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PUBLIC UTILITIES
COMMISSION



Darcy L. Endo-Omoto
Vice President
Government & Community Affairs

June 27, 2011

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

Dear Commissioners:

Subject: Hawaiian Electric Annual Service Reliability Report for 2010

Hawaiian Electric Company, Inc. respectfully submits a copy of its Annual Service Reliability Report for the year 2010.

Sincerely,

Attachment

c: Division of Consumer Advocacy (with Attachment)

HAWAIIAN ELECTRIC COMPANY, INC.
ANNUAL SERVICE RELIABILITY REPORT
2010

Prepared by
System Operation Department

March 25, 2011

INTRODUCTION

This is the 2010 annual service reliability report of the Hawaiian Electric Company (HECO). The average number of electric customers increased from 294,802 in 2009 to 295,637 in 2010 (a 0.28% increase). The 2010 peak demand for the system was 1,200 MW (evening peak) this is 60 MW lower than the peak in 2009; however, the highest system peak demand remains at 1,327 MW set on the evening of October 12, 2004.

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

The definition of terms, the explanation and equations for the reliability indices are contained in Attachment C.

Indices measure reliability in terms of the overall availability of electrical service (ASAI), the frequency or number of times HECO'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 HECO'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 HECO's total customer base (in this case 295,637 customers).

ANALYSIS

This analysis of the annual system reliability for HECO is for the year 2010. To determine the relative level of reliability, the statistics for four prior years, 2006 through 2009, 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. That report indicates 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.)

2010 RESULTS

Annual Service Reliability Indices

The annual service reliability for 2010 was the second best in the past 5 years in terms System Average Interruption Frequency Index (SAIFI). The reliability results for 2010 and four prior years are shown below in Table 1: Annual Service Reliability Indices – All Events, and Table 2: Annual Service Reliability Indices – with Normalizations. No outage events were normalized in 2010. All subsequent comparisons and discussion are based on the normalized data.

Table 1: Annual Service Reliability Indices - All Events

	2006	2007	2008	2009	2010
Number of Customers	292,554	293,893	294,371	294,802	295,637
Customer Interruptions	724,280	639,886	729,784	333,908	361,334
Customer-Hours Interrupted	4,260,045	1,970,925	3,985,756	442,546	564,424
SAIDI (Minutes)	873.69	402.38	812.39	90.08	114.55
CAIDI (Minutes)	352.91	184.81	327.69	79.52	93.72
SAIFI (Occurrences)	2.476	2.177	2.479	1.133	1.222
ASAI (Percent)	99.834	99.923	99.846	99.983	99.978

Table 2: Annual Service Reliability Indices - with Normalization

	2006*	2007**	2008***	2009	2010
Number of Customers	292,554	293,893	294,371	294,802	295,637
Customer Interruptions	420,749	367,837	382,124	333,908	361,334
Customer-Hours Interrupted	666,188	488,144	490,842	442,546	564,424
SAIDI (Minutes)	136.63	99.66	100.05	90.08	114.55
CAIDI (Minutes)	95.00	79.62	77.07	79.52	93.72
SAIFI (Occurrences)	1.438	1.252	1.298	1.133	1.222
ASAI (Percent)	99.974	99.981	99.981	99.983	99.978

NOTE:

- 2006*** Data normalized to exclude the 6/01/06 Load Shedding Outage
- Data normalized to exclude the 10/15/06 Earthquake Outage
- 2007**** Data normalized to exclude the 1/29/07 and 02/02/07 High Wind Outages
- Data normalized to exclude the 11/04/07 - 11/05/07 and 12/04/07 - 12/06/07 Storms
- 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

Figure 1: System Average Interruption Duration Index (SAIDI)

