

NorthWestern[®] Energy

2019
-Montana-
Electric Distribution
Annual Reliability Report



March 2020

TABLE OF CONTENTS

EXECUTIVE SUMMARY	3
1. GENERAL	4
2. MONTANA SYSTEM RELIABILITY	5
3. BILLINGS SYSTEM RELIABILITY	7
4. BOZEMAN SYSTEM RELIABILITY	9
5. BUTTE SYSTEM RELIABILITY	11
6. GREAT FALLS SYSTEM RELIABILITY	13
7. HAVRE SYSTEM RELIABILITY	15
8. HELENA SYSTEM RELIABILITY	17
9. MISSOULA SYSTEM RELIABILITY	19
10. CONCLUSION	21

EXECUTIVE SUMMARY

This report provides information and insights into NorthWestern Energy's (NorthWestern) 2019 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 Institute of Electrical and Electronics Engineers (IEEE) standard definitions, these indices are for “sustained interruptions” meaning they lasted longer than five minutes.

System indices are given for the NorthWestern 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 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.

NorthWestern implemented the InService mobile work force and outage management system 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). NorthWestern implemented this option 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 2019, NorthWestern did not experience any Major Event Days. For the Montana region, it would take 5.45 SAIDI minutes in 2019 to declare an MED.

Since there were no MEDs in 2019, no catastrophic events occurred. NorthWestern has defined a “Catastrophic Event” as a sequential series of days that begins with an MED and has a combined SAIDI that is seven times the MED threshold, or 38.15 SAIDI minutes in 2019. 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:

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

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

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

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.

2. MONTANA SYSTEM RELIABILITY

Outage Metrics

All Divisions

Division
All

With MEDs
Without MEDs

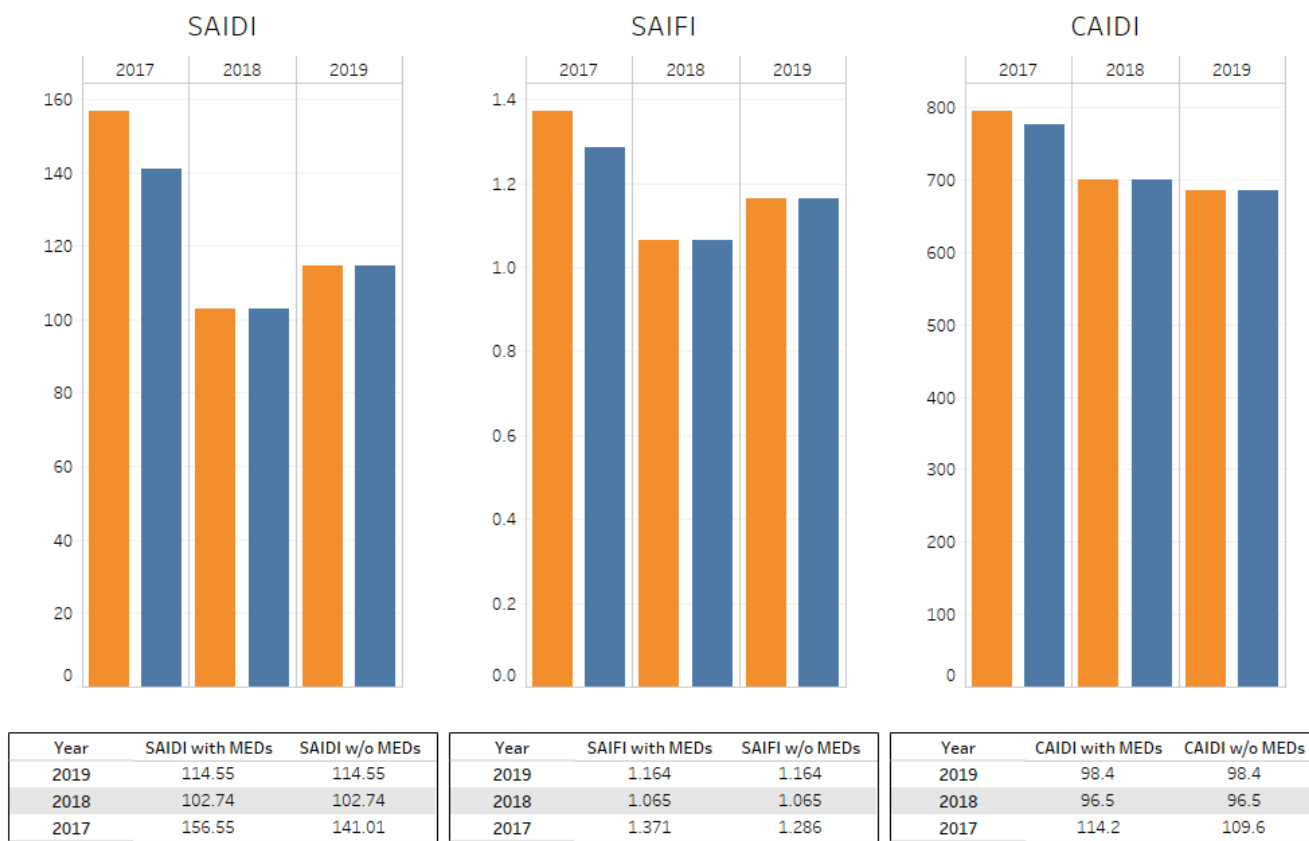


Figure 2.1 Montana system indices with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

The figure above displays NorthWestern Energy’s Montana region indices for the years 2017-2019 from year-end audited data. There were no MEDs in either 2018 or 2019; therefore, the reported indices are the same. Please note that SAIDI and CAIDI are given in minutes and SAIFI is given in the frequency of occurrence.

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 with and without MEDs to demonstrate the effect MEDs had on the system reliability in previous years.

