Utah Service Reliability Performance Baselines

Pursuant to Utah Public Service Commission Rule R746-313

February 28, 2013

Table of Contents

Executive Summary

Utah Public Service Commission ("Commission") Rule R746-313-4(2), requires that an electric company whose governing authority is the commission must file for commission approval of reliability performance baselines for SAIDI (System Average Interruption Duration Index) and SAIFI (System Average Interruption Frequency Index) reliability indices. Further, the filing must include:

(a) the basis for the proposed SAIDI and SAIFI values; and

(b) identification of systems and description of internal processes to collect, monitor and analyze interruption data and events including:

(i) definitions of all parameters used to calculate the proposed standards and major event days, and the time-period upon which the proposed standards are based (e.g. 12-month rolling average, 365-day rolling average, annual average);

(ii) identification of all proposed deviations from IEEE 1366 used in the calculation of reliability indices and determination of major event days; and

(iii) a description of all data estimation methods used for the collection and calculation of SAIDI, SAIFI, CAIDI, and $MAIFI_E$.

1.0 Performance Baselines: History and Basis

1.1 *Overview*

PacifiCorp, dba Rocky Mountain Power ("Company"), continues to monitor and evaluate system reliability in Utah. In the future, performance baselines may require modification to recognize changes in the system. The Company proposes a control limit of underlying SAIDI of 176 minutes and SAIFI of 1.6 events with a notification limit of 201 minutes for SAIDI and 1.9 events for SAIFI, which are shown graphically in Figures 1 and 2.

The performance baselines were based on underlying distribution interruptions, which are exclusive of major events as identified in IEEE 1366-2003/2012. These interruptions moderately align to the normal day to day performance of the system and provide a consistent view for evaluation of trends across time. Further, underlying metrics exclude prearranged and customer requested interruptions, which do not correlate to inconvenience to customers. In order to recognize improvements made by the Company over the last decade, only the last six years of history have been considered.

The rules specifically require the development of performance baselines. The Company proposes to use a control limit to establish a range within which reliability delivered to customers is falling within a normally expectable level, as well as a notification limit, whereupon performance is outside the expected range of performance and additional analysis should occur.

At the control limit level, the Company and Commission are expected to be closely monitoring performance using the Service Quality Reports and under the direction of the Service Quality Review Group. If however, the notification limit level[1] is reached, the rules require that the Commission is apprised within 60 days of that level being exceeded.

Another important aspect in developing baselines is determining the historically normal ratio of outage causes that result in 365-day rolling performance history. Therefore, the Company has prepared its cause code weighted history, against which any underlying performance variances would be compared as shown in Figure 3 and 4.

1.2 *SAIDI Baseline*

Since 2005, the Company has applied IEEE 1366-2003 major event definitions. Prior to 2005, it applied the previous definition from IEEE 1366-1998, which results in historical performance different than what has been reported in prior Service Quality Reports. In Figure 1 below, the Company provides historic 365-day rolling SAIDI performance consistently applying the current definition for a major event; the definition and its application are detailed further on Page 11. Using this history, the Company calculates a control limit using a 95% confidence interval level on the past six years of history resulting in 176 minutes. To establish a notification limit, the Company used a 95% probability level[2] for the same history which resulted in 201 minutes for SAIDI.

[1] Notification limit notice, as discussed in Section 1.5, requires that the daily rolling 365-day reliability performance (either SAIDI or SAIFI) has exceeded the notification limit for three consecutive months. If such event occurs the Company will file notice with the Commission per 746-313-7(1) within 60 days of the third month of exceedence.
[2] The Company applied 2 standard deviations to determine the calculated probability of the performance level.

