5 Cost

Chapter Five: Cost

To shift electric supply to clean generation by 2045, PSE needs to acquire significant resources in the near term to meet our obligations to provide affordable electricity, and an electric supply that benefits customers and reduces burdens on vulnerable customers. Achieving the specific targets and other requirements to meet the Clean Energy Transformation Act's (CETA) 2030 and 2045 goals requires a wide range of actions and investments. These actions range from developing renewable energy resources to grid modernization to customer education. Building a carbon-neutral direction for PSE's portfolio comes at a cost. The forecasted cost of the actions in this plan are $450 million more than they would have been without pursuing these plans. This amount equals an additional ≈ $6/month per residential customer in 2025 and barely exceeds the mark of a two-percent average annual rate increase.

PSE considers the costs of achieving CETA's targets as groupings of related investments; each supports different associated activities designed to achieve the goals of the Act. These investment categories include resources, delivery systems, operations, technology, and customer and administrative costs. Given PSE's electric supply today, PSE anticipates needing to make significant investments in clean energy activities in this implementation period equal to approximately a two-percent rate increase per year to meet the specific and interim targets in this CEIP.

Table 5-1 lists the primary investment categories and examples of the kind of specific investments PSE needs to support the changing resource mix required under CETA.

Table 5-1: Investments Categories

Investment Category	Examples of Specific Investments
Resources	Energy Efficiency Program development, operation, and customer incentives Demand Response Program development, operation, and customer incentives Power Purchase Agreements for renewable energy or emissions-free capacity Purchase renewable resources of emission-free capacity sources Operation of energy resources, including large scale and distributed resources
Resource Enablement and Delivery	Distributed Energy Resource design actions and tools Transmission capacity to deliver new resources Grid modernization to support distributed energy resources Grid operations to incorporate distributed energy resources Operations of distributed energy resources
Customer Education and Engagement	Detailed program design and customer enrollment Customer education and engagement on the clean energy transition

Investment Category	Examples of Specific Investments
Administration and Monitoring	Measuring customer benefit indicators Tracking and reporting

The investment profile to achieve the clean energy goals will change over time. For example, in this Clean Energy Implementation Plan (CEIP), PSE required no investments in energy transformation projects. Investment needs may change in future CEIPs.

Directly Attributable Activities

We identify activities directly attributable to pursuing the 2030 and 2045 standards based on those necessary to support the 2022–2025 CEIP. These activities are consistent with the conditions described in WAC 480-100-660.

Activities that relate to implementing the resource portfolio in this CEIP include those from all investment categories. Many activities are driven by CETA, such as a significant increase in renewable energy acquisition, whereas others were already part of the non-CETA portfolio, but we increased amounts or implementation timing due to CETA; an example of this is energy efficiency. The portfolio without CETA included energy efficiency, but when we added the requirements of CETA, we gained significantly more energy efficiency, which is reflected in our 2022–2023 Biennial Conservation Plan.

To identify incremental activities, PSE compared the energy resource portfolios included in this CEIP to a generic resource portfolio that AURORA selected without CETA. We included the social cost of greenhouse gas emissions in both portfolios, and explain the methodology and additional details later in this chapter. We provide the four-year summary of these portfolios below.

Incremental Cost

This section describes how we calculated the incremental cost for each CETA-related investment contributing to the incremental cost.

This section uses the terminology “baseline portfolio” and “CEIP portfolio.” The baseline portfolio[64] is the portfolio of generic resources selected by the model in a lowest reasonable cost analysis that does not include the requirement to comply with the clean energy standards set forth in RCW 19.405.040 or 19.405.050. The CEIP portfolio is the portfolio in this plan that considers the need to meet RCW 19.405.040 or 19.405.050. Both portfolios include the social cost of greenhouse gas emissions in the modeling analysis, as described below.