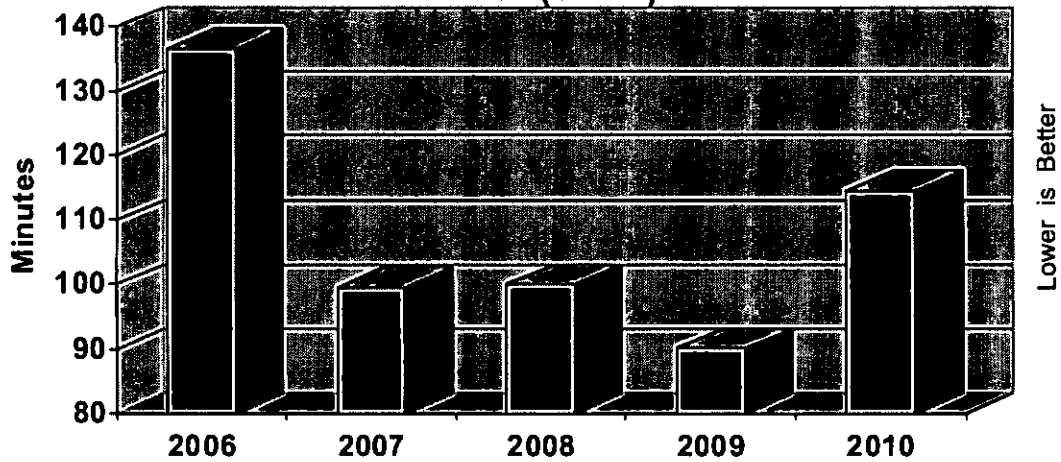


Figure 1 shows the System Average Interruption Duration (SAIDI) indices for the past five years. It shows that the 2010 SAIDI is 114.55 minutes, a 27% increase as compared to the 2009 SAIDI results. The SAIDI is the composite of both the SAIFI and CAIDI indices and produces a broader benchmark of system reliability by combining both the duration and the number of customer interruptions during a given period of time. The increase of the SAIDI result was due to the increase in both the CAIDI and SAIFI statistics.

Figure 2: Customer Average Interruption Duration Index (CAIDI)

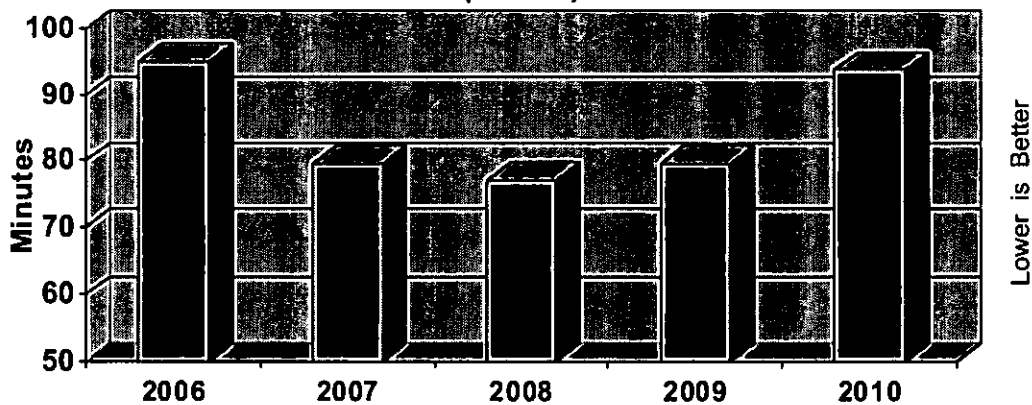


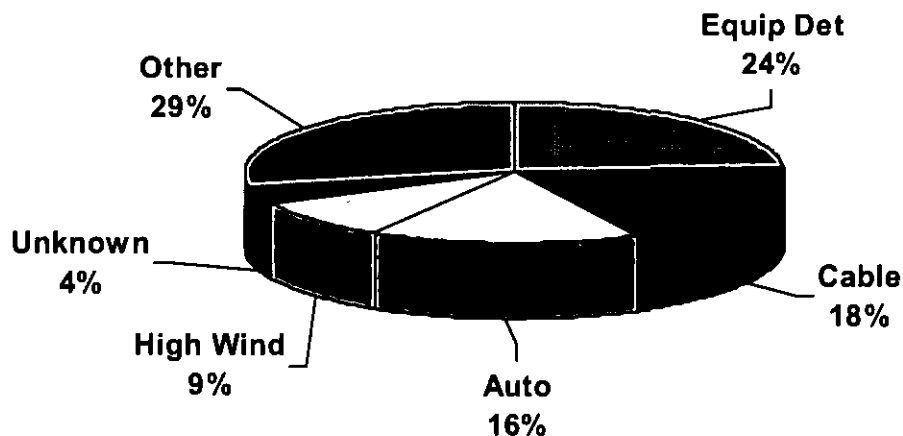
Figure 2 shows that the average duration of a customer's outage (CAIDI) for 2010 significantly increased and in the five year period was approaching the results of 2006, which was the worst of the five years from 2006 to 2010. The average electrical outage duration (CAIDI) for 2010 was 93.72 minutes, an increase over the 2009 results of 79.52 minutes. Automobile accidents greatly affected the CAIDI results for 2010. Foregoing the six events listed below would have reduced the 2010 annual CAIDI by nearly 7 minutes.

