MINNESOTA
PUBLIC UTILITIES COMMISSION

Staff Briefing Papers: Volume 1/2

Meeting Date	November 3, 2022		Agenda Item 1*
Company	Northern States Power Company d/b/a Xcel Energy, Minnesota Power, and Otter Tail Power Company.		
Docket No.	**Minnesota Power E015/ M-22-163** **Otter Tail Power Company E017/ M-22-159** **Xcel Energy E002/ M-22-162**		
	In the Matter of Minnesota Power's, Otter Tail Power Company's, and Xcel Energy's 2021 Annual Safety, Reliability and Service Quality Report and Proposed SAIFI, SAIDI, and CAIDI Reliability Standards for 2022		
Issues	1. Should the Commission accept Minnesota Power's, Otter Tail Power Company's, and Xcel Energy's 2021 Safety, Reliability, and Service Quality Metrics Reports? 2. Are the utilities' reports consistent with recent Orders[1] and Minn. Rules Ch. 7826 on Electric Utility Standards? 3. At what level should the Commission set the utilities' 2022 Reliability Standards? 4. Are there other issues or concerns related to this matter?		
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[1] See Orders associated with Docket Nos.: Xcel Energy (E002/M-21-237 and E002/M-20-406); Minnesota Power (E015/M-21- 230 and E015/M-20-404); Otter Tail Power (E017/M-21-225 and E017/M-20-401).

✓ **Relevant Documents**	**Date**
Annual Report, Otter Tail Power	April 1, 2022
Annual Report and Appendices A & B, Minnesota Power	April 1, 2022
Annual Report parts 1 & 2 and ATTL K & L, Xcel Energy	April 1, 2022
Errata, Corrected Call Center Response Time, Xcel Energy	April 28, 2022
Errata, Corrected JD Power index scores and Electronic Access data, Xcel Energy	June 24, 2022
Comment, Department of Commerce, to 22-159 (OTP)	May 16, 2022
Comment, Department of Commerce, to 22-163 (MP)	May 26, 2022
Comment, Department of Commerce, to 22-162 (Xcel)	June 2, 2022
Correct Public [Version of] Comments originally filed 6-2-2022, Department of Commerce, to 22-162 (Xcel)	June 7, 2022
Reply, Otter Tail Power	May 26, 2022
Reply, Minnesota Power	June 15, 2022
Reply, Xcel Energy	June 24, 2022
Letter, Department of Commerce, to 22-159 (OTP)	September 20, 2022
Amendment to SRSQ Report, to 22-159 (OTP)	September 26, 2022
IEEE Supplemental Filing to 22-159 (OTP)	August 25, 2022
Compliance Filing to 22-163 (MP)	August 29, 2022
Supplement- IEEE Reliability Benchmarking, to 22-162 (Xcel)	August 24, 2022

Contents

Introduction

Each year Minnesota's Investor-Owned Utilities (IOUs) submit Safety, Reliability, and Service Quality (SQSR) Reports. For the past several years, Commission staff split the reports into two sections. The Service Quality portion will be summarized in the separate Volume 2 of the briefing papers, while Volume 1 includes the Safety and Reliability metrics as laid out in Minnesota Rules, Chapter 7826, Electric Utility Standards, with specific attention to the reporting requirements outlined by Minn. Rules 7826.0400 to 7826.0600 and order points from the Commission's March 19, 2019 Order.[2]

In its March 2, 2022, Order Accepting Reports and Setting 2021 Reliability Standards, the Commission set utility reliability standards that benchmark to the IEEE working group results. The Commission required utilities make a supplemental filing to their April 1, 2022, reports within 30 days of the IEEE results being available, with an explanation addressing any standards the utility did not meet.

All three investor-owned electric utilities filed annual safety, reliability, and service quality reports on April 1, 2022 along with their IEEE results once available. By June 2, 2022 the Department was the only group to comment on the filings. After review and additional utility provided information, the Department recommended acceptance of annual service quality and

[2] Commission Order dated March 19, 2019 in Docket 18-250

reliability reports for all three utilities and acknowledged utility compliance with the Commission's rules. Below, Staff summarizes the utility reports and Department Comments.

Acronyms

AMI	Advanced Metering Infrastructure
ASAI	Average Service Availability Index
CAIDI	Customer Average Interruption Duration Index
CELI	Customers Experiencing Lengthy Interruptions
CEMI	Customer Experiencing Multiple Interruptions
EEI	Edison Electric Institute
ERT	Estimated Restoration Time
FLISR	Fault Location, Isolation, and Service Restoration
IEEE	Institute of Electrical and Electronics Engineers
IMS	Interruption Monitoring System
MAIFI	Momentary Average Interruption Frequency Index
MED	Major Event Day
OMS	Outage Management System
QSP	Quality of Service Plan
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SCADA	Supervisory Control and Data Acquisition
SQSR	Service Quality, Safety, and Reliability

Reliability

Utilities must report reliability results under Minn. Rules 7826.0500. This includes outage tracking metrics like SAIDI, SAIFI, and CAIDI, along with indices like staffing levels and bulk power supply interruptions. The Commission has also asked for various additional information in various orders.

SAIDI, SAIFI, and CAIDI

SAIDI stands for System Average Interruption Duration Index which measures the annual average outage duration for each customer served in hours. SAIFI stands for System Average Interruption Frequency Index which measures the average number of disruptions for a customer in a year. CAIDI stands for Customer Average Interruption Duration Index which measures the average outage duration (or conversely, restoration time) for a given customer. When examining these results, they can fluctuate from year to year due to a number of external factors impacting reliability of the utility grid. Due to this, it is also helpful to normalize these indices so that outlier data points, usually caused by storms and other weather-related

events, are removed or controlled for. Both normalized[3] and non-normalized results provide important information to examine when looking to see how ratepayers have been impacted by reliability issues within one year and from year to year; as well as, how each utility is meeting their IEEE standards.

In its March 19, 2019 Order the Commission required all utilities to use the IEEE 1366 standard (also known as the 2.5 Beta method) for normalizing Major Event Days. The utilities also propose numerical, individual reliability standards[4] for each work center. The Commission then sets reliability performance standards annually for the utilities, which "remain in effect until final action is taken on a filing proposing new standards or changes them in another proceeding."[5]

Historically, the Commission had directed utilities to use a rolling five-year average of SAIDI, SAIFI, and CAIDI metrics for each work center in a utility's service territory. However, utilities have now transitioned to IEEE benchmarking standard that expects each utility and their regions to be at or above the second quartile in SAIDI, SAIFI, and CAIDI when compared to their peers in IEEE. Utilities are also required to provide "an action plan for remedying any failure to comply with the standard" or "why non-compliance was unavoidable under the circumstances."[6]

The following sections summarize individual utility reliability performance for 2021. Instances where normalized performance did not meet the standard are indicated in red. Staff will explain the challenges and improvements utilities continue to make to achieve their unmet goals.

Minnesota Power

MP's service territory is divided into three work centers. Below are MP's service territory wide results for SAIDI, SAIFI, and CAIDI.

Table 1: Minnesota Power 2021 Results and 2022 Proposed Standards

Metric	SAIDI	SAIFI	CAIDI
2021 Standard (IEEE 2nd Quartile)	136.00	1.08	126
2021 Performance Results (*Normalized*)	126.00	**1.34**	93.8
2021 Performance Results (*Non-Normalized*)	150.76	1.45	103.68

[3] Per Minn. Rules 7826.0200, Subp. 9. "Storm-normalized data" means data that have been adjusted to neutralize the effects of outages due to major storms. Minn. Rules 7826.0500 Subd. D requires "an explanation of how the utility normalizes its reliability data to account for major storms."

[4] Minn. Rules 7826.0600, Subp. 1

[5] Minn. Rules 7826.0600, Subp. 2

[6] Minn. Rules 7826.0500, Subp. 1E

Minnesota Power met their SAIDI and CAIDI standards but did not meet their SAIFI standard for 2021. This indicates that MP experienced more SAIFI interruptions than the national average for utilities of a similar size.

The Company did not meet their CAIDI goal for the Northern Work Center nor did they meet their SAIFI goal for the Western Work Center. MP met their SAIDI, SAIFI, and CAIDI goals in their Central Work Center but the Northern Work center failed to meet their CAIDI goal and the Western Work Center failed to meet their SAIFI goal.[7] Similar to last year, the Company gave weather and equipment failure as the primary reasons for not meeting various metrics in the Northern, Western, and overall service territory. MP included in their reasons a higher prevalence of lightning and heavy snowfall. Leading causes of outages were similar to 2019 and 2020. To counteract this challenge, the Company is installing Trip Savers to clear temporary faults along with strategic undergrounding efforts for the Company's worst performing overhead lines.[8]

Figure 1 and Figure 2 compare the contributing factors to MP's SAIDI and SAIFI values for 2019-2021, created by Commission Staff. Both figures include all outages (non-normalized). This information help us determine factors that are causing reliability issues with regards to the data points that will be removed when SAIDI and SAIFI are normalized to control for major events. When normalizing, utilities employ the IEEE 2.5 beta method which is designed to remove all outage records attributed to a specific, major event.

