eReliabilityTracker ™

2014 Annual Report

APPA Municipal Utility

The eReliability Tracker Annual Report was created by the American Public Power Association to assist utilities in their efforts to understand and analyze their electric system. This report focuses on distribution system reliability across the country and is customized to each utility's system. The data used to generate this report reflect activity in the eReliability Tracker from January 1, 2014 to December 31, 2014. Note that if you currently do not have a full year of data in the system, this analysis may not properly reflect your utility's statistics since it only includes data recorded for your utility as of February 24, 2015; therefore, any changes made after that date are not represented in this report.

I. General Overview

Reliability reflects historic and ongoing engineering investment decisions within a utility. Proper use of reliability metrics ensures that the utility is not only performing its intended function, but also is providing service in a consistent and effective manner. Even though the primary use of reliability statistics is for self-evaluation, utilities can use these statistics to compare with data from similar utilities. However, differences such as electrical network configuration, ambient environment, weather conditions, and number of customers served typically limit most utility-to-utility comparisons. Due to the diverse range of utilities that use the eReliability Tracker, this report endeavors to group utilities by size and region to improve comparative analyses while reducing differences.

Since this report contains overall data for all utilities that use the eReliability Tracker, it is important to consider the effect that a particularly large or small utility can have on the rest of the data. To ease the issues associated with comparability, reliability statistics are calculated for each utility with their respective customer weight taken into account prior to being aggregated with other utilities. All utilities are equally weighted and all statistics are developed on a per customer basis.

The aggregate statistics displayed in this report are calculated from utilities that experienced more than two outages in 2014. Also, utilities that experienced no outages this year, or did not upload any data, will have None/Null values in their report for their utility-specific data and were not included in the aggregate analysis.

The aggregate statistics provided in the following sections of the report are based on approximately 17,606 outages from 143 utilities, that recorded more than two outages for 2014 during the time period of analysis.

SAMPLE REPORT DATA

To limit the comparison of utilities of truly different sizes, this report separates utilities into groups according to their number of customers served. In Table 1, the customer size distribution of utilities that use the eReliability Tracker is split into fifths to create five distinct customer size classes.

Since the utilities considered in this report represent a wide variety of locations across the United States, each utility is grouped with all others located in their corresponding APPA region. Figure 1 shows the number of utilities using the eReliability Tracker in each APPA region and Figure 2 displays the current United States map of APPA regional divisions.

Your utility belongs to customer size class 2 and region 5 .

Table 1
Customer size range per customer size class

Class 1:	0 -3,600
Class 2:	3,600 - 6,265
Class 3:	6,265 - 10,220
Class 4:	10,220 - 20,364
Class 5:	20,364- 1,481,735

Figure 1
Number of eRT utilities per APPA region
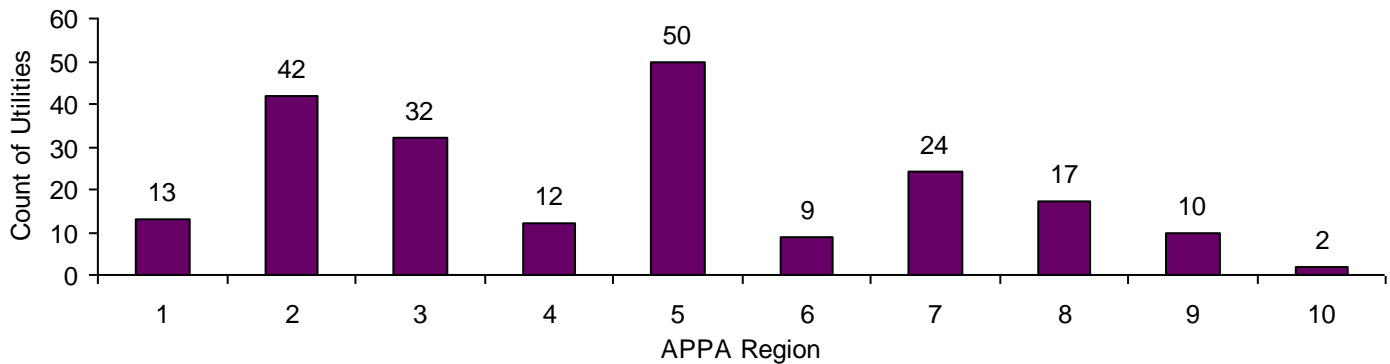
Figure 2
Map of APPA Regions as of January 1, 2014

SAMPLE REPORT DATA

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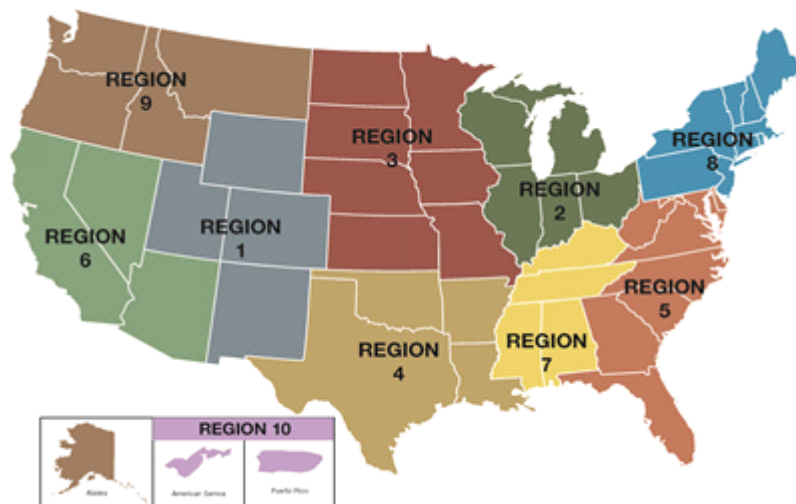
II. IEEE Statistics

