



March 1, 2022

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

RE: 2021 Annual Electric Reliability Report – Docket No. 2022.01.002

Dear Mr. Rosquist:

With this letter, NorthWestern Energy submits the 2021 Reliability Report in compliance with Mont. Admin. R. 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 note that the 2020 indices in this report differ from what was reported in the 2020 Reliability Report. There have been several changes in data collection in the past year including the implementation of a new outage management system that resulted in more accurate reporting.

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

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Sincerely,

Alyssa Bender, P.E.
Asset Management Engineer

Enclosure: 2021 Annual Electric Reliability Report

NorthWestern[®] Energy

2021
-Montana-
Electric Distribution
Annual Reliability Report



March 2022

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EXECUTIVE SUMMARY

This report provides information and insights into NorthWestern Energy's (NorthWestern) 2021 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 (ADMS) to replace the InService mobile work force. In 2021, improvements were made to ADMS for more timely and accurate 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 unpredictability 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 provides all information, including and excluding MEDs, for all three indices to better demonstrate and allow for analysis of normal versus emergency conditions. In 2021, NorthWestern's Montana service territory experienced three MEDs: a lightning event in June, an October snow storm, and a November wind storm. An MED was declared if there were more than 5.7 SAIDI minutes in a 24-hour period in 2021.

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.

In addition to these large wind and snow events throughout the year, there was one catastrophic event in 2021 caused by a snow/wind storm in mid-January. 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 40.1 SAIDI minutes in 2021. 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:

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

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

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

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



Division
All

■ without MED
■ with MED



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 2019-2021 from year-end audited data. There were no MEDs in 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 2021 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 below 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.

