

**Data Center and Disaster Recovery Program
Corporate Spending Authorization (CSA)**

Application Request

Date Submitted:	February 9, 2018
Officer Sponsor:	Margaret Hopkins
Completed By:	Carolyn Danielson, Jeff Neumann, Brian Fellon
Phase Gate:	Design

I. Project Overview

Problem Statement:

Data Center Problem Statement: PSE has approximately 65 IT systems classified by Corporate Business Continuity as Critical to PSE's core business functions. Per the business continuity classification criteria, these systems must be recovered within 24 hours in the event of a disaster. Examples of systems that fall into this category are the Energy Management System, Geospatial Information System, Outage Management System, Email, etc. In addition to the disaster recovery requirements, these critical systems are expected to be secure, reliable, and available 24X7. In our current Data Center scenario, PSE would not be able to recover these systems within their designated Recovery Time Objectives (RTO) and meet the 24X7 availability expectations. Our existing Data Centers are substandard and geographically located on the same earthquake zone. A major earthquake in the Cascadia subduction zone could simultaneously render all of our Data Center facilities unusable.

Current State

- PSE operates and maintains four Data Centers:
 - **Bothell H** Building serves as the primary Production Data Center
 - **Bellevue EST 2nd floor** (EST-02) serves as the Backup Data Center and the Backup Control Center.
 - **Bellevue, PSE 9th floor** (PSE-09) supports Trade Floor operations and the phone systems used by the entire Bellevue campus. PSE-09 also houses 234 Telco circuits that extend to other PSE facilities outside of Bellevue.
 - **Eastside Operations (ESO)** Data Center supports critical communications for System Operations/Load Office and Gas Operations.
- The IT Network Operations Center, located in Bothell H, monitors PSE's IT Production Systems 24x7 at all four Data Center locations.

Limitations:

- All Data Centers have limited/costly expansion capabilities
- All are located within 12 miles of each other along the I-405 corridor within the same earthquake zone.
- We cannot shift load from the Bothell H Production Data Center to our Backup Data Center in EST-02 to perform maintenance.
- All sites have inherent limitations, such as available power, cooling, and capacity, which prevent PSE from providing adequate redundancy.
- Bothell H, EST-02 and PSE-09 are in leased office buildings not suitable for Data Center Infrastructure.
- EST-02 cannot scale or expand to house all critical systems for the purposes of Disaster Recovery.
- Bothell H is located in a flood zone

Disaster Recovery (DR) Problem Statement: PSE needs to ensure that applications and infrastructure are available to support critical business functions in the event of a disaster. Many critical systems have limited or no disaster recovery capabilities and require a solution to ensure that these systems can be recovered within their designated Recovery Time Objectives (RTO).

Current DR Limitations:

- 37% of PSE's critical applications do not meet Business Continuity's requirements for disaster recovery or redundancy.
- While 63% of the critical systems have some level of disaster recovery in place, it would be difficult to simultaneously recover these systems within 24 hours if a site-wide incident occurred. This is due to the manual nature of the current system architecture.
- Many critical systems cannot failover today, because of downstream dependencies on other applications that do not have disaster recovery capabilities.
- We do not have the ability to "return" to the primary production Data Center after we invoke the disaster recovery site, without rebuilding from scratch.
- Disaster recovery testing requires significant downtime to production systems and is highly disruptive to critical business processes.

A robust solution needs to be implemented to:

- Support the day to day reliability and availability requirements of critical systems
 - Automate (or nearly automate) the failover and recovery of critical systems in the event of a disaster
 - Successfully failover an entire Data Center
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Future Vision: PSE must replace our current Data Centers with highly redundant and resilient facilities and infrastructure that meets availability requirements for day to day operations and the business continuity/disaster recovery requirements for critical business processes and systems.

Proposed Solution: This program proposes to construct two new Data Center facilities architected to mitigate the Business Continuity/Disaster Recovery Entity Risk and to close all outstanding Internal Audit commitments.