[7] MP, Initial Filing, Docket 22-163, pdf p. 21
[8] MP, Initial Filing, Docket 22-163, pdf p. 22

Figure 1: Comparison of SAIDI causes, 2019 to 2021[9]

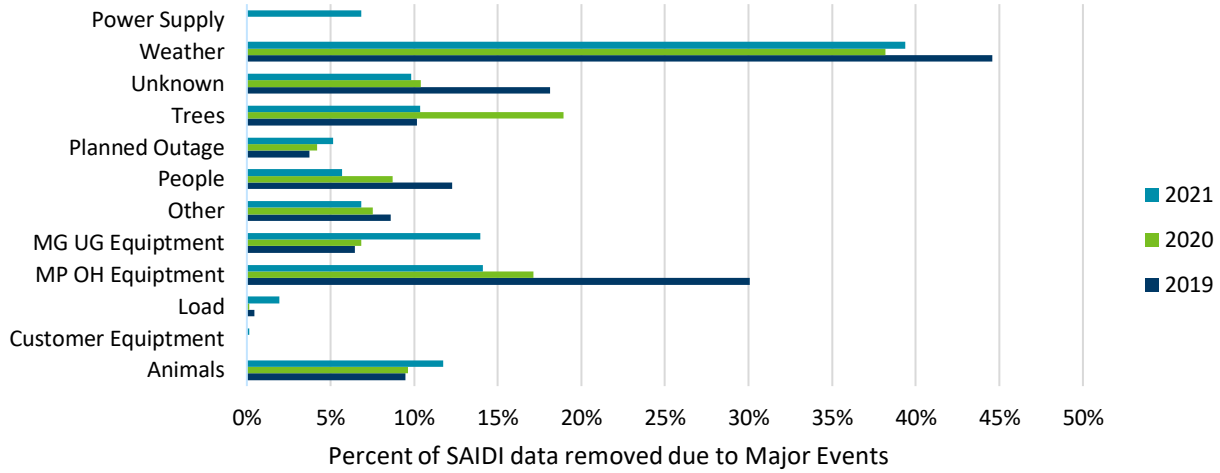
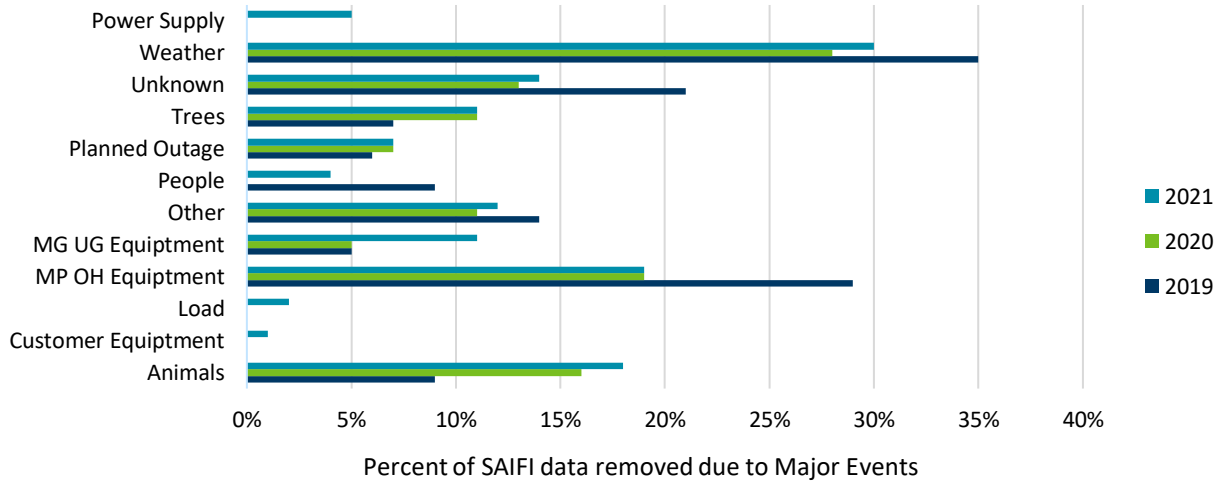


Figure 2: Comparison of SAIFI causes, 2019-2021[10]



The figures below show MP's reliability results for the SAIDI, SAIFI, and CAIDI metrics, along with their trend lines, over the past 10 years.

[9] MP, Initial Filing, Docket 22-163, pdf pp. 23-25
[10] *Id.*

Figure 3: Minnesota Power SAIDI 2012-2021

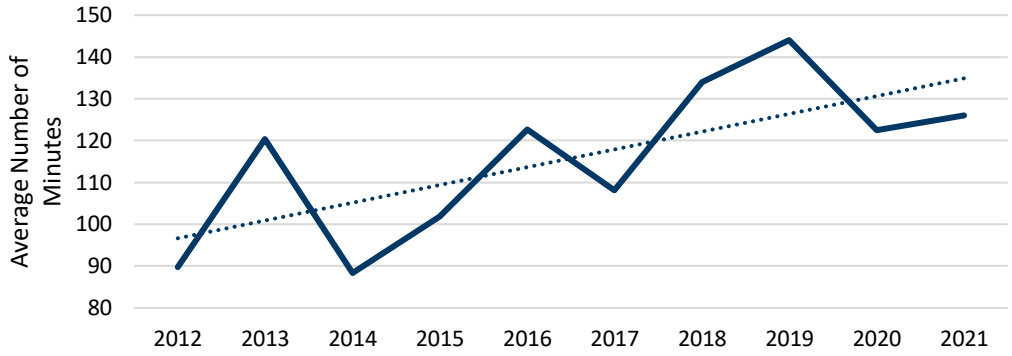


Figure 4: Minnesota Power SAIFI 2012-2021

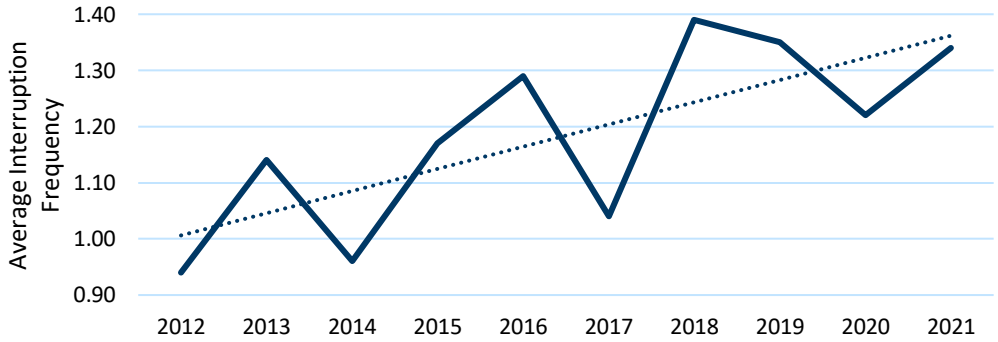
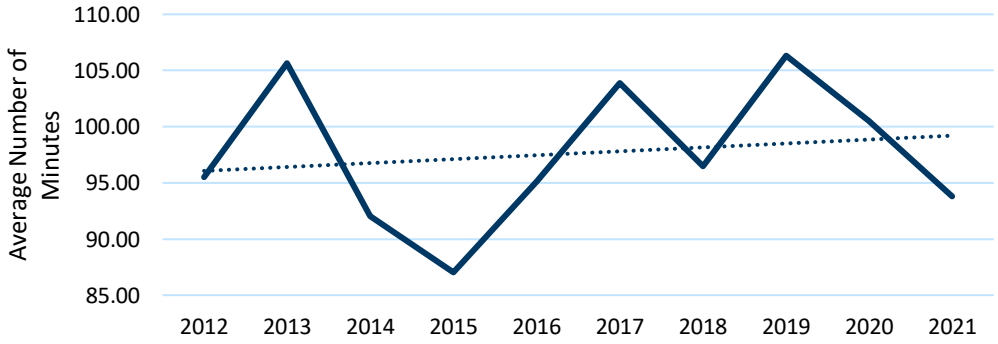


Figure 5: Minnesota Power CAIDI 2012-2021



Staff Analysis

MP's SAIDI, SAIFI, and CAIDI have increased over the past ten years. As equipment and other failure points continue to be reduced, MP continues to work towards improving their SAIDI, SAIFI, and CAIDI metrics. MP continues to work with Commission staff to implement prudent reliability investments including items such as trip savers as well as strategic undergrounding efforts, which were expanded upon in MP's Integrated Distribution Plan.[11] Staff hope that the regional granularity granted from utilities reporting at a work-center-scale, as opposed

[11] Docket 21-390

providing a single metric for their whole service territory, will allow the Commission and the utility to further improve problem areas.

Otter Tail Power

Table 2: Otter Tail Power 2021 Reliability Results

Region	Metric	2021 Standard	2021 Performance Results
Overall Service Territory	SAIDI	136	79.03
	SAIFI	1.08	**1.24**
	CAIDI	126	66.89
Bemidji	SAIDI	136	30.32
	SAIFI	1.08	0.46
	CAIDI	126	66.03
Crookston	SAIDI	136	85.67
	SAIFI	1.08	**1.13**
	CAIDI	126	76.08
Fergus Falls	SAIDI	136	76.49
	SAIFI	1.08	**1.15**
	CAIDI	126	66.44
Morris	SAIDI	136	72.82
	SAIFI	1.08	1.05
	CAIDI	126	69.14

Beginning in this year's report, Otter Tail reduced their reporting from six regions down to four. The Millbank Service Center has been moved into the Morris Service Center and the Wahpeton Service Center customers have been moved into the Fergus Falls Service Center.[12] This was due to the Millbank and Wahpeton Service Centers being so small that they would see extreme fluctuations from year to year in their metrics with only two feeders that made it difficult to examine their longitudinal data.

In its previous reports, Otter Tail explained the implementation of its new Interruption Monitoring System (IMS), which captures a larger volume of customer outages due to monitoring on all three-phases overhead transformers. OTP believes that due to the small historical database available in their new system, the Major Event Day threshold is artificially high and with more data, the threshold levels will decrease.[13] This will impact their normalized values, improving them over time.

[12] OTP, Initial Filing, Docket 22-159, pdf p. 31
[13] OTP, Initial Filing, Docket 21-225, p. 15

The Department noted Otter Tail's reliability performance improved relative to meeting historical goals by 11 percent from 2020 to 2021.[14] OTP achieved its SAIDI and CAIDI goals at the statewide level but has failed to achieve all three goals since 2018, in this case, SAIFI.[15]

Figures 6 through 8 depict OTP's SAIDI, SAIFI, and CAIDI trends over the past decade. As a whole, Otter Tail has seen mainly flat or slightly increasing reliability indices over the past 10 years aside from the Milbank and Wahpeton work centers which have now been rolled into Morris and Fergus Falls work centers respectively.