Outage Count Dashboard

Division
All

■ without MED
■ with MED

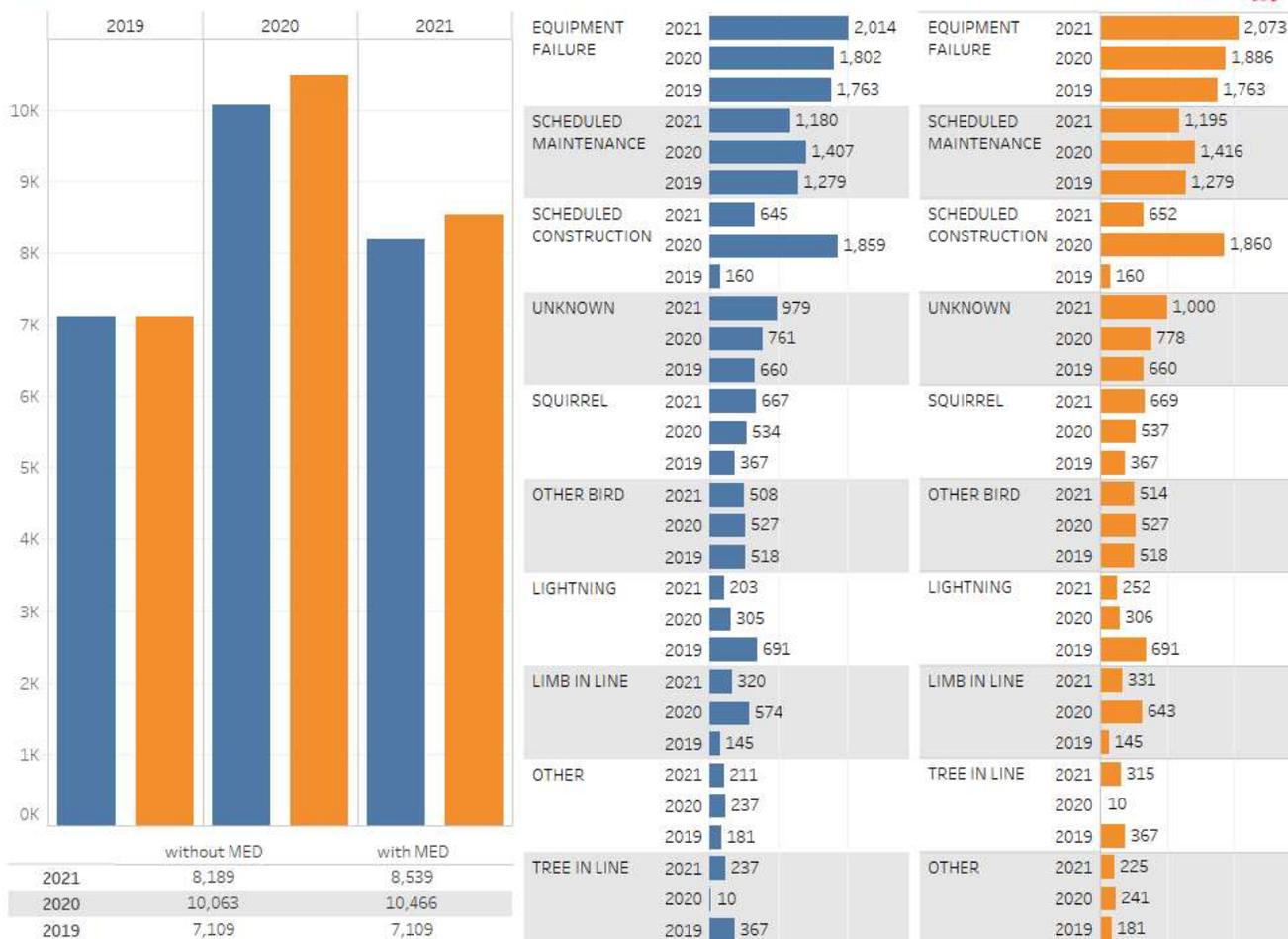


Figure 2.2 Montana system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

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 decreased in 2021 and closely align with 5-year and 10-year data.

Equipment Failure is the most common of unscheduled outage causes due to the broadness of the category. 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 a quarter of the total outages experienced in 2021. Unknown causes of outages continue to remain a top contributor, though most often these outages only affect a single customer or occur during a weather event (rain, thunderstorm, etc.). The remaining top 10 outage causes have been fairly steady in number in recent years.

3. BILLINGS SYSTEM RELIABILITY



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

SAIDI decreased from 2020 to 2021 in the Billings Division. MEDs made a fairly significant impact in this area in 2021 with the November wind storm taking the largest toll at over 2.2 SAIDI minutes. Other non-MED weather-related outages made up nearly half of the remaining SAIDI minutes. SAIFI numbers align closely with 3-year averages while CAIDI is slightly elevated.



