Avista Utilities
Electric System Service Reliability Report
2021

April 2022

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Avista's Electric System Service Reliability Report for 2021

Introduction

Background

Avista's Electric System Service Reliability Report (Report) documents the annual reliability performance of our electric system for the prior reporting year, which is filed each year with the Washington Utilities and Transportation Commission (WUTC or Commission).[1] This Report contains results of the Company's electric service reliability in 2021.

For this annual Report our definition of "electric system" has always referred to Avista's overall network[2] of transmission lines, substations, and the distribution lines, or "feeders," that carry electricity to every home and business in our Washington and Idaho service area. "Service reliability" refers to the "uptime"[3] our customers experience for the year. Interruptions in service to our customers (service outages) reduce the uptime they experience. Like all electric utilities, Avista tracks and reports-out on various measures regarding the number of times throughout the year that our customers experience a service outage, and the length of time of these outages (outage duration). In accordance with Commission rules,[4] the Company established a baseline year of 2005 for each of its reliability measures and then annually compares the results for each reporting year with the baseline statistics and results for the most recent seven-year period. In addition to reporting reliability statistics, Avista must also report any changes to the methods used to collect and report the results, identify the geographic areas of greatest reliability concern on the Company's electric system, and explain our plans to improve reliability performance in those areas. The detailed reporting requirements are listed under definitions and electric system reliability reporting requirements, provided in Appendix A. Additionally, Avista reports on the complaints from its customers related to power quality and service reliability, as shown in Appendix E.

[1] Pursuant to Washington Administrative Code (WAC) 480-100-398.

[2] Entire electric system, irrespective of state jurisdiction.

[3] Uptime is a measure of the time electric system is available and in-service for customers during the year. A customer who experiences no service outages during the year would have a service uptime of 100%.

[4] WAC 480-100-393.

Providing Our Customers Reliable Electric Service

Avista is focused on maintaining a high degree of reliability as an important aspect of the quality of our service,[5] particularly as our society becomes ever more reliant upon electronic technologies. The Company's objective has been to generally uphold our current level of reliability, which we believe is acceptable to our customers. Providing a level of system reliability that is adequate for our customers represents a complex balance of customer expectations, cost, and performance. Because it is expensive to achieve every new increment of system reliability, and because these investments must be sustained over a period of many years to achieve objectives measured at the level of the overall system, it is important to ensure that we are prudently investing only the amount of money necessary to achieve an acceptable level of safe, reliable performance. Our customers' satisfaction with their service reliability is also heavily dependent on factors other than the actual reliability of our physical system. For example, perceptions of the priority Avista places on avoiding outages and quickly restoring service when outages occur, as well as the quality and timeliness of information we provide customers during an outage, have much greater bearing on customer satisfaction than our actual reliability performance.[6] Avista believes the current reliability performance of our system, along with our customer care and communications, achieves an effective balance, and because of this, represents a cost-effective value for our customers. This assessment is evidenced by our high level of customer satisfaction with their overall service from Avista, including aspects of electric reliability, our customers' satisfaction with their power quality and reliability, the low number of complaints we receive each year that are related to reliability issues, and our performance being in a reasonable range for the electric utility industry.

Purpose of this Report

As noted above, this Report describes results of the Company's annual monitoring of several key reliability indices, statistics, metrics, or measures. Primary indices are industry standard measures developed by the Institute of Electrical and Electronic Engineers (IEEE), which are important in promoting standardized and comparable reporting across the utility industry. In addition to these IEEE indices, the Company also monitors and uses in its analyses several other reliability measures, all of which are briefly described below.

- **System Average Interruption Frequency Index:** Often referred to by its acronym **SAIFI**, is the average number of sustained[7] interruptions or outages per customer for the year. This index value, developed by the IEEE, is calculated by dividing the total number of outages on the system each year by the average total number of customers on the system for that year. Dividing the value by the total number of customers normalizes the number of outages for comparison with other utilities.
- **System Average Interruption Duration Index**: Often referred to by its acronym **SAIDI**, is the average duration (or length) of sustained interruptions per customer for the year. This index value, developed by the IEEE, is calculated by dividing the total number of customer outage hours (number of customers experiencing an outage multiplied by the duration of the outage) experienced on the system for the year by the average total number of customers on the system for that year.

[5] Electric customers regularly report that service reliability is the most important aspect of the service they receive from their electric provider (example: JD Power reports that power quality and reliability accounts for 28% of the overall satisfaction electric customers report for their utility service).

[6] Assessing Residential Customer Satisfaction for Large Electric Utilities. L. Douglas Smith, et al., University of Missouri St. Louis, Department of Economics Working Paper #1007, May 2015.

[7] Any service interruption greater than five minutes in duration.

Dividing the value by the total number of customers normalizes the number of outages for comparison with other utilities.

- **Customer Average Interruption Duration Index**: Often referred to by its acronym **CAIDI**, is the average duration of sustained interruptions for those customers who experienced a service outage that year. This index value, developed by the IEEE, is calculated by dividing the total number of customer outage hours experienced on the system for the year by the total number of customers who experienced an outage that year. Since this measure reflects the duration of outages for customers experiencing those outages, it is often used to represent the utility's average outage restoration time.

- **Average Outage Duration**: This measure is used by Avista to describe the average duration of outages on the system. Since this average number of hours per outage is not divided by any number of customers or any other value, it is not an index value.

- **Average Number of Customers per Outage Event:** This measure is used by Avista to describe the average number of customers that were impacted by all the outages on the system during the year. This value is calculated by totaling all customers impacted by outage events for the year and dividing by the number of outage events for the year. This measures the effectiveness of our efforts to minimize the impact of individual outage events on our customers.

- **Number of Outage Events**: This measure is the number of outage events on our system each year that result in a sustained outage for our customers. Since the number of outage events is not divided by any other number it is not an index value.

- **Total Customer Outage Hours**: This measure is the total number of customer outage hours that were experienced by the customers on our system for the year. For each event, the number of customers experiencing the sustained outage is multiplied by the duration of the outage to yield the customer outage hours for each event. Summing all individual events' customer outage hours over a year yields the total customer outage hours. Since this total number of customer hours is not divided by any other number it is not an index value.

In addition to these primary reliability metrics, Avista also tracks the following measures:

- **Momentary Average Interruption Frequency Index**: Often referred to by its acronym **MAIFI,** this index is the average number of momentary interruptions (outages) per customer for the year. It is calculated the same way as SAIFI but uses the number of momentary outages instead of the number of sustained outages. By definition, a momentary outage has a duration of less than five minutes.

- **Customer Experiencing Multiple Interruptions**: Often referred to by its acronym **CEMI**, this metric is the number of customers who experience greater than an identified or set number of interruptions for the year.

The standard reliability statistics and their calculation are discussed in greater detail in Appendix B.

The Company is also required to report on any changes it has made in the prior year in the collection of reliability data or in calculating values for each reliability index. A brief record of such changes the Company has made historically is provided in Appendix C. As part of this reporting, Avista must also compare its annual reliability performance to a set of baseline reliability statistics, which were established in 2005.[8] All of the data included in this Report, as noted above, is based on system data representing Avista's entire electric service territory in Washington and Idaho.

[8] WAC 480-100-393(3)(b).

Results for Avista's Electric System Reliability in 2021

System Results

Results for several of the above-referenced reliability measures for 2021 are provided in Table 1 below. In addition to the current year results we have also listed the prior year result, the five-year average for each measure, and the 2005 baseline value.

Reliability Measure	2021 Results	2020 Results	Prior 5-Year Average (2016-2020)	2005 Baseline
System Average Interruption Frequency Index (SAIFI)	1.24	0.87	0.93	0.97
System Average Interruption Duration Index (SAIDI)	164 minutes (2.74 hours)	129 minutes (2.15 hours)	142 minutes (2.36 hours)	108 minutes (1.80 hours)
Customer Average Interruption Duration Index (CAIDI)	132 minutes (2.21 hours)	149 minutes (2.49 hours)	152 minutes (2.53 hours)	112 minutes (1.87 hours)

Table 1: Reliability Results for Key Measures in 2021[9]

Major Event Days

Avista tracks and reports reliability issues associated with major events,[10] and listed in Table 2 below are the Major Event Days (MEDs) affecting its system in 2021. A historic record of MEDs on our system is provided in Appendix G.

Major Event Days (2021)	SAIDI (hours)	Event Cause
2021 Major Event Day Threshold (T_{MED})	7.86	
January 13	495.30	Weather-Wind
January 14	36.84	Weather-Wind
January 15	28.06	Weather-Wind
January 16	11.91	Weather-Wind
March 28	21.94	Weather-Wind
April 18	20.30	Weather-Wind
November 15	41.36	Weather-Wind

Table 2: Major Event[11] and Major Event Days[12] Experienced in 2021

[9] Excludes outage results for qualifying major event days.

[10] Major Events and Major Event Days as used in this report are defined by the IEEE *Guide for Electric Power Distribution Reliability Indices*, IEEE P1366-2012. Avista's definition and use of the terms 'major event' and 'major event days' are taken from this IEEE Standard. The Company will use the process defined in IEEE P1366 to calculate the threshold value of T_{MED} and to determine MEDs. All indices will be reported both including and excluding MEDs. The comparisons of service reliability to the baseline statistics in subsequent years will be made using the indices calculated without MEDs.

[11] Major Event – Designates an event that exceeds reasonable design and or operation limits of the electric power system. A Major Event includes at least one Major Event Day.

[12] Major Event Day – A day in which the daily system SAIDI exceeds a threshold value, T_{MED}. For the purposes of calculating daily system SAIDI, any interruption that spans multiple calendar days is accrued to the day on which the interruption began. Statistically, days having a daily system SAIDI greater than T_{MED} are days on which the energy delivery system experienced stresses beyond that normally expected, such as severe weather. Activities that occur on major event days should be separately analyzed and reported.

System Average Interruption Frequency Index

Figure 1 below shows the SAIFI on the Company's system for the seven-year period of 2015-2021, including the linear trend.[13] As shown, after decreasing in 2020 from 2019, there was an increase in 2021. The primary cause of the increase was a combination of trailing impacts of weather events as well as an increase in planned work during 2021 to improve the overall reliability of the system in the long term. The planned outages tend to be a shorter duration and thus, adversely impact results in the short term. There were also more feeders in "dry land mode"[14] during 2021 that had an unfavorable impact. As noted in Table 1, the SAIFI value of customer outages in 2021 is 1.24, as compared to 0.87 in 2020.

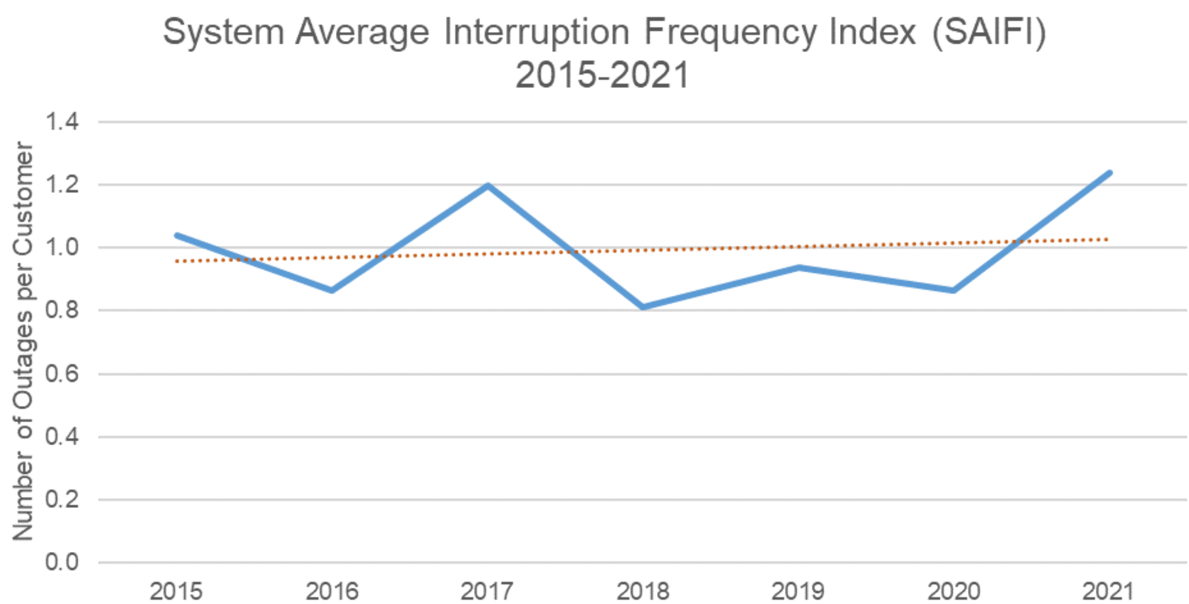

Figure 1: System Average Interruption Frequency Index (SAIFI) 2015-2021

A historical summary of SAIFI data since 2004 is included in Appendix F.

