Customer benefit indicator metrics

For the 2021 Draft CEIP, PSE developed draft customer benefit indicators as seen in Figure H-1. With the help and guidance of the third-party consultant DNV Energy USA Inc. (DNV), PSE has developed potential metrics and data sources for each customer benefit indicator. As of the final CEIP, PSE is still evaluating data availability for the potential metrics, as well as other regulatory requirements and policies that would apply. These include SB 5126, passed by the Washington State Legislature in 2021, as well as WUTC and other rules around data collection and privacy.

These indicators will be used to forecast the distribution of benefits and measure progress over time. The purpose of this Appendix H is to outline each metric, an equation to calculate, the expected data source, and expected impact to customers. Data availability and relevancy will evolve over time, and changes to how metrics are measured will be required.

Some of the metrics rely on customer data, which may be already held by PSE, publicly available, or available for purchase. Prior to establishing any measurements of customer information, PSE must carefully evaluate relevant privacy requirements, policies, regulatory requirements, and stakeholder perceptions.

Other metrics rely on data that PSE already reports, sometimes in multiple different ways depending on the reporting requirement or agency. Clarity in measurement and reporting will be important for these areas.

Finally, some of the potential metrics considered as options in the attached report are not in common use in the northwest region today, and further evaluation will be needed to identify if they are applicable or if better metrics are available.

Table H-1: Draft customer benefit indicators and metrics

CETA Category	CBI	Metric
Energy benefits Non-energy benefits Burden Reduction	Improved participation in clean energy programs from highly impacted communities and vulnerable populations	Increase percentage of participation in energy efficiency, demand response and distributed resource programs or services by PSE customers within highly impacted communities and vulnerable populations Increase percentage of electricity generated by distributed renewable energy projects
Non-energy benefits	Increase in quantity and quality of clean energy jobs	Increase quantity of jobs based on: • Number of jobs created by PSE programs for residents of highly impacted and vulnerable populations • Number of local workers in jobs for programs • Number of part-time and full-time jobs by project Increase quality of jobs based on: • Range of wages paid to workers • Additional benefits offered • Demographics of workers
Non-energy benefits	Improved home comfort	Increase total dollar in NPV in NEI benefits for EE programs.

CETA Category	CBI	Metric
Reduction of burdens	Increase in culturally- and linguistically-accessible program communications for named communities	Increase outreach material available in non-English languages
Cost Reduction Burden Reduction	Improved affordability of clean energy	Reduce median electric bill as a percentage of income for residential customers Reduce median electric bill as a percentage of income for residential customers who are also energy-burdened
Environment	Reduced greenhouse gas emissions	Reduce PSE-owned electric operations metric tons of annual CO2e emissions Reduce PSE contracted electric supply metric tons of annual CO2e emissions
Environment Risk Reduction	Reduction of climate change impacts	Increase avoided emissions times social cost of carbon
Public Health	Improved outdoor air quality	Reduce regulated pollutant emissions (SO2, NOx, PM2.5)
Public Health	Improved community health	Reduce occurrence of health factors like hospital admittance and work loss days
Resilience	Decrease frequency and duration of outages	Decrease number of outages, total hours of outages and total backup load served during outages using SAIDI and SAIFI Reduce peak demand through demand response programs
Risk reduction Energy security	Improved access to reliable clean energy	Increase number of customers who have access to emergency power

MEASUREMENT OF DRAFT CUSTOMER BENEFIT INDICATORS - OUTLINE IMPROVED AFFORDABILITY OF CLEAN ENERGY

Customer Benefit Indicator Categories

Burden Reduction. For the purposes of this metric, we consider median electric bill as a percentage of income for residential customers and the median electric bill as a percentage of income for residential customers who are also energy-burdened.

Applicable population

This metric applies to all residential PSE customers, including highly impacted communities and vulnerable populations.

Examples

Stakeholder Example Question: Does the program decrease the percentage of customers' income dedicated to electric energy costs?

Example: Rooftop solar incentives Program. In an example where PSE provides subsidies to customers for the installation of solar, this would reduce the customer's annual electric energy bill and would increase the affordability of clean energy.

Metric

This metric will measure the median electric bill as a percentage of income for residential customers and the median electric bill as a percentage of income for residential customers who are also energy-burdened. The metric can be calculated and presented for the following populations:

- **All Residential PSE customers**
- **Highly Impacted Communities**
- **Vulnerable Populations**

Measurement

Table 1 below presents the affordability calculation. To determine whether affordability is increasing or decreasing over time, PSE should calculate this measurement for residential program participants over time.

Table 1: Affordability Calculation

Title	
Median electric bill as a percentage of income for residential customers	The median electric bill as a percentage of income for residential customers in all PSE electric residential customers, vulnerable populations or highly impacted communities
Median electric bill as a percentage of income for residential customers who are also energy-burdened	The median electric bill as a percentage of income for residential customers who are also energy-burdened for cusomters in all PSE electric residential customers, vulnerable populations or highly impacted communities

Issues and Data Gaps

Issue 1: Delay in Census Tract Data Availability. Census tract-level income data from the ACS 5-year rollup has about a 2-year lag in reporting.

> **Risk Mitigation Recommendation.** Use purchased household income data, or PSE would have to use slightly outdated income data for census tract.