Outage Count Dashboard

Division
Multiple values

■ without MED
■ with MED

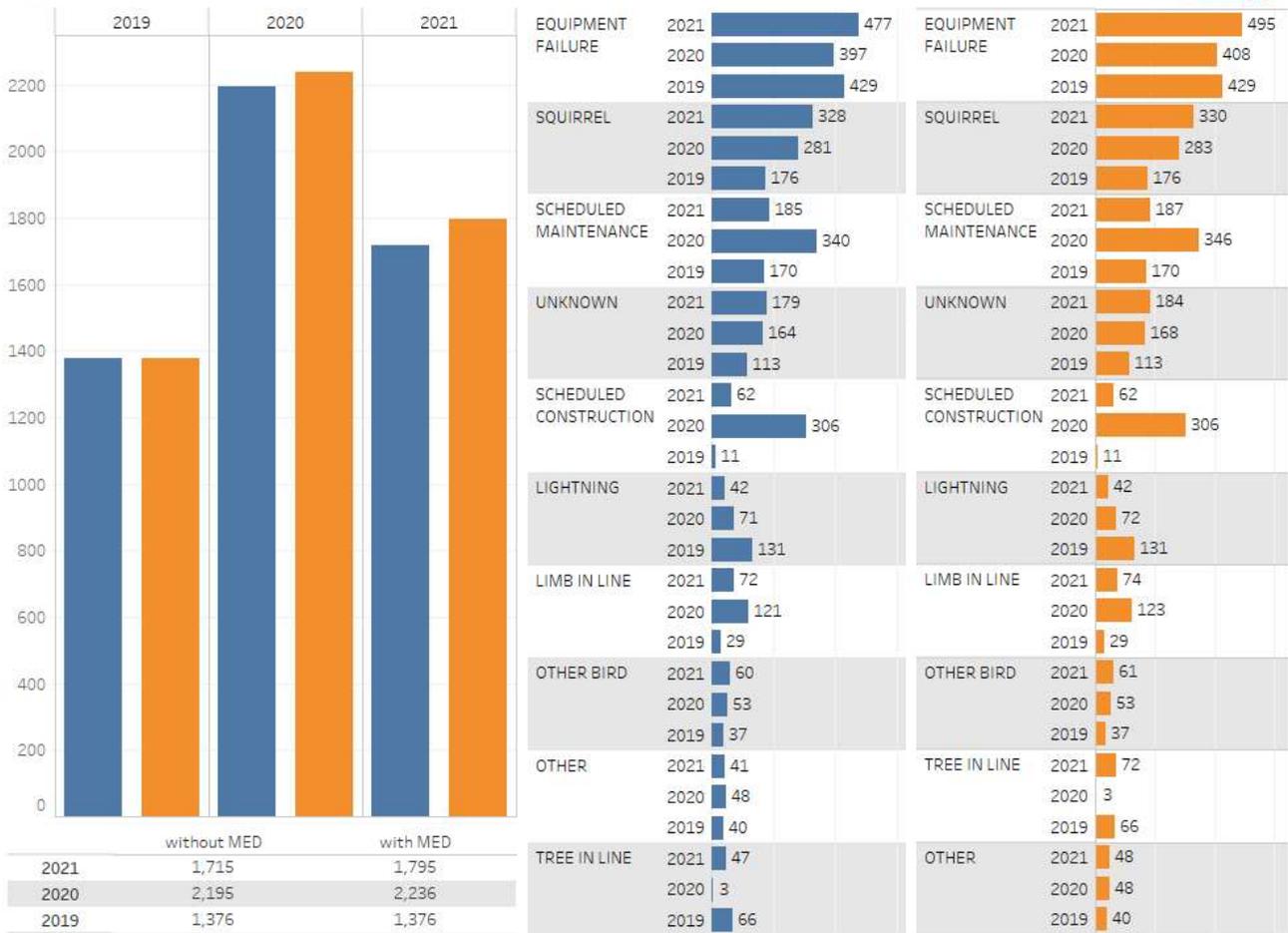


Figure 3.2 Billings system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

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. As with previous years, outages caused by squirrels still remain high on the cause list. Scheduled outages steadied, indicating that maintenance and construction are being done proactively to mitigate longer, reactive outages. Outages where a cause could not be identified (Unknown) increased again in 2021. These are often shorter outages with small customer impacts. Lightning, birds, and trees remain in the top outage causes for this division, but are mostly steady or decreasing in number.

4. BOZEMAN SYSTEM RELIABILITY



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

Bozeman division indices steadied a bit for 2021, though SAIFI continues to increase. MEDs continue to contribute to a large portion of the total SAIDI. In fact, over 60% of the SAIDI contribution in this region had contributing weather (wind, snow, extreme temperatures, etc.). During the October snow storm event alone, Bozeman experienced over 4.5 SAIDI minutes of outages.

