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PUBLIC UTILITIES
COMMISSION

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

Dear Commissioners:

Subject: Hawaiian Electric Companies Annual Service Reliability Reports for 2014

Hawaiian Electric Company, Inc., Hawai'i Electric Light Company, Inc., and Maui Electric Company, Limited respectfully submit a copy of its Annual Service Reliability Report for the year 2014. (See Attachments 1, 2, and 3, respectively.)

Sincerely,

Daniel G. Brown
Manager, Regulatory Non-Rate Proceedings

Attachments

c: Division of Consumer Advocacy (with Attachments)

HAWAIIAN ELECTRIC COMPANY, INC.
ANNUAL SERVICE RELIABILITY REPORT
2014

Prepared by
System Operation Department

April 10, 2015

INTRODUCTION

This is the 2014 annual service reliability report of the Hawaiian Electric Company. The year-end average number of electric customers increased from 298,920 in 2013 to 300,722 in 2014 (a 0.60% increase). The 2014 peak demand for the system was 1,201 MW (evening peak), 26 MW higher than the peak demand in 2013; the highest system peak demand remains at 1,327 MW set on the evening of October 12, 2004.

The system interruption summary for 2014 (Attachments A and B) 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 C contains the definition of terms and the reliability indices explanations and equations.

Indices measure reliability in terms of the overall availability of electrical service (Average Service Availability Index or ASAI), the frequency or number of times Hawaiian Electric Company's customers experience an outage during the year (System Average Interruption Frequency Index or SAIFI), the average length of time an interrupted customer is out of power (Customer Average Interruption Duration Index or CAIDI), and the average length of time Hawaiian Electric Company's customers are out of power during the year (System Average Interruption Duration Index or 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 Hawaiian Electric Company's total customer base (in this case 300,722 customers).

ANALYSIS

This analysis of the annual system reliability for Hawaiian Electric Company is for the year 2014. To determine the relative level of reliability, the statistics for five prior years, 2009 through 2013, 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 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.)

2014 RESULTS

Annual Service Reliability Indices

The annual service reliability results for 2014 was ranked the best for CAIDI and SAIDI was the second best result in the past 6 years, in terms of the indices for all events. The reliability results for 2014 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. Tables 3-8 break out the events into three groups, Transmission and Distribution, Generation – Hawaiian Electric, and Generation – Other [non-utility] for all events and with normalization. No outage events were normalized in 2014. All subsequent graphic comparisons and discussion are based on the normalized data.

Table 1: Annual Service Reliability Indices - All Events

	2009	2010	2011*	2012	2013	2014
Number of Customers	294,802	295,637	296,679	297,598	298,920	300,722
Customer Interruptions	333,908	361,334	502,253	407,197	409,516	447,048
Customer-Hours Interrupted	442,546.1	564,424.3	1,257,349.4	563,806.5	605,965	541,434.6
SAIDI (Minutes)	90.07	114.55	254.28	113.67	121.63	108.03
CAIDI (Minutes)	79.52	93.72	150.21	83.08	88.78	72.67
SAIFI (Occurrences)	1.133	1.222	1.693	1.368	1.370	1.487
ASAI (Percent)	99.983%	99.978%	99.952%	99.978%	99.977%	99.979%

Table 2: Annual Service Reliability Indices - with Normalization

	2009	2010	2011*	2012	2013	2014
Number of Customers	294,802	295,637	296,679	297,598	298,920	300,722
Customer Interruptions	333,908	361,334	408,327	407,197	409,516	447,048
Customer-Hours Interrupted	442,546.1	564,424.3	1,044,915.7	563,806.5	605,965	541,434.6
SAIDI (Minutes)	90.07	114.55	211.32	113.67	121.63	108.03
CAIDI (Minutes)	79.52	93.72	153.54	83.08	88.78	72.67
SAIFI (Occurrences)	1.133	1.222	1.376	1.368	1.370	1.487
ASAI (Percent)	99.983%	99.978%	99.960%	99.978%	99.977%	99.979%

NOTE:

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

Table 3: Transmission & Distribution Events

	2009	2010	2011	2012	2013	2014
Number of Customers	294,802	295,637	296,679	297,598	298,920	300,722
Customer Interruptions	333,908	361,334	477,798	341,118	341,930	382,867
Customer-Hours Interrupted	442,546.1	564,424.3	1,238,615.1	524,554	576,305.6	524,146.1
SAIDI (Minutes)	90.07	114.55	250.50	105.76	115.68	104.58
CAIDI (Minutes)	79.52	93.72	155.54	92.26	101.13	82.14
SAIFI (Occurrences)	1.133	1.222	1.610	1.146	1.144	1.273
ASAI (Percent)	99.983%	99.978%	99.952%	99.980%	99.978%	99.980%

Table 4: Generation Events – Hawaiian Electric

	2009	2010	2011	2012	2013	2014
Number of Customers	294,802	295,637	296,679	297,598	298,920	300,722
Customer Interruptions	0	0	24,455	0	0	0
Customer-Hours Interrupted	0	0	18,734.3	0	0	0
SAIDI (Minutes)	0.00	0.00	3.79	0.00	0.00	0.00
CAIDI (Minutes)	0.00	0.00	45.96	0.00	0.00	0.00
SAIFI (Occurrences)	0.000	0.000	0.082	0.000	0.000	0.000
ASAI (Percent)	100.000%	100.000%	99.999%	100.000%	100.000%	100.000%

Table 5: Generation Events – Other [non-utility]

	2009	2010	2011	2012	2013	2014
Number of Customers	294,802	295,637	296,679	297,598	298,920	300,722
Customer Interruptions	0	3	0	66,079	67,586	64,181
Customer-Hours Interrupted	0	4.9	0	39,252.5	29,659.4	17,288.5
SAIDI (Minutes)	0.00	0.00	0.00	7.91	5.95	3.45
CAIDI (Minutes)	0.00	98.00	0.00	35.64	26.33	16.16
SAIFI (Occurrences)	0.000	0.000	0.000	0.222	0.226	0.213
ASAI (Percent)	100.000%	100.000%	100.000%	99.998%	99.999%	99.999%

Table 6: Transmission & Distribution Events with Normalization

	2009	2010	2011*	2012	2013	2014
Number of Customers	294,802	295,637	296,679	297,598	298,920	300,722
Customer Interruptions	333,908	361,334	383,872	341,118	341,930	382,867
Customer-Hours Interrupted	442,546.1	564,424.3	1,026,181.4	524,554	576,305.6	524,146.1
SAIDI (Minutes)	90.07	114.55	207.53	105.76	115.68	104.58
CAIDI (Minutes)	79.52	93.72	160.39	92.26	101.13	82.14
SAIFI (Occurrences)	1.133	1.222	1.294	1.146	1.144	1.273
ASAI (Percent)	99.983%	99.978%	99.961%	99.980%	99.978%	99.980%

Table 7: Generation Events – Hawaiian Electric with Normalization

	2009	2010	2011	2012	2013	2014
Number of Customers	294,802	295,637	296,679	297,598	298,920	300,722
Customer Interruptions	0	0	24,455	0	0	0
Customer-Hours Interrupted	0	0	18,734.3	0	0	0
SAIDI (Minutes)	0.00	0.00	3.79	0.00	0.00	0.00
CAIDI (Minutes)	0.00	0.00	45.96	0.00	0.00	0.00
SAIFI (Occurrences)	0.000	0.000	0.082	0.000	0.000	0.000
ASAI (Percent)	100.000%	100.000%	99.999%	100.000%	100.000%	100.000%

Table 8: Generation Events – Other [non-utility] with Normalization

	2009	2010	2011	2012	2013	2014
Number of Customers	294,802	295,637	296,679	297,598	298,920	300,722
Customer Interruptions	0	3	0	66,079	67,586	64,181
Customer-Hours Interrupted	0	4.9	0	39,252.5	29,659.4	17,288.5
SAIDI (Minutes)	0.00	0.00	0.00	7.91	5.95	3.45
CAIDI (Minutes)	0.00	98.00	0.00	35.64	26.33	16.16
SAIFI (Occurrences)	0.000	0.000	0.000	0.222	0.226	0.213
ASAI (Percent)	100.000%	100.000%	100.000%	99.998%	99.999%	99.999%

**Figure 1: System Average Interruption
Duration Index (SAIDI)**

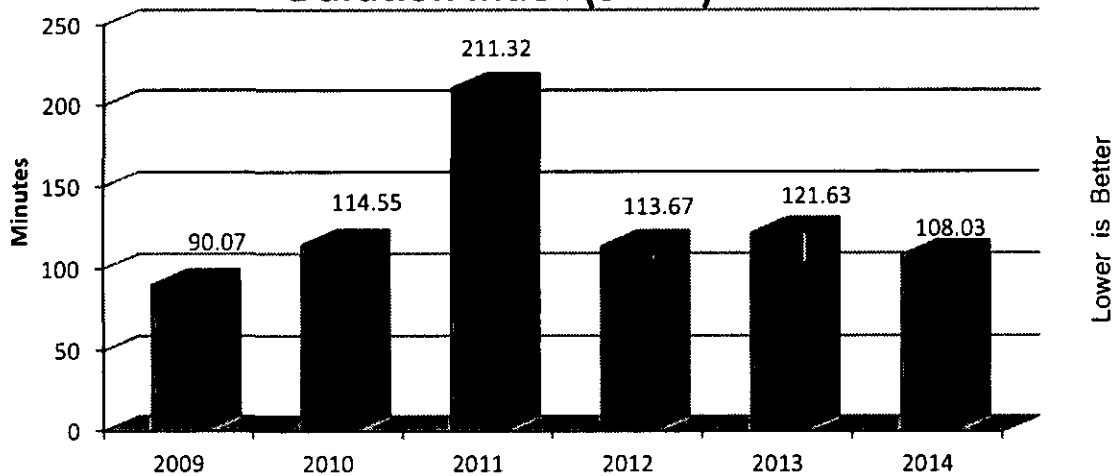
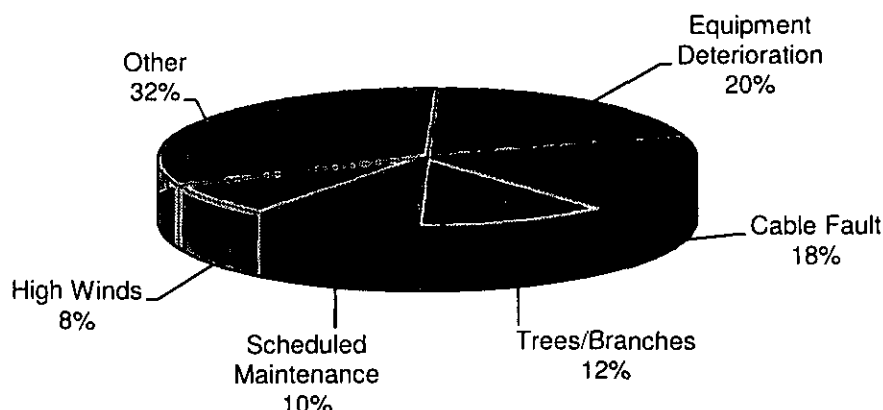


Figure 1 shows the System Average Interruption Duration Indices (SAIDI) for the past six years. The 2014 SAIDI is 108.03 minutes, an 11% decrease compared to the 2013 SAIDI, and resulted as the second best SAIDI performance in the last six years. The SAIDI is the composite of both the SAIFI and CAIDI 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.

In 2014, there were six events that resulted in the loss of more than 10,000 customers:

1. June 9, 2014, Oahu experienced an under frequency load shedding (UFLS) event due to the loss of the island's largest generating unit at the AES facility. This event caused a series of interruptions to 86,512 customers or 29% of our customers with outage durations ranging from a momentary interruption to 4 hours and 11 minutes.
2. May 21, 2014, an outage event affecting 25,166 customers caused by faulty equipment operation at Pukele Substation. This outage ranged from a momentary interruption to 33 minutes.
3. July 19, 2014, Koolau-Wailupe 2 46KV line auto-reclosed during a lightning storm affecting 10,601 customers for a momentary interruption event.
4. May 2, 2014, Ewa Nui 41 46KV line tripped due to a flashover in the Ewa Beach Substation affecting 10,382 customers ranging from a momentary interruption to 12 minutes.
5. July 20, 2014, Koolau-Pohakupu 46KV line tripped during a lightning storm due to a broken crossarm. This outage affected 10,160 customers ranging from a momentary interruption to 6 hours and 3 minutes.
6. January 26, 2014, Koolau-Wailupe 2 46KV line auto-reclosed during a high wind condition due to a slack-span. This affected 10,099 customers for a momentary interruption.

Figure 2: Outage Categories



The Top 5 Outage Categories, by number of customer interruption hours affected, as illustrated in Figure 2, equates to about 68% of the total Customer hours in 2014. These top outage causes are:

<u>Outage Category</u>	<u>Sample Causes</u>
1. Equipment Deterioration	Failed, broken, corroded equipment
2. Cable Faults	Underground equipment failures
3. Trees/Branches	Contact by vegetation regardless of what caused it to make contact
4. Scheduled Maintenance	Planned maintenance
5. High Winds	Direct wind force on any electrical equipment

The top five major cause factors for 2014 were varied from 2013, "Under frequency load shedding, switching errors, and auto accidents" were replaced by "trees/branches, scheduled maintenance and high winds" respectively. The reliability improvement for "Switching Errors" is attributed primarily to an increased focus and emphasis on safety and accountability and changed work practices. 2014 resulted in a 31% decrease in switching error outages and 23% decrease in customers affected by the switching errors. The results in 2014 show that there were significantly less outages caused by "Auto Accident". There was a 45% decrease in auto accidents combined with a 72% decrease in customers affected by auto accidents in 2014.

The number of customer interruption hours due to "Trees/Branches" increased from 37,343.07 in 2013 to 67,573.97 in 2014, an increase of 81%. The number of customer interruption hours due to "High Winds" increased from 15,644.50 in 2013 to 41,062.65 in 2014, a 162% increase. "Trees/Branches" most likely increased in direct correlation with the significant increase of "High Winds" outages during storm effects the system experienced in 2014.

The number of customer interruption hours due to "Scheduled Maintenance" increased from 39,298.63 in 2013 to 56,762.85 in 2014, a 44% increase. The "Scheduled Maintenance" outage increase is primarily driven from:

- 1) Our increasing capital expenditures directed towards our efforts for grid modernization and the upgrades to address the Equipment Deterioration issues (i.e. Cable, Pole, Transformer and Hardware replacements, etc.)
- 2) New, improved and safer work practices implemented to consistently comply with our corporate goal of keeping safety first (i.e. a de-energized work environment requires more outages).

Through our grid modernization efforts, the number of customer interruption hours due to "Equipment Deterioration" decreased from 221,078.38 in 2013 to 108,772.65 in 2014, a 51% reduction and the number of customer interruption hours from "Cable Fault" decreased from 100,704.22 in 2013 to 97,504.37 in 2014 a 3% reduction.

Figure 3: Customer Average Interruption Duration Index (CAIDI)

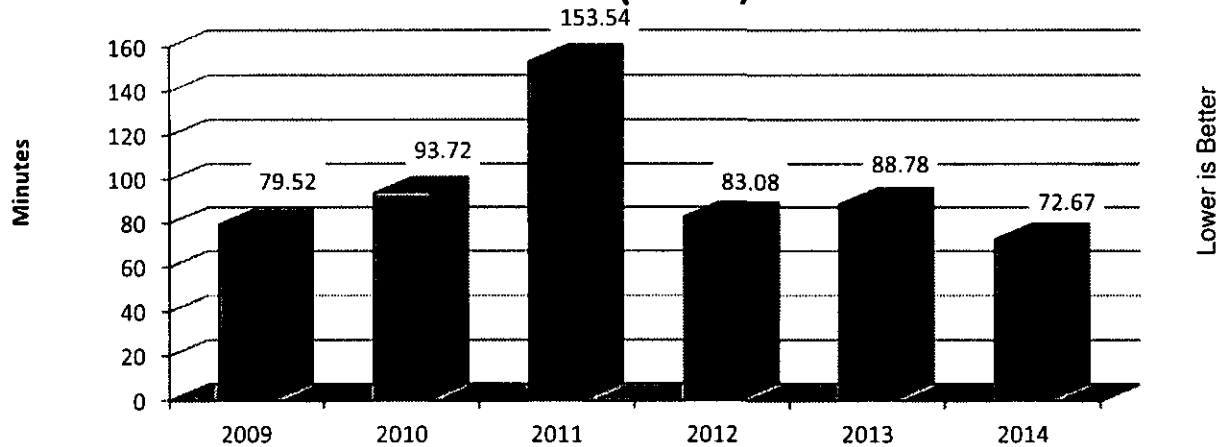


Figure 3 shows the Customer Average Interruption Duration Indices (CAIDI) for the past six years. The 2014 CAIDI of 72.67 minutes, is an 18% decrease compared to the 2013 CAIDI, making it the best CAIDI result in the last six years.

