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PUBLIC UTILITIES  
COMMISSION



Jay M. Ignacio, P.E.  
President

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: HELCO Annual Service Reliability Report for 2010

Hawaii Electric Light 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)



Hawaii Electric Light Co., Inc.

**ANNUAL SERVICE RELIABILITY REPORT**  
**2010**

Prepared By:

Roger Keller  
Manager  
Distribution Department

June 24, 2011

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## INTRODUCTION

The 2010 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 2010 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 2010 RELIABILITY DATA

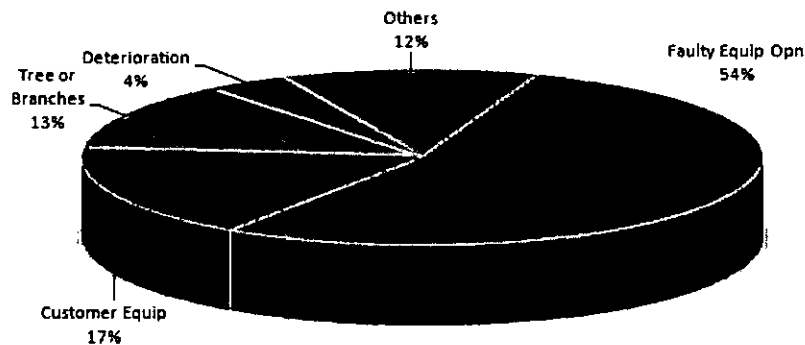
The average customer count increased 0.62% from 79,679 in 2009 to 80,171 in 2010.

On a Not-Normalized basis, in 2010, a total of 302,402 Customer Interruptions were recorded for a total of 207,607 Customer Hours of Interruption. The System Average Interruption Frequency (SAIF) index was 3.772 and the Customer Average Interruption Duration (CAID) was 41.19 minutes.

On the Normalized basis, a total of 176,622 Customer Interruptions were recorded for a total of 169,522 Customer Hours of Interruptions. The System Average Interruption Frequency (SAIF) index was 2.203 and the Customer Average Interruption Duration (CAID) was 57.59 minutes.

On a Not-Normalized basis, the following were the leading causes of customer interruptions in 2010:

1. **Faulty Equipment Operation.** There were 163,340 Customer Interruptions, 162,370 (99%) of those were related to HELCO Generation.
2. **Failure of Customer Equipment.** There were 51,726 Customer Interruptions, 51,711 (nearly 100%) of those were related to Independent Power Producers (non-HELCO Generation).
3. **Trees and Branches.** There were 38,489 Customer Interruptions.
4. **Deterioration.** There were 11,530 Customer Interruptions.



There were 214,081 generation related Customer Interruptions in 2010, of which 162,320 were related to HELCO Generation sources (76%) and 51,711 were related to Independent Power Producer (non-HELCO Generation) sources (24%). In 2010, 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 four events in 2010:

- Underfrequency Loadshedding event on January 26 due to Puna Plant tripping off-line resulted in 10,972 Customer Interruptions and 563 Customer Hours of Interruption.
- Underfrequency Loadshedding event on April 9 due to Keahole CT-5, CT-4 and ST-7 tripping off-line while exporting 48.1MW resulted in 28,229 Customer Interruptions and 5,524 Customer Hours of Interruption.
- Underfrequency Loadshedding event on July 3 when Keahole CT-5 tripped during on-line water wash, which caused other units to ramp-up. Other units that tripped were Keahole CT-4 and ST-7, HEP CT-1, CT-2, and ST, and HRD Windfarm. This resulted in 63,329 customers and 28,560 Customer Hours of Interruption.
- Underfrequency Loadshedding event on October 27 due to Keahole CT-4 tripping because of a speed probe problem. HEP followed and tripped due to high temperatures, which resulted in a total of 23,250 Customer Interruptions and 3,437 Customer Hours of Interruption.

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 17	Overhead conductors fell along Kahakai Boulevard due to deterioration.	1,635	5,480
February 22	Underfrequency Loadshedding – Keahole CT-5 tripped offline.	9,543	755
February 27	Underfrequency Loadshedding – Puna Steam unit tripped offline.	9,585	739
March 19	Underfrequency Loadshedding – Hamakua energy Partners CT-1 tripped offline.	5,406	455
April 24	Tree fell on lines affecting distribution circuit	3,282	5,074

<u>Date</u>	<u>Problem</u>	<u>CI</u>	<u>CID</u>
May 7	Tree branch touching transmission lines	2,742	8,394
May 24	Underfrequency Loadshedding – Keahole CT-4	10,774	1,215
June 8	Underfrequency Loadshedding – Keahole ST-7	5,406	269
July 7	Underfrequency Loadshedding – Keahole ST-7	10,870	1,003
July 22	Brush Fire caused Waimea CB 3301 to open	1,972	6,179
July 22	Waimea CB 3301 failure	1,972	14,139
August 12	Scheduled outage to do repairs at Waimea Switching Station.	1,989	16,176
August 22	Underfrequency Loadshedding – Kamaoa Wind Farm – broken breaker switch	10,902	730
November 18	Underfrequency Loadshedding – Keahole CT-5 and ST-7	16,328	2,698
December 4	Scheduled outage maintenance to Paauilo Substation	486	3,815
December 19	Tree fell on lines affecting distribution circuit	1,512	5,241
	<b>Total</b>	<b>94,404</b>	<b>72,362</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  
2005-2010 Annual Service Reliability Indices**

