EXH. MFH-1T
DOCKETS UE-19___/UG-19___
2019 PSE GENERAL RATE CASE
WITNESS: MARGARET F. HOPKINS

BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND ENERGY,** **Respondent.**	**Docket UE-19____** **Docket UG-19____**

PREFILED DIRECT TESTIMONY (NONCONFIDENTIAL) OF

MARGARET F. HOPKINS

ON BEHALF OF PUGET SOUND ENERGY

JUNE 20, 2019

PUGET SOUND ENERGY

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I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Margaret F. Hopkins. My business address is 355 110th Ave. NE, Bellevue, Washington 98004.

Q. By whom are you employed and in what capacity?

A. I am employed by Puget Sound Energy ("PSE") as Vice President and Chief Information Officer.

Q. What are your duties as Vice President and Chief Information Officer?

A. I am responsible for leading PSE's information technology ("IT") and cyber security program and building and managing the infrastructure, technologies, systems, and data that enable PSE to support our customers and achieve business success.

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

A. Yes. Please see the Prefiled Direct Testimony of Margaret F. Hopkins, Exh. MFH-2, for an exhibit describing my education, relevant employment experience, and other professional qualifications.

Q. Please summarize the purpose of your testimony.

A. My testimony provides an overview of PSE's IT strategy and of the technology investments placed in service between October 1, 2016 and December 31, 2018. My testimony also addresses the IT investments PSE intends to pro form into the test year for this case through June 30, 2019, and I share a forward looking prospective of the IT work anticipated through the rate year in accordance with PSE's corporate strategy and business plan.

II. PSE IS APPROPRIATELY INVESTING IN INFORMATION TECHNOLOGY TO SUPPORT CUSTOMER NEEDS NOW AND IN THE FUTURE

Q. Please provide a high-level overview of PSE's strategy for making technology investments.

A. Utilities are undergoing tremendous change and transformation. Rapid advancements in IT have altered the approaches utilities use to operate and transform, as they are increasingly dependent on technology solutions to enable business objectives such as reliability, resource efficiency and customer service. Technology assets are as foundational as the classic pipes and wires that deliver service to our customers, and are inextricably linked to advancing, securing, and enabling the day-to-day operation of our gas and electric service.

Digitalization, or the use of digital technologies to transform business operations, is reshaping how utilities operate and is necessary to meet customer needs more efficiently and responsively. Distributed generation, grid modernization, data-driven customer expectations, mobile field workers, predictive maintenance

schedules, and customer self-service, are all examples of how digital modernization enables greater efficiency and increased speed to improve customer satisfaction.

Q. Has digital modernization impacted customer behavior?

A. Yes. The evolution of digital customer engagement has changed customer behaviors and expectations. Customers demand information on their energy usage, payment history and service options, and they want the ability to interact with their utility 24/7, on their own terms, and via the communication channel(s) they prefer. Those channels can include online, mobile, interactive voice response systems, or simply a telephone call to an agent. Regardless of channel, customers expect to have the same (consistent) information available to easily transact business with PSE. The Get to Zero initiative, as set forth in the Prefiled Direct Testimony of Joshua J. Jacobs, Exh. JJJ-1T, was launched in response to these changing expectations with the ultimate objective of improving the end-to-end customer experience for all PSE customers.

Safe and reliable delivery of energy is foundational to customer expectations and to PSE's digital efforts. PSE's IT strategy builds the foundational capabilities, architectures and platforms needed to support digital transformation through the automation and modernization of existing/legacy systems, to align with new digital technologies, and to stay in line with customer expectations for reliability, efficiency and clean energy. PSE's digital initiatives such as Advanced Meter Infrastructure, as discussed in the Prefiled Direct Testimony of Catherine A.

Koch, Exh. CAK-1T, and the Energy Management System Upgrade (discussed later in this testimony), directly support improvements to the reliability of our electric grid and gas service.

Q. Are there any risks or challenges associated with digital modernization?

A. Yes. While the transition to digital solutions creates opportunities and improvements for customers, it also introduces risks and challenges that must be taken into consideration with each IT investment.

Risks:

The cyber threat to the electric grid, both nationally and globally, has driven a change in how IT solutions are architected for utilities. Every system must be designed not only to meet business needs, but to meet them in a secure manner that protects the grid and maintains the privacy of customers' and employees' sensitive information. The Data Center and Disaster Recovery initiative (discussed later in this testimony) directly supports PSE's efforts to protect PSE's critical assets and information from cyber-attacks and ensures the reliability and resiliency of the systems that support our gas and electric service should we experience a localized catastrophic event.

Challenges:

The significant increase in technology investment to support the business needs has created challenges for PSE from an expense and regulatory perspective:

- Increased expense related to "cloud" and Software as a Service ("SaaS") agreements: Cloud and SaaS have become necessary in providing technology solutions to meet business challenges for two reasons. First, many technology vendors are forcing companies to host technology solutions in the cloud by eliminating the option to host in their own data centers. Second, IT often looks to cloud computing and SaaS solutions to provide more affordable, timely and reliable service, which in turn benefits our customers. While cloud offerings are typically more cost effective, migration to cloud is driving an increase in operating expenses at an accelerated pace, as little progress has been made to improve regulatory treatment for cloud computing arrangement across the utility industry.
- Increased hardware and software maintenance costs: As new technology solutions (and the associated hardware and software assets) are deployed to meet business needs, maintenance agreements must be purchased to ensure vendor support, system updates and ongoing security patches. Without these maintenance agreements, we cannot guarantee the reliability, security, and recoverability, of these systems.
- The impact of regulatory lag is amplified as the proportion of IT capital spending has increased relative to our total capital spend: Traditional regulatory recovery mechanisms were developed to support deployment of assets with longer life spans. Technology investments typically have a depreciable life of ten or less years and most often three to five years. The

typical 27-month regulatory lag has a greater impact on these short-lived assets than traditional transmission and distribution investments, resulting in earnings erosion.