Incorporating the Social Cost of Carbon

[64] The baseline portfolio is the same as the alternative lowest reasonable cost portfolio. PSE used a portfolio optimization model as basis for calculating the alternative lowest reasonable cost portfolio to show the difference in portfolio choices and investment needs. [WAC 480-100-660(1) and (4)(c)]

CETA requires utilities incorporate the social cost of greenhouse gas emissions (SCGHG) as a cost adder when developing IRPs and clean energy action plans and when evaluating and selecting intermediate-term and long-term resource options[65]. PSE applies the cost adder by first estimating the amount of pollution a power plant will emit, then multiplying by the SCGHG as specified by the WUTC. This means the total cost of a resource has two components. First are the direct costs, including capital to build the plant, fuel to run it, and operations and maintenance expense to keep it operating. The second component of total cost is the externality cost of pollution — it is called an externality because it is not internal to the utility's cost structure. When we develop a lowest reasonable cost portfolio, PSE includes both the direct and externality costs to estimate the cost of all fossil fuel generation.

Figure 5-1: Total Cost Equation

Total Cost = Direct Cost + Externality Cost

CETA requires utilities to consider SCGHG when deciding whether to acquire a resource, not as a variable cost in deciding whether to run a unit once it has been acquired. PSE's portfolio modeling relies on a total cost of a resource to meet both hourly loads and peaks and does not rely on the levelized cost of energy (LCOE) for modeling resource additions and retirements. A full explanation of how the portfolio evaluates total resource costs is included in the 2021 IRP, Appendix G. Therefore, PSE forecasts the total cost of fossil fuel generation under CETA which requires a two-step approach:

1. Estimate Direct Costs: Forecast fixed and variable operating costs based on economic dispatch of the fossil fuel plant. This must be based on how the unit is expected to dispatch. The analysis reflects all internal costs. It also provides a forecast of greenhouse gas pollution that will be emitted (in tons) by that expected operation.

2. Estimate Externality Costs: From step 1, apply the SCGHG to the tons of emissions, based on how we expect the plant operate.

During development of the 2021 IRP, stakeholders requested PSE examine the implications of reflecting the SCGHG as a dispatch cost, rather than as an externality adder. Doing so understates the amount of greenhouse gas pollution that will be emitted. This bias will make fossil fuel plants appear more cost effective than appropriate, i.e., this methodology encourages utilities to acquire fossil fuel plants. Table 5-2 compares the total cost of a combined cycle gas plant under two scenarios. The first scenario uses the two-step process, where the gas plant is economically dispatched as it will be, without the SCGHG as a variable cost. We add the externality costs of the resulting pollution based on expected consumption of fossil fuel. Scenario 2 includes the social cost of carbon as a dispatch cost, or cost penalty to dispatch. The costs are from the portfolio model and used for the resource evaluations. Table 5-2 compares the results of the two scenarios. Scenario 1 is how the plant would operate.

[65] See RCW 19.280.030

Scenario 2 shows a much lower dispatch, which means lower fuel costs and lower pollution cost. Logically, these are not equally valid cases — Scenario 1 represents how the plant will operate. This example illustrates if PSE incorporated the SCGHG in economic dispatch for making resource decisions — but not in operation — natural gas plants would look lower cost than they will in operation. Incorrectly applying the SCGHG as a dispatch cost understates greenhouse gas emissions by nearly 60 percent. In total, this approach makes base load gas plants appear 20 percent less expensive than they will in actual operation. PSE believes such an artificial bias toward fossil fuel plants is clearly inconsistent with the need to reduce GHG emissions and contrary to the intent of CETA.

