McPherson Board of Public Utilities

2022 ANNUAL BENCHMARKING REPORT

eRELIABILITY TRACKER

DEED PUBLIC POWER RESEARCH & DEVELOPMENT
American Public Power Association

AMERICAN PUBLIC POWER ASSOCIATION
80 Years of Powering Strong Communities

Utility Classifications

This report separates utilities into groups according to geographic region and the number of customers served. Table 1 shows the range of customer counts for utilities that use the eReliability Tracker by five distinct groups of approximately 105 utilities per group.

Your utility is in size class 4 and region 3.

Table 1. Customer count range per size class

Utility Size Class	Customer Count Range
Class 1	[0, 1481)
Class 2	[1481, 3239)
Class 3	[3239, 7154)
Class 4	[7154, 13594)
Class 5	[13594, 503649)

Each utility is also grouped with all other participating utilities within their region. Figure 1 shows the number of utilities using the eReliability Tracker in each region and Figure 2 shows the states and territories included in each region.

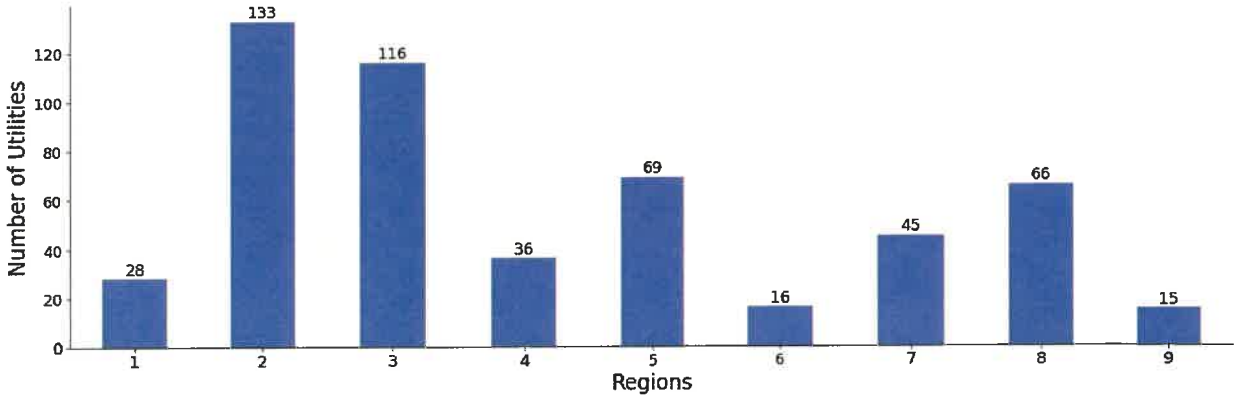


Figure 1. Number of utilities subscribed to the eReliability Tracker by region

II. IEEE Statistics

When it comes to reliability, the industry standard metrics are defined in the Institute for Electrical and Electronics Engineers' Guide for Electric Power Distribution Reliability Indices, or IEEE 1366 guidelines. For each 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).

It is important to note how major events (MEs) are calculated and used in this report. An example of a ME includes severe weather, such as a tornado or hurricane, that leads to unusually long outages in comparison to your distribution system's typical outage. This report uses the **APPA ME threshold**, which is based directly on the SAIDI for specific outage events, rather than a daily SAIDI. The APPA ME threshold allows a utility to remove outages that exceed the IEEE 2.5 beta threshold for outage events, which considers up to 10 years of the utility's outage history. In the eReliability Tracker, if a utility does not have at least 36 outage events prior to the year being analyzed, then no threshold is calculated. If this is the case for your utility, then you will have a NULL value in the following field and the calculations without MEs in the SAIDI, SAIFI, CAIDI, and ASAI sections 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 APPA major event threshold is 3.23 minutes.

For each of the reliability indices, this report displays your utility's metrics alongside the mean values for all utilities using the eReliability Tracker and within the same calss and region as your utility. The first table within each of the following subsections allows you to better understand the performance of your electric system relative to other utilities nationwide and to those within your same region or size class. The second table breaks down the national data into quartile ranges, a minimum value, and a maximum value.

All indices, except MAIFI, are calculated for outages with and without MEs. Furthermore, the tables show indices for scheduled and unscheduled outages. Note that scheduled and unscheduled calculations include MEs. Also note that wherever MEs are excluded, the exclusion is based on the APPA ME threshold for your system.