Data Sources

Table 2 presents the data sources needed to calculate affordability of clean energy. Note that we present three possible data sources for household income. The first source is household income data purchased by PSE. The second is ACS data, which are easily accessible but naturally do not provide individual household income. Nevertheless, ACS data would allow PSE to compare the bill reduction and the affordability of clean energy by census tract. A more granular assessment of the metric would include collecting customer self-reported income. One direct way that PSE can collect this information is to request it on the customer's program application. Collection of customer data should be evaluated carefully, with stakeholder input, and also with consideration given to privacy issues and applicable regulatory requirements.

Other data sources may be available and PSE should continue to update data sources over time.

Table 2: Data Sources to Calculate Energy Burden

Category	Dataset	Source	Units	Source Reporting	Date of Release	Estimated Cost to Collect
Participant Identification	Program participation	PSE Program Tracking Database	T/F	Annually	TBD - PSE	$1,600 - $4,000
	PSE Customers	PSE Customer Database	Utility meter	Annually	TBD - PSE	$1,600 - $4,000
Energy Cost	Electricity cost	PSE Customer Billing Data	$/year	Annually	TBD - PSE	$1,600 - $4,000
Household Income	Option 1. Household income	Data purchased by PSE	$/year	Annually	TBD - PSE	$4,000 - $8,000
	Option 2. Average and Median household income by census tract	ACS (American Community Survey) 5-Year Estimates Subject Table S1901	$/year	Annually	December 9 of following year	$1,600 - $4,000
	Option 3. Self-reported income	Collect During Program Sign Up	$/year	Annually	TBD-PSE	Unknown

Expected Program Impact on Metric

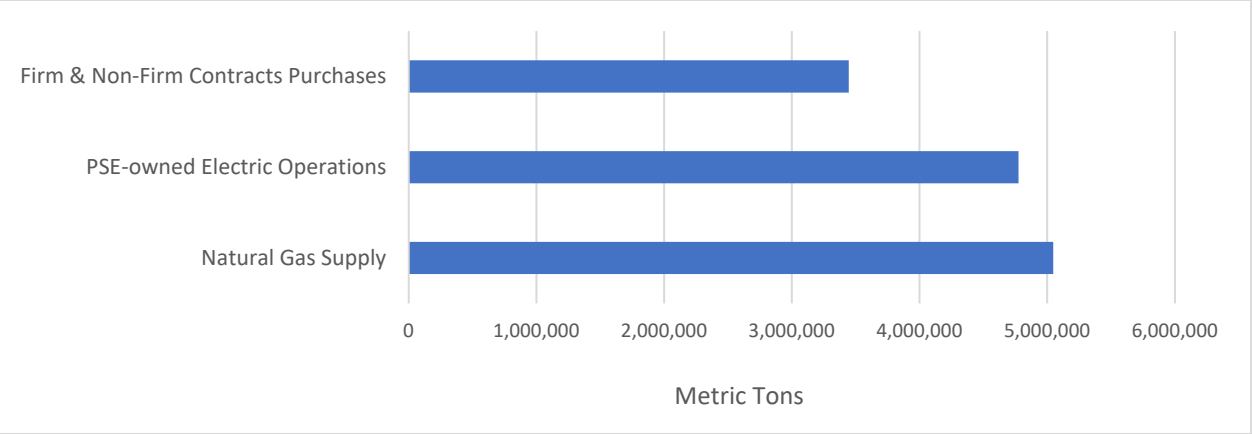
Overall, CETA is expected to increase customers' bills over time. PSE lacks control over factors that may impact customer incomes, such as a recession or another pandemic.

REDUCED GREENHOUSE GAS EMISSIONS

Customer Benefit Indicator Categories

Environment. This metric will measure the extent that PSE's programs are affecting greenhouse gas (GHG) emissions. The resulting reduction of GHGs will directly support the environment and are in synergy with Washington's larger umbrella climate policies such as the Clean Energy Transformation Act (CETA). As established by CETA, PSE will be eliminating coal-fired electricity by or before 2025, reach carbon neutrality by or before 2030, and eventually deliver 100% renewable or non-emitting electricity by 2045. While PSE is transforming its supply, it will need to simultaneously accommodate added load due to buildings and transportation electrification efforts. Figure 2 presents PSE's CO_{2e} emission inventory by emissions source for 2020, which totaled just over 13 million metric tons. Ultimately, this metric will measure the GHG impacts of each PSE program individually and in aggregate.

Figure 2: PSE 2020 CO_2 Emissions Inventory



Source: PSE Greenhouse Gas Inventory, 2020 (https://www.pse.com/en/pages/greenhouse-gas-policy)

Applicable Population

GHG emissions and resulting climate change affect the entire planet, and although there may be differences in the effect of climate change in localized areas, this metric will not track those downstream effects of climate change. PSE can use this metric to measure avoided emissions due to EE, DR and DER programs as well as utility scale resource emissions and PSE contracted electric supply metric tons of annual CO2e emissions.

Examples

Stakeholder Example Question: Does the program reduce air pollution by decreasing carbon emissions?

Example: DER + Storage with Remote Dispatch Program. In an example where PSE administers a program that incentivizes customers to give PSE the ability to charge and dispatch their distributed storage capacity to support PSE's energy/demand costs and GHG impacts, this metric will calculate the impact that the program's remote dispatch activities had on GHG emissions by quantifying the impact using marginal emission rates.