This significant performance improvement and noticeable downward trend is a result of our increasing grid modernization initiatives. DA (distribution automation) and SCADA (supervisory control and data acquisition) apparatuses are strategically placed smart grid devices to aide in circuit fault detection which enables quicker isolation of the problem resulting in quicker power restoration. Fundamentally, the grid modernization provides immediate alarms to the system operation control center (SOCC), enabling and alerting the SOCC personnel to assess and respond to deploy field crews effectively and efficiently, and allowing more capability to restore customers remotely as well.

Three major events impacting the 2014 CAIDI results were:

1. October 30, 2014 – A large tree broke and fell into overhead conductors in Laulani Valley in Mililani affecting 2,865 customers causing a momentary interruption for some customers and a sustained interruption lasting 17 hours and 49 minutes to others. This incident added 2.5 minutes to the annual 2014 CAIDI.
2. May 25, 2014 – During a lightning storm a 46KV insulator broke in Waialua affecting 12,930 customers again with some customers seeing a momentary interruption and others experiencing an outage lasting 2 hours and 54 minutes. This event added slightly over 1 minute to the annual 2014 CAIDI.
3. July 20, 2014 – During a lightning storm a 12KV crossarm broke in Makaha affecting 2,398 customers with a momentary interruption and some customers experiencing an outage lasting 6 hours and 4 minutes. This event added slightly over 1 minute to the annual 2014 CAIDI.

Figure 4: System Average Interruption Frequency Index (SAIFI)

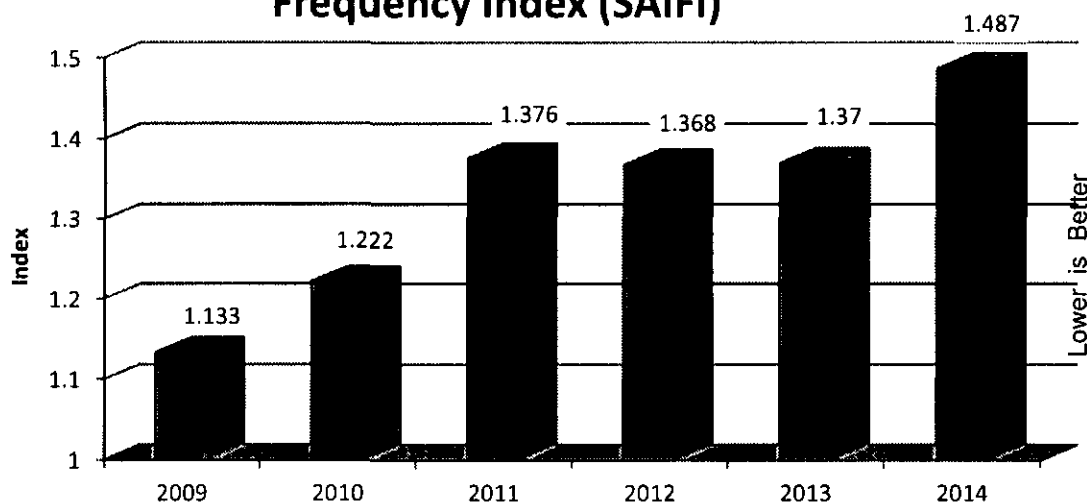


Figure 4 illustrates the System Average Interruption Frequency Index (SAIFI) for the past six years. The 2014 SAIFI of 1.487 had the most customer interruption occurrences of the past six years, increasing 9% from the 2013 SAIFI of 1.370. The total number of customer interruptions in 2014 was 447,048 compared to 409,516 interruptions in 2013.

This result is an indication that as we continue to make improvements in certain causes of outages (e.g, equipment deterioration) storms and other weather incidents continue to have a large impact on the system reliability. As was pointed out in the discussion regarding the CAIDI results, the three significant events were weather related incidents, particularly the lightning storm in May, also contributed to the overall SAIFI as large numbers of customers were affected by these outages.

**Figure 5: Average Service Availability Index
(ASAI)**

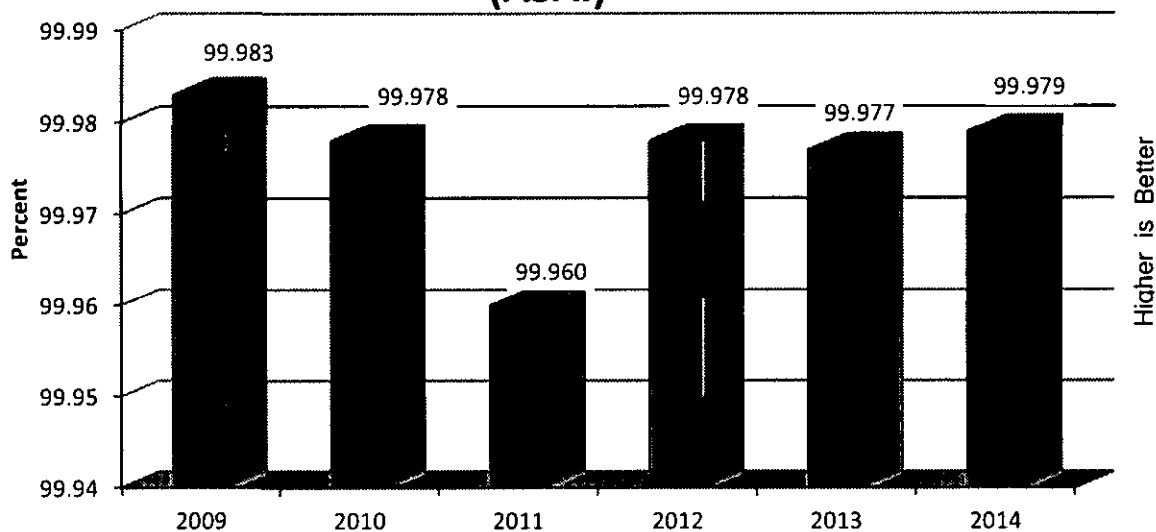


Figure 5 shows that the 2014 Average Service Availability is the second highest in the last six years, increasing ever so slightly from 2013. While 2014 experienced the highest amount of customer interruptions (SAIFI) for the last six years, the ability to restore power quicker resulted in the best performance for CAIDI, therefore causing SAIDI to be the second best performance in the period. These results in combination with a larger customer base attributes to a higher ASAI. With a customer base increase of about 1,800 over 2013, the difference of availability equates to approximately 53 more hours of availability per customer for 2014, ranking second best performance in the last six years

Hawaiian Electric Company Normalized Sustained Interruption Summary

From: January 1, 2014

To: December 31, 2014

Outage Cause	Customer Hours	Customer Interruptions	SAIFI	SAIDI	CAIDI
EQUIP DETERIORATION	108,772.65	62,002	0.206	21.70	105.26
CABLE FAULT	97,504.37	69,867	0.232	19.45	83.73
TREES/BRANCHES IN LINES	67,573.97	35,044	0.117	13.48	115.70
SCHEDULED MAINTENANCE	56,762.85	15,425	0.051	11.33	220.80
HIGH WINDS	41,062.65	21,949	0.073	8.19	112.25
LIGHTNING	35,394.37	12,956	0.043	7.06	163.91
FAULTY EQUIP OPERATION	24,653.55	51,399	0.171	4.92	28.78
AUTO ACCIDENT	24,333.82	14,062	0.047	4.86	103.83
AUTO UF LOADSHED	17,279.97	64,175	0.213	3.45	16.16
UNKNOWN	10,223.77	13,682	0.045	2.04	44.83
FOREIGN OBJECT IN LINES	5,720.07	3,348	0.011	1.14	102.51
CONTAMINATION FLASHOVER	5,575.55	5,116	0.017	1.11	65.39
CONSTRUCTION ACCIDENT	5,562.92	7,291	0.024	1.11	45.78
EQUIP ROT OR TERMITES	5,480.97	2,554	0.008	1.09	128.76
COMPANY PERSONNEL ERROR	5,058.95	11,254	0.037	1.01	26.97
FORCED MAINTENANCE	4,704.68	8,075	0.027	0.94	34.96
FLASHOVER	3,921.98	14,633	0.049	0.78	16.08
LANDSLIDE/FLOODING	2,805.77	2,476	0.008	0.56	67.99
OVERGROWN VEGETATION	2,734.67	1,670	0.006	0.55	98.25
TRANSFORMER FAILURE	2,645.97	494	0.002	0.53	321.37
SYSTEM LOAD MAINTENANCE	2,360.47	3,059	0.010	0.47	46.30
COMPANY SWITCHING ERROR	2,206.18	19,140	0.064	0.44	6.92
ANIMAL IN LINES	2,156.77	2,841	0.009	0.43	45.55
MYLAR BALLOON	1,959.68	1,636	0.005	0.39	71.87
TRANSFORMER OVERLOAD	1,802.57	1,283	0.004	0.36	84.30
VANDALISM	994.95	737	0.002	0.20	81.00
EQUIP OVERLOAD	985.57	614	0.002	0.20	96.31
CUSTOMER EQUIP	881.85	137	0.000	0.18	386.21
MOVING EQUIP ACCIDENT	166.20	75	0.000	0.03	132.96
OTHER	86.18	39	0.000	0.02	132.59
FIRE	52.18	9	0.000	0.01	347.89
OTHER-GENERATION	8.50	6	0.000	0.00	85.00
MANUAL UF LOADSHED	0.00	0	0.000	0.00	0.00
MAN IN LINES	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
SWITCH LOAD MAINTENANCE	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

Hawaiian Electric Company Normalized Sustained Interruption Summary

From: January 1, 2014

To: December 31, 2014

Outage Cause	Customer Hours	Customer Interruptions	SAIFI	SAIDI	CAIDI
Total	541,434.57	447,048	1.487	108.03	72.67
AVERAGE SYSTEM AVAILABILITY =			99.979%		
NUMBER OF CUSTOMERS FOR THE PERIOD =			300,722		
24 MONTH ANNUALIZED SAIDI AVERAGE FOR THE PERIOD 1/1/2013 - 12/31/2014 =			114.81		
24 MONTH AVERAGE NUMBER OF CUSTOMERS FOR THE PERIOD 1/1/2013 - 12/31/2014			299,821		

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, 2014

To: December 31, 2014

Outage Cause	<u>Interruptions</u>		<u>Customer Hours</u>	
	Number	% of Total	Number	% of Total
<u>ACCIDENT</u>	44	1.60	30,062.93	5.55
AUTO ACCIDENT	28	1.02	24,333.82	4.49
CONSTRUCTION ACCIDENT	14	0.51	5,562.92	1.03
MOVING EQUIP ACCIDENT	2	0.07	166.20	0.03
<u>CABLE FAULT</u>	602	21.83	97,504.37	18.01
CABLE FAULT	602	21.83	97,504.37	18.01
<u>COMPANY ERROR</u>	34	1.23	7,265.13	1.34
COMPANY PERSONNEL ERROR	18	0.65	5,058.95	0.93
COMPANY SWITCHING ERROR	16	0.58	2,206.18	0.41
<u>EQUIPMENT</u>	403	14.61	140,774.58	26.00
EQUIP DETERIORATION	339	12.29	108,772.65	20.09
FAULTY EQUIP OPERATION	29	1.05	24,653.55	4.55
EQUIP ROT OR TERMITES	2	0.07	5,480.97	1.01
EQUIP OVERLOAD	7	0.25	985.57	0.18
CUSTOMER EQUIP	26	0.94	881.85	0.16
IPP EQUIP FAILURE	0	0.00	0.00	0.00
MANUFACTURER EQUIP DEFECT	0	0.00	0.00	0.00
<u>FIRE</u>	2	0.07	52.18	0.01
FIRE	2	0.07	52.18	0.01
<u>FLASHOVER</u>	17	0.62	9,497.53	1.75
CONTAMINATION FLASHOVER	3	0.11	5,575.55	1.03
FLASHOVER	14	0.51	3,921.98	0.72
<u>GENERATION</u>	61	2.21	17,288.47	3.19
AUTO UF LOADSHED	58	2.10	17,279.97	3.19
OTHER-GENERATION	3	0.11	8.50	0.00
MANUAL UF LOADSHED	0	0.00	0.00	0.00
<u>MAINTENANCE</u>	1,235	44.78	63,828.00	11.79
SCHEDULED MAINTENANCE	1,089	39.49	56,762.85	10.48
FORCED MAINTENANCE	137	4.97	4,704.68	0.87
SYSTEM LOAD MAINTENANCE	9	0.33	2,360.47	0.44
CUSTOMER MAINTENANCE	0	0.00	0.00	0.00
TRANSFER LOAD MAINTENANCE	0	0.00	0.00	0.00
SWITCH LOAD MAINTENANCE	0	0.00	0.00	0.00

Hawaiian Electric Company Normalized Sustained Interruption Summary

From: January 1, 2014

To: December 31, 2014

	<u>Interruptions</u>		<u>Customer Hours</u>	
<u>OBJECT IN LINES OR EQUIP</u>	29	1.05	9,836.52	1.82
FOREIGN OBJECT IN LINES	4	0.15	5,720.07	1.06
ANIMAL IN LINES	19	0.69	2,156.77	0.40
MYLAR BALLOON	6	0.22	1,959.68	0.36
MAN IN LINES	0	0.00	0.00	0.00
<u>OTHER</u>	4	0.15	86.18	0.02
OTHER	4	0.15	86.18	0.02
<u>TRANSFORMER</u>	79	2.86	4,448.53	0.82
TRANSFORMER FAILURE	52	1.89	2,645.97	0.49
TRANSFORM OVERLOAD	27	0.98	1,802.57	0.33
<u>UNKNOWN</u>	41	1.49	10,223.77	1.89
UNKNOWN	41	1.49	10,223.77	1.89
<u>VANDALISM</u>	1	0.04	994.95	0.18
VANDALISM	1	0.04	994.95	0.18
<u>VEGETATION</u>	96	3.48	70,308.63	12.99
TREES/BRANCHES IN LINES	87	3.15	67,573.97	12.48
OVERGROWN VEGETATION	9	0.33	2,734.67	0.51
<u>WEATHER</u>	110	3.99	79,262.78	14.64
HIGH WINDS	66	2.39	41,062.65	7.58
LIGHTNING	42	1.52	35,394.37	6.54
LANDSLIDE/FLOODING	2	0.07	2,805.77	0.52
NATURAL DISASTER	0	0.00	0.00	0.00
Total:	2,758		541,434.57	

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

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:

AVERAGE SERVICE AVAILABILITY INDEX (ASAI)

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.

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

HAWAI'I ELECTRIC LIGHT COMPANY, INC.

ANNUAL SERVICE RELIABILITY REPORT

2014

Prepared by
Operations, Distribution Department

July 2, 2015

INTRODUCTION

This is the 2014 annual service reliability report of the Hawai'i Electric Light Company (HAWAI'I ELECTRIC LIGHT). The year-end average number of electric customers increased from 82,074 in 2013 to 82,872 in 2014 (a 0.96% increase). The 2014 peak demand for the system was 187.8 MW (evening peak), 2.4 MW lower than the peak demand of 190.2 MW in 2013.

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 (SAI), the frequency or number of times HAWAI'I ELECTRIC LIGHT'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 HAWAI'I ELECTRIC LIGHT'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 HAWAI'I ELECTRIC LIGHT's total customer base (in this case 82,872 customers).

ANALYSIS

This analysis of the annual system reliability for HAWAI'I ELECTRIC LIGHT is for the year 2014. To determine the relative level of reliability, the statistics for five prior years, 2009 through 2013, 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 HAWAI'I ELECTRIC LIGHT 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.)

Hawai'i Electric Light Company, Inc.
Annual Service Reliability Report 2014

2014 RESULTS

Annual Service Reliability Indices

The reliability results for 2014 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. Tables 3-8 break out the events into three groups, Transmission and Distribution, Generation – Hawaiian Electric, and Generation – Other [non-utility] for all events and with normalization. Three outage events were normalized in 2014, including two T&D and one Generation related events. All subsequent comparisons and discussion are based on the normalized data.

