July 7, 2014

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 2013

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 2013. (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

2013

Prepared by
System Operation Department

March 24, 2014
INTRODUCTION

This is the 2013 annual service reliability report of the Hawaiian Electric Company. The year-end average number of electric customers increased from 297,598 in 2012 to 298,920 in 2013 (a 0.44% increase). The 2013 peak demand for the system was 1,175 MW (evening peak), 6 MW higher than the peak demand in 2012; the highest system peak demand remains at 1,327 MW set on the evening of October 12, 2004.

The system interruption summary for 2013 (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 298,920 customers).

ANALYSIS

This analysis of the annual system reliability for Hawaiian Electric Company is for the year 2013. To determine the relative level of reliability, the statistics for five prior years, 2008 through 2012, are used for comparison.

The reliability indices are calculated using the data from all sustained\textsuperscript{1} 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.

\textsuperscript{1}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.)
# 2013 RESULTS

## Annual Service Reliability Indices

The annual service reliability for 2013 was ranked third for the best CAIDI and fourth for the best SAIDI in the past 6 years in terms of the indices for all events. The reliability results for 2013 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]. No outage events were normalized in 2013. All subsequent comparisons and discussion are based on the normalized data.

### Table 1: Annual Service Reliability Indices - All Events

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrences)</th>
<th>ASAI (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>294,802</td>
<td>333,908</td>
<td>442,546</td>
<td>90.08</td>
<td>79.52</td>
<td>1.133</td>
<td>99.983</td>
</tr>
<tr>
<td>2010</td>
<td>295,637</td>
<td>361,334</td>
<td>564,424</td>
<td>114.55</td>
<td>93.72</td>
<td>1.222</td>
<td>99.978</td>
</tr>
<tr>
<td>2011</td>
<td>296,679</td>
<td>408,326</td>
<td>1,257,338</td>
<td>254.59</td>
<td>150.20</td>
<td>1.693</td>
<td>99.977</td>
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<tr>
<td>2012</td>
<td>297,598</td>
<td>407,197</td>
<td>563,807</td>
<td>113.67</td>
<td>83.08</td>
<td>1.368</td>
<td>99.978</td>
</tr>
<tr>
<td>2013</td>
<td>298,920</td>
<td>409,516</td>
<td>605,964</td>
<td>121.63</td>
<td>88.78</td>
<td>1.370</td>
<td>99.977</td>
</tr>
</tbody>
</table>

### Table 2: Annual Service Reliability Indices - with Normalization

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrences)</th>
<th>ASAI (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008*</td>
<td>294,371</td>
<td>294,802</td>
<td>295,637</td>
<td>100.05</td>
<td>90.08</td>
<td>114.55</td>
<td>99.983</td>
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<tr>
<td>2009</td>
<td>294,802</td>
<td>333,908</td>
<td>442,546</td>
<td>93.72</td>
<td>79.52</td>
<td>1.222</td>
<td>99.978</td>
</tr>
<tr>
<td>2010</td>
<td>295,637</td>
<td>361,334</td>
<td>564,424</td>
<td>153.54</td>
<td>93.72</td>
<td>1.222</td>
<td>99.977</td>
</tr>
<tr>
<td>2011**</td>
<td>296,679</td>
<td>408,326</td>
<td>1,044,904</td>
<td>211.32</td>
<td>150.20</td>
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<td>2012</td>
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<td>407,197</td>
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<td>113.67</td>
<td>83.08</td>
<td>1.368</td>
<td>99.978</td>
</tr>
<tr>
<td>2013</td>
<td>298,920</td>
<td>409,516</td>
<td>605,964</td>
<td>121.63</td>
<td>88.78</td>
<td>1.370</td>
<td>99.977</td>
</tr>
</tbody>
</table>

**NOTE:**

2008* Data normalized to exclude the 12/10/08 - 12/14/08 High Wind Outages
2008 Data normalized to exclude the 12/26/08 Island Wide Blackout
2011** Data normalized to exclude the 03/04/11 Labor Work Stoppage
2011 Data normalized to exclude the 05/02/11 - 05/03/11 Lightning Storm
Table 3: Transmission & Distribution Events

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrences)</th>
<th>ASAI (Percent)</th>
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<td></td>
<td>729,784</td>
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<td>2013</td>
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<td></td>
<td>115.68</td>
<td>101.13</td>
<td>68.633</td>
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</tr>
</tbody>
</table>

Table 4: Generation Events – Hawaiian Electric

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrences)</th>
<th>ASAI (Percent)</th>
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<td>100.000</td>
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Table 5: Generation Events – Other [non-utility]

<table>
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<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrences)</th>
<th>ASAI (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
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<td></td>
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<td>0.00</td>
<td>0.000</td>
<td>100.000</td>
</tr>
<tr>
<td>2009</td>
<td>294,802</td>
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<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.000</td>
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<tr>
<td>2010</td>
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<td>100.000</td>
</tr>
<tr>
<td>2011</td>
<td>296,679</td>
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<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.000</td>
<td>99.999</td>
</tr>
<tr>
<td>2012</td>
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<td>100.000</td>
</tr>
<tr>
<td>2013</td>
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<td>0.000</td>
<td>100.000</td>
</tr>
</tbody>
</table>
### Table 6: Transmission & Distribution Events with Normalization

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrences)</th>
<th>ASAI (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008*</td>
<td>294,371</td>
<td>382,124</td>
<td>490,842</td>
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</tr>
<tr>
<td>2009</td>
<td>294,802</td>
<td>333,908</td>
<td>442,546</td>
<td>90.07</td>
<td>79.52</td>
<td>67.959</td>
<td>99.983</td>
</tr>
<tr>
<td>2010</td>
<td>295,637</td>
<td>361,331</td>
<td>564,419</td>
<td>114.55</td>
<td>93.72</td>
<td>73.333</td>
<td>99.988</td>
</tr>
<tr>
<td>2011**</td>
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<td>160.39</td>
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<td>99.978</td>
</tr>
<tr>
<td>2012</td>
<td>297,598</td>
<td>341,118</td>
<td>524,554</td>
<td>105.76</td>
<td>92.26</td>
<td>68.774</td>
<td>99.978</td>
</tr>
<tr>
<td>2013</td>
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<td>341,931</td>
<td>576,307</td>
<td>115.68</td>
<td>101.13</td>
<td>68.633</td>
<td>99.978</td>
</tr>
</tbody>
</table>

### Table 7: Generation Events – Hawaiian Electric with Normalization

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrences)</th>
<th>ASAI (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>294,371</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.000</td>
<td>100.000</td>
</tr>
<tr>
<td>2009</td>
<td>294,802</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.000</td>
<td>100.000</td>
</tr>
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<td>295,637</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.000</td>
<td>100.000</td>
</tr>
<tr>
<td>2011</td>
<td>296,679</td>
<td>24,455</td>
<td>18,734</td>
<td>3.79</td>
<td>45.96</td>
<td>4.946</td>
<td>99.999</td>
</tr>
<tr>
<td>2012</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.000</td>
<td>100.000</td>
</tr>
<tr>
<td>2013</td>
<td>298,920</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.000</td>
<td>100.000</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrences)</th>
<th>ASAI (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008*</td>
<td>294,371</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.000</td>
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<tr>
<td>2009</td>
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<td>100.000</td>
</tr>
<tr>
<td>2010</td>
<td>295,637</td>
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<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.000</td>
<td>100.000</td>
</tr>
<tr>
<td>2011**</td>
<td>296,679</td>
<td>24,455</td>
<td>18,734</td>
<td>3.79</td>
<td>45.96</td>
<td>4.946</td>
<td>99.999</td>
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<tr>
<td>2012</td>
<td>297,598</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.000</td>
<td>100.000</td>
</tr>
<tr>
<td>2013</td>
<td>298,920</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.000</td>
<td>100.000</td>
</tr>
</tbody>
</table>
Figure 1 shows the System Average Interruption Duration Indices (SAIDI) for the past six years. It shows that the 2013 SAIDI is 121.63 minutes, a 7% increase compared to the 2012 SAIDI result of 113.67 minutes. The SAIDI is the composite of both the SAIFI and CAIDI indices and produces a broader benchmark of system reliability by combining both the duration and the number of customer interruptions during a given period of time.

Figure 2 shows the Customer Average Interruption Duration Indices (CAIDI) for the past six years. It shows that the average duration of a customer's outage (CAIDI) for 2013 is 88.78 minutes, a 7% increase compared to the 2012 CAIDI result of 83.08 minutes. The following two events added over 9 minutes to the 2013 CAIDI, well over the 5 minute increase from the 2012 CAIDI.
The two major events affecting the 2013 CAIDI results were:

1. February 17, 2013 – Broken switch hardware fell into conductors atop the Kamehame Ridge in the Koolau Mountain Range affecting 12,691 customers and lasting from a momentary interruption to 4 hours and 39 minutes. This incident added nearly 6 minutes to the annual 2013 CAIDI.

2. October 14, 2013 – A broken strain insulator on Woodlawn Drive caused the attached conductor line to fall affecting about 5,210 customers ranging from a momentary interruption to 7 hours and 7 minutes. This incident added nearly 4 minutes to the annual 2013 CAIDI.

Figure 3: Outage Categories

The Top 5 Outage Categories, by number of customers affected, as illustrated in Figure 3, equates to about 69% of the total Customer Interruptions in 2013; these causes are:

<table>
<thead>
<tr>
<th>Outage Category</th>
<th>Sample Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Equipment Deterioration</td>
<td>failed, broken, corroded equipment</td>
</tr>
<tr>
<td>2. Loadshed</td>
<td>loss of generation, major disruptions to distribution</td>
</tr>
<tr>
<td>3. Cable Faults</td>
<td>underground equipment failures</td>
</tr>
<tr>
<td>4. Switching Errors</td>
<td>errors during activities to reroute power for maintenance purposes</td>
</tr>
<tr>
<td>5. Auto Accidents</td>
<td>vehicular contact with poles, vaults, and support structures</td>
</tr>
</tbody>
</table>

The major cause factors for 2012 were similar to those for 2013, except “High Winds” which was replaced by “Switching Errors” in 2013. The total number of customer interruptions in 2013 was 409,516 compared with 407,197 interruptions in 2012. In the six year period, 2013 had the highest number of interruptions however it was the second highest in SAIFI indicating the increase in customers served.
The number of customer interruptions due to "Equipment Deterioration" increased from 59,320 in 2012 to 102,637 in 2013, an increase of 73%. The number of customer interruptions due to "Loadshed" increased from 53,424 in 2012 to 67,586 in 2013, a 27% increase. All of the "Loadshed" interruptions were caused by a single non-utility loss of generation event on April 2, 2013.

In contrast to the above areas, the number of customer interruptions due to "Cable Fault" decreased from 88,965 in 2012 to 65,201 in 2013, a 27% reduction. The number of customer interruptions from "Auto Accidents" decreased from 24,790 in 2012 to 21,915 in 2013 a 12% reduction. The interruptions due to "High Winds" also decreased from 37,807 in 2012 to 5,818 in 2013, an 85% reduction. The reliability improvement in the outage cause category "High Winds" may be attributed primarily to two program areas. The first is the area of pole replacement and overhead line maintenance programs. In the past, older poles on the system were damaged by high winds causing outages. The results in 2013 show that there were significantly less outages caused by pole failures and the ones that did occur were the result of "Auto Accidents." The second program area is vegetation management which focuses on trimming trees and other vegetation away from the lines. Although vegetation related outages would normally be coded to "Trees and Branches," during high wind conditions some of the outages occur due to intermittent contact or debris from tree branches flying into the lines. The results indicate that with Hawaiian Electric Company's focus in this area it is improving in reliability and is reflected in the lower number of outages in 2013 due to "High Winds."

In 2013, there were three events that resulted in the loss of more than 10,000 customers. On April 2, 2013, the island experienced a load shedding event due to the loss of the island's largest generating unit at the AES facility. This event caused an interruption to 67,586 customers or 23% of our customers with outage durations ranging from 3 minutes to 1 hour and 54 minutes. On January 15, 2013, an outage affecting 13,182 customers caused by a switching error deenergized a transformer at Koolau Substation. This outage lasted 25 minutes. On February 17, 2013, broken switch hardware affected 12,691 customers in the CAIDI affecting event.
Figure 4 shows the System Average Interruption Frequency Index (SAIFI) for the past six years. It shows that the 2013 SAIFI of 1.370 was the second worst performance in the past six years, increasing 0.15% from the 1.368 SAIFI in 2012.