The program will:

1. Combine the Data Center and Disaster Recovery Initiatives to optimize cost, schedule and resources, as approved by the CIO and Officers in August 2016.
2. Develop *Facility Resiliency* design options such as Active/Active or Active/Near Active to enable less than 24 hour recovery capability for all critical systems.
3. Evaluate Data Center facility options (co-location, co-location/modular build, modular build) and location options to establish Seismic Zone separation. Determine optimal solution and implement selected option.
4. Implement Industry Best Practice for Data Center facility and operations.
5. Address the maturation of the infrastructure technology standards and asset management, as well as any other data, environment, and or processing standards required.
6. Design and configure all applications to the new Data Centers standards, such that they meet their Recovery Time Objectives (RTO) and Recovery Point Objectives (RPO)
7. Design the core IT Infrastructure to accommodate current workload and scale for projected growth through 2019.
8. Migrate, validate, remediate, and cutover all **Critical** Applications and systems to the new Data Centers by June 30 2018.
9. Validate Disaster Recovery plans & capabilities for all Critical applications.
10. Migrate, all *non-critical* applications to the new Data Centers by end of 2018. Validate disaster recovery plans for all non-critical applications.

Alternatives Evaluated: Alternatives considered:

1. **Do nothing** – This option leaves the company at risk of severely diminished ability to operate if a natural disaster occurs. Additionally, the ability to support future growth is severely limited.
 2. **Attempt to fortify the existing Data Centers.** This option could address some of the issues requiring mitigation; however, it does
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not provide a comprehensive solution to protect the company from the exposure of a regional earthquake or allow for future growth and expansion capabilities.

Primary ISP Alignment:

Processes & Tools

Type of Project:

Risk Mitigation

OCM Considerations:

Impacted Users (Internal):

< 100 < 500 > 500

Impacted Customers (External):

None < 100K Electric or < 1K Gas > 100K Electric or >1K Gas

Internal Organizational Impact:

1 Dept or less 2-5 Dept > 5 Dept / Business Platform / Enterprise

Project Complexity & Duration:

<input type="checkbox"/> Straightforward, well understood	<input type="checkbox"/> < 6 months
<input checked="" type="checkbox"/> Complex and well understood	<input type="checkbox"/> < 12 months
<input type="checkbox"/> Complex and not well articulated	<input checked="" type="checkbox"/> > 12 months

II. Phase Gate Change Summary

Scope:	<p>The initial scope was to build a secondary Data Center to support migration and failover of applications from the primary Data Center to the secondary.</p> <p>Significant scope changes include:</p> <ul style="list-style-type: none"> • Combine the Data Center upgrade with the Disaster Recovery Initiatives as approved by the CIO and Officers in August 2016. • Construct two new Data Centers capable of supporting the full spectrum of PSE’s business continuity/disaster recovery objectives and mitigating the risk associated with the existing Data Centers all residing within the Cascadia subduction zone. • Implement highly resilient and redundant facilities that provide near instantaneous failover (Active/Active) for applications that can leverage this capability, along with improved architecture for the remaining applications (e.g. Active/Near Active). • Migrate all applications/systems to the new Data Centers to meet disaster recovery objectives (vs. just Critical Applications).
Budget:	<p>Adding a Data Center and the high availability architecture significantly increased the budget. The original capital budget estimated at \$40,000,000 was expanded to accommodate the second Data Center, the highly resilient infrastructure, ancillary systems/services, and the migration of all applications to meet disaster recovery objectives.</p> <p>Current estimation is:</p> <p style="padding-left: 40px;">Capital: \$ 76,322,000(Comprised of \$1,322,000 in 2016, \$63,000,000 in 2017, \$10,000,000 in 2018 and \$2,000,000 in 2019)</p> <p style="padding-left: 40px;">Project related O&M: \$647,558 in 2017, \$2,732,889 in 2018, \$2,139,396 in 2019.</p> <p style="padding-left: 40px;">On-going annual OM from 2020: ~\$2.48M on average.</p> <p style="padding-left: 40px;">Five year OM (2018 to 2022) total: \$ 12.2M</p> <p style="padding-left: 40px;">Twenty year OM (2018 to 2037) total: \$49M</p>
Schedule:	<p>The addition of a second Data Center with full failover capabilities and the transition of all applications to the new architecture increased the level of effort. The updated schedule is forecasted to extend the program to the end of 2019.</p>
Risk Profile:	<p>The risk posed by the substandard nature of existing Data Centers remains unchanged; however, the risk of completing the project on time and within budget has increased due to:</p> <ul style="list-style-type: none"> • The addition of a significant amount of scope • The loss of the planned Data Center site at Wild Horse • The implementation of Active/Active, Active/Near Active technology that is new to PSE • The combination of two significant efforts: Data Center project and the Disaster Recovery project

