

*Slm Gen. File
C. JG
MEC*



Jay M. Ignacio, P.E.
President

May 20, 2013

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

FILED
MAY 20 P 3 47
PUBLIC UTILITIES
COMMISSION

Dear Commissioners:

Subject: HELCO Annual Service Reliability Report for 2012

Hawaii Electric Light Company, Inc. respectfully submits a copy of its Annual Service Reliability Report for the year 2012.

Sincerely,

Attachment

c: Division of Consumer Advocacy (with Attachment)

HAWAII ELECTRIC LIGHT COMPANY, INC.

ANNUAL SERVICE RELIABILITY REPORT

2012

Prepared by

Distribution Department

April 9, 2013

INTRODUCTION

This is the 2012 annual service reliability report of the Hawaiian Electric Light Company, Inc. (HELCO). The year-end average number of electric customers increased from 80,807 in 2011 to 81,537 in 2012 (a 0.90% increase). The 2012 peak demand for the system was 189.3 MW (evening peak), 0.1 MW higher than the peak demand of 189.2 MW in 2011.

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

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

Indices measure reliability in terms of the overall availability of electrical service (ASAI), the frequency or number of times HELCO'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 HELCO'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 HELCO's total customer base (in this case 81,537 customers).

ANALYSIS

This analysis of the annual system reliability for HELCO is for the year 2012. To determine the relative level of reliability, the statistics for five prior years, 2007 through 2011, 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 HELCO Utilities," dated December 1990. The guidelines indicate that normalization is allowed for "abnormal" situations such as hurricanes, tsunamis, earthquakes, floods, catastrophic equipment failures, and single outages that cascade into a loss of load greater than 10% of the system peak load. These normalizations are made in calculating the reliability indices because good engineering design takes into account safety, reliability, utility industry standards, and economics, and cannot always plan for catastrophic events.

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

2012 RESULTS

Annual Service Reliability Indices

The annual service reliability for 2012 was ranked the best SAIDI in the past 6 years in terms of the indices for all events. The reliability results for 2012 and five prior years are shown below in Table 1: Annual Service Reliability Indices – All Events, and Table 2: Annual Service Reliability Indices – with Normalizations. No outage events were normalized in 2012. All subsequent comparisons and discussion are based on the normalized data.

Table 1: Annual Service Reliability Indices - All Events

Year	2007	2008	2009	2010	2011	2012
Number of Customers	77,933	79,386	79,679	80,171	80,807	81,537
Customer Interruptions	257,924	194,807	298,334	302,402	290,616	228,549
Customer-Hour Interruptions	305,681	190,314	246,916	207,607	242,120	190,395
SAID	235.34	143.83	185.93	155.3	179.7	140.1
CAID	71.11	58.62	49.66	41.19	49.99	49.98
SAIF	3.31	2.454	3.744	3.772	3.596	2.803
ASA	99.955	99.973	99.965	99.97	99.966	99.973

Table 2: Annual Service Reliability Indices - with Normalization

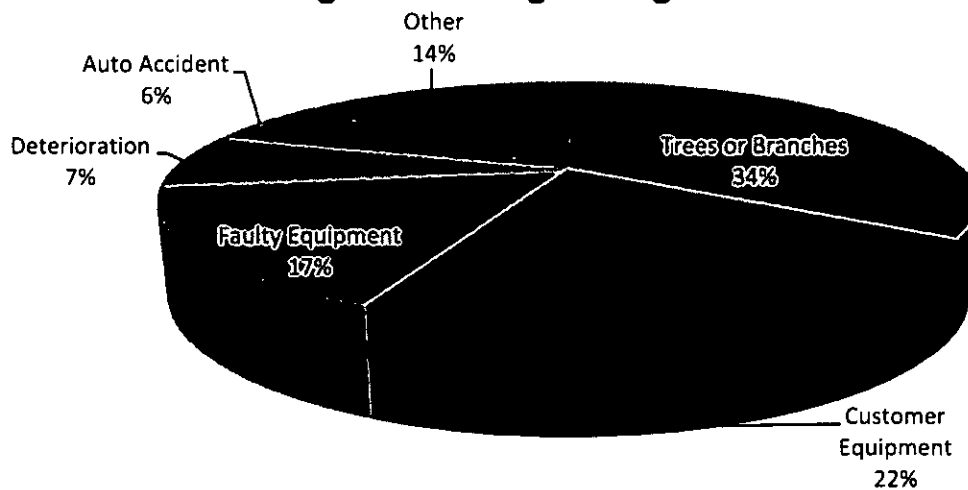
Year	2007	2008	2009	2010	2011	2012
Number of Customers	77,933	79,386	79,679	80,171	80,807	81,537
Customer Interruptions	208,000	179,862	246,437	176,622	236,688	228,549
Customer-Hours Interrupted	269,475	189,156	197,371	169,522	232,981	190,395
SAID	207.47	142.96	148.62	126.8	172.99	140.1
CAID	77.73	63.1	48.05	57.59	59.06	49.98
SAIF	2.669	2.266	3.093	2.203	2.929	2.803
ASA	99.961	99.973	99.972	99.976	99.967	99.973

