EXH. DJL-5 (Apdx. G)
DOCKETS UE-240004/UG-240005
2024 PSE GENERAL RATE CASE
WITNESS: DAVID J. LANDERS

BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND ENERGY,** **Respondent.**	**Docket UE-240004** **Docket UG-240005**

APPENDIX G (NONCONFIDENTIAL) TO THE FOURTH EXHIBIT TO THE PREFILED DIRECT TESTIMONY OF

DAVID J. LANDERS

ON BEHALF OF PUGET SOUND ENERGY

FEBRUARY 15, 2024

PUGET SOUND ENERGY

Grid Modernization: Voltage Reduction

Corporate Spending Authorization (CSA)

Date Created:	Friday, February 10, 2023
Discretionary/ Non-Discretionary:	Discretionary
Multi Year Rate Plan:	Programmatic
Equity Impact:	Yes
Strategic Alignment:	Operate the Business-Environmental & Compliance
Estimated In-Service Date:	Sunday, December 31, 2028
Current State (Business Need):	Washington State Initiative 937 requires large utilities to obtain a portion of electricity from new renewable resources and requires that utilities undertake all cost-effective energy conservation. CETA added to this requirement driving greater value of more energy efficiency than prior requirements. Lowering the voltage in the grid reduces the energy supply needed, saving power costs and energy savings for bills. Conservation voltage reduction ("CVR") is the first step towards this with future maturity to volt var optimization ("VVO") which moves from static settings to dynamic voltage control. This is referred to as Distribution Efficiency in PSE's energy efficiency programs and is a very inexpensive contribution to PSE's overall Energy Efficiency targets. This is enabled by PSE's AMI system and a foundation customer benefit that justifies the AMI investment.

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Desired State (Proposed Solution):

In order to implement this cost effective energy efficiency measure, voltage is lowered at the substation after ensuring circuits have balanced load on all phases and AMI has been installed in order to monitor and measure the effectiveness.
The program is based on NW study work dating back to 2007 that determines a 3 Volt drop on average saves 2.5% energy savings at the end of the line. There is various technology that moves this implementation to static, set and review periodically, to real time automatic voltage adjustments based on loading conditions monitored in real time which requires additional equipment on the circuit and substation. The CVR program in its current methodology is proposed to complete 55 substations over 2021-2025 and nearly 158 substations by 2037. The CVR implementation schedule will coordinate with the implementation of ADMS at which time PSE will mature the methodology to VVO.

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Outcome/Results (What are the anticipated benefits):	The intent of the Voltage Reduction Plan is the ability to operate the utility distribution system in the lower half of the acceptable voltage range (120-114 volts) to save energy, reduce demand, and reduce reactive power requirements without negatively impacting the customer. PSE must deliver over 12,000,000 kWh of distribution efficiency by 2023 to meet EE commitments towards CETA energy efficiency targets. Using the AMI benefit analysis work planned for 2021-2025, the NPV of the benefit is $28.9M.

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Dependencies: No

Dependencies comment: None.

Escalation Included: No, escalation has not been included.

Total Estimated Costs: $16,000,000

Estimated Five Year Allocation:

Funds Type	ID	Line Item Description	Previous Years Actuals	Fiscal 2024 Requested	Fiscal 2025 Requested	Fiscal 2026 Requested	Fiscal 2027 Requested	Fiscal 2028 Requested
Capital	W_R.10059.02.01.03	E Volt Var Optimization	$ -	$ 5,200,000	$ 5,700,000	$ 5,700,000	$ 5,700,000	$ 5,700,000

Incremental O&M: Labor

Qualitative Benefits:

The primary benefits of PSE's CVR plan is saving energy with some side benefits of reducing demand and reactive power. The Energy Efficiency team creates an annual report which is calculated savings based on CVR factors, (CVR Factor)(MWhrs) = Energy Savings. Using the AMI benefit analysis work planned for 2021-2025, the NPV of the benefit is $28.9M.