Outage Count Dashboard

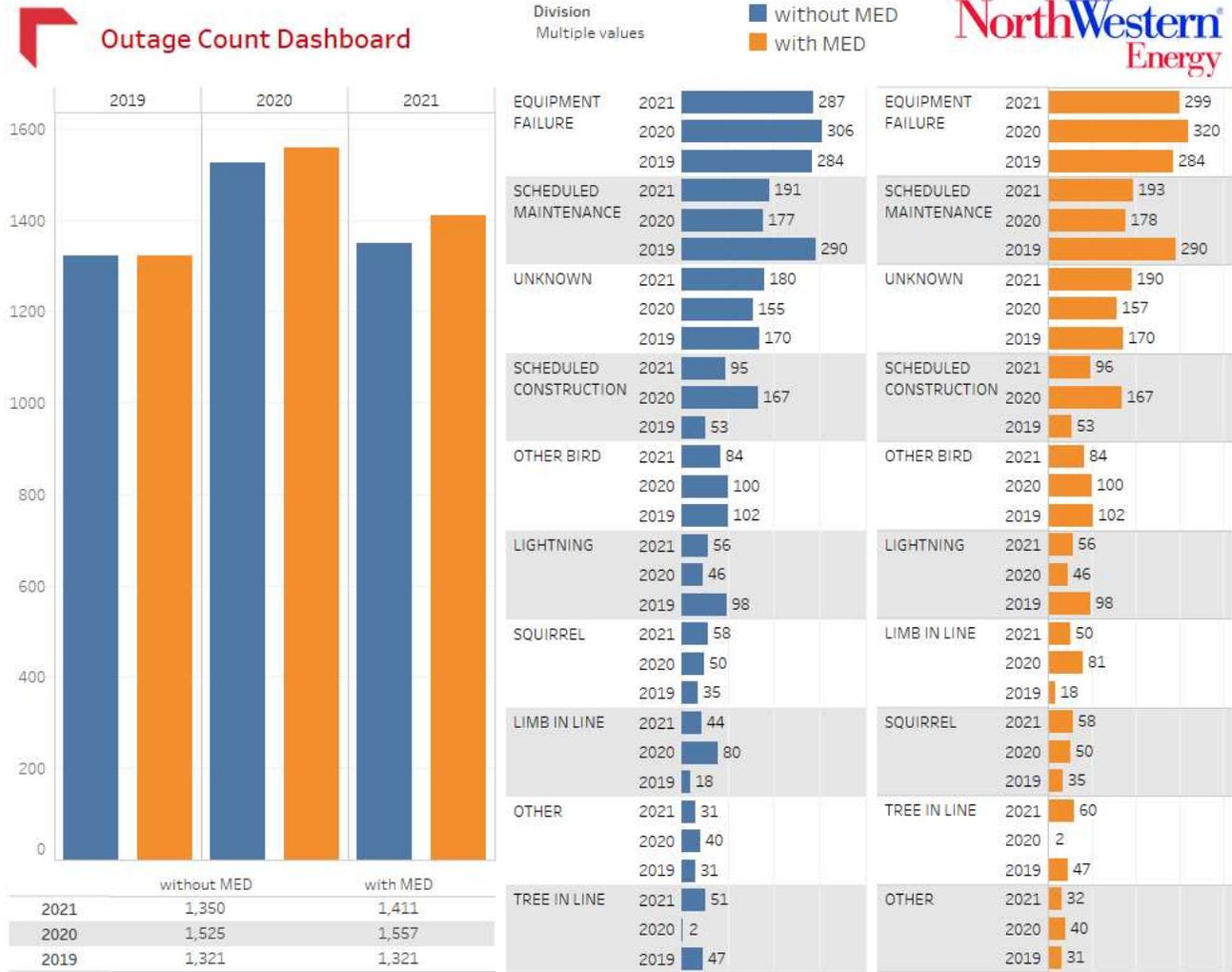


Figure 4.2 Bozeman system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

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 2021 were during snow or wind storms. Scheduled outages remain at about 20% of outages between maintenance and construction. Unknown outages, as with the state as a whole, increased in 2021. Most of the remaining outage causes, including trees, lightning, and animals, are fairly steady from year to year.

5. BUTTE SYSTEM RELIABILITY



Division
BUTTE

■ without MED
■ with MED



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 decreased in Butte in 2021 and more closely align with 5-year averages. In 2021, Butte was relatively unaffected by large MEDs as they were centralized over other portions of the state. The summer months of June – August contributed nearly half of the SAIDI for the whole year in this division.