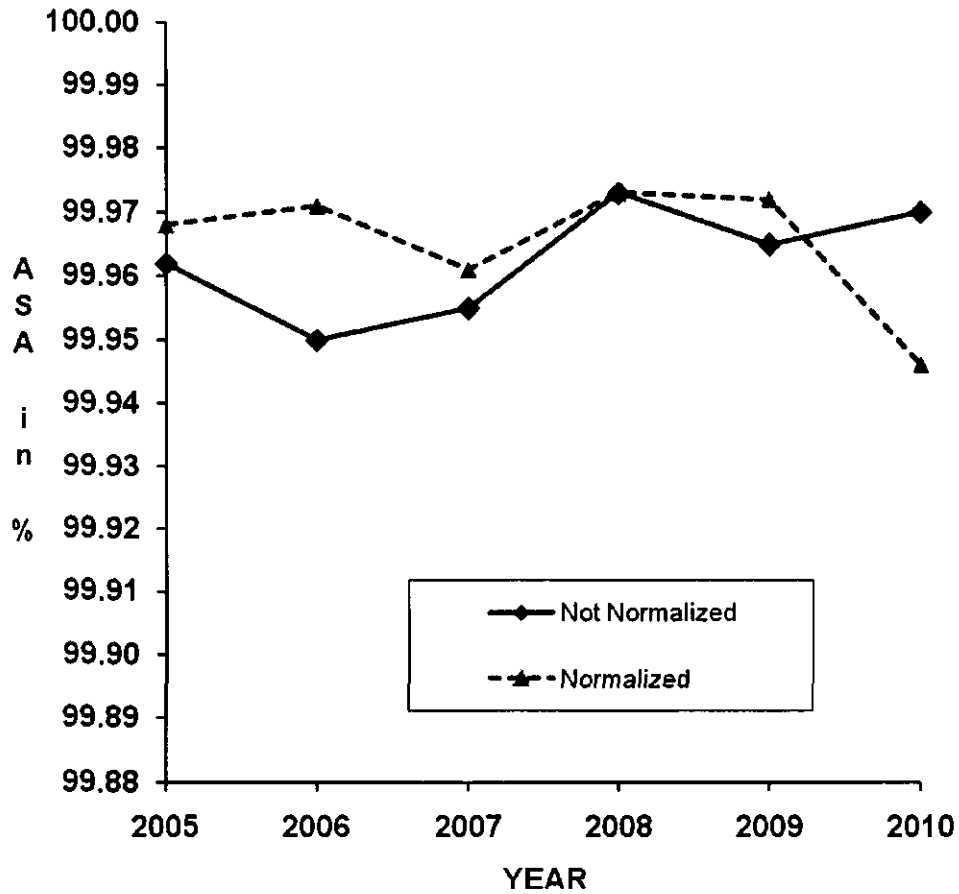
**Normalized**

<b>Year</b>	<b>ASA</b>	<b>Number of Customers</b>	<b>Customer Interruptions</b>	<b>CID</b>	<b>SAIF</b>	<b>CAID</b>
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
2010	99.946	80,171	176,622	169,522	2.203	57.59