System Average Interruption Duration Index

Figure 2 below shows the SAIDI on the Company's electric system for the seven-year period of 2015-2021, including the linear trend.[15] The average duration of outages for all customers increased to 2.74 hours in 2021 from 2.15 hours in 2020, as noted in Table 1. Prior to 2021, the relatively low values reported over the most recent three years had shifted the linear trend to slightly improving the SAIDI results for Avista's customers. Although SAIDI increased in 2021, the linear trend line continues to improve going into 2022.

[13] Excluding outages associated with Major Event Days.

[14] "Dry Land Mode" is a part of Avista's Fire Mode Operations in which Avista turns off automatic reclosing on distribution circuits located in high-risk fire prone areas. For further information, please see the Company's Wildfire Resiliency Plan, Docket U-210254.

[15] Excluding Major Event Days.

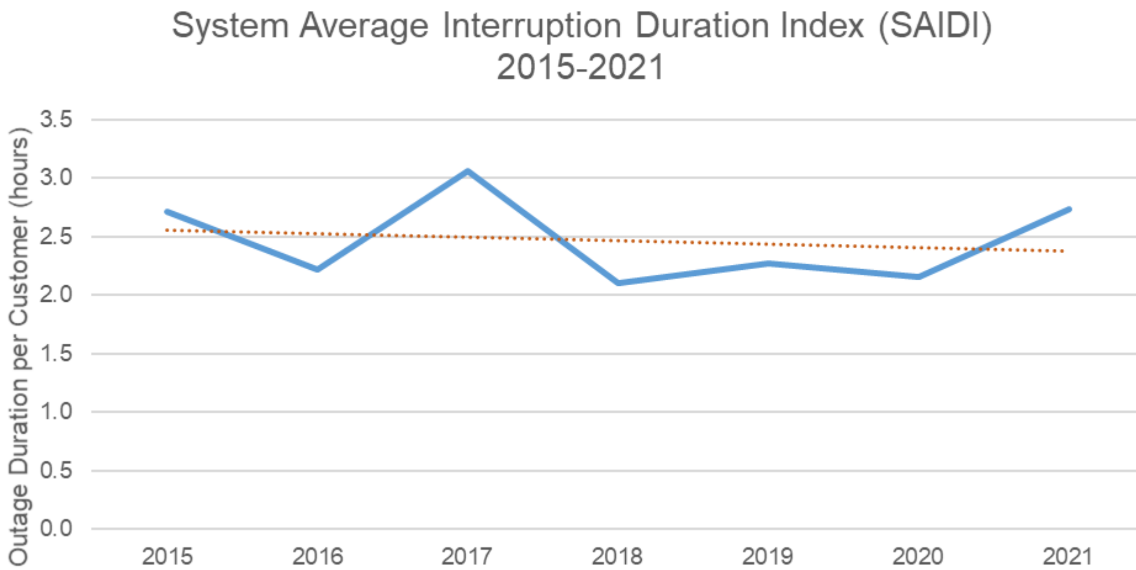

Figure 2: System Average Interruption Duration Index (SAIDI) 2015-2021

A historical summary of SAIDI data since 2004 is included in Appendix F.

Customer Average Interruption Duration Index

Figure 3 below shows the CAIDI on the Company's system for the seven-year period of 2015-2021, including the linear trend.[16] The continuation of relatively similar results reported since 2015 in CAIDI resulted in a continuing decrease in the linear trend. In 2021, this metric improved compared to 2020. The trend line continues to show the metric's longer-term improvement as efforts to improve the system has resulted in shorter outages. As noted in Table 1, the CAIDI value of customer interruption durations in 2021 is 2.21 hours, an 11.25% decrease from the prior year.

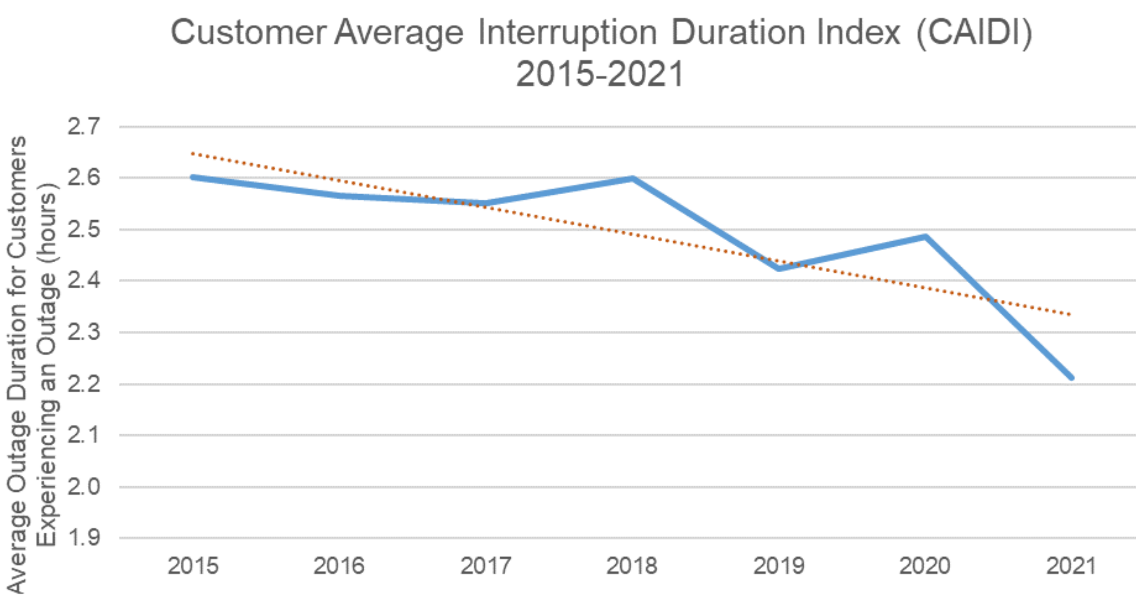

Figure 3: Customer Average Interruption Duration Index (CAIDI) 2015-2021

[16] Excluding Major Event Days.

Average Outage Duration

Figure 4 below shows the average outage duration on Avista's system for the seven-year period of 2015-2021, including the linear trend.[17] The trend reflects a leveling off in the average duration of outage events on Avista's system. In 2021, the average duration of outages remained relatively flat with the duration in 2020. While this trend may appear to conflict with the trend for CAIDI shown above in Figure 3, this measure considers only the average of outage duration times and does not include the total number of customers or number of customers associated with the outages, and therefore is not an index value.[18]

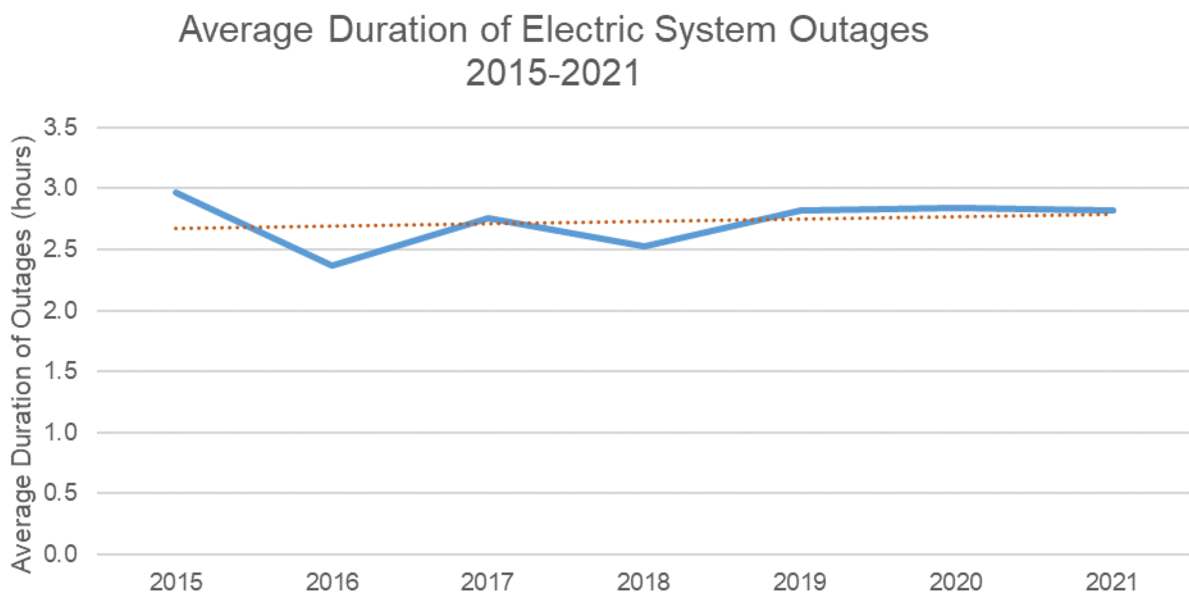

Figure 4: Average Outage Duration 2015-2021

Average Number of Affected Customers per Outage Event

Figure 5 below shows the average number of affected customers per outage event on Avista's electric system for the seven-year period of 2015-2021, including the linear trend.[19] The trend shows an increase in 2021 in the average number of customers affected per outage event on Avista's system. The increase in 2021 was a result of planned outages to address underperforming feeders, trailing impact of weather events (MEDs) and more "dry land outages" than in a typical year. Some of the activities in 2021 to improve feeders included efforts to improve fuse coordination on feeders and laterals, install midline reclosers on feeders of all types, and implement feeder automation and communications with Fault Detection Isolation and Restoration (FDIR) and other Distribution Management System (DMS) capabilities.

[17] Excluding Major Event Days.

[18] Avista understands this trend in reduced outage duration is likely the result of the increasing number of outage events associated with maintenance and upgrades on the Company's system. These planned outages typically involve a small number of customers and short in duration, such that they serve to reduce the overall average duration for outages of all causes.

[19] Excluding Major Event Days.

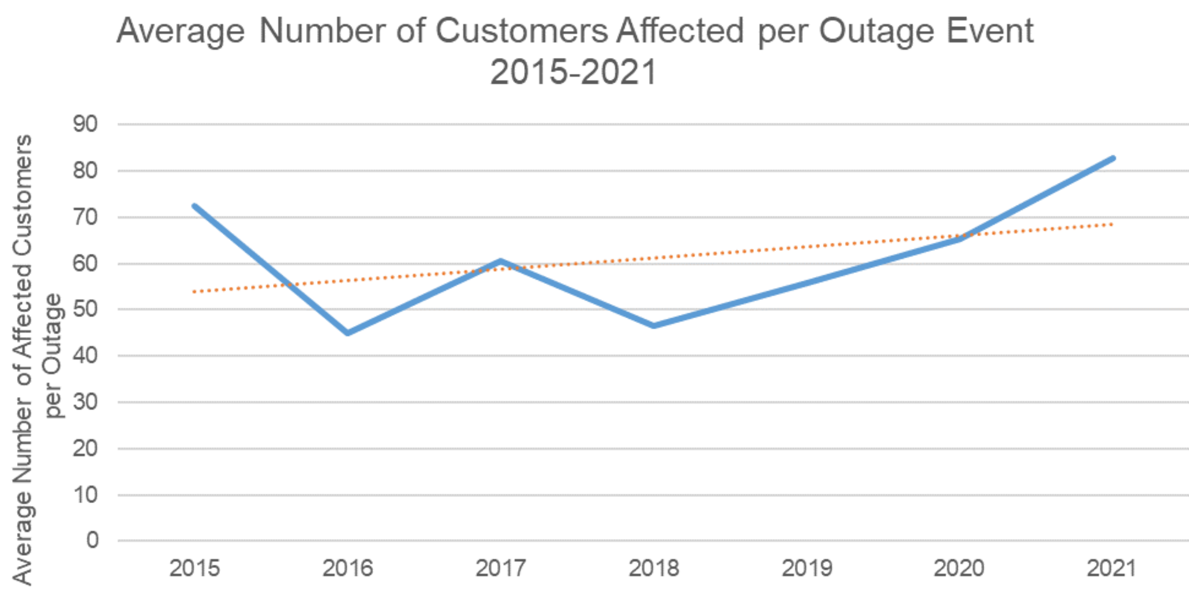

Figure 5: Average Number of Customers Affected per Outage Event 2015-2021

Number of Outage Events

Figure 6 below shows the number of outage events on Avista's system for the seven-year period of 2015-2021, including the linear trend.[20] The results for 2021 show an uptick in outages due to the aforementioned "dry land" days, impact of trailing weather events, planned outages to improve the distribution system, as well as a wind event that occurred in 2021. Even with the 2021's uptick, the number of outages in 2021 was below the peak in 2017 and this metric is stable as evidenced by the linear trend for the 7-year period. As in recent prior years, one of the leading factors driving an increase in the number of outage events is the amount of planned maintenance and construction work being performed on Avista's system.

