Dockets UE-170033 and UG-170034 (consolidated) and Dockets UE-072300 and UG-072301 (consolidated)

Puget Sound Energy
2018 Service Quality Program and Electric Service Reliability Filing

Attachment A:
Service Quality and Electric Service Reliability Report

Puget Sound Energy

2018

Service Quality and Electric Service Reliability Report

Filed on March 29, 2019

PUGET SOUND ENERGY

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CHAPTER 1

INTRODUCTION

Executive Summary

As Washington State's oldest and largest energy utility, with a 6,000-square-mile service territory stretching across 10 counties, Puget Sound Energy (PSE) serves more than 1.1 million electric customers and over 800,000 natural gas customers primarily in the Puget Sound region of Western Washington. PSE meets the energy needs of its customer base through cost-effective energy efficiency measures, procurement of sustainable energy resources and far-sighted investment in the energy-delivery infrastructure. PSE employees are dedicated to providing quality customer service and to delivering energy that is safe, dependable, efficient and environmentally responsible.

The report provides PSE's 2018 performance and results for the following areas: Customer Service Guarantee, Restoration Service Guarantees, service quality of PSE and its service providers, and electric service reliability.

For the 2018 Service Quality Reporting year, PSE met its benchmarks for the following Service Quality Indices (SQI): WUTC Complaint Ratio (SQI[1] #2), System Average Interruption Duration Index (SQI #3), System Average Interruption Frequency Index (SQI #4), Customer Access Center Answering Performance (SQI #5), Customer Access Center Transactions and Field Service Operations Transactions Customer Satisfaction (SQI #6 and #8), Gas and Electric Safety Response Time (SQI #7 and #11), and Kept Appointments (SQI #10).

Background

PSE first implemented its Service Quality Program (the SQ Program) when the Washington Utilities and Transportation Commission (UTC, WUTC, or the Commission) authorized the merger of Washington Natural Gas Company and Puget Sound Power & Light Company in 1997.[2] The stated purpose of the SQ Program was to "provide a specific mechanism to assure customers that they will not experience deterioration in quality of service" and to "protect customers of PSE from poorly-targeted cost cutting." The SQ Program has been further

[1] Service Quality Index

[2] Under consolidated Dockets UE-951270 and UE-960195.

extended[3] with various modifications to demonstrate PSE's continuous commitment to customer protection and quality service.

Service Quality Program

The Service Quality Program includes three components:

- **Service Quality Index (SQI)**—PSE reports annually to the UTC on the final performance of these nine SQIs. This document explains the SQIs, how they are calculated and PSE's performance on each of the SQIs for the 2018 reporting year. PSE also provides preliminary SQI results to the UTC semi-annually.
- **Customer Service Guarantee (CSG)**—The Customer Service Guarantee provides for a $50 credit when PSE misses an SQI #10 appointment. This appointment guarantee has been available to all customers since the inception of PSE's Service Quality Program in 1997.
- **Restoration Service Guarantees (RSG)**—The Restoration Service Guarantees provides for a $50 credit to a qualified PSE electric customer based upon the conditions and exceptions outlined in PSE's electric Schedule 131 Restoration Service Guarantees. There are two RSGs: the 120-hour guarantee during any storm event and the 24-hour guarantee during a non-major storm event. The 120-hour guarantee was established in 2008. The 24-hour guarantee became effective on January 1, 2017.

In addition to these three components, the SQ Program also prescribes reporting requirements for PSE's primary service providers. Several Service Provider Indices (SPIs) benchmark performances in areas of construction standards compliance, reliability/service restoration and kept appointments.

The SQ Program also includes PSE's natural gas emergency response plans for outlying areas, which are filed concurrently with this Report as Attachment B to the annual UTC SQ and Electric Service Reliability filing.

Attachment C to the 2018 annual UTC SQ and Electric Service Reliability Report filing is PSE's 2018 Critical Infrastructure Security Annual Report, which contains a discussion of PSE's cybersecurity and physical security policies and related information for 2018.

Attachment D to the 2018 annual UTC SQ and Electric Service Reliability Report filing is the supplemental SQI #5 report; per the reporting requirement outlined in Dockets UE-170033 and UG-170034 Order 08, page 79, paragraph 231; which includes PSE's evaluation of customer's contact experience with PSE's call center and supporting evidence demonstrating that the change in the SQI #5 benchmark standard has not led to a deterioration in service quality.

[3] Under Dockets UE-011570 and UG-011571 (consolidated), and UE-072300 and UG-072301 (consolidated).

SQI and Electric Service Reliability Report

This *Puget Sound Energy 2018 SQ and Electric Service Reliability Report* meets PSE's SQ Program reporting requirements[4] and the electric service reliability reporting requirements set forth by the UTC.[5,6] To facilitate external review of PSE's SQ and Electric Service Reliability performance, the two reports were combined starting with the 2010 reporting year.[7]

Overview of Performance

Table 1a summarizes PSE's 2018 SQ and Electric Service Reliability performance, along with relevant service providers' performance metrics and the two service guarantees. PSE met all nine of the Service Quality Indices under PSE's Service Quality Program.

Table 1a: SQ and Electric Service Reliability and Service Provider Performance Metrics

Key Measurement	Type of Metric	Benchmark/Description	2018 Performance Results	Achieved
Customer Satisfaction				
WUTC complaint ratio	**Service Quality Index #2**	**No more than 0.40 complaints per 1,000 customers, including all complaints filed with WUTC**	**0.16**	☑
Customer Access Center transactions customer satisfaction	**Service Quality Index #6**	**At least 90% satisfied (rating of 5 or higher on a 7-point scale)**	**94%**	☑
Field service operations transactions customer satisfaction	**Service Quality Index #8**	**At least 90% satisfied (rating of 5 or higher on a 7-point scale)**	**95%**	☑

[4] The performance benchmark, calculation and reporting of each of the Service Quality Indices (SQIs) in this Report reflect all modifications regarding SQI mechanics stipulated in the Twelfth Supplemental Order of Dockets UE-011570 and UG-011571; Orders 1 and 2 of UE-031946; Orders 12, 14, 16, 17, 18, 19, 20, 21, 23, and 29 of consolidated Dockets UE-072300 and UG-072301; and Order 8 of Dockets UE-170033 and UG-170034.

[5] The Electric Service Reliability section of this Report reflects all of PSE's electric service reliability reporting requirements outlined in Docket UE-110060 and in the following sections of the electric service reliability WAC:

- WAC 480-100-388, Electric service reliability definitions,
- WAC 480-100-393, Electric service reliability monitoring and reporting plan,
- WAC 480-100-398, Electric service reliability reports.

[6] Two PSE commitments regarding the preparation of the Electric Service Reliability section, as outlined in Section F, Reporting of Customer Compliant Information, of Appendix D to Order 12 of consolidated Dockets UE-072300 and UG-072301 (Section F), are also satisfied in this annual report. 1) Chapter 3 Customer Electric Reliability Complaints section describes how the customer complaint information is used in PSE's circuit reliability evaluation. Appendix M details PSE's actions to resolve these complaints. 2) Prior to the filing of each annual report, PSE used to invite UTC Staff and the Public Counsel Section of the Washington State Attorney General's Office ("Public Counsel") to discuss the format and content of the Electric Service Reliability section since the adoption of Order 12. However, as agreed to by Public Counsel, UTC Staff and PSE at the March 13, 2012 meeting, an annual external review meeting of PSE's reliability results, prior to the filing, is not required. If, however, an external meeting on the format and content of PSE's Electric Service Reliability section is called for by an external party or PSE, then Public Counsel should be invited.

[7]The annual reporting of the Service Quality Program and the electric service reliability was due separately before the UTC by February 15 and March 31 of each year, respectively. To facilitate external review, PSE filed a petition in October 2010 to consolidate the two reporting requirements, among other petition requests. The UTC granted PSE's petition in November 2010 (Order 17 of consolidated Dockets UE-072300 and UG-072301) and the reporting consolidation became effective for the 2010 performance periods and each report thereafter.

Key Measurement	Type of Metric	Benchmark/Description	2018 Performance Results	Achieved
Customer Service				
Customer Access Center answering performance	Service Quality Index #5	At least 80% of calls answered by a live representative within 60 seconds of request to speak with live operator[8]	81%	☑
Operations Services—*Appointments*				
Appointments kept	Service Quality Index #10	At least 92% of appointments kept	100%[9]	☑
Service provider appointments kept—Quanta Electric	Service Provider Index #3B[10]	At least 92% of appointments kept	99%	☑
Service provider appointments kept—Quanta Gas	Service Provider Index #3C	At least 92% of appointments kept	99%	☑
Customer Service Guarantee	Service Guarantee #10	A $50 credit to customers when PSE fails to meet a scheduled SQI appointment	$24,450	--
Operations Services—*Gas*				
Gas safety response time	Service Quality Index #7	Average 55 minutes or less from customer call to arrival of field technician	30 minutes	☑
Secondary safety response time—Quanta Gas	Service Provider Index #4D	Within 60 minutes from first response assessment completion to second response arrival	48 minutes	☑

[8] Benchmark revision per UTC Dockets UE-170033 and UG-170034 Order 08, dated December 5, 2017, for SQI #5 annual performance from 2018 and years after.

[9] Results shown are rounded from 99.5% to the nearest whole percentage per UTC order. However, the 100% 2018 annual performance result does not reflect that PSE and its service providers met all the appointments during the reporting period. Numbers of missed appointments by appointment type are detailed in Appendix F: *Customer Service Guarantee Performance Detail*.

[10] There was no result for Service Provider Indices #1A, #2A, #3A and #4A. These indices were assigned to a service provider, Pilchuck, which no longer works for PSE. PSE transitioned all natural gas construction and maintenance work to Quanta Gas as of April 30, 2011. Service Provider Indices #2B and #2C, Service Provider Customer Satisfaction for Quanta Electric and Quanta Gas, respectively, were applicable in the prior years' reporting had been ended since the 2013 reporting period.

Key Measurement	Type of Metric	Benchmark/Description	2018 Performance Results	Achieved
Service provider standards compliance—Quanta Gas	Service Provider Index #1C	Level 1 ≤ 8 dev/1000 Level 2 ≤ 15 dev/1000 Level 3 ≤ 12 dev/1000	Level 1 4.11 Level 2 7.33 Level 3 2.71	☑
Operations Services—*Electric*				
Electric safety response time	Service Quality Index #11	Average 55 minutes or less from customer call to arrival of field technician	52 minutes	☑
Secondary Core-Hours, Non-Emergency Safety Response and Restoration Time—Quanta Electric	Service Provider Index #4B	Within 250 minutes from the dispatch time to the restoration of non-emergency outage during core hours	249 minutes	☑
Secondary Non-Core-Hours, Non-Emergency Safety Response and Restoration Time—Quanta Electric	Service Provider Index #4C	Within 316 minutes from the dispatch time to the restoration of non-emergency outage during non-core hours	263 minutes	☑
Service provider standards compliance—Quanta Electric	Service Provider Index #1B	Level 1 ≤ 15 dev/1000 Level 2 ≤ 25 dev/1000 Level 3 ≤ 25 dev/1000	Level 1 6.70 Level 2 12.40 Level 3 10.53	☑
120-Consecutive –hour power outage restoration guarantee	Service Guarantee #2	A $50 credit to eligible customers when experienced a power outage is longer than 120 consecutive hours	$50	--
24-Consecutive-hour non-major storm power outage restoration guarantee	Service Guarantee #3	A $50 credit to eligible customers when experienced a power outage is longer than 24 consecutive hours during non-major storms	$1,450	--
Electric Service Reliability—*SAIFI & SAIDI*				
$SAIFI_{Total}$ Total (all outages current year) Outage Frequency—System Average Interruption Frequency Index (SAIFI)	Reliability	Power interruptions per customer per year, including all types of outage event	1.52 interruptions	--

Key Measurement	Type of Metric	Benchmark/Description	2018 Performance Results	Achieved
$SAIFI_{Total\ 5\text{-}year\ Average}$ Total (all outages five-year average) SAIFI	**Reliability**	**Five years average of the power interruptions per customer per year, including all types of outage event**	**1.82 interruptions**	**--**
$SAIFI_{5\%}$ <5% Non-Major-Storm (<5% customers affected) SAIFI	**Service Quality Index #4**	**No more than 1.30 interruptions per year per customer**	**1.02 interruptions**	**☑**
$SAIFI_{IEEE}$ IEEE Non-Major-Storm (T_{MED}) SAIFI	**Reliability**	**Power interruptions per customer per year, excluding days exceeding the T_{MED} threshold**	**0.99 interruptions**	**--**
$SAIDI_{Total}$ Total (all outages current year) Outage Frequency–System Average Interruption Duration Index (SAIDI)	**Reliability**	**Outage minutes per customer per year, including all types of outage event**	**434 minutes**	**--**
$SAIDI_{Total\ 5\text{-}year\ Average}$ Total (all outages five-year average) SAIDI	**Reliability**	**Outage minutes per customer per year, including all types of outage event five-year average**	**432 minutes**	**--**
$SAIDI_{5\%}$ <5% Non-Major-Storm (<5% customers affected) SAIDI	**Reliability**	**Outage minutes per customer per year, excluding outage events that affected 5% or more customers**	**148 minutes**	**--**
$SAIDI_{IEEE}$ IEEE Non-Major-Storm (T_{MED}) SAIDI	**Reliability**	**Outage minutes per customer per year, excluding days exceeding the T_{MED} threshold**	**145 minutes**	**--**
$SAIDI_{SQI}$ SQI IEEE Non-Major-Storm (T_{MEDADJ}) SAIDI	**Service Quality Index #3**	**No more than 155 minutes per customer per year Outage minutes, excluding days exceeding the T_{MEDADJ} threshold with catastrophic day adjustment**	**145 minutes**	**☑**

Detailed SQI monthly performance results and supplemental information can be found in the following appendices:

- **Appendix A: Monthly SQI Performance**—This appendix details monthly PSE SQI performance and the relevant performance of PSE's service providers. The attachments to this appendix provide

information on the major outage event and localized electric emergency event days and the natural gas reportable incidents and control time. This appendix has three attachments:

- **Attachment A to Appendix A**—Major Event and Localized Emergency Event Days (Affected Local Areas Only),
- **Attachment B to Appendix A**—Major Event and Localized Emergency Event Days (Non Affected Local Areas Only), and
- **Attachment C to Appendix A**—Gas Reportable Incidents and Control Time.

- **Appendix B: Certification of Survey** Results—The independent survey company, EMC Research, certify that all SQI-related customer surveys were conducted with applicable guidelines and the results are unbiased and valid in accordance with the survey procedures established in consolidated Dockets UE-011570 and UG-011571[11].
- **Appendix C: Penalty Calculation**—This appendix shows penalty calculations and allocation if PSE incurs any SQI penalty. For the 2018 reporting year, PSE met all the performance benchmarks with potential penalty assessment, therefore PSE did not incur any penalty associated with its service quality index performance.
- **Appendix D: Proposed Customer Notice (Report Card**)—This appendix presents PSE's proposed 2018 customer service performance report. The Customer Service Performance Report Card is designed to inform customers of how well PSE delivers its services in key areas to its customers.
- **Appendix E: Disconnection Results**—This appendix provides the number of disconnections per 1,000 customers for non-payment of amounts due when the UTC disconnection policy would permit service curtailment.
- **Appendix F: Customer Service Guarantee Performance Detail**—This appendix details annual and monthly Kept Appointments and Customer Service Guarantee payment results by appointment type.
- **Appendix G: Customer Awareness of Service Guarantee**—This appendix discusses the ways PSE makes customers aware of its Customer Service Guarantee and the results of the survey.

Detailed Electric system and reliability information is found in the following appendices:

- **Appendix H: Electric Reliability Terms and** Definitions—This appendix discusses the terms and definitions found in this report.
- **Appendix I: Electric Reliability Data Collection Process and Calculations**—This appendix discusses data collection methods and issues. It explains how the various data were collected.
- **Appendix J: Current Year Electric Service Outage by Cause by Area**—This appendix details the 2018 Outage Cause by County.
- **Appendix K: Historical SAIDI and SAIFI by Area**—This appendix details the three-year history of SAIDI and SAIFI data by county.

[11] PSE's compliance filing pursuant to paragraph 13 of Order 21 of Dockets UE-072300 and UG-072301 (consolidated), Granting in Part, and Denying in Part, Puget Sound Energy's Petition for Waiver and Suspension of Service Quality Index Nos. 6 AND 8 (June 21, 2013)

- **Appendix L: 1997-Current Year PSE SAIFI and SAIDI Performance by Different Measurements**—This appendix presents PSE SAIFI and SAIDI performance from 1997 through the current year using different measurements.
- **Appendix M: Current-Year Commission and Rolling-Two-Year PSE Customer Electric Service Reliability Complaints with Resolutions**—This appendix lists the current-year UTC and rolling two- year PSE customer electric service reliability complaints with resolutions.
- **Appendix N: Areas of Greatest Concern with Action Plan**— This appendix details the areas of greatest concern with an action plan.
- **Appendix O: Current Year Geographic Location of Electric Service Reliability Customer Complaints on Service Territory Map with Number of Next Year's Proposed Projects and Vegetation-Management Mileage**— This appendix illustrates current-year geographic location of electric service reliability customer complaints on service territory map with the number of 2019 and 2020 proposed projects and 2019 vegetation-management mileage.
- **Appendix P: System Planning Budget Process**— This appendix illustrates the System Planning Budget Process from project identification through project completion and post-project reliability improvement verification.

Customer Notice of SQI Performance

Appendix D: **Proposed Customer Notice (Report Card)** is PSE's proposed customer notice of PSE's 2018 SQI performance. After consultation with the UTC staff and Public Counsel, PSE will begin distributing the final SQI report card by June 27, 2019, as part of the customer billing package.

Data and Reporting Issues

There was no data gathering or reporting difficulty in 2018 that impacted the SQI performance categories, or their results, in any way.

Service Quality Program Changes

On December 5, 2017, under the consolidated Dockets UE-170033 and UG-170034 Order 08, the UTC approved the current SQI #5 benchmark of at least 80% of the calls answered in 60 seconds after considering how different communications technology and practice is today relative to 1997 when PSE's SQ program was initiated. To ensure quality customer service, the WUTC also adopted the following requirement:

> "To ensure that this change does not lead to deteriorating service for those customers trying to contact the Company by phone, require PSE report to the Commission after one year of the change in this measure data concerning the customer's experience in contacting the company by phone, through the company's website and through the IVR methodology. Specifically, the Company must file evidence demonstrating that the new standard has not led to a deterioration in service quality and has not led to poorly targeting cost cutting." (Dockets UE-170033 and UG-170034 Order 08, page 79, paragraph 231)

The supplemental report of PSE's evaluation of the customer experience of contacting PSE in 2018 is filed concurrently with this annual Service Quality and Electric Service Reliability Report as Attachment D to the filing. As the analyses presented in the supplemental report, the PSE found no deterioration in service quality because of the SQI #5 benchmark change.

Continuing to Improve Customer Experience

Get to Zero

PSE is continuing a long-term initiative called Get to Zero. PSE's goal for the technology and business processes advanced by the Get to Zero initiative is to anticipate customer needs and provide solutions to address those needs. The Get to Zero initiative further improves customer experience with PSE by providing more self-service options that customers have been requesting, by developing new ways to proactively communicate with customers and by creating seamless, integrated operations to tie PSE's business processes together. Some of the key highlights that were completed within 2018 include:

- **New Website—**The new www.pse.com features a cleaner, more stream-lined look and feel with more self-service options. Now, it's easier than ever for our customers to get the answers they need quickly and easily. In addition to the updated design and simpler layout, the new site has additional features including enhanced communication preferences, budget billing enrollment, and payment arrangement enrollment.

- **New Mobile Application—**The new mobile application allows customers to manage their accounts, review account summaries, make a payment, report an outage, and allows them to start, stop, or move their service.
- **Predictive Interactive Voice Response (IVR)** —The Predictive IVR uses the customer's phone number to check account information for predictive options including Payment Overdue, Ongoing Outage, Service Disconnect, etc.
- **Enhanced Online Bill Payments**—PSE's enhanced debit and credit card payment experience includes a new, simplified user experience with a responsive mobile design, faster posting of payments to customers' accounts (typically within two minutes or less), as well as the ability to contribute to the warm home fund, which is available to all PSE customers.
- **Transitioning to a Mobile Workforce**—Electric Meter Operations and Meter Network Services were transitioned to new mobile tools, allowing them to consolidate existing tools, and begin to move from paper processes to digital forms. This increases the efficiency of field employees and reduces the need for paperwork to be completed within the office.
- **Operational Efficiencies for Work Force Optimization, Scheduling and Customer Appointments**—PSE implemented new work management functionality in order to optimize Meter Operations field employee schedules for tighter customer appointment timeframes, work priority, and drive time reduction.
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CHAPTER 2

CUSTOMER SERVICES, CUSTOMER SATISFACTION AND OPERATIONS SERVICES

PSE has been meeting the Puget Sound region's energy needs for more than 135 years. PSE proudly embraces the responsibility to provide customers with safe, reliable, reasonably-priced energy service.

This section summarizes the 2018 results of PSE's seven service quality indices (SQIs) related to customer services, customer satisfaction and operations services:

- WUTC Complaint Ratio (SQI #2)
- Customer Access Center Answering Performance (SQI #5)
- Customer Access Center Transactions Customer Satisfaction (SQI #6)
- Gas Safety Response Time (SQI #7)
- Field Service Operations Transactions Customer Satisfaction (SQI #8)
- Appointments Kept (SQI #10)
- Electric Safety Response Time (SQI #11)
- Service Provider Performance
- Service Guarantees

WUTC Complaint Ratio (SQI #2)

Table 2a: WUTC Complaint Ratio for 2018

Key Measurement	Type of Metric	Benchmark/Description	2018 Performance Results	Achieved
Customer Satisfaction				
WUTC complaint ratio	**Service Quality Index #2**	**No more than 0.40 complaints per 1,000 customers, including all complaints filed with WUTC**	**0.16**	☑

Overview

Each year the UTC receives complaints from PSE customers on a variety of topics. In 2018, there were a total of 325 complaints, down from 388 in 2017. The 2017 SQI #2 complaint ratio was 0.20, while the 2018 complaint ratio was 0.16.

About the Benchmark

The WUTC complaint ratio is calculated by dividing the sum of all natural gas and electric complaints reported to the UTC by the average monthly number of PSE customers. The quotient is then multiplied by 1,000. The formula follows:

$$WUTC\ complaint\ ratio = \frac{electric\ and\ natural\ gas\ complaints\ recorded\ by\ WUTC}{average\ monthly\ number\ of\ electric\ and\ natural\ gas\ customers} \ X\ 1{,}000$$

The average monthly customer count is the average of the total number of PSE customers, per month, during the reporting period.

Going Forward

PSE will continue identifying potential issues that could trigger customer complaints. The focus is on prevention of the cause of these issues through timely and accurate support for each customer. Areas of focus for 2019 include:

- Continue to focus on the UTC "Consumer Upheld" complaint dispositions to identify root cause, to establish preventive and corrective actions, and follow-up to determine the effectiveness of the actions.
- Continue to improve PSE's company-wide customer experience by using knowledge gained in managing escalated complaints for training and education of others in PSE.
- Continue to work with the UTC staff to make complaint response and resolution processes more efficient for the UTC and PSE.

Customer Access Center Answering Performance (SQI #5)

Table 2b: Customer Access Center Answering Performance for 2018

Key Measurement	Benchmark	2018 Performance Results	Achieved
Customer Service			
Customer Access Center answering performance (SQI #5)	**At least 80% of calls answered by a live representative within 60 seconds of request to speak with live operator**	**81%**	☑

Overview

PSE's Customer Care Center (i.e. Customer Access Center) receives all of PSE's customer general inquiries and typically represents PSE to customers. Customers calling PSE have the option of going into an Interactive Voice Response (IVR) system where they are able to perform self-serve transactions or to speak with a representative. PSE's customer service representatives (CSRs) answer calls promptly providing customers with the information or assistance they require, including natural gas and electric emergencies.

For effective starting from the SQ Program performance year 2018, the revised Service Quality Program's benchmark for the Customer Care Center's call answering performance is to answer at least 80% of calls within 60 seconds on an annual basis. This goal is achieved through training on quality, efficient call handling and adherence to CSR performance expectations.

The old benchmark, which was set in 1997 before the technology for the current customer contact channels became mature, is to answer at least 75% of calls within 30 seconds. The WUTC approved the revisions to the legacy benchmark after considering how different communications technology and practice is today relative to two decades ago. Attachment D to this 2018 annual UTC SQ and Electric Service Reliability Report filing is the supplemental report of PSE's evaluation of the change in customer's experience of contacting PSE because of the SQI #5 benchmark revision. The supplement report substantiates the improvement in the customer's PSE call center contact experience and demonstrates that is no deterioration in customer service quality because of the change of SQI #5 call center service level benchmark.

In 2018, the CSRs answered 81 percent of the calls within 60 seconds of customer requests.

About the Benchmark

The Customer Care Center call answering performance is measured from the time the customer initiated a request to speak with a CSR until a CSR arrived on the line. The annual performance is determined by the average of the 12 monthly call answering performance percentages. The calculation of the monthly answering performance is demonstrated through the following formula:

$$\textit{Monthly call answering performance} = \frac{\textit{aggregate number of calls answered by a company rep within 60 seconds}}{\textit{aggregate number of calls received}}$$

Busy Calls

PSE's phone system is configured with a backup system to handle overflow customer calls to 1-888-Call-PSE. Overflow calls from PSE's main IVR system are routed to a separate IVR system provided by PSE's phone service vendor that enables customers to contact PSE through a different channel. All 2.6 million calls received in 2018 to 1-888-Call-PSE went through either the main phone system or the overflow phone backup system.

Going Forward

PSE is engaged in initiatives to further the Customer Care Center's answering performance and ensure that the new SQI #5 benchmark of 80% of calls being answered within 60 seconds will be achieved. In 2019, PSE will:

- Continue to deliver on-going agent training to improve proficiency and elevate the customer experience
- Through the Get to Zero initiative, continue to improve self-service options and allow the customers to complete various transactions online, 24 hours a day.
- Continue to improve processes to optimize efficiency and leverage the information systems and technology.
- Continue to improve the quality of each customer contact through the ongoing collaboration within the Customer Care Center.
- Continue to improve upon the debt collection and disconnection processes to ensure the customer is well served as sound business practices are followed.

Customer Access Center Transactions Customer Satisfaction (SQI #6)

Table 2c: Customer Access Center Transactions Customer Satisfaction for 2018

Key Measurement	Type of Metric	Benchmark/Description	2018 Performance Results	Achieved
Customer Satisfaction				
Customer Access Center transactions customer satisfaction	**Service Quality Index #6**	**At least 90% satisfied (rating of 5 or higher on a 7-point scale)**	**94%**	☑

Overview

Most of the telephone calls to PSE's general customer help phone number 1-888-CALL-PSE are handled by PSE's Customer Care Center (i.e. Customer Access Center). EMC Research, an independent research company for PSE's Service Quality Program[12], conducted telephone surveys with PSE customers and prepared monthly and semi-annual reports on customer satisfaction regarding Customer Access Center transactions during the 2018 SQ Program reporting year. The independent survey-results found that 94% of customers surveyed were satisfied with the Customer Access Center's overall transaction performance (SQI #6). This is an improvement of 1% from 2017.

About the Benchmark

An independent research company conducts phone surveys to customers who have made calls to PSE and asks the following questions:

> "Overall, how would you rate your satisfaction with this call to Puget Sound Energy? Would you say 7-completely satisfied, 1-not at all satisfied or some number in between?"

A customer is considered to be satisfied if they responded 5, 6 or 7. The annual performance is determined by the weighted monthly average percent of satisfied customers. The formula for the monthly percentage follows:

$$\textit{Monthly percentage of satisfied customers} = \frac{\textit{aggregate number of survey responses of 5, 6 or 7}}{\textit{aggregate number of survey responses of 1, 2, 3, 4, 5, 6 or 7}}$$

[12] Per Order 21 in Dockets UE-072300 and UG-072301 (consolidated) issued by WUTC on April 8, 2013, EMC Research Inc. has been the exclusive survey company conducting and preparing the survey results for SQI #6 and #8. The methodology and procedures used by EMC Research Inc. was validated by Dr. MacLachlan of University of Washington as "being of high validity and reliability" as indicated in the Attachment A to PSE's compliance filing under Order 21 on June 21, 2013.

Going Forward

PSE recognizes that continuous improvements are required to maintain customer satisfaction.

- PSE will continue to focus on improvement in customer satisfaction through quality assurance processes as well as on-going training and customer initiatives.

Gas Safety Response Time (SQI #7)

Table 2d: Gas Safety Response Time for 2018

Key Measurement	Type of Metric	Benchmark/Description	2018 Performance Results	Achieved
Operations Services				
Gas Safety Response Time	**Service Quality Index #7**	**Average 55 minutes or less from customer call to arrival of field technician**	**30 minutes**	☑

Overview

The primary responsibility of PSE's Gas First Response (GFR) team is to respond to natural gas emergencies. In 2018, PSE responded to more than 21,000 emergency calls concerning natural gas safety. These emergencies include reports of odors, third-party damage to PSE's system, and leaks and carbon monoxide concerns. The GFR team also supports local and state first-response organizations, such as fire departments. PSE has GFR personnel located throughout its service territory. These responders are available on a 24/7/365 basis.

In addition to responding to natural gas emergencies, the GFR team performs various natural gas system maintenance and inspection activities, adjusts and performs minor repairs on customer equipment and monitors construction excavation when it occurs near certain underground facilities.

About the Benchmark

The natural gas safety response time is calculated by logging the time each customer service call is created and the time the natural gas field technician arrives on site. The calculated response time for each service call is averaged for all emergency calls during the performance year to determine the overall annual performance.

$$\textit{Gas safety response time annual performance} = \frac{\textit{sum of all natural gas emergency response times}}{\textit{annual number of natural gas emergency calls received}}$$

Going Forward

- All of our major processes in strategic response to emergencies are being assessed and improved where possible as PSE ramps toward going live with Integrated Work Management tools for Gas First Response in 2019.

Field Service Operations Transactions Customer Satisfaction (SQI #8)

Table 2e: Field Service Operations Transactions Customer Satisfaction for 2018

Key Measurement	Type of Metric	Benchmark/Description	2018 Performance Results	Achieved
Customer Satisfaction				
Field Service Operations transactions customer satisfaction	**Service Quality Index #8**	**At least 90% satisfied (rating of 5 or higher on a 7-point scale)**	**95%**	☑

Overview

EMC Research[13], an independent research company, conducts telephone surveys with PSE customers who have requested and received natural gas field service. In 2018, these surveys found that 95% of customers were satisfied with PSE's field service operations transaction performance.

About the Benchmark

Every week, EMC Research contacts randomly-selected customers who have called PSE the previous week and received natural gas field service. The firm prepares monthly and semi-annual reports on PSE's field service operations transaction performance.

Customers are asked a number of questions including the following question for the purpose of SQI #8:

> "Thinking about the entire service, from the time you first made the call until the work was completed, how would you rate your satisfaction with Puget Sound Energy? Would you say 7- completely satisfied, 1- not at all satisfied or some number in between?"

A customer is considered to be "satisfied" if they responded 5, 6 or 7.

The annual performance is determined by the weighted monthly average of percent of satisfied customers. The formula for the monthly percentage follows:

$$\textit{Monthly percent of satisfied customers} = \frac{\textit{aggregate number of survey responses of 5, 6 or 7}}{\textit{aggregate number of survey responses of 1, 2, 3, 4, 5, 6 or 7}}$$

[13] SQI-related customer surveys were conducted with applicable guidelines and the results are unbiased and valid in accordance with the survey procedures established in consolidated Dockets UE-011570 and UG-011571. EMC Research and the survey procedures used by EMC Research met these guidelines as detailed in PSE's compliance filing pursuant to the paragraph 13 of Order 21 of Dockets UE-072300 and UG-072301 (consolidated), Granting in Part, and Denying in Part, Puget Sound Energy, Inc's Petition for Waiver and Suspension of Service Quality Index Nos. 6 AND 8 (June 21, 2013).

Going Forwardl

- IWM will be introduced to GFR in 2019 and will make response to customer calls more streamlined and efficient.

Appointments Kept (SQI #10)

Table 2f: Appointments Kept for 2018

Key Measurement	Type of Metric	Benchmark/Description	2018 Performance Results	Achieved
Operations Services				
Appointments kept	**Service Quality Index #10**	**At least 92% of appointments kept**	**100%**[14]	☑

Overview

PSE provides its customers with a variety of scheduled service appointments including:

- **Permanent service**—Permanent natural gas service from an existing main or permanent electric secondary voltage service from existing secondary lines
- **Reconnection of existing service**—Reconnection following move-out, move-in or disconnection for non-payment
- **Natural gas diagnostic service request**—For water heater, furnace checkup, furnace not operating, other diagnostic or repair or follow-up appointments

Service appointments that involve safety do not require scheduling and are performed on a 24/7/365 basis. These non-scheduled services include restoring electric service or responding to a reported gas odor.

When a natural gas or electric customer requests a scheduled field service, PSE provides the customer with either a guaranteed appointment date and time-frame or a guaranteed commitment to provide service on or before a specified date.

In 2018, PSE achieved a result of 100% for this appointments kept metric. Data on missed appointments and other appointment information by service type is detailed in Appendix F: *Customer Service Guarantee Performance Detail.*

[14] Results shown are rounded from 99.5% to the nearest whole percentage per UTC order. However, the 100% 2017 annual performance result does not reflect that PSE and its service providers met all the appointments during the reporting period. Numbers of missed appointments by appointment type are detailed in Appendix F: *Customer Service Guarantee Performance Detail.*

About the Benchmark

The appointments kept SQI is calculated by dividing the number of appointments kept by the total number of appointments made. The formula follows:

$$Appointments\ kept = \frac{annual\ appointments\ kept}{annual\ appointments\ missed + annual\ appointments\ kept}$$

Appointments are considered missed when PSE does not arrive during the time period or on the agreed upon date except when the appointments have been missed due to the following reasons:

- The customer fails to keep the appointment
- The customer calls PSE to specifically request the appointment be rescheduled
- PSE reschedules the appointment because conditions at the customer site make it impractical to perform the service
- The appointment falls during an SQI Major Event[15] period

These types of appointments are not considered missed appointments but "excused" appointments.

Appointments that were canceled by the customer, regardless of the customer's reason, will be considered "canceled" appointments.

Excused and canceled appointments are not counted as either kept or missed appointments.

Additional appointments to complete repairs are considered new appointments.

