Ms. Kate Whitney  
Administrator  
Montana Public Service Commission  
1701 Prospect Avenue  
PO Box 202601  
Helena, MT  59620-2601  

RE:  2014 Annual Electric Reliability Report  

Dear Ms. Whitney:

With this letter, NorthWestern Energy (NWE) submits the 2014 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. Similar to the previous four years, additional transmission line reliability information is attached to the report.

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

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Sincerely,  

Nate Linder  
Manager, Electric System Integrity

Enclosure: 2014 Annual Electric Reliability Report
2014
-Montana-
Electric Distribution/Transmission
Annual Reliability Report

March 2015
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EXECUTIVE SUMMARY

This report provides information and insights into NorthWestern Energy’s (NWE) 2014 Electric Distribution and Transmission 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 eight operating areas of the state: Billings, Bozeman, Butte, Great Falls, Havre, Helena, Lewistown, 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.

NorthWestern Energy has an active relationship with the IEEE Power and Energy Society Reliability Working Group to ensure a consistent and accurate portrayal of our utility’s ability to report and benchmark reliability indices. MEDs are identified through a monthly 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 2014, there were no Major Event Days, but the “Including MEDs” graphs are shown for previous years’ comparisons and consistency. By comparison, there were no MED’s in 2009, one in 2010, none in 2011, two in 2012 and two in 2013. For the Montana region, it took 6.52 SAIDI minutes in 2014 to declare an MED. In Montana, a larger MED event could be 20 SAIDI minutes or more.

Transmission related reliability data and graphs have been added as an annex to the report again this year.
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 laymen’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 were three days with a “Customer-Minutes Interrupted” (CMI) number greater than one million (an MED for 2014 required 2.23 million CMI). Please see table below, listed in descending CMI. These storm events, while not being MEDs, added significantly to the SAIDI minutes for 2014. For comparison, there were nine days in 2013 with over a million CMI, not including the two MEDs.

<table>
<thead>
<tr>
<th>Date</th>
<th>CMI</th>
<th>Divisions Impacted</th>
<th>Majority Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/26/2014</td>
<td>2205689</td>
<td>Hillings, Boneman, Butte, Great Falls, Helena, Havre, Lewistown, Missoula</td>
<td>Lightning, Wind, Equipment Failure, Human Error/Accident</td>
</tr>
<tr>
<td>1/13/2014</td>
<td>1729426</td>
<td>Hillings, Boneman, Butte, Great Falls, Helena, Havre, Lewistown</td>
<td>Limb In Line, Tree In Line, Wind, Equipment Failure</td>
</tr>
<tr>
<td>6/17/2014</td>
<td>1250748</td>
<td>Hillings, Boneman, Butte, Great Falls, Havre</td>
<td>Lightning, Equipment Failure, Equipment Overload</td>
</tr>
<tr>
<td>8/20/2014</td>
<td>1079795</td>
<td>Hillings, Boneman, Butte, Great Falls, Helena, Missoula</td>
<td>Wind, Human Error/Accident, Equipment Failure</td>
</tr>
</tbody>
</table>

Table 1: Additional Notable Events (2014)

Further details on these events are provided in the operating area discussions below.
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 2011-2014. Region indices shown for 2011 to 2014 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, 2014 SAIDI, CAIDI and SAIFI were all lower than 2013. Also, all three indices in 2014 were lower than the previous three-year averages.

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

As there were no MEDs in 2014, the graph values for 2014 are identical in both graphs. You can see how the year relates to previous years containing MEDs.
Outages by cause (excluding MEDs) are shown in **Figure 2.3**.

![Montana - Outages By Top Ten Causes (Excluding MEDs)](image_url)

**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 and Transmission system. Overall outages reported increased 15% to 6,724. The top ten outage counts increased from 4,990 in 2013 to 5,692 in 2014. Nature related outages such as wind, lightning and snow/ice went down by 17 outages. Overall Equipment Failure outages increased 364. Equipment Failure is the most common of the 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 outages also went up 340 outages. In the past, small planned outages, where the crew notified the customers of the pending outage were not well documented but they are now. It is anticipated that this will increase outage counts for scheduled maintenance noticeably, but have a minimal impact on SAIDI (1-2 minutes additional for the year).
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. As stated above, there were no MEDs in Montana for 2014. One change of note is the Tree In Line category with a decrease of 89 outages. That may possibly be attributed to the proactive vegetation management program instituted by NorthWestern Energy, as well as a less severe wind year.
3. BILLINGS SYSTEM RELIABILITY

Billings saw considerable improvement in all three indices for 2014 as compared to 2013 and the three-year average. Storm problems were down appreciably from 2013 and although equipment outage counts were up, the SAIDI impact was lower. Larger outages for the year were a bad lightning arrester that took out a feeder and two “vehicle hit pole” incidents. Squirrels still cause a large number of outages, but tree problem outages are down considerably, most likely due to fewer storms and increased trimming efforts.

