EXH. CAK-1Tr2
DOCKETS UE-190529/UG-190530
UE-190274/UG-190275
2019 PSE GENERAL RATE CASE
WITNESS: CATHERINE A. KOCH

BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND ENERGY,** **Respondent.**	**Docket UE-190529** **Docket UG-190530 (*Consolidated*)**
In the Matter of the Petition of **PUGET SOUND ENERGY** **For an Order Authorizing Deferral Accounting and Ratemaking Treatment for Short-life IT/Technology Investment**	**Docket UE-190274** **Docket UG-190275 (*Consolidated*)**

PREFILED REBUTTAL TESTIMONY (NONCONFIDENTIAL) OF

CATHERINE A. KOCH

ON BEHALF OF PUGET SOUND ENERGY

REVISED
AUGUST 22, 2019

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JANUARY 29, 2020

JUNE 20, 2019

PUGET SOUND ENERGY

PREFILED DIRECT TESTIMONY (NONCONFIDENTIAL) OF CATHERINE A. KOCH

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I. INTRODUCTION

Q. Please state your name, business address, and position with Puget Sound Energy.

A. My name is Catherine A. Koch. My business address is 355 110th Ave. NE, Bellevue, Washington, 98004-5591. I am Director, Planning with Puget Sound Energy ("PSE").

Q. Have you prepared an exhibit describing your education, relevant employment experience, and other professional qualifications?

A. Yes, I have. It is Exh. CAK-2.

Q. What is the scope of your testimony in this proceeding?

A. My testimony describes PSE's continued focus on safe, dependable, and efficient service to customers, setting the context to discuss the significant transmission and distribution work performed by PSE since the 2017 general rate case. I will discuss specifically the work performed from October 1, 2016, the end of the test year in PSE's 2017 general rate case, to December 31, 2018, the end of the test year in this proceeding, including the need for the work and the benefit to PSE's customers. More detail regarding system major projects that are greater than $10 million are detailed in Exh. CAK-3. In addition, my testimony revisits the discussion of PSE's initial Advanced Metering Infrastructure ("AMI") work that was described in my testimony in Dockets UE-180899 and UG-180900, PSE's 2018 Expedited Rate Filing. The AMI testimony is further supported by Exh. CAK-4. I will also discuss the storm events that qualified for the storm deferral mechanism which will refer to Exh. CAK-5. My testimony also addresses the infrastructure investments PSE intends to pro form into the test year for this case through June 30, 2019, and I share a forward-looking perspective of the infrastructure work anticipated through the rate year (April 30, 2021) in accordance with PSE's corporate strategy and business plan, including major projects as well as foundational technology infrastructure such as Advanced Distribution Management System ("ADMS") that supports grid benefits. The context of this discussion is provided by the Prefiled Direct Testimony of Booga K. Gilbertson, Exh. BKG-1T, that describes PSE operations and trends from the customer perspective and which provides a high-level view of PSE's operations philosophy, key objectives, and PSE's vision for the future from an operations perspective.

II. SIGNIFICANT TRANSMISSION AND DISTRIBUTION WORK

A. Overview

Q. Please provide an overview of the gas and electric transmission and distribution work performed between October 1, 2016 and December 31, 2018.

A. Between October 1, 2016 and December 31, 2018, PSE has invested $686 million in electric transmission and distribution infrastructure as a result of over 39,000 projects, and $529 million in gas distribution infrastructure as a result of over 44,000 projects. Additionally, PSE invested $52 million in infrastructure that is shared between electric and gas transmission and distribution, the majority of which is AMI. Figures 1 and 2 below detail the electric and gas capital expenditures by category.

Figure 1: Electric Plant in Service by Objective

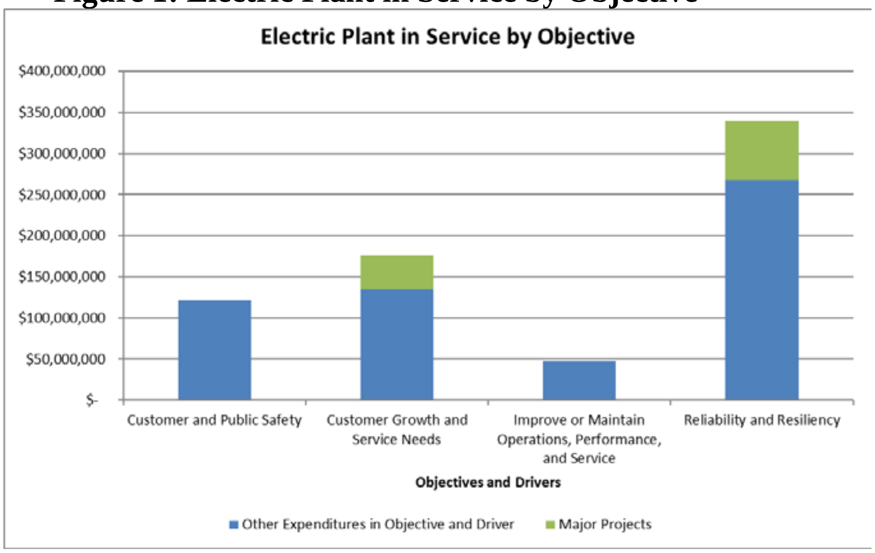
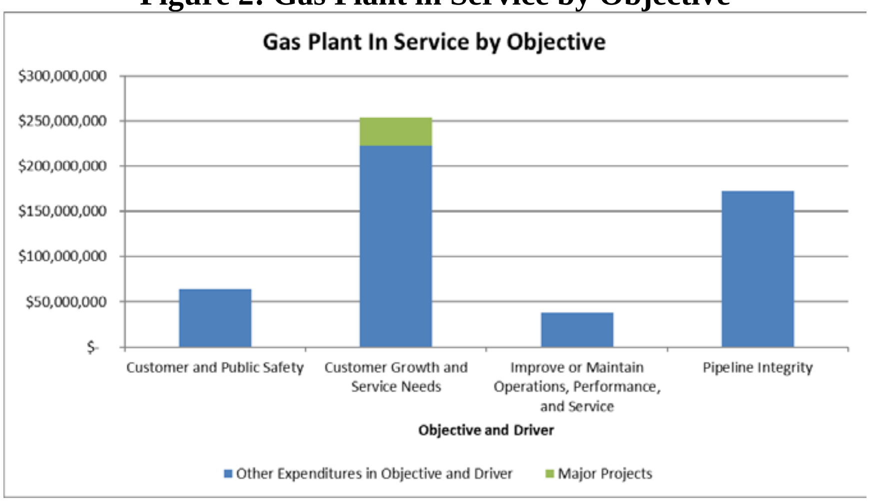


Figure 2: Gas Plant in Service by Objective



PSE invested $19 million in operations and maintenance (“O&M”) relating to the capital investment (“OMRC”) associated with the $686 million for electric infrastructure and $3 million in OMRC associated with the $529 million for gas infrastructure. One example of the work driving OMRC is transferring existing conductor to new poles, which is the largest contributor to OMRC on electric projects. For gas projects, tying existing services to new mains accounts for the majority of OMRC.

As operating the gas and electric system becomes more digital, electronic technology assets associated with traditional work is increasing. These assets totaled $12 million of the investment made between October 1, 2016 and December 31, 2018. I discuss these projects in more detail within Section II.C of my testimony.

Finally, PSE also invested approximately $~~90~~92 million in AMI by replacing its existing legacy Automated Meter Reading ("AMR") system that dates back to 1998. I discuss this in more detail in Section II.C.1.

Q. Please describe generally how PSE determines and manages transmission and distribution work to ensure the best outcome for customers.

A. There are three ways that projects originate: 1) through an intake process associated with external requests such as customer or jurisdictional requests; 2) through an internal infrastructure planning process; and 3) through field identified work, including emergency response and repair work that is associated with damage to infrastructure and requires priority to restore quickly. This could also include safety work that is identified through continuous surveillance activities. For the first and third origination processes, PSE is simply responding to requests or immediate needed actions which are generally field designed. For the internal infrastructure planned work, PSE follows a robust planning and decision process evaluating need and alternatives followed by investment decision optimization or "iDOT" to determine the projects and portfolio that generates the greatest benefit to customers. Ms. Gilbertson provides an overview of PSE's planning process and the use of iDOT, in her Prefiled Direct Testimony, Exh. BKG-1T.

For most work, a project manager is assigned who manages the project from inception through closeout, driving the schedule, managing budgets and coordinates construction and design activities and milestones with both internal and external team members. For larger programmatic work, program managers oversee delivery of program objectives over the many specific individual projects. Designs are developed by engineers, peer reviewed, and approved for compliance with standards, accuracy and cost effectiveness. Designs are also reviewed to ensure any constructability challenges are proactively addressed prior to the start of construction. Construction management provides inspection during construction to ensure compliance with the engineering design and works collaboratively with the project management team to address any field issues that arise during construction. Quality inspections are performed based on performance sampling rates. As with all work, project managers and/or contract management and construction performance management reviews records, documentation, and payments prior to invoice payments.

Q. Please describe emerging or growing challenges in completing this work and how PSE is addressing these challenges.

A. There are several emerging challenges that create pressure on scope, schedule, and costs: 1) local jurisdictional permit requirements and conditions, specifically including restoration of hard surfaces; 2) state and federal listings of aquatic and terrestrial plants and animals, "endangered species protection"; 3) compliance with Section 106 National Historic Preservation Act, "cultural resources protection"; and 4) general permitting volume.

PSE's infrastructure is predominantly located in the public rights of way and pursuant to franchise and permitting terms and conditions, PSE is required to restore hard surfaces (i.e., asphalt, curb, gutter and sidewalk) upon completion of work. Between 2014 and 2018, PSE annual restoration costs rose from $24.5 million to $40.4 million (not including jurisdictional permit and inspection fees or costs to manage and administer the restoration program). These annual upward trends are due to multiple factors, including PSE's increasing work volume for system improvements, new customer growth and additional jurisdictional requirements. These additional requirements include compliance with the American's With Disabilities Act through the installation of wheel chair ramps at intersections, as well as a trend in work limitations that protect hard surface through seasonal, hourly, and locational moratoriums, and pavement degradation fees above and beyond the restoration requirements. Additionally, primarily due to utility congestion in rights of way, PSE is experiencing a trend towards franchise and permit conditions requiring removal of decommissioned facilities as part of system improvement projects. To address these impacts to PSE, a primary criteria of early project engineering is to design new utility installation at locations that minimize hard surface disturbance. Additionally, PSE's construction representatives work closely with jurisdiction inspectors onsite from the initiation of construction through the completion of restoration to address the impacts of each project.