1. Customer minutes of interruption is calculated by multiplying total customers interrupted and total minutes of interruption. ↩

II.3. Customer Average Interruption Duration Index

CAIDI is 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. CAIDI is calculated by dividing the sum of all customer minutes of interruption by the number of customers that experienced one or more interruptions during that period. This metric reflects the average customer experience (minutes of duration) during an outage.

Note that in the tables below, scheduled and unscheduled calculations include MEs. Also note that wherever MEs are excluded, the exclusion is based on the APPA ME threshold for your system.

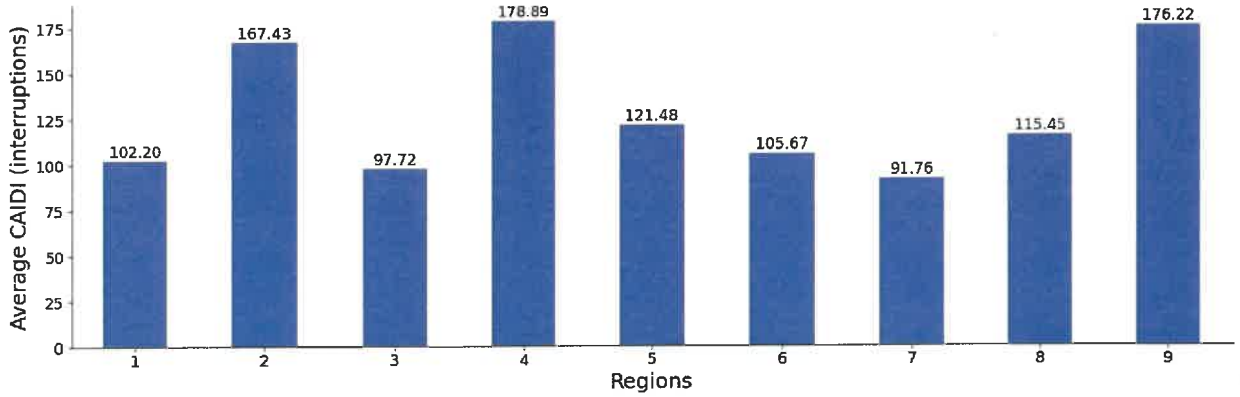
Table 6. Average CAIDI with and without MEs
In minutes

	All	No MEs	Unscheduled	Scheduled
Your utility	90.24	90.24	90.29	49.15
Utilities that use the eReliability Tracker	126.53	93.65	126.95	112.97
Utilities in your region	97.72	91.77	98.34	87.71
Utilities in your size class	97.17	86.09	96.16	112.35

Table 7. Summary CAIDI data from the eReliability Tracker
In minutes

	All	No MEs	Unscheduled	Scheduled
Minimum	0	0	0	0
First Quartile	64.21	57.12	61.19	53.43
Median	88.09	75.62	86.11	83
Third Quartile	121.48	105.3	122.98	128.43
Maximum	4365.94	1382.29	4504.81	747.38

Figure 5. Average CAIDI by region



II.5. Average Service Availability Index

ASAI is the percentage of time the sub-transmission and distribution systems are available to serve customers during a specific time frame.

This load-based index represents the percentage availability of electric service to customers within the period analyzed. It is calculated by dividing the total hours in which service is available to customers by the total hours that service is demanded by the customers. For example, an ASAI of 99.99% means that electric service was available for 99.99% of the time during the given period. Note that the higher your ASAI value, the better the performance.

In the tables below, scheduled and unscheduled calculations include MEs. Also note that wherever MEs are excluded, the exclusion is based on the APPA ME threshold for your system.