Division
All

With MEDs
Without MEDs

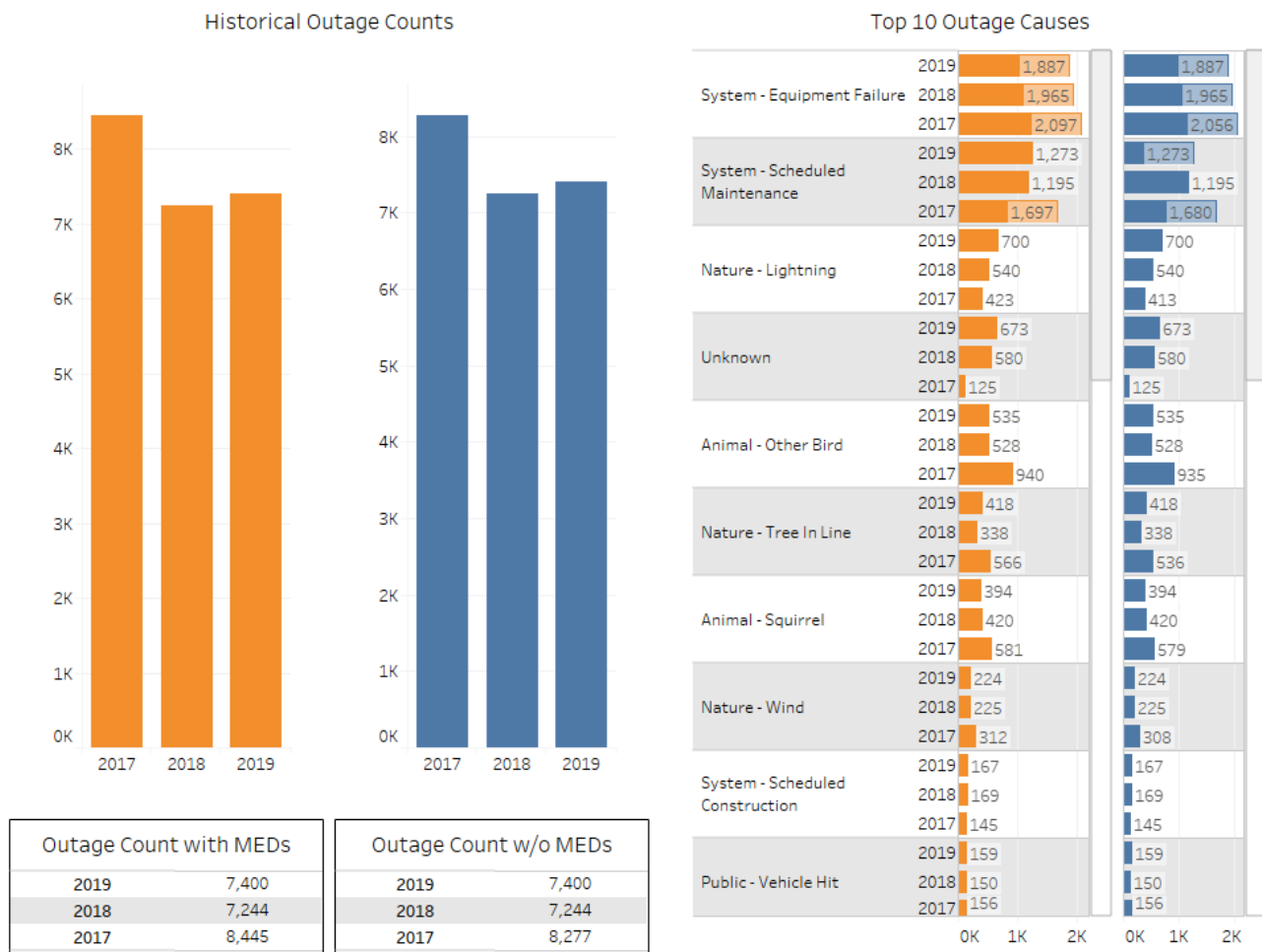


Figure 2.2 Montana system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

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 increased 2% from 2018 to 2019, though the numbers are still significantly less than in 2017.

Equipment Failure is the most common of the unscheduled outage causes due to its broad and all-inclusive category nature, although it is decreasing in trend. 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. Seven of the top 10 outage causes have been decreasing since 2017, although Nature – Lightning and Unknown causes have been slowly trending upwards as well as Scheduled Maintenance.

3. BILLINGS SYSTEM RELIABILITY

Outage Metrics Billings Division

Division
Billings

With MEDs
Without MEDs

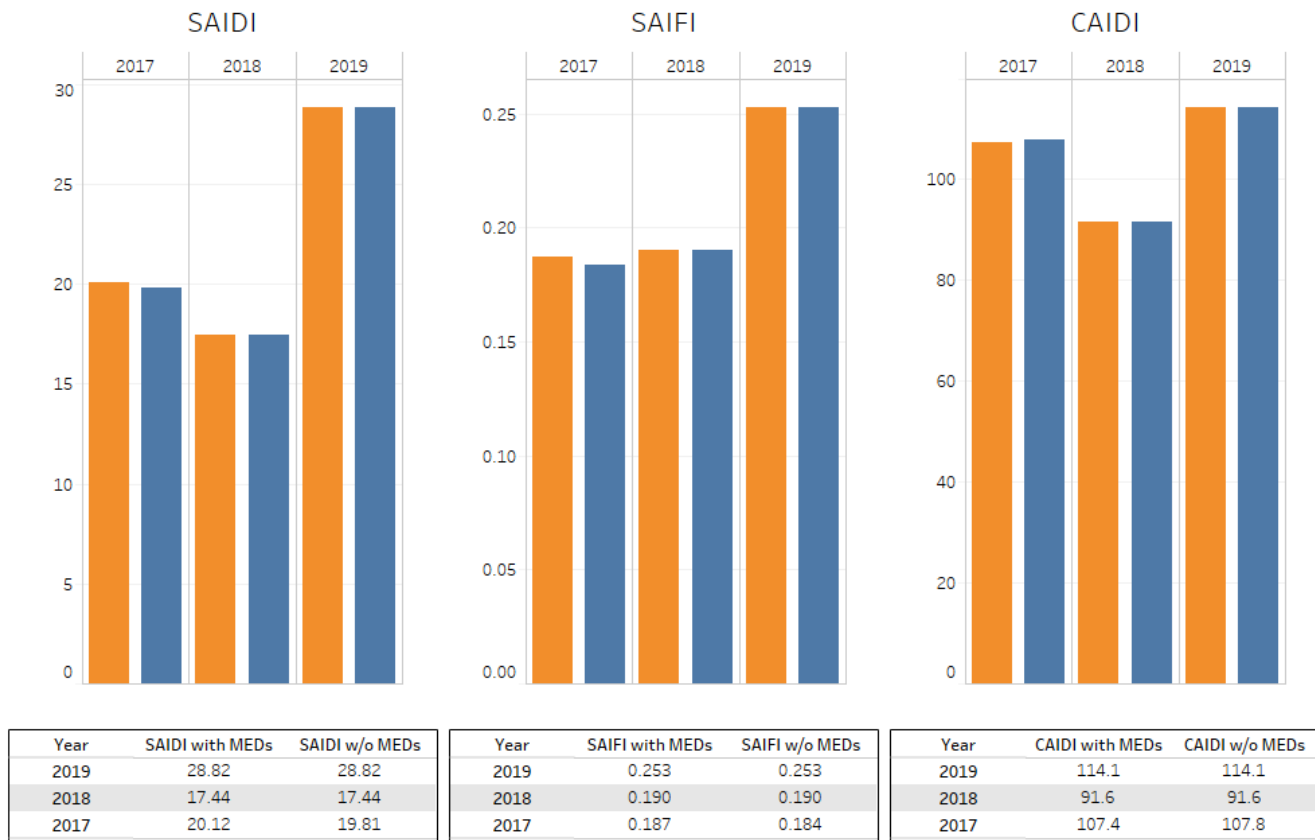


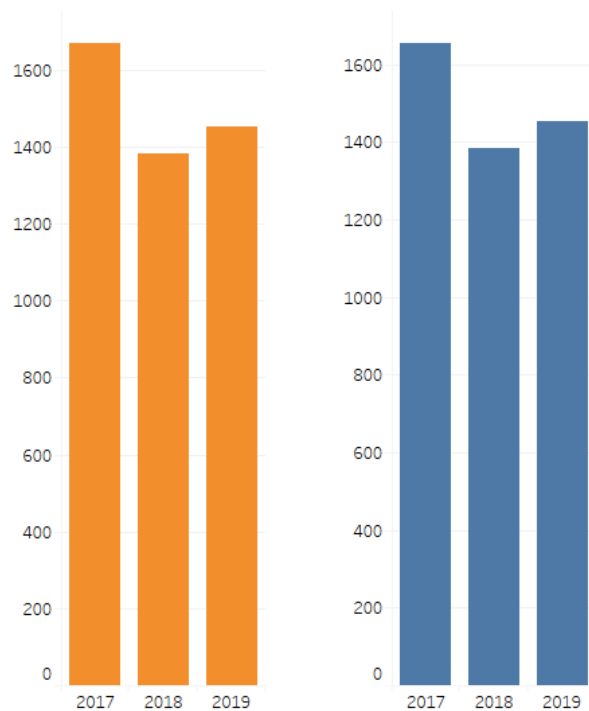
Figure 3.1 Billings system indices with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

For Billings, SAIDI increased in 2019. There were two hail and rain storms that passed through this division in August that accounted for 7.73 total SAIDI minutes – nearly 27% of the division’s SAIDI minutes. Due to the larger SAIDI numbers, SAIFI and CAIDI also increased for the year.