The Top 5 Outage Categories, by number of customers affected, as illustrated in Figure 1, equates to about 86% of the total Customer Interruptions in 2012; these causes are:

<u>Outage Category</u>	<u>Sample Causes</u>
1. Trees or Branches	tree or branch contact
2. Customer Equipment	IPP generation load shedding
3. Faulty Equipment	HELCO generation load shedding
4. Deterioration	rotten poles/cross arms, rusted hardware and insulators, corroded connections
5. Auto Accidents	

A total of 228,549 Customer Interruptions were recorded for a total of 190,395 Customer Hours of Interruptions. The System Average Interruption Frequency (SAIF) index was 2.803 and the Customer Average Interruption Duration (CAID) was 49.98 minutes.

Figure 1: Outage Categories



In 2012, HELCO generation sources experienced 12 load shedding events. HELCO generation experienced 5 load shed events, Puna Geothermal Ventures (PGV) experienced 2 load shed events, Hamakua Energy Partners (HEP) experienced 3 load shed events, and Pakini Nui Wind Farm experienced 2 load shed events.

T&D vs. Generation – All Events

Table 3: Annual Service Reliability Indices – T&D

Year	2007	2008	2009	2010	2011	2012
Number of Customers	77933	79386	79679	80171	80807	81537
Customer Interruptions	165461	108517	165478	88321	180770	145331
CID	294463	185015	232344	161218.8	228431.9	183773.2
SAID	226.7	139.83	174.96	120.6	169.61	135.23
CAID	106.78	102.3	84.24	109.52	75.82	75.87
SAIF	2.123	1.367	2.077	1.102	2.237	1.782

Table 4: Annual Service Reliability Indices – Generation

Year	2007	2008	2009	2010	2011	2012
Number of Customers	77933	79386	79679	80171	80807	81537
Customer Interruptions	92463	86290	132856	214081	109846	83218
CID	11218	5299	14572	46387.9	13688.4	6621.3
SAID	8.64	4	10.97	34.7	10.16	4.87
CAID	7.28	3.68	6.58	13	7.48	4.77
SAIF	1.186	1.087	1.667	2.67	1.359	1.021

T&D vs. Generation – With Normalization

Table 5: Normalized Annual Service Reliability Indices – T&D

Year	2007	2008	2009	2010	2011	2012
Number of Customers	77933	79386	79679	80171	80807	81537
Customer Interruptions	165461	108517	165478	88321	180770	145331
CID	294463	185015	232344	161218.8	228431.9	183773.2
SAID	226.69	139.84	174.97	120.69	169.61	135.20
CAID	106.78	102.30	84.24	109.52	75.82	75.87
SAIF	2.123	1.367	2.077	1.102	2.237	1.782

Table 6: Normalized Annual Service Reliability Indices – Generation

Year	2007	2008	2009	2010	2011	2012
Number of Customers	77933	79386	79679	80171	80807	81537
Customer Interruptions	92463	86290	121221	88301	55918	83218
CID	11218	5299	12871.1	9048.5	4548.74	6621.3
SAID	0	0	9.69	6.77	3.38	4.87
CAID	7.28	3.68	6.37	6.15	4.88	4.77
SAIF	1.186	1.087	1.521	1.1	0.692	1.021

Figure 2: System Average Interruption Frequency Index (SAIFI)