When using reliability metrics, a good place to start is with the industry standard metrics found in the IEEE 1366 guide. For each individual utility, the eReliability Tracker performs IEEE 1366 calculations for System Average Interruption Duration Index (SAIDI), System Average Interruption Frequency Index (SAIFI), Customer Average Interruption Duration Index (CAIDI), Momentary Average Interruption Frequency Index (MAIFI) and Average Service Availability Index (ASAI).

When collecting the necessary data for reliability indices, utilities often take differing approaches. Some utilities prefer to include information as detailed as circuit type or phases impacted, while others include only the bare minimum required. In all cases, the more details a utility provides, the more practical their analysis will be. As a basis for calculating these statistics in the eReliability Tracker, the following are required to create an outage in the system:

-Total number of customers served on the day of the outage
-Time and date when the outage began
-Primary cause of outage
-Address where the outage was located

It is important to note that the time when the outage ended is not required in case the outage is ongoing; therefore, outages without end dates at the time of the report analysis are not included in the indices that measure duration, such as SAIDI and CAIDI. However, they are included in the calculations measuring interruption frequencies, such as SAIFI or MAIFI, as well as in the analysis of outage causes.

Due to the differences in how some utilities analyze major events (MEs) relative to their base statistics, it is important to note how they are calculated and used in this report. An example of a major event could be severe weather, such as a tornado or thunderstorm, which can lead to unusually long outages in comparison to your distribution system's typical outage. In the eReliability Tracker and in this report, the APPA major event threshold is used, which is a calculation based directly on outage events, rather than event days. The major event threshold allows a utility to remove outages that exceed the IEEE 2.5 beta threshold for events. The threshold takes into account the utility's past outage history up to 10 years in order to make this calculation. In the eReliability Tracker, if a utility does not have at least 36 outage events prior to the year being analyzed, no threshold is calculated; therefore, the field below showing your utility's threshold will be blank and the calculations without MEs in the SAIDI section of this report will be the same as the calculations with MEs for your utility. More outage history will provide a better threshold for your utility.

Your utility's major event threshold is _____2.8583_____ (minutes)[1].

If you wish to remove major events, the threshold calculated above is important to note because it impacts your SAIDI analysis. For the next year, based on your utility's outage history, any event with a SAIDI greater than ____2.8583____ minutes is considered as a major event and can be removed in your analysis.

The tables in this section can be used by utilities to better understand the performance of their electric system relative to other utilities nationally and to those within their region or size class. In the SAIDI section, indices are calculated for all outages with and without major events; furthermore, the data are broken down to show calculations for scheduled and unscheduled outages. For each of the reliability

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[1] If there is no major event threshold calculated for your utility, these fields are left blank and the calculations in this report including Major Events and excluding them will be the same. Your utility must have at least 36 outage events recorded in the eReliability Tracker in order to calculate a Major Event Threshold.

System Average Interruption Duration Index (SAIDI)

SAIDI is defined as the average interruption duration (in minutes) for customers served by the utility system during a specific time period.

Since SAIDI is a sustained interruption index, only outages lasting longer than five minutes are included in the calculations. SAIDI is calculated by dividing the sum of all customer interruption durations within the specified time frame by the average number of customers served during that period. For example, a utility with 100 customer minutes of outages and 100 customers would have a SAIDI of 1.

Note that in the tables below, scheduled and unscheduled calculations include major events.

Table 2
Average SAIDI for all utilities that use the eReliability Tracker (with and without MEs), belong to your region, and are grouped in your customer size class

|	All	No MEs	Unscheduled	Scheduled
Your utility's SAIDI:	39.6421	12.4368	35.6573	3.2451
Average eReliability Tracker Utility SAIDI	111.6347	67.8888	105.3348	6.2962
Average SAIDI for Utilities Within Your Region	52.8402	32.0671	48.7954	2.9015
Average SAIDI for Utilities Within Your Customer Size Class	87.6369	34.8901	88.6412	3.547

Table 3
Summary statistics of the SAIDI data compiled from the eReliability Tracker

	All	No MEs	Unscheduled	Scheduled
Minimum Value	0.2461	0.2461	0.2461	0
First Quartile (25th percentile)	18.6824	11.2111	18.6751	0
Median Quartile (50th percentile)	50.4729	25.1516	47.6868	0.0146
Third Quartile (75th percentile)	97.2444	56.433	91.815	0.701
Maximum Value	3128.437	3128.437	2974.7748	308.3812

Figure 3
Average SAIDI for all utilities that use the eReliability Tracker per region