Q. How has PSE's IT investment strategy responded to these risks and challenges?

A. Given the aforementioned context, PSE's overarching IT investment strategy aims to provide cost effective secure technology solutions that improve grid and gas reliability, meet evolving customer expectations, enable clean energy solutions, and support key business objectives. We adhere to a set of established technology principles to guide our decisions:

- Plan: Technology roadmaps and plans are developed at the enterprise and business levels, balancing risk, function, and the future needs of PSE and its customers. These plans align Company and customer needs with supporting technology solutions and influence the priority and timing of technology investments for current and future years.
- Acquire: A business case, known as a Corporate Spending Authorization ("CSA") document, is developed by management to support the need for each technology initiative. The CSA outlines the business problem, evaluates various solutions, and assesses the risk, cost and benefits associated with each option. Total cost of ownership is considered at all decision points, with a bias toward cost effectiveness and optimization of prior technology investments. We make every effort to minimize cost by

leveraging existing technology assets and maximizing their use. If an existing IT asset meets the majority of business and/or technical requirements, we will build upon the existing platform to the extent possible. By leveraging existing assets and vendor relationships, we optimize cost through volume discounts and lower integration costs. PSE's SAP platform is a good illustration of this principle. By building upon the SAP platform to implement our Financial Transparency and Improvement Program, as set forth in the Prefiled Direct Testimony of Matthew R. Marcelia, Exh. MRM-1T, we were able to capitalize on the existing platform and integrate more easily into the current IT infrastructure. This keeps implementation costs in line and allows us to use in-house skill sets familiar with the technology to deliver solutions more quickly. When an existing system does not meet business requirements, we evaluate multiple options with a preference toward cloud or "purchased" products. In doing so, we lower development and maintenance costs, align with industry best practices, and increase speed of implementation. We also avoid developing highly customized systems that are difficult and costly to maintain. All purchases follow a standard contracting and procurement process to obtain the best value for PSE and our customers.

- Design: Once selected, we design each system to meet the stated business requirements and leverage out-of-the box capabilities to minimize customizations and to avoid over-reaching or gold plating with extraneous functionality. This helps to keep support and maintenance down and

lowers the cost of future upgrades. Cyber security, data privacy, availability, and disaster recovery capabilities are paramount, and designed into the system in accordance with PSE's security and compliance obligations such as the North American Electric Reliability Corporation Critical Infrastructure Protection ("NERC/CIP") standards. We architect for reuse, adaptability, growth, ease of operation and speed, and standardize and consolidate where possible. We also embed data governance and data management best practices into our design to ensure that customer, asset, and employee data is protected and accurate. We apply this rigor across all technology platforms to achieve maximum value from prior investments and to minimize the overall growth of ongoing IT expenses.

- Operate and Secure: Once operational, we properly maintain and keep our assets current. Technical currency is necessary to keep the systems available and secure. Hundreds of vulnerabilities are introduced into the technology landscape each month, and all systems must be patched to ensure the proper security protections are in place, particularly as we see an increase in the viruses and malware specifically targeted at the grid. These patches are not built to support out-of-date systems, so we must invest in upgrades on a continual basis. We follow security best practices and adhere to corporate policy and compliance obligations to protect PSE systems and data from unauthorized use and disclosure. We benchmark our security practices against the National Institute of Standards and

Technology framework—the recommended cyber security framework for critical infrastructure as outlined in Executive Order 13636.[1] This framework allows us to assess the maturity of our security protections and identify gaps that require additional efforts and investment to further strengthen our security posture. Our Data Center and Disaster Recovery program (discussed in more detail below) is an example of an IT investment put in place to manage cyber and business continuity risk, and to protect the systems and data critical to PSE's gas and electric operations.

Q. What process does PSE undertake before purchasing new systems applications and infrastructure?

A. Guided by the principles outlined above, PSE conducts cost/benefit analyses in advance of incremental system purchases. We work with technology vendors that provide business solutions that create long-term scale economies and competitive advantages for PSE's customers. Through PSE's contract services group, we acquire technology that is competitively priced, reliable, and relevant to the utility industry and best serves customers. The competitive bid process allows us to enable scale economies in pricing and ongoing maintenance, thereby providing a lower total cost of ownership on behalf of PSE's customers.

[1] https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/executive-order-improving-critical-infrastructure-cybersecurity.

Q. What is IT management's role in the purchasing process?

A. All technology purchases require the oversight of an IT Manager. The manager is involved in the evaluation and analysis of the criteria used during the bid process, the selection of the technology, and final approval. The formal spend authorization process is automated through our procurement system and uses built-in requirements to escalate to the IT Director or Chief Information Officer level for additional approval, when total spend exceeds pre-defined corporate limits.

Q. Please elaborate on the Contract Services procurement process and the cost/benefit analyses PSE uses for systems acquisitions.

A. For all new systems, cost/benefit analyses typically include a project overview (e.g. problem statement, proposed solution, alternatives evaluated, etc.) and a vendor evaluation conducted through PSE's Contract Services procurement process. Form and format for such evaluations may vary based on the size and complexity of the proposed systems.

