

March 1, 2019

Will Rosquist
Administrator, Regulatory Division
Montana Public Service Commission
1701 Prospect Avenue
PO Box 202601
Helena, MT 59620-2601

RE: 2018 Annual Electric Reliability Report

Dear Mr. Rosquist:

With this letter, NorthWestern Energy submits the 2018 Reliability Report in compliance with Administrative Rules of Montana 38.5.8619 Annual Electric Reliability Report, effective on July 29, 2005. The data provided in this report includes the information requested in ARM 38.5.8619 and utilizes the *IEEE Guide for Electric Power Distribution Reliability Indices (IEEE Std. 1366-2012)* for definition of major events and the appropriate reliability indices.

Please contact me to answer any questions concerning this report. My contact information is as follows:

Bill Bowden
Technical Advisor, Senior
NorthWestern Energy
11 East Park Street
Butte, Montana 59701-1711
(406) 497-2211
William.bowden@northwestern.com

Sincerely,

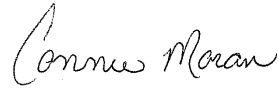
Bill Bowden, P.E.
Technical Advisor, Senior

Enclosure: 2018 Annual Electric Reliability Report

CERTIFICATE OF SERVICE

I hereby certify that NorthWestern Energy's 2018 Annual Electric Reliability Report has been hand delivered to the Montana Public Service Commission and the Montana Consumer Counsel this date. It has also been e-filed on the MPSC website.

Date: March 1, 2019

A handwritten signature in cursive script that reads "Connie Moran".

Connie Moran
Administrative Assistant
Regulatory Affairs

NorthWestern[®] Energy

2018
-Montana-
Electric Distribution
Annual Reliability Report



March 2019

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EXECUTIVE SUMMARY

This report provides information and insights into NorthWestern Energy's (NWE) 2018 Electric Distribution System reliability indices for the Montana region, in accordance with the guidelines outlined by the Administrative Rules of Montana (Rule 38.5.8619). The indices included are **SAIDI** (System Average Interruption Duration Index – in minutes), **CAIDI** (Customer Average Interruption Duration Index – in minutes), **SAIFI** (System Average Interruption Frequency Index – in frequency) and **Outage Counts**. By the IEEE standard definitions, these indices are for “sustained interruptions” meaning they lasted longer than five minutes.

System indices are given for the NWE Montana operating region and are also broken down into the seven operating areas of the state: Billings, Bozeman, Butte, Great Falls, Havre, Helena, and Missoula. As with the previous years' annual reports, the Institute of Electrical and Electronics Engineers (IEEE) Standard 1366-2012 will again be followed. This standard is directly related to the use of a statistically based definition for classification of Major Event Days (MEDs) – also commonly referred to as the 2.5 Beta Method. Major Event Days are days in which the regional SAIDI exceeds a statistically derived threshold value and represent days in which the electric system experienced stresses beyond normal operating conditions (such as a severe weather storm) and often requiring additional crews be brought into the area for repairs.

The InService mobile work force and outage management system was implemented by NWE during the fall of 2014. This provides more accurate and timely outage reporting. Outage customer counts and times are derived from the GIS, call logging, and automated systems, eliminating the earlier manual outage reporting system and its inherent approximations. Both IEEE and the Department of Energy reports indicate that SAIDI numbers normally increase with this improved accuracy, but with the whims of nature, this may be difficult to determine for some time. The IEEE reliability standard (1366-2012) does not define the 24 hour day and many of the utilities involved in the IEEE benchmark survey have gone to something other than midnight-to-midnight. Some will “roll” the 24 hours to more accurately capture the full impact of a storm day (and possible MED). This option was implemented by NWE in 2015.

MEDs are identified through a daily process for each region and can be included or excluded per the data requested. This report will provide all information, including and excluding MEDs, for all three indices to better demonstrate and analyze normal versus emergency conditions. In 2018, NorthWestern did not experience any Major Event Days. By comparison, there were two MEDs in 2013, none in 2014, five in 2015, three in 2016, and four in 2017. For the Montana region, it would take 6.17 SAIDI minutes in 2018 to declare an MED. Historically in Montana, a larger MED event could be 20 SAIDI minutes or more.

Since there were no MEDs in 2018, no catastrophic events occurred. NorthWestern has defined a “Catastrophic Event” as a sequential series of days, that begins with an MED, that have a combined SAIDI that is seven times the MED threshold, or 43.17 SAIDI minutes in 2018. Catastrophic events are not included in any reliability metric.

1. GENERAL

1.1 Reliability indices calculation

The calculation of SAIDI and CAIDI, (in minutes) and SAIFI (in outages per customer) are based on the following IEEE formulas:

$$SAIDI = \frac{\text{sum of all customer outage durations(minutes)}}{\text{total number of customers served}}$$

$$SAIFI = \frac{\text{total number of customers experiencing outages}}{\text{total number of customers served}}$$

$$CAIDI = \frac{\text{sum of all customer outage duration(minutes)}}{\text{total number of customers experiencing outages}} = \frac{SAIDI}{SAIFI}$$

In layman's terms, SAIDI represents the average outage in minutes for each customer served. SAIFI is the average number of interruptions that a customer would typically experience in a year. CAIDI is the average outage duration any given customer would experience. CAIDI is also typically thought of as the average restoration time.

1.2 Additional Notable Events

There was one day with a "Customer-Minutes Interrupted" (CMI) number greater than one million (an MED for 2018 required 2.21 million CMI). Please see table below. This storm event, while not an MED, added significantly to the SAIDI minutes for 2018. For comparison, there were four days in 2017 with over a million CMI.

Date	CMI	Divisions Impacted	Majority Causes
5/7/2018	1,332,787	Missoula	Thunderstorm with strong winds and lightning with trees in lines.

Table 1: Additional Notable Events (2018)

2. MONTANA SYSTEM RELIABILITY

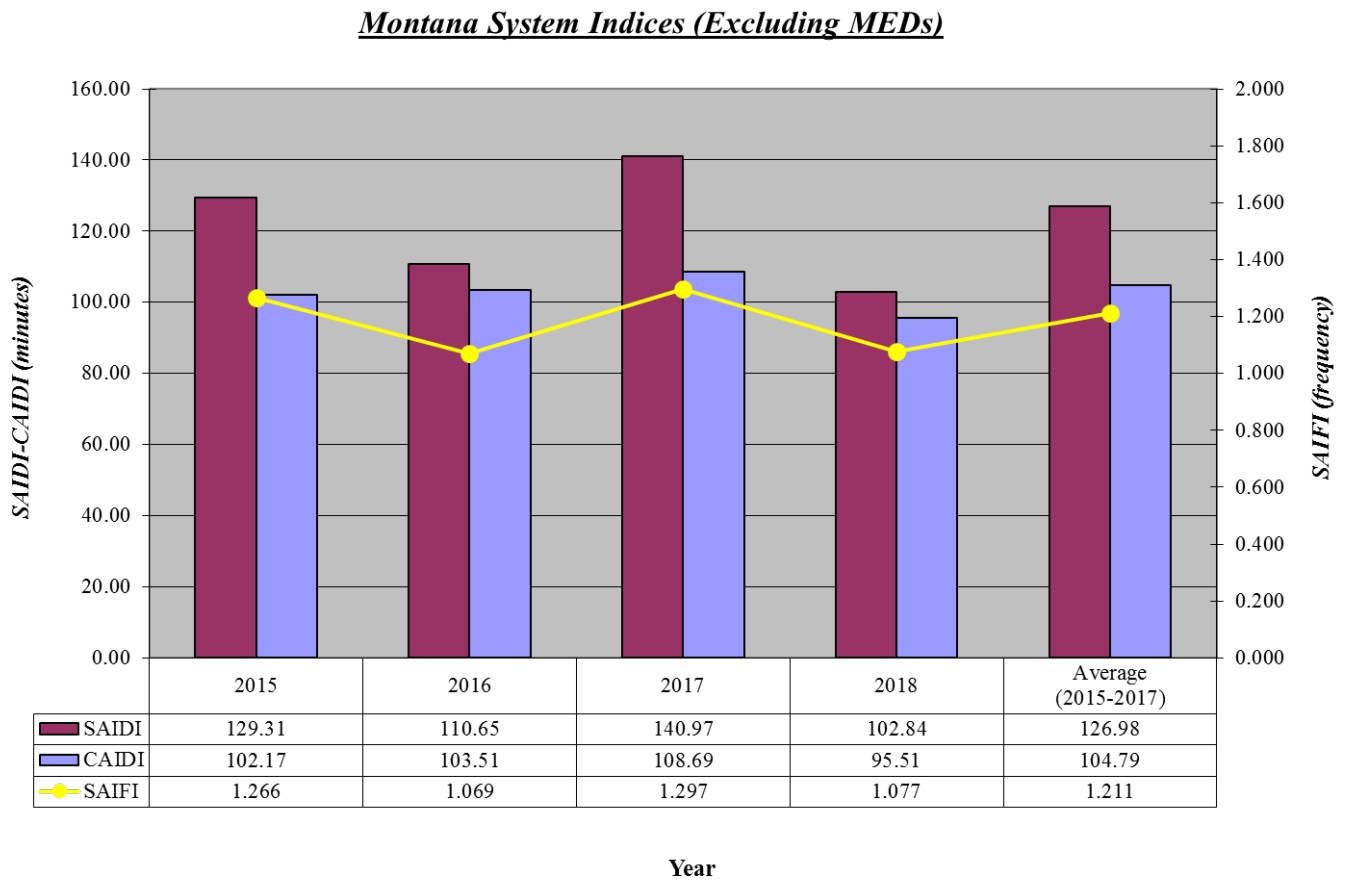


Figure 2.1 Montana system indices excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.

The figure above displays NorthWestern Energy’s Montana region indices for the years 2015-2018. Region indices shown for 2015 to 2018 data (excluding MEDs) are from year-end audited data (excluding MEDs). Please note that SAIDI and CAIDI are given in minutes and SAIFI is given in the frequency of occurrence.

As can be seen by **Figure 2.1**, SAIDI, SAIFI, and CAIDI decreased compared to 2017. Also, all three indices in 2018 were lower than the previous three-year averages. In 2018, NWE saw a decrease in the number and duration of weather-related outages throughout the Montana region.

Contributing factors to system reliability will be discussed as each of the operating divisions of the Montana region are examined and in the report conclusion. Data and figures are presented that characterize the system reliability both including and excluding MEDs to demonstrate the effect MEDs had on the system reliability in previous years.

Montana System Indices (Including MEDs)

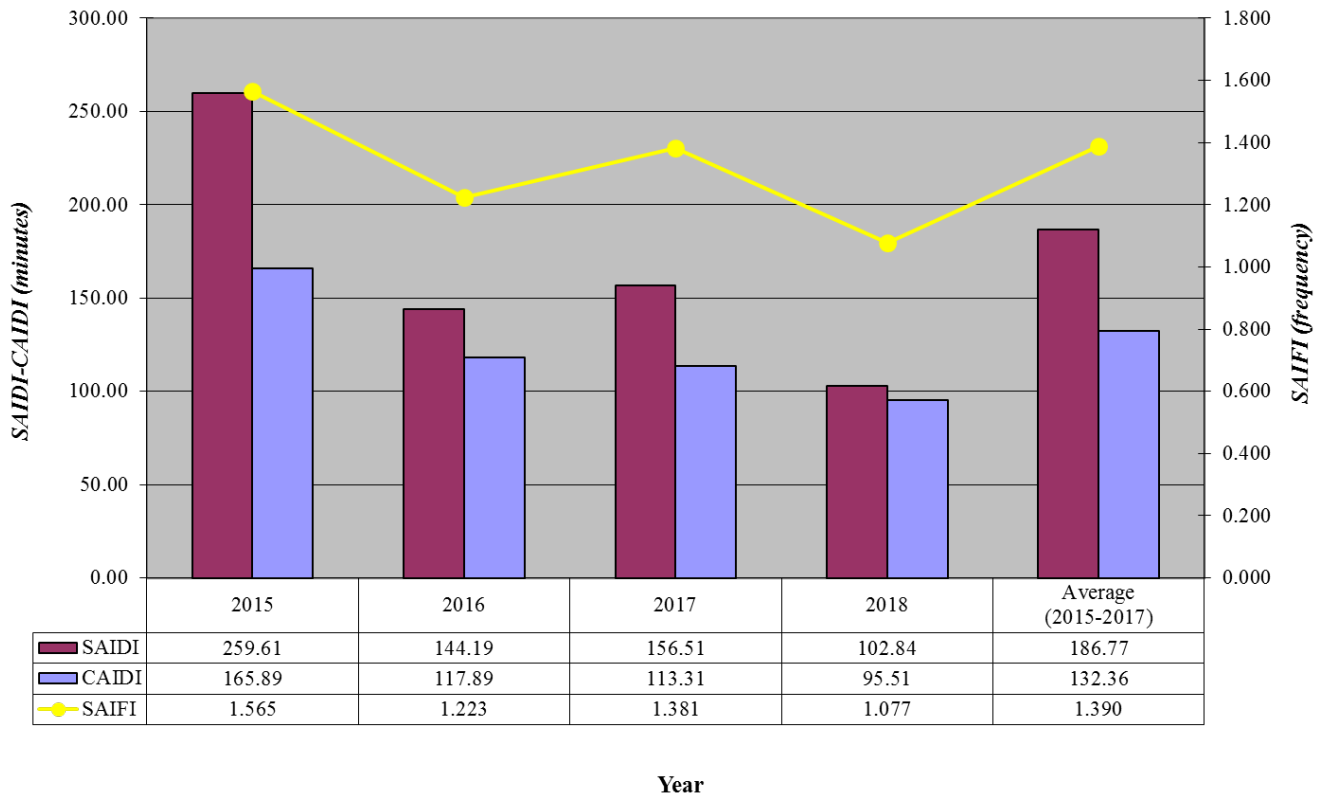


Figure 2.2 Montana system indices including major event days (MEDs) as defined in IEEE Standard 1366-2012.

Since there were no MEDs in 2018, the with and without indices are the same.

Outages by cause (excluding MEDs) are shown in **Figure 2.3**.