Table 5-2: SCGHG as a Dispatch Cost Artificially Makes Gas Plants Appear More Cost Effective

	Scenario 1	Scenario 2	Comparisons	
Direct Costs	Cost and Emission Forecasts based on Expected Operation	Cost and Emission treating SCGHG as Dispatch Cost	Direct Cost Understated	%
Levelized Capital $ (Gas CCCT)	$85,511,000	$85,511,000	$ -	0%
Fuel Cost	$22,406,810	$10,277,184	$(12,129,626)	-54%
All Other O&M	$ 83,172,706	$78,799,839	$(4,372,867)	-5%
(a) Direct Cost of Operation	$191,090,516	$ 174,588,023	$(16,502,494)	-9%

Externality Costs			Externality Understated	%
Emissions (tons)	637,920 Tons	272,455 Tons	(365,465)	-57%
SCGHG ($/ton)	$89.17/Ton	$89.17/Ton		
(b) Externality Costs	$56,883,799	$24,295,000	$(32,588,799)	-57%

			Total Cost Understated	%
Total Costs (a) + (b)	$247,974,316	$198,883,023	$(49,091,293)	-20%

Specific Costs for the Transition to Clean Energy

From 2022–2025, a connected set of investments will allow PSE to meet the specific and interim CETA targets and ensure we achieve customer benefits in the process. This section discusses the costs for the 2022–2025 period within each investment category.

Energy Efficiency: Energy efficiency has a four-year incremental cost of $150,279,000. We calculated incremental costs based on the average cost of savings in the 2022–2023 Biennial Conservation Plan (BCP) and multiplied them by the increased amount of energy efficiency in the CEIP portfolio vs. the baseline portfolio. For example, assuming that the unit cost per savings from the BCP is $100/MWh,

and the energy efficiency level in the CEIP portfolio is 10,000 MWh above that of the baseline portfolio, then the incremental cost in this scenario will be $100 times 10,000, which equals $1,000,000. We allocated the amount of energy efficiency based on the EIA target setting method, which took 20 percent of the total 10-year savings in IRP plus five percent decoupling commitment. We provide more information on energy efficiency costs in Appendix E.

Demand Response: Demand response has a four-year incremental cost of $4,080,003. We based these costs on the generic program costs included in PSE's most recent conservation potential assessment. We calculated incremental costs based on the difference between program costs for the demand response amounts in the baseline and CEIP portfolios. The program costs were prorated based on the forecast demand response targets in the baseline and CEIP portfolios, which represented the total energy level of all the active demand response programs selected in each portfolio. For example, assuming that the target of the baseline is 30 percent of that in the CEIP portfolio, and the cost of the CEIP portfolio is $10 million based on Aurora output, then the cost of the baseline portfolio will be 30 percent of $10 million. The incremental cost in this scenario will be $10 million minus $3 million ($10 million times 30 percent), which equals $7 million. We provide more information on demand response costs in Appendix E and Appendix F.

We will identify updated costs when we choose specific resources and programs from the 2021 All-Source, and the 2022 Targeted DER RFPs. We will incorporate these selected resources and their associated resource and program costs in the 2023 IRP progress report and 2023 biennial CEIP update.

Energy Supply Portfolio, including Generation Resources and Storage: Energy Supply Portfolio has a four-year incremental cost of $200,840,460. We calculated incremental costs based on the difference between the generation portion of the baseline and the CEIP portfolio. We isolated the generation costs by providing an AURORA capacity expansion and dispatch of the baseline portfolio, but with the energy efficiency and demand response amounts held at the same amount in the CEIP and baseline portfolios. This method allowed us to consider only the difference in generation costs between the two portfolios. This approach isolated the changes in energy supply cost from any changes in energy efficiency and demand response. The approach for specific resources is described in the following sections.

Renewable Energy: A wide range of activities contribute renewable energy to PSE’s energy supply portfolio, as we discuss in Chapter Four.

PSE used several sources of cost data for renewable energy programs to develop this CEIP. For large-scale generating resources, we used NREL’s most recent Annual Technology Baseline (ATB) report cost assumptions, which are included in Appendix A.

For distributed energy resources, PSE commissioned more program-specific cost estimates from Black & Veatch that fully captured the costs of resources and program operations. We include these program-level cost estimates in Appendix K. To identify the combined costs of specific portfolios of resources,

PSE used the AURORA model, which was updated to incorporate the more specific distributed energy resource costs.