Table 1: Annual Service Reliability Indices - All Events

Year	2009	2010	2011	2012	2013	2014
Number of Customers	79,679	80,171	80,800	81,537	82,068	82,872
Customer Interruptions	298,122	300,528	289,448	229,461	377,561	405,362
Customer-Hour Interruptions	245,593	209,919	245,465	191,973	277,087	1,320,024
SAID	184.94	157.10	182.28	141.27	202.58	955.7
CAID	49.43	41.91	50.88	50.2	44.03	195.38
SAIF	3.742	3.749	3.582	2.814	4.601	4.891
ASA	99.965	99.965	99.964	99.973	99.961	99.811

Table 2: Annual Service Reliability Indices - with Normalization

Year	2009*	2010*	2011*	2012	2013*	2014*
Number of Customers	79,679	80,171	80,800	81,537	82,068	82,872
Customer Interruptions	246,226	176,252	235,520	229,461	239,369	281,467
Customer-Hours Interrupted	195,655	170,798	235,894	191,973	155,975	222,297
SAID	147.33	127.83	175.17	141.27	114.03	160.94
CAID	47.68	58.14	60.1	50.2	39.1	47.39
SAIF	3.09	2.198	2.915	2.814	2.917	3.396
ASA	99.972	99.97	99.966	99.973	99.978	99.962

NOTE:

2009* Data normalized to exclude 6/25 HRD UFLS
Data normalized to exclude 9/22 Keahole ST7 UFLS
Data normalized to exclude 12/19-20 Lightning Storm

2010* Data normalized to exclude 1/26 Puna Plant UFLS
Data normalized to exclude 4/9 and 7/3 Keahole CT5 UFLS
Data normalized to exclude 10/27 Keahole CT4 UFLS

Hawai'i Electric Light Company, Inc.
Annual Service Reliability Report 2014

- 2011* Data normalized to 6/30 exclude Keahole CT4 UFLS
Data normalized to exclude Keahole CT5 and ST7 UFLS
Data normalized to exclude 8/2 HEP UFLS
- 2013* Data normalized to exclude 1/25 7600 Line fault
Data normalized to exclude 3/2, Keahole CT4 UFLS
Data normalized to exclude 3/13 6500 Line fault
Data normalized to exclude 6/27, 8/14 Waimea Sub upgrade
Data normalized to exclude 7/29 Wind Storm
Data normalized to exclude 10/26, 12/30 PGV UFLS
Data normalized to exclude 11/25 Hill 6 UFLS
Data normalized to exclude 12/30 Lightning Storm
- 2014* Data normalized to exclude 1/22 Wind Storm
Data normalized to exclude 4/12 Keahole CT 5 UFLS
Data normalized to exclude 8/7 Hurricane Iselle

Table 3: Transmission & Distribution Events

Year	2009	2010	2011	2012	2013	2014
Number of Customers	79,679	80,171	80,800	81,537	82,068	82,872
Customer Interruptions	165,266	87,951	178,277	146,243	189,384	232,992
CID	229,869.2	161,749.1	230,936.3	184,668.8	256,892.7	1,294,789.2
SAID	173.1	121.05	171.49	135.89	187.81	937.44
CAID	83.45	110.34	77.72	75.77	81.39	333.43
SAIF	2.074	1.097	2.206	1.794	2.308	2.811

Table 4: Generation Events – Hawai'i Electric Light

Year	2009	2010	2011	2012	2013	2014
Number of Customers	79,679	80,171	80,800	81,537	82,068	82,872
Customer Interruptions	112,196	160,866	57,396	31,421	117,362	118,641
CID	14,299	32,265.7	6,272.8	2,714.8	13,785	15,257.9
SAID	10.77	24.15	4.66	2	10.08	11.05
CAID	7.65	12.03	6.56	5.18	7.05	7.72
SAIF	1.408	2.007	0.71	0.385	1.43	1.432

Table 5: Generation Events – Other (non-utility)

Year	2009	2010	2011	2012	2013	2014
Number of Customers	79,679	80,171	80,800	81,537	82,068	82,872
Customer Interruptions	20,660	51,711	53,775	5,1797	70,815	53,729
CID	1,424.8	15,903.8	8,255.7	4,589.8	6,409.7	9,976.5
SAID	1.07	11.9	6.13	3.38	4.69	7.22
CAID	4.14	18.45	9.21	5.32	5.43	11.14
SAIF	0.259	0.645	0.666	0.635	0.863	0.648

Hawai'i Electric Light Company, Inc.
Annual Service Reliability Report 2014

Table 6: Transmission & Distribution Events with Normalization

Year	2009*	2010	2011	2012	2013*	2014
Number of Customers	79,679	80,171	80,800	81,537	82,068	82,872
Customer Interruptions	125,005	87,951	178,277	14,6243	125,999	141,684
CID	181,760.7	161,749.1	230,936.3	184,668.8	146,321.3	204,185.5
SAID	136.87	121.05	171.49	135.89	106.98	147.83
CAID	87.24	110.34	77.72	75.77	69.68	86.47
SAIF	1.569	1.097	2.206	1.794	1.535	1.710

Table 7: Generation Events – Hawai'i Electric Light with Normalization

Year	2009	2010	2011	2012	2013	2014
Number of Customers	79,679	80,171	80,800	81,537	82,068	82,872
Customer Interruptions	100,561	71,993	29,754	31,421	71,236	86,054
CID	12,469.8	7,733.5	3,061.3	2,714.8	6,375	8,134.9
SAID	9.39	5.79	2.27	2	4.66	5.89
CAID	7.44	6.45	6.17	5.18	5.37	5.67
SAIF	1.262	0.898	0.368	0.385	0.868	1.038

Table 8: Generation Events – Other (non-utility) with Normalization

Year	2009	2010	2011	2012	2013	2014
Number of Customers	79,679	80,171	8,0800	81,537	82,068	82,872
Customer Interruptions	20,660	16,308	27,489	51,797	42,134	53,729
CID	1,424.8	1,315	1,896	4,589.8	3,278.5	9,976.5
SAID	1.07	0.98	1.41	3.38	2.4	7.22
CAID	4.14	4.84	4.14	5.32	4.67	11.14
SAIF	0.259	0.203	0.340	0.635	0.513	0.648

Hawai'i Electric Light Company, Inc.
Annual Service Reliability Report 2014

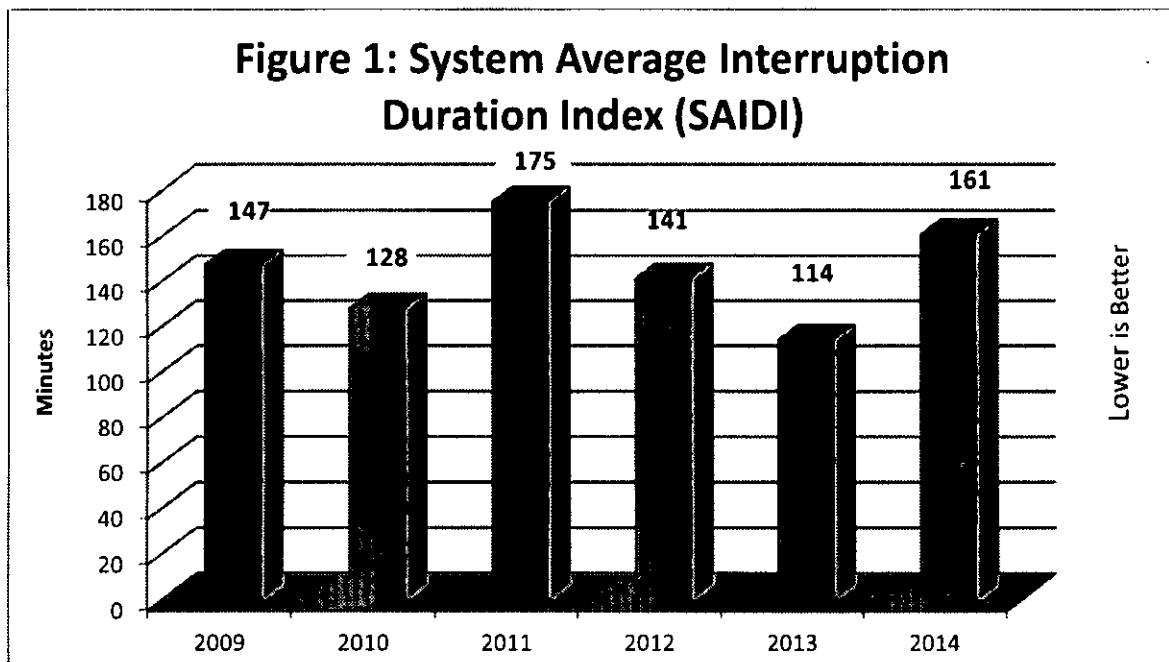


Figure 1 shows the System Average Interruption Duration Indices (SAIDI) for the past six years. It shows that the 2014 SAIDI is 161 minutes, a 29% increase compared to the 2013 SAIDI result of 114 minutes. The SAIDI is the composite of both the SAIFI and CAIDI indices and produces a broader benchmark of system reliability by combining both the duration and the number of customer interruptions during a given period of time.

In 2014, there were 15 sustained outages that resulted in the loss of more than 5,000 customers:

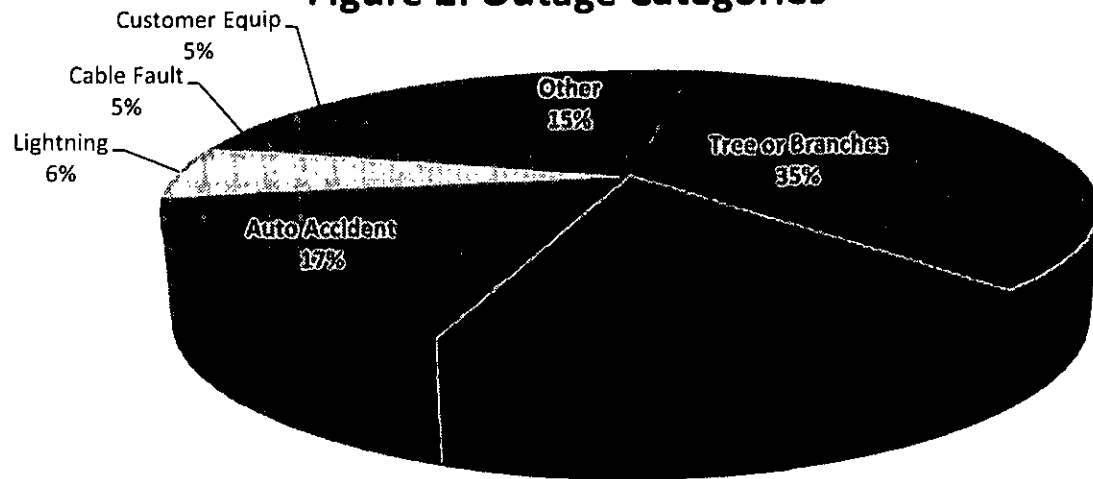
1. **January 6, 2014:** Deteriorated hardware failed on the 34kV Line 3400 and tripped CB 3402 Kilauea during high winds, affecting 13,362 customers for up to 9 hours and 10 minutes.
2. **January 22, 2014:** Fallen tree during high winds caused 69kV Line 6500 to trip, affecting 12,076 customers for 2 minutes.
3. **January 28, 2014:** Fallen tree caused 69kV Line 9600 to trip, affecting 5,503 customers for up to 3 hours and 10 minutes.
4. **April 29, 2014:** Underfrequency load shed event occurred when Keahole CT5 tripped offline, affecting 19,054 customers for up to 9 minutes.
5. **June 7, 2014:** Underfrequency load shed event occurred when Keahole CT5 tripped offline, affecting 7,043 customers for up to 3 minutes.

Hawai'i Electric Light Company, Inc.
Annual Service Reliability Report 2014

6. **June 15, 2014:** Motor vehicle accident caused the 69kV Line 6100 to trip, affecting 5,908 customers for up to 4 hours and 27 minutes.
7. **June 26, 2014:** Underfrequency load shed event occurred when Hill 6 tripped offline, affecting 13,768 customers for up to 8 minutes.
8. **July 11, 2014:** Underfrequency load shed event occurred when Keahole CT4 tripped offline, affecting 10,220 customers for up to 10 minutes.
9. **July 11, 2014:** Underfrequency load shed event occurred for a second time when Keahole CT4 tripped offline, affecting 10,220 customers for up to 8 minutes.
10. **August 28, 2014:** Underfrequency load shed event caused Hill 5 to trip offline, affecting 10,220 customers for up to 6 minutes.
11. **September 8, 2014:** Underfrequency load shed event occurred when Pakini Nui wind farm tripped offline, affecting 12,174 customers for up to 7 minutes.
12. **October 6, 2014:** Underfrequency load shed event occurred when Keahole ST7 tripped offline, affecting 5,309 customers for up to 3 minutes.
13. **October 27, 2014:** Underfrequency load shed event occurred when Hamakua Energy Partners CT2 tripped offline, affecting 12,174 customers for up to 8 minutes.
14. **December 24, 2014:** Underfrequency load shed event occurred when Hamakua energy Partners CT1 tripped offline, affecting 29,381 customers for up to 23 minutes.

Hawai'i Electric Light Company, Inc.
Annual Service Reliability Report 2014

Figure 2: Outage Categories



The Top 5 Outage Categories, by number of customer interruption hours affected, as illustrated in Figure 2, equates to about 80% of the total Customer hours in 2014. These top outage causes are:

<u>Outage Category</u>	<u>Sample Causes</u>
1. Trees/Branches	Contact by vegetation regardless of what caused it to make contact
2. Deterioration	Failed, broken corroded equipment
3. Motor Vehicle Accidents	
4. Lightning	
5. Cable Faults	Underground equipment failures

The top three major cause factors for 2014 were exactly the same as 2013. The top 4th and 5th major causes for 2014 varied from 2013, whereas "Scheduled Maintenance and Faulty Equipment Operation" was replaced by "Lightning and Cable Faults."

A total of 281,451 Customer Interruptions were recorded for a total of 222,264 Customer Hours of Interruptions. The System Average Interruption Frequency (SAIF) index was 3.396 and the Customer Average Interruption Duration (CAID) was 47.38 minutes.

Hawai'i Electric Light Company, Inc.
Annual Service Reliability Report 2014

Figure 3: Customer Average Interruption Duration Index (CAIDI)

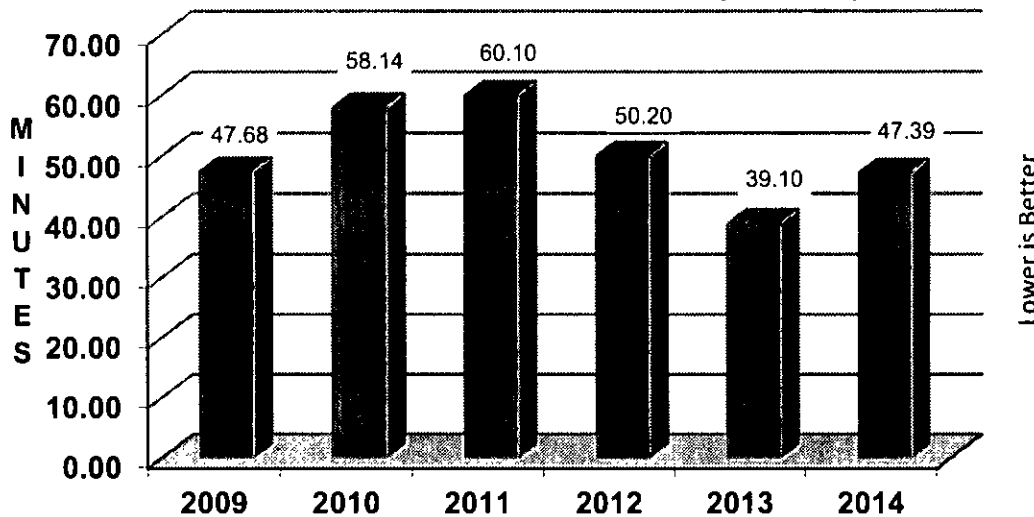


Figure 3 shows the Customer Average Interruption Duration Indices (CAIDI) for the past six years. The CAIDI for 2014 is 47.38 minutes, an 18% increase compared to the 2013 CAIDI result of 39.10 minutes. In the six year period, 2014 was the second best performing year for CAIDI.

The largest contributing factor for the increase in the annual 2014 CAIDI was longer sustained outages due to motor vehicle accidents. In 2013, CAIDI caused by auto accidents was 44.56 minutes as compared to 122.19 minutes in 2014.

Trees and branches also contributed to the increase, with a 2013 CAIDI of 77.32 as compared to 95.92 in 2014. In contrast, CAIDI due to deterioration and scheduled maintenance decreased in 2014 as compared to 2013.

