March 31, 2023

Ms. Lisa Felice
Executive Secretary
Michigan Public Service Commission
7109 West Saginaw Highway
P.O. Box 30221
Lansing, MI 48909

RE: Case No. U-16066 – In the matter, on the Commission's own motion, to require Consumers Energy Company to provide electric power reliability information in its annual power quality report

Dear Ms. Felice:

Enclosed for electronic filing in the above-captioned case is **Consumers Energy Company's Annual Power Quality Report**.

This is a paperless filing and is therefore being filed only in a PDF format.

Sincerely,

Digitally signed by Robert W. Beach
Date: 2023.03.31 08:35:00 -04'00'

Robert W. Beach
Phone: 517-788-1846
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cc: Pat Poli
Pete Derkos
Charyl Kirkland
Don Mazuchowski
Jordan Reasoner

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter, on the Commission's own motion, to require **CONSUMERS ENERGY COMPANY** to provide electric power reliability information in its annual power quality report	)))))	Case No. U-16066

CONSUMERS ENERGY COMPANY'S ANNUAL POWER QUALITY REPORT:
I. RELIABILITY INDICES
II. PRIMARY CUSTOMER POWER QUALITY INVESTIGATIONS
III. INCREASED REPORTING REQUIREMENTS

Background

On September 15, 2009, the Michigan Public Service Commission ("MPSC" or the "Commission") issued an Opinion and Order in Case No. U-16066, in which it directed that the two major Michigan utilities: (1) provide information related to System Average Interruption Frequency Index ("SAIFI"),[1] Customer Average Interruption Duration Index ("CAIDI"),[2] and System Average Interruption Duration Index ("SAIDI")[3] reliability indices with and without major events, on a rolling five-year average basis, using the industry standard Institute of Electrical and Electronics Engineers ("IEEE") method of calculation; and (2) file an annual power quality report which contains data on all primary customer power quality investigations conducted in the past year for end-use customers, derived from their power quality meters, and the outcome of each investigation.

[1] SAIFI represents the average number of interruptions per customer per year.
[2] CAIDI represents the average restoration time per outage.
[3] SAIDI represents the average number of minutes of interruptions per customer.

On December 4, 2014, the Commission issued an Opinion and Order in Case No. U-17542, in which it directed that the two major Michigan utilities provide the following additional information on an annual basis:

(1) A list of their ten worst performing circuits for the prior year in terms of both SAIDI and SAIFI;

(2) For each of the ten worst performing circuits, the utility shall provide the following information: (a) SAIDI and SAIFI excluding major events for the year; (b) circuit name, number, and location; (c) length of circuit (miles); (d) number of customers served; (e) substation name; (f) last circuit trim; (g) list of outages and causes; and (h) corrective action plan to improve performance;

(3) Number of Customers Experiencing Multiple Interruptions ("CEMI") reporting for indices $CEMI_0$ through $CEMI_{10+}$; and

(4) Number of Customers Experiencing Long Interruption Durations ("CELID") reporting for indices $CELID_{60hrs}$ and $CELID_{8hrs}$ (excluding catastrophic events).

This report contains Consumers Energy Company's ("Consumers Energy" or the "Company") January 1, 2022 through December 31, 2022 results and compliance status per these requirements.

I. Reliability Indices

Consumers Energy's rolling five-year average SAIDI, SAIFI, and CAIDI indices are summarized in the following table. These indices were calculated using the Major Event Day ("MED") [4] methodology contained in IEEE Standard 1366-2012. Graphical representations of this data can be found on pages 7 through 9.

	All Conditions						Excluding Major Event Days					
	SAIDI		SAIFI		CAIDI		SAIDI		SAIFI		CAIDI	
Year	Annual	5 Year Avg.	Annual	5 Year Avg.	Annual	5 Year Avg.	Annual	5 Year Avg.	Annual	5 Year Avg.	Annual	5 Year Avg.
2012	508	541	1.38	1.43	369	375	204	247	1.06	1.12	192	220
2013	1,108	620	1.50	1.43	738	426	218	234	1.00	1.10	218	212
2014	377	625	1.10	1.40	342	437	168	222	0.91	1.08	184	205
2015	441	620	1.18	1.36	374	446	177	214	0.98	1.06	180	200
2016	284	543	1.15	1.26	247	414	207	195	1.01	0.99	206	196
2017	606	563	1.31	1.25	464	433	161	186	0.89	0.96	181	194
2018	407	423	1.30	1.21	314	348	201	183	1.02	0.96	197	190
2019	691	486	1.58	1.30	437	367	233	196	1.12	1.00	208	194
2020	510	500	1.35	1.34	379	368	195	199	1.03	1.01	188	196
2021	911	625	1.60	1.43	569	432	228	204	1.05	1.02	216	198
2022	467	597	1.29	1.42	363	412	182	208	0.96	1.04	189	200

[4] A MED is a 24-hour period for which the reliability metrics for outages experienced during that time are excluded from the Company's statistics, in accordance with IEEE Standard 1366-2012, which defines a MED threshold based on a statistical analysis of five sequential years of daily outage minutes.

Tactics are employed each year at Consumers Energy to continue to improve the operational performance of its electrical infrastructure and response to customer outages. In 2022, Consumers Energy further improved in these areas by implementing tactics as follows:

- Continued use of a Reliability Collaboration Room, a cross-functional collaboration space and forum for coordinated problem solving and continuous improvement that minimizes organizational barriers and promotes visibility and accountability. The Rally Room focuses on achieving our SAIDI target by considering all elements of our service delivery: Low Voltage Distribution ("LVD") design and construction, Forestry, High Voltage Distribution ("HVD") design and construction, Electronic Grid Modernization, Storm Preparation and Response, and Electric Operation response. A weekly Operating Review takes place to cover the previous week's performance in each area that contributes to the reliability goals;

- On-going targeted investments in electric system infrastructure upgrades and line clearing to minimize the potential for outages during storms which includes pole, wire, relays, and substation improvements and moving toward a LVD line clearing seven-year effective cycle;

- Trained over 400 Company employees on their specific Incident Command System ("ICS") storm role;

- Applied the advanced zonal report model to improve risk predictions for optimization of where tree clearing or line investments are applied to prevent repetitive interruptions. The repetitive outage zonal report identifies all protective device zones upstream of a customer's location to be able to pinpoint the highest influence protective device zones;

- Leveraged the Damage Assessment Visual Enhancement application into storm response processes;

- Trained contract Damage Assessors to increase the number of circuits that can be assessed early in a storm event;

- Standardize the use of drones to survey difficult to access areas and report damage back to the Emergency Operations Center;

- Increased Company capacity to manage more crews during Storms by training Electric Field Leaders to implement the restoration tactic of Field Control;

- Conducted a tabletop restoration exercise in preparation for storm season, and after-action reviews after large storms as part of the preparedness cycle for emergency response;

- Increased forestry spending by targeting circuits typically resulting in a 62% reduction in tree caused outages for customers where the work was completed;

- Increased inspections to identify LVD pole and pole top upgrades identified as fails. Also, identified fusing opportunities to reduce customer impact;

- Upgraded the Company's Outage Management System to a new Advanced Distribution Management System thus improving outage detection and response by integrating with supervisory control and data acquisition ("SCADA");

- Increased restoration speed by: (1) Continuing to equip HVD substation breakers with relays that can assist the control room with fault location; and (2) Expanding line sensors on various circuits and HVD lines to assist with fault location;

- Expanded the HVD pole top rehabilitation program by 37 miles. This expansion targeted customers on the edges of the Company's service territory, which have higher outage response times due to their location;

- Pre-staged Line Crews and ICS storm positions prior to the storm event;

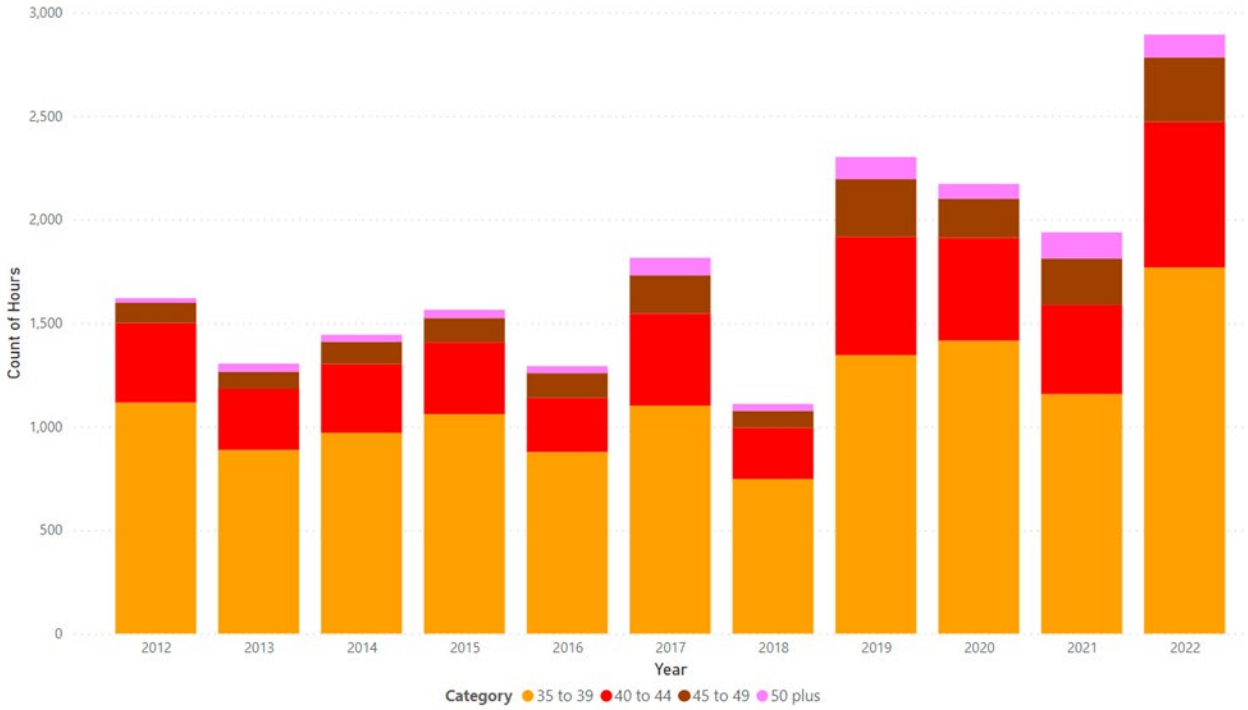
- Leveraged Company contracts with off-system storm contractors providing the quick ability to expand available resources to respond to severe weather events; and

- Continued to invest and build Automatic Transfer Recloser loop installations to sectionalize and restore customers with adjacent circuits, reducing the number of customers impacted by the outage.

The Company compares system performance before and after investments are made to validate that, where work is completed, the investment provides value for the customer. While the Company's operational improvements and infrastructure investments do create local system benefits for customers, additional investments and continued improvements are needed to further improve reliability performance for customers system wide as severe storms become more frequent. Adverse weather conditions compared to prior years are evident in the below chart. In 2022, the Company saw nine MEDs, one of which qualified as a Catastrophic Storm. The number

of hours recorded with wind gusts exceeding 35 miles per hour in 2022 was the highest total of the past eleven years – and represents a 26% increase in hours over the last most severe year, 2019.[5]

Number of Station-Hours per Year Exceeding 35 mph Gust Threshold



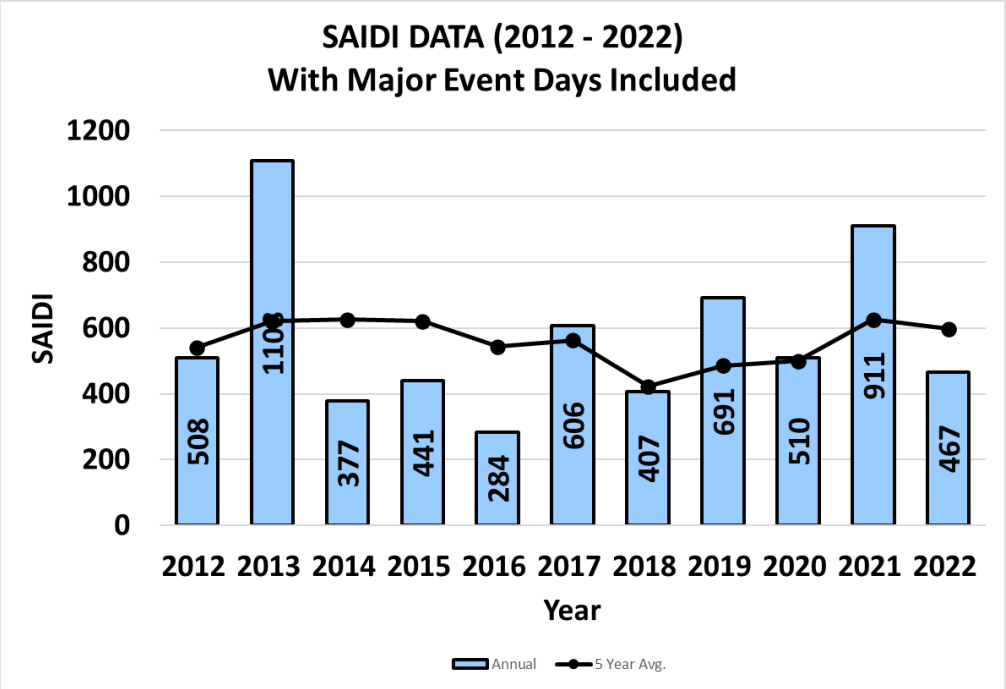
A. Reliability Indices Summary

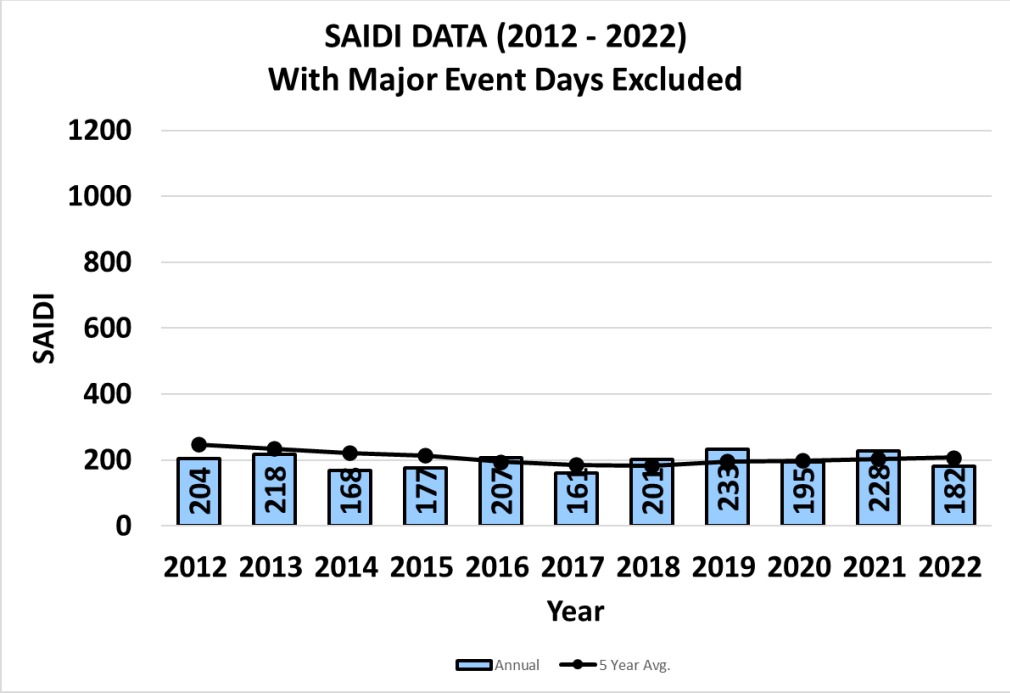
The Company's reliability goals for 2022 included achieving an annual SAIDI (excluding MEDs) performance of 189 minutes, an annual CAIDI (excluding MEDs) of 190, and an annual SAIFI of 0.994 (excluding MEDs). The Company achieved an annual SAIDI (excluding MEDs) performance of 182 minutes, 7 minutes below target, and an annual CAIDI (excluding MEDs) of 189 minutes, 1 minute below target, and an annual SAIFI of 0.96, 0.34 below target. The

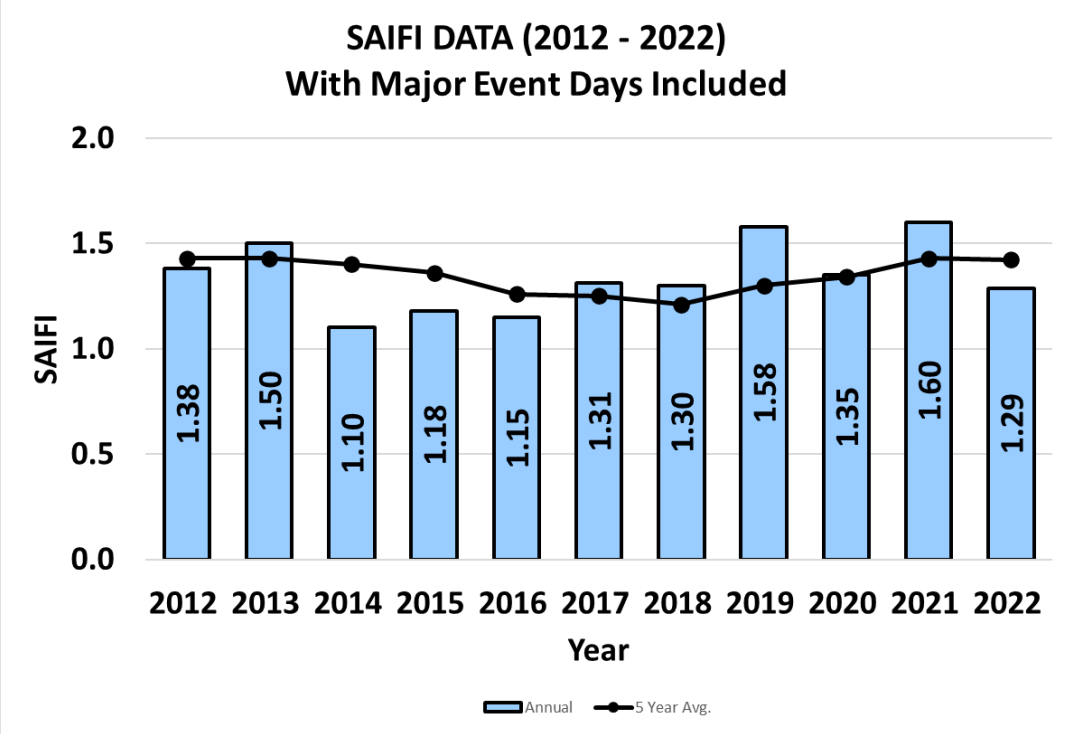
[5] Publicly available wind gust data were collected from 21 National Weather Service ("NWS") observation stations distributed across the Lower Peninsula of Michigan except for the southeast portion of the state, e.g. Detroit. Stations are located at airports such as Lansing's Capital Region International Airport or at an NWS Weather Forecast Office ("WFO") such as the one in Grand Rapids. Observations tracked are report types FM-15, aviation routine weather report, and FM-16, aviation selected special weather report.

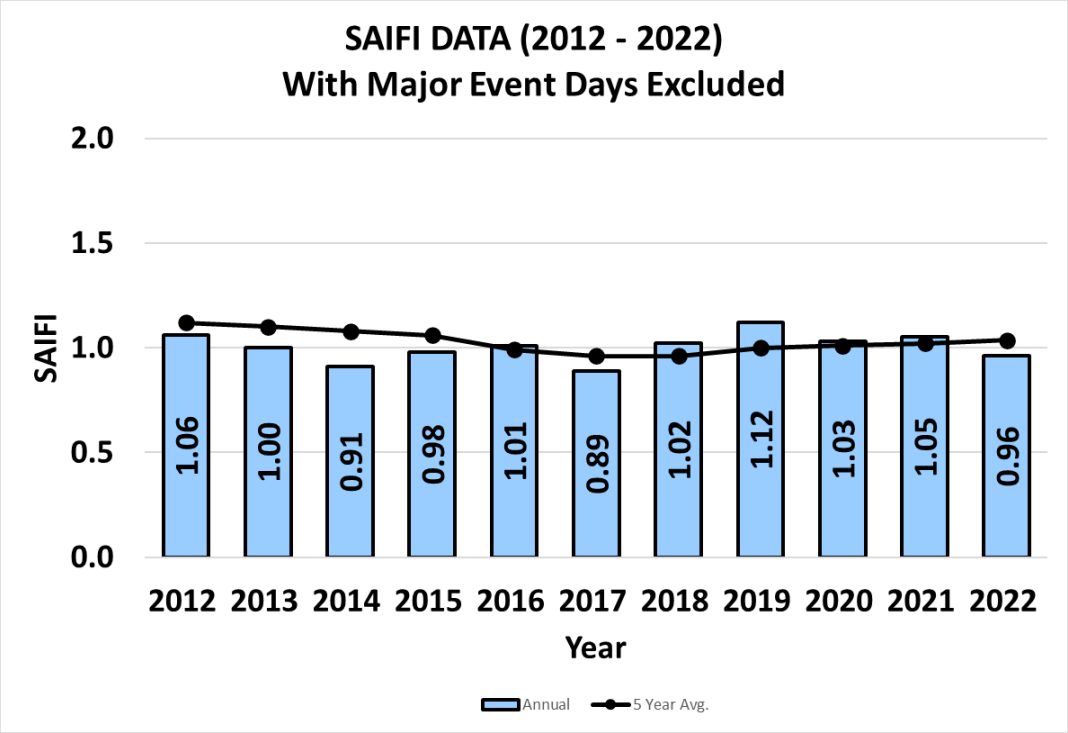
Company's performance is reflective of both the tactics highlighted above in the "Reliability Indices" section, as well as the stabilization of weather relative to historic trends. The Company will continue to use visual management and operating reviews in the Reliability Rally Room to measure performance, identify barriers, and drive improvements in the coming year.

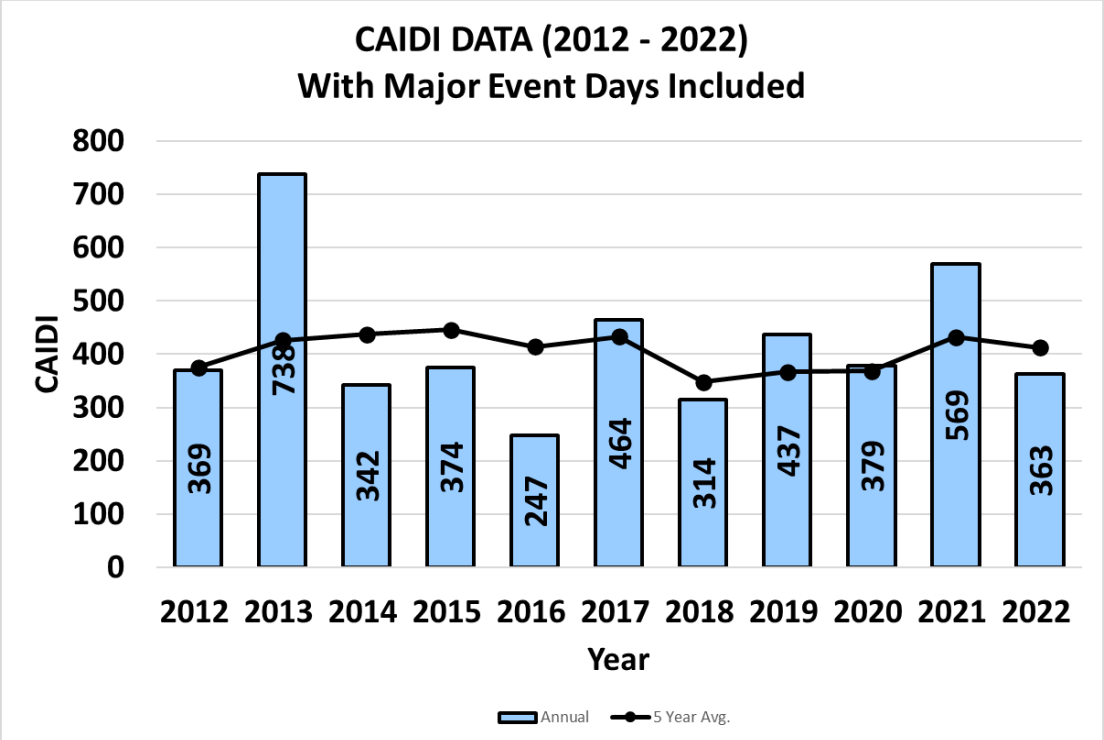
The annual and rolling five-year average values for SAIDI, SAIFI and CAIDI calculations including and excluding major events are shown in the following graphs:

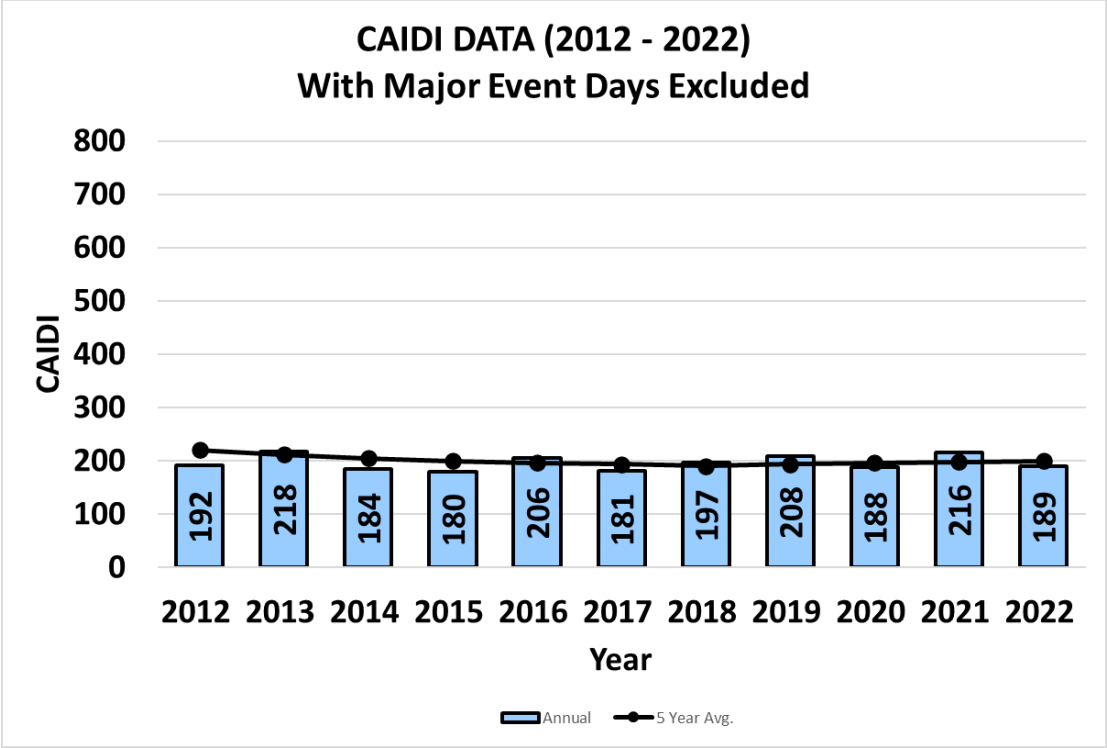



SAIDI DATA (2012 - 2022)
With Major Event Days Excluded
SAIDI
1200
1000
800
600
400
200
0
204
218
168
177
207
161
201
233
195
228
182
2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
Year
Annual
5 Year Avg.


SAIFI DATA (2012 - 2022)
With Major Event Days Included
SAIFI
2.0
1.5
1.0
0.5
0.0
1.38
1.50
1.10
1.18
1.15
1.31
1.30
1.58
1.35
1.60
1.29
2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
Year
Annual
5 Year Avg.


SAIFI DATA (2012 - 2022)
With Major Event Days Excluded
2.0
1.5
1.0
0.5
0.0
SAIFI
1.06
1.00
0.91
0.98
1.01
0.89
1.02
1.12
1.03
1.05
0.96
2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
Year
Annual
5 Year Avg.


CAIDI DATA (2012 - 2022)
With Major Event Days Included
800
700
600
500
400
300
200
100
0
CAIDI
369
738
342
374
247
464
314
437
379
569
363
2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
Year
Annual
5 Year Avg.


CAIDI DATA (2012 - 2022)
With Major Event Days Excluded
800
700
600
500
400
300
200
100
0
CAIDI
192
218
184
180
206
181
197
208
188
216
189
2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
Year
Annual
5 Year Avg.

II. PRIMARY CUSTOMER POWER QUALITY INVESTIGATIONS

A. Power Quality Process

Consumers Energy continually monitors power quality at 227 industrial and commercial locations that have primary metering. These monitors are primarily installed at dedicated substations that have greater than 1 Mega Volt Ampere ("MVA") of load; however, monitors are also installed for a small number of customers on the distribution system in response to power quality concerns. Power quality monitoring uses a comprehensive process to monitor the electric system and provide customers with potential solutions to meet their needs.

The power quality data is downloaded periodically from the monitors. This data is imported and stored in an analysis database which is used to generate reports daily and on demand. Power quality information including voltage, current, power trends, harmonics, voltage and current unbalance, and detailed disturbance data is made available to customers upon request through Consumers Energy Business Customer Solutions Account Managers. Daily monitoring of this data by Consumers Energy's engineers has helped identify issues on the electric system and in customer's facilities.

B. 2022 Power Quality Data

Power quality issues are not widespread within Consumers Energy's electric system; however, customer inquiries are generated as a result of experienced or perceived voltage sags, overvoltage, voltage transients, voltage flicker, high frequency noise, voltage unbalance, momentary outages, or equipment problems. In 2022, there were 21 power quality events which generated customer inquiries. Of these, 11 (52%) of the 21 events were attributable to the customer's electric system. The remaining 10 (48%) events were electrical faults, equipment malfunction, or issues pertaining to operational configuration occurring on the utility electric system. The causes of these faults included lightning, equipment failure, animal contact, and tree

contact on the utility system owned by Consumers Energy or its transmission provider. For 5 of the 10 events attributed to the utility system, Consumers Energy or its transmission provider made repairs to the system or scheduled projects to address system performance. The remaining 5 of the 10 events were faults that were restored automatically by the electric system or that required no repairs or modifications of the electric system.

The table below indicates the power quality issues brought to the attention of Consumers Energy's Power Quality Monitoring group in 2022 where Power Quality Monitors ("PQM") were installed.

Inquiries			Power Quality Event [6]							Source of PQ Event			Outcomes		
Event	Date	Locations Impacted [7]	Transient	Voltage Sag	Voltage Swell	Interruption	Overvoltage	Under voltage	Other (inc. Harmonics)	Consumers Energy [8]	Transmission Provider [9]	Customer [10]	Customer Contact [11]	Modifications [12]	Description
01	01/01	1			x							x	x		Customer reported a voltage swell; PQM showed voltage to be within limits.
02	01/01	1		x								x	x		Customer reported voltage sag. PQM showed voltage to be within limits.
03	02/01	1				x						x	x		Fault on customer-owned equipment.
04	02/13	1				x				x			x		46kV line fault; cause unknown; Cleared fault and restored system.

[6] Heading definitions per IEEE Standard 1159-2009 Table 2 – Categories and Typical Characteristics of Power System Phenomena.
[7] Number of customer locations impacted per event.
[8] Equipment owned by Consumers Energy (138 kV, 46 kV, < 25 kV).
[9] Equipment owned by transmission provider (345 kV or 138 kV).
[10] Source of the event was within the customer's electrical system.
[11] Consumers Energy provided a response to the customer including the cause of the event and any modifications planned or completed.
[12] Consumers Energy made a like for like repair to return the system to normal or scheduled a project to address system performance.

Inquiries			Power Quality Event [6]							Source of PQ Event			Outcomes		
Event	Date	Locations Impacted [7]	Transient	Voltage Sag	Voltage Swell	Interruption	Overvoltage	Under voltage	Other (inc. Harmonics)	Consumers Energy [8]	Transmission Provider [9]	Customer [10]	Customer Contact [11]	Modifications [12]	Description
05	02/20	1		x						x			x		Voltage sag due to disturbance on neighboring line; Cleared fault and restored system.
06	02/27	1				x						x	x		Fault on customer-owned equipment.
07	03/31	1				x				x			x	x	46kV line fault due to failed insulator; Replaced failed insulator.
08	04/24	1				x						x	x		Fault on customer-owned equipment.
09	05/09	1			x							x	x		Customer reported a voltage swell, customer PQM showed to be within limits.
10	05/10	1				x						x	x		Mis-operation of customer equipment.
11	05/18	1				x						x	x		Mis-operation of customer equipment.
12	05/21	1					x					x	x		Customer reported voltage disturbance. PQM showed voltage to be within limits.
13	06/16	1		x						x			x		46kV line fault due to lightening; Cleared fault and restored system.
14	06/16	1		x						x			x		46kV line fault due to lightening; Cleared fault and restored system.
15	06/16	1				x				x			x	x	Substation fault due to failed regulator; Replaced failed regulator.
16	07/04	1				x				x			x	x	46kV substation fault due to failed regulator; Replaced failed equipment.

Inquiries			Power Quality Event [6]							Source of PQ Event			Outcomes		
Event	Date	Locations Impacted [7]	Transient	Voltage Sag	Voltage Swell	Interruption	Overvoltage	Under voltage	Other (inc. Harmonics)	Consumers Energy [8]	Transmission Provider [9]	Customer [10]	Customer Contact [11]	Modifications [12]	Description
17	07/13	1		x						x			x	x	Substation LTC controller not operating properly; Adjusted LTC controller settings.
18	08/01	1			x							x	x		Customer reported voltage disturbance. PQM showed voltage to be within limits.
19	09/19	1			x							x	x		Mis-operation of customer equipment.
20	10/01	1		x						x			x		138kV line fault; cause unknown; Cleared fault and restored system.
21	10/14	1		x							x		x	x	138kV line fault due to failed pole; Replaced failed pole.
Total	**21**	**21**	**0**	**7**	**4**	**9**	**1**	**0**	**0**	**9**	**1**	**11**	**21**	**5**	

C. Power Quality Summary

To the Company's knowledge, none of the power quality events referenced in the above table resulted in a formal MPSC complaint. Additionally, Consumers Energy shares information gathered from its power quality monitors with customers via its Business Customer Solutions Account Managers in response to requests regarding power factor, equipment loading, high-energy usage, billing comparisons, and other general inquiries.

III. Increased Reporting Requirements

A. Worst Performing Circuits

The following tables show 2022 performance for Consumers Energy's 10 worst performing circuits as ranked by circuit SAIDI with SAIFI metrics, excluding MEDs. The circuit performance is driven by the outage incident types and each circuit is reviewed in detail to develop a specific corrective action plan targeted at improving reliability.

10 Worst SAIDI Performing Circuits for 2022										
Circuit SAIDI Excluding MEDs	**Circuit SAIFI Excluding MEDs**	**Feeder ID**	**Substation/Circuit**	**Service Center Location**	**Length (Miles)**	**Number of Customers Served**	**Last Circuit Trim**	**Number of Customer Interruptions**	**Outage Causes**	**Corrective Action Plan to Improve Performance**
1987	7.99	42301	GERRISH/ LEGION	West Branch	105	2153	2017	17199	Equipment Failure and Trees	2022 - Forestry Zone Clearing 2022 - 2023 - HVD Line Projects 2022 - Substation Projects 2022-2024 - LVD Line Projects
1786	4.25	151602	HUBBARD LAKE/ MILLER ROAD	Tawas	68	633	2017	2693	Weather, No Specific Cause Found, and Trees Outside ROW	2024 - LVD Line Project

1518	3.59	31202	LINCOLN/ MIKADO	Tawas	89	970	2021	3485	Trees, Weather, and No Specific Cause Found	2023 - Forestry Zone Clearing 2022 - 2023 - HVD Line Projects 2024 - Substation Project 2023-2024 - LVD Line Projects
1612	2.44	1301	CENTREVILLE/ BUSINESS	Coldwater	62	1065	2008	2595	Trees, No Specific Cause Found, and Equipment Failure	2022-2023 - Full Forestry Clearing 2023 -2024 HVD Line Projects 2022 - LVD Line Projects
1686	3.82	12002	LEELANAU/ BELANGER CREEK	Traverse City	13	170	2011	649	Trees and Forced Outage or Emergency	2023 - Full Forestry Clearing 2023 - HVD 2022 - Substation Project
1730	4.85	151601	HUBBARD LAKE/ HUBBARD LAKE	Tawas	15	463	2018	2247	Trees and Animal	2023 - Full Forestry Clearing 2023 - LVD Line Project
1743	2.97	56903	NORTHPORT/ OMENA	Traverse City	10	230	2021	683	Trees and Weather	2023 - HVD 2024 - Substation Projects 2022 - LVD Line Project