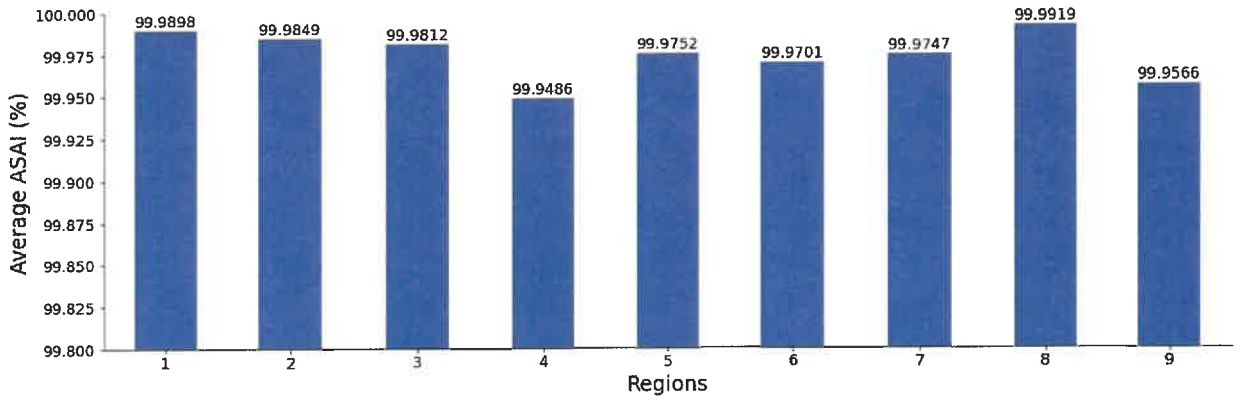
Table 10. Average ASAI with and without MEs
In percentage

	All	No MEs	Unscheduled	Scheduled
Your utility	99.9984	99.9984	99.9984	99.9999
Utilities that use the eReliability Tracker	99.9783	99.9872	99.9789	99.999
Utilities in your region	99.9812	99.9838	99.9814	99.9996
Utilities in your size class	99.9849	99.9922	99.9855	99.9991

Table 11. Summary ASAI data from the eReliability Tracker
In percentage

	All	No MEs	Unscheduled	Scheduled
Maximum	100	100	100	100
First Quartile	99.9964	99.9978	99.9967	99.9999
Median	99.991	99.995	99.9914	99.9997
Third Quartile	99.9779	99.9898	99.98	99.9992
Minimum	99.3597	99.3597	99.3597	99.9766

Figure 7. Average ASAI by region



	All	No MEs
Median	1.32	1
Third Quartile	2.06	1.52
Maximum	19.09	7.77

III. Outage Causes

Equipment failure, extreme weather events, wildlife, and vegetation are some of the most common causes of electric system outages.The following pie chart shows the percentages of the primary causes of outages for all utilities using the eReliability Tracker in 2022.

