EXH. DJL-4 (Apdx. C)
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 C (NONCONFIDENTIAL) TO THE THIRD EXHIBIT TO THE PREFILED DIRECT TESTIMONY OF

DAVID J. LANDERS

ON BEHALF OF PUGET SOUND ENERGY

FEBRUARY 15, 2024

PUGET SOUND ENERGY

Grid Modernization: DER Circuit Enablement

Corporate Spending Authorization (CSA)

Date Created:	Friday, February 10, 2023
Discretionary/ Non-Discretionary:	Discretionary
Multi Year Rate Plan:	Programmatic
Equity Impact:	Yes
Strategic Alignment:	Evolve the Business-Clean
Estimated In-Service Date:	Sunday, December 31, 2028
Current State (Business Need):	Over the past decade, net-metering trends point to approximately 1700% kW growth rate over PSE's service territory. The number of these systems will be compounded by the Clean Energy Implementation Plan (CEIP) and the results of PSE's DER request for proposals (RFP) put in place in response to CETA. PSE is beginning to implement tools such as Hosting Capacity Analysis and LoadSEER, which provide system-wide modeling to study the effects of DERs on a circuit-by-circuit basis. While these tools assist with system modeling, as the DER portfolio increases, the peak capacity output for DERs on a circuit will be clamped by the existing grid infrastructure, as the existing system was not designed for two-way power flow. This is a prevalent condition in 53% of distribution circuits (or 163 distribution substation with 22/23 Winter & 23 Summer Normalized Peak between 0-50%) where low station transformer loading conditions exist. Moreover, primary and/or secondary conductors on distribution feeders pose as chokepoints to DER capacity in both aggregated and non-aggregated instances. Lastly, DER production can cause voltage imbalances on the grid, impacting power quality and reliability, which in turn limits available hosting capacity. To meet these impacts, the grid will require dynamic voltage control and visibility to operate DERs effectively across the system. PSE is actively engaged in two microgrid pilot projects in the Tenino and Samish Island areas to realize the benefits of microgrids. The on/off grid use-cases being observed point to a potential increment in reliability and resiliency benefits. As value streams are defined using results of the microgrid pilots, non-wire alternative studies and customer plans will increase the prevalence of microgrids. Subsequently, key technology deployments are needed to develop the microgrid controls over DER assets on the grid.

PUGET SOUND ENERGY

Grid Modernization: DER Circuit Enablement

Corporate Spending Authorization (CSA)

Desired State (Proposed Solution):

The exact plan scope is subject to three major factors: 1) Hosting Capacity Study Results 2) The CEIP and 3) The DER strategy. Nonetheless, as DER initiatives and non-wires alternatives ramp-up penetration over time, the plan work will be set to follow targeted areas. Below are key tasks to achieve circuit enablement for DER and Microgrids:

- Upsizing of assets such as conductors and service transformers to accommodate additional renewable energy capacity
- Additional line capacitors/regulators and/or substation transformer upgrades for voltage regulation
- Additional reclosers and protective relays to form microgrids
- Substation upgrades such as smart circuit breakers, 115 kV circuit switchers, or communications to protect system from higher fault currents
- Improving communication networks for granular loading data

Future work streams to support DER and MG circuit enablement are evolving. New work will be informed by the learnings from PSE's two microgrid pilot projects in the Tenino and Samish Island, as well as our local jurisdictions and tribes community resiliency plans. PSE expects to partner with those efforts in enabling our grid to support potential microgrids.

Plan population size and data shall ultimately be determined by hosting capacity studies, the CEIP and the DER strategy. Although a range of factors can contribute to limited hosting capacity, lightly-loaded substation circuits pose as key investment areas for infrastructure upgrades. Initial studies point to 163 distribution substation (22/23 Winter & 23 Summer Normalized Peak) out of 305 total using low transformer loading criterion. Transformer peak winter/summer ratings are individually measured and ranked in this category if summer and or winter loading is between 0-50 percent of nameplate rating. By enabling these circuits, DERs and microgrids are able to add value in more parts of PSE's service territory, thus extending benefits to all of PSE's customers.

PUGET SOUND ENERGY

Grid Modernization: DER Circuit Enablement

Corporate Spending Authorization (CSA)

Outcome/Results (What are the anticipated benefits):	The current battery storage and solar PV projects at PSE target specific needs such as delivering capacity using a non-wires alternative or concept demonstrations for peak-shaving, demand-response, and resiliency use cases. By instantiating this plan, PSE is proactively addressing circuit constraints that limit DER penetration and microgrids.

