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Vice President
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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 2011

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

Sincerely,

Attachment

c: Division of Consumer Advocacy (with Attachment)

HAWAIIAN ELECTRIC COMPANY, INC.
ANNUAL SERVICE RELIABILITY REPORT
2011

Prepared by
System Operation Department

March 12, 2012

INTRODUCTION

This is the 2011 annual service reliability report of the Hawaiian Electric Company (HECO). The average number of electric customers increased from 295,637 in 2010 to 296,679 in 2011 (a 0.23% increase). The 2011 peak demand for the system was 1,177 MW (evening peak), 23 MW lower than the peak demand in 2010; 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 296,679 customers).

ANALYSIS

This analysis of the annual system reliability for HECO is for the year 2011. To determine the relative level of reliability, the statistics for four prior years, 2007 through 2010, 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 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.)

2011 RESULTS

Annual Service Reliability Indices

The annual service reliability for 2011 was the third best in the past five years in terms of all indices for all events. The reliability results for 2011 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. Two outage events were normalized in 2011. All subsequent comparisons and discussion are based on the normalized data.

Table 1: Annual Service Reliability Indices - All Events

	2007	2008	2009	2010	2011
Number of Customers	293,893	294,371	294,802	295,637	296,679
Customer Interruptions	639,886	729,784	333,908	361,334	502,252
Customer-Hours Interrupted	1,970,925	3,985,756	442,546	564,424	1,257,338
SAIDI (Minutes)	402.38	812.39	90.08	114.55	254.59
CAIDI (Minutes)	184.81	327.69	79.52	93.72	150.20
SAIFI (Occurrences)	2.177	2.479	1.133	1.222	1.693
ASAI (Percent)	99.923	99.846	99.983	99.978	99.952

Table 2: Annual Service Reliability Indices - with Normalization

	2007*	2008**	2009	2010	2011***
Number of Customers	293,893	294,371	294,802	295,637	296,679
Customer Interruptions	367,837	382,124	333,908	361,334	408,326
Customer-Hours Interrupted	488,144	490,842	442,546	564,424	1,044,904
SAIDI (Minutes)	99.66	100.05	90.08	114.55	211.32
CAIDI (Minutes)	79.62	77.07	79.52	93.72	153.54
SAIFI (Occurrences)	1.252	1.298	1.133	1.222	1.376
ASAI (Percent)	99.981	99.981	99.983	99.978	99.960

NOTE:

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

Figure 1: System Average Interruption Duration Index (SAIDI)