Q. What are PSE's major systems initiatives?

A. As mentioned above, PSE is engaged in several ongoing business transformation efforts with significant technology components:

- "Get to Zero ("GTZ") Initiative: GTZ is PSE's customer-focused, digital transformation initiative. This six-year initiative (2016-2021) is transforming the customer service experience with expanded and consistent digital self-

service options, updating or replacing aging technologies, removing obstacles for customers, providing proactive communications, and quickly anticipating and solving problems before they occur. GTZ has a strong emphasis on automation and process improvements in the customer-touching areas of data analytics, data management, work planning, scheduling and dispatch. As referenced previously, more detail on the GTZ initiative is provided in the Prefiled Direct Testimony of Joshua J. Jacobs, Exh. JJJ-1T.

- Advanced Meter Infrastructure ("AMI"): PSE's existing Automated Meter Reading ("AMR") infrastructure, installed between 1998-2001, is approaching the end of its useful life, forcing a system replacement in order to continue accurate energy billing for customers. Because AMR technology is near obsolescence, PSE was faced with the option to either refurbish the existing AMR system with the same limiting one-way technology or transition to a more up-to-date, two-way AMI. PSE elected to proceed with the installation of the AMI communication network and metering equipment throughout PSE's electric and gas service territory. Installation work is underway, and full deployment is expected to be complete in 2022-2023. IT is a key enabler to the successful deployment of the AMI infrastructure, including the build out of a core network and related hardware and software systems required to securely transfer data from the meter to PSE. Additionally, to mitigate new risks that may be introduced with two-way communication paths, PSE will implement the AMI advance security option to facilitate greater cyber and

data protections at the meter. More detail on the AMI program is provided in the Prefiled Direct Testimony of Catherine A. Koch, Exh. CAK-1T.

- Financial Transparency and Improvement Program ("FTIP"): FTIP modernized and implemented a redesign of PSE's financial systems, processes, tools and financial structure. It also paved the way for the GTZ initiative to take advantage of a more robust and capable SAP platform, particularly as it relates to the capabilities being built into the Integrated Work Management ("IWM") program. More detail on FTIP is provided in the Prefiled Direct Testimony of Matthew R. Marcelia, Exh. MRM-1T and the IWM program is discussed in Mr. Jacob's GTZ testimony, referenced above.

- Data Center and Disaster Recovery Program ("DCDR"): The DCDR program is focused on mitigating a significant corporate risk relating to insufficient disaster recovery capabilities of existing data center facilities and critical systems. This program replaces PSE's existing substandard data centers, which cannot meet corporate requirements for resiliency and disaster recovery, with geographically diverse, highly redundant modular facilities. It also implements the infrastructure (hardware and software) needed to meet availability and security requirements for day-to-day operations. Foundational to this program is the implementation of disaster recovery solutions that allow PSE to recover critical IT systems within 24 hours of a serious outage or catastrophic event such as an earthquake or crippling cyber-attack. Additional explanation on this initiative is provided later in my testimony.

III. TECHNOLOGY PLACED IN SERVICE

A. Overview

Q. Please provide an overview of the IT spending for which PSE seeks recovery in this case.

A. In general, for the time period from October 1, 2016, through December 31, 2018, PSE's technology expenditures fall into two main categories:

1) System Modernization and Optimization – This category represents capital efforts required to upgrade and maintain key and critical IT application and infrastructure platforms, and to ensure ongoing availability, stability, security, technical currency and vendor support. By keeping applications and infrastructure equipment at supported levels, PSE can continue to receive critical system and security patches, take advantage of the latest features, and maintain license compliance as defined by support agreements. Work under the Systems Modernization and Optimization category is funded annually, with proposals submitted from each of the major IT areas outlined below. The IT leadership team reviews and makes funding decisions based on business value and risk of each proposal.

The following areas are covered under this program:

- IT Applications operational work ensures the 264 applications used by PSE are kept technically current and are properly maintained in compliance with our vendor support agreements. This program provides funding for critical applications such as the Energy Management System,

Gas Control System, Outage Management System, SAP systems (Finance, Human Resources, Call Center, Billing, and Asset Management), Metering, PSE.com, and other critical business systems.

- IT Infrastructure consists of the computing and telecommunications hardware and software upon which critical business systems and capabilities are built. This is largely the IT equipment housed in our Data Centers (2,675 servers) and the network equipment and connectivity infrastructure (fiber, radio, microwave) that enable telecommunications throughout our service territory.
- IT Security and Risk focuses on cyber risks and ensures vulnerabilities are mitigated in alignment with the rapidly changing security landscape. PSE's cyber security program is based on the same national standards followed by leading companies in the energy and defense industries and is assessed annually against those standards by external security firms. Our annual assessment is utilized to evaluate our cyber security posture to ensure cyber investments are properly identified and funded under this category. Without this focus, we would not have been able to successfully protect against the millions of vulnerabilities that have been introduced to the IT landscape over the last several years. During this test period alone, 241 patches covering over 3,000 vulnerabilities were released by Microsoft for the systems we operate.

Detailed testimony on the major initiatives included in this category are provided later in this testimony.

2) New systems – This category includes costs associated with acquisition, development and installation of new systems based on business and operational needs. This work is primarily related to net-new additions to the PSE technology portfolio which introduces new maintenance and support expenses, including vendor costs, contract costs, hosting or cloud-related costs, and internal labor needed to ensure continued availability, resilience, and security of the new asset.

As business areas identify technology enablement opportunities, they create a business case in a CSA document to secure funding and to formalize the project. This process occurs annually and is used to inform the final approved IT capital budget for the subsequent year.