Figure 6: Otter Tail Power SAIDI Trends, 2012-2021

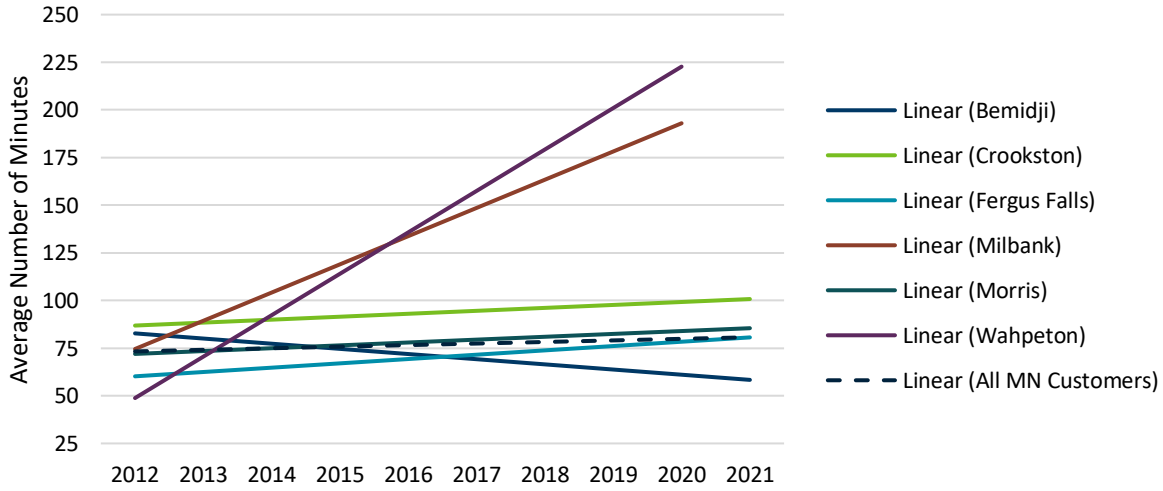
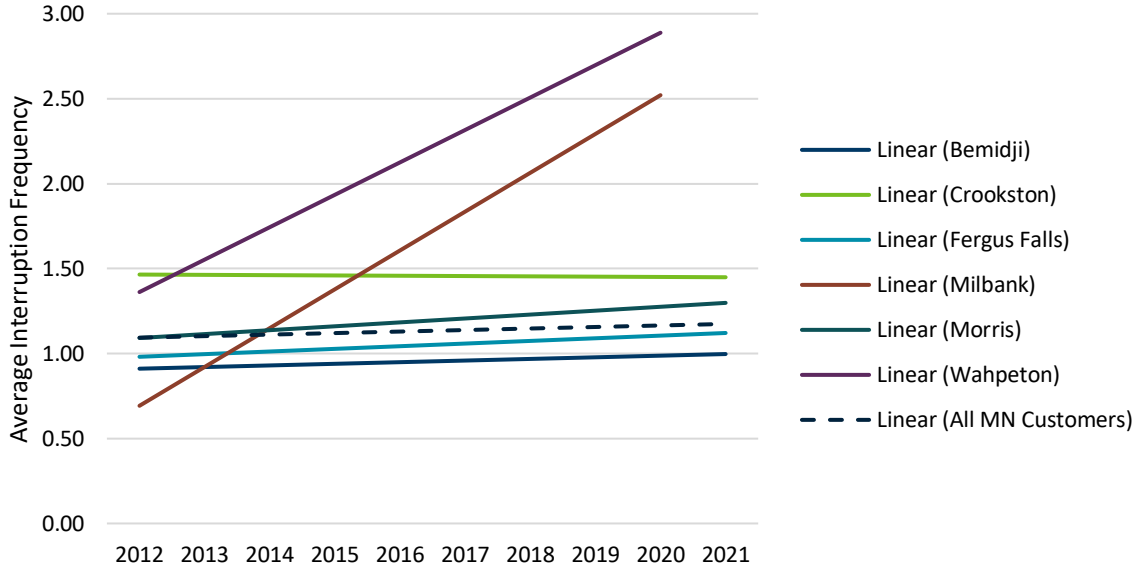
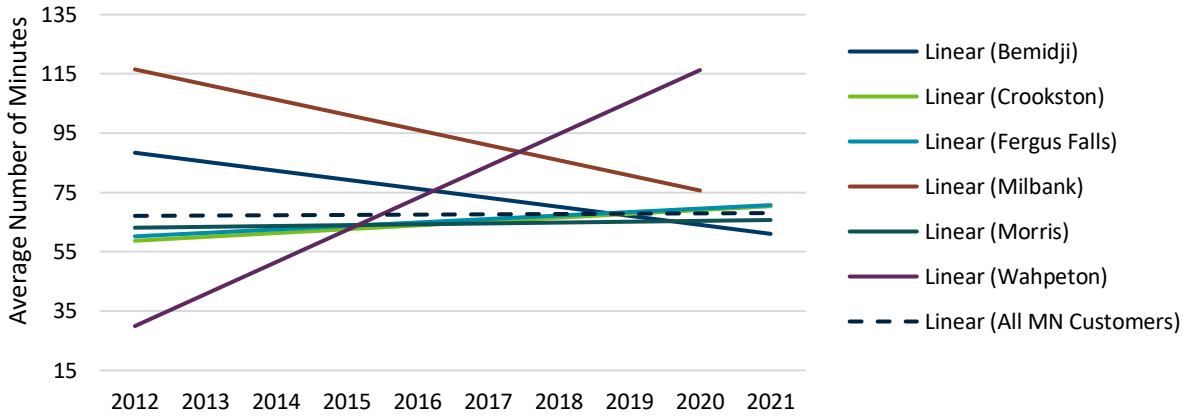


Figure 7: Otter Tail Power, SAIFI Trends, 2012-2021



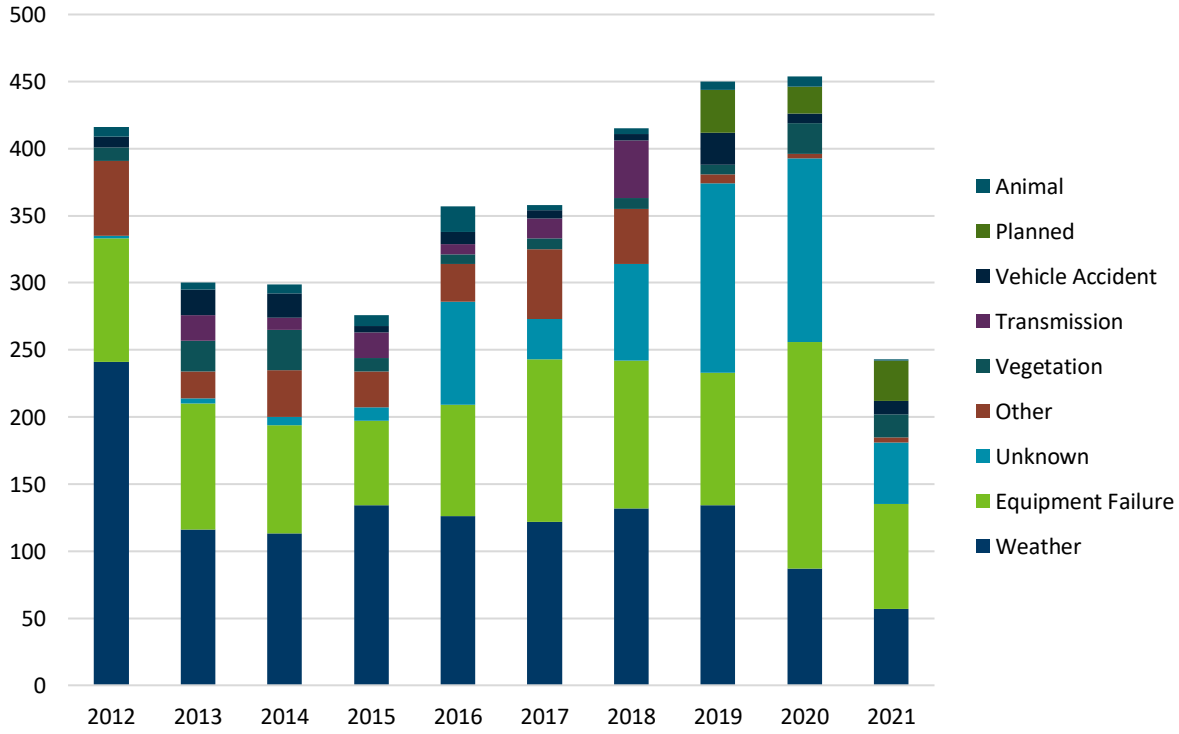
[14] Department, Initial Filing , Docket 22-159, pdf p. 11
[15] Department, Reply Comment, Docket 21-225, p. 17

Figure 8: Otter Tail Power, CAIDI Trends, 2012-2021



As in previous years, Otter Tail provided a table of outage causes by work center for its service area. Staff has compiled Figure 9 showing causes over the past decade.[16] Weather and equipment failure are the most common causes of outages for OTP. OTP reduced their weather and equipment failure outages significantly in 2021.

Figure 9: Otter Tail Power Outage Origins



[16] OTP, Initial Filing, Docket 22-159, pdf p. 19. In 2019 Otter Tail began reporting sources of outages with new categorizations in line with its new IMS. Staff has aligned new and old categories for comparison purposes.

*Other includes: Bird, Bulk Power Loss, Flood, Fuse, Human error, Investigated and Unknown, Other, Overload, Underground, Vandalism

Xcel Energy

Xcel met 11 of its 12 reliability goals for 2021, exceeding their national benchmarks statewide for their four work centers except for their Northwest Work Center CAIDI value. With a success rate of 91.66%, Xcel improved from 2020's 25% of goals met, reversing the decline from last year and prior years, when Xcel achieved 42% (2019), 17% (2018), 83% (2017), 50% (2016) and 67% (2015) of its reliability goals.