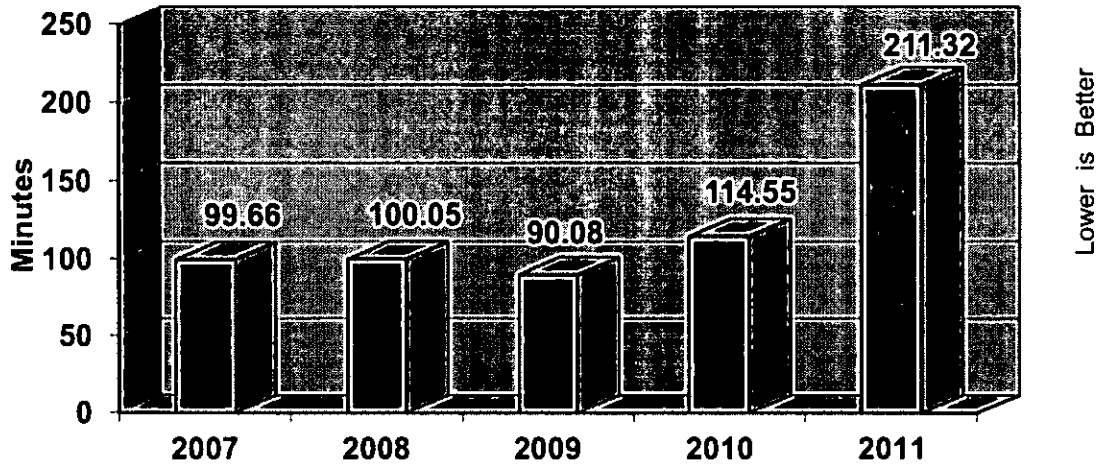


Figure 1 shows the System Average Interruption Duration (SAIDI) indices for the past five years. It shows that the 2011 SAIDI is 211.32 minutes, an 85% increase compared to the 2010 SAIDI result of 114.55 minutes. This increase is mainly due to the storm of March 4, 2011. Excluding this storm would reduce the 2011 SAIDI by 100 minutes, bringing the 2011 result to be lower than the 2010 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)

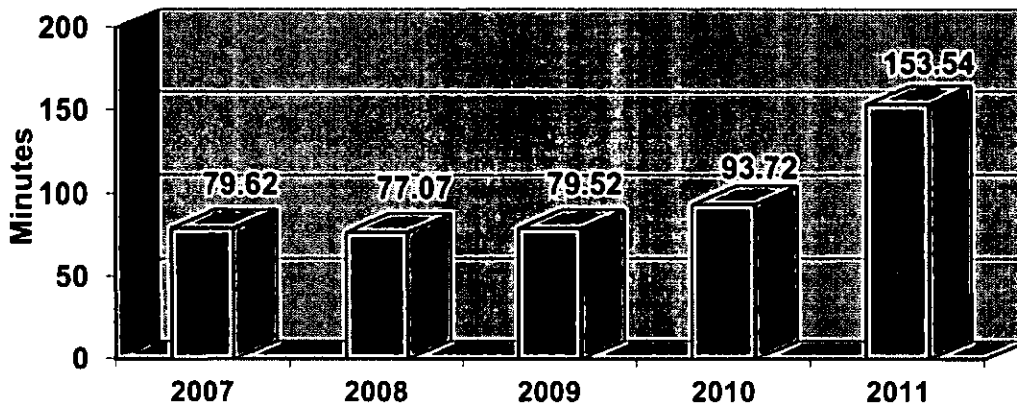


Figure 2 shows the Customer Average Interruption Duration (CAIDI) indices for the past five years. It shows that the average duration of a customer's outage (CAIDI) for 2011 is 153.54 minutes, a 64% increase compared to the 2010 CAIDI result of 93.72 minutes. This increase is due mainly to the March 4, 2011 storm. Excluding this storm would reduce the 2011 annual CAIDI by 56 minutes, bringing it on par with the 2010 CAIDI.

The three major events affecting the 2011 CAIDI results were:

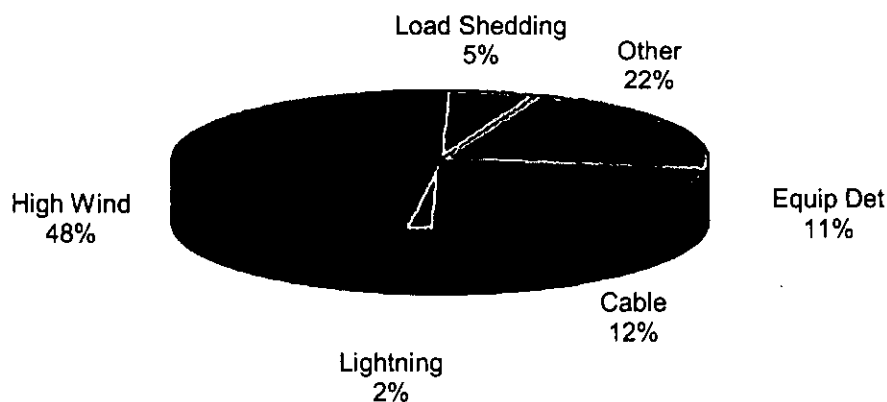
1. March 4, 2011 – Starting in the early morning, high winds and rainstorms across Oahu, especially on the Windward and Leeward sides of the island, caused numerous outages to over 43,000 customers. As stated in the letter to the Commission, dated April 29, 2011, “[a]t one point during the storm, approximately 14,000 customers were reported as being without electrical service.” These outages ranged in length from 39 minutes to the lengthiest duration of 6 days, 14 hours, and 24 minutes affecting 5 customers; where a felled tree took down 15 utility poles along Fort Weaver Road.