Figure 5 shows that the 2013 Average Service Availability changed very slightly from 2012. The decline was on the order of one one-thousandth of a percent. This difference of availability is about 2300 less hours of availability to a customer base of approximately 1300 more customers than in 2012.
Hawaiian Electric Company
Sustained Interruption Summary

From: January 1, 2013
To: December 31, 2013

<table>
<thead>
<tr>
<th>Outage Cause</th>
<th>Customer Hours</th>
<th>Customer Interruptions</th>
<th>SAIFI</th>
<th>SAIDI</th>
<th>CAIDI</th>
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<td>EQUIP DETERIORATION</td>
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<td>0.00</td>
<td>166.00</td>
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<td>0.00</td>
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<tr>
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<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
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<td>0.00</td>
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<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>CUSTOMER MAINTENANCE</td>
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<td>0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
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<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
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<td>0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Total: 605,964.98, 409,516, 1.370, 121.63, 88.78

AVERAGE SYSTEM AVAILABILITY = 99.977%

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
Sustained Interruption Summary

From: January 1, 2013  
To: December 31, 2013

<table>
<thead>
<tr>
<th>Outage Cause</th>
<th>Interruptions</th>
<th>Customer Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>% of Total</td>
</tr>
<tr>
<td>ACCIDENT</td>
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<td>23.17</td>
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<td>0.00</td>
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<tr>
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<tr>
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<td>0.08</td>
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<tr>
<td>FIRE</td>
<td>2</td>
<td>0.08</td>
</tr>
<tr>
<td>FLASHOVER</td>
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<td>0.42</td>
</tr>
<tr>
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<td>AUTO UF LOADSHED</td>
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<tr>
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<tr>
<td>TRANSFER LOAD MAINTENANCE</td>
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<td>0.04</td>
</tr>
<tr>
<td>SWITCH LOAD MAINTENANCE</td>
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<td>0.00</td>
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<tr>
<td>FOREIGN OBJECT IN LINES</td>
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<td>OTHER</td>
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<tr>
<td>OTHER</td>
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<td>0.21</td>
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<tr>
<td>TRANSFORM OVERLOAD</td>
<td>42</td>
<td>1.75</td>
</tr>
</tbody>
</table>
Hawaiian Electric Company
Sustained Interruption Summary

From: January 1, 2013  
To: December 31, 2013

<table>
<thead>
<tr>
<th>Outage Cause</th>
<th>Interruptions</th>
<th>Customer Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>% of Total</td>
</tr>
<tr>
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<td>32</td>
<td>1.33</td>
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<tr>
<td>UNKNOWN</td>
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<td>1.33</td>
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<tr>
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<tr>
<td>LANDSLIDE/FLOODING</td>
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<td>0.04</td>
</tr>
<tr>
<td>NATURAL DISASTER</td>
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<td>0.00</td>
</tr>
<tr>
<td>LIGHTNING</td>
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<td>1.08</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td>2,404</td>
<td>605,964.98</td>
</tr>
</tbody>
</table>

NOTES: Outages with zero customer hours or due to customer maintenance are not included in the report.
DEFINITION OF TERMS

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

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

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

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

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

CUSTOMER INTERRUPTION
One interruption of one customer.

NOTE: Interruptions to customers at their request (e.g., customer maintenance) are not considered.
Reliability indices used in this report conform to standards proposed by both the Edison Electric Institute (EEI) and the Institute of Electrical and Electronics Engineers (IEEE) unless otherwise indicated in the above definitions. Four reliability indices that convey a meaningful representation of the level of reliability were selected and are presented in this report. These reliability indices are as follows:

**RELIABILITY INDICES**

**AVERAGE SERVICE AVAILABILITY INDEX (ASA)**

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

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

**SYSTEM AVERAGE INTERRUPTION FREQUENCY INDEX (SAIFI)**

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

\[
SAIFI = \frac{\sum \text{No of Customer Interruptions Experienced during the year}}{\text{Average No of Customers served during the year}}
\]

**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.

\[
CAIDI = \frac{\sum \text{Duration of Interruption} \times \text{No of Customers affected}}{\sum \text{No of Customer Interruptions Experienced for the year}}
\]
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

2013

Prepared by
Operations, Distribution Department

June 20, 2014
INTRODUCTION

This is the 2013 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 81,537 in 2012 to 82,074 in 2013 (a 0.65% increase). The 2013 peak demand for the system was 190.2 MW (evening peak), 0.9 MW higher than the peak demand of 189.3 MW in 2012.

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

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

Indices measure reliability in terms of the overall availability of electrical service (ASAI), the frequency or number of times 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 82,074 customers).

ANALYSIS

This analysis of the annual system reliability for HAWAI‘I ELECTRIC LIGHT is for the year 2013. To determine the relative level of reliability, the statistics for five prior years, 2008 through 2012, are used for comparison.

The reliability indices are calculated using the data from all sustained\(^1\) 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.

\(^1\)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.)
2013 RESULTS

Annual Service Reliability Indices

The annual service reliability for 2013 was ranked the best SAIDI in the past 6 years in terms of the indices for all events (with Normalization). The reliability results for 2013 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. Ten outage events were normalized in 2013, including six T&D and four Generation related events. All subsequent comparisons and discussion are based on the normalized data.

Table 1: Annual Service Reliability Indices - All Events

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Customers</td>
<td>79,386</td>
<td>79,679</td>
<td>80,171</td>
<td>80,807</td>
<td>81,537</td>
<td>82,074</td>
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<tr>
<td>Customer Interruptions</td>
<td>193,982</td>
<td>298,334</td>
<td>302,402</td>
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<td>228,549</td>
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<td>Customer-Hour Interruptions</td>
<td>189,692</td>
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<td>207,607</td>
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<td>155.30</td>
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<td>202.35</td>
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<td>49.98</td>
<td>43.77</td>
</tr>
<tr>
<td>SAIF</td>
<td>2.444</td>
<td>3.744</td>
<td>3.772</td>
<td>3.596</td>
<td>2.803</td>
<td>4.623</td>
</tr>
</tbody>
</table>

Table 2: Annual Service Reliability Indices - with Normalization

<table>
<thead>
<tr>
<th>Year</th>
<th>2008*</th>
<th>2009*</th>
<th>2010*</th>
<th>2011*</th>
<th>2012</th>
<th>2013*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Customers</td>
<td>79,386</td>
<td>79,679</td>
<td>80,171</td>
<td>80,807</td>
<td>81,537</td>
<td>82,074</td>
</tr>
<tr>
<td>Customer Interruptions</td>
<td>179,037</td>
<td>246,437</td>
<td>176,622</td>
<td>236,688</td>
<td>228,549</td>
<td>241,169</td>
</tr>
<tr>
<td>Customer-Hours Interrupted</td>
<td>188,381</td>
<td>197,371</td>
<td>169,522</td>
<td>232,981</td>
<td>190,395</td>
<td>156,338</td>
</tr>
<tr>
<td>SAID</td>
<td>142.38</td>
<td>148.62</td>
<td>126.8</td>
<td>172.99</td>
<td>140.10</td>
<td>114.29</td>
</tr>
<tr>
<td>CAID</td>
<td>63.13</td>
<td>48.05</td>
<td>57.59</td>
<td>59.06</td>
<td>49.98</td>
<td>38.89</td>
</tr>
<tr>
<td>SAIF</td>
<td>2.255</td>
<td>3.093</td>
<td>2.203</td>
<td>2.929</td>
<td>2.803</td>
<td>2.938</td>
</tr>
</tbody>
</table>

NOTE:
2008* Data normalized to exclude 7/2 HEP UFLS
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
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

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
## T&D vs. Generation – All Events

### Table 3: Annual Service Reliability Indices – T&D

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Customers</td>
<td>79386</td>
<td>79679</td>
<td>80171</td>
<td>80807</td>
<td>81537</td>
<td>82074</td>
</tr>
<tr>
<td>Customer Interruptions</td>
<td>107692</td>
<td>165478</td>
<td>88321</td>
<td>180770</td>
<td>145331</td>
<td>189427</td>
</tr>
<tr>
<td>CID</td>
<td>184393</td>
<td>232344</td>
<td>161218.8</td>
<td>228431.9</td>
<td>183773.2</td>
<td>257620</td>
</tr>
<tr>
<td>SAID</td>
<td>139.36</td>
<td>174.96</td>
<td>120.66</td>
<td>169.61</td>
<td>135.23</td>
<td>188.33</td>
</tr>
<tr>
<td>CAID</td>
<td>102.73</td>
<td>84.24</td>
<td>109.52</td>
<td>75.82</td>
<td>75.87</td>
<td>81.6</td>
</tr>
<tr>
<td>SAIF</td>
<td>1.357</td>
<td>2.077</td>
<td>1.102</td>
<td>2.237</td>
<td>1.782</td>
<td>2.308</td>
</tr>
</tbody>
</table>

### Table 4: Annual Service Reliability Indices – Generation

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Customers</td>
<td>79386</td>
<td>79679</td>
<td>80171</td>
<td>80807</td>
<td>81537</td>
<td>82074</td>
</tr>
<tr>
<td>Customer Interruptions</td>
<td>86290</td>
<td>132856</td>
<td>214081</td>
<td>109846</td>
<td>83218</td>
<td>189971</td>
</tr>
<tr>
<td>CID</td>
<td>5299</td>
<td>14572</td>
<td>46387.9</td>
<td>13688.4</td>
<td>6621.3</td>
<td>19178</td>
</tr>
<tr>
<td>SAID</td>
<td>4</td>
<td>10.97</td>
<td>34.7</td>
<td>10.16</td>
<td>4.87</td>
<td>14.02</td>
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<tr>
<td>CAID</td>
<td>3.68</td>
<td>6.58</td>
<td>13</td>
<td>7.48</td>
<td>4.77</td>
<td>6.06</td>
</tr>
<tr>
<td>SAIF</td>
<td>1.087</td>
<td>1.667</td>
<td>2.67</td>
<td>1.359</td>
<td>1.021</td>
<td>2.315</td>
</tr>
</tbody>
</table>
**T&D vs. Generation – With Normalization**

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

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2009*</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Customers</td>
<td>79386</td>
<td>79679</td>
<td>80171</td>
<td>80807</td>
<td>81537</td>
<td>82074</td>
</tr>
<tr>
<td>Customer Interruptions</td>
<td>107692</td>
<td>129518</td>
<td>88321</td>
<td>180770</td>
<td>145331</td>
<td>126005</td>
</tr>
<tr>
<td>CID</td>
<td>184392.8</td>
<td>185854.8</td>
<td>161218.8</td>
<td>228431.9</td>
<td>183773.2</td>
<td>147483</td>
</tr>
<tr>
<td>SAID</td>
<td>139.36</td>
<td>139.95</td>
<td>120.66</td>
<td>169.61</td>
<td>135.20</td>
<td>107.82</td>
</tr>
<tr>
<td>CAID</td>
<td>102.73</td>
<td>86.10</td>
<td>109.52</td>
<td>75.82</td>
<td>75.87</td>
<td>70.23</td>
</tr>
<tr>
<td>SAIF</td>
<td>1.357</td>
<td>1.572</td>
<td>1.102</td>
<td>2.237</td>
<td>1.782</td>
<td>1.535</td>
</tr>
</tbody>
</table>

Table 6: Normalized Annual Service Reliability Indices – Generation

<table>
<thead>
<tr>
<th>Year</th>
<th>2008*</th>
<th>2009*</th>
<th>2010*</th>
<th>2011*</th>
<th>2012</th>
<th>2013*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Customers</td>
<td>79386</td>
<td>79679</td>
<td>80171</td>
<td>80807</td>
<td>81537</td>
<td>82074</td>
</tr>
<tr>
<td>Customer Interruptions</td>
<td>71345</td>
<td>121221</td>
<td>88301</td>
<td>55918</td>
<td>83218</td>
<td>115164</td>
</tr>
<tr>
<td>CID</td>
<td>3988</td>
<td>12871.1</td>
<td>8303.9</td>
<td>4548.74</td>
<td>6621.3</td>
<td>8854.9</td>
</tr>
<tr>
<td>SAID</td>
<td>3.01</td>
<td>9.17</td>
<td>6.21</td>
<td>3.38</td>
<td>4.87</td>
<td>6.47</td>
</tr>
<tr>
<td>CAID</td>
<td>3.35</td>
<td>6.03</td>
<td>6.15</td>
<td>4.88</td>
<td>4.77</td>
<td>4.61</td>
</tr>
<tr>
<td>SAIF</td>
<td>0.899</td>
<td>1.521</td>
<td>1.101</td>
<td>0.692</td>
<td>1.021</td>
<td>1.403</td>
</tr>
</tbody>
</table>
Figure 1 shows the System Average Interruption Duration Indices (SAIDI) for the past six years. It shows that the 2013 SAIDI is 114.29 minutes, an 18% decrease compared to the 2012 SAIDI result of 140.10 minutes. The SAIDI is the composite of both the SAIFI and CAIDI indices and produces a broader benchmark of system reliability by combining both the duration and the number of customer interruptions during a given period of time.

Figure 2: Customer Average Interruption Duration Index (CAIDI)
Figure 2 Customer Average Interruption Duration Indices (CAIDI) shows the average duration of a customer's outage (CAIDI) for 2013 is 38.89 minutes, a 22% decrease compared to the 2012 CAIDI result of 49.98 minutes.