Six major events affected the CAIDI results in 2010:

1. January 6, 2010 – An auto accident at the intersection of Lanikuhana Ave and Meheula Pkwy caused outages in the Mililani area affecting 2,309 customers from 52 minutes to 5 hours and 31 minutes.
2. February 10, 2010 – An auto accident on School St caused outages in the Kalihi area affecting 1,386 customers from 36 minutes to 10 hours and 13 minutes.
3. April 11, 2010 – An auto accident on Farrington Hwy caused outages in the Waialua area affecting 3,085 customers from 2 hours and 59 minutes to 14 hours and 22 minutes.
4. September 28, 2010 – An auto accident on California Ave caused outages in the Wahiawa area affecting 1,947 customers for 1 hour and 7 minutes to 9 hours and 41 minutes.
5. October 17, 2010 – An auto accident on Kukuna Rd caused outages in the Hauula area affecting 1,342 customers for 1 hour and 30 minutes to 22 hours and 1 minute.
6. November 28, 2010 – An auto accident at Hele St caused outages in the Kailua area affecting about 1,912 customers from 1 hour and 23 minutes to 12 hours and 40 minutes.

Outages caused by automobile accidents generally incur damage to poles or equipment that require replacement before power can be restored to customers. In some cases the accident scene can be isolated; restoring most customers, however there will often be a few customers who experience extended outage durations. Nonetheless, automobile accidents, because of the damage that is inflicted on the system, generally result in lengthy outage times for customers.

Figure 3: Outage Categories



The Top 5 Outage Categories, by number of customers affected, as illustrated in Figure 3, equates to about 71% of the total Customer Interruptions in 2010; these causes are:

<u>Outage Category</u>	<u>Sample Causes</u>
1. Equipment Deterioration	failed, broken, corroded equipment,
2. Cable Faults	underground equipment failures,
3. Auto Accidents	car, truck and bus accidents,
4. High Wind	objects blown into lines, conductor swing shorts,
5. Unknown	unidentified outage causes.

All of these were also major cause factors in 2009 with the exception of "High Wind" which replaced "Trees/Branches in Line" as a top contributor.

The total number of customer interruptions in 2010 was 361,334 and in the prior year 2009 there were 333,908 interruptions. In the five year period this was the second best performing year for the fewest number of interruptions. The results show that the number of Customer Interruptions due to "Equipment Deterioration" went up from 79,629 in 2009 to 86,108 in 2010, an increase of 8%. The number of Customer Interruptions due to "Auto Accidents" decreased from 35,194 in 2009 to 26,596 in 2010, an improvement of 24%. The number of Customer Interruptions due to "Cable Faults" increased from 63,868 in 2009 to 74,790 in 2010, an increase of 17%. Although the customer interruptions due to "Cable Faults" increased, the percentage of cable faults versus all interruptions remained about the same as in 2009. The increase in outages due to "High Winds" increased by over 300% from 7,433 in 2009 to 30,532 in 2010. In 2010 the following high wind periods contributed to the large increase in the number of outages. High wind events on December 9th - 10th amounted to 13,348 interruptions and events on April 29th -31st amounted to 6,928 interruptions.

There were no sustained interruptions affecting 10,000 or more customers during 2010 similar to that of 2009.

The outages and transformer fire that occurred during the heavy rains on December 19th and 20th affecting Ala Moana Shopping Center, nearby businesses and customers gained much media attention. The effect, however, on the reliability statistics for 2010 was relatively insignificant. The outages, in all, impacted about 2000 customers, or 0.6% of the customer interruptions for 2010. The impact to the CAIDI, SAIDI and SAIFI was 13 seconds, 35.4 seconds and 0.003, respectively.

