March 1, 2021

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

RE: 2020 Annual Electric Reliability Report

Dear Mr. Rosquist:

With this letter, NorthWestern Energy submits the 2020 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.

Several changes were made to this report for improved comprehensibility and an enhanced focus on key performance indicators in 2019, and these changes were maintained for this submittal.

Due to the workplace disruptions caused by the COVID-19 pandemic, the Commission has waived its requirement under ARM 38.2.1209 to provide it with paper copies and has also approved electronic service only.

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

Alyssa Bender
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Sincerely,

Alyssa Bender, P.E.
Asset Management Engineer

Enclosure: 2020 Annual Electric Reliability Report

NorthWestern® Energy

# *2020*
# *-Montana-*
# *Electric Distribution*
## *Annual Reliability Report*

***March 2021***

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## EXECUTIVE SUMMARY

This report provides information and insights into NorthWestern Energy's (NorthWestern) 2020 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** (**S**ystem **A**verage **I**nterruption **D**uration **I**ndex – in minutes), **CAIDI** (**C**ustomer **A**verage **I**nterruption **D**uration **I**ndex – in minutes), **SAIFI** (**S**ystem **A**verage **I**nterruption **F**requency **I**ndex – 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. MEDs are days in which the regional SAIDI exceeds a statistically derived threshold value and 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. In 2020, NorthWestern began implementing the Advanced Distribution Management System to replace the InService mobile work force in order to provide more accurate and timely outage reporting. Outage customer counts and times are derived from the Geographic Information System, call logging, and automated systems, though new equipment is being installed that allows for NorthWestern controllers to determine when devices are out of power without the need for customers to call in. 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.

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 allow for analysis of normal versus emergency conditions. In 2020, NorthWestern's Montana service territory experienced three MEDs: a wind storm at the beginning of February in the western and central parts of Montana, a June snowstorm in the Butte area, and a November snowstorm that impacted a large portion of the state. An MED was declared if there were more than 5.47 SAIDI minutes in a 24-hour period in 2020.

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.

Despite several large wind and snow events throughout the year, there were no catastrophic events in 2020. 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 38.29 SAIDI minutes in 2020. Catastrophic events are not included in any reliability metric.

## 1. GENERAL

1.1 Reliability indices calculation

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

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

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

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

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


| Year | SAIDI w/ MEDs | SAIDI w/o MEDs |
|---|---|---|
| 2020 | 165.85 | 120.49 |
| 2019 | 114.55 | 114.55 |
| 2018 | 102.74 | 102.74 |

| Year | SAIFI with MEDs | SAIFI w/o MEDs |
|---|---|---|
| 2020 | 1.136 | 1.026 |
| 2019 | 1.164 | 1.164 |
| 2018 | 1.065 | 1.065 |

| Year | CAIDI with MEDs | CAIDI w/o MEDs |
|---|---|---|
| 2020 | 146.0 | 117.4 |
| 2019 | 98.4 | 98.4 |
| 2018 | 96.5 | 96.5 |

**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's Montana region indices for the years 2018-2020 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. There were three MEDs in 2020 as well as several large events that didn't quite reach the threshold for an MED but had a significant impact on reliability.

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.