We will identify updated costs when we choose specific resources and programs from the 2021 All-Source, and the 2022 Targeted DER RFPs. We will incorporate these selected resources and their associated resource and program costs in the 2023 IRP progress report and 2023 biennial CEIP update.

Energy Storage Resources: PSE commissioned Black & Veatch to complete a study of equipment and program costs for distributed energy storage resources to provide a current view of the total anticipated costs of a mix of utility-owned and customer-owned energy storage resources. Based on their mix, we fed the costs of these programs into the AURORA modeling to calculate their part of the overall energy supply portfolio. We detail the costs of these resources and the program costs in Appendix K and Appendix E.

We will identify updated costs when we select specific resources and programs from the responses to our 2021 All-Source, and the 2022 Targeted DER RFPs. We will incorporate these selected resources and their associated resource and program costs in the 2023 IRP progress report and 2023 biennial CEIP updates.

Resource Enablement and Delivery

DER Enabling Systems: In Chapter Four we describe how we will sequence enabling strategies, tools, and functions so PSE can effectively operate distributed energy resources at scale. This process includes systems to operate and implement distributed energy resources.

Transmission: During the time covered by this 2021 CEIP, PSE may acquire additional transmission rights to deliver utility-scale resources to our electric service territory. We may also use our existing transmission rights to support the delivery of new renewable resources. In the 2021 All-Source RFP, PSE specifically sought renewable resources that meet both scenarios.

To estimate costs in this CEIP, PSE relies on the transmission costs used in the 2021 IRP. We include incremental transmission costs in the energy supply portfolio calculation, as the assumed transmission costs are part of the resource costs. We include the generic transmission estimates used in the 2021 IRP in the resource costs for this projection. As we select specific resources through the 2021 All-Source and 2022 Targeted DER RFPs process, we will detail revised enablement and transmission costs in the 2023 IRP progress report and biennial CEIP update.

Grid Modernization Costs: The CEAP, based on the 2021 IRP preferred portfolio, identified a significant number of DERs needed by 2030 to cost-effectively implement the goals of CETA. In total, 634 MW of distributed batteries, solar, and demand response are needed within PSE's service territory by 2030. In the CEIP, we set a target of 105 MW of distributed resources; this is over two times the 52 MW of DERs that PSE has integrated into the grid over the last four years. PSE's grid modernization investments were keeping pace with the economic driven customer adoption of DERs across the grid,

but the pace of DERs driven specifically by the CETA law and policies necessitate an acceleration of some programs.

This CEIP sets specific distributed energy resource targets in Chapter Two and outlines related grid modernization activities in Chapter Four. These related grid modernization activities are one small part of PSE's overall grid modernization strategy. More details of the grid modernization strategy are included in Appendix G.

To accommodate the rapid increase in DERs the grid will need to support over the next 10 years, PSE must accelerate portions of grid modernization investments to match that pace. The overall target over the next five years is to enable five percent of distribution circuits (~55) to be ready to support high penetrations of DERs in the range of 2–5 MW per circuit. To ensure the grid can support this while continuing to deliver reliable and resilient power to customers, we accelerated specific investments and identified new ones. This included:

- Enhancing the substation control and data acquisition (SCADA) system equipment at substations to support DER high penetration circuits, increasing work plan by over 60 percent over the historical pace.
- Enhancing circuit visibility and control by installing additional voltage regulation and automated circuit switching equipment on DER high penetration circuits; we added 100 percent of this work plan to address the consequences of this penetration.
- Enhancing access to gathered data to drive analysis and process for many operational tools and investment decisions, increasing focus by 50 percent. Enhancing resilience focused on proactive, high-risk grid monitoring and associated DER microgrid installations to enable alternate sources of power for customers with limited grid flexibility, increasing work plan by 70 percent to focus more aggressively on these valuable customer benefits.

