENTARY INTERRUPTION

An interruption that has a duration limited to the period required to restore service by automatic or supervisory-controlled switching operations or by manual switching at locations where an operator is immediately available. Such switching operations must be completed in a specific time not to exceed one minute. Previous issues of this report indicated that a momentary interruption has a duration not to exceed five minutes. A December 1990 report, "Methodology for Determining Reliability Indices for HECO Utilities," indicated that momentary interruptions will have a duration less than one minute.

SUSTAINED INTERRUPTION

Any interruption not classified as a momentary interruption. Only this type of interruption is included in the reliability indices which follow: In conformance with the guidelines established in the report, "Methodology for Determining Reliability Indices for HECO Utilities," dated December 1990, a sustained interruption has a duration of one minute or longer.

CUSTOMER INTERRUPTION

One interruption of one customer.

NOTE: Interruption to customers at their request (e.g., customer maintenance) are not considered.

RELIABILITY INDICES

Reliability indices used in this report conform to standards proposed by both the Edison Electric Institute (EEI) and the Institute of Electrical and Electronics Engineers (IEEE) unless otherwise indicated in the above definitions. Four reliability indices that convey a meaningful representation of the level of reliability were selected and are presented in this report. These reliability indices are as follows:

AVERAGE SERVICE AVAILABILITY (ASA)

Total customer hours actually served as a percentage of total customer hours possible during the year. This indicates the extent to which electrical service was available to all customers. This index has been commonly referred to as the "Index of Reliability." A customer-hour is calculated by multiplying the number of customers by the number of hours in the period being analyzed.

$$ASA = \frac{\sum \text{No. of Customer Hours Actually Served during the year}}{\sum \text{No. of Customer Hours Possible during the year}} \times 100\%$$

SYSTEM AVERAGE INTERRUPTION FREQUENCY INDEX (SAIFI)

The number of customer interruptions per customer served during the year. This index indicates the average number of sustained interruptions experienced by all customers serviced on the system.

$$SAIFI = \frac{\sum \text{No. of Customer Interruptions Experienced during the year}}{\text{Average No. of Customers served during the year}}$$

CUSTOMER AVERAGE INTERRUPTION DURATION INDEX (CAIDI)

The interruption duration per customer interrupted during the year. This index indicates the average duration of an interruption for those customers affected by a sustained interruption.

$$CAIDI = \frac{\sum \text{Duration of Interruptions} \times \text{No. of Customers affected}}{\sum \text{No. of Customer Interruptions Experienced for the year}}$$

SYSTEM AVERAGE INTERRUPTION DURATION INDEX (SAIDI)

The interruption duration per customer served during the year. This index indicates the average interruption time experienced by all customers serviced on the system.

$$SAIDI = \frac{\sum \text{Duration of Interruption} \times \text{No. of Customers affected}}{\text{Average No. of Customers Served during the year}}$$