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Jay M. Ignacio, P.E.  
*President*

May 18, 2010

PUBLIC UTILITIES  
COMMISSION

2010 MAY 18 P 3:48

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

Dear Commissioners:

Subject: HELCO Annual Service Reliability Report for 2009

Hawaii Electric Light Company, Inc. respectfully submits a copy of its Annual Service Reliability Report for the year 2009.

Sincerely,

Attachment

c: Division of Consumer Advocacy (with Attachment)



Hawaii Electric Light Co., Inc.

# **ANNUAL SERVICE RELIABILITY REPORT**

## **2009**

Prepared By:

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Manager  
Distribution Department

May 6, 2010

Hawaii Electric Light Company, Inc.  
Annual Service Reliability Report 2009

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## INTRODUCTION

The 2009 service reliability indices and the system reliability indices for the past five years are provided to depict HELCO's quality of service. A summary of 2009 system reliability data is provided in the subsequent sections. Definitions of terms and descriptions of the reliability indices are attached in Appendices A and B. Reliability data are presented in tables and graphs contained in Appendices C through E.

## SUMMARY OF 2009 RELIABILITY DATA

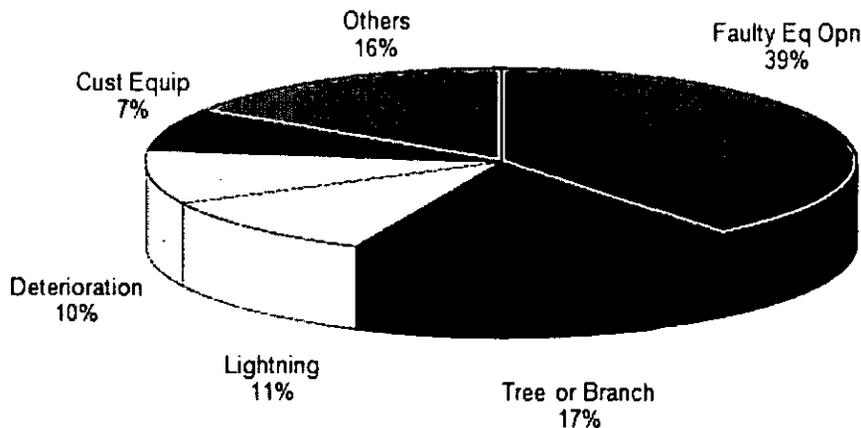
The average customer count increased 0.37% from 79,386 in 2008 to 79,679 in 2009.

On a Not-Normalized basis, in 2009 a total of 298,334 Customer Interruptions were recorded for a total of 246,916 Customer Hours of Interruption. The System Average Interruption Frequency (SAIF) index was 3.744 and the Customer Average Interruption Duration (CAID) was 49.66 minutes.

On the Normalized basis, a total of 246,437 Customer Interruptions were recorded for a total of 197,371 Customer Hours of Interruptions. The System Average Interruption Frequency (SAIF) index was 3.093 and the Customer Average Interruption Duration (CAID) was 48.05 minutes.

On a Not-Normalized basis, the following were the leading causes of customer interruptions in 2009:

1. **Faulty Equipment Operation.** There were 117,361 Customer Interruptions, 112,196 (96%) of those were related to HELCO Generation.
2. **Trees and Branches.** There were 51,754 Customer Interruptions.
3. **Lightning.** There were 32,419 Customer Interruptions.
4. **Deterioration.** There were 28,362 Customer Interruptions.
5. **Failure of Customer Equipment.** There were 20,666 Customer Interruptions, 20,660 (nearly 100%) of those were related to Independent Power Producers (non-HELCO Generation).



There were 132,856 generation related Customer Interruptions in 2009, of which 112,196 were related to HELCO Generation sources (84%) and 20,660 were related to Independent Power Producer (non-HELCO Generation) sources (16%). In 2009 Hamakua Energy Partners (HEP) and Pakini Nui Windfarm were the non-HELCO generation sources that caused customer interruptions.

HELCO normalized data per guidelines specified in a special report on reliability prepared for the Public Utilities Commission. This report, "Methodology for Determining Reliability Indices for HECO Utilities", dated December 1990, indicates that normalization may be utilized for "abnormal" situations such as hurricanes, tsunamis, earthquakes, floods, catastrophic equipment failures, and a single equipment outage that cascades into a loss of load that is greater than 10% of the system peak load. HELCO normalized three events in 2009:

- Transmission line insulator failure that lead to an Underfrequency Loadshedding event on June 25 and isolated HRD Windfarm, resulted in 11,654 Customer Interruptions and 6,065 Customer Hours of Interruptions.
- Underfrequency Loadshedding event on September 22 due to Keahole ST-7 tripping off-line while exporting 12.6MW resulted in 11,635 Customer Interruptions and 1,700 Customer Hours of Interruption.
- Lightning storm on December 19-20 affecting customers in the Puna area resulted in 28,608 Customer Interruptions and 41,779 Customer Hours of Interruptions

Significant interruptions, contributing more than 5,000 Customer Interruptions (CI) or Customer Interruption Duration (CID) greater than 5,000 Customer Hours of Interruption, that did not meet the normalization criteria were:

<u>Date</u>	<u>Problem</u>	<u>CI</u>	<u>CID</u>
January 15	Trees & Branches contacted transmission lines in the Lower Puna area during windy conditions.	8,960	194
February 5	Underfrequency Loadshedding – Hill 6 Tripped offline.	7,647	2,310
March 19	Distribution capacitor bank failed and caused distribution circuit to trip.	3,385	6,714
March 20	Underfrequency Loadshedding – Pakini Nui Windfarm trip following fault at South Point Substation.	5,499	605
April 25	Scheduled maintenance for North Kohala	1,935	13,821
May 21	Underfrequency Loadshedding – Puna CT-3	9,723	303