There are grid modernization tools and associated costs that are critical to CEIP implementation but are not included as incremental costs because they are investments that PSE will make to improve systems regardless of CETA requirements. For example, transmission capacity investments in compliance with the North American Electric Reliability Corporation (NERC) reliability standards are required to deliver the increased load and provide the flexibility and reliability that will be needed with the proliferation of DERs and electric vehicles. Power must still flow along lines and those transmission and distribution lines must be reliable. These investments are intentionally not included in the incremental costs for CETA.

PSE's 2021 IRP, Chapter Eight and Appendix M, recognized the important investments in the grid to enable this transition and avoid reactive expenditures to accommodate unanticipated growth in distributed energy resources[66]. The CEAP reaffirms the 10-year plan for the deliverability of

[66] RCW 19.280.100(2)(e)

resources[67]. PSE's entire grid modernization investments drive progress in visibility, analysis, and control; reliability and resiliency; DER integration processes; security, cybersecurity, and privacy; and backbone infrastructure.

PSE's CEIP must consider these foundational investments and sustain and advance programs and plans associated with PSE's entire grid modernization investments. The 2021 CEIP is mindful of the risk to clean energy delivery if the overall grid modernization approach is not on track, even though a small part of it is included in the actual incremental costs for this CEIP.

Customer Management Costs

Implementation of CETA requires a range of customer programs and administrative functions.

Customer Education and Engagement. CETA creates significant new requirements for customer education and engagement to support customer benefit indicators[68], in the development of the CEIP[69], implementation of the plan[70], and through customer notices[71]. As we developed this CEIP, stakeholder and customer feedback focused on the need for customer education. CETA also requires ongoing customer engagement with all customers and members of highly impacted communities and vulnerable populations through education about clean energy. We include PSE's public participation plan as Appendix C. We detail cost estimates for the work in Appendix E.

Monitoring and Reporting. Implementing CETA includes several critical administrative activities, including tracking progress toward energy goals, the performance of customer benefit indicators, tracking costs, and reporting. We developed a forecast of the costs of these activities based on our experience with other programs and include it in Appendix E.

Summary of Incremental Cost Projection

We summarize the incremental cost of the actions in this plan compared to the baseline portfolio in Table 5-3. We developed these incremental costs using the projection, allocation, and modeling methodologies described in this section and include detailed spreadsheets in Appendix E. Consistent with WAC 480-100-660(4), we compared the projected cost to PSE's projected weather-adjusted sales revenue.

[67] 2021 IRP; pg. 2-20
[68] WAC 480-100-640(4)(c)
[69] WAC 480-100-655(2)
[70] WAC 480-100-655(2)
[71] WAC 480-100-655(3)

Table 5-3: Incremental Cost Summary

			2022	2023	2024	2025	2022–25 Incremental Cost	Percent Forecast
Estimated Incremental Cost Calculation ($000)								
Energy Efficiency								
No CETA Requirements	662,048	MWh through 2025	$64,352	$64,352	$64,352	$64,352		
With CETA Requirements	*1,048,831*	MWh through 2025	$101,922	$101,922	$101,922	$101,922		
Incremental Cost			$37,570	$37,570	$37,570	$37,570	$150,279	33%
Demand Response								
No CETA Requirements	7	MW by 2025	$100	$296	$365	$915		
With CETA Requirements	24	MW by 2025	$342	$1,018	$1,253	$3,142		
Incremental Cost			$242	$722	$888	$2,228	$4,080	1%
Energy Supply Portfolio								
No CETA Requirements	1081	aMW in 2025	$561,731	$588,959	$586,771	$585,728		
With CETA Requirements	1316	aMW in 2025	$562,142	$600,124	$661,577	$700,186		
Incremental Cost			$412	$11,165	$74,806	$114,458	$200,840	45%
Technology and Enabling Costs for Distributed Energy Resources								
No CETA Requirements			$135,957	$258,264	$307,597	$320,903		
With CETA Requirements			$146,728	$305,044	$358,249	$376,526		
Incremental Cost[72]			$4,075	$10,785	$16,969	$23,321	$55,150	12%
Customer Education and Outreach								
No CETA Requirements								
With CETA Requirements			$960	$9,830	$10,215	$10,406	$31,410	
Incremental Cost			$960	$9,830	$10,215	$10,406	$31,410	7%
Administration and Reporting								
No CETA Requirements								