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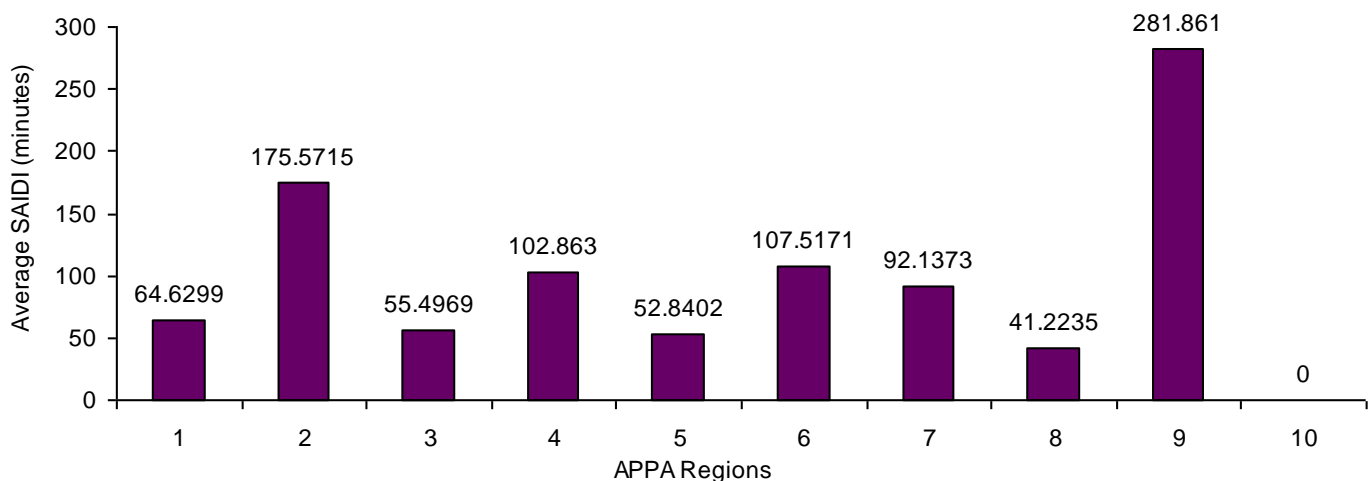
System Average Interruption Frequency Index (SAIFI)

SAIFI is defined as the average number of instances a customer on the utility system will experience an interruption during a specific time period.

Since SAIFI is a sustained interruption index, only outages lasting longer than five minutes are included in the calculations. SAIFI is calculated by dividing the total number of customer interruptions by the average number of customers served during that time period. For example, a utility with 150 customer interruptions and 200 customers would have a SAIFI of .75 interruptions per customer.

Table 4
Average SAIFI for all utilities that use the eReliability Tracker, belong to your region, and are grouped in your customer size class

|	
Your utility's SAIFI:	0.4267
Average eReliability Tracker Utility SAIFI	0.9615
Average SAIFI for Utilities Within Your Region	1.0892
Average SAIFI for Utilities Within Your Customer Size Class	1.2674

Table 5
Summary statistics of the SAIFI data compiled from the eReliability Tracker

Minimum Value	0.0019
First Quartile (25th percentile)	0.3184
Median Quartile (50th percentile)	0.621
Third Quartile (75th percentile)	1.0821
Maximum Value	20

Figure 4
Average SAIFI for all utilities that use the eReliability Tracker per region

SAMPLE REPORT DATA
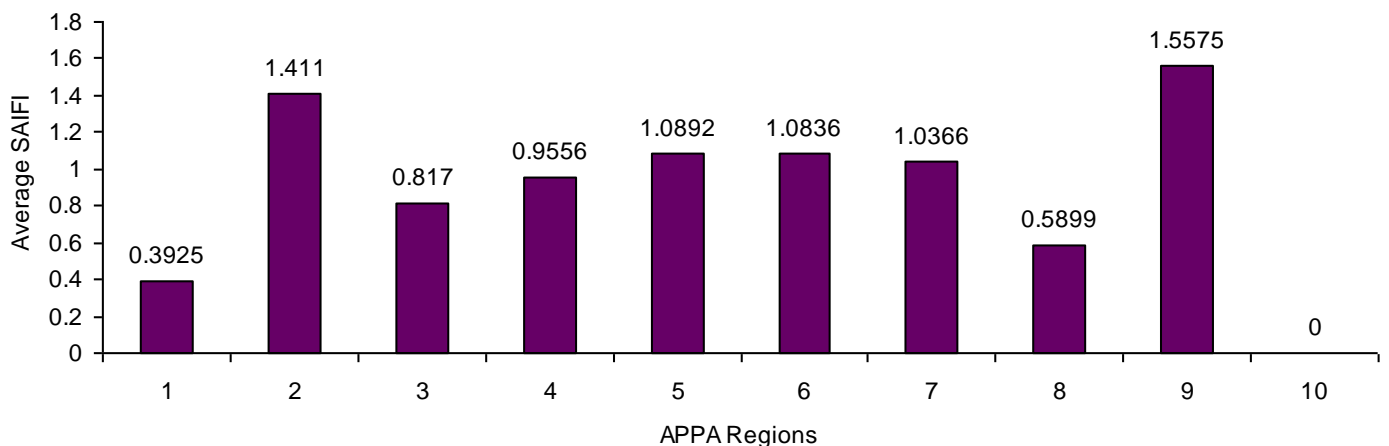
Customer Average Interruption Duration Index (CAIDI)

CAIDI is defined as the average duration (in minutes) of an interruption experienced by customers during a specific time frame.