The three major events affecting the 2013 CAIDI results were:

1. August 10, 2013 – fallen tree on 34kV Line 3400 near Volcano affecting 4,568 customers and 9,967 customer-hours.

These three events increased the 2013 CAIDI by 1.24 minutes.

Figure 3: Outage Categories

The Top 5 Outage Categories, by number of customers affected, as illustrated in Figure 3, equates to about 81% of the total Customer Interruptions in 2013; these causes are:

<table>
<thead>
<tr>
<th>Outage Category</th>
<th>Sample Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Faulty Equipment</td>
<td>HAWAI'I ELECTRIC LIGHT generation load shedding</td>
</tr>
<tr>
<td>2. Trees or Branches</td>
<td>tree or branch contact</td>
</tr>
<tr>
<td>3. Customer Equipment</td>
<td>IPP generation load shedding</td>
</tr>
</tbody>
</table>
4. Deterioration

rotten poles/cross arms, rusted hardware and insulators, corroded connections

5. Auto Accidents

The major cause factors for 2013 were the same as 2012, but in a different order.

A total of 241,168 Customer Interruptions were recorded for a total of 156,332 Customer Hours of Interruptions. The System Average Interruption Frequency (SAIF) index was 2.938 and the Customer Average Interruption Duration (CAID) was 38.89 minutes.

In 2013, Hawai'i Electric Light customers experienced 20 load shedding events. 12 load shed events were due to Hawai'i Electric Light generating units, 3 load shed events were due to loss of PGV generating units, 3 load shed events due to loss of HEP generating units, 1 load shed event due to loss of HRD, and 1 load shed event due to loss of Pakini Nui Wind Farm. Of the 20 events, 16 were caused by generation equipment and 4 were caused by T&D equipment.

<table>
<thead>
<tr>
<th>Loss of Generating Unit</th>
<th>UFLS Events</th>
<th>Generation Related</th>
<th>T&amp;D Related</th>
</tr>
</thead>
<tbody>
<tr>
<td>HELCO</td>
<td>12</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>PGV</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>HEP</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>HRD</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Pakini Nui</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 4 shows the System Average Interruption Frequency Index (SAIFI) increased as compared to 2012 from 2.803 to 2.938.
Figure 5 shows that the 2013 Average Service Availability Index increased as compared to the 2012 from 99.973% to 99.978%
HAWAI’I ELECTRIC LIGHT vs. NON-HAWAI’I ELECTRIC LIGHT GENERATION
Service Reliability Indices Normalized

**HAWAI’I ELECTRIC LIGHT Generation**

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Customers</td>
<td>79386</td>
<td>79679</td>
<td>80171</td>
<td>80807</td>
<td>81537</td>
<td>82074</td>
</tr>
<tr>
<td>Customer Interruptions</td>
<td>66538</td>
<td>100561</td>
<td>71993</td>
<td>28429</td>
<td>31421</td>
<td>72547</td>
</tr>
<tr>
<td>CID</td>
<td>3709</td>
<td>11647</td>
<td>7118.4</td>
<td>2802.4</td>
<td>2492.6</td>
<td>5834</td>
</tr>
<tr>
<td>SAID</td>
<td>2.80</td>
<td>8.77</td>
<td>5.33</td>
<td>2.08</td>
<td>1.83</td>
<td>4.27</td>
</tr>
<tr>
<td>CAID</td>
<td>3.34</td>
<td>6.95</td>
<td>5.93</td>
<td>5.91</td>
<td>4.76</td>
<td>4.83</td>
</tr>
<tr>
<td>SAIF</td>
<td>0.838</td>
<td>1.262</td>
<td>0.898</td>
<td>0.352</td>
<td>0.385</td>
<td>0.884</td>
</tr>
</tbody>
</table>

**Non-HAWAI’I ELECTRIC LIGHT Generation**

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Customers</td>
<td>79386</td>
<td>79679</td>
<td>80171</td>
<td>80807</td>
<td>81537</td>
<td>82074</td>
</tr>
<tr>
<td>Customer Interruptions</td>
<td>4807</td>
<td>20660</td>
<td>16308</td>
<td>27489</td>
<td>51797</td>
<td>42617</td>
</tr>
<tr>
<td>CID</td>
<td>279</td>
<td>1224.3</td>
<td>1185.1</td>
<td>1747</td>
<td>4128.7</td>
<td>3020</td>
</tr>
<tr>
<td>SAID</td>
<td>0.21</td>
<td>0.92</td>
<td>0.89</td>
<td>1.30</td>
<td>3.04</td>
<td>2.21</td>
</tr>
<tr>
<td>CAID</td>
<td>3.48</td>
<td>3.56</td>
<td>4.36</td>
<td>3.81</td>
<td>4.78</td>
<td>4.25</td>
</tr>
<tr>
<td>SAIF</td>
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<td>0.259</td>
<td>0.203</td>
<td>0.340</td>
<td>0.635</td>
<td>0.519</td>
</tr>
</tbody>
</table>
INTERRUPTIONS CAUSED BY TREES & BRANCHES

Normalized
Hawai‘i Electric Light Company
2013

YEAR

2008 2009 2010 2011 2012 2013

38,497 51,732 38,489 45,152 79,628 47,651

CUST O M E R I N T E R R U P T I O N
2013
SERVICE RELIABILITY SUMMARY
Normalized

<table>
<thead>
<tr>
<th>Cause of Outage</th>
<th>CUST-HR</th>
<th>CUST-INT</th>
<th>SAIF</th>
<th>SAID</th>
<th>CAID</th>
<th>SAID RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faulty Equipment Operation</td>
<td>5439.0</td>
<td>67504</td>
<td>0.822</td>
<td>3.98</td>
<td>4.83</td>
<td>8</td>
</tr>
<tr>
<td>Tree or Branches</td>
<td>62670.8</td>
<td>47951</td>
<td>0.584</td>
<td>45.82</td>
<td>78.42</td>
<td>1</td>
</tr>
<tr>
<td>Customer Equip</td>
<td>3035.6</td>
<td>42625</td>
<td>0.519</td>
<td>2.22</td>
<td>4.27</td>
<td>12</td>
</tr>
<tr>
<td>Deterioration</td>
<td>28059.6</td>
<td>18762</td>
<td>0.229</td>
<td>20.51</td>
<td>89.73</td>
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</tr>
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<td>Auto Accident</td>
<td>12672.4</td>
<td>17235</td>
<td>0.210</td>
<td>9.26</td>
<td>44.12</td>
<td>3</td>
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<td>Unknown</td>
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<td>11817</td>
<td>0.144</td>
<td>5.10</td>
<td>35.45</td>
<td>5</td>
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<tr>
<td>Operation or Switching Error</td>
<td>527.5</td>
<td>6569</td>
<td>0.080</td>
<td>0.39</td>
<td>4.82</td>
<td>16</td>
</tr>
<tr>
<td>Foreign Objects</td>
<td>320.8</td>
<td>6558</td>
<td>0.080</td>
<td>0.23</td>
<td>2.94</td>
<td>19</td>
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<td>Man or Animal</td>
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<td>4619</td>
<td>0.056</td>
<td>3.32</td>
<td>50.87</td>
<td>10</td>
</tr>
<tr>
<td>Scheduled Maintenance</td>
<td>7613.4</td>
<td>3825</td>
<td>0.047</td>
<td>5.57</td>
<td>119.43</td>
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</tr>
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<td>Cable Fault</td>
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<td>0.044</td>
<td>4.08</td>
<td>92.32</td>
<td>7</td>
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<td>Other Personnel Error</td>
<td>872.8</td>
<td>2487</td>
<td>0.030</td>
<td>0.64</td>
<td>21.06</td>
<td>14</td>
</tr>
<tr>
<td>Lightning</td>
<td>4725.9</td>
<td>2117</td>
<td>0.026</td>
<td>3.45</td>
<td>133.94</td>
<td>9</td>
</tr>
<tr>
<td>Sys Add/Removal</td>
<td>5919.1</td>
<td>1446</td>
<td>0.018</td>
<td>4.33</td>
<td>245.60</td>
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<td>3813.5</td>
<td>1439</td>
<td>0.018</td>
<td>2.79</td>
<td>159.01</td>
<td>11</td>
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<td>Tsf Failure</td>
<td>1906.3</td>
<td>1315</td>
<td>0.016</td>
<td>1.39</td>
<td>86.98</td>
<td>13</td>
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<tr>
<td>Forced Maintenance</td>
<td>482.4</td>
<td>466</td>
<td>0.006</td>
<td>0.35</td>
<td>62.11</td>
<td>17</td>
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<tr>
<td>Excavate Construction</td>
<td>329.9</td>
<td>312</td>
<td>0.004</td>
<td>0.24</td>
<td>63.44</td>
<td>18</td>
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<tr>
<td>Equip Contact</td>
<td>623.3</td>
<td>194</td>
<td>0.002</td>
<td>0.46</td>
<td>192.76</td>
<td>15</td>
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<td>88.5</td>
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<td>0.001</td>
<td>0.06</td>
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<td>Loose Connection</td>
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<td>84</td>
<td>0.001</td>
<td>0.05</td>
<td>48.19</td>
<td>21</td>
</tr>
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<td>82</td>
<td>0.001</td>
<td>0.02</td>
<td>20.04</td>
<td>22</td>
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<td>21.1</td>
<td>19</td>
<td>0.000</td>
<td>0.02</td>
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NUMBER OF CUSTOMERS FOR THE PERIOD = 82074
ASA = 99.978%

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY
SAID = SYSTEM AVERAGE INTERRUPTION DURATION
CAID = CUSTOMER AVERAGE INTERRUPTION DURATION
THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF
## 2013 SYSTEM INTERRUPTION CAUSE REPORT

### Normalized

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**TOTALS**                                           | 2972                 | 156337.9       |
### 2013 T&D Service Reliability Summary

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<th>CAID</th>
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**TOTALS**: 147482.9 | 126005 | 1.535 | 107.82 | 70.23

**NUMBER OF CUSTOMERS FOR THE PERIOD = 82074**

% ASA = 99.979

**SAIF = System Average Interruption Frequency**

**SAID = System Average Interruption Duration**

**CAID = Customer Average Interruption Duration**

The outage causes are listed in order of its SAIF.
## 2013 GENERATION SERVICE RELIABILITY SUMMARY

### Normalized

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**TOTALS** 8854.9 115164 1.403 6.47 4.61

**NUMBER OF CUSTOMERS FOR THE PERIOD = 82074**

**% ASA = 99.998**

**SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY**

**SAID = SYSTEM AVERAGE INTERRUPTION DURATION**

**CAID = CUSTOMER AVERAGE INTERRUPTION DURATION**

**THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF**
2013
HAWAI’I ELECTRIC LIGHT GENERATION SERVICE RELIABILITY SUMMARY
Normalized

<table>
<thead>
<tr>
<th>Cause of Outage</th>
<th>CUST-HR</th>
<th>CUST-INT</th>
<th>SAIF</th>
<th>SAID</th>
<th>CAID</th>
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TOTALS  5834.7  72547  0.884  4.27  4.83  1

NUMBER OF CUSTOMERS FOR THE PERIOD = 82074

SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY
SAID = SYSTEM AVERAGE INTERRUPTION DURATION
CAID = CUSTOMER AVERAGE INTERRUPTION DURATION
THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

% ASA = 99.999
## 2013

### Non-HAWAI'I ELECTRIC LIGHT GENERATION SERVICE RELIABILITY SUMMARY

Normalized

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<th>Cause of Outage</th>
<th>CUST-HR</th>
<th>CUST-INT</th>
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<th>SAID</th>
<th>CAID</th>
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**TOTALS** 3020.3 42617 0.519 2.21 4.25

**NUMBER OF CUSTOMERS FOR THE PERIOD = 82074**

**SAIF = SYSTEM AVERAGE INTERRUPTION FREQUENCY**

**SAID = SYSTEM AVERAGE INTERRUPTION DURATION**

**CAID = CUSTOMER AVERAGE INTERRUPTION DURATION**

THE OUTAGE CAUSES ARE LISTED IN ORDER OF ITS SAIF

% ASA = 99.999
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.

\[
ASA = \sum \frac{\text{No. of Customer Hours Actually Served During the Year}}{\sum \text{No. of Customer Hours Possible During the Year}} \times 100\%
\]

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.

\[
SAIFI = \sum \frac{\text{No. of Customer Interruptions Experienced During the Year}}{\text{Average No. of Customers Served During the Year}}
\]

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.

\[
CAIDI = \sum \frac{\text{Duration of Interruption} \times \text{No. of Customers Affected}}{\sum \text{No. of Customer Interruptions Experienced for the Year}}
\]

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.

\[
SAIDI = \sum \frac{\text{Duration of Interruption} \times \text{No. of Customers Affected}}{\text{Average No. of Customers Served during the Year}}
\]
INTRODUCTION

This is the 2013 annual service reliability report for Maui Electric Company, Limited (MECO). The year-end average number of electric customers increased from 68,575 in 2012 to 69,303 in 2013 (a 1.06% increase). The 2013 peak demand for the system was 194.5 MW (evening peak), 4.6 MW lower than the peak demand in 2012; the highest system peak demand remains at 210.9 MW set on the evening of October 11, 2004.