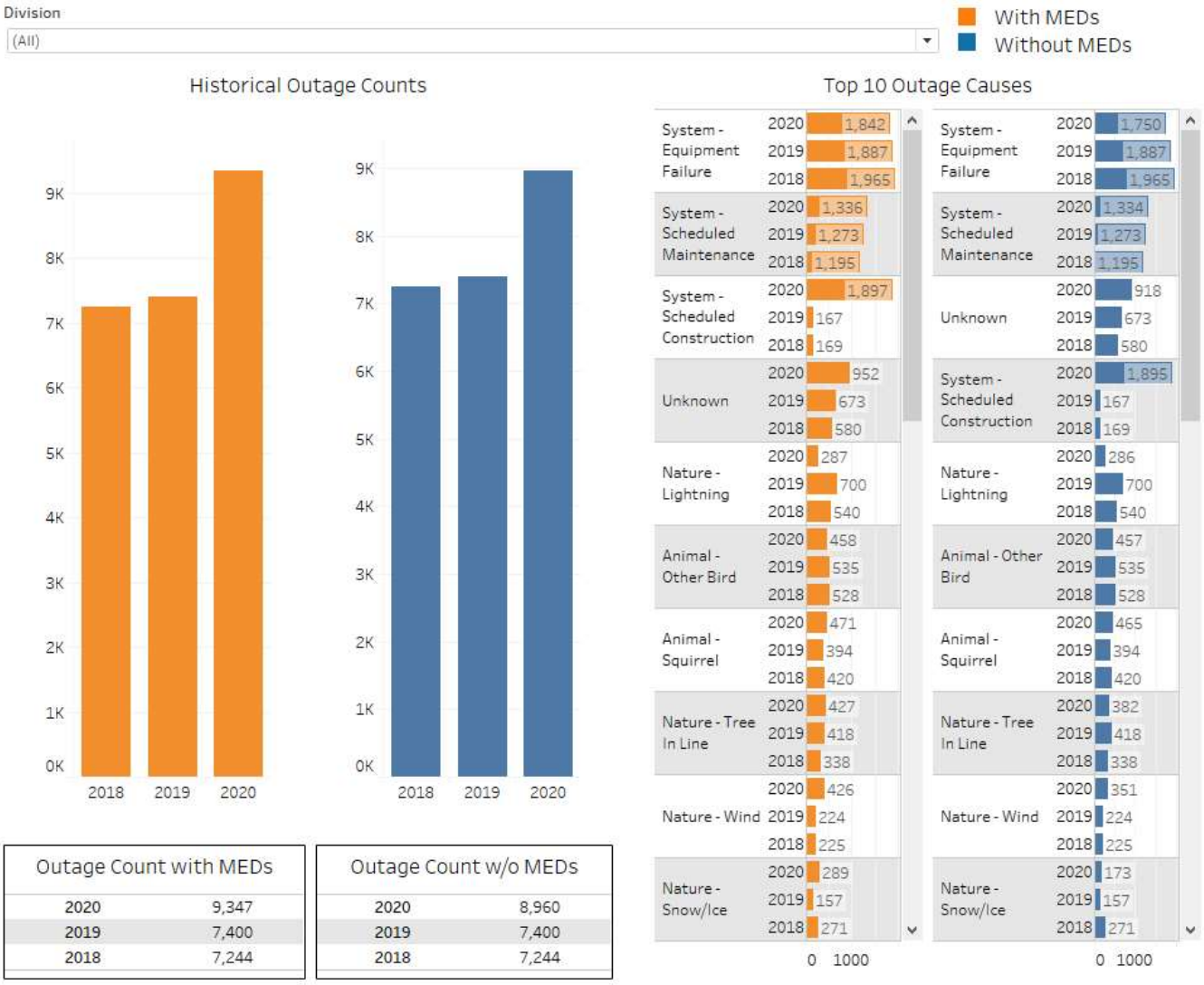



**Figure 2.2** Montana system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

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 in 2020, though more closely align with 5-year and 10-year data. In comparison, outages in 2018 and 2019 significantly decreased from the typical number of outages seen in the Montana service territory.

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, making it customarily the largest outage cause on our system. However, scheduled outages are also among the most significant outage causes, accounting for approximately 35% of the total outages experienced in 2020. There was a significant amount of proactive work completed as part of the 2020 work plan, which is likely the reason for the large increase in scheduled outages. The remaining top 10 outage causes have been fairly steady in number since 2018.

## 3. BILLINGS SYSTEM RELIABILITY


| Year | SAIDI w/ MEDs | SAIDI w/o MEDs |
|---|---|---|
| 2020 | 25.93 | 25.42 |
| 2019 | 28.82 | 28.82 |
| 2018 | 17.44 | 17.44 |

| Year | SAIFI with MEDs | SAIFI w/o MEDs |
|---|---|---|
| 2020 | 0.209 | 0.202 |
| 2019 | 0.253 | 0.253 |
| 2018 | 0.190 | 0.190 |

| Year | CAIDI with MEDs | CAIDI w/o MEDs |
|---|---|---|
| 2020 | 124.2 | 125.6 |
| 2019 | 114.1 | 114.1 |
| 2018 | 91.6 | 91.6 |

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

SAIDI decreased from 2019 to 2020 in the Billings Division. There was a very minimal impact of outages due to MEDs. However, in April a snowstorm passed through the Lewistown area that accounted for nearly 3.3 SAIDI minutes of the total SAIDI contribution, and again in May another storm caused nearly 1.7 SAIDI minutes of outages. Due to the decrease in SAIDI and even larger decrease in SAIFI, CAIDI numbers were elevated slightly for 2020.