Table 3: Xcel Energy 2021 Results[17]

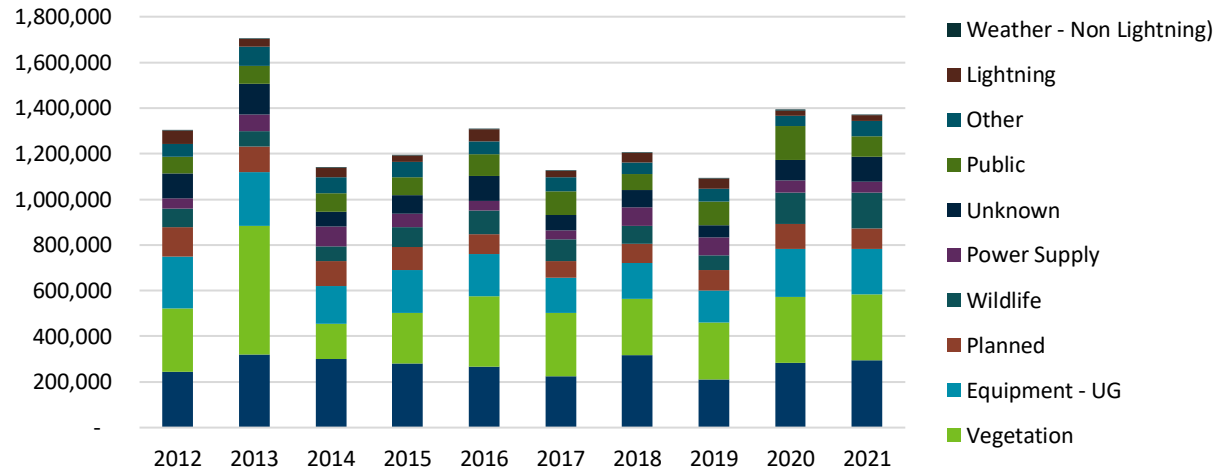
Region	Metric	2021 Standard	2021 Performance Results (normalized)	2021 Performance Results (non-normalized)
Minnesota	SAIDI	139	88.83	129.93
	SAIFI	1.09	0.92	1.04
	CAIDI	117	96.33	124.67
Metro East	SAIDI	139	82	145.5
	SAIFI	1.09	0.92	1.01
	CAIDI	117	98.41	144.49
Metro West	SAIDI	139	94.56	121.15
	SAIFI	1.09	1.05	1.14
	CAIDI	117	89.67	106.02
Northwest	SAIDI	136	93.42	104.01
	SAIFI	1.08	0.74	0.79
	CAIDI	126	**126.13**	131.22
Southeast	SAIDI	136	79.8	144.95
	SAIFI	1.08	0.76	0.92
	CAIDI	126	105.14	157.71

In its January 28, 2020 Order, the Commission required utilities to submit a compliance filing with sustained outage causes by work center, and also to continue filing the same data on an annual basis. Xcel, OTP, and MP complied with this requirement.[18] Staff provides Figure 10 showing Xcel's sustained outage trends for 2012-2021 for all outages.

[17] Xcel, Initial Filing Part 2, Docket 22-162, pdf p. 21

[18] Department, Comment, Docket 22-162, pdf p. 30; OTP, Initial Filing, Docket 22-159, pdf p. 19; MP, Initial Filing Appendix A, Docket 22-163

Figure 10: Causes of Xcel Sustained Outages



The number of outages remained relatively steady in 2021 compared to 2020. This year, more wildlife caused sustained outages than previous years. However, a majority of outages are related to vegetation and equipment failure, both of which can be managed with tree trimming and equipment maintenance and end of life retirements.

Xcel proposed a benchmarking standard for each work center that are consistent with last year's recommendations. For the two Metro regions (Metro East and Metro West), Xcel proposed the same standards as their Minnesota service area: better than the 2nd quartile of the IEEE benchmark for large utilities. For the two rural areas (Northwest and Southeast), Xcel proposed better than the 2nd quartile of the IEEE benchmark for medium utilities.[19]

Southeast Work Center

In its January 28, 2020 Order, the Commission directed Xcel to file the following information about its Southeast work center, which had seen worsening reliability (only meeting two of their twelve standards) over the past few reports. In their quarterly compliance filing, Xcel reported:

i. steps taken to increase Full Time Equivalent employees at the Southeast work center in 2020,
ii. the number of contractors versus employees at the Southeast work center, and
iii. steps taken to improve reliability standards that are lagging at the Southeast work center.

[19] Xcel, Initial Filing part 2, Docket 22-162, pdf p. 4

Xcel also continued its commitment to providing quarterly updates on efforts to improve reliability for the Southeast work center, which it has done in 2021. Most recently in their quarter 4 report from 2021, they hired for three positions, have determined they are seeing high levels of conductor contact in this area, and are continuing to remediate by their pole inspection program and cutout replacement in 2021.[20]

The Department acknowledged Xcel's fulfillment of the requirements of Minnesota Rules part 7826.0500, subp. 1.E.[21]

Staff Analysis

Utility goals sometimes rise slightly from year to year due to external weather-related factors. This makes it important to look at the overall trend lines of goals and actual performance. Staff provides the following figures of SAIDI, SAIFI, and CAIDI. The three graphs show *trends* of actual SAIDI, SAIFI, and CAIDI over time for Xcel's various service areas, not actual numbers. From this we can see that Xcel has improved or maintained their statewide SAIDI, SAIFI, and CAIDI trends even if individual Work Centers have recently seen some swings.

Figure 11: SAIDI Trends, 2012-2021

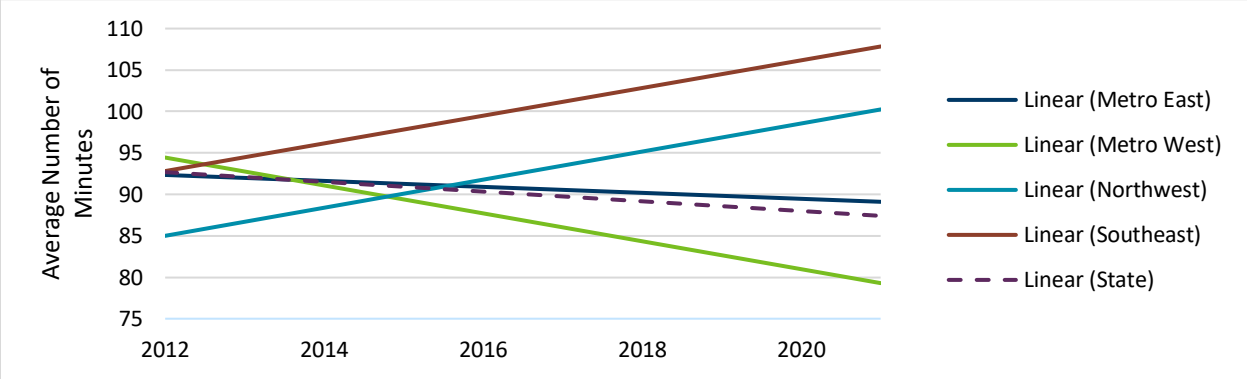
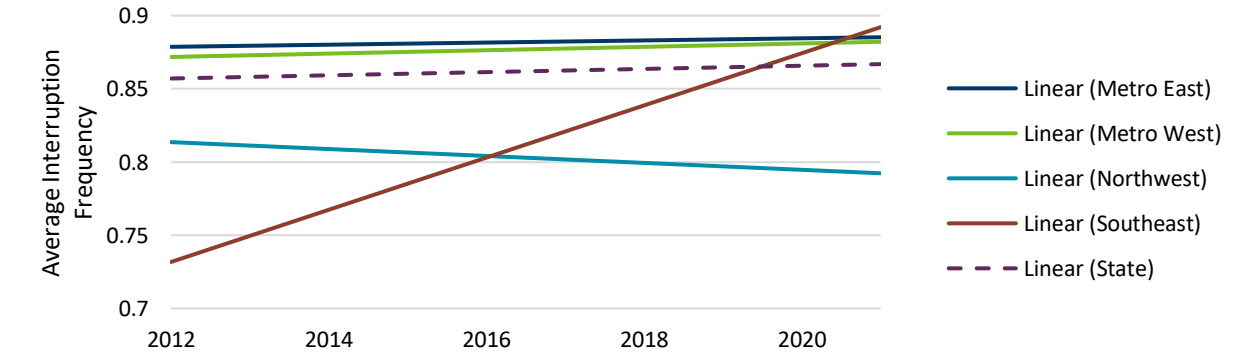
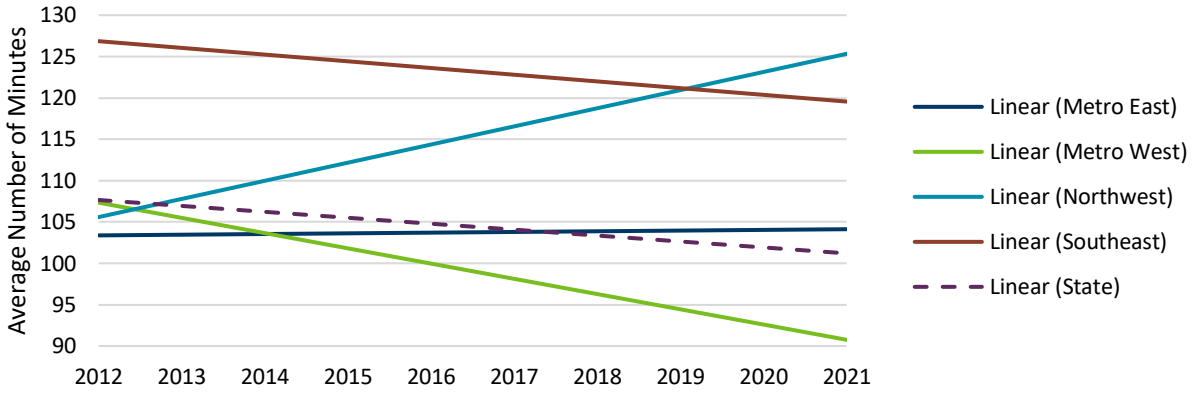


Figure 12: SAIFI Trends, 2012-2021



[20] Xcel, Compliance Filing received 02/05/2021, Docket 19-261, pdf pp. 2, 9
[21] Department, Initial Comment, Docket 22-162, pdf p. 18

Figure 13: CAIDI Trends, 2012-2021



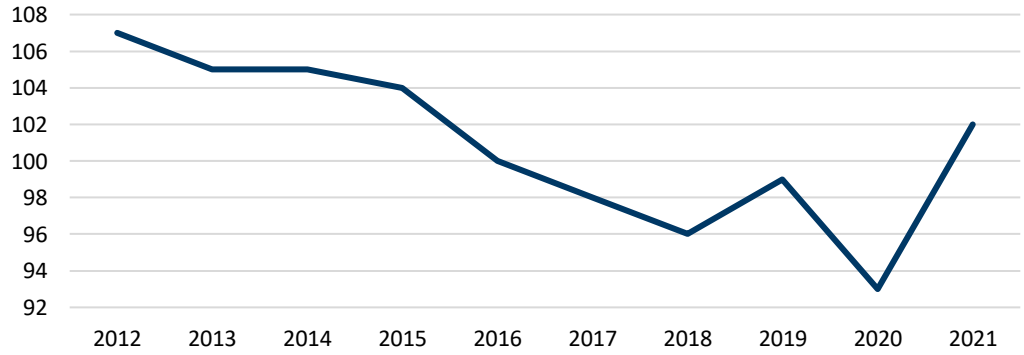
Work Center Staffing Levels

Minn. Rules 7826.0500 Subp. 1K requires utilities to report "data on staffing levels at each work center, including the number of full-time equivalent positions held by field employees responsible for responding to trouble and for the operation and maintenance of distribution lines." The Department acknowledged compliance with Minnesota rules by all three utilities.[22]

Minnesota Power

Minnesota Power reported 102 line worker positions, along with 22 full time equivalent contractor positions.[23] 2021 marks a reversal in Minnesota Power's line worker positions from a 2020 decrease, however looking back through a 10 year time frame, we are still seeing fewer line workers than MP historically has had. Figure 107 depicts the overall level of line worker positions.