Division
Billings

With MEDs
Without MEDs

Historical Outage Counts



Outage Count with MEDs		Outage Count w/o MEDs	
2019	1,453	2019	1,453
2018	1,383	2018	1,383
2017	1,670	2017	1,654

Top 10 Outage Causes

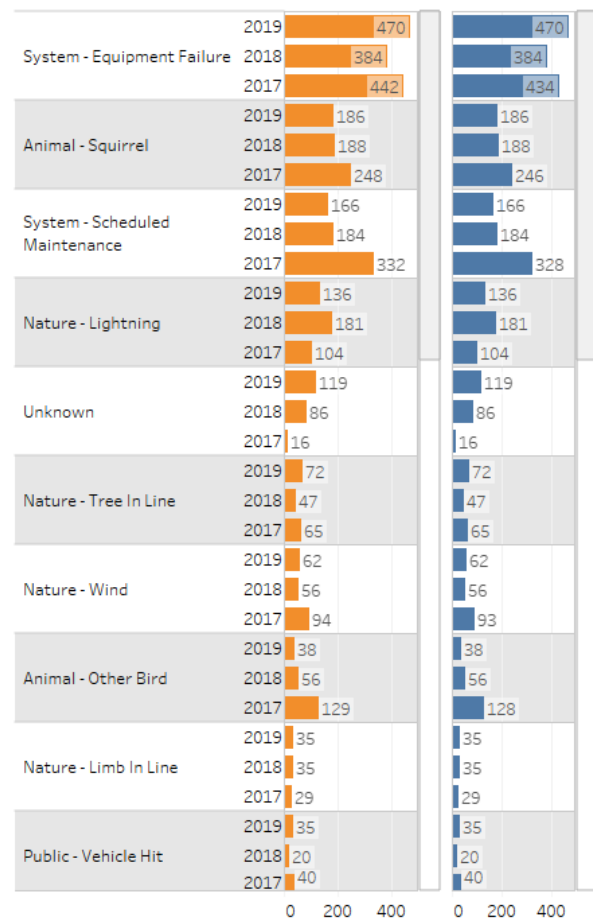


Figure 3.2 Billings system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

Equipment failure remains to be the cause of the largest number of outages in the Billings division. These outages are anything from transformer failures to underground equipment faults. Outages caused by squirrels have decreased in the past few years, but still remain high on the outage cause list. Nature, animal, and scheduled outages have also been decreasing, although the number of unknown causes has increased since 2017.

4. BOZEMAN SYSTEM RELIABILITY

Outage Metrics

Bozeman Division

Division
Bozeman

With MEDs
Without MEDs

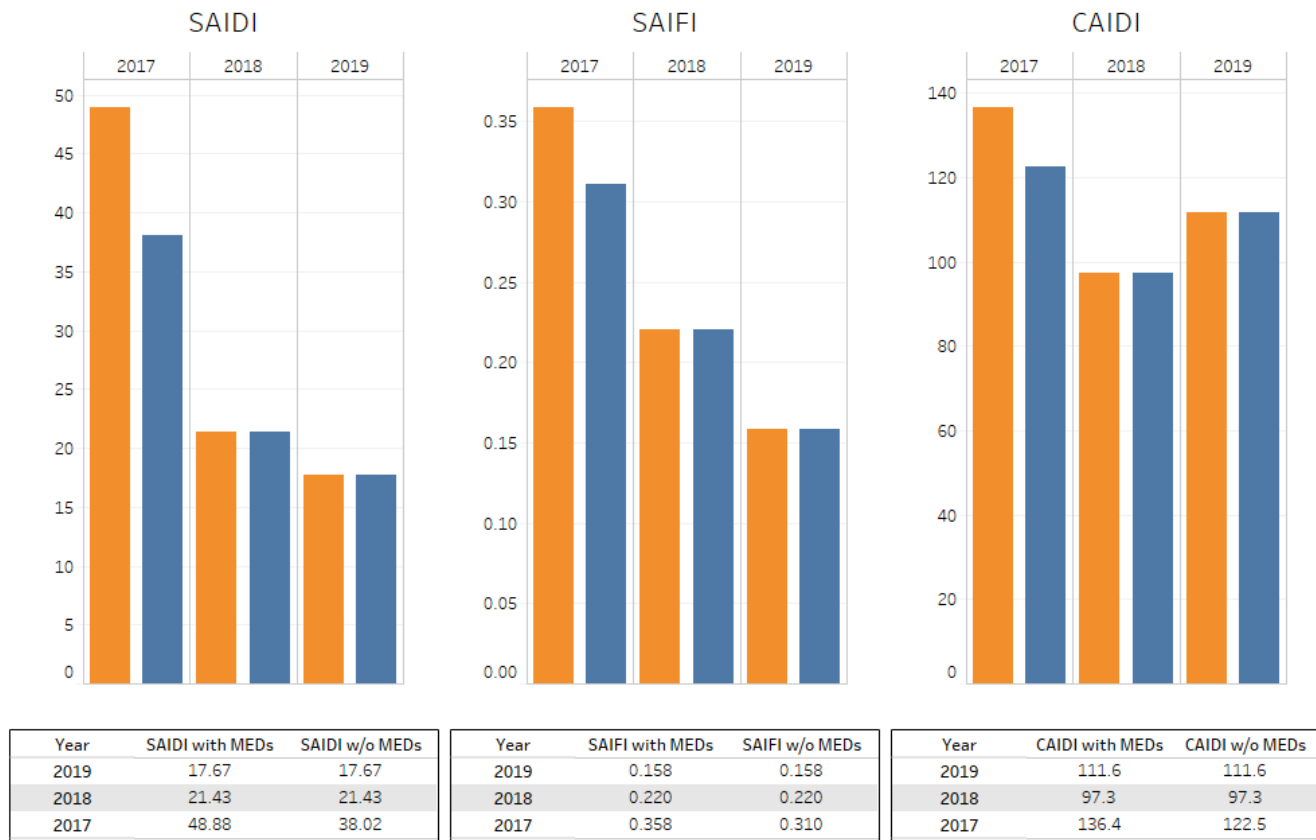


Figure 4.1 Bozeman system indices with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

Bozeman division indices for 2019 saw a decrease in SAIDI and SAIFI. CAIDI increased slightly in this time, meaning that the duration of the outage a customer may have experienced was slightly longer than in 2018, though still less than what they would have seen in 2017.

Division
Bozeman

With MEDs
Without MEDs

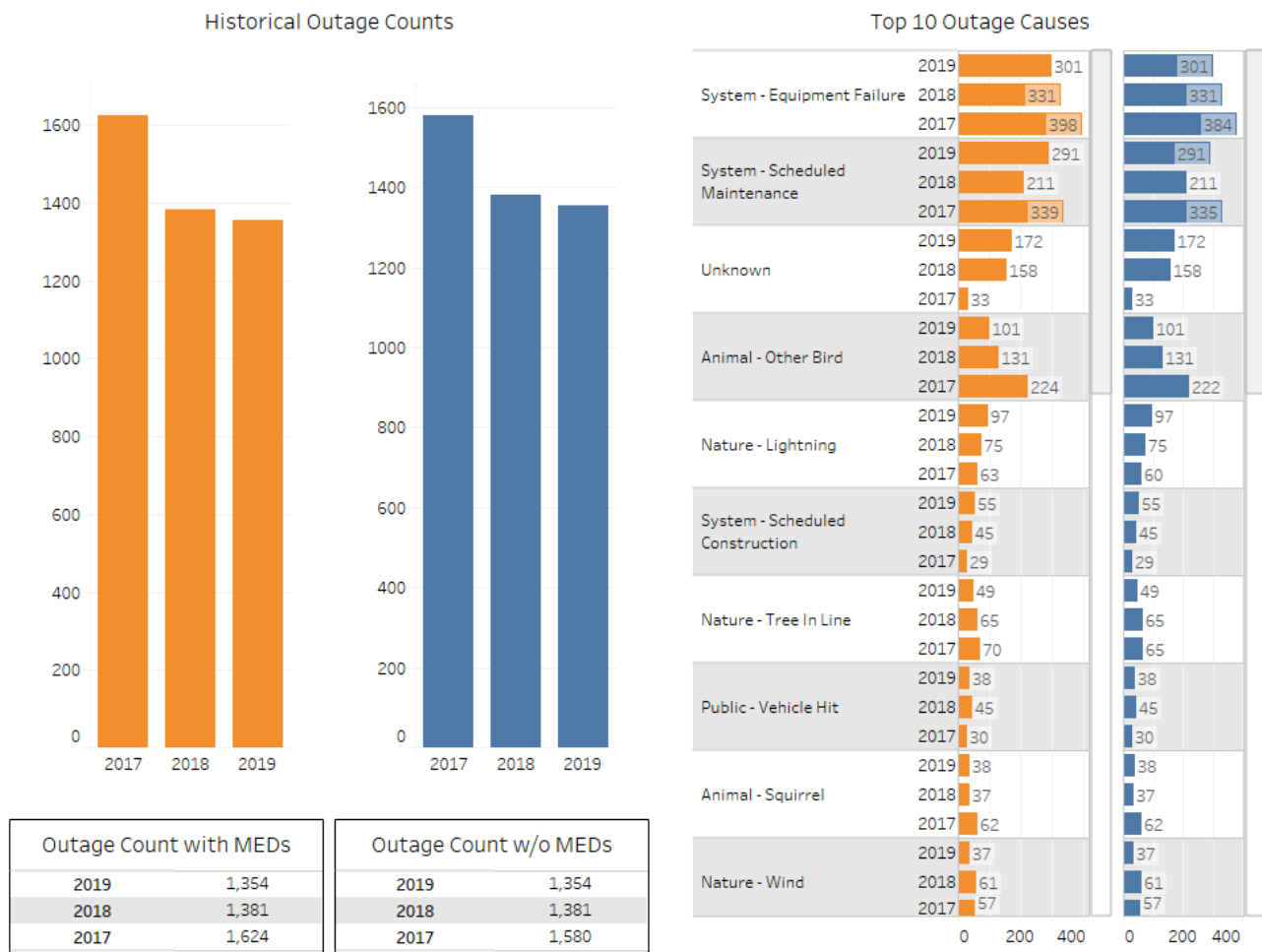


Figure 4.2 Bozeman system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

Equipment failure is also the largest outage cause in the Bozeman division. These outages are mostly underground equipment failures and insulator failures. Most of the remaining outage causes are fairly steady from 2017-2019, though scheduled outages have increased as well as unknown causes.