Outage Count Dashboard

Division
BUTTE

■ without MED
■ with MED

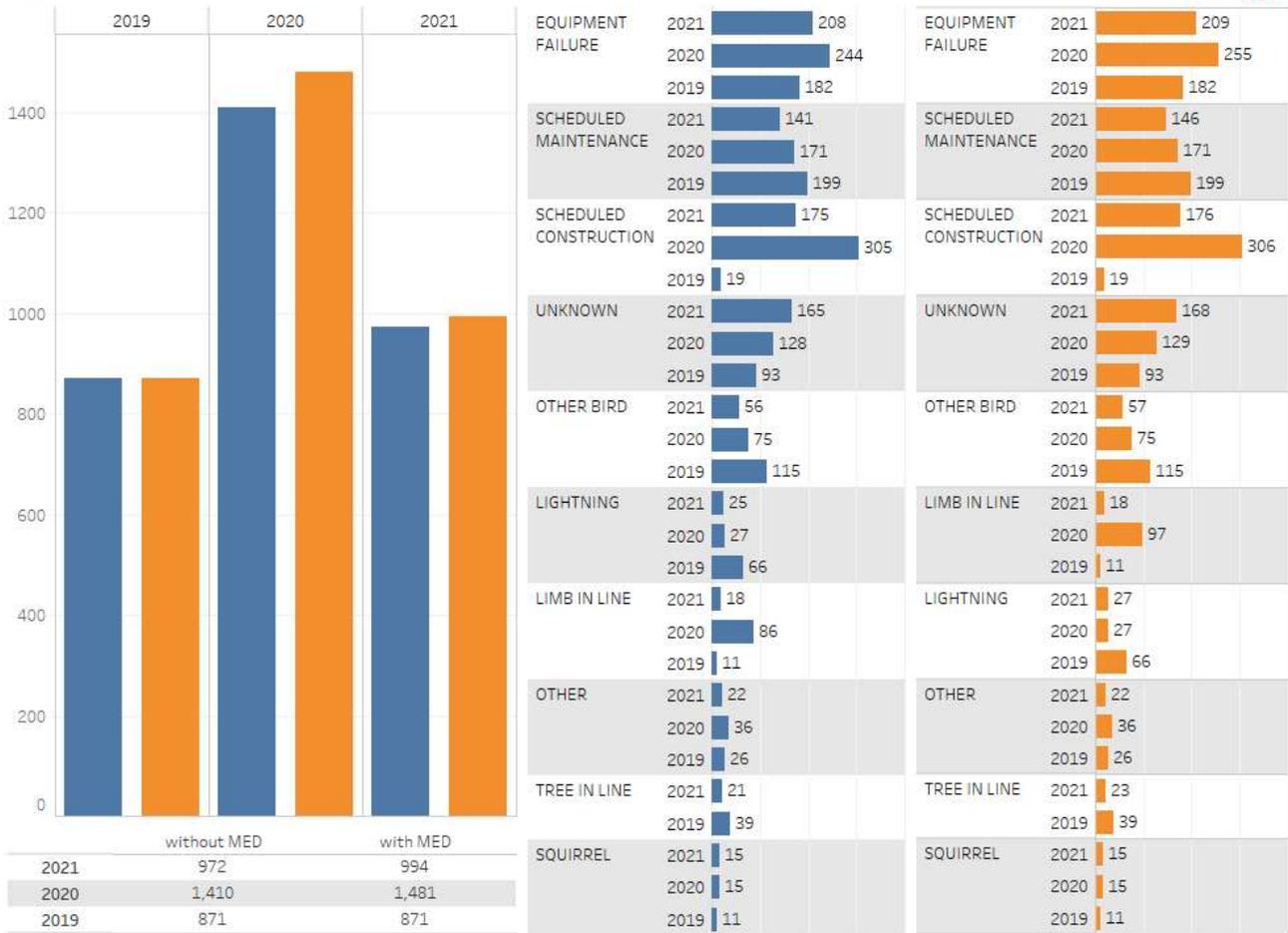


Figure 5.2 Butte system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

Outage counts decreased in 2021 and most of the top 10 outage causes continue to remain steady. Unknown outages are the only category that increased in 2021, similar to what was seen among the whole state. Scheduled outages account for over 30% of the outages in this region due to proactive maintenance being completed to prevent reactive failures. Equipment failure was again the largest outage contributor with conductor and connectors being the largest contributors within that category.

6. GREAT FALLS SYSTEM RELIABILITY



Division
GREAT FALLS

■ without MED
■ with MED



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, remained largely unaffected by MEDs in 2021. However, weather-related outages did account for over half of the region’s SAIDI, with several non-MED events in April accounting for over 4.6 SAIDI minutes of outages. Overall, all indices decreased in 2021 and remain aligned with previous 5-year averages.