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 69,303 customers).

ANALYSIS

This analysis of the annual system reliability for MECO is for the year 2013. To determine the relative level of reliability, the statistics for five prior years, 2008 through 2012, are used for comparison.

The reliability indices are calculated using the data from all sustained\(^1\) 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.

\(^1\)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.)
2013 RESULTS

Annual Service Reliability Indices

The annual service reliability for 2013 was ranked fourth for the best SAIDI and ASA in the past 6 years in terms of the indices for all events. The reliability results for all events in 2013 and five prior years are shown below in Table 1 through Table 4. The normalized reliability results for all events in 2013 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 2013 and five prior years are shown below in Table 8 through Table 16. The normalized reliability results comparing T&D and generation related outages in 2013 and five prior years are shown below in Table 16 through Table 24.

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrence)</th>
<th>ASA (Percent)</th>
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<td>2008</td>
<td>66,810</td>
<td>163,120</td>
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<td>99.9617%</td>
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<td>2009</td>
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<td>124,864</td>
<td>195,853.4</td>
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<td>94.11</td>
<td>1.860</td>
<td>99.9667%</td>
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<tr>
<td>2010</td>
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<td>103,416.1</td>
<td>92.05</td>
<td>47.26</td>
<td>1.948</td>
<td>99.9824%</td>
</tr>
<tr>
<td>2011</td>
<td>68,010</td>
<td>170,379</td>
<td>210,185.7</td>
<td>185.43</td>
<td>74.02</td>
<td>2.505</td>
<td>99.9646%</td>
</tr>
<tr>
<td>2012</td>
<td>68,575</td>
<td>195,618</td>
<td>248,500.5</td>
<td>217.43</td>
<td>76.22</td>
<td>2.853</td>
<td>99.9586%</td>
</tr>
<tr>
<td>2013</td>
<td>69,303</td>
<td>138,480</td>
<td>221,000.3</td>
<td>191.33</td>
<td>95.75</td>
<td>1.998</td>
<td>99.9635%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrence)</th>
<th>ASA (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>61,981</td>
<td>146,230</td>
<td>197,033.8</td>
<td>190.74</td>
<td>80.85</td>
<td>2.359</td>
<td>99.9637%</td>
</tr>
<tr>
<td>2009</td>
<td>62,328</td>
<td>118,205</td>
<td>189,744.8</td>
<td>182.66</td>
<td>96.31</td>
<td>1.896</td>
<td>99.9652%</td>
</tr>
<tr>
<td>2010</td>
<td>62,640</td>
<td>110,350</td>
<td>70,072.9</td>
<td>67.12</td>
<td>38.10</td>
<td>1.762</td>
<td>99.9819%</td>
</tr>
<tr>
<td>2011</td>
<td>63,225</td>
<td>156,145</td>
<td>194,603.0</td>
<td>184.68</td>
<td>74.78</td>
<td>2.470</td>
<td>99.9648%</td>
</tr>
<tr>
<td>2012</td>
<td>63,745</td>
<td>181,244</td>
<td>199,620.7</td>
<td>187.89</td>
<td>74.78</td>
<td>2.843</td>
<td>99.9643%</td>
</tr>
<tr>
<td>2013</td>
<td>64,397</td>
<td>100,316</td>
<td>171,316.7</td>
<td>159.62</td>
<td>102.47</td>
<td>1.558</td>
<td>99.9695%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrence)</th>
<th>ASA (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>3,149</td>
<td>4,452</td>
<td>24,045.4</td>
<td>458.15</td>
<td>95.01</td>
<td>596.35</td>
<td>99.9128%</td>
</tr>
<tr>
<td>2009</td>
<td>3,151</td>
<td>4,452</td>
<td>4,989.6</td>
<td>121.22</td>
<td>67.25</td>
<td>101.53</td>
<td>99.9819%</td>
</tr>
<tr>
<td>2010</td>
<td>3,145</td>
<td>18,473</td>
<td>31,258.9</td>
<td>3,780</td>
<td>1,413</td>
<td>5.874</td>
<td>99.8862%</td>
</tr>
<tr>
<td>2011</td>
<td>3,161</td>
<td>8,018</td>
<td>7,022.2</td>
<td>455.8</td>
<td>95.01</td>
<td>133.29</td>
<td>99.9746%</td>
</tr>
<tr>
<td>2012</td>
<td>3,187</td>
<td>12,171</td>
<td>47,466.7</td>
<td>458.15</td>
<td>95.01</td>
<td>893.63</td>
<td>99.8300%</td>
</tr>
<tr>
<td>2013</td>
<td>3,205</td>
<td>33,224</td>
<td>44,162.1</td>
<td>826.75</td>
<td>103.66</td>
<td>10.366</td>
<td>99.8423%</td>
</tr>
</tbody>
</table>
### Table 4: Annual Service Reliability Indices – Lanai with All Events

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers</td>
<td>1,680</td>
<td>1,648</td>
<td>1,621</td>
<td>1,624</td>
<td>1,643</td>
<td>1,702</td>
</tr>
<tr>
<td>Interruptions</td>
<td>4,988</td>
<td>2,207</td>
<td>2,471</td>
<td>6,216</td>
<td>2,203</td>
<td>4,940</td>
</tr>
<tr>
<td>Hours Interrupted</td>
<td>3,129.7</td>
<td>1,119.1</td>
<td>2,084.3</td>
<td>8,560.4</td>
<td>1,413.1</td>
<td>5,521.5</td>
</tr>
<tr>
<td>SAIDI (Minutes)</td>
<td>111.77</td>
<td>40.74</td>
<td>77.15</td>
<td>316.27</td>
<td>51.60</td>
<td>194.65</td>
</tr>
<tr>
<td>CAIDI (Minutes)</td>
<td>37.65</td>
<td>30.42</td>
<td>50.61</td>
<td>82.63</td>
<td>38.49</td>
<td>67.06</td>
</tr>
<tr>
<td>SAIFI (Occurrence)</td>
<td>2.969</td>
<td>1.339</td>
<td>1.524</td>
<td>3.828</td>
<td>1.341</td>
<td>2.902</td>
</tr>
<tr>
<td>ASA (Percent)</td>
<td>99.9787%</td>
<td>99.9922%</td>
<td>99.9853%</td>
<td>99.9397%</td>
<td>99.9902%</td>
<td>99.9629%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>2008*</th>
<th>2009*</th>
<th>2010*</th>
<th>2011*</th>
<th>2012*</th>
<th>2013*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers</td>
<td>66,810</td>
<td>67,126</td>
<td>67,405</td>
<td>68,010</td>
<td>68,575</td>
<td>69,303</td>
</tr>
<tr>
<td>Interruptions</td>
<td>75,764</td>
<td>108,368</td>
<td>67,481</td>
<td>101,268</td>
<td>81,428</td>
<td>71,894</td>
</tr>
<tr>
<td>Hours Interrupted</td>
<td>114,000.7</td>
<td>173,602.0</td>
<td>60,006.6</td>
<td>145,710.8</td>
<td>125,836.1</td>
<td>108,360.7</td>
</tr>
<tr>
<td>SAIDI (Minutes)</td>
<td>102.39</td>
<td>155.18</td>
<td>53.41</td>
<td>128.55</td>
<td>110.10</td>
<td>93.81</td>
</tr>
<tr>
<td>CAIDI (Minutes)</td>
<td>90.29</td>
<td>96.12</td>
<td>53.35</td>
<td>86.33</td>
<td>92.72</td>
<td>90.43</td>
</tr>
<tr>
<td>SAIFI (Occurrence)</td>
<td>1.134</td>
<td>1.615</td>
<td>1.001</td>
<td>1.489</td>
<td>1.187</td>
<td>1.037</td>
</tr>
<tr>
<td>ASA (Percent)</td>
<td>99.9805%</td>
<td>99.9705%</td>
<td>99.9898%</td>
<td>99.9755%</td>
<td>99.9911%</td>
<td>99.9821%</td>
</tr>
</tbody>
</table>

### Table 6: Annual Service Reliability Indices - Maui with Normalization

<table>
<thead>
<tr>
<th>Year</th>
<th>2008*</th>
<th>2009*</th>
<th>2010*</th>
<th>2011*</th>
<th>2012*</th>
<th>2013*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers</td>
<td>61,981</td>
<td>62,328</td>
<td>62,640</td>
<td>63,225</td>
<td>63,745</td>
<td>64,397</td>
</tr>
<tr>
<td>Interruptions</td>
<td>73,414</td>
<td>106,498</td>
<td>65,654</td>
<td>99,729</td>
<td>77,968</td>
<td>64,459</td>
</tr>
<tr>
<td>Hours Interrupted</td>
<td>109,806.9</td>
<td>169,242.7</td>
<td>55,954.1</td>
<td>144,404.5</td>
<td>119,045.4</td>
<td>101,098.4</td>
</tr>
<tr>
<td>SAIDI (Minutes)</td>
<td>106.30</td>
<td>162.92</td>
<td>53.60</td>
<td>137.04</td>
<td>112.05</td>
<td>94.20</td>
</tr>
<tr>
<td>CAIDI (Minutes)</td>
<td>89.74</td>
<td>95.35</td>
<td>51.14</td>
<td>86.88</td>
<td>91.61</td>
<td>94.10</td>
</tr>
<tr>
<td>SAIFI (Occurrence)</td>
<td>1.184</td>
<td>1.709</td>
<td>1.048</td>
<td>1.577</td>
<td>1.223</td>
<td>1.001</td>
</tr>
<tr>
<td>ASA (Percent)</td>
<td>99.9798%</td>
<td>99.9689%</td>
<td>99.9898%</td>
<td>99.9739%</td>
<td>99.9787%</td>
<td>99.9820%</td>
</tr>
</tbody>
</table>

### Table 7: Annual Service Reliability Indices - Molokai with Normalization

<table>
<thead>
<tr>
<th>Year</th>
<th>2008*</th>
<th>2009*</th>
<th>2010*</th>
<th>2011*</th>
<th>2012*</th>
<th>2013*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers</td>
<td>3,149</td>
<td>3,151</td>
<td>3,145</td>
<td>3,161</td>
<td>3,187</td>
<td>3,205</td>
</tr>
<tr>
<td>Interruptions</td>
<td>1,393</td>
<td>1,284</td>
<td>1,498</td>
<td>1,252</td>
<td>3,229</td>
<td>6,180</td>
</tr>
<tr>
<td>Hours Interrupted</td>
<td>3,746.5</td>
<td>3,748.6</td>
<td>3,800.1</td>
<td>1,218.5</td>
<td>6,338.9</td>
<td>5,942.2</td>
</tr>
<tr>
<td>SAIDI (Minutes)</td>
<td>71.38</td>
<td>71.38</td>
<td>72.50</td>
<td>23.13</td>
<td>119.34</td>
<td>111.24</td>
</tr>
<tr>
<td>CAIDI (Minutes)</td>
<td>161.37</td>
<td>175.17</td>
<td>152.21</td>
<td>58.39</td>
<td>117.79</td>
<td>57.69</td>
</tr>
<tr>
<td>SAIFI (Occurrence)</td>
<td>0.442</td>
<td>0.407</td>
<td>0.476</td>
<td>0.396</td>
<td>1.013</td>
<td>1.928</td>
</tr>
<tr>
<td>ASA (Percent)</td>
<td>99.9864%</td>
<td>99.9864%</td>
<td>99.9862%</td>
<td>99.9956%</td>
<td>99.9773%</td>
<td>99.9788%</td>
</tr>
</tbody>
</table>
### Table 8: Annual Service Reliability Indices - Lanai with Normalization

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrence)</th>
<th>ASA (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>1,680</td>
<td>957</td>
<td>447.4</td>
<td>15.98</td>
<td>28.05</td>
<td>0.570</td>
<td>99.9970%</td>
</tr>
<tr>
<td>2009</td>
<td>1,648</td>
<td>586</td>
<td>610.8</td>
<td>22.24</td>
<td>62.54</td>
<td>0.356</td>
<td>99.9958%</td>
</tr>
<tr>
<td>2010</td>
<td>1,621</td>
<td>329</td>
<td>252.4</td>
<td>9.34</td>
<td>46.04</td>
<td>0.203</td>
<td>99.9982%</td>
</tr>
<tr>
<td>2011</td>
<td>1,624</td>
<td>287</td>
<td>87.8</td>
<td>3.24</td>
<td>18.36</td>
<td>0.177</td>
<td>99.9994%</td>
</tr>
<tr>
<td>2012</td>
<td>1,643</td>
<td>231</td>
<td>451.7</td>
<td>16.50</td>
<td>117.33</td>
<td>0.141</td>
<td>99.9969%</td>
</tr>
<tr>
<td>2013</td>
<td>1,702</td>
<td>1,255</td>
<td>1,320.1</td>
<td>46.54</td>
<td>63.11</td>
<td>0.737</td>
<td>99.9911%</td>
</tr>
</tbody>
</table>