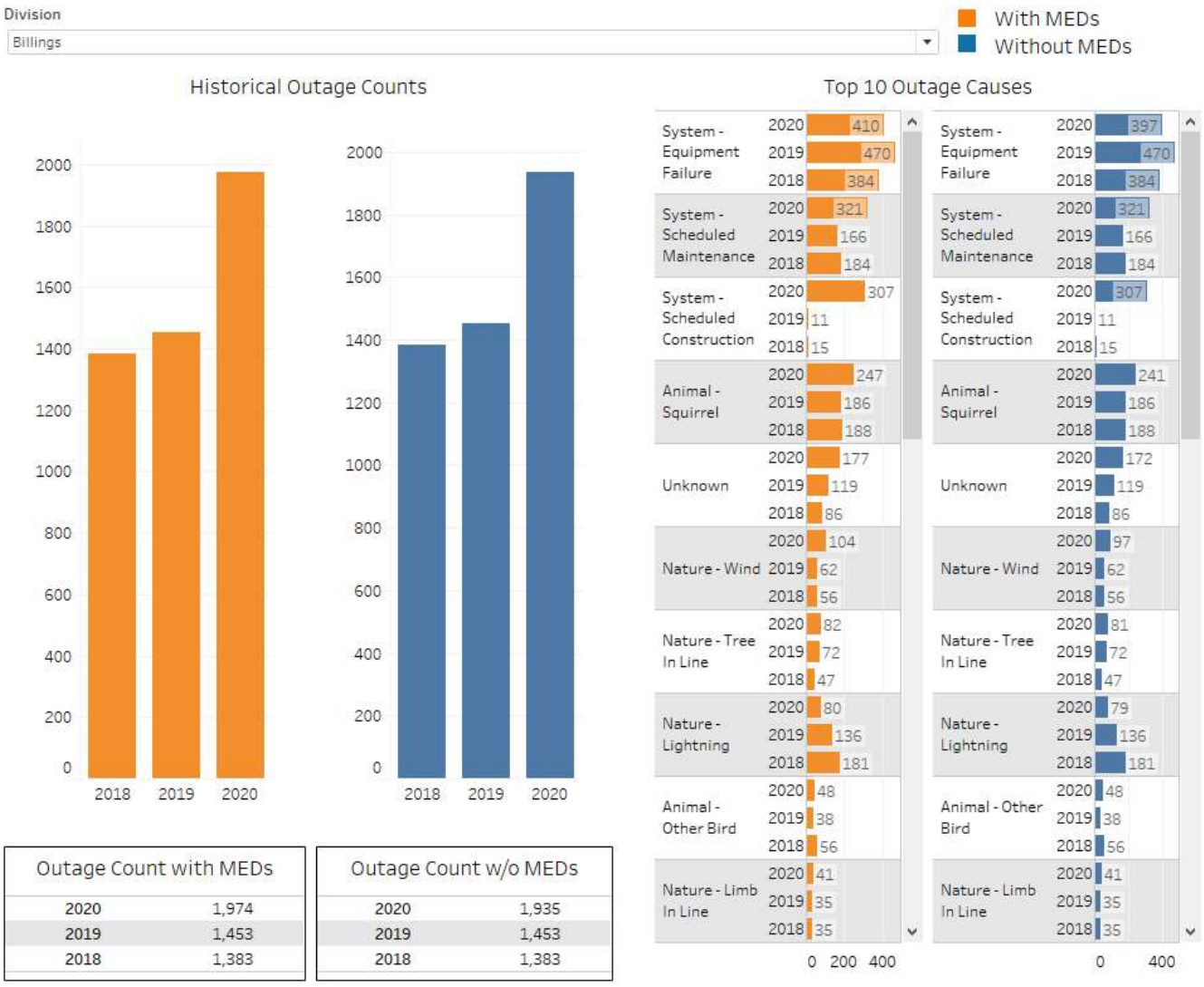
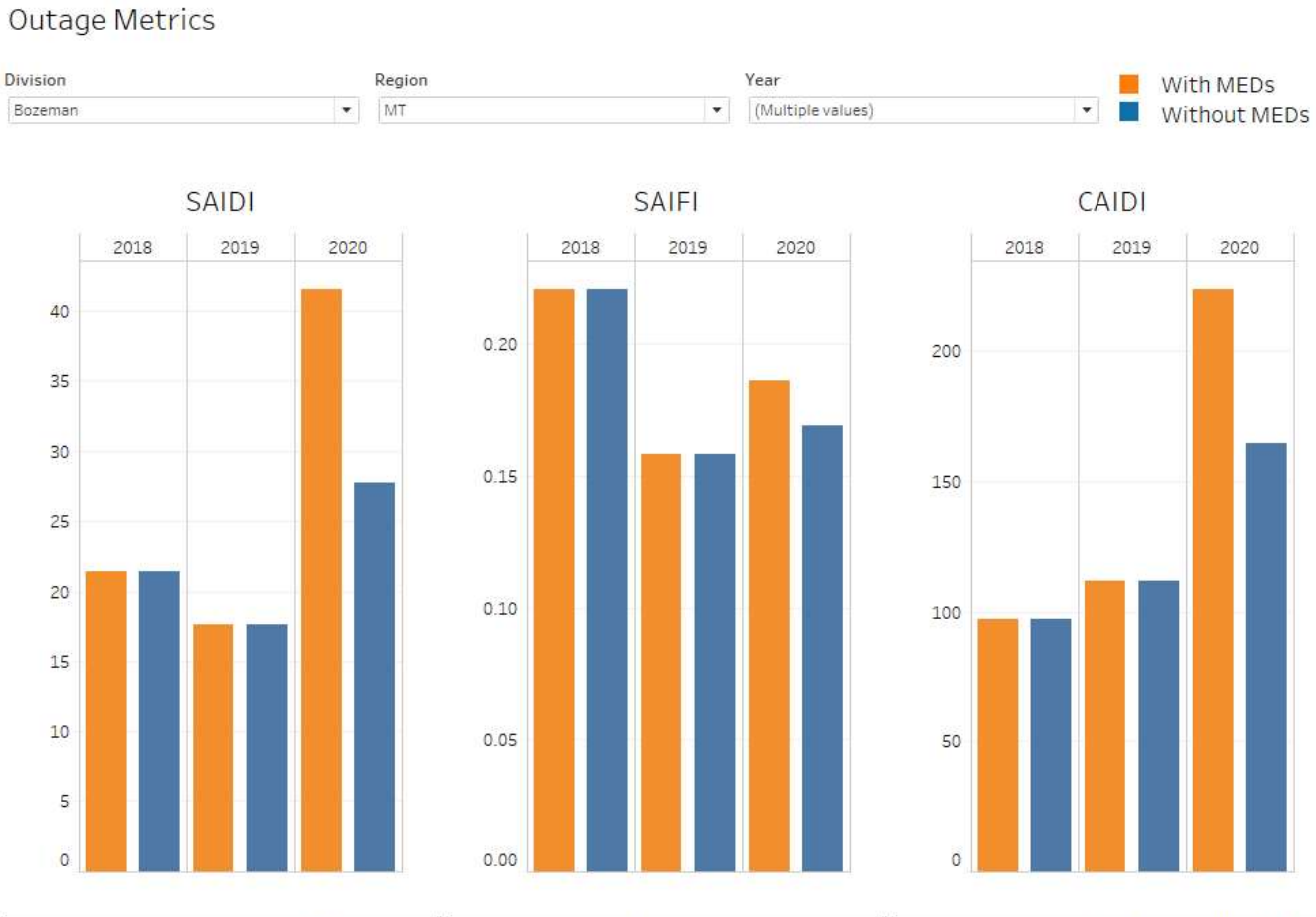