Figure 4: System Average Interruption Frequency Index (SAIFI)

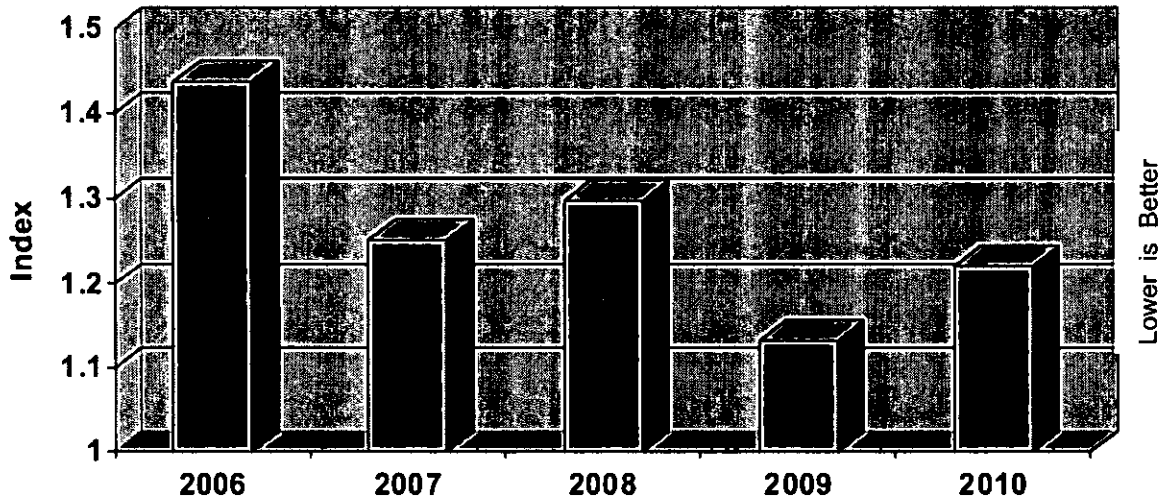


Figure 4 shows the System Average Interruption Frequency Index (SAIFI) for the past five years. It shows that the 2010 SAIFI of 1.222 was the second lowest index in the past five years, increasing from the 30 year low of 1.133 in 2009.

Figure 5: Average Service Availability Index (ASAI)

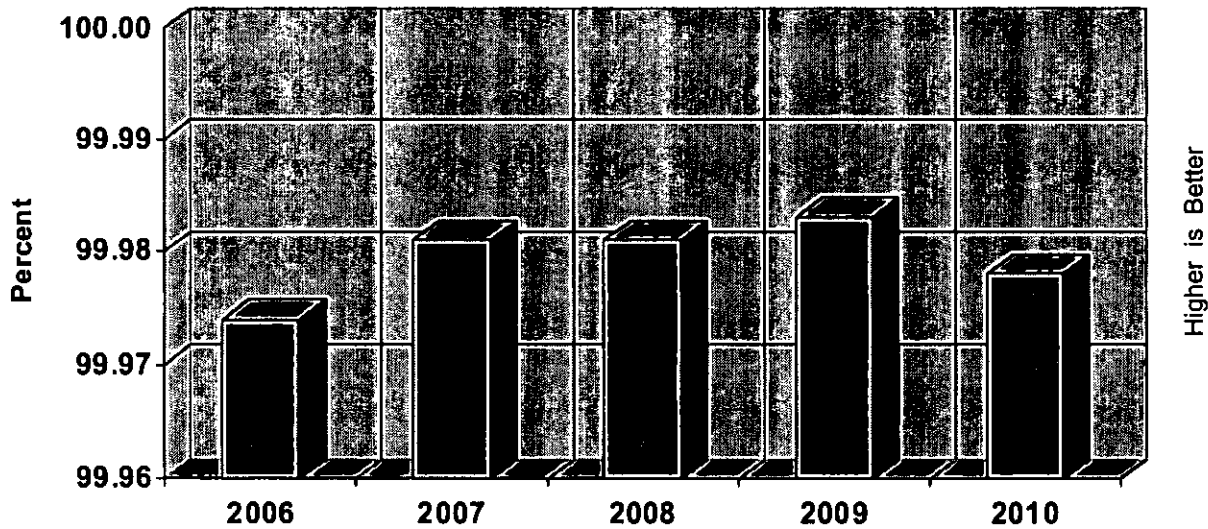


Figure 5 shows that the 2010 ASAI index decreased when compared to the 2009 results after a period of growth (higher is better) from 2006 to 2009. Approximately 27,343 more customers experienced sustained service interruptions during 2010 compared to the previous year, an increase of 8.2% that caused the ASAI to decrease from 99.983% to 99.978%.

