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PUBLIC UTILITIES
COMMISSION

July 7, 2014

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

Dear Commissioners:

Subject: Hawaiian Electric Companies Annual Service Reliability Reports for 2013

Hawaiian Electric Company, Inc., Hawai'i Electric Light Company, Inc., and Maui Electric Company, Limited respectfully submit a copy of its Annual Service Reliability Report for the year 2013. (See Attachments 1, 2, and 3, respectively.)

Sincerely,

Daniel G. Brown
Manager, Regulatory Non-Rate Proceedings

Attachments

c: Division of Consumer Advocacy (with Attachments)

HAWAIIAN ELECTRIC COMPANY, INC.
ANNUAL SERVICE RELIABILITY REPORT
2013

Prepared by
System Operation Department

March 24, 2014

INTRODUCTION

This is the 2013 annual service reliability report of the Hawaiian Electric Company. The year-end average number of electric customers increased from 297,598 in 2012 to 298,920 in 2013 (a 0.44% increase). The 2013 peak demand for the system was 1,175 MW (evening peak), 6 MW higher than the peak demand in 2012; the highest system peak demand remains at 1,327 MW set on the evening of October 12, 2004.

The system interruption summary for 2013 (Attachments A and B) and the system reliability indices for the five prior years are presented to depict the quality of service provided to the electrical energy consumer. Attachment C contains the definition of terms and the reliability indices explanations and equations.

Indices measure reliability in terms of the overall availability of electrical service (Average Service Availability Index or ASAI), the frequency or number of times Hawaiian Electric Company's customers experience an outage during the year (System Average Interruption Frequency Index or SAIFI), the average length of time an interrupted customer is out of power (Customer Average Interruption Duration Index or CAIDI), and the average length of time Hawaiian Electric Company's customers are out of power during the year (System Average Interruption Duration Index or SAIDI). 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 Hawaiian Electric Company's total customer base (in this case 298,920 customers).

ANALYSIS

This analysis of the annual system reliability for Hawaiian Electric Company is for the year 2013. To determine the relative level of reliability, the statistics for five prior years, 2008 through 2012, are used for comparison.

The reliability indices are calculated using the data from all sustained¹ system outages except customer maintenance outages. If data normalization is required, it is done using 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. The guidelines indicate that normalization is allowed for "abnormal" situations such as hurricanes, tsunamis, earthquakes, floods, catastrophic equipment failures, and single outages that cascade into a loss of load 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.

¹An electrical service interruption of more than one minute. (The majority of peer companies in the Edison Electric Institute association use a threshold of five minutes to identify sustained interruptions.)

2013 RESULTS

Annual Service Reliability Indices

The annual service reliability for 2013 was ranked third for the best CAIDI and fourth for the best SAIDI in the past 6 years in terms of the indices for all events. The reliability results for 2013 and five prior years are shown below in Table 1: Annual Service Reliability Indices – All Events and Table 2: Annual Service Reliability Indices – with Normalizations. Tables 3-8 break out the events into three groups, Transmission and Distribution, Generation – Hawaiian Electric, and Generation – Other [non-utility]. No outage events were normalized in 2013. All subsequent comparisons and discussion are based on the normalized data.

Table 1: Annual Service Reliability Indices - All Events

	2008	2009	2010	2011	2012	2013
Number of Customers	294,371	294,802	295,637	296,679	297,598	298,920
Customer Interruptions	729,784	333,908	361,334	502,252	407,197	409,516
Customer-Hours Interrupted	3,985,756	442,546	564,424	1,257,338	563,807	605,964
SAIDI (Minutes)	812.39	90.08	114.55	254.59	113.67	121.63
CAIDI (Minutes)	327.69	79.52	93.72	150.20	83.08	88.78
SAIFI (Occurrences)	2.479	1.133	1.222	1.693	1.368	1.370
ASAI (Percent)	99.846	99.983	99.978	99.952	99.978	99.977

Table 2: Annual Service Reliability Indices - with Normalization

	2008*	2009	2010	2011**	2012	2013
Number of Customers	294,371	294,802	295,637	296,679	297,598	298,920
Customer Interruptions	382,124	333,908	361,334	408,326	407,197	409,516
Customer-Hours Interrupted	490,842	442,546	564,424	1,044,904	563,807	605,964
SAIDI (Minutes)	100.05	90.08	114.55	211.32	113.67	121.63
CAIDI (Minutes)	77.07	79.52	93.72	153.54	83.08	88.78
SAIFI (Occurrences)	1.298	1.133	1.222	1.376	1.368	1.370
ASAI (Percent)	99.981	99.983	99.978	99.960	99.978	99.977

NOTE:

2008* Data normalized to exclude the 12/10/08 - 12/14/08 High Wind Outages
Data normalized to exclude the 12/26/08 Island Wide Blackout

2011** Data normalized to exclude the 03/04/11 Labor Work Stoppage
Data normalized to exclude the 05/02/11 – 05/03/11 Lightning Storm

Table 3: Transmission & Distribution Events

	2008	2009	2010	2011	2012	2013
Number of Customers	294,371	294,802	295,637	296,679	297,598	298,920
Customer Interruptions	729,784	333,908	361,331	477,798	341,118	341,931
Customer-Hours Interrupted	3,985,757	442,546	564,419	1,238,615	524,554	576,307
SAIDI (Minutes)	812.39	90.07	114.55	250.50	105.76	115.68
CAIDI (Minutes)	327.69	79.52	93.72	155.54	92.26	101.13
SAIFI (Occurrences)	2.479	67.959	73.333	96.629	68.774	68.633
ASAI (Percent)	99.845	99.983	99.978	99.952	99.980	99.978

Table 4: Generation Events – Hawaiian Electric

	2008*	2009	2010	2011	2012	2013
Number of Customers	294,371	294,802	295,637	296,679	297,598	298,920
Customer Interruptions	0	0	0	24,455	0	0
Customer-Hours Interrupted	0	0	0	18,734	0	0
SAIDI (Minutes)	0.00	0.00	0.00	3.79	0.00	0.00
CAIDI (Minutes)	0.00	0.00	0.00	45.96	0.00	0.00
SAIFI (Occurrences)	0.000	0.000	0.000	4.946	0.000	0.000
ASAI (Percent)	100.000	100.000	100.000	99.999	100.000	100.000

Table 5: Generation Events – Other [non-utility]

	2008	2009	2010	2011	2012	2013
Number of Customers	294,371	294,802	295,637	296,679	297,598	298,920
Customer Interruptions	0	3	0	0	66,079	67,586
Customer-Hours Interrupted	0	5	0	0	39,253	29,659
SAIDI (Minutes)	0.00	0.00	0.00	0.00	7.91	5.95
CAIDI (Minutes)	0.00	98.00	0.00	0.00	35.64	26.33
SAIFI (Occurrences)	0.000	0.001	0.000	0.000	13.322	13.566
ASAI (Percent)	100.000	100.000	100.000	100.000	99.998	99.999

Table 6: Transmission & Distribution Events with Normalization

	2008*	2009	2010	2011**	2012	2013
Number of Customers	294,371	294,802	295,637	296,679	297,598	298,920
Customer Interruptions	382,124	333,908	361,331	383,872	341,118	341,931
Customer-Hours Interrupted	490,842	442,546	564,419	1,026,181	524,554	576,307
SAIDI (Minutes)	100.05	90.07	114.55	207.53	105.76	115.68
CAIDI (Minutes)	77.07	79.52	93.72	160.39	92.26	101.13
SAIFI (Occurrences)	77.886	67.959	73.333	77.634	68.774	68.633
ASAI (Percent)	99.981	99.983	99.978	99.961	99.980	99.978

Table 7: Generation Events – Hawaiian Electric with Normalization

	2008	2009	2010	2011	2012	2013
Number of Customers	294,371	294,802	295,637	296,679	297,598	298,920
Customer Interruptions	0	0	0	24,455	0	0
Customer-Hours Interrupted	0	0	0	18,734	0	0
SAIDI (Minutes)	0.00	0.00	0.00	3.79	0.00	0.00
CAIDI (Minutes)	0.00	0.00	0.00	45.96	0.00	0.00
SAIFI (Occurrences)	0.000	0.000	0.000	4.946	0.000	0.000
ASAI (Percent)	100.000	100.000	100.000	99.999	100.000	100.000

Table 8: Generation Events – Other [non-utility] with Normalization

	2008*	2009	2010	2011**	2012	2013
Number of Customers	294,371	294,802	295,637	296,679	297,598	298,920
Customer Interruptions	0	0	3	0	66,079	67,586
Customer-Hours Interrupted	0	0	5	0	39,253	29,659
SAIDI (Minutes)	0.00	0.00	0.00	0.00	7.91	5.95
CAIDI (Minutes)	0.00	0.00	98.00	0.00	35.64	26.33
SAIFI (Occurrences)	0.000	0.000	0.001	0.000	13.322	13.566
ASAI (Percent)	100.000	100.000	100.000	100.000	99.998	99.999

**Figure 1: System Average Interruption
Duration Index (SAIDI)**

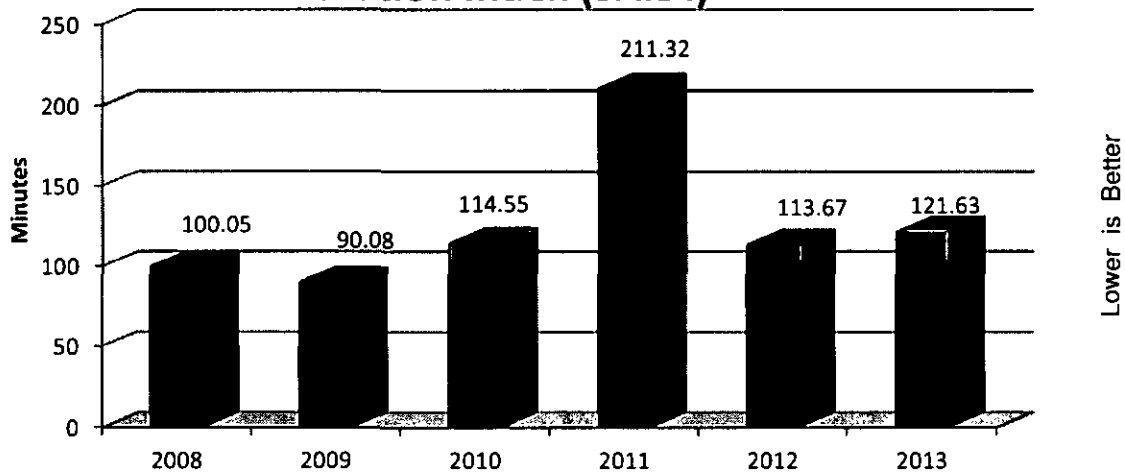


Figure 1 shows the System Average Interruption Duration Indices (SAIDI) for the past six years. It shows that the 2013 SAIDI is 121.63 minutes, a 7% increase compared to the 2012 SAIDI result of 113.67 minutes. The SAIDI is the composite of both the SAIFI and CAIDI indices and produces a broader benchmark of system reliability by combining both the duration and the number of customer interruptions during a given period of time.

**Figure 2: Customer Average Interruption
Duration Index (CAIDI)**

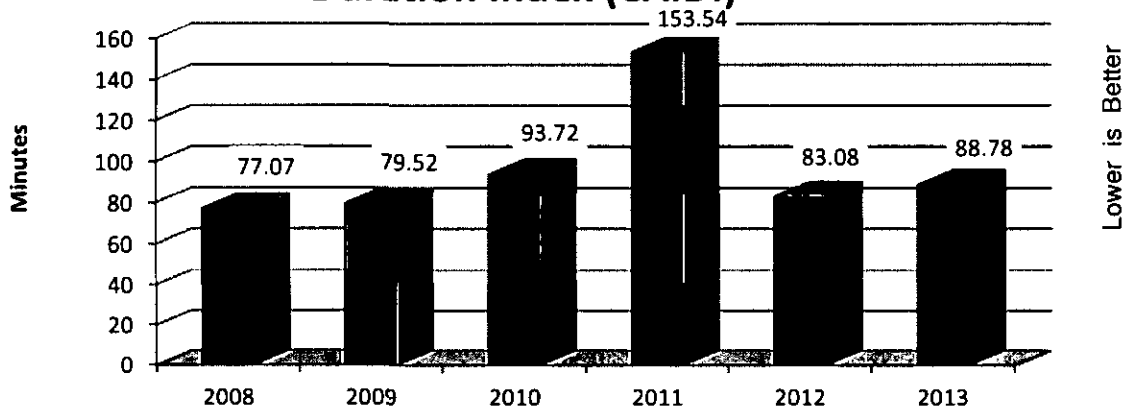
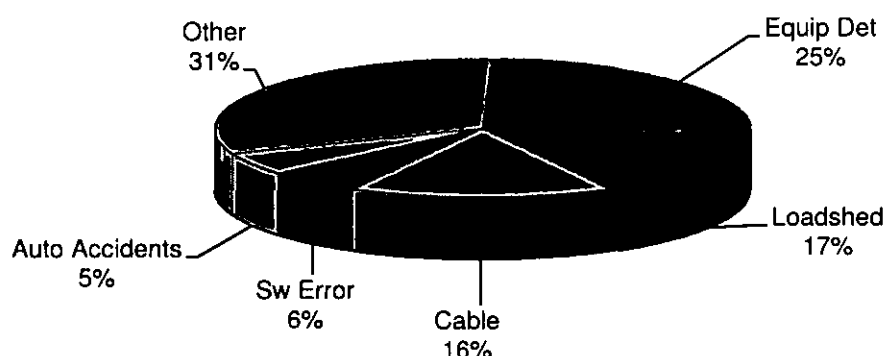


Figure 2 shows the Customer Average Interruption Duration Indices (CAIDI) for the past six years. It shows that the average duration of a customer's outage (CAIDI) for 2013 is 88.78 minutes, a 7% increase compared to the 2012 CAIDI result of 83.08 minutes. The following two events added over 9 minutes to the 2013 CAIDI, well over the 5 minute increase from the 2012 CAIDI.

The two major events affecting the 2013 CAIDI results were:

1. February 17, 2013 – Broken switch hardware fell into conductors atop the Kamehame Ridge in the Koolau Mountain Range affecting 12,691 customers and lasting from a momentary interruption to 4 hours and 39 minutes. This incident added nearly 6 minutes to the annual 2013 CAIDI.
2. October 14, 2013 – A broken strain insulator on Woodlawn Drive caused the attached conductor line to fall affecting about 5,210 customers ranging from a momentary interruption to 7 hours and 7 minutes. This incident added nearly 4 minutes to the annual 2013 CAIDI.

Figure 3: Outage Categories



The Top 5 Outage Categories, by number of customers affected, as illustrated in Figure 3, equates to about 69% of the total Customer Interruptions in 2013; these causes are:

<u>Outage Category</u>	<u>Sample Causes</u>
1. Equipment Deterioration	failed, broken, corroded equipment
2. Loadshed	loss of generation, major disruptions to distribution
3. Cable Faults	underground equipment failures
4. Switching Errors	errors during activities to reroute power for maintenance purposes
5. Auto Accidents	vehicular contact with poles, vaults, and support structures

The major cause factors for 2012 were similar to those for 2013, except "High Winds" which was replaced by "Switching Errors" in 2013. The total number of customer interruptions in 2013 was 409,516 compared with 407,197 interruptions in 2012. In the six year period, 2013 had the highest number of interruptions however it was the second highest in SAIFI indicating the increase in customers served.

The number of customer interruptions due to "Equipment Deterioration" increased from 59,320 in 2012 to 102,637 in 2013, an increase of 73%. The number of customer interruptions due to "Loadshed" increased from 53,424 in 2012 to 67,586 in 2013, a 27% increase. All of the "Loadshed" interruptions were caused by a single non-utility loss of generation event on April 2, 2013.

In contrast to the above areas, the number of customer interruptions due to "Cable Fault" decreased from 88,965 in 2012 to 65,201 in 2013, a 27% reduction. The number of customer interruptions from "Auto Accidents" decreased from 24,790 in 2012 to 21,915 in 2013 a 12% reduction. The interruptions due to "High Winds" also decreased from 37,807 in 2012 to 5,818 in 2013, an 85% reduction. The reliability improvement in the outage cause category "High Winds" may be attributed primarily to two program areas. The first is the area of pole replacement and overhead line maintenance programs. In the past, older poles on the system were damaged by high winds causing outages. The results in 2013 show that there were significantly less outages caused by pole failures and the ones that did occur were the result of "Auto Accidents." The second program area is vegetation management which focuses on trimming trees and other vegetation away from the lines. Although vegetation related outages would normally be coded to "Trees and Branches," during high wind conditions some of the outages occur due to intermittent contact or debris from tree branches flying into the lines. The results indicate that with Hawaiian Electric Company's focus in this area it is improving in reliability and is reflected in the lower number of outages in 2013 due to "High Winds."

In 2013, there were three events that resulted in the loss of more than 10,000 customers. On April 2, 2013, the island experienced a load shedding event due to the loss of the island's largest generating unit at the AES facility. This event caused an interruption to 67,586 customers or 23% of our customers with outage durations ranging from 3 minutes to 1 hour and 54 minutes. On January 15, 2013, an outage affecting 13,182 customers caused by a switching error deenergized a transformer at Koolau Substation. This outage lasted 25 minutes. On February 17, 2013, broken switch hardware affected 12,691 customers in the CAIDI affecting event.