**Figure 3.2** Billings system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

Equipment failure remains the cause of the largest number of outages in the Billings division. These outages range from underground faults to overhead cutout failures. Scheduled outages have increased significantly, indicating that maintenance and construction are being done proactively to mitigate longer, reactive outages. Outages caused by squirrels still remain high on the outage cause list. Wind, vegetation, and bird outages have remained in the top outage causes for this division, but are mostly steady or decreasing in number. Unknown outage causes increased in 2020, though upon further investigation many of these are caused by loss of source (generation) or transmission line issues due to inclement weather.

## 4. BOZEMAN SYSTEM RELIABILITY



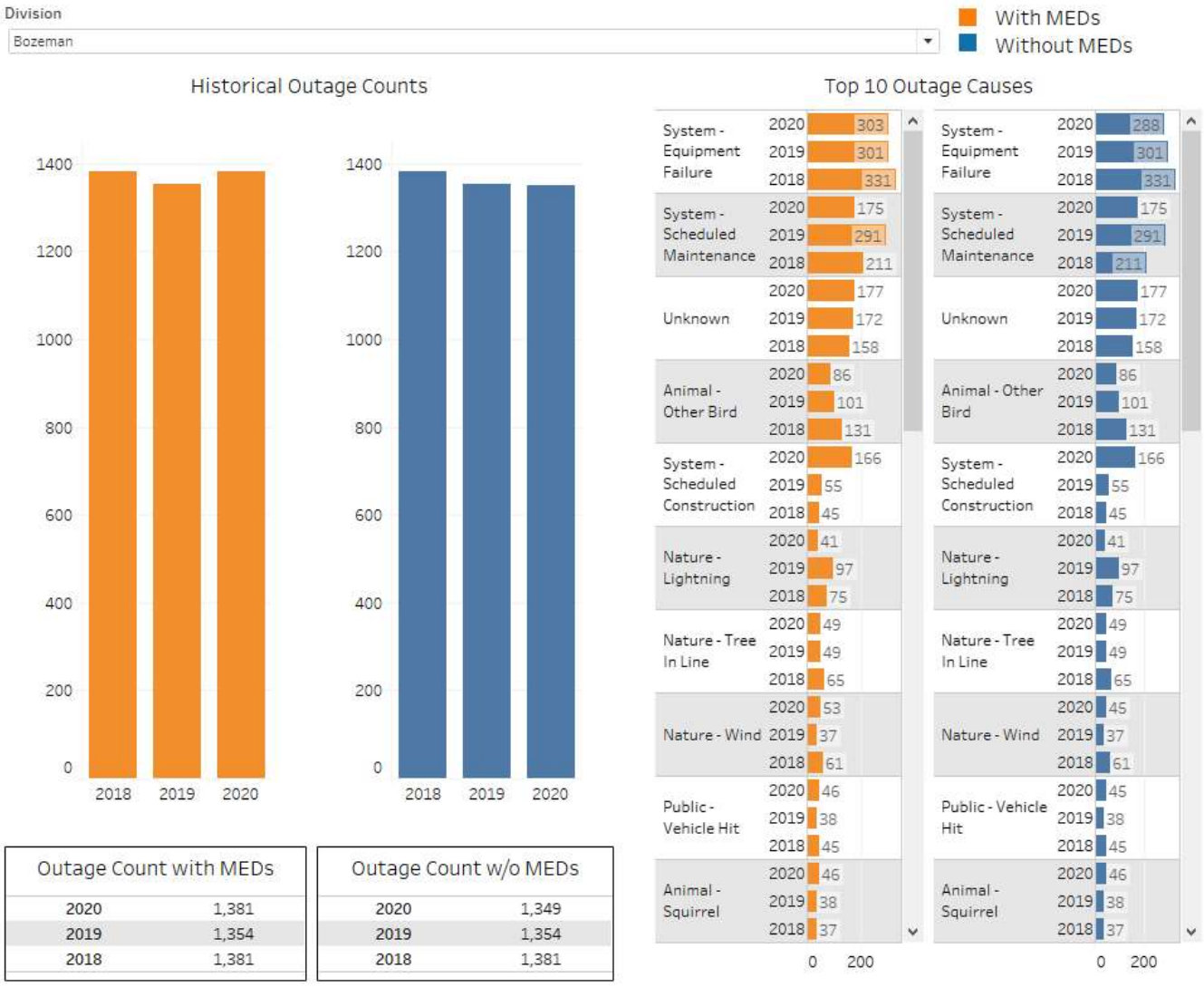

| Year | SAIDI w/ MEDs | SAIDI w/o MEDs |
|---|---|---|
| 2020 | 41.48 | 27.78 |
| 2019 | 17.67 | 17.67 |
| 2018 | 21.43 | 21.43 |

| Year | SAIFI with MEDs | SAIFI w/o MEDs |
|---|---|---|
| 2020 | 0.186 | 0.169 |
| 2019 | 0.158 | 0.158 |
| 2018 | 0.220 | 0.220 |

| Year | CAIDI with MEDs | CAIDI w/o MEDs |
|---|---|---|
| 2020 | 223.3 | 164.3 |
| 2019 | 111.6 | 111.6 |
| 2018 | 97.3 | 97.3 |