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<u>Date</u>	<u>Problem</u>	<u>CI</u>	<u>CID</u>
July 8	Underfrequency Loadshedding – Keahole CT-4	12,094	4,206
July 14	Underfrequency Loadshedding – Keahole CT-4	12,094	1,083
August 13	Underfrequency Loadshedding – Keahole CT-5	10,521	743
September 25	Failed insulator bolt on distribution circuit	3,400	6,037
September 29	Tree fell on lines affecting distribution circuit	3,400	6,592
October 3	Tree fell on transmission lines	2,122	6,207
October 14	Underfrequency Loadshedding – Hamakua Energy Partners	10,549	579
October 20	Tree fell on lines affecting distribution circuit	661	5,519
October 23	Underfrequency Loadshedding – Keahole ST-7	8,618	418
November 18	Underfrequency Loadshedding – Hamakua Energy Partners	6,117	510
November 30	Underfrequency Loadshedding – Keahole CT-5	8,618	592
December 3	Underfrequency Loadshedding – Keahole CT-5	<u>8,618</u>	<u>536</u>
	<b>Total</b>	<b>123,961</b>	<b>56,969</b>

## **APPENDIX A DEFINITION OF TERMS**

### **OUTAGE**

The state of 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 customers depending on system configuration.

### **INTERRUPTION**

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

### **INTERRUPTION DURATION**

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

### **MOMENTARY INTERRUPTION**

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

### **SUSTAINED INTERRUPTION**

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

### **CUSTOMER INTERRUPTION**

One interruption of one customer. NOTE: Interruption to customers at their request (e.g., customer maintenance) is not considered.

## **APPENDIX B RELIABILITY INDICES**

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

### **AVERAGE SERVICE AVAILABILITY 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 who are affected by the length of time they are affected.

### **SYSTEM AVERAGE INTERRUPTION FREQUENCY INDEX (SAIF)**

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

### **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.

These three reliability indices give a good indication of how reliable the electrical service is to the customer:

1. Is electrical service available most of the time (ASA).
2. How often an outage occurs (SAIF).
3. How long the outage might last (CAID).

The average number of customers on the system for the year is used for the value of number of customers served during the year and only sustained interruptions are considered.

**APPENDIX C**  
**ALL CAUSES**  
**2004-2009 Annual Service Reliability Indices**

**Normalized**

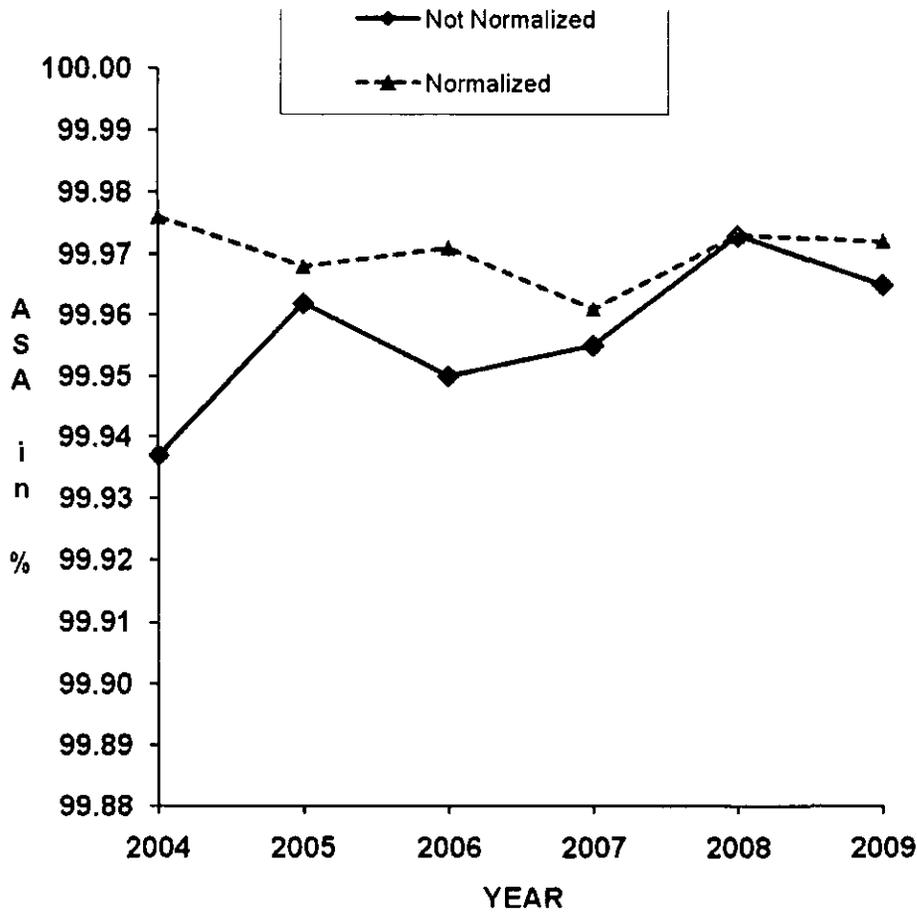
<b>Year</b>	<b>ASA</b>	<b>Number of Customers</b>	<b>Customer Interruptions</b>	<b>CID</b>	<b>SAIF</b>	<b>CAID</b>
2004	99.976	70,124	163,745	150,905	2.335	55.30
2005	99.968	72,513	153,982	200,374	2.124	78.08
2006	99.971	75,353	188,602	190,061	2.503	60.46
2007	99.961	77,933	208,000	269,475	2.669	77.73
2008	99.973	79,386	179,862	189,156	2.266	63.10
2009	99.972	79,679	246,437	197,371	3.093	48.05

**Not-Normalized**

<b>Year</b>	<b>ASA</b>	<b>Number of Customers</b>	<b>Customer Interruptions</b>	<b>CID</b>	<b>SAIF</b>	<b>CAID</b>
2004	99.937	70,124	417,462	388,891	5.953	55.89
2005	99.962	72,513	246,557	239,935	3.400	58.39
2006	99.950	75,353	341,289	328,758	4.529	57.80
2007	99.955	77,933	257,924	305,681	3.310	71.11
2008	99.973	79,386	194,807	190,314	2.454	58.62
2009	99.965	79,679	298,334	246,916	3.744	49.66