Since CAIDI is a sustained interruption index, only outages lasting longer than five minutes are included in the calculations. It is calculated by dividing the sum of all customer interruption durations during that time period by the number of customers that experienced one or more interruptions during that time period. This metric reflects the average customer experience (minutes of duration) during an outage.

Table 6
Average CAIDI for all utilities that use the eReliability Tracker, belong to your region, and are grouped in your customer size class

|	
Your utility's CAIDI:	75.2134
Average eReliability Tracker Utility CAIDI	108.8292
Average CAIDI for Utilities Within Your Region	93.4772
Average CAIDI for Utilities Within Your Customer Size Class	102.3369

Table 7
Summary statistics of the CAIDI data compiled from the eReliability Tracker

Minimum Value	17.2115
First Quartile (25th percentile)	60.0165
Median Quartile (50th percentile)	82.1022
Third Quartile (75th percentile)	132.3397
Maximum Value	782.4045

Figure 5
Average CAIDI for all utilities that use the eReliability Tracker per region
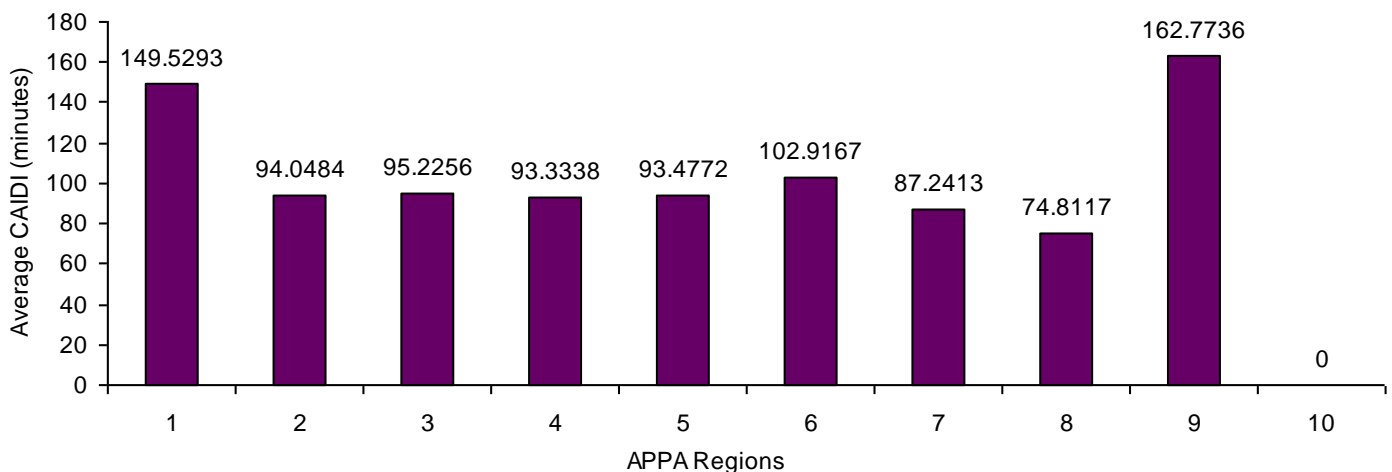
Momentary Average Interruption Frequency Index (MAIFI)

MAIFI is defined as the average number of times a customer on the utility system will experience a momentary interruption.

In this report, an outage with a duration of less than five minutes is classfied as momentary. The index is calculated by dividing the total number of momentary customer interruptions by the total number of customers served by the utility. Momentary outages can be more difficult to track and many smaller utilities may not have the technology to do so; therefore, some utilities may have a MAIFI of zero below.

Table 8
Average MAIFI for all utilities that use the eReliability Tracker, belong to your region, and are grouped in your customer size class

|	
Your utility's MAIFI:	0.0113
Average eReliability Tracker Utility MAIFI	0.463
Average MAIFI for Utilities Within Your Region	0.2497
Average MAIFI for Utilities Within Your Customer Size Class	0.3478

Table 9
Summary statistics of the MAIFI data compiled from the eReliability Tracker

Minimum Value	0
First Quartile (25th percentile)	0
Median Quartile (50th percentile)	0
Third Quartile (75th percentile)	0.1539
Maximum Value	12.7241

Figure 6
Average MAIFI for all utilities that use the eReliability Tracker per region

SAMPLE REPORT DATA
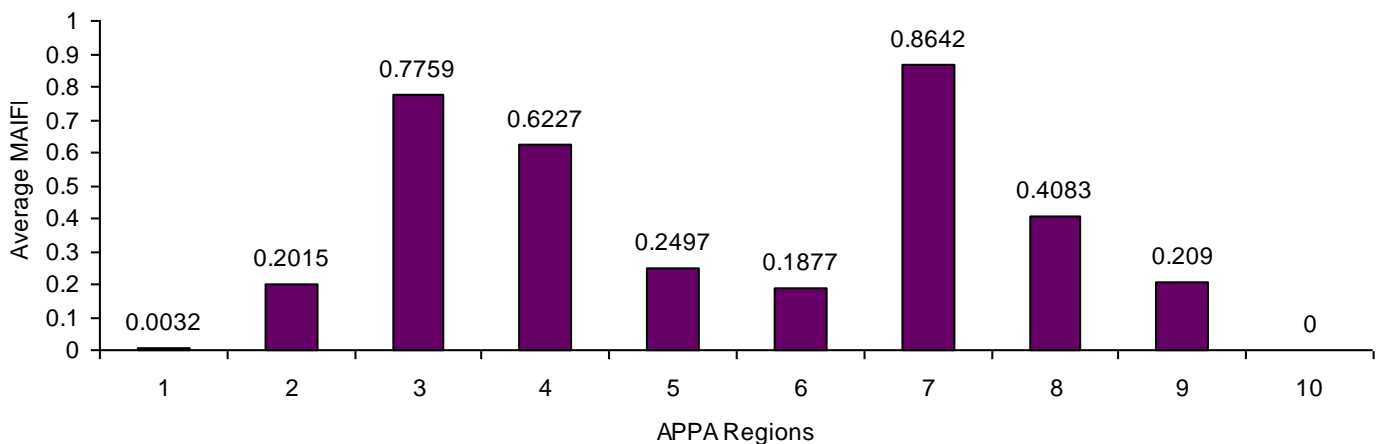
Average Service Availability Index (ASAI)