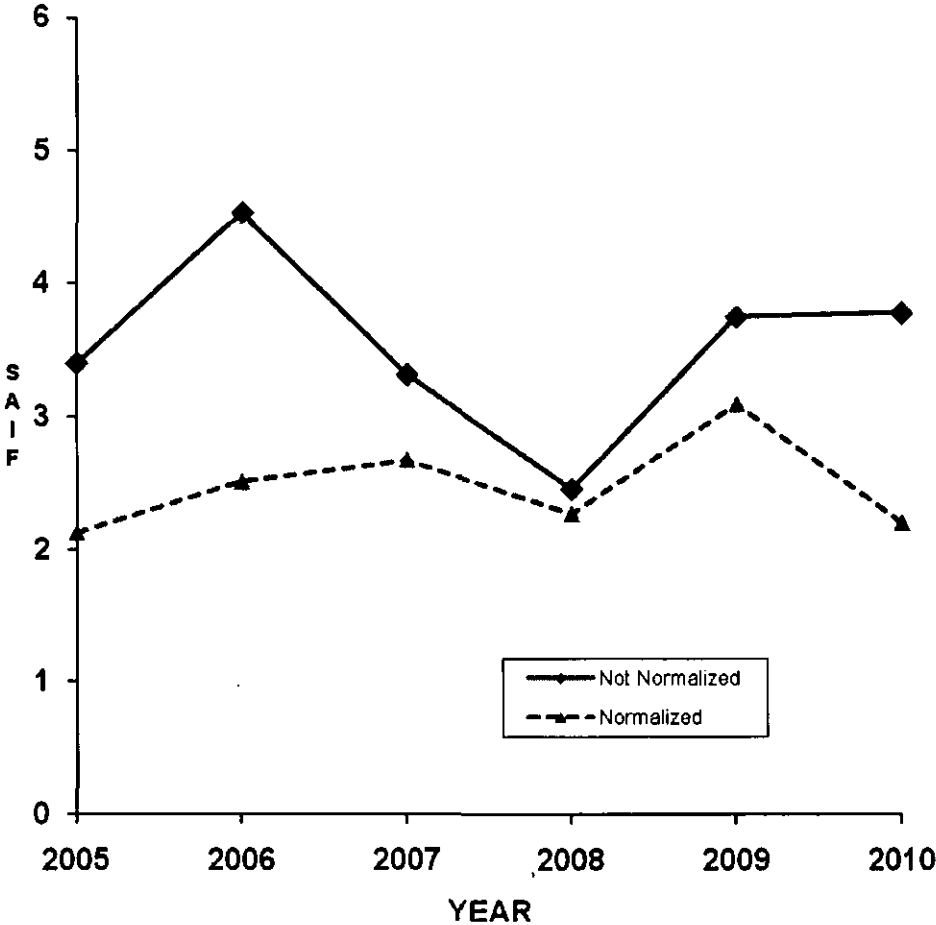
**Not-Normalized**

<b>Year</b>	<b>ASA</b>	<b>Number of Customers</b>	<b>Customer Interruptions</b>	<b>CID</b>	<b>SAIF</b>	<b>CAID</b>
2005	99.962	72,513	246,557	239,935	3.4	58.39
2006	99.95	75,353	341,289	328,758	4.529	57.80
2007	99.955	77,933	257,924	305,681	3.31	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
2010	99.97	80,171	302,402	207,607	3.772	41.19

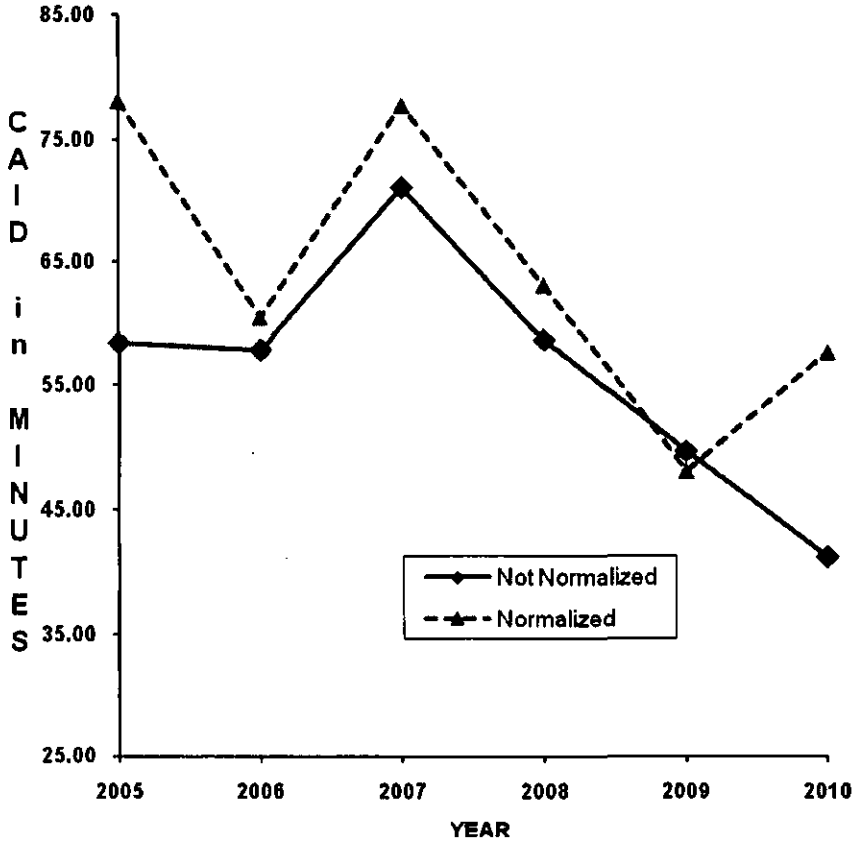
### AVERAGE SERVICE AVAILABILITY INDEX (ASA IN %)



### SYSTEM AVERAGE INTERRUPTION FREQUENCY (SAIF)



### CUSTOMER AVERAGE INTERRUPTION DURATION (CAID)



**2010**  
**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	8768.8	72963	0.910	6.56	7.21	6
Tree or Branches	58486.3	38489	0.480	43.77	91.17	1
Customer Equip	1273.3	16323	0.204	0.95	4.68	14
Deterioration	19001.1	11530	0.144	14.22	98.88	3
High Wind	4925.7	5507	0.069	3.69	53.67	8
Cable Fault	12854.4	5372	0.067	9.62	143.57	5
Forced Maint	3191.1	5115	0.064	2.39	37.43	11
Scheduled Maint	24414.4	4789	0.060	18.27	305.88	2
Equip Failure	16994.2	4029	0.050	12.72	253.08	4
Unknown	3363.7	2749	0.034	2.52	73.42	10
Other Persnl Err	221.3	2478	0.031	0.17	5.36	17
Fire	6925.5	2242	0.028	5.18	185.34	7
Auto Accident	3939.5	2008	0.025	2.95	117.71	9
Equip Contact	1310.9	1349	0.017	0.98	58.31	12
Opn or Sw Error	37.6	564	0.007	0.03	4.00	20
Lightning	1151.0	523	0.007	0.86	132.04	16
Tsf Failure	1285.6	220	0.003	0.96	350.62	13
Excavate Constr	1155.4	130	0.002	0.86	533.27	15
Flashover	18.7	98	0.001	0.01	11.43	22
Loose Connection	75.3	80	0.001	0.06	56.50	19
Man or Animal	86.8	54	0.001	0.06	96.39	18
Vandalism	36.2	8	0.000	0.03	271.50	21
Sys Add/Removal	5.6	2	0.000	0.00	168.00	23
Foreign Objects	0.0	0	0.000	0.00	0.00	30
Balloon/Kite	0.0	0	0.000	0.00	0.00	29
Balance Load	0.0	0	0.000	0.00	0.00	28
Transfer Load	0.0	0	0.000	0.00	0.00	27
Flood / Tsunami	0.0	0	0.000	0.00	0.00	26
Tsf Overload	0.0	0	0.000	0.00	0.00	24
Customer Maint	0.0	0	0.000	0.00	0.00	31
Equip Overload	0.0	0	0.000	0.00	0.00	25
<b>TOTAL</b>	<b>169522.3</b>	<b>176622</b>	<b>2.203</b>	<b>126.87</b>	<b>57.59</b>	