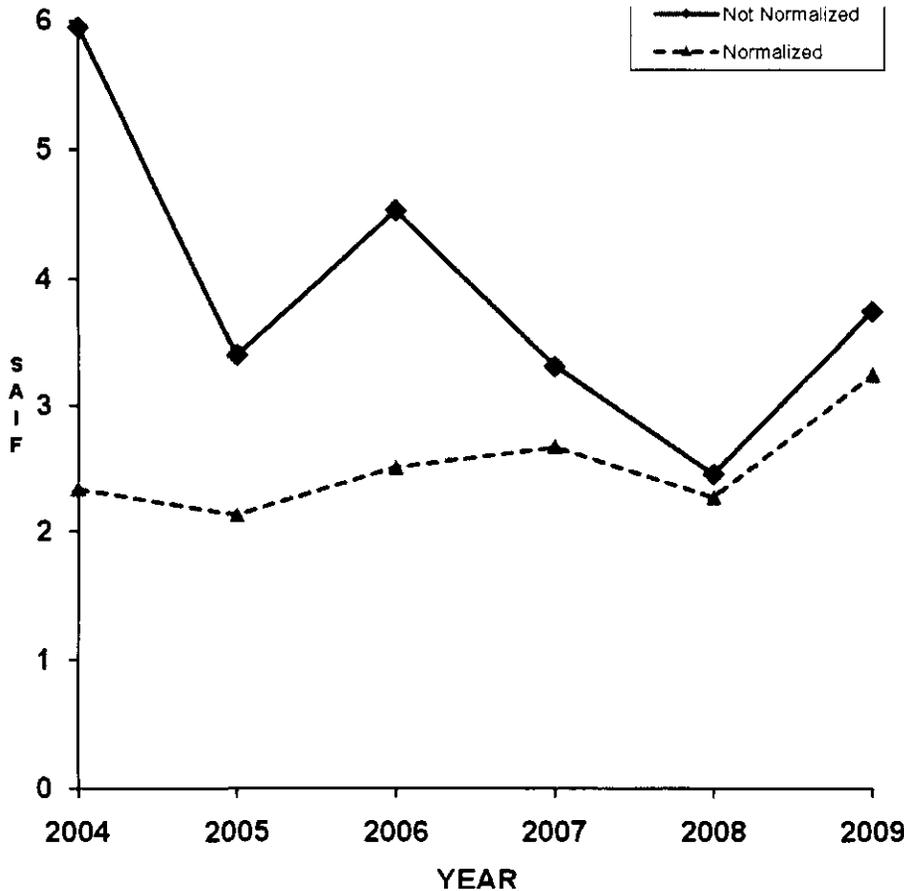
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**AVERAGE SERVICE AVAILABILITY INDEX  
(ASA IN %)**



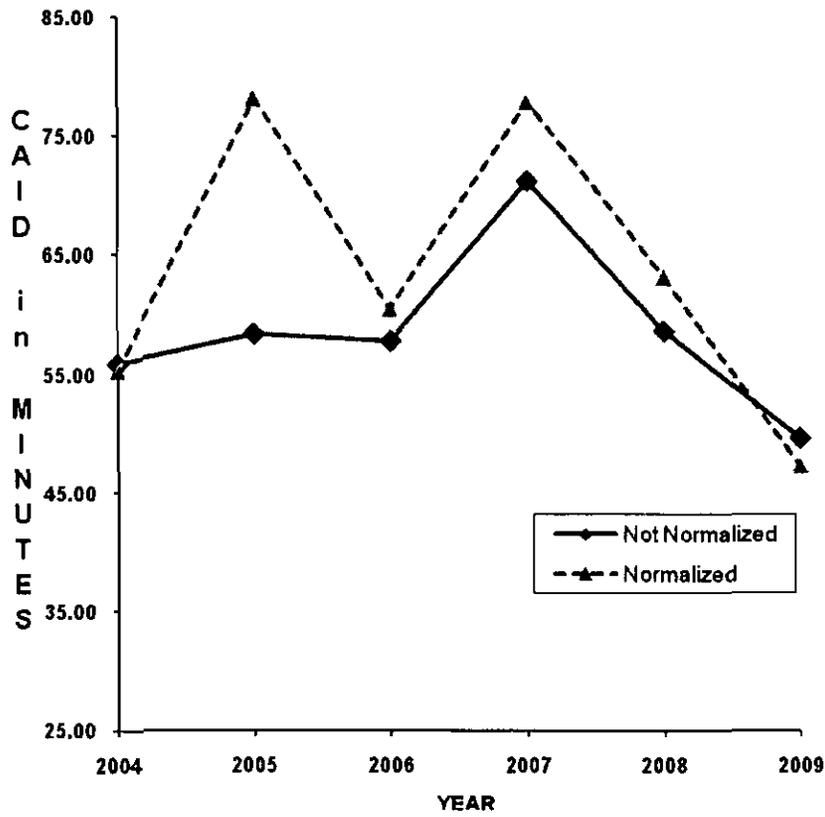
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**SYSTEM AVERAGE INTERRUPTION FREQUENCY  
(SAIF)**



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### CUSTOMER AVERAGE INTERRUPTION DURATION (CAID)