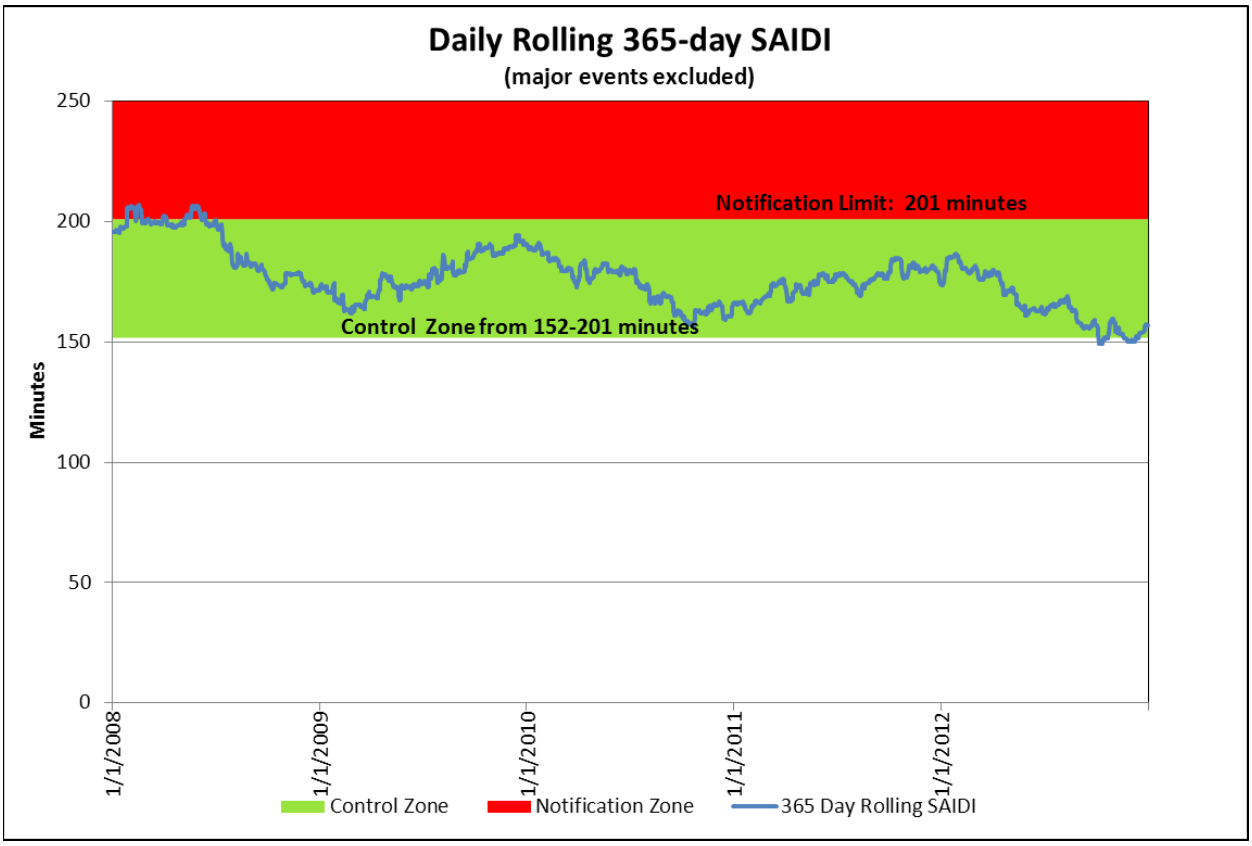


Figure 1: SAIDI History and Baseline Level

1.3 *SAIFI Baseline*

Similarly, using the past six years of history, the Company calculates a control limit using a 95% confidence interval level resulting in 1.6 events. To establish a notification level, the Company used a 95% probability level[1] for the same history which resulted in 1.9 events for SAIFI, which is shown in Figure 2.