Quantitative Benefits:

Quantitative Benefits	Benefit Type	Previous Years	Fiscal 2024	Fiscal 2025	Fiscal 2026	Fiscal 2027	Fiscal 2028	Fiscal 2029	Remaining Costs	Life Total
Energy savings	Cost Avoidance	$ -	$ 239,000,000	$ 239,000,000	$ 239,000,000	$ 239,000,000	$ 239,000,000	$ -	$ -	$ 1,195,000,000

Risk Summary:

Project risk includes O&M constraints associated with phase balancing and operationalizing the new settings voltage reduction so that under changing configurations or complaints field personnel understand the CVR status and decisions to be made.

Benefit risk is based on successfully setting voltage lower and keeping it versus disabling it for operational reasons.

System risk is associated with poor deployment and operationalization. Distribution automation conflicts with static CVR pitting energy savings and reliability at odds. Quick transition of ADMS to VVO would eliminate this conflict and allow both benefits to be realized effectively.

Reputational risk is significant in the event that PSE doesn't keep pace with EE commitments or disables this customer benefit which UTC staff and Commissioners feels is very important.

Recovery risk still looms relative to the return on the AMI investment which is dependent on PSE demonstrating it maximizes the AMI benefit. The larges benefit identified comes from the CVR program.

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Change Summary:

Planning Cycle	Change Summary	Last Update Date
2022 Baseline Cycle	This CSA has been migrated into the EPPM tool at go-live as part of the Phase 1 EPPM implementation effort. The projects in this CSA were previously approved for the 2023-2027 capital plan. Please refer to the original CSA document for additional information (if available.)	2/10/2023
2023 Cycle 1	Updated from current business case information	3/15/2023

PUGET SOUND ENERGY

Grid Modernization: Voltage Reduction

Corporate Spending Authorization (CSA)

Approval History:

Approved By	Date Approved
Approved by Cost Center Owner: Lambert , Ryan	3/30/2023
Approved by Cost Center Owner: Lambert , Ryan	4/3/2023
Approved by Director Sponsor: Landers , David	4/7/2023
Approved by Executive Sponsor: Jacobs , Josh	4/8/2023
CSA Status changed to Approved	4/8/2023
Approved by Cost Center Owner: Shrum , Bailey	12/4/2023
Approved by Director Sponsor: Shrum , Bailey	12/4/2023
Approved by Executive Sponsor: Shrum , Bailey	12/4/2023
CSA Status changed to Approved	12/4/2023
Approved by Cost Center Owner: Lambert , Ryan	1/29/2024
Approved by Director Sponsor: Landers , David	1/29/2024
Approved by Executive Sponsor: Jacobs , Josh	2/2/2024
CSA Status changed to Approved	2/2/2024

VOLTAGE REDUCTION

ENERGY TYPE: ELECTRIC

1. SHORT DESCRIPTION

The intent of the Voltage Reduction Plan is the ability to operate the utility distribution system in the lower half of the acceptable voltage range (114-120 volts) to save energy, reduce demand, and reduce reactive power requirements without negatively impacting the customer.

2. BACKGROUND

Voltage reduction is primarily a plan motivated by Washington State Initiative 937 which is a clean energy initiatve that appeared on the ballot and passed in the November 2006 election. The initiative specifically pinpoints "cost-effective energy conservation" on the distribution system. Voltage reduction is a proven technology for reducing energy and peak demand. It is a measure implemented upstream of end service points in the distribution system so the efficiency benefits are realized by consumers and the serving utility. These combined benefits to consumers and distributing utility can achieve the requirements of Initiative 937.

In 2007, PSE participated in a study with 13 northwest utilities and 395 residential households. This study was called the Distribution Efficiency Initiative (DEI). Each utility selected multiple substations and over the course of one year voltage reduction settings were administered at the substation breaker level (alternating day-on and day-off settings). During that time, there were no customer complaints related to voltage reduction and the two PSE substations involved in the study saw an average of 2.5% energy savings for a 3-Volt drop (0.833% per Volt). The key finding was that substations serving primarily residential load will save energy when the voltage is lowered. This study determined a relationship by which PSE can calculate an estimated energy savings which is used in final reporting.