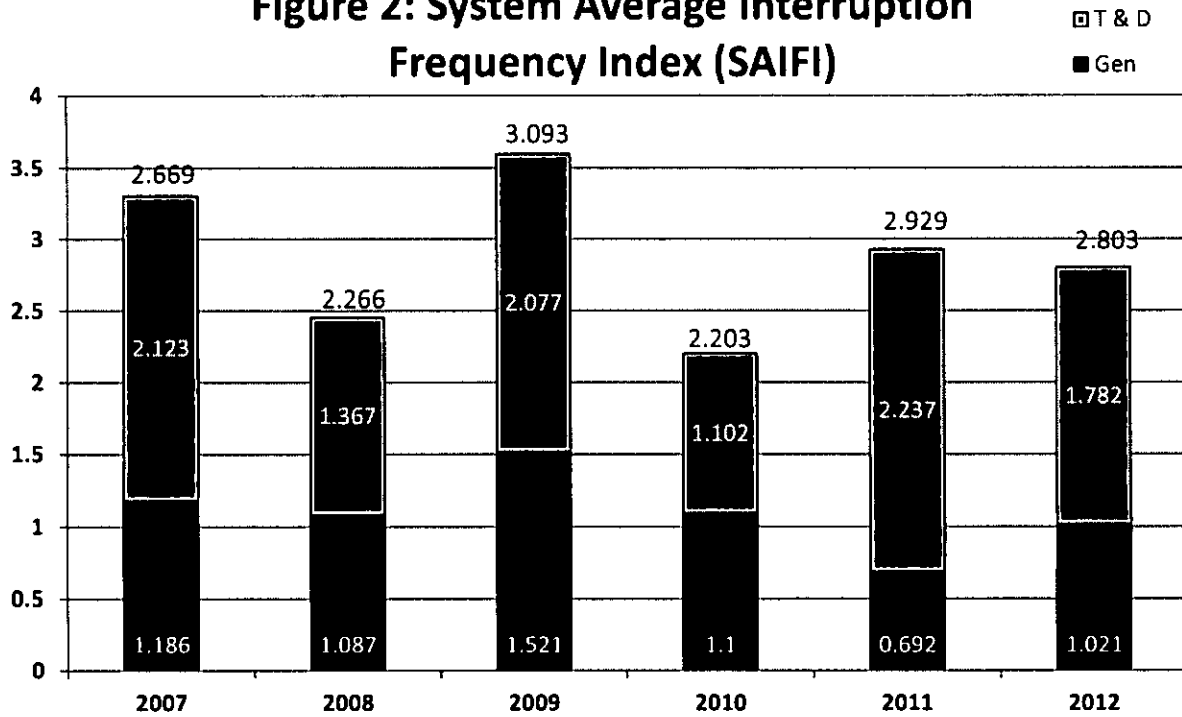


Figure 2 shows the System Average Interruption Frequency Index (SAIFI) decreased as compared to 2011 from 2.929 to 2.803.

Figure 3: Customer Average Interruption Duration Index (CAIDI)

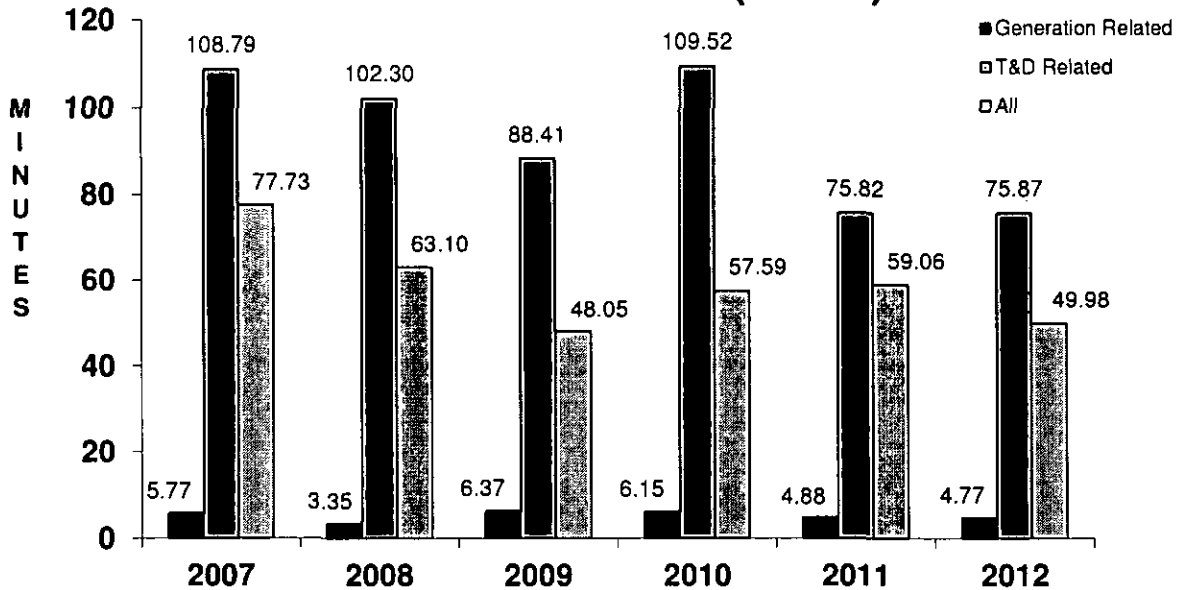


Figure 3 Customer Average Interruption Duration Indices (CAIDI) shows the average duration of a customer's outage (CAIDI) for 2012 is 49.98 minutes, a 15% decrease compared to the 2011 CAIDI result of 59.06 minutes.

The three major events affecting the 2012 CAIDI results were:

1. February 11, 2012 – automobile accident in Kamuela caused an outage affecting 722 customers and 15,644 customer-hours.
2. May 29, 2012 – 3100 Line insulator caused an outage affecting 1,299 customers and 6,259 customer-hours.
3. September 25, 2012– fallen tree in Hawaiian Beaches caused an outage affecting 1,498 and 5,332 customer-hours.

These three events alone increased the 2012 CAIDI by over 6 minutes.