NUMBER OF CUSTOMERS FOR THE PERIOD 80171                      ASA = 99.976%

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

**2010**  
**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	32562.8	163340	2.037	24.37	11.96	2
Customer Equip	15563.8	51726	0.645	11.65	18.05	6
Tree or Branches	58486.3	38489	0.480	43.77	91.17	1
Deterioration	19001.1	11530	0.144	14.22	98.88	4
High Wind	4925.7	5507	0.069	3.69	53.67	9
Cable Fault	12854.4	5372	0.067	9.62	143.57	7
Forced Maint	3191.1	5115	0.064	2.39	37.43	12
Scheduled Maint	24414.4	4789	0.060	18.27	305.88	3
Equip Failure	16994.2	4029	0.050	12.72	253.08	5
Unknown	3363.7	2749	0.034	2.52	73.42	11
Other Persnl Err	221.3	2478	0.031	0.17	5.36	17
Fire	6925.5	2242	0.028	5.18	185.34	8
Auto Accident	3939.5	2008	0.025	2.95	117.71	10
Equip Contact	1310.9	1349	0.017	0.98	58.31	13
Opn or Sw Error	37.6	564	0.007	0.03	4.00	20
Lightning	1151.0	523	0.007	0.86	132.04	16
Tsf Failure	1285.6	220	0.003	0.96	350.62	14
Excavate Constr	1155.4	130	0.002	0.86	533.27	15
Flashover	18.7	98	0.001	0.01	11.43	22
Loose Connection	75.3	80	0.001	0.06	56.50	19
Man or Animal	86.8	54	0.001	0.06	96.39	18
Vandalism	36.2	8	0.000	0.03	271.50	21
Sys Add/Removal	5.6	2	0.000	0.00	168.00	23
Foreign Objects	0.0	0	0.000	0.00	0.00	30
Balloon/Kite	0.0	0	0.000	0.00	0.00	29
Balance Load	0.0	0	0.000	0.00	0.00	28
Transfer Load	0.0	0	0.000	0.00	0.00	27
Flood / Tsunami	0.0	0	0.000	0.00	0.00	26
Tsf Overload	0.0	0	0.000	0.00	0.00	24
Customer Maint	0.0	0	0.000	0.00	0.00	31
Equip Overload	0.0	0	0.000	0.00	0.00	25
<b>TOTAL</b>	<b>207606.7</b>	<b>302402</b>	<b>3.772</b>	<b>155.37</b>	<b>41.19</b>	

NUMBER OF CUSTOMERS FOR THE PERIOD=80171                      ASA = 99.970%

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

**2010**  
**SYSTEM INTERRUPTION CAUSE REPORT**  
**Not-Normalized**

CAUSE		# of		Customer Hours	
		Interruptions			
<b>NON-CONNECTED SYSTEM EMERGENCY</b>	(Totals)	<b>340</b>	<b>24.13%</b>	<b>87504.3</b>	<b>42.15%</b>
Tree or Branches		244	17.32%	58486.3	28.17%
Auto Accident		36	2.56%	3939.5	1.90%
Customer Equip		16	1.14%	15563.8	7.50%
Excavate Constr		15	1.06%	1155.4	0.56%
Man or Animal		13	0.92%	86.8	0.04%
Fire		7	0.50%	6925.5	3.34%
Equip Contact		6	0.43%	1310.9	0.63%
Vandalism		3	0.21%	36.2	0.02%
Foreign Objects		0	0.00%	0.0	0.00%
Flood/Tsunami		0	0.00%	0.0	0.00%
Transfer Load		0	0.00%	0.0	0.00%
Balance Load		0	0.00%	0.0	0.00%
Balloon/Kite		0	0.00%	0.0	0.00%
<b>ERROR</b>	(Totals)	<b>25</b>	<b>1.77%</b>	<b>258.9</b>	<b>0.12%</b>
Other Personl Err		24	1.70%	221.3	0.11%
Opn or Sw Error		1	0.07%	37.6	0.02%
<b>WEATHER</b>	(Totals)	<b>37</b>	<b>2.63%</b>	<b>6076.7</b>	<b>2.93%</b>
High Wind		24	1.70%	4925.7	2.37%
Lightning		13	0.92%	1151.0	0.55%
<b>EQUIPMENT FAILURE</b>	(Totals)	<b>193</b>	<b>13.70%</b>	<b>81506.4</b>	<b>39.26%</b>
Deterioration		100	7.10%	19001.1	9.15%
Cable Fault		55	3.90%	12854.4	6.19%
Faulty Equip Opn		17	1.21%	32562.8	15.68%
Equip Failure		15	1.06%	16994.2	8.19%
Flashover		4	0.28%	18.7	0.01%
Loose Connection		2	0.14%	75.3	0.04%
Equip Overload		0	0.00%	0.0	0.00%
<b>TRANSFORMER FAILURE</b>	(Totals)	<b>41</b>	<b>2.91%</b>	<b>1285.6</b>	<b>0.62%</b>
Tsf Failure		41	2.91%	1285.6	0.62%
Tsf Overload		0	0.00%	0.0	0.00%
<b>UNKNOWN AFTER TESTS AND INSPECTIONS</b>	(Totals)	<b>103</b>	<b>7.31%</b>	<b>3363.7</b>	<b>1.62%</b>
Unknown		103	7.31%	3363.7	1.62%
<b>MAINTENANCE</b>	(Totals)	<b>669</b>	<b>47.48%</b>	<b>27605.5</b>	<b>13.30%</b>
Forced Maint		416	29.52%	3191.1	1.54%
Scheduled Maint		253	17.96%	24414.4	11.76%
<b>SYSTEM ADDITIONS OR REMOVALS</b>	(Totals)	<b>1</b>	<b>0.07%</b>	<b>5.6</b>	<b>0.00%</b>