Going Forward

In 2018 PSE will focus on the following:

- Continue to review the reasons for missed appointments and work to find solutions so that PSE can meet all its customer commitments
- Continue to evaluate tools and technologies that would enable a higher level of customer service and convenience through PSE's Get to Zero initiative by offering better ways for self-service options, including scheduling of field services

[15] Major Event Days when 5% or more electric customers are without power during a 24 hour period and associated carry-forward days that it will take to restore electric service to these customers, which are excluded from the performance calculations of SQI #4-SAIFI and SQI #11-Electric safety response time.

Electric Safety Response Time (SQI #11)

Table 2g: Electric Safety Response Time for 2018

Key Measurement	Type of Metric	Benchmark/Description	2018 Performance Results	Achieved
Operations Services				
Electric Safety Response Time	**Service Quality Index #11**	**Average 55 minutes or less from customer call to arrival of field technician**	**52 minutes**	☑

Overview

PSE responded to more than 15,000 electric incidents in 2018. PSE's Electric First Response (EFR) team has the primary responsibility of responding to electric outages and electric emergencies. Examples of the types of outages and emergency events that PSE responds to include: downed wires, equipment failures, car-pole accidents, bird and animal-related outages, trees or limbs on lines, third-party dig-ins, etc.

EFR personnel are located throughout PSE's service territory and are available to respond on a 24/7/365 basis. EFR's priority is to ensure public and worker safety and then to restore service to customers. After addressing safety concerns, service restoration is made through temporary or permanent repairs or reconfiguration of the electric system. If the repair is beyond the capability of EFR personnel, construction crews are called in to make permanent repairs.

About the Benchmark

The electric safety response time for emergency incidents is calculated by logging the time of each customer service call and the time the EFR personnel arrives on site. The annual performance is determined by the average number of minutes from the time a customer calls to the arrival of the EFR personnel for electric safety incidents occurring during the performance year. The formula follows:

$$\textit{Annual electric safety response time} = \frac{\textit{sum of all response times}}{\textit{annual number of electric safety incidents}}$$

Certain incidents are excluded from the measurement if they occurred during the following days:

- Major Event Days when 5% or more electric customers are without power during a 24-hour period and associated carry-forward days that it will take to restore electric service to these customers.
- Localized emergency event days when all available EFR in a local area are dispatched to respond to service outages or safety incidents.

Going Forward

In 2019, PSE will continue its efforts to reduce electric safety incident response time. The efforts include:

- PSE will continue to evaluate staffing levels to ensure adequate support and response.
- The ongoing deployment of PSE's 'Advanced Metering Infrastructure' over the next several years will improve customer outage confirmation capability.

Service Provider Performance

Table 2h: Service Provider Performance for 2018

Key Measurement	Type of Metric	Benchmark/Description	2018 Performance Results	Achieved
Customer Services and Satisfaction and Operations Services				
Service provider standards compliance—Quanta Electric	**Service Provider Index #1B**	**Level 1 ≤ 15 dev/1000 Level 2 ≤ 25 dev/1000 Level 3 ≤ 25 dev/1000**	**Level 1 6.70 Level 2 12.40 Level 3 10.53**	☑
Service provider standards compliance—Quanta Gas	**Service Provider Index #1C**	**Level 1 ≤ 8 dev/1000 Level 2 ≤ 15 dev/1000 Level 3 ≤ 12 dev/1000**	**Level 1 4.11 Level 2 7.33 Level 3 2.71**	☑
Service provider appointments kept—Quanta Electric	**Service Provider Index #3B[16]**	**At least 92% of appointments kept**	**99%**	☑
Service provider appointments kept—Quanta Gas	**Service Provider Index #3C**	**At least 92% of appointments kept**	**99%**	☑
Secondary safety response time—Quanta Gas	**Service Provider Index #4D**	**Within 60 minutes from first response assessment completion to second response arrival**	**48 minutes**	☑
Secondary Core-Hours, Non-Emergency Safety Response and Restoration Time—Quanta Electric	**Service Provider Index #4B**	**Within 250 minutes from the dispatch time to the restoration of non-emergency outage during core hours**	**249 minutes**	☑
Secondary Non-Core-Hours, Non-Emergency Safety Response and Restoration Time—Quanta Electric	**Service Provider Index #4C**	**Within 316 minutes from the dispatch time to the restoration of non-emergency outage during non-core hours**	**263 minutes**	☑

[16] There were no results for Service Provider Indices (SPI) #1A, #2A, #3A and #4A. These indices were assigned to a service provider, Pilchuck that no longer works for PSE. PSE transitioned all natural gas construction and maintenance work to Quanta Gas as of April 30, 2011. Service Provider Indices #2B and #2C, Service Provider Customer Satisfaction, Quanta Electric and Quanta Gas, respectively, which were applicable in prior years' reports, have been terminated since the 2013 reporting period.

Overview

This section details the service provider metrics relevant to PSE's SQ Program. PSE monitors and assesses the performance of its primary natural gas and electric service providers (Quanta Gas and Quanta Electric). The metrics addresses PSE standards compliance, new construction service appointments, and safety response and restoration time. Each measure is designed to monitor and improve PSE's service.

About the Benchmark

- **Service Provider Standards Compliance (SPI #1)**—Service providers must achieve a level of conformance to PSE standards, where the metric is segregated across three relative risk levels assigned to the construction inspection items to support the establishment of continuous improvement activities according to risk. These levels are as follows:
  - Quanta Gas
    - For Level 1 inspection items: ≤ 8 deviations/1000 items inspected
    - For Level 2 inspection items: ≤ 15 deviations/1000 items inspected
    - For Level 3 inspection items: ≤ 12 deviations/1000 items inspected
  - Quanta Electric
    - For Level 1 inspection items: ≤ 15 deviations/1000 items inspected
    - For Level 2 inspection items: ≤ 25 deviations/1000 items inspected
    - For Level 3 inspection items: ≤ 25 deviations/1000 items inspected
- **Service Provider New Customer Construction Appointments Kept (SPI #3)**—Quanta Gas and Quanta Electric must keep at least 92% of their new customer construction appointments.
- **Secondary Safety Response Time (SPI #4)**—This SPI consists of three sub-indices:
- **Service Provider Indices #4B and #4C**—Quanta Electric's secondary safety response and restoration time during core and non-core hours, respectively. Quanta Electric must respond and complete power restoration in less than 250 minutes on average during core hours and less than 316 minutes on average during non-core hours. Core hours are 7:00 a.m.–3:30 p.m., Monday through Friday, except holidays. Restoration time is measured from the time a Quanta Electric crew is dispatched to the time the problem causing the interruption has been resolved and the line has been re-energized. Both the core-hours and non-core-hours measurements exclude emergency events and significant storm events.
- **Service Provider Index #4D**—Secondary safety response time—Quanta Gas. Quanta Gas must respond within 60 minutes on average from PSE's Gas First Response assessment completion to the service provider's secondary response arrival.

Service Provider Appointments and Related Penaltie

Table 2i shows the number of new customer construction appointments completed by PSE service providers and the amount of penalties paid due to missed appointments.

Table 2i: 2018 Service Provider Appointments and Missed Appointment Penalties for 2018

Service Provider Appointments				Missed Appointment Penalties		
Service Provider	Electric	Natural Gas	Total	Electric	Natural Gas	Total
Quanta Gas	N/A	10,310	10,310	N/A	$15,100	$15,100
Quanta Electric	9,230	N/A	9,230	$4,150	N/A	$4,150
Total	***9,230***	***10,310***	***19,540***	***$4,150***	***$15,100***	***$19,250***

Going Forward

PSE and our service providers will continue the following initiatives for 2019:

- Identify areas of improvement to meet core-hour benchmark of 250 minutes
- Partner with large municipalities to improve the permitting process
- Identify and implement improvements to customer scheduling for new construction

Service Guarantees

Overview

PSE offers two types of service guarantees to its customers: Customer Service Guarantee (Service Guarantee #1) for a scheduled appointment and Restoration Service Guarantees (Service Guarantee #2 and Service Guarantee #3) for electric service restoration.

PSE promotes its Customer Service Guarantee and the Restoration Service Guarantees on pse.com, the back of billing stock, and on the billing/return envelope. It is also highlighted in the customer newsletter[17] as part of customer bill inserts. These promoting efforts are detailed in Appendix F: Customer Service Guarantee Performance Detail.

PSE also surveys its customers monthly about the Customer Service Guarantee. Appendix G discusses the ways PSE has made customers aware of its Customer Service Guarantee and the results of the customer awareness survey.

Customer Service Guarantee

The Customer Service Guarantee (CSG) is designed to give customers a $50 missed appointment credit if PSE or its service providers fail to arrive by the mutually agreed upon time and date to provide one of the following types of service:

- **Permanent service**—Permanent natural gas service from an existing main or permanent electric secondary voltage service from existing secondary lines
- **Reconnection**—Reconnection following move-out, move-in or disconnection for non-payment
- **Natural gas diagnostic service request**—For water heater, furnace checkup, furnace not operating, other diagnostic or repair or follow-up appointments

This service appointment guarantee applies in the absence of Major Storms, earthquakes, supply interruptions or other adverse events beyond PSE's control. In these cases, PSE will reschedule service appointments as quickly as possible.

The number of CSG by energy, service type, and month is detailed in Appendix F: *Customer Service Guarantee Performance Detail.* For additional details on the promotion and communication of CSG, see Appendix G: *Customer Awareness of Service Guarantee.*

[17] SQI settlement requirement: "A promotion of the customer service guarantee will be included in the customer newsletter, "EnergyWise," at least three times per year."

Restoration Service Guarantees

PSE has two Restoration Service Guarantees (RSG) under the conditions of electric Schedule 131 that provides a $50 credit to a qualified customer who experiences a prolonged outage during a non-storm outage for more than 24 consecutive hours or is out of electric service for at least 120 consecutive hours for any outage. To receive the RSG credit, affected customers must report the outage or request the credit within seven days of their service restoration. The 120-hour Restoration Service Guarantee has been effective since November 1, 2008. The 24-hour Restoration Service Guarantee became effective on January 1, 2017, which was established to replace the SQI #3 SAIDI penalty mechanism.

Both Restoration Service Guarantees will be suspended if PSE lacks safe access to its facilities to perform the needed repair work. To receive either or both the service guarantee payments, affected customers must report the outage or apply within 7 days after the restoration of their electric service.

The maximum credit payment to customers for the 120-hour Restoration Service Guarantee is $1.5 million. There is no limit of PSE's 24-hour Restoration Service Guarantee credit payment to customers.

The availability of the 120-hour Restoration Service Guarantee is emphasized and messaged in PSE's phone system when customers call and report their outage during a major outage event, when 5% or more PSE electric customers are without power, or when PSE opens its Emergency Operations Center in response to a significant outage event.

2018 Service Guarantees Credits

Customer Service Guarantee Credits

In 2018, PSE credited customers a total of $24,450 for missing 489 of the 107,3295 SQI #10 appointments. Table 2j provides summary values of Service Guarantee counts and payments to customers in 2018 by service type.

Table 2j: 2018 PSE SQI #10 Appointment Count and Customer Service Guarantee Credits

	SQI #10 Appointment Counts			Customer Service Guarantee Payments to Customers		
Service Type	Electric	Natural Gas	Total	Electric	Natural Gas	Total
Permanent Service	9,230	10,310	19,540	$4,150	$15,100	$19,250
Reconnection	47,515	17,483	64,998	$2,700	$550	$3,250
Diagnostic	N/A	22,791	22,791	N/A	$1,950	$1,950
Total	***56,745***	***50,584***	***107,329***	***$6,850***	***$17,600***	***$24,450***

Appendix F: *Customer Service Guarantee Performance Detail* provides additional detail on missed appointments along with the credits paid by month and appointment service type as of December 31, 2018.

Restoration Service Guarantee Credits

PSE is committed to reviewing all prolonged outages that may trigger the Restoration Service Guarantees and any customer requests for the RSG credit within 30 days of a request. The following table summarizes payments to customers in 2018.

Key Measurement	Type of Metric	Benchmark/Description	No. of Customers	Restoration Service Guarantee Payments to Customers
120-Consecutive – hour power outage restoration guarantee	**Service Guarantee #2**	**A $50 credit to eligible customers when experienced a power outage is longer than 120 consecutive hours**	**1**	**$50**
24-Consecutive-hour non-major storm power outage restoration guarantee	**Service Guarantee #3**	**A $50 credit to eligible customers when experienced a power outage is longer than 24 consecutive hours during non-major storms**	**29**	**$1,450**
Total			***30***	***$1,500***

CHAPTER 3

ELECTRIC SERVICE RELIABILITY

Safe and reliable electric service is one of PSE's paramount goals. This report defines what electric system reliability is at PSE and provides the Washington Utilities and Transportation Commission (UTC) and customers with reliability metrics on the services that PSE provides its customers. Information on electric reliability is provided by the commonly used reliability metrics and by PSE's resolution of customer concerns. The two commonly used reliability metrics are System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI). Customer concerns about electric service quality and reliability are received either directly by PSE or through the UTC. Reporting of these customer concerns and PSE's resolution provides another important perspective of electric reliability.

PSE follows SQI #3 (SAIDI) and #4 (SAIFI) as part of the indicators of reliability improvement progress and understands that there are variations such as weather which impact the results. PSE has a long term strategy to focus on reliability and this report details PSE's current progress and roadmap to improve reliability for customers.

PSE believes electric service reliability performance should be looked at from multiple lenses in addition to the system-wide SAIDI and SAIFI over a single year's time frame. PSE's reliability strategy roadmap includes expanding lenses to include reliability metrics beyond the system-wide SAIDI and SAIFI by further evaluating Customers Experiencing Multiple Interruptions (CEMI), reviewing econometric based targets, Momentary Average Interruption Frequency Index (MAIFI), as well as individual customer reliability to ensure a more comprehensive view of overall electric service reliability performance. This multiple lenses approach is in recognition that there is more than one consideration, metric and method for which reliability performance can be solely based upon.

While this annual report provides useful information to interested parties for a given calendar year, a single year's result may not lend to adequate identification of the best solution for long-term electric system improvement, and the actions taken based on an annual snapshot may result in Band-Aid solutions that may not meet long-term objectives. Factors such as variation in weather, service territory change[18] and random events (e.g. third-

[18] Prior to April 1, 2013, PSE provided electric service to Jefferson County. On April 1, 2013, the government of Jefferson County assumed responsibility for the electric service in the county.

party damage) will all impact year-to-year comparison of system performance. Notwithstanding the limits of using the annual reports to assess year-to-year trends, PSE believes the annual snapshots provide a useful lens to consider in context of the overall electric system performance trends. PSE serves approximately 1.1 million electric customers across an eight county geographical area. Refer to Appendix O: *Current Year Geographic Location of Electric Service Reliability Customer Complaints on Service Territory Map with Number of Next Year's Proposed Projects and Vegetation Management Mileage* for a map of the electric service area. More information about PSE's infrastructure can be found at PSE.com[19].

SQI Performance

The following sections detail PSE's SQI #3 (SAIDI) and #4 (SAIFI) performance and discuss the annual reliability reporting requirements and results for the 2018 reporting year. Based on the recorded outages, both SQI SAIDI and SQI SAIFI saw an improvement in 2018 as compared to 2017, 17% and 15% respectively, as illustrated in Table 3a. PSE met the benchmark for both SQI #3 and #4.

Table 3a: 2017 and 2018 SQI #4 SAIFI and SQI #3 SAIDI Annual Results

	Benchmark	2017	2018
SQI #4 SAIFI	**1.30**	**1.20**	**1.02**
SQI #3 SAIDI	**155**	**175**	**145**

2018 Weather Events

Weather events continue to impact overall reliability performance and are a key contributing factor PSE considers as one lens to evaluate reliability. PSE utilizes "Total" electric reliability performance information which includes "storm" days, in addition to "blue-sky" days which excludes these storm days. PSE recognizes that customer expectations may be different during these storms versus a blue-sky day, and as such both storm and non-storm information continues to be a focus.

PSE experienced four significant weather events during 2018: one each in January and February, and two in December. Three of the four events met the exclusion criteria for SQI #4 (SAIFI) and all four events met the exclusion criteria for SQI #3 (SAIDI). One of the days in the second December event, December 20th, meets the definition of a catastrophic event day. During the course of the event, approximately 282,000 customers were without power.

Long-Term Electric Service Reliability Strategy

The electric service reliability targets are used as a guideline for a reasonable level of reliability. In addition, PSE has also tracked industry metrics through the Institute of Electrical and Electronics Engineers (IEEE) Reliability

[19] https://pse.com/aboutpse/CorporateInfo/Pages/PSE-Primer.aspx

Benchmarking Survey[20] to measure how performance aligns with industry. In 2017, PSE added analysis information from the econometric benchmarking study initiated by UTC staff as well as data from the Interruption Cost Estimate (ICE) calculator[21] to come up with new targets for system-wide SAIDI and SAIFI reliability metrics. The analysis suggested that achieving a SAIDI of 120 – 130 and maintaining SAIFI at 1.00 – 1.15 should be PSE's primary focus over the next five years and achieving first quartile performance should be a long-term target.

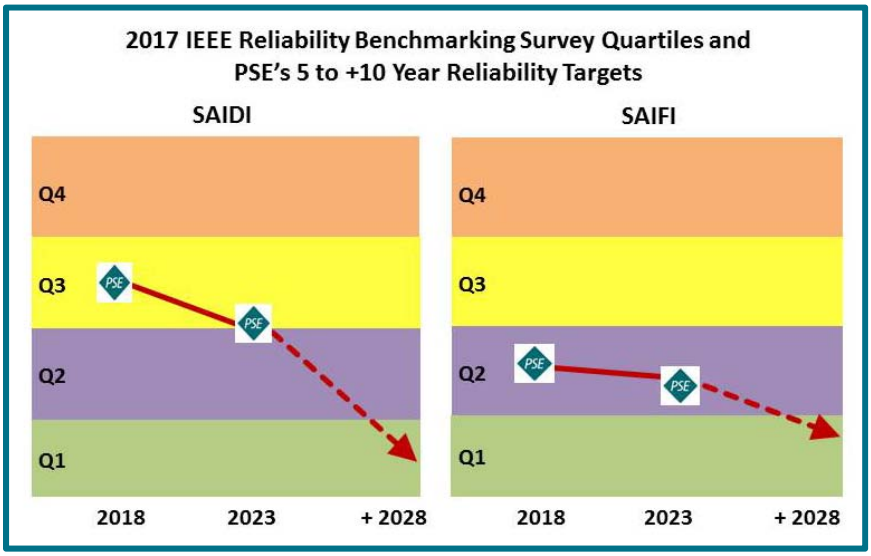

Figure 3a: PSE's 5 to +10 Year Reliability Targets

PSE does not believe system level performance or targets provide the clarity or vision of what customers expect for reliability and therefore PSE is developing targets for individual customer reliability in addition to the system targets. To address reliability at both customer and system levels, PSE is focusing on improving the reliability culture, electric system design, data analysis, new metrics and incorporating emerging technologies. PSE's reliability strategy moving forward and details on these strategies can be found in the Going Forward– Action Plan for 2019 to 2023 discussion in the *Working to Improve Reliability* section.

[20] Refer to the IEEE Reliability Benchmarking Survey discussion in the *About Electric Service Reliability Measurements and Baseline Statistics* section for more information

[21] The Interruption Cost Estimate (ICE) Calculator is a tool estimating electric service interruption costs. It was funded by the Office of Electricity Delivery and Energy Reliability at the U.S. Department of Energy and developed by Freeman, Sullivan & Co. and Lawrence Berkeley National Laboratory.

About Electric Service Reliability Measurements and Baseline Statistics

Overview

PSE, like most electric utilities, uses industry standard electric service system-wide reliability indices, SAIFI and SAIDI, to monitor its annual performance. PSE reports the SAIFI and SAIDI performance results in many key measurements, which provide a more complete representation of the overall electric customer service reliability. The standard formulas, as noted in Appendix H: *Electric Terms and Definitions*, are used to calculate each of the measurements but with one critical difference that showcases a particular area of electric service reliability performance. Each measurement is based on specific criteria, as noted in the respective SAIFI (SQI #4) and SAIDI (SQI #3) sections.

In addition to system-wide reliability metrics, PSE has begun tracking customer level reliability. Beginning in 2019, PSE will be providing CEMI data and using this information to identify pockets of customers experiencing poor reliability that may not be visible when focusing on system-wide or circuit level reliability.

Baseline Year

To meet UTC requirements[22], PSE established 2003 as its baseline year. While meeting the requirements, PSE would prefer to develop a baseline using multiple years, which mitigates the fluctuation of reliability statistics and proves more useful in trend analysis. PSE recommends using multi-year trends in addition to multiple lenses to be more aligned with industry best practices to evaluate overall reliability performance, such as a five-year average. An attempt to use a single year's system performance data or information to assess year-to-year trends may prove inconclusive. PSE believes that there is limited usefulness in designating one specific year's information as a "baseline." Also, comparing current year results to a 15-year old baseline year that was established based on different outage data collection methods and changing customer expectations is not meaningful.

[22] WAC 480-100-393, Electric service reliability monitoring and reporting plan, (b) When the utility will establish baseline reliability statistics to report to the commission. Prior to establishing baseline reliability statistics, the utility must report the best information available. The utility must establish baseline reliability statistics within three years of the effective date of this rule.

IEEE Reliability Benchmarking Survey

Annually, PSE participates in a benchmarking survey coordinated by IEEE. IEEE collects information from participating utilities and documents the IEEE Standard 1366[23] performance on an individual utility ranking (#1 being the best) and within four quartiles (first quartile being the best). This survey is used as one lens through which PSE looks to help establish reliability targets. As the survey does not account for differences in utility characteristics it is not a fair comparison of performance between utilities and therefore should only be one of many data points used when developing reliability targets. It is important to note that since participation is voluntary, the number of utilities that participate varies from year to year. While there are guidelines for how to provide the outage data, how each utility tracks its outages can, and does, create inconsistencies in the results. It is also important to note that the IEEE survey does not adjust its methodology for catastrophic event days. Therefore, PSE's annual performance in the IEEE survey versus the SQI SAIDI results could be different.[24] IEEE conducts the annual survey in the spring of each year with results available in late summer for the outages that occurred in the preceding year. Due to the timing of the survey, there is a year time-lag in reporting PSE's annual rank. In the 2017 IEEE survey of 95 member utilities, PSE ranked 65th (3rd quartile) in SAIDI and 53rd (3rd quartile) in SAIFI. PSE remained in the same quartile for SAIDI as 2016 and moved to the 3rd quartile for SAIFI.

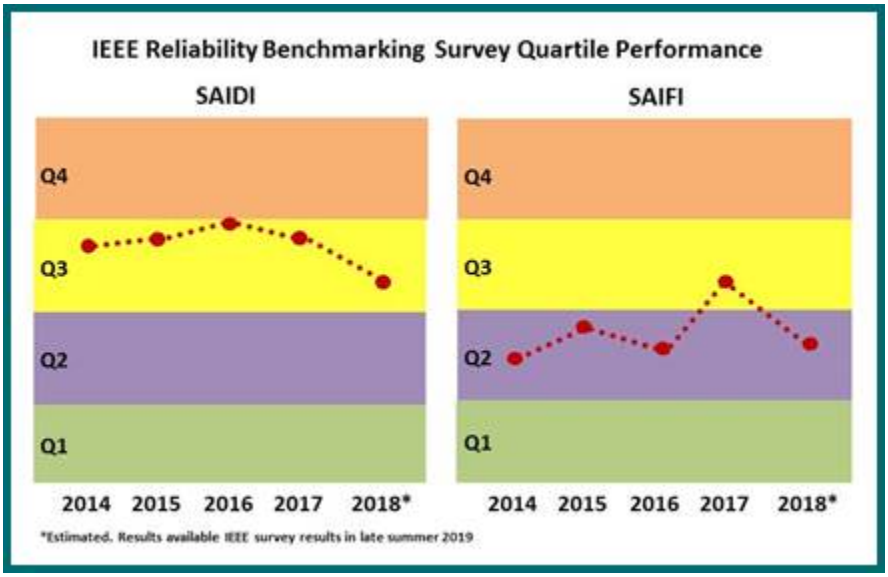

Figure 3b: IEEE Reliability Benchmarking Survey Quartile Performance

[23] Refer to Appendix H: *Terms and Definitions* for the IEEE Standard 1366 definition.

[24] Refer to the Major Events discussion for more information

Major Events

PSE has multiple major event definitions that apply to SAIFI (also referred to as 5% SQI Exclusion) or SAIDI metrics. For SAIFI, major events are defined as days when 5% or more of the electric customer base in a 24-hour period experiences power interruption and the days following (carried-forward days), until all those customers have service restored. The days that meet that criterion are excluded from that metric.

For the purpose of measuring SQI SAIDI, days that exceed the annual adjusted Major Event Day Threshold are excluded from the performance calculation. Starting in the 2016 reporting year, PSE's SQI SAIDI calculation is based on the industry standard IEEE 2.5 Beta methodology and PSE is allowed to adjust catastrophic days. A catastrophic day is defined as any day that exceeds the 4.5 Beta threshold. In addition, PSE also calculates SAIDI using the IEEE 1366 2.5 Beta methodology without adjusting for catastrophic days, referred to IEEE SAIDI. More information concerning these metrics, definitions and calculations can be found the About the Benchmark discussion in the *SQI #4 SAIFI and SQI #3 SAIDI* sections of this report.

In 2018, PSE experienced the following major storm events that met the SQI SAIDI, 5% SQI exclusion, or the IEEE Standard 1366 exclusion criteria:

- A January event that affected customers in Thurston County.
- A February event that affected customers throughout PSE's Western Washington service territory except for the northern part of King County and Pierce County.
- A mid-December event that affected customers throughout all of PSE's service territory.
- A second December event that affected customers throughout PSE's Western Washington service territory.

Table 3b, on the following page, details the dates, causes and exclusion criteria for the SQI SAIDI, IEEE, and 5% exclusion events in 2018. Typically, an event that meets the 5% Exclusion Major Event Day criteria will also exceed the SQI SAIDI T_{MEDADJ} and IEEE T_{MED} criteria. Since the initial reporting of the IEEE methodology in 2003, all 5% Exclusion Major Event Days have met the IEEE T_{MED}. With the addition of reporting SQI SAIDI events in 2017, all 5% Exclusion Major Event Days met the SQI SAIDI T_{MEDADJ} as well.

IEEE T_{MED} and SQI SAIDI are based on the customer minutes rather than the number of customers impacted. Therefore, if PSE experiences a storm event that is isolated to a small geographic area or a less populated county, it is possible that events exceed the IEEE T_{MED} and SQI SAIDI but not meet the 5% exclusion criteria. In 2018, one of the IEEE T_{MED} and SQI SAIDI events did not meet the 5% Exclusion Major Event Day criteria.

Table 3b: 2018 SQI SAIDI, IEEE T_{MED} and SQI SAIFI Exclusion Events

SQI SAIDI Exclusion Date	IEEE T_{MED} Exclusion Date	Daily SAIDI	Exceed TCAT	5% Customers Out SAIFI Exclusion	Cause	Span of 5% Customers Out Exclusion Period
1/27/2018	1/27/2018	7.89	--	n/a	Wind	n/a
2/17/2018	2/7/2018	16.50	--	7.34%	Wind, Snow	2/17/2018 11:00 AM - 2/20/2018 11:00 PM
2/18/2018	2/18/2018	31.13	--			
12/14/2018	12/14/2018	42.30	--	11.81%	Wind	12/14/2018 4:00 PM - 12/17/2018 2:00 AM
12/20/2018	12/20/2018	174.63	☑	21.07%	Wind	12/20/2018 8:00 AM - 12/27/2018 12:00 PM
12/21/2018	12/21/2018	15.33	--			

Table 3c details the threshold values and number of major events IEEE SAIDI and 5% SQI exclusion from 2014 through 2018 and the 2017 through 2018 SQI SAIDI threshold values and number of events for major and catastrophic events.

Table 3c: Comparison of the threshold values and major events

	2014	2015	2016	2017	2018
SQI SAIDI T_{MEDADJ}	n/a	n/a	5.53	5.62	5.98
Number of SQI SAIDI Major Event Days	n/a	n/a	6	9	6
IEEE SAIDI T_{MED}	5.60	6.10	6.46	6.72	6.73
Number of IEEE T_{MED} Major Event Days	12	10	5	9	6
SQI SAIDI T_{CAT}	n/a	n/a	99.25	98.72	92.64
Number of SQI SAIDI Catastrophic Event Days	n/a	n/a	1	1	1
Number of SQI SAIFI Major Events	6	5	4	4	3
Number of SQI SAIFI Major Event Days	22	18	10	17	13

Outage Causes

To continually improve and provide reliable electric service throughout its service area, PSE reviews the cause of outages to better understand performance at the subsystem level. Appendix J: *Current Year Electric Service Outage by Cause by Area* details the recorded outage causes in each county in 2018. The five-year history of number of outages by cause and customer minute interruptions by cause is illustrated in Figure 3c and Figure 3d respectively. Both figures show that equipment failures (EF), trees (TF, TO, TV) and scheduled outages (SO) continue to be the primary reasons for non-Major Event Day (non-MED) outages. The 'Other' cause is an accumulation of 20 other cause codes, which explains the high customer minute interruptions in Figure 3d.

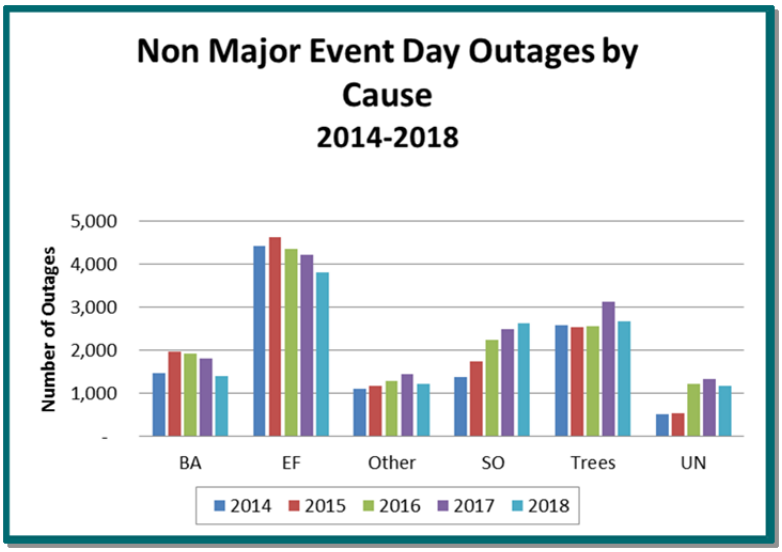

Figure 3c: Non Major Event Day Number of Outages by Cause

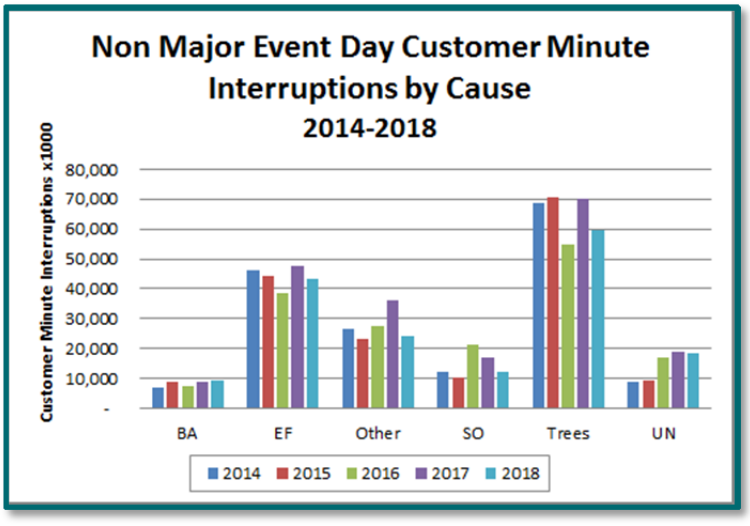

Figure 3d: Non Major Event Day Customer Minute Interruptions by Cause

With over 23,000 miles of equipment in PSE's electric system, equipment failure (EF) is a large contributor to the number of outages. The equipment failure category covers many equipment types, the largest of which, as measured by number of outages, SAIDI and SAIFI, was underground cable. Aging cable is addressed by PSE's cable remediation program and is described in the Aging Infrastructure discussion in the *Working to Improve Reliability* section of this report.

A significant number of outages from trees make sense given that PSE's territory is heavily forested with approximately twice the United States average in number of trees per mile[25]. Trees are the largest outage contributor to customer minute interruptions; even though trees are the second largest contributor to outage count. This is because, on average, tree-caused outages affect twice as many than equipment failure caused outages. Trees off right-of-way, in particular, cause an estimated 86% of tree related outages and can only partially be avoided with traditional tree trimming and alternatives such as replacing conductor with stronger insulated "tree wire". Entirely avoiding tree outages requires converting overhead lines to underground systems or developing ways to gain access to trees on private property.

The Northwest is heavily forested which provides habitat for large populations of birds and squirrels. The overall relatively flat trend in bird and animal (BA) outages is impressive considering that squirrels, in particular the Eastern grey squirrel, have been increasing both in population and territory. This is discussed further in the Wildlife discussion in the *Working to Improve Reliability* section of this report.

Scheduled outages, for the purpose of performing system upgrades and maintenance, also contribute a significant number of outages. The duration of the scheduled outages is minimized to lessen the effect on customers and the system is reconfigured prior to construction to minimize the number of customers affected. Though the number of scheduled outages slightly increased in 2018 as a result of an increased focus on reliability related projects, the total customer minute interruptions decreased. While the number of customers affected by scheduled outages increased by 20% on average, the average duration decreased by more than half.

Figure 3c also illustrates that outages labeled as unknown (UN) have recently had a sizable increase which is partially due to improvements in guidelines on how outages are categorized. Previously these outages would likely have been categorized as trees or equipment failures. As fault location technologies and root cause analyses improves, as noted in the Going Forward– Action Plan for 2018 to 2022 discussion in the *Working to Improve Reliability* section, the number of outages with unknown cause should decrease.

[25] Distribution Utility Vegetation Management Benchmark Survey Results 2016

Balanced Approach to Reliability Improvements Targeting Areas of Concern

PSE's system planning personnel (Planners) investigate multiple "areas of concern" and propose projects that will improve the reliability for customers being served by those circuits. As noted in Docket UE-110060, PSE "areas of greatest concern" are the Top 50 worst-performing distribution circuits over the past five years that consistently contributed the most customer-minute interruptions (CMI). Each circuit is ranked by the total CMI seen by the circuit for each of the previous five years and those with the highest ranking are considered the Top 50 worst-performing distribution circuits.