Montana - Outages By Top Ten Causes (Excluding MEDs)

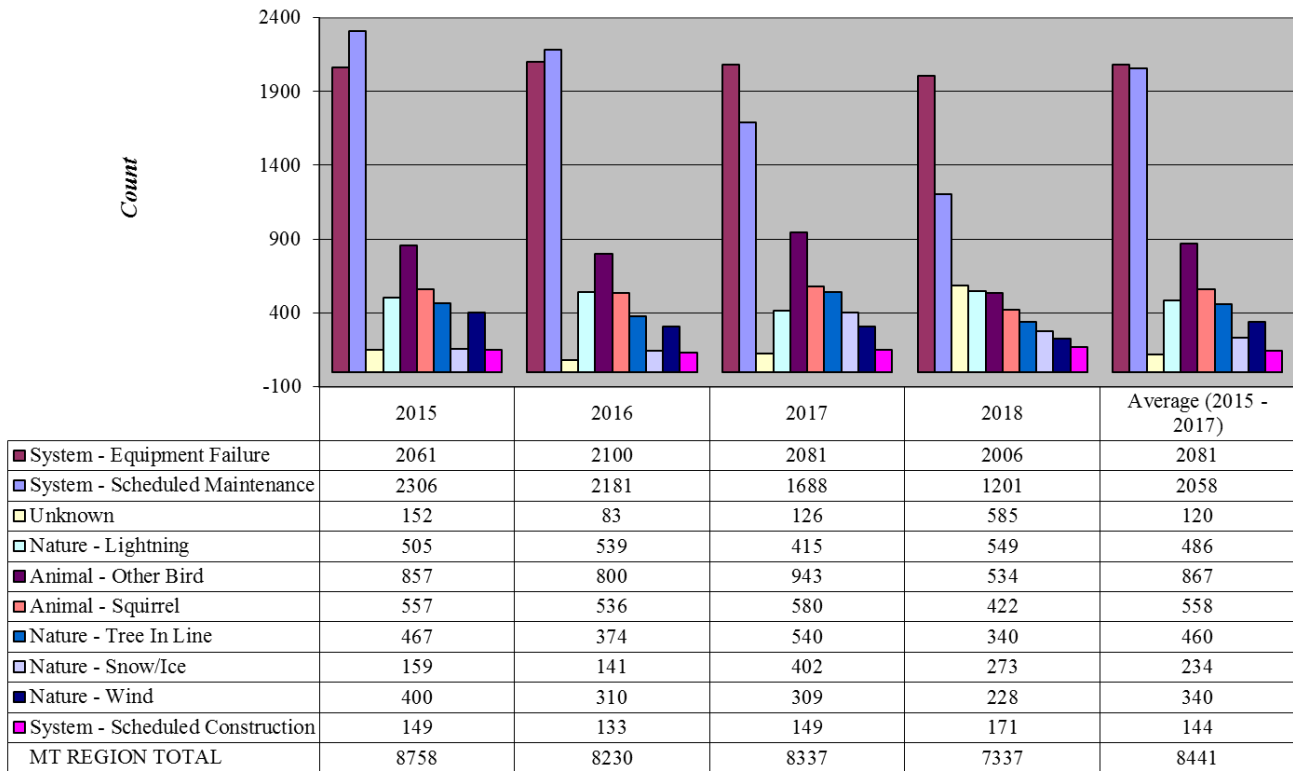


Figure 2.3 Montana system outages by top ten causes excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.

The outage causes represented in this table are the top ten major contributors for customer outages on the NorthWestern Energy Electric Distribution system. Overall outages reported decreased 12% to 7,337.

The top ten outage counts decreased from 7,233 in 2017 to 6,309 in 2018. Nature-related outages such as wind, lightning and snow/ice decreased by 334 outages or 18.5%. Overall Equipment Failure outages decreased by 75. Equipment Failure is the most common of the unscheduled outage causes due to its broad and all-inclusive category nature. Outages can be related back to Equipment Failure in many different ways, and it is the responsibility of the operations personnel to correctly identify the cause. Scheduled Maintenance decreased by 487 outages.

Montana - Outages By Top Ten Causes (Including MEDs)

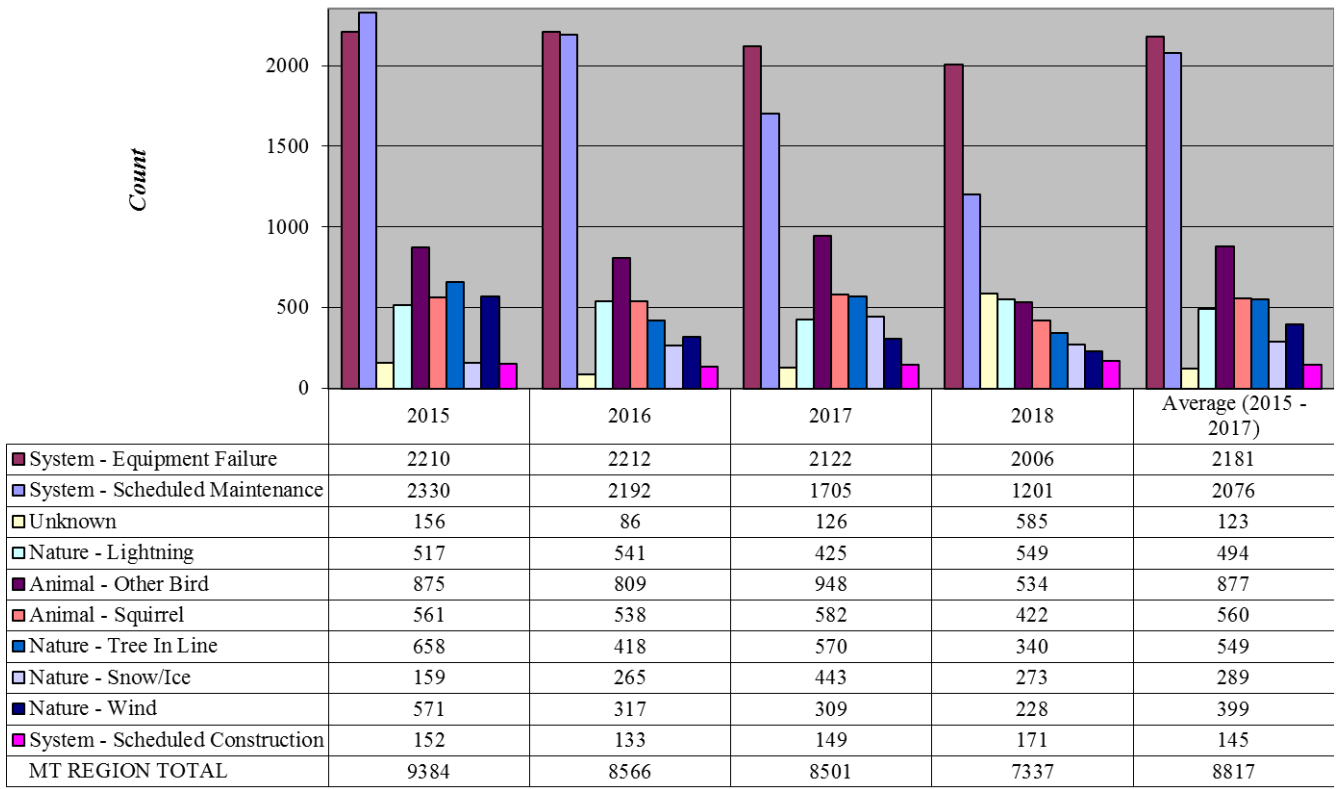


Figure 2.4 Montana system outages by top ten causes including major event days (MEDs) as defined in IEEE Standard 1366-2012.

The graph and table above show outage causes with MEDs. Most of the outage categories in 2018 have decreased when comparing them to 2017 numbers. Lightning outages increased by 124 or 29%.

3. BILLINGS SYSTEM RELIABILITY

For Billings, SAIFI increased in 2018. SAIDI and CAIDI had large decreases while SAIFI increased. SAIDI and CAIDI are less than their three year averages. SAIFI is greater than its three-year average. Storm problem and equipment failure outage counts are down from 2017. A pole washed out by a river affected the Lewistown area; an outage caused a by raccoon affected the area around the Billings 8th St. Substation. Larger outages for the year were equipment failures caused by insulators, a crossarm, and an arrestor. Squirrels and Other Birds still cause a large number of outages. Tree problem outages are up slightly.

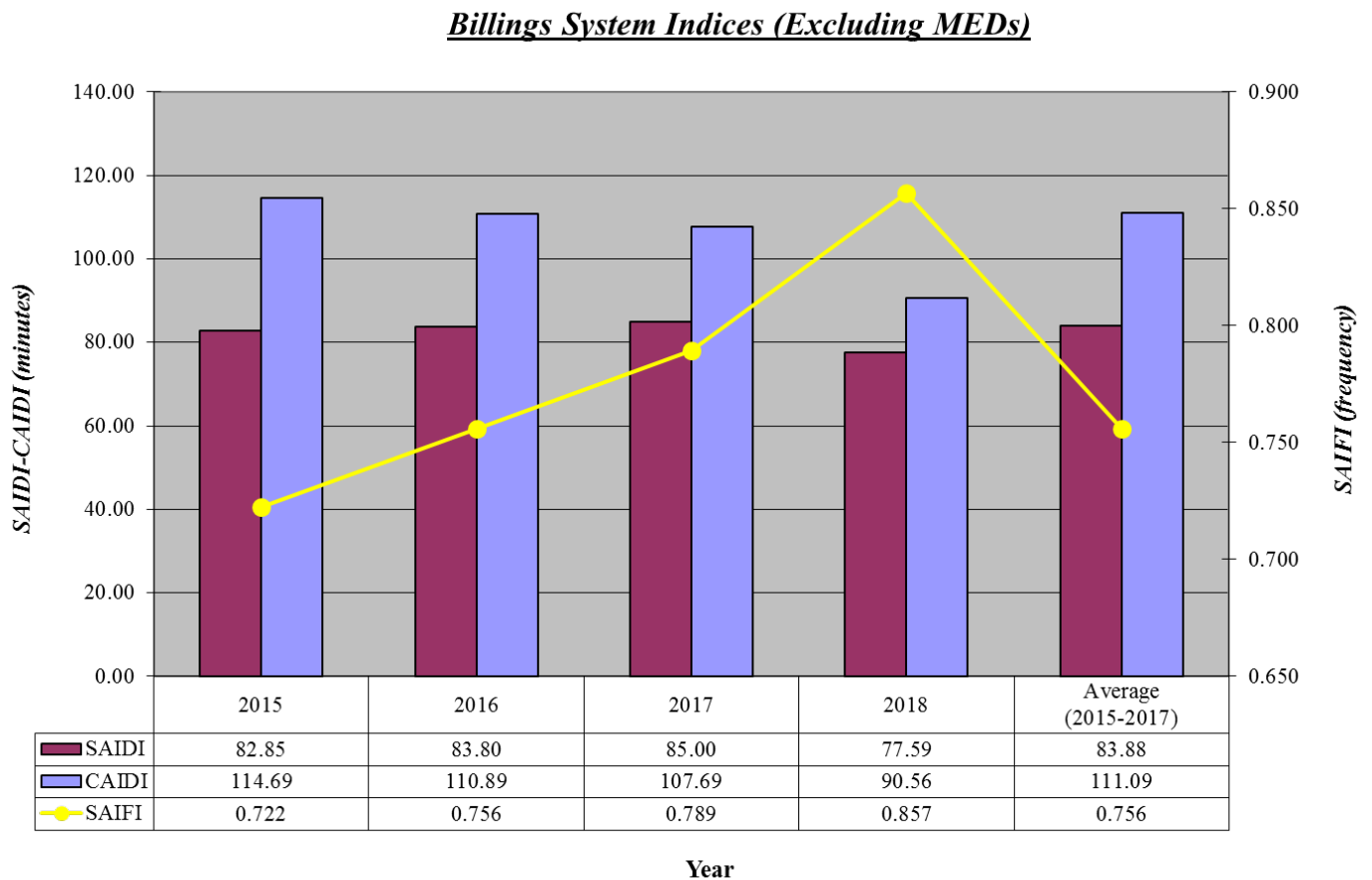


Figure 3.1 Billings system indices excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.

Billings System Indices (Including MEDs)

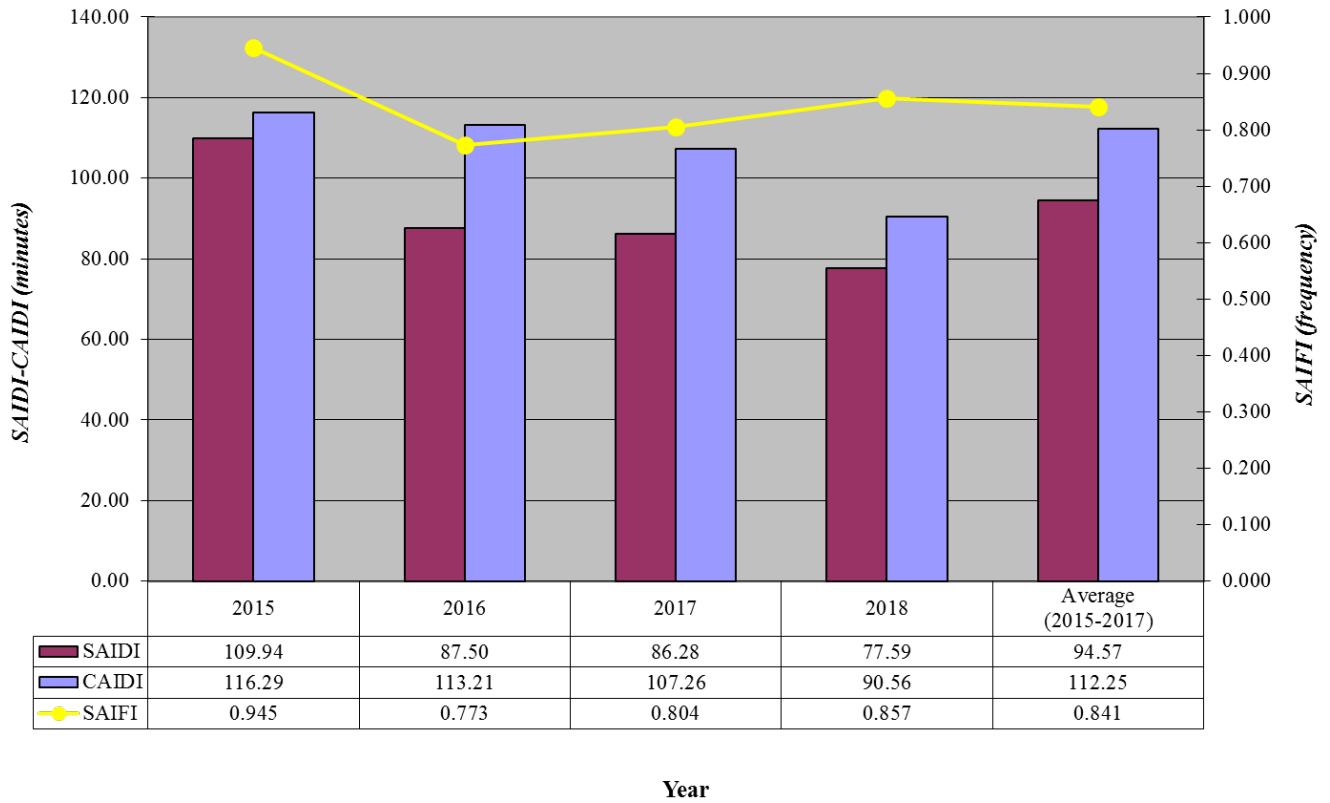


Figure 3.2 Billings system indices including major event days (MEDs) as defined in IEEE Standard 1366-2012.