Figure 4: System Average Interruption Frequency Index (SAIFI)

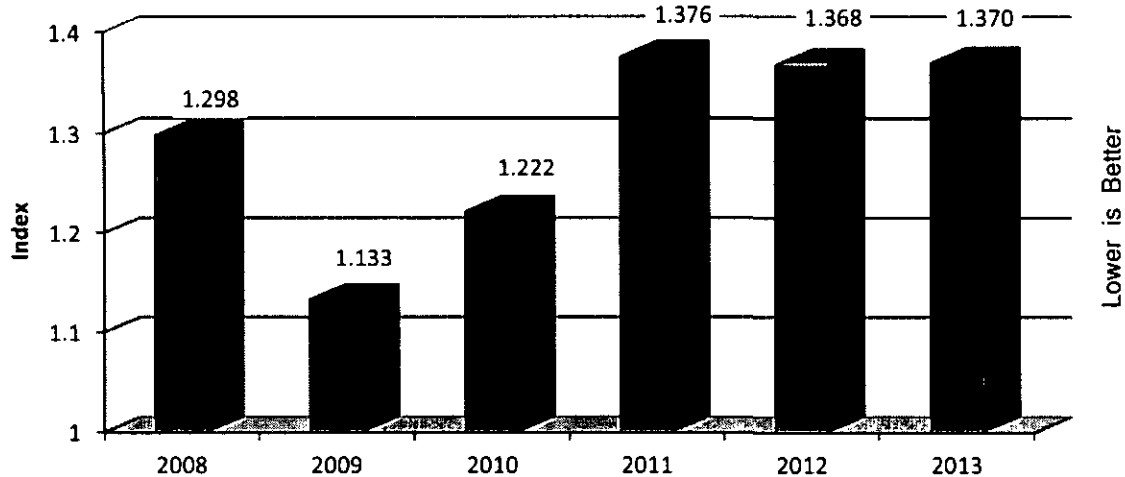


Figure 4 shows the System Average Interruption Frequency Index (SAIFI) for the past six years. It shows that the 2013 SAIFI of 1.370 was the second worst performance in the past six years, increasing 0.15% from the 1.368 SAIFI in 2012.

Figure 5: Average Service Availability Index (ASAI)

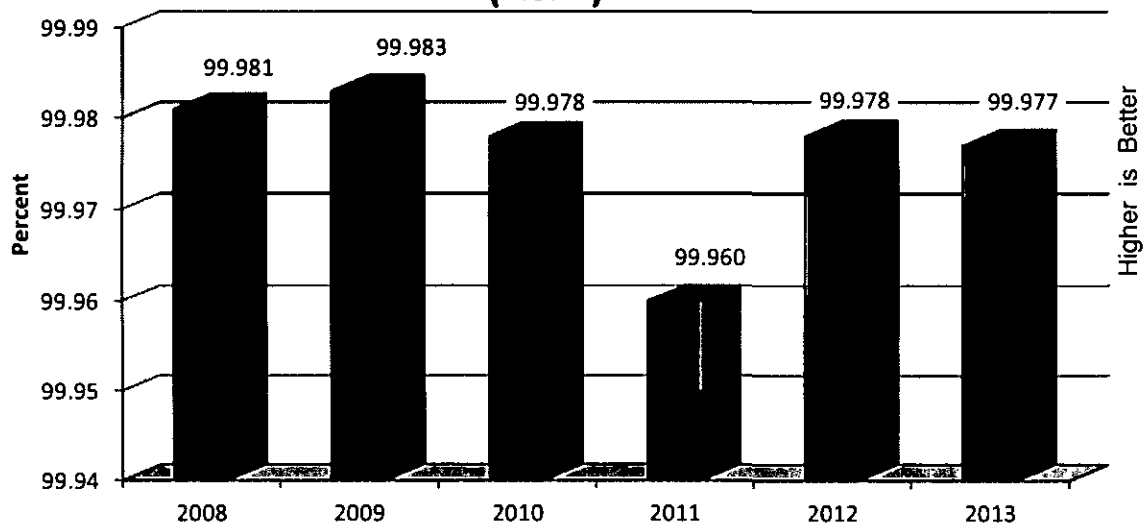


Figure 5 shows that the 2013 Average Service Availability changed very slightly from 2012. The decline was on the order of one one-thousandth of a percent. This difference of availability is about 2300 less hours of availability to a customer base of approximately 1300 more customers than in 2012.

Hawaiian Electric Company Sustained Interruption Summary

From: January 1, 2013

To: December 31, 2013

Outage Cause	Customer Hours	Customer Interruptions	SAIFI	SAIDI	CAIDI
EQUIP DETERIORATION	221,078.38	102,637	0.343	44.38	129.24
AUTO UF LOADSHED	29,659.35	67,586	0.226	5.95	26.33
CABLE FAULT	100,704.22	65,201	0.218	20.21	92.67
COMPANY SWITCHING ERROR	6,724.25	23,453	0.078	1.35	17.20
AUTO ACCIDENT	48,212.62	21,915	0.073	9.68	132.00
TREES/BRANCHES IN LINES	37,343.07	21,716	0.073	7.50	103.18
COMPANY PERSONNEL ERROR	15,198.33	13,514	0.045	3.05	67.48
FORCED MAINTENANCE	8,330.57	12,850	0.043	1.67	38.90
SCHEDULED MAINTENANCE	39,298.63	11,011	0.037	7.89	214.14
MYLAR BALLOON	7,106.78	9,958	0.033	1.43	42.82
ANIMAL IN LINES	7,861.88	8,470	0.028	1.58	55.69
FAULTY EQUIP OPERATION	11,131.73	8,291	0.028	2.23	80.56
CONSTRUCTION ACCIDENT	11,691.42	7,994	0.027	2.35	87.75
LIGHTNING	11,253.95	7,196	0.024	2.26	93.84
UNKNOWN	7,886.30	6,200	0.021	1.58	76.32
HIGH WINDS	15,644.50	5,818	0.019	3.14	161.34
FOREIGN OBJECT IN LINES	3,217.98	3,141	0.011	0.65	61.47
FLASHOVER	2,167.88	3,116	0.010	0.44	41.74
MOVING EQUIP ACCIDENT	3,504.63	2,771	0.009	0.70	75.89
TRANSFORMER FAILURE	7,739.37	2,217	0.007	1.55	209.46
CONTAMINATION FLASHOVER	1,754.08	1,039	0.003	0.35	101.29
TRANSFORM OVERLOAD	3,217.98	994	0.003	0.65	194.24
OVERGROWN VEGETATION	2,865.82	945	0.003	0.58	181.96
EQUIP OVERLOAD	1,189.22	715	0.002	0.24	99.79
OTHER	389.07	535	0.002	0.08	43.63
MAN IN LINES	215.47	128	0.000	0.04	101.00
CUSTOMER EQUIP	69.55	35	0.000	0.01	119.23
SYSTEM LOAD MAINTENANCE	238.13	26	0.000	0.05	549.54
FIRE	186.63	26	0.000	0.04	430.69
VANDALISM	57.67	9	0.000	0.01	384.44
EQUIP ROT OR TERMITES	14.00	5	0.000	0.00	168.00
LANDSLIDE/FLOODING	11.18	3	0.000	0.00	223.67
TRANSFER LOAD MAINTENANCE	0.33	1	0.000	0.00	20.00
MANUAL UF LOADSHED	0.00	0	0.000	0.00	0.00
NATURAL DISASTER	0.00	0	0.000	0.00	0.00
MANUFACTURER EQUIP DEFECT	0.00	0	0.000	0.00	0.00
SWITCH LOAD MAINTENANCE	0.00	0	0.000	0.00	0.00
CUSTOMER MAINTENANCE	0.00	0	0.000	0.00	0.00
OTHER-GENERATION	0.00	0	0.000	0.00	0.00
IPP EQUIP FAILURE	0.00	0	0.000	0.00	0.00
Total	605,964.98	409,516	1.370	121.63	88.78

AVERAGE SYSTEM AVAILABILITY = 99.977%
NUMBER OF CUSTOMERS FOR THE PERIOD = 298,920
24 MONTH ANNUALIZED SAIDI AVERAGE FOR THE PERIOD 1/1/2012 - 12/31/2013 = 117.66
24 MONTH AVERAGE NUMBER OF CUSTOMERS FOR THE PERIOD 1/1/2012 - 12/31/2013 = 298,259

SAIFI = SYSTEM AVERAGE INTERRUPTION FREQUENCY INDEX
SAIDI = SYSTEM AVERAGE INTERRUPTION DURATION INDEX (MINUTES)
CAIDI = CUSTOMER AVERAGE INTERRUPTION DURATION INDEX(MINUTES)

NOTES: Outage causes are listed in order of SAIFI.

Outages with zero customer hours or due to customer maintenance are not included in the report.

Hawaiian Electric Company Sustained Interruption Summary

From: January 1, 2013

To: December 31, 2013

Outage Cause	<u>Interruptions</u>		<u>Customer Hours</u>	
	Number	% of Total	Number	% of Total
<u>ACCIDENT</u>	71	2.95	63,408.67	10.46
MOVING EQUIP ACCIDENT	2	0.08	3,504.63	0.58
CONSTRUCTION ACCIDENT	22	0.92	11,691.42	1.93
AUTO ACCIDENT	47	1.96	48,212.62	7.96
<u>CABLE FAULT</u>	557	23.17	100,704.22	16.62
CABLE FAULT	557	23.17	100,704.22	16.62
<u>COMPANY ERROR</u>	53	2.20	21,922.58	3.62
COMPANY PERSONNEL ERROR	25	1.04	15,198.33	2.51
COMPANY SWITCHING ERROR	28	1.16	6,724.25	1.11
<u>EQUIPMENT</u>	368	15.31	233,482.88	38.53
EQUIP OVERLOAD	10	0.42	1,189.22	0.20
MANUFACTURER EQUIP DEFECT	0	0.00	0.00	0.00
IPP EQUIP FAILURE	0	0.00	0.00	0.00
FAULTY EQUIP OPERATION	13	0.54	11,131.73	1.84
EQUIP DETERIORATION	332	13.81	221,078.38	36.48
CUSTOMER EQUIP	12	0.50	69.55	0.01
EQUIP ROT OR TERMITES	1	0.04	14.00	0.00
<u>FIRE</u>	2	0.08	186.63	0.03
FIRE	2	0.08	186.63	0.03
<u>FLASHOVER</u>	10	0.42	3,921.97	0.65
CONTAMINATION FLASHOVER	3	0.12	1,754.08	0.29
FLASHOVER	7	0.29	2,167.88	0.36
<u>GENERATION</u>	44	1.83	29,659.35	4.89
MANUAL UF LOADSHED	0	0.00	0.00	0.00
AUTO UF LOADSHED	44	1.83	29,659.35	4.89
OTHER-GENERATION	0	0.00	0.00	0.00
<u>MAINTENANCE</u>	934	38.85	47,867.67	7.90
SYSTEM LOAD MAINTENANCE	3	0.12	238.13	0.04
TRANSFER LOAD MAINTENANCE	1	0.04	0.33	0.00
SWITCH LOAD MAINTENANCE	0	0.00	0.00	0.00
SCHEDULED MAINTENANCE	804	33.44	39,298.63	6.49
FORCED MAINTENANCE	126	5.24	8,330.57	1.37
CUSTOMER MAINTENANCE	0	0.00	0.00	0.00
<u>OBJECT IN LINES OR EQUIP</u>	51	2.12	18,402.12	3.04
ANIMAL IN LINES	27	1.12	7,861.88	1.30
FOREIGN OBJECT IN LINES	7	0.29	3,217.98	0.53
MYLAR BALLOON	16	0.67	7,106.78	1.17
MAN IN LINES	1	0.04	215.47	0.04
<u>OTHER</u>	5	0.21	389.07	0.06
OTHER	5	0.21	389.07	0.06
<u>TRANSFORMER</u>	122	5.07	10,957.35	1.81
TRANSFORMER FAILURE	80	3.33	7,739.37	1.28
TRANSFORM OVERLOAD	42	1.75	3,217.98	0.53

Hawaiian Electric Company Sustained Interruption Summary

From: January 1, 2013

To: December 31, 2013

Outage Cause	<u>Interruptions</u>		<u>Customer Hours</u>	
	Number	% of Total	Number	% of Total
<u>UNKNOWN</u>	32	1.33	7,886.30	1.30
UNKNOWN	32	1.33	7,886.30	1.30
<u>VANDALISM</u>	4	0.17	57.67	0.01
VANDALISM	4	0.17	57.67	0.01
<u>VEGETATION</u>	102	4.24	40,208.88	6.64
TREES/BRANCHES IN LINES	95	3.95	37,343.07	6.16
OVERGROWN VEGETATION	7	0.29	2,865.82	0.47
<u>WEATHER</u>	49	2.04	26,909.63	4.44
HIGH WINDS	22	0.92	15,644.50	2.58
LANDSLIDE/FLOODING	1	0.04	11.18	0.00
NATURAL DISASTER	0	0.00	0.00	0.00
LIGHTNING	26	1.08	11,253.95	1.86
Total:	2,404	605,964.98		

NOTES: Outages with zero customer hours or due to customer maintenance are not included in the report.

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 the system configuration.

INTERRUPTION

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

INTERRUPTION DURATION

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

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 of 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 within this report. 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: Interruptions to customers at their request (e.g., customer maintenance) are not considered.

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:

RELIABILITY INDICES

AVERAGE SERVICE AVAILABILITY INDEX (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.

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

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.

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

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.

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

HAWAI'I ELECTRIC LIGHT COMPANY, INC.

ANNUAL SERVICE RELIABILITY REPORT

2013

Prepared by
Operations, Distribution Department

June 20, 2014

INTRODUCTION

This is the 2013 annual service reliability report of the Hawai'i Electric Light Company (HAWAI'I ELECTRIC LIGHT). The year-end average number of electric customers increased from 81,537 in 2012 to 82,074 in 2013 (a 0.65% increase). The 2013 peak demand for the system was 190.2 MW (evening peak), 0.9 MW higher than the peak demand of 189.3 MW in 2012.

The system interruption summaries (Attachment A) for the past year and the system reliability indices for the five prior years are presented to depict the quality of service provided to the electrical energy consumer.

Attachment B contains the definition of terms and the reliability indices explanations and equations.

Indices measure reliability in terms of the overall availability of electrical service (ASAI), the frequency or number of times HAWAI'I ELECTRIC LIGHT's customers experience an outage during the year (SAIFI), the average length of time an interrupted customer is out of power (CAIDI), and the average length of time HAWAI'I ELECTRIC LIGHT's customers are out of power during the year (SAIDI). 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 HAWAI'I ELECTRIC LIGHT's total customer base (in this case 82,074 customers).

ANALYSIS

This analysis of the annual system reliability for HAWAI'I ELECTRIC LIGHT is for the year 2013. To determine the relative level of reliability, the statistics for five prior years, 2008 through 2012, are used for comparison.

The reliability indices are calculated using the data from all sustained¹ system outages except Customer Maintenance outages. If data normalization is required, it is done using the guidelines specified in the report on reliability that was prepared for the Public Utilities Commission, titled "Methodology for Determining Reliability Indices for HAWAI'I ELECTRIC LIGHT Utilities," dated December 1990. The guidelines indicate that normalization is allowed for "abnormal" situations such as hurricanes, tsunamis, earthquakes, floods, catastrophic equipment failures, and single outages that cascade into a loss of load 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.*

¹An electrical service interruption of more than one minute. (The majority of peer companies in the Edison Electric Institute association use a threshold of five minutes to identify sustained interruptions.)

2013 RESULTS**Annual Service Reliability Indices**

The annual service reliability for 2013 was ranked the best SAIDI in the past 6 years in terms of the indices for all events (with Normalization). The reliability results for 2013 and five prior years are shown below in Table 1: Annual Service Reliability Indices – All Events, and Table 2: Annual Service Reliability Indices – with Normalizations. Ten outage events were normalized in 2013, including six T&D and four Generation related events. All subsequent comparisons and discussion are based on the normalized data.