Three major events affecting the 2014 CAIDI results were:

1. April 13, 2014 – Broken pole due to a motor vehicle accident affected 1,385 customers in the Kapoho area and caused a sustained outage of 4 hours and 52 minutes. This incident added .76 minutes to the annual 2014 CAIDI.
2. April 26, 2014 – Deteriorated hardware on the 34kV Line 3300 affected 2,049 customers in North Kohala and caused a sustained outage of 4 hours and 39 minutes. This incident added 1.7 minutes to the annual 2014 CAIDI.
3. December 24, 2014 – Broken pole due to motor vehicle accident affected 2,957 customers in the Kahaluu area and caused a sustained outage of 3 hours and 35 minutes. This incident added 1.4 minutes to the annual 2014 CAIDI.

Hawai'i Electric Light Company, Inc.
Annual Service Reliability Report 2014

**Figure 4: System Average Interruption
Frequency Index (SAIFI)**

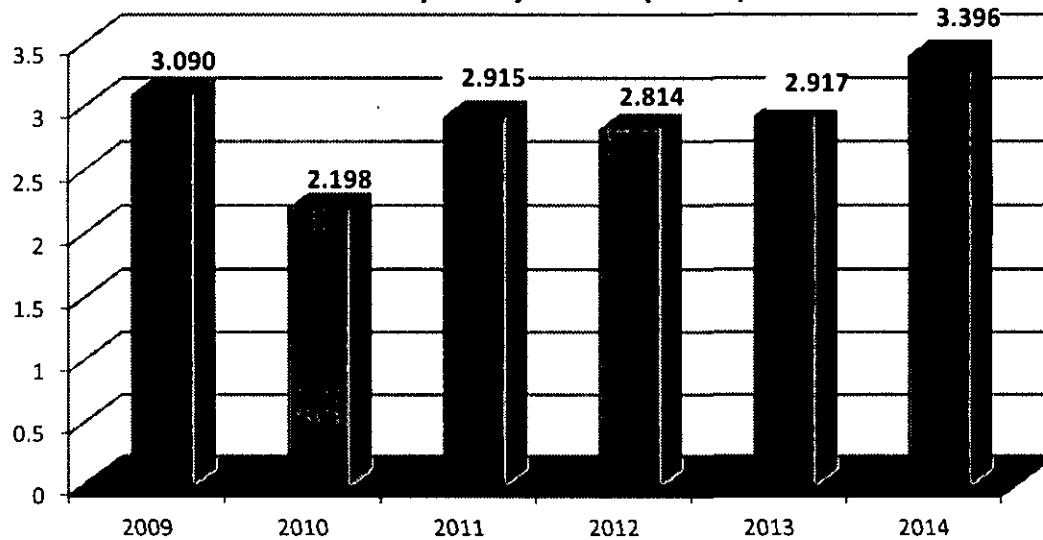


Figure 4 shows the System Average Interruption Frequency Index (SAIFI) increased from 2.917 in 2013 to 3.396 in 2014. 2014 had the highest customer interruption occurrences of the past six years.

While underfrequency load shed events continue to be the leading cause of customer interruptions, the largest contributing factor for the increase in the annual 2014 SAIFI was the rise in the number of interruptions due to equipment deterioration. 2013 saw 18,763 customer interruptions related to deterioration, compared to 33,007 in 2014. Of the 33,007 interruptions, 14,053 were also weather related.

Hawai'i Electric Light Company, Inc.
Annual Service Reliability Report 2014

Figure 5: Average Service Availability Index (ASAI)

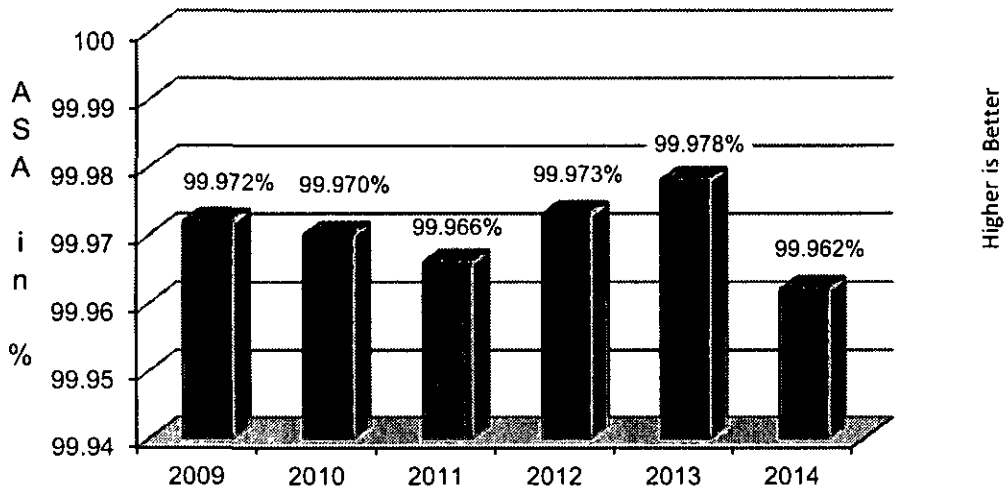


Figure 5 shows that the 2014 Average Service Availability Index was the lowest when compared to the prior five years. An increase of customer-hour interruptions in 2014 shows a direct relationship to the decrease of the ASAI in 2014. The top three SAIDI causes (as shown in above Figure 2), trees and branches, deterioration, and auto accidents, also account for the top three causes of customer-hour interruptions.

2014
SERVICE RELIABILITY SUMMARY
Normalized

Cause of Outage	CUST-HRS	CUST-INT	SAIF	SAID	CAID	MAIF	SAID Rank
Tree or Branches	78253.3	48949	0.591	56.66	95.92	0.000	1
Deterioration	38491.8	33007	0.398	27.87	69.97	0.022	2
Auto Accident	38417.8	18865	0.228	27.81	122.19	0.000	3
Lightning	13759.4	6049	0.073	9.96	136.48	0.001	4
Cable Fault	10167.0	4634	0.056	7.36	131.64	0.000	5
Customer Equip	9984.4	53733	0.648	7.23	11.15	0.000	6
Faulty Equip Opn	6966.1	73101	0.882	5.04	5.72	0.000	7
Scheduled Maint	5927.0	3732	0.045	4.29	95.29	0.000	8
Unknown	5605.7	4411	0.053	4.06	76.25	0.135	9
Flashover	3708.6	5112	0.062	2.69	43.53	0.000	10
High Wind	3297.6	10532	0.127	2.39	18.79	0.000	11
Sys Add/Removal	2096.7	753	0.009	1.52	167.07	0.000	12
Other Persnl Err	2035.6	15617	0.188	1.47	7.82	0.000	13
Tsf Failure	1260.1	903	0.011	0.91	83.73	0.005	14
Equip Overload	882.5	750	0.009	0.64	70.60	0.000	15
Flood Tsunami	370.8	50	0.001	0.27	445.00	0.000	16
Excavate Constr	358.8	590	0.007	0.26	36.49	0.000	17
Loose Connection	350.0	115	0.001	0.25	182.61	0.000	18
Man or Animal	107.6	51	0.001	0.08	126.55	0.000	19
Forced Maint	104.3	390	0.005	0.08	16.05	0.000	20
Equip Failure	102.0	92	0.001	0.07	66.52	0.000	21
Fire	18.8	16	0.000	0.01	70.50	0.000	22
Equip Contact	11.9	5	0.000	0.01	142.20	0.000	23
Vandalism	10.6	1	0.000	0.01	636.00	0.000	24
Foreign Objects	4.9	6	0.000	0.00	49.00	0.000	25
Balloon/Kite	3.7	3	0.000	0.00	73.00	0.000	26
Tsf Overload	0.0	0	0.000	0.00	0.00	0.000	27
Opn or Sw Error	0.0	0	0.000	0.00	0.00	0.000	28
Transfer Load	0.0	0	0.000	0.00	0.00	0.000	29
Balance Load	0.0	0	0.000	0.00	0.00	0.000	30
Customer Maint	0.0	0	0.000	0.00	0.00	0.000	31
TOTALS	222297.0	281467	3.396	160.94	47.39	0.164	

NUMBER OF CUSTOMERS FOR THE PERIOD = 82872

ASA = 99.962%

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY

SAID = SYSTEM AVERAGE INTERRUPTION DURATION

CAID = CUSTOMER AVERAGE INTERRUPTION DURATION

MAIF = MOMENTARY AVERAGE INTERRUPTION FREQUENCY

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

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Hawai'i Electric Light Company, Inc.
Annual Service Reliability Report 2014
Attachment A- Summaries

2014
SYSTEM INTERRUPTION CAUSE REPORT
Normalized

CAUSE		No. of Interruptions		Customer Hours	
NON-CONNECTED SYSTEM	(Totals)	670	24.98%	127542.5	57.37%
Tree or Branches		486	18.12%	78253.3	35.20%
Customer Equip		83	3.09%	9984.4	4.49%
Auto Accident		66	2.46%	38417.8	17.28%
Man or Animal		13	0.48%	107.6	0.05%
Excavate Constr		12	0.45%	358.8	0.16%
Fire		3	0.11%	18.8	0.01%
Equip Contact		3	0.11%	11.9	0.01%
Flood Tsunami		1	0.04%	370.8	0.17%
Foreign Objects		1	0.04%	4.9	0.00%
Balloon/Kite		1	0.04%	3.7	0.00%
Vandalism		1	0.04%	10.6	0.00%
Transfer Load		0	0.00%	0.0	0.00%
Balance Load		0	0.00%	0.0	0.00%
ERROR	(Totals)	32	1.19%	2035.6	0.92%
Other Persnl Err		32	1.19%	2035.6	0.92%
Opn or Sw Error		0	0.00%	0.0	0.00%
WEATHER	(Totals)	179	6.67%	17057.1	7.67%
Lightning		148	5.52%	13759.4	6.19%
High Wind		31	1.16%	3297.6	1.48%
EQUIPMENT FAILURE	(Totals)	513	19.13%	60668.0	27.29%
Deterioration		231	8.61%	38491.8	17.32%
Cable Fault		154	5.74%	10167.0	4.57%
Faulty Equip Opn		97	3.62%	6966.1	3.13%
Loose Connection		19	0.71%	350.0	0.16%
Flashover		6	0.22%	3708.6	1.67%
Equip Failure		4	0.15%	102.0	0.05%
Equip Overload		2	0.07%	882.5	0.40%
TRANSFORMER FAILURE	(Totals)	64	2.39%	1260.1	0.57%
Tsf Failure		64	2.39%	1260.1	0.57%
Tsf Overload		0	0.00%	0.0	0.00%
UNKNOWN AFTER TESTS AND INSPECTIONS	(Totals)	85	3.17%	5605.7	2.52%
Unknown		85	3.17%	5605.7	2.52%
MAINTENANCE	(Totals)	1052	39.22%	6031.3	2.71%
Scheduled Maint		1023	38.14%	5927.0	2.67%
Forced Maint		29	1.08%	104.3	0.05%
SYSTEM ADDITIONS OR REMOVALS	(Totals)	87	3.24%	2096.7	0.94%
Sys Add/Removal		87	3.24%	2096.7	0.94%
TOTALS		2682		222297.0	

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 HAWAI'I ELECTRIC LIGHT 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 HAWAI'I ELECTRIC LIGHT 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.

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

MAUI ELECTRIC COMPANY, LIMITED

ANNUAL SERVICE RELIABILITY REPORT

2014

Prepared by

Transmission and Distribution Department

March 24, 2015

INTRODUCTION

This is the 2014 annual service reliability report for Maui Electric Company, Limited (MECO). The year-end average number of electric customers increased from 69,303 in 2013 to 69,825 in 2014 (a 0.75% increase). The 2014 peak demand for the system was 194.9 MW (gross)¹, 0.4 MW higher than the peak demand in 2013; the highest system peak demand remains at 210.9 MW (gross) set on October 11, 2004, at approximately 6:45 p.m.

The system interruption summaries (Attachments A and B) 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 C, 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 MECO'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 MECO'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 MECO's total customer base (in this case 69,825 customers).

ANALYSIS

This analysis of the annual system reliability for MECO is for the year 2014. To determine the relative level of reliability, the statistics for five prior years, 2009 through 2013, are used for comparison.

The reliability indices are calculated using the data from all sustained² 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 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.

¹ The system peak occurred on November 4th, 2014, at approximately 6:29 p.m.

² An 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.)

2014 RESULTS

Annual Service Reliability Indices

The annual service reliability for 2014 was ranked fourth for the best SAIDI and ASA in the prior 5 years in terms of the indices for all events. The reliability results for all events in 2014 and five prior years are shown below in Table 1 through Table 4. The normalized reliability results for all events in 2014 and five prior years are shown below in Table 5 through Table 8. The reliability results comparing T&D and generation related outages with all events in 2014 and five prior years are shown below in Table 9 through Table 16. The normalized reliability results comparing T&D and generation related outages in 2014 and five prior years are shown below in Table 17 through Table 24.

Table 1: Annual Service Reliability Indices – All Islands with All Events

	2009	2010	2011	2012	2013	2014
Number of Customers	67,126	67,405	68,010	68,575	69,303	69,825
Customer Interruptions	124,864	131,294	170,379	195,618	138,480	179,256
Customer-Hours Interrupted	195,853.4	103,416.1	210,185.7	248,500.5	221,000.3	219,243.8
SAIDI (Minutes)	175.06	92.05	185.43	217.43	191.33	188.39
CAIDI (Minutes)	94.11	47.26	74.02	76.22	95.75	73.38
SAIFI (Occurrence)	1.860	1.948	2.505	2.853	1.998	2.567
ASA (Percent)	99.9667%	99.9824%	99.9646%	99.9586%	99.9635%	99.9641%

Table 2: Annual Service Reliability Indices – Maui with All Events

	2009	2010	2011	2012	2013	2014
Number of Customers	62,328	62,640	63,225	63,745	64,397	64,909
Customer Interruptions	118,205	110,350	156,145	181,244	100,316	145,117
Customer-Hours Interrupted	189,744.8	70,072.9	194,603.0	199,620.7	171,316.7	167,244.6
SAIDI (Minutes)	182.66	67.12	184.68	187.89	159.62	154.60
CAIDI (Minutes)	96.31	38.10	74.78	66.08	102.47	69.15
SAIFI (Occurrence)	1.896	1.762	2.470	2.843	1.558	2.236
ASA (Percent)	99.9652%	99.9872%	99.9648%	99.9643%	99.9695%	99.9705%

Table 3: Annual Service Reliability Indices – Molokai with All Events

	2009	2010	2011	2012	2013	2014
Number of Customers	3,151	3,145	3,161	3,187	3,205	3,191
Customer Interruptions	4,452	18,473	8,018	12,171	33,224	21,114
Customer-Hours Interrupted	4,989.6	31,258.9	7,022.2	47,466.7	44,162.1	35,756.2
SAIDI (Minutes)	95.01	596.35	133.29	893.63	826.75	672.32
CAIDI (Minutes)	67.25	101.53	52.55	234.00	79.75	101.61
SAIFI (Occurrence)	1.413	5.874	2.537	3.819	10.366	6.617
ASA (Percent)	99.9819%	99.8862%	99.9746%	99.8300%	99.8423%	99.8717%

Table 4: Annual Service Reliability Indices – Lanai with All Events

	2009	2010	2011	2012	2013	2014
Number of Customers	1,648	1,621	1,624	1,643	1,702	1,724
Customer Interruptions	2,207	2,471	6,216	2,203	4,940	13,025
Customer-Hours Interrupted	1,119.1	2,084.3	8,560.4	1,413.1	5,521.5	16,243.1
SAIDI (Minutes)	40.74	77.15	316.27	51.60	194.65	565.30
CAIDI (Minutes)	30.42	50.61	82.63	38.49	67.06	74.82
SAIFI (Occurrence)	1.339	1.524	3.828	1.341	2.902	7.555
ASA (Percent)	99.9922%	99.9853%	99.9397%	99.9902%	99.9629%	99.8922%

Table 5: Annual Service Reliability Indices - All Islands with Normalization

	2009*	2010*	2011*	2012*	2013*	2014*
Number of Customers	67,126	67,405	68,010	68,575	69,303	69,825
Customer Interruptions	108,368	67,481	101,268	81,428	71,894	107,847
Customer-Hours Interrupted	173,602.0	60,006.6	145,710.8	125,836.1	108,360.7	120,684.7
SAIDI (Minutes)	155.18	53.41	128.55	110.10	93.81	103.70
CAIDI (Minutes)	96.12	53.35	86.33	92.72	90.43	67.14
SAIFI (Occurrence)	1.615	1.001	1.489	1.187	1.037	1.545
ASA (Percent)	99.9705%	99.9898%	99.9755%	99.9791%	99.9821%	99.9802%