Metric

This metric can be calculated at four levels of granularity as follows:

- **Energy Efficiency:** This is a future use metric. Depending on the technology available, PSE would measure the total energy saved by EE measures and determine how many metric tons of annual CO2 emissions were avoided.
- **Demand Response:** This is a future use metric. Depending on the technology available, PSE would measure the total energy saved by EE measures and determine how many metric tons of annual CO2 emissions were avoided.
- **Utility Scale Resources:** This represents the PSE-owned electric operations metric tons of annual CO2 emissions as well as the PSE contracted electric supply metric tons of annual CO2 emissions (Total – Firm and Non-Firm Contracts Purchases).
- **Distributed Resources:** This is a future use metric. Depending on the technology available, PSE would measure the total energy saved by EE measures and determine how many metric tons of annual CO2 emissions were avoided.

Measurement

Table 3 below presents one approach to calculate program impacts on greenhouse gases. The approach presented is a high-level annual GHG approximation that uses EPA's AVERT model based on annual avoided generation user inputs. The

equation shown in Table 3 represents the annual method of quantifying emissions reductions and is generally applicable to resources such as energy efficiency or solar that reduce net grid-supplied kWh consumption. The first step is to estimate the amount of energy the clean energy programs saved or generated over the course of the program year. The second step is to use the AVERT tool to provide annual GHG reductions based on avoided conventional energy production.

With the passage of the Climate Commitment Act (CCA) in Washington in 2021, the CCA rulemaking will define potentially different emissions measurement approaches. In addition, PSE already reports greenhouse gas emissions as required under EPA and Washington State regulations. There is an option presented here, but as the regulatory requirements of different programs become clearer, the measurement and reporting should align with these regulatory requirements.

Table 3: Reduced Greenhouse Gas Emissions Calculation

Title	Notes
Annual Avoided Emissions [CO_{2e}/year]	*AVERT = EPA tool that estimates annual CO_{2e} reductions based on Avoided Generation input* $AG_{(u,y)}$ = Avoided Generation by Participant, Program, and/or PSE per Year

Issues and Data Gaps

Table 4 below presents data sources for an annual approach to calculate GHG reductions. As shown, the annual approach can be calculated using tracking data. PSE may also use annual greenhouse gas inventory report to use as a benchmark to the results of this calculation.

Table 4: Data Sources for Calculating Reduction in Greenhouse Gas Emissions

Category	Dataset	Units	Source	Source Reporting	Date of Release	Cost
Annual Avoided Generation	Renewable Energy Generated	MWh/year	PSE Program Tracking Data	Annually	TBD - PSE	$1,600 - $4,000
	Energy Storage Dispatched	MWh/year		Annually	TBD - PSE	$1,600 - $4,000
	Peak Demand Savings	MWh/year		Annually	TBD - PSE	$1,600 - $4,000
	Energy Efficiency Savings	MWh/year		Annually	TBD - PSE	$1,600 - $4,000
PSE GHG Reports	Emissions Rate of PSE Generation	tons CO2/kWh	PSE Greenhouse Gas Inventory	Annually	TBD - PSE	$1,600 - $4,000

†Depending on data quality, this cost may be higher

Expected Program Impact on Metric

Solar PV, demand-response/load flexibility, and energy efficiency resources will reduce CO_2. While all distributed resources have the potential to reduce GHGs, storage will not always reduce marginal emissions. If customers use storage to capture arbitrage opportunities or reduce demand charges, or if PSE uses storage to reduce wholesale electricity costs, this calculation may reveal that marginal GHGs stay neutral or may even increase. PSE therefore may wish to consider using marginal emissions forecasts to inform storage dispatch optimization algorithms.

Energy storage impacts emissions at the grid level by increasing or decreasing net demand on a marginal basis, i.e. conceptually impacting whether the marginal power plant operating (the last power plant in the plant "stack") ramps up or down

with respect to grid demand. The marginal power plant in the stack tends to be the least efficient, most costly to run, and highest emitting. When storage charges it conceptually increases demand from this marginal power plant thereby increasing emissions, and when storage discharges it decreases demand from this last power plant. The marginal power plant operating changes frequently throughout the day, at an hourly or shorter time interval. If energy storage tends to charge when the marginal power plant is a relatively low emitter of GHGs (e.g. during daytime when solar plants are operating, or when hydro or wind is operating) and discharge when the marginal power plant is a relatively high emitter of GHGs (e.g. during peak periods of demand, late afternoons or evenings), storage can effectively reduce net emissions from marginal power plants for a given time period, when taking into account energy storage efficiency losses.

However, battery operational software that is programmed to decide when to charge and discharge energy storage projects is often based upon economic objectives and not GHG emission objectives. Maximizing economic gain (or utility bill savings for behind the meter projects) tends to be the driving factor. Retail tariffs (rate structure) tend to be relatively static in nature and designed to have some time sensitive economic structures (e.g. peak and off-peak rates) to incentivize changes in demand. Retail tariffs are typically designed based on average system characteristics like peak demand and are often immutable for years until periodic general rate cases making them hard to align with hourly, daily, or seasonal variations. Retail tariffs are not aligned with marginal GHG emission rates. When a battery is programmed to maximize return to the owner based on a retail tariff, the legacy retail tariff price signals may not incentivize the battery to charge when marginal emission rates are lowest and discharge when marginal emission rates are highest. The result can increase net emissions for the system even if the battery is operating optimally from an economic perspective.

IMPROVED OUTDOOR AIR QUALITY

Customer Benefit Indicator Categories

Public Health. Recent studies have suggested that regional territories can save millions of dollars through renewable energy and energy efficiency resources.[1] As PSE's meets the CETA requirements, reduced fossil fuel use in electric generation decreases emissions, increasing outdoor air quality, which will directly benefit public health. This metric will quantify the reduction of PM2.5, SO_2, and NOx, the conventional generation emissions that contribute to poor outdoor air quality and impact public health. The net impacts of transportation electrification on these emissions will also be measured, when these projects are included as part of PSE's future Clean Energy Implementation Plan.