In addition, a strike by the company’s bargaining employees commenced at 3:30pm on March 4th and ended on March 11th, hampered restoration efforts. Management and contracted personnel were mobilized to the affected areas to respond to the outages. For the purpose of this report, outages occurring after 3:30pm on March 4, 2011 were normalized out, as noted in Table 2.

2. March 12, 2011 – A wooden pole fell on School Street in the Kalihi area affecting 1,388 customers from 34 minutes to 17 hours and 28 minutes.
3. June 3, 2011 - June 4, 2011 – A lightning storm over the island of Oahu affected about 19,228 customers from 47 minutes to 3 days, 10 hours and 17 minutes.

2011 experienced a large variety of storms from lightning storms spanning days and tens of thousands of land strikes, to excessive high wind situations and high winds blowing against their normal flow direction.

Figure 3: Outage Categories



The Top 5 Outage Categories, by number of customers affected, as illustrated in Figure 3, equates to about 78% of the total Customer Interruptions in 2011; 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. Lightning	lightning storms,
4. High Wind	objects blown into lines, conductor swing shorts,
5. Load Shedding	loss of Generation

The major cause factors for 2010 were similar, except "Auto Accidents" and "Unknown" were replaced by "Lightning" and "Load Shedding" in 2011.

The total number of customer interruptions in 2011 was 408,329 compared with 361,334 interruptions in 2010. In the five year period, 2011 was the worst performing year for the number of interruptions. The number of Customer Interruptions due to "Cable Faults" increased from 74,790 in 2010 to 84,523 in 2011, an increase of 13%. Although the customer interruptions due to "Cable Faults" increased, the percentage of cable faults versus all interruptions decreased from 18% to 12%. The increase in outages due to "High Winds" went from 30,532 in 2010 to 57,562 in 2011, an 89% increase. In 2011, the high wind periods in March contributed to the large increase in the number of outages, amounting to 47,231 interruptions. However, the number of Customer Interruptions due to "Equipment Deterioration" decreased from 86,108 in 2010 to 55,216 in 2011, an improvement of 36%.

In 2011, there were two events that resulted in the loss of more than 10,000 customers. On November 29, 2011, the island experienced a load shedding event due to the loss of two generating units, affecting 34,464 customers. On June 4, 2011 at 9 pm, lightning caused the loss of two sub-transmission lines resulting in 10,881 customers losing power for 47 minutes to 2 hours and 3 minutes. In 2010, there were no single events that resulted in the sustained interruptions of more than 10,000 customers.

Figure 4: System Average Interruption Frequency Index (SAIFI)