5. BUTTE SYSTEM RELIABILITY

Outage Metrics

Butte Division

Division
Butte

With MEDs
Without MEDs

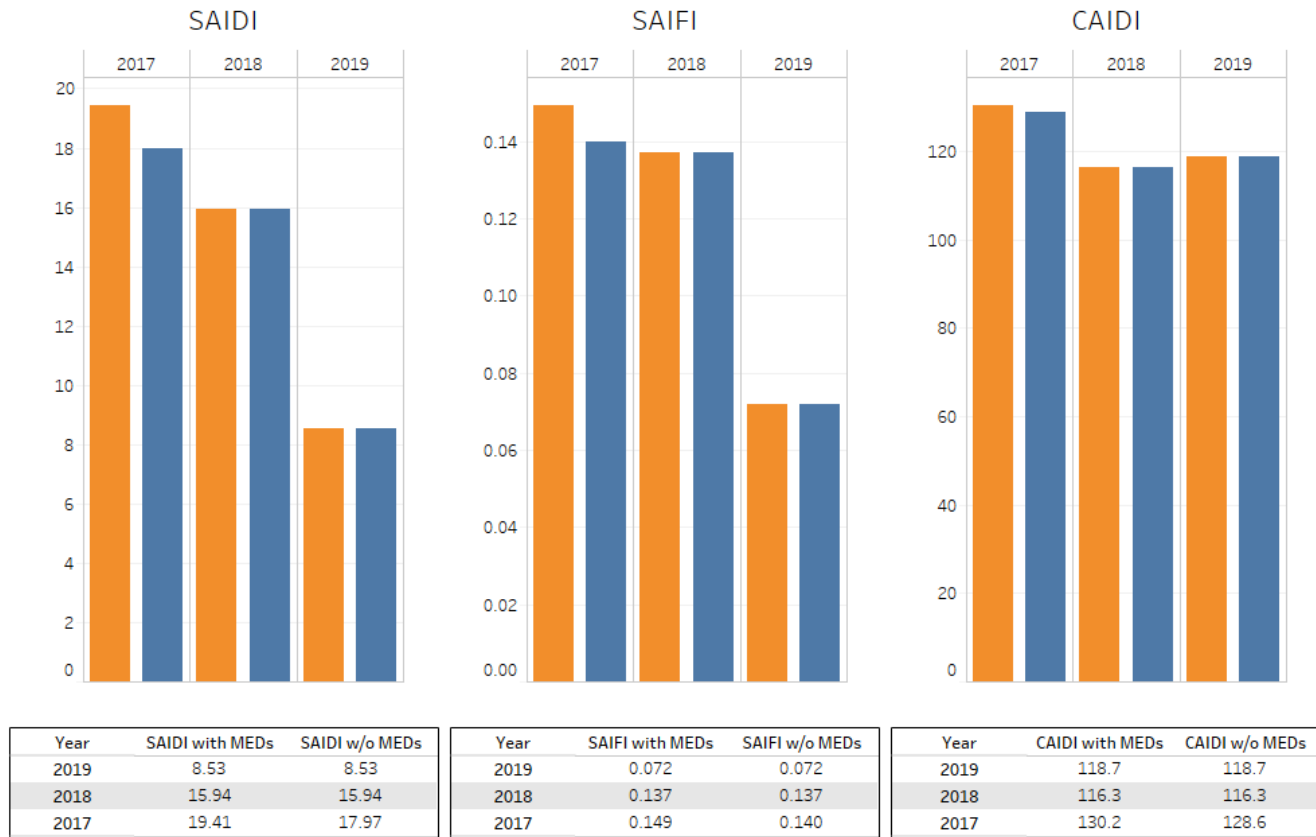


Figure 5.1 Butte system indices excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.

SAIDI and SAIFI both significantly decreased in the Butte division in 2019. CAIDI had a very slight increase, though it is still fairly steady with the three-year average. The largest daily SAIDI in 2019 was due to a scheduled outage due to a transmission line rebuild.

Division
Butte

With MEDs
Without MEDs

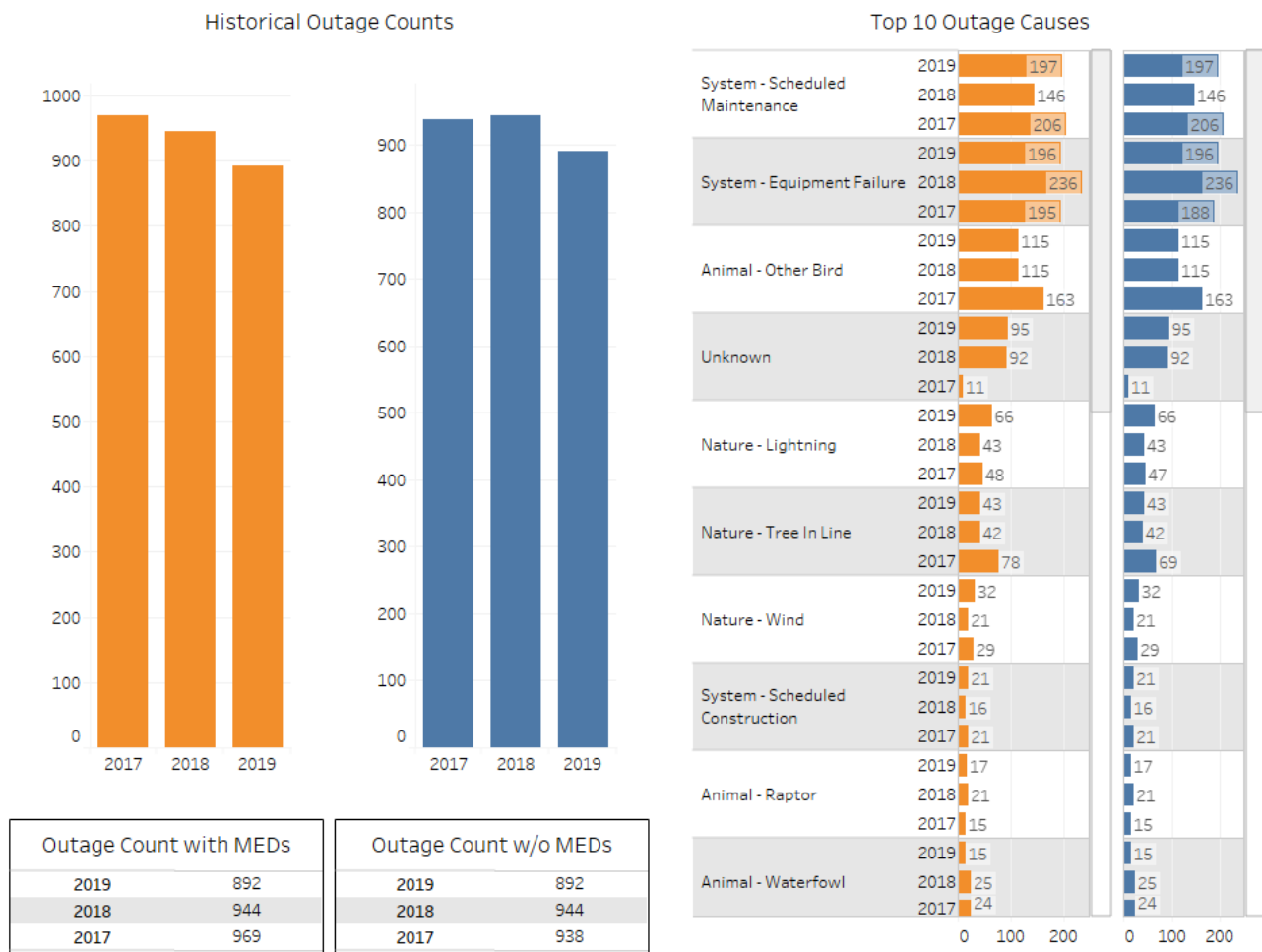


Figure 5.2 Butte system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

As shown above, scheduled maintenance was the largest outage contributor in the Butte division in 2019. Equipment failure was also high on this list, which included several outages caused by arrestor and conductor failures.