Based upon reviewing the outage history, number of customers impacted, outage location and other factors, Planners propose projects that are designed to improve reliability on these circuits. Appendix N: *Areas of Greatest Concern with Action Plan* details the Year End 2018 Top 50 list along with PSE's completed or future plan for system improvements on each circuit. It is a multi-year process as it will take a number of years to plan, approve, design and build the necessary improvements. A one year snapshot comparing the Year End 2018 Top 50 worst-performing distribution circuits to the Year End 2017 Top 50 worst-performing distribution circuits, PSE found that 8 circuits were improved enough to fall off the list and 42 remained on the list from the previous year.

In 2017, as part of Docket UE-170033, PSE expanded the "areas of concern" to also include circuits that exceed specific SAIDI, SAIFI and CMI thresholds. The circuits identified using these expanded thresholds are now considered as PSE's worst performing circuits (WPC). The WPC provide focus areas for the Planners in developing electric system improvement projects. Table 3j shows a summary of the 2018 completed project counts and plan for 2019 and 2020 for these worst performing circuits.

The planners also monitor performance on circuits that do not meet the current WPC criteria to ensure the reliability performance does not falter in other parts of the system. The planners review outage history, number of customers impacted, outage location, as well as receiving feedback from field personnel to identify and propose reliability improvement projects. Collectively, the information gathered is used to establish a project benefit which is compared to the overall cost of the improvement resulting in a benefit-to-cost (B/C) ratio. This system planning process is detailed in the planning process discussion in the *Working to Improve Reliability* section, and allows PSE to distinguish those improvements that can help significantly improve reliability.

The system planning process also establishes a B/C ratio for projects to address the reliability on WPC. This helps optimize work on those circuits which best improves system reliability. It is important to note that projects to address the reliability on WPC do not always bring the greatest value to all customers. Those projects are needed to address the on-going reliability concerns of the customers on WPC. Without this distinct focus on the WPC, the individual customer experience will continue to degrade.

As customer level reliability reporting tools are developed, smaller pockets of customers with reliability issues are identified and evaluated for improvements. This complements the WPC analysis to provide a comprehensive approach to reviewing reliability performance for all customers. As system management tools improve and new technologies, such as Advanced Metering Infrastructure (AMI), are implemented, the accuracy of this reporting will improve and allow for ever more efficient targeting of reliability improvement projects.

Customer Electric Reliability Complaints

Customer complaints and jurisdictional concerns about electric reliability and power quality are additional metrics that measure PSE's success in delivering safe and reliable electric service.

PSE Complaints

PSE responds to customer inquiries concerning outage frequency or duration and/or power quality. Most of the first inquiries are adequately addressed in the initial response and the customer does not contact PSE again. However, when two or more customer inquiries on outage frequency or duration and/or power quality have been recorded from the same customer, during the current and prior reporting year, PSE considers this combination as a complaint. .

Figure 3e illustrates the 2014–2018 number of recorded PSE complaints. During the rolling two-year period of 2017–2018, PSE received complaints from 30 customers relating to reliability and power quality concerns as compared to 56 complaints recorded in the rolling two year period of 2016-2017. On average, PSE has seen an increase in the number of complaints since 2012-2013 which might be attributed to the improvement in the data collections method and business processes for customers inquiries. Another increase in complaints can be attributed to organized neighborhood groups calling PSE to complain about electric reliability in their area. This occurred most recently in 2016, as a number of customers in the Kenmore area called PSE. PSE's complaint process and the change in data collection are described in Appendix I: *Electric Reliability Data Collection Process and Calculations*. The 2017-2018 complaints are shown in tabular form in Appendix M: *Current-Year Commission and Rolling-Two-Year PSE Customer Electric Service Reliability Complaints with Resolutions*.

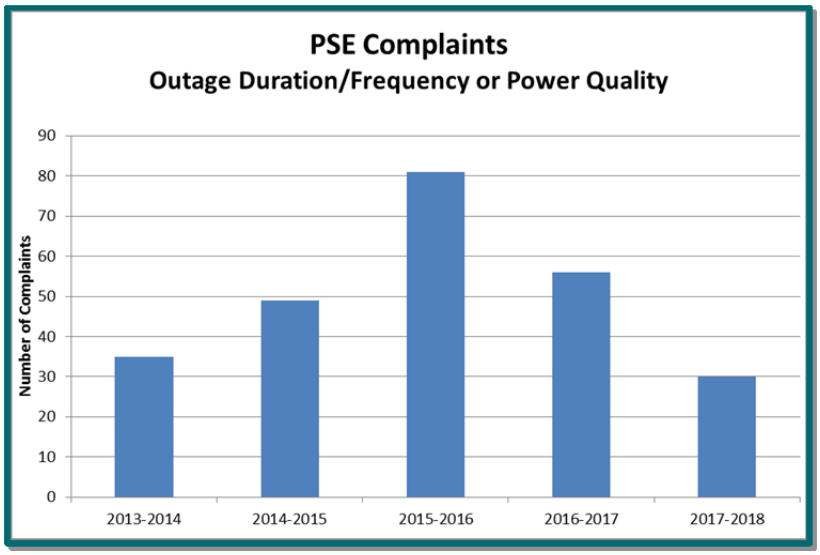

Figure 3e: Five Year History of PSE Complaints

UTC Complaints

The number of electric service quality complaints received by the UTC in regards to outage duration or frequency and/or power quality is another important indicator to measure PSE's electric service reliability success. Figure 3f illustrates 2014 – 2018 number of UTC electric service quality complaints in regards to outage duration or frequency and/or power quality. PSE believes the increase in 2015 was primarily due to the UTC's ad campaign which encouraged the public to reach out to them with reliability concerns**.** In 2018, the UTC received 20 complaints relating to PSE's electric service quality as compared to 12 in 2017. The 2018 complaints are shown in Appendix M: *Current-Year Commission and Rolling-Two-Year PSE Customer Electric Service Reliability Complaints with Resolutions.*

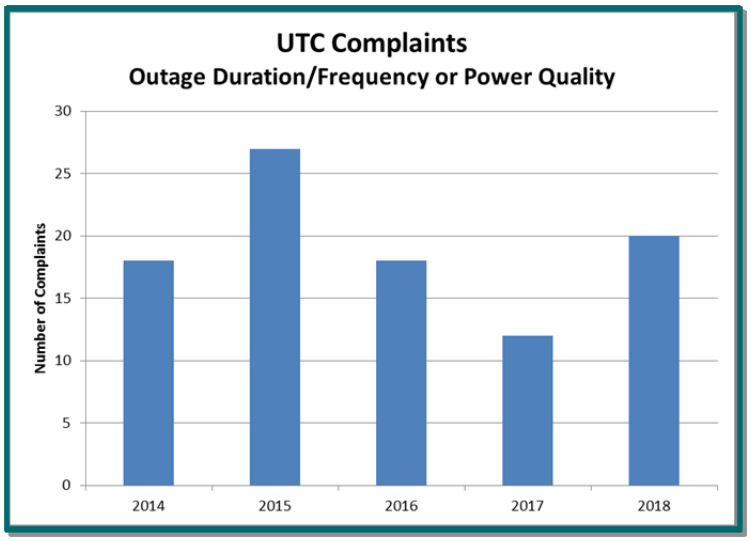

Figure 3f: Five Year History of UTC Complaints

In addition to the customer inquiries and UTC complaints, jurisdictions also have concerns about electric service reliability. Oftentimes, this is a result of constituents initiating contact with their local government entity to act as a unified voice to PSE. PSE works with these jurisdictions to address the reliability concerns.

PSE investigates these customer inquiries, UTC complaints and jurisdictional concerns, and tracks service issues. Customers receive follow-up correspondence from PSE that address their specific concern, as well as PSE's plan for resolution. The outage history surrounding each of these customer inquiries and complaint is reviewed for the overall circuit reliability and then an appropriate plan for resolution is prepared and communicated.

Depending on the nature of the circuit reliability, the plan for resolution could be continued monitoring of the circuit or a planner may propose projects which will improve the circuit reliability. The map in Appendix O: *Current Year Geographic Location of Electric Service Reliability Customer Complaints on Service Territory Map with Number of Next Year's Proposed Projects and Vegetation-Management Mileage* summarizes the number of complaints by county for 2018.

With customer expectations rising, PSE can anticipate continued complaints and will continue to work to address concerns at the initial inquiry to decrease PSE and UTC complaints.

SAIFI (SQI #4)

Overview

Maintaining a high level of reliability requires constant commitment. Supplying power depends on an interconnected network of generation, transmission and distribution systems to get power to homes and businesses. Most customer interruptions can be traced to trees and equipment failure.

SAIFI measures the number of outages or interruptions per customer per year. Most electric utilities use this measurement in reviewing the reliability of their electrical system, excluding major outage events that cause interruptions to a significant portion of their customer base.

About the Benchmark

SAIFI is calculated by adding up the number of customers experiencing a sustained outage of 60 seconds or longer during the reporting period and then dividing it by the average annual number of electric customers.[26]

At PSE, for the purpose of measuring the SQI SAIFI, major outage events are excluded from the performance calculation per the following 5% Exclusion SAIFI definition. More details concerning major outage events are in the *Major Events* discussion in the *About Electric Service Reliability Measurements and Baseline Statistics* section.

The SQI SAIFI measurement is also referred to as $SAIFI_{5\%}$.

- **5% Exclusion SAIFI ($SAIFI_{5\%}$) (Non-major-storm SAIFI)**—Excludes customer interruptions during a Major Event. Major Events are defined as days when 5% or more of the electric customer base in a 24-hour period experiences power interruption and the days following (carried-forward days), until all those customers have service restored.

In addition to the SQI SAIFI measurement, PSE also reports on three additional key measurements:

- **Total SAIFI ($SAIFI_{Total}$)**—Includes all customer interruptions that occurred during the current reporting year, without exclusion.
- **Total 5-Year Average SAIFI ($SAIFI_{Total\ 5\text{-}year\ Average}$)**—Includes all customer interruptions that occurred during the current reporting year and the previous four years, except for events that have been approved by the UTC for exclusion.

[26] Refer to Appendix H: *Terms and Definitions* for the SAIFI formula

- **IEEE SAIFI ($SAIFI_{IEEE}$)**—Measures the number of customer interruptions utilizing the IEEE Standard 1366 methodology. Days that exceed the IEEE T_{MED}[27] are excluded. The 2018 T_{MED} is 6.73minutes—that is, any day that exceeds 6.73 minutes per customer is excluded due to IEEE-defined Major Event Days.

2018 SAIFI Results

The 2018 results based on the recorded outages are reported in Table 3d.

Table 3d: 2018 SAIFI Results

	Key Measurement	Benchmark	Baseline	Current Year Results	Achieved
$SAIFI_{Total}$	**Total (all outages current year) Outage Frequency–System Average Interruption Frequency Index (SAIFI)**	**n/a**	**1.24**	**1.52**	**--**
$SAIFI_{Total\ 5\text{-}year\ Average}$	**Total (all outages five-year average) SAIFI**	**n/a**	**1.37**	**1.82**	**--**
$SAIFI_{5\%}$ **(SQI #4)**	**<5% Non-Major-Storm (<5% customers affected) SAIFI**	**No more than 1.30 interruptions per year per customer**	**0.80**	**1.02**	☑
$SAIFI_{IEEE}$	**IEEE Non-Major-Storm (T_{MED}) SAIFI**	**n/a**	**0.71**	**0.99**	**--**

Appendix L: *1997-Current Year PSE SAIFI and SAIDI Performance by Different Measurements* details the historical results of the four measurements from 1997 through the current reporting year.

What Influences SAIFI

PSE tracks outages by cause codes and groups. System damage caused by trees and vegetation continue to impact the most customers in 2018, as in previous years. The other major causes of outages were:

- Equipment failures (EF): This outage cause covers many equipment types, the largest of which is underground cable failures. Aging cable is addressed by PSE's cable remediation program and is described in the Aging Infrastructure discussion in the *Working to Improve Reliability* section of this report.

[27] Refer to Appendix H: *Terms and Definitions* for the IEEE T_{MED} definition

- Unknown (UN): This cause code covers those outages when electric first response (EFR) personnel were unable to determine the cause of the outage.
- Scheduled Outages (SO): Planned outages to perform system maintenance or installation of new infrastructure
- Bird and Animal (BA): Outages cause by wild life, primarily squirrels
- Other: The Other category includes the other 20 cause codes that PSE tracks, such as underground dig-ups, vehicle-related outages (vehicle impacting pole, padmount switch, guy wire, etc.) and errors in operating the electric system.

Figure 3g shows the common causes for the recorded outages in 2018 and their impact on customers across $SAIFI_{Total}$ and $SAIFI_{5\%}$ measurements.

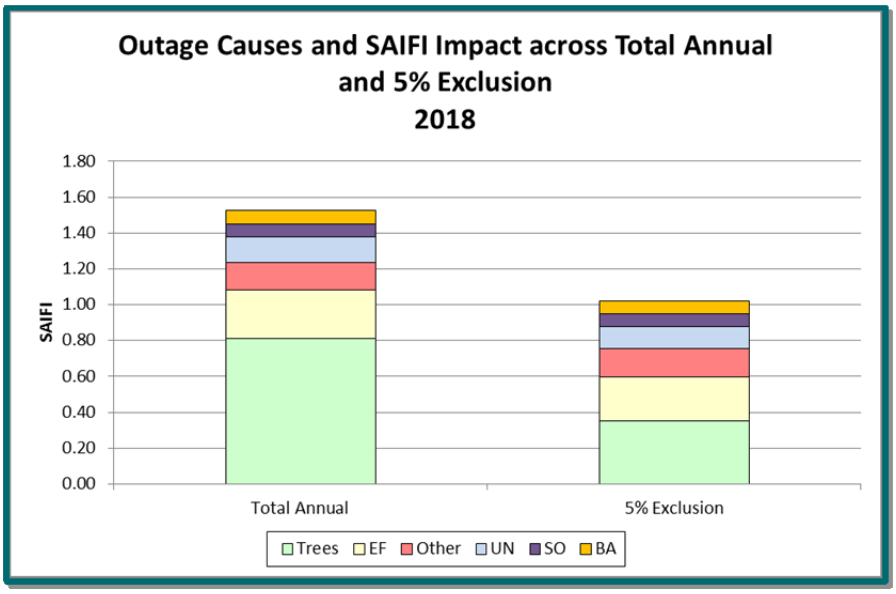

Figure 3g: Common Outage Causes and SAIFI Impact a across Total Annual and 5% Exclusion in 2018

Historical Trends for SAIFI

Table 3e shows SQI SAIFI from 2014 to 2018.

Table 3e: SQI SAIFI from 2014 to 2018

	2014	2015	2016	2017	2018
$SAIFI_{5\%}$ **(SQI #4)**	**1.05**	**1.11**	**1.06**	**1.20**	**1.02**
Benchmark	**1.30 interruptions per year per customer**				

As shown in Table 3e, the SQI SAIFI requirements have been met annually for the past five years.

Appendix L: *1997-Current Year PSE SAIFI and SAIDI Performance by Different Measurements* illustrates the comparison among the four SAIFI measurements for 1997–2018. Based on the recorded outages, the 2018 results across all four of the measurements improved when compared to 2016.

Figure 3h illustrates the 2018 $SAIFI_{Total}$ to the 2017 $SAIFI_{Total}$ performance measurement for each county.

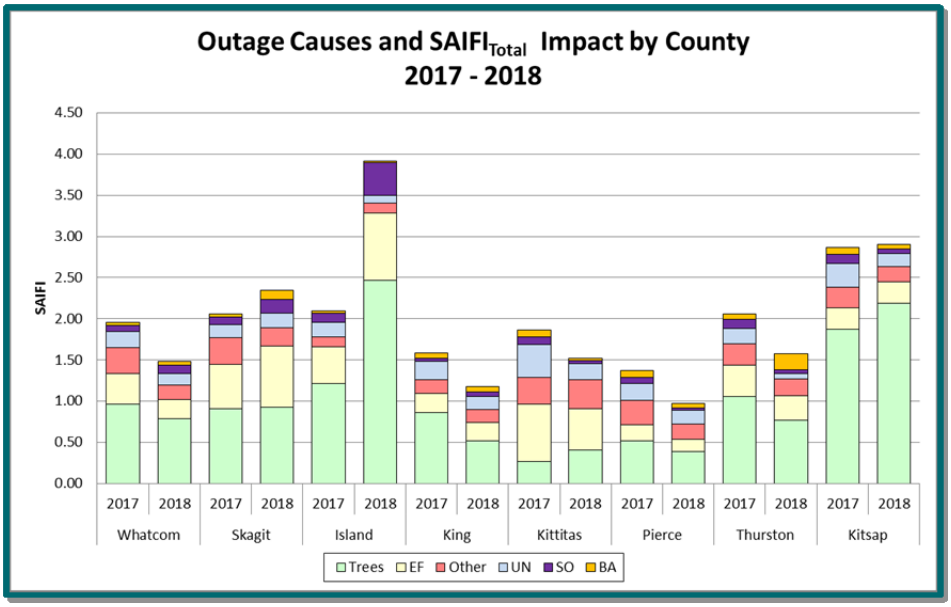

Figure 3h: Common Outage Causes and $SAIFI_{Total}$ Impact by County

Several changes in 2018, in comparison to the 2017 performance for each county, noted as follows:

- Whatcom, King, Kittitas, Pierce and Thurston Counties saw an improvement in performance
  - Whatcom, King, Pierce, and Thurston Counties improvement was due to fewer customers affected by tree related and equipment related outages.
  - Kittitas County improvement in performance was due to fewer customers affected by equipment related and bird/animal outages.
- Skagit, Island and Kitsap Counties saw a decline in performance
  - Skagit County decline in performance was due to a widespread equipment failure outage and more customers affected by scheduled outages.
  - Island and Kitsap Counties decline in performance was more customers affected by tree related outages during major storm events.

Figure 3i illustrates the 2018 $SAIFI_{5\%}$ to the 2017 $SAIFI_{5\%}$ performance measurement for each county.

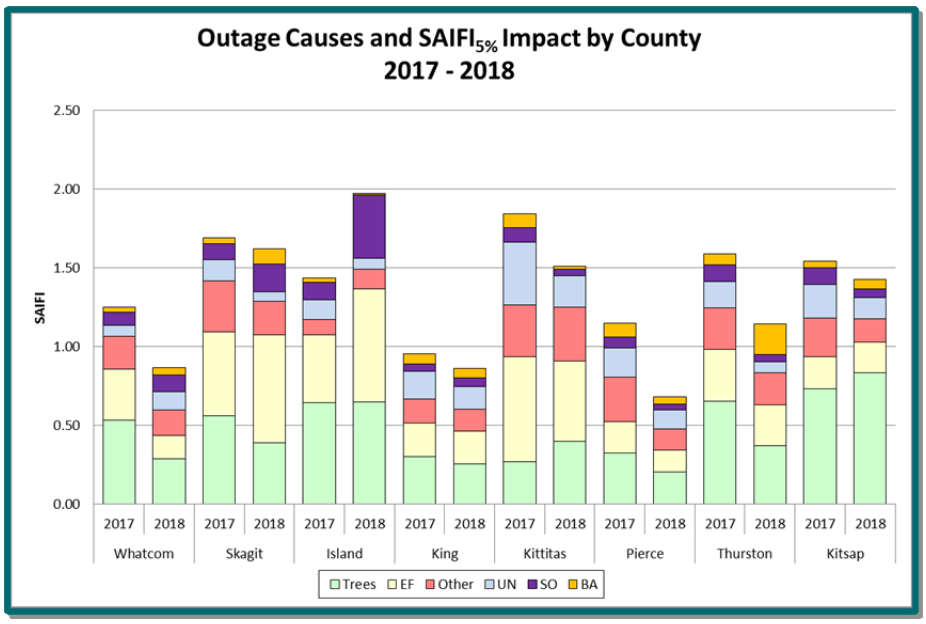

Figure 3i: Common Outage Causes and $SAIFI_{5\%}$ Impact by County

Several changes in 2018, in comparison to the 2017 performance for each county, noted as follows:

- All counties other than Island County saw an improvement in performance
  - Whatcom, Skagit, King, Pierce, and Thurston Counties improvement was due to fewer customers affected by tree related outages
  - Kittitas County improvement was due to few customers affected by equipment failure outages
  - Kitsap County improvement was due to few customers affected by third party accidents and unknown outages causes
  - Island County saw a decline in performance due to a widespread equipment failure outage and the subsequent scheduled outage to replace the failed equipment.

Appendix K: *Historical SAIDI and SAIFI by Area* details the 2016–2018 results by county under the $SAIFI_{Total}$ and $SAIFI_{5\%}$ measurements.

As described more fully in the *Working to Improve Reliability* section, PSE continues to focus on identifying projects that will improve SAIFI, while managing other aspects of electric system performance

.

SAIDI (SQI #3)

Overview

Providing reliable electric service is a top priority for PSE. PSE's electric service reliability maintenance programs (i.e. vegetation management and substation inspections), capital investments, and improvement efforts around response and repair time, are targeted to prevent or reduce the number and duration of outages. Despite PSE's best efforts, sometimes power outages are simply unavoidable. Most outage minutes are caused by equipment failure and trees. Whenever power failures occur, PSE works around the clock to restore service as soon as possible.

SAIDI measures the number of outage minutes per customer per year. Most electric utilities use this measurement in reviewing the reliability of their electrical system, excluding outage events that cause interruptions to a significant portion of their customer base due to extreme weather or unusual events.

SAIDI is similar to SAIFI, but SAIDI measures the duration of customer interruptions while SAIFI measures the number of customer interruptions.

About the Benchmark

SAIDI is calculated by adding up the outage minutes of all the customers that have been without power and then dividing by the average annual number of electric customers.[28]

At PSE, for the purpose of measuring SQI #3 SAIDI, days that exceed the annual adjusted Major Event Day Threshold (T_{MEDADJ}) are excluded from the performance calculation. Starting in the 2016 reporting year, PSE's SQI SAIDI calculation is based on the industry standard IEEE 2.5 beta methodology with an additional and adjustment of catastrophic days to establish the annual T_{MEDADJ}. A catastrophic day is defined as any day that exceeds the 4.5 Beta threshold (T_{CAT}). Only outages longer than five minutes are included in this metric.

More details concerning major outage events and catastrophic days are in the *Major Events* discussion in the *About Electric Service Reliability Measurements and Baseline Statistics* section.

For the purposes of this report, the SQI SAIDI measurement is referred to as $SAIDI_{SQI}$.

- **SQI SAIDI ($SAIDI_{SQI}$)—** Measures the number of customer-minute interruptions utilizing the IEEE Standard 1366 methodology. Days that exceed the IEEE T_{MEDADJ} are excluded. The 2018 T_{MEDADJ} is 5.98 minutes—that is, any day that exceeds 5.98 minutes per customer is excluded from the annual SQI SAIDI results.

[28] Refer to Appendix H: *Terms and Definitions* for the formula

In addition to the SQI SAIDI measurement, PSE also reports on five additional key measurements:

- **Total SAIDI ($SAIDI_{Total}$)**—Includes all customer minute interruptions that occurred during the current reporting year, without exclusion.
- **Total 5-Year Average SAIDI ($SAIDI_{Total\ 5\text{-}year\ Average}$)**—Includes all customer-minute interruptions that occurred during the current reporting year and the previous four years, except for extreme weather or unusual events.
- **5% Exclusion SAIDI ($SAIDI_{5\%}$) (Non-major-storm SAIDI)**—Excludes customer-minute interruptions during Major Events, where Major Events are defined as days when 5% or more of the electric customer base in a 24-hour period experiences power interruption and the days following (carried-forward days), until all those customers have service restored.
- **IEEE SAIDI ($SAIDI_{IEEE}$)**—Measures the number of customer-minute interruptions utilizing the IEEE Standard 1366 methodology. Days that exceed the IEEE T_{MED} are excluded. The 2018 T_{MED} is 6.73 minutes—that is, any day that exceeds 6.73 minutes per customer is excluded due to IEEE-defined Major Event Days.

2018 SAIDI Results

The 2018 results based on the recorded outages are reported in Table 3f.

Table 3f: 2018 SAIDI Results

	Key Measurement	Benchmark	Baseline	Current Year Results	Achieved
$SAIDI_{Total}$	**Total (all outages current year) Outage Frequency–System Average Interruption Duration Index (SAIDI)**	**n/a**	**532**	**434**	**--**
$SAIDI_{Total\ 5\text{-}year\ Average}$	**Total (all outages five-year average) SAIDI**	**n/a**	**326**	**432**	**--**
$SAIDI_{5\%}$	**<5% Non-Major-Storm (<5% customers affected) SAIDI**	**n/a**	**132**	**148**	**--**
$SAIDI_{IEEE}$	**IEEE Non-Major-Storm (T_{MED}) SAIDI**	**n/a**	**107**	**145**	**--**
$SAIDI_{SQI}$	**IEEE Non-Major Storm (T_{MEDADJ}) SAIDI**	**No more than 155 minutes per customer per year**		**145**	☑

Appendix L: *1997-Current Year PSE SAIFI and SAIDI Performance by Different Measurements* reports the historical results of the four measurements from 1997 through the current reporting year.

What Influences SAIDI

As noted in the SAIFI section, PSE tracks outages by cause codes and groups. Figure 3j illustrates the impact of tree-related outages, accounting for 35–67% of customer minutes, across the $SAIDI_{Total}$ and $SAIDI_{SQI}$ measurements.

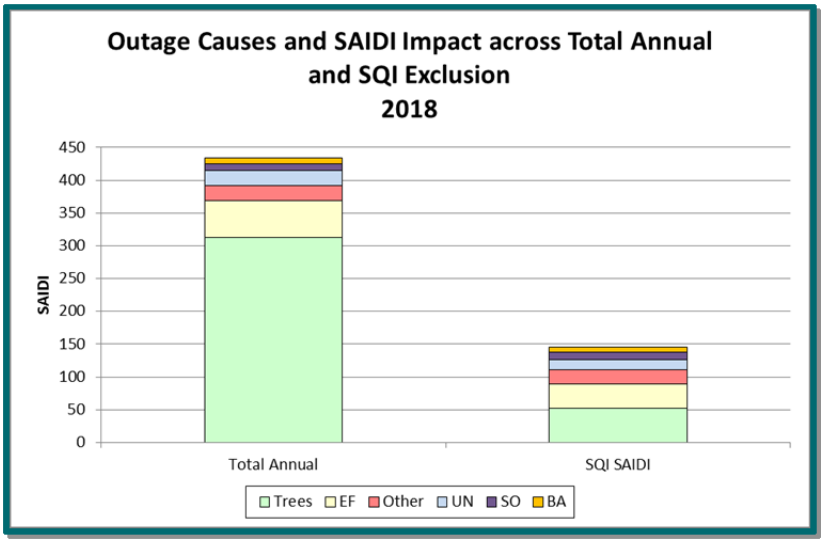

Figure 3j: Outage Causes and SAIDI Impact across Total Annual and SQI SAIDI in 2018

Despite PSE's best efforts to minimize tree-related outages, these outages can greatly influence SAIDI performance. Falling trees can damage the infrastructure and require a specialized tree removal crew to remove fallen trees before field personnel can begin restoration efforts, producing prolonged outages.

A fallen tree or large limb will damage the line and may also tear down supporting structures, cross arms and poles. The number of trees growing near power lines in the Pacific Northwest is unique among other regions in the United States. Nearly 75% of PSE right-of-way edge is treed. On average there are 1,995 trees per mile on PSE's transmission system.[29] In comparison, National Grid, the second largest utility in the United States representing four states on the East Coast, has 313 trees per mile.[30]

High winds in the fall season increase the risk of tree limb failure in deciduous trees because the trees have not fully shed their leaves. The crown of a tree is less permeable when fully leafed; thus, there is a greater degree of

[29] Ecological Solutions Inc. study, March 3, 2009, page 73.

[30] Ecological Solutions Inc. study, March 3, 2009, page 82.

limb breakage due to the "sail" effect. The fully leafed crown acts like a sail, causing a higher degree of wind loading or pressure on branches and limbs and increases the potential for breakage.[31]

Response and Repair Time

Response and repair time also play an important factor to SAIDI. How long it takes to restore service depends on the complexity of the system, the number and types of damaged system components, the extent of the damage, and the location of the problem. The number of outages occurring at one time can also impact the availability of repair personnel to respond, thus adding to outage minutes.

PSE tracks all outage events longer than sixty seconds. The outage length is composed of response, assessment and repair time. Response time, the time from when the customer notifies PSE that an outage has occurred until EFR personnel arrives at the site of the outage, is measured by SQI #11, Electric Safety Response Time. See *Electric Safety Response Time* section in Chapter 2 for more detail.

The average response time for 2017 was 55 minutes and 2018 was 52 minutes. The 5% Exclusion Major Events as well as localized emergency event days are excluded from this metric.

Response and repair time for service providers are also tracked and measured. Certain outages are either excluded from the service provider metrics or adjusted on a case-by-case basis. Examples include access issues and third-party imposed constraints that might limit the service provider's ability to repair the outage in a timely manner. Please see the Service Provider Performance section in Chapter 2 for more details.

The Electric Safety Response Time metric (SQI #11) and the service provider secondary safety response and restoration time metrics (SP Indices #4B and 4C) are designed to measure specific parts of PSE's outage restoration effort, which should not be compared with any of the SAIDI measures. The three response time metrics track different tasks of restoration and exclude specific outages that are included in the SAIDI measures. As an example, the inability to repair and restore outages due to a third party imposed constraint can be excluded or adjusted in both the SQI #11 and Service Provider metrics but the entire duration of that outage is included in the SAIDI measure.

[31] E. Thomas Smiley and Brian Kane, *"The Effects of Pruning Type on Wind Loading of Acer Rubrum," –Arboriculture & Urban Forestry* 32(1): January 2006, pages 33-40, International Society of Arboriculture.

Historical Trends for SAIDI

Table 3g shows the SQI SAIDI from 2014 to 2018.

Table 3g: SQI SAIDI from 2014 to 2018

	2014	2015	2016	2017	2018
SAIDI **(SQI #3)**	**312**	**272**	**148**	**175**	**145**
Benchmark	**320 minutes per customer per year, all outage events**		**155 minutes per customer per year, Non-Major Event Days**		

Appendix L: *1997-Current Year PSE SAIFI and SAIDI Performance by Different Measurements* illustrates the comparison among the different SAIDI measurements for 1997-2018. Based on the recorded outages, the 2018 results across all the measurements improved when compared to 2017.

Figure 3k illustrates the 2018 $SAIDI_{Total}$ to the 2017 $SAIDI_{Total}$ performance measurement for each county.

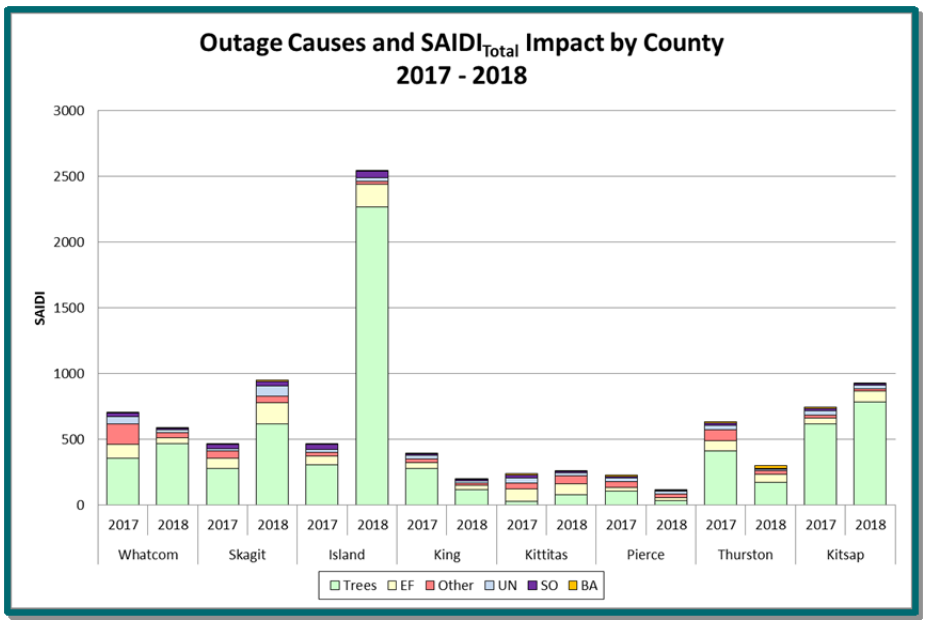

Figure 3k: Common Outage Causes and $SAIDI_{Total}$ Impact by County in 2017-2018

Several changes in 2018, in comparison to the 2017 performance for each county, noted as follows:

- Whatcom, King, Pierce, and Thurston Counties saw an improvement
  - Whatcom County improvement in performance was due to fewer ice and snow related outages
  - King, Pierce, and Thurston Counties improvement was due to fewer tree related outages
- Skagit, Island, Kittitas and Kitsap Counties saw a decline in performance
  - Skagit County decline in performance was due to a widespread equipment failure outage.

- Island, Kittitas, and Kitsap Counties decline in performance was due to more tree related outages.

Figure 3l illustrates the 2018 $SAIDI_{SQi}$ to the 2017 $SAIDI_{SQI}$ performance measurement for each county.

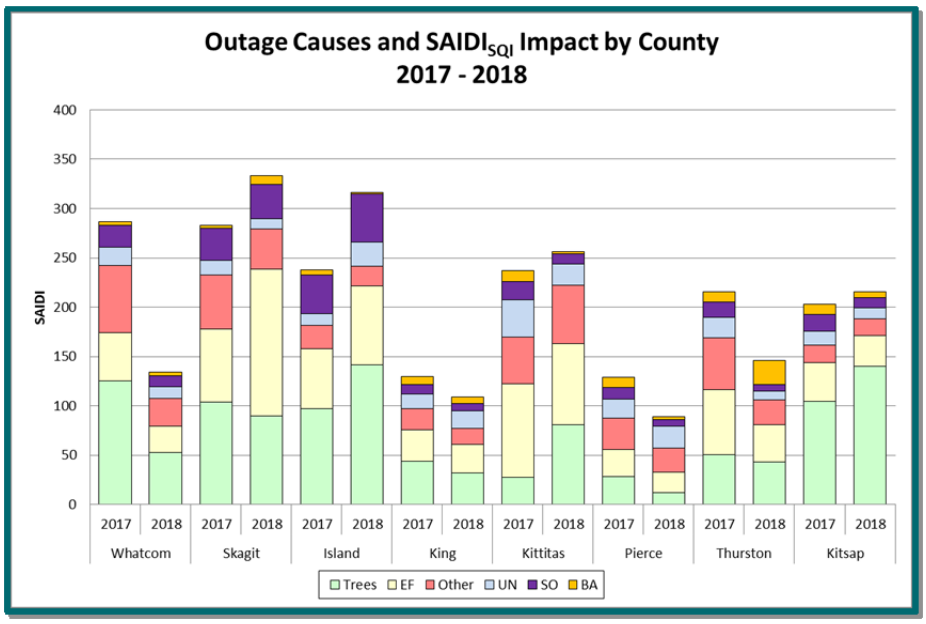

Figure 3l: Common Outage Causes and $SAIDI_{SQI}$ Impact by County in 2017-2018

Several changes in 2018, in comparison to the 2017 performance for each county, noted as follows:

- Whatcom, King, Pierce, and Thurston Counties saw an improvement
  - Whatcom, King, and Pierce Counties improvement was due to fewer tree related outages.
  - Thurston County improvement was driven by fewer equipment failure and third party caused outages.
- Skagit, Island, Kittitas and Kitsap Counties saw a decline in performance
  - Skagit County decline in performance was due to a widespread equipment failure outage.
  - Island County was impacted by more tree related outages and a widespread outage due to equipment failure.
  - Kittitas and Kitsap Counties decline in performance was due to more tree related outages

Appendix K: *Historical SAIDI and SAIFI by Area* illustrates the 2016–2018 results by county under the $SAIDI_{Total}$ and $SAIDI_{SQI}$ measurements.