III. Key Schedule and Financial Information

Proposed Budget Year(s):	2016-2019
Expected In-Service Date:	Data Centers 12/2017, Migrated Critical Applications 06/30/2018, Migrated Non-critical Applications 12/31/2018
Initial Estimate:	The projected cost associated with the original Data Center project was \$46.7 million dollars.

Cost Estimate Maturity Score:

Score: **Class 3 - Baseline Budget Ready**

Cost Estimation Classification Document: **N/A**

Updated Estimate for Total Project Cost:

Phase Name:	Design Phase	Contingency 15%	15%	
Cost Type	Capital	OMRC	Opex	Total
Cost (without contingency)	\$ 66,366,956	\$ 100,000	\$ 5,419,843	\$ 1,886,799
Contingency (auto-calculated)	\$ 9,955,043		-	\$ 9,955,043
Total (auto-calculated)	\$ 76,321,999	\$ 100,000	\$ 419,843	\$ 1,841,842
Total Annual Cash Benefits	\$ -	If Applicable		
Payback in Years (auto-calculated)	\$ -	If Applicable		

Estimated Five Year Allocation:

Category:	2016	2017	2018	2019	2020
Capital (incl. contingency)*	\$1,322,000	\$63,000,000	\$10,000,000	\$2,000,000	\$0,000
OMRC	\$0,000	\$0,000	\$100,000	\$0,000	\$0,000
Opex**	\$\$0,000	\$647,558	\$2,632,889	\$2,139,396	\$2,472,043
Cash O&M Benefits***	\$0,000	\$0,000	\$0,000	\$0,000	\$ 2,874,966

* IT Operational funds were used to cover additional HW not covered by the Data Center initiative.

** The O&M expense includes the \$800K EMC credit offset.

*** OM benefits are from the elimination of lease and non-electricity spend for Bellevue EST2 and Bothell building H.

Cash Benefits by Department:

Ongoing Annual O&M by Department:	2017	2018	2019	2020	2021	2022
Software Hardware	\$ 647,558	\$ 1,520,767	\$ 1,007,274	\$ 1,339,921	\$ 1,349,480	\$ 1,359,995
Facilities Infra (1239)	\$ 14,000	\$ 38,000	\$ 45,900	\$ 54,590	\$ 64,149	\$ 74,664
Enterprise Sys (1213)	\$ 396,939	\$ 347,726	\$ (224,290)	\$ (224,290)	\$ (224,290)	\$ (224,290)
Ntwk & Secur Infra (1211)	\$ 236,620	\$ 766,828	\$ 817,451	\$ 1,141,408	\$ 1,141,408	\$ 1,141,408
Telecom (1215)	\$ -	\$ 130,613	\$ 130,613	\$ 130,613	\$ 130,613	\$ 130,613
Application	\$ -	\$ 237,600	\$ 237,600	\$ 237,600	\$ 237,600	\$ 237,600