Applicable Population

This benefit will affect all customers and may more specifically benefit customers living in highly impacted communities with worse air quality. This may also impact people outside PSE's service territory as energy sources used for PSE's electric supply include some outside PSE's electric service territory.

Examples

Stakeholder Example Question: Does the program improve outdoor air quality?

Example: PV Program. A program that installs PV capacity will reduce the need to supply that electricity from conventional generation. This metric will estimate the improvement in outdoor air quality due to the reduced conventional electricity generation.

Metric

This metric can be calculated as follows:

[1] https://www.hsph.harvard.edu/news/hsph-in-the-news/renewable-energy-projects-can-improve-health/

- **PSE Customers.** Metric tons of annual PM2.5, SO_2, and NOx emissions from resources that serve PSE load
- **PSE Customers:** Metric tons of avoided annual PM2.5, SO_2, and NOx emissions from resources that serve PSE load

Measurement

Table 5 presents the calculation to measure PSE's program improvements on outdoor air quality.

Table 5: Improved Outdoor Air Quality Calculation

Title	Notes
Annual Avoided AQ Emissions [PM2.5,SO_2, NO_x/year]	This will use PSE emissions data and data from EE, DER, and DR programs to calculate avoided emissions

Measuring this indicator first requires estimating the annual energy saved or generated from the programs being evaluated. The next step is to identify the marginal generating units and associated emissions characteristics, expressed as an emissions factor for each pollutant in kilograms per Megawatt-hour (kg/MWh). Emissions factors can be adopted from the EPA Avoided Emissions and generation Tool (AVERT). This methodology is computationally simple and requires less labor and data than other analysis types, however it is somewhat insensitive to the dispatch process. Total emissions reductions are calculated by applying the emission factors from AVERT to the avoided generation from clean energy programs. Alternatively, the emissions can be tracked by measuring them directly at PSE generation facilities.

Issues and Data Gaps

Issue 1: Lack of Localized Measurement. EPA AVERT tool provides outputs at the county level, which may not be granular enough to determine effects in named populations. Further, this does not reflect the full range of supply portfolio issues, such as from power purchased on the wholesale market.

> **Risk Mitigation Recommendation.** PSE could consider how emissions overall will evolve as its electric portfolio changes. PSE could consider performing an analysis to develop scaling factors.

Data Sources

Table 6 presents the data sources to calculate reductions in PM2.5, SO_2, and NOx.

Table 6: Data Sources for Calculating Improvements in Outdoor Air Quality

Category	Dataset	Units	Source	Source Reporting	Date of Release	Estimated Cost
Annual Avoided Generation	Renewable Energy Generated	MWh/year	PSE Program Tracking Data	Annually	TBD - PSE	$1,600 - $4,000
	Energy Storage Dispatched	MWh/year		Annually	TBD - PSE	$1,600 - $4,000
	Peak Demand Savings	MWh/year		Annually	TBD - PSE	$1,600 - $4,000
	Energy Efficiency Savings	MWh/year		Annually	TBD - PSE	$1,600 - $4,000
PSE GHG Reports	Emissions Rate of PSE Generation	tons CO_2/ kWh	PSE Greenhouse Gas Inventory	Annually	TBD - PSE	$1,600 - $4,000

Expected Program Impact on Metric

Reductions in PM2.5, SO_2, and NOx emissions should follow similar trends to those reported in reductions in GHGs. As with GHGs, most resources will reduce these emissions, but PSE will need to monitor storage dispatch as dispatching to optimize cost may not always reduce emissions.

IMPROVED COMMUNITY HEALTH

Customer Benefit Indicator Categories

Public Health. Similar to improved outdoor air quality, this metric, improved community health, measures a PSE public health benefit. While the metric quantifying improvements to outdoor air quality focused on specific reductions in emissions, this metric uses those emissions reductions to quantify specific changes in health conditions, such as the instance and monetary value of asthma, heart disease, etc.

PSE is in the process of evaluating potential metrics for Community Health. As a baseline, PSE is looking at data from the Washington Department of Health hospital discharge rates, which is being used as a proxy for admission rates.

Applicable Population

This benefit will impact all customers. However, it will benefit customers who live in highly impacted communities and are close to emissions sources more than those further away.

Examples

Stakeholder Example Question: Does the program help abate health and safety issues related to poor air quality (e.g., asthma, heart disease)?

Example: PV Program. Similar to Section 4, improvements in outdoor air quality, this example considers a program that installs PV capacity will reduce the need to supply that electricity from conventional generation.

Metric

One metric that could be used is the PM2.5, SO2, and PM2.5 emissions outputs to calculate changes in outdoor air quality and measure the incidence and monetary impacts that PSE's program have on various health conditions. The metric can be calculated and presented for the following populations:

- **All Residential PSE customers**
- **Highly Impacted Communities**
- **Vulnerable Populations**

Health research has established relationships between air pollution and community health. Air pollution related health effects that can be quantified include: premature death (i.e., mortality), chronic and acute bronchitis, Non-fatal heart attacks, respiratory or cardiovascular hospital admissions, upper and lower respiratory symptom episodes, asthma-related health effects, asthma emergency room visits, minor restricted activity days, and work or school loss days.