ASAI is defined as a measure of the average availability of the sub-transmission and distribution systems that serve customers.

This load-based index represents the percentage availability of electric service to customers within the time period analyzed. It is caclulated by dividing the total hours service is available to customers by the total hours that service is demanded by the customers.

Table 10
Average ASAI for all utilities that use the eReliability Tracker, belong to your region, and are grouped in your customer size class

|	
Your utility's ASAI (%):	99.999998
Average eReliability Tracker Utility ASAI	99.979141
Average ASAI for Utilities Within Your Region	99.980624
Average ASAI for Utilities Within Your Customer Size Class	99.984412

Table 11
Summary statistics of the ASAI data compiled from the eReliability Tracker

Minimum Value	99.404787
First Quartile (25th percentile)	99.981498
Median Quartile (50th percentile)	99.990397
Third Quartile (75th percentile)	99.996445
Maximum Value	99.999953

Figure 7
Average ASAI for all utilities that use the eReliability Tracker per region
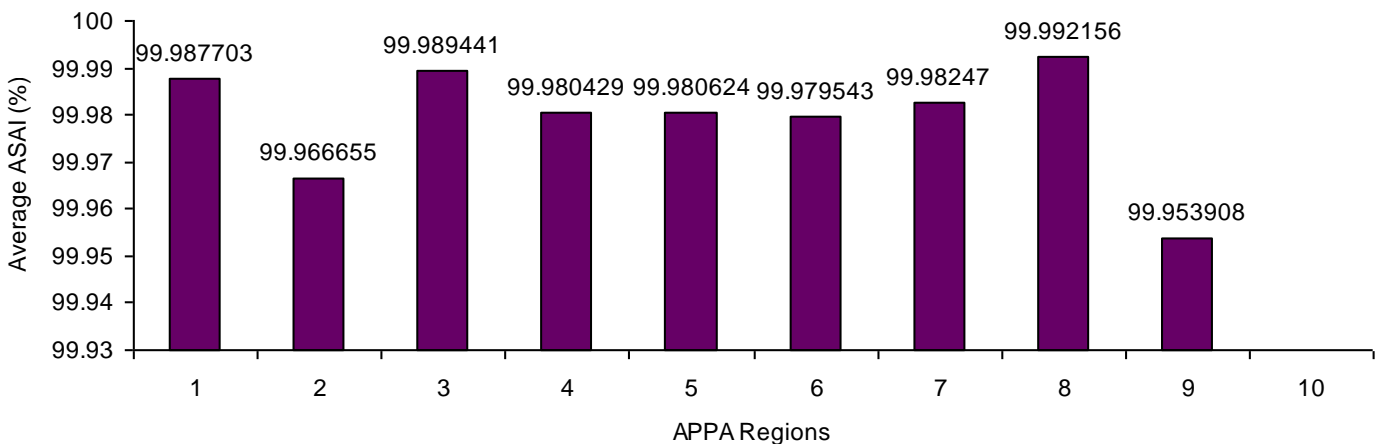
2013 Energy Information Administration (EIA) Form 861 Data

Form EIA-861 collects information on the status of electric power industry participants involved in the generation, transmission, distribution, and sale of electric energy in the United States, its territories, and Puerto Rico.

EIA surveys electric power utilities annually through EIA Form 861 to collect electric industry data and subsequently make that data available to the public. In 2014, EIA began requesting reliability statistics in their survey from utility participants; therefore, APPA included EIA reliability statistics in this report for informational purposes. Please note that the following data includes investor-owned, rural cooperative, and public power utilities that were large enough to be required to fill out the full EIA 861, not the EIA 861-S form (for smaller entities). In addition, since the collection and release of EIA form data lags by more than a year, the data provided is based on 2013 data only. Therefore, it is suggested that the aggregate statistics contained herein be used only as an informational tool for further comparison of reliability statistics.

In the table, if an entity calculates SAIDI, SAIFI, and determines major event days in accordance with the IEEE 1366-2003 or IEEE 1366-2012 standard, they are included under the "IEEE Method" columns. If the entity calculates these values via another method, they are included under the "Other Method" columns.