Table 1: Annual Service Reliability Indices - All Events

Year	2008	2009	2010	2011	2012	2013
Number of Customers	79,386	79,679	80,171	80,807	81,537	82,074
Customer Interruptions	193,982	298,334	302,402	290,616	228,549	379,397
Customer-Hour Interruptions	189,692	246,916	207,607	242,120	190,395	276,798
SAID	143.37	185.93	155.30	179.70	140.10	202.35
CAID	58.67	49.66	41.19	49.99	49.98	43.77
SAIF	2.444	3.744	3.772	3.596	2.803	4.623
ASA	99.973	99.965	99.97	99.966	99.973	99.962

Table 2: Annual Service Reliability Indices - with Normalization

Year	2008*	2009*	2010*	2011*	2012	2013*
Number of Customers	79,386	79,679	80,171	80,807	81,537	82,074
Customer Interruptions	179,037	246,437	176,622	236,688	228,549	241,169
Customer-Hours Interrupted	188,381	197,371	169,522	232,981	190,395	156,338
SAID	142.38	148.62	126.8	172.99	140.10	114.29
CAID	63.13	48.05	57.59	59.06	49.98	38.89
SAIF	2.255	3.093	2.203	2.929	2.803	2.938
ASA	99.973	99.972	99.976	99.967	99.973	99.978

NOTE:

2008* Data normalized to exclude 7/2 HEP UFLS
 2009* Data normalized to exclude 6/25 HRD UFLS
 Data normalized to exclude 9/22 Keahole ST7 UFLS
 Data normalized to exclude 12/19-20 Lightning Storm

Hawai'i Electric Light Company, Inc.
Annual Service Reliability Report 2013
Annual Service Reliability Indices

2010* Data normalized to exclude 1/26 Puna Plant UFLS
 Data normalized to exclude 4/9 and 7/3 Keahole CT5 UFLS
 Data normalized to exclude 10/27 Keahole CT4 UFLS
2011* Data normalized to 6/30 exclude Keahole CT4 UFLS
 Data normalized to exclude Keahole CT5 and ST7 UFLS
 Data normalized to exclude 8/2 HEP UFLS
2013* Data normalized to exclude 1/25 7600 Line fault
 Data normalized to exclude 3/2, Keahole CT4 UFLS
 Data normalized to exclude 3/13 6500 Line fault
 Data normalized to exclude 6/27, 8/14 Waimea Sub upgrade
 Data normalized to exclude 7/29 Wind Storm
 Data normalized to exclude 10/26, 12/30 PGV UFLS
 Data normalized to exclude 11/25 Hill 6 UFLS
 Data normalized to exclude 12/30 Lightning Storm

T&D vs. Generation – All Events**Table 3: Annual Service Reliability Indices – T&D**

Year	2008	2009	2010	2011	2012	2013
Number of Customers	79386	79679	80171	80807	81537	82074
Customer Interruptions	107692	165478	88321	180770	145331	189427
CID	184393	232344	161218.8	228431.9	183773.2	257620
SAID	139.36	174.96	120.66	169.61	135.23	188.33
CAID	102.73	84.24	109.52	75.82	75.87	81.6
SAIF	1.357	2.077	1.102	2.237	1.782	2.308

Table 4: Annual Service Reliability Indices – Generation

Year	2008	2009	2010	2011	2012	2013
Number of Customers	79386	79679	80171	80807	81537	82074
Customer Interruptions	86290	132856	214081	109846	83218	189971
CID	5299	14572	46387.9	13688.4	6621.3	19178
SAID	4	10.97	34.7	10.16	4.87	14.02
CAID	3.68	6.58	13	7.48	4.77	6.06
SAIF	1.087	1.667	2.67	1.359	1.021	2.315

T&D vs. Generation – With Normalization**Table 5: Normalized Annual Service Reliability Indices – T&D**

Year	2008	2009*	2010	2011	2012	2013*
Number of Customers	79386	79679	80171	80807	81537	82074
Customer Interruptions	107692	129518	88321	180770	145331	126005
CID	184392.8	185854.8	161218.8	228431.9	183773.2	147483
SAID	139.36	139.95	120.66	169.61	135.20	107.82
CAID	102.73	86.10	109.52	75.82	75.87	70.23
SAIF	1.357	1.572	1.102	2.237	1.782	1.535

Table 6: Normalized Annual Service Reliability Indices – Generation

Year	2008*	2009*	2010*	2011*	2012	2013*
Number of Customers	79386	79679	80171	80807	81537	82074
Customer Interruptions	71345	121221	88301	55918	83218	115164
CID	3988	12871.1	8303.9	4548.74	6621.3	8854.9
SAID	3.01	9.17	6.21	3.38	4.87	6.47
CAID	3.35	6.03	6.15	4.88	4.77	4.61
SAIF	0.899	1.521	1.101	0.692	1.021	1.403

**Figure 1: System Average Interruption
Duration Index (SAIDI)**

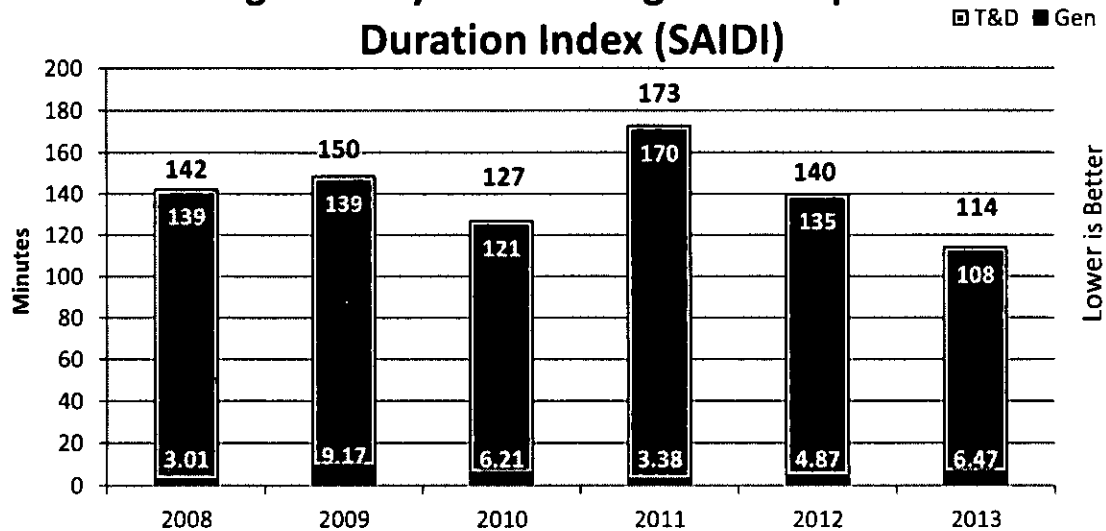


Figure 1 shows the System Average Interruption Duration Indices (SAIDI) for the past six years. It shows that the 2013 SAIDI is 114.29 minutes, an 18% decrease compared to the 2012 SAIDI result of 140.10 minutes. The SAIDI is the composite of both the SAIFI and CAIDI indices and produces a broader benchmark of system reliability by combining both the duration and the number of customer interruptions during a given period of time.

**Figure 2: Customer Average Interruption
Duration Index (CAIDI)**

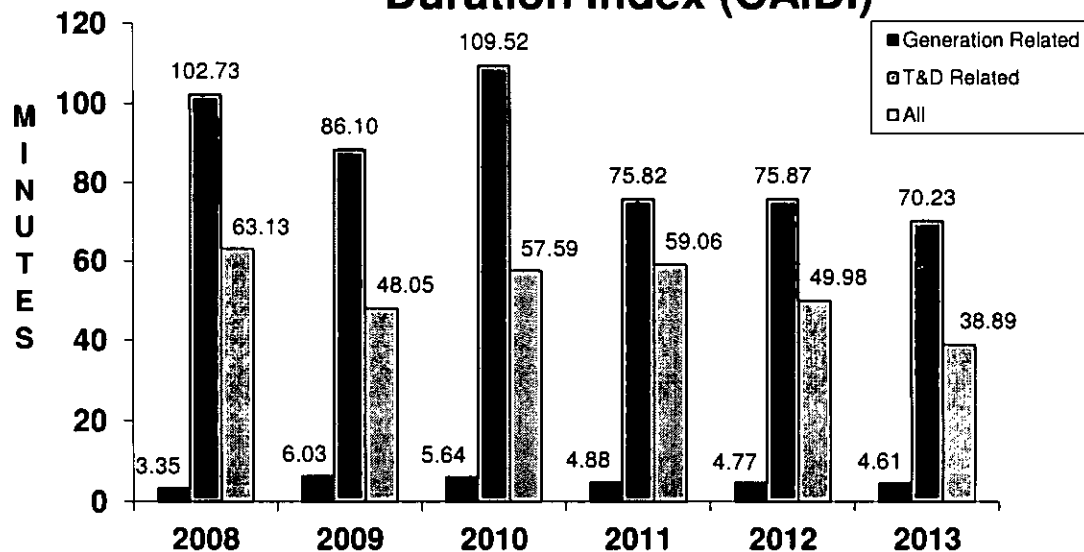


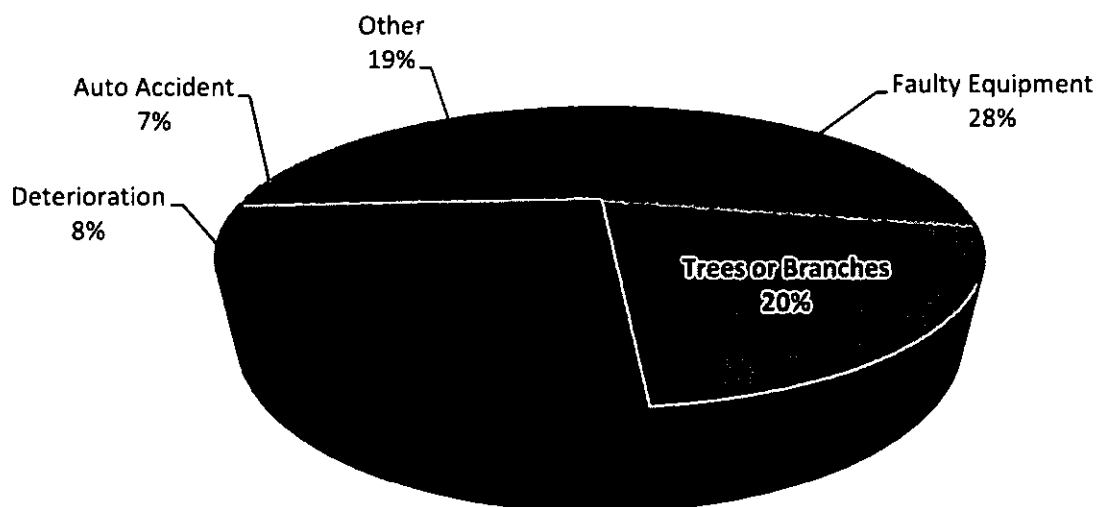
Figure 2 Customer Average Interruption Duration Indices (CAIDI) shows the average duration of a customer's outage (CAIDI) for 2013 is 38.89 minutes, a 22% decrease compared to the 2012 CAIDI result of 49.98 minutes.

The three major events affecting the 2013 CAIDI results were:

1. August 10, 2013 – fallen tree on 34kV Line 3400 near Volcano affecting 4,568 customers and 9,967 customer-hours.
2. March 1, 2013 – Motor Vehicle Accident on 34kV Line 3400 near Kurtistown affecting 5,647 customers and 4,226 customer-hours.
3. March 3, 2013 – Underfrequency load shedding event due to Operator Error affecting 5,046 customers and 401 customer-hours

These three events increased the 2013 CAIDI by 1.24 minutes.

Figure 3: Outage Categories



The Top 5 Outage Categories, by number of customers affected, as illustrated in Figure 3, equates to about 81% of the total Customer Interruptions in 2013; these causes are:

<u>Outage Category</u>	<u>Sample Causes</u>
1. Faulty Equipment	HAWAII ELECTRIC LIGHT generation load shedding
2. Trees or Branches	tree or branch contact
3. Customer Equipment	IPP generation load shedding

4. Deterioration rotten poles/cross arms, rusted hardware and insulators, corroded connections
5. Auto Accidents

The major cause factors for 2013 were the same as 2012, but in a different order.

A total of 241,168 Customer Interruptions were recorded for a total of 156,332 Customer Hours of Interruptions. The System Average Interruption Frequency (SAIF) index was 2.938 and the Customer Average Interruption Duration (CAID) was 38.89 minutes.

In 2013, Hawai'i Electric Light customers experienced 20 load shedding events. 12 load shed events were due to Hawai'i Electric Light generating units, 3 load shed events were due to loss of PGV generating units, 3 load shed events due to loss of HEP generating units, 1 load shed event due to loss of HRD, and 1 load shed event due to loss of Pakini Nui Wind Farm. Of the 20 events, 16 were caused by generation equipment and 4 were caused by T&D equipment.

Loss of Generating Unit	UFLS Events	Generation Related	T&D Related
HELCO	12	9	3
PGV	3	3	0
HEP	3	3	0
HRD	1	0	1
Pakini Nui	1	1	0

**Figure 4: System Average Interruption
Frequency Index (SAIFI)**

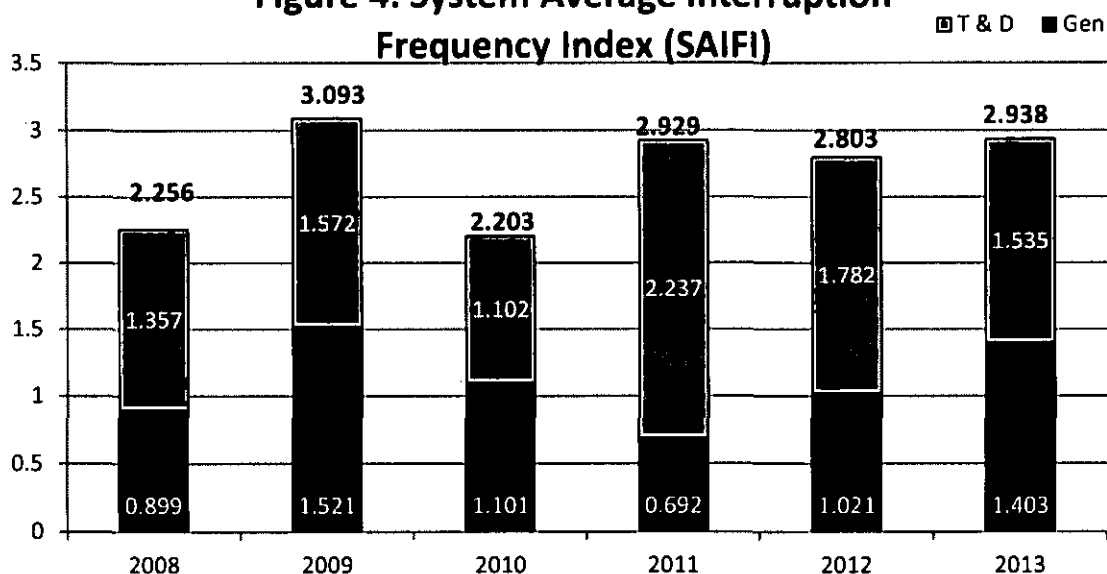


Figure 4 shows the System Average Interruption Frequency Index (SAIFI) increased as compared to 2012 from 2.803 to 2.938.

**Figure 5: Average Service Availability Index
(ASAI)**

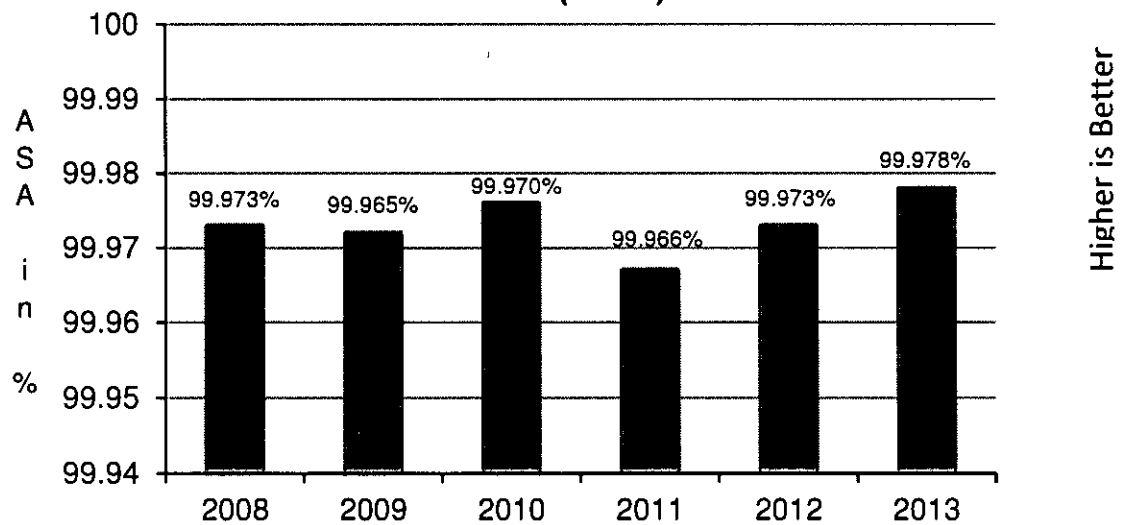


Figure 5 shows that the 2013 Average Service Availability Index increased as compared to the 2012 from 99.973% to 99.978%

Hawai'i Electric Light Company, Inc.

Annual Reliability Service 2013

HELCO Generation vs. NON-HELCO Generation

HAWAI'I ELECTRIC LIGHT vs. NON-HAWAI'I ELECTRIC LIGHT GENERATION

Service Reliability Indices Normalized

HAWAI'I ELECTRIC LIGHT Generation

Year	2008	2009	2010	2011	2012	2013
Number of Customers	79386	79679	80171	80807	81537	82074
Customer Interruptions	66538	100561	71993	28429	31421	72547
CID	3709	11647	7118.4	2802.4	2492.6	5834
SAID	2.80	8.77	5.33	2.08	1.83	4.27
CAID	3.34	6.95	5.93	5.91	4.76	4.83
SAIF	0.838	1.262	0.898	0.352	0.385	0.884

Non-HAWAI'I ELECTRIC LIGHT Generation

Year	2008	2009	2010	2011	2012	2013
Number of Customers	79386	79679	80171	80807	81537	82074
Customer Interruptions	4807	20660	16308	27489	51797	42617
CID	279	1224.3	1185.1	1747	4128.7	3020
SAID	0.21	0.92	0.89	1.30	3.04	2.21
CAID	3.48	3.56	4.36	3.81	4.78	4.25
SAIF	0.061	0.259	0.203	0.340	0.635	0.519

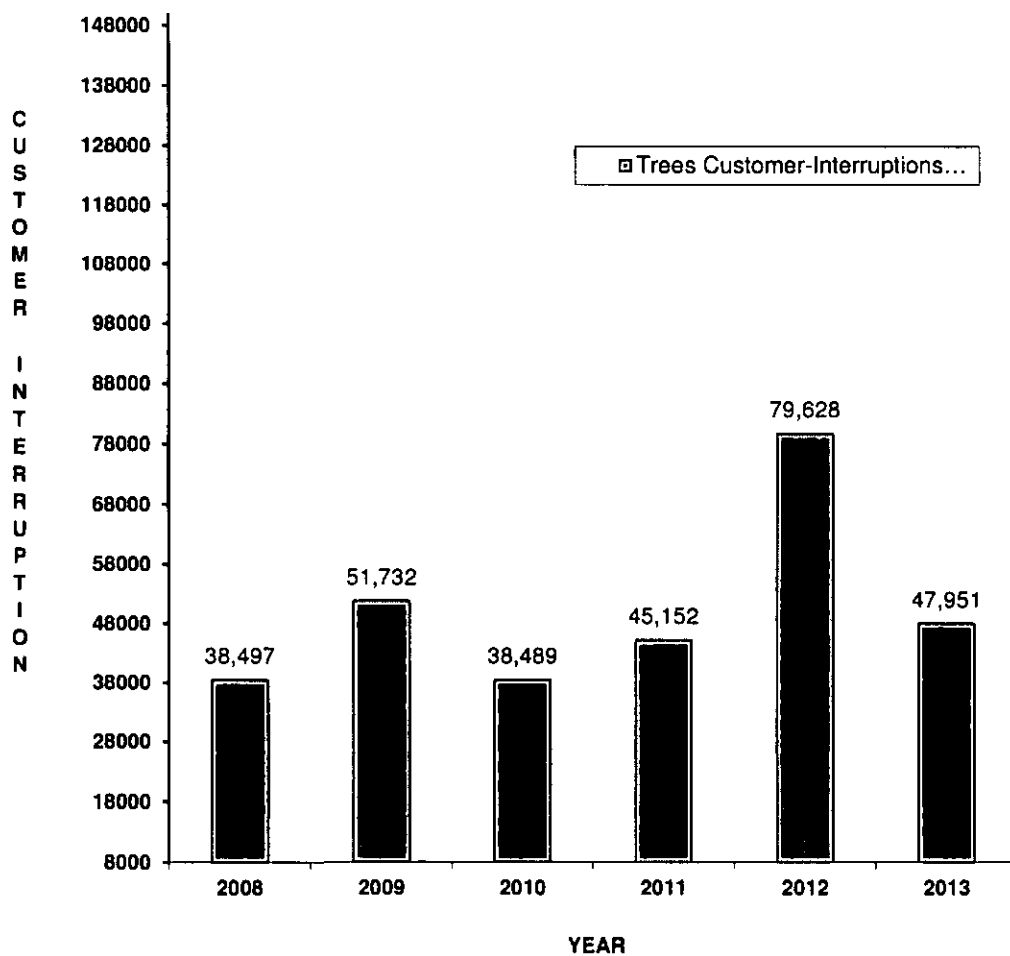
Hawai'i Electric Light Company, Inc.