PSE is in the process of evaluating other metrics related to community health. Currently, PSE is using hospital discharge information as a proxy for hospital admissions.

REDUCTION OF CLIMATE CHANGE IMPACTS

Customer Benefit Indicator Categories

Environment. Weather and climate have always been a major factor in power system planning. Climate change will alter climate and weather during the next decades and subsequently our power system. Climate change has both supply and demand-side impacts on our power system.

Risk reduction. This calculation provides a monetary amount to understand the social cost of carbon; a reduction in carbon emissions means a reduction in the effects of climate change.

Applicable Population

This metric applies to all PSE customers, and cannot be applied at a locationally granular level because the impacts of climate change such as rising temperatures, wildfire and drought do not have a local cause and effect. Rising temperatures are expected throughout the Pacific Northwest increasing air conditioning loads for all PSE customers. At the same time, decreasing summer rainfall due to climate change will decrease summer hydroelectric production. These issues affect all PSE customers similarly so we will not subset the population for this indicator.

Examples

Stakeholder Example Question: Does the program mitigate the impacts of climate change i.e. Wildfires, droughts?

Example #1: Wildfire Risk Mitigation. Distributed energy resources (DERs) can offset potential risks from long-distance transmission. Wildfires can interrupt service on transmissions lines, leading to lower reliability. Measuring the social cost of carbon can help quantify the value of reducing carbon using DERs.

Metric

We plan to measure our CO2 emissions in the social cost of carbon, as defined by the WUTC, in dollars as an indicator of reduction of climate change impacts.

- Total CO2 metric tons of carbon multiplied by the social cost of carbon, as defined by the WUTC, in dollars.
- EE programs avoided emissions multiplied by the social cost of carbon, as defined by the WUTC, in dollars.
- DR programs avoided emissions multiplied by the social cost of carbon, as defined by the WUTC, in dollars.
- DER programs avoided emissions multiplied by the social cost of carbon, as defined by the WUTC, in dollars.

Measurement

For each program, calculate the social cost of carbon, as defined by the WUTC, in dollars, by the avoided CO2 emissions for EE, DR, and DER, and times the CO2 emissions for the Utility Scale Resources.

We present a direct estimation method that relies on primary data in Table 7 below. This calculation will generally involve creating mathematical models of the affected loads before and after implementation of the program.

Table 7: Reduction of Climate Change Impacts Calculation

Title	Calculation
Social cost of carbon times emissions	Total metric tons CO2 emission multiplied by the social cost of carbon as defined by the WUTC for that specific year.
Social cost of carbon times avoided emissions for EE	Total metric tons avoided CO2 emission multiplied by the social cost of carbon as defined by the WUTC for that specific year.
Social cost of carbon times avoided emissions for DR	Total metric tons avoided CO2 emission multiplied by the social cost of carbon as defined by the WUTC for that specific year.
Social cost of carbon times avoided emissions for DER	Total metric tons avoided CO2 emission multiplied by the social cost of carbon as defined by the WUTC for that specific year.

Issues and Data Gaps

Determining the Baseline

In order to determine the impacts of the programs, a baseline must be developed for comparison for avoided emissions. It is difficult to calculate a counterfactual of what would have happened but for CETA regulations. One potential source of baseline data is to use the utility scale resource emissions per WAC 173-444 from year-to-year.

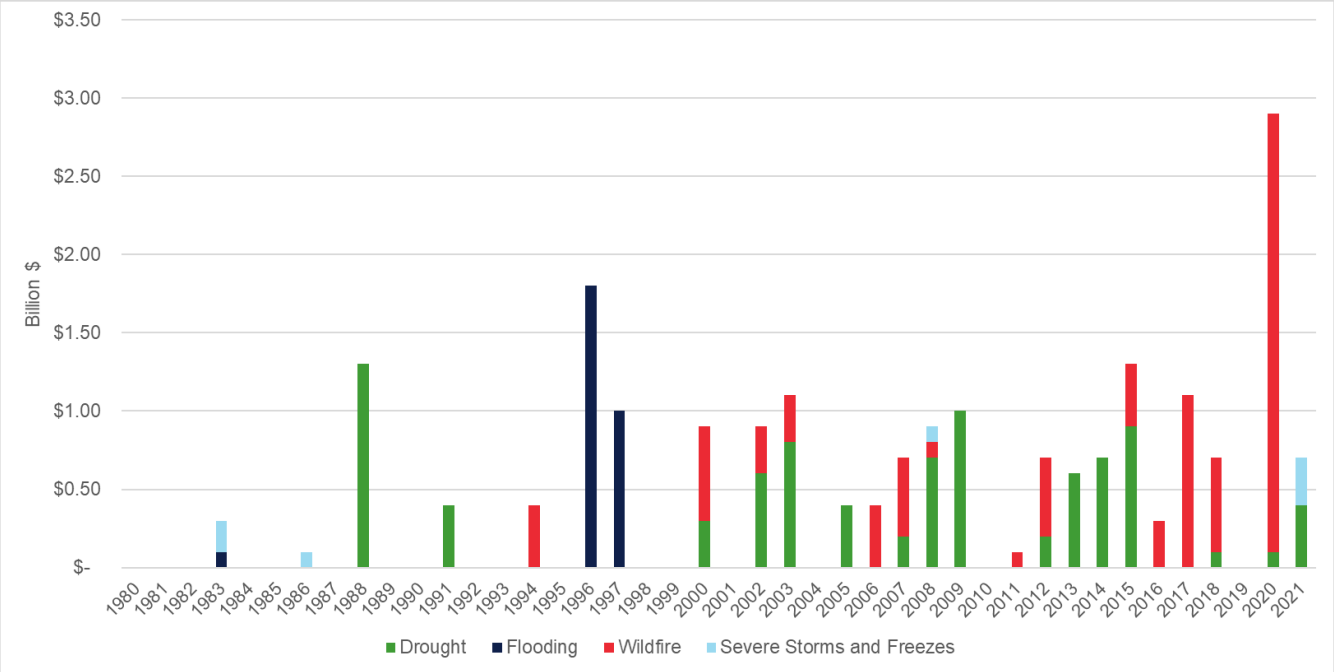
Expected Program Impact on Metric

The addition of EE, DER and DR programs is expected to reduce the total metric tons avoided CO2.