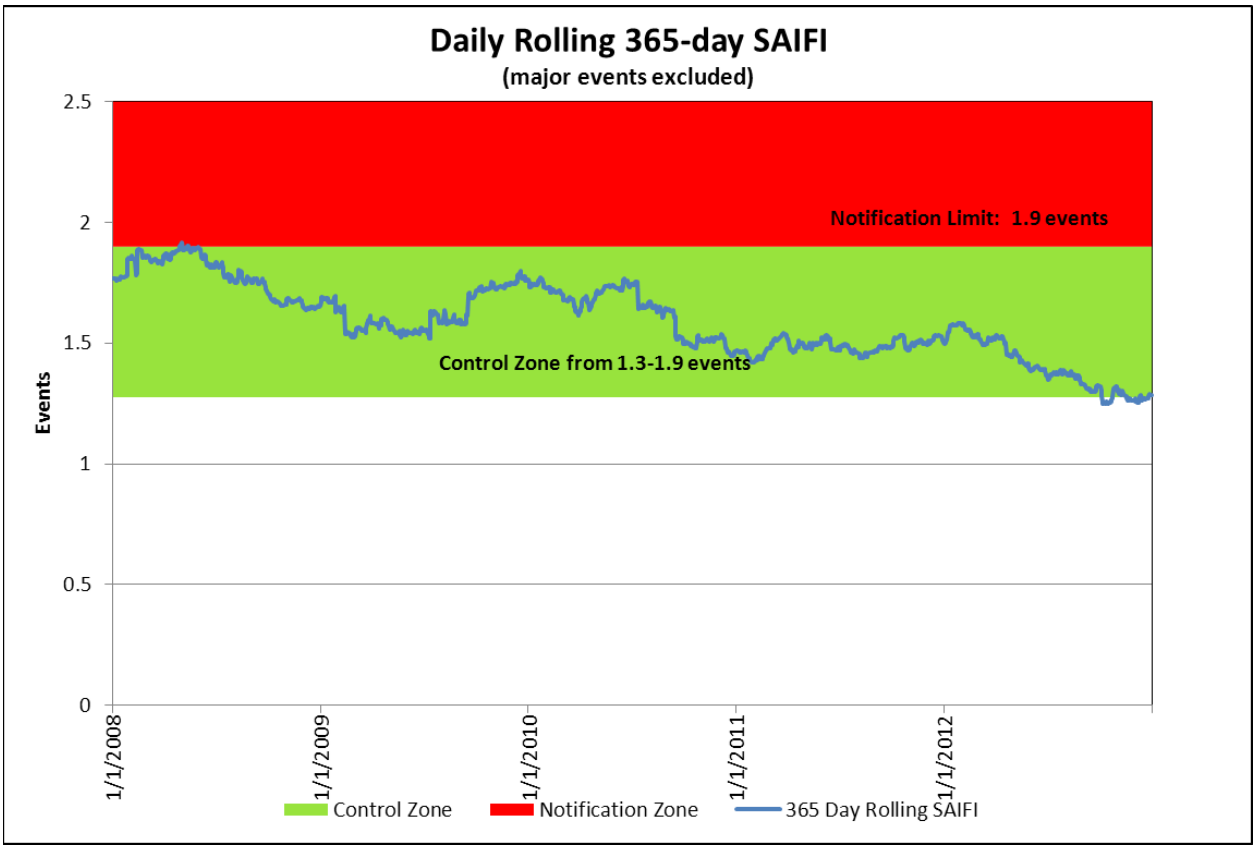


Figure 2: SAIFI History and Baseline Level

1.4 *Performance Monitoring*

The intent of the plan is to evaluate and communicate reliability results delivered. The Company, however, cautions that while general trends may be detectable, underlying causes for these trends are not always obvious. For instance, substantial variation in weather may lead to significantly differing results. While the Company believes such attention to system and subsystem reliability is critical to effective operations, comparisons should recognize influences that may impact such comparisons. For example, as reporting systems evolve they can influence system metrics, but actual customer experience may remain the same as or be similar to prior periods. Further, comparisons among companies reporting similar metrics may not yield accurate or useful conclusions due to differences in data collection methods, customer demographics, system age or physical environments. Current reporting practices are described further in Section 2.

In order to provide transparency to the baseline levels that were established, the Company provides a historically-expectable percentage of outage metrics by cause code in Figures 3 and 4. In the future, if a given cause code exceeds that level, discussion about the cause code performance, its impact on underlying performance, and its initiating events can be reviewed with stakeholders. This is particularly noteworthy since certain outage causes may have period-to-period volatility that could result in over-baseline performance. Rather than providing large

baseline contingency, the development of this information allows the Company to submit less conservative baselines, which are presumed to be more valuable for stakeholder monitoring.