Table 6: Annual Service Reliability Indices - Maui with Normalization

	2009*	2010*	2011*	2012*	2013*	2014*
Number of Customers	62,328	62,640	63,225	63,745	64,397	64,909
Customer Interruptions	106,498	65,654	99,729	77,968	64,459	102,328
Customer-Hours Interrupted	169,242.7	55,954.1	144,404.5	119,045.4	101,098.4	114,071.1
SAIDI (Minutes)	162.92	53.60	137.04	112.05	94.20	105.44
CAIDI (Minutes)	95.35	51.14	86.88	91.61	94.10	66.89
SAIFI (Occurrence)	1.709	1.048	1.577	1.223	1.001	1.576
ASA (Percent)	99.9689%	99.9898%	99.9739%	99.9787%	99.9820%	99.9799%

Table 7: Annual Service Reliability Indices - Molokai with Normalization

	2009*	2010*	2011*	2012*	2013*	2014*
Number of Customers	3,151	3,145	3,161	3,187	3,205	3,191
Customer Interruptions	1,284	1,498	1,252	3,229	6,180	4,064
Customer-Hours Interrupted	3,748.6	3,800.1	1,218.5	6,338.9	5,942.2	4,870.6
SAIDI (Minutes)	71.38	72.50	23.13	119.34	111.24	91.58
CAIDI (Minutes)	175.17	152.21	58.39	117.79	57.69	71.91
SAIFI (Occurrence)	0.407	0.476	0.396	1.013	1.928	1.274
ASA (Percent)	99.9864%	99.9862%	99.9956%	99.9773%	99.9788%	99.9825%

Table 8: Annual Service Reliability Indices - Lanai with Normalization

	2009*	2010*	2011*	2012*	2013*	2014*
Number of Customers	1,648	1,621	1,624	1,643	1,702	1,724
Customer Interruptions	586	329	287	231	1,255	1,455
Customer-Hours Interrupted	610.8	252.4	87.8	451.7	1,320.1	1,742.9
SAIDI (Minutes)	22.24	9.34	3.24	16.50	46.54	60.66
CAIDI (Minutes)	62.54	46.04	18.36	117.33	63.11	71.87
SAIFI (Occurrence)	0.356	0.203	0.177	0.141	0.737	0.844
ASA (Percent)	99.9958%	99.9982%	99.9994%	99.9969%	99.9911%	99.9884%

NOTE:

2009*	Data normalized to exclude the 01/16/09 High Winds Data normalized to exclude the 06/19/09 High Winds Data normalized to exclude various equipment failures and faults on Lanai and Molokai
2010*	Data normalized to exclude the 03/28/10 – 04/01/2010 High Winds Data normalized to exclude the 06/7/10 Flashover Data normalized to exclude the 12/9/10 – 12/10/10 Kona Storm Data normalized to exclude various equipment failures and faults on Lanai and Molokai
2011*	Data normalized to exclude the 01/10/11 High Winds Data normalized to exclude the 01/12/11 – 01/14/11 High Winds and Lightning Storm Data normalized to exclude the 12/24/11 High Winds Data normalized to exclude various equipment failures and faults on Lanai and Molokai
2012*	Data normalized to exclude the 02/7/12 – 02/08/12 High Winds Data normalized to exclude the 09/5/12 Operator Error Data normalized to exclude the 11/6/12 Flashover Data normalized to exclude the 12/4/12 Substation Fire Data normalized to exclude various equipment failures and faults on Lanai and Molokai
2013*	Data normalized to exclude the 01/2/13 Trees in Transmission Lines Data normalized to exclude the 07/29/13 – 07/30/13 Tropical Storm Flossie Data normalized to exclude various equipment failures and faults on Lanai and Molokai
2014*	Data normalized to exclude the 5/9/14 Flashover on the Maalaea/Kihei 69KV Line Data normalized to exclude the 08/7/14 – 08/9/13 Tropical Storm Iselle Data normalized to exclude the 10/7/14 Equipment failure Data normalized to exclude various equipment failures and faults on Lanai and Molokai

T&D vs. Generation – All Events

Table 9: Annual Service Reliability Indices for All Islands – T&D

	2009	2010	2011	2012	2013	2014
Number of Customers	67,126	67,405	68,010	68,575	69,303	69,825
Customer Interruptions	109,218	89,347	129,554	120,420	88,944	155,067
Customer-Hours Interrupted	184,174.3	82,311.0	188,364.0	182,315.6	186,857.1	198,535.5
SAIDI (Minutes)	164.62	73.27	166.18	159.52	161.77	170.60
CAIDI (Minutes)	101.18	55.28	87.24	90.84	126.05	76.82
SAIFI (Occurrence)	1.627	1.326	1.905	1.756	1.283	2.221
ASA (Percent)	99.9686%	99.9860%	99.9683%	99.9697%	99.9691%	99.9675%

Table 10: Annual Service Reliability Indices for All Islands - Generation

	2009	2010	2011	2012	2013	2014
Number of Customers	67,126	67,405	68,010	68,575	69,303	69,825
Customer Interruptions	15,646	41,947	40,825	75,198	49,536	155,067
Customer-Hours Interrupted	11,679.1	21,105.1	21,821.7	66,185.0	34,143.2	20,708.3
SAIDI (Minutes)	10.44	18.79	19.25	57.91	29.56	17.79
CAIDI (Minutes)	44.79	30.19	32.07	52.81	41.36	8.01
SAIFI (Occurrence)	0.233	0.622	0.600	1.097	0.715	0.346
ASA (Percent)	99.9980%	99.9964%	99.9963%	99.9890%	99.9944%	99.9966%

Table 11: Annual Service Reliability Indices for Maui – T&D

	2009	2010	2011	2012	2013	2014
Number of Customers	62,328	62,640	63,225	63,745	64,397	64,909
Customer Interruptions	106,913	80,270	121,962	109,200	73,357	131,670
Customer-Hours Interrupted	179,116.6	62,462.0	179,049.6	134,348.7	159,261.0	159,909.0
SAIDI (Minutes)	172.43	59.83	169.92	126.46	148.39	147.82
CAIDI (Minutes)	100.52	46.69	88.08	73.82	130.26	72.87
SAIFI (Occurrence)	1.715	1.281	1.929	1.713	1.139	2.029
ASA (Percent)	99.9671%	99.9886%	99.9676%	99.9759%	99.9717%	99.9718%

Table 12: Annual Service Reliability Indices for Maui - Generation

	2009	2010	2011	2012	2013	2014
Number of Customers	62,328	62,640	63,225	63,745	64,397	64,909
Customer Interruptions	11,292	30,080	34,183	72,044	26,959	131,670
Customer-Hours Interrupted	10,628.2	7,610.9	15,553.4	65,272.0	12,055.7	7,335.6
SAIDI (Minutes)	10.23	7.29	14.76	61.44	11.23	6.78
CAIDI (Minutes)	56.47	15.18	27.30	54.36	26.83	3.34
SAIFI (Occurrence)	0.181	0.48	0.541	1.130	0.419	0.207
ASA (Percent)	99.9980%	99.9986%	99.9972%	99.9883%	99.9979%	99.9987%

Table 13: Annual Service Reliability Indices for Molokai – T&D

	2009	2010	2011	2012	2013	2014
Number of Customers	3,151	3,145	3,161	3,187	3,205	3,191
Customer Interruptions	1,668	7,914	3,261	10,338	12,730	18,190
Customer-Hours Interrupted	4,433.4	19,294.9	2,753.4	47,081.8	23,428.8	32,789.8
SAIDI (Minutes)	84.42	368.11	52.26	886.38	438.60	616.54
CAIDI (Minutes)	159.47	146.28	50.66	273.25	110.43	108.16
SAIFI (Occurrence)	0.529	2.516	1.032	3.244	3.972	5.700
ASA (Percent)	99.9839%	99.9298%	99.9900%	99.8314%	99.9163%	99.8824%

Table 14: Annual Service Reliability Indices for Molokai - Generation

	2009	2010	2011	2012	2013	2014
Number of Customers	3,151	3,145	3,161	3,187	3,205	3,191
Customer Interruptions	2,784	10,559	4,757	1,833	20,494	18,190
Customer-Hours Interrupted	556.2	11,964.0	4,268.9	385.0	20,733.4	2,966.4
SAIDI (Minutes)	10.59	228.25	81.03	7.25	388.14	55.78
CAIDI (Minutes)	11.99	67.98	53.84	12.60	60.70	9.78
SAIFI (Occurrence)	0.884	3.357	1.505	0.575	6.394	0.916
ASA (Percent)	99.9980%	99.9565%	99.9845%	99.9986%	99.9259%	99.9894%

Table 15: Annual Service Reliability Indices for Lanai – T&D

	2009	2010	2011	2012	2013	2014
Number of Customers	1,648	1,621	1,624	1,643	1,702	1,724
Customer Interruptions	637	1,163	4,331	882	2,857	5,207
Customer-Hours Interrupted	624.4	554.1	6,561.0	885.1	4,167.4	5,836.8
SAIDI (Minutes)	22.73	20.51	242.40	32.32	146.91	203.14
CAIDI (Minutes)	58.81	28.59	90.89	60.21	87.52	67.26
SAIFI (Occurrence)	0.387	0.717	2.667	0.537	1.679	3.020
ASA (Percent)	99.9957%	99.9961%	99.9538%	99.9939%	99.9720%	99.9612%

Table 16: Annual Service Reliability Indices for Lanai - Generation

	2009	2010	2011	2012	2013	2014
Number of Customers	1,648	1,621	1,624	1,643	1,702	1,724
Customer Interruptions	1,570	1,308	1,885	1,321	2,083	5,207
Customer-Hours Interrupted	494.7	1,530.1	1,999.5	528.0	1,354.1	10,406.3
SAIDI (Minutes)	18.01	56.64	73.87	19.28	47.74	362.17
CAIDI (Minutes)	18.91	70.19	63.64	23.98	39.00	119.91
SAIFI (Occurrence)	0.953	0.807	1.161	0.804	1.224	4.535
ASA (Percent)	99.9966%	99.9892%	99.9859%	99.9963%	99.9909%	99.9309%

T&D vs. Generation – With Normalization

Table 17: Normalized Annual Service Reliability Indices for All Islands – T&D

	2009*	2010*	2011*	2012*	2013*	2014*
Number of Customers	67,126	67,405	68,010	68,575	69,303	69,825
Customer Interruptions	96,773	44,699	92,997	53,218	59,404	94,451
Customer-Hours Interrupted	162,889.6	53,754.4	139,223.9	111,142.1	101,339.0	113,310.1
SAIDI (Minutes)	145.60	47.85	122.83	97.24	87.74	97.37
CAIDI (Minutes)	100.99	72.16	89.82	125.31	102.36	71.98
SAIFI (Occurrence)	1.442	0.663	1.367	0.776	0.857	1.353
ASA (Percent)	99.9722%	99.9909%	99.9766%	99.9815%	99.9833%	99.9814%

Table 18: Normalized Annual Service Reliability Indices for All Islands – Generation

	2009*	2010*	2011*	2012*	2013*	2014*
Number of Customers	67,126	67,405	68,010	68,575	69,303	69,825
Customer Interruptions	11,595	22,782	8,271	28,210	12,490	13,396
Customer-Hours Interrupted	10,712.4	6,252.2	6,486.9	14,694.0	7,021.7	7,374.6
SAIDI (Minutes)	9.58	5.57	5.72	12.86	6.08	6.34
CAIDI (Minutes)	55.43	16.47	47.06	31.25	33.73	33.03
SAIFI (Occurrence)	0.173	0.338	0.012	0.411	0.180	0.192
ASA (Percent)	99.9982%	99.9989%	99.9989%	99.9976%	99.9988%	99.9988%

Table 19: Normalized Annual Service Reliability Indices for Maui – T&D

	2009*	2010*	2011*	2012*	2013*	2014*
Number of Customers	62,328	62,640	63,225	63,745	64,397	64,909
Customer Interruptions	95,206	42,938	91,828	50,306	54,680	89,101
Customer-Hours Interrupted	158,614.5	49,743.3	137,980.4	104,638.8	96,167.0	106,764.9
SAIDI (Minutes)	152.69	47.65	130.94	98.49	89.60	98.69
CAIDI (Minutes)	99.96	69.51	90.16	124.80	105.52	71.89
SAIFI (Occurrence)	1.527	0.685	1.452	0.789	0.849	1.373
ASA (Percent)	99.9709%	99.9909%	99.9800%	99.9813%	99.9829%	99.9812%

Table 20: Normalized Annual Service Reliability Indices for Maui – Generation

	2009*	2010*	2011*	2012*	2013*	2014*
Number of Customers	62,328	62,640	63,225	63,745	64,397	64,909
Customer Interruptions	11,292.0	22,716.0	7,901.0	27,662.0	9,779	13,227
Customer-Hours Interrupted	10,628.2	6,210.7	6,424.1	14,406.7	4,931.4	7,306.3
SAIDI (Minutes)	10.23	5.95	6.10	13.56	4.59	6.75
CAIDI (Minutes)	56.47	16.40	48.78	31.25	30.26	33.14
SAIFI (Occurrence)	0.181	0.363	0.125	0.434	0.152	0.204
ASA (Percent)	99.9980%	99.9989%	99.9988%	99.9974%	99.9991%	99.9987%

Table 21: Normalized Annual Service Reliability Indices for Molokai – T&D

	2009*	2010*	2011*	2012*	2013*	2014*
Number of Customers	3,151	3,145	3,161	3,187	3,205	3,191
Customer Interruptions	1,284	1,498	1,102	2,752	3,487	4,064
Customer-Hours Interrupted	3,748.6	3,800.1	1,163.5	6,067.0	3,856.5	4,870.6
SAIDI (Minutes)	71.38	72.50	22.08	114.22	72.20	91.58
CAIDI (Minutes)	175.17	152.21	63.35	132.27	66.36	71.91
SAIFI (Occurrence)	0.407	0.476	0.349	0.864	1.088	1.274
ASA (Percent)	99.9864%	99.9862%	99.9958%	99.9783%	99.9862%	99.9825%

Table 22: Normalized Annual Service Reliability Indices for Molokai – Generation

	2009*	2010*	2011*	2012*	2013*	2014*
Number of Customers	3,151	3,145	3,161	3,187	3,205	3,191
Customer Interruptions	0	0	150	477	2,693	0
Customer-Hours Interrupted	0.0	0.0	55.0	272.0	2,085.7	0.0
SAIDI (Minutes)	0.00	0.00	1.04	5.12	39.05	0.00
CAIDI (Minutes)	0.00	0.00	22.00	34.21	46.47	0.00
SAIFI (Occurrence)	0.000	0.000	0.047	0.150	0.840	0.000
ASA (Percent)	100.0000%	100.0000%	99.9998%	99.9990%	99.9926%	100.0000%

Table 23: Normalized Annual Service Reliability Indices for Lanai – T&D

	2009*	2010*	2011*	2012*	2013*	2014*
Number of Customers	1,648	1,621	1,624	1,643	1,702	1,724
Customer Interruptions	283	263	67	160	1,237	1,286
Customer-Hours Interrupted	526.5	211.0	80.0	436.3	1,315.6	1,674.7
SAIDI (Minutes)	19.17	7.81	2.96	15.93	46.38	58.28
CAIDI (Minutes)	111.62	48.13	71.66	163.61	63.81	78.13
SAIFI (Occurrence)	0.172	0.162	0.041	0.097	0.727	0.746
ASA (Percent)	99.9963%	99.9985%	99.9994%	99.9970%	99.9912%	99.9889%

Table 24: Normalized Annual Service Reliability Indices for Lanai – Generation

	2009*	2010*	2011*	2012*	2013*	2014*
Number of Customers	1,648	1,621	1,624	1,643	1,702	1,724
Customer Interruptions	303	66	220	71	18	169
Customer-Hours Interrupted	84.3	41.5	7.8	15.4	4.5	68.3
SAIDI (Minutes)	3.07	1.53	0.29	0.56	0.16	2.38
CAIDI (Minutes)	16.69	37.70	2.13	13.03	15.00	24.24
SAIFI (Occurrence)	0.184	0.041	0.135	0.043	0.011	0.098
ASA (Percent)	99.9994%	99.9997%	99.9999%	99.9999%	100.0000%	99.9995%

Figure 1: System Average Interruption Duration Index (SAIDI)