The current voltage reduction methodology implemented by PSE is a simplified approach called LDC (Load Drop Compensation) often refered to as Conservation Voltage Reduction (CVR). The voltage reduction or CVR plan is dependent on using end-of-line Advanced Metering Infrastructure (AMI) voltage data to verify that voltage reduction settings are correctly modeled and monitor the end-of-line customer voltages on each circuit for compliance to the standards. End-of-line AMI voltage data is also used in calculating the energy savings after implementation of CVR. PSE's Energy Efficiency programs capture the avoided cost benefits of CVR, using the term Distribution Efficiency. PSE's AMI deployment expands the capability to implement CVR widely across PSE's system.

To better able to manage the customer's experience, PSE will be transitioning over to the more advanced Volt-VAR Optimization (VVO) technology, this new VVO will see improved voltage reduction and energy savings. This VVO system will be managed by an Advanced Distribution Management System (ADMS).

3. STATEMENT OF NEED

From the combined efforts of PSE's Energy Efficiency and Electric System Planning departments, there are several needs and opportunities to be addressed by further development of CVR with the application of the VVO method. The primary need driver is meeting the I-937 requirement of doing cost effective distribution energy efficiency. The LDC method of CVR is limited in the amount of energy savings it can achieve per substation and the extent by which it can be implemented on the system. There are already instances where PSE is not doing CVR because of a pre-existing distribution automation (DA) scheme on that system. The static implementation of CVR prevents flexible coordination with DA in order to effectively manage and operate the distribution system. The needs of improving reliability with DA and improving distribution efficiency with CVR are at the moment not very compatible. However, the electric utility industry has grown from formerly using static control settings with LDC to more advance distribution efficiency methods of rule-based or model-based VVO. Utilizing this advanced centralized VVO module will allow PSE to integrate future modernization efforts such as Distribution Automation FLISR (Fault Location, Isolation & Service Restoration), Distributed Energy Resources Management System (DERMS), and/or Non-Wire Alternatives (NWA).

3.1 Need Drivers

- **Compliance** – Meeting the requirements of I-937 and CETA by pursuing cost effective distribution efficiency savings
- **Strategic** –
  - Decreasing energy consumption and peak capacity needs to support the Washington State Clean Energy Transformation Act (CETA)
  - Leveraging the additional capabilities of the AMI System, especially regarding end-of-line voltage monitoring
  - Leveraging the additional capabilities of the ADMS System
- **Customer** – Increase customer efficiency
- **Capacity & Energy Planning** – Meet future, increasing capacity and energy needs
- **Smart & Flexible** –
  - Increased visibility and control of the distribution system is becoming more important in addressing increasing DER penetration and system power factor (PF) management.
  - Increased integration with other modernization efforts, VVO is flexible and can manage abnormal system conditions created by DA FLISR, DERs (Distributed Energy Resources), DERMS. As a result, this increases the potential for VVO to scale compared to LDC CVR.

- VVO is much more flexible from a system operations perspective, it allows for operators to remotely control the system and enable/disable as day-to-day operations dictate

3.2 EQUITY

PSE evaluates equity in the planning process with consideration of the four core tenets of energy justice: Recognition Justice, Procedural Justice, Distributional Justice, and Restorative Justice in various steps of the process.

As specific studies are performed and projects proposed to further a business plan, planners review system, customers, and now equity data to recognize the specific customer burdens, whether there are highly impacted or vulnerable customers that are or will be affected by addressing the specific business need. Planners must prioritize where to focus study each year, thus the full understanding of the historic and ongoing inequities for the entire business plan is extrapolated, maturing over time which greater tools and data.

PSE is building process and tools to enable procedural inclusion in defining the need and solutions through engagement with specific communities and community-based organizations, increasing understanding of local needs and consequences to inform specific study development as well as options to address need. Maturity in where and how this occurs will increase over the next several years. Business plans will be updated as informed this collective engagement to reflect broader equity benefits and burdens as this engagement increases over time.