Billings - Outages By Top Ten Causes (Excluding MEDs)

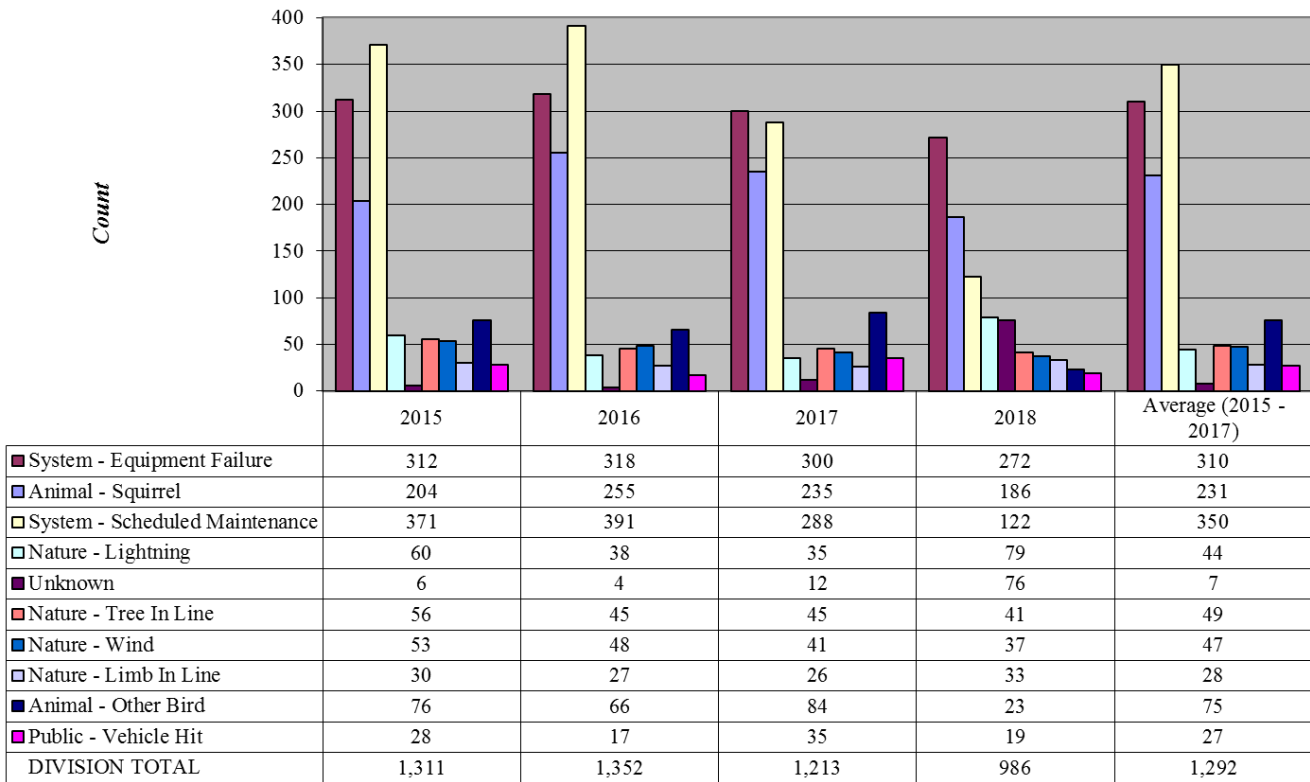


Figure 3.3 Billings system outages by top ten causes excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.

Billings - Outages By Top Ten Causes (Including MEDs)

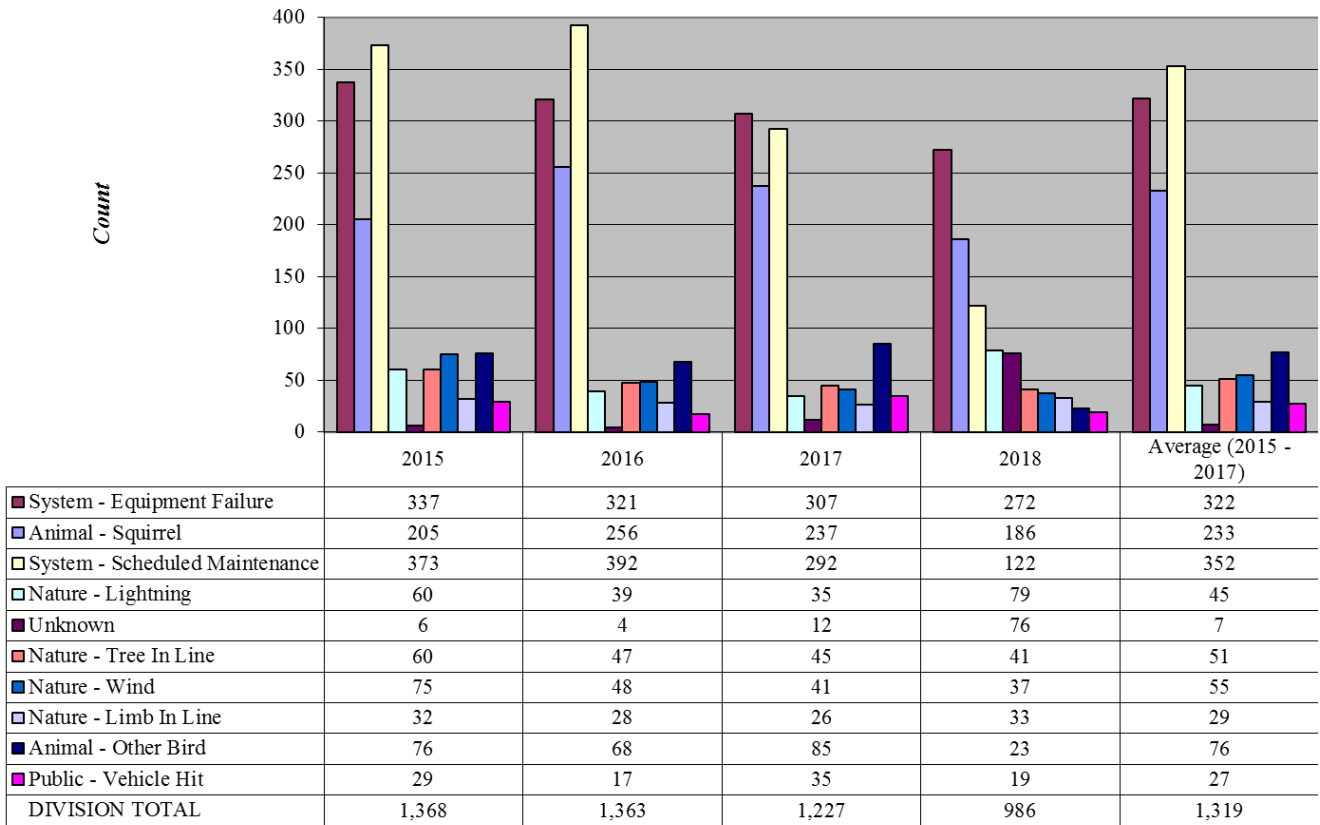


Figure 3.4 Billings system outages by top ten causes including major event days (MEDs) as defined in IEEE Standard 1366-2012.

4. BOZEMAN SYSTEM RELIABILITY

Bozeman division indices for 2018 saw a significant decrease in all indexes compared to 2017. All were below their three year averages. On April 15, a vehicle hit a pole affecting two circuits fed from the Sourdough Substation. Many vehicle hits also affected customers in the Bozeman area. Equipment failure and planned outage counts decreased. However, nature-caused outages increased.

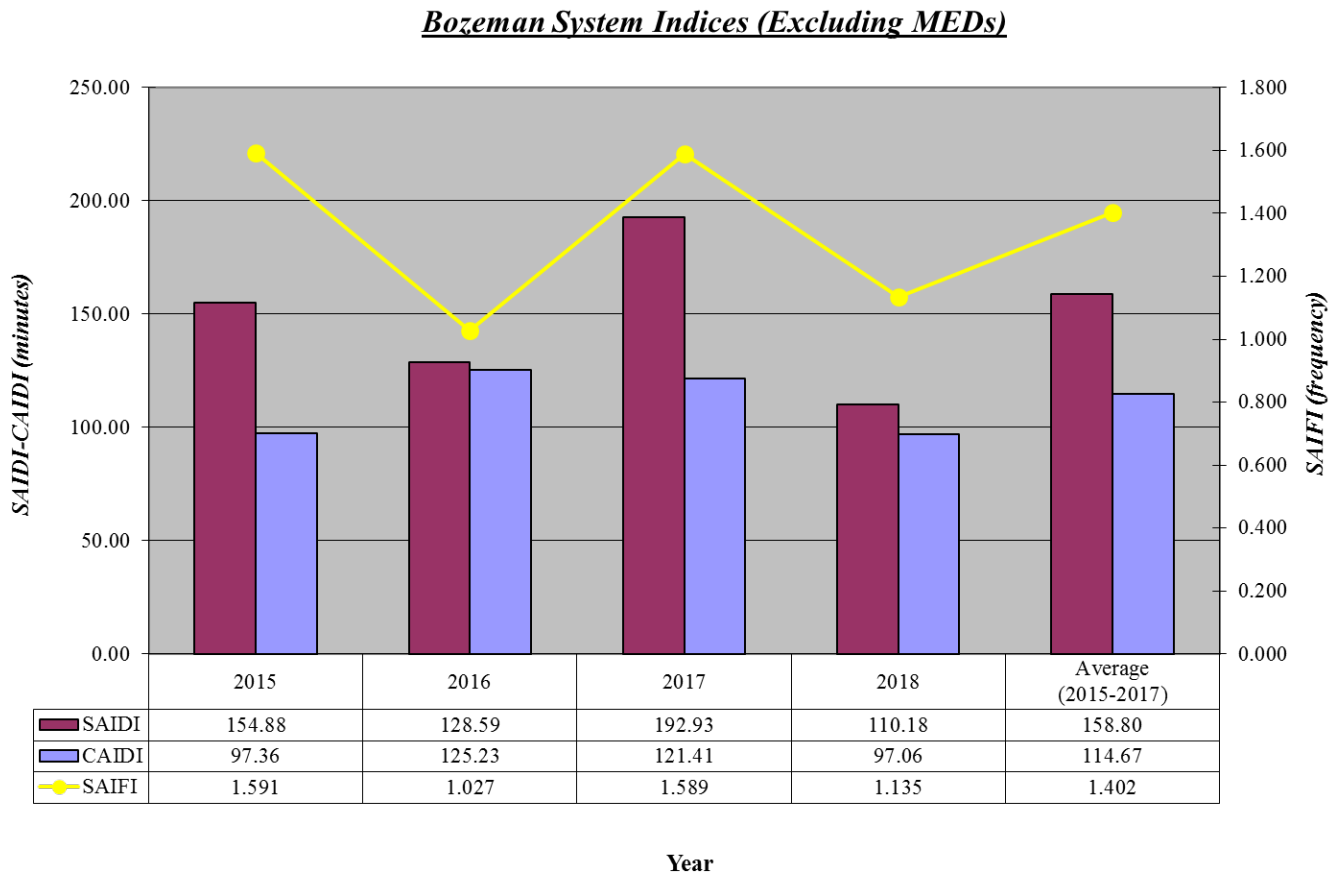


Figure 4.1 Bozeman system indices excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.

Bozeman System Indices (Including MEDs)

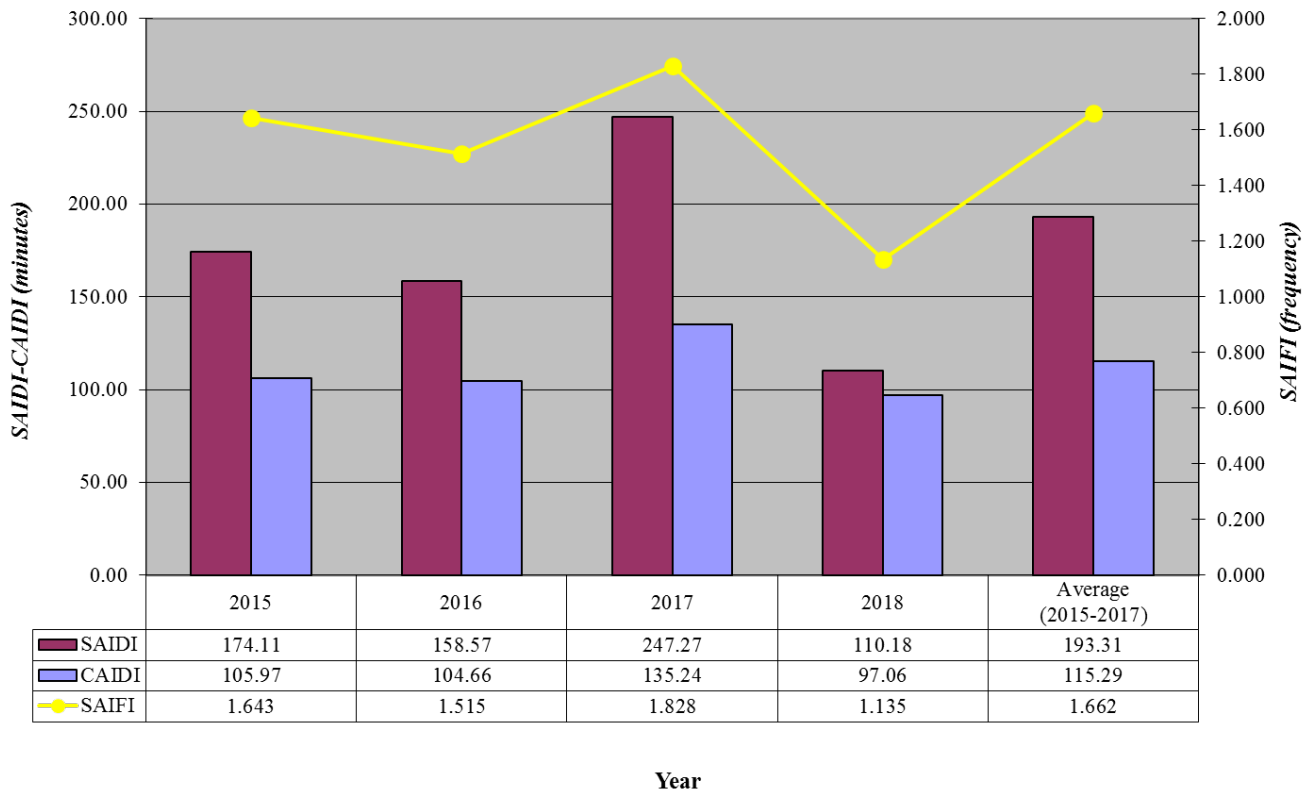


Figure 4.2 Bozeman system indices including major event days (MEDs) as defined in IEEE Standard 1366-2012.

Bozeman - Outages By Top Ten Causes (Excluding MEDs)

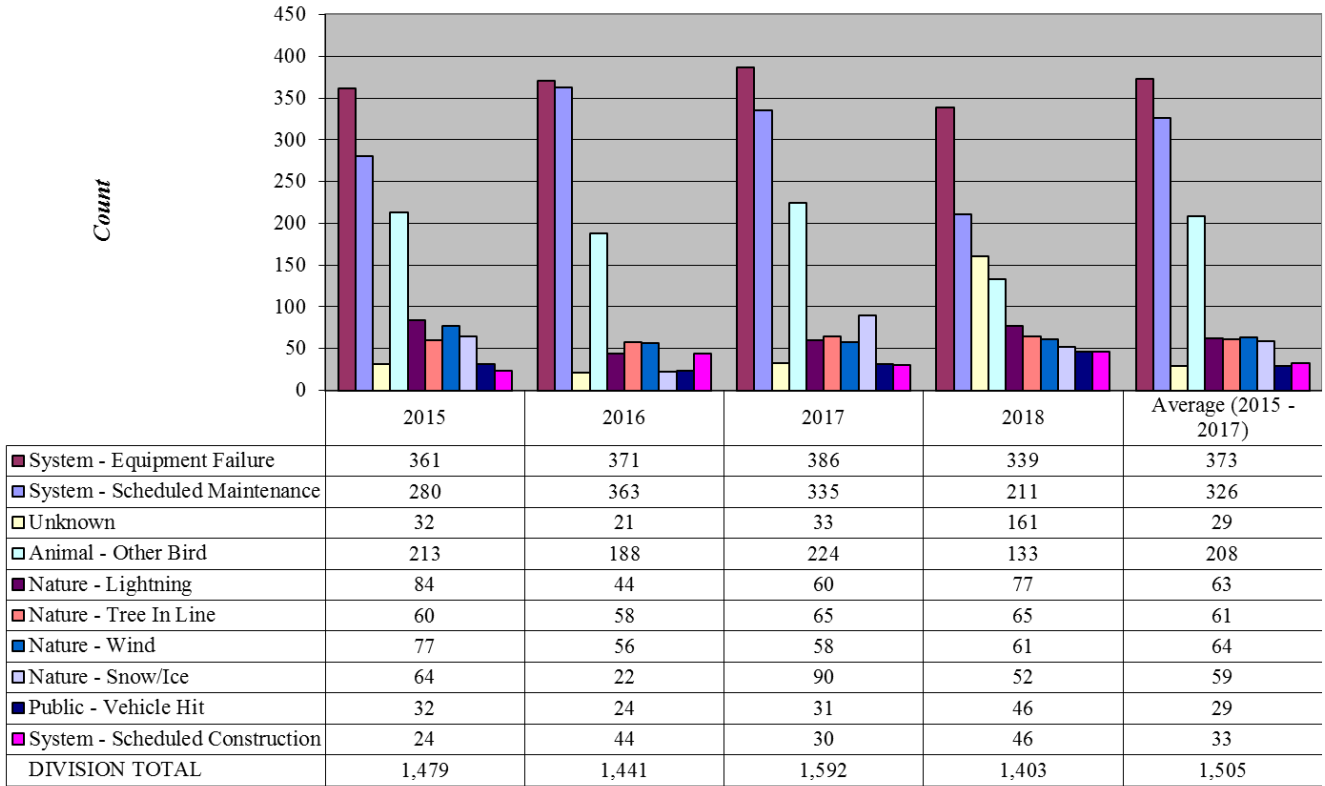


Figure 4.3 Bozeman system outages by top ten causes excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.