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

Bozeman division indices saw an increase in SAIDI, SAIFI, and CAIDI for 2020. There were several large events in this area that contributed to the higher numbers. A grass fire in September and another in October that caused damage to NorthWestern electrical poles account for 4.9 SAIDI minutes; a hit pole reported 3.3 SAIDI minutes in October, and the wind event in November that was identified as an MED contributed 13.5 SAIDI minutes to this division.




| Outage Count with MEDs | |
|---|---|
| 2020 | 1,381 |
| 2019 | 1,354 |
| 2018 | 1,381 |

| Outage Count w/o MEDs | |
|---|---|
| 2020 | 1,349 |
| 2019 | 1,354 |
| 2018 | 1,381 |

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

The number of outages has remained fairly steady in Bozeman in recent years. Equipment failure remains the largest cause of outages in the Bozeman division. Many of these failures that occurred in 2020 were during snow or wind storms. Most of the remaining outage causes are fairly steady from year to year, though scheduled outages have increased as well as outages due to unknown causes.

## 5. BUTTE SYSTEM RELIABILITY


| Year | SAIDI w/ MEDs | SAIDI w/o MEDs |
|---|---|---|
| 2020 | 25.76 | 17.35 |
| 2019 | 8.53 | 8.53 |
| 2018 | 15.94 | 15.94 |

| Year | SAIFI with MEDs | SAIFI w/o MEDs |
|---|---|---|
| 2020 | 0.170 | 0.150 |
| 2019 | 0.072 | 0.072 |
| 2018 | 0.137 | 0.137 |

| Year | CAIDI with MEDs | CAIDI w/o MEDs |
|---|---|---|
| 2020 | 151.9 | 115.4 |
| 2019 | 118.7 | 118.7 |
| 2018 | 116.3 | 116.3 |

**Figure 5.1** Butte system indices with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

SAIDI, SAIFI, and CAIDI metrics increased in Butte in 2020 mainly due to large weather events. The June snowstorm identified as an MED caused significant damage to this division. Over 10 SAIDI minutes were attributed to outages between June 8th and 13th, though only one of these days was officially identified as an MED. The remainder of the year closely followed normal outage trends.