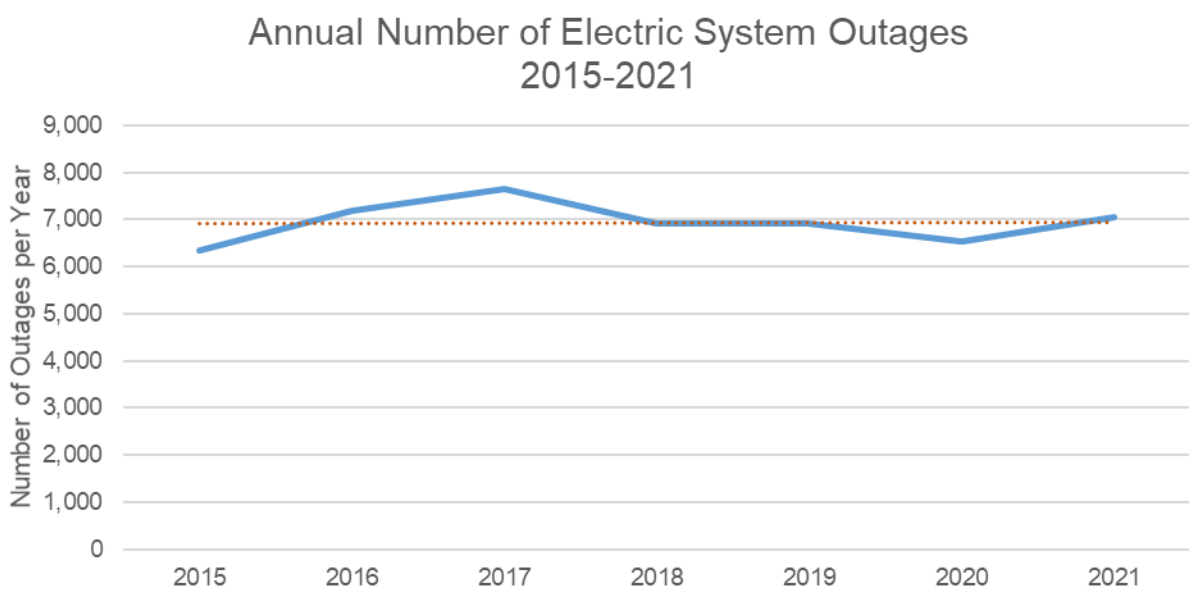

Figure 6: Annual Number of Outage Events 2015-2021

[20] Excluding Major Event Days.

Customer Outage Hours

Figure 7 below shows the number of customer outage hours on Avista's system for the seven-year period of 2015-2021, including the linear trend.[21] The consistent results for 2018, 2019 and 2020, offset the 2021 increase, resulting in the overall trend for this seven-year reporting period remaining flat, as shown by the linear trend. The formulas for calculation of the number of outages (SAIDI) and outage restoration time (CAIDI) share the same numerator, which is the number of customer outage hours. The number of outages and the duration of these outages impact the customer outage hours metric. Both these factors are discussed briefly in the sections below.

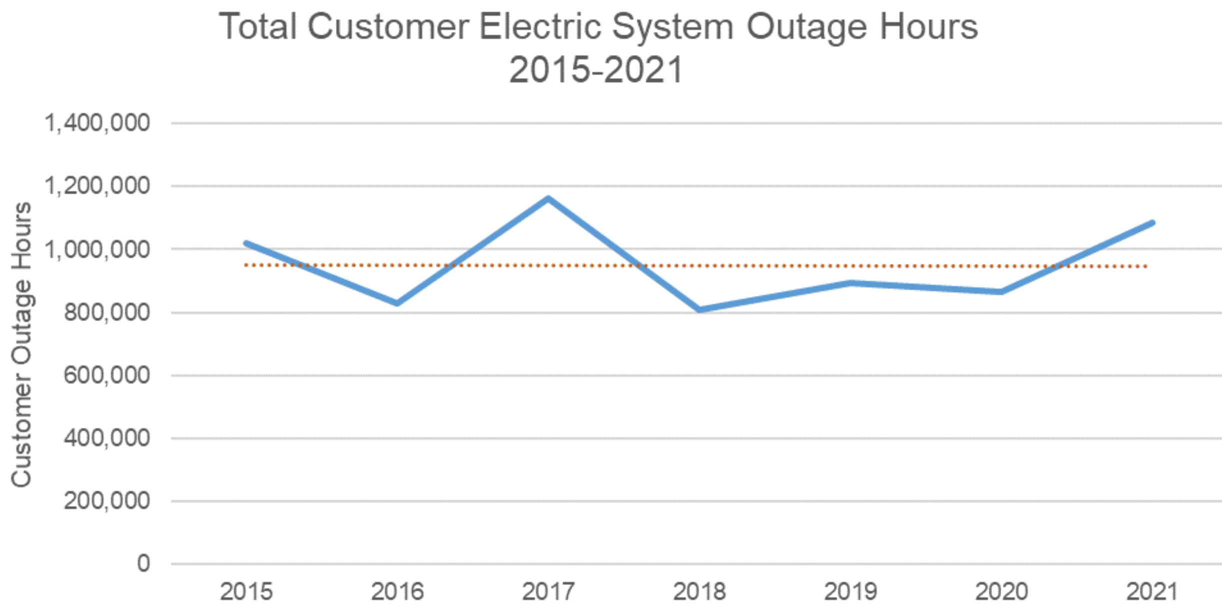

Figure 7: Total Customer Outage Hours 2015-2021

[21] Excluding Major Event Days.

Analysis of System Reliability Measures by Feeder Classification

Classification of Feeders by Customer Density

Following the evaluation of the system reliability measures presented previously, summary statistics for the electric system segmented into urban, suburban, and rural feeders is shown in Table 3 below.[22]

Feeder Classification	Customer Distribution	Energy Consumption	Contribution to Customer Outage Hours	Contribution to Number of Outage Events
Urban	11.6%	8.8%	3.6%	6.4%
Suburban	54.4%	46.4%	23.5%	34.3%
Rural	34.0%	44.8%	72.9%	59.3%

Table 3: Summary Comparison of Feeder Data, Outage Hours, and Outage Events[23]

This summary data provides insight as to the unique characteristics and diversity of Avista's service territory. While customers on suburban feeders represent more than half the service population for Avista, this group experiences just 34% of the outage events. Conversely, customers on rural feeders represent just of one-third of the customer base but experience almost 59% of the outage events. These summary characteristics also highlight:

- Customer outage hours on rural feeders account for nearly 73% of the system total, despite accounting for only 34% of the customer base.
- Customers on a suburban feeder accounted for 24% of total outage hours compared to just 3.6% for the urban customers.

SAIFI by Feeder Type

The system-level trend for this reliability measure, as shown above in Figure 1, after several years of improvement, decreased in 2021. Again, this was attributable to the additional "dry land" days, increased number of planned outages and trailing wind event impacts. Figure 8 below shows that despite the increase in 2021 for both rural and suburban feeders the trend lines remained relatively flat. Urban feeders in 2021 remained relatively consistent with the prior years' results.

[22] Avista's feeder classification is based on customer density per feeder mile: Urban is more than 150 customers per mile, Suburban is between 50 and 150 customers per mile, and Rural is less than 50 customers per mile.

[23] Results for this table are based on number of customers and electricity consumption in 2021, and their contribution to customer outage hours and number of outage events for the 2015-2021 period.

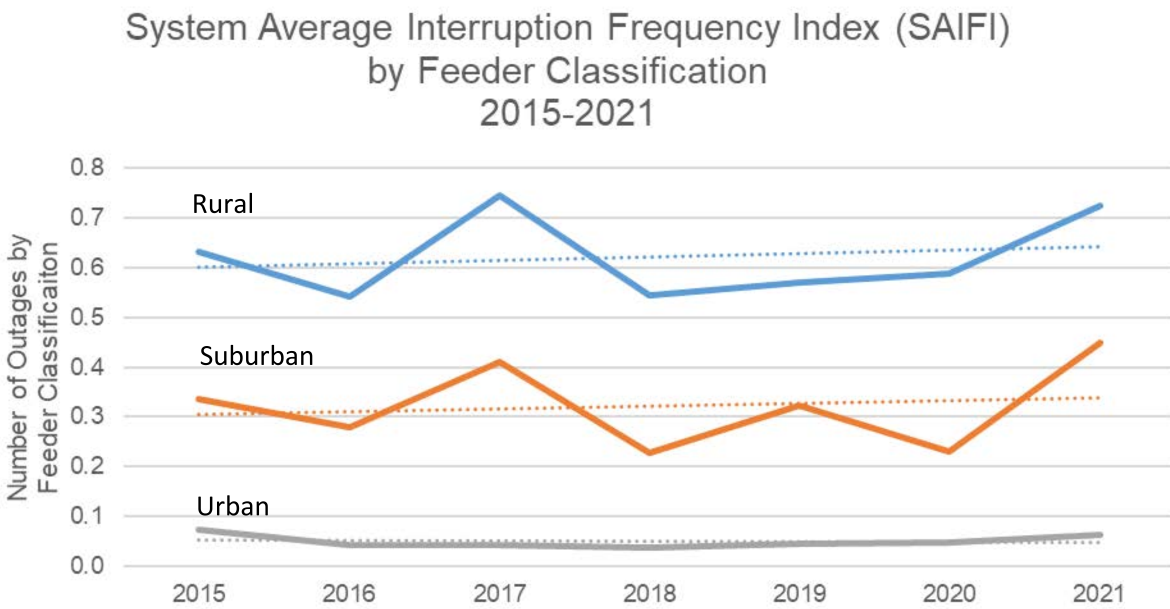

Figure 8: SAIFI by Feeder Classification 2015-2021

SAIDI by Feeder Type

The system-level trend for this reliability measure, as shown above in Figure 2, reflects continuing improvement in reliability performance over this seven-year reporting period. After several years of decreasing SAIDI, the last 2 years have seen an increase in rural feeders and now suburban, yet the trend line continued its downward path. Results for the remaining feeder classifications, shown in Figure 9 below, indicate a relatively flat trend.

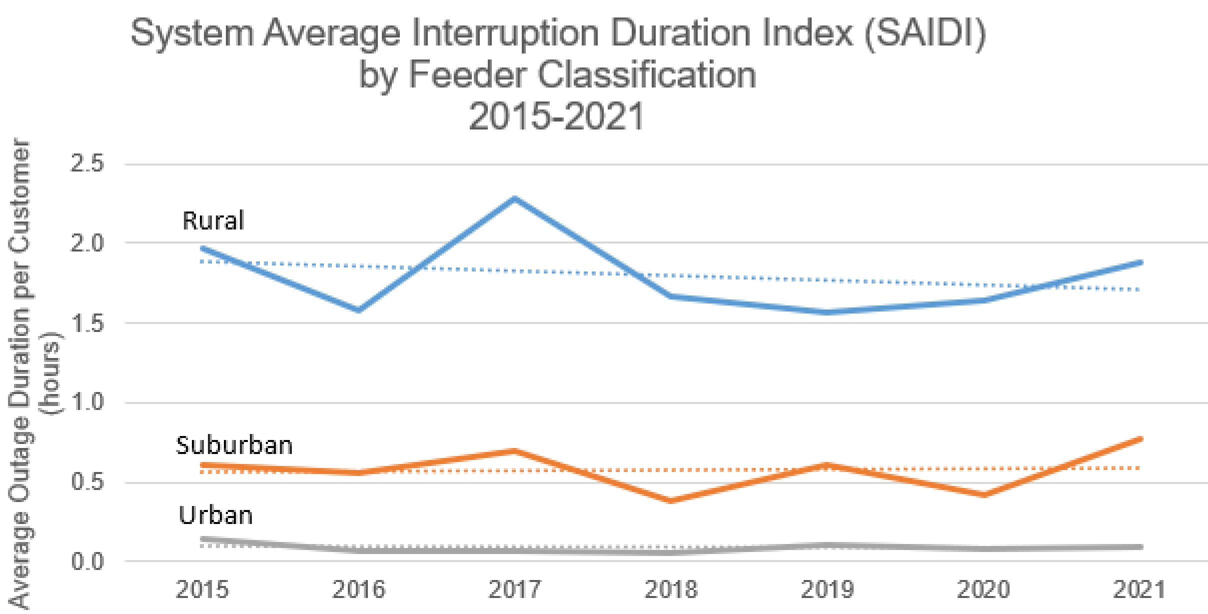

Figure 9: SAIDI by Feeder Classification 2015-2021

CAIDI by Feeder Type

The system-level trend for this reliability measure, as shown above in Figure 3, reflects a slight decrease in outage restoration time for Avista's customers who experience an outage. Reported by feeder classification in Figure 10 below, this index shows slightly decreasing trends for urban, suburban, and rural feeders. The trend for rural feeders, as well as the suburban and urban feeders, appeared in line with the current seven-year average where the trend is decreasing. These results show a continuing pattern where the contribution of outage events on rural feeders is largely driving the overall system performance toward a modest improvement in reliability for this index.