As specific projects are proposed, PSE investment decision optimization tool captures equity benefits. An optimized portfolio of projects across many business plans ensures the distribution of benefits and burdens are spread across all segments of the community and aim to ensure that marginalized and vulnerable communities do not receive an inordinate share of burdens or are denied access to benefits. As an initial step, PSE leverages Customer Benefit Indicators ("CBI") and information established as part of the 2021 Clean Energy Implementation Plan ("CEIP") to identify an equity framework to evaluate system projects. The CBI approach was developed through an iterative process coordinated with the Equity Advisory Group. These CBI span the core tenets of energy justice and provide a framework to evaluate the comparative equity benefit of each solution alternative considered. Refer to Table 1 for a brief description of the CBIs that address equity and the applicable benefits for the Targeted Capacity program. PSE will continue to adjust and refine equity consideration in projects, when necessary, as the process continues to mature.

Projects will be evaluated on each CBI category and a total equity benefit score is provided.

Table 1: Equity Applicable Benefits

Customer Benefit Indicator	Description	Program Applicable Benefit
Customer Energy Savings	Solutions that lead customers to use less energy, which leads to less energy that must be purchased and potentially a reduction in planned system upgrades.	No
Greenhouse Gas Emissions	Solutions that lead to a reduction of greenhouse gas emissions, either directly or indirectly	No
Enables Cleaner Energy	Solutions that either directly integrate DER on the system or enable the grid to more readily accommodate future DER.	Yes
Air Quality	Solutions that either directly eliminate the source of a common pollutant or reduce the risk that could cause a common pollutant to increase, such as enabling Electric Vehicle or DER adoption	No
Resilience	Solutions that address major event outages or harden critical facilities to prevent catastrophic events from creating long duration outages.	No
Cost Reduction	Solutions that identify least cost alternatives and therefore reduce costs for all customers	Yes
Clean Energy Jobs	Solutions that increase clean energy jobs by furthering clean energy technology application, as described in the CEIP	Yes
Home Comfort	Solutions that deploy residential energy efficiency in either a targeted solution area or by leveraging load reduction from system wide energy efficiency installations	Yes

The program attempts to annually address distribution electric capacity needs and is programmatically optimized based on total benefit value to cost. Specific program projects are identified based total benefit to cost with named communities receiving additional scored benefit based on vulnerable population designation and highly impact community characteristics, essentially ensure investments are distributed appropriately to named communities.

Business plans in isolation do not address restorative justice, but continued planning process improvements which include considerations of data, tools, and documentation as well as operational practices will help to restore equity over time.

4. PLAN DETAIL

4.1. PLAN SIZE/POPULATION

There are 158 substations identified as candidates for the CVR/VVO plan out of 278 distribution substations. At the end of 2022, 21 substations have CVR implemented, two VVO pilots are on the way and an additional five VVO stations are currently scoped for 2026 and each subsequent year. Proposed strategies for CVR include substations with greater than 51 percent of residential customers as it has been demonstrated that residential customers are the greatest benefactors of the energy reduction that will be realized. The strategy for the VVO expansion includes the need to expand this technology to other operations areas ensuring both system operators and other field crews are exposed and familiar with these systems. Another important strategy includes the need to have both distribution automation and voltage reduction systems seamlessly coexisting on the same station, with the dynamic nature of the VVO system, the experience of the customer will be better managed.

4.2. PROPOSED COMPLETION DATE

The CVR plan in its current methodology is proposed to complete 55 substations by 2025. The CVR plan schedule will coordinate with the implementation of ADMS at which time PSE will mature the methodology to VVO. The plan is to have 12 voltage reduction systems installed per year. For years prior to VVO implementation, that is before 2025 – 12 CVR systems per year, with VVO "pilot" scheduled for 2025 therefore that year will see 10 CVR implementation that year with the two VVO stations, post-pilot implementation, there will be five VVO and seven CVR stations implemented per year.

4.3. SUMMARY OF PLAN BENEFITS

Energy Savings – The primary benefits of PSE's CVR/VVO plan is saving energy with some side benefits of reducing demand and reactive power. The Energy Efficiency team creates an annual report which calculates savings based on CVR factors, (CVR Factor)(MWhrs) = Energy Savings. Note: Energy savings is realized when the system is at less than peak loading.