Figure 4: System Average Interruption Duration Index (SAIDI)

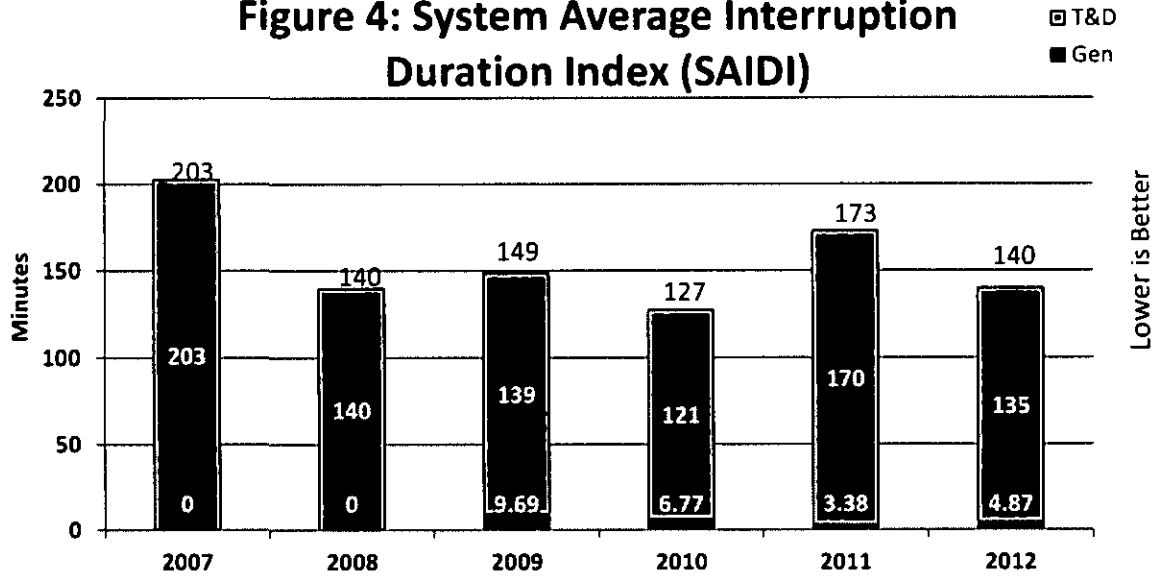


Figure 4 shows the System Average Interruption Duration Indices (SAIDI) for the past six years. It shows that the 2012 SAIDI is 140.10 minutes, a 19% decrease compared to the 2011 SAIDI result of 172.99 minutes. The SAIDI is the composite of both the SAIFI and CAIDI indices and produces a broader benchmark of system reliability by combining both the duration and the number of customer interruptions during a given period of time.

Figure 5: Average Service Availability Index (ASAI)

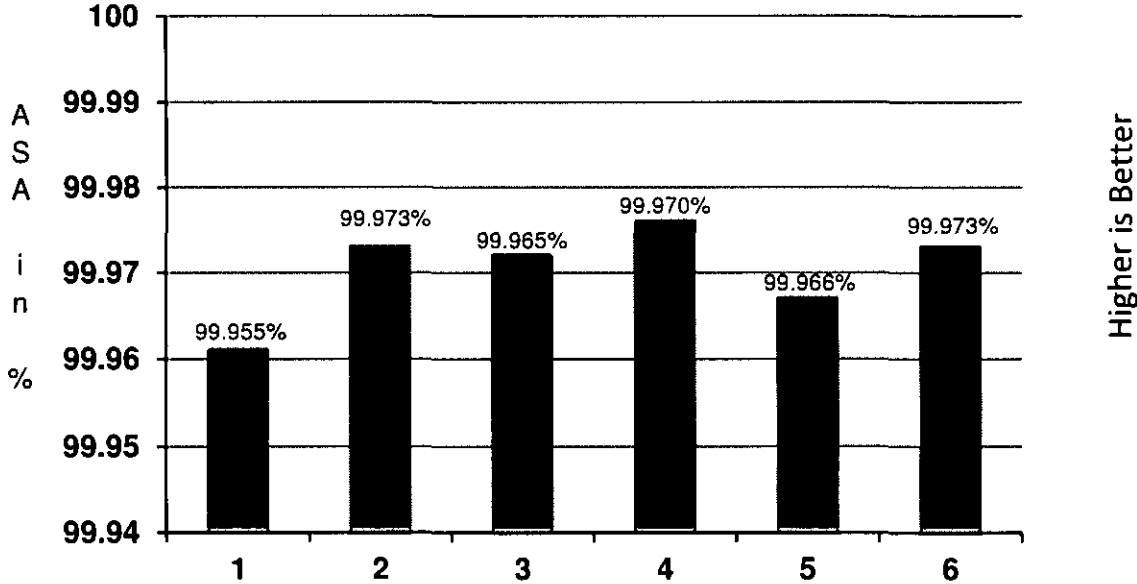


Figure 5 shows that the 2012 Average Service Availability Index increased as compared to the 2011 from 99.966% to 99.973%