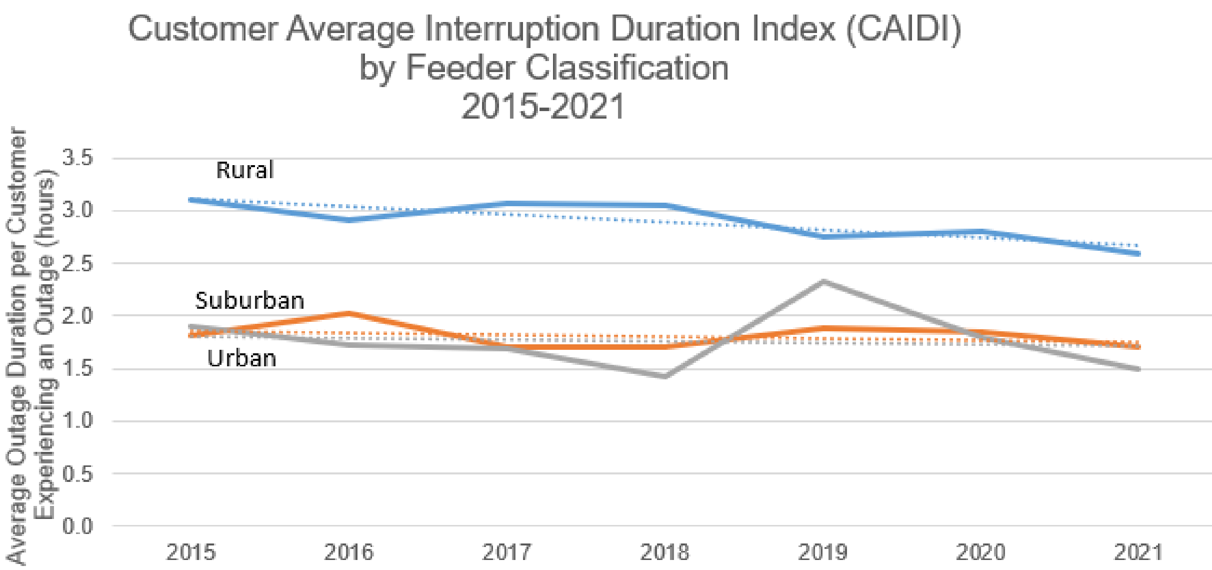

Figure 10: CAIDI by Feeder Classification 2015-2021

Average Outage Duration Time by Feeder Type

While the system average for annual outage duration has leveled out, as shown above in Figure 4, the results by feeder classification shown below in Figure 11 demonstrate that the system trend is being driven mostly by improvements in urban and rural feeders. Suburban feeders are seeing an increasing trend.

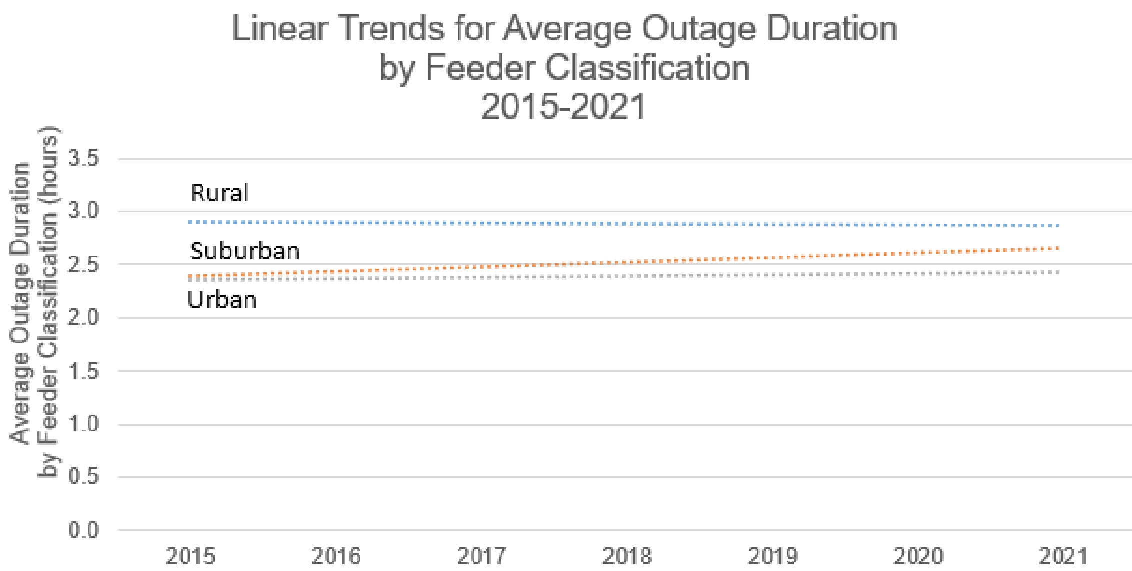

Figure 11: Linear Trend for Average Outage Duration by Feeder Classification 2015-2021

Average Number of Affected Customers per Outage Event by Feeder Type

The system average number of affected customers spiked upwards in 2021 as shown above in Figure 5, and Figure 12 below. The increase was primarily driven by the rural and suburban feeders, as shown in Figure 12. Urban feeders also experienced an increase but at a much slighter level. These results, as discussed above, reflect the impact of weather events, mitigation efforts such as "dry land" days, and an increased number of planned outages in-line with the Company's efforts to reduce the impact of sustained outage events on customers across its system.

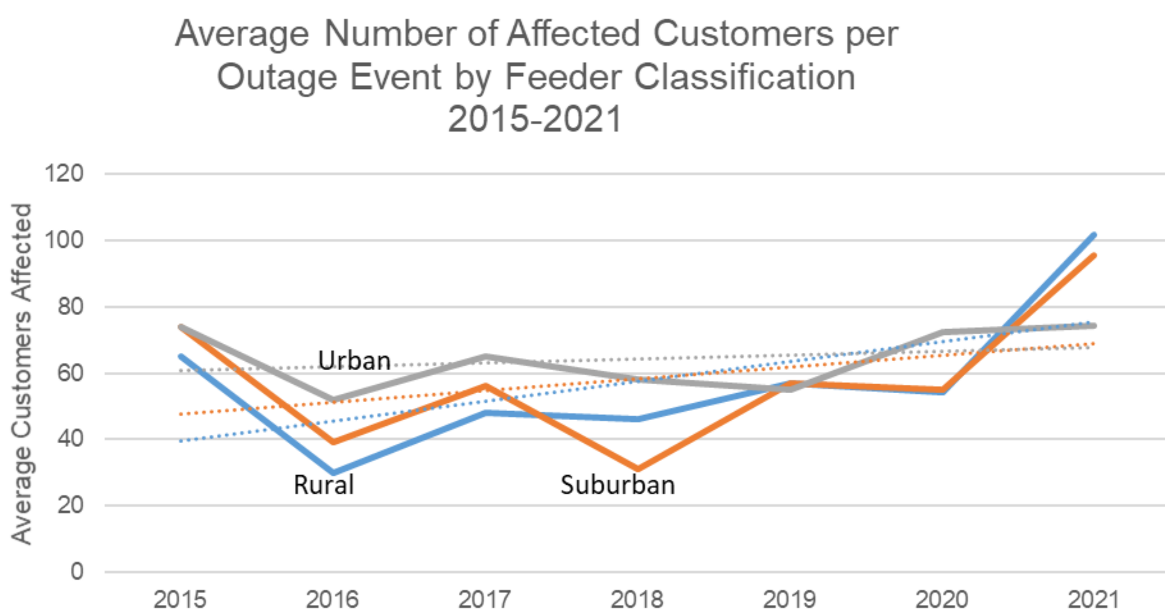

Figure 12: Average Number of Affected Customers per Outage Event by Feeder Classification 2015-2021

Number of Outage Events by Feeder Type

In Figure 6 above, for number of outage events on the Company's electric system, the results showed a levelization in the linear trend over the seven-year period. Breaking down these events by feeder classification, shown in Figure 13 below, shows the disparity in annual outages among feeder types. The number of outage events on suburban and urban feeders has seen a decrease in its overall trend line, despite the slight uptick in suburban outages in 2021. Rural feeders continue the upward trend, enhanced by the increase in 2021 outages. The results also show the much greater contribution of outage events associated with our rural feeders, which accounted for approximately 59% of outages in 2021.

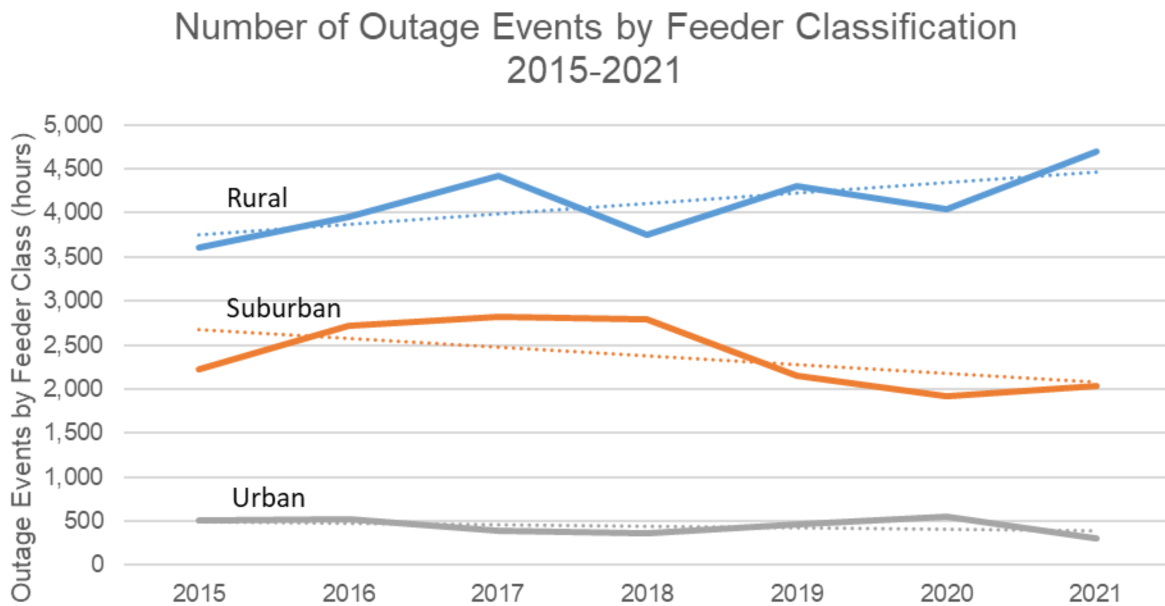

Figure 13: Number of Outage Events by Feeder Classification 2015-2021

Customer Outage Hours by Feeder Type

Figure 7 above shows that the total number of customer outage hours on the Company's electric system remained level over the current seven-year period. Based on the data shown in Figure 14 below, the contribution of outage hours by feeder classification, demonstrates that all feeders over the seven-year period remained flat or decreased slightly. As discussed above, rural feeders accounted for nearly 73% of total outage hours in the current seven-year period. While prior reports showed a growing difference between the combined urban and suburban feeders to the rural feeders over time, the difference in the trends has moderated while the magnitude of comparative outage hours remains significant.