Figure 107: MP Line Workers (FTE), 2012-2021

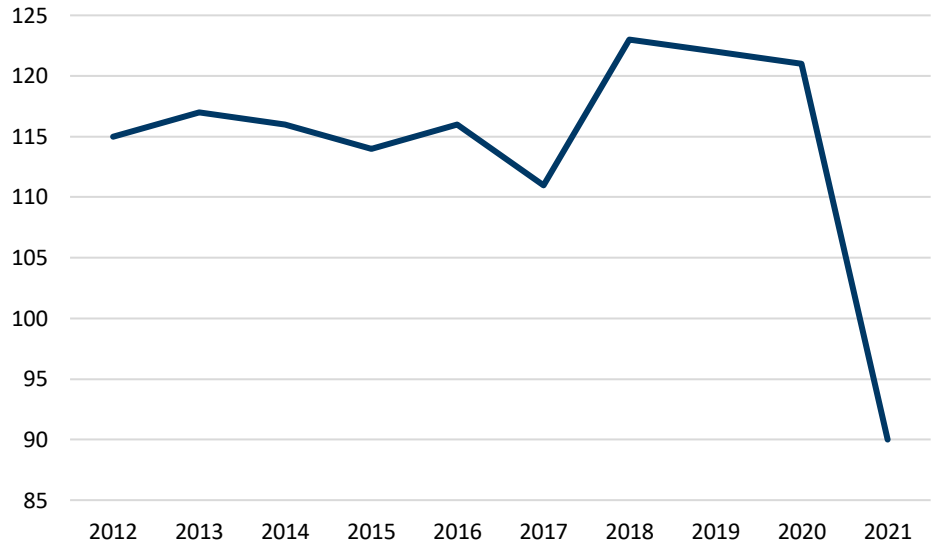


[22] DOC, Initial Comment, Docket 22-159, pdf p. 13; DOC, Initial Comment, Docket 22-162, pdf p. 20; DOC, Initial Comment, Docket 22-163, pdf p. 14
[23] MP, Initial Filing, Docket 22-163 pdf p. 57

Otter Tail Power

Otter Tail provided the number of line workers, depicted in Figure 18. The decrease in work center staffing between 2020 and 2021 is the result of an accounting change. Operationally, the number of staff available did not change.[24]

Figure 18: OTP Line Workers (FTE), 2012-2021



Xcel Energy

In its compliance filing, Xcel provided updated staffing levels at its work centers broken down by linemen and support staff. With the updated information, Xcel's staffing levels are largely static across its service territory, with minor fluctuations. The Southeast Work Center has hired a number of staff since a low in 2017.

[24] OTP, Initial Filing, Docket 22-159, pdf p. 12

Table 7: Xcel Energy Linemen Staffing Levels, 2012-2021[25]

Years	Metro East	Metro West	Northwest	Southeast	Other*	Total
2012	131	169	32	51	37	420
2013	128	173	32	53	41	427
2014	126	176	33	53	46	434
2015	128	176	33	53	46	436
2016	124	184	30	47	46	431
2017	119	176	31	46	46	418
2018	124	180	32	49	47	432
2019	123	177	30	49	45	424
2020	125	181	31	49	49	435
2021	132	171	33	51	52	439
Historical Average	126	176	32	50	46	430

[25] Xcel, Initial Filing part 2, Docket 22-162, pdf p. 61

Table 8: Xcel Energy Work Center Support (with Contractors) Staffing Levels, 2012-2021[26]

Year	Metro East	Metro West	Northwest	Southeast	Other*	Total
2012	64	68	22	31	25	210
2013	62	67	21	31	37	218
2014	61	65	21	31	36	214
2015	60	63	22	34	35	214
2016	60	64	25	33	35	217
2017	64	75	21	34	35	229
2018	62	74	22	32	35	225
2019	59	79	22	31	35	226
2020	54	71	21	28	35	209
2021	55	83	22	32	36	228
Historical Average	60	71	22	32	34	219
% change from 2012 to 2021	-14%	22%	0%	3%	44%	9%

* Xcel Energy employees associated with the Fargo and Sioux Falls Service Centers respond to trouble in western Minnesota and the Dakotas.

As we can see, Xcel has seen improvements in their work center support levels since 2012 except in the Metro East where their staffing levels are about 5 FTEs lower than their 10-year historical average and 14% lower than 2012.

Reliability by Class

In its March 19, 2019 Order, the Commission required the utilities to provide information on how different customer classes are impacted by outages.

Minnesota Power

Average Service Availability Index (ASAI) represents the percentage of time that power was available.[27] Minnesota Power reported the ASAI for each class. Minnesota Power's 2021 ASAI was similar to 2018, 2019, and 2020 values.

[26] Xcel, Initial Filing part 2, Docket 22-162, pdf p. 61
[27] MP, Initial Filing, Docket 22-163, pdf p. 44

Table 9: Minnesota Power Reliability by Customer Class (ASAI)[28]

Customer Class	Residential	Commercial	Industrial
2018	99.97500%	99.99558%	99.99992%
2019	99.97387%	99.99527%	99.99987%
2020	99.97115%	99.99480%	99.99991%
2021	99.98%	99.99%	99.99%

Otter Tail Power

In its 2018 report, OTP indicated that it does not have the ability to differentiate reliability by customer class due to the retirement of its old Interruption Monitoring System (IMS), but its new IMS system would be able to provide reliability details by customer class starting in reporting year 2019. [29] However, in its 2019 report, the Company indicated it did not have the ability to do so until it implements an outage management system or advanced metering infrastructure, which as of their 2021 report, they do not have but continue to make progress towards their implementation.[30]

Xcel Energy

Xcel indicated that it does not currently track customer reliability by class on the feeder level basis, and provided its justification along with calculations based on their other data points:

> We have reviewed the SAIDI by feeder and compared feeders with primarily residential customers to feeders with primarily commercial/industrial customers. Feeders that have more than 50 percent residential customers averaged a SAIDI of 90.6, SAIFI of 0.9 and a CAIDI of 118.2 normalized in 2021, while feeders with more than 50 percent commercial customers averaged a SAIDI of a 87.0, SAIFI of 0.88 and a CAIDI of 119.6. Although not studied, the difference between feeders primarily serving commercial versus residential customers is likely due to less vegetation in industrial and commercial areas, shorter feeders due to high load density resulting in less exposure to the environment, and a higher percentage of customers with underground service.
>
> The Company cannot provide the data specifically requested by the Commission at this time and is investigating opportunities to be able to provide it in the future.[31]

Staff Analysis

Staff expects, at a minimum, Xcel will be able to report reliability by class when it implements its new AMI system and other associated grid modernization improvements which should give it the ability to parse more granular data. The Company plans to deploy the integration between their AMI and their Outage Management System in 2022.[32] Vegetation management, shorter feeders, and undergrounding are solutions that are not class dependent and the indication by Xcel that those are the reasons for the difference between feeders by class is at

[28] MP, Initial Filing, Docket 22-163, pdf p. 59
[29] OTP, Initial Filing, Docket 19-260, p. 33
[30] OTP, Reply, Docket 20-401, p. 2; OTP, Initial Filing, Docket 22-159, pdf p. 39
[31] Xcel, Initial Filing part 2, Docket 22-162, pdf p. 28
[32] Xcel, Initial Filing part 2, Docket 22-162, pdf p. 33

odds with a utility's ability to manage those items on the grid no matter who the class of customer is. To Staff, this suggest that Xcel may want to examine how to lower this difference between feeders associated with the different customer classes.

MAIFI

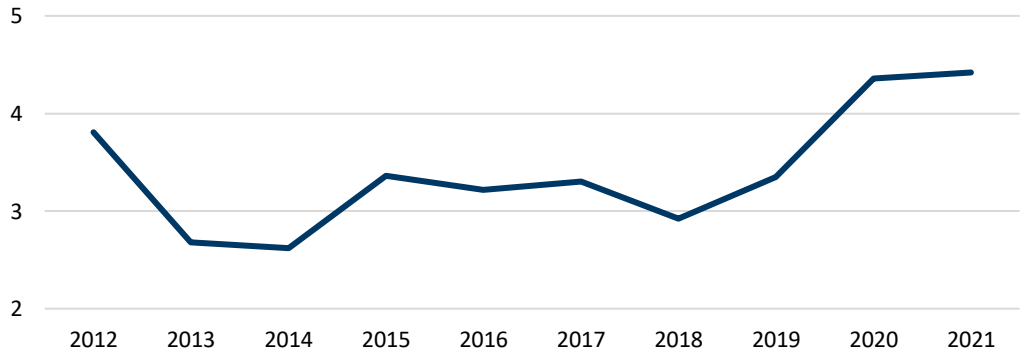
MAIFI (Momentary Average Interruption Frequency Index) consists of interruptions lasting less than five minutes, which are excluded from SAIDI, SAIFI, and CAIDI calculations. These types of interruptions tend to have a more disproportionate impact on commercial and industrial customers for whom even a 30 second lapse in power can cause hours of lost productivity as for example, when machinery restarts are required.

Minnesota Power

MP indicated that while it has tracked MAIFI for the past decade, its data collection will be incomplete without a significant investment in further sensing technology. Approximately 30 percent of MP's data is collected by its SCADA system with the rest collected manually, either via customer calls or when device maintenance is done.[33] A SCADA system, or Supervisory Control and Data Acquisition system, is software applications and field equipment that uses data in order to maintain control or awareness of remote equipment and conditions. Without these systems in place, manual data must be collected, causing potential delays and expense.

Figure 11 from MP's report indicates its storm excluded MAIFI results over the past 10 years.