PUGET SOUND ENERGY

Grid Modernization: DER Circuit Enablement

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Dependencies: CEIP approval

Dependencies comment: None.

Escalation Included: No, escalation has not been included.

Total Estimated Costs: $201,589,184

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.10059.02.01.04	DER Circuit Enable DERs Microgrids	$ -	$ 12,540,000	$ 5,000,000	$ 22,500,000	$ 28,325,000	$ 21,200,000
Capital	W_R.10059.03.01.01	E Resilience Enhancement CEIP	$ -	$ -	$ -	$ -	$ -	$ -
Capital	W_R.10006.01.01.03	E Substation SCADA CEIP	$ -	$ -	$ -	$ -	$ -	$ -

Incremental O&M: Both

Qualitative Benefits:

The benefits of this program are focused on equity as defined through the CEIP Customer Benefit Indicators.

Quantitative Benefits:

Quantitative Benefits	Benefit Type	Previous Years	Fiscal 2024	Fiscal 2025	Fiscal 2026	Fiscal 2027	Fiscal 2028	Fiscal 2029	Remaining Costs	Life Total
Reliability - avoided outages	Other	$ -	$ 23,000,000	$ 23,000,000	$ 23,000,000	$ 23,000,000	$ -	$ -	$ -	$ 92,000,000
Environmental impact	Other	$ -	$ 148,864,000	$ 148,864,000	$ 148,864,000	$ 148,864,000	$ -	$ -	$ -	$ 595,456,000

Risk Summary:

Project risk is associated with CEIP process and hesitation to initiate work while CEIP was undecided. Original plan was to begin work in 2022 but deferred. Although PSE has pushed ahead to accelerate SCADA.

Benefit risk exists if PSE does not pursue DERs as the pace envision by the IRP/CEAP.

System risk exists if PSE is reactive to DER adoption and investments can't be completed to safely operate DERs that customers or the utility adds.

PUGET SOUND ENERGY

Grid Modernization: DER Circuit Enablement

Corporate Spending Authorization (CSA)

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 with knowledge and historical information	3/17/2023

PUGET SOUND ENERGY

Grid Modernization: DER Circuit Enablement

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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

CIRCUIT ENABLEMENT – DER AND MICROGRIDS (CE DER & MG)

ENERGY TYPE: ELECTRIC

1. SHORT DESCRIPTION

A grid modernized distribution circuit is one that permits transactive energy from sources that either produce (i.e. solar photovoltaics or wind turbines) or store energy (i.e. battery storage). In either scenario, there are multiple use-cases that improve electric system performance when used for peak load shaving, demand response, and back-up power during outages. This translates to non-wire alternatives, SAIDI & SAIFI savings, and new customer plans inclined towards renewable energy. With the enactment of the state's Clean Energy Transformation Act (CETA), this has accelerated PSE's grid modernization efforts to meet the clean energy targets. Consequently, the Distributed Energy Resources (DER) and Microgrid Circuit Enablement (DER & MG CE) plan will address constraints on the electric system in order to enable behind-the-meter (BTM) and front-of-the-meter (FTM) assets at scale.

2. BACKGROUND

The electric grid has seen a growth in DERs both in front and behind the meter. In FTM, PSE installed various battery systems in the cities of Glacier and Poulsbo. PSE is engineering more systems that involve batteries and/or solar systems in Tenino, Bainbridge Island, and Samish Island. On Bainbridge Island, PSE has two behind-the-meter demonstrations to study the effects of DERs on utility operations. In addition, there are 19,932 BTM DER systems in PSE's service territory recorded (since 2010) that have seen in total ~163.3 MW of power export from customers onto the electric grid as of September 30, 2023.

The number of these systems will rapidly expand to match the CETA enacted by the state of Washington and PSE's Integrated Resources Plan (IRP) which call for 80% of electric sales (delivered load) to be met by non-emitting/renewable resources by 2030. This presents two unique challenges: 1) Increasing BTM and FTM DER penetration to achieve the goals laid out by CETA/IRP, and 2) Developing microgrids that deliver increased system reliability and resiliency.