DECREASE IN FREQUENCY AND DURATION OF OUTAGES

Customer Benefit Indicator Categories

Figure 3: Cost of Extreme Weather Events in the Northwest Region



[2]

Resiliency. The DOE and other organizations have published several articles that advocate that utilities take specific steps to increase resilience to these events, including the number and duration of outages. This metric focuses on the degree to which PSE programs can specifically reduce customer outages. The next metric, Resilience, more fully covers elements that address community resilience.

Applicable Population

This metric applies to all PSE customers, highly impacted communities and vulnerable populations.

Examples

Stakeholder Example Question: How will PSE's programs contribute towards a decrease in frequency and duration of outages?

Example: Solar Plus Storage Program. The solar plus storage program would provide a source of backup power during these events.

Metric

This metric will measure frequency and duration of outages using SAIDI (the average duration (or length) of sustained interruptions per customer for the year) and SAIFI (the average number of sustained interruptions (or outages) per customer for the year. As a possible future metric, PSE would like to measure peak demand reductions through demand response programs. The metric can be calculated and presented for the following populations:

[2] https://www.ncdc.noaa.gov/billions/time-series

- **All Residential PSE customers**
- **Highly Impacted Communities**
- **Vulnerable Populations**

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Measurement

Table 8 below presents a series of measurements to calculate the decrease in number and duration of outages.

Table 8: Decrease in Number and Duration of Outages Calculation

Title	Notes
Average number of sustained interruptions per customer for the year	This is the SAIFI metric that is published on the WUTC's website.
Average Duration of Outages	This is the SAIDI metric that is published on the WUTC's website.
Peak Demand Through Demand Response Programs	This is a future measure based on DR programs.

Issues and Data Gaps

Issue 1: Counterfactuals are not necessarily clear. Outages can be driven by many causes, including weather, car accidents and many other causes. A historical baseline or other formulaic approaches must be determined to quantify reductions.

> **Risk Mitigation Strategy.** This approach also may require interaction with PSE system operation and planning teams to determine or at least approximate the counterfactual as a baseline.

Issue 2: Behind the Meter (BTM) Resource Data Not Necessarily Available to PSE. If PSE wishes to calculate storage-mitigated outages, they will not have access to battery dispatch data unless they have coordinated with battery vendors to have access to those data.

> **Risk Mitigation Strategy.** PSE should seek to include site-specific battery dispatch data transfers within contracts with participating vendors. If battery vendors are willing, able, and incentivized to provide each outage metric, this will be the easiest path for PSE to calculate this measurement. However, if battery vendors do not have full visibility into the customer's outage duration, these details may not be enough to calculate the full metric. If vendors cannot provide full calculated metrics, they should be able to provide battery state of charge, so PSE could align battery performance during known outages to calculate the metric. This, however, would complicate the calculation.

Data Sources

Table 9 below presents the data sources to use for this calculation.

Table 9: Data Sources for Calculating Decrease in Number and Duration of Outages

Category	Dataset	Units	Source	Source Reporting	Date of Release	Estimated Cost
Module 1: Outage Statistics	Average number of sustained interruptions per customer for the year	Average number	PSE Outage Data	Annually	TBD	$1,600 - $4,000
	Average Duration of Outages [hour]	Average Duration		Annually	TBD	$1,600 - $4,000

†Depending on data quality, cost may be higher

Expected Program Impact on Metric

We anticipate that storage programs participants should have less time without power during an outage compared to customers without energy storage. All PSE customers should have less exposure to supply related outages.

IMPROVED ACCESS TO RELIABLE CLEAN ENERGY

Customer Benefit Indicator Categories

Risk reduction. The continued rise in extreme weather events, from extreme heat and cold events to severe storms, sea level rise, and wildfires, puts PSE and its customers at increased risk of experiencing extended power outages. By providing customers with backup power during outages, PSE can reduce some of the risks associated with these events.

Energy security. In addition to climate change, this metric will also in part measure PSE's ability to provide customers with backup power potential in response to extreme weather events.

Where another metric accounts for the specific reduction in frequency and duration of specific outages, this metric interprets improved access to reliable clean energy through the lens of the number of customers who have access to emergency power. As described below, metric 8 quantifies the extent to which PSE can increase access to backup power for more of its customers.

Applicable Population

This metric applies to all program participants, including highly impacted communities and vulnerable populations.

Examples

Stakeholder Example Question #1: Does the program support an increase in improved access to reliable clean energy?
Stakeholder Example Question #2: Does the program improve or create multiple access points to distributed resources for residencies and communities to mitigate the impacts from outages?

Example: Storage as a Service Backup Power Program. If PSE installs a large backup power supply at a local school or community center, that facility will be able to provide backup power to a certain number of residents located near the facility. This metric will quantify the number of customers who have access to this facility's emergency power.