Figure 11: Minnesota Power MAIFI 2012 – 2021



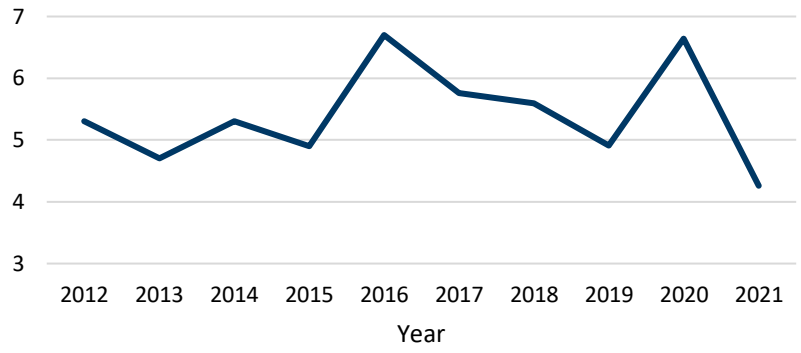
Otter Tail Power

OTP indicated that it uses MAIFI as a predictor of future SAIDI values; this means OTP can utilize MAIFI values to seek out line sections with high MAIFI for additional vegetation management or infrastructure investments to reduce the risk of outages in the future. Figure 13 depicts OTP's 2020 and historic MAIFI values.

[33] MP, Initial Filing, Docket 20-404, p. 16-17

Figure 13: Otter Tail Power MAIFI (non-normalized)[34]

Customer Service Center	MAIFI
Bemidji	2.06
Crookston	4.48
Fergus Falls	4.17
Morris	5.85
MN Total	4.26



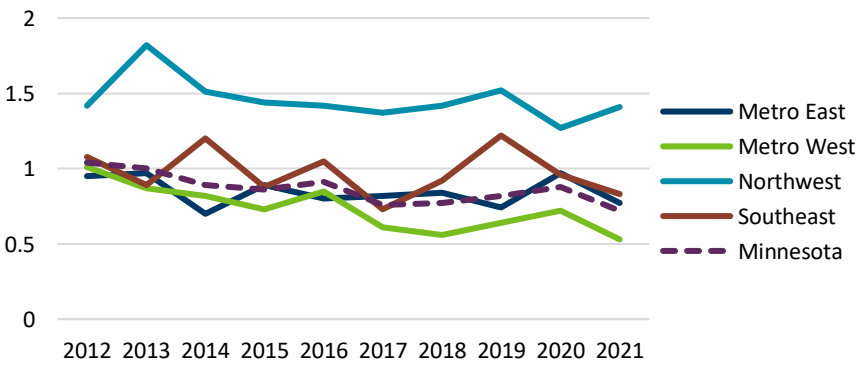
Xcel Energy

Xcel provided MAIFI calculations for its feeders that are SCADA enabled using the IEEE Momentary Interruption Event Definition which is the aggregation of all momentary interruptions of one or more reclosing types of interrupting devices, completed in five minutes or less that do not result in a sustained loss of power delivery to one or more customer.[35] Xcel noted that "momentary outage information is available at the Feeder-level and above, by Feeder circuit, and only on Feeders that are located in substations with SCADA capability. With current distribution infrastructure, there is SCADA capacity at 67 percent of our substations and approximately 90 percent of our customers are served from these substations.[36]

These calculations depended on which method the Company used: non-normalized, IEEE, or QSP method.[37] Figure 14 depicts Xcel's non-normalized 2021 results.

Figure 14: Xcel MAIFI (non-normalized)[38]

Region	2021 MAIFI
Minnesota	0.72
Metro East	0.77
Metro West	0.53
Northwest	1.41
Southeast	0.83



[34] OTP, Initial Filing, Docket 22-159, pdf p. 12
[35] IEEE Guide for Electric Power Distribution Reliability Indices, definition 3.14
[36] Xcel, Initial Filing part 2, Docket 22-162, pdf p. 62
[37] Xcel, Initial Filing, Docket 20-406, p. 35
[38] Xcel, Initial Filing part 2, Docket 22-162, pdf p. 63

CEMI and CELI

CEMI (Customers Experiencing Multiple Interruptions) and CELI (Customers Experiencing Lengthy Interruptions) focus on customers who deal with repeated or longer than average outages.[39] The Commission required reporting at the following intervals:

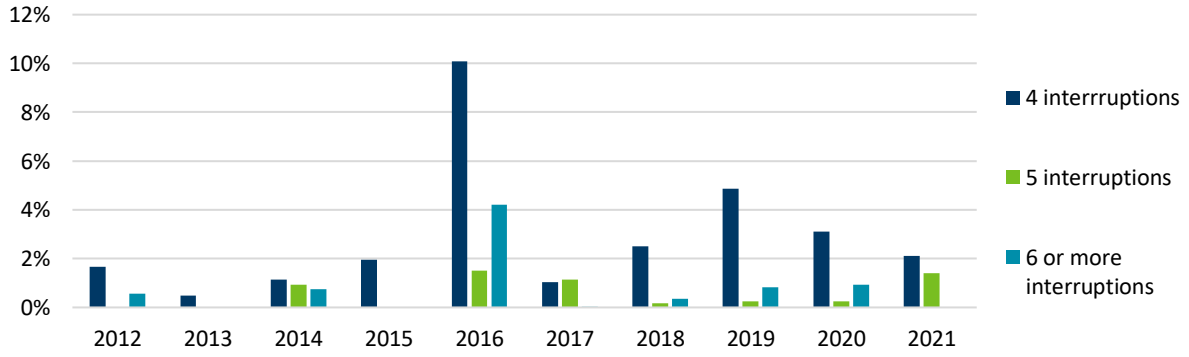
> CEMI – normalized and non-normalized, percent of customers experiencing more than 4, 5, or 6 outages in a year.
>
> CELI –percent of customers experiencing outages lasting longer than 6 hours, 12 hours, and 24 hours.

The Commission also required utilities to report the longest interruption and the most interruptions experienced by any one customer (or feeder, if customer level is not available).[40]

Minnesota Power

Figure 20 shows Minnesota Power's non-normalized CEMI performance over the past ten years while figure 21 depicts CELI over the same time period. The longest experienced interruption was by one customer in the Northern Work Center, with an outage lasting 2,967 minutes (over 49 hours) due to a broken cutout at a remote customer site within a secured area.[41]

Figure 20: Minnesota Power Non-Normalized CEMI

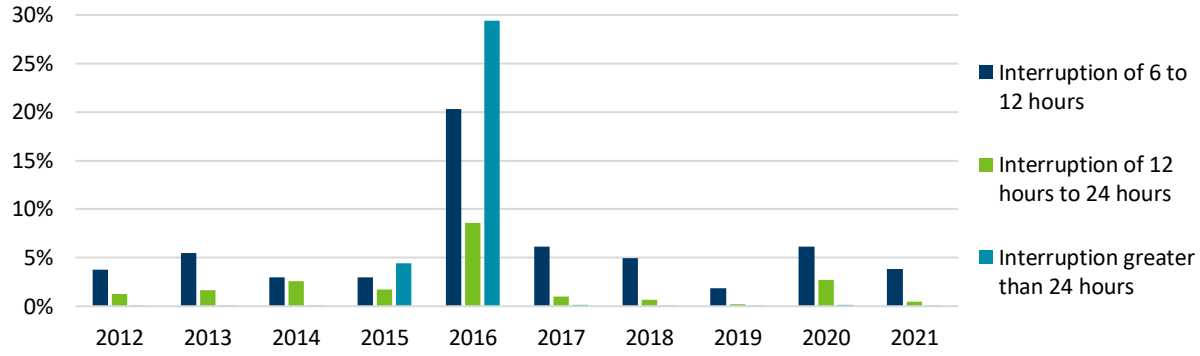


[39] The Commission required utilities to report on CEMI and CELI in its March 19, 2019 Order accepting the 2017 reports. Order Accepting Reports, Setting 2018 Reliability Standards, and Setting Future Reporting Requirements, Docket 18-250.

[40] Order Accepting Reports, Setting Reliability Standards, and Requiring Additional Filings, Docket Nos. 19-261, 19-260, 19-254

[41] MP, Initial Filing, Docket 22-163, pdf p. 58

Figure 21: Minnesota Power Non-Normalized CELI



Otter Tail Power

Figure 22 shows Otter Tail's non-normalized CEMI performance over the past ten years for customers experiencing 4, 5, or 6+ outages in a year.

Figure 22: Otter Tail Non-Normalized CEMI

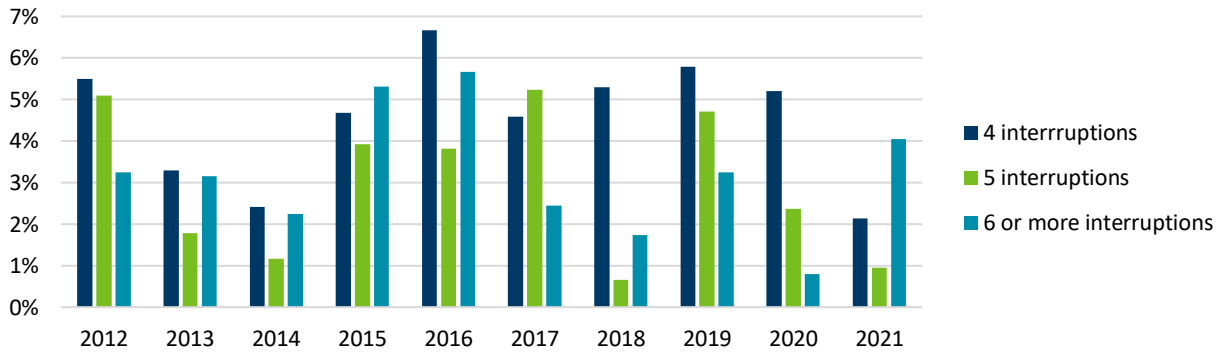
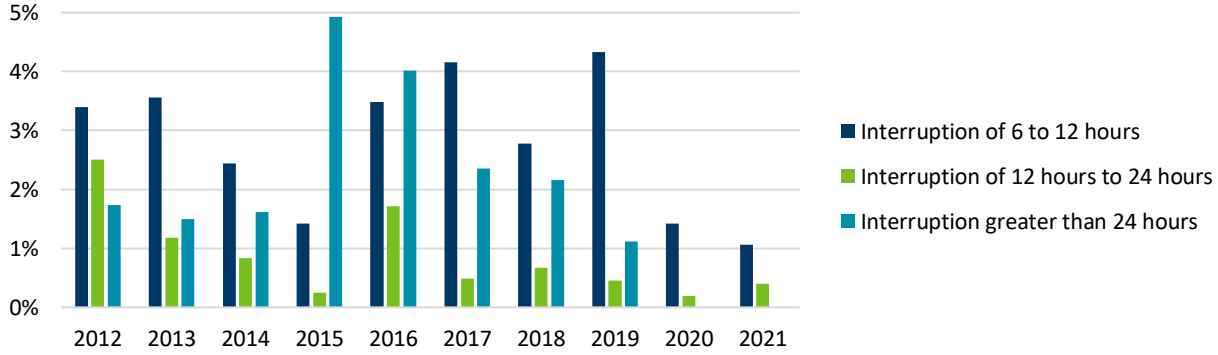


Figure 23 indicates the percentage of customers experiencing outages of 6, 12, or 24 hours or longer for 2012-2021.