**NOTE:**
- Data normalized to exclude the 03/15/08 Flashover
- Data normalized to exclude the 04/02/08 Equipment Failure
- Data normalized to exclude the 08/07/08 Deterioration, Corrosion
- Data normalized to exclude the 12/17/08 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

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrence)</th>
<th>ASA (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>66,810</td>
<td>67,126</td>
<td>67,405</td>
<td>106.63</td>
<td>164.62</td>
<td>73.27</td>
<td>99.9797%</td>
</tr>
<tr>
<td>2009</td>
<td>83,683</td>
<td>109,218</td>
<td>89,347</td>
<td>85.13</td>
<td>55.28</td>
<td>87.24</td>
<td>99.9686%</td>
</tr>
<tr>
<td>2010</td>
<td>67,126</td>
<td>129,554</td>
<td>120,420</td>
<td>159.52</td>
<td>90.84</td>
<td>1.756</td>
<td>99.9683%</td>
</tr>
<tr>
<td>2011</td>
<td>67,405</td>
<td>188,364.0</td>
<td>182,315.6</td>
<td>161.77</td>
<td>126.05</td>
<td>1.283</td>
<td>99.9691%</td>
</tr>
<tr>
<td>2012</td>
<td>68,010</td>
<td>184,174.3</td>
<td>186,857.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>68,575</td>
<td>188,364.0</td>
<td>182,315.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 10: Annual Service Reliability Indices for All Islands - Generation

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrence)</th>
<th>ASA (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>66,810</td>
<td>79,437</td>
<td>105,477.0</td>
<td>94.73</td>
<td>79.67</td>
<td>1.189</td>
<td>99.9820%</td>
</tr>
<tr>
<td>2009</td>
<td>67,126</td>
<td>15,646</td>
<td>11,679.1</td>
<td>10.44</td>
<td>44.79</td>
<td>0.233</td>
<td>99.9980%</td>
</tr>
<tr>
<td>2010</td>
<td>67,405</td>
<td>41,947</td>
<td>21,105.1</td>
<td>18.79</td>
<td>30.19</td>
<td>0.622</td>
<td>99.9964%</td>
</tr>
<tr>
<td>2011</td>
<td>68,010</td>
<td>40,825</td>
<td>21,821.7</td>
<td>19.25</td>
<td>32.07</td>
<td>0.600</td>
<td>99.9963%</td>
</tr>
<tr>
<td>2012</td>
<td>68,575</td>
<td>75,198</td>
<td>66,185.0</td>
<td>57.91</td>
<td>52.81</td>
<td>1.097</td>
<td>99.9890%</td>
</tr>
<tr>
<td>2013</td>
<td>69,303</td>
<td>49,536</td>
<td>34,143.2</td>
<td>29.56</td>
<td>41.36</td>
<td>0.715</td>
<td>99.9944%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrence)</th>
<th>ASA (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>61,981</td>
<td>66,799</td>
<td>85,799.9</td>
<td>83.06</td>
<td>77.07</td>
<td>1.078</td>
<td>99.99842%</td>
</tr>
<tr>
<td>2009</td>
<td>62,328</td>
<td>30,080</td>
<td>10,628.2</td>
<td>10.23</td>
<td>7.29</td>
<td>14.76</td>
<td>99.9886%</td>
</tr>
<tr>
<td>2010</td>
<td>62,640</td>
<td>34,183</td>
<td>7,610.9</td>
<td>7.29</td>
<td>14.76</td>
<td>15.553.4</td>
<td>99.9972%</td>
</tr>
<tr>
<td>2011</td>
<td>63,225</td>
<td>65,272.0</td>
<td>15,553.4</td>
<td>83.06</td>
<td>77.07</td>
<td>1.078</td>
<td>99.99842%</td>
</tr>
<tr>
<td>2012</td>
<td>63,745</td>
<td>65,272.0</td>
<td>15,553.4</td>
<td>83.06</td>
<td>77.07</td>
<td>1.078</td>
<td>99.99842%</td>
</tr>
<tr>
<td>2013</td>
<td>64,397</td>
<td>65,272.0</td>
<td>15,553.4</td>
<td>83.06</td>
<td>77.07</td>
<td>1.078</td>
<td>99.99842%</td>
</tr>
</tbody>
</table>

### Table 12: Annual Service Reliability Indices for Maui - Generation

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrence)</th>
<th>ASA (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>61,981</td>
<td>66,799</td>
<td>85,799.9</td>
<td>83.06</td>
<td>77.07</td>
<td>1.078</td>
<td>99.9842%</td>
</tr>
<tr>
<td>2009</td>
<td>62,328</td>
<td>30,080</td>
<td>10,628.2</td>
<td>10.23</td>
<td>7.29</td>
<td>14.76</td>
<td>99.9886%</td>
</tr>
<tr>
<td>2010</td>
<td>62,640</td>
<td>34,183</td>
<td>7,610.9</td>
<td>7.29</td>
<td>14.76</td>
<td>15.553.4</td>
<td>99.9972%</td>
</tr>
<tr>
<td>2011</td>
<td>63,225</td>
<td>65,272.0</td>
<td>15,553.4</td>
<td>83.06</td>
<td>77.07</td>
<td>1.078</td>
<td>99.99842%</td>
</tr>
<tr>
<td>2012</td>
<td>63,745</td>
<td>65,272.0</td>
<td>15,553.4</td>
<td>83.06</td>
<td>77.07</td>
<td>1.078</td>
<td>99.99842%</td>
</tr>
<tr>
<td>2013</td>
<td>64,397</td>
<td>65,272.0</td>
<td>15,553.4</td>
<td>83.06</td>
<td>77.07</td>
<td>1.078</td>
<td>99.99842%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrence)</th>
<th>ASA (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>3,205</td>
<td>3,205</td>
<td>3,205</td>
<td>3,205</td>
<td>3,205</td>
<td>3,205</td>
<td>99.9736%</td>
</tr>
</tbody>
</table>

### Table 14: Annual Service Reliability Indices for Molokai – Generation

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrence)</th>
<th>ASA (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>3,205</td>
<td>3,205</td>
<td>3,205</td>
<td>3,205</td>
<td>3,205</td>
<td>3,205</td>
<td>99.9736%</td>
</tr>
</tbody>
</table>
### Table 14: Annual Service Reliability Indices for Molokai - Generation

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Customers</td>
<td>3,149</td>
<td>3,151</td>
<td>3,145</td>
<td>3,161</td>
<td>3,187</td>
<td>3,205</td>
</tr>
<tr>
<td>Customer Interruptions</td>
<td>80,10</td>
<td>2,784</td>
<td>10,559</td>
<td>4,757</td>
<td>1,833</td>
<td>20,494</td>
</tr>
<tr>
<td>Customer-Hours Interrupted</td>
<td>16,772.7</td>
<td>556.2</td>
<td>11,964.0</td>
<td>4,268.9</td>
<td>385.0</td>
<td>20,733.4</td>
</tr>
<tr>
<td>SAIDI (Minutes)</td>
<td>319.58</td>
<td>10.59</td>
<td>228.25</td>
<td>81.03</td>
<td>7.25</td>
<td>388.14</td>
</tr>
<tr>
<td>CAIDI (Minutes)</td>
<td>125.64</td>
<td>11.99</td>
<td>67.98</td>
<td>53.84</td>
<td>12.60</td>
<td>60.70</td>
</tr>
<tr>
<td>SAIFI (Occurrence)</td>
<td>2.544</td>
<td>0.884</td>
<td>3.357</td>
<td>1.505</td>
<td>0.575</td>
<td>6.394</td>
</tr>
<tr>
<td>ASA (Percent)</td>
<td>99.9392%</td>
<td>99.9980%</td>
<td>99.9565%</td>
<td>99.9845%</td>
<td>99.9986%</td>
<td>99.9259%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Customers</td>
<td>1,680</td>
<td>1,648</td>
<td>1,621</td>
<td>1,624</td>
<td>1,643</td>
<td>1,702</td>
</tr>
<tr>
<td>Customer Interruptions</td>
<td>360</td>
<td>637</td>
<td>1,163</td>
<td>4,331</td>
<td>882</td>
<td>2,857</td>
</tr>
<tr>
<td>Customer-Hours Interrupted</td>
<td>225.3</td>
<td>624.4</td>
<td>554.1</td>
<td>6,561.0</td>
<td>885.1</td>
<td>4,167.4</td>
</tr>
<tr>
<td>SAIDI (Minutes)</td>
<td>8.05</td>
<td>22.73</td>
<td>20.51</td>
<td>242.40</td>
<td>32.32</td>
<td>146.91</td>
</tr>
<tr>
<td>CAIDI (Minutes)</td>
<td>37.55</td>
<td>58.81</td>
<td>28.59</td>
<td>90.89</td>
<td>60.21</td>
<td>87.52</td>
</tr>
<tr>
<td>SAIFI (Occurrence)</td>
<td>0.214</td>
<td>0.387</td>
<td>0.717</td>
<td>2.667</td>
<td>0.537</td>
<td>1.679</td>
</tr>
<tr>
<td>ASA (Percent)</td>
<td>99.9985%</td>
<td>99.9957%</td>
<td>99.9961%</td>
<td>99.9538%</td>
<td>99.9939%</td>
<td>99.9728%</td>
</tr>
</tbody>
</table>

### Table 16: Annual Service Reliability Indices for Lanai - Generation

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Customers</td>
<td>1,680</td>
<td>1,648</td>
<td>1,621</td>
<td>1,624</td>
<td>1,643</td>
<td>1,702</td>
</tr>
<tr>
<td>Customer Interruptions</td>
<td>4,628</td>
<td>1,570</td>
<td>1,308</td>
<td>1,885</td>
<td>1,321</td>
<td>2,083</td>
</tr>
<tr>
<td>Customer-Hours Interrupted</td>
<td>2,904.4</td>
<td>494.7</td>
<td>1,530.1</td>
<td>1,999.5</td>
<td>528.0</td>
<td>1,354.1</td>
</tr>
<tr>
<td>SAIDI (Minutes)</td>
<td>103.73</td>
<td>18.01</td>
<td>56.64</td>
<td>73.87</td>
<td>19.28</td>
<td>47.74</td>
</tr>
<tr>
<td>CAIDI (Minutes)</td>
<td>37.65</td>
<td>18.91</td>
<td>70.19</td>
<td>63.64</td>
<td>23.98</td>
<td>39.00</td>
</tr>
<tr>
<td>SAIFI (Occurrence)</td>
<td>2.755</td>
<td>0.953</td>
<td>0.807</td>
<td>1.161</td>
<td>0.804</td>
<td>1.224</td>
</tr>
<tr>
<td>ASA (Percent)</td>
<td>99.9803%</td>
<td>99.9966%</td>
<td>99.9892%</td>
<td>99.9859%</td>
<td>99.9963%</td>
<td>99.9909%</td>
</tr>
</tbody>
</table>

### T&D vs. Generation – With Normalization

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

<table>
<thead>
<tr>
<th></th>
<th>2008*</th>
<th>2009*</th>
<th>2010*</th>
<th>2011*</th>
<th>2012*</th>
<th>2013*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Customers</td>
<td>66,810</td>
<td>67,126</td>
<td>67,405</td>
<td>68,010</td>
<td>68,575</td>
<td>69,303</td>
</tr>
<tr>
<td>Customer Interruptions</td>
<td>69,556</td>
<td>96,773</td>
<td>44,699</td>
<td>92,997</td>
<td>53,218</td>
<td>59,404</td>
</tr>
<tr>
<td>Customer-Hours Interrupted</td>
<td>111,656.4</td>
<td>162,889.6</td>
<td>53,754.4</td>
<td>139,223.9</td>
<td>111,142.1</td>
<td>101,339.0</td>
</tr>
<tr>
<td>SAIDI (Minutes)</td>
<td>100.28</td>
<td>145.60</td>
<td>47.85</td>
<td>122.83</td>
<td>97.24</td>
<td>87.74</td>
</tr>
<tr>
<td>CAIDI (Minutes)</td>
<td>96.32</td>
<td>100.99</td>
<td>72.16</td>
<td>89.82</td>
<td>125.31</td>
<td>102.36</td>
</tr>
<tr>
<td>SAIFI (Occurrence)</td>
<td>1.041</td>
<td>1.442</td>
<td>0.663</td>
<td>1.367</td>
<td>0.776</td>
<td>0.857</td>
</tr>
<tr>
<td>ASA (Percent)</td>
<td>99.9809%</td>
<td>99.9722%</td>
<td>99.9909%</td>
<td>99.9766%</td>
<td>99.9815%</td>
<td>99.9833%</td>
</tr>
</tbody>
</table>
### Table 18: Normalized Annual Service Reliability Indices for All Islands – Generation