Bozeman - Outages By Top Ten Causes (Including MEDs)

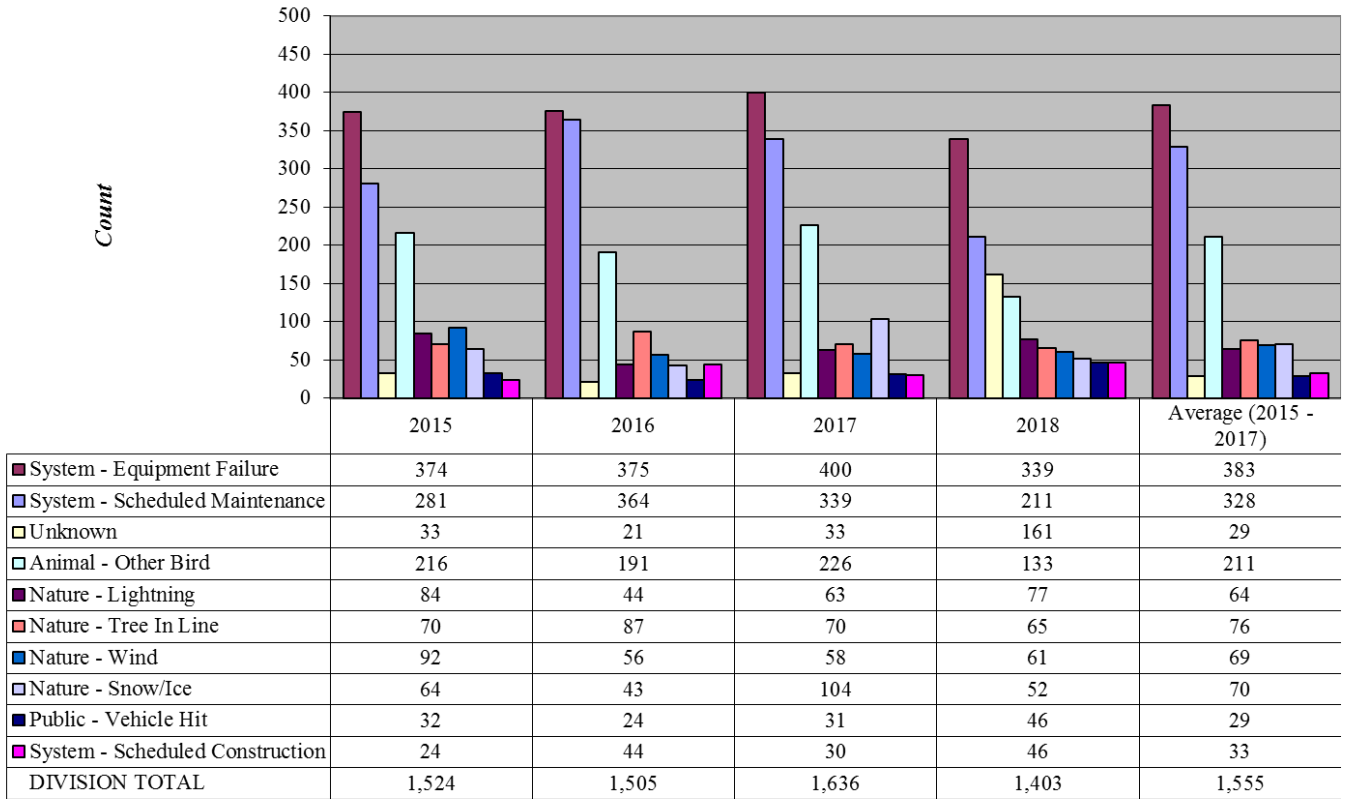


Figure 4.4 Bozeman system outages by top ten causes including major event days (MEDs) as defined in IEEE Standard 1366-2012.

5. BUTTE SYSTEM RELIABILITY

For 2018, SAIDI and CAIFI decreased and SAIFI increased for the Butte Division. Failed spacers on the Cora 53 circuit caused a large outage in January. A breaker problem at the Renova Substation caused several outages affecting the Whitehall Valley in June. In June and August, a current transformer caused outages at the Montana Street Substation. Equipment outages increased for Butte. There was a large decrease in animal-related outages, in particular birds other than raptors. Tree outages also decreased greatly.

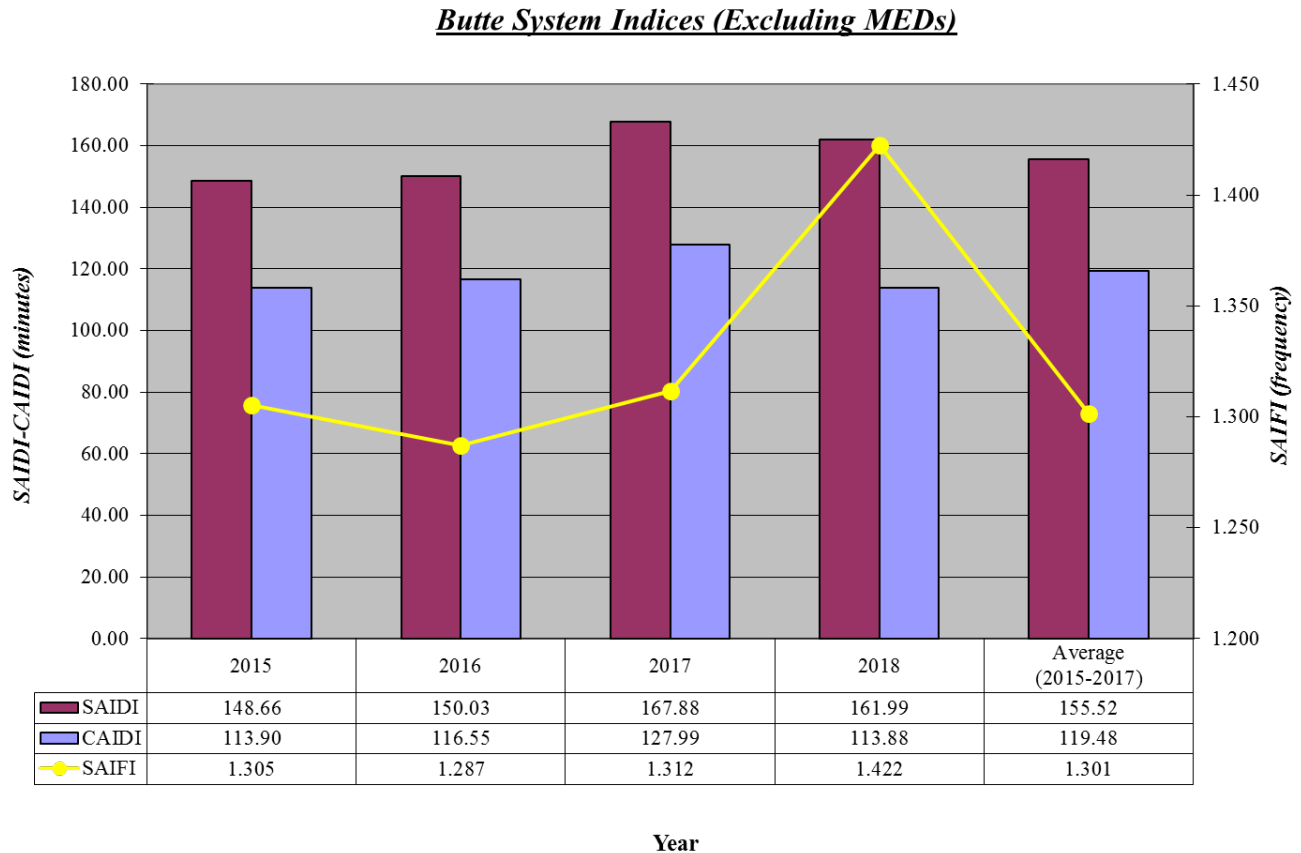


Figure 5.1 Butte system indices excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.

Butte System Indices (Including MEDs)

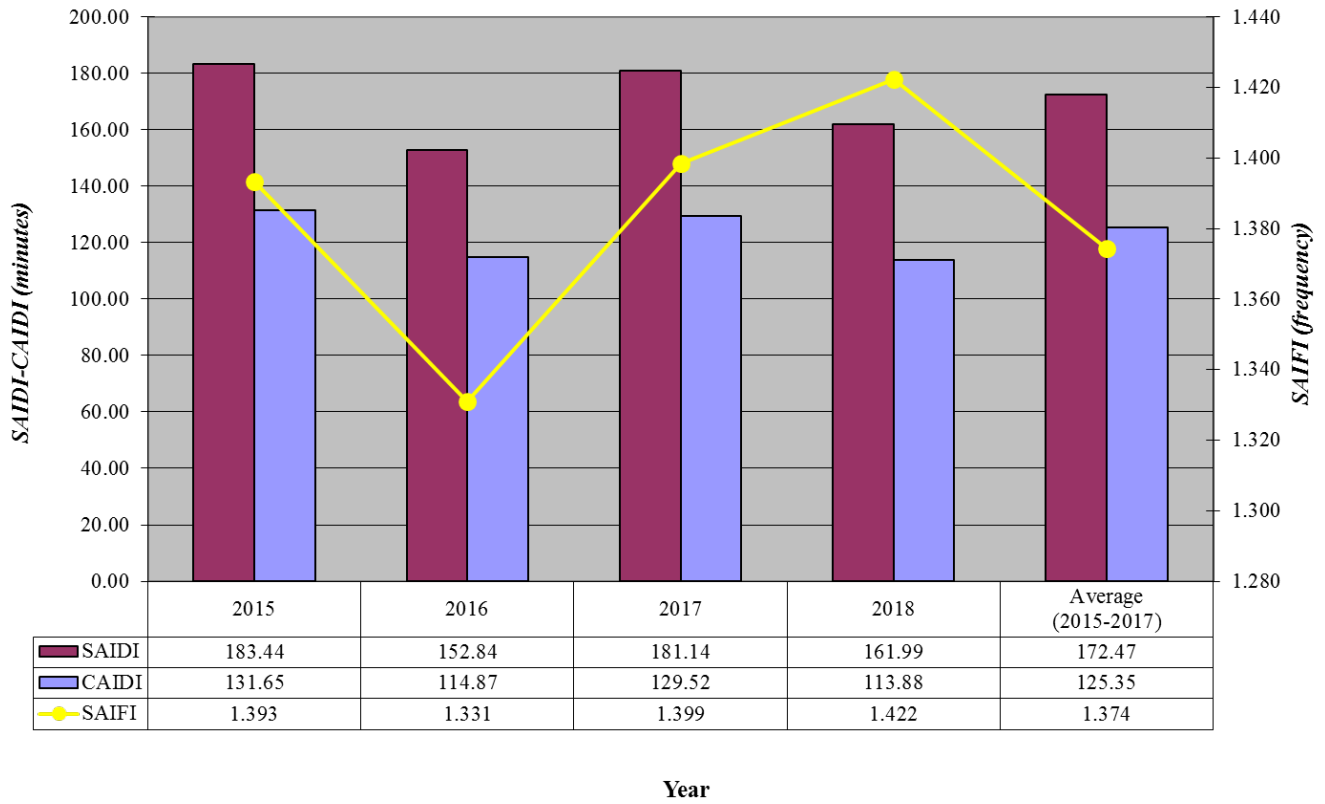
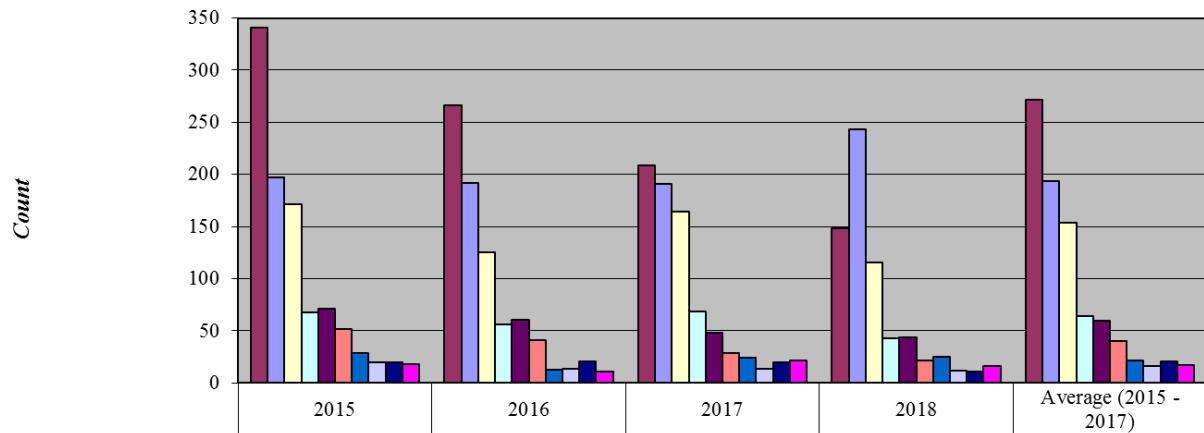


Figure 5.2 Butte system indices including major event days (MEDs) as defined in IEEE Standard 1366-2012.