**HELCO vs. NON-HELCO GENERATION
Service Reliability Indices
Normalized**

HELCO Generation

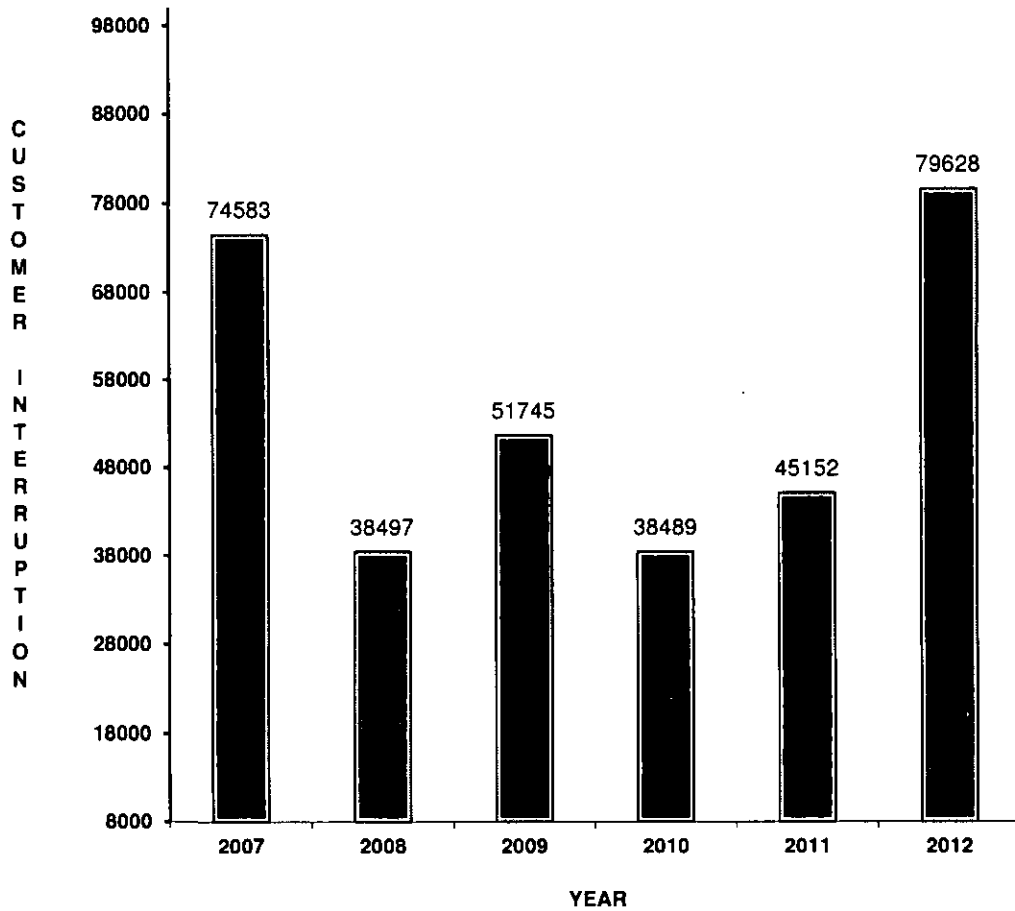
Year	2007	2008	2009	2010	2011	2012
Number of Customers	77933	79386	79679	80171	80807	81537
Customer Interruptions	28246	66538	100561	71993	28429	31421
CID	3348.5	3709	11647	7735.3	2802.4	2492.6
SAID	2.58	2.80	8.77	5.79	2.08	1.83
CAID	7.11	3.34	6.95	6.45	5.91	4.76
SAIF	0.362	0.838	1.262	0.898	0.352	0.385

Non-HELCO Generation

Year	2007	2008	2009	2010	2011	2012
Number of Customers	77933	79386	79679	80171	80807	81537
Customer Interruptions	34457	4807	20660	16308	27489	51797
CID	2680.4	279	1224.3	1314.6	1747	4128.7
SAID	2.06	0.21	0.92	0.98	1.30	3.04
CAID	4.67	3.48	3.56	4.84	3.81	4.78
SAIF	0.382	0.188	0.259	0.442	0.325	0.635