Environmental resource protection has always been important to PSE. The Endangered Species Act ("ESA") listings of Chinook Salmon and Bull Trout approximately 20 years ago have created a cascading effect on PSE's ability to conduct work. Requirements of the Washington Shoreline Management Act and the Growth Management Act have been implemented through state, county and local jurisdictional regulations. Additionally, in response to requirements under the Clean Water Act, there has been implementation of increasingly stringent stormwater management through state and local administration of the National Pollutant Discharge Elimination System program. Indirect and direct effects of these regulations create additional permitting requirements for PSE. Often there are multiple, overlapping agency approvals including US Army Corps of Engineers Section 404/Ecology Water Quality Certification Section 401, Shoreline Substantial Development/Shoreline Conditional Use, Hydraulic Project Approval, local jurisdictional Critical Areas (wetland/wetland buffer) reviews and approvals, Clear and Grade, and Stormwater Project Protection Plans. The potential for direct impact to the hundreds of state and federally protected species impacts PSE work in both private and public forested habitat, protecting animals such as Spotted Owl and Marbled Murrelet, and oak-prairie lands protecting animals such as the Mazama Pocket Gopher, which means greater regulatory scrutiny and approval processes that impact projects. An example is the ESA listing and associated habitat protection for the Mazama Pocket Gopher in Thurston County, which through 2017 and into 2018, brought PSE work almost to a stop while determination of gopher presence and habitat quality evaluations and determinations were completed. PSE is working collaboratively with the U.S. Fish and Wildlife Service to complete both an Interim Habitat Protection Plan and a Long-term Habitat Protection Plan to provide certainty for current and future projects while concurrently providing protection from Species Take protection under the ESA. These efforts will enable PSE to complete more projects successfully while at the same time being a good steward of the surrounding environment.

Cultural resource protection is not new to PSE but can also impact project cost and timeline. Cultural resource protection issues often arise with circuits in remote areas like the worst performing circuits that PSE is now aggressively addressing and where failure prone cable has not yet been addressed. Projects located primarily within shoreline environments also have the potential to contain known or suspected archaeological features. In order to gain approval under Section 106 of the Historic Preservation Act, which is administered by the Washington State Department of Archaeology and Historic Preservation in consultation with local Tribes, PSE is required to conduct detailed pre-project investigation as well as detailed archeological monitoring during project construction activities.

Finally, permitting processes in general can be challenging and can increase the time and expense of projects. With the increased volume of PSE work, including work in right of ways, obtaining needed permits can be a lengthy process due to jurisdictional delays, often caused by limited staffing or employee turnover. To minimize the impacts of these challenges, to the extent possible, PSE works with local jurisdictions to complete system improvement in advance of jurisdictional overlays and to coordinate gas and electric projects together.

B. PSE's Objectives Drive Transmission and Distribution Work

Q. Please describe the reasons or drivers for PSE's gas and electric transmission and distribution work.

A. As described in the Prefiled Direct Testimony of Booga K. Gilbertson, Exh. BKG-1T, PSE's objectives include maintaining customer and public safety, meeting electric and gas growth and service needs, enhancing electric reliability and resiliency as well as gas pipeline integrity, and pursuing operational excellence and continuous improvements to meet customer expectations. Ms. Gilbertson also describes the process for how investment decisions are made to deliver upon these objectives.

1. Investments made to maintain customer and public safety

Q. Please describe PSE's investments made towards customer and public safety.

A. Customer and public safety is the highest priority and primary focus in the daily operations of PSE's gas and electric systems including all work performed on PSE's systems. It is the primary driver of key activities such as emergency repair, active engagement with jurisdictions regarding public improvement projects that may impact PSE's infrastructure, and security enhancements.

a. Emergency repair investments

Q. Please describe the investments associated with emergency repair.

A. The primary focus of PSE's operational emergency response procedures is the safety of our customers and the general public. In the industry, the emergency repair category is often referred to as "corrective maintenance." In the timeframe from October 1, 2016 to December 31, 2018, PSE invested $77 million in corrective maintenance on the electrical system. This corrective maintenance includes the repair and replacement of failed or compromised infrastructure, such as replacing a pole that has been damaged by a car or that PSE has inspected and determined that imminent failure could occur. This also includes responding to storm damage.[1] For that same period of time, PSE invested $17 million in corrective maintenance on the gas system, which includes repair and replacement

[1] Costs referenced here are outside of those that are eligible for storm deferral accounting mechanism.

of failed or damaged infrastructure such as a meter set that has been damaged by a car or a leak that requires extensive pipe replacement.

Additionally, within this category is the programmatic resolution of circuits that are left in an abnormal configuration (not as designed) due to a historical outage that temporarily reconfigured the circuit to maximize restoration of customers. At the close of December 2018, PSE reduced the number of system abnormal configurations from 744 to 563.

Q. Please describe how PSE decides what emergency repair investments are needed.

A. Emergency work is unplanned as it is in direct response to notifications of a problem or outage through a variety of internal and external communication channels. This work is non-discretionary due to it being a public safety priority. Upon notification of such an event, qualified electrical and gas personnel are dispatched as quickly as possible to ensure the scene is safe for the public and to determine what repair work is needed, making simple repairs themselves, if possible. If they determine the need for a more complex follow-up repair, larger crew resources from PSE's service providers are dispatched.

Annual funding estimates for emergency work are based on historical failure trends along with considerations of how the planned electric and gas integrity and reliability improvements reduce these trends into the future. As noted above, Ms. Gilbertson's testimony describes the planning process and how iDOT is used specifically to make decisions regarding discretionary work such as the reliability and pipeline integrity work that drive failure trends down. These emergency repair investments are not ranked against the evaluation criteria in the iDOT planning model due to their unplanned, immediate or non-discretionary nature.

b. Public improvement project investments

Q. Please describe the investments associated with public improvement projects.

A. Public improvement projects promote safety and respond to requests by municipalities to relocate facilities as specified in jurisdictional franchise agreements. These franchises allow PSE the ability to locate facilities in the public right of way, but when road or transportation projects change the right of way, PSE often must relocate those facilities, generally at our cost. From October 1, 2016 to December 31, 2018, PSE invested $45 million in relocating 455 electric infrastructure facilities and $47 million in relocating 147 gas infrastructure facilities associated with public improvements. This work also includes large transportation projects or initiatives that require substantial and multi-year plans such as, (i) the Washington State Department of Transportation ("WSDOT") Clear Zone program that requires the relocation of over 4,300 poles from the edge of a WSDOT right-of-way to a specified distance away; (ii) Sound Transit rail and station relocations, as light rail expands across the region; (iii) Tacoma's High Occupancy Vehicle expansion projects; and (iv) Seattle's revitalization of the waterfront, viaduct, and tunnel work.

Q. Please describe how PSE decides what public improvement investments are needed.

A. When public improvement projects are initiated, a project manager meets with the jurisdiction to determine the scope and requirements of the work and plans required relocation work. In most cases, existing infrastructure is relocated by replacing with like-kind equipment and materials, preserving the existing functionality of the system. However, as part of PSE's planning process, sometimes opportunities are identified to install PSE infrastructure that has been identified in other PSE work plans in conjunction with the facility relocation saving future costs related to paving and transportation disruption. When provided the advance notice, PSE negotiates road and transportation design changes in an effort to minimize relocation work, reduce costs, and ensure ongoing infrastructure safety.

PSE estimates annual funding for public improvement projects by evaluating trends and known projects received from the jurisdictions. This work is not ranked in iDOT due to either its obligatory or unplanned nature.

c. Security enhancement investments

Q. Please describe the investments associated with security enhancements.

A. Security is another area that PSE focuses on to keep the public safe. PSE maintains and improves its physical security systems routinely to eliminate vulnerabilities. From October 1, 2016 to December 31, 2018, PSE invested $5 million in physical security enhancements.

Q. Please describe how PSE decides what physical security enhancement investments are needed.

A. PSE conducts threat and vulnerability assessments of its key infrastructure on a semi-annual basis. The threat assessment defines the potential threats to PSE assets and is used as the roadmap for the vulnerability assessment. The vulnerability assessment identifies and evaluates weaknesses across a broad range of threats and hazards and serves as the basis for developing a security master plan. The security master plan consists of a five-year strategy that includes a list of projects and initiatives to meet PSE's security objectives and outlines security upgrades, modifications of operational procedures and/or policy changes designed to mitigate potential risks.

Annual funding estimates are based on the security master plan. This work is not ranked in iDOT due to either its compliance or non-discretionary nature.

2. Investments made to meet customer growth and service needs

Q. Please describe the investments made towards gas and electric customer growth and service needs.

Per WAC 480-100-148, PSE has an obligation to make electric service available, but gas service is primarily driven by a customer's desire for gas due to its lower rates or quality of cooking and heating performance. The primary driver of PSE's investments to meet customer growth and service needs include responding to customer requests for service and ensuring the backbone gas and electric system has the capacity to meet growing load as a result of customer additions over time.

PSE's established tariffs define costs and contributions required for customer requested work. I will discuss major system projects that are a result of capacity concerns in Section II.E, including the Pierce County 230 kV Transmission and Substation capacity project. Additionally, PSE has made some distribution upgrades associated with the additional supply that will be gained from the Liquefied Natural Gas project, which will address capacity concerns. This work is discussed separately in the Prefiled Direct Testimony of Duane A. Henderson, Exh. DAH-1T.

a. Customer-requested investments

Q. Please describe the investments associated with customer requested work.

A. From October 1, 2016 to December 31, 2018, PSE invested $201 million in meeting gas customer growth, adding 27,771 new meters over this time period. For that same period, PSE invested $104 million in meeting electric growth, adding 35,122 new meters.

Q. Please describe how PSE decides what customer-requested investments are needed.

A. When PSE receives a customer request for new service, PSE works with the customer to scope the work in alignment with established tariffs and in a way that is most cost effective for their need. Annual funding is based on customer addition forecasts and historical trends. Traditionally, customer request investments are not ranked in iDOT due to established tariff costs and customer choice for service.

b. Capacity investments

Q. Please describe the investments associated with capacity work.

A. The collective increase in customer additions can strain the gas and electric infrastructure and require additional investment. This is referred to as "capacity work," which addresses infrastructure that cannot serve the load on the system due to expected increases. If capacity concerns are left unaddressed, equipment could overload and fail, resulting in diminished reliability and energy unserved. From October 1, 2016 to December 31, 2018, PSE invested $22 million in meeting gas capacity needs, including 12 significant projects and $67 million in meeting electric capacity needs, including 24 significant projects. Nearly 62 percent of the electric investment is associated with the Pierce County 230 kV Transmission and Substation project to meet capacity needs in Pierce County.

Q. Please describe how PSE decides what capacity investments are needed.

A. Capacity planning is developed using corporate customer and load forecasts that are based on econometric data science. This work follows the established robust planning process described by Ms. Gilbertson to predict and respond to future needs for more capacity in the system to meet the future customer load. Annual funding is based on specific plans developed by area and is captured in iDOT by specific project. Benefits considered include the energy and customers that cannot be served if capacity is not increased, operational flexibility by having adequate capacity to carry loads from other circuits when line configurations are needed to change for maintenance or due to an outage, and to address North American Electric Reliability Corporation ("NERC") reliability criteria.