Figure 3: SAIDI by Cause Code

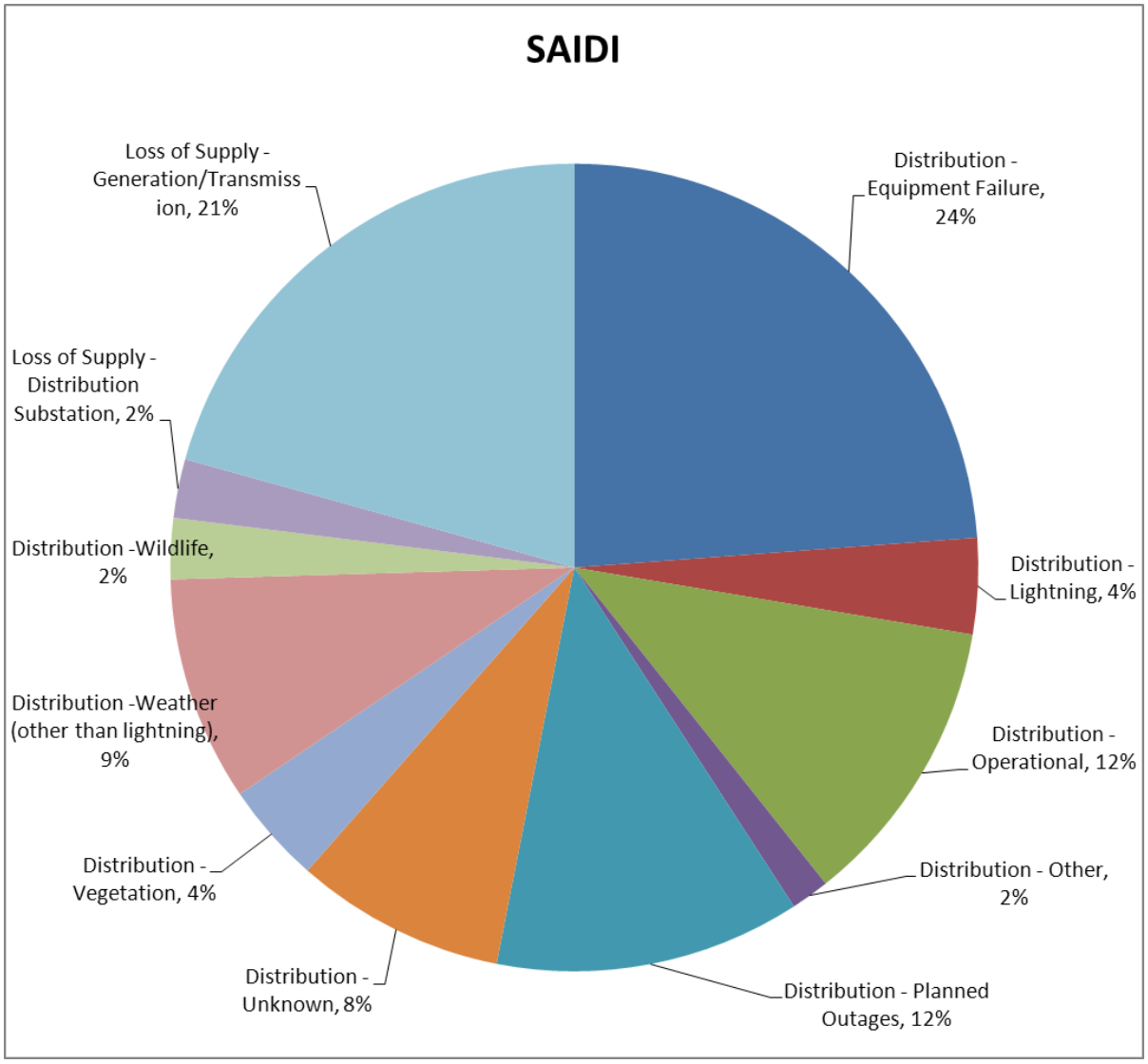