INTERRUPTIONS CAUSED BY TREES & BRANCHES

Normalized
Hawaii Electric Light Company
2012



2012
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	80132.6	79628	0.977	58.97	60.38	1
Customer Equip	4128.7	51797	0.635	3.04	4.78	8
Faulty Equip Operation	6610.3	38772	0.476	4.86	10.23	6
Deterioration	29178.0	16299	0.200	21.47	107.41	2
Auto Accident	27765.8	14123	0.173	20.43	117.96	3
Scheduled Maintenance	14114.7	5861	0.072	10.39	144.49	4
Unknown	6278.4	4943	0.061	4.62	76.21	7
Cable Fault	9175.5	4285	0.053	6.75	128.48	5
Other Personnel Err	1160.8	4072	0.050	0.85	17.10	12
Forced Maintenance	3113.8	2506	0.031	2.29	74.55	10
Vandalism	35.7	1807	0.022	0.03	1.18	23
Flashover	2792.5	1455	0.018	2.05	115.16	11
Man or Animal	3283.9	1079	0.013	2.42	182.61	9
Equip Contact	114.5	737	0.009	0.08	9.32	19
Balance Load	280.0	300	0.004	0.21	56.00	15
Sys Add/Removal	944.5	190	0.002	0.70	298.26	13
Excavate Construction	122.3	151	0.002	0.09	48.58	18
Tsf Failure	541.5	131	0.002	0.40	248.03	14
Loose Connection	147.1	126	0.002	0.11	70.06	17
High Wind	278.6	117	0.001	0.20	142.85	16
Balloon/Kite	83.3	110	0.001	0.06	45.45	20
Equip Failure	47.2	29	0.000	0.03	97.62	22
Lightning	58.7	16	0.000	0.04	220.25	21
Equip Overload	1.5	9	0.000	0.00	10.00	25
Transfer Load	1.3	5	0.000	0.00	15.40	26
Tsf Overload	3.4	1	0.000	0.00	201.00	24
Operation or Switching Error	0.0	0	0.000	0.00	0.00	31
Fire	0.0	0	0.000	0.00	0.00	27
Foreign Objects	0.0	0	0.000	0.00	0.00	28
Customer Maintenance	0.0	0	0.000	0.00	0.00	29
Flood / Tsunami	0.0	0	0.000	0.00	0.00	30
TOTALS	190394.5	228549	2.803	140.10	49.98	

NUMBER OF CUSTOMERS FOR THE PERIOD = 81537

ASA = 99.973%

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

2012
SYSTEM INTERRUPTION CAUSE REPORT
Normalized

CAUSE Hours		No. of Interruptions		Customer	
NON-CONNECTED SYSTEM EMERGENCY	(Totals)	905	28.60%	115947.9	60.90%
Tree or Branches		668	21.11%	80132.6	42.09%
Auto Accident		99	3.13%	27765.8	14.58%
Customer Equip		67	2.12%	4128.7	2.17%
Vandalism		27	0.85%	35.7	0.02%
Man or Animal		16	0.51%	3283.9	1.72%
Equip Contact		10	0.32%	114.5	0.06%
Excavate Construction		9	0.28%	122.3	0.06%
Balloon/Kite		3	0.09%	83.3	0.04%
Balance Load		2	0.06%	280.0	0.15%
Foreign Objects		2	0.06%	0.0	0.00%
Transfer Load		2	0.06%	1.3	0.00%
Fire		0	0.00%	0.0	0.00%
Flood / Tsunami		0	0.00%	0.0	0.00%
ERROR	(Totals)	23	0.73%	1160.8	0.61%
Other Personnel Err		23	0.73%	1160.8	0.61%
Operation or Switching Error		0	0.00%	0.0	0.00%
WEATHER	(Totals)	76	2.40%	337.3	0.18%
High Wind		47	1.49%	278.6	0.15%
Lightning		29	0.92%	58.7	0.03%
EQUIPMENT FAILURE	(Totals)	521	16.47%	47952.1	25.19%
Deterioration		177	5.59%	29178.0	15.33%
Cable Fault		167	5.28%	9175.5	4.82%
Faulty Equip Operation		80	2.53%	6610.3	3.47%
Flashover		64	2.02%	2792.5	1.47%
Equip Failure		18	0.57%	47.2	0.02%
Loose Connection		14	0.44%	147.1	0.08%
Equip Overload		1	0.03%	1.5	0.00%
TRANSFORMER FAILURE	(Totals)	39	1.23%	544.9	0.29%
Tsf Failure		38	1.20%	541.5	0.28%
Tsf Overload		1	0.03%	3.4	0.00%
UNKNOWN AFTER TESTS AND INSPECTIONS	(Totals)	196	6.19%	6278.4	3.30%
Unknown		196	6.19%	6278.4	3.30%
MAINTENANCE	(Totals)	1368	43.24%	17228.5	9.05%
Scheduled Maintenance		1114	35.21%	14114.7	7.41%
Forced Maintenance		254	8.03%	3113.8	1.64%
SYSTEM ADDITIONS OR REMOVALS	(Totals)	36	1.14%	944.5	0.50%
Sys Add/Removal		36	1.14%	944.5	0.50%
TOTALS		3164		190394.5	