Outage Count Dashboard

Division
GREAT FALLS

■ without MED
■ with MED

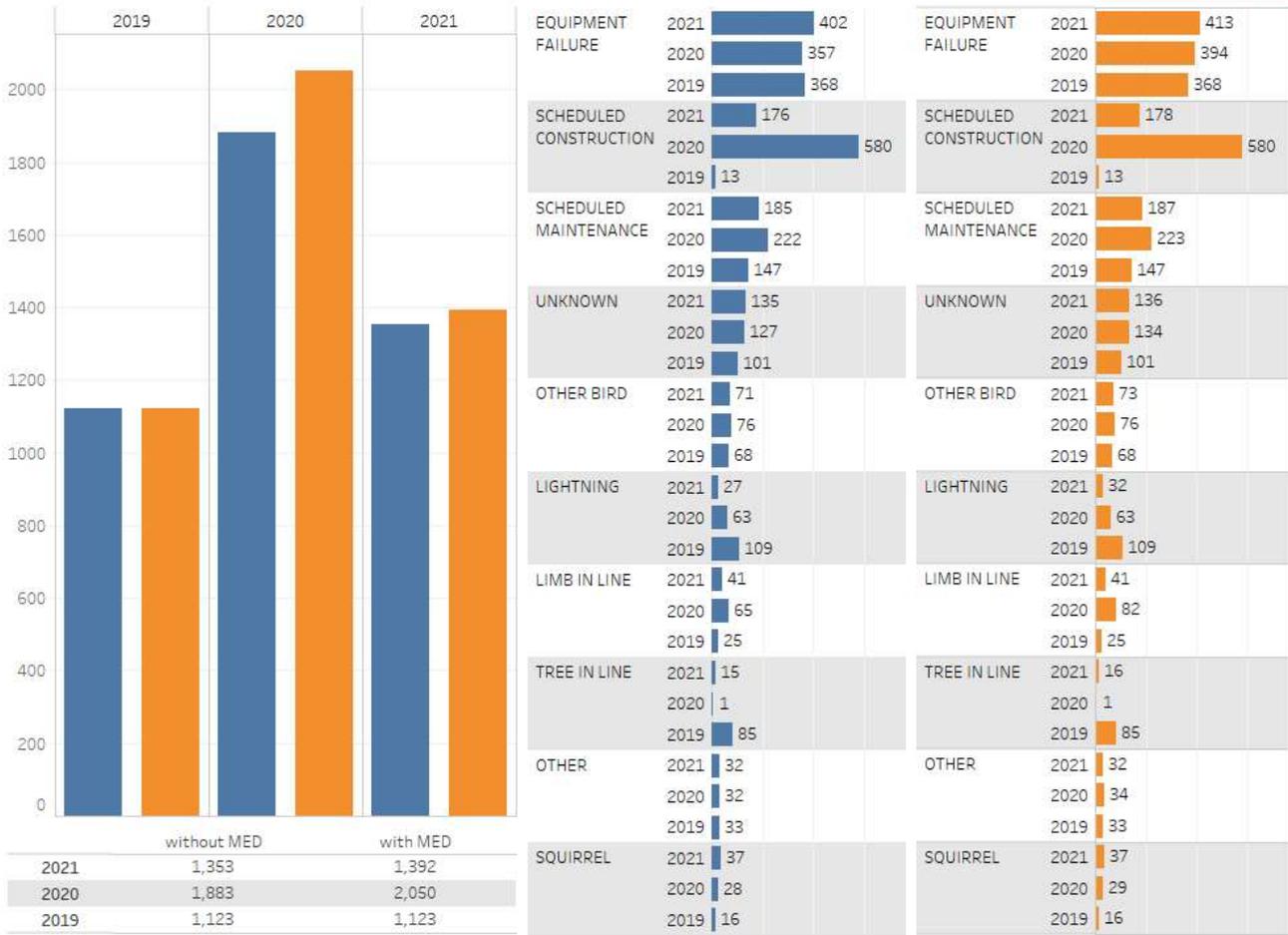


Figure 6.2 Great Falls system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

Outages decreased in 2021, aligning more closely with 5-year averages. The 2020 capital work plan included many short outages and this stabilized in 2021, though scheduled interruptions still remain the cause for over a quarter of the total outages in order to reduce longer reactive outages. Unknown outages increased in 2021 although the rest of the top outage causes either decreased or remained steady. Lightning-caused outages have significantly declined over the past few years likely due to arrester maintenance and replacements.