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**2009**  
**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 Equip Opn	12003.0	105726	1.327	9.04	6.81	6
Tree or Branches	68445.8	51732	0.649	51.54	79.39	1
Customer Equip	1238.8	20666	0.259	0.93	3.60	14
Deterioration	22684.1	16707	0.210	17.08	81.47	3
Auto Accident	14897.3	7794	0.098	11.22	114.68	4
Equip Failure	9218.1	6611	0.083	6.94	83.66	8
Cable Fault	13140.8	6418	0.081	9.90	122.85	5
Man or Animal	2047.6	6311	0.079	1.54	19.47	12
Scheduled Maint	24426.7	5335	0.067	18.39	274.71	2
Other Persnl Err	3813.0	4918	0.062	2.87	46.52	10
Unknown	3689.1	4366	0.055	2.78	50.70	11
High Wind	11116.7	3853	0.048	8.37	173.11	7
Lightning	7330.7	3834	0.048	5.52	114.72	9
Forced Maint	1585.6	1598	0.020	1.19	59.53	13
Tsf Failure	967.6	226	0.003	0.73	256.89	15
Loose Connection	285.4	101	0.001	0.21	169.51	16
Equip Contact	88.6	87	0.001	0.07	61.08	19
Excavate Constr	100.4	63	0.001	0.08	95.63	18
Fire	272.4	32	0.000	0.21	510.75	17
Opn or Sw Error	3.7	28	0.000	0.00	8.00	22
Sys Add/Removal	8.7	21	0.000	0.01	24.71	20
Tsf Overload	4.0	8	0.000	0.00	30.00	21
Vandalism	1.9	1	0.000	0.00	113.00	23
Flashover	1.5	1	0.000	0.00	90.00	24
Balloon/Kite	0.0	0	0.000	0.00	0.00	31
Customer Maint	0.0	0	0.000	0.00	0.00	26
Balance Load	0.0	0	0.000	0.00	0.00	27
Transfer Load	0.0	0	0.000	0.00	0.00	28
Flood / Tsunami	0.0	0	0.000	0.00	0.00	29
Equip Overload	0.0	0	0.000	0.00	0.00	30
Foreign Objects	0.0	0	0.000	0.00	0.00	25
<b>TOTALS:</b>	<b>197371.3</b>	<b>246437</b>	<b>3.093</b>	<b>148.62</b>	<b>48.05</b>	

NUMBER OF CUSTOMERS FOR THE PERIOD =79679 ASA = 99.972%

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION (MINUTES)

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

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**2009**  
**SERVICE RELIABILITY SUMMARY**  
**Not-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 Equip Opn	13703.4	117361	1.473	10.32	7.01	6
Tree or Branches	68578.5	51754	0.650	51.64	79.51	1
Lightning	48955.4	32419	0.407	36.86	90.60	2
Deterioration	28770.4	28362	0.356	21.66	60.86	3
Customer Equip	1238.8	20666	0.259	0.93	3.60	14
Auto Accident	14897.3	7794	0.098	11.22	114.68	5
Equip Failure	9218.1	6611	0.083	6.94	83.66	9
Cable Fault	13140.8	6418	0.081	9.90	122.85	7
Man or Animal	2047.6	6311	0.079	1.54	19.47	12
Scheduled Maint	24426.7	5335	0.067	18.39	274.71	4
Other Persnl Err	3813.0	4918	0.062	2.87	46.52	10
Unknown	3689.1	4366	0.055	2.78	50.70	11
High Wind	11116.7	3853	0.048	8.37	173.11	8
Forced Maint	1585.6	1598	0.020	1.19	59.53	13
Tsf Failure	967.6	226	0.003	0.73	256.89	15
Loose Connection	285.4	101	0.001	0.21	169.51	16
Equip Contact	88.6	87	0.001	0.07	61.08	19
Excavate Constr	100.4	63	0.001	0.08	95.63	18
Fire	272.4	32	0.000	0.21	510.75	17
Opn or Sw Error	3.7	28	0.000	0.00	8.00	22
Sys Add/Removal	8.7	21	0.000	0.01	24.71	20
Tsf Overload	4.0	8	0.000	0.00	30.00	21
Vandalism	1.9	1	0.000	0.00	113.00	23
Flashover	1.5	1	0.000	0.00	90.00	24
Balloon/Kite	0.0	0	0.000	0.00	0.00	31
Customer Maint	0.0	0	0.000	0.00	0.00	26
Balance Load	0.0	0	0.000	0.00	0.00	27
Transfer Load	0.0	0	0.000	0.00	0.00	28
Flood / Tsunami	0.0	0	0.000	0.00	0.00	29
Equip Overload	0.0	0	0.000	0.00	0.00	30
Foreign Objects	0.0	0	0.000	0.00	0.00	25
TOTALS:	246915.5	298334	3.744	185.93	49.66	

NUMBER OF CUSTOMERS FOR THE PERIOD =79679 ASA = 99.965%

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION (MINUTES)

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

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**2009**  
**SYSTEM INTERRUPTION CAUSE REPORT**  
**Not-Normalized**

CAUSE		# of		Customer Hours	
		Interruptions			
<b>NON-CONNECTED SYSTEM EMERGENCY</b>	<b>(Totals)</b>	<b>389</b>	<b>24.24%</b>	<b>87225.5</b>	<b>35.33%</b>
Tree or Branches		306	19.07%	68578.5	27.77%
Auto Accident		38	2.37%	14897.3	6.03%
Man or Animal		15	0.93%	2047.6	0.83%
Equip Contact		11	0.69%	88.6	0.04%
Fire		7	0.44%	272.4	0.11%
Customer Equip		6	0.37%	1238.8	0.50%
Excavate Constr		4	0.25%	100.4	0.04%
Vandalism		1	0.06%	1.9	0.00%
Balloon/Kite		1	0.06%	0	0.00%
Foreign Objects		0	0.00%	0	0.00%
Flood/Tsunami		0	0.00%	0	0.00%
Transfer Load		0	0.00%	0	0.00%
Balance Load		0	0.00%	0	0.00%
<b>ERROR</b>	<b>(Totals)</b>	<b>25</b>	<b>1.56%</b>	<b>3816.7</b>	<b>1.55%</b>
Other Personl Err		23	1.43%	3813	1.54%
Opn or Sw Error		2	0.12%	3.7	0.00%
<b>WEATHER</b>	<b>(Totals)</b>	<b>264</b>	<b>16.45%</b>	<b>60072.1</b>	<b>24.33%</b>
Lightning		230	14.33%	48955.4	19.83%
High Wind		34	2.12%	11116.7	4.50%
<b>EQUIPMENT FAILURE</b>	<b>(Totals)</b>	<b>209</b>	<b>13.02%</b>	<b>65119.6</b>	<b>26.37%</b>
Deterioration		102	6.36%	28770.4	11.65%
Cable Fault		62	3.86%	13140.8	5.32%
Faulty Equip Opn		21	1.31%	13703.4	5.55%
Equip Failure		19	1.18%	9218.1	3.73%
Loose Connection		4	0.25%	285.4	0.12%
Flashover		1	0.06%	1.5	0.00%
Equip Overload		0	0.00%	0	0.00%
<b>TRANSFORMER FAILURE</b>	<b>(Totals)</b>	<b>63</b>	<b>3.93%</b>	<b>971.6</b>	<b>0.39%</b>
Tsf Failure		62	3.86%	967.6	0.39%
Tsf Overload		1	0.06%	4	0.00%
<b>UNKNOWN AFTER TESTS AND INSPECTIONS</b>	<b>(Totals)</b>	<b>89</b>	<b>5.55%</b>	<b>3689.1</b>	<b>1.49%</b>
Unknown		89	5.55%	3689.1	1.49%
<b>MAINTENANCE</b>	<b>(Totals)</b>	<b>564</b>	<b>35.14%</b>	<b>26012.3</b>	<b>10.53%</b>
Forced Maint		318	19.81%	1585.6	0.64%
Scheduled Maint		246	15.33%	24426.7	9.89%