As described more fully in the *Working to Improve Reliability* section, PSE continues to focus on identifying projects that will affect SAIDI, while managing other aspects of electric system performance.

Customer Experiencing Multiple Interruptions (CEMI)

Overview

Starting in 2019, PSE agreed to report on Customers Experiencing Multiple Interruptions. Whereas SAIDI and SAIFI are an average system measure of customer experience, CEMI provides the range of customer experiences related to outage frequency pertaining to customers who experienced an outage. Metrics like SAIDI and SAIFI are useful for tracking system-wide progress but may not address customer level reliability concerns. CEMI fills this gap, however, as it is expressed here as a range, there is no target for it with which to compare performance.

About CEMI

CEMI measures the percentage of customers who have experienced zero to multiple sustained interruptions. It is calculated by totaling the number of non-major event day interruptions experienced by each customer. Then the number of customers who had the set number of interruptions is totaled and divided by the average annual number of electric customers.[32]

2018 CEMI Results

Figure 3m shows the percentage of PSE customers experiencing varying numbers of outages. For example, 50% of customers experienced no sustained outages while 28% of customers experienced one sustained outage.

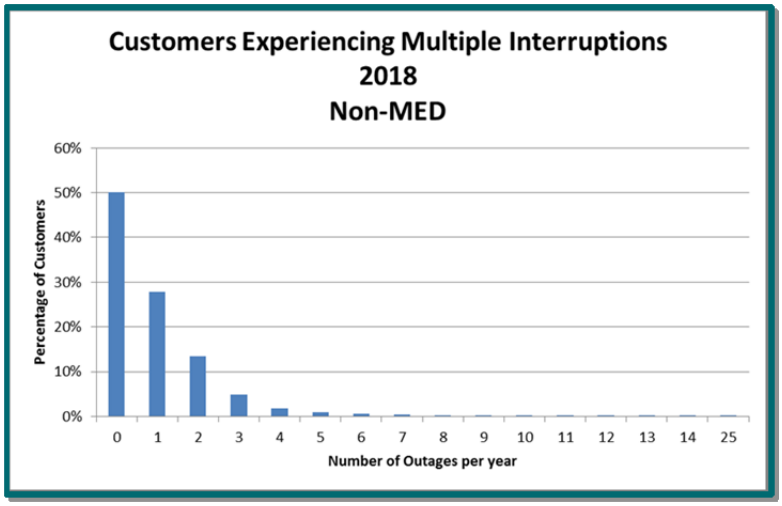

Figure 3m: Customers Experiencing Multiple Interruptions in 2018

[32] Refer to Appendix H: *Terms and Definitions* for the formula

Currently, there is no historical CEMI data for PSE with which to compare, we cannot determine how it has changed or what impact various projects and programs have had. Moving forward, PSE will integrate this information into decisions that affect reliability and track the result.

Working to Improve Reliability

Overview

PSE continues to implement existing processes and programs to address the reliability of the electric system. In addition, PSE evaluates and identifies new strategies to further improve reliability across PSE's service territory. This section covers PSE's system planning analysis and optimization process, the 2018 reliability programs and completed work, and the roadmap for the long term reliability strategy as outlined in the 2019 & Beyond Action Plan.

System Planning Process

Figure 3n illustrates the system planning process for both natural gas and electric system infrastructure projects. The following discussion focuses on how the system planning process is used to evaluate electric reliability projects.

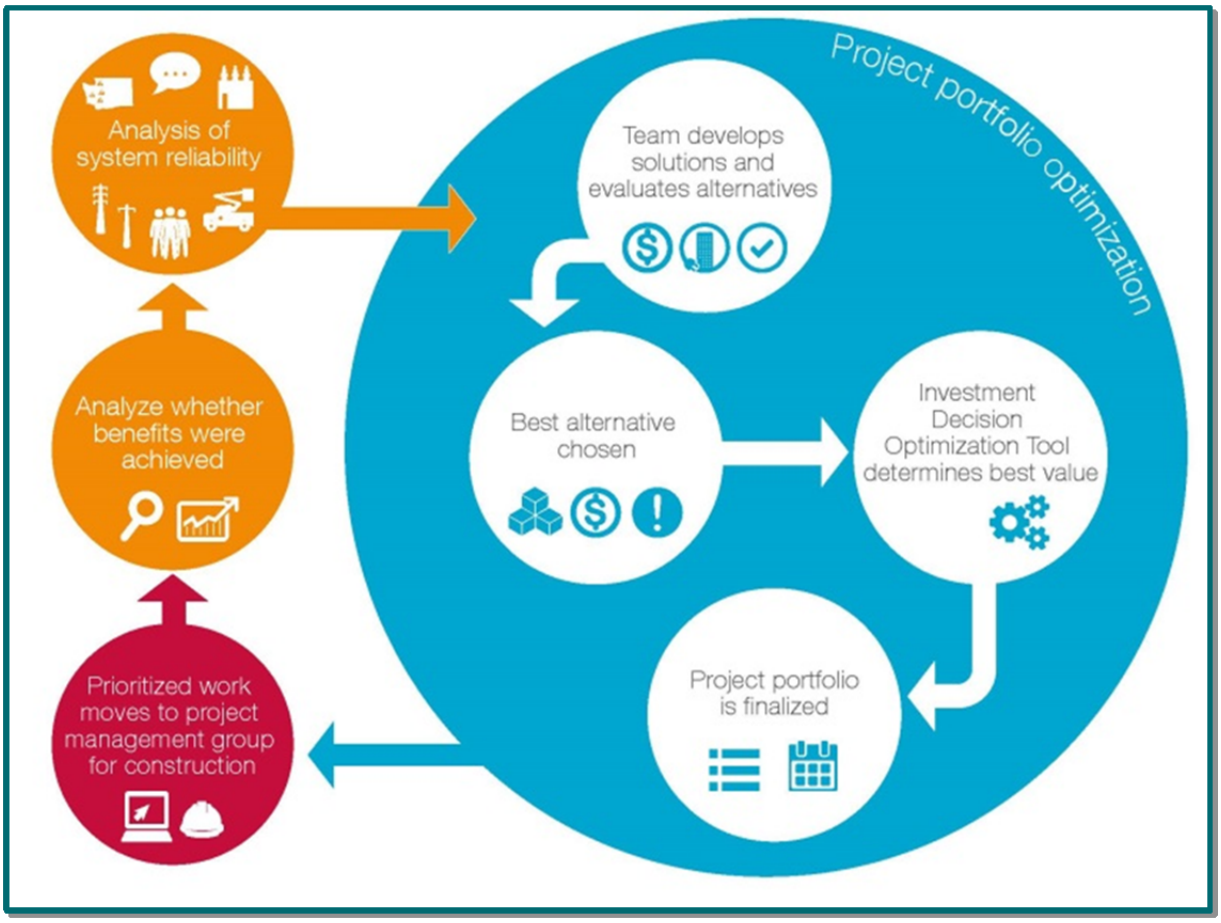

Figure 3n: System Planning Process

As it relates to improving the electric system reliability, PSE's system planning process begins with an analysis and evaluation of the system's current performance. System planning considerations include multiple inputs such as reliability indices (SAIDI, SAIFI, etc.), customer complaints/feedback, equipment condition or failure analysis, outage causes, etc. Additionally, PSE identifies smaller targeted areas to improve reliability at the customer level. This approach ensures that customers with poor reliability, regardless of their circuit's reliability, are identified and improved. Targeted customers are identified based on a high number of interruptions or high outage duration.

Next, projects solutions and alternatives are developed and reviewed. PSE has multiple strategies and methodologies to resolve reliability issues, such as, rebuilding/re-routing existing infrastructure, installing tree-wire conductors, converting overhead conductors to underground, adding new sectionalizing devices, adding automation to the system, or implementing distributed energy resources.

Each viable project solution entered into the Investment Decision Optimization Tool (iDOT) that involves building a hierarchy of the value of benefits, illustrated in Figure 3o, and compares the net present value against the total project cost, also known as the B/C ratio. For a particular reliability issue where the planner identifies multiple project solutions, the tool supports the identification of which individual solution may have the best value for the reliability of the impacted customers.

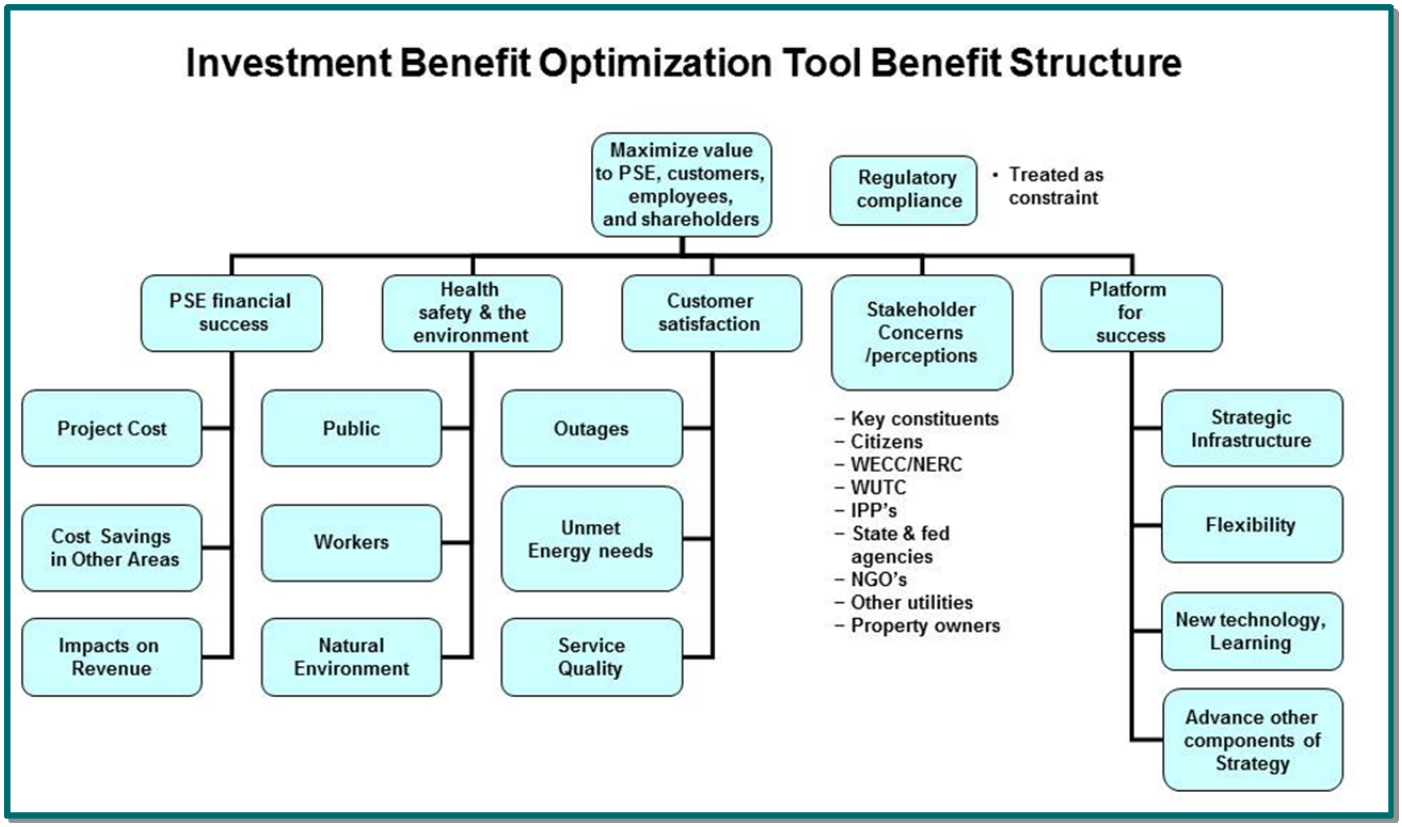

Figure 3o: Investment Benefit Optimization Tool Benefit Structure

On a broader portfolio perspective, iDOT optimizes the total value of the project across the electric and natural gas system infrastructure projects and identifies a list of selected projects to meet a financial constraint, which are then analyzed and reviewed for prudency. Finally, System Planning approves the final set of capital projects that provides the maximum value to PSE's customers. Appendix P: *System Planning Budget Process* provides more detail on the Planning Process.

In addition to the annual process as described above, some system planning projects are identified throughout the year. These projects can be a result of a municipality altering its infrastructure plans such as a road widening, new system performance issues or addressing a resource need for a given area. PSE also identifies and implements projects throughout the year to address emergency repairs and replacements as they emerge.

After projects are put into service, PSE performs a Reliability Improvement Verification (Backcasting) to confirm the expected benefits. The outages within the improved project area are typically reviewed several years after being placed in service to provide "outage opportunity" and compared to the outage history, prior to the system improvement project. This verification helps to confirm the success of certain reliability strategies or provides insight on how to make adjustments and improvements in the future.

2018 Reliability Programs and Completed Work

Table 3h illustrates PSE's different programs and projects that directly impact the reliability of the electric transmission and distribution systems. Each program addresses one or multiple outage causes, such as Trees (TF, TO, TV), Bird and Animal (BA), Equipment Failure (EF), Scheduled Outages (SO), Unknown (UN), or others. The table also includes what was completed at the end of 2018. The last column in the table shows the estimated yearly SAIDI savings for programs that are expected to reduce SAIDI. Programs that maintain existing SAIDI levels and programs that do not have a quantifiable SAIDI impact are not included. Note that because the listed projects were implemented in 2018, only a portion of the estimated savings may have been realized in 2018. The full estimated benefit is expected to be realized starting in 2019 and can be confirmed with backcasting methods in future years. Program descriptions and details are below the table.

Table 3h: Reliability Programs and 2018 Completed Work

Program Category	Outage Cause Each Program Addresses						2018 Completed
	TREES	BA	EF	SO	UN	Other	
Reliability Strategy Initiatives							
Root Cause Analysis / Outage Review	✓	✓	✓	✓	✓	✓	20
Spacer Cable Application Analysis	✓						Analysis
CEMI Reporting	✓	✓	✓		✓	✓	Completed
Fault Locating Technologies	✓	✓	✓		✓	✓	Analysis
Vegetation Management							
Cyclical Programs	✓						2,950 miles
TreeWatch	✓						8,000 trees
Tree Replanting	✓						On-going
Substation Landscape Renovation	✓						None
Targeted Reliability Improvements							
Worst Performing Circuits	✓	✓	✓			✓	30 projects
Tree Wire	✓	✓					9 projects
Distribution Sectionalizing Devices	✓	✓	✓	✓	✓	✓	21 projects
Other System Reliability Projects	✓	✓	✓			✓	16 projects
Distribution Automation	✓	✓	✓	✓	✓	✓	6 projects
Transmission & Distribution SCADA	✓	✓	✓		✓	✓	16 projects
Pilot Projects							
Single Phase Reclosers	✓	✓	✓			✓	On hold
Tollgrade Sensors	✓	✓	✓			✓	Monitor
Transmission Line Automatic	✓	✓	✓			✓	Testing

Switching							
Aging Infrastructure							
Cable Remediation			✓			✓	456 projects
Pole Test & Treat			✓				1,925 poles
Pole Reinforcement			✓				690 poles
Pole Replacement			✓				234 poles
Substation Equipment Replacement			✓				61 projects
Substation Maintenance			✓				On-going
Wildlife							
Wildlife Protection Devices		✓					~4,000 devices
Avian Protection Program		✓					41 projects
Third Party Outages						✓	135 Control Zone Poles
Scheduled Outages				✓			Monitor

Reliability Strategy Initiatives

Root Cause Analysis

In 2018 PSE began a root cause analysis program, primarily focused on the electric distribution system. Processes for in-depth analysis of substation outages affecting major equipment as well as large interruptions caused by vegetation were common at PSE, but no general customer interruption root cause analysis process yet existed. Other utilities implementing root cause analysis programs have seen significant improvements in reliability, though it can take a few years to realize the benefits. In 2018, PSE completed 20 in-depth field root cause analyses on a variety of interruptions. While this covered only about 0.2% of the overall number of interruptions, it accounted for about 9% of the system-wide non-storm SAIDI. The program was successful in identifying opportunities to improve reliability related activities including system design, work practices and maintenance activities. The program will be continued not only for the specific improvements that were identified but for its success in increasing reliability awareness and understanding within the company.

Spacer Cable

In 2018 PSE analyzed the potential for using spacer cable on the overhead distribution system. Spacer cable has thicker insulation than treewire and is more resistant to vegetation related damage. It is also more compact than standard construction, which is useful in tight areas or where operating rights are limited. Furthermore, it is stronger than standard construction designs and can be used in areas where longer spans are needed such as river crossings. Though it is unlikely to be an optimal solution in all scenarios, spacer cable could be a cost-effective reliability solutions in some situations. This technology is planned to be piloted in 2019-2020.

Fault Locating

PSE started evaluating fault locating technologies in 2018. The evaluation consists of analyzing protective relay fault data and researching line fault sensors in order to develop a comprehensive strategy for locating the cause of interruptions. Increasing accuracy in identifying the location of damage related to an outage can reduce the time required to find and repair the damage. It is also useful in assisting root cause analysis of an outage, which is used to develop measures to prevent or mitigate future interruptions. The analysis done in 2018 was promising and will continue in 2019.

Vegetation Management

Outages related to trees and vegetation continues to be a major factor in the SAIDI and SAIFI performance. Trees remain a vital element of the region's quality of life, but they are also a major cause of power outages. To mitigate trees and limbs growing into electric power lines, PSE performs vegetation maintenance based on a cyclical schedule. The maintenance programs focus on achieving a safe and reliable electric system. Vegetation management involves a variety of practices and techniques designed to keep trees and limbs from coming in contact with power lines and causing outages. Less than 10% of tree-related outages are caused by tree growth, illustrating an effective vegetation management program.

Cyclical Programs

PSE spends more than $14 million annually on systematic, cyclical vegetation management program to reduce outages in its overhead electric distribution, high-voltage distribution and transmission systems.

- **Overhead distribution system**—Usually trees are trimmed every four years for distribution lines in urban areas and every six years for lines in rural areas. Danger trees, trees that are an imminent threat of falling into power lines, are removed in these rights-of-way or within 12 feet of the system at the same time that trees are trimmed.
- **55/115kV transmission corridor system**—Trees are trimmed every three years on PSE's 55/115kV transmission rights-of-way. Spray and mowing activities are performed and danger trees are removed along the edge of these corridors, typically within 12 feet of the system at the same time trees are trimmed.
- **230kV transmission corridor system**—Trees are trimmed annually in transmission corridor system over 200kV. Spray and mowing activities are performed and danger trees are removed along the edge of these corridors, typically within 16 feet of the system at the same time trees are trimmed. These maintenance activities are compliance driven per the North American Electric Reliability Corporation (NERC) clearing requirements.
- **Hotspotting—**On the overhead distribution and 55/115kV transmission systems, hotspotting occurs yearly. Hotspotting, or unscheduled trimming or removal, is driven by PSE field technicians or customer requests.

TreeWatch Program

PSE also manages vegetation impacts from beyond the 12 foot right of way and on average spends $2 million annually on its TreeWatch program. Within this program, certified arborists work with communities and property owners to identify and remove "at-risk" trees on private property that are more than 12 feet away from power lines located beyond the limits of normal cyclical vegetation management standards. The trim and removal numbers vary year to year due to the size and complexity of the trees targeted to be trimmed and removed. The focus in 2018 was on critical 55/115kV transmission lines, and those distribution circuits that are the worst circuits for tree-related outages. In 2017, the TreeWatch program budget was increased to specifically address four distribution circuits that historically reoccur as the worst circuits for tree-related outages. The four circuits are Fragaria-13, Hobart-16, Longmire-17 and Miller Bay-17. In 2018 these four circuits saw an average reduction in tree related outages of 25% from the previous three years.

Tree Replanting Program

PSE devotes about $500,000 each year to replanting trees and non-construction related mitigation in PSE's service area to prevent future reliability concerns from developing. In addition, PSE developed and makes available to customers a vegetation planning handbook called *Energy Landscaping*. The handbook helps customers evaluate landscaping opportunities and is a how-to for planting trees and shrubs and tree-care solutions. It also lists recommended trees and shrubs to plant near power lines.

Substation Landscape Renovation

In 2018, PSE did not renovate any substation sites.

Targeted Reliability Improvements

Along with vegetation management to minimize tree-related outages, PSE has implemented other programs to reduce the frequency and duration of outages on the transmission and distribution systems, with a particular focus on improving the reliability on the worst-performing circuits. These programs include Worst Performing Circuits, replacing existing overhead distribution wire with tree wire to prevent tree limb outages, installing more sectionalizing devices (some which are remotely monitored and controlled), adding distribution automation and enhancing the transmission and distribution Supervisory Control and Data Acquisition (SCADA) devices.

Worst Performing Circuits

As discussed earlier, PSE's planners investigate the worst performing circuits and propose projects that will improve the reliability for customers being served by those circuits. Planners focused their attention to improve the reliability of 135 circuits that were identified as worst-performers. Different reliability strategies were applied

to these circuits, including tree wire, underground conversions, overhead rebuilds, adding new feeder ties and distribution automation and more recently considering non-wire alternatives, i.e., energy storage solutions.

Tree Wire/Spacer Cable

The vast majority of tree wire, a thick-coated power line, is installed at locations where there has been a previous history of outages related to tree branches and a field assessment confirms that installing tree wire would reduce the likelihood of outages. Tree wire improvements also provide a benefit to reduce the number of bird or animal caused outages. PSE is also looking to use a spacer cable which is a more robust coated overhead conductor than tree wire in selected situations to help improve reliability related to tree related outages.

Distribution Sectionalizing Devices

Installation of reclosers has been an effective tactic to improve reliability. These devices are an improvement over conventional fuses. With a conventional fuse, a temporary fault, typically a branch brushing against the power line, causes the fuse to blow open and de-energize the line. Service is not restored until EFR personnel patrols the line and manually replaces the blown fuse using a bucket truck.

In comparison, reclosers sense the fault on the power line and automatically attempt to re-energize the line. If the recloser no longer senses the fault, it will reclose and re-energize the line. If the fault is not temporary, the recloser can isolate the damaged section of the line and customers upstream from the recloser do not experience an outage. Another effective tactic implemented is the installation of gang-operated switches. Gang-operated switches provide the ability to simultaneously disconnect the three-phase lines rather than disconnecting one phase at a time, and to better isolate damaged infrastructure so more customers can continue to be served.

Distribution Automation

In 2016, a new pilot was launched to automate outage restoration on the distribution grid by using sensors to locate faults, remotely operate switches to isolate faulted sections and to restore power to the non-faulted sections. A computer control system automates this action by collecting information from grid devices and determines the optimal switching to restore power to the largest number of customers in less than five minutes. The faulted section will still remain without power until crews can repair the damage. In 2016, PSE completed the installation of the computer control system that orchestrates the self-healing. The first automated circuits were enabled in 2016 and new automated circuits continue to be enabled using the same control system.

Transmission and Distribution SCADA

Supervisory Control and Data Acquisition (SCADA) is an important aspect of managing the electric transmission and distribution power systems. SCADA is a system used for monitoring and controlling electrical

equipment that provides situational awareness for PSE's operators and enables faster restoration of power to the customers. Approximately 99% of PSE's feeder breakers have loading visibility and indication only, while 45% of PSE's feeder breakers have loading visibility, indication and supervisory control.

Pilot Projects

In addition to these ongoing targeted reliability improvement programs, PSE continued to monitor, in 2018, the pilot projects which have been implemented..

Single-Phase Reclosers *(Tripsavers)*

Tripsavers are single-phase reclosing devices that would replace 100T lateral overhead fuses. The tripsavers will help reduce temporary outages related to tree limbs and animal contact, similar to a recloser, but at a reduced cost. In the 2016-2017 pilot program, 245 tripsavers were installed in 106 locations and PSE estimates that they could prevent 44 outages per year, which would have lasted about 120 minutes each. During the pilot, several design and operational issues came to light. It was identified that operational training to our field personnel would improve on the issues previously identified. Training is currently on-going. Concurrently, PSE is taking this opportunity to evaluate and compare the tripsaver device to a similar product known as a "fuse saver" from a different vendor.

Tollgrade Sensors

This pilot project involved installing 51 Tollgrade Lighthouse sensors on the three worst performing circuits (Chico-12, Baker River Switch-24, and Cottage Brook-13). The sensors can help improve reliability due to immediate notification of a fault beyond the sensor, and the ability to proactively identify potential problems on the line that may cause momentary or permanent outages. The sensors can also help diagnose the pattern of events prior to customer complaints, and help identify failing or misoperating equipment. No quantifiable actions were taken in 2018 as a result of the Tollgrade sensor outputs. PSE is continuing to collect the outage information provided from these devices and plan to evaluate the benefits achieved from them.

Transmission Line Automatic Switching

Currently, PSE has existing automation schemes on PSE's transmission system. These schemes were developed back in the 1970's, and were state-of-the-art technology for that time. Using local sensors, and multiple reclosing at either end of the transmission line, a logic scheme was set up to restore the maximum number of customers and isolate the faulted section of the transmission line. Though the restoration of customers is typically optimized, the existing automatic schemes do not cover every scenario, thus leaving a potential for extended outages to one or more substations on a particular transmission line. This pilot project will provide a solution that automatically locates a transmission line fault, isolates the fault, and reconfigure the system to restore the

power to the maximum number of customers. The pilot was scoped in 2016. In 2017, the hardware equipment was installed, and the automation logic was under development. In 2018, the system was tested and the issues that were found were corrected. The goal in 2019 will be to enable 2 pilot projects before storm season.

Aging Infrastructure

Cable Remediation

For an underground electric distribution system, age and moisture makes buried cable vulnerable to failures and prolonged outages, particularly the commonly installed high molecular weight ("HMW") bare concentric neutral direct-bury cable installed prior to 1965. Since 1989, PSE has managed a cable remediation program that considers two remediation options: silicone injection or cable replacement. At the end of 2018, PSE had approximately 1,430 miles of HMW cable remaining in the system.

- Silicone injection extends the life of underground power cable for 20 years by restoring the cable's insulating properties. This alternative is only used on single phase cables which have been pre-tested to verify the condition. Due to cost of testing and implementing on three phase cables, replacing the cable is more cost-effective.
- Cable replacement has an expected life that exceeds 30 years.

The Electric Reliability Plan[33] has provided the focus to address specific system needs such as the underground cable. Figure 3p, on the following page, illustrates the reliability benefits of increased investment in the cable remediation program. Outages are decreasing as PSE is increasing the investment in the cable remediation program.

[33] Refer to Areas of Greatest Concern discussion in *Appendix I: Electric Reliability Data Collection Process and Calculation* for more information on the Electric Reliability Plan.

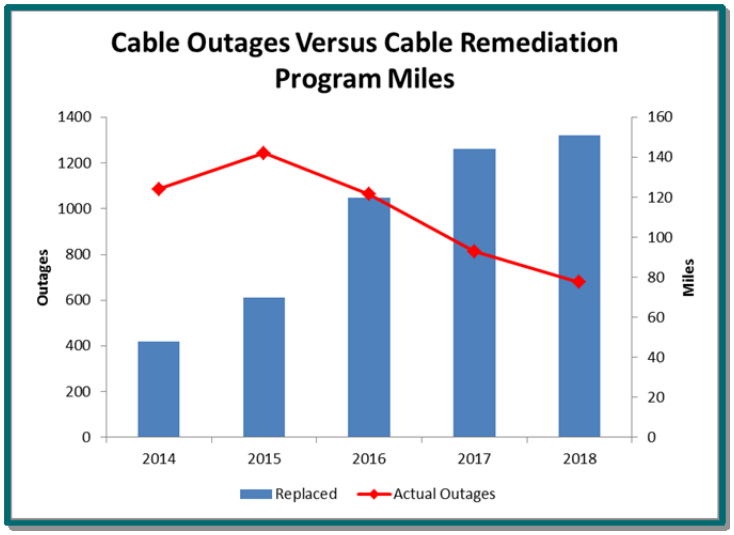

Figure 3p: Five Year History of Cable Outages versus Cable Remediation Program Miles

Pole Test and Treat and Replacement Programs

In an overhead electric system, the failure of a utility pole can cause an outage that could affect thousands of customers. In 2018, there were 183 outages (including storms) caused by a structural failure on the pole. To minimize the risk of a large outage, PSE has a pole inspection, treatment, reinforcement and replacement program for both transmission and distribution wood poles.

PSE assesses each wood pole's condition by excavating around the base to determine the extent of below-ground decay and by boring into the pole to assess decay within the pole. The remaining strength of the pole is calculated based on the measurements of decay. Poles with remaining strength that still meets the National Electric Safety Code (NESC) guidelines are treated with an internal fumigant, which extends its serviceable life. Poles not meeting NESC guidelines are scheduled for replacement or reinforcement. In 2018, there were 1,400 distribution poles and 525 transmission poles assessed. In addition to the conventional pole assessment, there was a targeted transmission visual inspection to provide a condition assessment of wishbone structures on 80 transmission lines.

Industry data shows that the average serviceable life of a wood pole in the Pacific Northwest without remedial treatment is 43 years. Poles which have received routine treatment throughout their life last significantly longer. Industry data suggests the average life could be around 100 years.

In addition to the programmatic investment in pole replacement and reinforcement, PSE also replaces poles identified as near failure during the year and in storm restoration efforts which are not included in these numbers.

In 2018, the PSE Wood Pole Program was updated to align with industry best practices. Processes were improved to maximize efficiencies and effectiveness of the program and increase the impact on customer reliability. Reporting mechanisms and guidelines were put in place to include the reviewing of all elements of the structure, with a specific focus on the crossarm. Greater requirements were given for the data reporting in order to maximize the value of the information provided back from the field.

Substation Equipment Replacement Programs

Substations are the key hubs connecting high-voltage power lines and the electric distribution power lines that serve customers. Substations typically serve between 500 and 5,000 customers and contain major pieces of electric system equipment, technology to monitor and operate the system, and backup systems. Substations are inspected monthly and maintenance programs are in place to ensure performance and efficiently maintain expensive equipment.

As PSE continues adding more infrastructure, reliability measures are incorporated into the design. Building a substation requires the installation of the transmission and distribution lines; to enhance reliability and operational flexibility, the power lines typically connect to adjacent substations. New substations enable the operational ability to shift customers to the neighboring substations during an outage as a reliability measure.

Upgrades to the substations and equipment are important strategies for reliability and overall asset management. Specific types of equipment are proactively replaced under replacement programs to maintain system reliability, reduce operational costs and offset impacts from aging infrastructure.

- Transformers – 63
- Transmission Breakers – 87
- Distribution Breakers – 3
- Relay Packages – 279
- Transformer Protection Devices – 4
- Substation Switches – 4
- Substation Batteries – 815
- Transfer Trip Scheme – 1
- Spill Prevention, Control, and Countermeasures (SPCC) – 2

Substation Maintenance

In addition to the planned replacements, PSE administers planned diagnostics which determines the condition based maintenance in order to improve performance and increase the asset life. The transmission and

distribution substation maintenance program utilizes low cost, non-intrusive diagnostic tasks to identify problems that could result in equipment failure. Several diagnostic tests on substation major equipment which help to determine equipment needs are:

- Infrared scans, performed every other year to identify problem areas on the electrified portion of the station
- Dissolved gas analysis in oil to determine overheating or arcing
- Breaker profiling to evaluate the quality of mechanism operation
- SF6 gas testing to determine insulation integrity
- Monthly inspections for a visual evaluation

Depending on the results of diagnostic testing and time since last maintenance, the portfolio of planned maintenance is scheduled each year to more thoroughly evaluate the condition and administer maintenance tasks per the manufacturer recommendation. The current substation maintenance program includes maintenance activities for:

- Large substation equipment (transformer, breaker, regulator, etc.), which includes the equipment required by Western Electric Coordinating Council (WECC), per the Transmission Maintenance and Inspection Plan
- Station batteries
- Protective relays, which includes transmission line & transformer relays (required per NERC compliance) and distribution transformer, feeder and line recloser relays
- Transmission automatic switch controllers

Wildlife

In 2018, there were 1,408 bird and animal-caused outages which was a decrease of 436 from the 1,844 bird and animal-caused outages in 2017. Figure 3q illustrates that bird and animal caused outages have trended down for the last 15 years. From 2004 -2013 PSE averaged 1,766 animal-caused outages per year. In the last 5 years, 2014-2018, PSE has averaged 1,736 animal caused outages per year. Therefore, PSE has reduced animal-caused outages on average, by approximately 30 outages; even as eastern gray squirrels population and territory have been increasing.Squirrels account for approximately 90% of PSE's animal caused outages. The fact that outages are trending down or even remaining the same while both the squirrel populations and PSE's customer base are increasing indicates that the efforts to strengthen PSE's electrical systems to wildlife are positively impacting reliability.