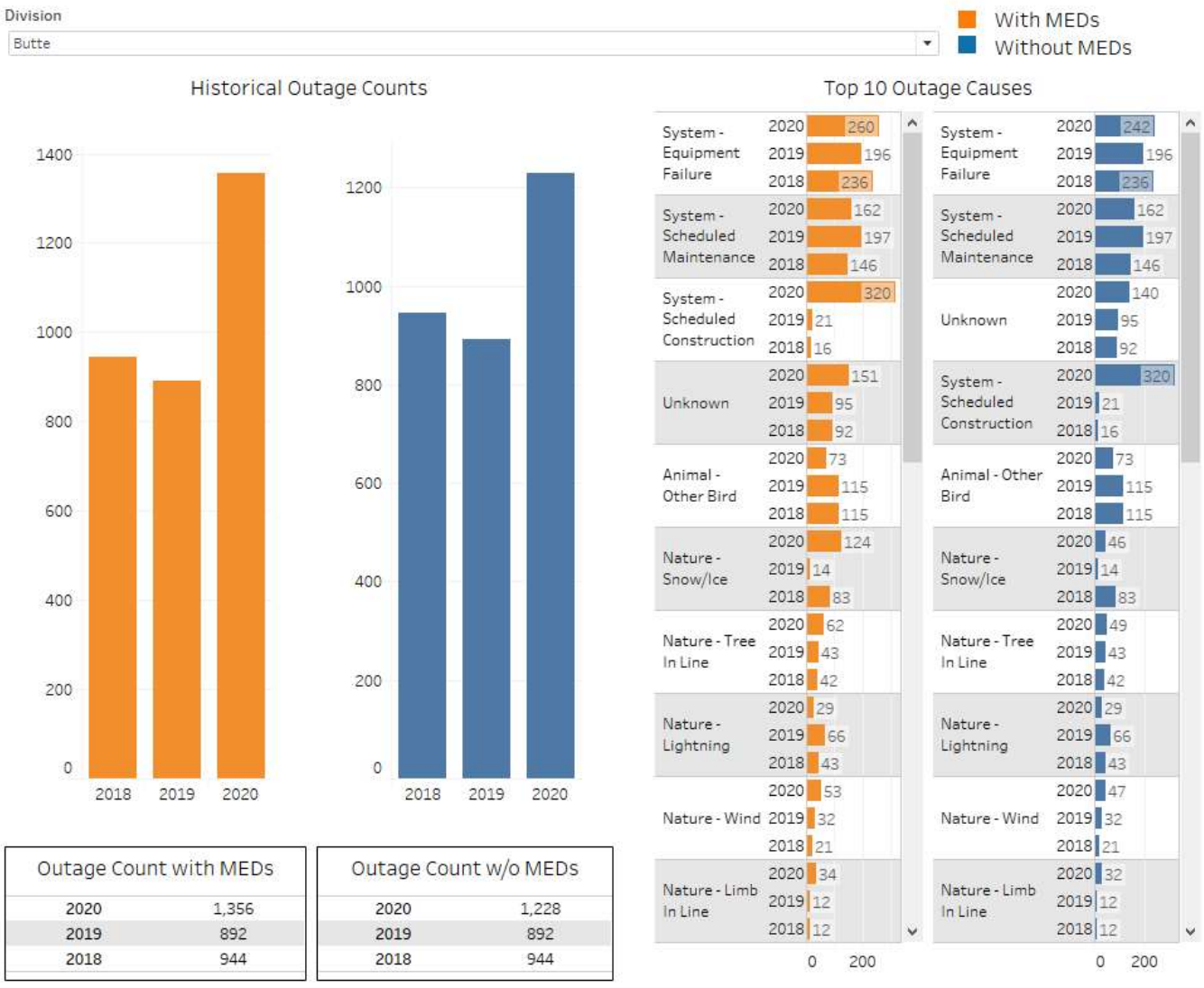



**Figure 5.2** Butte system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

Outage counts increased in 2020, though much of this increase was due to scheduled outages. As with the state as a whole, nearly 35% of the outages in this division were due to proactive maintenance being completed to prevent reactive failures. Equipment failure was again the largest outage contributor, and unknown outage causes are increasing, which will be closely monitored. The remaining top outage causes have held fairly steady in comparison to past years.

## 6. GREAT FALLS SYSTEM RELIABILTY


| Year | SAIDI w/ MEDs | SAIDI w/o MEDs |
|---|---|---|
| 2020 | 35.60 | 18.08 |
| 2019 | 15.94 | 15.94 |
| 2018 | 11.42 | 11.42 |

| Year | SAIFI with MEDs | SAIFI w/o MEDs |
|---|---|---|
| 2020 | 0.233 | 0.185 |
| 2019 | 0.164 | 0.164 |
| 2018 | 0.165 | 0.165 |

| Year | CAIDI with MEDs | CAIDI w/o MEDs |
|---|---|---|
| 2020 | 153.0 | 97.9 |
| 2019 | 97.1 | 97.1 |
| 2018 | 69.3 | 69.3 |

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

Great Falls Division, like Butte, was largely affected due to MEDs. All indices increased in 2020, though "excluding MED" metrics are close to past years. The February MED caused 7.8 SAIDI in Great Falls whereas the November event led to 9.7 SAIDI minutes. Besides the MEDs, there were several substation-level events that added up to several SAIDI minutes with causes ranging from animal to relay issues and also some notable wind events throughout the year that caused significant outages.


**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 a large increase in the number of outages in Great Falls for 2020, though nearly half of the outages in this division were due to planned construction. There were several substation and distribution line projects that largely contributed to these higher numbers. Unknown and wind-caused outages also increased in 2020 though most other top outage causes including lightning, vegetation, and animal outages remained fairly steady in comparison to previous years.

## 7. HAVRE SYSTEM RELIABILITY


| Year | SAIDI w/ MEDs | SAIDI w/o MEDs |
|---|---|---|
| 2020 | 7.854 | 6.894 |
| 2019 | 6.549 | 6.549 |
| 2018 | 6.156 | 6.156 |

| Year | SAIFI with MEDs | SAIFI w/o MEDs |
|---|---|---|
| 2020 | 0.073 | 0.068 |
| 2019 | 0.097 | 0.097 |
| 2018 | 0.058 | 0.058 |

| Year | CAIDI with MEDs | CAIDI w/o MEDs |
|---|---|---|
| 2020 | 107.4 | 101.1 |
| 2019 | 67.7 | 67.7 |
| 2018 | 106.6 | 106.6 |

**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 CAIDI and a decrease in SAIFI in 2020 although the numbers remain fairly steady compared to previous years. There was an outage in April due to equipment failure in the Havre City Substation that caused a significant portion of the SAIDI minutes for the division in 2020. There were also several days throughout the year with high winds that caused issues to both transmission and distribution lines and resulted in outages.