4.4. INVESTMENT DECISION BENEFITS

PSE employs an Investment Decision Optimization Tool (iDOT) to evaluate benefits of projects and optimize the annual portfolios for construction. The top primary iDOT benefits this plan addresses are:

- Expected Unserved Energy:
- Contribution to Strategy
- Flexibility

Table 2: Total Plan Benefits, Population, and iDOT B/C Score

2025 -2026	Total Substations	Total Plan ($M)	EUE Saved (kWh)	iDOT B/C Score
CVR	16	4.88	26,104,288	866.95
VVO	7	5.74	14,400,803	463.86
Total	**23**	**10.62**	**40,805,091**	**822.79**

4.5 ESTIMATED COSTS

Estimated costs are generated based off historical costs on similar types of projects, allowing for variations in project scope, increase in project cost due to inflation, and added contingency to account for unforeseen conditions associated with the project.

Historically, the actual cost for phase balancing to support CVR projects was $40K per substation allocated to only O&M. There has been a need to re-evaluate the stations to ensure customers are not negatively impacted, so the historic cost may change. Future CVR substations are estimated at $250K based on two changes:

- Replacing older controllers with a history of operational issues to enable CVR, the capital cost for this replacement is projected at $25K each
- Addition of line regulators to ensure supplied voltages remains at acceptable levels

PSE will simultaneously transition from CVR to VVO where the approximate cost per substation is $1.2M to allow implementing Intelligent Electronic Devices (IED) at the substation and in the field to enable VVO.

Capital costs reflect the need for some system improvements like load tap changer (LTC) controller replacement, Line Regulators, Capacitors, Line/Phase upgrades. O&M costs reflect the need for phase balancing, study time and settings implementation.

5. ALTERNATIVES

5.1. SOLUTION ALTERNATIVES

No Action - The CVR program meets the I937 Initiative compliance driver as a cost-effective energy conservation measure. No action or not implementing CVR would go against the I937 Initiative. VVO is the next step in achieving more energy savings. Since CVR is a static program which does not automatically react and adjust to large system changes, it will continue to hamper our ability to implement Grid Modernization programs like Distribution Automation on circuits with CVR.

5.2. FUNDING ALTERNATIVES

Increase Funding - With increased funding, energy savings through CVR could be achieved in earlier years. PSE is currently on a course where benefits are realized under the existing CVR plan until ADMS is fully implemented at which time the CVR plan transitions gradually over to the more advanced VVO technology.

Decrease Funding - Decreased funding reduces PSE's ability to realize available system and energy efficiencies through the CVR/VVO plan which meets the criteria of the I937 initiative. A reduction could put other programs at risk, including the DA program as there is the need to have multiple capabilities coexisting on the same system.

6. PLAN DOCUMENT HISTORY

The current version of the project summary supersedes all previous versions.

Date	Reason(s) for Update	Summary of Significant Change(s)	Modified By
10/25/2019	Initial Document – New plan template	Initial Document – Summarize historical plans	Sam Di Re
4/14/2020	Revision	Added budget and iDOT details	Sam Di Re
5/06/2021	Revision	Added VVO alignment	Ray Hisayasu
10/26/2021	Used and Useful Policy guidance	Update for current information; add alternatives and cost information	Reid Shibata/Ray Hisayasu
12/1/2021	Annual Review	Minor word and format changes	Reid Shibata/Ray Hisayasu
1/19/2022	Revision	Updated iDOT values	Ray Hisayasu
9/24/2023	Revision	Equity addition, ISP removal, modified cost information, updated language in multiple sections	Dwight Brown
12/6/2023	2024 MYRP Update	Updated Equity Table, Top 3 iDOT Benefits, Summary Table to align with other business plans	Krista Malmgren

7. SUPPORTING DOCUMENTATION

Document Name
WASHINGTON STATE INITIATIVE 937
DISTRIBUTION EFFICIENCY INITIATIVE REPORT BY NORTHWEST ENERGY EFFICIENCY ALLIANCE, DECEMBER 2007
2016 AMI BUSINESS CASE