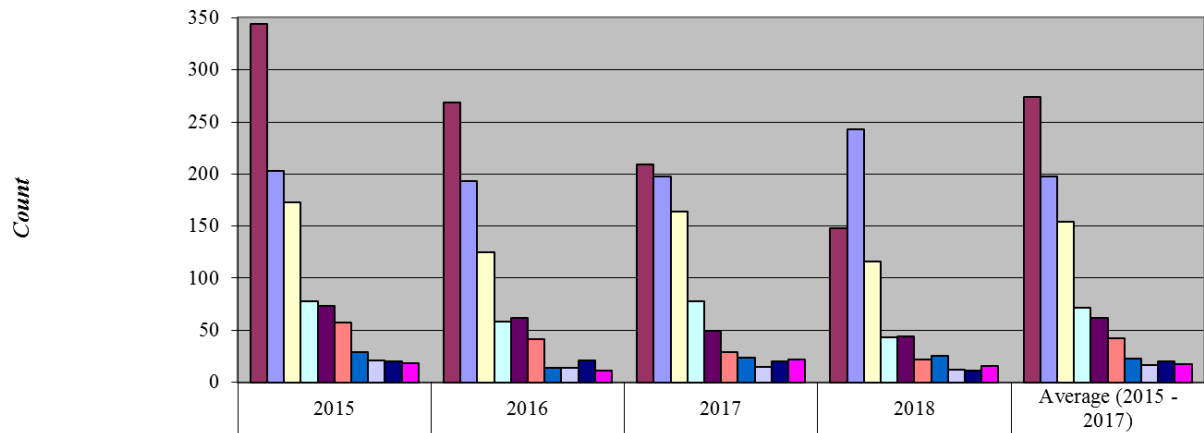
Butte - Outages By Top Ten Causes (Excluding MEDs)



	2015	2016	2017	2018	Average (2015 - 2017)
System - Scheduled Maintenance	341	266	209	148	272
System - Equipment Failure	197	192	191	243	193
Animal - Other Bird	171	125	164	116	153
Nature - Tree In Line	68	56	69	43	64
Nature - Lightning	71	61	48	44	60
Nature - Wind	52	41	29	22	41
Animal - Waterfowl	29	13	24	25	22
Nature - Limb In Line	20	14	14	12	16
Animal - Squirrel	20	21	20	11	20
System - Scheduled Construction	18	11	22	16	17
DIVISION TOTAL	1,112	908	948	958	988

Figure 5.3 Butte system outages by top ten causes excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.

Butte - Outages By Top Ten Causes (Including MEDs)



■ System - Scheduled Maintenance	344	269	209	148	274
■ System - Equipment Failure	203	193	198	243	198
■ Animal - Other Bird	173	125	164	116	154
■ Nature - Tree In Line	78	58	78	43	71
■ Nature - Lightning	73	62	49	44	61
■ Nature - Wind	57	41	29	22	42
■ Animal - Waterfowl	29	14	24	25	22
■ Nature - Limb In Line	21	14	15	12	17
■ Animal - Squirrel	20	21	20	11	20
■ System - Scheduled Construction	18	11	22	16	17
DIVISION TOTAL	1,146	922	979	958	1,016

Figure 5.4 Butte system outages by top ten causes including major event days (MEDs) as defined in IEEE Standard 1366-2012.

6. GREAT FALLS SYSTEM RELIABILITY

Great Falls Division had a great year for reliability in 2018. Great Falls saw very large decreases in SAIDI, SAIFI, and CAIDI. Lightning-caused outages increased. The number of equipment failure, animal-related, and planned outages decreased from 2017. The largest outages in the division were caused by a downed transmission line in August, and a thunderstorm in July affected the Choteau area.

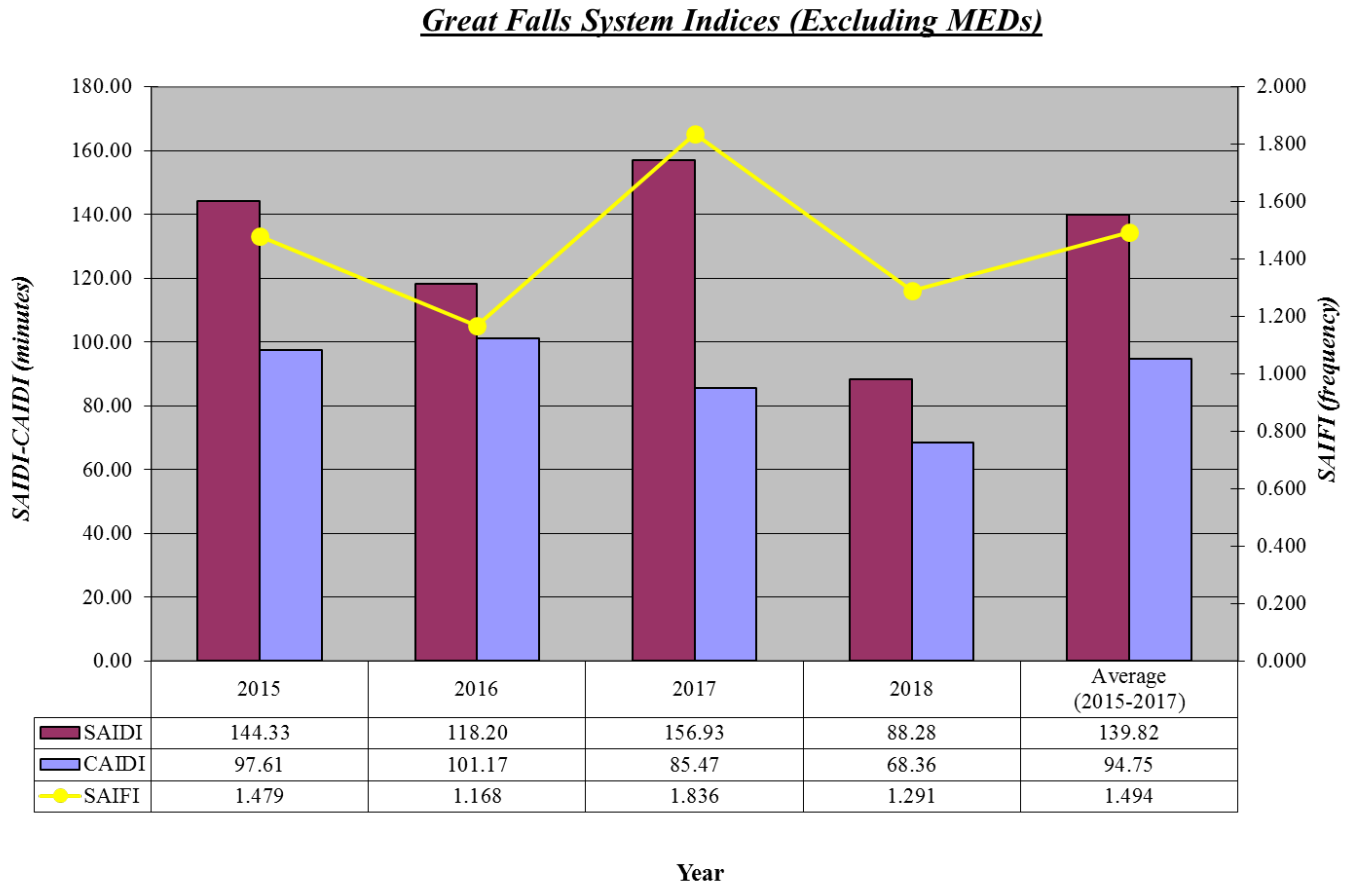


Figure 6.1 Great Falls system indices excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.

Great Falls System Indices (Including MEDs)

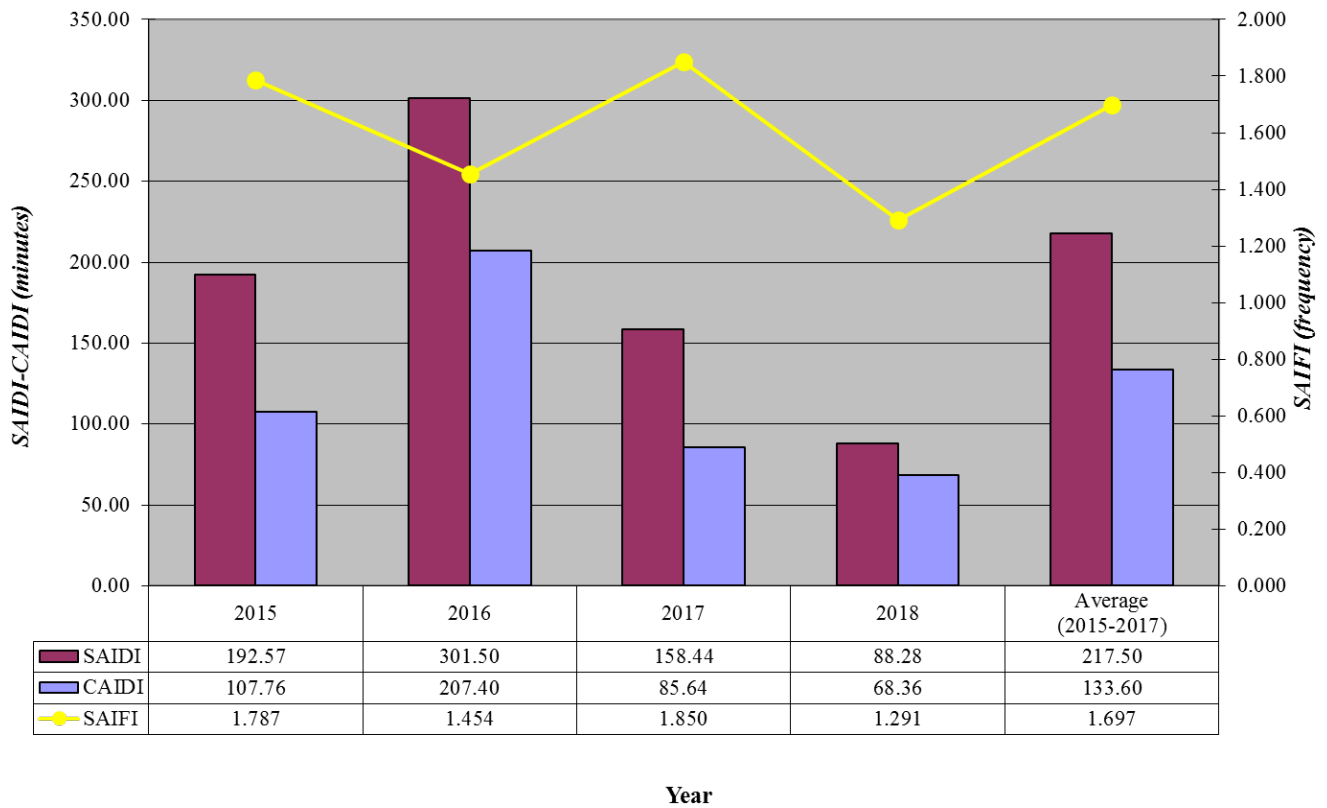


Figure 6.2 Great Falls system indices including major event days (MEDs) as defined in IEEE Standard 1366-2012.

Great Falls - Outages By Top Ten Causes (Excluding MEDs)

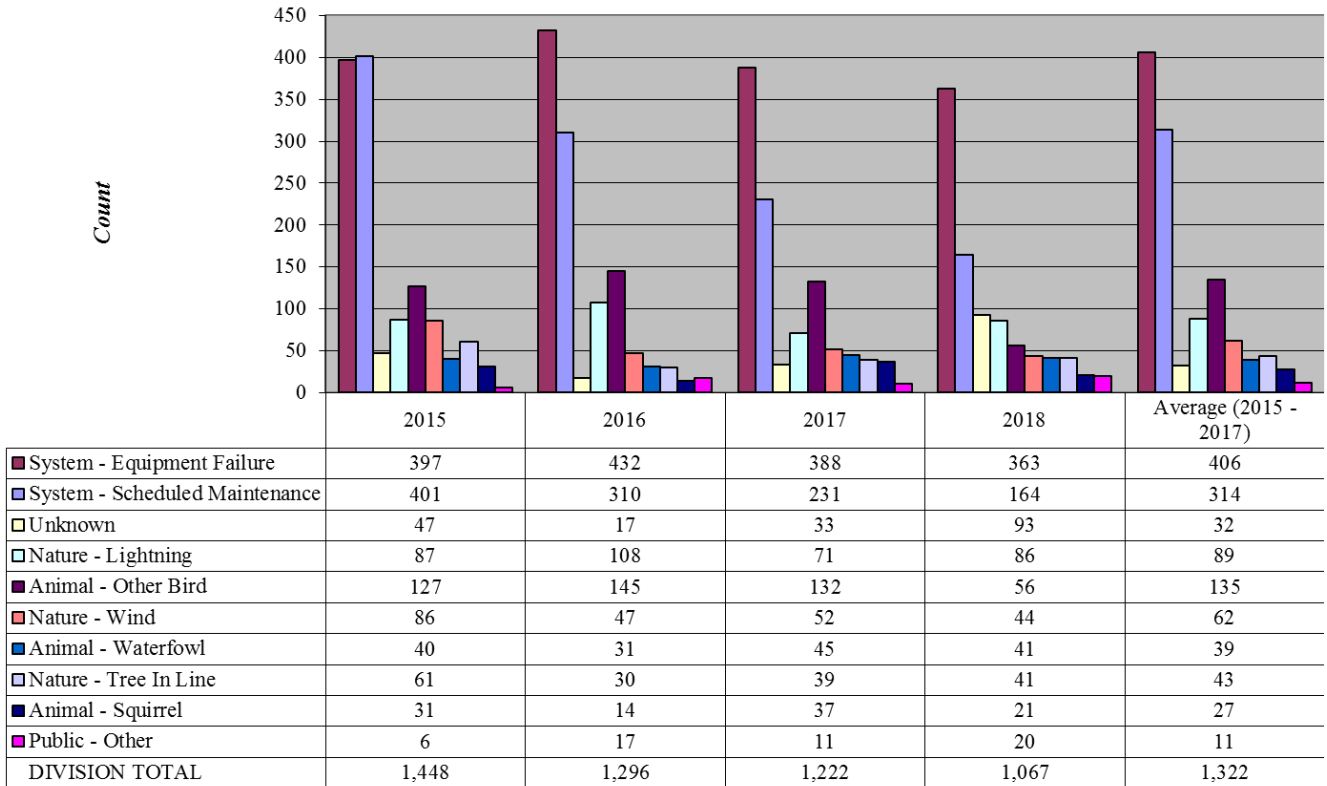


Figure 6.3 Great Falls system outages by top ten causes excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.

Great Falls - Outages By Top Ten Causes (Including MEDs)

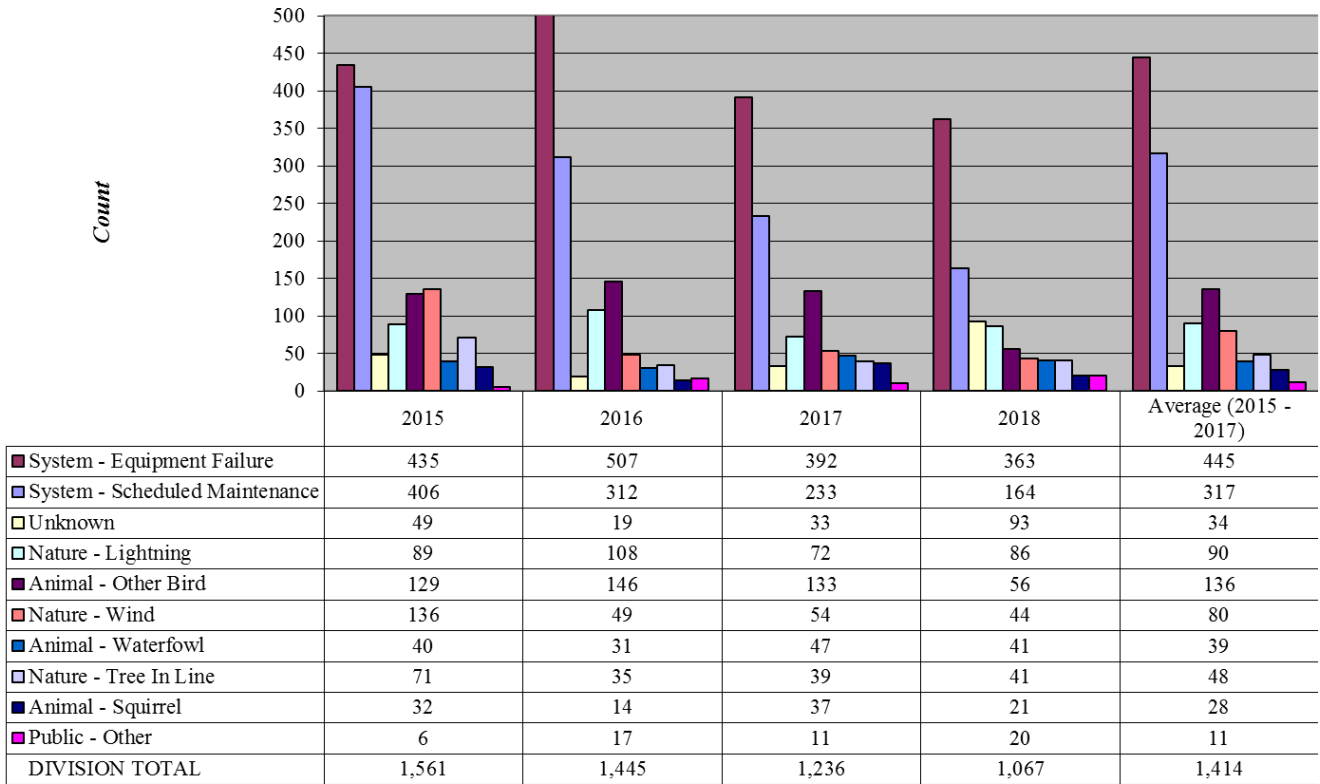


Figure 6.4 Great Falls system outages by top ten causes including major event days (MEDs) as defined in IEEE Standard 1366-2012.