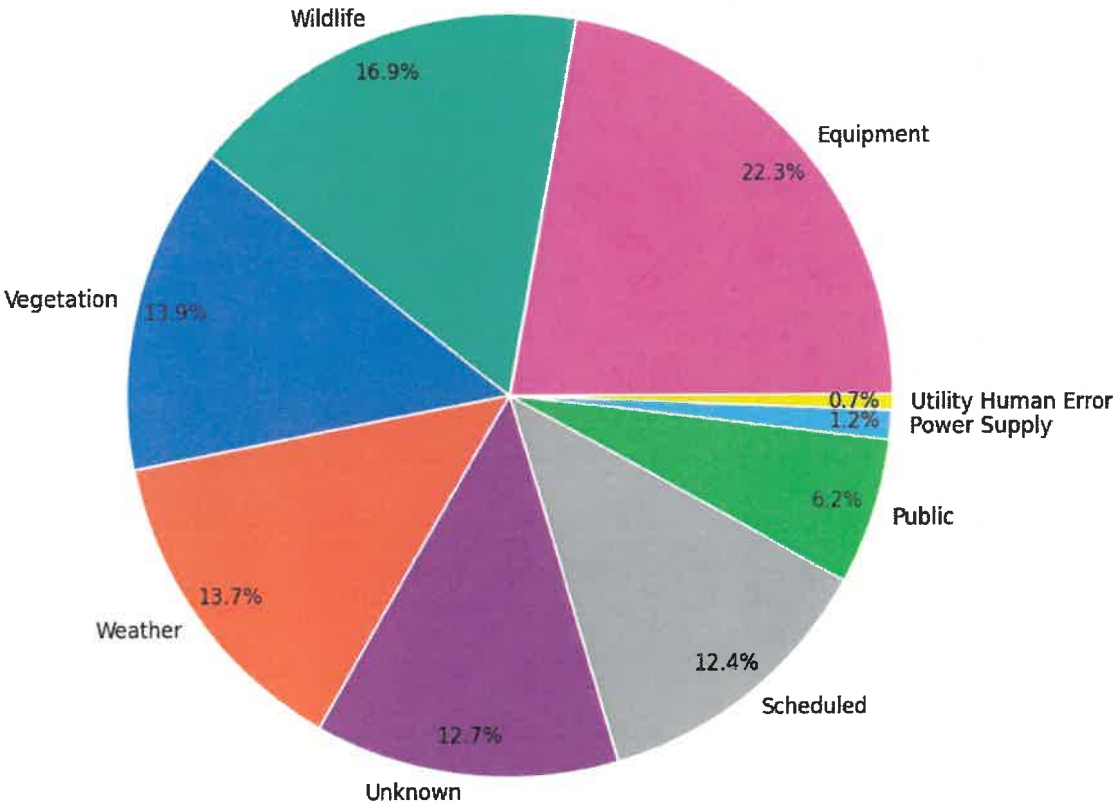


Figure 8. Primary causes of outages in 2022

Certain factors, such as regional weather and animal/vegetation patterns, can make some causes more prevalent for a specific group of utilities. The following section includes graphs depicting common causes of outages for your utility, all utilities in your region, and all utilities using the eReliability Tracker.

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 may have a large number of outages compared to a small utility. To avoid skewing the data toward large utilities, the number of cause occurrences is divided by customer size to account for the differences. In Figures 9 -14, the data represent the

III.1. Sustained Outage Causes

In general, sustained outages are the most commonly tracked outage type. In 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 sustained outages are classified in this report as outages that last longer than five minutes, as defined by IEEE 1366.

Figure 9. Top five causes of sustained outages for all utilities that use the eReliability Tracker

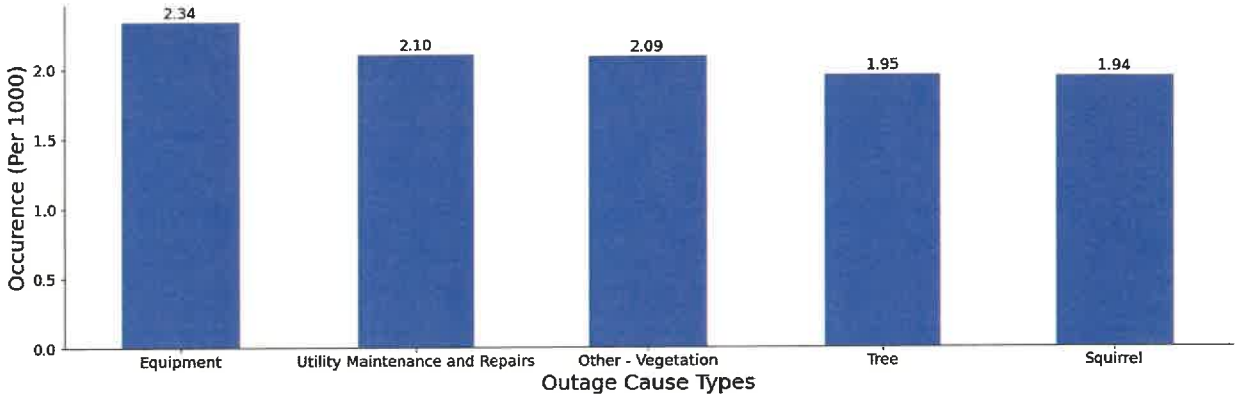
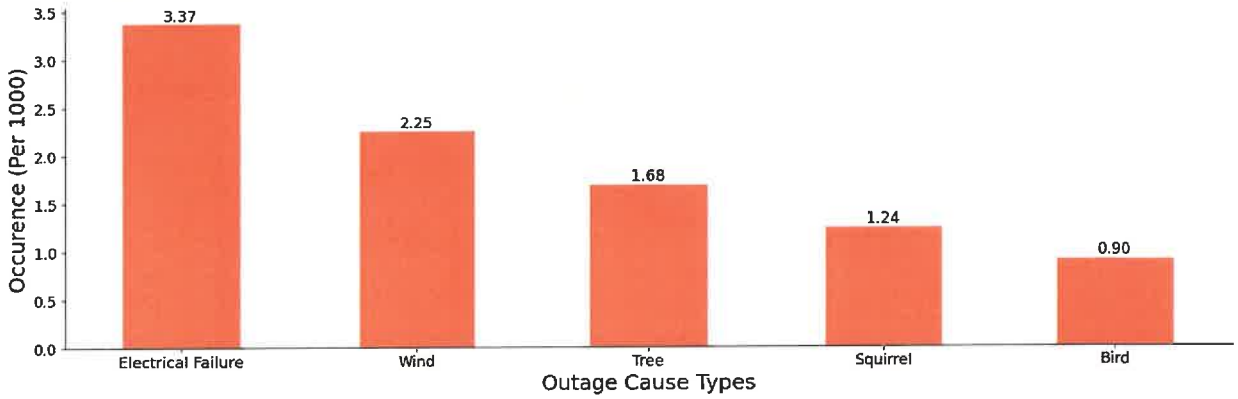