Annual Reliability Service 2013

Trees & Branches

INTERRUPTIONS CAUSED BY TREES & BRANCHES

Normalized

**Hawai'i Electric Light Company
2013**

2013
SERVICE RELIABILITY SUMMARY
Normalized

<u>Cause of Outage</u>	<u>CUST-HR</u>	<u>CUST-INT</u>	<u>SAIF</u>	<u>SAID</u>	<u>CAID</u>	<u>SAID RANK</u>
Faulty Equipment Operation	5439.0	67504	0.822	3.98	4.83	8
Tree or Branches	62670.8	47951	0.584	45.82	78.42	1
Customer Equip	3035.6	42625	0.519	2.22	4.27	12
Deterioration	28059.6	18762	0.229	20.51	89.73	2
Auto Accident	12672.4	17235	0.210	9.26	44.12	3
Unknown	6981.8	11817	0.144	5.10	35.45	5
Operation or Switching Error	527.5	6569	0.080	0.39	4.82	16
Foreign Objects	320.8	6558	0.080	0.23	2.94	19
Man or Animal	4539.8	4619	0.056	3.32	58.97	10
Scheduled Maintenance	7613.4	3825	0.047	5.57	119.43	4
Cable Fault	5586.7	3631	0.044	4.08	92.32	7
Other Personnel Error	872.8	2487	0.030	0.64	21.06	14
Lightning	4725.9	2117	0.026	3.45	133.94	9
Sys Add/Removal	5919.1	1446	0.018	4.33	245.60	6
High Wind	3813.5	1439	0.018	2.79	159.01	11
Tsf Failure	1906.3	1315	0.016	1.39	86.98	13
Forced Maintenance	482.4	466	0.006	0.35	62.11	17
Excavate Construction	329.9	312	0.004	0.24	63.44	18
Equip Contact	623.3	194	0.002	0.46	192.76	15
Balance Load	88.5	108	0.001	0.06	49.17	20
Loose Connection	67.5	84	0.001	0.05	48.19	21
Equip Failure	27.4	82	0.001	0.02	20.04	22
Fire	21.1	19	0.000	0.02	66.47	23
Flashover	12.4	3	0.000	0.01	248.00	24
Vandalism	0.5	1	0.000	0.00	30.00	25
Equip Overload	0.0	0	0.000	0.00	0.00	31
Tsf Overload	0.0	0	0.000	0.00	0.00	26
Balloon/Kite	0.0	0	0.000	0.00	0.00	27
Customer Maintenance	0.0	0	0.000	0.00	0.00	28
Transfer Load	0.0	0	0.000	0.00	0.00	29
Flood / Tsunami	0.0	0	0.000	0.00	0.00	30
TOTALS	156337.9	241169	2.938	114.29	38.90	

NUMBER OF CUSTOMERS FOR THE PERIOD = 82074

ASA = 99.978%

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

2013
SYSTEM INTERRUPTION CAUSE REPORT
Normalized

CAUSE		No. of Interruptions		Customer Hours	
NON-CONNECTED SYSTEM EMERGENCY	(Totals)	845	28.43%	84302.6	53.92%
Tree or Branches		601	20.22%	62670.8	40.09%
Auto Accident		72	2.42%	12672.4	8.11%
Customer Equip		68	2.29%	3035.6	1.94%
Man or Animal		41	1.38%	4539.8	2.90%
Equip Contact		16	0.54%	623.3	0.40%
Excavate Construction		15	0.50%	329.9	0.21%
Foreign Objects		14	0.47%	320.8	0.21%
Balance Load		11	0.37%	88.5	0.06%
Fire		5	0.17%	21.1	0.01%
Balloon/Kite		1	0.03%	0.0	0.00%
Vandalism		1	0.03%	0.5	0.00%
Flood / Tsunami		0	0.00%	0.0	0.00%
Transfer Load		0	0.00%	0.0	0.00%
ERROR	(Totals)	64	2.15%	1400.3	0.90%
Other Personnel Err		56	1.88%	872.8	0.56%
Operation or Switching Error		8	0.27%	527.5	0.34%
WEATHER	(Totals)	50	1.68%	8539.5	5.46%
Lightning		44	1.48%	4725.9	3.02%
High Wind		6	0.20%	3813.5	2.44%
EQUIPMENT FAILURE	(Totals)	442	14.87%	39192.6	25.07%
Deterioration		182	6.12%	28059.6	17.95%
Cable Fault		127	4.27%	5586.7	3.57%
Faulty Equip Operation		110	3.70%	5439.0	3.48%
Equip Failure		13	0.44%	27.4	0.02%
Loose Connection		9	0.30%	67.5	0.04%
Flashover		1	0.03%	12.4	0.01%
Equip Overload		0	0.00%	0.0	0.00%
TRANSFORMER FAILURE	(Totals)	44	1.48%	1906.3	1.22%
Tsf Failure		44	1.48%	1906.3	1.22%
Tsf Overload		0	0.00%	0.0	0.00%
UNKNOWN AFTER TESTS AND INSPECTIONS	(Totals)	175	5.89%	6981.8	4.47%
Unknown		175	5.89%	6981.8	4.47%
MAINTENANCE	(Totals)	1213	40.81%	8095.8	5.18%
Scheduled Maintenance		1074	36.14%	7613.4	4.87%
Forced Maintenance		139	4.68%	482.4	0.31%
SYSTEM ADDITIONS OR REMOVALS	(Totals)	139	4.68%	5919.1	3.79%
Sys Add/Removal		139	4.68%	5919.1	3.79%
TOTALS		2972		156337.9	

2013
T&D SERVICE RELIABILITY SUMMARY
Normalized

<u>Cause of Outage</u>	<u>CUST-HR</u>	<u>CUST-INT</u>	<u>SAIF</u>	<u>SAID</u>	<u>CAID</u>	<u>SAID RANK</u>
Tree or Branches	62670.8	47951	0.584	45.82	78.42	1
Deterioration	28059.6	18762	0.229	20.51	89.73	2
Auto Accident	12672.4	17235	0.210	9.26	44.12	3
Unknown	6981.8	11817	0.144	5.10	35.45	5
Foreign Objects	320.8	6558	0.080	0.23	2.94	16
Man or Animal	4539.8	4619	0.056	3.32	58.97	9
Scheduled Maintenance	7613.4	3825	0.047	5.57	119.43	4
Cable Fault	5586.7	3631	0.044	4.08	92.32	7
Other Personnel Error	872.8	2487	0.030	0.64	21.06	12
Lightning	4725.9	2117	0.026	3.45	133.94	8
Operation or Switching Error	126.9	1523	0.019	0.09	5.00	17
Sys Add/Removal	5919.1	1446	0.018	4.33	245.60	6
High Wind	3813.5	1439	0.018	2.79	159.01	10
Tsf Failure	1906.3	1315	0.016	1.39	86.98	11
Forced Maintenance	482.4	466	0.006	0.35	62.11	14
Excavate Construction	329.9	312	0.004	0.24	63.44	15
Equip Contact	623.3	194	0.002	0.46	192.76	13
Balance Load	88.5	108	0.001	0.06	49.17	18
Loose Connection	67.5	84	0.001	0.05	48.19	19
Equip Failure	27.4	82	0.001	0.02	20.04	20
Fire	21.1	19	0.000	0.02	66.47	21
Customer Equip	15.3	8	0.000	0.01	115.00	22
Flashover	12.4	3	0.000	0.01	248.00	23
Faulty Equipment Operation	5.0	3	0.000	0.00	99.00	24
Vandalism	0.5	1	0.000	0.00	30.00	25
Equip Overload	0.0	0	0.000	0.00	0.00	31
Balloon/Kite	0.0	0	0.000	0.00	0.00	26
Customer Maintenance	0.0	0	0.000	0.00	0.00	27
Tsf Overload	0.0	0	0.000	0.00	0.00	28
Transfer Load	0.0	0	0.000	0.00	0.00	29
Flood / Tsunami	0.0	0	0.000	0.00	0.00	30
TOTALS	147482.9	126005	1.535	107.82	70.23	

NUMBER OF CUSTOMERS FOR THE PERIOD = 82074

% ASA = 99.979

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

2013 GENERATION SERVICE RELIABILITY SUMMARY Normalized

<u>Cause of Outage</u>	<u>CUST-HR</u>	<u>CUST-INT</u>	<u>SAIF</u>	<u>SAID</u>	<u>CAID</u>	<u>SAID RANK</u>
Faulty Equipment Operation	5434.1	67501	0.822	3.97	4.83	1
Customer Equip	3020.3	42617	0.519	2.21	4.25	2
Operation or Switching Error	400.6	5046	0.061	0.29	4.76	3
Man or Animal	0.0	0	0.000	0.00	0.00	17
Tsf Overload	0.0	0	0.000	0.00	0.00	4
Unknown	0.0	0	0.000	0.00	0.00	5
Forced Maintenance	0.0	0	0.000	0.00	0.00	6
Equip Failure	0.0	0	0.000	0.00	0.00	7
Balloon/Kite	0.0	0	0.000	0.00	0.00	8
Other Personnel Error	0.0	0	0.000	0.00	0.00	9
Customer Maintenance	0.0	0	0.000	0.00	0.00	10
Sys Add/Removal	0.0	0	0.000	0.00	0.00	11
Scheduled Maintenance	0.0	0	0.000	0.00	0.00	12
Balance Load	0.0	0	0.000	0.00	0.00	13
Transfer Load	0.0	0	0.000	0.00	0.00	14
Deterioration	0.0	0	0.000	0.00	0.00	23
Auto Accident	0.0	0	0.000	0.00	0.00	30
Tsf Failure	0.0	0	0.000	0.00	0.00	29
Cable Fault	0.0	0	0.000	0.00	0.00	28
Flashover	0.0	0	0.000	0.00	0.00	27
Loose Connection	0.0	0	0.000	0.00	0.00	26
Flood / Tsunami	0.0	0	0.000	0.00	0.00	15
Equip Overload	0.0	0	0.000	0.00	0.00	24
Lightning	0.0	0	0.000	0.00	0.00	16
Vandalism	0.0	0	0.000	0.00	0.00	22
Excavate Construction	0.0	0	0.000	0.00	0.00	21
Equip Contact	0.0	0	0.000	0.00	0.00	20
Fire	0.0	0	0.000	0.00	0.00	19
Foreign Objects	0.0	0	0.000	0.00	0.00	18
Tree or Branches	0.0	0	0.000	0.00	0.00	31
High Wind	0.0	0	0.000	0.00	0.00	25
TOTALS	8854.9	115164	1.403	6.47	4.61	

NUMBER OF CUSTOMERS FOR THE PERIOD = 82074

% ASA = 99.998

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

2013
HAWAI'I ELECTRIC LIGHT GENERATION SERVICE RELIABILITY SUMMARY
Normalized

<u>Cause of Outage</u>	<u>CUST-HR</u>	<u>CUST-INT</u>	<u>SAIF</u>	<u>SAID</u>	<u>CAID</u>	<u>SAID RANK</u>
Faulty Equipment Operation	5434.1	67501	0.822	3.97	4.83	1
Operation or Switching Error	400.6	5046	0.061	0.29	4.76	2
Man or Animal	0.0	0	0.000	0.00	0.00	17
Tsf Overload	0.0	0	0.000	0.00	0.00	3
Unknown	0.0	0	0.000	0.00	0.00	4
Forced Maintenance	0.0	0	0.000	0.00	0.00	5
Equip Failure	0.0	0	0.000	0.00	0.00	6
Balloon/Kite	0.0	0	0.000	0.00	0.00	7
Other Personnel Error	0.0	0	0.000	0.00	0.00	8
Customer Maintenance	0.0	0	0.000	0.00	0.00	9
Sys Add/Removal	0.0	0	0.000	0.00	0.00	10
Scheduled Maintenance	0.0	0	0.000	0.00	0.00	11
Balance Load	0.0	0	0.000	0.00	0.00	12
Transfer Load	0.0	0	0.000	0.00	0.00	13
Flood / Tsunami	0.0	0	0.000	0.00	0.00	14
Deterioration	0.0	0	0.000	0.00	0.00	23
Auto Accident	0.0	0	0.000	0.00	0.00	30
Tsf Failure	0.0	0	0.000	0.00	0.00	29
Cable Fault	0.0	0	0.000	0.00	0.00	28
Flashover	0.0	0	0.000	0.00	0.00	27
Loose Connection	0.0	0	0.000	0.00	0.00	26
Customer Equip	0.0	0	0.000	0.00	0.00	15
Equip Overload	0.0	0	0.000	0.00	0.00	24
Lightning	0.0	0	0.000	0.00	0.00	16
Vandalism	0.0	0	0.000	0.00	0.00	22
Excavate Construction	0.0	0	0.000	0.00	0.00	21
Equip Contact	0.0	0	0.000	0.00	0.00	20
Fire	0.0	0	0.000	0.00	0.00	19
Foreign Objects	0.0	0	0.000	0.00	0.00	18
Tree or Branches	0.0	0	0.000	0.00	0.00	31
High Wind	0.0	0	0.000	0.00	0.00	25
TOTALS	5834.7	72547	0.884	4.27	4.83	

NUMBER OF CUSTOMERS FOR THE PERIOD = 82074

% ASA = 99.999

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

2013
Non-HAWAI'I ELECTRIC LIGHT GENERATION SERVICE RELIABILITY SUMMARY
Normalized

<u>Cause of Outage</u>	<u>CUST-HR</u>	<u>CUST-INT</u>	<u>SAIF</u>	<u>SAID</u>	<u>CAID</u>	<u>SAID RANK</u>
Customer Equip	3020.3	42617	0.519	2.21	4.25	1
Man or Animal	0.0	0	0.000	0.00	0.00	17
Tsf Overload	0.0	0	0.000	0.00	0.00	2
Balloon/Kite	0.0	0	0.000	0.00	0.00	3
Other Personnel Error	0.0	0	0.000	0.00	0.00	4
Unknown	0.0	0	0.000	0.00	0.00	5
Customer Maintenance	0.0	0	0.000	0.00	0.00	6
Sys Add/Removal	0.0	0	0.000	0.00	0.00	7
Forced Maintenance	0.0	0	0.000	0.00	0.00	8
Scheduled Maintenance	0.0	0	0.000	0.00	0.00	9
Balance Load	0.0	0	0.000	0.00	0.00	10
Transfer Load	0.0	0	0.000	0.00	0.00	11
Flood / Tsunami	0.0	0	0.000	0.00	0.00	12
Operation or Switching Error	0.0	0	0.000	0.00	0.00	13
Faulty Equipment Operation	0.0	0	0.000	0.00	0.00	14
Deterioration	0.0	0	0.000	0.00	0.00	23
Auto Accident	0.0	0	0.000	0.00	0.00	30
Tsf Failure	0.0	0	0.000	0.00	0.00	29
Cable Fault	0.0	0	0.000	0.00	0.00	28
Flashover	0.0	0	0.000	0.00	0.00	27
Loose Connection	0.0	0	0.000	0.00	0.00	26
Vandalism	0.0	0	0.000	0.00	0.00	15
Equip Overload	0.0	0	0.000	0.00	0.00	24
Lightning	0.0	0	0.000	0.00	0.00	16
Equip Failure	0.0	0	0.000	0.00	0.00	22
Excavate Construction	0.0	0	0.000	0.00	0.00	21
Equip Contact	0.0	0	0.000	0.00	0.00	20
Fire	0.0	0	0.000	0.00	0.00	19
Foreign Objects	0.0	0	0.000	0.00	0.00	18
Tree or Branches	0.0	0	0.000	0.00	0.00	31
High Wind	0.0	0	0.000	0.00	0.00	25
TOTALS	3020.3	42617	0.519	2.21	4.25	

NUMBER OF CUSTOMERS FOR THE PERIOD = 82074

% ASA = 99.999

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

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 the system configuration.

INTERRUPTION

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

INTERRUPTION DURATION

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

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 HAWAII ELECTRIC LIGHT Utilities" indicated that momentary interruptions will have duration of 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 within this report. In conformance with the guidelines established in the report, "Methodology for Determining Reliability Indices for HAWAII ELECTRIC LIGHT Utilities," dated December 1990, a sustained interruption has duration of one minute or longer.