2012
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	80132.6	79628	0.977	58.97	60.38	1
Deterioration	29178.0	16299	0.200	21.47	107.41	2
Auto Accident	27765.8	14123	0.173	20.43	117.96	3
Faulty Equip Operation	4117.7	7351	0.090	3.03	33.61	7
Scheduled Maintenance	14114.7	5861	0.072	10.39	144.49	4
Unknown	6278.4	4943	0.061	4.62	76.21	6
Cable Fault	9175.5	4285	0.053	6.75	128.48	5
Other Personnel Err	1160.8	4072	0.050	0.85	17.10	11
Forced Maintenance	3113.8	2506	0.031	2.29	74.55	9
Vandalism	35.7	1807	0.022	0.03	1.18	22
Flashover	2792.5	1455	0.018	2.05	115.16	10
Man or Animal	3283.9	1079	0.013	2.42	182.61	8
Equip Contact	114.5	737	0.009	0.08	9.32	18
Balance Load	280.0	300	0.004	0.21	56.00	14
Sys Add/Removal	944.5	190	0.002	0.70	298.26	12
Excavate Construction	122.3	151	0.002	0.09	48.58	17
Tsf Failure	541.5	131	0.002	0.40	248.03	13
Loose Connection	147.1	126	0.002	0.11	70.06	16
High Wind	278.6	117	0.001	0.20	142.85	15
Balloon/Kite	83.3	110	0.001	0.06	45.45	19
Equip Failure	47.2	29	0.000	0.03	97.62	21
Lightning	58.7	16	0.000	0.04	220.25	20
Equip Overload	1.5	9	0.000	0.00	10.00	24
Transfer Load	1.3	5	0.000	0.00	15.40	25
Tsf Overload	3.4	1	0.000	0.00	201.00	23
Operation or Switching Error	0.0	0	0.000	0.00	0.00	31
Fire	0.0	0	0.000	0.00	0.00	26
Foreign Objects	0.0	0	0.000	0.00	0.00	27
Customer Maintenance	0.0	0	0.000	0.00	0.00	28
Flood / Tsunami	0.0	0	0.000	0.00	0.00	29
Customer Equip	0.0	0	0.000	0.00	0.00	30
TOTALS	183773.2	145331	1.782	135.23	75.87	

NUMBER OF CUSTOMERS FOR THE PERIOD = 81537

% ASA = 99.974

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

2012
GENERATION SERVICE RELIABILITY SUMMARY
Normalized

<u>Cause of Outage</u>	<u>CUST-HR</u>	<u>CUST-INT</u>	<u>SAIF</u>	<u>SAID</u>	<u>CAID</u>	<u>SAID RANK</u>
Customer Equip	4128.7	51797	0.635	3.04	4.78	1
Faulty Equip Operation	2492.6	31421	0.385	1.83	4.76	2
Man or Animal	0.0	0	0.000	0.00	0.00	17
Tsf Overload	0.0	0	0.000	0.00	0.00	3
Unknown	0.0	0	0.000	0.00	0.00	4
Forced Maintenance	0.0	0	0.000	0.00	0.00	5
Equip Failure	0.0	0	0.000	0.00	0.00	6
Balloon/Kite	0.0	0	0.000	0.00	0.00	7
Other Personnel Err	0.0	0	0.000	0.00	0.00	8
Customer Maintenance	0.0	0	0.000	0.00	0.00	9
Sys Add/Removal	0.0	0	0.000	0.00	0.00	10
Scheduled Maintenance	0.0	0	0.000	0.00	0.00	11
Balance Load	0.0	0	0.000	0.00	0.00	12
Transfer Load	0.0	0	0.000	0.00	0.00	13
Flood / Tsunami	0.0	0	0.000	0.00	0.00	14
Deterioration	0.0	0	0.000	0.00	0.00	23
Auto Accident	0.0	0	0.000	0.00	0.00	30
Tsf Failure	0.0	0	0.000	0.00	0.00	29
Cable Fault	0.0	0	0.000	0.00	0.00	28
Flashover	0.0	0	0.000	0.00	0.00	27
Loose Connection	0.0	0	0.000	0.00	0.00	26
Operation or Switching 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 Construction	0.0	0	0.000	0.00	0.00	21
Equip Contact	0.0	0	0.000	0.00	0.00	20
Fire	0.0	0	0.000	0.00	0.00	19
Foreign Objects	0.0	0	0.000	0.00	0.00	18
Tree or Branches	0.0	0	0.000	0.00	0.00	31
High Wind	0.0	0	0.000	0.00	0.00	25
TOTALS	6621.3	83218	1.021	4.87	4.77	