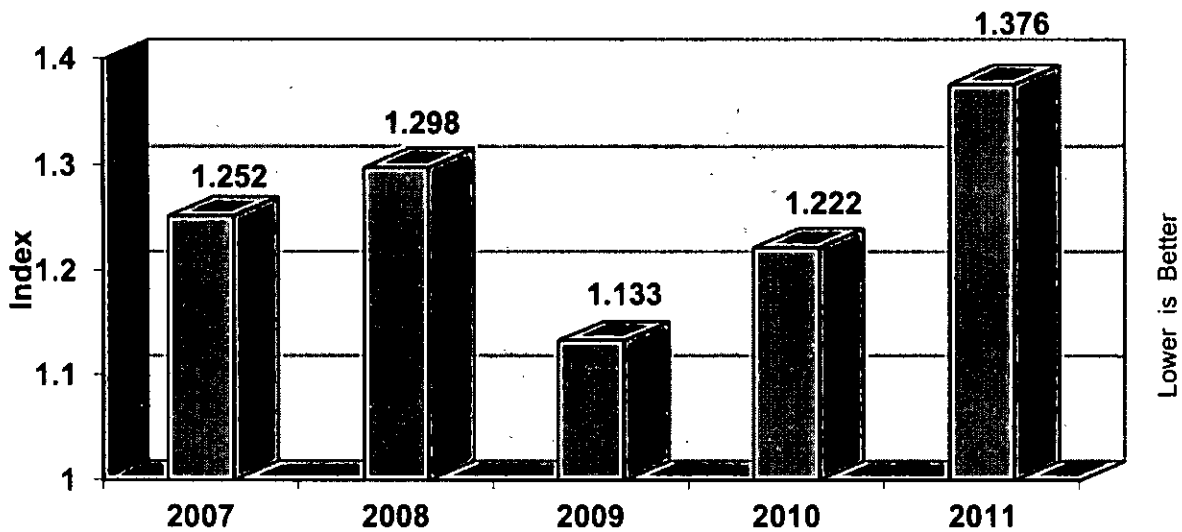


Figure 4 shows the System Average Interruption Frequency Index (SAIFI) for the past five years. It shows that the 2011 SAIFI of 1.376 was the highest index in the past five years, increasing again from the 30 year low of 1.133 in 2009.

Figure 5: Average Service Availability Index (ASAI)

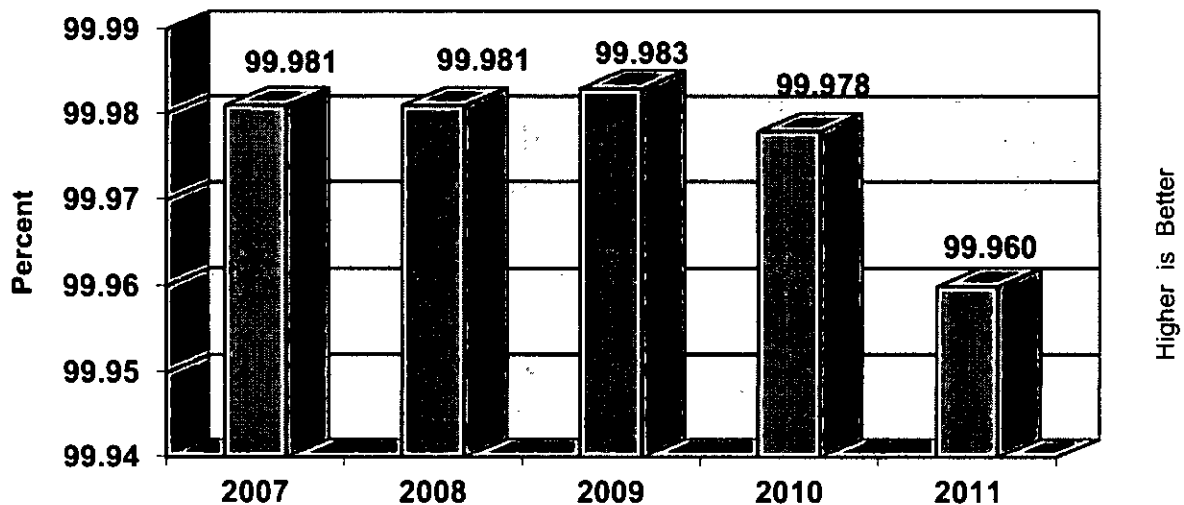


Figure 5 shows that the 2011 ASAI index decreased when compared to the 2010 results after a period of increases (higher is better) from 2007 to 2009. Approximately 46,995 more customers experienced sustained service interruptions during 2011 compared to the previous year, an increase of 13%, thus causing the ASAI to decrease from 99.978% to 99.960%.