<table>
<thead>
<tr>
<th></th>
<th>2008*</th>
<th>2009*</th>
<th>2010*</th>
<th>2011*</th>
<th>2012*</th>
<th>2013*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Customers</td>
<td>66,810</td>
<td>67,126</td>
<td>67,405</td>
<td>68,010</td>
<td>68,575</td>
<td>69,303</td>
</tr>
<tr>
<td>Customer Interruptions</td>
<td>6,208</td>
<td>11,595</td>
<td>22,782</td>
<td>8,271</td>
<td>28,210</td>
<td>12,490</td>
</tr>
<tr>
<td>Customer-Hours Interrupted</td>
<td>2,344.3</td>
<td>10,712.4</td>
<td>6,252.2</td>
<td>6,486.9</td>
<td>14,694.0</td>
<td>7,021.7</td>
</tr>
<tr>
<td>SAIDI (Minutes)</td>
<td>2.11</td>
<td>9.58</td>
<td>5.57</td>
<td>5.72</td>
<td>12.86</td>
<td>6.08</td>
</tr>
<tr>
<td>CAIDI (Minutes)</td>
<td>22.66</td>
<td>55.43</td>
<td>16.47</td>
<td>47.06</td>
<td>31.25</td>
<td>33.73</td>
</tr>
<tr>
<td>SAIFI (Occurrence)</td>
<td>0.093</td>
<td>0.173</td>
<td>0.338</td>
<td>0.012</td>
<td>0.411</td>
<td>0.180</td>
</tr>
<tr>
<td>ASA (Percent)</td>
<td>99.9996%</td>
<td>99.9982%</td>
<td>99.9989%</td>
<td>99.9989%</td>
<td>99.9976%</td>
<td>99.9988%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>2008*</th>
<th>2009*</th>
<th>2010*</th>
<th>2011*</th>
<th>2012*</th>
<th>2013*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Customers</td>
<td>61,981</td>
<td>62,328</td>
<td>62,640</td>
<td>63,225</td>
<td>63,745</td>
<td>64,397</td>
</tr>
<tr>
<td>Customer Interruptions</td>
<td>68,001</td>
<td>95,206</td>
<td>42,938</td>
<td>91,828</td>
<td>50,306</td>
<td>54,680</td>
</tr>
<tr>
<td>Customer-Hours Interrupted</td>
<td>107,798.7</td>
<td>158,614.5</td>
<td>49,743.3</td>
<td>137,980.4</td>
<td>104,638.8</td>
<td>96,167.0</td>
</tr>
<tr>
<td>SAIDI (Minutes)</td>
<td>104.35</td>
<td>152.69</td>
<td>47.65</td>
<td>130.94</td>
<td>98.49</td>
<td>89.60</td>
</tr>
<tr>
<td>CAIDI (Minutes)</td>
<td>95.12</td>
<td>99.96</td>
<td>69.51</td>
<td>90.16</td>
<td>124.80</td>
<td>105.52</td>
</tr>
<tr>
<td>SAIFI (Occurrence)</td>
<td>1.097</td>
<td>1.527</td>
<td>0.685</td>
<td>1.452</td>
<td>0.789</td>
<td>0.849</td>
</tr>
<tr>
<td>ASA (Percent)</td>
<td>99.9801%</td>
<td>99.9709%</td>
<td>99.9909%</td>
<td>99.9989%</td>
<td>99.98%</td>
<td>99.98%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>2008*</th>
<th>2009*</th>
<th>2010*</th>
<th>2011*</th>
<th>2012*</th>
<th>2013*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Customers</td>
<td>61,981</td>
<td>62,328</td>
<td>62,640</td>
<td>63,225</td>
<td>63,745</td>
<td>64,397</td>
</tr>
<tr>
<td>Customer Interruptions</td>
<td>5,413.0</td>
<td>11,292.0</td>
<td>22,716.0</td>
<td>7,901.0</td>
<td>27,662.0</td>
<td>9,779</td>
</tr>
<tr>
<td>Customer-Hours Interrupted</td>
<td>2,008.2</td>
<td>10,628.2</td>
<td>6,210.7</td>
<td>6,424.1</td>
<td>14,406.7</td>
<td>4,931.4</td>
</tr>
<tr>
<td>SAIDI (Minutes)</td>
<td>1.94</td>
<td>10.23</td>
<td>5.95</td>
<td>6.10</td>
<td>13.56</td>
<td>4.59</td>
</tr>
<tr>
<td>CAIDI (Minutes)</td>
<td>22.26</td>
<td>56.47</td>
<td>16.40</td>
<td>48.78</td>
<td>31.25</td>
<td>30.26</td>
</tr>
<tr>
<td>SAIFI (Occurrence)</td>
<td>0.087</td>
<td>0.181</td>
<td>0.363</td>
<td>0.125</td>
<td>0.434</td>
<td>0.152</td>
</tr>
<tr>
<td>ASA (Percent)</td>
<td>99.9996%</td>
<td>99.9980%</td>
<td>99.9989%</td>
<td>99.9988%</td>
<td>99.9974%</td>
<td>99.9991%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>2008*</th>
<th>2009*</th>
<th>2010*</th>
<th>2011*</th>
<th>2012*</th>
<th>2013*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Customers</td>
<td>3,149</td>
<td>3,151</td>
<td>3,145</td>
<td>3,161</td>
<td>3,187</td>
<td>3,205</td>
</tr>
<tr>
<td>Customer Interruptions</td>
<td>1,393</td>
<td>1,284</td>
<td>1,498</td>
<td>1,102</td>
<td>2,752</td>
<td>3,487</td>
</tr>
<tr>
<td>Customer-Hours Interrupted</td>
<td>3,746.5</td>
<td>3,748.6</td>
<td>3,800.1</td>
<td>1,163.5</td>
<td>6,067.0</td>
<td>3,856.5</td>
</tr>
<tr>
<td>SAIDI (Minutes)</td>
<td>71.38</td>
<td>71.38</td>
<td>72.50</td>
<td>22.08</td>
<td>114.22</td>
<td>72.20</td>
</tr>
<tr>
<td>CAIDI (Minutes)</td>
<td>161.37</td>
<td>175.17</td>
<td>152.21</td>
<td>63.35</td>
<td>122.27</td>
<td>66.36</td>
</tr>
<tr>
<td>SAIFI (Occurrence)</td>
<td>0.442</td>
<td>0.407</td>
<td>0.476</td>
<td>0.349</td>
<td>0.864</td>
<td>1.088</td>
</tr>
<tr>
<td>ASA (Percent)</td>
<td>99.9864%</td>
<td>99.9864%</td>
<td>99.9862%</td>
<td>99.9958%</td>
<td>99.9783%</td>
<td>99.9862%</td>
</tr>
</tbody>
</table>
**Table 22: Normalized Annual Service Reliability Indices for Molokai – Generation**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrence)</th>
<th>ASA (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>3,149</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.000</td>
<td>100.0000%</td>
</tr>
<tr>
<td>2009</td>
<td>3,151</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.000</td>
<td>100.0000%</td>
</tr>
<tr>
<td>2010</td>
<td>3,145</td>
<td>0</td>
<td>0</td>
<td>1.04</td>
<td>5.12</td>
<td>0.047</td>
<td>99.9998%</td>
</tr>
<tr>
<td>2011</td>
<td>3,161</td>
<td>150.0</td>
<td>55.0</td>
<td>2.00</td>
<td>34.21</td>
<td>0.150</td>
<td>99.9990%</td>
</tr>
<tr>
<td>2012</td>
<td>3,187</td>
<td>477.0</td>
<td>272.0</td>
<td>5.12</td>
<td>34.21</td>
<td>0.150</td>
<td>99.9990%</td>
</tr>
<tr>
<td>2013</td>
<td>3,205</td>
<td>2,693</td>
<td>2,085.7</td>
<td>9.05</td>
<td>46.47</td>
<td>0.840</td>
<td>99.9926%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrence)</th>
<th>ASA (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>1,680</td>
<td>162</td>
<td>111.2</td>
<td>3.97</td>
<td>41.19</td>
<td>0.096</td>
<td>99.9992%</td>
</tr>
<tr>
<td>2009</td>
<td>1,648</td>
<td>283</td>
<td>526.5</td>
<td>19.17</td>
<td>111.62</td>
<td>0.172</td>
<td>99.9963%</td>
</tr>
<tr>
<td>2010</td>
<td>1,621</td>
<td>263</td>
<td>211.0</td>
<td>7.81</td>
<td>71.66</td>
<td>0.184</td>
<td>99.9985%</td>
</tr>
<tr>
<td>2011</td>
<td>1,624</td>
<td>67</td>
<td>80.0</td>
<td>2.96</td>
<td>163.61</td>
<td>0.297</td>
<td>99.9994%</td>
</tr>
<tr>
<td>2012</td>
<td>1,643</td>
<td>160</td>
<td>436.3</td>
<td>15.93</td>
<td>63.81</td>
<td>0.097</td>
<td>99.9970%</td>
</tr>
<tr>
<td>2013</td>
<td>1,702</td>
<td>1,237</td>
<td>1,315.6</td>
<td>46.38</td>
<td>0.727</td>
<td>0.011</td>
<td>99.9912%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Customers</th>
<th>Customer Interruptions</th>
<th>Customer-Hours Interrupted</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
<th>SAIFI (Occurrence)</th>
<th>ASA (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>1,680</td>
<td>795</td>
<td>336.2</td>
<td>12.01</td>
<td>25.37</td>
<td>0.473</td>
<td>99.9977%</td>
</tr>
<tr>
<td>2009</td>
<td>1,648</td>
<td>303</td>
<td>84.3</td>
<td>3.07</td>
<td>16.69</td>
<td>0.184</td>
<td>99.9994%</td>
</tr>
<tr>
<td>2010</td>
<td>1,621</td>
<td>66</td>
<td>41.5</td>
<td>1.53</td>
<td>220</td>
<td>0.041</td>
<td>99.9997%</td>
</tr>
<tr>
<td>2011</td>
<td>1,624</td>
<td>220</td>
<td>7.8</td>
<td>0.29</td>
<td>71</td>
<td>0.135</td>
<td>99.9999%</td>
</tr>
<tr>
<td>2012</td>
<td>1,643</td>
<td>71</td>
<td>15.4</td>
<td>0.56</td>
<td>15.00</td>
<td>0.043</td>
<td>99.9999%</td>
</tr>
<tr>
<td>2013</td>
<td>1,702</td>
<td>18</td>
<td>4.5</td>
<td>0.16</td>
<td>0.011</td>
<td>0.011</td>
<td>100.0000%</td>
</tr>
</tbody>
</table>
Figure 1 shows the System Average Interruption Duration Indices (SAIDI) for 2013 and the past five years. It shows that the 2013 SAIDI is 93.81 minutes, a 14.80% decrease compared to the 2012 SAIDI result of 110.10 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 lower SAIDI result was due to a decrease in the SAIFI and CAIDI statistics.
Figure 2 shows the Customer Average Interruption Duration Indices (CAIDI) for 2013 and the past five years. It shows that the average duration of a customer's outage (CAIDI) for 2013 is 90.43 minutes, a 2.47% decrease compared to the 2012 CAIDI result of 92.72 minutes.

The contributing factors to the decrease of the CAIDI index from 2012 were shorter outage durations related to deterioration or corrosion, scheduled maintenance and equipment failure. Outage durations due to deterioration or corrosion decreased in 2013, which incurred 1,999.9 customer interruption hours, as compared to 23,657.0 customer interruption hours in 2012. Outages due to deterioration or corrosion accounted for 1.8% of all customer interruption hours in 2013. Outages durations due to scheduled maintenance decreased in 2013, which incurred 3,181.4 customer interruption hours, as compared to 14,004.1 customer interruption hours in 2012. Outages due to scheduled maintenance accounted for 2.9% of all customer interruption hours in 2013. Outages durations due to equipment failure also decreased in 2013, which incurred 1,269.0 customer interruption hours, as compared to 7,945.8 customer interruption hours in 2012. Outages due to high winds accounted for 1.2% of all customer interruption hours in 2013.
The three major events affecting the 2013 CAIDI results were:

1. January 05, 2013 – During a period of high winds, a fallen tree took down
distribution lines affecting 558 customers from 21 hours 54 minutes to 24 hours 39
minutes.

2. March 01, 2013 – During a period of high winds, a tree branch took down
distribution lines affecting 1,252 customers from 28 minutes to 3 hours 43 minutes.

3. October 12, 2013 – A vehicle pole accident affecting 1,906 customers from 2 hours
6 minutes to 8 hours 33 minutes.

These three events increased the 2013 CAIDI by over 15 minutes.