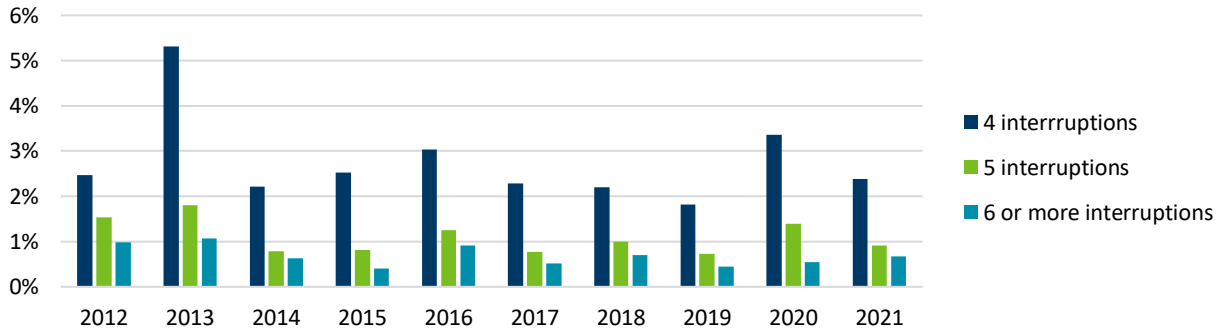
Figure 23: Otter Tail Non-Normalized CELI



Xcel Energy

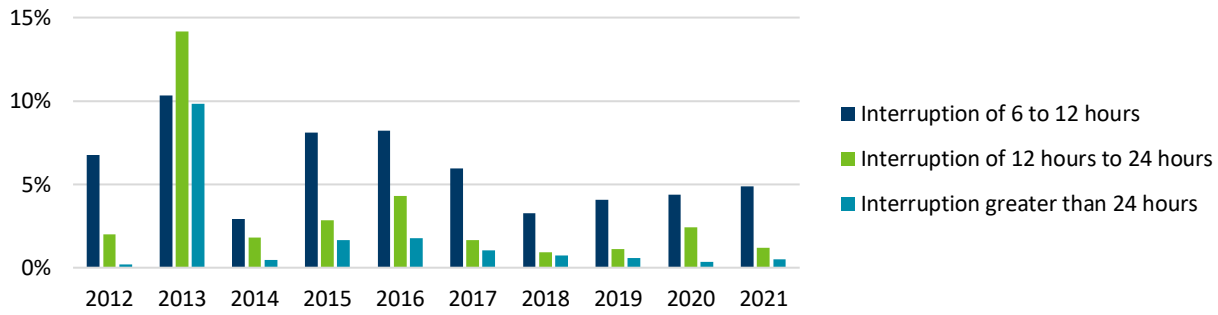
Figure 24 shows Xcel's non-normalized CEMI performance over the past ten years for customers. The most outages experienced was 11 (experienced by two customers), believed to be due to intentional outages, equipment failures, and weather-related incidences.[42]

Figure 24: Xcel Non-Normalized CEMI[43]



In 2021 the longest outage experienced by a customer was 64 hours, 8 minutes, during a severe thunderstorm.[44]

Figure 25: Xcel Non-Normalized CELI



Over the past few years, Xcel has seen decreases in customers experiencing lengthy interruptions but less progress with the number of customers experiencing multiple interruptions. Commission staff welcome an explanation from Xcel on what options are available for implementation of improved future CEMI results.

Estimated Restoration Times

In its March 2019 Order, the Commission required utilities to report on the accuracy of their estimates for when power will be restored to customers who have lost service.

[42] Xcel, Initial Filing part 2, Docket 22-162, pdf p. 70
[43] Xcel, Initial Filing, Docket 22-162, pdf p. 69
[44] Xcel, Initial Filing, Docket 22-162, pdf p. 72

Minnesota Power

Minnesota Power provided data indicating over 98.59% of estimated restoration times were met or exceeded, with only 1.41% underestimating the amount of time to restore power. This is the first year Minnesota Power has tracked the information.[45]

Otter Tail Power

Otter Tail indicated it is unable to estimate restoration times, due to the lack of an OMS system with which to do so. However, OTP plans to implement an OMS before the end of 2022 allowing them to provide this information in future reports.[46]

Xcel Energy

To measure estimated restoration time, Xcel uses a window beginning 90 minutes before the estimated restoration time and lasting up until the actual time (reported as -90 to 0). Xcel explained customer satisfaction drastically drops off once the restoration time exceeds the estimate, hence its use of the -90 to 0 window. The Company continues to refine its predicted restoration time algorithm to enhance accuracy. Xcel's restoration accuracy estimates for Minnesota improved in 2021, to 54.8% of customers had their power restored either before, or up to the stated restoration event time, up slightly from 54.3% the year before. In its 2019 Order, the Commission requested Xcel provide the percent of outages restored 0 to 30 minutes after the estimated time which was 10.9% in 2021. [47]

Worst Performing Feeder

Minn. Rules 7826.0500 Subp. 1H requires utilities to file, "to the extent technically feasible, circuit interruption data, including identifying the worst performing circuit in each work center, stating the criteria the utility used to identify the worst performing circuit, stating the circuit's SAIDI, SAIFI, and CAIDI, explaining the reasons that the circuit's performance is in last place, and describing any operational changes the utility has made, is considering, or intends to make to improve its performance."

The Department acknowledged all 3 utilities fulfilled the reporting requirement.

Minnesota Power

The Company identified its four worst performing feeders, two urban and two rural for each of its three work centers (12 total).[48] The Department noted that the highest SAIDI results were for feeders located in the Northern Work Center in both the urban and rural settings. The highest

[45] MP, Initial Filing, Docket 22-163, pdf p. 59
[46] OTP, Initial Filing, Docket 22-159, pdf p. 39
[47] Xcel, Initial Filing Part 2, Docket 22-162, pdf pp. 30-31
[48] MP, Initial Filing, Docket 22-163, pdf p. 53

CAIDI results were for a feeder located in an urban area in the Central work center and in a rural area in the Northern work center. The Burnett 408 feeder had the highest SAIDI for a rural feeder in the Central work center for the second year in a row.[49] To improve the performance of this feeder, MP has completed vegetation management on the circuit and ground line inspection and resolution, as well as maintenance on the midpoint hydraulic recloser and installation of drop out reclosers.[50]

Otter Tail Power

The Company explained it changed its internal methods for determining its worst performing feeders in 2019, shifting to include MAIFI in its calculations, instead of just sustained outage metrics. It identified its worst performing feeders in each work center.[51] The Department provide the following analysis of OTP's historical worst feeder performance.

> The Department notes that, according to OTP's annual reports over the years, there is no apparent trend in terms of outage causes or continuing poor performance for any particular feeder. The Department uses historical data to identify potential areas of concerns regarding any feeders that appear multiple times as a worst performing feeder. After reviewing 15 years of historical data, the Department concludes that there is no concern with any specific feeder at this time.[52]

Xcel Energy

Xcel identified the four to five worst performing feeders for each of the four work centers, and the efforts taken to improve them which included scheduled tree trimming, equipment repair or replacement if necessary, and isolation of sections that were experiencing galloping (when wires are oscillating due to weather).[53] Xcel also includes a longer list of 25 feeders for each work center that have the poorest performing SAIDI numbers. The Department acknowledged Xcel met the reporting requirements under Minnesota Rules.[54]

Major Service Interruptions

Minn. Rules 7826.0500 Subp. 1G requires utilities to file copies of reports submitted to the Commission's Consumer Affairs Office under Minn. R. 7826.0700. Utilities must provide the following information on major service interruptions:

A. the location and cause of the interruption;
B. the number of customers affected;
C. the expected duration of the interruption; and

[49] DOC, Initial Comment, Docket 22-163, pdf p. 10
[50] MP, Reply Comment, Docket 22-163, pdf p. 4
[51] OTP, Initial Filing, Docket 22-159, pdf p. 23
[52] Department, Initial Comment, Docket 22-159, pdf p. 13
[53] Xcel, Initial Filing Part 2 Attachment M & N, Docket 22-162, pdf pp. 99-104
[54] Department, Initial Comment, 22-162, pdf p. 20

D. the utility's best estimate of when service will be restored, by geographical area.

In its December 18, 2020 Order the Commission varied Minn. Rules 7826.0500 Subpart 1.G to reduce contemporaneous reporting of major outages to the Commission's Consumer Affairs Office as well as with their SQSR report.[55] With the approval of this variance, the utilities did not provide copies of the contemporaneous reporting with their annual reports, but did provide a summary of major outage reporting.

The Department acknowledged utilities' fulfillment of the reporting requirement.

Minnesota Power

MP identified five bulk power interruptions, none of which met the definition of "major service interruption" provided by Minnesota Rules 7826.0200, subp. 7.[56]

Otter Tail Power

The largest major service interruption affected approximately 1,254 customers, interrupting service for customers for one hour and 35 minutes.[57]

Xcel Energy

Xcel reported 231 major service interruptions for 2021. Of these, 13 were not contemporaneously reported to the Commission's Consumer Affairs Office.[58]

Bulk Power Interruptions

Minn. Rules 7826.0500 Subp. 1F requires, "to the extent feasible, a report on each interruption of a bulk power supply facility during the calendar year, including the reasons for interruption, duration of interruption, and any remedial steps that have been taken or will be taken to prevent future interruption."