Hawaiian Electric Company Normalized Sustained Interruption Summary

From: January 1, 2011

To: December 31, 2011

Outage Cause	Customer Hours	Customer Interruptions	SAIFI	SAIDI	CAIDI
CABLE FAULT	124,571.93	84,523	0.285	25.19	88.43
HIGH WINDS	511,318.33	57,562	0.194	103.41	532.97
EQUIP DETERIORATION	113,703.70	55,215	0.186	23.00	123.56
LIGHTNING	58,904.68	24,693	0.083	11.91	143.13
AUTO ACCIDENT	36,801.08	20,548	0.069	7.44	107.46
UNKNOWN	31,049.43	19,987	0.067	6.28	93.21
FORCED MAINTENANCE	12,681.08	19,591	0.066	2.56	38.84
TREES/BRANCHES IN LINES	30,380.25	18,596	0.063	6.14	98.02
FAULTY EQUIP OPERATION	14,781.40	16,174	0.055	2.99	54.83
AUTO UF LOADSHED	8,009.23	13,115	0.044	1.62	36.64
MANUAL UF LOADSHED	10,725.03	11,340	0.038	2.17	56.75
COMPANY PERSONNEL ERROR	3,091.50	10,861	0.037	0.63	17.08
SCHEDULED MAINTENANCE	29,625.12	7,214	0.024	5.99	246.40
FLASHOVER	4,859.25	6,084	0.021	0.98	47.92
FOREIGN OBJECT IN LINES	5,165.17	6,003	0.020	1.04	51.63
ANIMAL IN LINES	5,025.87	5,421	0.018	1.02	55.63
MYLAR BALLOON	3,957.27	5,176	0.017	0.80	45.87
CONTAMINATION FLASHOVER	7,483.28	4,450	0.015	1.51	100.90
COMPANY SWITCHING ERROR	2,375.07	4,182	0.014	0.48	34.08
TRANSFORM OVERLOAD	5,280.23	3,958	0.013	1.07	80.04
TRANSFORMER FAILURE	8,239.57	3,312	0.011	1.67	149.27
FIRE	1,963.13	2,286	0.008	0.40	51.53
VANDALISM	5,957.65	2,095	0.007	1.20	170.62
CUSTOMER EQUIP	1,027.28	2,080	0.007	0.21	29.63
OVERGROWN VEGETATION	3,388.90	1,861	0.006	0.69	109.26
CONSTRUCTION ACCIDENT	4,028.67	1,673	0.006	0.81	144.48
EQUIP OVERLOAD	506.15	322	0.001	0.10	94.31
MOVING EQUIP ACCIDENT	4.13	4	0.000	0.00	62.00
MAN IN LINES	0.00	0	0.000	0.00	0.00
OTHER	0.00	0	0.000	0.00	0.00
TRANSFER LOAD MAINTENANCE	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
EQUIP ROT OR TERMITES	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
SWITCH LOAD MAINTENANCE	0.00	0	0.000	0.00	0.00
OTHER-GENERATION	0.00	0	0.000	0.00	0.00
CUSTOMER MAINTENANCE	0.00	0	0.000	0.00	0.00
IPP EQUIP FAILURE	0.00	0	0.000	0.00	0.00
Total	1,044,904.40	408,326	1.376	211.32	153.54

AVERAGE SYSTEM AVAILABILITY = 99.960%
 NUMBER OF CUSTOMERS FOR THE PERIOD = 296,679
 AUTO-TRANSFER MOMENTARY CUSTOMER INTERRUPTIONS FOR THE PERIOD = 228,591
 AUTO-TRANSFER MAIFI = 0.770
 24 MONTH ANNUALIZED SAIDI AVERAGE FOR THE PERIOD 1/1/2010 - 12/31/2011 = 163.02
 24 MONTH AVERAGE NUMBER OF CUSTOMERS FOR THE PERIOD 1/1/2010 - 12/31/2011 = 296,158