Circuit Lease	\$ -	\$ 962,122	\$ 962,122	\$ 962,122	\$ 962,122	\$ 962,122
IT Shared Servc (1256)		\$ 962,122	\$ 962,122	\$ 962,122	\$ 962,122	\$ 962,122
Outside Service Other	\$ -	\$ 150,000	\$ 170,000	\$ 170,000	\$ 170,000	\$ 170,000
Facilities Infra (1239)	\$ -	\$ 150,000	\$ 170,000	\$ 170,000	\$ 170,000	\$ 170,000
Total On-going OM Costs	\$ 647,558	\$ 2,632,889	\$ 2,139,396	\$ 2,472,043	\$ 2,481,602	\$ 2,492,117

**Non-Cash Benefits /
Future Cost Avoidance:**

Securing the facility and sharing the building as office space at Snoqualmie benefits PSE by reducing the costs for both the Data Center and the office space in the original purchase, as well as for on-going maintenance. Additionally, implementing the new Data Centers, and supporting technology will ensure PSE is able to continue operations in the event of a disaster and will enable the future expansion of the modules, should PSE need to do so.

Cash on Cash Single Payback: N/A

IV. Project Description and Objectives

Project Description: The Data Center/Disaster Recovery project will establish two new Data Centers and migrate all applications and systems from the existing Data Centers in order to create seismic separation and enable recovery of these systems within their designated Recovery Time Objectives (RTO) and meet the 24X7 availability expectations.

ISP Alignment:

ISP Objectives, Mandatory and/or Corporate Risk	Strategy <i>Abbreviated ISP strategy descriptions</i>	Benefit Description <i>Benefit, measurement and/or scorecard affected</i>
Financial	<input checked="" type="checkbox"/> Five-Year Strategic Plan <input type="checkbox"/> Maximize long-term value <input type="checkbox"/> Grow core business <input type="checkbox"/> Grow new business	
Customer	<input type="checkbox"/> Execute the Customer Experience Intent Statement <input checked="" type="checkbox"/> Recognition of PSE role in community <input checked="" type="checkbox"/> Customer preparedness & safety <input type="checkbox"/> Ideal customer behaviors <input type="checkbox"/> Listen & dialogue with customers	Enhancing PSE's ability to recover systems quickly and reliably during an event, supports our Customers preparedness and safety, and demonstrates our commitment to the communities we serve.
Process and Tools	<input type="checkbox"/> Streamline processes to drive effectiveness and efficiency <input checked="" type="checkbox"/> System reliability and integrity <input checked="" type="checkbox"/> Safety and security of systems, information and assets <input type="checkbox"/> Extract and leverage value from existing technology and assets <input type="checkbox"/> Optimize product/service portfolio consistent with long-term strategy	Introducing two new Data Centers and migrating to Active/Active technology is intended to improve reliability of the systems, particularly during an "event". In the transition, migrating systems to virtual environments will have the added benefit of streamlining the support and maintenance of our infrastructure.
People	<input type="checkbox"/> Develop/Retain best employees <input type="checkbox"/> Ownership, innovation and continuous improvement	
Safety	<input type="checkbox"/> Educate and train employees on effective safety and wellness strategies	

Project Objectives and Deliverables:

Objective	Outcomes / Deliverables	KPIs – Describe; Indicated Leading/Lagging	KPI Data Sources
Enhance business continuity capabilities.	2 Data Center's that enable the failover and recovery of critical applications in less than 24 hours and well within their Recovery Time Objectives.	Disaster Recovery test results meet stated RTO and RPOs. (Lagging)	
Expand Data Center capacity to support future growth.	Ability to expand Data Center environments along with prepositioned capacity through 2019.	PSE will not be required to secure additional facilities to support anticipated growth for the near future. (Lagging)	

Project Alternatives Assessment:

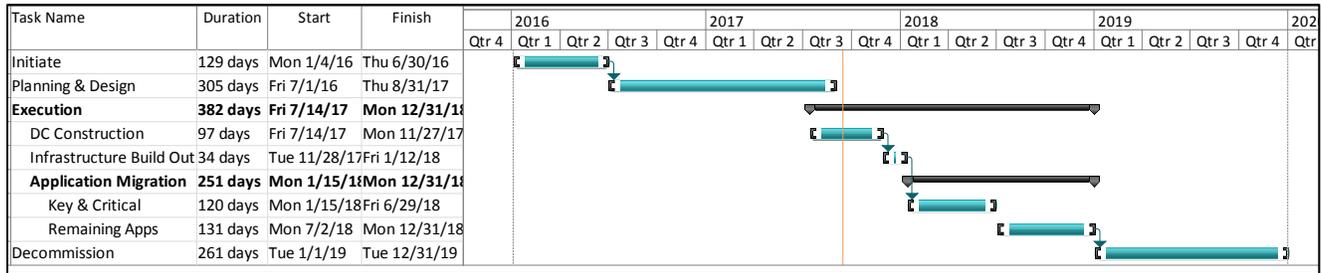
Alternative	Pros	Cons	Cost	Duration
Do nothing.	No Cost	Does not meet the business objectives.	\$0	1 Year NA
Fortify existing Data Center.	Less cost Less project risk Can be accomplished sooner.	Does not meet the business objectives.	\$3.1M	1 Year
Build Colocation Data Center	Lower lifetime cost	<ul style="list-style-type: none"> • Risk of not being able to support NERC and SCADA applications • Higher O&M expense during and after Data Center construction • Less control of Data Center operations 	\$48M capital \$60.2M O&M	Twenty years (2018- 2037)

V. Risk Management

Risk	Likelihood	Impact of Occurrence	How Monitored	Mitigation
Program will not meet the planned schedule.	Medium	High	Daily/Weekly Program status meetings to follow progress	Additional resources are being added to key groups to provide backup. Additionally if issues are encountered teams will work long days/weekends to recover the schedule.
Disruption to other programs' schedules and day to day operations due to migration disruption.	Medium	Medium	Monitored through status meeting on migration plans	Strong coordination and communication with business customers and in-flight programs. OCM program will play a critical role in this mitigation process.
Resource Contention	High	Medium	Project plans identify required resources. These requirements are communicated to resource managers.	PM's and Tower Leads work together to identify contentions and options for addressing them.
Cost	Medium	High	Forecasts will be created for each area and compared with actuals.	The program will compare actual costs against progress at the end of March to validate projections.
Complexity of Migrations	High	Medium	Extensive design sessions have been conducted to evaluate the complexity by application.	To accommodate the complexity, three patterns of migrations have been identified, and applications will follow one of the approved patterns based on its architecture.

Risk Register: [Program Risks Log](#)

VI. High Level Schedule



VII. Supporting Documentation

Cost Estimating and Budget:	Cost Analysis Feb 8 2018
Business Needs and Alternatives:	Alternatives Analysis Feb 8 2018
Benefits Realization Plan:	Benefits Realization Plan
Project Audit Checklist:	Project Audit Checklist By Phase
OCM Sizing Worksheet:	N/A

VIII. Original CSA Approvals: *Add/remove rows as applicable.*

I. Prepared By	Title	Role	Date	Signature
Carolyn Danielson	Mgr IT Infrastructure Facilities	Program Owner	 RE Revised CSA for DC DR Program.msg	
Gregg Hynek	PM	Program Manager	 RE CSA.msg	

Approved By	Title	Role	Date	Signature
Carolyn Danielson	Mgr IT Infrastructure Facilities	Program Owner	 RE Revised CSA for DC DR Program.msg	
Brian Fellon	Dir IT Applications Services	Program Sponsor	 RE Revised CSA for DC DR Program.msg	
Margaret Hopkins	CIO	Exec Steering Committee Member		
Doug Loreen	Dir Safety & Preparedness Safety & Business Continuity	Steering Committee Member	 RE Revised CSA for DC DR Program.msg	
Jeff Neumann	Dir IT Infrastructure Svcs,	Program Sponsor	 RE Revised CSA for DC DR Program.msg	

Acknowledgements	Title	Role	Date	Signature
		Benefit Owner*		
		IT		

*Benefit Owners must be added to the Approved By section during Execution Phase/Gate.