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<b>SYSTEM ADDITIONS OR REMOVALS</b>	<b>(Totals)</b>	<b>2</b>	<b>0.12%</b>	<b>8.7</b>	<b>0.00%</b>
Sys Add/Removal		2	0.12%	8.7	0.00%
	<b>Totals</b>	<b>1605</b>		<b>246915.5</b>	

**APPENDIX D  
T&D vs GENERATION  
2004-2009 Service Reliability Indices  
Not-Normalized**

**T&D Related Outages Only**

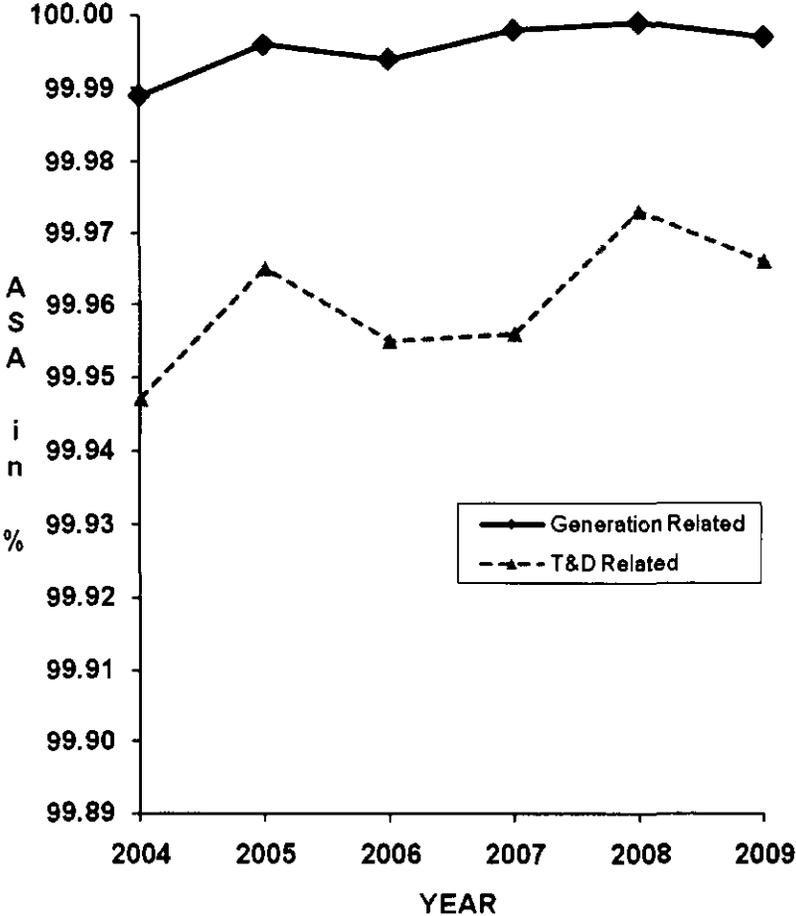
Year	ASA	Number of Customers	Customer Interruptions	CID	SAIF	CAID
2004	99.947	70,124	186,792	322,510	2.664	103.59
2005	99.965	72,513	140,092	219,045	1.932	93.81
2006	99.955	75,353	175,438	292,048	2.328	99.88
2007	99.956	77,933	165,461	294,463	2.123	106.78
2008	99.973	79,386	108,517	185,015	1.367	102.30
2009	99.966	79,679	165,478	232,344	2.077	84.24

**Generation Related Outages Only**

Year	ASA	Number of Customers	Customer Interruptions	CID	SAIF	CAID
2004	99.989	70,124	230,670	66,381	3.289	17.27
2005	99.996	72,513	106,465	20,890	1.468	11.77
2006	99.994	75,353	165,851	36,710	2.201	13.28
2007	99.998	77,933	92,463	11,218	1.186	7.28
2008	99.999	79,386	86,290	5,299	1.087	3.68
2009	99.997	79,679	132,856	14,572	1.667	6.58