Detailed testimony for the "New Systems" projects exceeding $10 million during the period October 1, 2016 through December 31, 2018, for which PSE seeks recovery, are provided in the following prefiled direct testimonies:

- GTZ is provided in the Prefiled Direct Testimony of Joshua J. Jacobs, Exh. JJJ-1T;
- AMI is provided in the Prefiled Direct Testimony of Catherine A. Koch, Exh. CAK-1T;
- FTIP is provided in the Prefiled Direct Testimony of Matthew R. Marcelia, Exh. MRM-1T; and
- DCDR, which I address below.

The Second Exhibit to the Prefiled Direct Testimony of Margaret F. Hopkins, Exh. MFH-3, provides a listing of all new or upgraded technology placed into service after October 1, 2016, and before December 31, 2018, for which PSE seeks recovery in this case.

B. System Modernization and Optimization Program

Q. What types of projects are run under the Systems Modernization and Optimization program?

A. As mentioned above, work is aligned to the various departments (Infrastructure, Applications, Security and Risk). Within each department the projects can be further broken down into the following work types:

1) Technology Refresh projects – These projects undertake upgrades to existing technology to keep them current and to protect PSE's IT investments. These upgrades are necessary to maintain service level requirements, security patches from vendors, continued operations, and compliance with NERC/CIP obligations.

2) Technology Growth projects – These projects support efforts needed to scale core infrastructure in alignment with natural business growth and new business requirements and capabilities. This growth could come in the form of software licenses, storage and data growth, server expansion and telecommunications bandwidth increases.

3) Upgrades or enhancements – These projects include upgrades and enhancements to existing applications based on business requests for

additional functionality, software licensing and maintenance agreement requirements, and new security or compliance considerations.

Q. What process is used to prioritize and fund the work in this program?

A. Program funds are requested annually through the corporate budgeting process. In addition, IT management develops a CSA (referred to as an Operational Program CSA) to support the budget request. Within IT we undertake an annual planning process to prioritize and select initiatives that will be funded in the subsequent year under this program. Requests are submitted via a business justification form that describes the funding required and the risk associated with not doing the work. Funding requests are evaluated by all IT Managers, with final decision on budget allocation made during a formal review with IT Directors and the Chief Information Officer.

Q. What governance and oversight is in place to track performance and manage budget?

A. An IT Manager is aligned with each initiative in this program as the project sponsor/delivery manager, and is responsible for managing to the scope, schedule and budget for each individual project. The manager is also required to submit monthly budget forecasts for leadership review. Additional layers of management oversight are in place at the "portfolio" level to ensure effective governance over the entire program. Monthly program reviews are held with all IT Managers, including IT Directors, to review program status and address any project risks, issues or changes.

Q. What is the combined cost of the system modernization and optimization program efforts for which you seek recovery from October 1, 2016 through December 31, 2018?

A. Approximately $102.3 million in program work is included in this request, as referenced in the Second Exhibit to the Prefiled Direct Testimony of Margaret F. Hopkins, Exh. MFH-3, under the category of system upgrades. Of this, the largest spend category is aligned with Infrastructure at $55.2 million. Although the majority of this spend is related to technology refresh and growth, Infrastructure projects also cover security infrastructure and critical system upgrades required to maintain reliability of our systems and introduce expanded functionality. As an example, approximately $8.8 million of the Infrastructure spend is related to upgrading the communication equipment necessary for communications between our substations and the Energy Management System. PSE's existing analog system is over 25 years old, and this upgrade is required to eliminate failures in aging equipment by replacing the analog system with a modernized, stable and secure communications platform.

Applications represent the next largest category, with approximately $33.8 million in spend, the majority ($10.7 million) of which is allocated to a critical system upgrade of our aging Gas Control System and work needed to prepare for an upgrade to SAP HANA, the database management system on which our FTIP program was built.

The next largest bucket of spending associated with this program is related to funding required to support internal service requests ("ITSR") from the business units. This spending represents $5.6 million and is associated with a series of smaller projects that introduce high priority functional enhancements to drive business improvements. IT coordinates with business leadership to prioritize and approve ITSR work in accordance with their budget constraints. Monthly steering committee meetings are held with each business area to monitor progress against scope, schedule, and budget.

Finally, approximately $7.6 million of this spending can be attributed to security and compliance work. The largest spending associated with this category is related to enhancements to our electronic governance, risk and compliance system, which accounts for $4.7 million of spending. Enhancements supported under this spending include implementation of a risk register to track security related risks, creation of templates and a repository for documenting and storing disaster recovery plans, and introduction of automated capabilities needed to support compliance requirements, including self-certification for NERC/CIP.

C. Data Center and Disaster Recovery Program

Q. Please describe PSE's DCDR program.

A. The DCDR program is a four-year effort to mitigate a significant business continuity risk associated with the critical IT systems that are essential to the safe and secure operation of our electric and gas services. There are three phases to the program: 1) replacement of the existing substandard Data Center facilities; 2)

implementation of Disaster Recovery capabilities for IT systems; and 3) decommissioning of existing Data Center facilities.

1) Replacement of sub-standard Data Center Facilities – PSE's IT systems previously operated out of two data center facilities: Bothell and Bellevue. These facilities were located 12 miles apart on the same seismic fault, creating a significant business continuity risk to PSE in the event of a localized disaster or a single seismic event. In addition, both facilities were substandard, as neither were sufficient to meet PSE's power, redundancy, and cooling requirements to ensure the safe operation of the IT equipment. The Bothell data center is positioned in a flood plain and is located on the second floor of an office building, which introduces structural concerns due to the weight of the IT equipment. Bothell has experienced two significant data center outages directly attributed to the deficiencies noted above, causing significant impact to PSE's ability to operate. During these outages, PSE was forced to revert to manual (paper) processes to answer customer calls, which negatively affected SQI 5, and the Load Office also reverted to manual processes increasing risk to field operations.