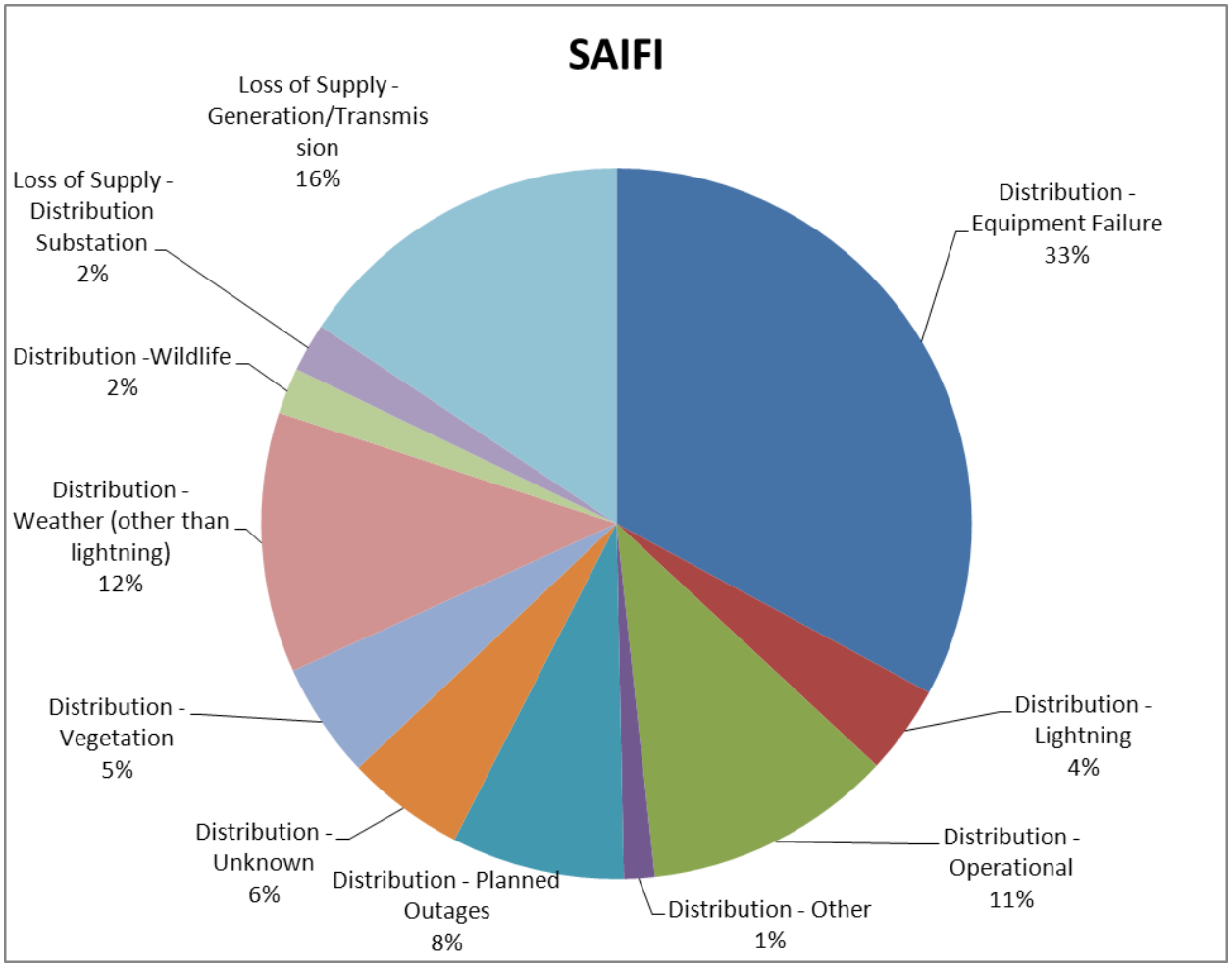