![Billings System Indices (Excluding MEDs)](image)

**Figure 3.1** Billings system indices excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.
Figure 3.2 Billings system indices including major event days (MEDs) as defined in IEEE Standard 1366-2012.
Figure 3.3 Billings system outages by top ten causes excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.
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 2014 saw an increase in CAIDI from 2013 but decreases in SAIDI and SAIFI. Larger events in the area were a planned outage on Big Sky Meadow Substation to repair equipment and an outage at Ennis Auto Sub. Equipment failure outage counts were up, but both tree and wind related outage counts were down appreciably.

![Bozeman System Indices (Excluding MEDs)](image)

**Figure 4.1** Bozeman system indices excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.
Figure 4.2 Bozeman system indices including major event days (MEDs) as defined in IEEE Standard 1366-2012.
Figure 4.3 Bozeman system outages by top ten causes excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.
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 2014, SAIDI and CAIDI increased and SAIFI held about the same for the Butte Division, excluding Major Event Days. An insulator failure on a Philipsburg feeder and the loss of a Butte Montana Street feeder, both during storms, were the two largest single events for the division. Equipment outages were up considerably for Butte as well as bird related outages to a lesser degree. But tree outages were down, likely from less wind for the year.

![Butte System Indices (Excluding MEDs)](image)

**Figure 5.1** Butte system indices excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.
Figure 5.2  Butte system indices including major event days (MEDs) as defined in IEEE Standard 1366-2012.

Butte Division was heavily impacted by the August 1st, 2013 Major Event Day, so the 2014 numbers (without any MED) dropped noticeably.
Figure 5.3  Butte system outages by top ten causes excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.
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 saw a decrease in SAIDI and CAIDI and an increase in SAIFI for 2014. Snow/Ice, and Scheduled outages were up, but Lightning related outages were much lower. The larger outages for the division were a substation differential at GF Eastside sub, the loss of the Conrad and Choteau subs due to transmission problems, loss of a City feeder from a loose connection, and several planned outages to facilitate substation upgrades.

*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)

<table>
<thead>
<tr>
<th>Year</th>
<th>SAIDI (minutes)</th>
<th>CAIDI</th>
<th>SAIFI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>165.38</td>
<td>107.23</td>
<td>1.542</td>
</tr>
<tr>
<td>2012</td>
<td>288.35</td>
<td>117.74</td>
<td>2.449</td>
</tr>
<tr>
<td>2013</td>
<td>191.31</td>
<td>93.41</td>
<td>2.048</td>
</tr>
<tr>
<td>2014</td>
<td>151.88</td>
<td>102.84</td>
<td>1.477</td>
</tr>
<tr>
<td>Average (2011-2013)</td>
<td>215.01</td>
<td>106.13</td>
<td>2.01</td>
</tr>
</tbody>
</table>

**Figure 6.2** Great Falls system indices including major event days (MEDs) as defined in IEEE Standard 1366-2012.
Figure 6.3  Great Falls system outages by top ten causes excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.
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 a 132 minute improvement in SAIDI and almost a 25 minute reduction in CAIDI for 2014 as compared to 2013, which had one large substation event that amounted to 109 SAIDI minutes. Both these indices are lower than for the previous three years though. Larger outages were a Chinook City Substation regulator failure and a subsequent planned outage a couple days later to replace the damaged equipment and a transmission insulator failure that took out two Havre City subs. Lightning and unknown outages were notably down, scheduled maintenance and vehicle hits were notably higher.

![Havre System Indices (Excluding MEDs)](image)

**Figure 7.1** Havre system indices excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.
Figure 7.2 Havre system indices including major event days (MEDs) as defined in IEEE Standard 1366-2012.
Figure 7.3 Havre system outages by top ten causes excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.
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 moderate increase of all three indices for 2014 over 2013 values, though only CAIDI was above the previous three-year average. Landers Fork Sub feeder had extended outages in January due to high winds and the Helena Valley Sub had two larger outages from equipment failures during December. Equipment failure and scheduled outages were higher. The scheduled work is largely due to system improvements.

![Helena System Indices (Excluding MEDs)](image)

<table>
<thead>
<tr>
<th>Year</th>
<th>SAIDI (minutes)</th>
<th>CAIDI (minutes)</th>
<th>SAIFI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>82.79</td>
<td>119.11</td>
<td>0.695</td>
</tr>
<tr>
<td>2012</td>
<td>92.61</td>
<td>110.41</td>
<td>0.741</td>
</tr>
<tr>
<td>2013</td>
<td>108.80</td>
<td>125.06</td>
<td>1.01</td>
</tr>
</tbody>
</table>

Figure 8.1 Helena system indices excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.
Figure 8.2  Helena system indices including major event days (MEDs) as defined in IEEE Standard 1366-2012.
Figure 8.3 Helena system outages by top ten causes excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.
Figure 8.4 Helena system outages by top ten causes including major event days (MEDs) as defined in IEEE Standard 1366-2012.
9. LEWISTOWN SYSTEM RELIABILITY

Lewistown District saw improvement in all three indices in 2014. With SAIDI at 54 minutes and SAIFI at 0.53, it was a very reliable year! Larger outages were an arrestor failure at the Roundup Auto Sub and a recloser failure at the Moccasin Sub. Lightning related outages were significantly down, but raccoons and other animals are making a comeback.