Hawaii Electric Light Company, Inc.  
Annual Service Reliability Report 2010  
Appendix D – T&D vs. Generation

Sys Add/Removal

	1	0.07%	5.6	0.00%
<b>Totals</b>	<b>1409</b>		<b>207606.7</b>	



**APPENDIX D**  
**T&D vs GENERATION**  
**2005-2010 Service Reliability Indices**  
**Not-Normalized**

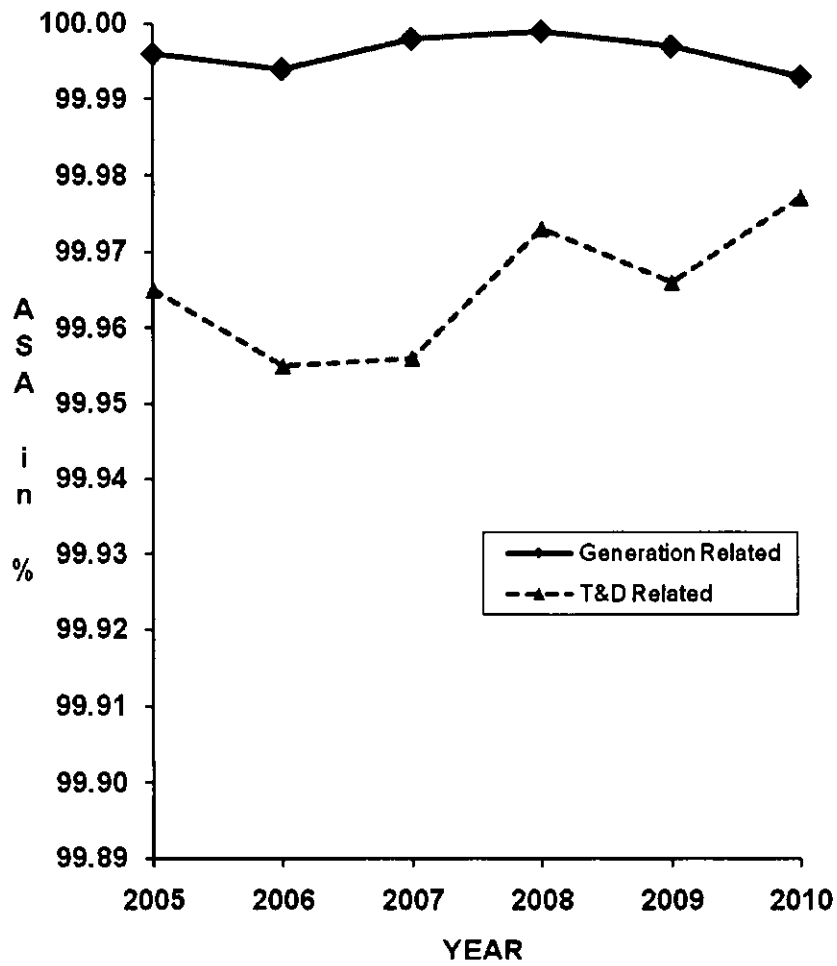
**T&D Related Outages Only**

Year	ASA	Number of Customers	Customer Interruptions	CID	SAIF	CAID
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
2010	99.977	80,171	88,321	161,219	1.102	109.52