CUSTOMER INTERRUPTION

One interruption of one customer.

NOTE: Interruptions to customers at their request (e.g., Customer Maintenance) are not considered.

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:

RELIABILITY INDICES

AVERAGE SERVICE AVAILABILITY INDEX (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.

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

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.

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

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.

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

MAUI ELECTRIC COMPANY, LIMITED
ANNUAL SERVICE RELIABILITY REPORT
2013

Prepared by
Transmission and Distribution Department

July 3, 2014

INTRODUCTION

This is the 2013 annual service reliability report for Maui Electric Company, Limited (MECO). The year-end average number of electric customers increased from 68,575 in 2012 to 69,303 in 2013 (a 1.06% increase). The 2013 peak demand for the system was 194.5 MW (evening peak), 4.6 MW lower than the peak demand in 2012; the highest system peak demand remains at 210.9 MW set on the evening of October 11, 2004.

The system interruption summaries (Attachments A and B) for the past year and the system reliability indices for the five prior years are presented to depict the quality of service provided to the electrical energy consumer.

Attachment C, contains the definition of terms and the reliability indices explanations and equations.

Indices measure reliability in terms of the overall availability of electrical service (ASAI), the frequency or number of times MECO's customers experience an outage during the year (SAIFI), the average length of time an interrupted customer is out of power (CAIDI), and the average length of time MECO's customers are out of power during the year (SAIDI). 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 69,303 customers).

ANALYSIS

This analysis of the annual system reliability for MECO is for the year 2013. To determine the relative level of reliability, the statistics for five prior years, 2008 through 2012, are used for comparison.

The reliability indices are calculated using the data from all sustained¹ system outages except customer maintenance outages. If data normalization is required, it is done using 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. The guidelines indicate that normalization is allowed for "abnormal" situations such as hurricanes, tsunamis, earthquakes, floods, catastrophic equipment failures, and single outages that cascade into a loss of load 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.

¹An electrical service interruption of more than one minute. (The majority of peer companies in the Edison Electric Institute association use a threshold of five minutes to identify sustained interruptions.)

2013 RESULTS**Annual Service Reliability Indices**

The annual service reliability for 2013 was ranked fourth for the best SAIDI and ASA in the past 6 years in terms of the indices for all events. The reliability results for all events in 2013 and five prior years are shown below in Table 1 through Table 4. The normalized reliability results for all events in 2013 and five prior years are shown below in Table 5 through Table 8. The reliability results comparing T&D and generation related outages with all events in 2013 and five prior years are shown below in Table 8 through Table 16. The normalized reliability results comparing T&D and generation related outages in 2013 and five prior years are shown below in Table 16 through Table 24.

Table 1: Annual Service Reliability Indices – All Islands with All Events

	2008	2009	2010	2011	2012	2013
Number of Customers	66,810	67,126	67,405	68,010	68,575	69,303
Customer Interruptions	163,120	124,864	131,294	170,379	195,618	138,480
Customer-Hours Interrupted	224,208.8	195,853.4	103,416.1	210,185.7	248,500.5	221,000.3
SAIDI (Minutes)	201.35	175.06	92.05	185.43	217.43	191.33
CAIDI (Minutes)	82.47	94.11	47.26	74.02	76.22	95.75
SAIFI (Occurrence)	2.442	1.860	1.948	2.505	2.853	1.998
ASA (Percent)	99.9617%	99.9667%	99.9824%	99.9646%	99.9586%	99.9635%

Table 2: Annual Service Reliability Indices – Maui with All Events

	2008	2009	2010	2011	2012	2013
Number of Customers	61,981	62,328	62,640	63,225	63,745	64,397
Customer Interruptions	146,230	118,205	110,350	156,145	181,244	100,316
Customer-Hours Interrupted	197,033.8	189,744.8	70,072.9	194,603.0	199,620.7	171,316.7
SAIDI (Minutes)	190.74	182.66	67.12	184.68	187.89	159.62
CAIDI (Minutes)	80.85	96.31	38.10	74.78	66.08	102.47
SAIFI (Occurrence)	2.359	1.896	1.762	2.470	2.843	1.558
ASA (Percent)	99.9637%	99.9652%	99.9872%	99.9648%	99.9643%	99.9695%

Table 3: Annual Service Reliability Indices – Molokai with All Events

	2008	2009	2010	2011	2012	2013
Number of Customers	3,149	3,151	3,145	3,161	3,187	3,205
Customer Interruptions	11,902	4,452	18,473	8,018	12,171	33,224
Customer-Hours Interrupted	24,045.4	4,989.6	31,258.9	7,022.2	47,466.7	44,162.1
SAIDI (Minutes)	458.15	95.01	596.35	133.29	893.63	826.75
CAIDI (Minutes)	121.22	67.25	101.53	52.55	234.00	79.75
SAIFI (Occurrence)	3.780	1.413	5.874	2.537	3.819	10.366
ASA (Percent)	99.9128%	99.9819%	99.8862%	99.9746%	99.8300%	99.8423%

Table 4: Annual Service Reliability Indices – Lanai with All Events

	2008	2009	2010	2011	2012	2013
Number of Customers	1,680	1,648	1,621	1,624	1,643	1,702
Customer Interruptions	4,988	2,207	2,471	6,216	2,203	4,940
Customer-Hours Interrupted	3,129.7	1,119.1	2,084.3	8,560.4	1,413.1	5,521.5
SAIDI (Minutes)	111.77	40.74	77.15	316.27	51.60	194.65
CAIDI (Minutes)	37.65	30.42	50.61	82.63	38.49	67.06
SAIFI (Occurrence)	2.969	1.339	1.524	3.828	1.341	2.902
ASA (Percent)	99.9787%	99.9922%	99.9853%	99.9397%	99.9902%	99.9629%

Table 5: Annual Service Reliability Indices - All Islands with Normalization

	2008*	2009*	2010*	2011*	2012*	2013*
Number of Customers	66,810	67,126	67,405	68,010	68,575	69,303
Customer Interruptions	75,764	108,368	67,481	101,268	81,428	71,894
Customer-Hours Interrupted	114,000.7	173,602.0	60,006.6	145,710.8	125,836.1	108,360.7
SAIDI (Minutes)	102.39	155.18	53.41	128.55	110.10	93.81
CAIDI (Minutes)	90.29	96.12	53.35	86.33	92.72	90.43
SAIFI (Occurrence)	1.134	1.615	1.001	1.489	1.187	1.037
ASA (Percent)	99.9805%	99.9705%	99.9898%	99.9755%	99.9791%	99.9821%

Table 6: Annual Service Reliability Indices - Maui with Normalization

	2008*	2009*	2010*	2011*	2012*	2013*
Number of Customers	61,981	62,328	62,640	63,225	63,745	64,397
Customer Interruptions	73,414	106,498	65,654	99,729	77,968	64,459
Customer-Hours Interrupted	109,806.9	169,242.7	55,954.1	144,404.5	119,045.4	101,098.4
SAIDI (Minutes)	106.30	162.92	53.60	137.04	112.05	94.20
CAIDI (Minutes)	89.74	95.35	51.14	86.88	91.61	94.10
SAIFI (Occurrence)	1.184	1.709	1.048	1.577	1.223	1.001
ASA (Percent)	99.9798%	99.9689%	99.9898%	99.9739%	99.9787%	99.9820%

Table 7: Annual Service Reliability Indices - Molokai with Normalization

	2008*	2009*	2010*	2011*	2012*	2013*
Number of Customers	3,149	3,151	3,145	3,161	3,187	3,205
Customer Interruptions	1,393	1,284	1,498	1,252	3,229	6,180
Customer-Hours Interrupted	3,746.5	3,748.6	3,800.1	1,218.5	6,338.9	5,942.2
SAIDI (Minutes)	71.38	71.38	72.50	23.13	119.34	111.24
CAIDI (Minutes)	161.37	175.17	152.21	58.39	117.79	57.69
SAIFI (Occurrence)	0.442	0.407	0.476	0.396	1.013	1.928
ASA (Percent)	99.9864%	99.9864%	99.9862%	99.9956%	99.9773%	99.9788%

Table 8: Annual Service Reliability Indices - Lanai with Normalization

	2008*	2009*	2010*	2011*	2012*	2013*
Number of Customers	1,680	1,648	1,621	1,624	1,643	1,702
Customer Interruptions	957	586	329	287	231	1,255
Customer-Hours Interrupted	447.4	610.8	252.4	87.8	451.7	1,320.1
SAIDI (Minutes)	15.98	22.24	9.34	3.24	16.50	46.54
CAIDI (Minutes)	28.05	62.54	46.04	18.36	117.33	63.11
SAIFI (Occurrence)	0.570	0.356	0.203	0.177	0.141	0.737
ASA (Percent)	99.9970%	99.9958%	99.9982%	99.9994%	99.9969%	99.9911%

NOTE:

2008*	Data normalized to exclude the 03/15/08 Flashover Data normalized to exclude the 04/02/08 Equipment Failure Data normalized to exclude the 08/05/08 Equipment Failure Data normalized to exclude the 08/07/08 Deterioration, Corrosion Data normalized to exclude the 12/17/08 Equipment Failure Data normalized to exclude various equipment failures and faults on Lanai and Molokai
2009*	Data normalized to exclude the 01/16/09 High Winds Data normalized to exclude the 06/19/09 High Winds Data normalized to exclude various equipment failures and faults on Lanai and Molokai
2010*	Data normalized to exclude the 03/28/10 – 04/01/2010 High Winds Data normalized to exclude the 06/07/10 Flashover Data normalized to exclude the 12/09/10 – 12/10/10 Kona Storm Data normalized to exclude various equipment failures and faults on Lanai and Molokai
2011*	Data normalized to exclude the 01/10/11 High Winds Data normalized to exclude the 01/12/11 – 01/14/11 High Winds and Lightning Storm Data normalized to exclude the 12/24/11 High Winds Data normalized to exclude various equipment failures and faults on Lanai and Molokai
2012*	Data normalized to exclude the 02/07/12 – 02/08/12 High Winds Data normalized to exclude the 09/05/12 Operator Error Data normalized to exclude the 11/06/12 Flashover Data normalized to exclude the 12/04/12 Substation Fire Data normalized to exclude various equipment failures and faults on Lanai and Molokai
2013*	Data normalized to exclude the 01/02/13 Trees in Transmission Lines Data normalized to exclude the 07/29/13 – 07/30/13 Tropical Storm Flossie Data normalized to exclude various equipment failures and faults on Lanai and Molokai

T&D vs. Generation – All Events

Table 9: Annual Service Reliability Indices for All Islands – T&D

	2008	2009	2010	2011	2012	2013
Number of Customers	66,810	67,126	67,405	68,010	68,575	69,303
Customer Interruptions	83,683	109,218	89,347	129,554	120,420	88,944
Customer-Hours Interrupted	118,731.8	184,174.3	82,311.0	188,364.0	182,315.6	186,857.1
SAIDI (Minutes)	106.63	164.62	73.27	166.18	159.52	161.77
CAIDI (Minutes)	85.13	101.18	55.28	87.24	90.84	126.05
SAIFI (Occurrence)	1.253	1.627	1.326	1.905	1.756	1.283
ASA (Percent)	99.9797%	99.9686%	99.9860%	99.9683%	99.9697%	99.9691%

Table 10: Annual Service Reliability Indices for All Islands - Generation

	2008	2009	2010	2011	2012	2013
Number of Customers	66,810	67,126	67,405	68,010	68,575	69,303
Customer Interruptions	79,437	15,646	41,947	40,825	75,198	49,536
Customer-Hours Interrupted	105,477.0	11,679.1	21,105.1	21,821.7	66,185.0	34,143.2
SAIDI (Minutes)	94.73	10.44	18.79	19.25	57.91	29.56
CAIDI (Minutes)	79.67	44.79	30.19	32.07	52.81	41.36
SAIFI (Occurrence)	1.189	0.233	0.622	0.600	1.097	0.715
ASA (Percent)	99.9820%	99.9980%	99.9964%	99.9963%	99.9890%	99.9944%

Table 11: Annual Service Reliability Indices for Maui – T&D

	2008	2009	2010	2011	2012	2013
Number of Customers	61,981	62,328	62,640	63,225	63,745	64,397
Customer Interruptions	79,431	106,913	80,270	121,962	109,200	73,357
Customer-Hours Interrupted	111,233.9	179,116.6	62,462.0	179,049.6	134,348.7	159,261.0
SAIDI (Minutes)	107.68	172.43	59.83	169.92	126.46	148.39
CAIDI (Minutes)	84.02	100.52	46.69	88.08	73.82	130.26
SAIFI (Occurrence)	1.282	1.715	1.281	1.929	1.713	1.139
ASA (Percent)	99.9795%	99.9671%	99.9886%	99.9676%	99.9759%	99.9717%

Table 12: Annual Service Reliability Indices for Maui - Generation

	2008	2009	2010	2011	2012	2013
Number of Customers	61,981	62,328	62,640	63,225	63,745	64,397
Customer Interruptions	66,799	11,292	30,080	34,183	72,044	26,959
Customer-Hours Interrupted	85,799.9	10,628.2	7,610.9	15,553.4	65,272.0	12,055.7
SAIDI (Minutes)	83.06	10.23	7.29	14.76	61.44	11.23
CAIDI (Minutes)	77.07	56.47	15.18	27.30	54.36	26.83
SAIFI (Occurrence)	1.078	0.181	0.48	0.541	1.130	0.419
ASA (Percent)	99.9842%	99.9980%	99.9986%	99.9972%	99.9883%	99.9979%

Table 13: Annual Service Reliability Indices for Molokai – T&D

	2008	2009	2010	2011	2012	2013
Number of Customers	3,149	3,151	3,145	3,161	3,187	3,205
Customer Interruptions	3,892	1,668	7,914	3,261	10,338	12,730
Customer-Hours Interrupted	7,272.6	4,433.4	19,294.9	2,753.4	47,081.8	23,428.8
SAIDI (Minutes)	138.57	84.42	368.11	52.26	886.38	438.60
CAIDI (Minutes)	112.12	159.47	146.28	50.66	273.25	110.43
SAIFI (Occurrence)	1.236	0.529	2.516	1.032	3.244	3.972
ASA (Percent)	99.9736%	99.9839%	99.9298%	99.9900%	99.8314%	99.9163%

Table 14: Annual Service Reliability Indices for Molokai - Generation

	2008	2009	2010	2011	2012	2013
Number of Customers	3,149	3,151	3,145	3,161	3,187	3,205
Customer Interruptions	80,10	2,784	10,559	4,757	1,833	20,494
Customer-Hours Interrupted	16,772.7	556.2	11,964.0	4,268.9	385.0	20,733.4
SAIDI (Minutes)	319.58	10.59	228.25	81.03	7.25	388.14
CAIDI (Minutes)	125.64	11.99	67.98	53.84	12.60	60.70
SAIFI (Occurrence)	2.544	0.884	3.357	1.505	0.575	6.394
ASA (Percent)	99.9392%	99.9980%	99.9565%	99.9845%	99.9986%	99.9259%

Table 15: Annual Service Reliability Indices for Lanai – T&D

	2008	2009	2010	2011	2012	2013
Number of Customers	1,680	1,648	1,621	1,624	1,643	1,702
Customer Interruptions	360	637	1,163	4,331	882	2,857
Customer-Hours Interrupted	225.3	624.4	554.1	6,561.0	885.1	4,167.4
SAIDI (Minutes)	8.05	22.73	20.51	242.40	32.32	146.91
CAIDI (Minutes)	37.55	58.81	28.59	90.89	60.21	87.52
SAIFI (Occurrence)	0.214	0.387	0.717	2.667	0.537	1.679
ASA (Percent)	99.9985%	99.9957%	99.9961%	99.9538%	99.9939%	99.9720%

Table 16: Annual Service Reliability Indices for Lanai - Generation

	2008	2009	2010	2011	2012	2013
Number of Customers	1,680	1,648	1,621	1,624	1,643	1,702
Customer Interruptions	4,628	1,570	1,308	1,885	1,321	2,083
Customer-Hours Interrupted	2,904.4	494.7	1,530.1	1,999.5	528.0	1,354.1
SAIDI (Minutes)	103.73	18.01	56.64	73.87	19.28	47.74
CAIDI (Minutes)	37.65	18.91	70.19	63.64	23.98	39.00
SAIFI (Occurrence)	2.755	0.953	0.807	1.161	0.804	1.224
ASA (Percent)	99.9803%	99.9966%	99.9892%	99.9859%	99.9963%	99.9909%

T&D vs. Generation – With Normalization

Table 17: Normalized Annual Service Reliability Indices for All Islands – T&D

	2008*	2009*	2010*	2011*	2012*	2013*
Number of Customers	66,810	67,126	67,405	68,010	68,575	69,303
Customer Interruptions	69,556	96,773	44,699	92,997	53,218	59,404
Customer-Hours Interrupted	111,656.4	162,889.6	53,754.4	139,223.9	111,142.1	101,339.0
SAIDI (Minutes)	100.28	145.60	47.85	122.83	97.24	87.74
CAIDI (Minutes)	96.32	100.99	72.16	89.82	125.31	102.36
SAIFI (Occurrence)	1.041	1.442	0.663	1.367	0.776	0.857
ASA (Percent)	99.9809%	99.9722%	99.9909%	99.9766%	99.9815%	99.9833%

Table 18: Normalized Annual Service Reliability Indices for All Islands – Generation

	2008*	2009*	2010*	2011*	2012*	2013*
Number of Customers	66,810	67,126	67,405	68,010	68,575	69,303
Customer Interruptions	6,208	11,595	22,782	8,271	28,210	12,490
Customer-Hours Interrupted	2,344.3	10,712.4	6,252.2	6,486.9	14,694.0	7,021.7
SAIDI (Minutes)	2.11	9.58	5.57	5.72	12.86	6.08
CAIDI (Minutes)	22.66	55.43	16.47	47.06	31.25	33.73
SAIFI (Occurrence)	0.093	0.173	0.338	0.012	0.411	0.180
ASA (Percent)	99.9996%	99.9982%	99.9989%	99.9989%	99.9976%	99.9988%