3. Investments made to modernize the grid, bringing enhanced electric reliability and resiliency

Q. Please describe the investments made towards electric reliability and resiliency.

A. From October 1, 2016 to December 31, 2018, PSE invested $340 million[2] in electric reliability and resiliency work, which includes investments in replacement of high molecular weight ("HMW") underground cable, increased focus on worst performing circuits, targeted reliability circuits with high benefit/cost value, ongoing pole asset management, substation asset management, increased application of smart equipment such as Supervisory Control and Data Acquisition ("SCADA") upgrades and automation, and demonstration pilots. Vegetation management is also an important element of maintaining and improving reliability.

PSE's electric reliability work encompasses work that maintains or improves electric system performance as a result of known causes of failure that has or may result in an outage to customers. These causes include trees, animals, equipment failure, and third-party damage.

Electric resiliency work addresses aging infrastructure that has reached end of life and is beginning to fail by remediating or replacing an asset before an outage

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[2] The majority of vegetation management discussed in Section II.C.5 is not included in this total as it is primarily O&M. Additionally, AMI is not included in the $340 million.

occurs. Some of PSE's electric infrastructure currently in service is over 80 years old. Adding smart equipment to the system can also be viewed as a resiliency effort to facilitate quick recovery in weather extremes or other emergencies.

On the transmission system, PSE must address infrastructure per NERC reliability standards, which require analyzing the system for potential equipment failure scenarios over a ten-year horizon and then ensuring infrastructure investments are made to prevent failures from rippling to other transmission operators that are interconnected. These investments help to develop the electric system's reliability and resiliency toward outages and increasing demands on the infrastructure.

I will discuss reliability and resiliency work in Section II.C and large transmission major reliability projects in Section II.E.

Q. Please describe how PSE decides what reliability and resiliency investments are needed.

A. Reliability and resiliency planning is developed by analyzing historical asset and circuit performance. This work follows the established robust planning process described by Ms. Gilbertson to predict and respond to poor reliability areas and identify ways to prevent outages from occurring in the future. Annual funding is based on specific plans developed by area and is captured in iDOT by specific project.

This work benefits customers by avoiding outages in the future and reducing the duration when an outage does occur. Data from large outages such as the northeast blackout of 2003[3] demonstrate that outages can have an economic impact to customers and a community. Lawrence Berkley National Laboratory has studied the cost of an interruption to a customer, concluding in a 2015 report that a one-hour outage costs the average medium and large commercial customer $17,804, in 2013 dollars.[4]

Outages and equipment failing can bring safety concerns as well, which is a very important factor in this work. The operational flexibility that is gained through this work means customers are less likely to experience a planned outage for PSE electric system maintenance, or when part of PSE's system is temporarily de-energized to accommodate the safe work of others who are working near power lines.

4. Investments made to enhance gas pipeline integrity

Q. Please describe the investments made towards gas pipeline integrity.

A. From October 1, 2016 to December 31, 2018, PSE invested $173 million in gas pipeline integrity work.[5] Gas pipeline integrity work addresses aging infrastructure that has reached end of life and is beginning to fail. It also addresses

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[3] U.S.-Canada Power System Outage Task Force Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations, at 1 (Apr. 2004) (highlights the economic impact of the multi day loss of power to over 50 million customers, which ranged from $4-$10 billion), available at https://www.energy.gov/sites/prod/files/oeprod/DocumentsandMedia/BlackoutFinal-Web.pdf.

[4] Sullivan, Schellenberg and Blundell, Updated Value of Service Reliability Estimates for Electric Utility Customers in the United States, pg. xii (Ernest Orlando Lawrence Berkeley National Laboratory, 2015), available at http://eta-publications.lbl.gov/sites/default/files/lbnl-6941e.pdf.

[5] Some of sewer cross bore work discussed in Section II.D.2 is not included as it is embedded in customer and project work. Additionally the majority of damage prevention work discussed in Section II.D.1 is not included in the $173 million.

gas distribution facilities determined to have an elevated risk of failure regardless of age, which includes investments in prevention of damage to infrastructure, elimination of sewer cross bores, replacement of DuPont pipe in the system, remediation of buried meter set assemblies, and addressing additional integrity risks. Some of PSE's gas infrastructure currently in service is over fifty years old. PSE filed with the Commission a gas pipeline replacement program ("PRP") plan and cost recovery mechanism that focuses on replacing certain high-risk pipe. Not all gas pipeline integrity work is included in the PRP plan. Please see the Prefiled Direct Testimony of Susan E. Free, Exh. SEF-1T, for a discussion of the treatment of the plant replaced through the PRP and recovered through the cost recovery mechanism. Irrespective of inclusion in the PRP, pipeline integrity issues, if unaddressed, result in leaks and other failures that require emergency response and result in diminished reliability. I will discuss this work in more detail in Section II.D.

Q. Please describe how PSE decides what gas pipeline safety investments are needed.

A. As mentioned in the Prefiled Direct Testimony of Booga K. Gilbertson, Exh. BKG-1T, gas pipeline integrity is evaluated and addressed through established distribution and transmission integrity management programs. These programs gather condition and environment information to monitor and trend system integrity data in order to identify the threats in the gas distribution system that pose the most risk.

Annual funding is based on specific plans developed by area and is captured in iDOT by specific project. Generally, this work benefits customers by reducing the risk of failure of pipeline assets that bring unacceptable consequences. These safety consequences may transpire from a low-grade leak or something more catastrophic depending on location and the event.

<u>5. Investments made towards operational excellence and continuous improvement</u>

Q. Please describe the investments made to improve or maintain operations, performance and service.

A. From October 1, 2016 to December 31, 2018, PSE invested $1~~34~~36 million in projects associated with specific improvement efforts to better serve our customers. PSE's meter reading system is one of those areas as the AMR system is reaching end of life and obsolescence that prevents further progress to meet customer needs. I will discuss the replacement of the AMR system with the AMI system in Section II.C.1.

From October 1, 2016 to December 31, 2018, PSE invested $7 million for new tools. PSE is active in evaluating the tools it uses to ensure safe work but also to leverage new technologies for more efficient work. One example is PSE's implementation of newer leak detection units that are more accurate in differentiating methane from ethane, which reduced the number of leaks that are misidentified as originating from PSE's gas system. Additionally, a separate tool was identified that makes hard to reach locations easier to leak survey. These new tools have benefited customers by helping PSE more efficiently and accurately maintain its gas system.

Ms. Gilbertson mentions several other operational excellence activities including implementation of Integrated Work Management technology. Other operational excellence improvements are realized by reference to specific applications; for example, the steel reinforcement for wood poles that results in cost savings of roughly 90 percent per pole, as compared to the cost of pole replacement, makes the reliability investments go further.

C. Grid Modernization Investments to Improve Electric Reliability and Resiliency

Q. Please describe the work performed to improve electric reliability and resiliency.

A. PSE manages and maintains several reliability and resiliency programs. Some programsaddress specific infrastructure needs while others provide the foundational technology needed to support a reliable and resilient grid. These include:

(i) AMI;

(ii) accelerated replacement of high HMW cables that are prone to failure;

(iii) the worst-performing distribution circuits (“WPC”);

(iv) targeted reliability areas;

(v) vegetation management;

(vi) pole asset management;

(vii) substation asset management; and

(viii) smart equipment and demonstration pilots.

Seven of these programs represent 74 percent[6] of the $340 million invested in electric reliability and resiliency. The following detail describes each relevant program, the work completed, how this benefits customers, and the current performance. Additionally, this work included $8 million in technology-related assets that increase the reliability of installed infrastructure through redundant and secure telecommunications paths, IP (Internet Protocol) enabled voice and SCADA systems, and technology required to provide the proper physical security protections.

Q. Describe PSE's reliability performance as a result of this work.

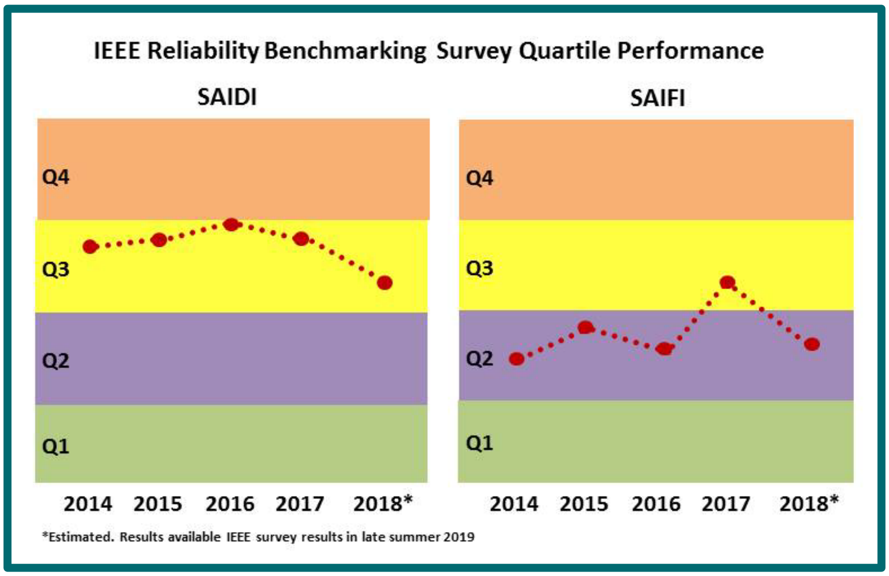
A. There are two primary measures of reliability: System Average Interuption Duration Index ("SAIDI") and System Average Interuption Frequency Index ("SAIFI"). As described in PSE's 2018 Service Quality and Electric Reliability Service Report,[7] PSE's 2018 SAIDI performance was 145, which is an improvement in reliability from 175 in 2017. In addition, PSE's 2018 SAIFI performance was 1.02, which is an improvemment in reliabilty from 1.20 in 2017. While PSE improved over 2017, the industry is improving as well, making it

[6] The seven programs associated with the 74 percent includes HMW, worst performing circuits, targeted reliability; approximately $120,000 is associated with Vegetation Management, pole asset management, substation asset management and smart equipment/demonstration pilots. The remainder is primarily associated with major projects.

[7] https://www.utc.wa.gov/layouts/15/CasesPublicWebsite/GetDocument.ashx?docID=2460&year=2007&docketNumber=072300.

difficult to move dramatically from IEEE industry benchmark quartiles, as PSE remained within quartile three relative to SAIDI performance and quartile two relative to SAIFI performance. Figure 3 shows PSE's SAIDI and SAIFI performance since 2014[8] relative to the IEEE benchmark. While weather events have a signficant impact on this, PSE attributes the trending reduction to the work completed along with efforts to minimize scheduled outages, operational improvements, and returning circuits to normal operation in a timely manner.

Figure 3: PSE's Reliability Performance from 2014-2018 against the IEEE Benchmark Quartiles



[8] 2014 was the first year after full implementation of PSE's outage management system, geographic information system and associated business processes that makes performance statistics less comparable prior to 2014.

Q. Beyond system level measures and industry benchmarks, how does PSE confirm the completed work delivered the expected reliability benefit and improvement?