Metric

This metric will calculate the number of customers who have access to emergency power in their home or facility through net metering and battery storage.

The metric can be calculated and presented for the following populations:

- **All Residential PSE customers**
- **Highly impacted communities**
- **Vulnerable populations**

Measurement

Table 10 below presents the sets of possible calculations that PSE can use to represent this metric.

Table 10: Increased Resiliency Calculation

Title	Type of Program
Number of Customers with Solar + Storage	Net metering and Battery Storage [customer count]
Number of Customers in Highly Impacted Communities with Solar + Storage	Net metering and Battery Storage [customer count]
Number of Customers Vulnerable Populations Low with Solar + Storage	Net metering and Battery Storage [customer count]
Number of Customers Vulnerable populations Medium with Solar + Storage	Net metering and Battery Storage [customer count]
Number of Customers in Vulnerable populations High with Solar + Storage	Net metering and Battery Storage [customer count]

Issues and Data Gaps

Defining a community resilience hub or number of customers with access to (and knowledge of) one versus those that actually utilize one may be difficult metrics to confirm and are highly subjective. E.g., someone may come by to charge his or her phone for 30 minutes while someone else may sleep overnight. Is the value to each of those people different for this metric?

Issue 1: Challenges Identifying Number of People Served by Community Centers. Defining the number of people who have access to a community center with backup power will require estimating facility capacity through sources such as fire department occupation limits or collecting these data through the course of program administration. In addition, the number of people who have access to the facility does not account for the variation in the amount of time that residents will spend at the facility. For example, someone may come by to charge his or her phone for 30 minutes while someone else may sleep overnight.

> **Risk Mitigation Strategy.** One option would be to follow up with community resilience facilities following outages to estimate the number of customers who utilized the center during the outage.

Data Sources

Table 11 below presents the data sources to use for this calculation.

Table 11: Data Sources for Calculating Increased Resiliency

Category	Dataset	Units	Source	Source Reporting	Date of Release	Estimated Cost
Customers Served by Program	Number of customers with solar + storage	Count of Customers	PSE Tracking Data	Annually	TBD	$1,600 - $4,000
	Number of Customers in Highly Impacted Communities with Solar + Storage	Count of Customers		Annually	TBD	$1,600 - $4,000
	Number of Customers Vulnerable Populations Low with Solar + Storage	Count of Customers		Annually	TBD	$1,600 - $4,000
	Number of Customers Vulnerable populations Medium with Solar + Storage	Count of Customers		Annually	TBD	$1,600 - $4,000
	Number of Customers in Vulnerable populations High with Solar + Storage	Count of Customers		Annually	TBD	$1,600 - $4,000

Expected Program Impact on Metric

This metric will quantify the extent to which PSE programs provide customers backup power within their residence or at a community center. As customers utilize these centers to access power during an outage, it will be important for PSE to assess whether facility capacities are large enough to provide sufficient power resources to community members. For example, it is possible that customers wish to stay at facilities longer-than-expected to have sufficient and sustained power for work. It is also possible that as electric vehicle adoption enters a mass-market phase that customers will require charging infrastructure to power their vehicles. This metric as currently defined does not yet capture such nuances, although it is designed to add small additional statistics (e.g. backup EV charging station utilization) to assess whether facilities are delivering adequate services. Such additions can be made once programs are in place and PSE receives customer feedback.

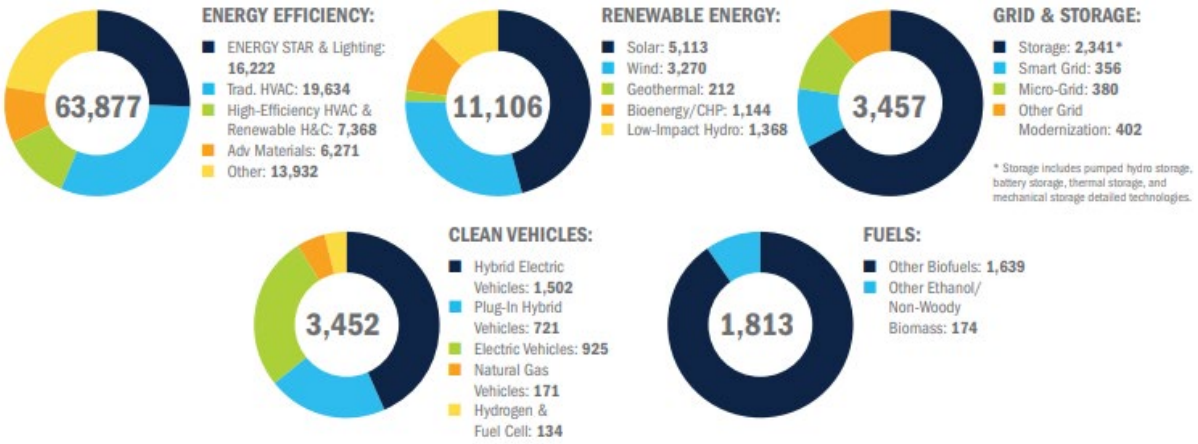
INCREASE IN QUANTITY AND QUALITY OF CLEAN ENERGY JOBS

Customer Benefit Indicator Categories

Non-energy benefits. One of the key benefits for PSE's clean energy programs is job creation. As Figure 4 shows below, E2 has reported in their annual report that clean energy industries created over 83,000 jobs in Washington statewide in 2019.[3] According to the report, over 36,000 of those jobs are in King County alone. PSE's ability to continue to induce the creation of these jobs and measure and report them will not only support accelerating and promoting these benefits, but also facilitate a deeper understanding of how these industries create and sustain new jobs over time. This metric will ensure PSE's program continuously work to achieve the promise of new and sustained clean job creation.