6. GREAT FALLS SYSTEM RELIABILITY

Outage Metrics

Great Falls Division

Division
Great Falls

With MEDs
Without MEDs

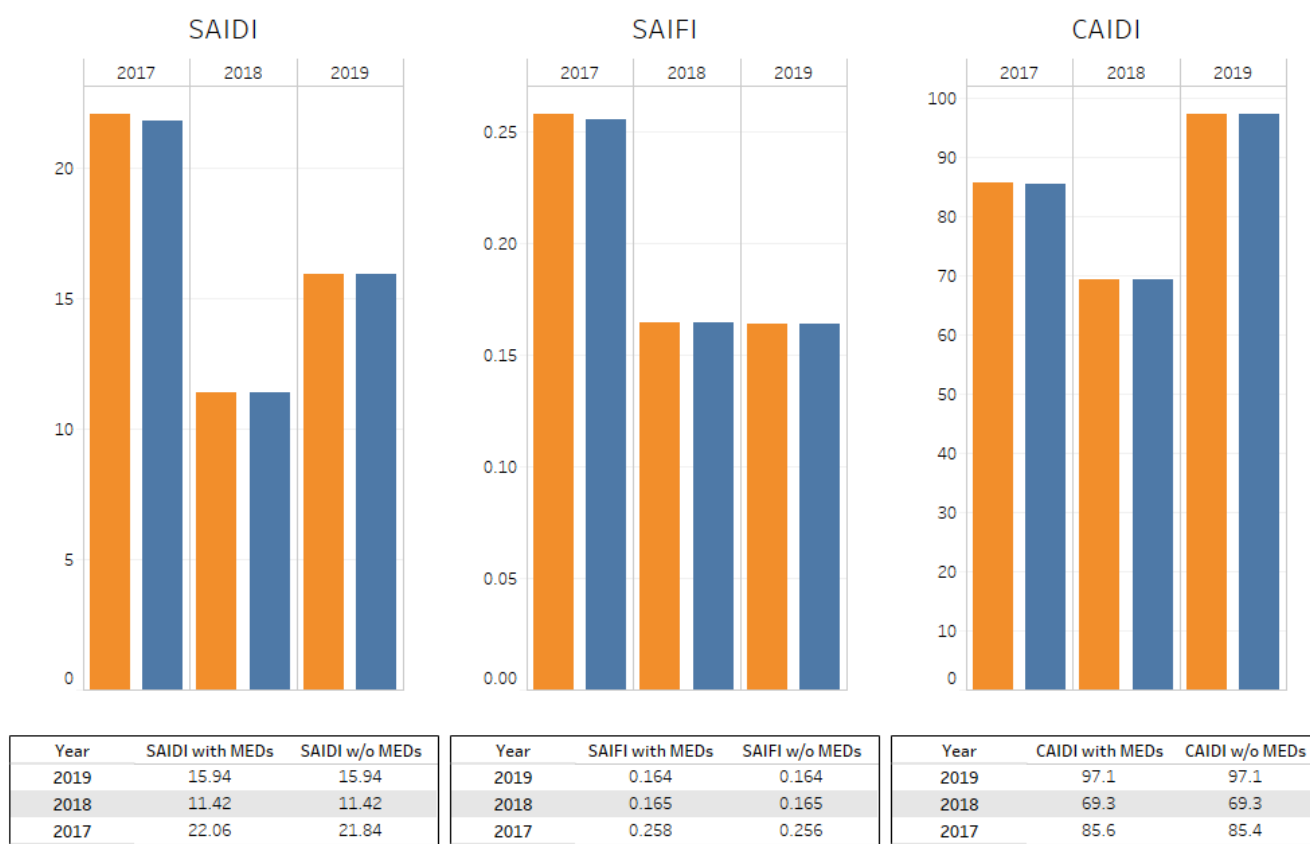


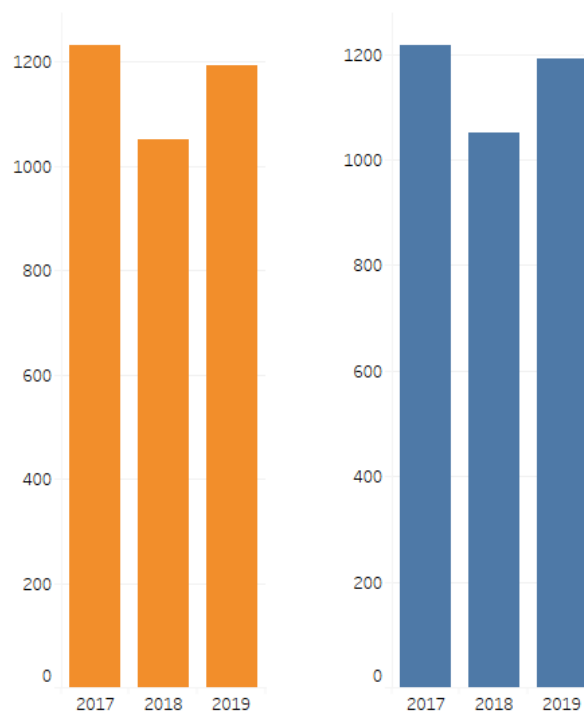
Figure 6.1 Great Falls system indices with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

Great Falls Division had an increase in outages in 2019 after a sharp decline in 2018. SAIDI and CAIDI increased, with SAIFI staying close to 2018 numbers. There were two hail storms in the Great Falls division that accounted for 1.45 SAIDI minutes in April and another 1.78 SAIDI minutes in July, making up about 20% of the year's outages in this division. There was also a conductor failure on transmission underbuild in May that accounted for 0.99 SAIDI minutes.

Division
Great Falls

With MEDs
Without MEDs

Historical Outage Counts



Outage Count with MEDs

2019	1,192
2018	1,050
2017	1,231

Outage Count w/o MEDs

2019	1,192
2018	1,050
2017	1,217

Top 10 Outage Causes

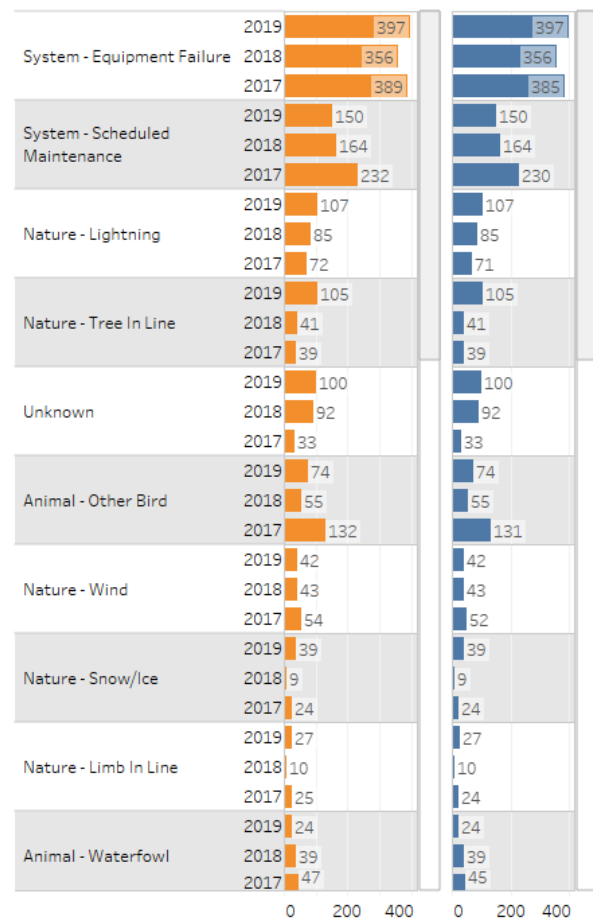


Figure 6.2 Great Falls system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

There was an increase in outage counts as well in 2019. The largest number of equipment failures were conductor and insulator failures in the Great Falls division. Nature outages are either steady or increasing in Great Falls, and unknown causes are increasing.