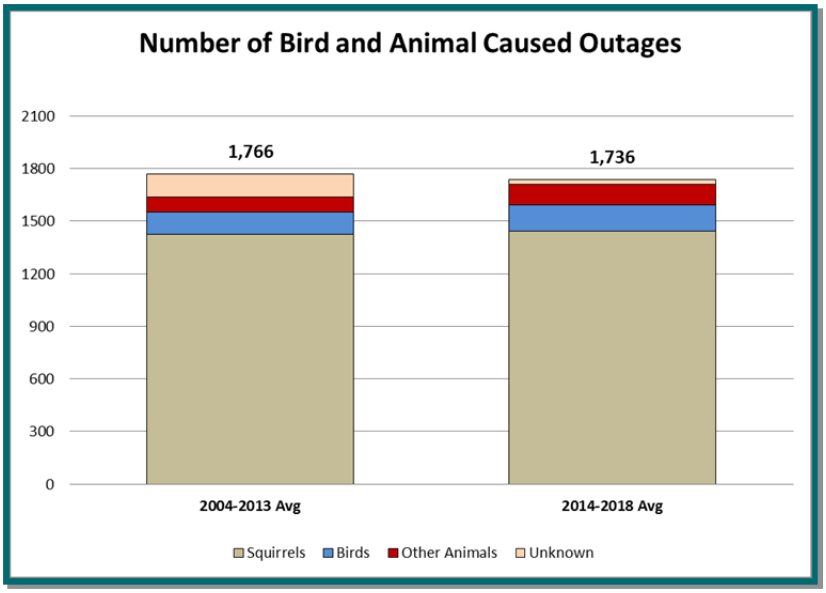

Figure 3q: Number of Bird and Animal Caused Outages 2003-2018

Figure 3r demonstrates the effectiveness of the PSE's Avian Protection Program in reducing trumpeter swan collision and associated outages. From 2008-2017, the trumpeter swan population in PSE's service territory has more than doubled. PSE began marking lines to prevent outages and trumpeter swan mortalities in 2008. In an effort to reduce outages and mortalities, over 17,000 line markers have been installed on approximately 1,700 high risk spans to date. In addition to markers, PSE has been installing tree wire which is more visible than bare conductor and also helps reduce risk of trumpeter swan phase to phase contact. Scientific studies[34] indicate that markers reduce bird mortality and outages by approximately 60%. Since PSE began installing line markers and tree wire, the number of swan mortalities due to power line contact has trended downward.

[34] Avian Power Line Committee, "*Reducing Avian Collisions with Power Lines: The State of the Art in 2012"*, October 2012, page 97, Edison Electric Institute

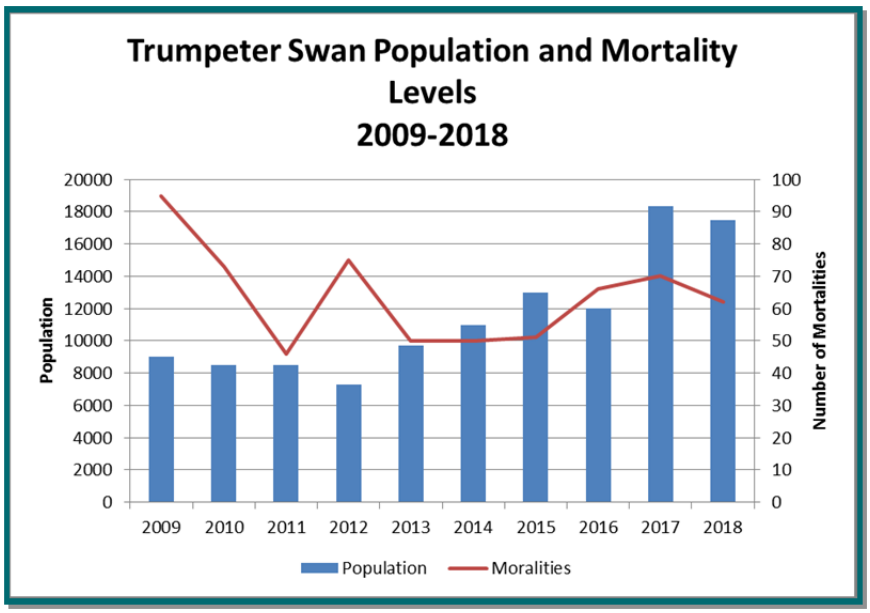

Figure 3r: Trumpeter Swan Population and Mortality Levels

Since early 2000, PSE has modified its construction standards to reduce the risk of animal-related outages. Today, in an effort to avoid bird and animal-caused outages, equipment poles are upgraded with bushing covers, cutout covers and covered jumpers when maintenance activities are performed. New electric infrastructure projects that are located within avian-safe designated habitats are constructed to avian safe standards.

PSE's Avian Protection Program tracks all avian-related outages and retrofits mortality sites using avian protection products and techniques to reduce the risk of recurring outages and avian mortality. The program evaluates circuits that are identified as higher risk for an avian-related outage or mortality. Where appropriate, avian protection techniques and products are used proactively to prevent avian morality and outages.

PSE's Avian Protection Program aims to provide regular avian protection online training to all PSE employees. In addition, more targeted training is provided to operational employees to keep them up-to-date on avian protection procedures, materials and regulatory requirements. In 2018, PSE provided targeted training to vegetation management employees, customer and system project employees and new electric servicemen.

Third-Party Outages

When a vehicle hits a utility pole, there is a potential for a power outage to occur. As part of an ongoing effort to prevent outages and improve motor vehicle safety, PSE Planners review the location of the poles whenever a car-pole incident causes an outage. PSE's Clear Zone program also relocates poles that are likely to behit.

In addition, PSE continues to work toward preventing third party damage to the underground electric distribution system. Prior to excavating, customers and builders are required to request locates of underground power lines in order to prevent accidental contact which could lead to outages.

Scheduled Outages

Scheduled outages, which are typically for connecting new or upgrading existing infrastructure, are the third leading outage cause and account for 17% of recorded interruptions in 2018. In many cases, service must be interrupted to safely connect new power lines or replace aging or damaged infrastructure. Scheduled outages are often driven by customer-requested projects that impact PSE's electrical system. As additional improvements are made, more scheduled outages may be necessary. Table 3i illustrates the 2014-2018 number of scheduled outages, customer minutes of interruptions (CMI) and number of customers interrupted (CI). While the number of scheduled outages increased in 2017 (as compared to prior years) the impact of those outages to customers and the duration of the service interruption was decreased. The 2018 reduction in CMI is owed to increased focus and conscious efforts by PSE and its' Service Provider to minimize periods of de-energization during construction.

Table 3i: Five Year history of Scheduled Outages

Total Scheduled Outages			
Year	**Outage Count**	**CMI**	**CI**
2014	1,363	12,501,901	48,808
2015	1,819	15,697,154	48,848
2016	2,207	21,970,541	83,580
2017	2,538	17,703,300	69,621
2018	2,657	12,395,320	81,491

The recording of all scheduled outages and the associated data accuracy continues to be an area of focus for PSE. The Outage Management System (OMS) interface improvements and increased OMS user proficiency has improved the data accuracy associated with scheduled outages.

Reliability Improvement Verification (Backcasting)

PSE believes it is very important to validate that reliability benefits on projects are achieved. This involves comparing the reliability in a project area, before and after improvement. Due to the number of projects completed each year, PSE verifies a sample of projects from each program. It is important to note that sometimes outages are unique and the effort to review performance several years later has an underlying assumption that there is similar outage potential after project completion. In 2017 the majority of reliability improvement projects were focused on PSE's 135 worst performing circuits. Figure 3s shows that this increased focus resulted in saving almost 9 SAIDI minutes on that group of circuits in 2018 from the years prior to project implementation. Note that this is nearly a third of the system-wide reduction in SAIDI from 2017 to 2018. The benefits realized in 2019 from projects implemented on this group of circuits in 2018 will be reviewed in 2020.

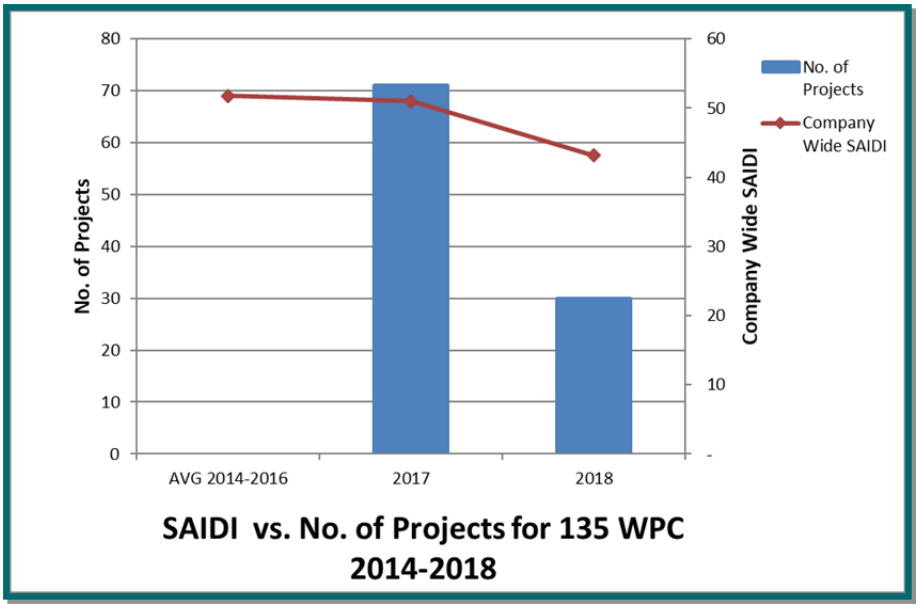

Figure 3s: SAIDI vs. No. of Projects for WPC

Going Forward – Action Plan for 2019 to 2023

The SQI SAIDI and SAIFI targets are used as a guideline for a reasonable level of reliability. In addition, PSE has also tracked its reliability performance through the IEEE reliability benchmarking survey to measure how its performance aligns with industry. In 2017, PSE added analysis information from the econometric benchmarking study initiated by the UTC staff as well as data from the ICE calculator and a report from industry experts estimating the costs to achieve specific levels of reliability to come up with new targets for system-wide SAIDI and SAIFI. The analysis suggested that achieving a SAIDI of 120 – 130 and maintaining SAIFI at 1.00 – 1.15 should be PSE's primary focus over the next five years.

In addition, PSE has been developing the capability to measure reliability at the customer level using data from OMS. This allows PSE to report CEMI and provide the ability to set new targets to help identify pockets of customers experiencing poor reliability that may not be identified through circuit level reliability metrics or customer complaints. As new technologies are implemented over time, it is expected that more accurate measurements will be possible and that metrics that more fully account for the customer experience will be available. For example, MAIFI provides the ability to track outages that are less than five minutes in length.

PSE has been continuously working on improving its electric reliability for many years. As the simplest and least cost reliability improvements are implemented first, additional levels of reliability require ever more complex or costly solutions. What has become apparent in other industries is the need to link activities together through more holistic management and awareness, often seen in practices such as safety management systems, quality management system, and most recently applicable to PSE is a pipeline safety management system (known as API Recommended Practice 1173). To achieve the improvement to reliability that is desired, PSE will apply this type of management system thought. As a result, PSE has developed alignment of infrastructure improvement and operational work and set a collective roadmap forward that will drive greater effectiveness as illustrated in Figure 3t. The strategy identifies five elements for focus over the next five years: improving the reliability culture, electric system design, data analysis, new metrics and emerging technologies. This roadmap is not intended to be static or assume all the opportunities for improvement are known, and will change as new information becomes available, providing flexibility, but continued focus towards established targets. This focus will closely tie together infrastructure design, construction, operation and maintenance as well as add constant feedback on progress through system monitoring to drive continuous improvement.

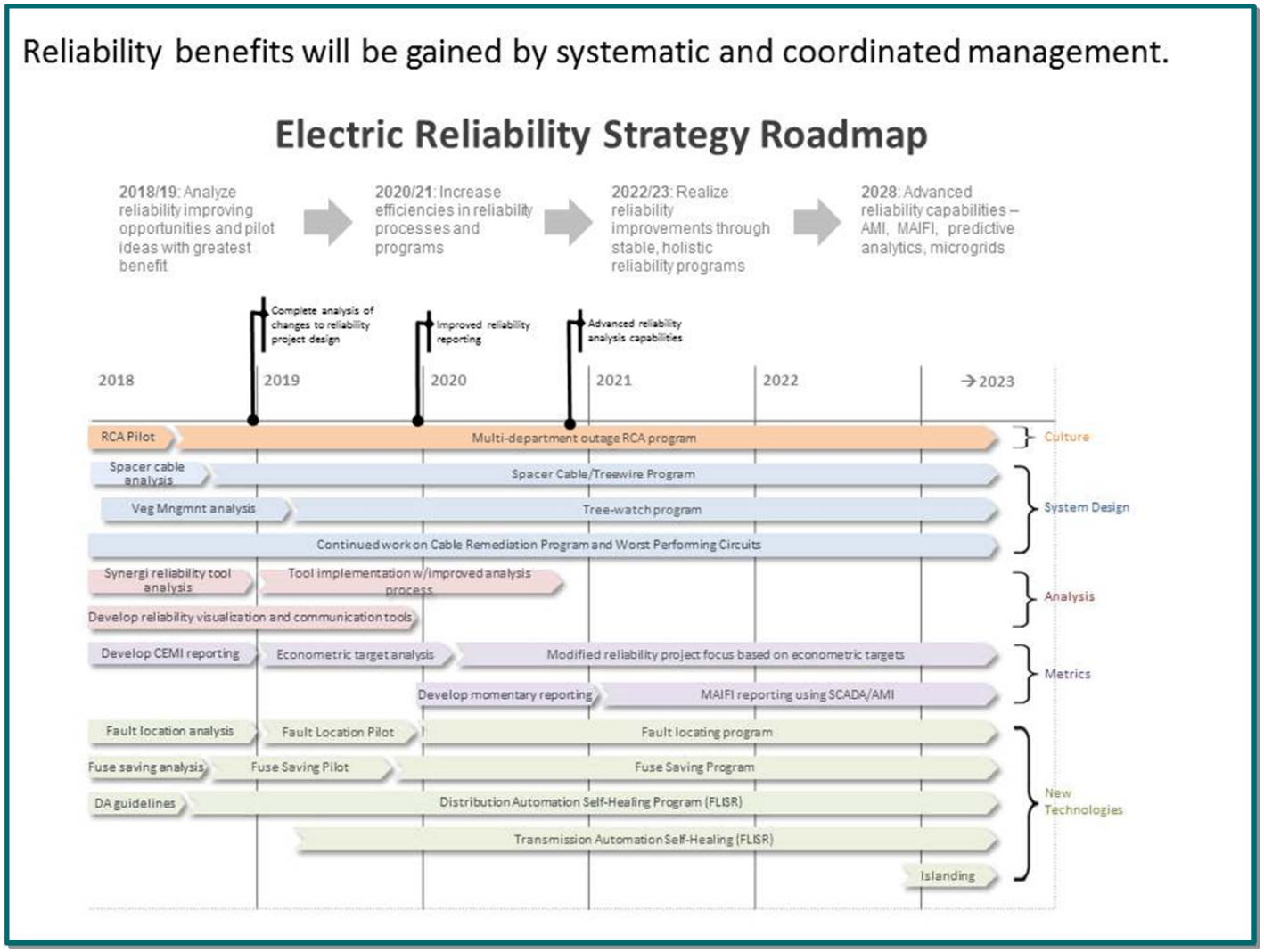

Figure 3t: Electric Reliability Strategy Roadmap

In 2019, PSE will continue the work started in 2018 implementing existing and new strategies to achieve PSE's reliability goals. Table 3j details PSE's plan for the different programs and projects that directly impact the reliability of the system, which includes some newly developed initiatives. Each program addresses one or multiple outage causes, such as Trees (TF, TO, TV), Bird/Animal (BA), Equipment Failure (EF), Scheduled Outages (SO), Unknown (UN), or others. The table includes the plan for 2019 and 2020, which is subject to change, as well as, a list of 2018 completed work for comparison purposes. The estimated SAIDI savings is determined when an investment is made after there have been one or many outages. It assumes the future outages will be similar to the historic if not addressed. However this model does not provide for the full value of investing in replacement in advance of failure, in essence preventing outages from occurring at all. For some assets this can be determined and investments made proactively to benefit customers such as with the cable remediation or pole program. PSE is working to determine this type of a predictive savings model as it is logical that this also has SAIDI savings value.

Table 3j: Reliability Programs Plan for 2019 and 2020

Program Category	Outage Cause Each Program Addresses						2018 Completed	2019 Plan	2020 Plan	Estimated Yearly SAIDI Savings for 2019 - 2020
	Trees	BA	EF	SO	UN	Other				
Reliability Strategy Initiatives										
Root Cause Analysis / Outage Review	✓	✓	✓	✓	✓	✓	20	Design/Implement	Implement recommendations /Improve	TBD
Spacer Cable Application Analysis	✓						Analysis	Engineer	Pilot	n/a
CEMI Reporting	✓	✓	✓		✓	✓	Completed	Update	Utilize Report	n/a
Fault Locating Technologies	✓	✓	✓		✓	✓	Analysis	Assessment	Pilot	n/a
Vegetation Management										
Cyclical Programs	✓						2,950 miles	2,981 miles	Adjust if needed	n/a
TreeWatch	✓						~8,000 trees	10,000 trees / Investigate increased application	Consider historic UTC approved program	n/a
Tree Replanting	✓						On-going	On-going	On-going	n/a
Substation Landscape Renovation	✓						83 trees	None	None	n/a
Targeted Reliability Improvements										
Worst Performing Circuits	✓	✓	✓			✓	30 projects	41 projects	66 projects	17 minutes
Tree Wire	✓	✓					9 projects	9 projects	24 projects	3 minutes
Sectionalizing Devices	✓	✓	✓	✓		✓	21 projects	1 projects	0 projects	0 minutes
Other System Reliability Projects	✓	✓	✓			✓	16 projects	21 projects	9 projects	1 minute
Distribution Automation	✓	✓	✓	✓	✓	✓	6 projects	22 projects	0 projects	1 minute
Transmission & Distribution SCADA	✓	✓	✓		✓	✓	16 projects	23 projects	24 projects	TBD

Table continues on next page

Program Category	Outage Cause Each Program Addresses						2018 Completed	2019 Plan	2020 Plan	Estimated Yearly SAIDI Savings for 2019 - 2020
	Trees	BA	EF	SO	UN	Other				
Pilot Projects										
Single Phase Reclosers	✓	✓	✓			✓	On hold	Assessment	Pilot	n/a
Transmission Line Automatic Switching	✓	✓	✓			✓	On-going	2 pilot projects	Monitor/New Projects	TBD
Aging Infrastructure										
Cable Remediation			✓			✓	456 projects	218 projects	150 projects	2 minutes
Pole Test & Treat			✓				1,925 poles	33,000 poles	33,000 poles	n/a
Pole Reinforcement			✓				690	743	743	n/a
Pole Replacement			✓				234	981	981	n/a
Substation Equipment Replacement			✓				61 projects	74 projects	35 projects	n/a
Substation Maintenance			✓				On-going	On-going	On-going	n/a
Wildlife										
Avian Protection Program		✓					41 projects	19 projects[35]	TBD	n/a
Third Party Outages						✓	135 Control Zone Poles	104 Control Zone Poles	161 Control Zone Poles	<1 minute
Scheduled Outages				✓			Monitor	Manage to minimize impact	Manage to minimize impact	TBD

The map in Appendix O: *Current Year Geographic Location of Electric Service Reliability Customer Complaints on Service Territory Map with Number of Next Year's Proposed Projects and Vegetation-Management Mileage* shows the number of 2018 and 2019 planned reliability projects and the planned 2018 vegetation mileage by county.

[35] As bird mortalities occur during the year, PSE will complete additional projects. PSE estimates that ~40 Avian Protection projects will be completed by year end.

- **Reliability Strategy Initiatives**
  - Root Cause Analysis/ Outage Review—PSE performs in-depth Root Cause Analysis reports on interruption events with high customer impacts or high budget impact. Other utilities who have implemented in-depth root cause analysis have seen significant reliability improvements. The work started in 2018 will continue in 2019 with a focus on improving efficiency and depth of analysis.
  - **Spacer Cable Application Analysis**—Spacer cable is a tightly spaced set of aerial insulated conductors that reduce vegetation related outages. Utilities in other states using spacer cable have experienced reliability improvements as it tends to be stronger and more resilient than even tree wire. Each utility has unique geographic, regulatory, and operating challenges that must be assessed to determine if spacer cable would be a cost effective solution. The initial analysis completed in 2018 showed that pilot projects are justified and PSE is in the process of developing 2 pilot projects. Construction standards, material specifications and operation practices will be developed in 2019 with assistance from the vendor.
  - **Visualization and Communication Tools** – PSE is working to improve analysis of interruption data with new tools. This includes the ability to map interruption locations as well as customers experiencing poor levels of reliability. These can be used to detect patterns and trends and more easily determine where reliability solutions are needed. This category of work will also provide improved methods for determining the benefits of reliability solution options. Better tools will ultimately enhance the ability to efficiently identify and implement reliability improvements.
  - **Fault Locating Technologies**—PSE is evaluating various fault locating technologies, including analyzing protective relay fault data and researching new fault sensors. These technologies can reduce the time needed to find system damage and assist root cause analysis on outage events.

- **Vegetation Management**
  - **TreeWatch Program** —Continue cycle maintenance to remain on cycle. Remove or prune between 6,000-10,000 off-right right-of-way trees under the TreeWatch program, again focusing on PSE's critical high voltage distribution lines, the worst performing distribution circuits, and transmission lines.
  - **High Voltage System Maintenance** —Miles associated with the 230kV system maintenance will be reduced as certain lines historically leased from BPA will expire.

- **Targeted Reliability Improvements**
  - **Worst Performing Circuits** —Continue to focus on the worst performing circuits, defined by the Top 50 and reliability metric thresholds. In addition, PSE will expand the focus to target individual customers/smaller pockets experiencing a lower level of reliability. PSE will continue to evaluate, explore and adopt new strategies to improve the reliability of the Areas of Greatest Concern.
  - **Tree Wire** —Continue to install covered conductor (tree wire) to prevent tree-limb outages and convert overhead lines to underground. Replace failing poles and install animal guards as appropriate in these projects. This has a secondary benefit of preventing outages caused by wildlife.
  - **Distribution Sectionalizing Devices**—Continue to install additional sectionalizing devices on the distribution system to help minimize outages and outage times. These devices include reclosers, switches and fuses. PSE will continue to evaluate the merits of implementing remote monitoring and control at additional locations.
  - **Distribution Automation**—Continue to expand the footprint of automated switching schemes throughout the distribution system. PSE will monitor the performance of the in-service automation schemes.

- **Transmission & Distribution SCADA**—Continue to upgrade distribution substations circuits with supervisory control and RTUs for enhanced data collection, as well as, adding supervisory control to transmission switches, based on specific benefit and cost.

- **Pilot Projects**
  - **Single-Phase Reclosers**—Data will continue to be collected from existing tripsavers to further ascertain the effectiveness of their ability to reduce customer outage minutes. In addition, the Planning team will be evaluating and comparing the tripsaver device to another similar product known as a "fuse saver" from a different vendor.
  - **Transmission Line Automatic Switching**—In 2019, the project team plans to finish hardware installation, complete data collection testing and enable 2 pilot projects before storm season.
- **Aging Infrastructure**
  - **Cable Remediation**—As part of the Cable Replacement Plan, PSE anticipates completing 368 projects.
  - **Poles**—Plan to replace 797 distribution poles and approximately 184 transmission poles. This number will increase due to unplanned replacements for bad poles identified in the field or due to storm damage. There will be poles reinforced the same year as diagnosed in 2019.
  - **Substation Equipment**—The ongoing substation reliability improvement plan includes replacement of 13 transmission breakers, 2 circuit switchers, 2 transformer protection packages, 15 station batteries, 40 relay packages, and 2 SPCC projects.
- **Wildlife**
  - Continue the on-going avian protection training of servicemen to keep them up-to-date on avian protection procedures, materials, and regulatory requirements.
  - Continue training resources to all PSE employees on the importance of avian protection via an on-line course. The main drivers are 1) compliance with avian protection regulations; 2) improved reliability; and 3) positive relationship with customers and agencies.
  - Continue to work cooperatively with state and federal agencies to monitor avian populations in PSE's service territory to better understand trends and impacts on both wildlife and PSE's electrical system.
- **Scheduled Outages**
  - Continue to monitor the data accuracy of recorded scheduled outages. Monitor impact on customer groups to minimize cumulative impact proactively.
- **Reliability Improvement Verification (Backcasting)**
  - The intent of backcasting is to verify the expected benefits on selected reliability projects. This process compares the reliability of a project area, before and after improvement. PSE's method for validating project benefits is being updated in 2019 to improve accuracy and account for new project types such as distribution automation.

Appendices

This section contains the following appendices:

- A: Monthly SQI Performance
  - Attachment A to Appendix A—Major Event and Localized Emergency Event Days (Affected Local Areas Only)
  - Attachment B to Appendix A—Major Event and Localized Emergency Event Days (Non Affected Local Areas Only)
  - Attachment C to Appendix A—Natural Gas Reportable Incidents and Control Time
- B: Certification of Survey Results
- C: Penalty Calculation
- D: Proposed Customer Notice (Report Card)
- E: Disconnection Results
- F: Customer Service Guarantee Performance Detail
- G: Customer Awareness of Customer Service Guarantee
- H: Electric Reliability Terms and Definitions
- I: Electric Reliability Data Collection Process and Calculations
- J: Current Year Electric Service Outage by Cause by Area
- K: Historical SAIDI and SAIFI by Area
- L: 1997-Current Year PSE SAIFI and SAIDI Performance by Different Measurements
- M: Current-Year Commission and Rolling Two Year PSE Customer Electric Service Reliability Complaints with Resolutions
- N: Areas of Greatest Concern with Action Plan
- O: Current Year Geographic Location of Electric Service Reliability Customer Complaints on Service Territory Map with Number of Next Year's Proposed Projects and Vegetation Management Mileage
- P: System Planning Budget Process

A
Monthly SQI Performance

Appendix A consists of Tables A1 and A2 that provide monthly details on the nine service quality indices.

It also contains the following attachments:

Attachment A to Appendix A—Major Event and Localized Emergency Event Days (Affected Local Areas Only)

Attachment B to Appendix A—Major Event and Localized Emergency Event Days (Non-Affected Local Areas Only)

Attachment C to Appendix A—Natural Gas Reportable Incident and Control Time

Table A1: PSE Monthly SQI Performance

Category of Service	SQI No.	Description	Annual Benchmark	Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	Jun 2018	Jul 2018	Aug 2018	Sep 2018	Oct 2018	Nov 2018	Dec 2018
Customer Satisfaction	2	WUTC Complaint Ratio	0.40 complaints per 1000 customers, including all complaints filed with WUTC	0.015	0.013	0.020	0.015	0.020	0.015	0.014	0.011	0.011	0.011	0.009	0.011
	6	Telephone Center Transactions Customer Satisfaction	90% satisfied (rating of 5 or higher on a 7-point scale)	92%	91%	95%	93%	91%	94%	94%	96%	92%	96%	96%	94%
	8	Field Service Operations Transactions Customer Satisfaction	90% satisfied (rating of 5 or higher on a 7-point scale)	90%	97%	93%	98%	98%	97%	96%	96%	95%	97%	95%	95%
Customer Services	5	Customer Access Center Answering Performance	80% of calls answered by a live representative within 60 seconds of request to speak with live operator	83%	81%	83%	82%	83%	87%	89%	81%	73%	71%	77%	77%
Operations Services	4	SAIFI	1.30 interruptions per year per customer	0.920	0.090	0.060	0.060	0.050	0.110	0.090	0.090	0.060	0.080	0.130	0.080
	3	SAIDI	155 minutes per customer per year	14	14	8	8	7	15	11	10	10	10	18	21
	7	Gas Safety Response Time	Average of 55 minutes from customer call to arrival of field technician	30	30	30	29	30	30	30	30	30	31	30	31
	10	Kept Appointments[Note]	92% of appointments kept	99%	100%	100%	100%	100%	100%	100%	99%	99%	99%	100%	100%
	11	Electric Safety Response Time	Average of 55 minutes from customer call to arrival of field technician	53	49	48	48	50	52	54	52	52	52	51	58

Note: Results shown are rounded to the nearest whole percentage per UTC order. However, these 100% monthly performance results do not reflect that PSE and its service providers met all the appointments during the reporting period. Numbers of PSE missed appointments, including the new customer construction appointments carried out the service providers are detailed in Appendix F: Customer Service Guarantee Performance Detail.

Table A2: Service Providers Monthly Service Quality Performance

Category of Service	Index	Service Provider	Annual Benchmark Description	Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	Jun 2018	Jul 2018	Aug 2018	Sep 2018	Oct 2018	Nov 2018	Dec 2018
Operations Services	Service Provider New Customer Construction Appointments Kept[Note1]	Quanta Electric	At least 92% of appointments kept	100%	100%	99%	100%	100%	100%	100%	99%	100%	99%	99%	99%
		Quanta Gas	At least 92% of appointments kept	100%	100%	100%	100%	97%	98%	99%	96%	98%	98%	99%	100%
	Service Provider Standards Compliance	Quanta Electric	Achieve a level of QA/QC compliance rate conformance to PSE Standards as follows: Level 1 inspection items: ≤ 15 deviations/1000 items inspected	14.20	4.09	13.83	15.31	8.75	4.02	4.20	3.30	4.26	0.00	3.85	0.00
		Quanta Electric	Level 2 inspection items: ≤ 25 deviations/1000 items inspected	13.77	5.06	28.12	26.40	8.66	10.43	10.17	5.04	12.21	5.89	1.95	7.28
		Quanta Electric	Level 3 inspection items: ≤ 25 deviations/1000 items inspected	15.41	14.91	7.39	18.67	11.15	15.08	4.98	8.81	6.47	6.84	8.86	5.62
		Quanta Gas	Achieve a level of QA/QC compliance rate conformance to PSE Standards as follows: Level 1 inspection items: ≤ 8 deviations/1000 items inspected	4.26	0.00	5.83	0.00	1.35	9.95	3.38	1.60	5.97	10.50	0.00	4.08
		Quanta Gas	Level 2 inspection items: ≤ 15 deviations/1000 items inspected	8.44	6.04	4.84	3.22	15.54	5.91	8.78	8.19	6.29	6.38	8.42	4.80
		Quanta Gas	Level 3 inspection items: ≤ 12 deviations/1000 items inspected	4.34	7.31	0.00	2.16	4.00	2.43	0.00	2.82	2.08	5.69	1.81	2.00
	Secondary Safety Response and Restoration Time-Core-Hour	Quanta Electric	Within 250 minutes from the dispatch time to the restoration of non-emergency outage during core hours	270	244	245	239	263	271	246	249	230	247	230	256
	Secondary Safety Response and Restoration Time-Non-Core-Hour	Quanta Electric	Within 316 minutes from the dispatch time to the restoration of non-emergency outage during non-core hours	267	263	268	251	250	273	260	262	253	259	278	266
	Secondary Safety Response Time	Quanta Gas	Within 60 minutes from first first response assessment completion to second response arrival	44	51	51	44	49	48	52	44	60	59	58	57

Note: Results shown are rounded to the nearest whole percentage per UTC order. However, these 100% monthly performance results do not reflect that the service providers met all the new construction appointments during the reporting period. Numbers of PSE missed appointments, including the new customer construction appointments carried out the service providers are detailed in Appendix F: Customer Service Guarantee Performance Detail.

Table A3: Attachment A to Appendix A—Major Event and Localized Emergency Event Days (Affected Local Areas Only)

This Attachment A to Appendix A provides detail on Major Event and localized emergency event days (Affected local areas only).

PUGET SOUND ENERGY

SQI #11 Supplemental Reporting Major Event And Localized Emergency Event Days Affected Local Areas Only

Date	Type of Event	Local Area	Duration (Days)	No. of Customers Affected	No. of Customers in Area	% of Customers Affected	No. of Outage Events	Resource Utilization (for the event, EFR Count only)	>5% Customer Affected or SAIDI Tmed Event	Comments[36]
1/21/2018	Wind	North	1	8,498	202,576	4.2%	72	11 of 14	No	11 Event Duty, 1 PTO, 2 Reg day-off, 8 Line Crews, 2 Tree Crews
1/27/2018	Wind	South	2	22,647	253,043	8.9%	59	15 of 15	No	15 Event Duty, 7 Line Crews, 5 Tree Crews
2/17/2018	Wind	North	4	35,779	202,746	17.6%	130	14 of 14	Yes	14 Event Duty, 13 Line Crews, 4 Tree Crews
2/17/2018	Wind	Central North	4	8,058	316,270	2.5%	90	21 of 21	Yes	21 Event Duty, 6 Line Crews, 2 Tree Crews
2/17/2018	Wind	Central South	4	47,895	243,293	19.7%	119	12 of 12	Yes	12 Event Duty, 8 Line Crews, 3 Tree Crews
2/17/2018	Wind	South	4	14,539	253,441	5.7%	96	15 of 15	Yes	15 Event Duty, 8 Line Crews, 4 Tree Crews
2/17/2018	Wind	West	4	93,628	128,351	72.9%	360	12 of 12	Yes	12 Event Duty, 25 Line Crews, 12 Tree Crews
11/2/2018	Wind	West	1	3,720	129,016	2.90%	17	9 of 12	No	9 Event Duty, 2 PTO, 1 Reg day-off, 6 Line Crews, 4 Tree Crews
11/4/2018	Wind	North	1	1,705	203,989	0.8%	26	10 of 16	No	10 Event Duty, 2 PTO, 4 Reg day-offs, 11 Line Crews, 1 Tree Crew
11/26/2018	Wind	North	1	4,118	203,989	2.0%	45	12 of 16	No	12 Event Duty, 3 PTO, 1 Reg day-off, 11 Line Crews, 1 Tree Crew
11/27/2018	Wind	West	1	1,811	129,016	1.4%	17	10 of 11	No	10 Event Duty, 1 PTO, 6 Line Crews, 2 Tree Crews
12/13/2018	Wind	North	1	2,425	204,219	1.2%	39	12 of 16	No	12 Event Duty, 2 PTO, 2 Reg day-off, 11 Line Crews, 2 Tree Crews

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[36] **EFR**—Electric First Responder, **PTO**—Paid Time Off, **Reg day-off**—Regular day-off, **STD**—Short-Term Disability, **SP**—Service Provider

Table A3: Attachment A to Appendix A—Major Event and Localized Emergency Event Days (Affected Local Areas Only)

Date	Type of Event	Local Area	Duration (Days)	No. of Customers Affected	No. of Customers in Area	% of Customers Affected	No. of Outage Events	Resource Utilization (for the event, EFR Count only)	>5% Customer Affected or SAIDI Tmed Event	Comments[37]
12/14/2018	Wind	North	4	27,048	204,219	13.2%	128	14 of 14	Yes	14 Event Duty, 9 Line Crews, 6 Tree Crews
12/14/2018	Wind	Central North	4	56,635	320,205	17.7%	165	21 of 21	Yes	21 Event Duty, 9 Line Crews, 7 Tree Crews
12/14/2018	Wind	Central South	4	13,456	245,067	5.5%	86	12 of 12	Yes	12 Event Duty, 6 Line Crews, 1 Tree Crew
12/14/2018	Wind	South	4	39,335	255,888	15.4%	140	15 of 15	Yes	15 Event Duty, 8 Line Crews, 4 Tree Crews
12/14/2018	Wind	West	4	40,634	129,120	31.5%	161	12 of 12	Yes	12 Event Duty, 16 Line Crews, 8 Tree Crews
12/18/2018	Wind	South	1	5,082	255,888	2.0%	27	14 of 16	No	14 Event Duty, 1 PTO, 1 Reg day-off, 8 Line Crews
12/18/2018	Wind	West	1	6,105	129,120	4.7%	17	12 of 12	No	12 Event Duty, 6 Line Crews
12/20/2018	Wind	North	8	128,939	204,219	63.1%	778	14 of 14	Yes	14 Event Duty, 50 Line Crews, 23 Tree Crews
12/20/2018	Wind	Central North	8	19,950	320,205	6.2%	159	21 of 21	Yes	21 Event Duty, 4 Line Crews, 5 Tree Crews
12/20/2018	Wind	Central South	8	30,548	245,067	12.5%	106	12 of 12	Yes	12 Event Duty, 5 Line Crews, 5 Tree Crews
12/20/2018	Wind	South	8	46,452	255,888	18.2%	148	15 of 15	Yes	15 Event Duty, 8 Line Crews, 10 Tree Crews
12/20/2018	Wind	West	8	70,309	129,120	54.5%	294	12 of 12	Yes	12 Event Duty, 25 Line Crews, 12 Tree Crews

[37] **EFR**—Electric First Responder, **PTO**—Paid Time Off, **Reg day-off**—Regular day-off, **STD**—Short-Term Disability, **SP**—Service Provider

Table A4: Attachment B to Appendix A—Major Event and Localized Emergency Event Days (Non-Affected Local Areas Only)

This Attachment B to Appendix A provides detail on Major Event and localized emergency event days (Non-affected local areas only).