7. HAVRE SYSTEM RELIABILITY



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 2021. Like Great Falls and Butte, Havre remained mostly unaffected by MEDs, though an outage caused by non-NorthWestern Transmission lines totaled over 3.4 SAIDI minutes in November, making up nearly 40% of Havre’s annual SAIDI.



Outage Count Dashboard

Division
HAVRE

■ without MED
■ with MED



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

Equipment failure increased in 2021, along with several other top outage causes including birds, trees, other, and unknown causes. Many of the unknown outages were due to the transmission line loss (mentioned above) on non-NorthWestern owned lines. Like Great Falls, lightning outages are declining likely due to arrestor maintenance and replacements. Scheduled outages due to proactive maintenance increased in Havre in 2021, accounting for over a quarter of all outages.

8. HELENA SYSTEM RELIABILITY



Division
HELENA

■ without MED
■ with MED



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

Helena SAIDI, SAIFI, and CAIDI increased in 2021 largely due to several weather events and MEDs. Almost 20% of the SAIDI in this region can be attributed to the June lightning storm in this area with an additional 20% due to other weather events (wind and snow being the largest contributors). In addition, there was a total of 4.9 SAIDI minutes in July due to several thunderstorms throughout the month.



Outage Count Dashboard

Division
HELENA

■ without MED
■ with MED

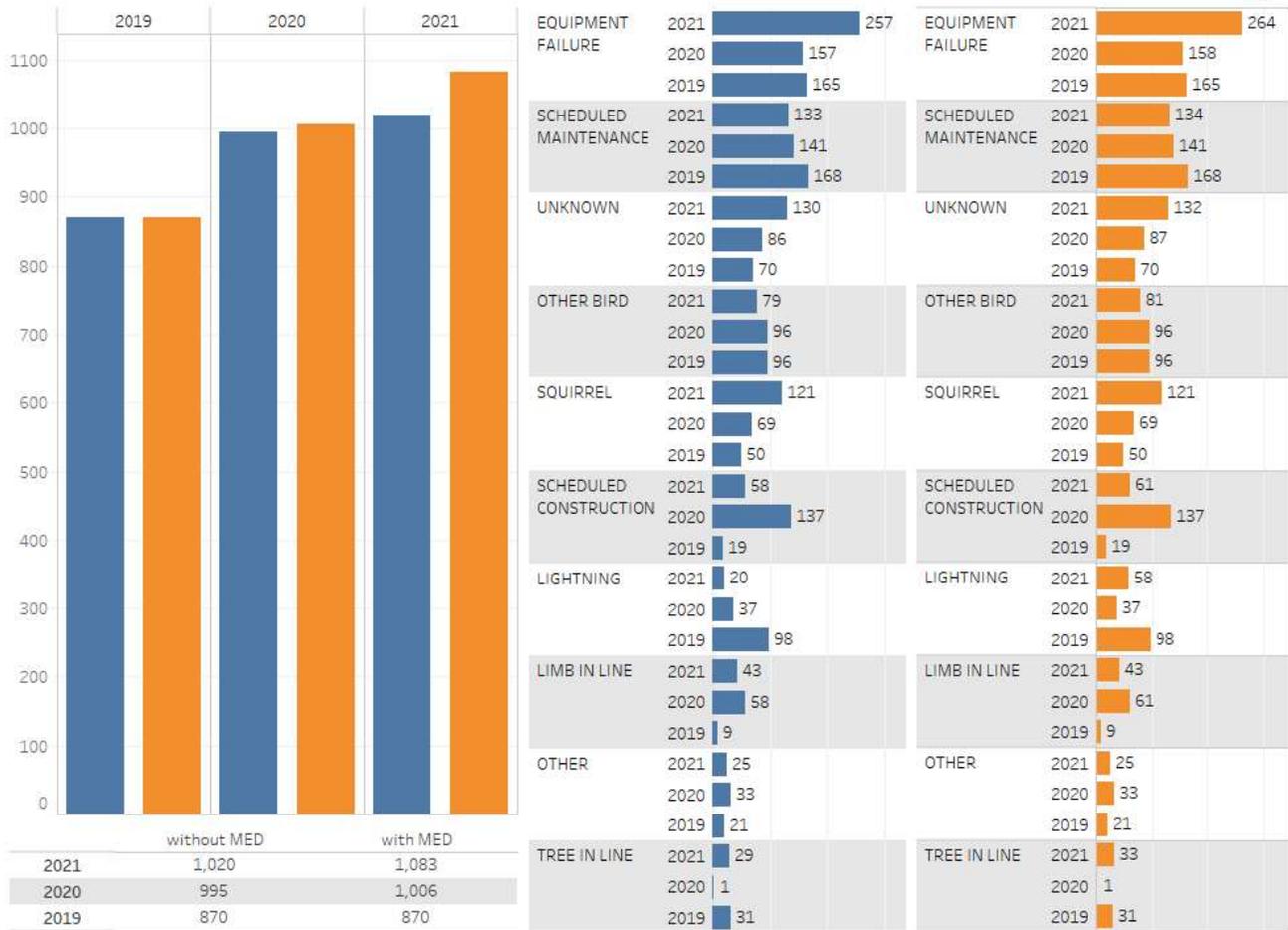


Figure 8.2 Helena system outages by top ten causes with and without major event days (MEDs) as defined in IEEE Standard 1366-2012.

Despite higher SAIDI values for the Helena division in 2021, outage counts remained close to 2020 values. As with other areas, Unknown and Equipment Failure increased this year and will be closely monitored. Scheduled outages make up nearly 20% of the outages. There were increases in animal outages as well, with squirrel-caused outages almost doubling from the previous year. Lightning outages are decreasing and tree outages remain consistent with previous year's data.

9. MISSOULA SYSTEM RELIABILITY



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