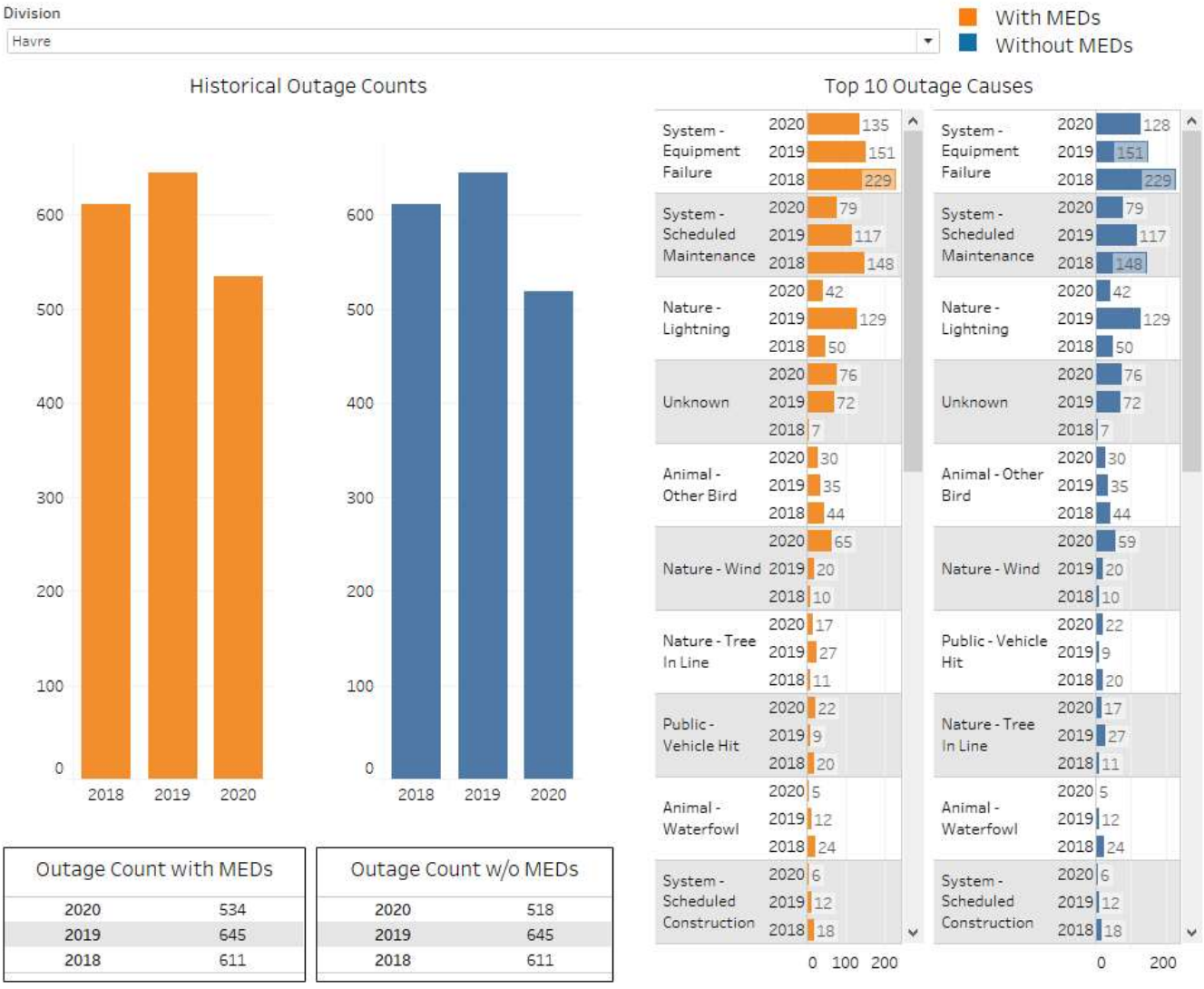



**Figure 7.2** Havre system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

Besides a slight increase in unknown and wind-caused outages, most outage causes are declining or remaining fairly steady in the Havre disivion. Like in other divisions, equipment failures account for most of the outages, although scheduled and lightning outages remain in the top causes.

## 8. HELENA SYSTEM RELIABILITY


| Year | SAIDI w/ MEDs | SAIDI w/o MEDs |
|---|---|---|
| 2020 | 10.602 | 10.537 |
| 2019 | 19.980 | 19.980 |
| 2018 | 11.750 | 11.750 |

| Year | SAIFI with MEDs | SAIFI w/o MEDs |
|---|---|---|
| 2020 | 0.117 | 0.116 |
| 2019 | 0.226 | 0.226 |
| 2018 | 0.094 | 0.094 |

| Year | CAIDI with MEDs | CAIDI w/o MEDs |
|---|---|---|
| 2020 | 90.9 | 90.6 |
| 2019 | 88.5 | 88.5 |
| 2018 | 125.4 | 125.4 |

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

Helena remained largely unaffected by the MEDs and therefore SAIDI and SAIFI metrics decreased from 2019 to 2020. CAIDI remained fairly steady in comparison to previous years in this division. There were two large substation equipment failure outages that accounted for 1.7 SAIDI minutes and another two large outages associated with wind that accounted for an additional 1.0 SAIDI minute.