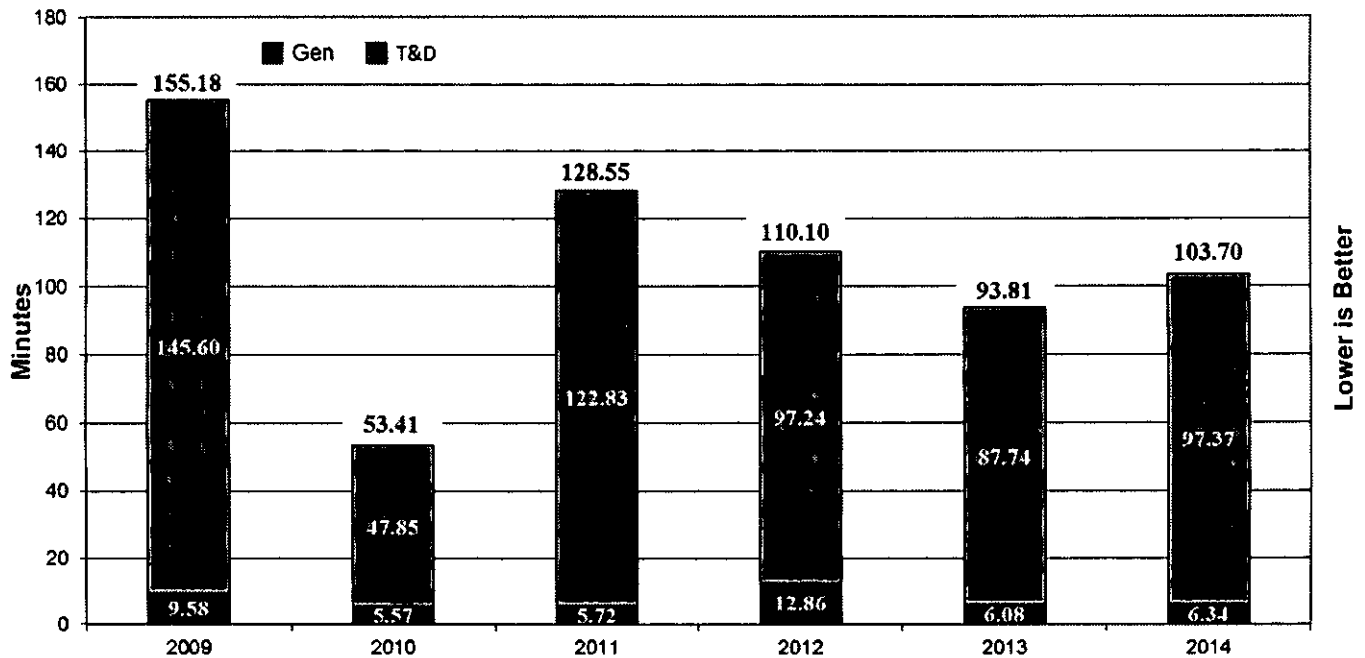


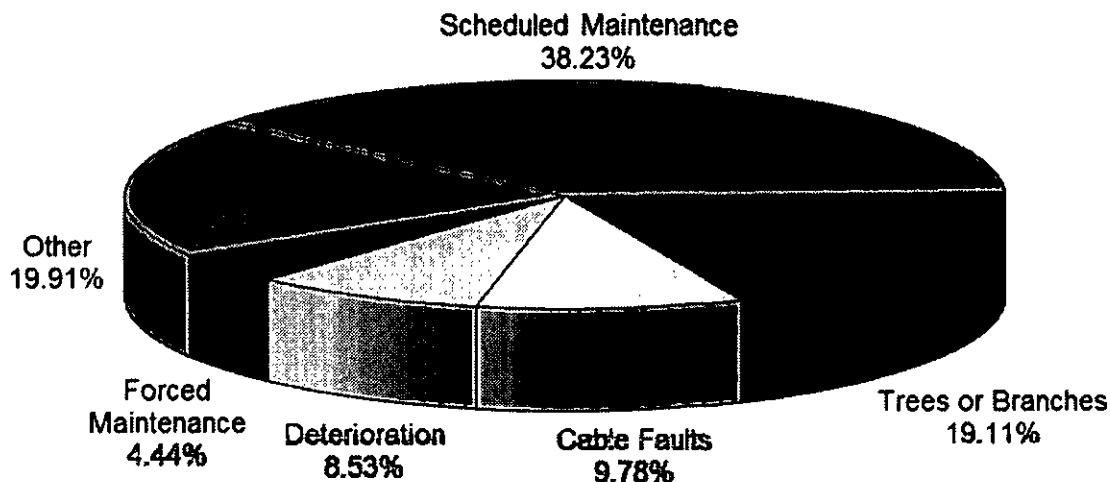
Figure 1 shows the System Average Interruption Duration Indices (SAIDI) for 2014 and the past five years. It shows that the 2014 SAIDI is 103.70 minutes, a 10.54% increase compared to the 2013 SAIDI result of 93.81 minutes. The SAIDI is the composite of both the SAIFI and CAIDI indices and produces a broader benchmark of system reliability by combining both the duration and the number of customer interruptions during a given period of time. The higher SAIDI result was due to an increase in the SAIFI statistics.

In 2014, there were ten sustained outages that resulted in the loss of more than 5,000 customers:

1. **January 29, 2014:** Maui experienced a major outage event when the Hana 23KV line tripped due to a fallen tree downing the 23KV conductors affecting 6,394 customers for up to 24 hours 28 minutes.
2. **February 1, 2014:** Maui experienced a major outage event when the Hana 23KV line tripped due to a fallen tree downing the 23KV conductors affecting 6,394 customers for up to 8 hours 14 minutes.
3. **February 2, 2014:** Maui experienced a major outage event when the Kanaha/Pukalani/Kula 69KV lines tripped due to a loose ground molding contacting the 69KV lines affecting 11,436 customers for up to 1 hour 4 minutes.
4. **April 29, 2014:** Maui experienced a major outage event when the Kahului Power Plant/Wailuku/Waiinu 23KV lines tripped due to the failure of a two 23KV transmission circuit breakers affecting 5,348 customers for up to 1 hour 28 minutes.

5. **May 9, 2014:** Maui experienced a major outage event when the Maalaea/Auwahi 69KV lines tripped due to a flashover on the Maalaea/Kihei 69KV line affecting 15,265 customers for up to 35 minutes.
6. **July 11, 2014:** Maui experienced a major outage event when the Hana 23KV line tripped due a vehicle pole accident that downed a pole and the 23KV conductors affecting 6,394 customers for up to 13 hours 45 minutes.
7. **August 8, 2014:** During Tropical Storm Iselle, Maui experienced a major outage event when the Kanaha/Pukalani/Kula 69KV lines tripped due to wind driven debris affecting 8,731 customers for up to 3 hours 11 minutes.
8. **October 7, 2014:** Maui experienced a major outage event when the Waiinu/Wailuku/Kanaha/Puunene 23KV lines tripped due to the failure of a 23KV recloser affecting 12,421 customers for up to 9 hours 6 minutes.
9. **November 15, 2014:** Maui experienced a major outage event when Maalaea generator M19 tripped offline dropping 28MW of generation resulting in an under frequency load shed affecting 6,826 customers for up to 28 minutes.
10. **November 19, 2014:** Maui experienced a major outage event when the Hana 23KV line tripped due to a disconnect jumper and c-clamp failing in service affecting 6,394 customers for up to 6 hours 53 minutes.

Figure 2: Top 5 Outage Categories



The top 5 outage categories, by number of customer interruptions, as illustrated in Figure 2, equates to about 80% of the total customer interruptions in 2014; these causes are:

<u>Outage Category</u>	<u>Sample Causes</u>
1. Scheduled Maintenance	Prearranged replacement of equipment still in service
2. Trees or Branches	Trees falling or contacting overhead lines
3. Cable Faults	Underground equipment failures
4. Deterioration	Failed or broken equipment due to corrosion
5. Forced Maintenance	Unscheduled outage to replace equipment in service

The top 5 major cause factors for 2014 based on customer interruptions remained similar in comparison to 2013. Forced maintenance was included in the top 5 listing of major cause factors for 2014, replacing the 2013 major cause factor of transformer failure. Scheduled maintenance, trees and branches, cable faults and deterioration remained in the top 5 listing from 2013 to 2014.

The total number of customer interruptions in 2014 was 107,847 compared with 71,894 customer interruptions in 2013. In the six year period, 2014 was ranked fifth for best performing year based on the number of customer interruptions.

The number of customer interruptions due to unknown causes decreased from 12,823 in 2013 to 8,478 in 2014, a 33.88% decrease. The number of customer interruptions due to trees and branches decreased from 30,160 in 2013 to 27,575 in 2014, an 8.57% decrease. Also, the number of customer interruption hours due to cable faults decreased from 6,428 in 2013 to 3,877 in 2014, a 39.69% decrease. However, the number of customer interruptions due to equipment failures increased from 2,865 in 2013 to 13,893 in 2014. The number of customer interruptions due to foreign objects in lines increased from 10 in 2013 to 10,375 in 2014. Also, the number of customer interruption hours due to deterioration increased from 1,770 in 2013 to 9,439 in 2014.

Figure 3: Customer Average Interruption Duration Index (CAIDI)

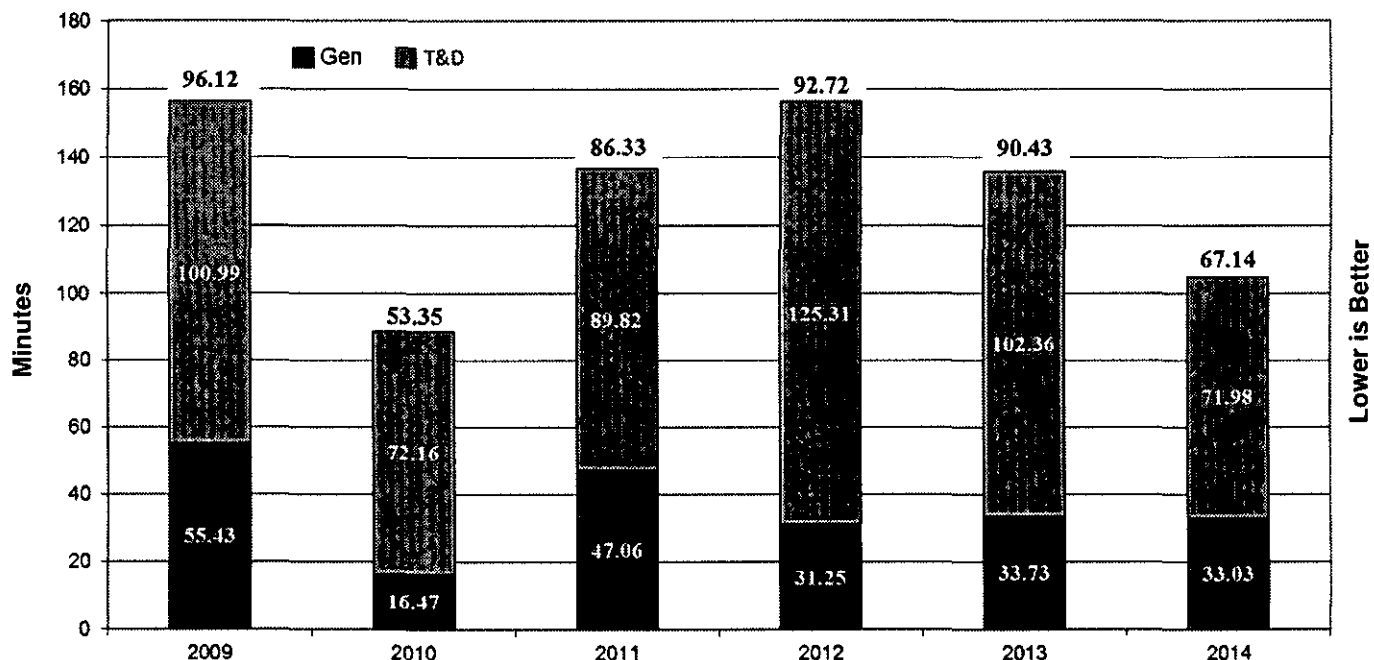


Figure 3 shows the Customer Average Interruption Duration Indices (CAIDI) for 2014 and the past five years. It shows that the average duration of a customer's outage (CAIDI) for 2014 is 67.14 minutes, a 25.75% decrease compared to the 2013 CAIDI result of 90.43 minutes. In the six year period, 2014 was the second best performing year for CAIDI.

The contributing factors to the decrease of the CAIDI index from 2014 were shorter outage durations related to trees or branches, auto accidents and foreign objects in lines. Outage durations due to trees or branches decreased in 2014, which incurred a CAIDI of 81.25 minutes, as compared to a CAIDI of 107.63 minutes in 2013. Outages due to trees or branches accounted for 30.9% of all customer interruption hours in 2014. Outages durations due to auto accidents decreased in 2014, which incurred a CAIDI of 100.75 minutes, as compared to a CAIDI of 161.41 minutes in 2013. Outages due to auto accidents accounted for 14.2% of all customer interruption hours in 2014. Outages durations due to foreign objects in lines also decreased in 2014, which incurred a CAIDI of 45.17 minutes, as compared to a CAIDI of 84.00 minutes in 2013. Outages due to foreign objects in lines accounted for 6.5% of all customer interruption hours in 2014.

The five major events affecting the 2014 CAIDI results were:

1. **January 03, 2014:** During a period of heavy rain, the cross arms on a distribution pole failed in service affecting 1,368 customers from 2 hours 55 minutes to 10 hours 30 minutes.

2. **January 17, 2014:** A flashover occurred at a substation transformer affecting 2,231 customers from 2 hours 19 minutes to 18 hours 12 minutes.
3. **March 15, 2014:** During a period of high winds, a tree branch took down distribution lines affecting 805 customers from 1 hour 14 minutes to 4 hours 25 minutes.
4. **April 12, 2014:** A vehicle pole accident affecting 1,906 customers from 1 hour 23 minutes to 6 hours 41 minutes.
5. **November 19, 2014:** 23KV disconnect jumper and C-clamp failed in service affecting 6,394 customers from momentarily to 6 hours 53 minutes.

These five events increased the 2014 CAIDI by less than 6 minutes.

Figure 4: System Average Interruption Frequency Index (SAIFI)

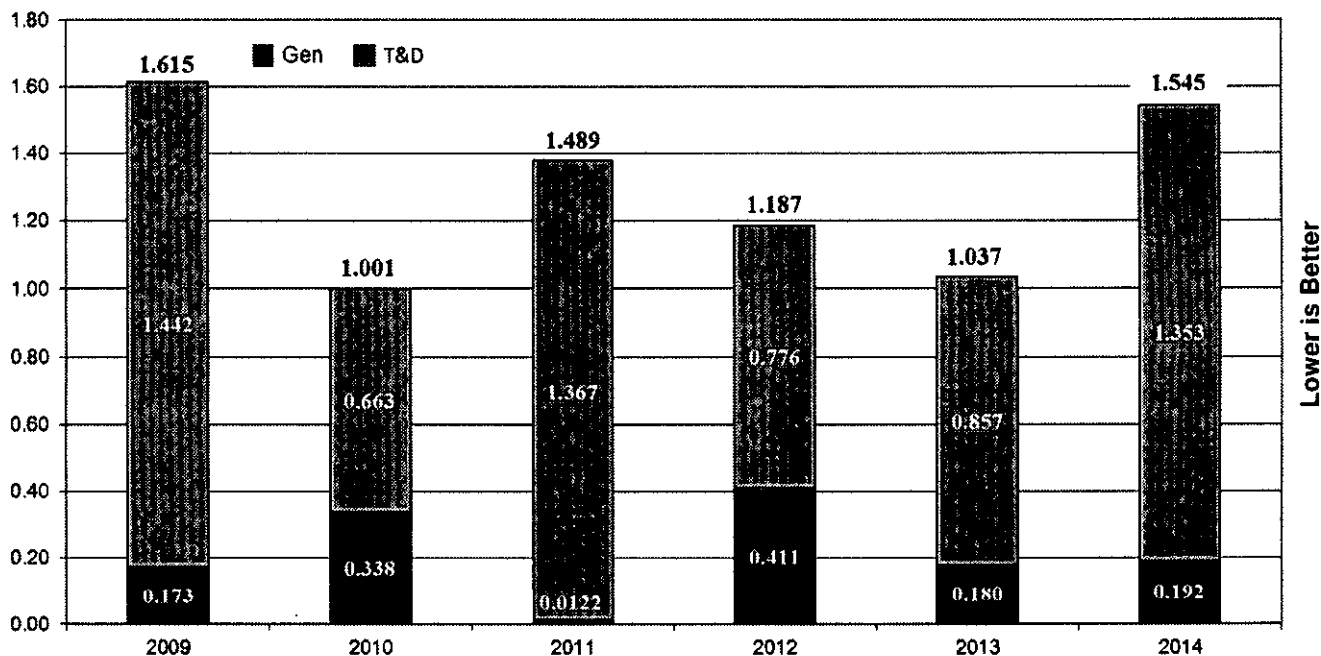


Figure 4 shows the System Average Interruption Frequency Index (SAIFI) for 2014 and the past five years. It shows that the 2014 SAIFI was 1.545, an increase of 48.99% compared to the 2013 SAIFI result of 1.037 minutes.