Figure 4: SAIFI by Cause Code



1.5 *Baseline Notification*

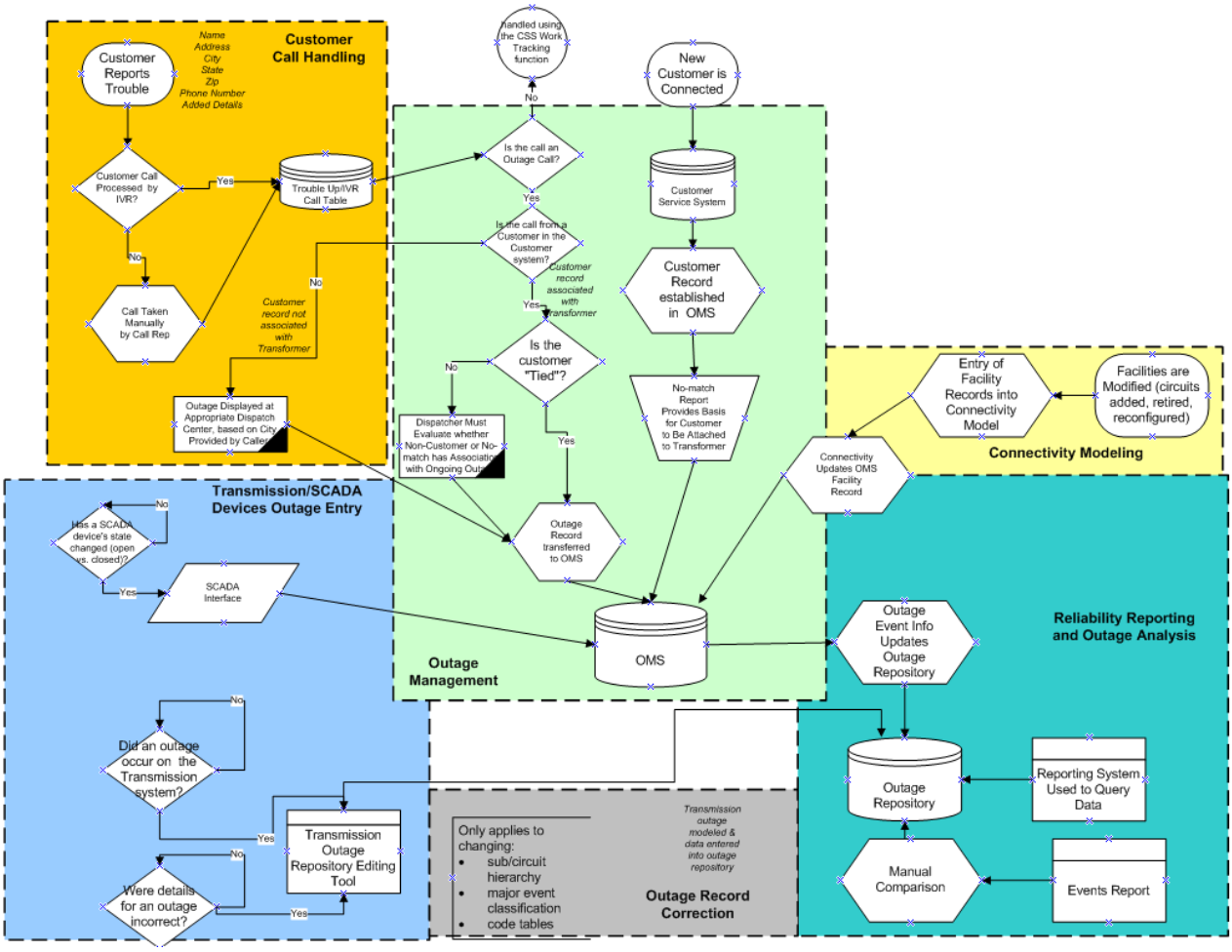
The Company has produced baselines predicated upon a 365-day rolling year of daily reliability data in order to smooth out any period-to-period volatility. If the reliability performance exceeds the 365-day notification level for three consecutive months, calculated at the end of the month, the Company will file notice with the Commission per 746-313-7(1) within 60 days of the performance being beyond its notification limit.

2.0 Data Collection

2.1 Monitoring, Recording and Reporting Reliability

How PacifiCorp Monitors Reliability

PacifiCorp operates automated outage management and reporting systems; a diagram of the data flow process is shown below. Customer trouble calls and SCADA events are interfaced with the Company's real-time network connectivity model, its CADOPS system (Computer Aided Distribution Operations System). By overlaying these events onto the network model, the program infers outages at the appropriate devices (such as a transformer, fuse or other interrupting device) for all customers down line of the interrupting device. The outage is then routed to appropriate field operations staff for restoration and the outage event is recorded in the Company's Prosper/US outage repository. In addition to this real-time model of the system's electrical flow, the Company relies heavily upon the SCADA system it has in place. This includes the Dispatch Log System (a database application) which serves to collect all events on SCADA-operable circuits. That data is then analyzed for momentary interruptions to establish state-level and circuit-level momentary interruption indices consistent with industry and statutory definitions.