Hawaiian Electric Company Normalized Sustained Interruption Summary

From: January 1, 2010

To: December 31, 2010

Outage Cause	Customer Hours	Customer Interruptions	SAIFI	SAIDI	CAIDI
EQUIP DETERIORATION	136,008.43	86,108	0.291	27.60	94.77
CABLE FAULT	103,748.68	74,790	0.253	21.06	83.23
HIGH WINDS	52,410.58	30,532	0.103	10.64	102.99
AUTO ACCIDENT	89,107.13	26,596	0.090	18.08	201.02
COMPANY PERSONNEL ERROR	13,525.00	23,769	0.080	2.74	34.14
FORCED MAINTENANCE	21,633.90	17,918	0.061	4.39	72.44
UNKNOWN	23,303.78	16,627	0.056	4.73	84.09
MYLAR BALLOON	9,950.72	13,114	0.044	2.02	45.53
COMPANY SWITCHING ERROR	2,678.48	10,861	0.037	0.54	14.80
TREES/BRANCHES IN LINES	15,641.45	10,093	0.034	3.17	92.98
FAULTY EQUIP OPERATION	13,970.57	8,711	0.029	2.84	96.23
FLASHOVER	13,422.83	7,936	0.027	2.72	101.48
SCHEDULED MAINTENANCE	22,507.13	7,040	0.024	4.57	191.82
CONTAMINATION FLASHOVER	4,197.20	5,245	0.018	0.85	48.01
ANIMAL IN LINES	2,824.95	3,359	0.011	0.57	50.46
LIGHTNING	10,624.88	2,707	0.009	2.16	235.50
EQUIP OVERLOAD	3,169.97	2,471	0.008	0.64	76.97
CONSTRUCTION ACCIDENT	3,742.00	2,444	0.008	0.76	91.87
FIRE	6,121.53	2,420	0.008	1.24	151.77
OVERGROWN VEGETATION	2,177.23	2,233	0.008	0.44	58.50
MOVING EQUIP ACCIDENT	3,235.43	1,856	0.006	0.66	104.59
TRANSFORMER FAILURE	6,048.78	1,743	0.006	1.23	208.22
FOREIGN OBJECT IN LINES	1,615.57	1,388	0.005	0.33	69.84
TRANSFORM OVERLOAD	1,468.35	714	0.002	0.30	123.39
VANDALISM	196.08	259	0.001	0.04	45.42
TRANSFER LOAD MAINTENANCE	10.65	213	0.001	0.00	3.00
CUSTOMER EQUIP	965.92	152	0.001	0.20	381.28
OTHER	117.00	35	0.000	0.02	200.57
MAN IN LINES	0.00	0	0.000	0.00	0.00
IPP EQUIP FAILURE	0.00	0	0.000	0.00	0.00
MANUFACTURER EQUIP DEFECT	0.00	0	0.000	0.00	0.00
EQUIP ROT OR TERMITES	0.00	0	0.000	0.00	0.00
NATURAL DISASTER	0.00	0	0.000	0.00	0.00
CUSTOMER MAINTENANCE	0.00	0	0.000	0.00	0.00
SWITCH LOAD MAINTENANCE	0.00	0	0.000	0.00	0.00
SYSTEM LOAD MAINTENANCE	0.00	0	0.000	0.00	0.00
LANDSLIDE/FLOODING	0.00	0	0.000	0.00	0.00
Total	564,424.25	361,334	1.222	114.55	93.72

AVERAGE SYSTEM AVAILABILITY = 99.978%
NUMBER OF CUSTOMERS FOR THE PERIOD = 295,637
AUTO-TRANSFER MOMENTARY CUSTOMER INTERRUPTIONS FOR THE PERIOD = 159,875
AUTO-TRANSFER MAIF= 0.541

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 Normalized Sustained Interruption Summary