The contributing factor to the increase of the SAIFI index from 2013 was the rise in the number of interruptions especially related to deterioration or corrosion, trees and branches and scheduled maintenance. The total number of sustained outages in 2014 was 879 as compared to 645 outages in 2013. The number of outages due to deterioration or corrosion increased in 2014, which incurred 75 interruptions, as compared to 51 interruptions in 2013. Outages due to deterioration or corrosion accounted for 8.53% of all customer interruptions in 2014. The number of outages due to trees and branches increased in 2014, which incurred 168 interruptions, as compared to 112 interruptions in 2013. Outages due to trees and branches in lines accounted for 19.11% of all customer interruption hours in 2014. The number of outages due to scheduled maintenance also increased in 2014, which incurred 336 interruptions, as compared to 158 interruptions in 2013. Outages due to scheduled maintenance accounted for 38.23% of all interruptions in 2014.

Figure 5: Average Service Availability Index (ASAI)

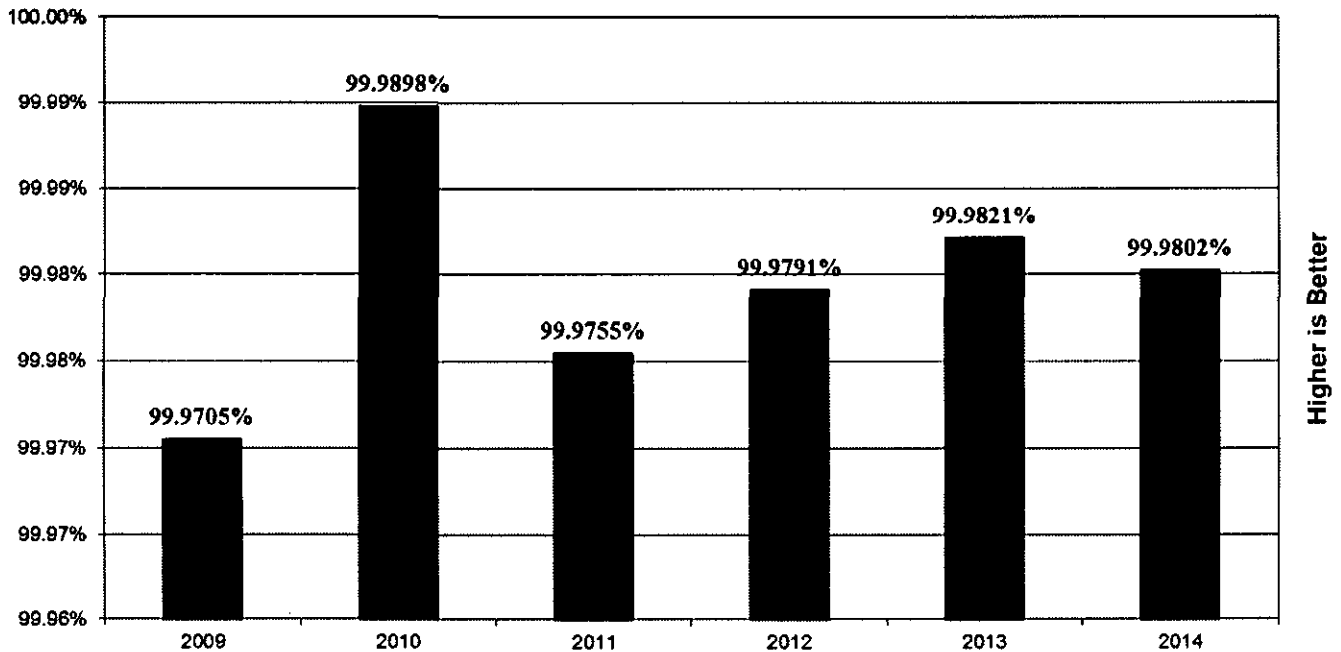


Figure 5 shows that the 2014 Average Service Availability Index decreased as compared to the 2013 results. It shows that the 2014 ASAI was 99.9802%, a decrease of 0.0019% compared to the 2013 ASAI result of 99.9821%.

The contributing factor to the decrease of the ASAI in 2014 was an increase of customer hour interruptions. The total number of customer hour interruptions in 2014 was 120,684.7 hours as compared to 108,360.7 hours in 2013, an increase of 11.37%.

The significant outage causes that lead to the increase of customer hour interruptions are deterioration or corrosion, foreign objects in lines and auto accidents. Customer interruption hours due to deterioration or corrosion increased in 2014, which incurred 17,630.9 customer interruption hours, as compared to 1,999.9 customer interruption hours in 2013. Outages due to deterioration or corrosion accounted for 14.6% of all customer interruption hours in 2014. Customer interruption hours due to foreign objects in lines increased in 2014, which incurred 7,811.1 customer interruption hours, as compared to 14.0 customer interruption hours in 2013. Outages due to foreign objects in lines accounted for 6.5% of all customer interruption hours in 2014. Customer interruption hours due to auto accidents also increased in 2014, which incurred 17,124.1 customer interruption hours, as compared to 11,239.8 customer interruption hours in 2013. Outages due to auto accidents accounted for 14.2% of all customer interruption hours in 2013.

Attachment-A

Maui Electric Company Normalized Sustained Interruption Summary – System Total

FROM: JANUARY 1, 2014

TO: DECEMBER 31, 2014

Outage Cause	Customer Hours	Customer Interruptions	SAIFI	SAIDI	CAIDI
TREES OR BRANCHES IN LINES	37,342.0	27,575	0.395	32.09	81.25
DETERIORATION, CORROSION, TERMITES	17,630.9	9,439	0.135	15.15	112.07
AUTOMOBILE ACCIDENT	17,124.1	10,198	0.146	14.71	100.75
FOREIGN OBJECTS IN LINES OR EQUIPMENT	7,811.1	10,375	0.149	6.71	45.17
EQUIPMENT FAILURE	6,983.6	13,893	0.199	6.00	30.16
MAN OR ANIMALS IN LINES OR EQUIPMENT	5,875.3	7,109	0.102	5.05	49.59
CABLE FAULT	5,668.1	3,877	0.056	4.87	87.72
UNKNOWN FAILURE	5,465.6	8,478	0.121	4.70	38.68
FAILURE OF CUSTOMER'S ELECTRICAL EQUIP	4,755.3	6,437	0.092	4.09	44.32
MAINTENANCE - SCHEDULED	3,994.1	1,841	0.026	3.43	130.17
MAINTENANCE - FORCED	3,128.4	1,455	0.021	2.69	129.00
HIGH WIND	1,854.5	3,035	0.043	1.59	36.66
FIRE	1,040.5	2,130	0.031	0.89	29.31
OTHER COMPANY PERSONNEL ERROR	583.4	493	0.007	0.50	71.01
LIGHTNING	538.2	158	0.002	0.46	204.38
TRANSFORMER FAILURE	486.4	106	0.002	0.42	275.32
OPERATOR OR SWITCHING ERROR	264.5	741	0.011	0.23	21.41
TRANSFORMER OVERLOAD	69.9	28	0.000	0.06	149.71
EXCAVATION AND CONSTRUCTION	29.8	39	0.001	0.03	45.82
FLASHOVER	25.5	12	0.000	0.02	127.67
INT. TO TRANSFER LOAD (OUT OF PHASE)	5.8	350	0.005	0.01	1.00
INT. TO BALANCE LOAD OR SYSTEM CONV.	3.6	69	0.001	0.00	3.13
LOOSE CONNECTION	1.7	5	0.000	0.00	21.00
MYLAR BALLOON	1.4	3	0.000	0.00	28.00
EQUIPMENT OVERLOAD	1.1	1	0.000	0.00	68.00
CONTACT BY MOVING EQUIPMENT	0.0	0	0.000	0.00	0.00
FAULTY OPERATION OF EQUIPMENT	0.0	0	0.000	0.00	0.00
SYSTEM ADDITIONS OR REMOVALS	0.0	0	0.000	0.00	0.00
VANDALISM	0.0	0	0.000	0.00	0.00
TSUNAMI, EARTHQUAKE, OR FLOODING	0.0	0	0.000	0.00	0.00
TOTAL	120,684.70	107,847	1.545	103.70	67.14

AVERAGE SYSTEM AVAILABILITY =	99.9802%
NUMBER OF CUSTOMERS FOR THE PERIOD =	69,825
24 MONTH ANNUALIZED SAIDI AVERAGE FOR THE PERIOD 1/1/2013 - 12/31/2014 =	98.50
24 MONTH AVERAGE NUMBER OF CUSTOMERS FOR THE PERIOD 1/1/2013 - 12/31/2014 =	69,564

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 SAIDI.
OUTAGES WITH ZERO CUSTOMER HOURS OR DUE TO CUSTOMER MAINTENANCE ARE NOT INCLUDED IN THE REPORT.

Maui Electric Company Normalized Sustained Interruption Summary – Maui

FROM: JANUARY 1, 2014

TO: DECEMBER 31, 2014

Outage Cause	Customer Hours	Customer Interruptions	SAIFI	SAIDI	CAIDI
TREES OR BRANCHES IN LINES	34,142.4	25,367	0.391	31.56	80.76
AUTOMOBILE ACCIDENT	17,097.4	10,098	0.156	15.80	101.59
DETERIORATION, CORROSION, TERMITES	17,022.5	8,896	0.137	15.74	114.81
FOREIGN OBJECTS IN LINES OR EQUIPMENT	7,811.1	10,375	0.160	7.22	45.17
EQUIPMENT FAILURE	6,111.9	13,421	0.207	5.65	27.32
MAN OR ANIMALS IN LINES OR EQUIPMENT	5,817.1	6,991	0.108	5.38	49.92
CABLE FAULT	5,588.6	3,865	0.060	5.17	86.76
UNKNOWN FAILURE	5,410.5	8,099	0.125	5.00	40.08
FAILURE OF CUSTOMER'S ELECTRICAL EQUIP	4,726.1	6,427	0.099	4.37	44.12
MAINTENANCE - SCHEDULED	3,708.8	1,771	0.027	3.43	125.65
MAINTENANCE - FORCED	3,126.6	1,452	0.022	2.89	129.2
FIRE	1,040.5	2,130	0.033	0.96	29.31
OTHER COMPANY PERSONNEL ERROR	583.4	493	0.008	0.54	71.01
LIGHTNING	538.2	158	0.002	0.50	204.38
HIGH WIND	489.3	1,438	0.022	0.45	20.42
TRANSFORMER FAILURE	470.0	104	0.002	0.43	271.15
OPERATOR OR SWITCHING ERROR	264.5	741	0.011	0.24	21.41
TRANSFORMER OVERLOAD	69.9	28	0.000	0.06	149.71
EXCAVATION AND CONSTRUCTION	29.8	39	0.001	0.03	45.82
FLASHOVER	8.9	7	0.000	0.01	76.00
INT. TO TRANSFER LOAD (OUT OF PHASE)	5.8	350	0.005	0.01	1.00
INT. TO BALANCE LOAD OR SYSTEM CONV.	3.6	69	0.001	0.00	3.13
LOOSE CONNECTION	1.7	5	0.000	0.00	21.00
MYLAR BALLOON	1.4	3	0.000	0.00	28.00
EQUIPMENT OVERLOAD	1.1	1	0.000	0.00	68.00
CONTACT BY MOVING EQUIPMENT	0.0	0	0.000	0.00	0.00
FAULTY OPERATION OF EQUIPMENT	0.0	0	0.000	0.00	0.00
SYSTEM ADDITIONS OR REMOVALS	0.0	0	0.000	0.00	0.00
VANDALISM	0.0	0	0.000	0.00	0.00
TSUNAMI, EARTHQUAKE, OR FLOODING	0.0	0	0.000	0.00	0.00
TOTAL	114,071.10	102,328	1.576	105.44	66.89

AVERAGE SYSTEM AVAILABILITY = 99.9799%
 NUMBER OF CUSTOMERS FOR THE PERIOD = 64,909
 24 MONTH ANNUALIZED SAIDI AVERAGE FOR THE PERIOD 1/1/2013 - 12/31/2014 = 99.83
 24 MONTH AVERAGE NUMBER OF CUSTOMERS FOR THE PERIOD 1/1/2013 - 12/31/2014 = 64,653
 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 SAIDI.
 OUTAGES WITH ZERO CUSTOMER HOURS OR DUE TO CUSTOMER MAINTENANCE ARE NOT INCLUDED
 IN THE REPORT.

Maui Electric Company Normalized Sustained Interruption Summary – Molokai

FROM: JANUARY 1, 2014

TO: DECEMBER 31, 2014

Outage Cause	Customer Hours	Customer Interruptions	SAIFI	SAIDI	CAIDI
TREES OR BRANCHES IN LINES	3,166.9	2,173	0.681	59.55	87.44
HIGH WIND	1,300.3	1,465	0.459	24.45	53.26
EQUIPMENT FAILURE	167.2	132	0.041	3.14	76.00
MAINTENANCE - SCHEDULED	81.6	30	0.009	1.53	163.23
MAN OR ANIMALS IN LINES OR EQUIPMENT	58.2	118	0.037	1.09	29.60
DETERIORATION, CORROSION, TERMITES	29.1	34	0.011	0.55	51.35
AUTOMOBILE ACCIDENT	26.7	100	0.031	0.50	16.00
CABLE FAULT	22.5	2	0.001	0.42	674.00
UNKNOWN FAILURE	18.2	10	0.003	0.34	109.00
FOREIGN OBJECTS IN LINES OR EQUIPMENT	0.0	0	0.000	0.00	0.00
FIRE	0.0	0	0.000	0.00	0.00
CONTACT BY MOVING EQUIPMENT	0.0	0	0.000	0.00	0.00
EXCAVATION AND CONSTRUCTION	0.0	0	0.000	0.00	0.00
LIGHTNING	0.0	0	0.000	0.00	0.00
LOOSE CONNECTION	0.0	0	0.000	0.00	0.00
FLASHOVER	0.0	0	0.000	0.00	0.00
TRANSFORMER FAILURE	0.0	0	0.000	0.00	0.00
TRANSFORMER OVERLOAD	0.0	0	0.000	0.00	0.00
EQUIPMENT OVERLOAD	0.0	0	0.000	0.00	0.00
VANDALISM	0.0	0	0.000	0.00	0.00
FAULTY OPERATION OF EQUIPMENT	0.0	0	0.000	0.00	0.00
OPERATOR OR SWITCHING ERROR	0.0	0	0.000	0.00	0.00
FAILURE OF CUSTOMER'S ELECTRICAL EQUIP	0.0	0	0.000	0.00	0.00
TSUNAMI, EARTHQUAKE, OR FLOODING	0.0	0	0.000	0.00	0.00
INT. TO TRANSFER LOAD (OUT OF PHASE)	0.0	0	0.000	0.00	0.00
INT. TO BALANCE LOAD OR SYSTEM CONV.	0.0	0	0.000	0.00	0.00
MAINTENANCE - FORCED	0.0	0	0.000	0.00	0.00
SYSTEM ADDITIONS OR REMOVALS	0.0	0	0.000	0.00	0.00
OTHER COMPANY PERSONNEL ERROR	0.0	0	0.000	0.00	0.00
MYLAR BALLOON	0.0	0	0.000	0.00	0.00
TOTAL	4,870.60	4,064	1.274	91.58	71.91

AVERAGE SYSTEM AVAILABILITY = 99.9825%
 NUMBER OF CUSTOMERS FOR THE PERIOD = 3,191
 24 MONTH ANNUALIZED SAIDI AVERAGE FOR THE PERIOD 1/1/2013 - 12/31/2014 = 101.44
 24 MONTH AVERAGE NUMBER OF CUSTOMERS FOR THE PERIOD 1/1/2013 - 12/31/2014 = 3,198
 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 SAIDI.
 OUTAGES WITH ZERO CUSTOMER HOURS OR DUE TO CUSTOMER MAINTENANCE ARE NOT INCLUDED
 IN THE REPORT.