**Figure 9.1** Lewistown system indices excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.
**Figure 9.2** Lewistown system indices including major event days (MEDs) as defined in IEEE Standard 1366-2012.
Figure 9.3 Lewistown system outages by top ten causes excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.
Figure 9.4 Lewistown system outages by top ten causes including major event days (MEDs) as defined in IEEE Standard 1366-2012.
10. MISSOULA SYSTEM RELIABILITY

Missoula Division improved in all three indices in 2014 after fairly high numbers in 2013. The largest event was a storm on November 26th that caused a number of outages in the Bitterroot Valley and at 6.34 MT SAIDI minutes, was just under a Major Event Day. Earlier in November, a failed conductor also caused a large outage in Hamilton. In August, a faulted air-break switch during a wind storm differentiated the Missoula Industrial Sub taking out over 10,000 customers. Tree, squirrel, and equipment related outages were down, while snow/ice and scheduled outages were up. Total division outages were down by 271.

![Missoula System Indices (Excluding MEDs)]

**Figure 10.1** Missoula system indices excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.
Figure 10.2 Missoula system indices including major event days (MEDs) as defined in IEEE Standard 1366-2012.
Figure 10.3 Missoula system outages by top ten causes excluding major event days (MEDs) as defined in IEEE Standard 1366-2012.
**Figure 10.4** Missoula system outages by top ten causes including major event days (MEDs) as defined in IEEE Standard 1366-2012.
11. CONCLUSION

Last year started off in January with several severe wind storms, which drove that month’s SAIDI over 11 minutes, compared to an earlier three-year January average of 4.7 minutes. With fairly average months through the spring, SAIDI remained higher than average. But then June and July were better, with few storms until August which saw average reliability. This trend was almost opposite that of 2013. Where September of 2013 had 26 minutes of SAIDI, due largely to storms in the Billings area, last September was mild with less than four minutes of SAIDI which continued the trend toward a good reliability year. Although storms in November drove the month to 19 SAIDI minutes, a better than average October and December helped to end the year at 112.9 minutes. This is the lowest Montana SAIDI in the last five years.

The InService mobile work force and outage management system was implemented by NWE during the fall of 2014. This will provide more accurate and timely outage reporting for 2015 and the future. 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 conversion to InService has also brought about the use of Universal Time (UT) for outage reporting. This eliminates the need to track the time zone difference between our Montana and South Dakota regions. Days will be looked at and tracked using UT rather MST, which entails a seven hour time shift. 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 is being reviewed by NWE.

Increased efforts in line patrol and repairs as well as vegetation work may have improved reliability in 2014, as well as reduced the impacts from larger storms. The November storm in the Bitterroot Valley is one event where increased vegetation work may have avoided a Major Event Day. Additionally, with the implementation of reliability projects under the Distribution System Infrastructure Project (DSIP), stability and hopefully improvement in electric system reliability should be realized. Of course the impacts of storms are a major contributor to reduced reliability and complicate any analysis. Substation and other asset improvements increased scheduled outages, but careful planning kept these outages to a minimum and 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.
ANNEX A: TRANSMISSION DATA AND GRAPHS

Attached below are graphs showing the electric transmission cumulative outage duration, cumulative outage frequency, ASAI and SAIFI. Each graph shows the 2011-2013 average and 2014 year end. Also included are graphs showing the outage cause duration and frequency by year from 2010 through 2014.

The 2014 outage duration is approximately **742 hours (39.3%) less** than the 2011-2013 average. The 2014 outage frequency (count) is approximately **211 outages (26.3%) less** than the 2011-2013 average. These numbers reflect a very reliable year at the transmission level. Lightning, Hardware, and Terminal Equipment outage numbers were all down from 2013, with only System Protection outages notably up in 2014.
Figure A.1  Electric transmission cumulative outage duration
Figure A.2  Electric transmission cumulative outage frequency
Figure A.3  Electric transmission Average Service Availability Index (ASAI)
Figure A.4 Electric transmission System Average Interruption Frequency Index (SAIFI)
Figure A.7  Comparison of 2014 outage duration to previous three-year average
Figure A.8  Comparison of 2014 outage frequency to previous three-year average
Figure A.9  Outage duration by cause by year for 2010-2014
Figure A.10 Outage frequency by cause by year for 2010-2014