A. After projects are put into service, PSE performs a reliability improvement verification, which is referred to as "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 to compare performance after the completion of the project to the outage history prior to the system improvement project. This verification typically (1) evaluates the elimination or reduction in the type and number of outages; (2) helps to confirm the success of certain reliability strategies; and (3) provides insight on how to make adjustments and improvements to project selection or design in the future. The 2016 completed work will be backcasted in 2020, and the 2017 and 2018 completed work will be backcasted in 2021 and 2022, respectively.

PSE is typically able to verify the duration reduction improvement of projects such as distribution automation more rapidly and directly. The impact with and without the automation project can be determined for each interruption and the difference calculated. In 2018, PSE had approximately 44 distribution circuits enabled with automation. Before automation, outage duration was on average 145 minutes but after automation the average outage duration was two minutes or less. The 44 circuits collectively brought a system level SAIDI improvement of nearly two minutes, including during storms.

1. Advanced Metering Infrastructure

Q. Please describe the AMI project.

A. In 2016, PSE began replacing its AMR system installed between 1998 to 2001 with AMI across PSE's electric and gas service territory for PSE's 1.2 million electric and 800,000 gas customers. In total, PSE will invest approximately $473 million in an AMI communication network and metering equipment, which is expected to be complete by 2022-2023. From October 1, 2016 to December 31, 2018, PSE invested $~~90~~92 million associated with the 2,740 communication network devices, the head-end software, and 217,346 meter/module assets placed in service. Details regarding AMI including business case, decision process, benefits, and cost are described fully in Exh. CAK-4.

PSE is seeking a determination that the decision to implement AMI was prudent, and PSE is seeking approval for recovery in rates of the AMI investment that has been placed in service.

2. HMW cable remediation

Q. Please describe the HMW cable remediation work completed.

A. From October 1, 2016 to December 31, 2018, PSE invested $113 million to replace approximately 315 miles through 883 projects of HMW direct-bury cable that were prone to failure.

Q. Please describe why this work is needed.

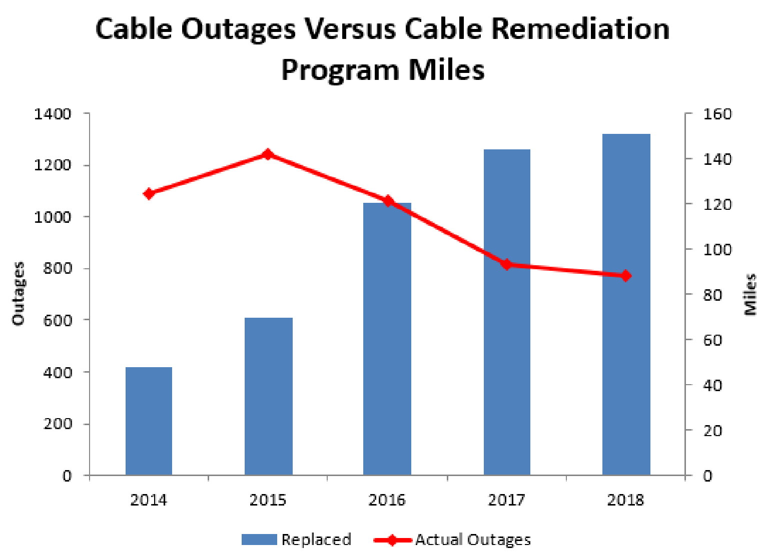
A. HMW cable was first installed just prior to 1965 and today there is approximately 1,430 miles of cable. At the time, it was state of the art, with expected life of 40-

60 years. However, 20 years later, cable installed prior to 1982 began failing much earlier than expected, and in the early 1990s, PSE implemented a remediation program to address the failing cable. In 2016, PSE ramped up its program to proactively replace the failing cable to prevent outages.

Q. Has reliability improved as a result of this work?

A. Yes. PSE has seen the number of cable caused outages improve by 38 percent since 2015, as shown in Figure 4, below. Additionally, PSE's system level SAIDI, has decreased by over four minutes from 2015 to 2018, due to replaced HMW cable.

Figure 4: Cable Outages and Miles of Cable Replaced by Year



3. Worst performing circuits

Q. Please describe the WPC work completed.

A. From October 1, 2016 to December 31, 2018, PSE invested $61 million on WPC, completing 101 projects on 64 circuits.

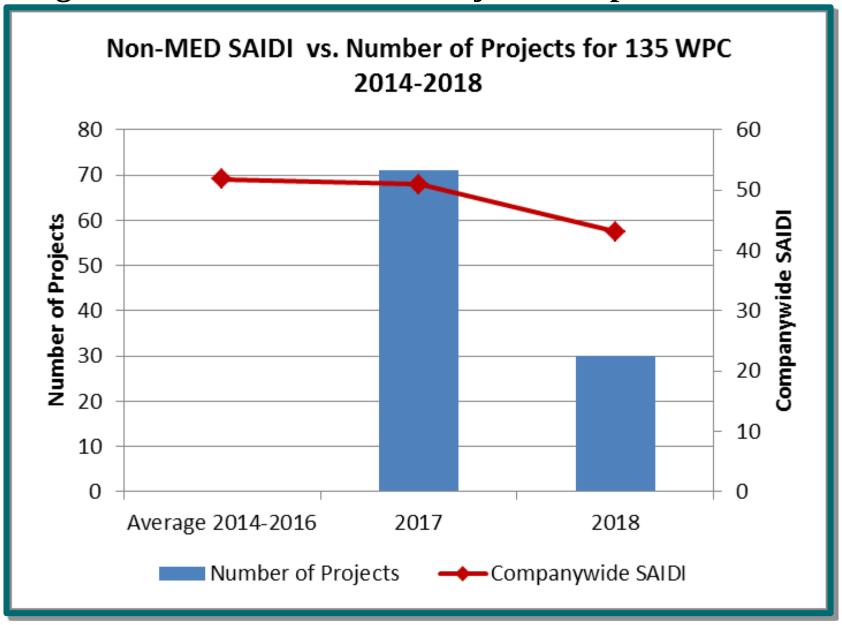
Q. Please describe why this work is needed.

A. In 2017, PSE began a program to address the WPC that historically had poor reliability performance year after year and focused on high customer minutes of interruption and high circuit SAIDI and SAIFI, identifying 135 distribution circuits that needed significant improvement. PSE embarked on a multi-year effort to make targeted investments to improve the performance of these circuits.

Q. Has reliability improved as a result of this work?

A. Yes. In reviewing the 64 circuits for which work was completed, circuit SAIDI performance is trending positive, with improvements on over 66 percent of the circuits (42 of 64 circuits). Figure 5 below compares the 2014-2018 SAIDI performance to the number of completed projects on the WPC during that same time period. As the reliability benefit is realized after a project is completed, the benefit is realized in the following years. Between 2017 and 2018, these 135 WPC saw an eight-minute reduction.

Figure 5: SAIDI Results and Projects Completed on WPC



An example of how system improvements have correlated to circuit reliability performance is circuit Kenmore No. 26 (KNM-26). From 2014-2016, KNM-26 had a circuit SAIDI performance of 400 for the circuit's 1,420 customers. In 2017, PSE addressed this circuit by re-routing a section with poor reliability to a path that was easily accessible and had less exposure to trees. The 2017-2018 circuit SAIDI performance for KNM-26 has drastically improved to 63, which is an 84 percent outage duration reduction for the customers on this circuit.

<u>4. Targeted reliability</u>

Q. Please describe the targeted reliability work completed.

A. From October 1, 2016 to December 31, 2018, PSE invested $42 million on targeted distribution circuits that have high benefit to cost ratio, completing 90 projects on 82 circuits and several transmission projects. Typically, these circuits have a high number of customers impacted when an outage occurs and for which solution costs are reasonable.

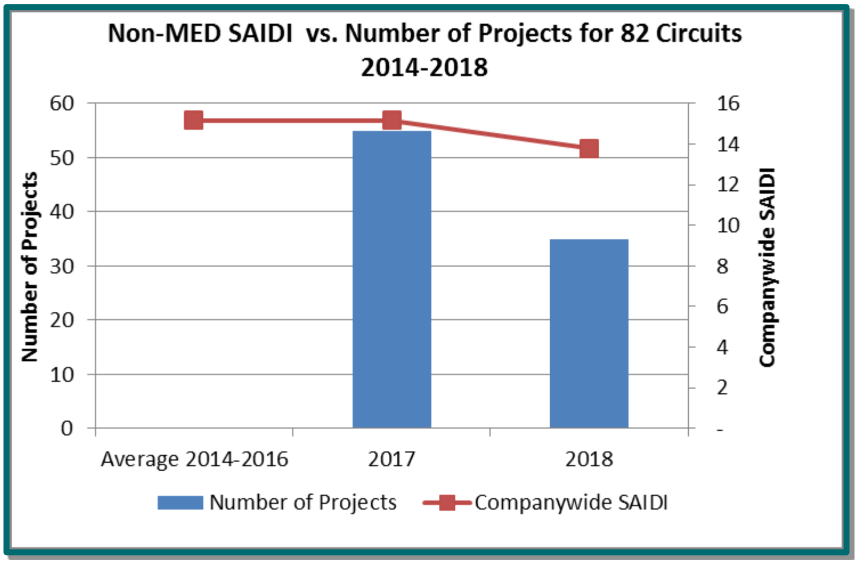
Q. Please describe why this work is needed.

A. Along with addressing specific assets and the WPCs, reliability performance can be influenced by targeting other circuits that contain pockets of customers experiencing poor reliability that may not be identified through circuit level reliability metrics or customer complaints. These circuits tend to be in urban or suburban areas and improvements to these circuits typically will have a high benefit and lower cost solution. Examples of improvement projects could range from a replacement of a short section of conductor to tree wire, the addition of a sectionalizing device, or the addition of a feeder tie to improve operational flexibility.

Q. Has reliability improved as a result of this work?

A. Yes. In reviewing the 82 circuits for which work was completed, circuit SAIDI performance is trending positive. Figure 6 below shows the 2014 to 2018 SAIDI performance of these 82 circuits and the number of targeted reliability improvement projects during that same time period. Between 2017 and 2018, these 82 circuits saw a 1.4-minute reduction.

Figure 6: SAIDI Results and Projects Completed on 82 Circuits with Targeted Reliability Improvements



An example of how targeted reliability system improvements have correlated to circuit reliability performance is on circuit Eld Inlet No. 23 (ELD-23). From 2014-2016, ELD-23 had an average circuit SAIDI performance of 624 for the circuit's 1,108 customers. In 2017, PSE replaced the main feeder conductor with tree wire, in heavily treed areas. The 2017-2018 average circuit SAIDI performance for ELD-23 has improved significantly to 94, which is an 85 percent outage duration reduction for the customers on this circuit.

<u>5. Vegetation management</u>

Q. Please describe the vegetation management work completed.

A. From October 1, 2016 to December 31, 2018, PSE invested $31.4 million in trimming 314,815 trees and removing 4,452 trees along 5,472 miles of overhead distribution and transmission system greater than 55 kV. Additionally, PSE invested $5.4 million dollars trimming 28,649 trees and removing 4,631 trees on 100 of circuits under a program called TreeWatch.