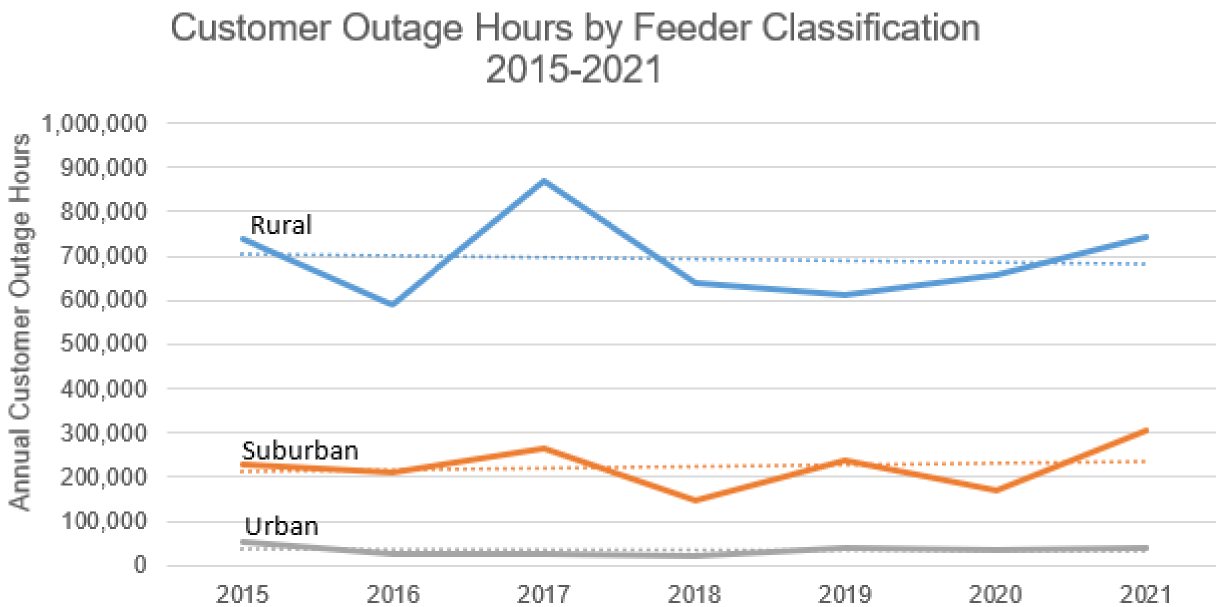

Figure 14: Customer Outage Hours by Feeder Classification 2015-2021

Overall Service Reliability by Feeder Type

Service Reliability on Urban Feeders

The Company's urban feeders serve approximately 12% of Avista's electric customers and generally provide very high levels of service reliability, having approximately 4% of the total customer outage hours and 6% of total outage events. As shown in Table 4 below, of the seven key measures for urban feeders included in this Report, four are at a comparative "*Very Low*" range for Avista's reliability results and two are in a "*Moderate"* range with one considered "*High"* (CAIDI). The trending results over the seven-year reporting period are considered stable, except for the measures addressing the *Average Number of Affected Customers,* which is increasing, and the decreasing *Number of Outage Events per Year.*

Reliability Measure	Range	Trend
System Average Interruption Frequency Index (SAIFI)	Very Low	Stable
System Average Interruption Duration Index (SAIDI)	Very Low	Stable
Customer Average Interruption Duration Index (CAIDI)	High	Stable
Average Duration of Outages	Moderate	Stable
Average Number of Affected Customers per Outage	Moderate	Increasing
Number of Outage Events per Year	Very Low	Decreasing
Total Customer Outage Hours	Very Low	Stable

Table 4: Key Reliability Trends for Urban Feeders, 2015-2021

Service Reliability on Suburban Feeders

The Company's suburban feeders serve approximately 54% of Avista's electric customers and, like the urban feeders discussed above, have historically provided very high levels of service reliability. Customers served by suburban feeders experience approximately 34% of total outage events but account for only about 24% of the total customer outage hours. Of the seven key measures for suburban feeders shown in Table 5 below, 5 are in the range of "*Low"* to "*Moderate"* relative to Avista's comparative range of reliability performance. SAIDI and *Average Number of Affected Customers per Outage* are in the "*High"* range. Three of the measures are on an increasing trend with the remaining four stable or decreasing over the seven-year reporting period. The trend for *Average Number of Affected Customers per Outage* is increasing, a product of, among other items, increased planned outages to improve the feeder system.

Reliability Measure	Range	Trend
System Average Interruption Frequency Index (SAIFI)	High	Increasing
System Average Interruption Duration Index (SAIDI)	Moderate	Stable
Customer Average Interruption Duration Index (CAIDI)	Low	Stable
Average Duration of Outages	Moderate	Increasing
Average Number of Affected Customers per Outage	High	Increasing
Number of Outage Events per Year	Moderate	Decreasing
Total Customer Outage Hours	Moderate	Stable

Table 5: Key Reliability Trends for Suburban Feeders, 2015-2021

Service Reliability on Rural Feeders

Avista's rural feeders serve 34% of Avista's electric customers, however these customers experience approximately 59% of the total outage events and nearly 73% of the total customer outage hours. Reliability performance on these rural feeders, while reasonable for the remote locations served and difficult conditions encountered, has historically been in the "*High"* end of the range of Avista's comparative range of reliability results as shown in Table 6. One of the measures, *Average Number of Affected Customers per*

Outage, is typically in the same range as that measurement for urban and suburban feeders, increased to "*High"* for 2021. From a trending perspective, five of the seven measures are increasing or stable, with the performance of CAIDI and SAIDI improving for 2021. As noted above, the magnitude of difference in outage events and customer outage hours between the rural feeders and the combined urban and suburban feeders asserts significant influence on Avista's system-level results for these measures.

The average duration of outages remained stable on Avista's rural feeders, as well the CAIDI trend improved as the duration of the outages was shorter than in prior years. The trend for the total customer outage hours metric was stable, a favorable impact of the increase in planned outages to improve the stability of the system.

Reliability Measure	Range	Trend
System Average Interruption Frequency Index (SAIFI)	High	Increasing
System Average Interruption Duration Index (SAIDI)	High	Decreasing
Customer Average Interruption Duration Index (CAIDI)	Low	Decreasing
Average Duration of Outages	Moderate	Stable
Average Number of Affected Customers per Outage	High	Increasing
Number of Outage Events per Year	High	Increasing
Total Customer Outage Hours	High	Stable

Table 6: Key Reliability Trends for Avista's Rural Feeders, 2015-2021

Service Reliability of Avista's Rural Feeders

Customer Outage Hours for Rural Feeders

In the previous reporting period, the Company's rural feeders experienced an increase in outage hours of approximately 85,000 customer outage hours compared to approximately 46,000 in 2020. The bulk of the increase was attributable to planned outages that increased 59,000 in 2021. For the 2015-2021 time period, this equates to a 149,000 increase in outage hours, with the two largest contributing components being planned outages (70k hours) and weather (77k hours). There were also improvements in equipment failures that offset some of these increases. Table 7 below shows the average rates of change for the top 12 causes, and the net change contribution to the slight increase of annual average customer outage hours.

Outage Cause Category	2014-2020 (hours)	2015-2021 (hours)	Change (hours/year)
Tree Intrusion	643,711	672,124	28,414
Undetermined	420,197	452,501	32,304
Public	433,464	425,532	-7,932
Weather	1,270,787	1,348,239	77,452
Pole Fire	353,713	345,232	-8,480
Miscellaneous	5,238	8,174	2,936
Company Operations	23,394	28,555	5,162
Underground Equipment	63,148	52,328	-10,820
Animal Intrusion	164,457	161,793	-2,663
Overhead Equipment	576,847	544,351	-32,497
Substation Equipment	67,846	62,540	-5,307
Planned Operations	684,412	754,942	70,529
Total	4,707,214	4,856,312	149,098

Table 7: Average Annual Change in Customer Outage Hours by Cause for Rural Feeders, 2015-2021

Consistent with previous comments, this assessment points to increasing outage impacts and customer outage hours from factors external to Avista's control, including weather, tree interference and public events such as car-hit pole. Avista's own work to improve the condition of these feeders continues to focus on minimizing requisite interruptions to the customer. Investments made in the system are having the effect of slightly reducing the customer outage hours associated with both underground and overhead equipment as well as substation equipment failures. The ongoing maintenance and upgrade work being performed by the Company on its rural feeders should continue to positively influence this data in subsequent periods.

The top twelve reasons contributing to customer outage hours on Avista's rural feeders are shown in Figure 15 below.

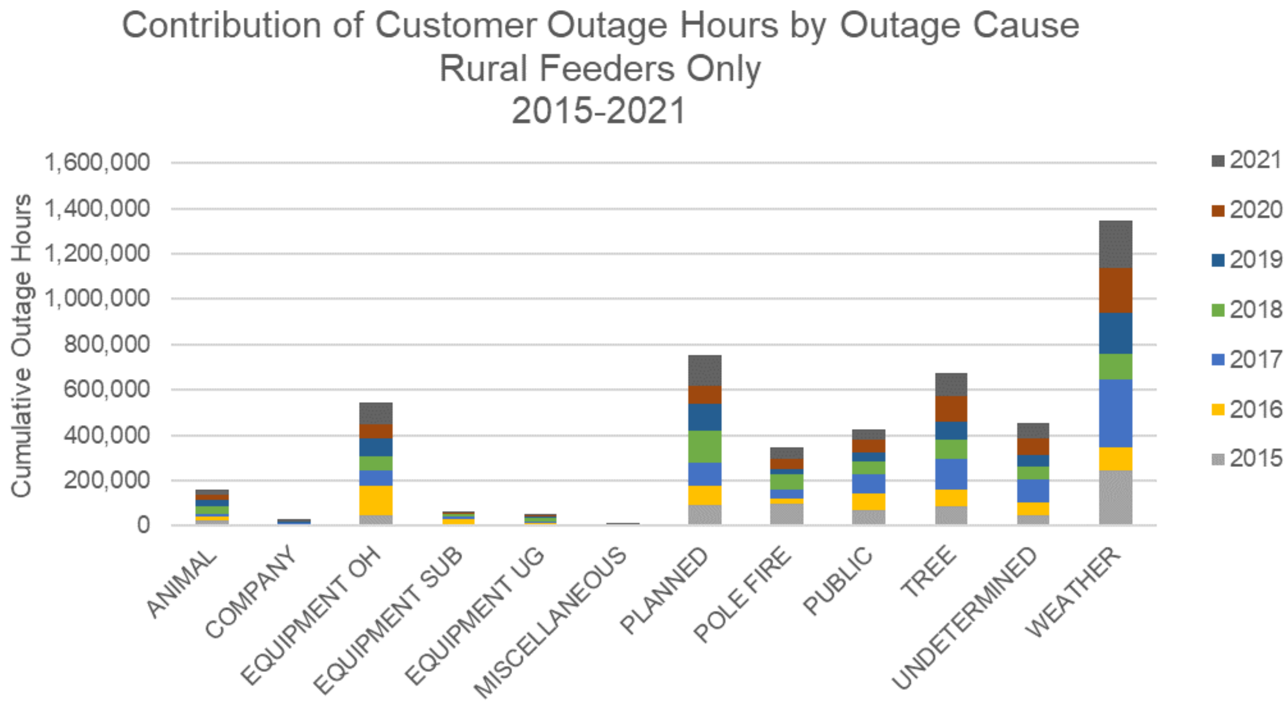

Figure 15: Contribution to Customer Outage Hours by Outage Cause on Rural Feeders, 2015-2021

As is typical on Avista's electric system, weather-related outages continue to be the leading contributor to customer outage hours on rural feeders, contributing more than 1.3 million hours over the seven-year period from 2015-2021. The second leading cause is Avista's planned maintenance and upgrade activities that contributed over 750,000 outage hours, an increase of approximately 71,000 hours from the prior year's Report. The remaining causes of outages, in order of contribution, include tree intrusion, overhead equipment failure, undetermined events, public events such as car-hit pole, pole fires, animal intrusions, substation equipment, underground equipment, Company activities, and finally, miscellaneous outages.

Feeders with Greatest Service Reliability Challenges

For the purposes of this limited discussion, the top ten feeders defined on Avista's system that have faced the greatest reliability challenges in the current reporting period, based on five of the reliability measures discussed above for the same seven-year reporting period, are listed in Table 8. In addition, a five-year trend in outage events on these feeders is included. The individual feeders are listed by the code abbreviations Avista uses as a naming convention for feeders in its system, with the first three characters in each label signifying the originating substation for the feeder.

System Average Interruption Frequency Index (SAIFI)	System Average Interruption Duration Index (SAIDI)	Customer Average Interruption Duration (CAIDI)	Total Customer Outage Hours	Annual Number of Outage Events	Five-year Trend in Outage Events
CLV34F1	CLV34F1	GRV1273	CLV34F1	CLV34F1	CLV34F1
STM633	GRV1273	GIF34F2	GRV1273	STM633	STM633
GIF34F1	GIF34F1	WEI1289	GIF34F1	ORI12F3	ORI12F3
GRV1273	STM633	SPI12F2	STM633	GIF34F2	GIF34F2
STM631	GIF34F2	GIF34F1	GIF34F2	GIF34F1	GIF34F1
ORI12F3	ORI12F3	KET12F2	ORI12F3	STM631	VAL12F1
GIF34F2	WEI1289	WAL543	WEI1289	CHW12F3	CHW12F3
SPI12F1	STM631	ORI12F1	STM631	VAL12F1	STM631
DER651	SPI12F1	ORI12F3	SPI12F1	RAT233	RAT233
ODN731	BLU321	BLU321	BLU321	BLU321	BLU321

Table 8: Top Ten Most Challenging Feeders by Reliability Measure

When considering the implications of feeders on these lists of reliability measures, the frequency of inclusion provides significant awareness for opportunities to improve the performance of those feeders. For instance, GIF34F1, GIF34F2 and ORI12F3 all appear in each of the six categories listed. Similarly, there are four feeders that are included in five of the categories, namely CLV34F1, STM633, STM631, and BLU321. Since the increase in outage events on rural feeders has been a key contributor to customer outage hours, that reliability measure is also included. Evaluating feeders by this measure resulted in the addition of a new feeder BLU321 with MLN12F1 dropping off. Sorting the rural feeders by the five-year trend in outage events introduced, again BLU321 with ARD12F2 falling off the list.