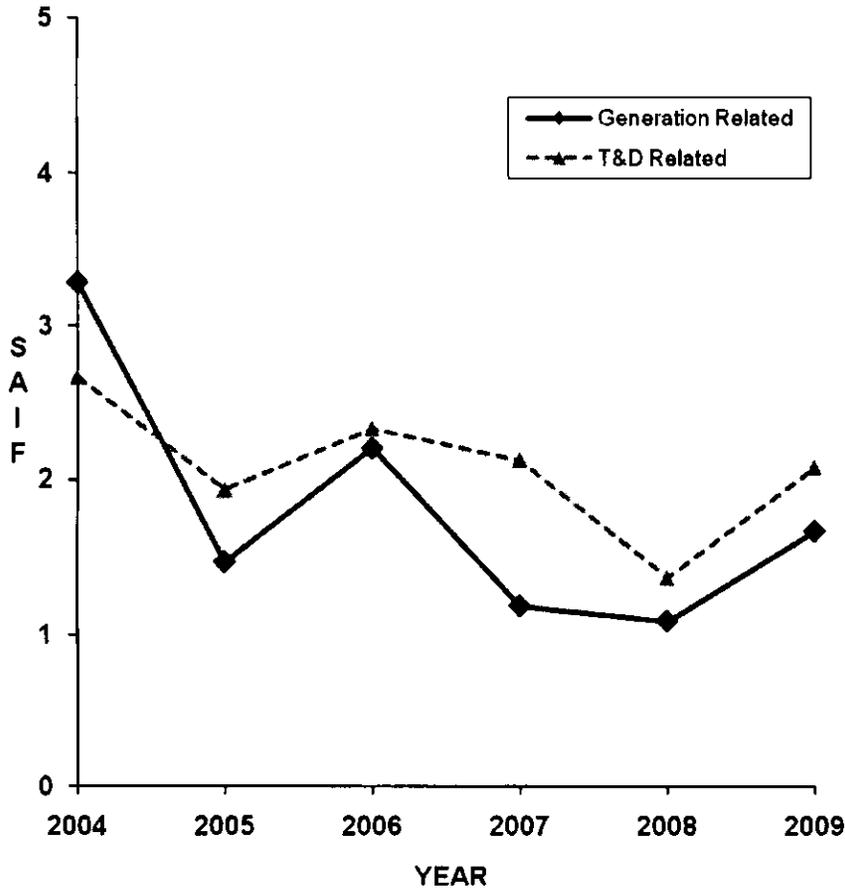
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**T&D vs. GENERATION**  
**AVERAGE SERVICE AVAILABILITY INDEX**  
**(ASA IN %)**  
**Not-Normalized**



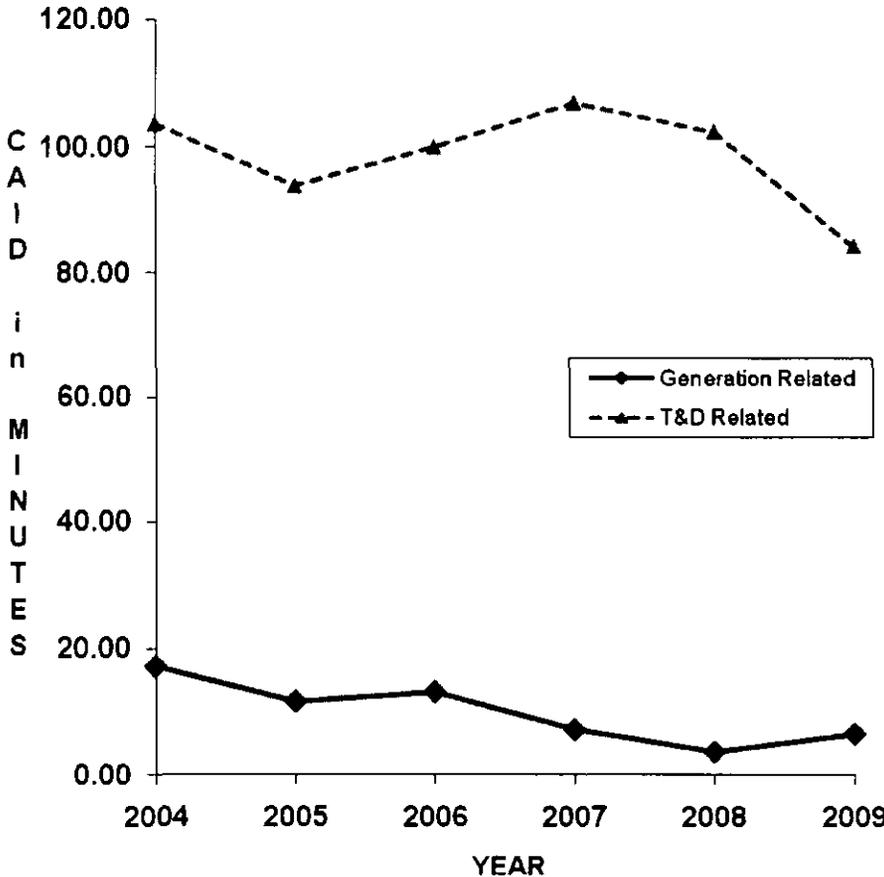
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Appendix D – T&D vs. Generation

**SYSTEM AVERAGE INTERRUPTION FREQUENCY  
(SAIF)  
Not-Normalized**



Hawaii Electric Light Company, Inc.  
Annual Service Reliability Report 2009  
Appendix D – T&D vs. Generation

**CUSTOMER AVERAGE INTERRUPTION DURATION  
(CAID)  
Not-Normalized**



Hawaii Electric Light Company, Inc.  
Annual Service Reliability Report 2009  
Appendix D – T&D vs. Generation

**2009**  
**T&D SERVICE RELIABILITY SUMMARY**  
**Not-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	68578.5	51754	0.650	51.64	79.51	1
Lightning	48955.4	32419	0.407	36.86	90.60	2
Deterioration	28770.4	28362	0.356	21.66	60.86	3
Auto Accident	14897.3	7794	0.098	11.22	114.68	5
Equip Failure	9218.1	6611	0.083	6.94	83.66	8
Cable Fault	13140.8	6418	0.081	9.90	122.85	6
Man or Animal	2047.6	6311	0.079	1.54	19.47	11
Scheduled Maint	24426.7	5335	0.067	18.39	274.71	4
Faulty Equip Opn	356.2	5165	0.065	0.27	4.14	14
Other Persnl Err	3813.0	4918	0.062	2.87	46.52	9
Unknown	3689.1	4366	0.055	2.78	50.70	10
High Wind	11116.7	3853	0.048	8.37	173.11	7
Forced Maint	1585.6	1598	0.020	1.19	59.53	12
Tsf Failure	967.6	226	0.003	0.73	256.89	13
Loose Connection	285.4	101	0.001	0.21	169.51	15
Equip Contact	88.6	87	0.001	0.07	61.08	18
Excavate Constr	100.4	63	0.001	0.08	95.63	17
Fire	272.4	32	0.000	0.21	510.75	16
Opn or Sw Error	3.7	28	0.000	0.00	8.00	22
Sys Add/Removal	8.7	21	0.000	0.01	24.71	20
Tsf Overload	4.0	8	0.000	0.00	30.00	21
Customer Equip	14.5	6	0.000	0.01	145.00	19
Vandalism	1.9	1	0.000	0.00	113.00	23
Flashover	1.5	1	0.000	0.00	90.00	24
Equip Overload	0.0	0	0.000	0.00	0.00	31
Foreign Objects	0.0	0	0.000	0.00	0.00	25
Balloon/Kite	0.0	0	0.000	0.00	0.00	26
Customer Maint	0.0	0	0.000	0.00	0.00	27
Balance Load	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:	232343.9	165478	2.077	174.96	84.24	