7. HAVRE SYSTEM RELIABILITY

Havre saw an increase in SAIDI, CAIDI, and SAIFI. SAIDI and SAIFI are lower than their three-year averages. A transmission pole caused problems in the Chinook area in May. Larger outages were also caused by repairing a switch in the Chinook City Substation in August and a vehicle hitting a transmission pole in November that caused an outage in Big Sandy. Tree outages were notably down. Equipment Failures and Scheduled Outages increased in 2018.

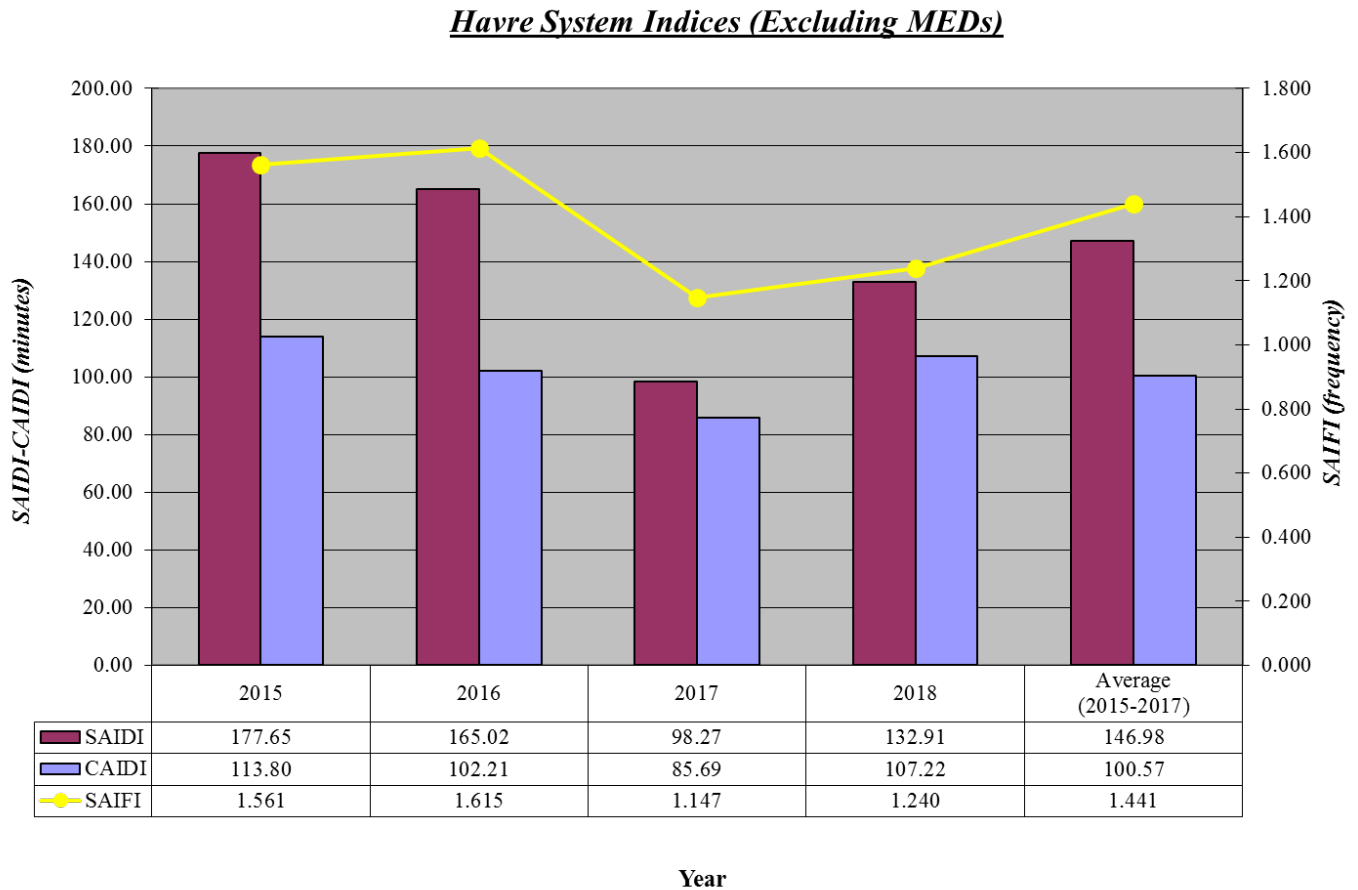


Figure 7.1 Havre system indices excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.

Havre System Indices (Including MEDs)

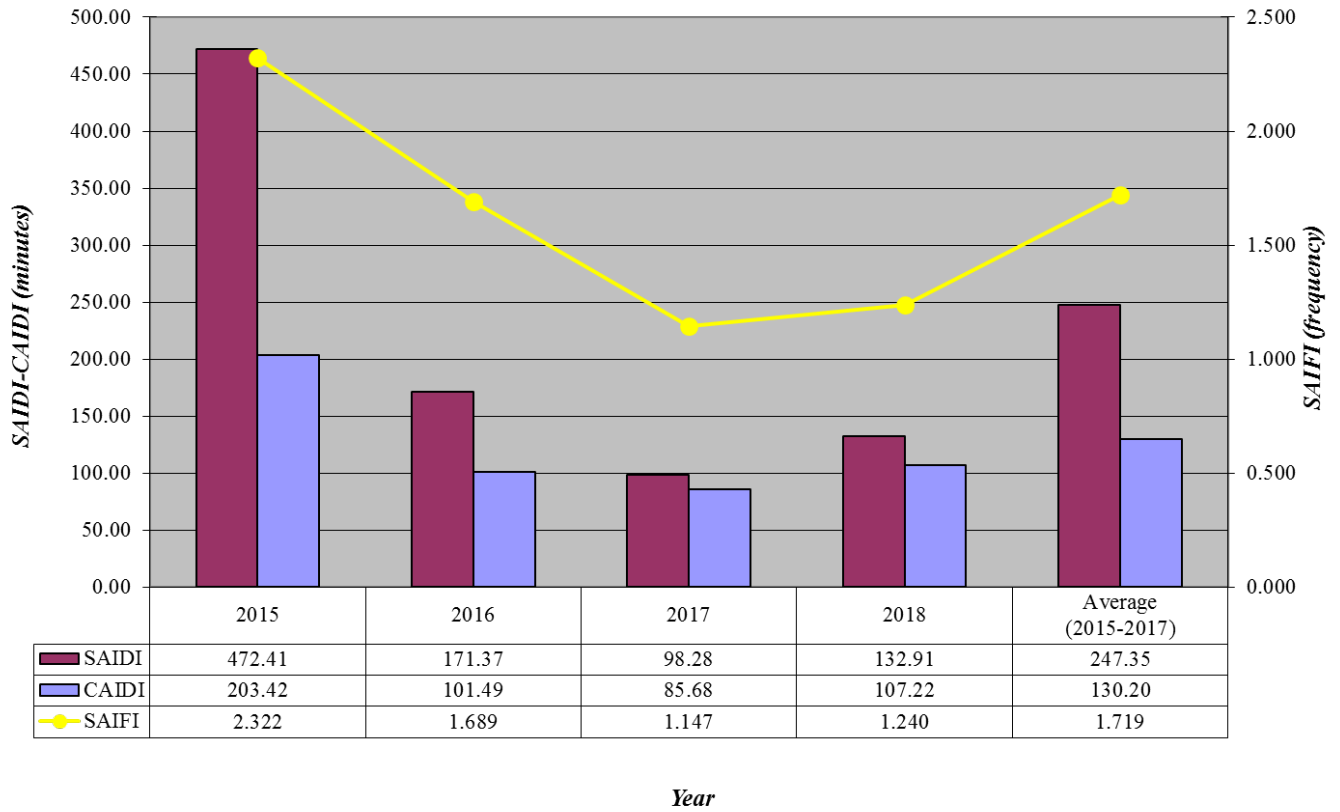


Figure 7.2 Havre system indices including major event days (MEDs) as defined in IEEE Standard 1366-2012.

Havre - Outages By Top Ten Causes (Excluding MEDs)

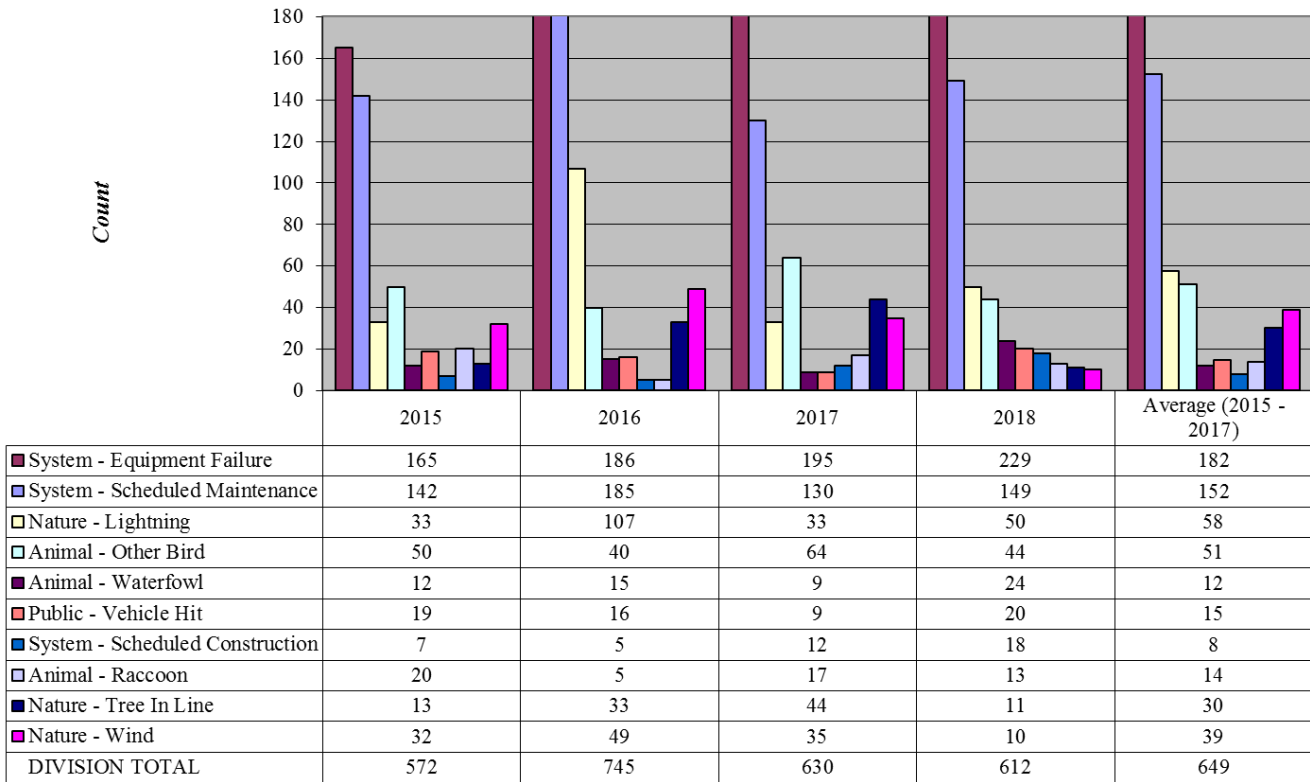


Figure 7.3 Havre system outages by top ten causes excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.

Havre - Outages By Cause (Including MEDs)

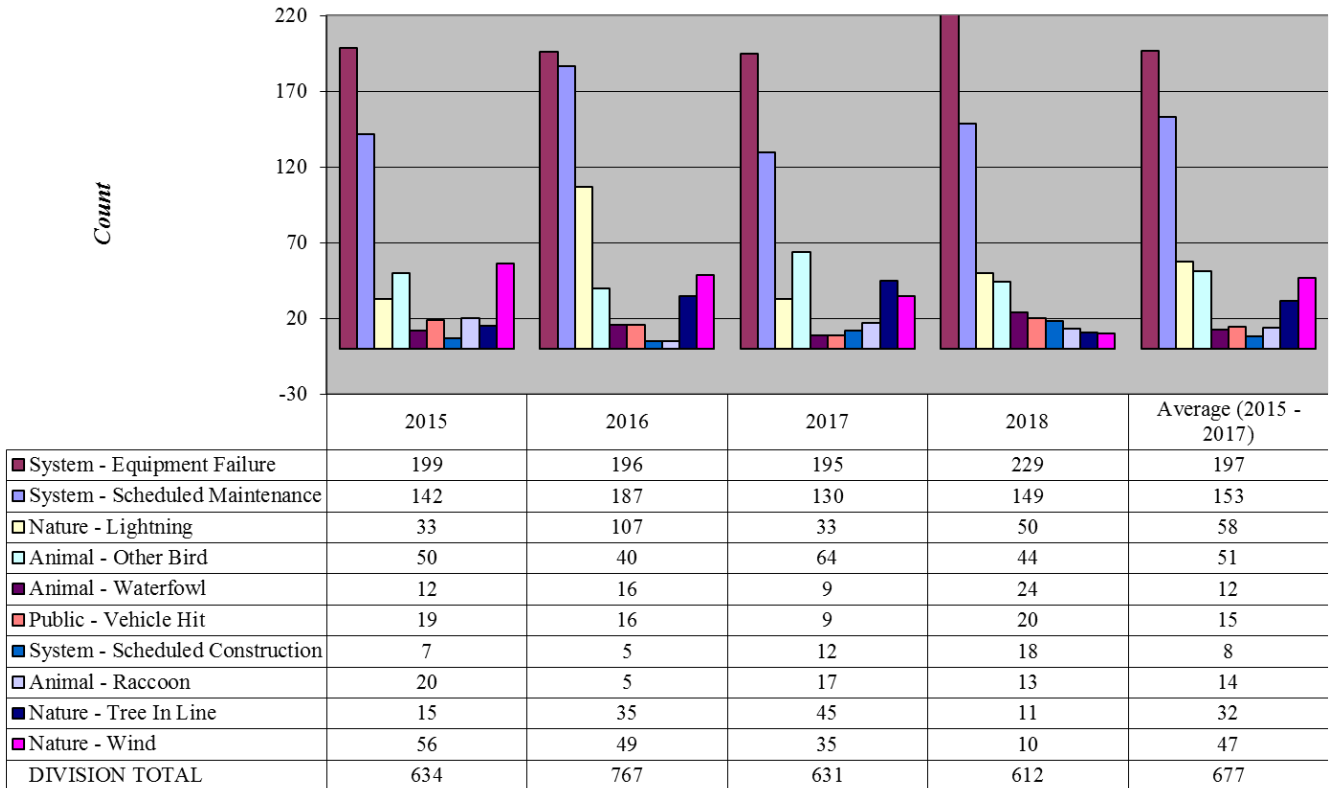


Figure 7.4 Havre system outages by top ten causes including major event days (MEDs) as defined in IEEE Standard 1366-2012.