Considering the measure for customer outage hours, the cumulative outage hours for the 2014-2020 Report timeframe are calculated for the top ten most challenging feeders by outage reason or cause and shown in Figure 16 below.

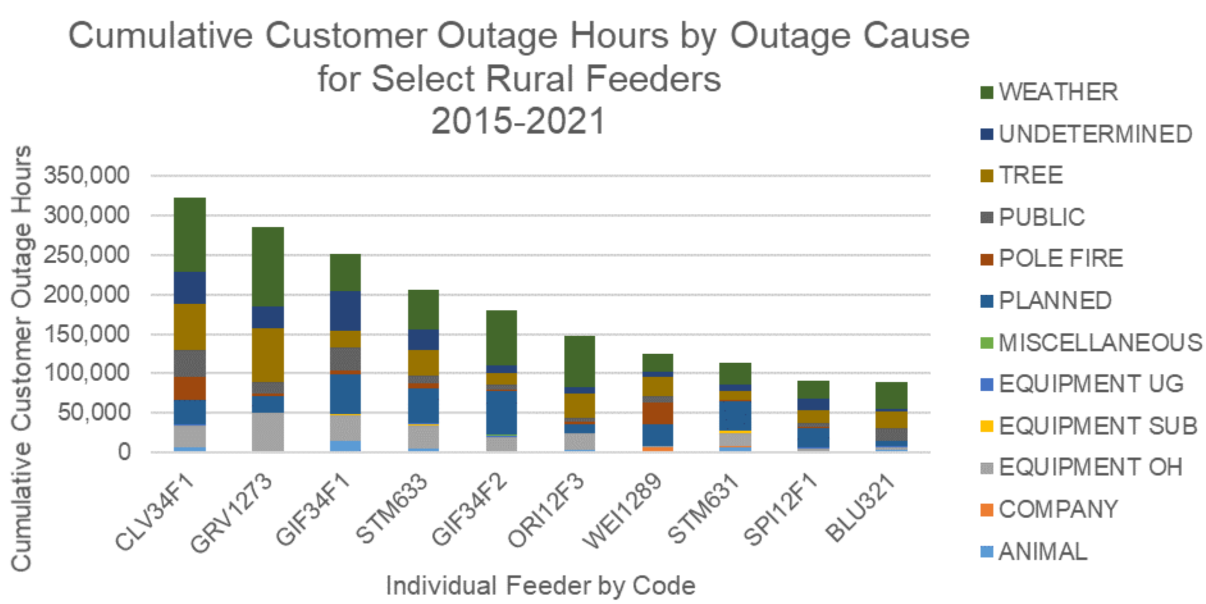

Figure 16: Cumulative Outage Hours by Feeder and Outage Cause, 2015-2021

Depending on the reliability objectives being pursued and the reliability measure determined to be important, this analysis may be useful in identifying the types of programs that could be effective in order to improve targeted performance.

Summary of Investments in Rural Feeders in 2021

Avista engineering and operations staff, apart from our ongoing Asset Maintenance programs,[24] are continuously evaluating opportunities to maintain the overall performance of the Company's rural feeders. These include specific investments that have the benefit of improving the service reliability of poorly performing circuits. Among these programs are Grid Modernization, Failed Plant and Operations, Feeder Tie and Reconductor, and Feeder Minor Rebuild. A brief summary of the program investments made in 2021 is provided in Table 9 below. In addition to the projects listed below, more than 30 Asset Replacement projects were completed, upgrading poles and equipment on portions of other rural feeders.

Feeder	Key Objectives	Work Performed	Investment
COB12F1	Reduce loading on COB12F1 which is hitting 93% of equipment rating during peak summer loading. Add Line Recloser to have acceptable margin for fault detection.	Added Viper Line Recloser, added Air Switch, and connected jumper from Buck Corner to transfer portion of COB12F1 onto COB 12F2. Performed switching to transfer portion of COB12F1 onto MLN12F2 by moving Normal Open location between feeders.	$63,000
INT12F2-DEP12F1	Eliminate voltage exceptions on INT12F2 and DEP12F1. Improve feeder fault detection and isolation for faults that occur on feeder. Balance loading on the feeders for less power losses. Improve feeder protective device coordination.	Added four sets of Line Voltage Regulators, added Viper Line Recloser, added two Air Switches, tapped laterals to balance section loading on feeder, resized fuses for successful fuse coordination.	$532,000
LIB12F2-LIB12F4	Add tie line to accommodate two 2.4MW load additions in Liberty Lake.	Install 6000 feet of 600A UG trunk cable to offload portion of LIB12F4 and to accommodate new load additions in Liberty Lake area.	$509,000
SPL361	Bay Crossing Conversion	Convert exiting 1300 feet of overhead primary crossing to underwater cable on south side of Spirit Lake. The existing overhead crossing often goes down during winter, impacting customer reliability and worker safety to restore.	$100,000
CKF711-ODN732	Three new Viper reclosers	Replace ODN732 Trestle Creek regulators with new Smart Regulators. Install new smart viper switches ZC4S86R & Z4S60R to replace existing air switches. Replace recloser 4S61 with smart viper recloser Z4S61R. This will allow for better feeder protection and allow for remote distribution switching capability through the DMS.	$260,000

[24] Avista's Asset Maintenance programs include Wood Pole Management, Vegetation Management, Street Lighting, and Overhead Transformer Changeout.

Feeder	Key Objectives	Work Performed	Investment
WAL543	Reconductor #6 Crapo	Reconductor two miles of #6 Crapo to improve voltage, improve fault detection, and reduce losses on the WAL543 feeder in the Pritchard area. First year of a multi-year project to remove #6 Crapo wire from this feeder	$265,000
WAL542	Remove overhead wire	Relocate/convert 3-ph line to be 4/0CN15 URD in Yellowstone Roadway. This is the feed to Lookout Pass. This will allow for eliminating a problematic section of overhead line and will allow for improved fuse coordination.	$110,000
BLU321	Overhead to Underground Conversion	Convert 1ph OH 6A/4ACSR to underground along Blue Creek Road. Cascade Cable to plow in about 3900ft of direct buried #1-15kv primary cable. Set JE1 near Dry Creek crossing. Conduit installed under creek. Hwy district will change out the culvert in future. Install new primary riser poles at both ends.	$64,000
COT2402	Install recloser	Installed 3 Phase Kyle OCR on Sandspur Road to replace fuses. Area is prone to "Unknown Cause" outages, many of which should be reduced to momentary outages by installing this Recloser	$32,000
CRG1261	Line rebuilds	Replaced approximately 3500 ft. of deteriorated 4cu conductor with new 2/0 ACSR, and replaced most of the poles to improve reliability	$75,000
NLW1222-LM41530 Tie	Intertie	Multi-year project to establish a tie between NLW1222 and LMR1530. There are currently no ties from North Lewiston to any other circuits. A span across the Clearwater River was completed in 2019, a connection to NLW1222 on the north side, and some work on the south side was done in 2020, and the remaining work on the south side of the river will be completed in 2021.	$150,000
POT321	Conductor replacement	Replaced approximately 750ft of overhead conductor above a playground with underground conductor, improving safety and reliability.	$89,000
LEO611	Conductor replacement	Replace approximately 6,200 feet of deteriorated single phase 6cu conductor and poles on Martinson Road with 1CN15 underground cable to improve reliability	$75,000

Feeder	Key Objectives	Work Performed	Investment
MIS431	Grid Modernization feeder rebuild to achieve multiple objectives.	Application of Avista's ongoing Grid Modernization Program to replace assets based on end of life, manage capacity issues and long-term O&M costs, and to improve service reliability.	$903,800
SPR761	Grid Modernization feeder rebuild to achieve multiple objectives.	Application of Avista's ongoing Grid Modernization Program to replace assets based on end of life, manage capacity issues and long-term O&M costs, and to improve service reliability.	$2,277,112
MIS431	Grid Modernization automation installations	Installed a viper recloser, a viper tie switch, and a Kyle recloser	$132,142
COT2401, COT2402	Grid Hardening feeder reducing wildfire hazards and impact in elevated areas of risk	Application of Avista's ongoing Grid Hardening Program to address and mitigate the risk and impact of wildfire while also accomplishing improvements to protection equipment coordination.	$1,601,649
SPR761, EWN241, LAT421, ROK451	Grid Hardening feeder reducing wildfire hazards and impact in elevated areas of risk	Application of Avista's ongoing Grid Hardening Program to address and mitigate the risk and impact of wildfire while also accomplishing improvements to protection equipment coordination.	$1,513,271
BIG412	Underground Conversion	Relocate 3800' of BIG412 feeder trunk to a new location adjacent to the Trail of the CDA between Big Creek and Osburn. Approx. 1400' will be 3-556AAC and the remaining will be 2500' will be UG 350CN15 in the trail R/W.	$290,214
STM631/STM633	Rebuild Double circuit	Rebuild/reconductor 4800' of double circuit overhead feeder line (STM631/STM633) that leaves the St. Maries sub and heads to east to the St. Joe River Road. New wire will be 556AAC for both feeders.	$786,745
OGA611	Extend trunk toward Carlin Bay	Rebuild/Reconductor 6500' of 2PH #4ACSR to 3PH 556AAC. This will support continued load growth in the area, including the Carlin Bay Lodge expansion. Also, this work is required to support the future Carlin Bay Sub. Year 1 of multi-year.	$545,963
BLU321	Turner Bay Regulator	Replace existing midline voltage regulator bank at Turner Bay with a new smart regulator bank, ZC953V. The smart regs will allow for monitoring loading and performance at the end of the BLU321 feeder that feeds Carlin Bay.	$97,522
BLU321	Add 3rd phase toward Carlin Bay	Add a 3rd phase to an existing 2-ph line for approximately 1.25 miles near the far end of the BLU321 feeder.	$27,179

Feeder	Key Objectives	Work Performed	Investment
WAL543	Repair Golconda Crash	Install 1200' of 3-3" conduit & 3-350CN15 cable to replace storm damaged overhead line with new underground line in same right-of-way. Remove 4 old poles, replace 1 old pole (w/ 45PCL1), and install 1 new pole (45PCL1).	$43,025
PRV751	Saddler Creek Cable Replacement	Install 6600 ft of conduit and 7000 ft of 1CN25 and 8 JE1's to replace old faulting direct bury cable.	$103,374
FOR12F1	Reconductoring	2 mile stretch of reconductoring for FOR12F1 leading to a strong tie with L1312F1 to improve reliability on both feeders	$450,000
SUN12F2	Reconductor & Create Tie to Increase Trunk Capacity (Heat Wave)	Convert / Reconductor 0.8mi of Single-Phase #4ACSR to Three-Phase 556AAC (along Abbott Rd), Add 2-Switches (96% SVL Mitigation)	$293,000
GRA12F1	Create Feeder Tie across I-90	Henry Rd Overpass (Add conduit and vaults in preparation for 600A underground tie).	$336,000
GLN12F2 - SE12F6	Unload at Capacity Feeder (Heat Wave)	Convert Single to Double Circuit 556AAC trunk for 1600ft (along 57th, Freya to Palouse Hwy), Add two Air Switches.	$173,000
COB12F1	Unload at Capacity Feeder & Provide for Fault Detection	Completed work to add Z713R Viper for fault protection, Add Air Switch, and Re-Jumper Buck Corner (93% SVL Mitigation)	$17,000
INT12F2 - DEP12F1	Create Tie between Feeders, Provide Voltage Support during Emergency Switching	Completed work started in 2020 to add 4 sets of Voltage Regulators, one Viper Recloser, and 2 Switches. Performed Load Balancing, updated Fusing for coordination, and reconductored 800ft of 1/0STCU to 556AAC.	$35,000
MIL12F2 - MIL12F3	Create Tie to Northwoods	Added conduit and vaults in preparation for 600A underground tie.	$37,000
LIB12F2 - LIB12F4	Unload at Capacity Feeder, Route Available Feeder Capacity to Growing Load	Completed work started in 2020 to construct 600A underground tie down Appleway in Liberty Lake (4800ft of 1000CN15AL).	$116,000
DRY1209	Recloser	Add new recloser to improve reliability	$65,000
GRV1273	Cable replacement	Replacing old inaccessible overhead line with new underground cable.	$250,000
LAT422	Underground rebuild	Replaced old overhead line with new underground cable.	$35,857
LMR1530-NLW1222	New tie	Completed new tie line to improve reliability through operational flexibility.	$48,504
M15514	Recloser	Added new recloser to improve reliability.	$10,000

Table 9: Brief Summary of Feeder Investments in 2021

Appendices

Appendix A - Definitions

Baseline reliability statistic - Avista will compare its reliability statistics to the year 2005.