From: January 1, 2010

To: December 31, 2010

Outage Cause	<u>Interruptions</u>		<u>Customer Hours</u>	
	Number	% of Total	Number	% of Total
<u>ACCIDENT</u>	71	3.34	96,084.57	17.02
CONSTRUCTION ACCIDENT	17	0.80	3,742.00	0.66
MOVING EQUIP ACCIDENT	4	0.19	3,235.43	0.57
AUTO ACCIDENT	50	2.35	89,107.13	15.79
<u>CABLE FAULT</u>	555	26.13	103,748.68	18.38
CABLE FAULT	555	26.13	103,748.68	18.38
<u>COMPANY ERROR</u>	52	2.45	16,203.48	2.87
COMPANY PERSONNEL ERROR	28	1.32	13,525.00	2.40
COMPANY SWITCHING ERROR	24	1.13	2,678.48	0.47
<u>EQUIPMENT</u>	363	17.09	154,114.88	27.30
IPP EQUIP FAILURE	0	0.00	0.00	0.00
MANUFACTURER EQUIP DEFECT	0	0.00	0.00	0.00
EQUIP OVERLOAD	13	0.61	3,169.97	0.56
EQUIP DETERIORATION	306	14.41	136,008.43	24.10
CUSTOMER EQUIP	24	1.13	965.92	0.17
EQUIP ROT OR TERMITES	0	0.00	0.00	0.00
FAULTY EQUIP OPERATION	20	0.94	13,970.57	2.48
<u>FIRE</u>	12	0.56	6,121.53	1.08
FIRE	12	0.56	6,121.53	1.08
<u>FLASHOVER</u>	23	1.08	17,620.03	3.12
FLASHOVER	15	0.71	13,422.83	2.38
CONTAMINATION FLASHOVER	8	0.38	4,197.20	0.74
<u>MAINTENANCE</u>	634	29.85	44,151.68	7.82
SCHEDULED MAINTENANCE	492	23.16	22,507.13	3.99
SYSTEM LOAD MAINTENANCE	0	0.00	0.00	0.00
SWITCH LOAD MAINTENANCE	0	0.00	0.00	0.00
CUSTOMER MAINTENANCE	0	0.00	0.00	0.00
FORCED MAINTENANCE	141	6.64	21,633.90	3.83
TRANSFER LOAD MAINTENANCE	1	0.05	10.65	0.00
<u>OBJECT IN LINES OR EQUIP</u>	45	2.12	14,391.23	2.55
ANIMAL IN LINES	15	0.71	2,824.95	0.50
MYLAR BALLOON	17	0.80	9,950.72	1.76
MAN IN LINES	0	0.00	0.00	0.00
FOREIGN OBJECT IN LINES	13	0.61	1,615.57	0.29
<u>OTHER</u>	5	0.24	117.00	0.02
OTHER	5	0.24	117.00	0.02
<u>TRANSFORMER</u>	133	6.26	7,517.13	1.33
TRANSFORMER FAILURE	83	3.91	6,048.78	1.07
TRANSFORM OVERLOAD	50	2.35	1,468.35	0.26
<u>UNKNOWN</u>	82	3.86	23,303.78	4.13
UNKNOWN	82	3.86	23,303.78	4.13

Hawaiian Electric Company Normalized Sustained Interruption Summary

From: January 1, 2010

To: December 31, 2010

Outage Cause	<u>Interruptions</u>		<u>Customer Hours</u>	
	Number	% of Total	Number	% of Total
<u>VANDALISM</u>	6	0.28	196.08	0.03
VANDALISM	6	0.28	196.08	0.03
<u>VEGETATION</u>	88	4.14	17,818.68	3.16
TREES/BRANCHES IN LINES	81	3.81	15,641.45	2.77
OVERGROWN VEGETATION	7	0.33	2,177.23	0.39
<u>WEATHER</u>	55	2.59	63,035.47	11.17
NATURAL DISASTER	0	0.00	0.00	0.00
HIGH WINDS	47	2.21	52,410.58	9.29
LIGHTNING	8	0.38	10,624.88	1.88
LANDSLIDE/FLOODING	0	0.00	0.00	0.00
Total:	2,124		564,424.25	

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 (SAIF)

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 (CAID)

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 (SAID)

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

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