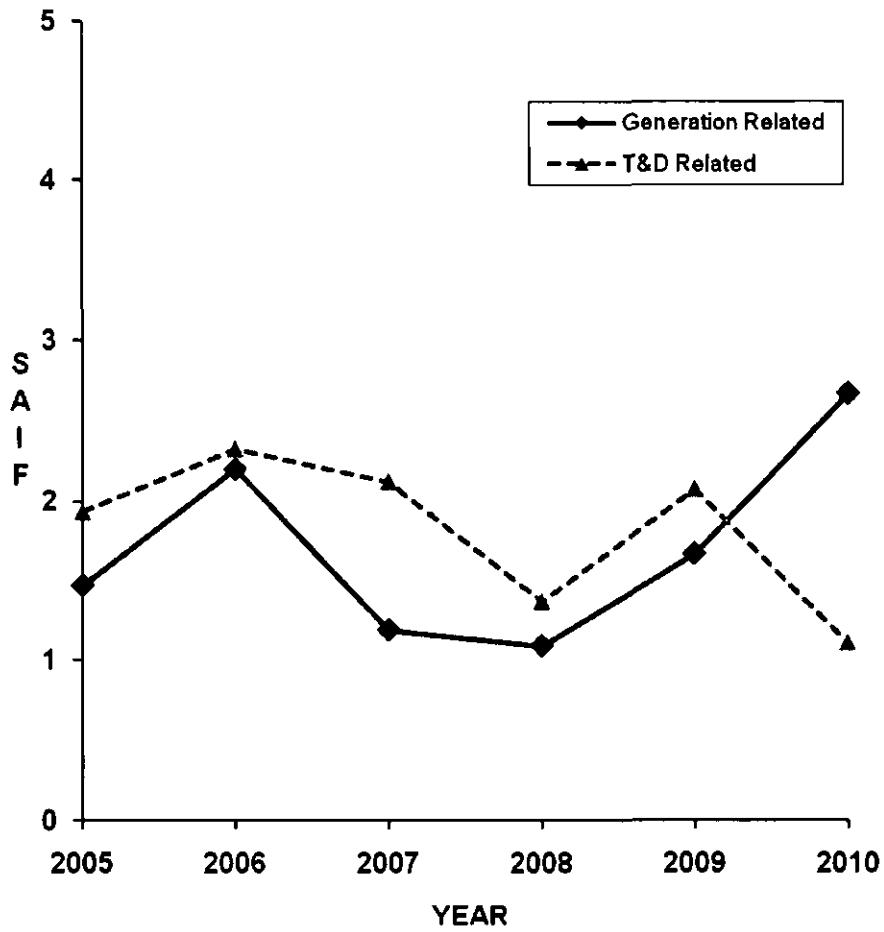
**Generation Related Outages Only**

Year	ASA	Number of Customers	Customer Interruptions	CID	SAIF	CAID
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
2010	99.993	80,171	214,081	46,388	2.67	13.00

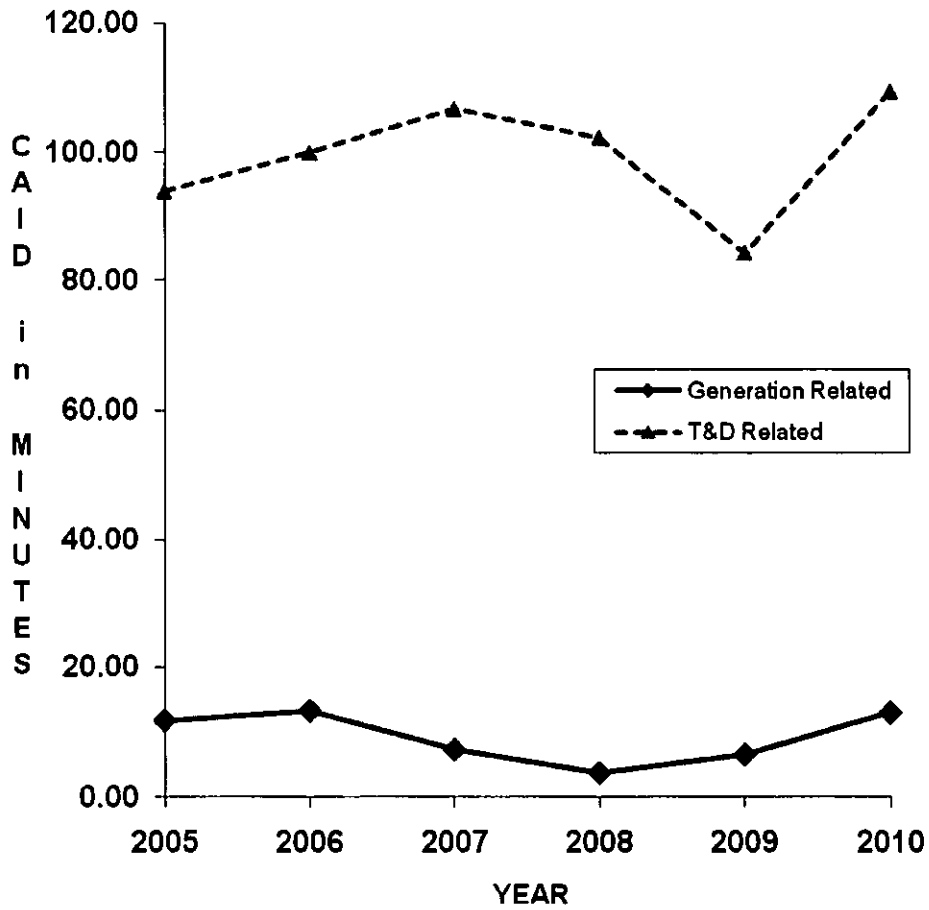
**T&D vs. GENERATION  
AVERAGE SERVICE AVAILABILITY INDEX  
(ASA IN %)  
Not-Normalized**