Commission Complaint - When a customer is not satisfied with the Company as it relates to electric reliability and files a complaint directly with the Commission.

Customer Complaint - When a customer is not satisfied with the Company as it relates to electric reliability and makes a complaint directly to a Company representative.

Electric Service Reliability - The continuity of electric service experienced by retail customers.

Electric System Reliability Reporting Requirements - The minimum reporting requirements are as follows:

> *(1) The report must be consistent with the electric service reliability monitoring and reporting plan filed under WAC 480-100-393. As set forth in the plan, in an identified year, baseline reliability statistics must be established and reported. In subsequent years, new reliability statistics must be compared to the baseline reliability statistics and to reliability statistics from all intervening years. The utility must maintain historical reliability information necessary to show trends for a minimum of seven years.*
>
> *(2) The report must address any changes that the utility may make in the collection of data and calculation of reliability information after initial baselines are set. The utility must explain why the changes occurred and explain how the change is expected to affect comparisons of the newer and older information. Additionally, to the extent practical, the utility must quantify the effect of such changes on the comparability of new reliability statistics to baseline reliability statistics.*
>
> *(3) The report must identify the utility's geographic areas of greatest reliability concern, explain their causes, and explain how the utility plans to address them.*
>
> *(4) The report must identify the total number of customer complaints about reliability and power quality made to the utility during the year and must distinguish between complaints about sustained interruptions and power quality. The report must also identify complaints that were made about major events.*

Full-system - All equipment and lines necessary to serve retail customers whether for the purpose of generation, transmission, distribution, or individual service.

Interruption Cause Code - Used to describe the cause of an interruption (i.e., animal, tree, public, etc.).

Major Event - Designates an event that exceeds reasonable design and or operation limits of the electric power system. A Major Event includes at least one Major Event Day (MED).

Major Event Day - A day in which the daily system SAIDI exceeds a threshold value, T_{MED}. For the purposes of calculating daily system SAIDI, any interruption that spans multiple calendar days is accrued to the day on which the interruption began. Statistically, days having a daily system SAIDI greater than T_{MED} are days on which the energy delivery system experienced stresses beyond that normally expected (such as severe weather). Activities that occur on major event days should be separately analyzed and reported.

Momentary Event Interruption - An interruption of duration five minutes or less. Each event consists of a single trip and reclose operation that occurs within five minutes. For example, if an interrupting device operates three times and then holds the circuit energized, this would be counted as three events with the number of customers affected as three times the N_i.

Power Quality – Characteristics of electricity, primarily voltage and frequency, that must meet certain specifications for safe, adequate, and efficient operations.

Reliability Statistic – Standard Statistics measures and calculation methods are per the IEEE Standard P1366-2012 (or latest version) titled *IEEE Guide for Electric Power Distribution Reliability Indices*. Same as Reliability Indices.

Sustained Interruption - An interruption lasting longer than five minutes.

Appendix B - Index Calculations

SAIFI – System Average Interruption Frequency Index

- The average number of sustained interruptions per customer
- = The number of customers which had ***sustained interruptions***
  Total number of customers served
- $= \dfrac{\sum N_i}{N_T}$

$MAIFI_E$ – Momentary Average Interruption Event Frequency Index

- The average number of momentary interruption events per customer
- = The number of customers which had ***momentary interruption events***
  Total number of customers served
- $= \dfrac{\sum ID_E N_i}{N_T}$
- MAIFI can be calculated by one of two methods. Using the number of momentary interruptions or the number momentary events. This report calculates $MAIFI_E$ using momentary events. The event includes all momentary interruptions occurring within five minutes of the first interruption. For example, when an automatic interrupting device opens and then recloses two, or three times before it remains closed, it is considered a single event.

SAIDI – System Average Interruption Duration Index

- Average sustained outage time per customer
- = Outage duration multiplied by the customers effected for all ***sustained interruptions***
  Total number of customers served
- $= \dfrac{\sum r_i N_i}{N_T}$

CAIDI – Customer Average Interruption Duration Index

- Average restoration time
- = Outage duration multiplied by the customers effected for all ***sustained interruptions***
  The number of customers which had ***sustained interruptions***
- $= \dfrac{\sum r_i N_i}{\sum N_i}$

Quantities:
i = An interruption event;
r_i = Restoration time for each interruption event;
T = Total;
ID_E = Number of interrupting device events;
N_i = Number of interrupted customers for each interruption event during the reporting period;
N_T = Total number of customers served for the area being indexed;

$CEMI_n$ – Customers Experiencing Multiple Sustained Interruptions more than *n*.

- $CEMI_n$
- = $\frac{\text{Total Number of Customers that experience more than } n \textbf{ sustained interruptions}}{\text{Total Number of Customers Served}}$
- = $\frac{CN_{(k>n)}}{N_T}$

$CEMSMI_n$ – Customers experiencing multiple sustained interruption and momentary interruption events.

- $CEMSMI_n$
- = $\frac{\text{Total Number of Customers experiencing more than } n \textbf{ interruptions}}{\text{Total Number of Customers Served}}$
- = $\frac{CNT_{(k>n)}}{N_T}$

MED - Major Event Day

A major event day is a day in which the daily system SAIDI exceeds a threshold value. Its purpose is to allow major events to be studied separately from daily operation, and in the process, to better reveal trends in daily operation that would be hidden by the large statistical effect of major events.

The MED identification threshold value, T_{MED}, is calculated based on the IEEE P1366-2012 Standard. T_{MED} is calculated at the end of each reporting period, typically one year, for use during the next reporting period as follows:

a) Collect values of daily SAIDI for five sequential years ending on the last day of the last complete reporting period. If fewer than five years of historical data are available, use all available historical data until five years of historical data are available.

b) Only those days that have a SAIDI/Day value will be used to calculate the T_{MED} (do not include days that did not have any interruptions).

c) Take the natural logarithm (*ln*) of each daily SAIDI value in the data set.

d) Find α (Alpha), the average of the logarithms (also known as the log-average) of the data set.

e) Find β (Beta), the standard deviation of the logarithms (also known as the log-standard deviation) of the data set.

f) Compute the major event day threshold, T_{MED}, using equation (25).

$$T_{MED} = e^{(a+ 2.5 b)}$$

g) Any day with daily SAIDI greater than the threshold value T_{MED} that occurs during the subsequent reporting period is classified as a major event day. Activities that occur on days classified as major event days should be separately analyzed and reported.

When an event has reached the threshold to constitute a MED described in subpart (f) above, all outage incidents associated with the MED will be flagged in the Company's Outage Management Tool. As the Company further assesses damage in the field while making repairs, new subsequent outage incidents that were a result of the MED may be created as more accurate information is made available. The subsequent incidents will be flagged and included as part of original outage event and MED.

Methodology for Calculating CEMI

The IEEE Standard P1366-2012 provides for two methods to analyze data associated with customers experiencing multiple momentary interruptions and/or sustained interruptions. Avista's Outage Management Tool (OMT) and Geographical Information System (GIS) provide the ability to geospatially associate an outage to individual customer service points. This association allows for graphically showing Customers Experiencing Multiple sustained Interruptions ($CEMI_n$) with Major Event Day data included onto

GIS produced areas. Data can be exported to Excel to also create graphs representing different values of *n*. The calculation for $CEMI_n$ and Customers Experiencing Multiple Sustained and Momentary Interruptions $CEMSMI_n$ is provided in Attachment B of the Standard.

Avista has used the data from the OMT system integrated with the GIS system to geospatially display reliability data for specific conditions. The specific conditions imply looking at the number of sustained interruptions for each service point, such as a meter point. This process would be similar to the SAIFI index but related to a certain number of sustained interruptions. Avista includes all sustained interruptions including those classified under Major Event Days. This provides a view of what each customer on a specific feeder experiences on an annual basis. Momentary Interruptions are not included in the $CEMI_n$ index because by IEEE definition only applies to sustained outages. Other Momentary Indices are not included because of the lack of indication at many rural substations and line locations.

Appendix C - Methods and Measures

WAC 480-100-398 (2) requires the Company to report changes made in data collection or calculation of reliability information after initial baselines are set. This section addresses changes that the Company has made to data collection.

Since Avista's Electric Service Reliability Monitoring and Reporting Plan was filed in 2001 (UE-011428), there have been several improvements in the methods used to collect outage data. In late 2001, centralizing the distribution trouble dispatch and data collection function for Avista's entire service territory began. The distribution dispatch office is located at the Spokane headquarters complex. At the end of September 2005, 100% of the Company's feeders, accounting for 100% of the customers, are served from offices that employ central dispatching.

The data collected for 2021 represents twenty years of outage data collected through the Outage Management Tool (OMT). Since 2016, all data has been collected using OMT based on the Company's Geographic Information System (GIS). The OMT system automates the logging of restoration times and customer counts.

Even as good as the OMT system is at quantifying the number of customers and duration of the outage duration, there still are areas where the data collection is not precise. Determining the exact starting time of an outage is dependent on when a customer calls in, how well the Avista Distribution Dispatcher determines where the outage is and defines the device that has opened to remove the faulted section.

As AMR and AMI metering reaches full implementation and the customer meter provides outage information to the OMT system through an interface, the SAIDI and CAIDI numbers are expected to increase, consistent with the discussion above.

Use of the OMT system and GIS data has improved the tracking of the numbers of customers without power, allowed for better prioritization of the restoration of service, and the improved dispatching of crews.

Beginning with the report for 2020, a minor revision to the number of MED outages for 2015 has been incorporated. The original sustained outage data used in the creation of this report had some outages that occurred in November 2015 erroneously excluded from the MED dataset. When the comprehensive data extract of sustained outage data from 2015 was refreshed, the identified outages from November 2015 were now correctly included as MED datapoints. Most reliability calculations exclude MED designated outages, so some minor changes may impact the results for 2015.

To determine the customer count for Avista system reliability data, the number of active service points are recorded at the beginning of the reporting year. While working on the Report for 2021, the 2020 and 2019 customer counts used in those reports were found to be higher than the recorded service point count at the beginning of those years by 1.7% and 0.6%, respectively. For the 2021 report, the active service points recorded at the beginning of the reporting year are being used again, leading to slightly elevated (worse) reliability metric results compared to the method used in the 2020 and 2019 Reports.

Appendix D - Areas of Greatest Concern

Please see Table 8, above, for the Company's current listing of its worst performing feeders based on current service reliability results. Figure 15 also provides feeder specific information related to outage causes by reason and sub-reason, and Figure 13 represents the outage events based on feeder classifications. As noted in the discussion above, because there are several approaches for determining "worst" performance, the designation of worst performing feeders should be informed by the reliability objectives the Company is intending to achieve. Avista continues to develop and update electric system reliability performance measures and strategic supporting plans in order to improve the reliability of its electric system.

Appendix E – Customer Complaint Summary

Commission Complaints are customer issues that require investigation and resolution by the Commission and are recorded in the UTC's Consumer Complaint Database. Complaint categories include power quality, electric reliability, or major events. This table below summarizes the Commission Complaints that occurred during 2021.