NUMBER OF CUSTOMERS FOR THE PERIOD = 81537

% ASA = 99.999

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

2012
HELCO 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 Operation	2492.6	31421	0.385	1.83	4.76	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 Maintenance	0.0	0	0.000	0.00	0.00	4
Equip Failure	0.0	0	0.000	0.00	0.00	5
Balloon/Kite	0.0	0	0.000	0.00	0.00	6
Other Personnel Err	0.0	0	0.000	0.00	0.00	7
Customer Maintenance	0.0	0	0.000	0.00	0.00	8
Sys Add/Removal	0.0	0	0.000	0.00	0.00	9
Scheduled Maintenance	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
Operation or Switching 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 Construction	0.0	0	0.000	0.00	0.00	21
Equip Contact	0.0	0	0.000	0.00	0.00	20
Fire	0.0	0	0.000	0.00	0.00	19
Foreign Objects	0.0	0	0.000	0.00	0.00	18
Tree or Branches	0.0	0	0.000	0.00	0.00	31
High Wind	0.0	0	0.000	0.00	0.00	25
TOTALS	2492.6	31421	0.385	1.83	4.76	

NUMBER OF CUSTOMERS FOR THE PERIOD = 81537

% ASA = 99.999

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

2012
Non-HELCO GENERATION SERVICE RELIABILITY SUMMARY
Normalized

<u>Cause of Outage</u>	<u>CUST-HR</u>	<u>CUST-INT</u>	<u>SAIF</u>	<u>SAID</u>	<u>CAID</u>	<u>SAID RANK</u>
Customer Equip	4128.7	51797	0.635	3.04	4.78	1
Man or Animal	0.0	0	0.000	0.00	0.00	17
Tsf Overload	0.0	0	0.000	0.00	0.00	2
Balloon/Kite	0.0	0	0.000	0.00	0.00	3
Other Personnel Err	0.0	0	0.000	0.00	0.00	4
Unknown	0.0	0	0.000	0.00	0.00	5
Customer Maintenance	0.0	0	0.000	0.00	0.00	6
Sys Add/Removal	0.0	0	0.000	0.00	0.00	7
Forced Maintenance	0.0	0	0.000	0.00	0.00	8
Scheduled Maintenance	0.0	0	0.000	0.00	0.00	9
Balance Load	0.0	0	0.000	0.00	0.00	10
Transfer Load	0.0	0	0.000	0.00	0.00	11
Flood / Tsunami	0.0	0	0.000	0.00	0.00	12
Operation or Switching Error	0.0	0	0.000	0.00	0.00	13
Faulty Equip Operation	0.0	0	0.000	0.00	0.00	14
Deterioration	0.0	0	0.000	0.00	0.00	23
Auto Accident	0.0	0	0.000	0.00	0.00	30
Tsf Failure	0.0	0	0.000	0.00	0.00	29
Cable Fault	0.0	0	0.000	0.00	0.00	28
Flashover	0.0	0	0.000	0.00	0.00	27
Loose Connection	0.0	0	0.000	0.00	0.00	26
Vandalism	0.0	0	0.000	0.00	0.00	15
Equip Overload	0.0	0	0.000	0.00	0.00	24
Lightning	0.0	0	0.000	0.00	0.00	16
Equip Failure	0.0	0	0.000	0.00	0.00	22
Excavate Construction	0.0	0	0.000	0.00	0.00	21
Equip Contact	0.0	0	0.000	0.00	0.00	20
Fire	0.0	0	0.000	0.00	0.00	19
Foreign Objects	0.0	0	0.000	0.00	0.00	18
Tree or Branches	0.0	0	0.000	0.00	0.00	31
High Wind	0.0	0	0.000	0.00	0.00	25
TOTALS	4128.7	51797	0.635	3.04	4.78	

NUMBER OF CUSTOMERS FOR THE PERIOD = 81537

% ASA = 99.999

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

DEFINITION OF TERMS

OUTAGE

The state of a component when it is not available to perform its intended function due to some event directly associated with that component. An outage may or may not cause an interruption of service to consumers depending on the system configuration.

INTERRUPTION

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

INTERRUPTION DURATION

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

MOMENTARY INTERRUPTION

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

SUSTAINED INTERRUPTION

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

CUSTOMER INTERRUPTION

One interruption of one customer.

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

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

RELIABILITY INDICES

AVERAGE SERVICE AVAILABILITY INDEX (ASA)

Total customer hours actually served as a percentage of total customer hours possible during the year. This indicates the extent to which electrical service was available to all customers. This index has been commonly referred to as the "Index of Reliability." A customer-hour is calculated by multiplying the number of customers by the number of hours in the period being analyzed.

$$ASA = \frac{\sum \text{No. of Customer Hours Actually Served during the year}}{\sum \text{No. of Customer Hours Possible during the year}} \times 100\%$$

SYSTEM AVERAGE INTERRUPTION FREQUENCY INDEX (SAIFI)

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

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

CUSTOMER AVERAGE INTERRUPTION DURATION INDEX (CAIDI)

The interruption duration per customer interrupted during the year. This index indicates the average duration of an interruption for those customers affected by a sustained interruption.

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

SYSTEM AVERAGE INTERRUPTION DURATION INDEX (SAIDI)

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

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