7. HAVRE SYSTEM RELIABILITY

Outage Metrics

Havre District

Division
Havre

With MEDs
Without MEDs

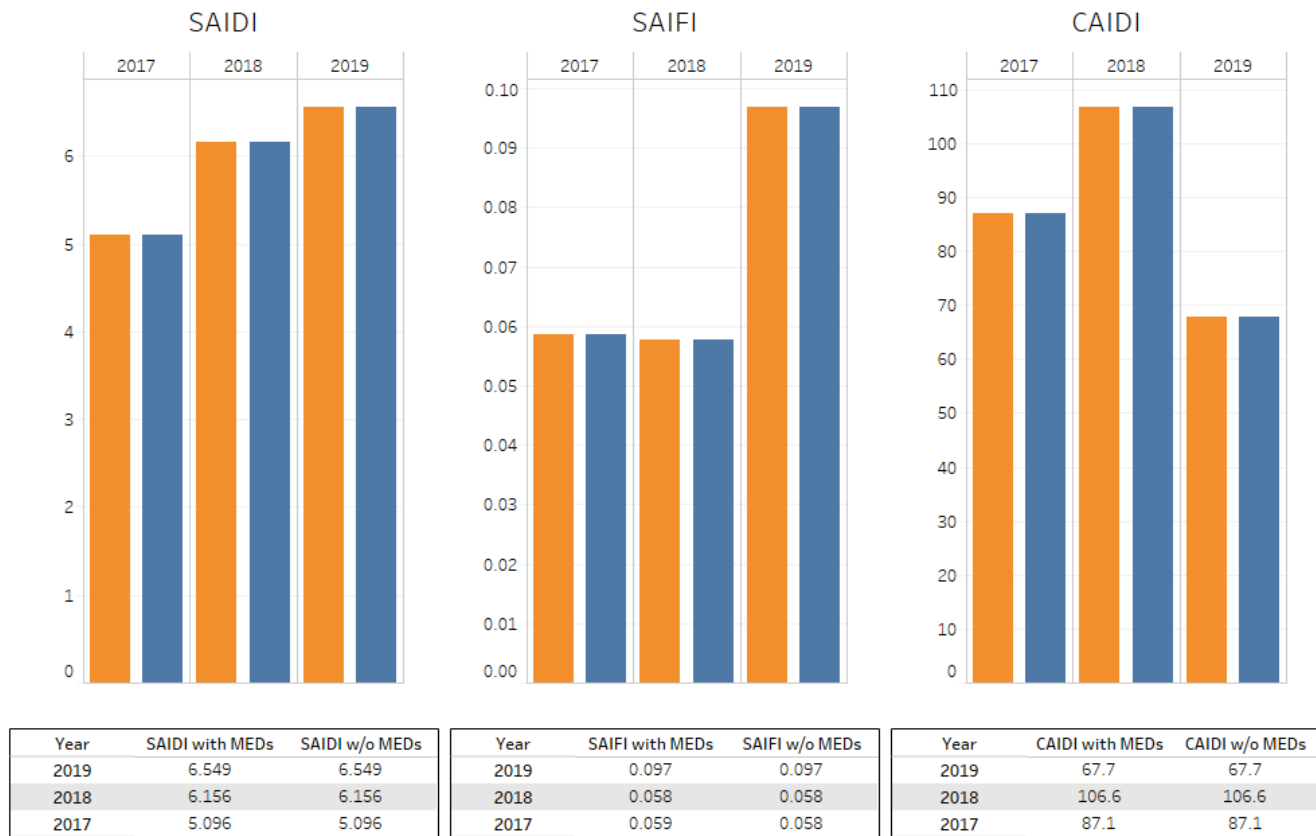


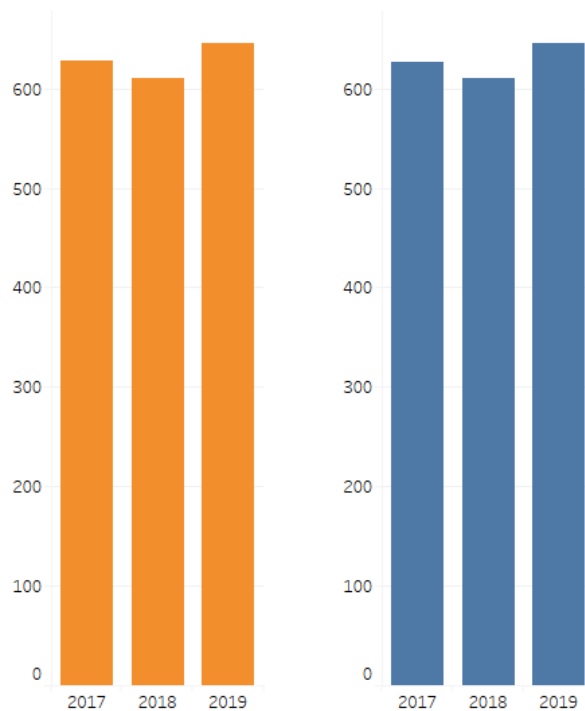
Figure 7.1 Havre system indices with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

Havre saw an increase in SAIDI and SAIFI and a decrease in CAIDI in 2019. A broken transmission pole accounts for 0.73 SAIDI minutes in March, while strong winds in February and a thunderstorm in June accounted for an additional 1.00 SAIDI minutes. These 3 events account for more than 26% of Havre's SAIDI in 2019.

Division
Havre

With MEDs
Without MEDs

Historical Outage Counts



Outage Count with MEDs		Outage Count w/o MEDs	
2019	645	2019	645
2018	611	2018	611
2017	628	2017	627

Top 10 Outage Causes

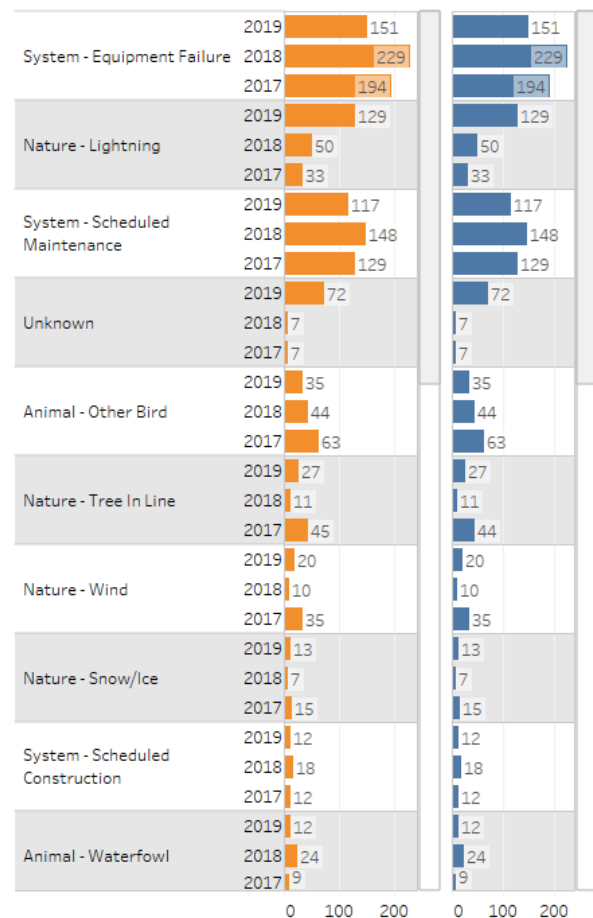


Figure 7.2 Havre system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

Most outage causes are steadily declining in Havre, and the outage counts remain fairly steady. Like in other divisions, Equipment Failures account for most of the outages in Havre. Lightning outages more than doubled from 2018 to 2019 due to several large storms passing through the area.