Commission Complaints			
Customer Location (Feeder)	**Complaint**	**Category**	**Resolution**
Spokane, Washington (SUN12F1)	CAS-27929-P8W0S0, the customer states Avista has not restored their electric service; they have been without electricity for over 26 hours. The customer stated when they contacted Avista's customer service about the outage, the agent had little to no information that was useful or any idea when their service would be restored. They were frustrated with the manner and tone the agent used to speak with them. They assert the length of time to restore electric service is unacceptable.	Outage	Company Upheld
Spokane, Washington (3HT12F4)	CAS-28622-D6J9M9, the customer states they were not notified ahead of time prior to the recent brownouts due to weather. The customer feels Avista failed to properly notify the impacted customers, primarily the elderly and low-income customers. The customer states Avista only started to notify customers after the issue became too large to manage and the public had to receive notice from the local newspaper. The customer cites an article in the Spokane Spokesman Review that indicates Avista knew about the severe weather and did nothing in the way of warning its customers. The customer has some issues they would like for Avista to address.	Outage	Company Upheld
Colville, Washington (SPI12F2)	CAS-28936-N6S1V9, the customer reports they lost electrical service at their home on August 3, 2021, and the outage occurred from approximately 1:16 a.m. to 3:20 a.m. The customer states their area often loses electric service and they would like to understand why their area loses services more often than other areas. The customer would like detailed information related to the outage on August 3, 2021, including the cause, the duration of the outage at their specific substation, and what steps Avista is taking to increase reliability for customers in this area. The customer would like this information for the past two years. Lastly, the customer would like to know if Avista has any plans to upgrade the infrastructure in this area?	Outage	Company Upheld

Customer Complaints			
Customer Location (Feeder)	**Complaint**	**Category**	**Resolution**
Spokane, Washington (FW12F2)	Customer Complaint: upset by the outages taking place to reduce strain on our system during extreme heat. Felt outages are being unfairly targeted and feels outages should be focused on downtown businesses. Will be taking her grievances to Facebook and "handling this publicly". Would not provide a phone number for a callback.	Outages	No call back requested.
Spokane, Washington (SE12F2)	Customer Complaint: concern about more power outages in the last few years. There is a group of 17 on the line that have far more outages than surrounding area. Thinks there are trees that need to be maintained better.	Outages	The customer has identified a possible area of concern with branches infringing on the line. Customer updated and taking further action to investigate.
Spokane, Washington (SUN12F2)	Customer Complaint: Customer wants a call back from whomever can answer the following question and stated that does not want a call from anyone who cannot answer it: Why is this general location always impacted by outages no matter the weather? Customer feels that this area is overly impacted compared to other areas and wants to understand the specific reasons for why continually without power.	Outages	Sr Op engineer responded to the customer. Documented each outage since 2018. Explained weather and equip are the 2 types of outages.
Spokane, Washington (SUN12F2)	Customer Complaint: Customer is extremely upset that we do not have services restored for yet. Only house on the block that does not have power and has not seen a single truck out, and has no lines, or trees that have fallen to delay the work to have power out until Sunday. Customer would like to talk to a manager who would know information on why still out of power.	Outages	Left voicemail for customer and direct call back number if she still has concerns, initially didn't like that estimate may be out until 01/17/21, we were able to restore sooner than estimated 01/16 2pm.
Hunters, Washington (GIF34F1)	Customer Complaint: Has had outages around 7am several times lately, wants explanation as to why this keeps happening, does not believe that they are caused by turkey or equipment failure. Customer is upset the power keeps going out	Outages	Spoke with customer day complaint was filed. No problems since the repair was made. Closed case.
Spokane, Washington (SUN12F2)	Customer Complaint: Customer upset because they called about an outage and we didn’t help/care about the customer's animals.	Outages	Left voicemail with customer to discuss concerns,

Customer Complaints			
Customer Location (Feeder)	**Complaint**	**Category**	**Resolution**
	Customer is upset because she is in rural area so when power goes out, water is out. Customer filing complaint about outage and priority on outages. Customer requesting a complaint and a call back from a supervisor.		advised to call back at 1800 #. Will attempt to call out 1 more time tomorrow.
Spokane, Washington (NE12F2)	Customer Complaint: So, are you able to tell me that my substation is as maintained as everyone else's? Because when they tried to turn my power back on it wouldn't work due to a problem at the substation, and for several hours we were told it would be 5:30 am before that was fixed. And in some cases that didn't happen. So, what's the actual disparity if it's not along the lines I'm thinking? Failure to maintain that box in the exact same manner as everyone else's is still an equity issue nobody else had. I see what you are saying, but there's still a problem right here, and I'd still like to know what it is. Especially after being called a target by your company, which sure felt like the accurate term to me.	Outages	Sent to legal to respond to customer
Spokane Valley, Washington (CHE12F1)	Customer Complaint: Wants to know what # the customer is on the list for repairs. Wants to know exactly when power will be turned back on. Says we are discriminating against customer because of the zip code she lives in. Thinks should have to pay less because we treat customer like a lesser customer. We try to get the most people on first and work down. Customer has been watching our Outage Map like a hawk and the numbers don't match our Estimated Restoration Time. Says needs a new transformer. And wants to know why we aren't out there working on it now. Says we are a backwoods company that runs lines down the back yards. Comes from AZ where lines are buried.	Outages	Customer did not call back. Appears power has been restored.
Spokane, Washington (3HT12F4)	Customer Complaint: Customer was upset that it took us 5 days to get power restored after the windstorm. Customer would like someone to call back regarding this issue.	Outages	Spoke with team leader to express his concerns
Spokane, Washington (C&W12F2)	Customer Complaint: Customer is upset because of lost food and had to stay in a hotel and could not work during the windstorm in January 2021. The customer is blaming Avista for the losses and was advised by a representative that we don't compensate for a natural weather event. The customer is pushing back and needs someone to contact them regarding this.	Outages	Left voicemail 2-9. Called again 2/16. They discussed outages, the grid, restoration efforts, and weather-related events. He is upset about experiencing a

Customer Complaints			
Customer Location (Feeder)	**Complaint**	**Category**	**Resolution**
			financial loss. Resolved.
Spokane, WA (SUN12F2)	Customer Complaint: Customer very frustrated regarding outages - wants to know why we are subjecting customer to an outage even though the power is underground, asking why we don't charge a load rate, or give incentives to use less energy, do we have any plans to better our infrastructure, wanted to speak with our CEO.	Outages	Complaint has been reviewed. It has been since 6-29, we have not heard back from the customer.

Appendix F – Historical Summary of SAIFI and SAIDI

For reference, the SAIFI and SAIDI values for each year since 2004 are included in the table below. In addition, the rolling average of the prior five years is provided. For example, the *Prior 5-year Average* value reported for 2020 is the average of the reported values from 2015-2019.

The data for 2005 is highlighted as the baseline for Avista's reporting of annual reliability performance data.

	SAIFI		**SAIDI**	
Year	Reported Value	Prior 5-year Average	Reported Value (minutes)	Prior 5-year Average (minutes)
2004	1.01	--	126	--
2005	0.97	--	108	--
2006	1.29	0.99	143	117
2007	1.14	1.09	132	126
2008	1.40	1.10	159	127
2009	1.52	1.16	193	134
2010	1.23	1.26	146	147
2011	1.08	1.32	118	155
2012	1.14	1.27	138	150
2013	1.05	1.27	138	151
2014	1.11	1.20	139	147
2015	1.05	1.12	163	136
2016	0.86	1.09	133	139
2017	1.20	1.04	183	142
2018	0.81	1.05	126	151
2019	0.94	1.01	136	149
2020	0.87	0.97	129	148
2021	1.24	0.93	169	156

Appendix G - Historical Major Event Days on Avista's System

The following table is provided as an initial review of Major Event Day information. The main premise of the IEEE Major Event Day calculation is that using the 2.5b method should classify 2.3 days each year as MEDs. This table lists the historical major event days, shows the daily SAIDI value for each MED, and reports the T_{MED} value calculated for each year.

Year	Date	SAIDI	T_{MED}
2004	5/21/2004	7.11	6.35
	08/02/2004	7.36	
	12/08/2004	31.00	
2005	06/21/2005	39.53	4.92
	06/22/2005	9.03	
	08/12/2005	19.60	
2006	01/11/2006	12.10	7.06
	03/09/2006	8.58	
	11/13/2006	30.79	
	12/14/2006	29.26	
	12/15/2006	158.31	
2007	01/06/2007	9.98	8.02
	06/29/2007	32.64	
	07/13/2007	12.79	
	08/31/2007	21.30	
2008	01/27/2008	17.57	9.22
	07/10/2008	36.74	
	08/18/2008	9.49	
2009	None		9.93
2010	5/3/2010	21.04	11.11
	11/16/2010	68.67	
2011	None		10.85
2012	1/19/2012	9.93	9.49
	12/17/2012	14.35	
2013	8/25/2013	24.97	8.96
	8/26/2013	11.78	
	9/15/2013	14.01	
	11/16/2013	11.09	
2014	7/23/14	92.95	8.72
	7/24/14	35.66	
	8/25/14	121.05	
	8/3/14	38.52	

	8/12/14	9.84	
2015	8/29/15	13.42	8.22
	9/30/15	9.99	
	11/17/15	2093.19	
	11/18/15	399.34	
	11/19/15	147.97	
	11/20/15	66.96	
	11/21/15	47.30	
	11/22/15	32.61	
	11/23/15	15.38	
	11/24/15	12.19	
	12/23/15	29.35	
	12/24/15	19.24	
2016	None		10.17
2017	12/19/17		10.19
2018	1/24/18	12.08	10.47
	11/24/18	13.30	
2019	7/23/19	26.64	9.55
	10/9/19	45.06	
2020	1/12/20	13.80	8.90
	1/13/20	9.57	
	2/1/20	12.57	
	2/23/20	9.14	
	3/14/20	9.25	
	9/7/20	94.09	
	9/8/20	15.75	
	10/23/20	35.97	
	10/24/20	15.53	
	11/13/20	21.27	
	12/6/20	10.10	
2021	1/13/21	495.30	7.86
	1/14/21	36.84	
	1/15/21	28.06	
	1/16/21	11.91	
	3/28/21	21.94	
	4/18/21	20.30	
	11/15/21	41.36	

Appendix H - Interruption Cause Codes

Cause code information is provided in this Report to give readers a better understanding of outage sources. Further, the Company uses cause information to analyze past outages and, if possible, reduce the frequency and duration of future outages.

Since 2011, Avista has stopped using the subcategory “protected” under the “Animal” category. Almost all birds are considered protected, so there is little differentiation between the “Bird” and “Protected” subcategories. Avista will include additional information in the Remarks section as reported from the field personnel.

MAIN CATEGORY	SUBCATEGORY	Definition
ANIMAL	Bird Squirrel Underground Other	Outages caused by animal contacts. Specific animal called out in subcategory.
PUBLIC COMPANY	Car Hit Pad Car Hit Pole Dig In Fire Tree Other Dig in Other	Underground outage due to car, truck, construction equipment etc. contact with pad transformer, junction enclosure etc... Overhead outage due to car, truck, construction equipment etc. contact with pole, guy, neutral etc. Dig in by a customer, a customer’s contractor, or another utility. Outages caused by or required for a house/structure or field/forest fire. Homeowner, tree service, logger etc. fells a tree into the line. Other public caused outages Dig in by company or contract crew. Other company caused outages

EQUIPMENT OH	Arrestors Capacitor Conductor/Pri Conductor/Sec Connector/Pri Connector/Sec Crossarm/rotten Cutout/Fuse Insulator Insulator Pin Other Pole/Rotten Recloser Regulator Switch/Disconnect Transformer/OH Wildlife Guard	Outages caused by equipment failure. Specific equipment called out in subcategory. Wildlife guard failed or caused an outage
EQUIPMENT UG	URD Cable/Pri URD Cable/Sec Connector/Sec Elbow Junctions Primary Splice Termination Transformer/UG Other	Outages caused by equipment failure. Specific equipment called out in subcategory.
EQUIPMENT SUB	High side fuse Bus Insulator High side PCB High side Swt/Disc Lowside OCB/Recloser Low side Swt/Disc Relay Misoperation Regulator Transformer Other	
MISCELLANEOUS		For causes not specifically listed elsewhere
NOT OUR PROBLEM (*Outages in this category are not included in reported statistics*)	Customer Equipment Other Utility	Customer equipment causing an outage to their service. If a customer causes an outage to another customer this is covered under Public. Outages when another utility's facilities cause an outage on our system.
POLE FIRE		Used when water and contamination cause insulator leakage current and fire. If insulator is leaking due to material failure list under equipment failure. If cracked due to gunfire use customer caused other.

PLANNED TREE UNDETERMINED	Maintenance/Upgrade Forced Tree fell Tree growth Service Weather	Outage, normally prearranged, needed for normal construction work. Outage scheduled to repair outage damage. For outages when a tree falls into distribution primary/secondary or transmission during normal weather. Tree growth causes a tree to contact distribution primary/secondary or transmission during normal weather. For outages when a tree falls or grows into a service. When snow or windstorms cause a tree or branch to fall into or contact the line. Includes snow loading and unloading. Use when the cause cannot be determined.
WEATHER	Snow/Ice Lightning Wind	Outages caused by snow or ice loading or unloading on a structure or conductor. Use weather tree for snow and ice loading on a tree. Lightning flashovers without equipment damage. Equipment failures reported under the equipment type. Outages when wind causes conductors to blow into each other, another structure, building etc.