There were approximately 965 utilities that submitted reliability data to the EIA. Additionally, it looks as though a number of utilities submitted incorrect data, which shows itself most in the average SAIFI numbers. For more general information on reliability metrics you can see APPA's website at http://publicpower.org/reliability. Although EIA collected other reliability related data, the tables below only include SAIDI and SAIFI data. The full set of data can be downloaded at this link: http://www.eia.gov/electricity/data/eia861/

Table 12
Summary statistics of the SAIDI data compiled from 2013 data collected by EIA

	IEEE Method		Other Method	
	All	No MEDs	All	No MEDs
Average	249.4246	139.3246	210.5557	136.5727
Minimum Value	0.0000	0.0000	0.0000	0.0000
First Quartile (25th percentile)	53.5000	42.0000	20.0000	6.0000
Median Quartile (50th percentile)	128.0000	88.0000	71.0000	50.5000
Third Quartile (75th percentile)	249.5000	145.0250	169.0000	112.0000
Maximum Value	10,983.0000	10,983.0000	12,944.0000	10,726.0000

Table 13
Summary statistics of the SAIFI data compiled from 2013 data collected by EIA

	IEEE Method		Other Method	
	All	No MEDs	All	No MEDs
Average	15.2657	13.5847	2.5339	4.1404
Minimum Value	0.0000	0.0000	0.0000	0.0000
First Quartile (25th percentile)	0.8400	0.6778	0.3443	0.1818
Median Quartile (50th percentile)	1.2300	1.0000	1.0000	0.7695
Third Quartile (75th percentile)	2.0000	1.6150	1.9455	1.3925
Maximum Value	2,837.0000	2,335.0000	87.0000	674.0000

III. Outage Causes

Equipment failure, extreme weather events, wildlife and vegetation are some of the most common causes of electric system outages. However, certain factors, such as regional weather and animal/vegetation patterns, can make a different set of causes more prevalent to a specific group of utilities. The following sections of this report include graphs depicting common causes of outages for your individual utility, all utilities in your region, and all utilities using the eReliability Tracker. The charts containing aggregate information are customer-weighted to account for differences in utility size for a better analytical comparison. For example, a particularly large utility will have a large number of outages compared to a small utility; in order to not have the collective information be more representative of the large utility, the number of occurrences is divided by customer size to account for the differences. In the figures below, the data represent the number of occurrences for each group of 1000 customers. For instance, a customer-weighted occurrence rate of "1" means 1 outage of that outage cause per 1000 customers on average in 2013.

Note that the sustained outage cause analysis is more comprehensive than the momentary outage cause analysis due to a bigger and more robust sample size for sustained outages. Regardless, tracking both sustained and momentary outages helps utilities understand and reduce outages. To successfully use the outage information tracked by your utility, it is imperative to classify and record outages in detail. The more information provided per outage, the more conclusive and practical your analyses will be.

Sustained Outage Causes

In general, sustained outages are the most commonly tracked outage type. In many analyses of sustained outages, utilities tend to exclude scheduled outages, partial power, customer-related problems, and qualifying major events from their reliability indices calculations. While this is a valid method for reporting, these outages should be included for internal review to make utility-level decisions. In this section, we evaluate common causes of sustained outages for your utility, corresponding region, and for all utilities that use the eReliability Tracker. It is important to note that in this report, sustained outages are classified as outages that last longer than five minutes, as defined by IEEE 1366.

SAMPLE REPORT DATA

Figure 8
Top five customer-weighted occurrence rates for common causes of sustained outages for all utilities that use the eReliability Tracker System [2]
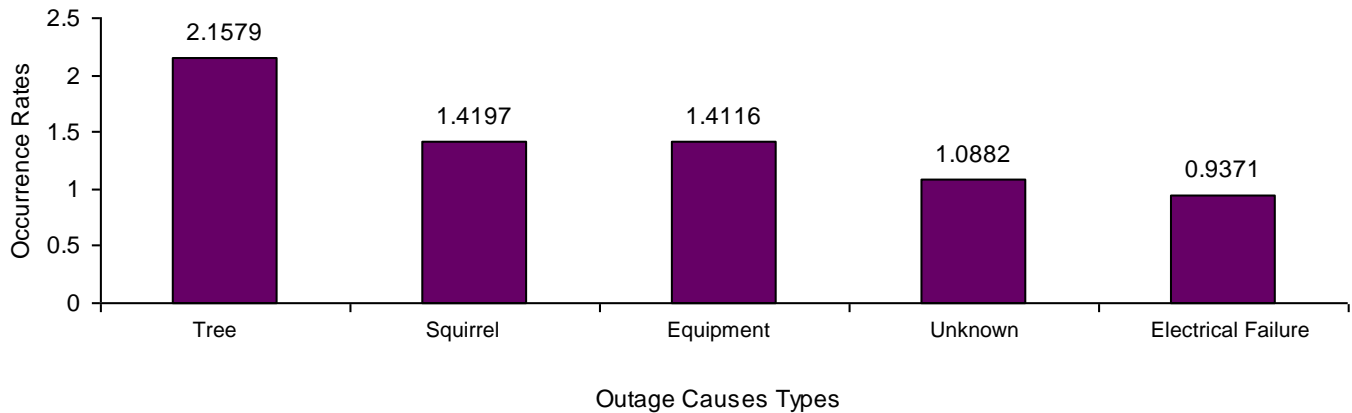