2) Implementation of Disaster Recovery capabilities for IT systems – The second component of the DCDR program focuses on improving disaster recovery ("DR") capabilities for PSE's IT systems. Of the 51 critical systems running in the data centers, 19 (roughly 40 percent) did not have DR capabilities. The impacts to PSE of not being able to run these systems in the event of a regional or localized disaster would be broad and significant.

3) Decommissioning – This involves removing all equipment from the Bothell and Bellevue facilities to make the space available for reuse.

Q. Please describe PSE's plan for replacing the existing data center facilities.

A. The project plan is being executed in three phases:

- Phase 1: Replacement of Substandard Data Center Facilities: Phase 1 began in 2016 with the assessment of PSE's needs, which led to the decision to build two new data centers utilizing state of the art data center modules built by Baselayer. Sites were selected, procured, and prepared for the new modules. By the end of 2017, both sites were complete, with the modules and network infrastructure complete and ready for application migrations. The Prefiled Direct Testimony of Douglas S. Loreen, Exh. DSL-1T, addresses the acquisition of the Snoqualmie Technology Center that houses one of the modular data centers.

- Phase 2: Application Migration and Disaster Recovery: Upon the completion of Phase 1, the focus turned to migrating the applications and services from the old data centers to the new ones and testing the disaster recovery capabilities. Over 200 applications were reconfigured to conform to the new architecture and in many cases to establish disaster recovery capabilities consistent with the policies and practices established for the new data centers. Each application was migrated and tested to ensure their disaster recovery plans met their time-to-recover objectives.

- Phase 3: Decommissioning: Decommissioning of the Bothell data center will be complete in 2019. This includes the removal of equipment and vacating of the data center space to make it available for reuse. The Bellevue data center will be decommissioned at a later date to coincide with the relocation of the Backup Control Center, which is currently tied to the Bellevue facility.

Q. What alternatives did PSE consider to replace the existing data center facilities?

A. In considering alternatives for the data centers, PSE utilized the following key criteria: (i) resolve the risks identified by Business Continuity (e.g. both sites affected by a single seismic event, flooding risk, stability of the building infrastructure, application recovery, etc.); (ii) PSE's ability to control the environments (site, building, environmental controls, security, etc.); (iii) PSE's ability to satisfy NERC/CIP requirements; and (iv) 20-year total cost.

After thorough vetting of the above-mentioned criteria, the decision was made to build two new modular data centers, located 80 miles apart, one in western Washington near corporate headquarters, and the other in eastern Washington on PSE property. This approach was the most cost effective and provided the optimal solution to mitigate the seismic and facility risks, to provide the security and resiliency required for business continuity, disaster recovery, and to meet NERC/CIP compliance.

Prior to deciding on the selected option, four alternatives were considered: 1) fortifying the existing data centers; 2) utilizing leased space by co-locating both data centers in shared facilities; 3) a combination of a co-located facility with a PSE owned data center; and 4) building PSE owned data centers using modular components specifically designed for data center use.

1) Fortifying the existing data centers – This approach did not eliminate the business continuity risks associated with the facilities residing in the same seismic zone and Bothell being situated in a flood zone. Further, because the existing locations were in office buildings not originally intended as data centers, the limitations on power and environmental conditioning could not be overcome.

2) Utilizing leased space by co-locating both data centers in shared facilities – This approach was not selected as it did not satisfy the required NERC/CIP security controls, or PSE's ability to control the environments (site, building, environmental controls, security, etc.). NERC/CIP requirements are routinely adjusted to meet current conditions, and PSE's ability to satisfy the requirements could be adversely impacted by the co-location provider's decisions. PSE polled Chief Information Officers of Edison Electric Institute and the American Gas Association to benchmark against the industry for utilizing leased facilities. We found no other utilities using co-located data centers, largely due to NERC/CIP requirements. PSE also found that leased facilities were not certified to handle NERC/CIP compliance obligations, posing a significant risk to the assets and potential penalties for violations.

3) Utilizing a combination of a co-located facility along with a PSE-owned data center – Similar to Option #2, this approach was not selected as it did not meet the criteria of satisfying NERC/CIP security controls, nor did it satisfy PSE's ability to control the environments (i.e., site, building, environmental controls, security, etc.) for the co-location site.

4) Building PSE owned data centers using modular components specifically designed for data center use – As described above, this approach met all criteria and was the most cost-effective solution on the 20-year total cost analysis.

The Third Exhibit to the Prefiled Direct Testimony of Margaret F. Hopkins, Exh. MFH-4, provides the CSA documentation for the DCDR program.

Q. Did PSE consider using hosted IT services, in which a third party provides data processing for applications (e.g., website, billing, e-mail, accounting, data warehousing, back-up, etc.) installed and operated from the third party's facilities?

A. A number of PSE applications already take advantage of a hosted services model (i.e. SaaS and cloud), and we anticipate further adoption of this model in the future. Analysis of how to best provide services such as website, billing, email, accounting, data warehousing, back-up, etc., is performed as part of the technology planning function within IT. The overall design of the new data centers anticipated and incorporated this gradual transition to the cloud in the following ways:

- The physical footprint of the new data centers was significantly reduced from that of the Bothell and Bellevue facilities—from a combined 21,273 square feet to 2,800 square feet;
- Rack space capacity was reduced to approximately 53 percent of that of Bothell and Bellevue; and
- The modular data center option allowed us to start with the smallest footprint possible (without over-building) enabling us to easily scale "just in time" rather than pre-buying modules (capacity) that may go unused for years. This was the most cost effective and flexible way to accommodate the slowing pace of growth as the nature of providing IT services adapts to new technologies and cloud-based services.