PUGET SOUND ENERGY	SQI #11 Supplemental Reporting Major Event And Localized Emergency Event Days Non-Affected Local Areas Only									
Date	Type of Event	Local Area	Duration (Days)	No. of Customers Affected	No. of Customers in Area	% of Customers Affected	No. of Outage Events	Resource Utilization (for the event, EFR Count only)	>5% Customer Affected or SAIDI Tmed Event)	Comments
1/21/2018	Wind	Central North	1	751	316,055	0.2%	9	Local	No	
1/21/2018	Wind	Central South	1	270	243,194	0.1%	2	Local	No	
1/21/2018	Wind	South	1	756	253,043	0.3%	18	Local	No	
1/21/2018	Wind	West	1	4,666	128,298	3.6%	13	Local	No	
1/27/2018	Wind	North	2	3,790	8,498	44.6%	23	Local	No	
1/27/2018	Wind	Central North	2	7,844	316,055	2.5%	33	Local	No	
1/27/2018	Wind	Central South	2	170	243,194	0.1%	15	Local	No	
1/27/2018	Wind	West	2	8,272	128,298	6.4%	36	Local	No	
11/2/2018	Wind	North	1	4,612	203,989	2.3%	56	Local	No	
11/2/2018	Wind	Central North	1	3,998	319,481	1.3%	27	Local	No	
11/2/2018	Wind	Central South	1	2,391	244,881	1.0%	18	Local	No	

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Table A4: Attachment B to Appendix A—Major Event and Localized Emergency Event Days (Non-Affected Local Areas Only)

Date	Type of Event	Local Area	Duration (Days)	No. of Customers Affected	No. of Customers in Area	% of Customers Affected	No. of Outage Events	Resource Utilization (for the event, EFR Count only)	>5% Customer Affected or SAIDI Tmed Event)	Comments
11/2/2018	Wind	South	1	1,111	255,663	0.4%	20	Local	No	
11/4/2018	Wind	Central North	1	4,571	319,481	1.4%	27	Local	No	
11/4/2018	Wind	Central South	1	2,503	244,881	1.0%	10	Local	No	
11/4/2018	Wind	South	1	2,335	255,663	0.9%	9	Local	No	
11/4/2018	Wind	West	1	100	129,016	0.1%	8	Local	No	
11/26/2018	Wind	Central North	1	1,240	319,481	0.4%	11	Local	No	
11/26/2018	Wind	Central South	1	389	244,881	0.2%	4	Local	No	
11/26/2018	Wind	South	1	2,517	255,663	1.0%	19	Local	No	
11/26/2018	Wind	West	1	294	129,016	0.2%	6	Local	No	
11/27/2018	Wind	North	1	255	203,989	0.1%	14	Local	No	
11/27/2018	Wind	Central North	1	77	319,481	0.0%	3	Local	No	
11/27/2018	Wind	Central South	1	10,598	244,881	4.3%	13	Local	No	
11/27/2018	Wind	South	1	332	255,663	0.1%	12	Local	No	
12/13/2018	Wind	Central North	1	15	320,205	0.0%	4	Local	No	

Table continues on next page

Table A4: Attachment B to Appendix A—Major Event and Localized Emergency Event Days (Non-Affected Local Areas Only)

Date	Type of Event	Local Area	Duration (Days)	No. of Customers Affected	No. of Customers in Area	% of Customers Affected	No. of Outage Events	Resource Utilization (for the event, EFR Count only)	>5% Customer Affected or SAIDI Tmed Event	Comments
12/13/2018	Wind	Central South	1	507	245,067	0.2%	10	Local	No	
12/13/2018	Wind	South	1	4,411	255,888	1.7%	23	Local	No	
12/13/2018	Wind	West	1	118	129,120	0.1%	9	Local	No	
12/18/2018	Wind	North	1	1,492	204,219	0.7%	9	Local	No	
12/18/2018	Wind	Central North	1	504	320,205	0.2%	17	Local	No	
12/18/2018	Wind	Central South	1	1,393	245,067	0.6%	17	Local	No	

Table A5: Attachment C to Appendix A—Natural Gas Reportable Incidents and Control Time

This Attachment C to Appendix A provides detail on each natural gas reportable incident and response times.[38]

Natural Gas Reportable Incidents and Control Time (in Hours : Minutes)						
Date	City	Address	1st Notice to PSE	First PSE Arrival	Emergency Controlled	Emergency Control Time
1/13/2018	Kirkland	2004 Market St	12:37	12:54	13:39	0:45
1/16/2018	Lynnwood	18600 Alderwood Mall Pkwy	11:47	11:55	12:08	0:13
1/24/2018	Kirkland	303 5th Ave W	7:59	8:33	8:43	0:10
2/23/2018	Tacoma	5223 S Prospect St	10:46	11:03	13:00	1:57
3/1/2018	Olympia	500 Washington St SE	1:42	2:28	3:49	1:21
3/2/2018	Puyallup	9903 168th St E	10:32	10:32	14:18	3:46
3/14/2018	Des Moines	26301 13th Pl S	9:36	9:36	20:30	10:54
3/14/2018	Edmonds	311 Elm ST	11:52	12:18	12:22	0:04
4/5/2018	Issaquah	3199 Issaquah Pine Lake Rd	8:52	9:08	9:08	0:00
4/10/2018	Tulalip	7204 27th Ave NE	13:42	14:01	14:11	0:10
4/30/2018	Lynnwood	19000 24th Ave W	23:54	1:15	9:23	8:08

Table continues on next page.

[38] Report of the time duration from first arrival to control of gas emergencies, for incidents subject to reporting under the 2003 edition of WAC 480-93-200 and WAC 480-93-210, Order R-374, Docket UG-911261.

Natural Gas Reportable Incidents and Control Time (in Hours : Minutes)						
Date	City	Address	1st Notice to PSE	First PSE Arrival	Emergency Controlled	Emergency Control Time
5/2/2018	Tacoma	3717 N 21st St	10:45	10:57	12:10	1:13
5/8/2018	Seattle	John St &Yale Ave N	9:53	10:02	10:23	0:21
5/8/2018	Seattle	5614 7th Ave S	11:15	10:19	11:25	1:06
5/10/2018	Edmonds	753 Bell Street	8:51	9:06	9:15	0:09
5/24/2018	Bothell	3305 Monte Villa Parkway	13:45	14:06	14:16	0:10
6/11/2018	Seattle	1024 Washington PL E	10:15	10:27	10:53	0:26
6/12/2018	Auburn	610 H St NE	7:52	8:07	8:21	0:14
6/12/2018	Redmond	14902 NE 64th St	12:26	12:46	13:01	0:15
6/18/2018	Kenmore	244th ST SW & 48th Ave W	3:00	3:40	3:45	0:05
6/19/2018	Kenmore	244th ST SW & 48th Ave W	1:54	2:30	3:00	0:30
6/20/2018	Seattle	2703 W Mcgraw St	10:03	10:13	10:26	0:13
6/20/2018	Seattle	3437 37th Ave SW	15:18	15:34	15:40	0:06
6/22/2018	Maple Valley	26135 Lake Wilderness Club Dr SE	8:22	8:55	9:04	0:09
6/25/2018	Tukwila	5116 S 142nd St	9:58	10:15	11:03	0:48
7/1/2018	Seattle	1508 McGilvra Blvd E	9:29	9:53	10:05	0:12
7/2/2018	Seattle	6000 16th Ave SW	8:43	8:59	9:27	0:28

Table continues on next page.

Natural Gas Reportable Incidents and Control Time (in Hours : Minutes)						
Date	City	Address	1st Notice to PSE	First PSE Arrival	Emergency Controlled	Emergency Control Time
7/4/2018	Bothell	4032 214 St SE	23.52	0:42	0:42	0:00
7/14/2018	Auburn	3325 S 300th Pl	13:18	13:34	13:34	0:00
7/18/2018	Kirkland	1306 3rd St	12:36	12:50	12:59	0:09
7/20/2018	Bothell	19606 96nd Ave NE	11:25	11:37	11:48	0:11
7/20/2018	Covington	16401 SE 251st St	11:03	11:15	17:20	6:05
7/30/2018	Tacoma	3502 S Gunnison ST	11:47	12:04	12:13	0:09
8/2/2018	Tacoma	912 E 64th St	17:35	18:02	18:02	0:00
8/7/2018	North Bend	45710 SE North Bend Way	9:36	10:22	12:03	1:41
8/9/2018	Tukwila	14110 Tukwila International Blvd	11:54	12:14	12:28	0:14
8/11/2018	Everett	13621 51st Dr SE	15:44	16:11	16:23	0:12
8/14/2018	Maple Valley	26135 Lake Wilderness Club Dr SE	9:18	9:52	10:10	0:18
8/15/2018	Kent	20761 SE 295 St	11:58	12:29	12:40	0:11
8/24/2018	Bothell	16815 29th Dr SE	11:09	11:24	12:09	0:45
8/25/2018	Centralia	1220 Saint Helens Street	14:30	16:18	16:50	0:32
9/5/2018	Seattle	403 Roy Str	14:40	14:57	15:06	0:09
9/13/2018	Kent	17605 SE 272ND St	23:53	23:53	5:28	5:35

Table continues on next page.

Natural Gas Reportable Incidents and Control Time (in Hours : Minutes)						
Date	City	Address	1st Notice to PSE	First PSE Arrival	Emergency Controlled	Emergency Control Time
9/18/2018	Woodinville	20725 NE 167th Pl	21:25	21:45	21:45	0:00
9/19/2018	Tacoma	5402 N 37th St	8:29	8:37	8:51	0:14
9/21/2018	Federal Way	35425 Enchanted Parkway S	10:57	11:10	14:18	3:08
9/21/2018	Olympia	4045 Rainwood Dr NW	15:04	15:33	15:43	0:10
10/11/2018	Kent	22610 85th Pl S	12:04	12:22	12:29	0:07
10/15/2018	Tacoma	2532 Bitar Ave #E, JBLM	8:29	8:59	9:05	0:06
10/15/2018	Monroe	15589 179 Ave SE	15:29	15:48	16:22	0:34
10/15/2018	Seattle	1722 N 45th St #2 Freemont	20:31	20:53	20:53	0:00
10/17/2018	Seattle	2629 SW Andover St	1:26	2:05	2:05	0:00
10/19/2018	Seattle	1st Ave & Cherry St	8:23	8:35	9:15	0:40
10/20/2018	Seattle	6334 50th Ave SW	14:20	14:31	14:40	0:09
10/24/2018	Bellevue	13710 Spring Blvd	13:47	14:06	16:22	2:16
10/30/2018	Redmond	17809 NE 103rd St	11:09	11:37	11:41	0:04
10/31/2018	YELM	11500 Bald Hill Rd SE	14:10	14:14	18:18	4:04
11/1/2018	Woodinville	17750 201st Ave NE	10:39	11:18	11:32	0:14
11/2/2018	Tacoma	920 S 9th St	11:46	11:56	11:56	0:00

Table continues on next page.

Natural Gas Reportable Incidents and Control Time (in Hours : Minutes)						
Date	City	Address	1st Notice to PSE	First PSE Arrival	Emergency Controlled	Emergency Control Time
11/8/2018	Renton	2099 Benson Rd	13:35	14:30	14:36	0:06
11/10/2018	Kent	26919 Saxon Ct	16:36	16:58	17:22	0:24
11/15/2018	Tacoma	4601 S Thompson Ave	10:50	11:01	11:19	0:18
12/6/2018	Seattle	2733 Franklin Ave E	0:32	1:20	1:36	0:16
12/7/2018	Kent	22029 70th Ave S	12:04	12:16	12:27	0:11
12/10/2018	Seattle	9551 Anshworth Ave N	9:51	10:07	10:56	0:49
12/11/2018	Centralia	112 N Tower Ave	13:34	13:49	14:15	0:26
12/12/2018	Seattle	187 S Holgate St	8:31	9:05	9:19	0:14
12/14/2018	Bellevue	6328 121st Ave SE	21:45	22:10	1:58	3:48
12/20/2018	Olympia	37Ave SE & Pifer Ct SE	13:47	14:04	14:52	0:48
					Average Control Time for 2018	**1:00**

B

Certification of Survey Results

TO: Eric Haechrel, Puget Sound Energy
FR: Andrew Thibault, EMC Research, Inc.
DT: December 2018
RE: PSE Service Quality Index Research

This memo constitutes certification by EMC Research, Inc. that the tabulations and underlying surveys were conducted and prepared in accordance with the procedures established in Docket Nos. UE-011570 and UG-011571.

These procedures, data collection methods, and quality controls are consistent with industry practices and, we believe, ensure that the data collected and information produced in the surveys is unbiased and valid.

We are glad to answer any questions about the research methodology and provide any additional information you may need.

Sincerely,

Andrew Thibault, Principal
EMC Research Inc.

C
Penalty Calculation

For the 2018 reporting year, PSE met all the performance benchmarks therefore PSE did not incur any penalty associated with its service quality index performance.

D
Proposed Customer Notice (Report Card)

2018 Service Quality Report Card

The Customer Service Performance Report Card is designed to inform customers of how well PSE delivers its services in key areas to its customers. The Report Card will be distributed to customers only after adequate consultation with Staff and Public Counsel, but no later than 90 days after PSE files its annual SQ and Electric Service Reliability Report.

Figure D1 shows PSE's proposed Customer Service Performance Report Card.

Figure D1: Draft 2018 Service Quality Report Card

2018 Service Quality Report Card

Key measurement	Benchmark	2018 Performance	Achieved
Customer Satisfaction			
Percent of customers satisfied with our Customer Care Center services, based on survey	At least 90 percent	94 percent	✓
Percent of customers satisfied with field services, based on survey	At least 90 percent	95 percent	✓
Number of complaints to the WUTC per 1,000 customers, per year	Less than 0.40	0.16	✓
CUSTOMER SERVICES			
Percent of calls answered live within 60 seconds by our Customer Care Center	At least 80 percent	81 percent	✓
OPERATIONS SERVICES			
Frequency of non-major-storm power outages, per year, per customer	Less than 1.30 outages	1.02 outages	✓
Length of power outages per year, per customer*	Less than 2 hours, 35 minutes	2 hours, 25 minutes	✓
Time from customer call to arrival of field technicians in response to electric system emergencies	No more than 55 minutes	52 minutes	✓
Time from customer call to arrival of field technicians in response to natural gas emergencies	No more than 55 minutes	30 minutes	✓
Percent of service appointments kept	At least 92 percent	100 percent **	✓

* There is no penalty associated with this measurement

**Percent in table rounded up from 99.5 percent result.

Each year Puget Sound Energy measures service-quality benchmarks established in cooperation with the Washington Utilities and Transportation Commission (UTC), the Public Counsel Section of the Attorney General's Office and other parties to gauge how well we deliver our services to you and all of our customers. Failure to achieve all nine service-quality measurements in a reporting year would have put us at risk of a penalty up to $12 million, or $1.5 million per measurement.

2018 Performance Highlights

In 2018 we met all nine service metrics (see chart above), including the new measure for the calls answering performance. In fact, compared to 2017-18, we improved our own record in all customer satisfaction measurements and the response-times to electric and natural gas emergencies. The annual results for non-major-storm power outages were also better. For these results we credit the efforts of all our employees and contractors.

We had three service guarantees in 2018. We credit your bill $50 if we fail to meet these guarantees.

- Keeping scheduled appointments
- If your power is out for 120 consecutive hours or longer during any power outage.
- If your power is out for 24 consecutive hours or longer during a non-major-storm power outage.

We credited customers a total of $24,450 for missing 489, or 0.5 percent, of our total 107,329 scheduled appointments.

We credited one customer $50 for not restoring electric service within 120 consecutive hours of a power outage.

Starting from 2017, we added a new service guarantee with a $50 credit if your power is out for longer than 24 hours, barring a major storm or event. For 2018, we gave 29 customers the $50 credit for not restoring electric service within 24 consecutive hours during certain non-major-storm power outages.

Every day our employees continually aim to achieve new levels of providing safe, dependable and efficient service to meet your expectations of us.

E
Disconnection Results

Tables E1 and E2 provide the annual and monthly number of disconnections per 1,000 customers for non-payment of amounts due when the UTC disconnection policy would permit service curtailment.

Table E1: Annual Disconnection Results from 2014 to 2018 per 1,000 Customers

2014	2015	2016	2017	2018
47	50	42	53	48

Table E2: Monthly Disconnection Results per 1,000 Customers for 2018

Month	Disconnections per 1,000 Customers
January	6
February	4
March	5
April	5
May	5
June	5
July	2
August	3
September	3
October	5
November	4
December	2

F
Customer Service Guarantee Performance Detail

This appendix provides detail on SQI #10, Appointments Kept, performance and customer service guarantee payment by service type and month.

Definition of the Categories:

Canceled—Appointments canceled by either customers or PSE

Excused—Appointments missed due to customer reasons or due to SQI Major Events

Manual Kept—Adjusted missed appointments resulting from review by the PSE personnel

Missed Approved—Appointments missed due to PSE reasons and customers are paid the $50 Customer Service Guarantee payment

Missed Open—Appointments not yet reviewed by PSE for the $50 Service Guarantee payment

Customer Service Guarantee Payment—Total for the $50 Customer Service Guarantee payments made to customers for each missed approved appointment

System Kept—Appointments in which PSE arrived at the customer site as promised

Total Appointments (Excludes Canceled and Excused)—Sum of Total Missed and Total Kept

Total Kept—Total number of Manual Kept and System Kept

Total Missed—Total number of Missed Approved, Missed Denied, and Missed Open

Table F1: SQI #10 and Customer Service Guarantee Payment Annual Summary for 2018

	Total Appointments (Exclude Canceled and Excused)	Missed Approved	Missed Open	Total Missed	Manual Kept	System Kept	Total Kept	Canceled	Excused	Customer Service Guarantee Payment	Percent Kept (Exclude Canceled and Excused) [39]
Electric											
Permanent Service	9,230	83	-	83	142	9,005	9,147	-	33	$4,150	99%
Reconnection	47,515	54	-	54	127	47,334	47,461	-	7	$2,700	100%
Subtotal	**56,745**	**137**	**-**	**137**	**269**	**56,339**	**56,608**	**-**	**40**	**$6,850**	**100%**
Natural Gas											
Diagnostic	22,791	39	-	39	750	22,002	22,752	-	-	$1,950	100%
Permanent Service	10,310	302	-	302	256	9,752	10,008	-	7	$15,100	97%
Reconnection	17,483	11	-	11	237	17,235	17,472	-	-	$550	100%
Subtotal	**50,584**	**352**	**-**	**352**	**1,243**	**48,989**	**50,232**	**-**	**7**	**$17,600**	**99%**
Grand Total	**107,329**	**489**	**-**	**489**	**1,512**	**105,328**	**106,840**	**-**	**47**	**$24,450**	**100%**

[39] Results shown are rounded to the nearest whole percentage per UTC order for performance calculation and comparison to the benchmark. However, these 100% performance results do not reflect that PSE met all its appointments during the reporting period.

Table F2: SQI #10 and Customer Service Guarantee Payment Annual Details for 2018

2018 SQI #10 and Customer Service Guarantee Payment Monthly Details												
Month	Fuel	Type	Total Appointments (Exclude Canceled and Excused)	Missed Approved	Missed Open	Total Missed	Manual Kept	System Kept	Total Kept	Canceled	Excused	Customer Service Guarantee Payment
Jan-18	Electric	Permanent Service	**734**	9	0	9	6	719	725	0	0	$450
Jan-18	Electric	Reconnection	**4,868**	3	0	3	9	4,856	4,865	0	0	$150
Jan-18	Gas	Diagnostic	**2,204**	2	0	2	79	2,123	2,202	0	0	$100
Jan-18	Gas	Permanent Service	**984**	43	0	43	26	915	941	0	0	$2,150
Jan-18	Gas	Reconnection	**1,853**	0	0	0	21	1,832	1,853	0	0	$0
Jan-18 Total			**10,643**	57	0	57	141	10,445	10,586	0	0	$2,850
Feb-18	Electric	Permanent Service	**603**	3	0	3	8	592	600	0	21	$150
Feb-18	Electric	Reconnection	**3,863**	3	0	3	9	3,851	3,860	0	0	$150
Feb-18	Gas	Diagnostic	**2,231**	4	0	4	74	2,153	2,227	0	0	$200
Feb-18	Gas	Permanent Service	**784**	4	0	4	15	765	780	0	3	$200
Feb-18	Gas	Reconnection	**1,344**	1	0	1	13	1,330	1,343	0	0	$50
Feb-18 Total			**8,825**	15	0	15	119	8,691	8,810	0	24	$750
Mar-18	Electric	Permanent Service	**741**	7	0	7	8	726	734	0	0	$350
Mar-18	Electric	Reconnection	**4,943**	5	0	5	8	4,930	4,938	0	0	$250
Mar-18	Gas	Diagnostic	**1,735**	2	0	2	63	1,670	1,733	0	0	$100
Mar-18	Gas	Permanent Service	**883**	9	0	9	18	856	874	0	4	$450
Mar-18	Gas	Reconnection	**1,496**	1	0	1	13	1,482	1,495	0	0	$50
Mar-18 Total			**9,798**	24	0	24	110	9,664	9,774	0	4	$1,200

Table continues on next page.

2018 SQI #10 and Customer Service Guarantee Payment Monthly Details												
Month	Fuel	Type	Total Appointments (Exclude Canceled and Excused)	Missed Approved	Missed Open	Total Missed	Manual Kept	System Kept	Total Kept	Canceled	Excused	Customer Service Guarantee Payment
Apr-18	Electric	Permanent Service	**743**	3	0	3	9	731	740	0	0	$150
Apr-18	Electric	Reconnection	**4,756**	2	0	2	11	4,743	4,754	0	0	$100
Apr-18	Gas	Diagnostic	**1,451**	2	0	2	38	1,411	1,449	0	0	$100
Apr-18	Gas	Permanent Service	**774**	16	0	16	14	744	758	0	0	$800
Apr-18	Gas	Reconnection	**1,490**	0	0	0	23	1,467	1,490	0	0	$0
Apr-18 Total			**9,214**	23	0	23	95	9,096	9,191	0	0	$1,150
May-18	Electric	Permanent Service	**802**	1	0	1	8	793	801	0	0	$50
May-18	Electric	Reconnection	**4,963**	1	0	1	7	4,955	4,962	0	0	$50
May-18	Gas	Diagnostic	**954**	2	0	2	32	920	952	0	0	$100
May-18	Gas	Permanent Service	**917**	22	0	22	17	878	895	0	0	$1,100
May-18	Gas	Reconnection	**1,381**	2	0	2	17	1,362	1,379	0	0	$100
May-18 Total			**9,017**	28	0	28	81	8,908	8,989	0	0	$1,400
Jun-18	Electric	Permanent Service	**740**	5	0	5	18	717	735	0	0	$250
Jun-18	Electric	Reconnection	**4,395**	6	0	6	14	4,375	4,389	0	0	$300
Jun-18	Gas	Diagnostic	**1,009**	1	0	1	34	974	1,008	0	0	$50
Jun-18	Gas	Permanent Service	**813**	18	0	18	15	780	795	0	0	$900
Jun-18	Gas	Reconnection	**1,484**	4	0	4	15	1,465	1,480	0	0	$200
Jun-18 Total			**8,441**	34	0	34	96	8,311	8,407	0	0	$1,700

Table continues on next page.

2018 SQI #10 and Customer Service Guarantee Payment Monthly Details												
Month	Fuel	Type	Total Appointments (Exclude Canceled and Excused)	Missed Approved	Missed Open	Total Missed	Manual Kept	System Kept	Total Kept	Canceled	Excused	Customer Service Guarantee Payment
Jul-18	Electric	Permanent Service	**781**	10	0	10	27	744	771	0	0	$500
Jul-18	Electric	Reconnection	**2,679**	3	0	3	1	2,675	2,676	0	0	$150
Jul-18	Gas	Diagnostic	**925**	2	0	2	21	902	923	0	0	$100
Jul-18	Gas	Permanent Service	**843**	14	0	14	21	808	829	0	0	$700
Jul-18	Gas	Reconnection	**996**	0	0	0	12	984	996	0	0	$0
Jul-18 Total			**6,224**	29	0	29	82	6,113	6,195	0	0	$1,450
Aug-18	Electric	Permanent Service	**957**	11	0	11	21	925	946	0	0	$550
Aug-18	Electric	Reconnection	**3,283**	2	0	2	12	3,269	3,281	0	0	$100
Aug-18	Gas	Diagnostic	**1,094**	5	0	5	37	1,052	1,089	0	0	$250
Aug-18	Gas	Permanent Service	**934**	44	0	44	38	852	890	0	0	$2,200
Aug-18	Gas	Reconnection	**1,365**	0	0	0	15	1,350	1,365	0	0	$0
Aug-18 Total			**7,633**	62	0	62	123	7,448	7,571	0	0	$3,100
Sep-18	Electric	Permanent Service	**769**	9	0	9	9	751	760	0	0	$450
Sep-18	Electric	Reconnection	**3,304**	5	0	5	10	3,289	3,299	0	0	$250
Sep-18	Gas	Diagnostic	**1,974**	4	0	4	62	1,908	1,970	0	0	$200
Sep-18	Gas	Permanent Service	**910**	48	0	48	13	849	862	0	0	$2,400
Sep-18	Gas	Reconnection	**1,320**	0	0	0	18	1,302	1,320	0	0	$0
Sep-18 Total			**8,277**	66	0	66	112	8,099	8,211	0	0	$3,300

Table continues on next page.

2018 SQI #10 and Customer Service Guarantee Payment Monthly Details												
Month	Fuel	Type	Total Appointments (Exclude Canceled and Excused)	Missed Approved	Missed open	Total Missed	Manual Kept	System Kept	Total Kept	Canceled	Excused	Customer Service Guarantee Payment
Oct-18	Electric	Permanent Service	**976**	12	0	12	13	951	964	0	0	$600
Oct-18	Electric	Reconnection	**4,878**	15	0	15	3	4,860	4,863	0	0	$750
Oct-18	Gas	Diagnostic	**3,509**	9	0	9	121	3,379	3,500	0	0	$450
Oct-18	Gas	Permanent Service	**967**	62	0	62	26	879	905	0	0	$3,100
Oct-18	Gas	Reconnection	**1,996**	1	0	1	28	1,967	1,995	0	0	$50
Oct-18 Total			**12,326**	99	0	99	191	12,036	12,227	0	0	$4,950
Nov-18	Electric	Permanent Service	**764**	5	0	5	8	751	759	0	0	$250
Nov-18	Electric	Reconnection	**3,708**	4	0	4	35	3,669	3,704	0	0	$200
Nov-18	Gas	Diagnostic	**2,933**	2	0	2	89	2,842	2,931	0	0	$100
Nov-18	Gas	Permanent Service	**843**	13	0	13	23	807	830	0	0	$650
Nov-18	Gas	Reconnection	**1,677**	1	0	1	32	1,644	1,676	0	0	$50
Nov-18 Total			**9,925**	25	0	25	187	9,713	9,900	0	0	$1,250
Dec-18	Electric	Permanent Service	**620**	8	0	8	7	605	612	0	12	$400
Dec-18	Electric	Reconnection	**1,875**	5	0	5	8	1,862	1,870	0	7	$250
Dec-18	Gas	Diagnostic	**2,772**	4	0	4	100	2,668	2,768	0	0	$200
Dec-18	Gas	Permanent Service	**658**	9	0	9	30	619	649	0	0	$450
Dec-18	Gas	Reconnection	**1,081**	1	0	1	30	1,050	1,080	0	0	$50
Dec-18 Total			**7,006**	27	0	27	175	6,804	6,979	0	19	$1,350
Grand Total			**107,329**	489	0	489	1,512	105,328	106,840	0	47	$24,450

G
Customer Awareness of Service Guarantees

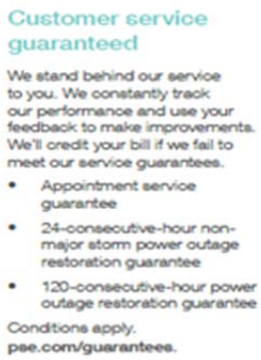
In 2018, Puget Sound Energy made customers aware of the three service guarantees through the following efforts:

1. PSE Customer Care Center and Customer Service Office representative received training about the Service Guarantee and the follow this script:

   If we miss your customer service guarantee appointment under normal operating conditions, we will automatically credit your energy account with $50—guaranteed.
2. An online job aid that explains the circumstances for notifying customers about the Customer Service Guarantee is available to all representatives and field employees.
3. Every customer new to PSE service receives the *Your customer rights and responsibilities* brochure, which is also posted year-round on pse.com.

The samples below illustrate some of the communications used to raise awareness about PSE's three Service Guarantees.

4. January 2018 bill-insert newsletter article to all customers, also posted on pse.com:

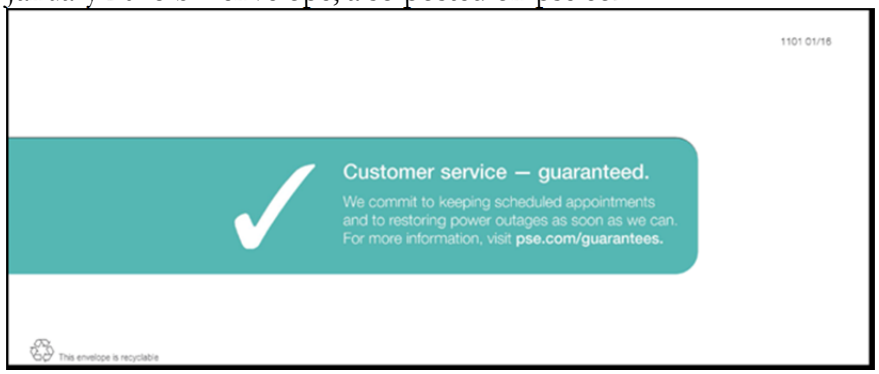

Customer service guaranteed

We stand behind our service to you. We constantly track our performance and use your feedback to make improvements. We'll credit your bill if we fail to meet our service guarantees.

- Appointment service guarantee
- 24-consecutive-hour non-major storm power outage restoration guarantee
- 120-consecutive-hour power outage restoration guarantee

Conditions apply.
pse.com/guarantees.

5. January 2018 bill envelope, also posted on pse.com:



6. May 2018 bill insert newsletter article to all customers, also posted on pse.com:

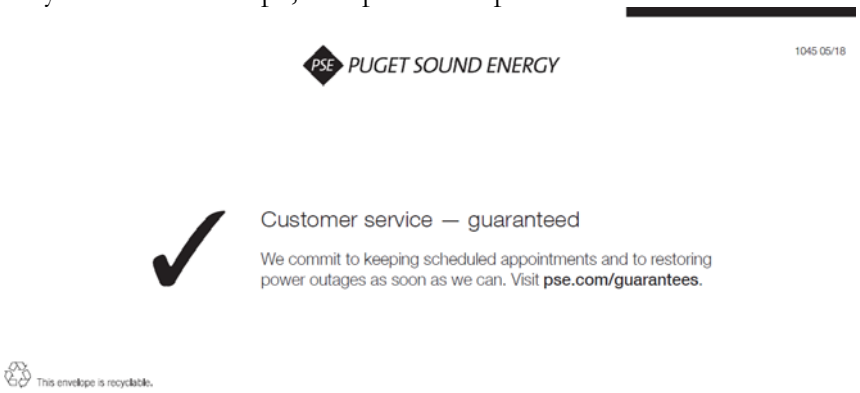
Customer service guaranteed

We stand behind our service to you. We constantly track our performance and use your feedback to make improvements. We'll credit your bill if we fail to meet our service guarantees.

- Appointment service guarantee
- 24-consecutive-hour non-major storm power outage restoration guarantee
- 120-consecutive-hour power outage restoration guarantee

Conditions apply. **pse.com/guarantees**

7. May 2018 bill envelope, also posted on pse.com:



PUGET SOUND ENERGY

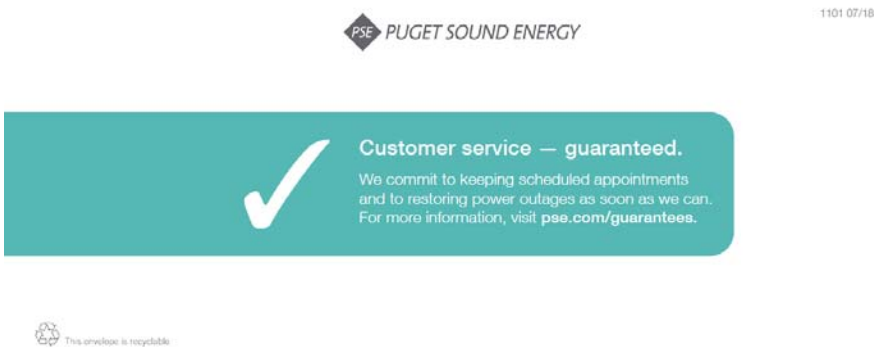
1045 05/18

Customer service — guaranteed

We commit to keeping scheduled appointments and to restoring power outages as soon as we can. Visit **pse.com/guarantees**.