Maui Electric Company Normalized Sustained Interruption Summary – Lanai

FROM: JANUARY 1, 2014

TO: DECEMBER 31, 2014

Outage Cause	Customer Hours	Customer Interruptions	SAIFI	SAIDI	CAIDI
EQUIPMENT FAILURE	704.6	340	0.197	24.52	124.34
DETERIORATION, CORROSION, TERMITES	579.2	509	0.295	20.16	68.28
MAINTENANCE - SCHEDULED	203.7	40	0.023	7.09	305.55
HIGH WIND	64.8	132	0.077	2.26	29.47
CABLE FAULT	57.0	10	0.006	1.98	342.00
UNKNOWN FAILURE	36.9	369	0.214	1.28	6.00
TREES OR BRANCHES IN LINES	32.7	35	0.020	1.14	56.06
FAILURE OF CUSTOMER'S ELECTRICAL EQUIP	29.2	10	0.006	1.02	175.30
FLASHOVER	16.7	5	0.003	0.58	200.00
TRANSFORMER FAILURE	16.4	2	0.001	0.57	492.00
MAINTENANCE - FORCED	1.7	3	0.002	0.06	34.33
MAN OR ANIMALS IN LINES OR EQUIPMENT	0.0	0	0.000	0.00	0.00
AUTOMOBILE ACCIDENT	0.0	0	0.000	0.00	0.00
FOREIGN OBJECTS IN LINES OR EQUIPMENT	0.0	0	0.000	0.00	0.00
FIRE	0.0	0	0.000	0.00	0.00
CONTACT BY MOVING EQUIPMENT	0.0	0	0.000	0.00	0.00
EXCAVATION AND CONSTRUCTION	0.0	0	0.000	0.00	0.00
LIGHTNING	0.0	0	0.000	0.00	0.00
LOOSE CONNECTION	0.0	0	0.000	0.00	0.00
TRANSFORMER OVERLOAD	0.0	0	0.000	0.00	0.00
EQUIPMENT OVERLOAD	0.0	0	0.000	0.00	0.00
VANDALISM	0.0	0	0.000	0.00	0.00
FAULTY OPERATION OF EQUIPMENT	0.0	0	0.000	0.00	0.00
OPERATOR OR SWITCHING ERROR	0.0	0	0.000	0.00	0.00
TSUNAMI, EARTHQUAKE, OR FLOODING	0.0	0	0.000	0.00	0.00
INT. TO TRANSFER LOAD (OUT OF PHASE)	0.0	0	0.000	0.00	0.00
INT. TO BALANCE LOAD OR SYSTEM CONV.	0.0	0	0.000	0.00	0.00
SYSTEM ADDITIONS OR REMOVALS	0.0	0	0.000	0.00	0.00
OTHER COMPANY PERSONNEL ERROR	0.0	0	0.000	0.00	0.00
MYLAR BALLOON	0.0	0	0.000	0.00	0.00
TOTAL	1,742.90	1,455	0.844	60.66	71.87

AVERAGE SYSTEM AVAILABILITY = 99.9884%
NUMBER OF CUSTOMERS FOR THE PERIOD = 1,724
24 MONTH ANNUALIZED SAIDI AVERAGE FOR THE PERIOD 1/1/2013 - 12/31/2014 = 43.80
24 MONTH AVERAGE NUMBER OF CUSTOMERS FOR THE PERIOD 1/1/2013 - 12/31/2014 = 1,713
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 SAIDI.
OUTAGES WITH ZERO CUSTOMER HOURS OR DUE TO CUSTOMER MAINTENANCE ARE NOT INCLUDED IN THE REPORT.

Attachment-B

Maui Electric Company Normalized Sustained Interruption Summary – System Total

FROM: JANUARY 1, 2014

TO: DECEMBER 31, 2014

Outage Cause	<u>Interruptions</u>		<u>Customer Hours</u>	
	Number	% of Total	Number	% of Total
<u>NON-CONNECTED SYSTEM EMERGENCY</u>	222	25.26%	73,979.4	61.30%
FOREIGN OBJECT IN LINES	5	0.57%	7,811.1	6.50%
CONTACT BY MOVING EQUIPMENT	0	0.00%	0.0	0.00%
EXCAVATION AND CONSTRUCTION	4	0.46%	29.8	0.00%
FIRE	2	0.23%	1,040.5	0.90%
AUTO ACCIDENT	13	1.48%	17,124.1	14.20%
MAN OR ANIMAL IN LINES	18	2.05%	5,875.3	4.90%
TREES OR BRANCHES IN LINES	168	19.11%	37,342.0	30.90%
VANDALISM	0	0.00%	0.0	0.00%
CUSTOMER EQUIP. FAILURE	11	1.25%	4,755.3	3.90%
MYLAR BALLOON	1	0.11%	1.4	0.00%
<u>ERROR</u>	18	2.05%	847.9	0.70%
OPERATOR OR SWITCHING ERROR	11	1.25%	264.5	0.20%
OTHER COMPANY PERSONNEL ERROR	7	0.80%	583.4	0.50%
<u>WEATHER</u>	23	2.62%	2,392.7	2.00%
LIGHTNING	7	0.80%	538.2	0.40%
HIGH WIND	16	1.82%	1,854.5	1.50%
TSUNAMI, EARTHQUAKE OR FLOODING	0	0.00%	0.0	0.00%
<u>NON-TRANSFORMER EQUIPMENT FAILURE</u>	182	20.71%	30,311.0	25.10%
LOOSE CONNECTION	1	0.11%	1.7	0.00%
FLASHOVER	4	0.46%	25.5	0.00%
EQUIPMENT FAILURE	15	1.71%	6,983.6	5.80%
CABLE FAULT	86	9.78%	5,668.1	4.70%
EQUIPMENT OVERLOAD	1	0.11%	1.1	0.00%
DETERIORATION, CORROSION OR TERMITES	75	8.53%	17,630.9	14.60%
FAULTY OPERATION OF EQUIPMENT	0	0.00%	0.0	0.00%
<u>TRANSFORMER</u>	19	2.16%	556.3	0.50%
TRANSFORMER OVERLOAD	3	0.34%	69.9	0.10%
TRANSFORMER FAILURE	16	1.82%	486.4	0.40%
<u>SWITCHING</u>	5	0.57%	9.4	0.00%
INT TO TRANSFER LOAD (OUT OF PHASE)	1	0.11%	5.8	0.00%
INT TO BALANCE LOAD OR CONVERSION	4	0.46%	3.6	0.00%
<u>UNKNOWN</u>	35	3.98%	5,465.6	4.50%
<u>MAINTENANCE</u>	375	42.66%	7,122.4	5.90%
SCHEDULED	336	38.23%	3,994.1	3.30%
FORCED	39	4.44%	3,128.4	2.60%
<u>SYSTEM ADDITIONS OR REMOVALS</u>	0	0.00%	0.0	0.00%
<u>TOTALS</u>	879		120,684.7	

NOTES: OUTAGES WITH ZERO CUSTOMER HOURS OR DUE TO CUSTOMER MAINTENANCE ARE NOT INCLUDED IN THE REPORT.

Maui Electric Company Normalized Sustained Interruption Summary – Maui

FROM: JANUARY 1, 2014

TO: DECEMBER 31, 2014

Outage Cause	Interruptions		Customer Hours	
	Number	% of Total	Number	% of Total
<u>NON-CONNECTED SYSTEM EMERGENCY</u>	206	24.85%	70,665.8	61.90%
FOREIGN OBJECT IN LINES	5	0.60%	7,811.1	6.80%
CONTACT BY MOVING EQUIPMENT	0	0.00%	0.0	0.00%
EXCAVATION AND CONSTRUCTION	4	0.48%	29.8	0.00%
FIRE	2	0.24%	1,040.5	0.90%
AUTO ACCIDENT	12	1.45%	17,097.4	15.00%
MAN OR ANIMAL IN LINES	15	1.81%	5,817.1	5.10%
TREES OR BRANCHES IN LINES	158	19.06%	34,142.4	29.90%
VANDALISM	0	0.00%	0.0	0.00%
CUSTOMER EQUIP. FAILURE	9	1.09%	4,726.1	4.10%
MYLAR BALLOON	1	0.12%	1.4	0.00%
<u>ERROR</u>	18	2.17%	847.9	0.70%
OPERATOR OR SWITCHING ERROR	11	1.33%	264.5	0.20%
OTHER COMPANY PERSONNEL ERROR	7	0.84%	583.4	0.50%
<u>WEATHER</u>	18	2.17%	1,027.6	0.90%
LIGHTNING	7	0.84%	538.2	0.50%
HIGH WIND	11	1.33%	489.3	0.40%
TSUNAMI, EARTHQUAKE OR FLOODING	0	0.00%	0.0	0.00%
<u>NON-TRANSFORMER EQUIPMENT FAILURE</u>	168	20.27%	28,734.7	25.20%
LOOSE CONNECTION	1	0.12%	1.7	0.00%
FLASHOVER	3	0.36%	8.9	0.00%
EQUIPMENT FAILURE	11	1.33%	6,111.9	5.40%
CABLE FAULT	84	10.13%	5,588.6	4.90%
EQUIPMENT OVERLOAD	1	0.12%	1.1	0.00%
DETERIORATION, CORROSION OR TERMITES	68	8.20%	17,022.5	14.90%
FAULTY OPERATION OF EQUIPMENT	0	0.00%	0.0	0.00%
<u>TRANSFORMER</u>	18	2.17%	539.9	0.50%
TRANSFORMER OVERLOAD	3	0.36%	69.9	0.10%
TRANSFORMER FAILURE	15	1.81%	470.0	0.40%
<u>SWITCHING</u>	5	0.60%	9.4	0.00%
INT TO TRANSFER LOAD (OUT OF PHASE)	1	0.12%	5.8	0.00%
INT TO BALANCE LOAD OR CONVERSION	4	0.48%	3.6	0.00%
<u>UNKNOWN</u>	33	3.98%	5,410.5	4.70%
<u>MAINTENANCE</u>	363	43.79%	6,835.4	6.00%
SCHEDULED	326	39.32%	3,708.8	3.30%
FORCED	37	4.46%	3,126.6	2.70%
<u>SYSTEM ADDITIONS OR REMOVALS</u>	0	0.00%	0.0	0.00%
<u>TOTALS</u>	829		114,071.1	

NOTES: OUTAGES WITH ZERO CUSTOMER HOURS OR DUE TO CUSTOMER MAINTENANCE ARE NOT INCLUDED IN THE REPORT.

Maui Electric Company Normalized Sustained Interruption Summary – Molokai

FROM: JANUARY 1, 2014

TO: DECEMBER 31, 2014

Outage Cause	<u>Interruptions</u>		<u>Customer Hours</u>	
	Number	% of Total	Number	% of Total
<u>NON-CONNECTED SYSTEM EMERGENCY</u>	12	50.00%	3,251.8	66.80%
FOREIGN OBJECT IN LINES	0	0.00%	0.0	0.00%
CONTACT BY MOVING EQUIPMENT	0	0.00%	0.0	0.00%
EXCAVATION AND CONSTRUCTION	0	0.00%	0.0	0.00%
FIRE	0	0.00%	0.0	0.00%
AUTO ACCIDENT	1	4.17%	26.7	0.50%
MAN OR ANIMAL IN LINES	3	12.50%	58.2	1.20%
TREES OR BRANCHES IN LINES	8	33.33%	3,166.9	65.00%
VANDALISM	0	0.00%	0.0	0.00%
CUSTOMER EQUIP. FAILURE	0	0.00%	0.0	0.00%
MYLAR BALLOON	0	0.00%	0.0	0.00%
<u>ERROR</u>	0	0.00%	0.0	0.00%
OPERATOR OR SWITCHING ERROR	0	0.00%	0.0	0.00%
OTHER COMPANY PERSONNEL ERROR	0	0.00%	0.0	0.00%
<u>WEATHER</u>	3	12.50%	1,300.3	26.70%
LIGHTNING	0	0.00%	0.0	0.00%
HIGH WIND	3	12.50%	1,300.3	26.70%
TSUNAMI, EARTHQUAKE OR FLOODING	0	0.00%	0.0	0.00%
<u>NON-TRANSFORMER EQUIPMENT FAILURE</u>	5	20.83%	218.8	4.50%
LOOSE CONNECTION	0	0.00%	0.0	0.00%
FLASHOVER	0	0.00%	0.0	0.00%
EQUIPMENT FAILURE	1	4.17%	167.2	3.40%
CABLE FAULT	1	4.17%	22.5	0.50%
EQUIPMENT OVERLOAD	0	0.00%	0.0	0.00%
DETERIORATION, CORROSION OR TERMITES	3	12.50%	29.1	0.60%
FAULTY OPERATION OF EQUIPMENT	0	0.00%	0.0	0.00%
<u>TRANSFORMER</u>	0	0.00%	0.0	0.00%
TRANSFORMER OVERLOAD	0	0.00%	0.0	0.00%
TRANSFORMER FAILURE	0	0.00%	0.0	0.00%
<u>SWITCHING</u>	0	0.00%	0.0	0.00%
INT TO TRANSFER LOAD (OUT OF PHASE)	0	0.00%	0.0	0.00%
INT TO BALANCE LOAD OR CONVERSION	0	0.00%	0.0	0.00%
<u>UNKNOWN</u>	1	4.17%	18.2	0.40%
<u>MAINTENANCE</u>	3	12.50%	81.6	1.70%
SCHEDULED	3	12.50%	81.6	1.70%
FORCED	0	0.00%	0	0.00%
<u>SYSTEM ADDITIONS OR REMOVALS</u>	0	0.00%	0	0.00%
<u>TOTALS</u>	24		4,870.6	

NOTES: OUTAGES WITH ZERO CUSTOMER HOURS OR DUE TO CUSTOMER MAINTENANCE ARE NOT INCLUDED IN THE REPORT.

Maui Electric Company Normalized Sustained Interruption Summary – Lanai

FROM: JANUARY 1, 2014

TO: DECEMBER 31, 2014

Outage Cause	Interruptions		Customer Hours	
	Number	% of Total	Number	% of Total
<u>NON-CONNECTED SYSTEM EMERGENCY</u>	4	15.38%	61.9	3.60%
FOREIGN OBJECT IN LINES	0	0.00%	0.0	0.00%
CONTACT BY MOVING EQUIPMENT	0	0.00%	0.0	0.00%
EXCAVATION AND CONSTRUCTION	0	0.00%	0.0	0.00%
FIRE	0	0.00%	0.0	0.00%
AUTO ACCIDENT	0	0.00%	0.0	0.00%
MAN OR ANIMAL IN LINES	0	0.00%	0.0	0.00%
TREES OR BRANCHES IN LINES	2	7.69%	32.7	1.90%
VANDALISM	0	0.00%	0.0	0.00%
CUSTOMER EQUIP. FAILURE	2	7.69%	29.2	1.70%
MYLAR BALLOON	0	0.00%	0.0	0.00%
<u>ERROR</u>	0	0.00%	0.0	0.00%
OPERATOR OR SWITCHING ERROR	0	0.00%	0.0	0.00%
OTHER COMPANY PERSONNEL ERROR	0	0.00%	0.0	0.00%
<u>WEATHER</u>	2	7.69%	64.8	3.70%
LIGHTNING	0	0.00%	0.0	0.00%
HIGH WIND	2	7.69%	64.8	3.70%
TSUNAMI, EARTHQUAKE OR FLOODING	0	0.00%	0.0	0.00%
<u>NON-TRANSFORMER EQUIPMENT FAILURE</u>	9	34.62%	1,357.5	77.90%
LOOSE CONNECTION	0	0.00%	0.0	0.00%
FLASHOVER	1	3.85%	16.7	1.00%
EQUIPMENT FAILURE	3	11.54%	704.6	40.40%
CABLE FAULT	1	3.85%	57	3.30%
EQUIPMENT OVERLOAD	0	0.00%	0.0	0.00%
DETERIORATION, CORROSION OR TERMITES	4	15.38%	579.2	33.20%
FAULTY OPERATION OF EQUIPMENT	0	0.00%	0.0	0.00%
<u>TRANSFORMER</u>	1	3.85%	16.4	0.90%
TRANSFORMER OVERLOAD	0	0.00%	0.0	0.00%
TRANSFORMER FAILURE	1	3.85%	16.4	0.90%
<u>SWITCHING</u>	0	0.00%	0.0	0.00%
INT TO TRANSFER LOAD (OUT OF PHASE)	0	0.00%	0.0	0.00%
INT TO BALANCE LOAD OR CONVERSION	0	0.00%	0.0	0.00%
<u>UNKNOWN</u>	1	3.85%	36.9	2.10%
<u>MAINTENANCE</u>	9	34.62%	205.4	11.80%
SCHEDULED	7	26.92%	203.7	11.70%
FORCED	2	7.69%	1.7	0.10%
<u>SYSTEM ADDITIONS OR REMOVALS</u>	0	0.00%	0.0	0.00%
<u>TOTALS</u>	26		1,742.9	

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 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 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. Five 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.

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