8. HELENA SYSTEM RELIABILITY

Outage Metrics

Helena Division

Division
Helena

With MEDs
Without MEDs

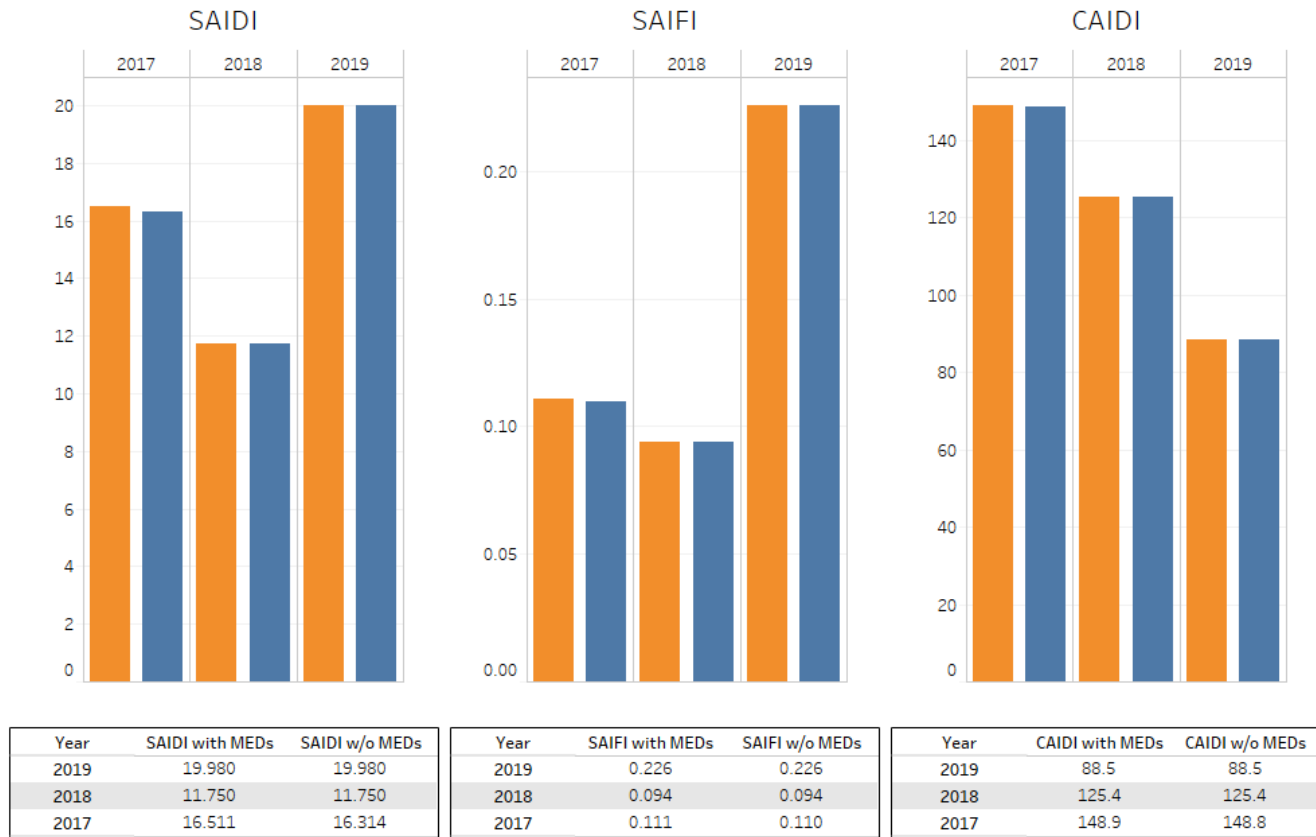


Figure 8.1 Helena system indices with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

Helena Division saw a large increase in SAIDI and SAIFI in 2019. CAIDI, however, decreased. There were several large outages on the transmission side of the lines that accounted for 5.77 SAIDI minutes in Helena. Excluding these outages, Helena SAIDI for 2019 is very close to the 3-year average.

Division
Helena

With MEDs
Without MEDs

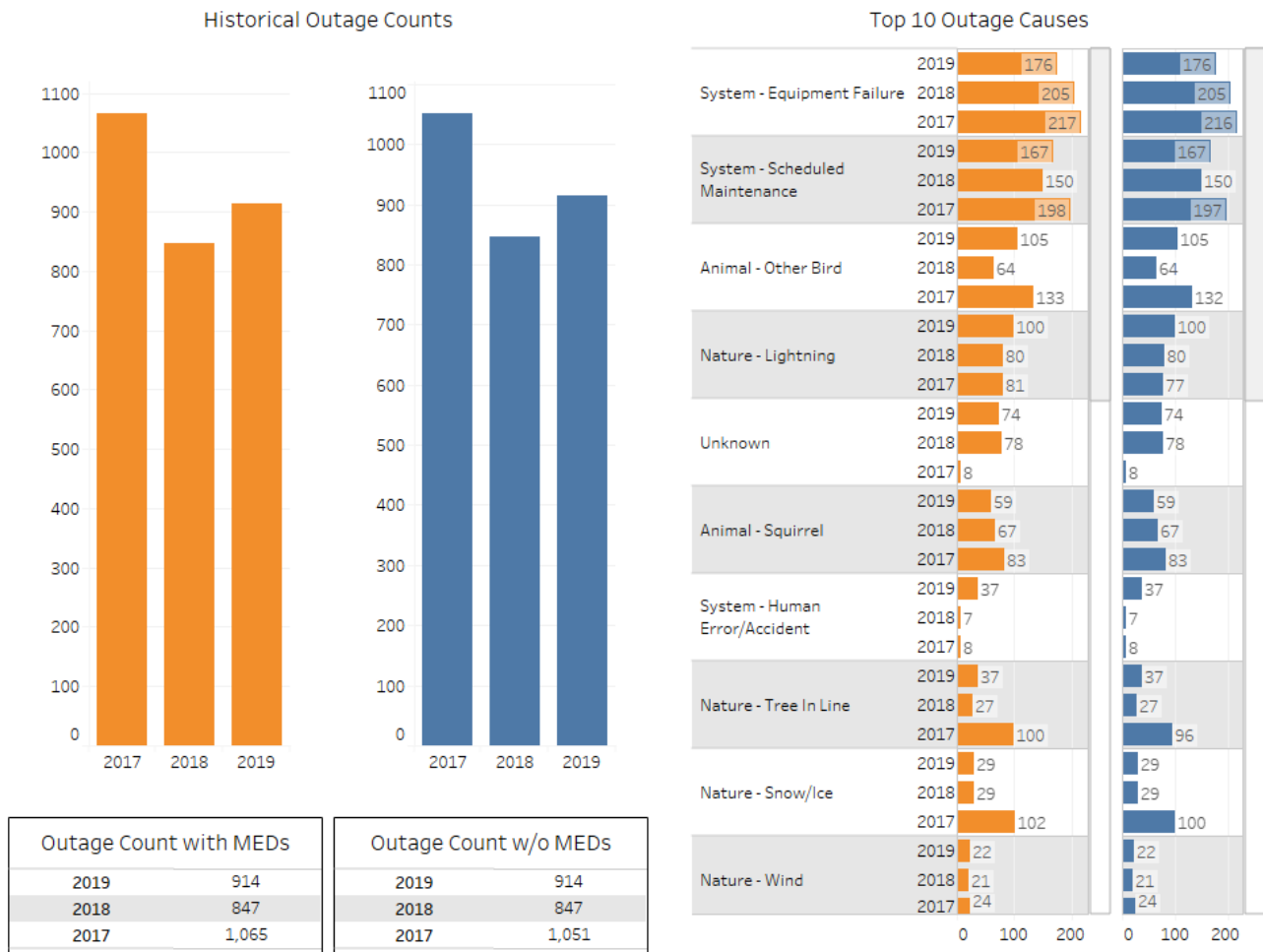


Figure 8.2 Helena system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

Most all of the outage causes in Helena decreased compared to 2018, although there was a slight uptick in lightning outages caused by several large thunderstorms in 2019.