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



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



**2010**  
**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	58486.3	38489	0.480	43.77	91.17	1
Deterioration	19001.1	11530	0.144	14.22	98.88	3
High Wind	4925.7	5507	0.069	3.69	53.67	7
Cable Fault	12854.4	5372	0.067	9.62	143.57	5
Forced Maint	3191.1	5115	0.064	2.39	37.43	10
Scheduled Maint	24414.4	4789	0.060	18.27	305.88	2
Equip Failure	16994.2	4029	0.050	12.72	253.08	4
Unknown	3363.7	2749	0.034	2.52	73.42	9
Other Persnl Err	221.3	2478	0.031	0.17	5.36	16
Fire	6925.5	2242	0.028	5.18	185.34	6
Auto Accident	3939.5	2008	0.025	2.95	117.71	8
Equip Contact	1310.9	1349	0.017	0.98	58.31	12
Faulty Equip Opn	1650.5	970	0.012	1.24	102.09	11
Opn or Sw Error	37.6	564	0.007	0.03	4.00	20
Lightning	1151.0	523	0.007	0.86	132.04	15
Tsf Failure	1285.6	220	0.003	0.96	350.62	13
Excavate Constr	1155.4	130	0.002	0.86	533.27	14
Flashover	18.7	98	0.001	0.01	11.43	22
Loose Connection	75.3	80	0.001	0.06	56.50	19
Man or Animal	86.8	54	0.001	0.06	96.39	18
Customer Equip	88.2	15	0.000	0.07	352.87	17
Vandalism	36.2	8	0.000	0.03	271.50	21
Sys Add/Removal	5.6	2	0.000	0.00	168.00	23
Tsf Overload	0.0	0	0.000	0.00	0.00	30
Equip Overload	0.0	0	0.000	0.00	0.00	29
Flood / Tsunami	0.0	0	0.000	0.00	0.00	28
Transfer Load	0.0	0	0.000	0.00	0.00	27
Balance Load	0.0	0	0.000	0.00	0.00	26
Foreign Objects	0.0	0	0.000	0.00	0.00	24
Balloon/Kite	0.0	0	0.000	0.00	0.00	31
Customer Maint	0.0	0	0.000	0.00	0.00	25
<b>TOTAL</b>	<b>161218.8</b>	<b>88321</b>	<b>1.102</b>	<b>120.66</b>	<b>109.52</b>	

NUMBER OF CUSTOMERS FOR THE PERIOD = 80171

% ASA = 99.977

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

**2010**  
**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	30912.3	162370	2.025	23.13	11.42	1
Customer Equip	15475.6	51711	0.645	11.58	17.96	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 Maint	0.0	0	0.000	0.00	0.00	5
Scheduled Maint	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 Persnl Err	0.0	0	0.000	0.00	0.00	9
Customer Maint	0.0	0	0.000	0.00	0.00	10
Sys Add/Removal	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>TOTAL</b>	<b>46387.9</b>	<b>214081</b>	<b>2.670</b>	<b>34.72</b>	<b>13.00</b>	

NUMBER OF CUSTOMERS FOR THE PERIOD = 80171

% ASA = 99.993

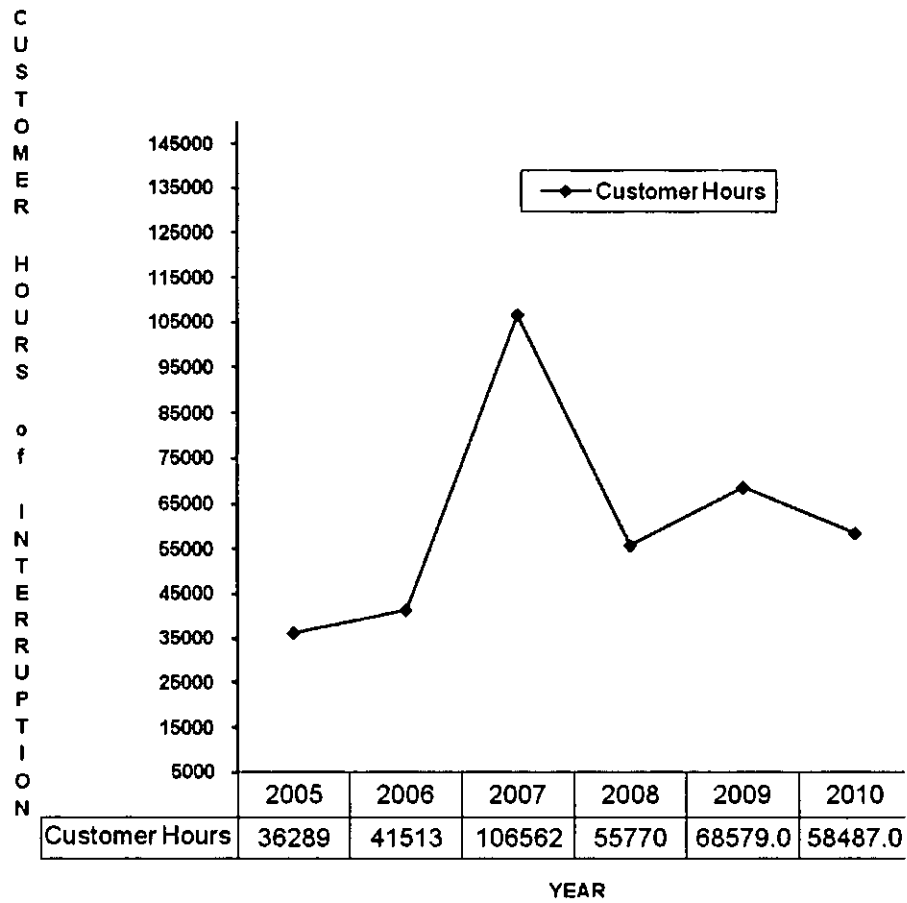
SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION (MINUTES)

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

**2005-2010**  
**INTERRUPTIONS CAUSED BY TREES & BRANCHES**  
 Not-Normalized



**APPENDIX E**  
**HELCO vs NON-HELCO GENERATION**  
**2005-2010 Service Reliability Indices**  
**Not-Normalized**

**HELCO Generation**

Year	ASA	Number of Customers	Customer Interruptions	CID	SAIF	CAID
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
2010	99.995	80,171	162,370	30,912	2.025	11.42

**Non-HELCO Generation**

Year	ASA	Number of Customers	Customer Interruptions	CID	SAIF	CAID
2005	99.998	72,513	36,956	6,577	0.51	10.68
2006	99.998	75,353	60,262	10,243	0.8	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
2010	99.997	80,171	51,711	15,476	0.645	17.96