3. STATEMENT OF NEED

Over the past decade, net-metering trends point to approximately 1700% kW growth rate over PSE's service territory[1]. The number of these systems will be compounded by the Clean Energy Implementation Plan (CEIP) and the results of PSE's DER request for proposals

[1] Update to align with CEIP filing and 2023 IRP Electric Progress Report PSE | 2023 IRP https://www.pse.com/-/media/PDFs/IRP/2023/electric/chapters/03_EPR23_Ch3_Final.pdf?modified=20230331182919

(RFP) put in place in response to CETA. The table below (derived from PSE's 2023 IRP Electric Progress Report) outlines future DER additions in order to meet CETA standards.

	Incremental Resource Additions			Total
	2024-2025	2026-2030	2031-2045	
Distributed Energy Resources				
Battery Energy Storage	40 MW	147 MW	80 MW	267 MW
DER Solar: Net Metered Solar	59 MW	225 MW	1,109 MW	1,393 MW
DER Solar: CEIP Solar	79 MW	-		79 MW
DER Solar: New DER Solar	40 MW	147 MW	80 MW	652 MW
Total	212 MW	527 MW	1,652 MW	2,392 MW

PSE is beginning to implement tools such as Hosting Capacity Analysis and LoadSEER, which provide system-wide modeling to study the effects of DERs on a circuit-by-circuit basis. While these tools assist with system modeling, as the DER portfolio increases, the peak capacity output for DERs on a circuit will be clamped by the existing grid infrastructure, as the existing system was not designed for two-way power flow. This is a prevalent condition in 53% of distribution circuits (or 163 distribution substation with 22/23 Winter & 23 Summer Normalized Peak between 0-50%) where low station transformer loading conditions exist. Moreover, primary and/or secondary conductors on distribution feeders pose as chokepoints to DER capacity in both aggregated and non-aggregated instances. Lastly, DER production can cause voltage imbalances on the grid, impacting power quality and reliability, which in turn limits available hosting capacity. To meet these impacts, the grid will require dynamic voltage control and visibility to operate DERs effectively across the system.

PSE is actively engaged in two microgrid pilot projects in the Tenino and Samish Island areas to realize the benefits of microgrids. The on/off grid use-cases being observed point to a potential increment in reliability and resiliency benefits. As value streams are defined using results of the microgrid pilots, non-wire alternative studies and customer plans will increase the prevalence of microgrids. Subsequently, key technology deployments are needed to develop the microgrid controls over DER assets on the grid.

3.1. NEED DRIVERS

- **Grid Modernization**
  - **Reliability –** The current grid infrastructure limits the ability for mass DER export. Managing the diverse energy portfolio with intermittent resources whilst being able to maintain reliable utility power creates new operating parameters on

the grid. Close studies of the circuits with higher DER penetration shall address circuit infrastructure constraints and create a path forward to enable them for DERs and Microgrids.

- **Safety –** Grid modernization needs to occur in order to effectively manage DERs and microgrids for worker and customer safety. This plan achieves this by implementing technology/equipment to ensure power backfeed is sectioned off appropriately during normal/abnormal events as well as managing their intended behaviors.

- **Resiliency** – DERs and Microgrids provide opportunities for backup power during system outage events. By modernizing the grid, this plan can expand those opportunities to greater parts of the system thus increasing resiliency.

- **Environment**
  - DER & MG circuit enablement is a tool to fight climate change and enable clean energy by allowing the connection of more DER resources to the distribution system.

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 at this time, 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 that was 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 DER &MG CE 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 will be 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	No
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	[No]

The program attempts to annually address the Hosting Capacity Analysis (HCA) MW gained on PSE's distribution system and is programmatically optimized based on total benefit value to cost which includes equity benefits. Specific program projects are identified based on 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

The exact plan scope is subject to three major factors: 1) Hosting Capacity Study Results 2) The CEIP and 3) The DER strategy. Nonetheless, as DER initiatives and non-wires alternatives ramp-up penetration over time, the plan work will be set to follow targeted areas. Below are key tasks to achieve circuit enablement for DER and Microgrids:

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Plan population size and data shall ultimately be determined by hosting capacity studies, the CEIP and the DER strategy. Although a range of factors can contribute to limited hosting capacity, lightly-loaded substation circuits pose as key investment areas for infrastructure upgrades. Initial studies point to 163 distribution substation (22/23 Winter & 23 Summer Normalized Peak) out of 305 total using low transformer loading criterion. [2]Transformer peak winter/summer ratings are individually measured and ranked in this category if summer and or winter loading is between 0-50 percent of nameplate rating. By enabling these circuits, DERs and microgrids are able to add value in more parts of PSE's service territory, thus extending benefits to all of PSE's customers.