9. MISSOULA SYSTEM RELIABILITY

Outage Metrics

Missoula Division

Division
Missoula

With MEDs
Without MEDs

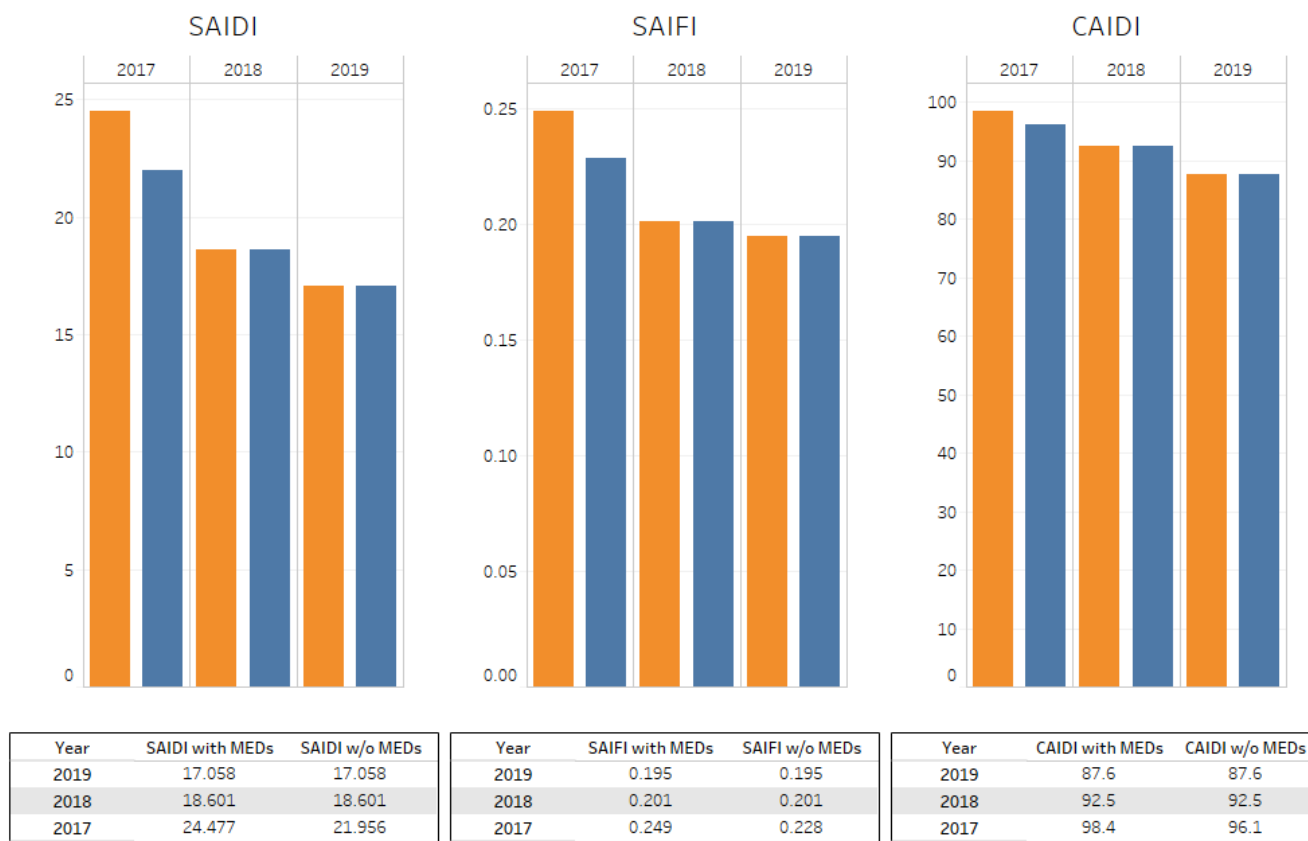


Figure 9.1 Missoula system indices with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

Missoula experienced a continual improvement in SAIDI, SAIFI, and CAIDI in 2019. A transmission line loss in June caused 2.77 SAIDI minutes, making up 16% of the outages for the year in this area.

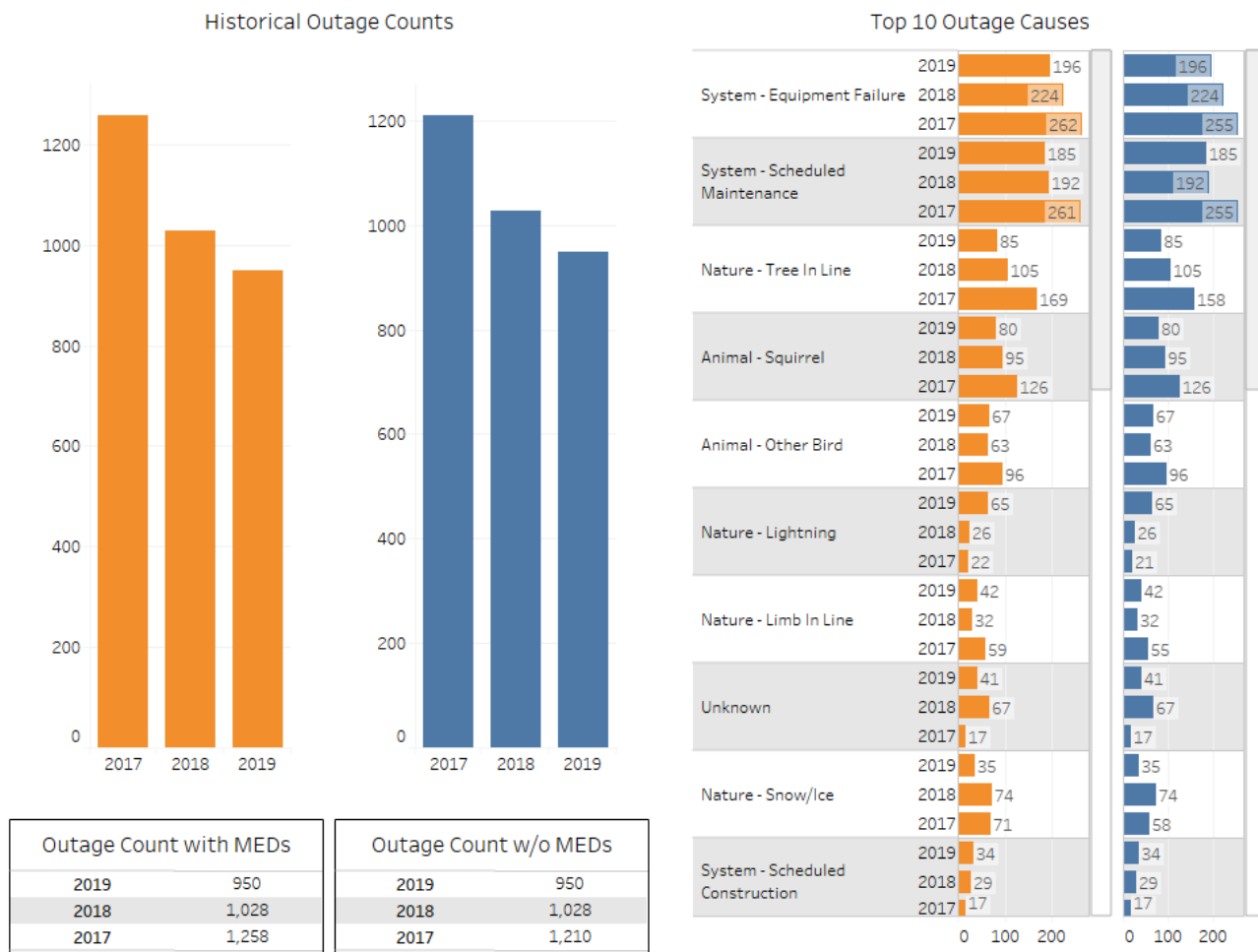


Figure 9.2 Missoula system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

All top ten outage causes decreased except for Lightning and Limb in Line outages. The increase in these two categories is likely due to large storm events in the area in June and July with lightning and strong winds and extreme cold in the month of February.

10. CONCLUSION

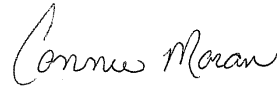
Despite several hail, wind, and thunderstorms that impacted various parts of the state in 2019, SAIDI remained below the 3-year average throughout the year. The year-end result was a SAIDI amounting to 114.6 minutes, significantly below the 3-year average of 134.5 SAIDI minutes. The count of outages was also significantly below the 3-year average for 2019, meaning customers saw fewer interruptions. Although 2019 had higher SAIDI minutes and outage counts than in 2018, 2019 was still a very strong year for reliability.

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.

CERTIFICATE OF SERVICE

I hereby certify that NorthWestern Energy's 2019 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 2, 2020

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

Connie Moran
Administrative Assistant
Regulatory Affairs