Q. Please describe why this work is needed.

A. With nearly 75 percent of PSE’s right of way edge treed, PSE has a comprehensive vegetation management program to keep the overhead electric system operating safely and to maintain reliability. Trees that grow or blow into a conductor can cause an outage, catch on fire, or create a public safety concern as electricity travels to ground. Maintaining our overhead electrical system is also required by law. PSE has an established tree trimming maintenance cycle based on voltage levels and circuit characteristics. Overhead distribution system trees are trimmed every four years for distribution lines in urban areas and every six years for lines in rural areas. For the high voltage 55/115kV transmission corridor system, trees are trimmed every three years and for the 230kV transmission corridor system, trees are trimmed annually.

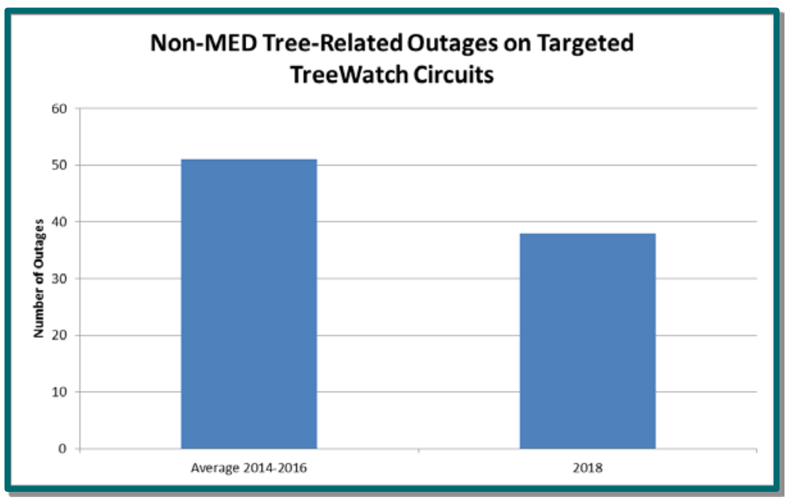
TreeWatch is a program that addresses at risk or hazard trees that are beyond PSE’s 12-foot right-of-way and on private property. It primarily focuses on the WPCs for tree-related outages working with each customer to educate, negotiate, and replace trees that are removed.

With urban forests experiencing several years of drought and changing weather conditions, declining health of native tree species and changing growing patterns means the historical vegetation management approach may need to become more dynamic and adaptable to change.

Q. Has reliability improved as a result of this work?

A. Yes. With PSE's robust tree trimming program, less than ten percent of outages are caused by trees within the right-of-way. Most of the tree-caused outages are from trees that fall-in or have branches that break from beyond the right-of-way where PSE does not have the authority to pursue. The TreeWatch program is intended to improve reliability by addressing these at-risk trees. In 2017 the TreeWatch program targeted four circuits that historically experienced high tree-related outages. Figure 7 shows an average reduction of 25 percent in tree-related outages from the previous three years on the four targeted circuits.

Figure 7: Non-MED Tree-Related Outages on Targeted TreeWatch Circuits



<u>6. Pole asset management</u>

Q. Please describe the pole asset management work completed.

A. From October 1, 2016 to December 31, 2018, PSE invested $9 million in assessing, treating, reinforcing, and replacing deteriorated poles and cross arms. PSE inspected and treated over 22,000 poles, reinforced about 690 poles and replaced about 100 transmission and 630 distribution poles.

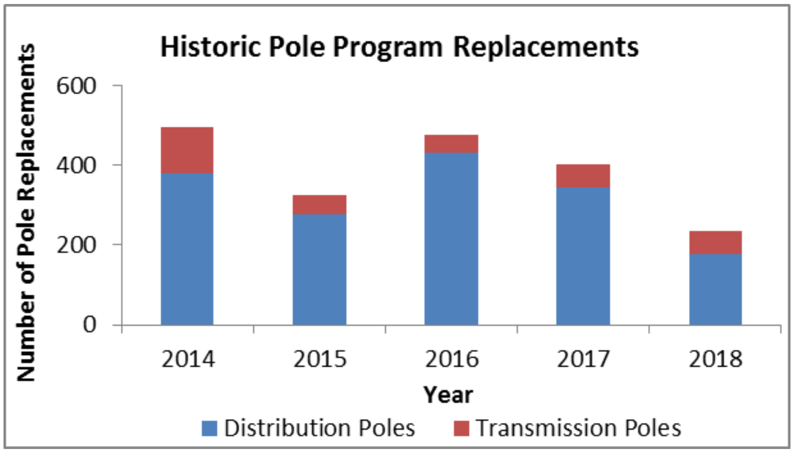
Q. Please describe why this work is needed.

A. The first line of defense for reliability is having a strong system. When 42 percent of the distribution system and 98 percent of the transmission systems are overhead, pole strength is important as the failure of a utility pole can cause an outage that could affect thousands of customers. In 2018, there were 183 total outages (including storms) caused by a structural failure on the pole. PSE has over 300,000 distribution poles and 40,000 transmission poles. Pole assets are managed through a comprehensive program that includes inspection, treatment, reinforcement, and replacement. PSE inspects poles on a ten-year cycle and as of today, PSE has inspected 100 percent of the transmission poles and about 20 percent of distribution poles. PSE prioritized transmission pole inspection over the last ten years due to the higher risk associated with failure. Moving forward, distribution pole inspection will gain momentum in the next cycle. On average, six percent of PSE's poles need to be replaced annually. Upon inspection, PSE injects a chemical treatment extending the life of the pole by ten years with each application. In addition to the programmatic investment in pole replacement and reinforcement, PSE also replaces poles due to capital projects, telecommunications joint use needs, and in storm restoration efforts.

Q. Has reliability and resilency improved as a result of this work?

A. Yes. PSE estimates it avoided 1,420 outages associated with pole failure, with about 100 that were imminent. In addition, this work improved the structural integrity and extended the life of about 22,000 poles by ten years providing additional strength when impacted by a tree, limb or other outside force. Figure 8 shows the historic pole program replacements based on known poor pole condition, which directly translates to outages avoided from this work.

Figure 8: Historic Pole Program Replacements



<u>7. Substation asset management</u>

Q. Please describe the substation asset management work completed.

A. From October 1, 2016 to December 31, 2018, PSE invested $29 million in assessing and replacing substation equipment, including 4,956 tasks to assess and maintain assets and the replacement of 121 assets.

Q. Please describe why this work is needed.

A. Substations are the key hubs for 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. Through monthly inspections and condition diagnostics, over 4,834 monitoring tasks were performed to develop the maintenance programs based on manufacturer recommendations and condition-based maintenance in order to improve performance and increase the asset life. The maintenance program also drives replacement of substation equipment in order to improve or maintain system reliability, reduce operational costs and offset impacts from aging infrastructure. On average, 50 substation assets need to be replaced annually.

Q. Has reliability and resiliency improved as a result of this work?

A. Yes. The diagnostic/maintenance programs identified 195 issues that were repaired before they failed in the substation, which directly translates to preventing 195 potential outages for 661,000 customers.

8. Smart equipment and demonstration pilots

Q. Please describe the smart grid work completed.

A. The term "smart grid" refers to an energy supply chain that employs modern technology to enhance, integrate, and automate monitoring, analysis, control and communications capabilities along the entire grid. From October 1, 2016 to December 31, 2018, PSE invested $14 million in smart grid technologies through application of smart equipment including scaling up control and reliability solutions such as distribution automation, distribution and transmission SCADA projects, and demonstration pilots to operationalize new technologies.

Distribution automation extends intelligent control over electrical power grid functions in the electric distribution network to minimize outage time to customers. PSE completed 44 distribution automation projects, nine of those are in alignment with the WPC completed work. PSE completed 26 transmission and 16 distribution SCADA projects that will provide supervisory control and advances data acquisition and analysis for operational flexibility and shorter outages because the grid can be operated and managed automatically and/or remotely instead of requiring a person to manually operate/manage equipment.

While not a capital investment associated with building a smarter grid, PSE completed a demand response pilot that was designed to test customer enrollment and acceptance as well as control technology for large industrial customers. Demand response load control can be used as an alternative to generation assets, power market purchases, or as a localized resource for grid support. Additionally, PSE further tested enhanced transmission line automatic switching to provide improved reliability over existing transmission automation schemes similarly to distribution automation. Smart grid technologies also include smart meters like PSE's AMI program already mentioned in Section II.B.5 and also detailed further in Section II.C.1.

Q. Please describe why this work is needed.

A. PSE has been doing smart grid work since 2010 as well as implementing various pilot projects.[9] This work is important in order to learn the technology, test for feasibility, understand cost of implementation, develop necessary skill and processes for implementation, and measure the benefit and value against expectations. Ms. Gilbertson's testimony discusses the current environment that

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[9] Between 2010 and 2016, PSE submitted a Smart Grid Technology report in compliance with WAC 480-100-505.

reinforces the need for a modern grid and focuses on PSE's need to continue its smart grid work.

Q. Has reliability and resiliency improved as a result of this work?

A. Yes. PSE has installed smart equipment and technologies for decades from its first AMR system in 1998 to transmission automation installed over three decades ago. As described above in Section II.C, distribution automation has begun to deliver benefits including an overall reduction of two system level SAIDI minutes. In addition, as a result of distribution SCADA projects, PSE estimates an overall reduction of 2.4 system level SAIDI minutes.

Q. Please describe the completed demonstration pilots and next steps.

A. There are two completed pilots: 1) Transmission Line Automated Switching ("TLAS") and 2) demand response for commercial application.

In 2016, the TLAS pilot program was developed because the existing practice of autoswitching is not optimized for the restoration of customers. The improvement over legacy transmission automation practices could be approximately 30-50 percent because it reduces incidences of closing into faults, thereby reducing damage to line switches, circuit breakers and other in-line equipment. Where implemented, TLAS will also increase the number of customers that can be automatically restored following a single transmission line fault to nearly 100 percent. In the existing transmission automation method, many lines do not have total fault restoration coverage. If the fault occurs in some specific locations or cannot be located within three reclose cycles (on some lines) then some loads may not be restored. The TLAS can function appropriately for all line configuration types and reduces reclose attempts. A pilot was proposed for three separate transmission lines and in 2017, line sensors were lab tested and then installed in the substations and data collection was fully implemented in December 2018. PSE worked through pilot challenges including strengthening the radio communication signal from the line sensor radios and firewall issues. The next steps for this pilot include documentation, process development for coordinated multiple department interface.