**2010**  
**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	30912.3	162370	2.025	23.13	11.42	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
Unknown	0.0	0	0.000	0.00	0.00	3
Forced Maint	0.0	0	0.000	0.00	0.00	4
Scheduled Maint	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 Persnl Err	0.0	0	0.000	0.00	0.00	8
Customer Maint	0.0	0	0.000	0.00	0.00	9
Sys Add/Removal	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
<b>TOTAL</b>	<b>30912.3</b>	<b>162370</b>	<b>2.025</b>	<b>23.13</b>	<b>11.42</b>	

NUMBER OF CUSTOMERS FOR THE PERIOD = 80171

% ASA = 99.995

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

**2010**  
**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	15475.6	51711	0.645	11.58	17.96	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
<b>TOTAL</b>	<b>15475.6</b>	<b>51711</b>	<b>0.645</b>	<b>11.58</b>	<b>17.96</b>	

NUMBER OF CUSTOMERS FOR THE PERIOD = 80171

% 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

**2010**  
**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	58,682.4	38,489	0.480	43.92	91.48	1
Deterioration	19,085.3	11,530	0.140	14.28	99.32	3
High Wind	4,969.5	5,507	0.070	3.72	54.14	7
Cable Fault	12,878.6	5,372	0.070	9.64	143.84	5
Forced Maint	3,219.0	5,115	0.060	2.41	37.76	10
Scheduled Maint	24,319.2	4,789	0.060	18.20	304.69	2
Equip Failure	17,027.2	4,029	0.050	12.74	253.57	4
Unknown	3,367.6	2,749	0.030	2.52	73.50	9
Other Persnl Err	238.8	2,478	0.030	0.18	5.78	16
Fire	6,955.9	2,242	0.030	5.21	186.15	6
Auto Accident	3,950.7	2,008	0.030	2.96	118.05	8
Equip Contact	1,326.9	1,349	0.020	0.99	59.02	12
Faulty Equip Opn	1,654.1	970	0.010	1.24	102.31	11
Opn or Sw Error	41.0	564	0.010	0.03	4.37	20
Lightning	1,151.0	523	0.010	0.86	132.04	15
Tsf Failure	1,285.6	220	0.000	0.96	350.62	13
Excavate Constr	1,155.4	130	0.000	0.86	533.27	14
Flashover	18.7	98	0.000	0.01	11.43	22
Loose Connection	75.3	80	0.000	0.06	56.50	19
Man or Animal	86.8	54	0.000	0.06	96.39	18
Customer Equip	88.2	15	0.000	0.07	352.87	17
Vandalism	36.2	8	0.000	0.03	271.50	21
Sys Add/Removal	5.6	2	0.000	0.00	168.00	23
Foreign Objects	0.0	0	0.000	0.00	0.00	24
Tsf Overload	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>161,618.9</b>	<b>88,321</b>	<b>1.100</b>	<b>120.96</b>	<b>109.79</b>	

NUMBER OF CUSTOMERS FOR THE PERIOD = 80171

% ASA = 99.977

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

**2010**  
**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	7,733.5	71,993	0.900	5.79	6.45	1
Customer Equip	1,315.0	16,308	0.200	0.98	4.84	2
Auto Accident	0.0	0	0.000	0.00	0.00	3
Man or Animal	0.0	0	0.000	0.00	0.00	4
Foreign Objects	0.0	0	0.000	0.00	0.00	5
Fire	0.0	0	0.000	0.00	0.00	6
Equip Contact	0.0	0	0.000	0.00	0.00	7
Excavate Constr	0.0	0	0.000	0.00	0.00	8
Tree or Branches	0.0	0	0.000	0.00	0.00	9
Deterioration	0.0	0	0.000	0.00	0.00	10
Lightning	0.0	0	0.000	0.00	0.00	11
High Wind	0.0	0	0.000	0.00	0.00	12
Loose Connection	0.0	0	0.000	0.00	0.00	13
Flashover	0.0	0	0.000	0.00	0.00	14
Cable Fault	0.0	0	0.000	0.00	0.00	15
Tsf Failure	0.0	0	0.000	0.00	0.00	16
Tsf Overload	0.0	0	0.000	0.00	0.00	17
Equip Overload	0.0	0	0.000	0.00	0.00	18
Equip Failure	0.0	0	0.000	0.00	0.00	19
Vandalism	0.0	0	0.000	0.00	0.00	20
Opn or Sw Error	0.0	0	0.000	0.00	0.00	21
Flood / Tsunami	0.0	0	0.000	0.00	0.00	22
Transfer Load	0.0	0	0.000	0.00	0.00	23
Balance Load	0.0	0	0.000	0.00	0.00	24
Scheduled Maint	0.0	0	0.000	0.00	0.00	25
Forced Maint	0.0	0	0.000	0.00	0.00	26
Sys Add/Removal	0.0	0	0.000	0.00	0.00	27
Customer Maint	0.0	0	0.000	0.00	0.00	28
Unknown	0.0	0	0.000	0.00	0.00	29
Other Persnl Err	0.0	0	0.000	0.00	0.00	30
Balloon/Kite	0.0	0	0.000	0.00	0.00	31
<b>TOTALS:</b>	<b>9,048.5</b>	<b>88,301</b>	<b>1.100</b>	<b>6.77</b>	<b>6.15</b>	

NUMBER OF CUSTOMERS FOR THE PERIOD = 80,171

% 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