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, 2011

To: December 31, 2011

Outage Cause	<u>Interruptions</u>		<u>Customer Hours</u>	
	Number	% of Total	Number	% of Total
<u>ACCIDENT</u>	56	2.56	40,833.88	3.91
CONSTRUCTION ACCIDENT	13	0.60	4,028.67	0.39
MOVING EQUIP ACCIDENT	3	0.14	4.13	0.00
AUTO ACCIDENT	40	1.83	36,801.08	3.52
<u>CABLE FAULT</u>	600	27.47	124,571.93	11.92
CABLE FAULT	600	27.47	124,571.93	11.92
<u>COMPANY ERROR</u>	34	1.56	5,466.57	0.52
COMPANY PERSONNEL ERROR	22	1.01	3,091.50	0.30
COMPANY SWITCHING ERROR	12	0.55	2,375.07	0.23
<u>EQUIPMENT</u>	321	14.70	130,018.53	12.44
IPP EQUIP FAILURE	0	0.00	0.00	0.00
MANUFACTURER EQUIP DEFECT	0	0.00	0.00	0.00
EQUIP OVERLOAD	3	0.14	506.15	0.05
EQUIP DETERIORATION	278	12.73	113,703.70	10.88
CUSTOMER EQUIP	20	0.92	1,027.28	0.10
EQUIP ROT OR TERMITES	0	0.00	0.00	0.00
FAULTY EQUIP OPERATION	20	0.92	14,781.40	1.41
<u>FIRE</u>	5	0.23	1,963.13	0.19
FIRE	5	0.23	1,963.13	0.19
<u>FLASHOVER</u>	17	0.78	12,342.53	1.18
FLASHOVER	15	0.69	4,859.25	0.47
CONTAMINATION FLASHOVER	2	0.09	7,483.28	0.72
<u>GENERATION</u>	16	0.73	18,734.27	1.79
MANUAL UF LOADSHED	4	0.18	10,725.03	1.03
AUTO UF LOADSHED	12	0.55	8,009.23	0.77
OTHER-GENERATION	0	0.00	0.00	0.00
<u>MAINTENANCE</u>	570	26.10	42,306.20	4.05
SCHEDULED MAINTENANCE	468	21.43	29,625.12	2.84
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	102	4.67	12,681.08	1.21
TRANSFER LOAD MAINTENANCE	0	0.00	0.00	0.00
<u>OBJECT IN LINES OR EQUIP</u>	44	2.01	14,148.30	1.35
ANIMAL IN LINES	17	0.78	5,025.87	0.48
MYLAR BALLOON	16	0.73	3,957.27	0.38
MAN IN LINES	0	0.00	0.00	0.00
FOREIGN OBJECT IN LINES	11	0.50	5,165.17	0.49
<u>OTHER</u>	0	0.00	0.00	0.00
OTHER	0	0.00	0.00	0.00
<u>TRANSFORMER</u>	171	7.83	13,519.80	1.29
TRANSFORMER FAILURE	97	4.44	8,239.57	0.79
TRANSFORM OVERLOAD	74	3.39	5,280.23	0.51
<u>UNKNOWN</u>	71	3.25	31,049.43	2.97
UNKNOWN	71	3.25	31,049.43	2.97

Hawaiian Electric Company Normalized Sustained Interruption Summary

From: January 1, 2011

To: December 31, 2011

Outage Cause	<u>Interruptions</u>		<u>Customer Hours</u>	
	Number	% of Total	Number	% of Total
<u>VANDALISM</u>	8	0.37	5,957.65	0.57
VANDALISM	8	0.37	5,957.65	0.57
<u>VEGETATION</u>	98	4.49	33,769.15	3.23
TREES/BRANCHES IN LINES	93	4.26	30,380.25	2.91
OVERGROWN VEGETATION	5	0.23	3,388.90	0.32
<u>WEATHER</u>	173	7.92	570,223.02	54.57
NATURAL DISASTER	0	0.00	0.00	0.00
HIGH WINDS	72	3.30	511,318.33	48.93
LIGHTNING	101	4.62	58,904.68	5.64
LANDSLIDE/FLOODING	0	0.00	0.00	0.00
Total:	2,184	1,044,904.40		

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.

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