2.2 Reliability Definitions

This section will define the various terms[3] used when referring to interruption types, performance metrics and the internal measures developed to meet the performance plans. These definitions are not materially different than as defined in IEEE-2003/2012. In addition, the Company is not proposing any deviations for the calculation of reliability indices from IEEE 1366-2003/2012.

Interruption Types

Sustained Outage
A sustained outage is defined as an outage of greater than 5 minutes in duration.

Momentary Outage Event
A momentary outage is defined as an outage equal to or less than 5 minutes in duration. Rocky Mountain Power has historically captured this data using substation breaker fault counts, but where SCADA (Supervisory Control and Data Acquisition Systems) exist, uses this data to calculate consistent with IEEE 1366-2003/2012.

Reliability Indices

Customers Served

On a periodic basis (annually at the beginning of each reporting year) a customer extract is prepared from the automated outage management system. Each site service location is assumed to be a "customer" at the specific location identified; these are normally associated with each customer meter location, and are tallied by circuit, operating area, regional reporting area and state. This result is established as the "Frozen Customer Count" for the specific reporting period and serves to hold the denominator stable for reliability metrics.

SAIDI = Σ sustained customer minutes interrupted/Σ system customers served
SAIDI (system average interruption duration index) is an industry-defined term to define the average duration summed for all sustained outages a customer experiences in a given period. It is calculated by summing all customer minutes lost for sustained outages (those exceeding 5 minutes) and dividing by all customers served within the study area. When not explicitly stated otherwise, this value can be assumed to be for a one-year period.

Daily SAIDI = Σ sustained customer minutes interrupted (for the day)/Σ system customers served

[3]IEEE 1366-2003/2012 was adopted by the Institute of Electrical and Electronics Engineers (IEEE) Commissioners on May 31, 2012, which provides the basis for the definitions of the terms used in this document.

In order to evaluate trends during a year and to establish Major Event Thresholds, a daily SAIDI value is often used as a measure. This concept was introduced in IEEE Standard 1366-2003/2012. This is the day's total customer minutes out of service divided by the static customer count for the year. It is the total average outage duration customers experienced for that given day. When these daily values are accumulated through the year, it yields the year's SAIDI results.

SAIFI = Σ sustained customers interrupted / Σ system customers served

SAIFI (system average interruption frequency index) is an industry-defined term that attempts to identify the frequency of all sustained outages that the average customer experiences during a given time-frame. It is calculated by summing all customer interruptions for sustained outages (those exceeding 5 minutes in duration) and dividing by all customers served within the study area.

CAIDI = sustained average interruption duration index / sustained average interruption frequency index

CAIDI (customer average interruption duration index) is an industry-defined term that is the result of dividing the duration of the average customer's sustained outages by the frequency of outages for that average customer. It is also derived by dividing SAIDI by SAIFI.

$MAIFI_E$

$MAIFI_E$ (momentary average interruption event frequency index) is an industry-defined term that attempts to identify the frequency of all momentary interruption events that the average customer experiences during a given time-frame. It is calculated by counting all momentary interruptions which occur within a 5 minute time period, as long as the interruption event did not result in a device experiencing a sustained interruptions. This sequence of events typically occurs when the system is trying to re-establish energy flow after a faulted condition, and is associated with circuit breakers or other automatic reclosing devices.

Lockout

Lockout is the state of device when it attempts to re-establish energy flow after a faulted condition but is unable to do so; it systematically opens to de-energize the facilities downstream of the device then recloses until a lockout operation occurs. The device then requires manual intervention to re-energize downstream facilities. This is generally associated with substation circuit breakers and is one of the variables used in the company's calculation of blended metrics.

CEMI = for each customer/Σ interruptions during period

CEMI is an acronym for Customers Experiencing Multiple (Momentary Event and Sustained) Interruptions. This index depicts repetition of outages across the period being reported and can be an indicator of recent portions of the system that have experienced reliability challenges.