In March 2018, PSE completed a demand response pilot that was implemented as a result of the 2015 Integrated Resource Plan that concluded demand response could be a cost-effective resource. The objective of the pilot was to demonstrate new technology and a program methodology to validate ease of use/participation for customers, create a seamless enrollment and participation process for future participants, work with hand-selected customers to explore resource value and dispatch strategies, and fine tune the program as winter season progresses. Two large commercial/industrial customers participated. PSE contracted with a vendor who provided software and controls to monitor and dispatch events wherein customers would reduce their electric load. PSE dispatched the resource four times in 2018. Events were dispatched to coincide with PSE's winter morning peak. The average load reduction for all four events was 3.3 MW. The demand response pilot encountered a challenge when implementing load controls at a participating customer site, needing real time visibility to the operating status of customer equipment. Cellular reception was not sufficient in the pilot location so

PSE was not able to utilize the customer's network and as such, PSE sought additional antenna solutions. PSE determined that the project would not be cost effective to scale and did not continue the program after March 2018. While the primary driver of the demonstration project was to evaluate the potential to utilize demand response as a deferral to traditional generation capacity resources, demand response can also be dispatched to reduce load in targeted locations to provide capacity and reliability benefits to the transmission and distribution system. PSE is exploring the use of demand response as part of a non-wires alternative approach to addressing electric system needs.

Q. Please describe the pilots or demonstration programs that are planned or currently underway.

A. PSE has developed several new pilots or demonstration programs including (1) a customer-sited energy storage program to better understand the technology impact and opportunity to engage customers to support grid needs; (2) smart street lighting that is actively being requested by municipalities; and (3) community solar to learn more about how location and control impact system costs and benefits; and (4) and a potential project submitted under the Clean Energy Fund 3 grant to test multiple technologies. Additionally, the electric vehicle supply equipment ("EVSE") pilots that have been approved will bring opportunity to understand the grid impacts and scenarios and conditions where infrastructure improvements are needed. More detail regarding the EVSE pilots is described in the Prefiled Direct Testimony of William T. Einstein, Exh. WTE-1T.

D. Gas Pipeline Integrity Investments Improve Pipeline Safety and Reduce Risk

Q. Please describe the work performed to improve gas pipeline integrity.

A. PSE continues to focus on five areas to improve gas pipeline integrity: (i) damage prevention; (ii) identification and elimination of sewer cross bores; (iii) DuPont pipe replacement; (iv) buried meter set remediation; and (v) additional integrity management risk mitigation. Four of these programs represent 93 percent[10] of the $173 million invested in gas pipeline integrity. PSE submits an annual Continuous Surveillance Report per the PSE Distribution Integrity Management Program ("DIMP") plan to the Commission. The report has detail about the additional and accelerated actions PSE is taking to reduce risk and improve gas pipeline integrity. The report describes PSE's top-priority programs due to risk including each relevant program, the work completed, how this benefits customers, and the current performance.[11] Customers and the public benefit from this focused safety of PSE pipelines as well as the decrease in repair costs over time.

Q. Describe PSE's gas pipeline integrity performance as a result of this work.

A. The primary measure of pipeline integrity is the number of leaks in the system. Over the last ten years, the number of new leaks has decreased for all leak grades

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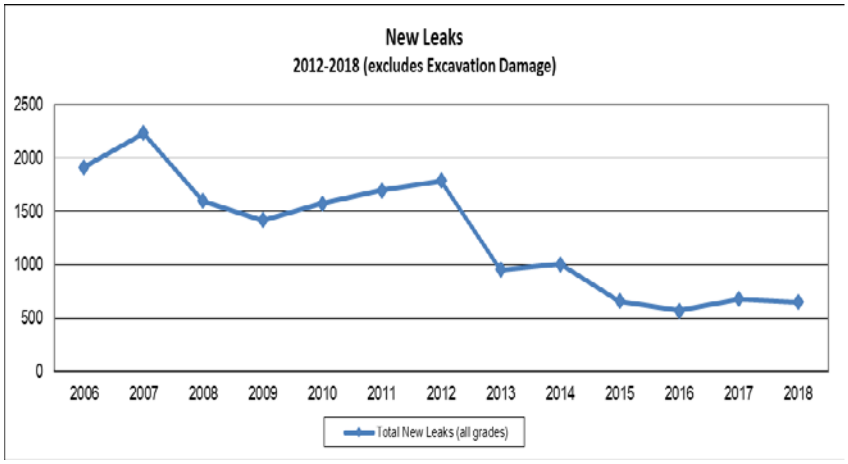
[10] The four programs associated with the 93 percent include approximately $955,000 of investment in sewer cross bore, DuPont pipe, buried meter sets, and additional integrity risk management programs.

[11] PSE has two more top-priority programs; PSE's Deactivated Gas Line Inspection and Remediation ("DGLI") Program and PSE's Active C Leak Reduction ("C Leak") Program. The DGLI program is primarily O&M and progressing per agreed upon settlement, UTC Docket UG-160924. The C Leak program is discussed at a high level in Section II.D.

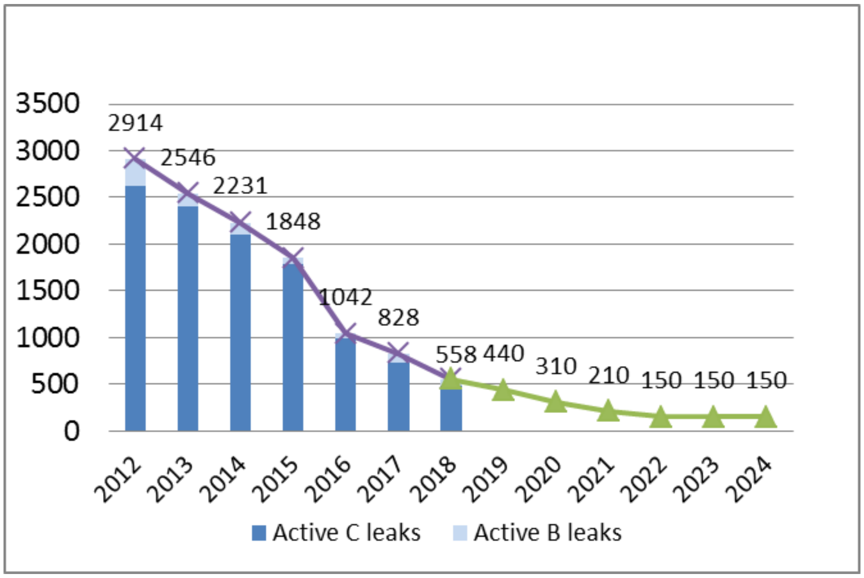
as shown in Figure 9. Compared to the 2018 American Gas Association ("AGA") national benchmarks, PSE ranks in quartile two for active leaks.

Figure 9: Number of New Leaks Annually 2006-2018



Along with the safety improvements this brings, the decreased repairs result in an average of $500,000 annually in O&M repair savings. PSE has leveraged these savings to increase the focus on reducing the number of active, non-hazardous leaks in the distribution system, eliminating 512 C leaks from October 1, 2016 to December 31, 2018. Figure 10 shows the historical leak inventory from January 2008 to December 2018 demonstrating the aggressive decline achieved as a result pipeline integrity work and focused C leak reduction. The data shown for 2019 through 2024 are projected total active leaks based on PSE's repair plan to reduce the number of non-hazardous leaks going forward.

Figure 10: Active Leak Reduction History and Plan



However, excavation damage continues to be a threat to pipeline integrity and results in hazardous leaks. PSE experienced 974 damages in 2017 and 1,035 damages in 2018. While excavation damage has increased, PSE has performed below, i.e., better than, the five-year average baseline in spite of the dramatic increase in excavation tickets, which is an indication of the volume of construction around PSE's infrastructure. Table 1 shows the baseline performance as measured through PSE's DIMP.

Table 1: Excavation Damage Performance against DIMP Baseline

Metric	5-yr Average	Baseline 5-yr Average	Performance Measure
Number of Excavation Damages	969	1410	< Baseline
Number of Excavation Tickets	215,690	167,544	> Baseline
Number of Excavation Damages/1000 Tickets	5.0	8.3	< Baseline

Leaks and damage are not the only result of PSE's gas pipeline integrity work, but they are easiest to measure against historical performance. As of the end of 2018, PSE's reduction of C leak inventory removed any chance that these leaks deteriorate to a hazardous condition and removed 8,946 metric tons of CO_2 equivalent.

As recognized by the DIMP regulation, gas infrastructure is threatened. Pipeline integrity management based on risks is important just like managing other core infrastructure systems like water or transportation systems. This work is focused on driving risk down through many strategies. Through DIMP work, all threats and risk received a number score for which a total is determined.[12] Specific mitigation programs discussed below reduce PSE's threat profile and are expressed in terms of a percentage of risk reduced as mitigative measures are put in place or the asset is eliminated.

1. Damage prevention

Q. Please describe the damage prevention work completed.

A. The damage prevention program has four primary activities: 1) locate all gas (and electric) infrastructure as requested through 811 "Call Before You Dig" service; 2) standby and monitor high risk third party construction activities; 3) provide public awareness messaging regarding pipeline safety through PSE sponsored advertising, social media posts, and advertising sponsored by Washington 811; and 4) provide active and present education through field personnel who visit job

[12] DIMP regulation specifies that utilities must understand the integrity of their system and determine risk through a documented process. Each utility has the flexibility to determine their approach and process that works best for them. As a result, the risk results, specifically threat scores and PSE's total score, is not comparable and not indicative of a risk profile that is comparable to other utilities.

sites, educate contractors about the state dig law, and initiate enforcement actions against repeat offenders. From October 1, 2016 to December 31, 2018, PSE invested $33 million in providing 1.032 million gas and electric locates, conducting numerous onsite standbys for third party construction projects, implementing public awareness messages, and leveraging 17 field personnel for standbys and more than 13,000 field contacts. About 25 percent of the total program cost is capital.

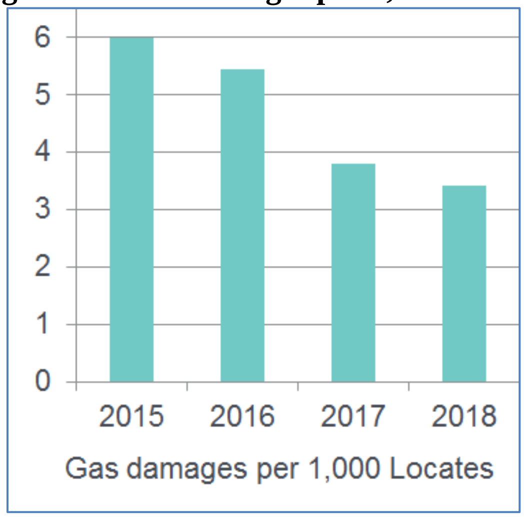
Q. Please describe why this work is needed.

A. As described above, leaks caused by excavation damage account for more than half of the leaks that occur in PSE's distribution system, and all are hazardous. As a result, excavation damage is PSE's highest threat and integrity risk. Excavation damage is typically caused by improper excavation practice, failing to request a locate, or digging where the utilities are improperly marked or mapped. PSE conducts 300,000 gas locates annually and experiences about 1,000 damage incidents a year to the gas infrastructure, creating safety concerns due to uncontrolled release of natural gas. PSE is currently in the fourth quartile of AGA benchmarking, but is targeting first quartile by the end of 2020. Safety is the primary driver for this improvement, but the cost associated with responding to these damages is $2.5 million annually.