Figure 10. Top five causes of sustained outages for your utility[1]



1. The number of occurrences for each cause is divided by the utility's customer count (in thousands) to create an occurrence rate that can be compared across different utility sizes. ↩

III.2. 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 the causes of momentary outages. This section evaluates the common causes of momentary outages for your utility, region, and size class as well as common causes for all utilities that use the eReliability Tracker. Please note that only outages lasting less than five minutes are classified as momentary, as defined by IEEE 1366. In Figures 12–14, for each utility, the number of occurrences for each cause is divided by that utility's customer count (in thousands) to create an occurrence rate that can be compared across different utility sizes.

Figure 12. Top five causes of momentary outages for all utilities that use the eReliability Tracker

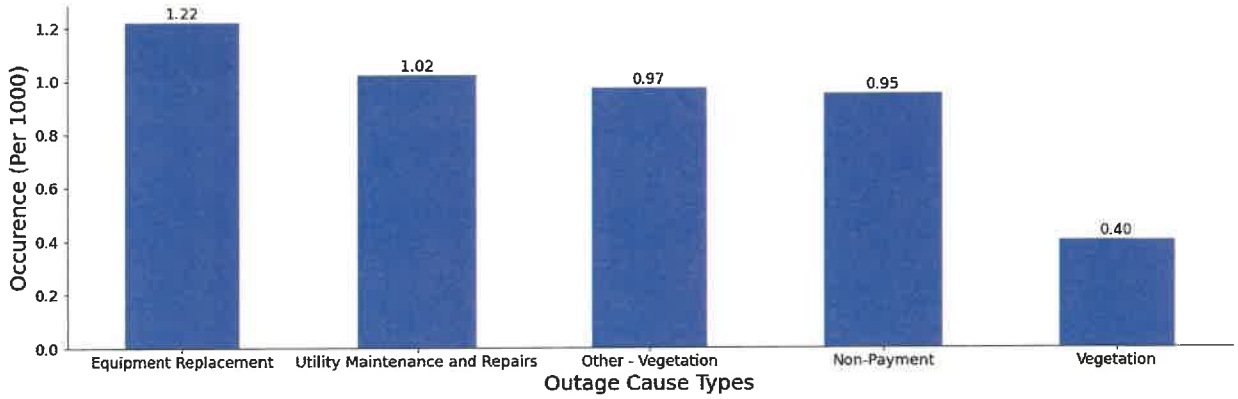
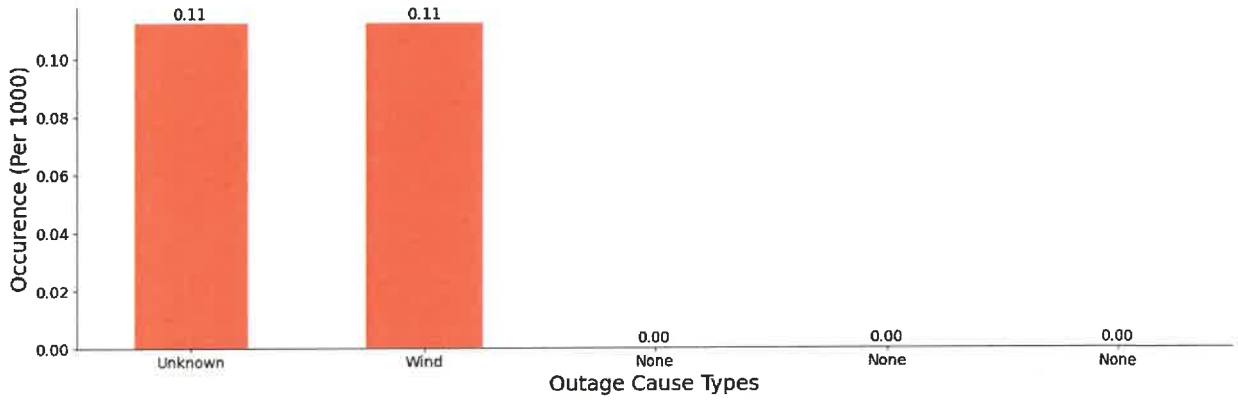


Figure 13. Top five causes of momentary outages for your utility



Thank you for your active participation in the eReliability Tracker service. 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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