Figure 3: Outage Categories

The Top 5 Outage Categories, by number of Customer Interruptions, as illustrated in
Figure 3, equates to about 76% of the total Customer Interruptions in 2013; these causes
are:

<table>
<thead>
<tr>
<th>Outage Category</th>
<th>Sample Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Scheduled Maintenance</td>
<td>Replacement of equipment still in service</td>
</tr>
<tr>
<td>2. Trees or Branches</td>
<td>Trees falling or contacting overhead lines</td>
</tr>
<tr>
<td>3. Cable Faults</td>
<td>Underground equipment failures</td>
</tr>
<tr>
<td>4. Deterioration</td>
<td>Failed, broken, corroded equipment</td>
</tr>
<tr>
<td>5. Transformer Failure</td>
<td>Transformers failing not related to overloading</td>
</tr>
</tbody>
</table>

The major cause factors for 2012 were similar to the 2013 major causes.
The total number of customer interruptions in 2013 was 71,894 compared with 81,428 customer interruptions in 2012. In the six year period, 2013 was the second best performing year for the number of interruptions. The number of customer interruptions due to equipment failure decreased from 13,768 in 2012 to 2,865 in 2013, a 79.2% decrease. Also, the number of customer interruptions due to deterioration or corrosion decreased from 10,945 in 2012 to 1,770 in 2013, an 83.8% decrease. However, the number of customer interruptions due to unknown failure increased from 398 in 2012 to 12,823 in 2013. Also, the number of customer interruptions due to trees or branches in lines increased from 18,203 in 2012 to 30,160 in 2013.

In 2013, there were four events that resulted in the loss of more than 5,000 customers.

- On January 02, 2013, Maui experienced a major outage due to trees in lines. This event caused outages to 14,826 customers or 21.4% of our customers with outage durations ranging from momentary to 43 minutes.

- On July 29, 2013, Maui experienced a major outage due to lightning strikes. This event caused outages to 7,490 customers or 10.8% of our customers with outage durations ranging from 2 hours 53 minutes to 7 hours 33 minutes.

- On July 29, 2013, Maui experienced a major outage due to lightning strikes. This event caused outages to 5,486 customers or 7.9% of our customers with outage durations of 53 minutes.

- On September 16, 2013, Maui experienced a major outage due to trees in lines. This event caused outages to 6,941 customers or 10% of our customers with outage durations ranging from 7 minutes to 2 hours 6 minutes.
Figure 4 shows the System Average Interruption Frequency Index (SAIFI) for 2013 and the past five years. It shows that the 2013 SAIFI of 1.037 was the second best performance in the past six years, decreasing from 1.187 in 2012.

The contributing factors to the decrease of the SAIFI index from 2012 were fewer outage interruptions related to equipment failure, deterioration or corrosion and interruptions to balance load or system conversions. Outage durations due to equipment failure decreased in 2013, which incurred 2,865 customer interruptions, as compared to 13,768 customer interruptions in 2012. Outages due to equipment failure accounted for 1.2% of all customer interruptions in 2013. Outages durations due to deterioration or corrosion decreased in 2013, which incurred 1,770 customer interruptions, as compared to 10,945 customer interruptions in 2012. Outages due to deterioration or corrosion accounted for 1.8% of all customer interruption hours in 2013. Outages durations due to interruptions to balance load or system conversions also decreased in 2013, which incurred 137 customer interruptions, as compared to 6,356 customer interruptions in 2011. Outages due to interruptions to balance load or system conversions accounted for 0.4% of all customer interruption hours in 2013.
Figure 5 shows that the 2013 Average Service Availability Index increased as compared to the 2012 results after another increase (higher is better) from 2011 to 2012. Approximately 14% fewer customer hours were sustained during 2013 compared to the previous year, thus causing a .003% increase to the ASAI, raising this statistic from 99.9791% to 99.9821%.

The contributing factors to the increase of the ASA index from 2012 was a reduction of customer hour interruptions related to equipment failure, scheduled maintenance and deterioration or corrosion. Outages due to deterioration or corrosion decreased in 2013, which incurred 1,999.9 customer interruption hours, as compared to 23,657 customer interruption hours in 2012. Outages due to deterioration or corrosion accounted for 1.8% of all customer interruption hours in 2013. Outages due to scheduled maintenance decreased in 2013, which incurred 3,181.4 customer interruption hours, as compared to 14,004.1 customer interruption hours in 2012. Outages due to scheduled maintenance accounted for 2.9% of all customer interruption hours in 2013. Outages due to equipment failure also decreased in 2013, which incurred 1,269 customer interruption hours, as compared to 7,945.8 customer interruption hours in 2012. Outages due to equipment failure accounted for 1.2% of all customer interruption hours in 2013.
Maui Electric Company  
Normalized Sustained Interruption Summary – System Total  
FROM: JANUARY 1, 2013  
TO: DECEMBER 31, 2013

<table>
<thead>
<tr>
<th>Outage Cause</th>
<th>Customer Hours</th>
<th>Customer Interruptions</th>
<th>SAIFI</th>
<th>SAIDI</th>
<th>CAIDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>TREES OR BRANCHES IN LINES</td>
<td>54101.8</td>
<td>30160.0</td>
<td>0.435</td>
<td>46.84</td>
<td>107.63</td>
</tr>
<tr>
<td>UNKNOWN FAILURE</td>
<td>9601.0</td>
<td>12823.0</td>
<td>0.185</td>
<td>8.31</td>
<td>44.92</td>
</tr>
<tr>
<td>CABLE FAULT</td>
<td>10335.1</td>
<td>6428.0</td>
<td>0.093</td>
<td>8.95</td>
<td>96.47</td>
</tr>
<tr>
<td>AUTOMOBILE ACCIDENT</td>
<td>11239.8</td>
<td>4178.0</td>
<td>0.060</td>
<td>9.73</td>
<td>161.41</td>
</tr>
<tr>
<td>EQUIPMENT FAILURE</td>
<td>1269.0</td>
<td>2865.0</td>
<td>0.041</td>
<td>1.10</td>
<td>26.58</td>
</tr>
<tr>
<td>FAULTY OPERATION OF EQUIPMENT</td>
<td>345.3</td>
<td>2044.0</td>
<td>0.029</td>
<td>0.30</td>
<td>10.14</td>
</tr>
<tr>
<td>FLASHOVER</td>
<td>3542.8</td>
<td>1795.0</td>
<td>0.026</td>
<td>3.07</td>
<td>118.42</td>
</tr>
<tr>
<td>DETERIORATION, CORROSION, TERMITES</td>
<td>1999.9</td>
<td>1770.0</td>
<td>0.026</td>
<td>1.73</td>
<td>67.79</td>
</tr>
<tr>
<td>MAINTENANCE - FORCED</td>
<td>1804.7</td>
<td>1767.0</td>
<td>0.025</td>
<td>1.56</td>
<td>61.28</td>
</tr>
<tr>
<td>MAN OR ANIMALS IN LINES OR EQUIPMENT</td>
<td>1824.3</td>
<td>1421.0</td>
<td>0.021</td>
<td>1.58</td>
<td>77.03</td>
</tr>
<tr>
<td>HIGH WIND</td>
<td>4445.5</td>
<td>1354.0</td>
<td>0.020</td>
<td>3.85</td>
<td>196.99</td>
</tr>
<tr>
<td>MAINTENANCE - SCHEDULED</td>
<td>3181.4</td>
<td>1272.0</td>
<td>0.018</td>
<td>2.75</td>
<td>150.07</td>
</tr>
<tr>
<td>OPERATOR OR SWITCHING ERROR</td>
<td>1523.5</td>
<td>1266.0</td>
<td>0.018</td>
<td>1.32</td>
<td>72.20</td>
</tr>
<tr>
<td>CONTACT BY MOVING EQUIPMENT</td>
<td>1121.2</td>
<td>1182.0</td>
<td>0.017</td>
<td>0.97</td>
<td>56.91</td>
</tr>
<tr>
<td>FIRE</td>
<td>413.7</td>
<td>880.0</td>
<td>0.013</td>
<td>0.36</td>
<td>28.20</td>
</tr>
<tr>
<td>TRANSFORMER FAILURE</td>
<td>845.0</td>
<td>153.0</td>
<td>0.002</td>
<td>0.73</td>
<td>331.38</td>
</tr>
<tr>
<td>INT. TO BALANCE LOAD OR SYSTEM CONV.</td>
<td>438.0</td>
<td>137.0</td>
<td>0.002</td>
<td>0.38</td>
<td>191.81</td>
</tr>
<tr>
<td>EXCAVATION AND CONSTRUCTION</td>
<td>108.9</td>
<td>114.0</td>
<td>0.002</td>
<td>0.09</td>
<td>57.29</td>
</tr>
<tr>
<td>EQUIPMENT OVERLOAD</td>
<td>51.7</td>
<td>100.0</td>
<td>0.001</td>
<td>0.04</td>
<td>31.00</td>
</tr>
<tr>
<td>LIGHTNING</td>
<td>43.9</td>
<td>94.0</td>
<td>0.001</td>
<td>0.04</td>
<td>28.00</td>
</tr>
<tr>
<td>SYSTEM ADDITIONS OR REMOVALS</td>
<td>75.4</td>
<td>32.0</td>
<td>0.000</td>
<td>0.07</td>
<td>141.44</td>
</tr>
<tr>
<td>INT. TO TRANSFER LOAD (OUT OF PHASE)</td>
<td>0.3</td>
<td>14.0</td>
<td>0.000</td>
<td>0.00</td>
<td>1.43</td>
</tr>
<tr>
<td>FAILURE OF CUSTOMER'S ELECTRICAL EQUIP</td>
<td>8.6</td>
<td>13.0</td>
<td>0.000</td>
<td>0.01</td>
<td>39.54</td>
</tr>
<tr>
<td>LOOSE CONNECTION</td>
<td>5.0</td>
<td>12.0</td>
<td>0.000</td>
<td>0.00</td>
<td>25.00</td>
</tr>
<tr>
<td>OTHER COMPANY PERSONNEL ERROR</td>
<td>21.2</td>
<td>10.0</td>
<td>0.000</td>
<td>0.02</td>
<td>127.20</td>
</tr>
<tr>
<td>FOREIGN OBJECTS IN LINES OR EQUIPMENT</td>
<td>14.0</td>
<td>10.0</td>
<td>0.000</td>
<td>0.01</td>
<td>84.00</td>
</tr>
<tr>
<td>MYLAR BALLOON</td>
<td>0.0</td>
<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>TSUNAMI, EARTHQUAKE, OR FLOODING</td>
<td>0.0</td>
<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>VANDALISM</td>
<td>0.0</td>
<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>TRANSFORMER OVERLOAD</td>
<td>0.0</td>
<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>TOTAL</td>
<td>168360.7</td>
<td>71894.0</td>
<td>1.037</td>
<td>93.81</td>
<td>90.43</td>
</tr>
</tbody>
</table>

AVERAGE SYSTEM AVAILABILITY = 99.9821%
NUMBER OF CUSTOMERS FOR THE PERIOD = 69,303
24 MONTH ANNUALIZED SAIDI AVERAGE FOR THE PERIOD 1/1/2012 - 12/31/2013 = 101.96
24 MONTH AVERAGE NUMBER OF CUSTOMERS FOR THE PERIOD 1/1/2012 - 12/31/2013 = 68,939