NUMBER OF CUSTOMERS FOR THE PERIOD = 79679

% ASA = 99.966

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION (MINUTES)

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

Hawaii Electric Light Company, Inc.  
Annual Service Reliability Report 2009  
Appendix D – T&D vs. Generation

**2009**  
**GENERATION SERVICE RELIABILITY SUMMARY**  
**Not-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 Equip Opn	13347.3	112196	1.408	10.05	7.14	1
Customer Equip	1224.3	20660	0.259	0.92	3.56	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
Equip Failure	0.0	0	0.000	0.00	0.00	4
Balloon/Kite	0.0	0	0.000	0.00	0.00	5
Other Persnl Err	0.0	0	0.000	0.00	0.00	6
Unknown	0.0	0	0.000	0.00	0.00	7
Customer Maint	0.0	0	0.000	0.00	0.00	8
Sys Add/Removal	0.0	0	0.000	0.00	0.00	9
Forced Maint	0.0	0	0.000	0.00	0.00	10
Scheduled Maint	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
Opn or Sw Error	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 Constr	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:	14571.6	132856	1.667	10.97	6.58	

NUMBER OF CUSTOMERS FOR THE PERIOD = 79679

% ASA = 99.997

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

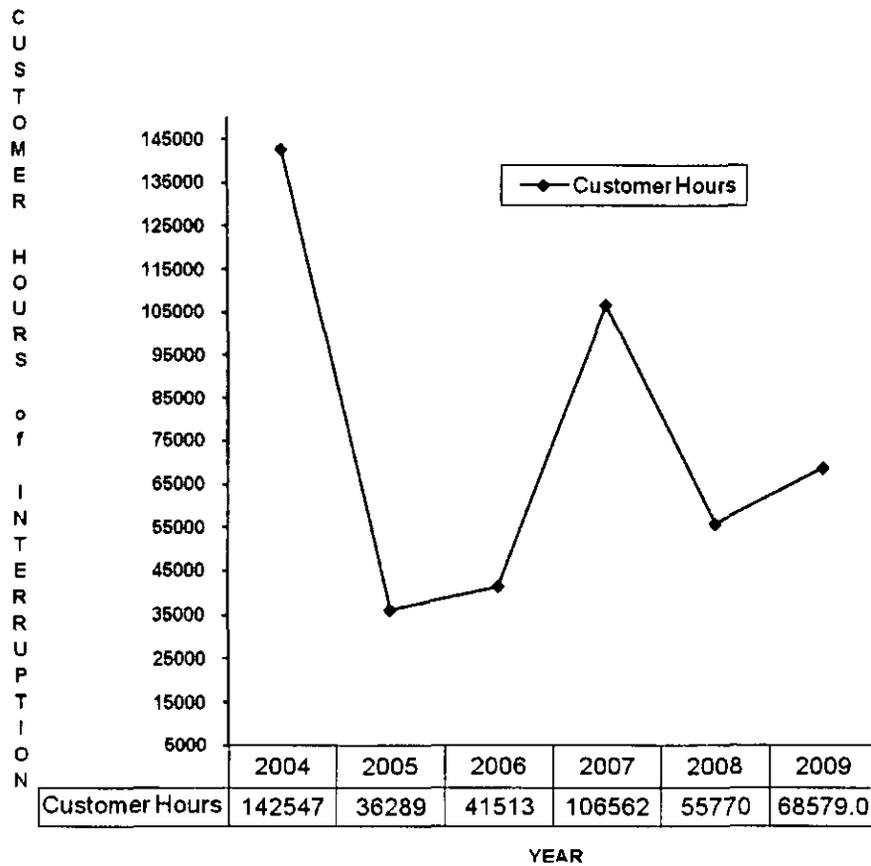
SAID = SYSTEM AVERAGE INTERRUPTION DURATION (MINUTES)

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

Hawaii Electric Light Company, Inc.  
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**2004-2009**  
**INTERRUPTIONS CAUSED BY TREES & BRANCHES**  
Not-Normalized



**APPENDIX E**  
**HELCO vs NON-HELCO GENERATION**  
**2004-2009 Service Reliability Indices**  
**Not-Normalized**

**HELCO Generation**

<b>Year</b>	<b>ASA</b>	<b>Number of Customers</b>	<b>Customer Interruptions</b>	<b>CID</b>	<b>SAIF</b>	<b>CAID</b>
2004	99.996	70,124	89,233	20,662	1.273	13.89
2005	99.997	72,513	69,509	14,314	0.959	12.36
2006	99.995	75,353	105,589	26,467	1.401	15.04
2007	99.999	77,933	28,246	3,349	0.362	7.11
2008	99.999	79,386	66,538	3,709	0.838	3.34
2009	99.998	79,679	112,196	13,347	1.408	7.14

**Non-HELCO Generation**

<b>Year</b>	<b>ASA</b>	<b>Number of Customers</b>	<b>Customer Interruptions</b>	<b>CID</b>	<b>SAIF</b>	<b>CAID</b>
2004	99.992	70,124	141,437	45,719	2.017	19.39
2005	99.998	72,513	36,956	6,577	0.510	10.68
2006	99.998	75,353	60,262	10,243	0.800	10.20
2007	99.998	77,933	64,217	7,869	0.824	7.35
2008	99.999	79,386	19,752	1,590	0.249	4.83
2009	99.999	79,679	20,660	1,224	0.259	3.56