This envelope is recyclable.

8. July 2018 bill envelope, also posted on pse.com:



PUGET SOUND ENERGY

1101 07/18

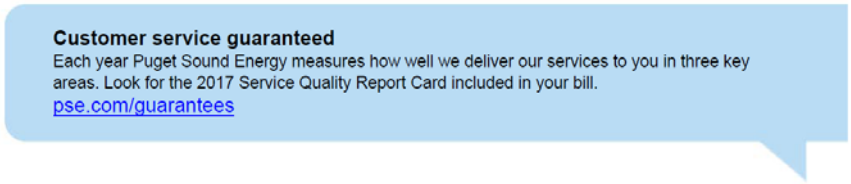
Customer service — guaranteed.

We commit to keeping scheduled appointments and to restoring power outages as soon as we can. For more information, visit **pse.com/guarantees.**

This envelope is recyclable.

9. July 2018 bill-print message for all customers with link to Service Guarantees page on pse.com:

July 2018 bill print messages
Summary page



Customer service guaranteed
Each year Puget Sound Energy measures how well we deliver our services to you in three key areas. Look for the 2017 Service Quality Report Card included in your bill.
pse.com/guarantees

10. September 2018 bill insert newsletter article to all customers, also posted on pse.com:

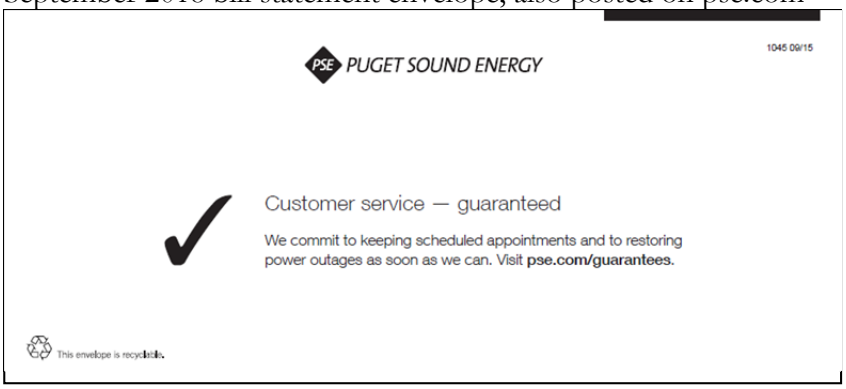
Customer service guaranteed

We stand behind our service to you. We constantly track our performance and use your feedback to make improvements. We'll credit your bill if we fail to meet our service guarantees.

- Appointment service guarantee
- 24-consecutive-hour non-major storm power outage restoration guarantee
- 120-consecutive-hour power outage restoration guarantee

Conditions apply. More at pse.com/guarantees.

11. September 2018 bill statement envelope, also posted on pse.com



12. October 2018 bill-insert newsletter article to all customers, also posted on pse.com:

Customer service guaranteed

We stand behind our service to you. We constantly track our performance and use your feedback to make improvements. We'll credit your bill if we fail to meet our service guarantees.

- Appointment service guarantee
- 24-consecutive-hour non-major storm power outage restoration guarantee
- 120-consecutive-hour power outage restoration guarantee

Conditions apply. More at pse.com/guarantees.

13. October 2018 bill print message for all customers with link to Service Guarantees page on pse.com:

October 2018 bill print messages

Summary page

Customer service, guaranteed
We stand behind our service, from keeping scheduled appointments to restoring power outages as soon as we can. We'll credit your bill if we fail to meet our service guarantees.
pse.com/guarantees

Detail section

14. PSE.com, posted year-round
    https://www.pse.com/pages/customer-service-guarantees

Customer service guarantees

We stand behind our service to you. We're continually tracking how we're doing and using your feedback to improve. And we'll credit your bill if we fail to meet our service guarantees.

Appointment service guarantee

We'll credit your bill $50 if we don't keep an appointment to install new service, reconnect existing service or inspect natural gas equipment.

Certain maintenance work, including exchanges related to the Meter Upgrade project, are not eligible. Please see links below for qualifications and exclusions.

- Electric appointment service guarantee
- Natural gas appointment service guarantee

24 hour power outage restoration guarantee

You may be eligible for a $50 credit if your power is out for longer than 24 hours, barring a major storm or other event. Conditions apply and you must either report your outage to PSE or request the credit within seven (7) calendar days following restoration.

Guarantee effective as of Jan. 1, 2017

- The consecutive 24-hour period begins when PSE is first notified of the outage. In the event PSE cannot safely access its facilities, the consecutive 24-hour period begins when safe access is made available for the company's personnel and standard equipment
- The guarantee is not applicable in the following circumstances:
  - The outage is associated with a major storm or event, which includes subsequent days;
  - Restoration is prevented by an action or default by someone outside PSE's control (other than a company employee or agent);
  - PSE does not have safe access to its facilities in order to perform the needed repair;
  - PSE verifies that there was no outage as reported by the customer;
  - The customer's equipment has caused the outage; or
  - The customer's system has not received the proper electrical inspections and certifications.

- All qualifications and conditions

120 hour power outage restoration guarantee

You may be eligible for a $50 credit if your power is out for 120 consecutive hours or longer. Qualifications apply and you must either report your outage to PSE or request the credit within seven (7) calendar days following restoration.

- All qualifications and conditions

Your customer rights and responsibilities

Puget Sound Energy wants to make sure you know your rights and responsibilities regarding your electric and/or natural gas service.

- Rights and responsibilities

Tracking our performance

Every year we set goals for improving our service. These performance report cards show how we're doing in areas such as customer satisfaction, appointment scheduling, response time, field services and more. We also track the effectiveness of our energy efficiency programs.

2017 Service Quality report card

2016-17 Electric energy efficiency report card

2016-17 Natural gas energy efficiency report card

Previous years

Service Quality: 2016, 2015, 2014, 2013

Energy Efficiency: 2014-15

Table G1: Customer Awareness of Customer Service Guarantee

Field Service Operations Transactions Customer Satisfaction Survey		Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	Jun 2018	Jul 2018	Aug 2018	Sep 2018	Oct 2018	Nov 2018	Dec 2018
Q26A. When you called to make the appointment for a service technician to come out, did the customer service representative tell you about PSE $50 Service Guarantee?	Yes	64	60	60	65	58	73	61	58	78	88	89	91
	No	105	101	112	109	130	102	107	135	112	90	98	103
	Don't Know	31	38	61	41	47	40	31	40	25	26	33	41
	Refused Response	-	2	-	1	-	-	-	1	-	-	-	-
	Total Customers Surveyed	**200**	**201**	**233**	**216**	**235**	**215**	**199**	**234**	**215**	**204**	**220**	**235**
Q26C. Which of the following best fits your understanding of how the service guarantee works if a scheduled appointment has to be changed by PSE.	You are given the $50 service guarantee if the rescheduled time causes you inconvenience.	23	19	24	24	28	37	30	28	34	27	31	36
	Whenever PSE changes an appointment, you are given the $50.	23	25	20	28	24	26	26	29	33	49	34	39
	You have no understanding or expectations about this part of the service guarantee plan.	116	120	120	120	141	132	136	146	134	112	116	111
	Don't Know	37	34	68	42	39	17	8	6	14	16	36	48
	Refused Response	1	3	1	2	3	3	-	5	-	-	3	1
	Total Customers Surveyed	**200**	**201**	**233**	**216**	**235**	**215**	**200**	**214**	**215**	**204**	**220**	**235**

Table continues on next page.

Field Service Operations Transactions Customer Satisfaction Survey		Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	Jun 2018	Jul 2018	Aug 2018	Sep 2018	Oct 2018	Nov 2018	Dec 2018
Q26D. Did your appointment have to be rescheduled or did it occur as planned?	It occurred as planned.	188	190	220	208	218	198	190	215	199	190	203	222
	It was rescheduled.	6	6	6	4	8	7	5	15	11	8	11	8
	Technician arrived but was late.	1	-	3	-	2	1	3	1	-	2	-	1
	Don't Know	5	3	3	3	6	7	2	3	4	4	6	3
	Refused Response	-	2	1	1	1	2	-	-	1	-	-	1
	Total Customers Surveyed	**200**	**201**	**233**	**216**	**235**	**215**	**200**	**234**	**215**	**204**	**220**	**235**
Q26E. Who initiated rescheduling your appointment?	Myself (Customer Initiated)	2	3	3	-	2	1	3	5	2	1	4	2
	Puget Sound Energy Initiated	4	3	3	4	6	5	2	8	8	6	7	6
	Don't Know	-	-	-	-	-	1	-	2	1	1	-	-
	Refused Response	-	-	-	-	-	-	-	-	-	-	-	-
	Total Customers Surveyed	**6**	**6**	**6**	**4**	**8**	**7**	**5**	**15**	**11**	**8**	**11**	**8**

H
Electric Reliability Terms and Definitions

Terms and Definitions

Area of Greatest Concern— Top 50 worst-performing distribution circuits over the past five years that consistently contributed the most customer-minute interruptions . An area targeted for specific actions to improve the level of service reliability or quality.

Blue-sky Days—Days when the energy-delivery system operates as normal

Catastrophic Event Days —Days when the daily SAIDI is greater than the annual catastrophic event day threshold (T_{CAT})

Cause Codes—Codes used to identify PSE's best estimation of what caused a Sustained Interruption to occur. The codes are listed below:

Code	Description	Code	Description
AO	Accident Other, with Fires	**FI**	Faulty Installation
BA	Bird or Animal	**LI**	Lightning
CP	Car Pole Accident	**SO**	Scheduled Outage (was WR − Work Required)
CR	Customer Request	**TF**	Tree − Off Right-of-Way
DU	Dig Up Underground	**TO**	Tree − On Right-of-Way
EF	Equipment Failure	**TV**	Trees/Vegetation
EO	Electrical Overload	**UN**	Unknown Cause (unknown equipment involved only)
EQ	Earthquake	**VA**	Vandalism

$CEMI_n$—Customers Experiencing Multiple Interruptions—This index indicates the ratio of individual customers experiencing n or more sustained interruptions to the total number of customers served. The performance result is calculated based on the below formula:

$$\mathbf{CEMI_n} = \frac{Total\ Number\ of\ Customers\ that\ experienced\ more\ than\ n\ sustained\ interruptions}{Average\ Annual\ Electric\ Customer\ Count}$$

Commission Complaint—Any single-customer electric-service reliability complaint filed by a customer with the Washington Utilities and Transportation Commission (UTC).

Customer Complaint—Repeated customer inquiries relating to dissatisfaction with the resolution or explanation of a concern related to a Sustained Interruption or Power Quality. This is indicated by two or more recorded contacts in PSE's customer information system during current and prior year.

Customer Count—The number of electric customers per the outage reporting system that is a part of SAP, PSE's work management, customer information and financial information system.

Customer Inquiry—An event whereby a customer contacts the Customer Care Center to report a Sustained Interruption or Power Quality concern.

Duration of Sustained Interruption—The period beginning when PSE is first informed that service to a customer has been interrupted, and ending when the problem which caused the interruption has been resolved and the line has been re-energized (measured in minutes, hours or days).

Equipment Codes

Code	Description	Code	Description
OCN	Overhead Secondary Connector	**OTF**	Overhead Transformer Fuse
OCO	Overhead Conductor	**OTR**	Overhead Transformer
OFC	Overhead Cut − Out	**UEL**	Underground Elbow
OFU	Overhead Line Fuse / Fuse Link	**UFJ**	Underground J – Box
OJU	Overhead Jumper Wire	**UPC**	Underground Primary Cable
OPO	Distribution Pole	**UPT**	Padmount Transformer
OSV	Overhead Service	**USV**	Underground Service

iDOT— Investment Decision Optimization Tool—An analysis tool that helps to identify a set of projects that will create maximum value by comparing the relative costs and benefits of each project

IEEE 1366—IEEE Standard 1366-2003, a guide approved and published by the Institute of Electrical and Electronics Engineers that defines electric power reliability indices and factors that affect their calculations.

MAIFI—Momentary Average Interruption Frequency Index—This index indicates the average frequency of momentary interruptions. The performance result is calculated based on the below formula:

$$\textbf{MAIFI} = \frac{\Sigma Number\ of\ Customer\ Momentary\ Interruptions}{Average\ Annual\ Electric\ Customer\ Count}$$

Major Event—An event, such as a storm, that causes serious reliability problems. PSE utilizes three Major Event criteria to evaluate its reliability performance: $SAIDI_{SQI}$ Exclusion Major Event Days and $SAIFI_{SQI}$ Exclusion Major Event Days and IEEE 1366 T_{MED} Exclusion Major Event Days.

Major Event Days—Days when outage events can be excluded from the reliability performance calculation. The three types of Major Event Days are:

> **$SAIDI_{SQI}$ Major Event Days**—Any day in which the daily system SAIDI exceeds the threshold value, T_{MEDADJ}.

5% Exclusion Major Event Days—Days that five percent or more of electric customers are experiencing an electric outage during a 24-hour period and subsequent days when the service to those customers is being restored

IEEE 1366 T_{MED} Exclusion Major Event Days—Any days in which the daily system SAIDI exceeds the threshold value, T_{MED}.

Momentary Interruption: The brief loss of power delivery to one or more customers caused by the opening and closing of an interrupting device

$SAIDI_{SQI}$ – any interruption five minutes or shorter

$SAIFI_{SQI}$ – any interruption one minute or shorter

Outage—The state of a system component when it is not available to perform its intended function, due to some event directly associated with that component. For the most part, a component's unavailability is considered an outage when it causes a Sustained Interruption of service to customers. The system component can be transmission, distribution or customer owned if it causes a Sustained Interruption to other customers.

Power Quality—Industry standards are not broad enough to define power quality or how and when to measure it. For purposes of this plan, power quality includes all other physical characteristics of electrical service except for Sustained Interruptions, including momentary outages, voltage sags, voltage flicker, harmonics and voltage spikes.

SAIDI—System Average Interruption Duration Index—This index is commonly referred to as customer-minutes of interruption (CMI) or customer hours, and is designed to provide information about the average time the customers are interrupted. The measurements used in PSE's Plan and reporting include Total methodology ($SAIDI_{Total}$), Total with five-year-rolling average methodology ($SAIDI_{Total\ 5\text{-}year\ Average}$), 5% exclusion methodology ($SAIDI_{5\%}$), IEEE methodology ($SAIDI_{IEEE}$) and SQI methodology ($SAIDI_{SQI}$). The performance result for each of the measurements is calculated based on the below formula:

$$\textbf{SAIDI} = \frac{\Sigma\, Customer\ Minute\ Interruptions}{Average\ Annual\ Electric\ Customer\ Count}$$

$SAIDI_{Total}$: the numerator includes all customer minute interruptions on outages one minute or longer.

$SAIDI_{Total\ 5\text{-}year\ Average}$:Rolling five-year average of current year Annual $SAIDI_{Total}$ and prior four years Annual $SAIDI_{Total}$ results, excluding any exclusion that has been approved by the UTC. Exclusions for an entire year will be replaced by the preceding Annual $SAIDI_{Total}$ performance results until there are five years included in the calculation of current year $SAIDI_{Total\ 5\text{-}year\ Average.}$ Exclusions for an event will not be included in the Annual $SAIDI_{Total}$ performance results.

$SAIDI_{5\%}$: the numerator includes customer minute interruptions during non-5% Exclusion Major Event Days. Outages one minute and longer are included in this metric

$SAIDI_{IEEE}$= the numerator includes customer minute interruptions during non-IEEE 1366 T_{MED} Exclusion Major Event Days. Outages that are longer than 5 minutes are included in this metric.

$SAIDI_{SQI}$: the numerator includes customer minute interruptions during non-SQI SAIDI T_{MEDADJ} Exclusion Major Event Days. Outages that are longer than 5 minutes are included in this metric.

SAIFI—System Average Interruption Frequency Index—This index is designed to give information about the average frequency of Sustained Interruptions per customers (CI). The measurements used in PSE's Plan and reporting include Total methodology, SQI-4 methodology and IEEE SAIFI methodology. The performance results for each of the measurement will be calculated according to the following:

$$\textbf{SAIFI} = \frac{\Sigma Number\ of\ Customer\ Interruptions}{Average\ Annual\ Electric\ Customer\ Count}$$

$SAIFI_{Total}$: the numerator includes all customer interruptions on outages one minute or longer.

$SAIFI_{Total\ 5\text{-}year\ Average}$:Rolling five-year average of current year Annual $SAIFI_{Total}$ and prior four years Annual $SAIFI_{Total}$ results, excluding any exclusion that has been approved by the UTC. Exclusions for an entire year will be replaced by the preceding Annual $SAIFI_{Total}$ performance results until there are five years included in the calculation of current year $SAIFI_{Total\ 5\text{-}year\ Average.}$ Exclusions for an event will not be included in the Annual $SAIFI_{Total}$ performance results.

$SAIFI_{5\%}$: the numerator includes customer interruptions during non-5% Exclusion Major Event Days. Outages one minute and longer are included in this metric

$SAIFI_{IEEE}$= the numerator includes customer interruptions during non-IEEE 1366 T_{MED} Exclusion Major Event Days. Outages that are longer than 5 minutes are included in this metric.

SQ—PSE's Service Quality Program was first established per conditions of the Puget Power and Washington Natural Gas merger in 1997 under Docket UE-960195. The SQ Program has been since extended and modified in Dockets UE-011570 and UG-011571 (consolidated), Docket UE-031946, and Dockets UE-072300 and UG-072301 (consolidated).

Step Restoration—The restoration of service to blocks of customers in an area until the entire area or feeder is restored.

Sustained Interruption—Any interruption not classified as momentary.

$SAIDI_{SQI}$ - Any interruption longer than five minutes

$SAIFI_{SQI}$ - Any interruption longer than one minute

T_{CAT}—The Catastrophic Event Day identification threshold value that is calculated at the end of each reporting year for use during the next reporting year. It is determined by reviewing the past five years of daily system SAIDI, and using a 4.5 beta methodology of the IEEE Standard 1366 in calculating the catastrophic threshold value. Any days having a daily system SAIDI greater than

T_{CAT} are days on which the energy-delivery system experienced catastrophic stresses, which are classified as Catastrophic Event Days.

$T_{CAT} = e^{(\alpha + 4.5\beta)}$ where α is the log-average of the data set and β is the log-standard deviation of the data set

T_{MED}—The Major Event Day identification threshold value that is calculated at the end of each reporting year for use during the next reporting year. It is determined by reviewing the past five years of daily system SAIDI, and using the IEEE 1366 2.5 beta methodology in calculating the threshold value. Any days having a daily system SAIDI greater than T_{MED} are days on which the energy-delivery system experienced stresses beyond those normally expected, which are classified as Major Event Days.

$T_{MED} = e^{(\alpha + 2.5\beta)}$ where α is the log-average of the data set and β is the log-standard deviation of the data set.

T_{MEDADJ}—The SQI-3 SAIDI Major Event Day identification threshold value that is calculated at the end of each reporting year for use during the next reporting year. It is determined by reviewing the past five years of daily system SAIDI. Any catastrophic event day (T_{CAT}) daily SAIDI is replaced with the previous five year monthly average daily SAIDI. A T_{MEDADJ} is then calculated using the IEEE 1366 2.5 beta methodology to determine threshold value. Any days having a daily system SAIDI greater than T_{MEDADJ} are days on which the energy-delivery system experienced stresses beyond those normally expected, which are classified as SQI-3 Major Event Days.

$T_{MEDADJ} = e^{(\alpha + 2.5\beta)}$ where α is the log-average of the data set and β is the log-standard deviation of the data set.

Worst Performing Circuit—Expanded list of the Areas Of Greatest Concern to describe areas targeted for specific actions to improve the level of service reliability or quality.

I
Electric Reliability Data Collection Process and Calculations

Data Collection – Methods and Issues

This appendix discusses data collection methods and issues. It explains how the various data were collected. Changes in methods from prior reporting periods are highlighted and the impact of the new method on data accuracy is discussed.

In April 2013, PSE implemented the new OMS and CIS replacing a legacy system. With the legacy system, the Automated Meter Reading (AMR) System had provided some of the data to indicate when a Sustained Interruption began or ended but this functionality was not implemented in the OMS. Today, the AMR System is integrated to OMS for the purpose of validating outage status through meter pings. In 2017, PSE performed an analysis to determine if the outage data integrity from the AMR was robust enough to enhance PSE's current processes for identifying the start and end times of an interruption. The study results indicated that AMR data was not robust enough and PSE did not pursue additional integration of the AMR System with OMS.

Methods for Identifying when a Sustained Interruption Begins

The following methods are used to determine the beginning point of an interruption:

- A customer calls to PSE's Customer Care Center, either through the automated voice response unit or talking with a customer representative.
- A customer calls to a PSE employee rather than through the Customer Care Center.
- A customer logging into their online PSE account and reporting an outage.
- A substation breaker operation that is reflected in the OMS based on a SCADA interface.

Possible Causes of Data Inconsistencies:

- If service to a customer affected by a service interruption remains out after the interruption has been corrected, a follow-up call from the customer may be reported as a new incident.
- Data entry mistakes can create inconsistencies.
- During a major storm event, the focus is on ensuring a safe environment for the responders and restoring customers as quickly as possible. While outage information is recorded, given the magnitude of the event and number of outages, the records may not accurately report the extent of the outage or if customers were systematically restored.

Methods to Specify When the Duration of a Sustained Interruption Ends

The following methods are used to determine the ending point of an interruption:

- PSE Service personnel will log the time when customers are restored.
- SCADA provides a signal to the OMS that a substation breaker has been restored.

Possible Causes of Data Inconsistencies:

- Multiple layers of issues may be contributing to a Sustained Interruption for a specific customer as described in the definition of Duration of Sustained Interruption.
- Data entry errors can affect the accuracy of the information.
- Getting consistent feedback from the field personnel responding to the outage.
- During a major storm event, the focus is on ensuring a safe environment for the responders and restoring customers as quickly as possible. While outage information is recorded, given the magnitude of the event and number of outages, the records may not accurately report the extent of the outage or if customers were systematically restored.

Recording Cause Codes

Outage cause codes are reported by the PSE service personnel responding to the outage location.

Possible Causes of Data Inconsistencies:

- During a major storm event, the focus is on ensuring a safe environment for the responders and restoring customers as quickly as possible. While outage information is recorded, given the magnitude of the event and number of outages, the records may not accurately report the extent of the outage or if customers were systematically restored.
- Restoration efforts take precedence over pinpointing the exact cause and location of the outage, especially in cross-country terrain or in darkness.

Recording and Tracking Customer Complaints

The CSR in PSE's Customer Care Center handling the call listens for key words and then categorizes the customer comments accordingly.

- The CSR creates a Service Miscellaneous request for the appropriate PSE personnel to contact the customer and discuss their concerns.
- All contact is tracked as an interaction record in PSE's Customer Information System and Service Miscellaneous Notification in PSE's work management system, SAP, and counted as a customer inquiry for electric reliability reporting purposes.
- When two or more customer inquiries on outage frequency or duration and/or power quality have been recorded in SAP from a customer during current and prior reporting year, these customer inquiries together will be considered as a PSE "Customer Complaint."

Possible Causes of Data Inconsistencies:

- Data entry errors from the initial inquiry or during the feedback loop can affect the accuracy of the information.
- High volumes of customer inquiries, during storms for example, may increase likelihood of data entry errors.

Change in Definitions and Calculations

This section describes the methodology used in defining and calculating reliability metrics, which are then used to evaluate performance. The UTC in WAC 480-100-398 (2) requires a utility to report changes made in this methodology including data collection and calculation of reliability information after the initial baselines are set. The utility must explain why the changes occurred and how the change is expected to affect comparisons of the newer and older information.

Change to Include the IEEE Methodology

In the 2004 Annual Electric Service Reliability Report, PSE indicated that starting in 2005, reliability metrics using the IEEE Standard 1366 methodology as a guideline would be included. This change and other modifications for monitoring and reporting electric service reliability information were adopted by PSE in UE-060391. The purpose for moving to the IEEE Standard 1366 methodology is to

- Provide uniformity in reliability indices
- Identify factors which affect these indices
- Aid in consistent reporting practices among utilities

T_{MED} (Major Event Day Threshold) is the reliability index that facilitates this consistency. A detailed equation for calculating T_{MED} is provided in Appendix H: *Electric Reliability Terms and* Definitions.

While the IEEE guidelines provide a standard for the industry, companies can create a variety of definitions of an outage or sustained outage.

- PSE defines sustained outages as those lasting longer than one minute for SQI SAIFI
- PSE utilizes the IEEE definition of a sustained outage to be longer than five minutes for SQI SAIDI

Changes for 2010 and Subsequent Years Reporting

In 2010, PSE met with the UTC staff to enhance the format of the Electric Service Reliability report and the reliability statistics information provided. Specific enhancements included clarification of baseline statistics and detailed comparison of and expanded set of reliability metrics. This annual report reflects all these reporting enhancements and the SQI SAIDI performance and benchmark calculation changes approved by the UTC.

Baseline Data Reliability Statistics

Pursuant to the WAC Electric Service Reliability requirements, PSE establishes 2003 as its baseline year as the performance from the year was about average for each of the reliability

measurements. However, PSE would rather develop a baseline using multiple years to mitigate the fluctuation of weather conditions and other external factors. PSE feels there is limited usefulness in designating one specific year's information as a "baseline" and cautions against the use of a single year's data to assess year-to-year system reliability trends.

Timing of Annual Report Filings

PSE will be reporting data and information on a calendar year basis. PSE's annual Electric Service Reliability report will be filed as part of the annual SQ and Electric Service Reliability report with the UTC no later than the end of March of each year.[40]

Tree-related Outage Codes

PSE conducted a review of tree-related outages and the use of the tree on-right-of-way (TO) and tree off-right-of-way (TF) cause codes on outage notifications. However, it was found that during an outage it was difficult for field personnel to accurately assess the correct use of TF and TO cause codes.

As a result, PSE created a new outage cause code, Trees/Vegetation (TV) and revised the tree-related outage coding process. After a tree-related outage has occurred on a transmission line or causes a complete distribution circuit outage, a certified arborist field-verifies if the tree was on or off right-of-way and the correct code is added to the outage notification. All other tree-related outages are coded as TV.

PSE complaints

The business process for recording customer inquiries changed with the new CIS implementation in March 2013. For the 2014 reporting, PSE used the service notification records pertaining to outage duration/frequency or power quality for reporting the number of PSE complaints for the last two calendar years. PSE feels that using this new method of data collection provides a more complete assessment of customer inquiries pertaining to reliability and power quality concern.

[40] Order 17 of consolidated Dockets UE-072300 and UG-072301, page 10, section 26.

Changes for 2017 and Subsequent Years Reporting

SQI SAIDI Benchmark and Calculation Methodology

PSE, the Washington State Public Counsel Unit personnel, and the UTC staff met throughout 2015 and 2016 to determine a new SQI SAIDI benchmark and calculation methodology. On June 17, 2016, in Order 29 of consolidated Dockets UE-072300 and UG-072301 (Order 29), the UTC adopted the changes on how PSE will calculate SQI SAIDI results using the IEEE Standard 1366 for 2016 and subsequent reporting years. The new SQI SAIDI benchmark is 155 minutes. Also a part of the Order 29, PSE will not be penalized if the SQI SAIDI benchmark is missed but PSE has new non-major event 24-hour Restoration Service Guarantee.

The Electric Reliability Terms and Definitions appendix was expanded to include the new terms and definitions as a result of the SQI SAIDI changes per Order 29. In addition, the SAIDI and SAIFI definitions and formulas were streamlined for ease of reading.

Areas of Greatest Concern

This section of the annual reporting includes information on specific areas PSE is targeting for specific actions to enhance the level of service reliability. For the 2018 Electric Service Reliability Report, PSE continues to designate the Areas of Greatest Concern as the Top 50 worst-performing circuits[41] over the previous five years that rank worst in terms of customer interruption minutes.

- Each circuit is first ranked by the annual total customer interruption minutes seen by the circuit for each of the previous five years.
- The yearly ranking results are then averaged to determine the overall Top 50 worst-performing circuits over the past five years.

The following information will be reported on each of these areas:

- Identification of each Area of Greatest Concern.
- Explanation of the specific actions PSE plans to take in each Area of Greatest Concern to improve the service in each area during the coming year.

Exclusion Events

Per Dockets UE-072300 and UG-072300 (consolidated), from 2010 through 2015 PSE petitioned to exclude certain annual results or outage minutes from the performance calculation for the current year and years

[41] This definition of Areas of Concern became effective in 2012 considering the trend in system performance based on circuits that exceed the SQI, number of customers affected by those circuits and the number of complaints.

following that will be affected. PSE demonstrated that event was unusual or extraordinary and that PSE's level of preparedness and response was reasonable. The UTC granted the following events to be considered extraordinary:

- Total SAIDI results for 2006.
- January 2012 storm event.
- August 2015 storm event
- November 2015 storm event

In June 2016, Order 29 sets forth an objective approach in identifying catastrophic events. Catastrophic days are identified based on the 4.5 Beta of the IEEE Standard 1366. Any days having a daily system SAIDI greater than T_{CAT} is considered a catastrophic event for purposes of the SQI SAIDI mechanics. While these catastrophic days are excluded from the annual SQI SAIDI results, these days negatively impact the standard 2.5 beta threshold value in the next year and the following four years. Per Order 29, the daily system SAIDI value for that day is replaced with the five year average of that month's previous daily SAIDI. The major event day threshold value is then calculated using the adjusted data (T_{MEDADJ}). The following days are considered catastrophic:

- March 13, 2016
- February 6, 2017
- December 20, 2018

J
Current Year Electric Service Outage by Cause by Area

This appendix details the 2017 Outage Cause by County. In Tables J1 through J3 color codes indicate which major outage category the outage cause is grouped into. The Cause Code definitions can be found in Appendix H: *Electric Reliability Terms and Definitions*.

Table J1: Color Code Legend

Color Code Legend
Preventable
Third Party (Non-Tree)
Tree-related

Table J2: Total Outages by Cause

	Northern			King/Kittitas		Southern/Western			
	Whatcom	Skagit	Island	King	Kittitas	Pierce	Thurston	Kitsap	Total
AO	54	21	3	131	13	25	44	25	316
BA	161	85	38	614	25	90	188	201	1,402
CP	30	41	9	81	9	42	34	24	270
CR	0	1	1	0	0	0	0	0	2
DU	14	8	7	72	5	16	19	28	169
EF	578	307	274	1,515	119	331	510	352	3,986
EO	0	0	0	6	0	0	0	3	9
EQ	0	0	0	0	0	0	0	0	0
FI	4	4	2	58	3	8	10	14	103
LI	1	2		18	4	1	5	4	35
SO	232	200	182	1,075	56	189	346	377	2,657
TF	7	10	8	28	3	4	8	22	90
TO	3	0	0	4	0	0	4	2	13
TV	596	432	369	1,282	28	171	498	1,120	4,496
UN	139	76	57	663	18	72	88	163	1,276
VA	0	1	0	12	0	4	5	1	23
Misc[Note]	52	19	31	142	34	47	23	39	387
Total	1,871	1,207	981	5,701	317	1,000	1,782	2,375	15,234

Note: Miscellaneous causes are included in both Preventable and Third Party (Non-Tree) categories

Table J3: SQI-3 Outages by Cause (non-major event day)

	Northern			King/Kittitas		Southern/Western			
	Whatcom	Skagit	Island	King	Kittitas	Pierce	Thurston	Kitsap	Total
AO	53	20	3	129	13	24	44	25	311
BA	161	85	38	613	25	88	187	201	1,398
CP	30	40	9	80	9	41	34	24	267
CR	0	1	1	0	0	0	0	0	2
DU	14	8	7	71	5	16	19	28	168
EF	539	289	258	1,481	117	321	481	337	3,823
EO	0	0	0	6	0	0	0	0	6
EQ	0	0	0	0	0	0	0	0	0
FI	3	4	2	56	2	8	10	14	99
LI	1	2		17	4	1	5	4	34
SO	231	197	182	1,066	54	189	346	366	2,631
TF	6	9	7	24	3	4	6	13	72
TO	3	0	0	3	0	0	3	1	10
TV	321	235	196	793	26	109	318	600	2,598
UN	113	68	52	641	18	70	84	138	1,184
VA	0	1	0	11	0	4	5	1	22
Misc[Note]	41	11	31	115	31	39	20	33	321
Total	1,516	970	786	5,106	307	914	1,562	1,785	12,946

Note: Miscellaneous causes are included in both Preventable and Third Party (Non-Tree) categories

K
Historical SAIDI and SAIFI by Area

This appendix details in Table K1, the three-year history of SAIDI and SAIFI data by county.

Table K1: SAIDI and SAIFI Data for the Past Three Years by County [Note]

Region/County	Year	Total SAIFI	SQI SAIFI	Total SAIDI	SQI SAIDI
Northern					
Whatcom	**2018**	**1.44**	**0.87**	**590**	**134**
	2017	1.95	1.25	701	287
	2016	1.80	0.92	446	122
Skagit	**2018**	**2.32**	**1.62**	**949**	**333**
	2017	2.05	1.69	467	283
	2016	2.13	1.52	496	211
Island	**2018**	**3.84**	**1.97**	**2541**	**316**
	2017	2.07	1.44	468	238
	2016	2.64	0.87	471	147
King/Kittitas					
King	**2018**	**1.15**	**0.86**	**202**	**109**
	2017	1.57	0.95	399	131
	2016	1.29	0.93	276	123
Kittitas	**2018**	**1.43**	**1.51**	**260**	**256**
	2017	1.84	1.84	238	237
	2016	1.35	1.34	198	197

Note: Reported figures are based on most current SAP outage data, as of January 2018.

Table continues on next page.

Region/County	Year	Total SAIFI	SQI SAIFI	Total SAIDI	SQI SAIDI
Southern/Western					
Pierce	**2018**	**0.96**	**0.68**	**118**	**89**
	2017	1.31	1.15	227	129
	2016	1.07	0.70	156	101
Thurston	**2018**	**1.52**	**1.14**	**303**	**146**
	2017	2.06	1.59	635	216
	2016	1.75	1.43	289	225
Kitsap	**2018**	**2.78**	**1.42**	**929**	**216**
	2017	2.73	1.54	745	204
	2016	3.59	1.50	1149	209

L

1997-Current Year PSE SAIFI and SAIDI Performance by Different Measurements –

This appendix presents PSE SAIFI and SAIDI performance from 1997 through the current year using different measurements.