Q. Has pipeline safety improved as a result of this work?

A. Yes. Since 2015, PSE's gas damages per 1,000 locates has declined 43 percent—from 6.0 per thousand in 2015 to 3.4 per thousand in 2018.[13] Figure 11 shows the improvement in gas damages per 1,000 locates since 2015.

Figure 11: Gas Damages per 1,000 Locates



The absolute number of gas damages during this period remained relatively flat, despite a 24 percent increase in construction activity as measured by statewide construction employment. An additional 1,500 more damages would have occurred since 2016 without the efforts of PSE's damage prevention program. PSE has avoided an increase in integrity risk associated with excavation damage by 40 percent as a result of this work.

[13] Ms. Gilbertson's testimony discusses damage prevention statistics that include both gas and electric infrastructure combined.

Q. Is this work accounted for in the PRP cost recovery mechanism?

A. No. PSE did not include this program in the 2018-2019 PRP master plan and therefore it is not in the cost recovery mechanism associated with the PRP.

<u>2. Sewer cross bore</u>

Q. Please describe the sewer cross bore work completed.

A. PSE's sewer cross bore program utilizes video inspections to identify and remediate cross bores in sewer lines and a public awareness program to prevent cross bore damage from plumbers cleaning a blocked sewer line. A cross bore is when a gas line is installed with trenchless technology through a sewer line. The program focuses on three activities: 1) public awareness; 2) stopping new cross bores from being left after new construction; and 3) doing inspections of legacy facilities that may have been installed using trenchless technology. From October 1, 2016 to December 31, 2018, PSE invested $30 million in inspecting 14,867 parcels for potential cross bores. Of the $30 million, $4 million is associated with legacy facilities and $26 million is associated with confirming new construction is cross bore free. About 87 percent of the total program cost is capital which is the work associated with confirming new construction.

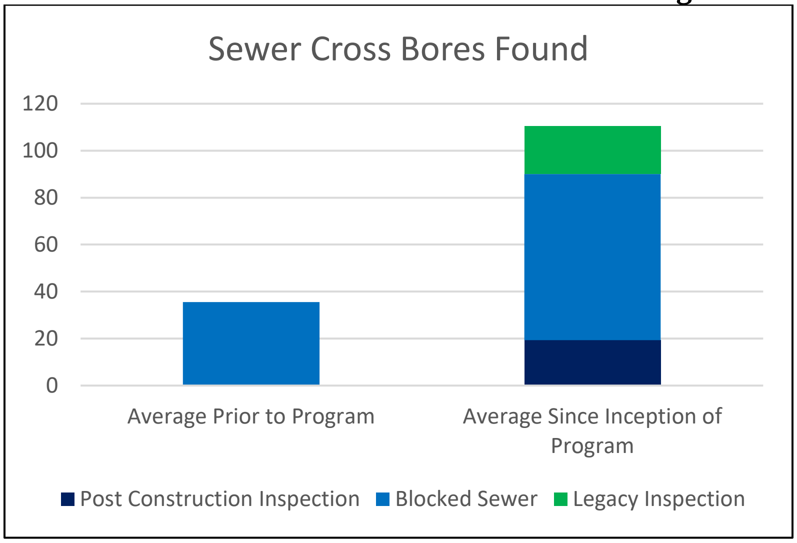
Q. Please describe why this work is needed.

A. Industry practices have changed toward more modern installation methods for gas pipelines that reduce restoration and impact to the public during installation. Jurisdictions have requested utilities perform trenchless installations more frequently and trenchless construction methods prove to be more cost effective than open trenching. However, many cities do not have their sewer mains and laterals located and mapped, nor do homeowners. Cross bores pose the second highest integrity risk compared to all risks to PSE facilities. The high risk is associated with gas entering a home in the event a cross bored pipe is damaged by a plumber clearing a sewer line. Initially, PSE identified 400,000 parcels with potential cross bore risk based on similar characteristics to discovered cross bores or due to unknown characteristics. Increased data analytics lowered the estimated potential parcels down to 220,000. PSE worked with third parties to develop and refine a risk model which identified approximately 60,000 locations with a high risk for sewer cross bore.

Q. Has pipeline safety improved as a result of this work?

A. Since 2013, PSE has discovered 743 cross bores through video inspection and plumber engagement eliminating the potential of future damage and catastrophic leaks. PSE inadvertently installs new cross bores at a rate of approximately 30 per year, but through video inspection of all new installations, no cross bores are ever left. Figure 12 shows how this focused program is increasing the annual discovery of historical sewer cross bores.

Figure 12: Annual Sewer Cross Bores Found After Program Initiated



Q. Is this work accounted for in the PRP cost recovery mechanism?

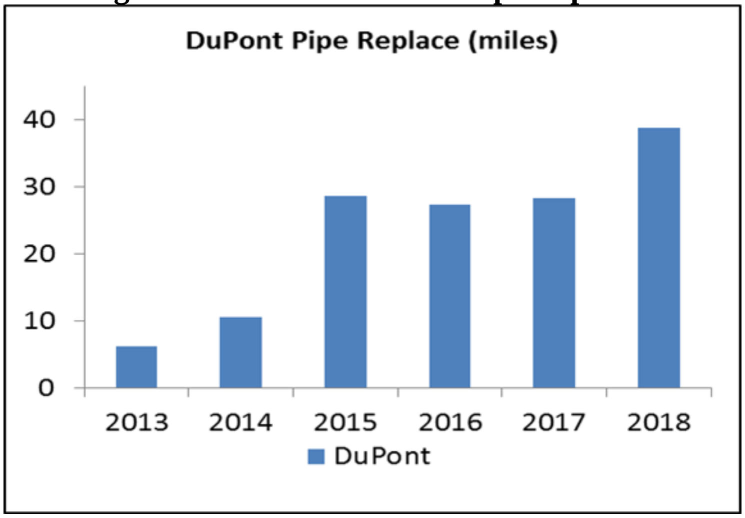
A. PSE did include this program in the 2018-2019 PRP plan but did not include it in the cost recovery mechanism. PSE will be including this program in the June 2019 PRP submittal and when approved, included in the cost recovery mechanism, having now a better understanding of the extent of the problem, risk management, and solution effectiveness to support an acceleration of this focus.

<u>3. DuPont pipe replacement</u>

Q. Please describe the DuPont pipe replacement work completed.

A. From October 1, 2016 to December 31, 2018, PSE invested $111 million in replacing and retiring approximately 400,000 feet of DuPont pipe with new polyethylene pipe. This includes completion of more than 300 projects. Figure 13 shows the miles of DuPont pipe replaced since 2013.

Figure 13: Miles of DuPont Pipe Replaced



Q. Please describe why this work is needed.

A. PSE identified an increased risk of brittle-like cracking and fusion failure of Aldyl "HD" PE pipe that was manufactured by DuPont and installed between 1977 and 1984. Data on leak repairs by leak grade and material type show leaks repaired on older vintage PE main are more than twice as likely to be hazardous than leaks on older wrapped steel main. PSE's experience with Aldyl "HD" PE pipe material is similar to industry experience with many of the older PE materials. As PSE ranks its risks through the risk management process, DuPont pipe is the third highest integrity risk due to the quantity of remaining pipe to replace and the catastrophic failure mode.

Q. Has pipeline safety improved as a result of this work?

A. Yes. Since 2013, PSE has replaced or retired over 139 miles of an expected 435 miles of the DuPont pipe in its system. PSE estimates risk reduction of 32 percent as a result of retiring or replacing the pipe.

Q. Is this work accounted for in the PRP and cost recovery mechanism?

A. Yes. PSE included this program in the 2018-2019 PRP master plan and cost recovery mechanism.

<u>4. Buried meter set remediation</u>

Q. Please describe the buried meter set remediation work completed.

A. From October 1, 2016 to December 31, 2018, PSE invested approximately $2 million in remediating approximately 5,000 meter set assemblies that had some portion of the above ground pipeline buried in asphalt, concrete or soil. About 54 percent of the total program cost is capital.

Q. Please describe why this work is needed.

A. The fittings and pipe on a gas riser and meter set are installed and intended to be operated above ground, but can be subsequently buried by changes in landscaping, hard surface additions, or other changing field conditions. Fittings unintentionally buried could result in corrosion and buried shut off valves, which may impede emergency response. Since the meter set is typically at the building wall, there would be higher consequence if there was a leak, and as such, buried meter sets pose the fourth highest integrity risk compared to all other assets in PSE. PSE identified over 40,000 meter sets that need remediation and experiences an average of 5,000 new reports a year. PSE plans to reduce the population of reported buried meters over the next ten years.

Q. Has pipeline safety improved as a result of this work?

A. Since 2012, PSE has remediated over 12,000 buried meter sets thus avoiding 12,000 future potential leaks and risks. PSE has reduced is integrity risk overall by an estimated 4.5 percent as a result of this work.

Q. Is this work accounted for in the PRP cost recovery mechanism?

A. No. PSE did not include this program in the 2018-2019 PRP plan and therefore it is not in the cost recovery mechanism associated with the PRP. PSE will be including this in the June 2019 PRP submittal and when approved, included in the cost recovery mechanism, having now a better understanding of the extent of the problem, risk management, and solution effectiveness to support an acceleration of this focus.

5. Additional integrity management risk mitigation

Q. Please describe the additional integrity management risk mitigation work completed.

A. From October 1, 2016 to December 31, 2018, PSE invested $47 million in the implementation of 29 additional programs to address distribution integrity threats through over 1,400 projects. About 93 percent of the total program cost is capital. Table 2 highlights those programs and the system risk level that drives the mitigation priority.

Table 2. Additional Distribution Integrity Risk and Mitigation Programs

	Program	System Risk
1	Deactivated Gas Line Inspection and Remediation Program	Top Priority
2	Active Leak Reduction Program	Top Priority
3	Wrapped Steel Service Assessment Program	Moderate-High
4	Bolt-on Service Tee Program	Moderate-High
5	Idle Riser Program	Moderate-High
6	Mapping Accuracy	Moderate-High
7	Older Wrapped Steel Mitigation Program	Moderate-High
8	Ground Faults and Lightning Program	Moderate-High
9	High Pressure Main Risk Assessment Program	Moderate-High
10	Regulator Station Mitigation Program	Moderate-High
11	Modified Farm Tap Program	Moderate-High
12	Encroachment Mobile Home Communities Survey Program	Moderate-High
13	Shallow Main and Service Remediation Program	Moderate-High
14	Encroachment Remediation Program	Moderate-High
15	Extended Utility Facility Program	Low
16	Rockwell IPH Remediation Program	Low
17	Bridge and Slide Program	Low
18	Heater Maintenance Program	Low
19	Traffic Protection Program	Low
20	Wrapped Steel Main in Casing Program	Low
21	Industrial Meter Set Remediation Program	Low
22	Celcon Service Tee Cap Program	Steady State
23	Double Insulated Flanged Valve Program	Steady State
24	Docks and Wharves Assessment Program	Steady State
25	High Voltage AC Mitigation Program	Steady State
27	High Pressure Valve Mitigation Program	Steady State
28	Pipe on Pipe Supports Program	Steady State
29	Excess Flow Valve Program	Steady State

Q. Please describe why this work is needed.

A. DIMP regulation requires PSE to identify and reduce pipeline safety and integrity risks. Each risk from top priority to low risk has a mitigation plan appropriately based on these risk levels. Top priority and moderate-high risks have a defined plan while low risks are programmatically monitored and have a strategy to keep the risk low and get the asset to a steady state within the distribution system. Most resources are focused on top priority and moderate-high risk mitigation programs due to population size affecting the frequency of occurrence. The four programs discussed in detail in Section II.D.1-4 are top priority risks. Failure to identify these or have appropriate plans would put PSE in non-compliance and, more importantly, put customers and public safety at risk.