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**2009**  
**HELCO GENERATION SERVICE RELIABILITY SUMMARY**  
**Not-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 Equip Opn	13347.3	112196	1.408	10.05	7.14	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
Equip Failure	0.0	0	0.000	0.00	0.00	3
Balloon/Kite	0.0	0	0.000	0.00	0.00	4
Other Persnl Err	0.0	0	0.000	0.00	0.00	5
Unknown	0.0	0	0.000	0.00	0.00	6
Customer Maint	0.0	0	0.000	0.00	0.00	7
Sys Add/Removal	0.0	0	0.000	0.00	0.00	8
Forced Maint	0.0	0	0.000	0.00	0.00	9
Scheduled Maint	0.0	0	0.000	0.00	0.00	10
Balance Load	0.0	0	0.000	0.00	0.00	11
Transfer Load	0.0	0	0.000	0.00	0.00	12
Flood / Tsunami	0.0	0	0.000	0.00	0.00	13
Customer Equip	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
Opn or Sw Error	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 Constr	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:	13347.3	112196	1.408	10.05	7.14	

NUMBER OF CUSTOMERS FOR THE PERIOD = 79679

% ASA = 99.998

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION (MINUTES)

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

Hawaii Electric Light Company, Inc.  
Annual Service Reliability Report 2009  
Appendix F – Normalized Data

**2009**  
**Non-HELCO GENERATION SERVICE RELIABILITY SUMMARY**  
**Not-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	1224.3	20660	0.259	0.92	3.56	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 Persnl Err	0.0	0	0.000	0.00	0.00	4
Unknown	0.0	0	0.000	0.00	0.00	5
Customer Maint	0.0	0	0.000	0.00	0.00	6
Sys Add/Removal	0.0	0	0.000	0.00	0.00	7
Forced Maint	0.0	0	0.000	0.00	0.00	8
Scheduled Maint	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
Opn or Sw Error	0.0	0	0.000	0.00	0.00	13
Faulty Equip Opn	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 Constr	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:	1224.3	20660	0.259	0.92	3.56	

NUMBER OF CUSTOMERS FOR THE PERIOD = 79679

% ASA = 99.999

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION (MINUTES)

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

Hawaii Electric Light Company, Inc.  
Annual Service Reliability Report 2009  
Appendix F – Normalized Data

**2009**  
**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	68445.8	51732	0.649	51.54	79.39	1
Deterioration	22684.1	16707	0.210	17.08	81.47	3
Auto Accident	14897.3	7794	0.098	11.22	114.68	4
Equip Failure	9218.1	6611	0.083	6.94	83.66	7
Cable Fault	13140.8	6418	0.081	9.90	122.85	5
Man or Animal	2047.6	6311	0.079	1.54	19.47	11
Scheduled Maint	24426.7	5335	0.067	18.39	274.71	2
Faulty Equip Opn	356.2	5165	0.065	0.27	4.14	14
Other Personl Err	3813.0	4918	0.062	2.87	46.52	9
Unknown	3689.1	4366	0.055	2.78	50.70	10
High Wind	11116.7	3853	0.048	8.37	173.11	6
Lightning	7330.7	3834	0.048	5.52	114.72	8
Forced Maint	1585.6	1598	0.020	1.19	59.53	12
Tsf Failure	967.6	226	0.003	0.73	256.89	13
Loose Connection	285.4	101	0.001	0.21	169.51	15
Equip Contact	88.6	87	0.001	0.07	61.08	18
Excavate Constr	100.4	63	0.001	0.08	95.63	17
Fire	272.4	32	0.000	0.21	510.75	16
Opn or Sw Error	3.7	28	0.000	0.00	8.00	22
Sys Add/Removal	8.7	21	0.000	0.01	24.71	20
Tsf Overload	4.0	8	0.000	0.00	30.00	21
Customer Equip	14.5	6	0.000	0.01	145.00	19
Vandalism	1.9	1	0.000	0.00	113.00	23
Flashover	1.5	1	0.000	0.00	90.00	24
Foreign Objects	0.0	0	0.000	0.00	0.00	25
Equip Overload	0.0	0	0.000	0.00	0.00	26
Flood/Tsunami	0.0	0	0.000	0.00	0.00	27
Transfer Load	0.0	0	0.000	0.00	0.00	28
Balance Load	0.0	0	0.000	0.00	0.00	29
Balloon/Kite	0.0	0	0.000	0.00	0.00	30
<b>TOTALS:</b>	<b>184500.2</b>	<b>125216</b>	<b>1.572</b>	<b>138.93</b>	<b>88.407</b>	

NUMBER OF CUSTOMERS FOR THE PERIOD = 79679

% ASA = 99.974

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION (MINUTES)

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

Hawaii Electric Light Company, Inc.  
Annual Service Reliability Report 2009  
Appendix F – Normalized Data

**2009**  
**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 Equip Opn	11646.8	100561	1.262	8.77	6.95	1
Customer Equip	1224.3	20660	0.259	0.92	3.56	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
Equip Failure	0.0	0	0.000	0.00	0.00	4
Balloon/Kite	0.0	0	0.000	0.00	0.00	5
Other Persnl Err	0.0	0	0.000	0.00	0.00	6
Unknown	0.0	0	0.000	0.00	0.00	7
Customer Maint	0.0	0	0.000	0.00	0.00	8
Sys Add/Removal	0.0	0	0.000	0.00	0.00	9
Forced Maint	0.0	0	0.000	0.00	0.00	10
Scheduled Maint	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
Opn or Sw Error	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 Constr	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
<b>TOTALS:</b>	<b>12871.1</b>	<b>121221</b>	<b>1.521</b>	<b>9.69</b>	<b>6.37</b>	

NUMBER OF CUSTOMERS FOR THE PERIOD = 79679

% ASA = 99.998

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION (MINUTES)

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF