

F. System Reliability Statistics

Please refer to Figure 6 and Section G for system reliability statistics and trends.

AVERAGE SERVICE AVAILABILITY INDEX – ASAI

The ASAI index is the ratio of total customer hours that service was available divided by the total customer hours demanded in a time period. The formula to calculate ASAI is:

$$\text{ASAI} = \frac{[(\text{customer-hours demanded}) - (\text{customer hours off})]}{(\text{customer-hours demanded})} \times 100$$

$$\text{customer-hours} = (12\text{-month average number of customers}) \times 8760 \text{ hours demanded}$$

The unit of ASAI is percent, and is generally carried out to four decimal places (such as: 99.9986%). A common usage of ASAI is: “the efficiency of the distribution system to deliver electric energy to our customer is \_\_\_\_\_%”

CUSTOMER AVERAGE INTERRUPTION DURATION INDEX – CAIDI

CAIDI is the weighted average length of an interruption for customers affected during a specified time period. The formula to determine this average is:

$$\text{CAIDI} = \frac{\text{sum of customer-minutes off for all sustained interruptions}}{\text{Total \# of customers affected by the sustained interruptions}}$$

The unit of CAIDI is minutes. A common usage of CAIDI is: “The average customer that experiences an outage on the distribution system is out for \_\_\_\_\_ minutes.”

SYSTEM AVERAGE INTERRUPTION DURATION INDEX – SAIDI

SAIDI is defined as the average duration of interruptions for customers served during a specified time period. Although similar to CAIDI, the average number of customers served is used instead of number of customers affected. The formula used to determine SAIDI is:

$$\text{SAIDI} = \frac{\text{sum of customer-minutes off for all interruptions}}{\text{Total \# of customers served}}$$

The unit of SAIDI is minutes. A common usage of SAIDI is: “If all the customers on the distribution system were without power the same amount of time, they would have been out for \_\_\_\_\_ minutes”.

SYSTEM AVERAGE INTERRUPTION FREQUENCY INDEX – SAIFI

SAIFI described the average number of times that a customer’s power is interrupted during a specified time period. “SAIFI-short” is calculated using the number of customers affected by momentary interruptions (such as brief breaker or recloser operations). “SAIFI-long” is calculated using the number of customers affected by sustained interruptions.

$$\text{SAIFI-long} = \frac{\text{total \# of customers affected by sustained interruptions}}{\text{Average number of customers served}}$$

$$\text{SAIFI-short} = \frac{\text{total \# of customers affected by momentary interruptions}}{\text{Average number of customers served}}$$

The units for SAIFI are “interruptions per customer”. A common usage of SAIFI is: “On the average, customers on the distribution system experienced \_\_\_\_\_ interruptions”.

### System Performance Measures & Reliability Indices

Year	ASAI (%)	CAIDI (Minutes)	SAIDI (Minutes)	SAIFI	
				LONG (Interruptions/Customer)	SHORT
1994	99.9909	14.06	47.76	1.22	2.18
1995	99.9829	41.82	89.99	1.35	0.80
1996	99.9960	15.39	20.96	0.37	0.99
1997	99.9957	17.14	22.65	0.44	0.88
1998	99.9205	113.48	417.84	2.30	1.39
1999	99.9815	36.50	97.26	1.25	1.41
2000	99.9962	15.62	20.11	0.64	0.65
2001	99.9937	13.93	33.01	0.89	1.47
2002	99.9916	47.19	44.16	0.94	2.33
2003	99.9943	30.01	30.28	1.01	0.31
2004	99.9936	52.29	33.99	0.65	0.83
2005	99.9934	46.15	34.88	0.76	0.37
2006	99.9862	99.30	72.47	0.73	0.27
2007	99.9899	65.41	53.23	0.81	0.30
2008	99.9936	69.01	33.59	0.49	0.48
2009	99.9892	80.24	56.90	0.71	0.27
Overall Averages	99.9875	42.35	65.96	0.94	1.12

### Five-Year Moving Averages

Year	ASAI (%)	CAIDI (Minutes)	SAIDI (Minutes)	SAIFI	
				LONG (Interruptions/Customer)	SHORT
1997	99.9917	19.50	43.64	0.86	1.60
1998	99.9772	40.38	119.84	1.14	1.25
1999	99.9753	44.87	129.74	1.14	1.09
2000	99.9780	39.62	115.76	1.00	1.06
2001	99.9775	39.33	118.17	1.10	1.16
2002	99.9767	45.34	122.48	1.20	1.45
2003	99.9915	28.65	44.96	0.95	1.23
2004	99.9939	31.81	32.31	0.83	1.12
2005	99.9933	37.91	35.26	0.85	1.06
2006	99.9918	54.99	43.16	0.82	0.82
2007	99.9915	58.63	44.97	0.79	0.42
2008	99.9913	66.43	45.63	0.69	0.45
2009	99.9905	72.02	50.21	0.70	0.34

**NOTES:**

1. Record-keeping methods for performance statistics were standardized during late 1986.
2. All outages of 1 minute or less, even instantaneous recloses of a temporary fault are recorded as 1-minute outages.
3. In 1998, Rochester experienced a complete blackout due to failure of transmission systems of DPC and NSP during a severe storm.
4. In 1999, Rochester experienced a partial blackout due to loss of a mile of 161kV line and relaying problems.
5. In 2006 RPU switched from a manual system to an automated process using outage management software to respond to and track outages. The statistics are all inclusive for all types of outages, including TD Major and Planned Outages.

Figure 6 displays the five-year moving averages of three important system performance measurements. Trends that show generally high average service availability index (ASAI) and low customer average and system average interruption duration indices (CAIDI and SAIDI) are desirable. In 2009, ASAI decreased very slightly (99.9913 to 99.9905%, SAIDI increased 10% (45.63 to 50.21 minutes), and CAIDI increased 8.4% (66.43 to 72.02 minutes) from 2008 values.

Figure 6