Outage Causes Types

Figure 9
Top five customer-weighted causes of sustained outages for your utility[2]
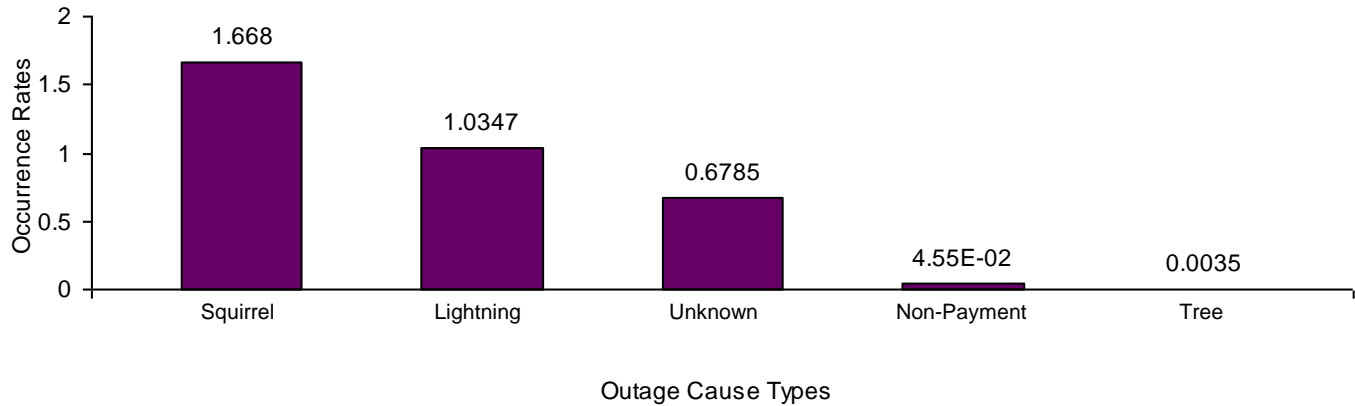
Outage Cause Types

Figure 10
Top five customer-weighted occurrence rates for sustained outage causes in your region[2]
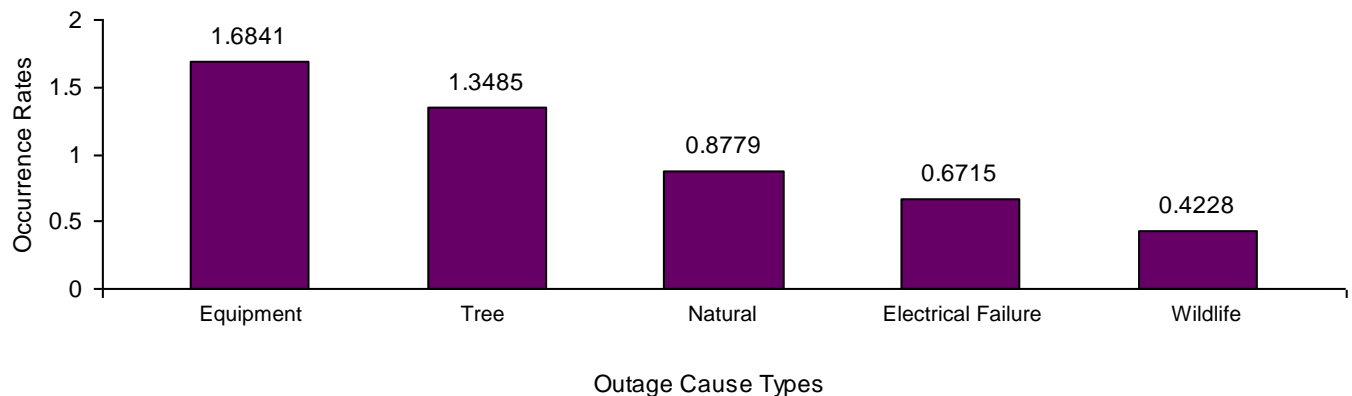
Outage Cause Types

[2] For each utility, the number of occurrences for each cause is divided by that utility's customer size (in 1000s) to create an occurence rate that can be compared across different utility sizes.

SAMPLE REPORT DATA

Momentary Outage Causes

The ability to track momentary outages can be difficult or unavailable on some systems, but due to the hazard they pose for electronic equipment, it is important to track and analyze their causes. In this section, we evaluate common causes of momentary outages for your utility, region and customer size class as well as common causes for all utilities that use the eReliability Tracker. Utilities with less than eight momentary outages recorded in the eReliability Tracker as of January 27, 2014 are not included in the following analysis of momentary outage causes. Please note that only outages lasting less than five minutes are classified as momentary, as defined by IEEE 1366.