8. HELENA SYSTEM RELIABILITY

Helena Division saw a large decrease in SAIDI and CAIDI. A reduction in SAIFI continued its trend down since at least 2015. SAIDI was below its three-year average. A storm with strong winds on May 7 caused problems on the transmission line serving White Sulphur Springs and Loweth. A house move on July 17 caused another outage for White Sulphur Springs. A planned outage occurred when a regulator was replaced at the Clancy Substation. Most all outage causes were down compared to 2017. However, lightning outages increased slightly.

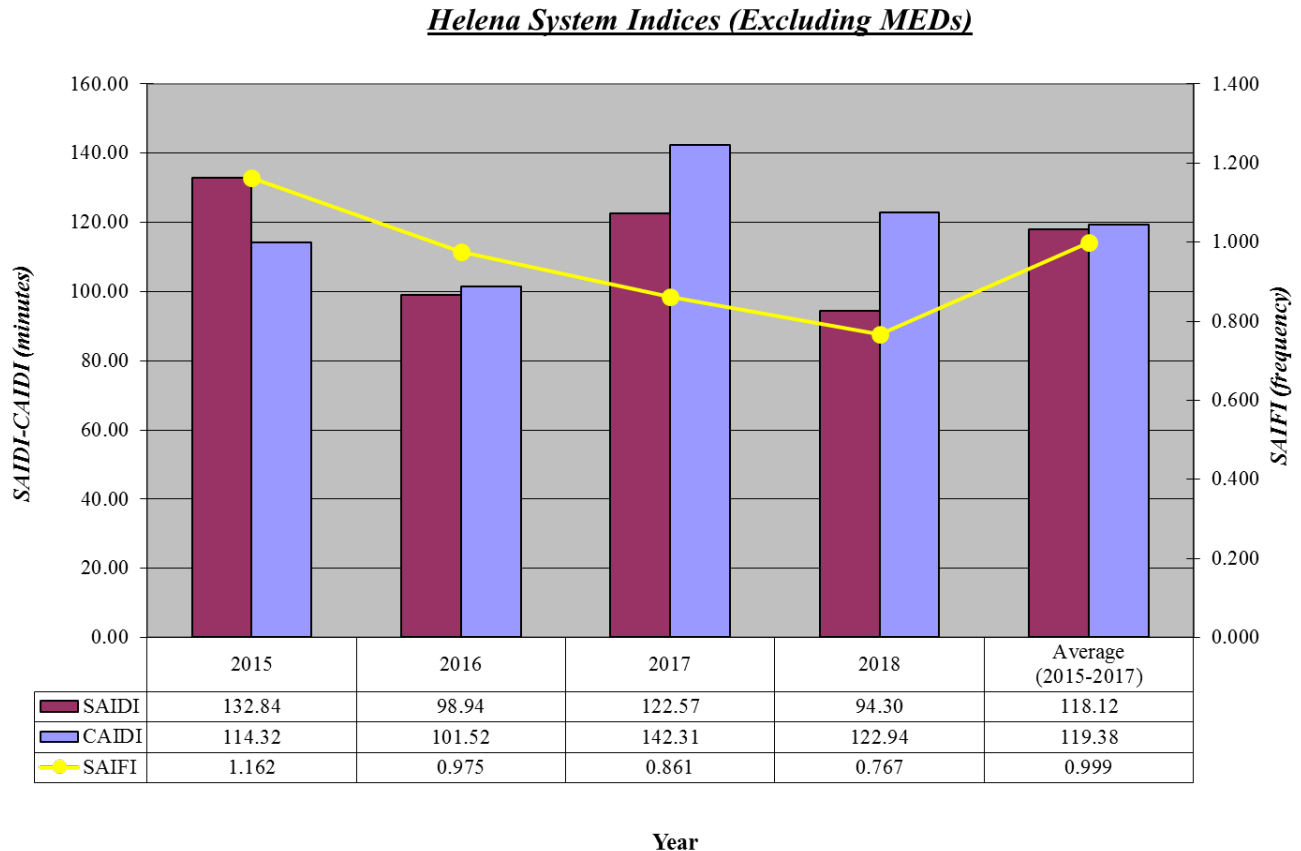


Figure 8.1 Helena system indices excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.

Helena System Indices (Including MEDs)

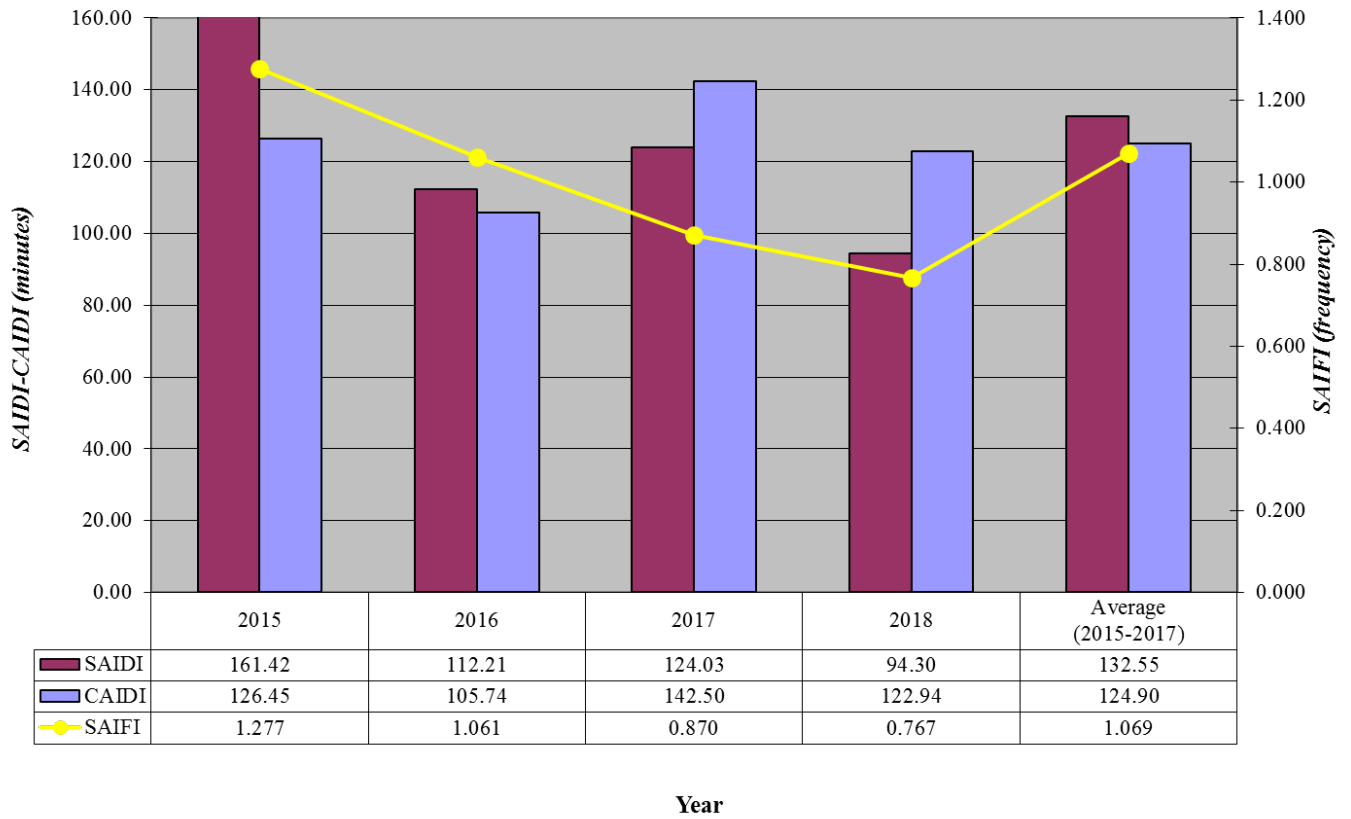


Figure 8.2 Helena system indices including major event days (MEDs) as defined in IEEE Standard 1366-2012.

Helena - Outages By Top Ten Causes (Excluding MEDs)

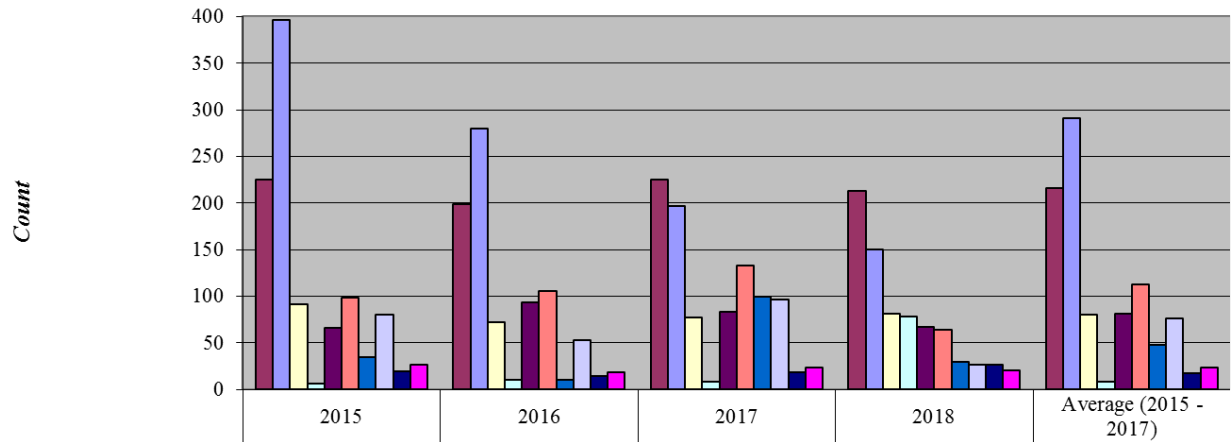


Figure 8.3 Helena system outages by top ten causes excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.

Helena - Outages By Top Ten Causes (Excluding MEDs)

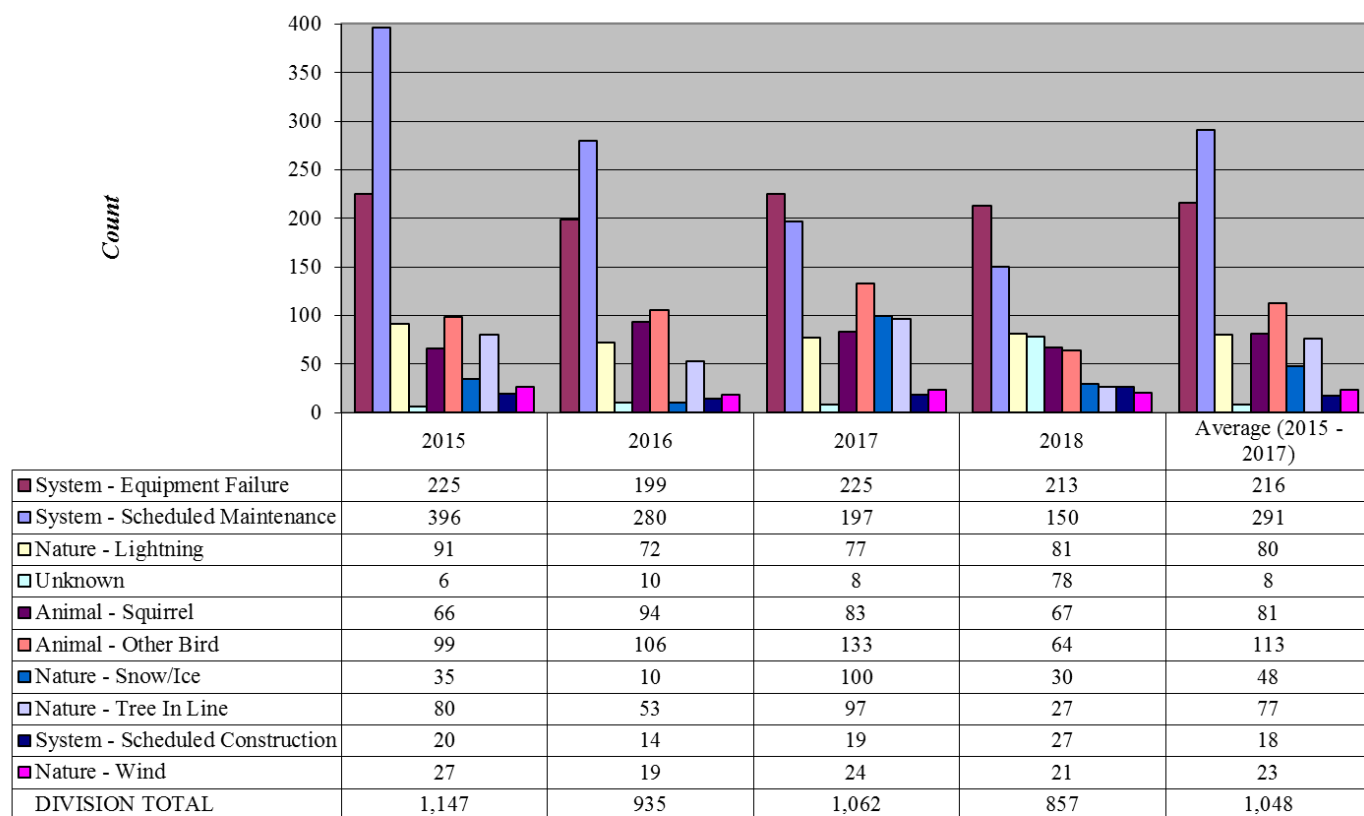


Figure 8.4 Helena system outages by top ten causes including major event days (MEDs) as defined in IEEE Standard 1366-2012.

9. MISSOULA SYSTEM RELIABILITY

The Missoula Division continues to improve SAIFI so that it remained below the three-year average. All three indices decreased in 2018. The largest event was caused by a wind storm on May 7 causing wires to slap together and get trees in the line. This affected customers in the Missoula and Bonner areas. In October, a contract crew hit a line in a substation causing outages for customers fed from the #5 Hillview Heights and #2 Service Center Substations. A winter storm caused problems for Missoula customers due to snow and ice loading and trees in the line on November 24. An arrestor failed on Russell Street Ckt 31 while it was on a hot line hold on August 28. All top ten outage causes decreased except for Snow/Ice, Unknown, and Scheduled Construction.