Table 19: Normalized Annual Service Reliability Indices for Maui – T&D

	2008*	2009*	2010*	2011*	2012*	2013*
Number of Customers	61,981	62,328	62,640	63,225	63,745	64,397
Customer Interruptions	68,001	95,206	42,938	91,828	50,306	54,680
Customer-Hours Interrupted	107,798.7	158,614.5	49,743.3	137,980.4	104,638.8	96,167.0
SAIDI (Minutes)	104.35	152.69	47.65	130.94	98.49	89.60
CAIDI (Minutes)	95.12	99.96	69.51	90.16	124.80	105.52
SAIFI (Occurrence)	1.097	1.527	0.685	1.452	0.789	0.849
ASA (Percent)	99.9801%	99.9709%	99.9909%	99.98%	99.9813%	99.9829%

Table 20: Normalized Annual Service Reliability Indices for Maui – Generation

	2008*	2009*	2010*	2011*	2012*	2013*
Number of Customers	61,981	62,328	62,640	63,225	63,745	64,397
Customer Interruptions	5,413.0	11,292.0	22,716.0	7,901.0	27,662.0	9,779
Customer-Hours Interrupted	2,008.2	10,628.2	6,210.7	6,424.1	14,406.7	4,931.4
SAIDI (Minutes)	1.94	10.23	5.95	6.10	13.56	4.59
CAIDI (Minutes)	22.26	56.47	16.40	48.78	31.25	30.26
SAIFI (Occurrence)	0.087	0.181	0.363	0.125	0.434	0.152
ASA (Percent)	99.9996%	99.9980%	99.9989%	99.9988%	99.9974%	99.9991%

Table 21: Normalized Annual Service Reliability Indices for Molokai – T&D

	2008*	2009*	2010*	2011*	2012*	2013*
Number of Customers	3,149	3,151	3,145	3,161	3,187	3,205
Customer Interruptions	1,393	1,284	1,498	1,102	2,752	3,487
Customer-Hours Interrupted	3,746.5	3,748.6	3,800.1	1,163.5	6,067.0	3,856.5
SAIDI (Minutes)	71.38	71.38	72.50	22.08	114.22	72.20
CAIDI (Minutes)	161.37	175.17	152.21	63.35	132.27	66.36
SAIFI (Occurrence)	0.442	0.407	0.476	0.349	0.864	1.088
ASA (Percent)	99.9864%	99.9864%	99.9862%	99.9958%	99.9783%	99.9862%

Table 22: Normalized Annual Service Reliability Indices for Molokai – Generation

	2008*	2009*	2010*	2011*	2012*	2013*
Number of Customers	3,149	3,151	3,145	3,161	3,187	3,205
Customer Interruptions	0.0	0.0	0.0	150.0	477.0	2,693
Customer-Hours Interrupted	0.0	0.0	0.0	55.0	272.0	2,085.7
SAIDI (Minutes)	0.00	0.00	0.00	1.04	5.12	39.05
CAIDI (Minutes)	0.00	0.00	0.00	22.00	34.21	46.47
SAIFI (Occurrence)	0.000	0.000	0	0.047	0.150	0.840
ASA (Percent)	100.0000%	100.0000%	100.0000%	99.9998%	99.9990%	99.9926%

Table 23: Normalized Annual Service Reliability Indices for Lanai – T&D

	2008*	2009*	2010*	2011*	2012*	2013*
Number of Customers	1,680	1,648	1,621	1,624	1,643	1,702
Customer Interruptions	162	283	263	67	160	1,237
Customer-Hours Interrupted	111.2	526.5	211.0	80.0	436.3	1,315.6
SAIDI (Minutes)	3.97	19.17	7.81	2.96	15.93	46.38
CAIDI (Minutes)	41.19	111.62	48.13	71.66	163.61	63.81
SAIFI (Occurrence)	0.096	0.172	0.162	0.041	0.097	0.727
ASA (Percent)	99.9992%	99.9963%	99.9985%	99.9994%	99.9970%	99.9912%

Table 24: Normalized Annual Service Reliability Indices for Lanai – Generation

	2008*	2009*	2010*	2011*	2012*	2013*
Number of Customers	1,680	1,648	1,621	1,624	1,643	1,702
Customer Interruptions	795	303	66	220	71	18
Customer-Hours Interrupted	336.2	84.3	41.5	7.8	15.4	4.5
SAIDI (Minutes)	12.01	3.07	1.53	0.29	0.56	0.16
CAIDI (Minutes)	25.37	16.69	37.70	2.13	13.03	15.00
SAIFI (Occurrence)	0.473	0.184	0.041	0.135	0.043	0.011
ASA (Percent)	99.9977%	99.9994%	99.9997%	99.9999%	99.9999%	100.0000%

Figure 1: System Average Interruption Duration Index (SAIDI)

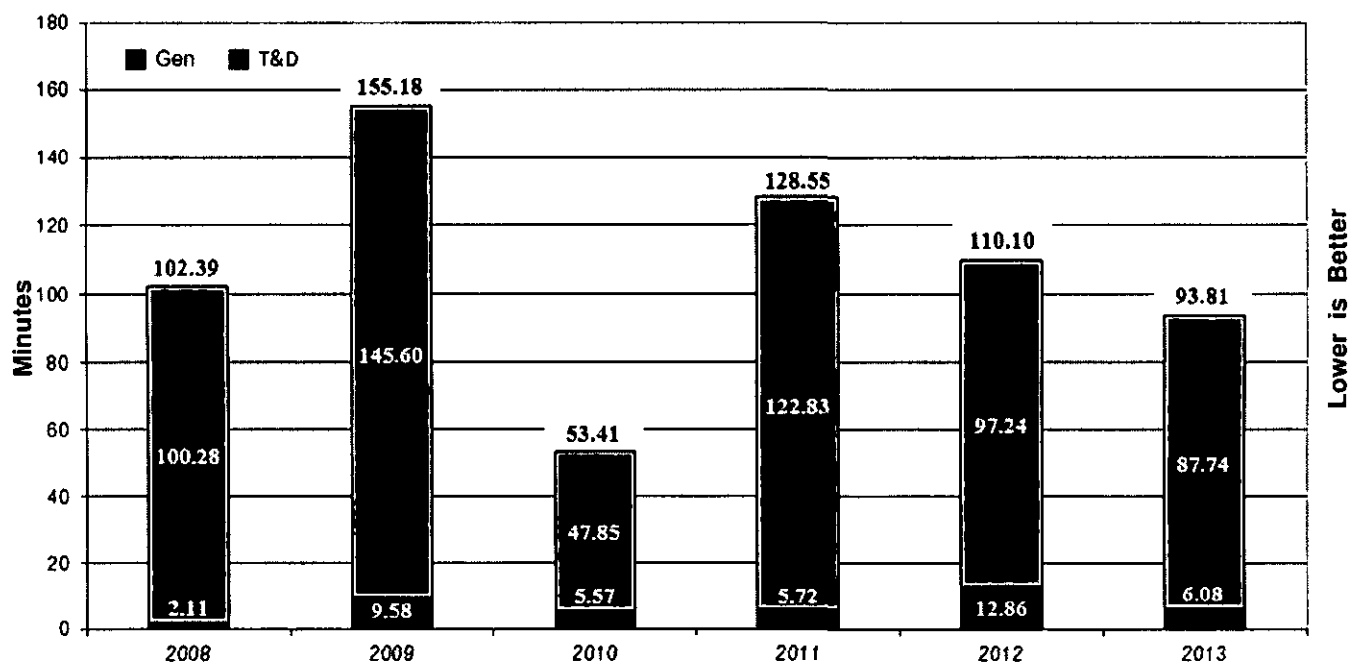


Figure 1 shows the System Average Interruption Duration Indices (SAIDI) for 2013 and the past five years. It shows that the 2013 SAIDI is 93.81 minutes, a 14.80% decrease compared to the 2012 SAIDI result of 110.10 minutes. The SAIDI is the composite of both the SAIFI and CAIDI indices and produces a broader benchmark of system reliability by combining both the duration and the number of customer interruptions during a given period of time. The lower SAIDI result was due to a decrease in the SAIFI and CAIDI statistics.

Figure 2: Customer Average Interruption Duration Index (CAIDI)

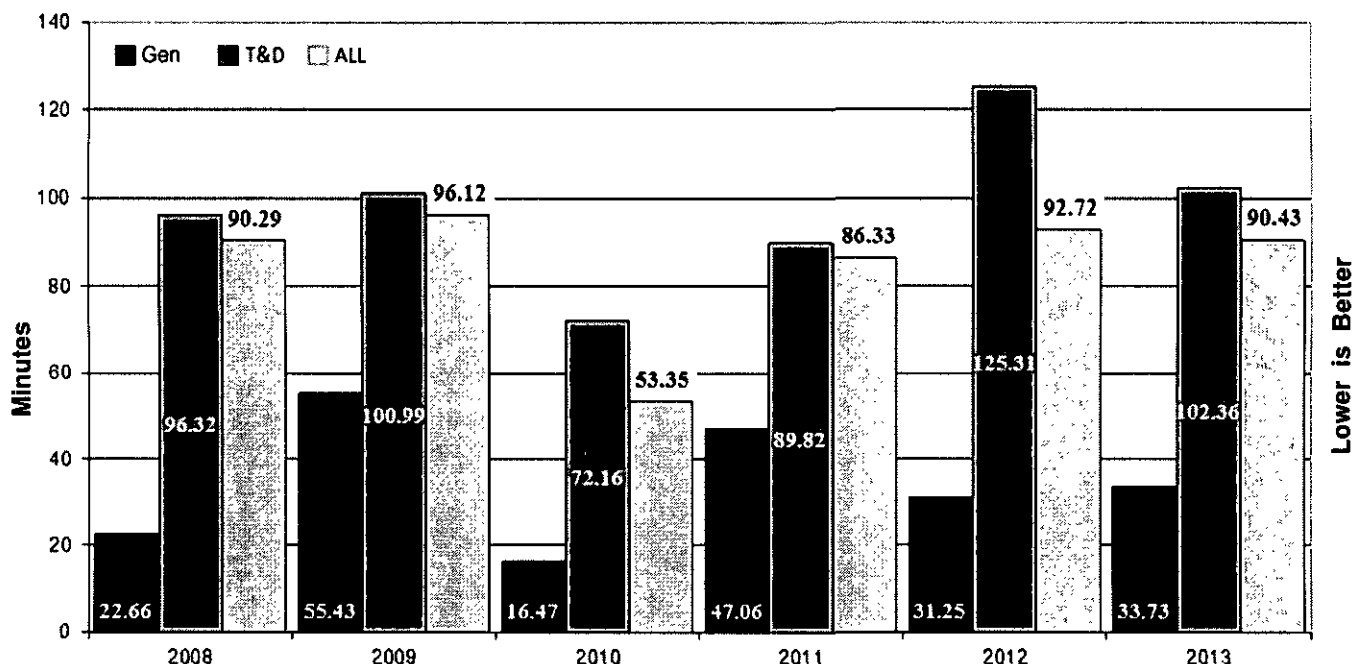


Figure 2 shows the Customer Average Interruption Duration Indices (CAIDI) for 2013 and the past five years. It shows that the average duration of a customer's outage (CAIDI) for 2013 is 90.43 minutes, a 2.47% decrease compared to the 2012 CAIDI result of 92.72 minutes.

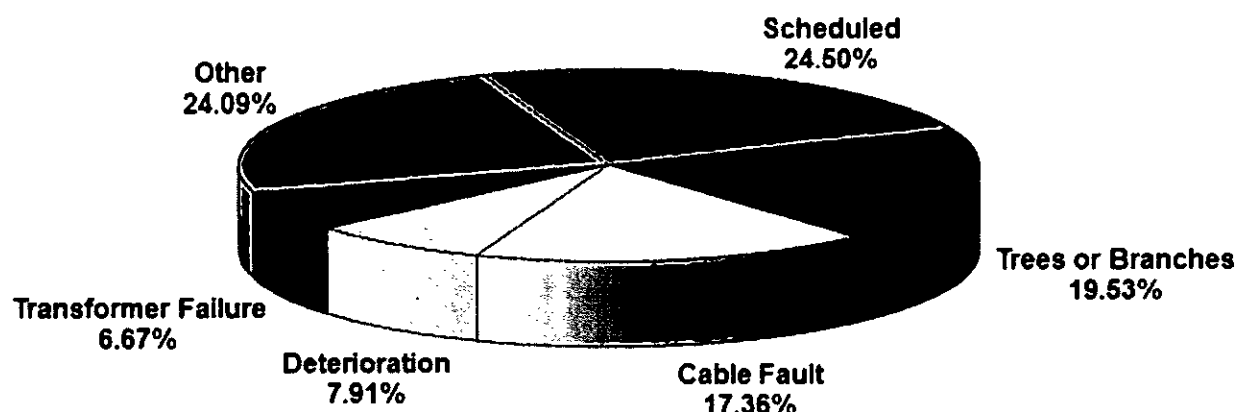
The contributing factors to the decrease of the CAIDI index from 2012 were shorter outage durations related to deterioration or corrosion, scheduled maintenance and equipment failure. Outage durations due to deterioration or corrosion decreased in 2013, which incurred 1,999.9 customer interruption hours, as compared to 23,657.0 customer interruption hours in 2012. Outages due to deterioration or corrosion accounted for 1.8% of all customer interruption hours in 2013. Outages durations due to scheduled maintenance decreased in 2013, which incurred 3,181.4 customer interruption hours, as compared to 14,004.1 customer interruption hours in 2012. Outages due to scheduled maintenance accounted for 2.9% of all customer interruption hours in 2013. Outages durations due to equipment failure also decreased in 2013, which incurred 1,269.0 customer interruption hours, as compared to 7,945.8 customer interruption hours in 2012. Outages due to high winds accounted for 1.2% of all customer interruption hours in 2013.

The three major events affecting the 2013 CAIDI results were:

1. January 05, 2013 – During a period of high winds, a fallen tree took down distribution lines affecting 558 customers from 21 hours 54 minutes to 24 hours 39 minutes.
2. March 01, 2013 – During a period of high winds, a tree branch took down distribution lines affecting 1,252 customers from 28 minutes to 3 hours 43 minutes.
3. October 12, 2013 – A vehicle pole accident affecting 1,906 customers from 2 hours 6 minutes to 8 hours 33 minutes.

These three events increased the 2013 CAIDI by over 15 minutes.

Figure 3: Outage Categories



The Top 5 Outage Categories, by number of Customer Interruptions, as illustrated in Figure 3, equates to about 76% of the total Customer Interruptions in 2013; these causes are:

<u>Outage Category</u>	<u>Sample Causes</u>
1. Scheduled Maintenance	Replacement of equipment still in service
2. Trees or Branches	Trees falling or contacting overhead lines
3. Cable Faults	Underground equipment failures
4. Deterioration	Failed, broken, corroded equipment
5. Transformer Failure	Transformers failing not related to overloading

The major cause factors for 2012 were similar to the 2013 major causes.

The total number of customer interruptions in 2013 was 71,894 compared with 81,428 customer interruptions in 2012. In the six year period, 2013 was the second best performing year for the number of interruptions. The number of customer interruptions due to equipment failure decreased from 13,768 in 2012 to 2,865 in 2013, a 79.2% decrease. Also, the number of customer interruptions due to deterioration or corrosion decreased from 10,945 in 2012 to 1,770 in 2013, an 83.8% decrease. However, the number of customer interruptions due to unknown failure increased from 398 in 2012 to 12,823 in 2013. Also, the number of customer interruptions due to trees or branches in lines increased from 18,203 in 2012 to 30,160 in 2013.

In 2013, there were four events that resulted in the loss of more than 5,000 customers.

- On January 02, 2013, Maui experienced a major outage due to trees in lines. This event caused outages to 14,826 customers or 21.4% of our customers with outage durations ranging from momentary to 43 minutes.
- On July 29, 2013, Maui experienced a major outage due to lightning strikes. This event caused outages to 7,490 customers or 10.8% of our customers with outage durations ranging from 2 hours 53 minutes to 7 hours 33 minutes.
- On July 29, 2013, Maui experienced a major outage due to lightning strikes. This event caused outages to 5,486 customers or 7.9% of our customers with outage durations of 53 minutes.
- On September 16, 2013, Maui experienced a major outage due to trees in lines. This event caused outages to 6,941 customers or 10% of our customers with outage durations ranging from 7 minutes to 2 hours 6 minutes.