Q. Are the new data centers completed and in service?

A. Yes. Phase 1 (construction) and Phase 2 (migration/disaster recovery) are complete. The data centers are fully operational and in service. All IT systems have been migrated to the new facilities. Redundant network and telecommunications paths are in place and fully operational, and full disaster recovery capabilities are in place for all IT systems according to their designated business continuity recovery time objectives. This is a significant step in reducing PSE's business continuity risk. Phase 3 activities (decommissioning) are in progress and will continue through 2019. The overall program is roughly 95 percent complete.

Q. What was the cost of the DCDR program?

A. The costs associated with each phase are as follows:

- Phase 1: Site selection, facility construction: $33.2 million. This figure includes the cost to construct the two modular data centers located at the Snoqualmie Technology Center Office and on the site of an existing PSE substation in Cle Elum, Washington. The Prefiled Direct Testimony of Douglas S. Loreen, Exh. DSL-1T, addresses the acquisition of the Snoqualmie Technology Center building that houses the Snoqualmie Data Center.
- Phase 1: Infrastructure hardware build: $31.2 million. This figure includes the cost to purchase the network, server, storage, telecommunications and security hardware and software needed to build and support the IT systems in the new facilities.
- Phase 2: System Migration/Disaster Recovery: $14.9 million. This figure includes the labor required to configure, test, and migrate all IT systems to operate under the new disaster recovery architecture in the new facilities.

Q. How did the actual cost compare to the estimated cost?

A. Phase 1 (facility construction, and infrastructure build) costs were estimated at $64.3 million, and came in .02 percent over budget with an actual cost of $64.4 million. The total budget for Phase 2 (migration/disaster recovery) was originally estimated at $10 million, assuming a migration to the new facilities in a like-for-like state with minimal modifications to the 264 systems planned for migration.

Actual spend was $14.9 million, an increase of $4.9 million, primarily due to increased labor costs. Initial labor estimates were based on moving applications into a data center environment with security and network architectures similar to the prior data centers. However, as requirements for recoverability of critical systems were refined, the need to modernize network and security platforms to accommodate the near instantaneous recovery of critical systems drove additional work in three areas:

- An architectural redesign of our network and firewall infrastructure was implemented to improve recoverability time frames and security postures in alignment with business continuity best practices. This change in architecture drove an increase in application upgrades and modifications required for the IT systems to operate under the new design;
- Actual testing was more comprehensive than planned due to the complexity of the new architecture and increased requirements to certify that applications met their disaster recovery requirements; and
- Additional and unplanned tasks were undertaken as part of system migrations to minimize disruption to daily operations of critical systems and in-flight project schedules.

Q. Did PSE keep management informed during the course of the project?

A. Yes. The DCDR governance structure consisted of an executive steering committee and a project-level steering committee made up of IT leaders. Together

these teams participated in project oversight, key decision making, risk mitigations, and approval of costs and changes.

Q. Were there any material changes that affected the project scope, schedule or budget?

A. There were no major changes to scope or schedule, other than those associated with Phase 2 (migration/data recovery), as described above.

IV. TECHNOLOGY TO BE PLACED IN SERVICE THROUGH JUNE 30, 2019

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

A. PSE intends to pro form approximately $32.5 million in investments related to GTZ as discussed in the Prefiled Direct Testimony of Joshua J. Jacobs, Exh. JJJ-1T. In addition, PSE intends to pro form spending for two additional IT projects: the Energy Management System upgrade and the Human Resources Technology Transformation, each of which I discuss in more detail below.

A. Energy Management System Upgrade

Q. Please describe PSE's Energy Management System ("EMS") upgrade project.

A. The EMS is a collection of software applications that are used for monitoring and controlling PSE's power system in real-time, including the transmission system, portions of the distribution system, and generating units that have the capability to

be remotely controlled. It is a critical system that provides the sole capability for balancing generation and power interchange to meet customer load, maintain overall situational awareness of our transmission system, and enable the fulfillment of the responsibilities of a Balancing Authority and Transmission Operator.

The EMS upgrade project went into service in January 2019 mitigating a significant obsolescence risk with the prior EMS installation. Vendor support for the prior EMS application software entered a legacy support phase in 2015, with no further product patches or defect fixes provided under the annual maintenance and support contract. The scope of the project included upgrading the EMS hardware, operating system, and application software to levels that are currently under vendor support and installing the upgraded system in the new Data Centers (described earlier in this testimony) to improve overall disaster recovery capabilities. The technology improvements embedded in the new software will also increase operator effectiveness through improved situational awareness.

The Fourth Exhibit to the Prefiled Direct Testimony of Margaret F. Hopkins, Exh. MFH-5, contains the CSA for this project.

Q. Describe the alternatives evaluated and how this solution was chosen.

A. Two alternatives, including the selected alternative, were evaluated and are discussed below. In evaluating the alternatives, PSE prioritized the following key decision components: (i) obsolescence risks; (ii) cost, including that of retraining personnel; and (iii) the DCDR program schedule.