1512	3.21	55801	BELLAIRE/ DOWNTOWN	Traverse City	22	988	2021	3174	Weather, Trees, and Equipment Failure	2022-2023 HVD Projects 2023-2024 - LVD Line Project
1481	5.35	70004	DEAN ROAD/ PARSHALLVILLE	Flint	54	954	2021	5108	Equipment Failure, Weather, and No Specific Cause Found	2022 - Herbicide Control on 5.5 Miles 2024 - Substation Project 2022 - LVD Line Projects
1447	5.22	138302	MILL GROVE/ ALLEGAN HYDRO	Hamilton	49	1236	2015	6451	Trees and Unique Incident	2022 - 2023 - Forestry Zone Clearing 2022 - 2023 - HVD Projects 2022 and 2024 - LVD Line Projects

The SAIDI and SAIFI values shown are circuit-specific based on the number of customers served by the circuit. As described in the tactics above, LVD inspections are being increased to proactively address deterioration on the system and reduce potential customer outages on circuits. It should be noted that circuit reliability performance is evaluated on a multi-year-combined basis and a single year of poor performance may not result in identification of near-term corrective actions. Also, circuit performance is evaluated on the contribution to overall system performance

in determining prioritization for capital investment and maintenance. A list of outages and causes for each of these circuits can be provided upon request.

B. Customers Experiencing Multiple Interruptions

CEMI has been calculated to align with the IEEE definition requirements to indicate the number of customers experiencing 'n' or more sustained interruptions. CEMI for 2022 is shown in the table below.

n	0	1	2	3	4	5	6	7	8	9	10+
Customers Affected	1,861,956	1,205,304	663,478	343,637	173,273	89,710	45,415	19,821	9,382	5,488	2,994

This metric is monitored on a bi-weekly basis throughout the year and work plans are adjusted as targeted zones are identified. In 2022, customers experiencing zero outages improved by 12.5% compared to 2021 levels. In 2022, 656,652 customers experienced no sustained interruptions compared to 583,551 in 2021. The number of customers experiencing greater than ten outages was 2,994 in 2022 which represents a decrease of 19% from the 2021 level of 3,709. Since there are no exclusions for this metric, large and small storms can be a factor in the changes from year to year. The number decrease from 2021 to 2022 can be attributed to the tactics referred in the "Reliability Indices" section, in combination with a stabilization of weather in 2022 relative to historic trends.

2022 continuous improvement tactics include a modernized forestry model that harnesses more sophisticated predictive and prescriptive analytics in Machine Learning and satellite imagery analysis to influence and guide its LVD full circuit clearing subprogram. Reliability metrics incorporated into this model for multi-objective optimization include historical performance of

and projected impacts to CEMI. There was, and continues to be, increased forestry spending on zones contributing to CEMI which is a proactive approach to address interruptions prior to meeting the repetitive outage level. The CEMI subprogram analyzes groups of customers experiencing numerous outages during the calendar year. Unlike the forestry repetitive outage subprogram, which is specific to a protective device's zone of influence, the CEMI subprogram looks at all zones upstream of a customer's location that is experiencing multiple interruptions to identify potential projects to improve reliability even though no one zone may be experiencing interruptions that rise to the repetitive outage level. Finally, the Company has a long-term plan to increase spending in maintenance clearing to further reduce repetitive outages.

Note that the $CEMI_n$ calculation differs from the Same Circuit Repetitive Interruption calculation in that individual customer interruptions are included in the $CEMI_n$ calculation whereas only interruptions impacting more than ten customers are included in the Same Circuit Repetitive Interruptions per its definition found in Rule 460.702(s) of the MPSC Service Quality and Reliability Standards for Electric Distribution Systems.

C. Customers Experiencing Long Interruption Durations

The Customers Experiencing Long Interruption Durations ("CELID") for 2022 is shown in the table below for Normal and Catastrophic Conditions. It should be noted that there was one event designated Catastrophic in 2022 (August 29 – September 2).

CELID	2021	2022
CELID exceeding 8 hrs during Normal Conditions	354,168	375,625
CELID exceeding 60 hrs during Catastrophic Conditions	77,089	4,743

The number of customers experiencing outages exceeding eight hours during normal conditions increased from 354,168 in 2021, to 375,625 in 2022. The stability in the weather in 2022 resulted in more storms being categorized as "normal conditions." Conversely, the customers experiencing outages exceeding 60 hours during catastrophic conditions decreased from 77,089 in 2021 to 4,734 in 2022. This is a decrease of 94%.

IV. Conclusion

In 2022, Consumers Energy saw some stabilization in the severity of storm events. However, wind trends continue to show Michigan is being impacted by more frequent and higher winds over past years. The impacts of climate change on Michigan require continued investment in the Company's electric infrastructure in addition to developing new response processes that will improve the experience for customers and increase the reliability of the grid.

Respectfully submitted,

Dated: March 31, 2023

CONSUMERS ENERGY COMPANY