Figure 4: System Average Interruption Frequency Index (SAIFI)

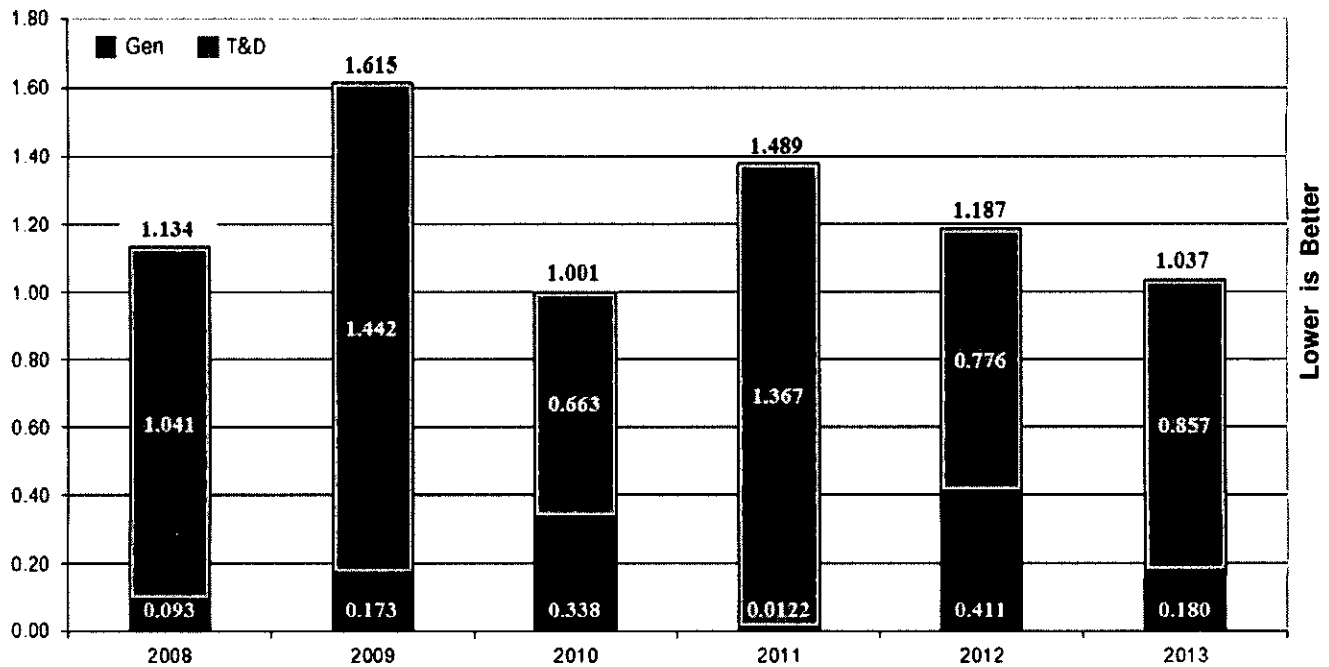


Figure 4 shows the System Average Interruption Frequency Index (SAIFI) for 2013 and the past five years. It shows that the 2013 SAIFI of 1.037 was the second best performance in the past six years, decreasing from 1.187 in 2012.

The contributing factors to the decrease of the SAIFI index from 2012 were fewer outage interruptions related to equipment failure, deterioration or corrosion and interruptions to balance load or system conversions. Outage durations due to equipment failure decreased in 2013, which incurred 2,865 customer interruptions, as compared to 13,768 customer interruptions in 2012. Outages due to equipment failure accounted for 1.2% of all customer interruptions in 2013. Outages durations due to deterioration or corrosion decreased in 2013, which incurred 1,770 customer interruptions, as compared to 10,945 customer interruptions in 2012. Outages due to deterioration or corrosion accounted for 1.8% of all customer interruption hours in 2013. Outages durations due to interruptions to balance load or system conversions also decreased in 2013, which incurred 137 customer interruptions, as compared to 6,356 customer interruptions in 2011. Outages due to interruptions to balance load or system conversions accounted for 0.4% of all customer interruption hours in 2013.

Figure 5: Average Service Availability Index (ASAI)

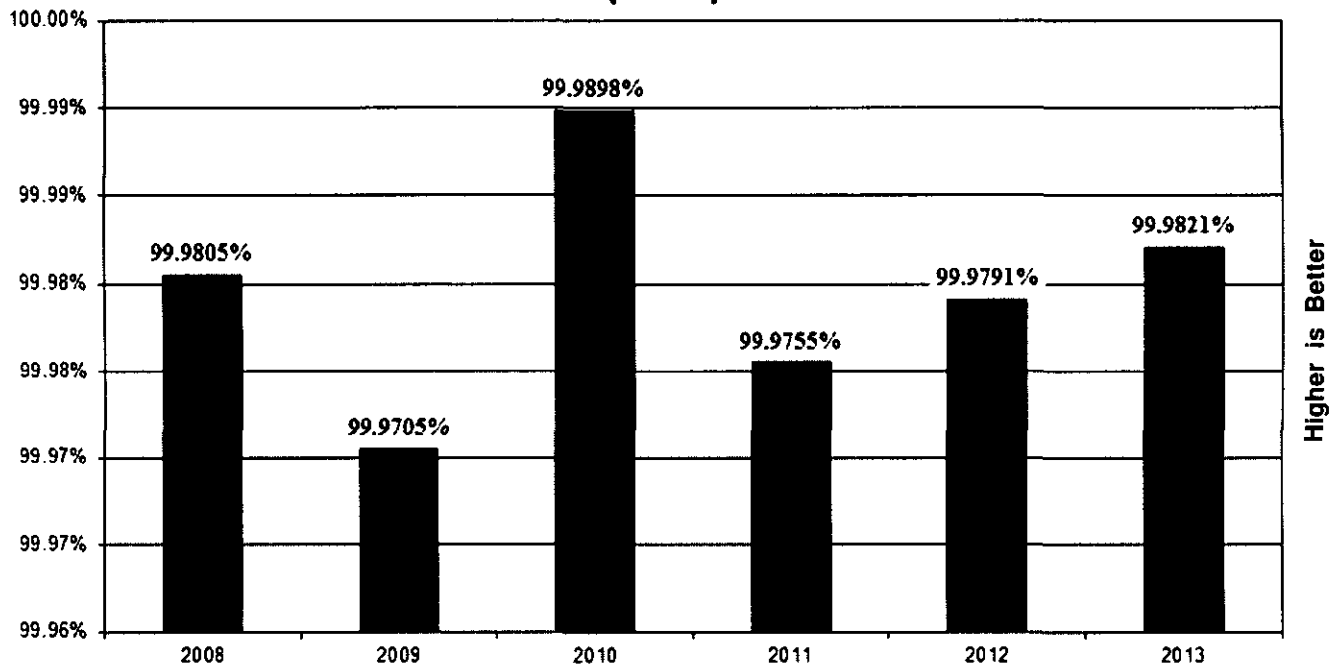


Figure 5 shows that the 2013 Average Service Availability Index increased as compared to the 2012 results after another increase (higher is better) from 2011 to 2012. Approximately 14% fewer customer hours were sustained during 2013 compared to the previous year, thus causing a .003% increase to the ASAI, raising this statistic from 99.9791% to 99.9821%.

The contributing factors to the increase of the ASA index from 2012 was a reduction of customer hour interruptions related to equipment failure, scheduled maintenance and deterioration or corrosion. Outages due to deterioration or corrosion decreased in 2013, which incurred 1,999.9 customer interruption hours, as compared to 23,657 customer interruption hours in 2012. Outages due to deterioration or corrosion accounted for 1.8% of all customer interruption hours in 2013. Outages due to scheduled maintenance decreased in 2013, which incurred 3,181.4 customer interruption hours, as compared to 14,004.1 customer interruption hours in 2012. Outages due to scheduled maintenance accounted for 2.9% of all customer interruption hours in 2013. Outages due to equipment failure also decreased in 2013, which incurred 1,269 customer interruption hours, as compared to 7,945.8 customer interruption hours in 2012. Outages due to equipment failure accounted for 1.2% of all customer interruption hours in 2013.

Attachment-A

Maui Electric Company
Normalized Sustained Interruption Summary – System Total

FROM: JANUARY 1, 2013

TO: DECEMBER 31, 2013

Outage Cause	Customer Hours	Customer Interruptions	SAIFI	SAIDI	CAIDI
TREES OR BRANCHES IN LINES	54101.8	30160.0	0.435	46.84	107.63
UNKNOWN FAILURE	9601.0	12823.0	0.185	8.31	44.92
CABLE FAULT	10335.1	6428.0	0.093	8.95	96.47
AUTOMOBILE ACCIDENT	11239.8	4178.0	0.060	9.73	161.41
EQUIPMENT FAILURE	1269.0	2865.0	0.041	1.10	26.58
FAULTY OPERATION OF EQUIPMENT	345.3	2044.0	0.029	0.30	10.14
FLASHOVER	3542.8	1795.0	0.026	3.07	118.42
DETERIORATION, CORROSION, TERMITES	1999.9	1770.0	0.026	1.73	67.79
MAINTENANCE - FORCED	1804.7	1767.0	0.025	1.56	61.28
MAN OR ANIMALS IN LINES OR EQUIPMENT	1824.3	1421.0	0.021	1.58	77.03
HIGH WIND	4445.5	1354.0	0.020	3.85	196.99
MAINTENANCE - SCHEDULED	3181.4	1272.0	0.018	2.75	150.07
OPERATOR OR SWITCHING ERROR	1523.5	1266.0	0.018	1.32	72.20
CONTACT BY MOVING EQUIPMENT	1121.2	1182.0	0.017	0.97	56.91
FIRE	413.7	880.0	0.013	0.36	28.20
TRANSFORMER FAILURE	845.0	153.0	0.002	0.73	331.38
INT. TO BALANCE LOAD OR SYSTEM CONV.	438.0	137.0	0.002	0.38	191.81
EXCAVATION AND CONSTRUCTION	108.9	114.0	0.002	0.09	57.29
EQUIPMENT OVERLOAD	51.7	100.0	0.001	0.04	31.00
LIGHTNING	43.9	94.0	0.001	0.04	28.00
SYSTEM ADDITIONS OR REMOVALS	75.4	32.0	0.000	0.07	141.44
INT. TO TRANSFER LOAD (OUT OF PHASE)	0.3	14.0	0.000	0.00	1.43
FAILURE OF CUSTOMER'S ELECTRICAL EQUIP	8.6	13.0	0.000	0.01	39.54
LOOSE CONNECTION	5.0	12.0	0.000	0.00	25.00
OTHER COMPANY PERSONNEL ERROR	21.2	10.0	0.000	0.02	127.20
FOREIGN OBJECTS IN LINES OR EQUIPMENT	14.0	10.0	0.000	0.01	84.00
MYLAR BALLOON	0.0	0.0	0.000	0.00	0.00
TSUNAMI, EARTHQUAKE, OR FLOODING	0.0	0.0	0.000	0.00	0.00
VANDALISM	0.0	0.0	0.000	0.00	0.00
TRANSFORMER OVERLOAD	0.0	0.0	0.000	0.00	0.00
TOTAL	108360.7	71894.0	1.037	93.81	90.43

AVERAGE SYSTEM AVAILABILITY = 99.9821%
NUMBER OF CUSTOMERS FOR THE PERIOD = 69,303
24 MONTH ANNUALIZED SAIDI AVERAGE FOR THE PERIOD 1/1/2012 - 12/31/2013 = 101.96
24 MONTH AVERAGE NUMBER OF CUSTOMERS FOR THE PERIOD 1/1/2012 - 12/31/2013 = 68,939
SAIFI = SYSTEM AVERAGE INTERRUPTION FREQUENCY INDEX
SAIDI = SYSTEM AVERAGE INTERRUPTION DURATION INDEX (MINUTES)
CAIDI = CUSTOMER AVERAGE INTERRUPTION DURATION INDEX (MINUTES)

NOTES: OUTAGE CAUSES ARE LISTED IN ORDER OF SAIFI.
OUTAGES WITH ZERO CUSTOMER HOURS OR DUE TO CUSTOMER MAINTENANCE ARE NOT INCLUDED IN THE REPORT.

Maui Electric Company **Normalized Sustained Interruption Summary – Maui**

FROM: JANUARY 1, 2013

TO: DECEMBER 31, 2013

Outage Cause	Customer Hours	Customer Interruptions	SAIFI	SAIDI	CAIDI
TREES OR BRANCHES IN LINES	53381.2	29725.0	0.462	49.74	107.75
UNKNOWN FAILURE	6862.1	8906.0	0.138	6.39	46.23
CABLE FAULT	10326.0	6425.0	0.100	9.62	96.43
AUTOMOBILE ACCIDENT	11239.8	4178.0	0.065	10.47	161.41
EQUIPMENT FAILURE	1245.4	2850.0	0.044	1.16	26.22
FAULTY OPERATION OF EQUIPMENT	345.3	2044.0	0.032	0.32	10.14
FLASHOVER	3421.2	1789.0	0.028	3.19	114.74
MAINTENANCE - FORCED	1804.7	1767.0	0.027	1.68	61.28
DETERIORATION, CORROSION, TERMITES	1863.2	1673.0	0.026	1.74	66.82
MAN OR ANIMALS IN LINES OR EQUIPMENT	1798.7	1408.0	0.022	1.68	76.65
MAINTENANCE - SCHEDULED	2735.0	1075.0	0.017	2.55	152.65
HIGH WIND	3930.2	1014.0	0.016	3.66	232.55
FIRE	413.7	880.0	0.014	0.39	28.20
TRANSFORMER FAILURE	845.0	153.0	0.002	0.79	331.38
INT. TO BALANCE LOAD OR SYSTEM CONV.	438.0	137.0	0.002	0.41	191.81
EXCAVATION AND CONSTRUCTION	108.9	114.0	0.002	0.10	57.29
EQUIPMENT OVERLOAD	51.7	100.0	0.002	0.05	31.00
CONTACT BY MOVING EQUIPMENT	144.2	86.0	0.001	0.13	100.60
OPERATOR OR SWITCHING ERROR	90.9	83.0	0.001	0.08	65.72
INT. TO TRANSFER LOAD (OUT OF PHASE)	0.3	14.0	0.000	0.00	1.43
LOOSE CONNECTION	5.0	12.0	0.000	0.00	25.00
OTHER COMPANY PERSONNEL ERROR	21.2	10.0	0.000	0.02	127.20
FOREIGN OBJECTS IN LINES OR EQUIPMENT	14.0	10.0	0.000	0.01	84.00
FAILURE OF CUSTOMER'S ELECTRICAL EQUIP	4.5	4.0	0.000	0.00	67.00
SYSTEM ADDITIONS OR REMOVALS	8.4	2.0	0.000	0.01	253.00
MYLAR BALLOON	0.0	0.0	0.000	0.00	0.00
TSUNAMI, EARTHQUAKE, OR FLOODING	0.0	0.0	0.000	0.00	0.00
VANDALISM	0.0	0.0	0.000	0.00	0.00
TRANSFORMER OVERLOAD	0.0	0.0	0.000	0.00	0.00
LIGHTNING	0.0	0.0	0.000	0.00	0.00
TOTAL	101098.4	64459.0	1.001	94.20	94.10

AVERAGE SYSTEM AVAILABILITY = 99.9820%
 NUMBER OF CUSTOMERS FOR THE PERIOD = 64,397
 24 MONTH ANNUALIZED SAIDI AVERAGE FOR THE PERIOD 1/1/2012 - 12/31/2013 = 103.13
 24 MONTH AVERAGE NUMBER OF CUSTOMERS FOR THE PERIOD 1/1/2012 - 12/31/2013 = 64,071
 SAIFI = SYSTEM AVERAGE INTERRUPTION FREQUENCY INDEX
 SAIDI = SYSTEM AVERAGE INTERRUPTION DURATION INDEX (MINUTES)
 CAIDI = CUSTOMER AVERAGE INTERRUPTION DURATION INDEX (MINUTES)

NOTES: OUTAGE CAUSES ARE LISTED IN ORDER OF SAIFI.
 OUTAGES WITH ZERO CUSTOMER HOURS OR DUE TO CUSTOMER MAINTENANCE ARE NOT INCLUDED IN THE REPORT.

Maui Electric Company Normalized Sustained Interruption Summary – Molokai

FROM: JANUARY 1, 2013

TO: DECEMBER 31, 2013

Outage Cause	Customer Hours	Customer Interruptions	SAIFI	SAIDI	CAIDI
UNKNOWN FAILURE	2695.7	3886.0	1.212	50.46	41.62
OPERATOR OR SWITCHING ERROR	1432.5	1183.0	0.369	26.82	72.66
TREES OR BRANCHES IN LINES	648.1	385.0	0.120	12.13	101.00
HIGH WIND	515.3	340.0	0.106	9.65	90.94
MAINTENANCE - SCHEDULED	393.9	162.0	0.051	7.37	145.89
DETERIORATION, CORROSION, TERMITES	136.7	97.0	0.030	2.56	84.57
LIGHTNING	43.9	94.0	0.029	0.82	28.00
SYSTEM ADDITIONS OR REMOVALS	67.0	30.0	0.009	1.25	134.00
CABLE FAULT	9.1	3.0	0.001	0.17	182.00
MYLAR BALLOON	0.0	0.0	0.000	0.00	0.00
OTHER COMPANY PERSONNEL ERROR	0.0	0.0	0.000	0.00	0.00
MAINTENANCE - FORCED	0.0	0.0	0.000	0.00	0.00
INT. TO BALANCE LOAD OR SYSTEM CONV.	0.0	0.0	0.000	0.00	0.00
INT. TO TRANSFER LOAD (OUT OF PHASE)	0.0	0.0	0.000	0.00	0.00
TSUNAMI, EARTHQUAKE, OR FLOODING	0.0	0.0	0.000	0.00	0.00
FAILURE OF CUSTOMER'S ELECTRICAL EQUIP	0.0	0.0	0.000	0.00	0.00
FAULTY OPERATION OF EQUIPMENT	0.0	0.0	0.000	0.00	0.00
VANDALISM	0.0	0.0	0.000	0.00	0.00
EQUIPMENT FAILURE	0.0	0.0	0.000	0.00	0.00
EQUIPMENT OVERLOAD	0.0	0.0	0.000	0.00	0.00
TRANSFORMER OVERLOAD	0.0	0.0	0.000	0.00	0.00
TRANSFORMER FAILURE	0.0	0.0	0.000	0.00	0.00
FLASHOVER	0.0	0.0	0.000	0.00	0.00
LOOSE CONNECTION	0.0	0.0	0.000	0.00	0.00
EXCAVATION AND CONSTRUCTION	0.0	0.0	0.000	0.00	0.00
CONTACT BY MOVING EQUIPMENT	0.0	0.0	0.000	0.00	0.00
FIRE	0.0	0.0	0.000	0.00	0.00
FOREIGN OBJECTS IN LINES OR EQUIPMENT	0.0	0.0	0.000	0.00	0.00
MAN OR ANIMALS IN LINES OR EQUIPMENT	0.0	0.0	0.000	0.00	0.00
AUTOMOBILE ACCIDENT	0.0	0.0	0.000	0.00	0.00
TOTAL	5942.2	6180.0	1.928	111.24	57.69

AVERAGE SYSTEM AVAILABILITY = 99.9788%
 NUMBER OF CUSTOMERS FOR THE PERIOD = 3,205
 24 MONTH ANNUALIZED SAIDI AVERAGE FOR THE PERIOD 1/1/2012 - 12/31/2013 = 115.29
 24 MONTH AVERAGE NUMBER OF CUSTOMERS FOR THE PERIOD 1/1/2012 - 12/31/2013 = 3,196
 SAIFI = SYSTEM AVERAGE INTERRUPTION FREQUENCY INDEX
 SAIDI = SYSTEM AVERAGE INTERRUPTION DURATION INDEX (MINUTES)
 CAIDI = CUSTOMER AVERAGE INTERRUPTION DURATION INDEX (MINUTES)

NOTES: OUTAGE CAUSES ARE LISTED IN ORDER OF SAIFI.
 OUTAGES WITH ZERO CUSTOMER HOURS OR DUE TO CUSTOMER MAINTENANCE ARE NOT INCLUDED IN THE REPORT.