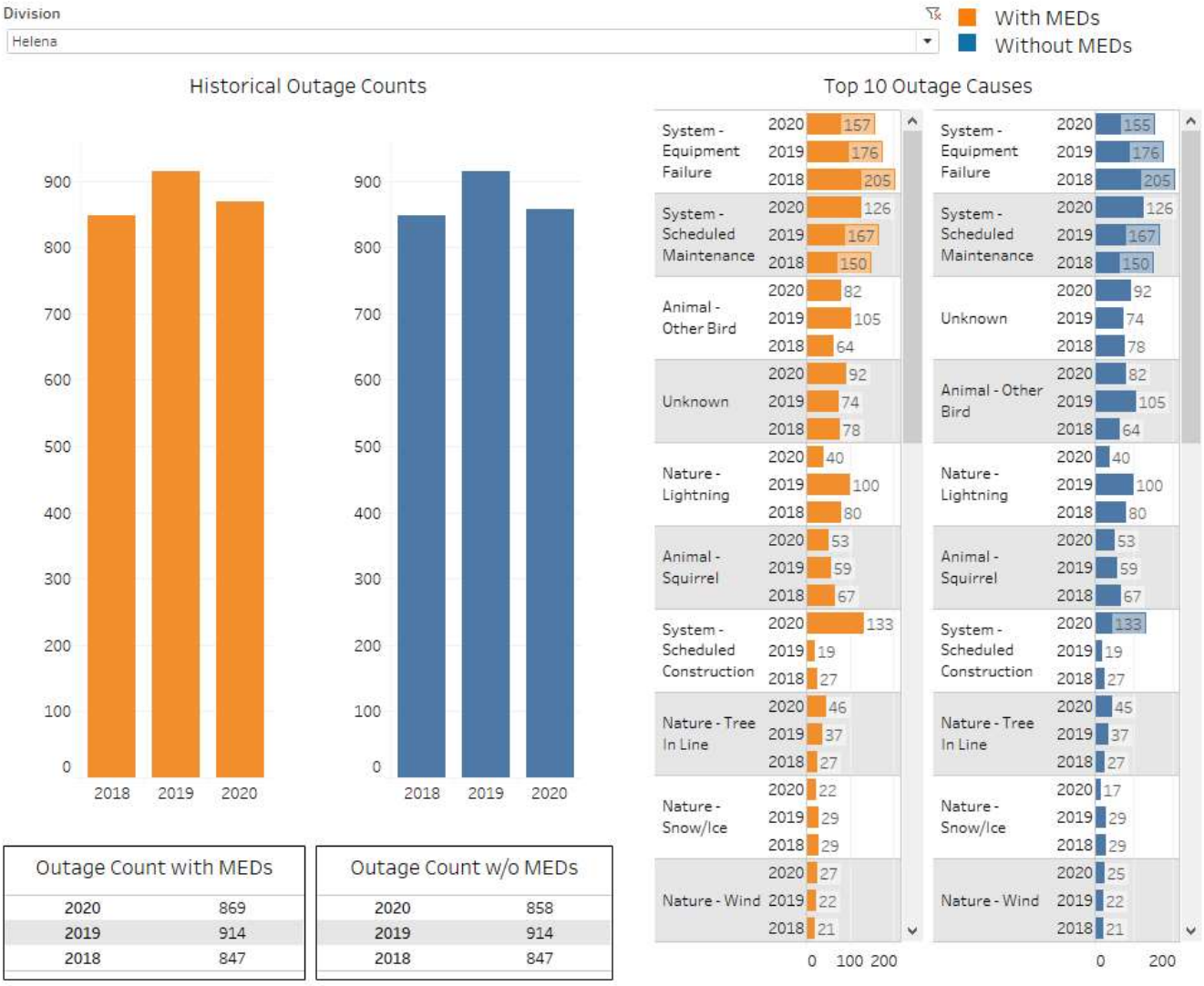



**Figure 8.2** Helena system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

Almost every outage cause decreased in Helena in 2020, with the exception of a slight uptick in unknown and vegetation outage causes as well as scheduled outages. Helena was one of the few divisions where outage counts decreased in 2020.

## 9. MISSOULA SYSTEM RELIABILITY


| Year | SAIDI w/ MEDs | SAIDI w/o MEDs |
|---|---|---|
| 2020 | 18.609 | 14.420 |
| 2019 | 17.058 | 17.058 |
| 2018 | 18.601 | 18.601 |

| Year | SAIFI with MEDs | SAIFI w/o MEDs |
|---|---|---|
| 2020 | 0.149 | 0.135 |
| 2019 | 0.195 | 0.195 |
| 2018 | 0.201 | 0.201 |

| Year | CAIDI with MEDs | CAIDI w/o MEDs |
|---|---|---|
| 2020 | 124.8 | 106.6 |
| 2019 | 87.6 | 87.6 |
| 2018 | 92.5 | 92.5 |

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

Missoula was affected by the February wind storm that caused an MED in the state, though the June and November storms did not have much of an effect on this division. However, there was a storm in March and another in September that did not reach MED thresholds but did add 2.4 SAIDI and 1.5 SAIDI minutes to the total SAIDI in this division in 2020.


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

Similar to Great Falls, Missoula experienced a large increase in the volume of outages, although nearly half were due to scheduled maintenance and construction. Animal and vegetation-caused outages remained steady in 2020, though outages due to unknown causes increased.

## 10. CONCLUSION

The final 2020 NorthWestern electric reliability numbers were higher than the previous three-year average of 124.6 SAIDI minutes when including Major Event Days, though with no MEDs recorded in 2018 or 2019, those numbers are slightly skewed. The final 165.9 SAIDI minutes recorded reflect three major storms as well as a year full of smaller storm and wind events. The 120.5 SAIDI minutes recorded without MEDs is closely in line with the 119.4 SAIDI minute three-year average.

Substation, distribution line, and other asset improvements increased the number of scheduled outages, but this work helps avoid equipment failures and provides facilities to serve future loads. The 2020 proactive workload was one of the largest in company history, which accounts for the higher number of outages seen throughout the year in most all divisions. 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 2020 Annual Electric Reliability Report has been e-filed with the Montana Public Service Commission ("Commission") under Docket No. 2021.02.023 and emailed to the Commission and the Montana Consumer Counsel. Due to the workplace disruptions caused by the COVID-19 pandemic, the Commission has waived its requirement under ARM 38.2.1209 to provide it with paper copies and approved electronic service only.

Date: March 1, 2021

Connie Moran

Connie Moran
Administrative Assistant
Regulatory Affairs