Figure 11
Top five customer-weighted occurrence rates for common causes of momentary outages for all utilities that use the eReliability Tracker System [2]
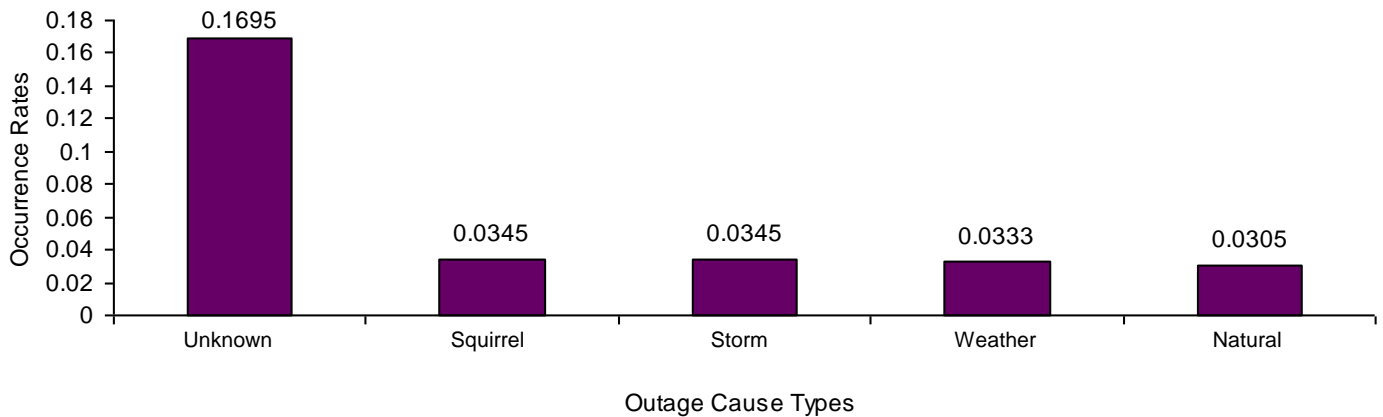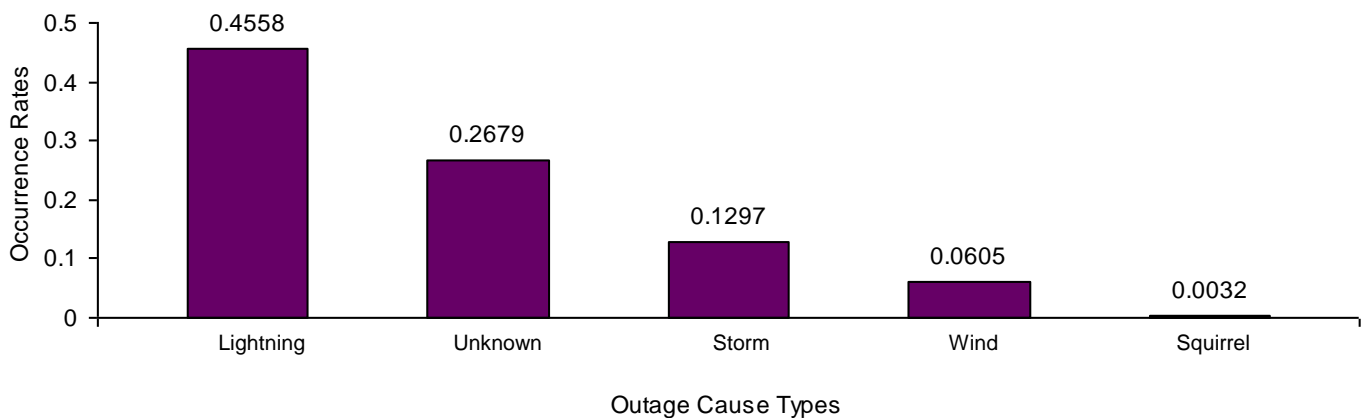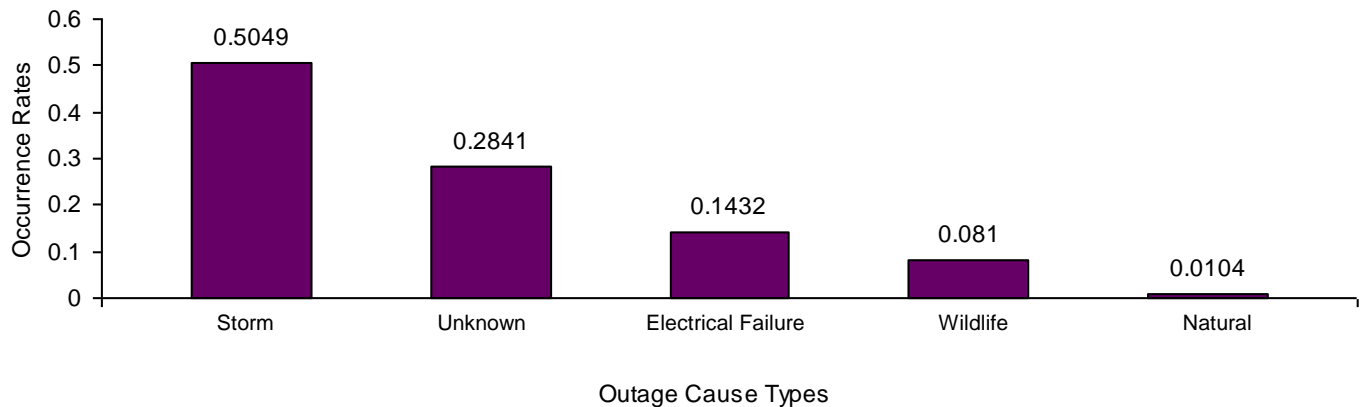

Figure 12
Top five customer-weighted causes of momentary outages for your utility[2, 3]

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[3] If your utility has less than eight momentary outages recorded in the eReliability Tracker, this graph will be blank.

Figure 13
Top five customer-weighted occurrence rates for momentary outage causes in your region[2]

Thank you for using the eReliability Tracker and we hope this report is useful to your utility in analyzing your system. If you have any questions regarding the material provided in this report, please contact:

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The eReliability Tracker was funded by a grant from the Demonstration of Energy & Efficiency Developments (DEED) Program.

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