Maui Electric Company **Normalized Sustained Interruption Summary – Lanai**

FROM: JANUARY 1, 2013

TO: DECEMBER 31, 2013

Outage Cause	Customer Hours	Customer Interruptions	SAIFI	SAIDI	CAIDI
CONTACT BY MOVING EQUIPMENT	977.0	1096.0	0.644	34.44	53.49
TREES OR BRANCHES IN LINES	72.5	50.0	0.029	2.56	87.00
MAINTENANCE - SCHEDULED	52.5	35.0	0.021	1.85	90.00
UNKNOWN FAILURE	43.2	31.0	0.018	1.52	83.65
EQUIPMENT FAILURE	23.6	15.0	0.009	0.83	94.40
MAN OR ANIMALS IN LINES OR EQUIPMENT	25.6	13.0	0.008	0.90	118.00
FAILURE OF CUSTOMER'S ELECTRICAL EQUIP	4.1	9.0	0.005	0.14	27.33
FLASHOVER	121.6	6.0	0.004	4.29	1216.00
MYLAR BALLOON	0.0	0.0	0.000	0.00	0.00
OTHER COMPANY PERSONNEL ERROR	0.0	0.0	0.000	0.00	0.00
SYSTEM ADDITIONS OR REMOVALS	0.0	0.0	0.000	0.00	0.00
MAINTENANCE - FORCED	0.0	0.0	0.000	0.00	0.00
INT. TO BALANCE LOAD OR SYSTEM CONV.	0.0	0.0	0.000	0.00	0.00
INT. TO TRANSFER LOAD (OUT OF PHASE)	0.0	0.0	0.000	0.00	0.00
TSUNAMI, EARTHQUAKE, OR FLOODING	0.0	0.0	0.000	0.00	0.00
OPERATOR OR SWITCHING ERROR	0.0	0.0	0.000	0.00	0.00
FAULTY OPERATION OF EQUIPMENT	0.0	0.0	0.000	0.00	0.00
VANDALISM	0.0	0.0	0.000	0.00	0.00
EQUIPMENT OVERLOAD	0.0	0.0	0.000	0.00	0.00
TRANSFORMER OVERLOAD	0.0	0.0	0.000	0.00	0.00
TRANSFORMER FAILURE	0.0	0.0	0.000	0.00	0.00
CABLE FAULT	0.0	0.0	0.000	0.00	0.00
LOOSE CONNECTION	0.0	0.0	0.000	0.00	0.00
HIGH WIND	0.0	0.0	0.000	0.00	0.00
LIGHTNING	0.0	0.0	0.000	0.00	0.00
DETERIORATION, CORROSION, TERMITES	0.0	0.0	0.000	0.00	0.00
EXCAVATION AND CONSTRUCTION	0.0	0.0	0.000	0.00	0.00
FIRE	0.0	0.0	0.000	0.00	0.00
FOREIGN OBJECTS IN LINES OR EQUIPMENT	0.0	0.0	0.000	0.00	0.00
AUTOMOBILE ACCIDENT	0.0	0.0	0.000	0.00	0.00
TOTAL	1320.1	1255.0	0.737	46.54	63.11

AVERAGE SYSTEM AVAILABILITY = 99.9911%
 NUMBER OF CUSTOMERS FOR THE PERIOD = 1,702
 24 MONTH ANNUALIZED SAIDI AVERAGE FOR THE PERIOD 1/1/2012 - 12/31/2013 = 31.52
 24 MONTH AVERAGE NUMBER OF CUSTOMERS FOR THE PERIOD 1/1/2012 - 12/31/2013 = 1,673
 SAIFI = SYSTEM AVERAGE INTERRUPTION FREQUENCY INDEX
 SAIDI = SYSTEM AVERAGE INTERRUPTION DURATION INDEX (MINUTES)
 CAIDI = CUSTOMER AVERAGE INTERRUPTION DURATION INDEX (MINUTES)

NOTES: OUTAGE CAUSES ARE LISTED IN ORDER OF SAIFI.
 OUTAGES WITH ZERO CUSTOMER HOURS OR DUE TO CUSTOMER MAINTENANCE ARE NOT INCLUDED IN THE REPORT.

Attachment-B

Maui Electric Company Normalized Sustained Interruption Summary – System Total

FROM: JANUARY 1, 2013

TO: DECEMBER 31, 2013

Outage Cause	<u>Interruptions</u>		<u>Customer Hours</u>	
	Number	% of Total	Number	% of Total
<u>NON-CONNECTED SYSTEM EMERGENCY</u>	150	23.26%	68832.1	63.5%
FOREIGN OBJECT IN LINES	1	0.16%	14.0	0.0%
CONTACT BY MOVING EQUIPMENT	2	0.31%	1121.2	1.0%
EXCAVATION AND CONSTRUCTION	6	0.93%	108.9	0.1%
FIRE	2	0.31%	413.7	0.4%
AUTO ACCIDENT	11	1.71%	11239.8	10.4%
MAN OR ANIMAL IN LINES	11	1.71%	1824.3	1.7%
TREES OR BRANCHES IN LINES	112	17.36%	54101.8	49.9%
VANDALISM	0	0.00%	0.0	0.0%
CUSTOMER EQUIP. FAILURE	5	0.78%	8.6	0.0%
MYLAR BALLOON	0	0.00%	0.0	0.0%
<u>ERROR</u>	9	1.40%	1544.7	1.4%
OPERATOR OR SWITCHING ERROR	7	1.09%	1523.5	1.4%
OTHER COMPANY PERSONNEL ERROR	2	0.31%	21.2	0.0%
<u>WEATHER</u>	14	2.17%	4489.4	4.1%
LIGHTNING	1	0.16%	43.9	0.0%
HIGH WIND	13	2.02%	4445.5	4.1%
TSUNAMI, EARTHQUAKE OR FLOODING	0	0.00%	0.0	0.0%
<u>NON-TRANSFORMER EQUIPMENT FAILURE</u>	202	31.32%	17548.7	16.2%
LOOSE CONNECTION	1	0.16%	5.0	0.0%
FLASHOVER	8	1.24%	3542.8	3.3%
EQUIPMENT FAILURE	12	1.86%	1269.0	1.2%
CABLE FAULT	126	19.53%	10335.1	9.5%
EQUIPMENT OVERLOAD	1	0.16%	51.7	0.0%
DETERIORATION, CORROSION OR TERMITES	51	7.91%	1999.9	1.8%
FAULTY OPERATION OF EQUIPMENT	3	0.47%	345.3	0.3%
<u>TRANSFORMER</u>	26	4.03%	845.0	0.8%
TRANSFORMER OVERLOAD	0	0.00%	0.0	0.0%
TRANSFORMER FAILURE	26	4.03%	845.0	0.8%
<u>SWITCHING</u>	9	1.40%	438.3	0.4%
INT TO TRANSFER LOAD (OUT OF PHASE)	3	0.47%	0.3	0.0%
INT TO BALANCE LOAD OR CONVERSION	6	0.93%	438.0	0.4%
<u>UNKNOWN</u>	43	6.67%	9601.0	8.9%
<u>MAINTENANCE</u>	189	29.30%	4986.1	4.6%
SCHEDULED	158	24.50%	3181.4	2.9%
FORCED	31	4.81%	1804.7	1.7%
<u>SYSTEM ADDITIONS OR REMOVALS</u>	3	0.47%	75.4	0.1%
<u>TOTALS</u>	645		108360.7	

NOTES: OUTAGES WITH ZERO CUSTOMER HOURS OR DUE TO CUSTOMER MAINTENANCE ARE NOT INCLUDED IN THE REPORT.

Maui Electric Company Normalized Sustained Interruption Summary – Maui

FROM: JANUARY 1, 2013

TO: DECEMBER 31, 2013

Outage Cause	<u>Interruptions</u>		<u>Customer Hours</u>	
	Number	% of Total	Number	% of Total
<u>NON-CONNECTED SYSTEM EMERGENCY</u>	144	23.53%	67104.8	66.4%
FOREIGN OBJECTS IN LINES	1	0.16%	14.0	0.0%
CONTACT BY MOVING EQUIPMENT	1	0.16%	144.2	0.1%
EXCAVATION AND CONSTRUCTION	6	0.98%	108.9	0.1%
FIRE	2	0.33%	413.7	0.4%
AUTO ACCIDENT	11	1.80%	11239.8	11.1%
MAN OR ANIMAL IN LINES	9	1.47%	1798.7	1.8%
TREES OR BRANCHES IN LINES	110	17.97%	53381.2	52.8%
VANDALISM	0	0.00%	0.0	0.0%
CUSTOMER EQUIP. FAILURE	4	0.65%	4.5	0.0%
MYLAR BALLON	0	0.00%	0.0	0.0%
<u>ERROR</u>	8	1.31%	112.1	0.1%
OPERATOR OR SWITCHING ERROR	6	0.98%	90.9	0.1%
OTHER COMPANY PERSONNEL	2	0.33%	21.2	0.0%
<u>WEATHER</u>	11	1.80%	3930.2	3.9%
LIGHTNING	0	0.00%	0.0	0.0%
HIGH WIND	11	1.80%	3930.2	3.9%
TSUNAMI, EARTHQUAKE OR FLOODING	0	0.00%	0.0	0.0%
<u>NON-TRANSFORMER EQUIPMENT FAILURE</u>	195	31.86%	17257.7	17.1%
LOOSE CONNECTION	1	0.16%	5.0	0.0%
FLASHOVER	7	1.14%	3421.2	3.4%
EQUIPMENT FAILURE	9	1.47%	1245.4	1.2%
CABLE FAULT	125	20.42%	10326.0	10.2%
EQUIPMENT OVERLOAD	1	0.16%	51.7	0.1%
DETERIORATION, CORROSION OR TERMITES	49	8.01%	1863.2	1.8%
FAULTY OPERATION OF EQUIPMENT	3	0.49%	345.3	0.3%
<u>TRANSFORMER</u>	26	4.25%	845.0	0.8%
TRANSFORMER OVERLOAD	0	0.00%	0.0	0.0%
TRANSFORMER FAILURE	26	4.25%	845.0	0.8%
<u>SWITCHING</u>	9	1.47%	438.3	0.4%
INT TO TRANSFER LOAD (OUT OF PHASE)	3	0.49%	0.3	0.0%
INT TO BALANCE LOAD OR CONVERSION	6	0.98%	438.0	0.4%
<u>UNKNOWN</u>	31	5.07%	6862.1	6.8%
<u>MAINTENANCE</u>	186	30.39%	4539.7	4.5%
SCHEDULED	155	25.33%	2735.0	2.7%
FORCED	31	5.07%	1804.7	1.8%
<u>SYSTEM ADDITIONS OR REMOVALS</u>	2	0.33%	8.4	0.0%
<u>TOTALS</u>	612		101098.4	

NOTES: OUTAGES WITH ZERO CUSTOMER HOURS OR DUE TO CUSTOMER MAINTENANCE ARE NOT INCLUDED IN THE REPORT.

Maui Electric Company Normalized Sustained Interruption Summary – Molokai

FROM: JANUARY 1, 2013

TO: DECEMBER 31, 2013

Outage Cause	<u>Interruptions</u>		<u>Customer Hours</u>	
	Number	% of Total	Number	% of Total
<u>NON-CONNECTED SYSTEM EMERGENCY</u>	1	5.88%	648.1	10.9%
FOREIGN OBJECT 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	0	0.00%	0.0	0.0%
TREES OR BRANCHES IN LINES	1	5.88%	648.1	10.9%
VANDALISM	0	0.00%	0.0	0.0%
CUSTOMER EQUIP. FAILURE	0	0.00%	0.0	0.0%
MYLAR BALLOONS	0	0.00%	0.0	0.0%
<u>ERROR</u>	1	5.88%	1432.5	24.1%
OPERATOR OR SWITCHING ERROR	1	5.88%	1432.5	24.1%
OTHER COMPANY PERSONNEL	0	0.00%	0.0	0.0%
<u>WEATHER</u>	3	17.65%	559.2	9.4%
LIGHTNING	1	5.88%	43.9	0.7%
HIGH WIND	2	11.76%	515.3	8.7%
TSUNAMI, EARTHQUAKE OR FLOODING	0	0.00%	0.0	0.0%
<u>NON-TRANSFORMER EQUIPMENT FAILURE</u>	3	17.65%	145.8	2.5%
LOOSE CONNECTION	0	0.00%	0.0	0.0%
FLASHOVER	0	0.00%	0.0	0.0%
EQUIPMENT FAILURE	0	0.00%	0.0	0.0%
CABLE FAULT	1	5.88%	9.1	0.2%
EQUIPMENT OVERLOAD	0	0.00%	0.0	0.0%
DETERIORATION, CORROSION OR TERMITES	2	11.76%	136.7	2.3%
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	0	0.00%	0.0	0.0%
<u>SWITCHING</u>	0	0.00%	0.0	0.0%
INT TO TRANSFER LOAD (OUT OF PHASE)	0	0.00%	0.0	0.0%
INT TO BALANCE LOAD OR CONVERSION	0	0.00%	0.0	0.0%
<u>UNKNOWN AFTER TESTS AND</u>	6	35.29%	2695.7	45.4%
<u>MAINTENANCE</u>	2	11.76%	393.9	6.6%
SCHEDULED	2	11.76%	393.9	6.6%
FORCED	0	0.00%	0.0	0.0%
<u>SYSTEM ADDITIONS OR</u>	1	5.88%	67.0	1.1%
<u>TOTALS</u>	17		5942.2	

NOTES: OUTAGES WITH ZERO CUSTOMER HOURS OR DUE TO CUSTOMER MAINTENANCE ARE NOT INCLUDED IN THE REPORT.

Maui Electric Company **Normalized Sustained Interruption Summary – Lanai**

FROM: JANUARY 1, 2013

TO: DECEMBER 31, 2013

Outage Cause	<u>Interruptions</u>		<u>Customer Hours</u>	
	Number	% of Total	Number	% of Total
<u>NON-CONNECTED SYSTEM EMERGENCY</u>	5	31.25%	1079.2	81.8%
FOREIGN OBJECTS IN LINES	0	0.00%	0.0	0.0%
CONTACT BY MOVING EQUIPMENT	1	6.25%	977.0	74.0%
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	2	12.50%	25.6	1.9%
TREES OR BRANCHES IN LINES	1	6.25%	72.5	5.5%
VANDALISM	0	0.00%	0.0	0.0%
CUSTOMER EQUIP. FAILURE	1	6.25%	4.1	0.3%
MYLAR BALLOON	0	0.00%	0.0	0.0%
<u>ERRO</u>	0	0.00%	0.0	0.0%
OPERATOR OR SWITCHING ERROR	0	0.00%	0.0	0.0%
OTHER COMPANY PERSONNEL	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 FAILURE</u>	4	25.00%	145.2	11.0%
LOOSE CONNECTION	0	0.00%	0.0	0.0%
FLASHOVER	1	6.25%	121.6	9.2%
EQUIPMENT OVERLOAD	3	18.75%	23.6	1.8%
CABLE FAULT	0	0.00%	0.0	0.0%
EQUIPMENT OVERLOAD	0	0.00%	0.0	0.0%
DETERIORATION, CORROSION OR TERMITES	0	0.00%	0.0	0.0%
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	0	0.00%	0.0	0.0%
<u>SWITCHING</u>	0	0.00%	0.0	0.0%
INT TO TRANSFER LOAD (OUT OF PHASE)	0	0.00%	0.0	0.0%
INT TO BALANCE LOAD OR CONVERSION	0	0.00%	0.0	0.0%
<u>UNKNOWN AFTER TESTS AND</u>	6	37.50%	43.2	3.3%
<u>MAINTENANCE</u>	1	6.25%	52.5	4.0%
SCHEDULED	1	6.25%	52.5	4.0%
FORCED	0	0.00%	0.0	0.0%
<u>SYSTEM ADDITIONS OR</u>	0	0.00%	0.0	0.0%
<u>TOTALS</u>	16		1320.1	

NOTES: OUTAGES WITH ZERO CUSTOMER HOURS OR DUE TO CUSTOMER MAINTENANCE ARE NOT INCLUDED IN THE REPORT.

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 the system configuration.

INTERRUPTION

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

INTERRUPTION DURATION

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

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 duration of 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 within this report. In conformance with the guidelines established in the report, "Methodology for Determining Reliability Indices for HECO Utilities," dated December 1990, a sustained interruption has duration of one minute or longer.

CUSTOMER INTERRUPTION

One interruption of one customer.

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

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:

RELIABILITY INDICES

AVERAGE SERVICE AVAILABILITY INDEX (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.

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

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.

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

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.

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