Q. Has pipeline safety improved as a result of this work?

A. Since 2016, PSE has reduced its integrity risk overall by an estimated five percent as a result of this work. Typically, the consequence has not changed but the risk reduction is due to the population reduction within each program, which in turn reduces the frequency of occurrence. For example, the Rockwell IPH Remediation Program replaced obsoleted equipment at 17 regulator stations from 2016 to 2018 reducing that specific program risk by approximately 50 percent.

Q. Is this work accounted for in the PRP cost recovery mechanism?

A. These integrity risk and mitigation programs do not rise to the level of “elevated risk” as stated by the Commission policy as of now and therefore, are not included in the 2018-2019 PRP plan and are not included in the cost recovery mechanism associated with the PRP. However, the majority of PSE’s top priority risks do.[14] PSE continues to monitor threat and performance trends for possible inclusion in the future.

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[14] The two top priorities that are not in the PRP master plan is PSE’s DGLI Program and PSE’s Active C Leak Reduction (“C Leak”) Program. The DGLI program is not included in the

E. Major Projects Greater Than $10 Million

Q. Please describe the major projects with capital costs greater than $10 million.

A. As part of the electric reliability and capacity work discussed above there are six major projects with capital costs greater than $10 million: (i) Pierce County 230 kV Transmission and Substation; (ii) Spurgeon Creek Substation; (iii) Lakeside Substation; (iv) Talbot Hill Substation; (v) White River-Electron Heights 115 kV Transmission Line; and (vi) Bellingham-Sedro #4 115 kV Reconductor Transmission Line. For each project, Exh. CAK-3 describes the need, alternatives considered, how the project is managed, how management is informed, and any major changes during the project lifecycle.

III. STORM DEFERRAL

Q. Please describe the storm deferrals associated with this general rate case.

A. PSE's storms associated with the Storm Deferral Mechanism in this general rate case are three IEEE qualifying events in 2017 and three IEEE qualifying events in 2018 that meet the threshold of total cost greater than $500,000. Additionally, three IEEE qualifying events for 2019 are discussed for purposes of pro forma adjustment to the test year. Details regarding the extent and type of event, system and customer impacts, and qualifying trigger are described fully in Exh. CAK-5. Please also see the Prefiled Direct Testimony of Susan E. Free, Exh. SEF-1T, for more detail on the accounting of these events.

PRP cost recovery mechanism per agreed upon settlement, Docket UG-160924. The C Leak program is not in the PRP as it is nearing its end.

IV. DELIVERY SYSTEM INFRASTRUCTURE TO BE PLACED IN SERVICE THROUGH JUNE 30, 2019

Q. What additional projects are expected to be implemented through June 30, 2019, that PSE intends to pro form in the test year for this case?

A. Through April 30, 2019, PSE placed in service approximately $165 million in gas and electric infrastructure expenditure. PSE intends to pro form in this case $69.5 million of projects already in progress during the test year. They include:

<u>1) AMI –</u> PSE is continuing its transition to AMI and through June 30, 2019, expects to invest $24.6 million in ongoing electric expenditures for the installation of meters and $12.5 million in ongoing gas expenditures for the installation of modules and completion of the gas AMI network.

<u>2) HMW –</u> PSE is continuing its replacement of failing HMW cable and through June 30, 2018, expects to invest $12.6 million in cable replacement.

<u>3) Public Improvement Projects –</u> Through June 30, 2019, PSE will incur $13.6 million in electric and $6.3 million in gas expenditures in responding to requests by municipalities to relocate facilities as specified in jurisdictional franchise agreements and other public improvement projects.

V. ONGOING DELIVERY SYSTEM INFRASTRUCTURE EXPENDITURES

A. Overview

Q. Please describe PSE's plans for investment in delivery system infrastructure from July 1, 2019, through the end of the rate year (April 30, 2021).

A. PSE's ongoing delivery system infrastructure investments are also largely a continuation of investments described previously in my testimony and can be broken down in the following categories: core services, grid modernization and pipeline safety. Overall, between these categories, PSE estimates an investment of $1.~~2~~1 billion from July 1, 2019 through the end of the rate year, or April 30, 2021.

Q. Are PSE's ongoing delivery system expenditures necessary and reasonable?

A. Yes, as discussed in my testimony, the level of spending that will continue throughout the rate year to support PSE's delivery system infrastructure is necessary and reasonable. As discussed below, PSE's core services work is generally non-discretionary. It is required in response to customer and public safety, public improvement projects, and customer growth. Likewise, PSE's electric reliability and gas pipeline safety work respond to federal and state requirements for the safety and integrity of the bulk electric system and the gas delivery system. PSE is spending at a level that allows it to maintain and improve its reliability in areas where PSE's performance has lagged, including addressing the number and duration of outages. Finally, PSE is spending to replace obsolete systems, as in the case of installation of AMI meters to replace the AMR system that is nearing the end of its useful life, and other expenditures aimed at grid modernization and ensuring that PSE is utilizing the requisite technologies to operate a safe and efficient delivery system that meets customer needs.

The major expenditures that PSE anticipates investing in during the rate year are described in greater detail below.

A. Core Services

Q. What Core Services investments does PSE anticipate making during the rate year?

A. Core services represents approximately $3~~88~~56 million in investments that support PSE's critical infrastructure obligations that are required in response to public improvement projects, customer and public safety, and customer growth and service needs. These expenditures are largely non-discretionary and include performing corrective maintenance, customer construction projects, system capacity projects, and public improvement work.

One specific expenditure that is planned and is expected to be completed in the rate year will address gas load growth in the Lake Tapps and Bonney Lake area. PSE has been increasing capacity to this area since 2017 through phased installations of a 12-inch high pressure pipeline and a Gate Station to reinforce the natural gas supply in alignment with growth. There are three phases of this project: for phase one, two miles of new 12-inch line was installed and place in service in 2017; phase two, currently in progress, is an additional two miles of new piping planned to be installed by 2020 in parallel to the existing six-inch line; and phase three is a new Gate Station that will be installed in 2022 to maintain sufficient pressure and provide additional capacity for the previous two phases. The anticipated rate year costs for this project are $5.9 million.

B. AMI

Q. What AMI investments does PSE anticipate making during the rate year?

A. This category represents approximately $1~~58~~46 million in investments aimed at installing AMI to replace the obsolete AMR system. Approximately $28 million of this investment is for the AMI network which will be completed by 2020 and approximately $80 million is for electric meters and $50 million is for gas modules.

C. Grid Modernization

Q. What Grid Modernization investments does PSE anticipate making during the rate year?

A. As described in my testimony, PSE is currently engaged in several significant critical projects aimed at modernizing the grid and ensuring the ongoing reliability of PSE's systems, including addressing obsolescence and implementing necessary foundational technologies. This category represents approximately $426 million in ongoing grid modernization and reliability investments supporting projects such as:

- Investing in foundational technologies specifically focusing on the installation of ADMS, which will replace PSE's existing OMS system that is obsolete and will no longer be supported by the vendor as of December

2020. The combination of AMI with ADMS and other SCADA devices in the field will allow PSE to have visibility and control over the distribution system that has not been possible in the past providing operational capability of distributed energy resources and advanced distribution tools and future technology to provide interface for traditional and non-traditional assets and approaches to meeting electric demand and services. PSE initiated this project in 2018 and has completed the project planning and design phases. PSE expects to have the platform operational by 2021, with an estimated total cost of $27 million, with additional advanced applications by 2022.

- Improving the WPC, improving reliability in targeted areas where the benefit to cost ratio is high, remediating HMW cable, hardening the overhead system assets through inspection and remediating wood pole and substation assets, continued tree trimming, and an expansion of the TreeWatch program. This category is estimated to include $323 million in investments.
- Investing in new technologies such as electric transportation infrastructure, smart equipment, demonstration pilots and projects, and the integration of customer distributed energy resources such as solar and storage through continued interconnection support. This category is estimated to include $27 million in investments. Please see the Prefiled Direct Testimony of William T. Einstein, Exh. WTE-1T, for additional information on these investments.

Q. Are there any specific transmission projects PSE intends to complete for reliability and grid modernization?

A. Yes. PSE has several transmission projects planned to address significant and emerging reliability needs, including:

- <u>Lake Hills – Phantom Lake 115 kV Transmission Line Project:</u> The Lake Hills – Phantom Lake 115 kV Transmission Line Project consists of constructing a new 2.5-mile 115 kV transmission line segment from the Phantom Lake substation to the Lake Hills substation. This project is needed to address reliability issues due to limited system capacity resulting in outages, particularly during maintenance or forced outages. The project is in the execution stage and is expected to be completed in late 2019 with an estimated rate year cost of $13 million.
- <u>Bellingham Substation Rebuild:</u> For this project, PSE will install a new breaker and a half configured 115 kV substation in PSE's former Bellingham substation 55 kV yard (now empty), then retire and remove PSE's existing Bellingham 115kV substation. The existing substation has limited capacity which will be exceeded soon, its equipment is degrading and needs replacement, and its current bus configuration is the least reliable among those that can be built. The project is currently in construction and is expected to be complete in October 2019, with a total final cost of approximately $24 million.
- <u>Bellingham-Sedro #4 115 kV Reconductor Transmission Line:</u> As discussed in Section II.E and in more detail in Exh. CAK-3, additional

phases of Sedro #4 project will proceed. Phase C is expected to be completed in 2020 and Phases D and E are expected to be completed in late in 2021. Phase C is expected to cost approximately $5 million.

- Talbot Hill Substation: As discussed in Section II.E and in more detail in Exh. CAK-3, Phase III of Talbot project is expected to be completed in 2020 with an expected cost of approximately $6 million.

D. Pipeline Safety

Q. What Pipeline Safety investments does PSE anticipate making during the rate year?

A. This category represents approximately $188 million in investments aimed at ensuring PSE’s natural gas pipelines remain safe and are a continuation of ongoing projects including damage prevention, identification and elimination of cross bores, Dupont pipe replacement, buried meter set remediation program, integrity management risk mitigation programs, and the C leak reduction program.

VI. CONCLUSION

Q. Does this conclude your testimony?

A. Yes, it does.