Missoula indices remain close to 5-year averages and, like the previous year, were largely affected by MEDs. The November MED accounts for over a quarter of the SAIDI for the entire year. August also had over 6.5 SAIDI minutes of outages due to unfavorable weather, though they did not reach the MED threshold.

Outage Count Dashboard

Division
Multiple values



■ without MED
■ with MED



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

Though SAIDI numbers increased in Missoula in 2021, outage counts did not. Oftentimes, longer outage durations can occur during an MED though there may not be more outages overall. Scheduled outages are the largest outage contributor in Missoula followed by Equipment Failure, which has remained steady over the previous 3 years. As in Helena, animal outages increased in 2021 as well as vegetation-caused outages.

10. CONCLUSION

The final 2021 NorthWestern electric reliability numbers were higher than the previous three-year average of 127.6 SAIDI minutes when including Major Event Days, though with no MEDs recorded in 2019, those numbers are slightly skewed. The final 151.4 SAIDI minutes recorded reflect three major storms as well as a year full of smaller storm and wind events. The catastrophic event that occurred in January (not included in any analysis above) resulted in over 42 SAIDI minutes of outages. The 128.4 SAIDI minutes recorded without MEDs is trending upwards from the three-year average of 106.5 SAIDI minutes. More accurate and timely outage reporting and recording is likely a key reason for the increasing SAIDI trends. In addition, extreme weather played a large part in reliability in 2021 ranging from extreme cold to extreme heat to widespread thunderstorms.

Substation, distribution line, and other asset improvements increased the number of scheduled outages. This work helps avoid longer reactive outages caused by equipment failures and provides facilities to serve future loads. Equipment Failure continues to be a broad outage cause that NorthWestern is always working to improve upon and Unknown outages will be further analyzed for future improvements in recordkeeping and reporting. 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 2021 Annual Electric Reliability Report has been e-filed with the Montana Public Service Commission ("Commission") under Docket No. 2022.01.002 and emailed to the Commission and the Montana Consumer Counsel.

Date: March 1, 2022



Connie Moran
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Regulatory Affairs