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.
### Maui Electric Company

**Normalized Sustained Interruption Summary – Maui**

**FROM:** JANUARY 1, 2013  
**TO:** DECEMBER 31, 2013

<table>
<thead>
<tr>
<th>Outage Cause</th>
<th>Customer Hours</th>
<th>Customer Interruptions</th>
<th>SAIFI</th>
<th>SAIDI</th>
<th>CAIDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>TREES OR BRANCHES IN LINES</td>
<td>53381.2</td>
<td>29725.0</td>
<td>0.462</td>
<td>49.74</td>
<td>107.75</td>
</tr>
<tr>
<td>UNKNOWN FAILURE</td>
<td>6862.1</td>
<td>8906.0</td>
<td>0.138</td>
<td>6.39</td>
<td>46.23</td>
</tr>
<tr>
<td>CABLE FAULT</td>
<td>10326.0</td>
<td>6425.0</td>
<td>0.100</td>
<td>9.62</td>
<td>96.43</td>
</tr>
<tr>
<td>AUTOMOBILE ACCIDENT</td>
<td>11239.8</td>
<td>4178.0</td>
<td>0.065</td>
<td>10.47</td>
<td>161.41</td>
</tr>
<tr>
<td>EQUIPMENT FAILURE</td>
<td>1245.4</td>
<td>2850.0</td>
<td>0.044</td>
<td>1.16</td>
<td>26.22</td>
</tr>
<tr>
<td>FAULTY OPERATION OF EQUIPMENT</td>
<td>345.3</td>
<td>2044.0</td>
<td>0.032</td>
<td>0.32</td>
<td>10.14</td>
</tr>
<tr>
<td>FLASHOVER</td>
<td>3421.2</td>
<td>1789.0</td>
<td>0.028</td>
<td>3.19</td>
<td>114.74</td>
</tr>
<tr>
<td>MAINTENANCE - FORCED</td>
<td>1804.7</td>
<td>1767.0</td>
<td>0.027</td>
<td>1.68</td>
<td>61.28</td>
</tr>
<tr>
<td>DETERIORATION, CORROSION, TERMITES</td>
<td>1863.2</td>
<td>1673.0</td>
<td>0.026</td>
<td>1.74</td>
<td>66.82</td>
</tr>
<tr>
<td>MAN OR ANIMALS IN LINES OR EQUIPMENT</td>
<td>1798.7</td>
<td>1408.0</td>
<td>0.022</td>
<td>1.68</td>
<td>76.65</td>
</tr>
<tr>
<td>MAINTENANCE - SCHEDULED</td>
<td>2735.0</td>
<td>1075.0</td>
<td>0.017</td>
<td>2.55</td>
<td>152.65</td>
</tr>
<tr>
<td>HIGH WIND</td>
<td>3930.2</td>
<td>1014.0</td>
<td>0.016</td>
<td>3.66</td>
<td>232.55</td>
</tr>
<tr>
<td>FIRE</td>
<td>413.7</td>
<td>880.0</td>
<td>0.014</td>
<td>0.39</td>
<td>28.20</td>
</tr>
<tr>
<td>TRANSFORMER FAILURE</td>
<td>845.0</td>
<td>153.0</td>
<td>0.002</td>
<td>0.79</td>
<td>331.38</td>
</tr>
<tr>
<td>INT. TO BALANCE LOAD OR SYSTEM CONV.</td>
<td>438.0</td>
<td>137.0</td>
<td>0.002</td>
<td>0.41</td>
<td>191.81</td>
</tr>
<tr>
<td>EXCAVATION AND CONSTRUCTION</td>
<td>108.9</td>
<td>114.0</td>
<td>0.002</td>
<td>0.10</td>
<td>57.29</td>
</tr>
<tr>
<td>EQUIPMENT OVERLOAD</td>
<td>51.7</td>
<td>100.0</td>
<td>0.002</td>
<td>0.05</td>
<td>31.00</td>
</tr>
<tr>
<td>CONTACT BY MOVING EQUIPMENT</td>
<td>144.2</td>
<td>85.0</td>
<td>0.001</td>
<td>0.13</td>
<td>100.60</td>
</tr>
<tr>
<td>OPERATOR OR SWITCHING ERROR</td>
<td>90.9</td>
<td>83.0</td>
<td>0.001</td>
<td>0.08</td>
<td>65.72</td>
</tr>
<tr>
<td>INT. TO TRANSFER LOAD (OUT OF PHASE)</td>
<td>0.3</td>
<td>14.0</td>
<td>0.000</td>
<td>0.00</td>
<td>1.43</td>
</tr>
<tr>
<td>LOOSE CONNECTION</td>
<td>5.0</td>
<td>12.0</td>
<td>0.000</td>
<td>0.00</td>
<td>25.00</td>
</tr>
<tr>
<td>OTHER COMPANY PERSONNEL ERROR</td>
<td>21.2</td>
<td>10.0</td>
<td>0.000</td>
<td>0.02</td>
<td>127.20</td>
</tr>
<tr>
<td>FOREIGN OBJECTS IN LINES OR EQUIPMENT</td>
<td>14.0</td>
<td>10.0</td>
<td>0.000</td>
<td>0.01</td>
<td>84.00</td>
</tr>
<tr>
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<td>0.0</td>
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<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>TSUNAMI, EARTHQUAKE, OR FLOODING</td>
<td>0.0</td>
<td>0.0</td>
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<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
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<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>TRANSFORMER OVERLOAD</td>
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<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>LIGHTNING</td>
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<td>0.00</td>
</tr>
<tr>
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<td>64459.0</td>
<td>1.001</td>
<td>94.20</td>
<td>94.10</td>
</tr>
</tbody>
</table>

**Average System Availability =** 99.9820%

**Number of Customers for the Period =** 64,397

**24 Month Annualized SAIDI Average for the Period 1/1/2012 - 12/31/2013 =** 103.13

**24 Month Average Number of Customers for the Period 1/1/2012 - 12/31/2013 =** 64,071

**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.
Maui Electric Company  
Normalized Sustained Interruption Summary – Molokai  
FROM: JANUARY 1, 2013  
TO: DECEMBER 31, 2013  

<table>
<thead>
<tr>
<th>Outage Cause</th>
<th>Customer Hours</th>
<th>Customer Interruptions</th>
<th>SAIFI</th>
<th>SAIDI (Minutes)</th>
<th>CAIDI (Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNKNOWN FAILURE</td>
<td>2695.7</td>
<td>3886.0</td>
<td>1.212</td>
<td>50.46</td>
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</tr>
<tr>
<td>OPERATOR OR SWITCHING ERROR</td>
<td>1432.5</td>
<td>1183.0</td>
<td>0.369</td>
<td>26.82</td>
<td>72.65</td>
</tr>
<tr>
<td>TREES OR BRANCHES IN LINES</td>
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<td>0.120</td>
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<td>101.00</td>
</tr>
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<td>90.94</td>
</tr>
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</tr>
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<td>DETERIORATION, CORROSION, TERMITES</td>
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<td>0.030</td>
<td>2.56</td>
<td>84.57</td>
</tr>
<tr>
<td>LIGHTNING</td>
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<td>94.0</td>
<td>0.029</td>
<td>0.82</td>
<td>28.00</td>
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<td>1.25</td>
<td>134.00</td>
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<td>0.0</td>
<td>0.001</td>
<td>0.00</td>
<td>182.00</td>
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<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>OTHER COMPANY PERSONNEL ERROR</td>
<td>0.0</td>
<td>0.0</td>
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<td>0.00</td>
<td>0.00</td>
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<tr>
<td>MAINTENANCE - FORCED</td>
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<td>0.0</td>
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<td>0.00</td>
</tr>
<tr>
<td>INT. TO BALANCE LOAD OR SYSTEM CONV.</td>
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<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>INT. TO TRANSFER LOAD (OUT OF PHASE)</td>
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<td>0.00</td>
</tr>
<tr>
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<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>FAILURE OF CUSTOMER'S ELECTRICAL EQUIP</td>
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<td>0.00</td>
<td>0.00</td>
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<tr>
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<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
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<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
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<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
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<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>TRANSFORMER OVERLOAD</td>
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<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>TRANSFORMER FAILURE</td>
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<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>FLASHOVER</td>
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<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>LOOSE CONNECTION</td>
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<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>EXCAVATION AND CONSTRUCTION</td>
<td>0.0</td>
<td>0.0</td>
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<td>0.00</td>
</tr>
<tr>
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<td>0.00</td>
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</tr>
<tr>
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<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
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<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>MAN OR ANIMALS IN LINES OR EQUIPMENT</td>
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<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
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<td>6180.0</td>
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</table>

**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.
Maui Electric Company
Normalized Sustained Interruption Summary – Lanai

FROM: JANUARY 1, 2013  TO: DECEMBER 31, 2013

<table>
<thead>
<tr>
<th>Outage Cause</th>
<th>Customer Hours</th>
<th>Customer Interruptions</th>
<th>SAIFI</th>
<th>SAIDI</th>
<th>CAIDI</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.029</td>
<td>2.56</td>
<td>87.00</td>
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<td>0.021</td>
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<td>90.00</td>
</tr>
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<td>1.52</td>
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</tr>
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<td>0.00</td>
</tr>
<tr>
<td>OTHER COMPANY PERSONNEL ERROR</td>
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<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>SYSTEM ADDITIONS OR REMOVALS</td>
<td>0.0</td>
<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>MAINTENANCE - FORCED</td>
<td>0.0</td>
<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>INT. TO BALANCE LOAD OR SYSTEM CONV.</td>
<td>0.0</td>
<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>INT. TO TRANSFER LOAD (OUT OF PHASE)</td>
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<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>TSUNAMI, EARTHQUAKE, OR FLOODING</td>
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<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>OPERATOR OR SWITCHING ERROR</td>
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<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>FAULTY OPERATION OF EQUIPMENT</td>
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<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>VANDALISM</td>
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<td>0.0</td>
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<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>EQUIPMENT OVERLOAD</td>
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<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>TRANSFORMER OVERLOAD</td>
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<td>0.0</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>TRANSFORMER FAILURE</td>
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<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>CABLE FAULT</td>
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<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>LOOSE CONNECTION</td>
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<td>0.00</td>
</tr>
<tr>
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<td>0.00</td>
</tr>
<tr>
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<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>DETERIORATION, CORROSION, TERMITES</td>
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<td>0.00</td>
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<tr>
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<tr>
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<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>FOREIGN OBJECTS IN LINES OR EQUIPMENT</td>
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<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>AUTOMOBILE ACCIDENT</td>
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<td>0.000</td>
<td>0.00</td>
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</tr>
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<td>1320.1</td>
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<td>0.737</td>
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</tr>
</tbody>
</table>

AVERAGE SYSTEM AVAILABILITY = 99.9911%
NUMBER OF CUSTOMERS FOR THE PERIOD = 1,702
24 MONTH ANNUALIZED SAIDI AVERAGE FOR THE PERIOD 1/1/2012 - 12/31/2013 = 31.52
24 MONTH AVERAGE NUMBER OF CUSTOMERS FOR THE PERIOD 1/1/2012 - 12/31/2013 = 1,673

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.
Maui Electric Company
Normalized Sustained Interruption Summary – System Total

FROM: JANUARY 1, 2013  TO: DECEMBER 31, 2013

<table>
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<th>Outage Cause</th>
<th>Interruptions</th>
<th>Customer Hours</th>
</tr>
</thead>
<tbody>
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<td></td>
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<td>% of Total</td>
</tr>
<tr>
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<tr>
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</tr>
<tr>
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<td>2</td>
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</tr>
<tr>
<td>EXCAVATION AND CONSTRUCTION</td>
<td>6</td>
<td>0.93%</td>
</tr>
<tr>
<td>FIRE</td>
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<td>0.31%</td>
</tr>
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<tr>
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<tr>
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<td>0.00%</td>
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<td>0.00%</td>
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<tr>
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<td>INT TO BALANCE LOAD OR CONVERSION</td>
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<tr>
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</tr>
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</tr>
<tr>
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</tr>
<tr>
<td>TOTALS</td>
<td>645</td>
<td>103360.7</td>
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</table>

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, 2013 TO: DECEMBER 31, 2013

<table>
<thead>
<tr>
<th>Outage Cause</th>
<th>Interruptions</th>
<th>Customer Hours</th>
</tr>
</thead>
<tbody>
<tr>
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<td>CONTACT BY MOVING EQUIPMENT</td>
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<td>0.16%</td>
</tr>
<tr>
<td>EXCAVATION AND CONSTRUCTION</td>
<td>6</td>
<td>0.98%</td>
</tr>
<tr>
<td>FIRE</td>
<td>2</td>
<td>0.33%</td>
</tr>
<tr>
<td>AUTO ACCIDENT</td>
<td>11</td>
<td>1.80%</td>
</tr>
<tr>
<td>MAN OR ANIMAL IN LINES</td>
<td>9</td>
<td>1.47%</td>
</tr>
<tr>
<td>TREES OR BRANCHES IN LINES</td>
<td>110</td>
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<td>0.00%</td>
</tr>
<tr>
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<td>4</td>
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</tr>
<tr>
<td>MYLAR BALLON</td>
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<td>0.00%</td>
</tr>
<tr>
<td>ERROR</td>
<td>8</td>
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<td>OTHER COMPANY PERSONNEL</td>
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</tr>
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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, 2013 TO: DECEMBER 31, 2013

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<tr>
<td>FOREIGN OBJECT IN LINES</td>
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</tr>
<tr>
<td>CONTACT BY MOVING EQUIPMENT</td>
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<tr>
<td>EXCAVATION AND CONSTRUCTION</td>
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</tr>
<tr>
<td>FIRE</td>
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<td>0.0</td>
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<tr>
<td>AUTO ACCIDENT</td>
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<td>0.0</td>
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<tr>
<td>MAN OR ANIMAL IN LINES</td>
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<td>TREES OR BRANCHES IN LINES</td>
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<td>TRANSFORMER OVERLOAD</td>
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<tr>
<td>TRANSFORMER FAILURE</td>
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<tr>
<td>SWITCHING</td>
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<td>INT TO TRANSFER LOAD (OUT OF PHASE)</td>
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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, 2013 TO: DECEMBER 31, 2013

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<tr>
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<td></td>
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<td></td>
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<td>DETERIORATION, CORROSION OR TERMITES</td>
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</tr>
<tr>
<td>TRANSFORMER OVERLOAD</td>
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<td>TRANSFORMER FAILURE</td>
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<td>0.00%</td>
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</tr>
</tbody>
</table>

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. 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.

\[
SAIFI = \frac{\sum \text{No. of Customer Interruptions Experienced during the year}}{\text{Average No. of Customers served during the year}}
\]

**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.

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

**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.

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