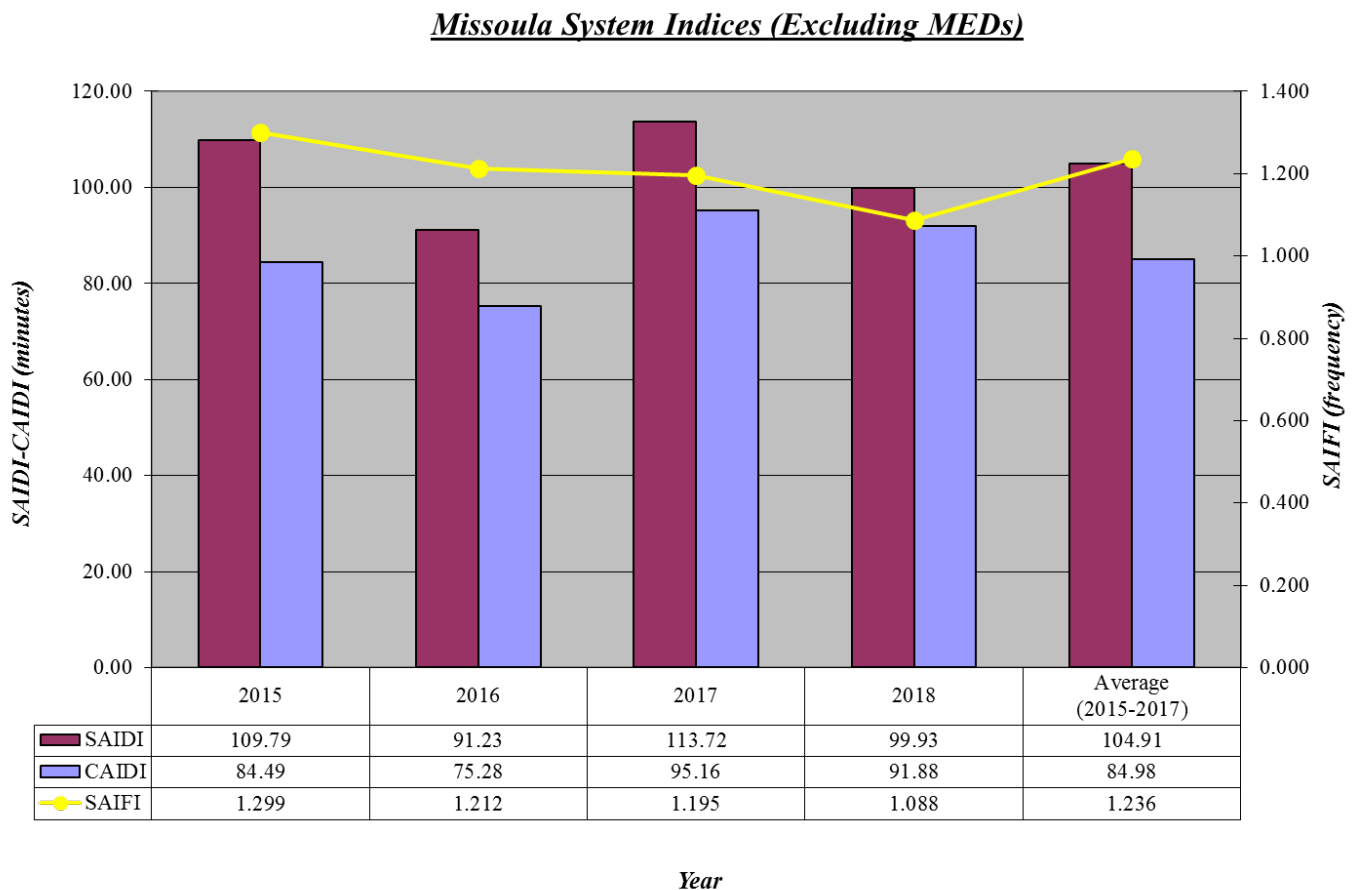


Figure 9.1 Missoula system indices excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.

Missoula System Indices (Including MEDs)

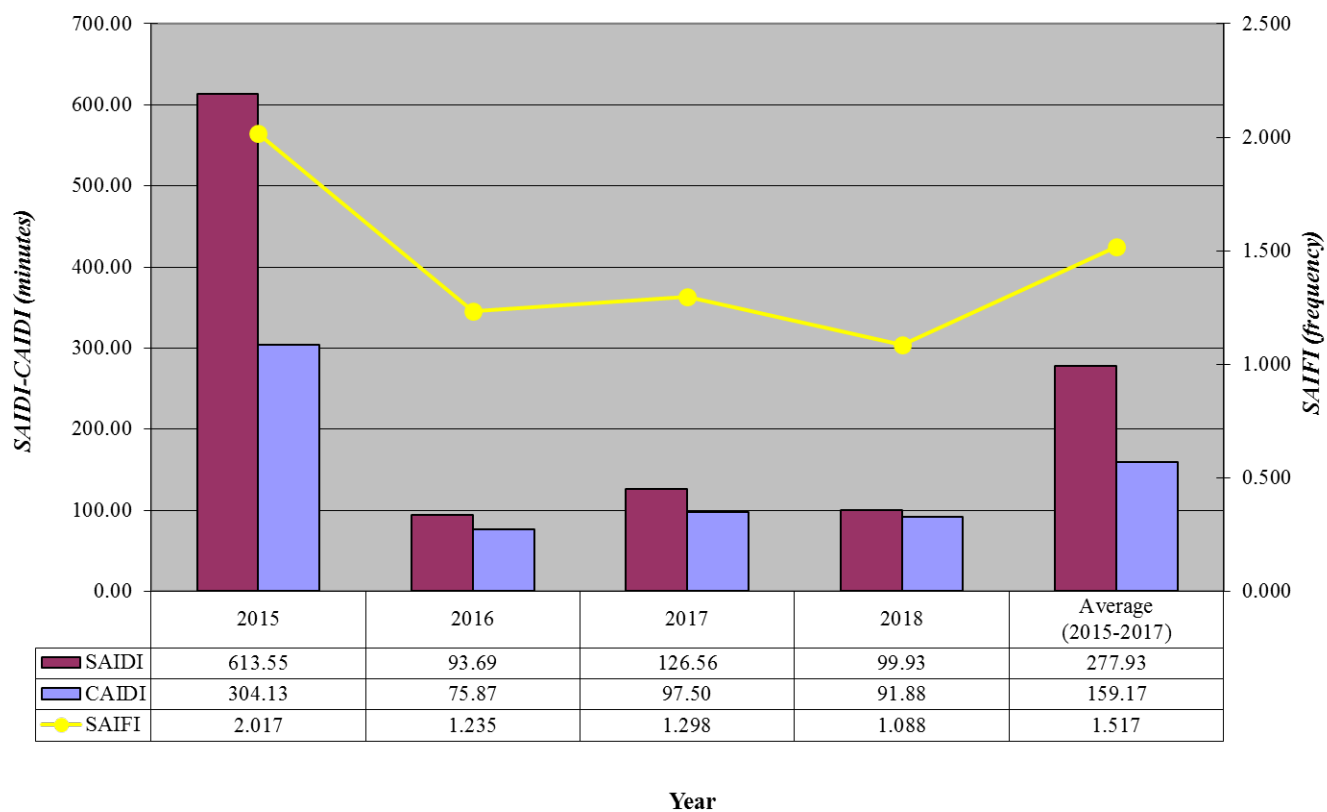


Figure 9.2 Missoula system indices including major event days (MEDs) as defined in IEEE Standard 1366-2012.

Missoula - Outages By Top Ten Causes (Excluding MEDs)

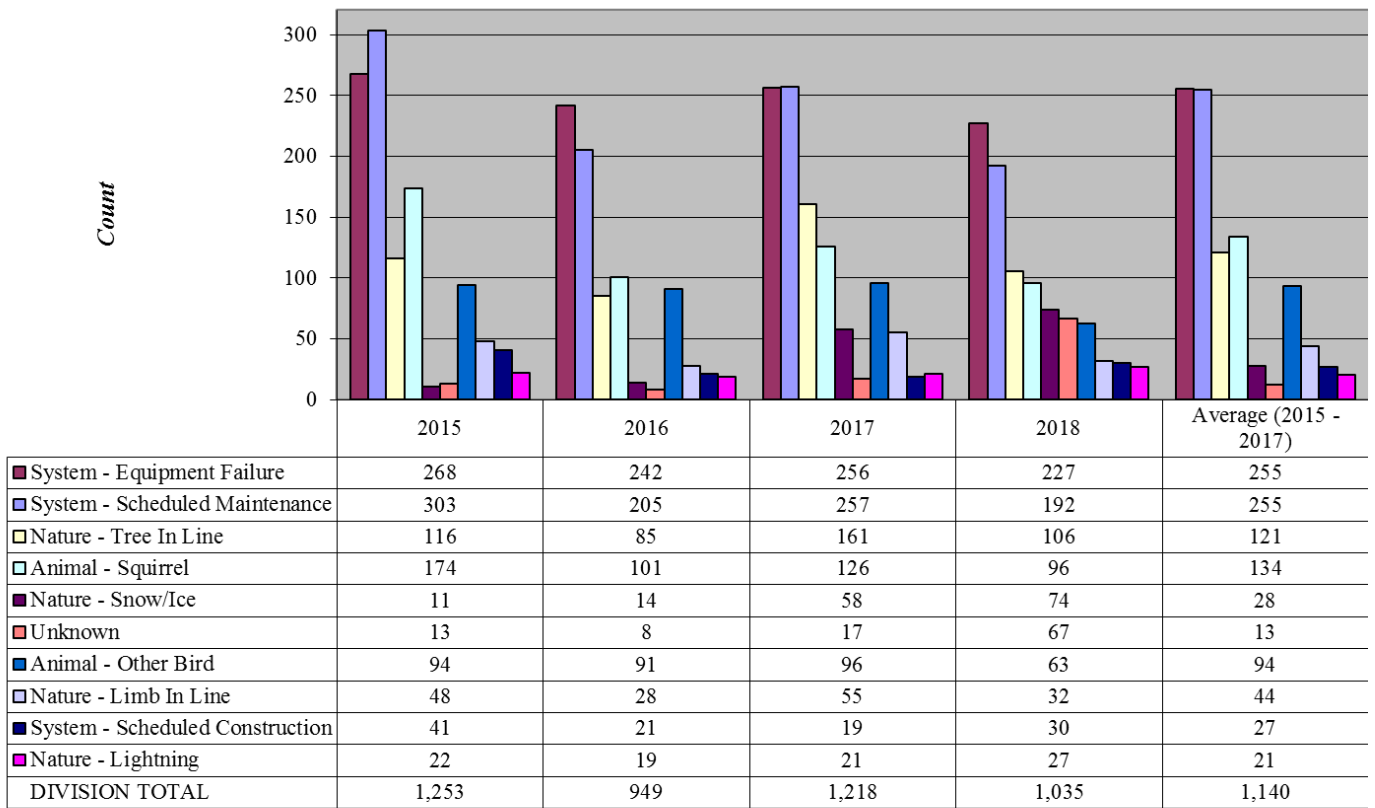


Figure 9.3 Missoula system outages by top ten causes excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.

Missoula - Outages By Top Ten Causes (Including MEDs)

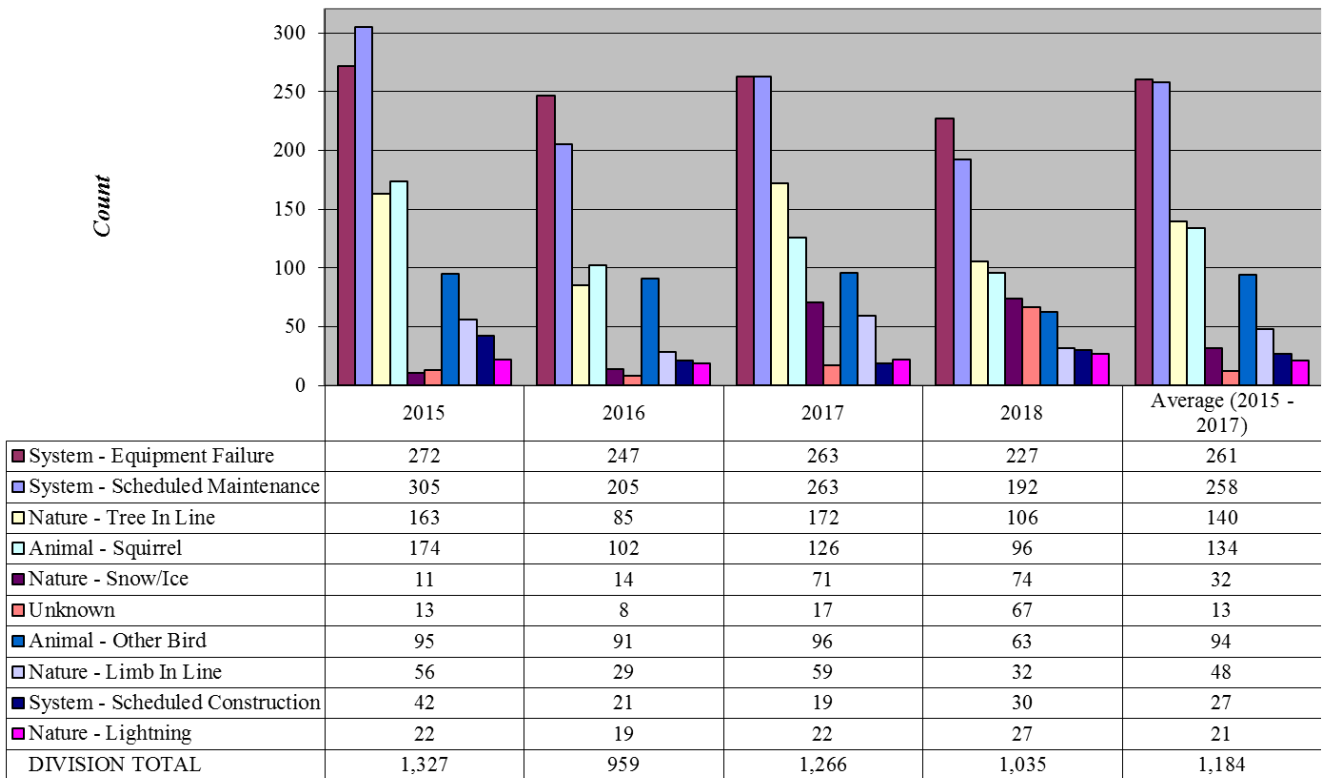


Figure 9.4 Missoula system outages by top ten causes including major event days (MEDs) as defined in IEEE Standard 1366-2012.

10. CONCLUSION

2018 started off with SAIDI at or above the three-year average until May. Unfortunately, SAIDI was then above the three-year average until mid-July. It was below the three-year average from then to the end of the year. With unusually fewer interruptions from July through December, SAIDI remained lower than average. The result was a year-end SAIDI, without MEDs, of 103 compared to the three-year average of 127. The year-end SAIDI, with MEDs, was 103 compared to the 187 three-year average. In summary, the Montana Region had an outstanding year for reliability.

The InService mobile work force and outage management system was implemented by NWE during the fall of 2014. This provided more accurate and timely outage reporting for 2018. Outage customer counts and times are derived from the GIS, call logging, and automated systems, eliminating the earlier manual outage reporting system and its inherent approximations. This was well illustrated in 2015 and 2016 with the large increase in Scheduled Construction and Maintenance outages. In the past, many of these outages were not reported. Both IEEE and the Department of Energy reports indicate that SAIDI numbers normally increase with this improved accuracy, but with the whims of nature, this may be difficult to determine for some time. The conversion to the IEEE reliability standard (1366-2012) does not define the 24 hour day, and many of the utilities involved in the IEEE benchmark survey have gone to something other than midnight-to-midnight. Some will even “roll” the 24 hours to more accurately capture the full impact of a storm day (and possible MED). This option was implemented by NWE in 2015.

As 2018 illustrates, the impacts of storms are a major contributor to reduced reliability and complicate any analysis. Substation and other asset improvements increased scheduled outages, but this work helps avoid equipment failures and provides facilities to serve future loads. With continued upgrades and planning, diligent work, and sincere effort, NorthWestern Energy strives to provide safe, reliable electric service to our customers and a safe working environment for our employees, now and into the future.