1) Upgrade the existing EMS software to the most current production version – The obsolescence risks associated with the prior EMS installation coupled with the DCDR program schedule to move all systems into the new Data Centers by December 2018 required the most expedient possible schedule for the EMS upgrade. Therefore, PSE elected to remain with our current vendor and upgrade the existing EMS software rather than selecting and implementing an entirely new EMS platform. This alternative was selected as it best met all three of the above-stated criteria, providing the lowest cost/lowest risk solution. Upgrading the existing EMS platform allowed us to optimize and leverage an existing technology platform and avoid the significant cost and schedule impacts associated with switching to an entirely new vendor and platform.

2) Select an entirely new EMS suite from a different vendor – This alternative was not selected because it introduced higher costs and significant risks to project schedule and success. It did not meet the timeline required for the Data Center program and drove costs higher due to the extensive re-training required for the user community and IT personnel on a new platform/product.

Q. What benefits does this project and the selected alternative provide for customers?

A. This project increases the reliability of monitoring and controlling PSE's entire electric power system by reducing the risk of EMS failures due to obsolescence

and improving disaster recovery capabilities. The selected alternative and emphasis on expediency also reduced project costs and duration, as noted below.

Q. Is the new EMS system in service?

A. Yes. The upgraded EMS went live on January 29, 2019. This was followed by a 100-hour period to observe system stability, which ended successfully on February 2, 2019. System fitness-for-use was observed for roughly two more weeks, and the upgraded EMS was declared stable on February 15, 2019.

Q. What was the cost of the EMS upgrade project and how did it compare to the estimated cost?

A. Original costs were estimated at $12.4 million. We expect the project to close approximately $3.0 million under plan. Budget reductions are primarily related to prudent cost management and key technology decisions that reduced project complexity.

Q. Did the team keep management informed during the course of the project?

A. Yes, the project governance structure aligned with the standard for all PSE technology projects and included involvement by an executive steering committee and a project-level steering committee made up of leaders across the company and from our product vendor and system integrator. Together, these teams participated in project oversight, key decision making, risk mitigations, and approval of costs and changes.

Q. Were there any material changes that affected the project scope, schedule or budget?

A. There were no major changes to scope or schedule. The overall project was delivered significantly under budget, as explained above.

B. Human Resources Technology Transformation

Q. Please describe PSE's Human Resources Technology Transformation ("HR-TOPS") project.

A. The HR-TOPS program is a three-year effort that replaces PSE's legacy human resources systems in an effort to:

- Improve PSE's ability to attract and hire qualified candidates;
- Create and automate critical reports to reduce the significant manual effort currently required;
- Implement self-service functionality and mobile capabilities necessary for managers and employees to perform their jobs;
- Integrate disparate systems to provide a more streamlined service offering and to maintain data integrity between systems; and
- Modernize the underlying SAP modules scheduled to become obsolete within the next few years, at which point we will no longer receive support, maintenance, or system patches for known security vulnerabilities.

The Fifth Exhibit to the Prefiled Direct Testimony of Margaret F. Hopkins, Exh. MFH-6, contains the CSA for HR-TOPS.

Q. Describe the alternatives evaluated and how this solution was chosen.

A. PSE considered three industry leading alternatives which were evaluated against established criteria and are discussed below. In evaluating the alternatives, PSE prioritized the following key decision components: (i) all services will be performed on a single platform consisting of recruiting, onboarding, human resources, compensation, and talent management processes; (ii) in-scope functions and work activities are easy to use, including mobile functionality; (iii) improved analytics to inform operational and strategic decision making; (iv) alignment with IT Technology Principles and low Total Cost of Ownership; (v) and potential to support future functionality such as payroll, timekeeping, and Learning Management in single product suite.

1) Cornerstone HR Suite ("Cornerstone") – This option was not selected because it did not meet the minimum criteria in several areas including coverage of entire project scope. Specific areas where Cornerstone fell short include (a) the product suite did not offer an end-to-end solution covering entire scope and requirements, and did not meet criteria (i); (b) the human resources and recruiting tools were significantly less mature than competitors, giving it lower scores on criteria (ii); and (c) while Cornerstone is the existing legacy Learning Management System, the

product did not offer payroll or timekeeping solutions, hence a lower score on criteria (v).

2) Workday HCM ("Workday") – Workday offered a compelling product suite, meeting many of the established criteria including (i), (iii), and most of (ii). However, it fell short because (a) its mobile functionality, part of criteria (ii), required a different mobile device management tool than was currently implemented at PSE, increasing cost and complexity of the mobile solution; (b) integration with existing technologies was more complex, making both implementation costs and ongoing maintenance costs higher than the selected alternative, hence a lower score on criteria (iv); and (c) payroll, timekeeping, and Learning Management functionality was less mature or missing from the Workday product suite, hence a lower score on criteria (v).

3) SAP SuccessFactors ("SAP SF") – After an extensive review of the features and functions offered by each alternative, including a total cost of ownership analysis, SAP SF was selected. SAP SF met all of the required criteria, and in many cases exceeded the others in individual categories. In addition, SAP SF is rated in the top quadrant for human resource product suites, and is widely used in the utility industry, particularly by utilities with an existing SAP presence, as it helps to achieve the highest degree of integration with existing systems.

Q. What benefits does this project and the selected alternative provide for customers?

A. HR-TOPS will significantly enhance our existing human resource capabilities, simplify all people related processes, and ultimately improve the user experience. It will increase productivity for managers and employees by reducing errors and manual work-arounds and provide actionable data and metrics to ensure compliance and mitigate risks. HR-TOPS will also drive changes in PSE's hiring process to better enable the identification and development of the talent needed to improve organizational strength and achieve business goals.