4.2. PROPOSED COMPLETION DATE

[2] SSP-Five Year Plan_2024-2028

This plan shall be ongoing to match the needs of the CETA and PSE's IRP. Current plans are through 2028.

4.3. SUMMARY OF PLAN BENEFITS

a) A new process that addresses DERs and Microgrids at scale

The current battery storage and solar PV projects at PSE target specific needs such as delivering capacity using a non-wires alternative or concept demonstrations for peak-shaving, demand-response, and resiliency use cases. By instantiating this plan, PSE is proactively addressing circuit constraints that limit DER penetration and microgrids.

b) Improved Customer Satisfaction/Experience

This plan aims to create more opportunities for customers seeking to interconnect DERs or form microgrids by proactively enabling circuits that are limited in hosting capacity/microgrid capabilities.

c) Grid Modernization

PSE is able to further its grid modernization efforts by increasing system visibility, automation, and flexibility. Furthermore, this plan plays a role in creating new operating practices/policies when interfacing with customers adding DERs or microgrids onto the grid.

4.4. INVESTMENT DECISION BENEFITS

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

- Environmental
- Public Engagement Perception
- Contribution to Strategy

Table 3. Summary of Plan Benefits, Population and iDOT B/C Score

	Total Projects	Total Plan ($M)	Circuit Miles Enabled	HCA MW Gained	iDOT B/C Score
2025-2026	43	$54.1	54	55	17.86

4.5. ESTIMATED TOTAL COSTS

DER and microgrid circuit enablement costs vary based on location and quantity. In worse-case scenarios, replacement of a substation's equipment to provide voltage regulation and short-circuit current breaking capabilities averages ~$1.5M. This figure can vastly change depending on coordination with other capital or O&M projects. The initial estimated costs for the 2024 and 2025 portfolio is an average of $1.4M per circuit. More accurate detail is to be determined pending better DER forecast and alignment with CEIP.

5. ALTERNATIVES

5.1. SOLUTION ALTERNATIVES

No Action – Failure to implement this plan puts PSE at risk to comply with CETA. The lack of targeted infrastructure improvements hinders the ability for DERs and microgrids to scale and provide benefits to all of PSE's customers.

Place a moratorium for DER and microgrids connections until a circuit enablement program is in place – this is not feasible as customers can still connect DERs without a way for the utility to manage them.

Curtail customer DER output – this is a much more costly solution that uses a separate communication infrastructure to control and monitor customer DER devices.

5.2. FUNDING ALTERNATIVES

Increase Funding from Proposed – Invest into modelling tools (LoadSEER, Hosting Capacity Analysis, and internal resources) to better identify impacted areas. Develop tools geared towards customers such as DER interconnection maps that show available hosting capacity across system. In addition, build similar tools to gauge customer interest in community microgrids based on current grid modernization capabilities.

Decrease Funding from Proposed –Decreased funding will delay DER interconnections which presents a bottleneck to achieving the goals set out by CETA.

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
5/7/2021	Initial Plan		Reid Shibata
11/12/2021	Update to confirm with latest business plan template and IRP final plan.	Update to latest template and align with CEAP targets in final IRP.	Joseph Do
9/25/2023	Update to align with latest business plan template and 2023 IRP Electric Progress Report	Program size Incremental Resource Additions Equity Concerns	Karen Pavletich
11/9/2023	Alignment with 2024 GRC	Changed program name from DER and Microgrid Circuit Enablement to Circuit Enablement – DER and Microgrids	Karen Pavletich
12/5/2023	2024 MYRP Update	Updated Equity, Top 3 Primary iDOT Benefits, and Program Summary Table to align with 2025-2026 project submittals. Deleted the Benefit Allocation chart.	Krista Malmgren

7. SUPPORTING DOCUMENTATION

Document Name
FINAL 2021 INTEGRATED RESOURCE PLAN, CHAPTERS 2/3/4/8/APPENDIX M
Integrated Resource Plan 2023 Electric Progress Report, Chapter 3 Resource Plan