1997-2018 PSE SAIFI Performance in Different Measurements
(Average number of interruptions per year per customer)

Calendar Year	(a) Annual SAIFI Excluding Any Days That 5% or More Customers Are w/o Power	(b) Annual IEEE SAIFI Excluding Daily Results over T_{MED}	(c) Annual Total SAIFI Results: No Exclusions	(d) Annual Total SAIFI Results with Exclusions	(e) Total SAIFI 5-Year Rolling Annual Average with Exclusions
1997	1.04	1.11	1.53	1.53	
1998	0.85	0.92	1.42	1.42	
1999	0.98	0.96	1.88	1.88	
2000	0.85	0.91	1.32	1.32	
2001	0.98	0.79	1.34	1.34	1.50
2002	0.83	0.80	1.07	1.07	1.41
2003	0.80	0.71	1.24	1.24	1.37
2004	0.77	0.77	1.09	1.09	1.21
2005	0.94	0.93	1.18	1.18	1.18
2006	1.23	1.05	2.52		
2007	0.98	0.91	1.42	1.42	1.20
2008	1.01	0.98	1.12	1.12	1.21
2009	1.09	0.94	1.24	1.24	1.22
2010	0.86	0.87	1.59	1.59	1.31
2011	1.02	1.02	1.07	1.07	1.29
2012	0.92	0.83	1.62	0.92	1.19
2013	0.86	0.86	1.13	1.13	1.19
2014	1.05	1.00	1.89	1.89	1.32
2015	1.11	1.04	2.18	2.18	1.44
2016	1.06	1.02	1.70	1.70	1.56
2017	1.20	1.12	1.80	1.80	1.74
2018	1.02	0.99	1.57	1.57	1.83

Figure L1: 1997–2018 SAIFI Performance by Different Measurements

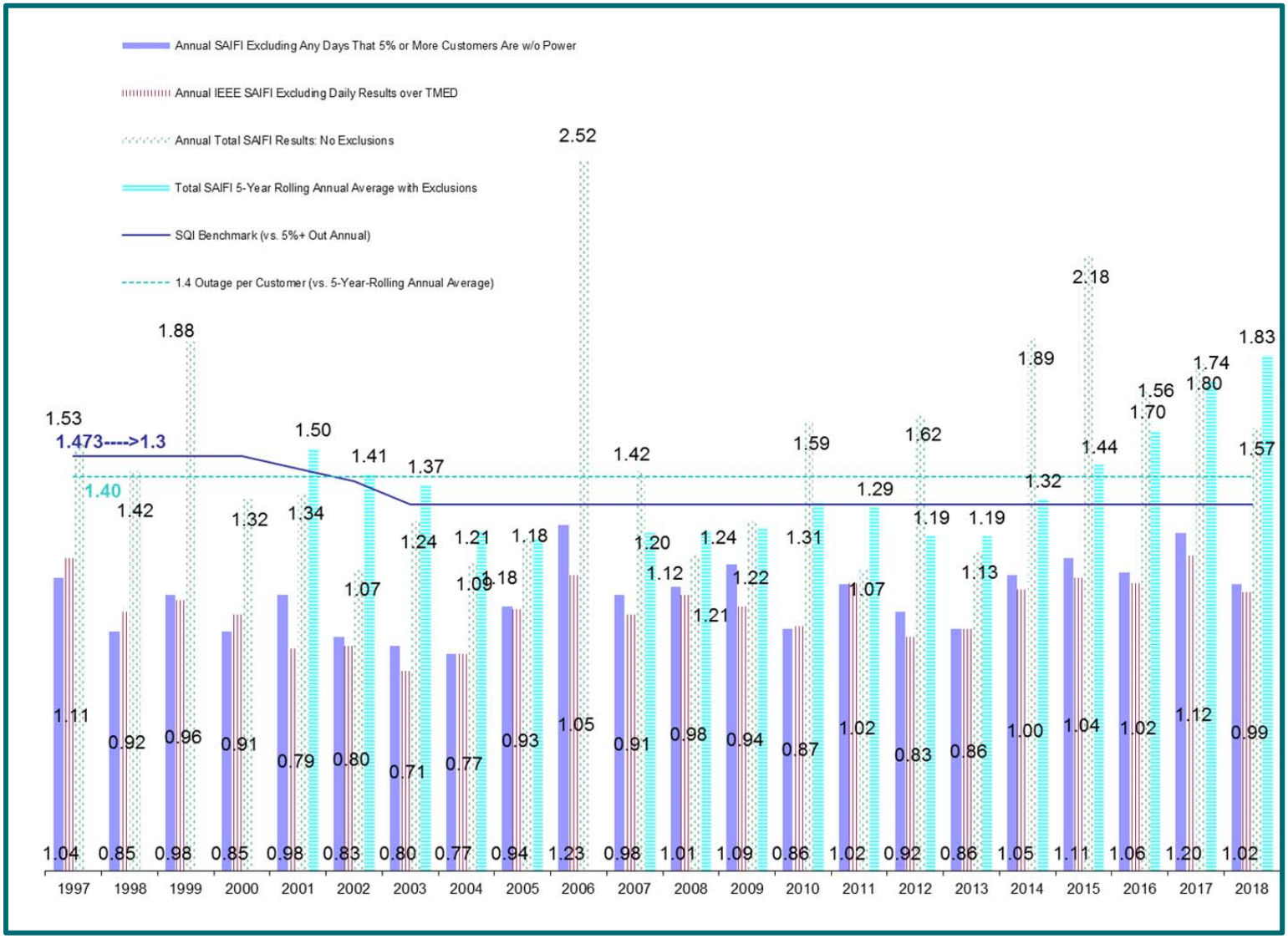


Figure L2: 1997–2018 SAIFI Performance by Different Measurements

1997-2018 PSE SAIDI Performance in Different Measurements
(Average number of outage minutes per customer per year)

Calendar Year	(a) Annual SAIDI Excluding Any Days That 5% or More Customers Are w/o Power	(b) Annual IEEE SAIDI Excluding Daily Results over T_{MED}	(c) Annual Total SAIDI Results: No Exclusions	(d) Annual Total SAIDI Results with Exclusions	(e) Total SAIDI 5-Year Rolling Annual Average with Exclusions	(f) Annual SQI SAIDI excluding Daily Results over T_{MEDADJ} (SQI-3)
1997	105	109	202	202		
1998	117	119	383	383		
1999	131	118	388	388		
2000	103	111	253	253		
2001	147	110	240	240	293	
2002	106	99	215	215	296	
2003	132	106	532	532	326	
2004	114	115	302	302	308	
2005	128	124	192	192	296	
2006	213	163	2,636			
2007	167	143	312	312	311	
2008	163	155	202	202	308	
2009	190	145	215	215	245	
2010	129	124	512	512	287	
2011	144	144	163	163	281	
2012	134	120	1,400	134[1]	245	
2013	122	125	209	209	247	
2014	173	154	540	540	312	
2015	180	163	760	313[2]	272	
2016	148	154	391	391	317	148
2017	222	175	477	477	386	175
2018	148	145	434	434	432	145

[1] Per UTC approval, excludes the January 2012 Storm Event

[2] Per UTC approval, excludes the August 2015 and November 2015 storm events

Figure L3: 1997–2018 SAIDI Performance by Different Measurements

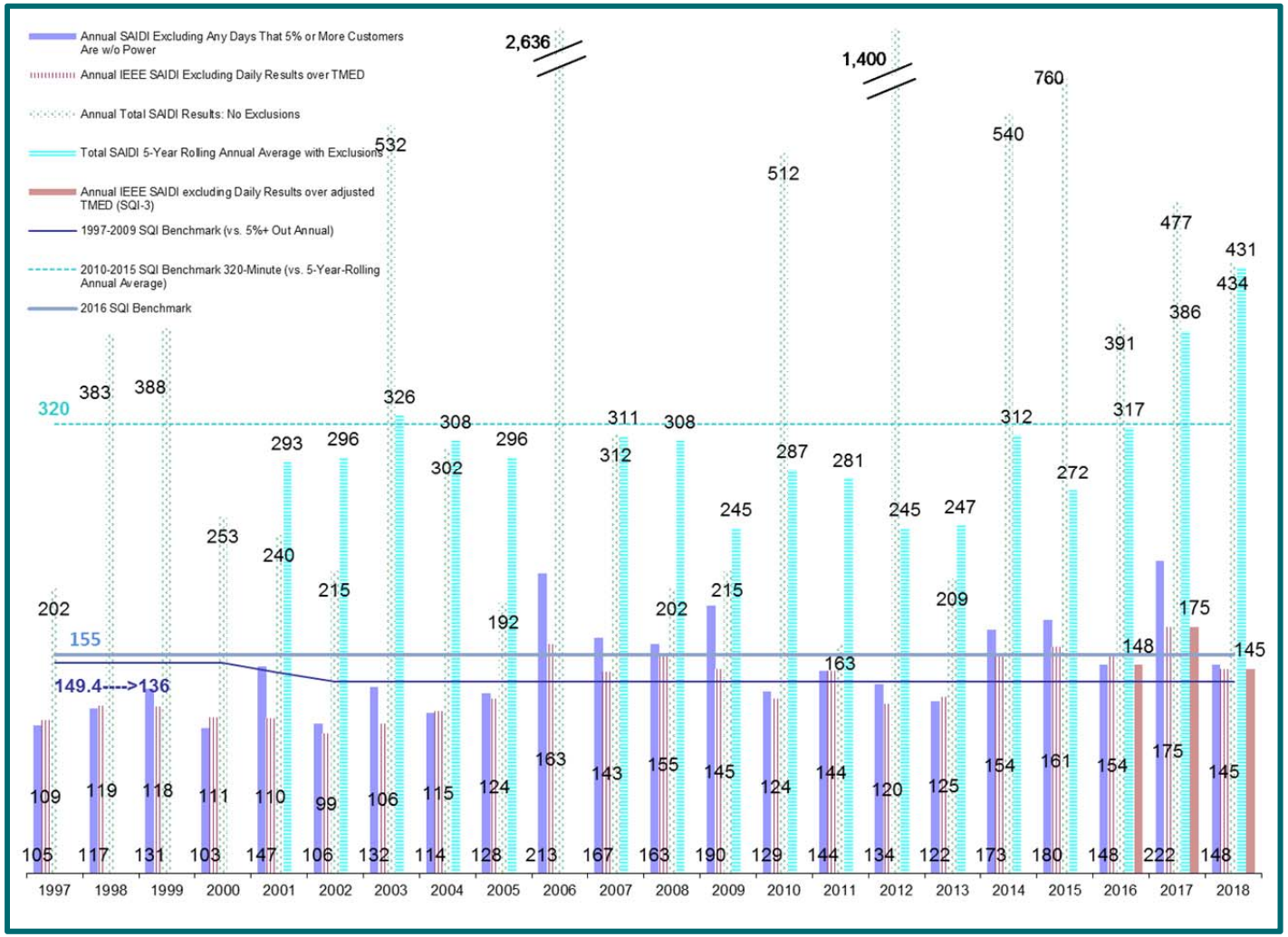


Figure L4: 1997–2018 SAIDI Performance by Different Measurements

M
Current-Year Commission and Rolling Two-Year PSE Customer Electric Service Reliability Complaints with Resolutions

This appendix lists, in Tables M1 and M2, the current-year UTC and rolling two-year PSE customer electric service reliability complaints with resolutions.

Table M1: Current Year Commission Complaints

No.	Complaint Type	Date of Complaint	Location	Closing Date	Case Resolution
1	Reliability	1/2/2018	Deming	1/16/2018	Company Upheld
2	Reliability	3/1/2018	Bellevue	3/12/2018	Company Upheld
3	Reliability	3/1/2018	Issaquah	3/7/2018	Company Upheld
4	Reliability	3/1/2018	Bellevue	3/12/2018	Company Upheld
5	Reliability	3/1/2018	Bellevue	3/9/2018	Company Upheld
6	Reliability	3/2/2018	Bellevue	3/9/2018	Company Upheld
7	Reliability	3/2/2018	Bellevue	3/14/2018	Company Upheld
8	Reliability	3/5/2018	Bellevue	3/12/2018	Company Upheld
9	Reliability	3/7/2018	Deming	3/14/2018	Company Upheld
10	Reliability	3/7/2018	Bellevue	3/14/2018	Company Upheld
11	Reliability	4/17/2018	Bellevue	4/20/2018	Company Upheld
12	Reliability	6/22/2018	Bellevue	6/26/2018	Company Upheld
13	Reliability	7/17/2018	Issaquah	7/26/2018	Company Upheld
14	Reliability	7/20/2018	Lynden	8/3/2018	Company Upheld
15	Reliability	7/20/2018	Bellevue	8/8/2018	Company Upheld
16	Reliability	11/2/2018	Issaquah	12/5/2018	Company Upheld
17	Reliability	12/17/2018	Kent	12/5/2018	Company Upheld
18	Reliability	12/17/2018	Kent	12/21/2018	Company Upheld
19	Power Quality	5/1/2018	Puyallup	7/30/2018	Company Upheld
20	Power Quality	11/1/2018	Bow	12/19/2018	Company Upheld

Table M2: Rolling Two-Year PSE Customer Electric Service Reliability Complaints with Resolutions (Sorted by County)

No.	County	Date of Complaint	Location	Complaint Type	Circuit	Response
1	Island	Jan-17 Jan-17 Feb-17	Oak Harbor	Reliability	Swantown-12	Reported in 2017, no new inquiries in 2018
2	King	Dec-18 Dec-18	Auburn	Reliability	Sherwood-18	Contacted customers to address concerns
3	King	Nov-17 Dec-17	Bellevue	Reliability	Eastgate-12	Reported in 2017, no new inquiries in 2018
4	King	Jul-17 Sep-17	Bellevue	Reliability	Factoria-12	Reported in 2017, no new inquiries in 2018
5	King	Jan-17 Jan-17	Bellevue	Power Quality	Midlakes-16	Reported in 2017, no new inquiries in 2018
6	King	Jan-17 Oct-17	Bellevue	Power Quality Reliability	Northrup-27	Reported in 2017, no new inquiries in 2018
7	King	Jul-18 Sep-18	Bellevue	Reliability	Somerset-13	Contacted customers to address concerns
8	King	Jan-18 Mar-18	Carnation	Reliability Power Quality	Klahanie-15	Contacted customers to address concerns
9	King	Jun-17 Sep-17	Des Moines	Reliability	Des Moines-12	Reported in 2017, no new inquiries in 2018

No.	County	Date of Complaint	Location	Complaint Type	Circuit	Response
10	King	Jan-18 Dec-18	Kent	Reliability	Boeing Aerospace-13	Contacted customers to address concerns
11	King	Nov-18 Dec-18	Kent	Reliability	Boeing Aerospace-13	Contacted customers to address concerns
12	King	Aug-17 Feb-18	Kent	Reliability Power Quality	Lake Meridian-15	Contacted customers to address concerns
13	King	Mar-17 Mar-17	Kirkland	Power Quality	Crestwood-22	Reported in 2017, no new inquiries in 2018
14	King	Feb-17 Oct-17	Kirkland	Power Quality	Norkirk-24	Reported in 2017, no new inquiries in 2018
15	King	Nov-17 Dec-18	Kirkland	Reliability	Norway Hill-15	Contacted customers to address concerns
16	King	Jan-17 Mar-17	Kirkland	Reliability	South Kirkland-16	Reported in 2017, no new inquiries in 2018
17	King	Sep-17 Jan-18	Mercer Island	Reliability	South Mercer-12	Contacted customers to address concerns
18	King	Jan-17 Jan-17	Normandy Park	Power Quality	North Normandy-15	Reported in 2017, no new inquiries in 2018
19	King	Oct-17 Nov-17	Redmond	Reliability	Avondale-15	Reported in 2017, no new inquiries in 2018
20	King	May-17 Jul-17	Sammamish	Power Quality	Pine Lake-27	Reported in 2017, no new inquiries in 2018

No.	County	Date of Complaint	Location	Complaint Type	Circuit	Response
21	King	Apr-18 May-18	Sammamish	Reliability	Plateau-22	Contacted customers to address concerns
22	King	Feb-18 Mar-18	Snoqualmie	Reliability	Snoqualmie-17	Contacted customers to address concerns
23	King	Jul-17 Jul-17 Oct-17	Woodinville	Reliability	Cottage Brook-13	Reported in 2017, no new inquiries in 2018
24	King	Jul-17 Nov-17	Woodinville	Reliability	Lake Leota-16	Reported in 2017, no new inquiries in 2018
25	King	Sep-17 Dec-18	Woodinville	Reliability	Lake Leota-16	Contacted customers to address concerns
26	Kitsap	Mar-18 Nov-18	Poulsbo	Reliability	Serwold-14	Contacted customers to address concerns
27	Kitsap	May-17 Dec-17	Silverdale	Reliability	Silverdale-16	Reported in 2017, no new inquiries in 2018
28	Skagit	Feb-17 Feb-17	La Conner	Reliability Power Quality	Peths Corner-15	Reported in 2017, no new inquiries in 2018
29	Thurston	Feb-18 Feb-18	Lacey	Power Quality Reliability	Mcallister Springs-16	Contacted customers to address concerns
30	Whatcom	Mar-17 Mar-17	Point Roberts	Reliability	Point Roberts-16	Reported in 2017, no new inquiries in 2018

N
Areas of Greatest Concern with Action Plan

This appendix details the areas of greatest concern with the 2018, 2019, and 2020 action plan.

Table N1 provides the 2018 list of the Top 50 Worst-Performing Circuits in the PSE territory.

CMI refers to Customer Minutes of Interruptions.

Table N1: 2018 Areas of Greatest Concern

Circuit	County	2018 Year End 5 Year Avg Rank	2018 Year End 5 Year Average Total CMI	2017 Year End 5 Year Avg Rank	2017 Year End 5 Year Average Total CMI	On WPC List	Action by PSE
Chico-12	Kitsap	1	5,937,671	1	5,560,930	✓	Three reclosers and one gang operated switch installed in 2018. Three underground cable replacement projects were completed in 2018. Four underground cable replacement projects are planned for 2019. There is a distribution automation project planned for 2019.
Longmire-17	Thurston	2	3,924,514	4	3,722,755	✓	One feeder tie project planned for 2020.
Big Rock-15	Skagit	3	3,490,764	5	3,269,553	✓	One overhead system rebuild project planned for 2019. One underground cable replacement project planned for 2020.
Baker River Switch-24	Skagit	4	3,579,924	9	2,549,290	✓	One underground conversion project planned for 2020.
Kingston-24	Kitsap	5	3,638,149	6	3,581,503	✓	A second circuit was built moving a significant portion of Kingston-24 to the new circuit in 2018. Two reclosers were installed in 2018. A feeder tree wire project is planned for 2019.
Fragaria-15	Kitsap	6	2,896,176	10	2,622,685	✓	One tree wire project was completed and one underground cable replacement project was completed in 2018. There are two tree wire projects (one is feeder) planned for 2019. There is a distribution automation project planned for 2020.

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Circuit	County	2018 Year End 5 Year Avg Rank	2018 Year End 5 Year Average Total CMI	2017 Year End 5 Year Avg Rank	2017 Year End 5 Year Average Total CMI	On WPC List	Action by PSE
Cottage Brook-13	King	7	2,893,645	7	3,156,640	✓	One tree wire project and one underground cable replacement project planned for 2019.
Freeland-12	Island	8	3,473,555	12	2,946,596	✓	One tree wire project planned for 2019.
Nugents Corner-26	Whatcom	9	3,539,663	15	2,913,051	✓	One underground cable replacement project completed in 2018. One underground conversion project planned for 2019. One underground conversion planned for 2020.
Langley-16	Island	10	4,055,241	14	3,182,307	✓	A reconfiguration of the circuit completed in 2018. Two underground cable replacement projects and two tree wire projects planned for 2019. One tree wire project planned for 2020.
Hamilton-15	Skagit	11	2,934,759	23	2,225,757	✓	One underground cable replacement project completed in 2018. A feeder tie project was completed in 2018. One tree wire project planned for 2019.
Poulsbo-15	Kitsap	12	2,558,204	13	2,412,750	✓	One underground cable replacement project planned for 2019. There is a distribution automation project planned for 2020.
Brooks Hill-15	Island	13	3,411,009	44	2,358,593		One underground cable replacement project planned for 2019.

Table continued on next page

Circuit	County	2018 Year End 5 Year Avg Rank	2018 Year End 5 Year Average Total CMI	2017 Year End 5 Year Avg Rank	2017 Year End 5 Year Average Total CMI	On WPC List	Action by PSE
Langley-12	Island	14	2,978,425	26	2,409,370	✓	Three underground cable replacement projects completed in 2018. Two underground cable replacement projects, one underground conversion project and one tree wire project planned for 2019.
Greenwater-16	King	15	3,205,235	30	3,098,952	✓	One underground cable replacement project completed in 2018. An underground conversion project is planned for 2020.
Kenmore-23	King	16	3,118,734	3	3,385,588	✓	Feeder upgrade planned for 2019. Three underground cable replacement projects and one distribution automation project planned for 2020.
Fernwood-17	Kitsap	17	2,687,799	27	2,150,699	✓	One tree wire project and an underground system upgrade were completed in 2018. One underground cable replacement project planned for 2019 and two for 2020. One distribution automation project planned for 2019.
Hickox-16	Skagit	18	2,051,955	16	1,980,001	✓	One underground cable replacement project completed and a recloser installed in 2018. WSDOT mitigation planned for 2019.
Slater-16	Whatcom	19	2,168,725	29	1,974,021	✓	One recloser installed in 2018. One underground cable replacement project planned for 2019. One tree wire project and one distribution automation project planned for 2020.

Table continued on next page

Circuit	County	2018 Year End 5 Year Avg Rank	2018 Year End 5 Year Average Total CMI	2017 Year End 5 Year Avg Rank	2017 Year End 5 Year Average Total CMI	On WPC List	Action by PSE
Vashon-23	King	20	1,948,886	17	1,854,724	✓	Circuit breaker upgraded, and reclosers had SCADA added in 2018. One feeder tie project and one underground cable replacement project completed in 2018. There is one feeder tie project and two underground cable replacement projects planned for 2019.
Alger-15	Skagit	21	2,289,864	34	1,451,737	✓	Four underground cable replacement projects completed in 2018. One underground cable replacement project and one tree wire project planned for 2019.
Fragaria-16	Kitsap	22	2,700,404	18	2,581,784	✓	Planning is reviewing for future reliability projects.
Fernwood-16	Kitsap	23	2,206,734	21	1,845,067	✓	Two underground cable replacement projects planned for 2019 and three for 2020.
Port Gamble-13	Kitsap	24	2,400,153	48	2,156,746	✓	One underground cable replacement project planned for 2019 and one for 2020.
Kendall-12	Whatcom	25	3,476,327	36	1,926,578	✓	Two underground cable replacement projects completed in 2018.
Fragaria-13	Kitsap	26	1,970,140	11	2,142,757	✓	One tree wire project completed in 2018, There is one tree wire project planned for 2019.

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Circuit	County	2018 Year End 5 Year Avg Rank	2018 Year End 5 Year Average Total CMI	2017 Year End 5 Year Avg Rank	2017 Year End 5 Year Average Total CMI	On WPC List	Action by PSE
Longmire-25	Thurston	27	1,759,230	35	1,484,226	✓	Two underground cable replacement projects completed in 2018. There is one underground cable replacement project planned for 2019 and one planned for 2020. There is a feeder reconductor project planned for 2020.
Silverdale-15	Kitsap	28	3,658,644	19	3,662,116	✓	One switch cabinet installation and one feeder tree wire project completed in 2018. There is one underground cable replacement project, one tree wire project and one underground conversion project planned for 2019.
Vashon-13	King	29	2,199,214	20	2,161,687	✓	Circuit breaker upgraded, and reclosers had SCADA added in 2018. Two tree wire projects and one underground cable replacement project completed in 2018. Five underground cable replacement projects planned for 2019, and one for 2020.
Vashon-12	King	30	2,366,509	24	2,257,569	✓	Circuit breaker upgraded, and reclosers had SCADA added in 2018. Three underground cable replacement projects completed and one tree wire project completed in 2018. Two tree wire projects planned for 2019.
Greenbank-13	Island	31	2,446,199	39	1,383,173	✓	One underground cable replacement project completed in 2018.

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Circuit	County	2018 Year End 5 Year Avg Rank	2018 Year End 5 Year Average Total CMI	2017 Year End 5 Year Avg Rank	2017 Year End 5 Year Average Total CMI	On WPC List	Action by PSE
Long Lake-25	Kitsap	32	1,999,402	Not on 2017 list			One distribution automation project planned for 2019.
Central Kitsap-14	Kitsap	33	1,892,197	22	1,909,073	✓	Three underground cable replacement projects and one tree wire feeder project completed in 2018.
Duvall-15	King	34	1,895,104	28	1,705,263	✓	Two tree wire projects and two underground cable replacement projects planned for 2019.
Summit Park-21	Skagit	35	2,072,128	Not on 2017 list		✓	Four underground cable replacement projects completed in 2018. Three tree wire projects and one underground cable replacement projects planned for 2019.
Skykomish-25	King	36	1,878,693	37	1,538,354	✓	One underground cable replacement project completed in 2018. One underground system project planned 2020.
Hamilton-13	Skagit	37	1,506,430	Not on 2017 list			Two underground cable replacement projects completed in 2018. One tree wire project planned for 2019.
Spurgeon-13	Thurston	38	2,681,191	2	4,737,846		One recloser project was completed in 2018.
Maxwellton-12	Island	39	2,471,411	Not on 2017 list			Three underground cable replacement projects completed in 2018. One underground cable replacement project planned for 2019 and one planned for 2020.

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Circuit	County	2018 Year End 5 Year Avg Rank	2018 Year End 5 Year Average Total CMI	2017 Year End 5 Year Avg Rank	2017 Year End 5 Year Average Total CMI	On WPC List	Action by PSE
Miller Bay-23	Kitsap	40	1,885,273	45	1,336,961	✓	One underground conversion project planned for 2019 and a feeder tie project planned for 2020.
Port Gamble-12	Kitsap	41	1,770,429	43	1,516,971	✓	Two tree wire projects and one underground cable replacement project planned for 2019. One distribution automation project planned for 2020.
Hobart-15	King	42	1,609,621	33	1,564,748	✓	One tree wire feeder project completed in 2018. Two tree wire feeder projects planned for 2020.
Fernwood-13	Kitsap	43	2,321,731	41	2,187,670		One tree wire project and two underground cable replacement projects planned for 2019.
Clover Valley-16	Island	44	2,091,307	Not on 2017 list			One underground cable replacement project completed in 2018. Two underground cable replacement projects planned for 2019 and one planned for 2020.
Port Madison-12	Kitsap	45	2,715,858	Not on 2017 list		✓	One tree wire feeder project completed in 2018. One underground cable replacement project planned in 2019, and one for 2020. One feeder tie project planned for 2020. There is an underground conversion project planned and one distribution automation project planned for 2020.

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Circuit	County	2018 Year End 5 Year Avg Rank	2018 Year End 5 Year Average Total CMI	2017 Year End 5 Year Avg Rank	2017 Year End 5 Year Average Total CMI	On WPC List	Action by PSE
Woburn-23	Whatcom	46	1,402,898	38	1,284,187	✓	One distribution automation project completed in 2018. One underground cable replacement project completed in 2018. One underground cable replacement project planned for 2019
Miller Bay-17	Kitsap	47	2,499,718	46	2,148,351	✓	Construction of new feeder tie planned for 2019. One distribution automation project planned for 2020.
Peths Corner-13	Skagit	48	1,850,008	42	1,724,976		One underground cable replacement project completed in 2018. One underground cable replacement project planned for 2019 and one planned for 2020.
Long Lake-21	Kitsap	49	1,432,248	Not on 2017 list		✓	One recloser installation project was completed in 2018. Three underground cable replacement projects are planned for 2019.
Norway Hill-15	King	50	1,739,255	Not on 2017 list			Planning is reviewing for future reliability projects.

O

Current Year Geographic Location of Electric Service Reliability Customer Complaints on Service Territory Map with Number of Next Year's Proposed Projects and Vegetation-Management Mileage

This appendix illustrates current-year geographic location of electric service reliability customer complaints on service territory map with the number of 2019 and 2020 proposed projects and 2019 vegetation-management mileage.

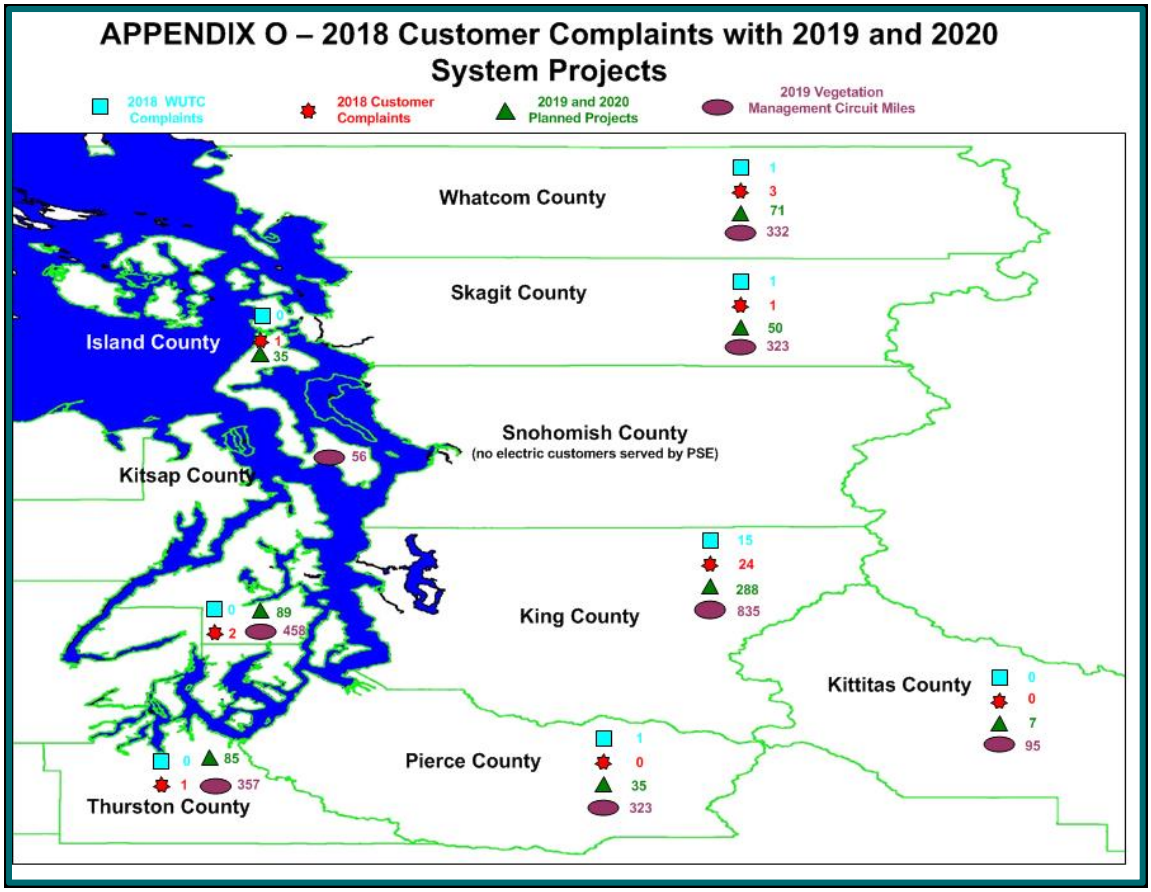

Figure O1: 2018 Customer Complaints with 2019 and 2020 System Projects

P

System Planning Budget Process

This appendix illustrates the System Planning Budget Process from project identification through project completion and post-project reliability improvement verification.

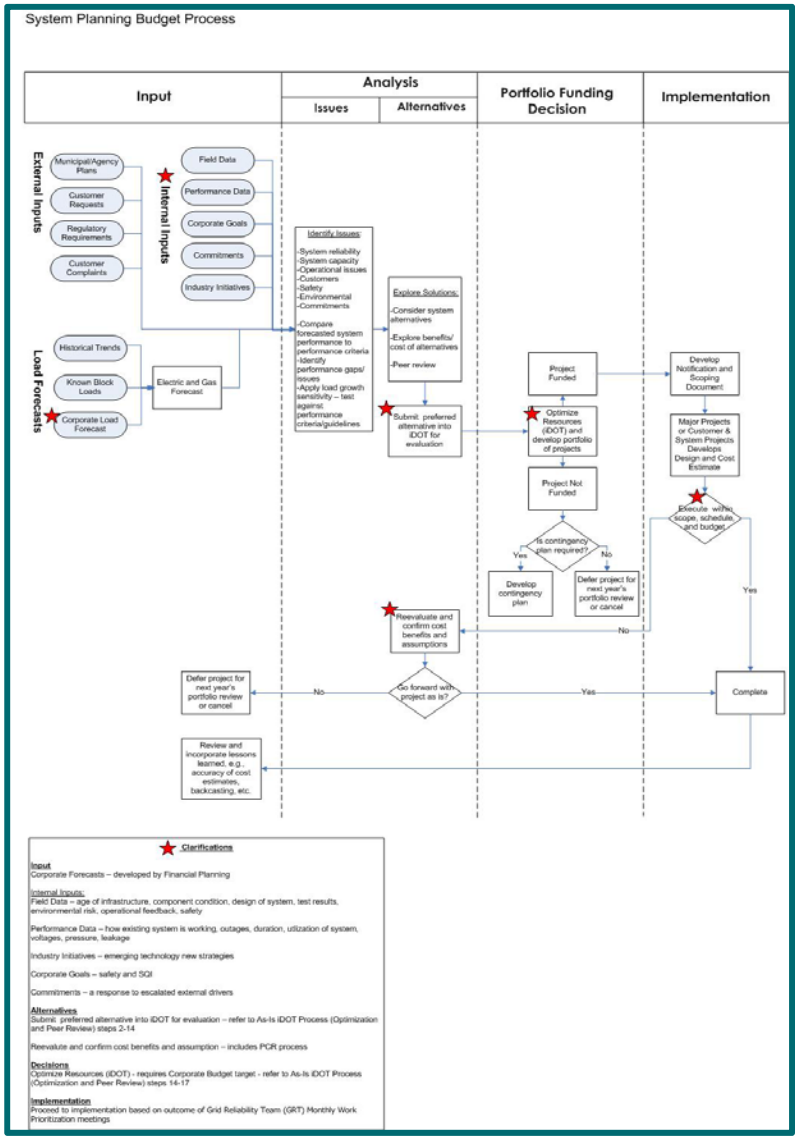

Figure P1: System Planning Budget Process