Q. Are the new HR-TOPS systems in place?

A. HR-TOPS will be deployed using a phased approach. Phase one includes recruiting, onboarding, and core human resource functions, and it will be placed in service in June 2019. Phase two will go into service in early 2020 and includes compensation, performance and goals management, career development planning and succession, labor relations and workforce planning and analytics.

Q. What is the cost of the HR-TOPS program?

A. The overall program spending is estimated at $14.3 million. Total cost of phase one is estimated at $10.3 million. This consists of $5.3 million spent in 2018, and an additional $5 million required to complete phase one activities by the in-service date of June 28, 2019. Phase two will go live in 2020 and is estimated at $4 million, made up of $3.5 million in 2019 spend and $0.5 million in 2020.

Overall projected program spending remains in alignment with the approved project budget.

Q. Did the project team keep management informed during the course of the project?

A. Yes. The HR-TOPS program governance structure aligned with the standard structure for PSE technology projects and includes involvement by an executive steering committee and a project-level steering committee made up of leaders across Business and IT. Together, these teams participate in program oversight, key decision making, risk mitigations, and approval of costs and changes.

Q. Were there any material changes that affected the project scope, schedule or budget?

A. To date there have been no major changes to scope, schedule or budget after initial approval of the project.

V. ONGOING INFORMATION TECHNOLOGY EXPENDITURES

Q. Describe PSE's strategic focus regarding IT expenditures going forward.

A. PSE's recent investments in technology, as outlined in this testimony, represent an ongoing shift due to the digitalization of our industry and are critical in the evolution of what PSE needs to operate reliably, efficiently and securely, and to meet both present and future changing customer expectations. Over the next few years, PSE will continue to invest in necessary technology to meet these requirements. Through these strategic investments, PSE will build upon its

existing technology foundation and platforms to enable and support a cost-effective transition toward a digital utility.

Q. Please describe PSE's plans for IT investments with an in-service date during the period July 1, 2019 through the end of the rate year (April 30, 2021).

A. PSE's future technology investments are largely a continuation of the investments described previously in my testimony and can be broken down into four categories, with an estimated overall spend of $211.4 million for IT investments going into service during the rate year.

1) Customer Experience – This category represents approximately $112 million of technology investments that directly support PSE's efforts to adapt and meet changing customer expectations in the digital environment, as noted in the JD Power and Market Strategies International studies, detailed in the Prefiled Direct Testimony of Andrew Wappler, Exh. AW-1T. GTZ is the only initiative slated for this category of work. This work will include the delivery of various IWM applications; project initiation, planning, design and execution for electric customer facing work, including Electric First Response and System Ops integration; providing remote functionality to the AMI meters; and the implementation of new payment options and processes for customers.

2) Grid Modernization and Reliability – This category represents $12.5 million in IT investment. Grid modernization and reliability technology investments directly support the objectives detailed in the Prefiled Direct

Testimony of Catherine A. Koch, Exh. CAK-1T. The largest technology initiative associated with this category of work is related to improvements to the IT systems supporting our Energy Imbalance Market, with an anticipated investment of $4 million.

3) Corporate, Compliance, and Risk – PSE plans to invest $29.7 million in corporate systems technology investments that create a secure, productive, and stable operating environment. The initiatives in this program mitigate risk and drive improvements to enterprise systems to support financial stability, employee productivity, cyber security and business enablement. The largest capital expenditure planned for this program at $7 million focuses on transforming our procurement systems and mitigating risk (cyber and financial) associated with conducting business with third parties. With approximately 2,500 active vendors who have physical and logical access to PSE properties and systems, it is important that we ensure these third parties are acting in the best interest of PSE and not introducing additional risk. PSE's current processes and systems are aging, and they pose constraints to timely management of access controls and limit our ability to mitigate risks and challenges related to effective third-party management.

4) System Modernization and Optimization – This category represents investment of approximately $57.2 million. As noted earlier in this testimony, the System Modernization and Optimization program is an ongoing program to maintain key critical technology platforms to ensure

their security, availability, and recoverability. Capital expenditures associated with the category can be broken out as follows:

- Technology Refresh and Growth projects: $52.2 million of the investment associated with the System Modernization and Optimization category is related to annual technology refresh and growth projects. These projects are funded via an annual program and, as described above, are necessary to maintain service level requirements, receive support from vendors to patch security vulnerabilities, and to continue operational compliance with NERC/CIP obligations. Investment in this category also supports efforts needed to scale core infrastructure in alignment with natural business growth and new business requirements and capabilities. The largest category of investment projected under this category is estimated at $6 million and is related to the replacement of end-of-life critical hardware required to run financial and customer information systems in our data centers. Other smaller projects will be planned annually, with most completing in the same year as they are initiated.
- Critical System Upgrades and Enhancements: $5 million of the investment associated with the System Modernization and Optimization category is related to critical system upgrades and enhancements that are prioritized based on business need and vendor requirements to maintain support.

Q. Are PSE's IT expenditures necessary and reasonable?

A. Yes. As discussed in this testimony, each of the investments described above are required to ensure that PSE acquires and maintains the requisite technological systems and processes so that PSE operates reliably, efficiently and securely. The level of spending that PSE has undertaken in the test year and will continue in the rate year, as described above, is necessary and reasonable. Unlike traditional transmission and distribution investments that typically have much longer depreciable life spans, technology investments have much shorter depreciable life spans that require more frequent updating, upgrading, and replacement, due to the rapidly evolving nature of technology and the digitalization of utility service. PSE has invested, and will continue to invest, appropriately at a level to keep its technology current and to address security threats.

VI. CONCLUSION

Q. Does this conclude your testimony?

A. Yes, it does.