OTP had three bulk power supply interruptions for 2021, none of which were on Otter Tail assets, but which caused sustained interruptions to Minnesota customers. The causes are believed to be strong winds and ice, an unknown cause, and a lightning arrestor failure.[59]

As mentioned, Minnesota Power identified five bulk power interruptions.[60] Remedial steps included tree trimming and removal as well as cable replacement.[61]

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[55] Order Point 4, Docket Nos E002/M-20-406; E017/M-20-401; E015/M-20-404
[56] DOC Comment, Docket 22-163, pdf p. 10
[57] OTP, Initial Filing, Docket 22-159, pdf p. 23
[58] DOC Comment, Docket 22-162, pdf p. 19
[59] OTP, Initial Filing, Docket 22-159, pdf p 22
[60] DOC, Comment, Docket 22-163, pdf p. 10
[61] MP, Initial Filing Appendix A, Docket 22-163

Xcel did not have any generation outages for 2021 but had 23 bulk power supply interruptions.[62] Xcel indicated that since the "incidents shown were reactionary due to storms, public damage, or other activities associated with random and unforeseen events, no plans have been developed to address the specific issues encountered."[63]

The Department acknowledged Xcel, MP, and OTP fulfilled the reporting requirement.

Voltage Violations

Minn. Rules 7826.0500 Subp. 1(I) requires utilities to submit "data on all known instances in which nominal electric service voltages on the utility's side of the meter did not meet the standards of the American National Standards Institute for nominal system voltages greater or less than voltage range B."

The Department acknowledged that all three utilities fulfilled the reporting requirement.

Minnesota Power

Minnesota Power reported 24 ANSI Voltage Range B violations in 2021.[64]

Otter Tail Power

The Department provided the following analysis on OTP's voltage violations in 2020:

> OTP provided a table listing the feeders and number of known occurrences where the voltage fell outside the American National Standards Institute (ANSI) voltage range B in 2021. OTP noted that most of the feeders with numerous occurrences were feeders serving a single large customer with a very large load (mostly pipelines). The Department observes no significant trend regarding this metric.[65]

Xcel Energy

Xcel reported 247 investigations for voltage violations in 2020. Of these, 69 resulted in actual voltages problems, typically due to equipment malfunction. In those instances, the Company takes appropriate actions including replacement, upgrades, and checking physical infrastructure.[66]

Grid Modernization Impacts on Reliability Metric

In its March 19, 2019 Order, the Commission requested utilities discuss the impact of grid modernization investments on measures of reliability, along with investments that could

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[62] Xcel, Initial Filing Part 2, Docket 22-162, pdf p. 103
[63] Xcel, Initial Filing part 2, Docket 22-162, pdf p. 53
[64] MP, Initial Filing, Docket 22-163, pdf p. 11
[65] DOC, Initial Comment, Docket 22-159, pdf p. 13
[66] Xcel, Initial Filing part 2, Docket 22-162, pdf p.60

improve tracking of outages or power quality issues. After reviewing utility responses in the 2018 reports, the Commission asked for input on a potential new metric relating to grid modernization:

> Provide a comparison of the reliability (SAIDI, SAIFI, CAIDI, MAIFI, normalized/non-normalized) of feeders with grid modernization investments such as Advanced Metering Infrastructure (AMI) or Fault Location Isolation and Service Restoration (FLISR), to the historic 5-year average reliability for the same feeders before grid modernization investments.

Xcel again expressed concern that the metric as outlined above could take a long time to show results given annual variability in reliability due to severe weather. It explained improvements from grid modernization are expected to be gradual, not immediate. The Company is working to expand its initial test area and feeders with their Open Loop FLISR as well as develop a deployment plan to expand the FLISR footprint.[67]

Otter Tail indicated any metric would not currently be applicable as it does not have FLISR or AMI installed.[68]

MP included a table of planned grid modernization investments along with details about how the improvements will help reliability. The first of these investments are anticipated to come online in 2021. MP also reported some additional grid modernization programs such as Trip Savers, Mobile Workforce application, and an inspection app.[69]

Staff Analysis

Staff continues to recommend the metric described above for utilities as grid modernization improvements continue to be invested in and implemented. Grid modernization improvements continue to be implemented and described in detail in utilities Integrated Distribution Plans but staff wish to see more directly how those improvements benefit reliability metrics that we highlight in these SQSR reports. Staff is aware of the potential for lengthy data reporting, and proposed for the purposes of the report that utilities provide aggregate comparisons of feeders – ex, the SAIDI of *all* feeders with grid modernization investments compared to the historic 5 year average SAIDI for the same set of feeders for the years preceding grid modernization improvements. This would also help assist in the variable nature when looking at feeder level reliability. Consistent with last year's staff recommendation, Staff continues to recommend utilities only start including feeders in the calculations once grid modernization improvements are implemented for one full calendar year.

Safety

Utilities report two categories in their annual safety reports:

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[67] Xcel, Initial Filing part 2, Docket 22-162, p. 33
[68] OTP, Initial Filing, Docket 22-159, pdf p. 40
[69] OTP, Initial Filing, Docket 22-159, pdf p 32

1. Occupational Illness and Injuries: summaries of all reports filed with the United States Occupational Safety and Health Administration and the Occupational Safety and Health Division of the Minnesota Department of Labor and Industry during the calendar year (Minn. Rules 7826.0400, Part A)
2. Property Damage Claims: a description of all incidents during the calendar year in which an injury requiring medical attention or property damage resulting in compensation occurred as a result of downed wires or other electrical system failures and all remedial action taken as a result of any injuries or property damage described. (Minn. Rules 7826.0400, Part B)

The Department acknowledged each utility had fulfilled the necessary reporting requirements.

Minnesota Power

The Department provided the following summary of MP's safety results:

> MP reported 18 injuries in 2021 and one death. The injuries resulted in a total of 287 lost work days, or approximately 16 days per injury. The Company had not had a death reported since 2010.
>
> In 2021, MP experienced 13 property damage claims totaling $67,487. The total amount of claims in 2021 was higher than in 2020.[70]

Otter Tail Power

The Department provided tables showing OTP's historic incident rate, which indicated that 2021 was similar to every category for the past 10 years. Otter Tail had no property damage claims for 2021.[71]

Xcel Energy

The Department provided tables showing Xcel's historical incident rate and a significant decrease in 2021.[72]

Work Group

In the Department's comments regarding Xcel Energy's Safety, Reliability, and Service Quality Report, the Department recommended a workgroup be formed to review and simplify the different reporting requirements in the Commission's Orders that cover the information for Xcel. The Department felt there were several overlapping Commission requirements regarding

[70] Department, Initial, Docket 22-163, pdf p. 5
[71] Department, Initial, Docket 22-159, pdf p.7
[72] DOC, Initial Comment, Docket 22-162, pdf p. 6

different aspects of the SQSR that they found overly cumbersome.[73] Xcel supported this recommendation.[74] Other utilities do not have as many requirements, nor do they overlap as often.

Staff also supports the Department's recommendation.

[73] DOC, Initial Comment, Docket 22-162, pdf p. 39
[74] Xcel, Reply Comment, Docket 22-162, pdf p. 8

Decision Options

1. Accept Otter Tail Power, Minnesota Power, and Xcel Energy's 2021 Safety, Reliability, and Service Quality reports (*Xcel, MP, OTP; Department confirmed for Xcel and OTP only*).

Volume 1 Decision Options

Staff note: a supplemental filing is required after the IEEE benchmarking data is posted, as that does not happen until after the April 1 filing deadline. This is consistent with last year's reports, and included in the decision options setting each utility's benchmarking standards for 2022. Decision Options 2-4 maintain the same IEEE benchmarking comparisons (e.g. 2nd quartile and utility size) for the utility's 2021 and 2022 reliability standards.

2. Set Minnesota Power's 2022 statewide Reliability Standard at the IEEE benchmarking 2nd Quartile for medium utilities. Set Minnesota Power's work center reliability standards at the IEEE benchmarking 2nd quartile for small utilities. Require a supplemental filing to Minnesota Power's 2022 SQSR report 30 days after IEEE publishes the 2022 benchmarking results, with an explanation for any standards the utility did not meet. (*Minnesota Power, Department*)
3. Set Otter Tail Power's 2022 statewide Reliability Standard at the IEEE benchmarking 2nd Quartile for medium utilities. Set Otter Tail's work center reliability standards at the IEEE benchmarking 2nd quartile for medium utilities. Require a supplemental filing to Otter Tail Power's 2022 SQSR report 30 days after IEEE publishes the 2022 benchmarking results, with an explanation for any standards the utility did not meet. (*Otter Tail Power, Department*)
4. Set Xcel Energy's 2022 statewide Reliability Standard at the IEEE benchmarking 2nd Quartile for large utilities. Set Xcel's Southeast and Northwest work center reliability standards at the IEEE benchmarking 2nd quartile for medium utilities and Xcel's Metro East and Metro West work center reliability center standards at the IEEE benchmarking 2nd quartile for large utilities. Require a supplemental filing to Xcel Energy's 2022 SQSR report 30 days after IEEE publishes the 2022 benchmarking results, with an explanation for any standards the utility did not meet. (*Xcel, Department)*
5. Initiate a work group to simplify Xcel Energy' SQSR reporting requirements. The workshop shall file recommendations or a progress update with the 2023 SQSR report. (*Xcel, Department)*

Staff Recommends decision options 1-5

Volume 2 Decision Options

6. Require Xcel Energy to provide, beginning with its April 1, 2023 service quality filing, an additional data set that reports discreet meters unread for 6-12 months and 12+ months, with a single meter listed in the longest appropriate category only, in Xcel Energy's reporting under MN Rules Section 7826.1400. To the extent possible, include historic data in this format as well, with the past five years being optimal. (*Staff*)

7. Xcel shall document response duration in days, beginning from the date of initial customer contact to the date of Company reply, for inquiries, complaints, or disputes related to DERs and/or the interconnection process that are received through Xcel's call center, email, or otherwise. Information shall be shared in a .xlsx format in the Company's 2023 service quality filing and in the temporary annual report in Docket No. E999/CI-16-521. (*Staff*)

8. Xcel Energy, Minnesota Power, and Otter Tail Power shall each display, either directly or via a link to a PDF file, the utility's public facing summary, as shown in Attachment A, on the utility's website placed such that the summary is available to a website user after a single click away from the home page. (*Staff*)