[72] The incremental cost of DER enablements and Grid Mod is not calculated as the delta between No-CETA and With-CETA requirements. These two requirements capture the capital costs from a budget view, while the incremental cost is in revenue requirement view. The values can be seen in Appendix E.

With CETA Requirements			$2,058	$2,110	$2,162	$2,162	$8,547	
Incremental Cost			$2,058	$2,110	$2,162	$2,162	$8,547	2%
Total Cost			**$814,151**	**$1,020,048**	**$1,135,379**	**$1,194,399**		
Total Incremental Cost Forecast			**$45,317**	**$72,182**	**$142,611**	**$190,198**	$450,306	100%

Calculation of Annual Threshold Amount

WAC 480-100-660 (2) specifies the means to identify the annual threshold amount, which is used to determine eligibility for reliance on RCW 19.405.060(3) for compliance. WAC 480-100-660(4) requires a projection of this amount be filed in the CEIP.

The annual threshold amount is specified by rule as:

$$Annual\ Threshold\ Amount = \frac{(WASR_0 \times 2\% \times 4) + (WASR_1 \times 2\% \times 3) + (WASR_2 \times 2\% \times 2) + (WASR_3 \times 2\%)}{4}$$

This calculation shows the annual threshold amount increases two percent above the previous year's spending and compounds over the four-year period. For the purposes of projecting the annual threshold amount, we assume a baseline of adjusted electric sales from PSE's 2020 Commission Basis Report, which includes weather normalization. For the purposes of this projection, we assume weather-adjusted sales revenue will rise at an inflation rate of 2.5 percent per year.

Many factors affect weather-adjusted sales revenue, including changes in sales volumes unrelated to weather, changes in wholesale energy markets typically reflected in PSE's annual PCA filing, changes in conservation costs, changes in tax rates, and other rate variations. PSE does not control these factors, so it is impossible to forecast weather-adjusted sales revenue accurately. PSE will track actual costs and weather-adjusted sales revenues during the implementation period.

Table 5-4: Calculation of Annual Threshold Amount and Comparison to Incremental Cost

		2021	2022	2023	2024	2025
Calculation of Estimated 2 Percent in Weather-adjusted Sales Revenue ($000)						
PSE 2020 Retail Sales to Customers	$1,988,341					
Escalated at 2.5% per year	$0	$2,038.050	$2,089,001	$2,141,226	$2,194,757	$2,249,626
2% of Previous Year's Forecasted Weather-adjusted Retail Sales			$40,761	$41,780	$42,825	$43,895
Compounding Effect for 2 percent Annual Increase in Weather-Adjusted Sales Revenue			--	$815	$1,651	$2,507
Estimated 2% Annual Increase in Weather-adjusted Sales Revenue			$40,761	$42,595	$44,475	$46.402
Cumulative Estimated 2% Annual Increase in Weather-adjusted Sales Revenue			$40,761	$83,356	$127,832	$174,234
Comparison of Forecast Incremental Cost and Estimated 2% Increase in Weather-adjusted Sales Revenue						
Estimated Incremental Cost			**$45,3117**	**$72,182**	**$142,611**	**$190,198**
Annual Comparison to 2% threshold value			**$4,556**	**-$11,174**	**$14,779**	**$15,964**
Cumulative			**$4,556**	**-$6,619**	**$8,160**	**$24,124**