CPI99

CPI99 is an acronym for Circuit Performance Indicator, which uses key reliability metrics of the circuit to identify underperforming circuits. It excludes Major Event and Loss of Supply or Transmission outages. The variables and equation for calculating CPI are:

CPI = Index * ((SAIDI * WF * NF) + (SAIFI * WF * NF) + (MAIFIE * WF * NF) + (Lockouts * WF * NF))

Index: 10.645

SAIDI: Weighting Factor 0.30, Normalizing Factor 0.029

SAIFI: Weighting Factor 0.30, Normalizing Factor 2.439

$MAIFI_E$: Weighting Factor 0.20, Normalizing Factor 0.70

Lockouts: Weighting Factor 0.20, Normalizing Factor 2.00

Therefore, **10.645 * ((3-year SAIDI * 0.30 * 0.029) + (3-year SAIFI * 0.30 * 2.439) + (3-year $MAIFI_E$* 0.20 * 0.70) + (3-year breaker lockouts * 0.20 * 2.00)) = CPI Score**

CPI05

CPI05 is an acronym for Circuit Performance Indicator, which uses key reliability metrics of the circuit to identify underperforming circuits. Unlike CPI99, it includes Major Event and Loss of Supply or Transmission outages. The calculation of CPI05 uses the same weighting and normalizing factors as CPI99.

Baseline Performance Monitoring Terms

Rocky Mountain Power, in accordance with 746-313-7(1), has established performance baselines comprised of two key levels of reliability performance. These types of performance levels are defined below. Unlike the application in statistical process control, only upper bound performance levels are used to monitor performance.

Control Limit

A control limit is a means to establish a statistically significant performance level that can serve as an indicator that the reliability delivered to customers is falling within a normally expectable level. The control limit includes both an upper and lower control limit, which are portrayed graphically in Figures 1 and 2.

Notification Limit

A notification limit is the maximum permissible value performance level; performance beyond this level serves as an indication that the reliability delivered to customers is falling outside a normally expectable level.

Performance Types

Rocky Mountain Power recognizes two categories of performance: underlying performance and major events. Major events represent the atypical, with extraordinary numbers and durations for outages beyond the usual. Ordinary outages are incorporated within underlying performance. These types of events are further defined below.

Major Events

A Major Event is defined as a 24-hour period where SAIDI exceeds a statistically derived threshold value (Reliability Standard IEEE 1366-2003/2012) based on the 2.5 beta methodology. A major event includes at least one major event day and may include initial interruption events that are related to the major event cause, in addition to interruptions that occur as a result of the major event cause that may occur after the major event day, until normal operations have been resumed. Such major events' start and end date/times are reviewed within the Company's Major Event Filing Documents.

Underlying Events

Within the industry, there has been a great need to develop methodologies to evaluate year-on-year performance. This has led to the development of methods for segregating outlier days, via the approaches described above. Those days which fall below the statistically derived threshold represent "underlying" performance, and are valid (with some minor considerations for changes in reporting practices) for establishing and evaluating meaningful performance trends over time. Underlying events includes all sustained interruptions, whether of a controllable or non-controllable cause, exclusive of major events, prearranged and customer requested interruptions.

Controllable Events

In 2008, the company identified the benefit of separating its tracking of outage causes into those that can be classified as "controllable" (and thereby reduced through preventive work) from those that are "non-controllable" (and thus cannot be mitigated through engineering programs). For example, outages caused by deteriorated equipment or animal interference are classified as controllable distribution since the company can take preventive measures with a high probability to avoid future recurrences; while vehicle interference or weather events are largely out of the company's control and generally not avoidable through engineering programs. It should be noted that Controllable Events is a subset of Underlying Events. The Cause Code Analysis section of this report contains two tables for Controllable Distribution and Non-controllable Distribution, which list the company's performance by direct cause under each classification. At the time that the Company established the determination of controllable and non-controllable distribution it undertook significant root cause analysis of each cause type and its proper categorization (either controllable or non-controllable). Thus, when outages are completed and evaluated, and if the outage cause designation is improperly identified as non-controllable, then it would result in correction to the outage's cause to preserve the association between controllable and non-controllable based on the outage cause code.