[3] https://www.e2.org/wp-content/uploads/2019/12/E2-Clean-Jobs-Washington-2019.pdf

Figure 4: Number of Washington jobs created by clean energy industries in 2019



Applicable Population

This metric applies to all of PSE service territory and the state as a whole, with a particular focus on customers in vulnerable populations and highly impacted communities.

Examples

Stakeholder Example Question #1: Does the program or action provide additional career opportunities to highly impacted communities or vulnerable populations?

Stakeholder Example Question #2: Does the program or action lower unemployment for highly impacted communities and vulnerable populations by providing jobs in the surrounding community?

Example #1: Multi-Family Rooftop Solar Incentive Program. If PSE provides incentives for rooftop solar, their program vendor could run trainings for local Solar Photovoltaic Installers and the number of solar installation contractors in the area could increase.

Example #2: Residential Rooftop Solar Leasing. In a direct install program where PSE installs solar on a customer's roof top (leasing the space from them) the third party running the program could hire local staff to perform the installations. This metric would measure the number of proposals that local contractors submitted to participate with PSE, and number of contracts that PSE awarded to local vendors.

Metric

- Number of jobs created for residents of named communities
- Number of Local workers in jobs for programs
- Number of part-time and full-time jobs by project
- Demographics of workers
- Range of wages paid to workers
- Additional benefits offered

Measurement

Table 2 presents potential categories of metrics to measure the increase in clean energy jobs that PSE programs cause. A few of these metrics refer to "local workers." PSE should workshop and vet the definition of this term among stakeholders to

determine whether a vendor with a local office would qualify or some additional criteria, such as minimum percentage or count of local employees is necessary. PSE can use one or more of these calculations to measure the impacts of this metric,

Table 12: Increase in Clean Energy Jobs Calculation

Title	Notes
Number of jobs created for residents of named communities	Measured using contractual terms that require reporting this data to PSE
Number of Local workers in jobs for programs	Measured using contractual terms that require reporting this data to PSE
Number of part-time and full-time jobs by project	Measured using contractual terms that require reporting this data to PSE
Demographics of workers	Measured using contractual terms that require reporting this data to PSE
Range of wages paid to workers	Measured using contractual terms that require reporting this data to PSE
Additional benefits offered	Measured using contractual terms that require reporting this data to PSE

Issues and Data Gaps

- **Issue #1: Construction jobs created will differ from O&M jobs.** PSE will need to consider an additional layer of how O&M activities for renewable resources will impact jobs once the respective resource is online. For example, solar and gas turbines will both have some number of jobs for construction, but during operation, solar will require much fewer jobs because they don't require as much maintenance.
    - **Mitigation Strategy.** We recommend ongoing research to establish the forward-looking sustainable jobs impacts relating to renewable resources compared to conventional power plants.
- **Issue #2: Duration and tenure of new jobs is uncertain.** Beyond simply construction and O&M job positions, job turnover complicates the tracking of jobs sustainably held by people from named populations. For example, it is possible that jobs are initially filled by people from named populations, but are replaced by people from outside of named populations after a while. It is not likely that PSE will be able to track such nuanced turnover.

- **Mitigation Strategy.** One way to account for this uncertainty is to run annual surveys among of DER maintenance crews and renewable plant employees to determine duration of tenure and whether they live in named populations or not. If retaining members of named populations proves too difficult, PSE can revisit this issue and determine whether program designs can and would be advisable to increase retention of these positions.

Data Sources

Table 13 below presents the data sources we recommend for calculating the increases in clean jobs that PSE programs induce.

Table 13: Data Sources for Calculating Increases in Clean Jobs

Category	Dataset	Units	Source	Source Reporting
Qualitative and Quantitative	Number of jobs created for residents of named communities	Numerical	Contracts with Vendors	The Vendor
	Number of Local workers in jobs for programs	Numerical	Contracts with Vendors	The Vendor
	Number of part-time and full-time jobs by project	Numerical	Contracts with Vendors	The Vendor
	Demographics of workers	Numerical	Contracts with Vendors	The Vendor
	Range of wages paid to workers	Numerical	Contracts with Vendors	The Vendor
	Additional benefits offered	Qualitative Description	Contracts with Vendors	The Vendor

Expected Program Impact on Metric

It is all but assured that PSE's programs will create new construction jobs. However, we have already highlighted a few potential challenges above. To recap, it is possible that ongoing O&M positions may be less than conventional power plants with comparable capacity. Additionally, the retention of newly created jobs among members of highly impacted communities and vulnerable populations is not guaranteed. Employment-related impacts can be represented as net jobs if job losses that may have occurred in non-energy efficiency or renewable energy-related sectors due to the program (e.g., decrease in demand for coal) are quantified, as well. Net jobs would present the program impacts on jobs after any losses have been subtracted from the increase.[4] With additional research, PSE can track and measure these risks and challenges and adjust program designs and metric calculation methodologies accordingly.

Lastly, it is important to note that new clean jobs are not necessarily or likely to be filled by members of highly impacted communities or vulnerable populations, or even local PSE residents unless programs or measurements are designed to specifically encourage and capture the locality of these jobs.

[4] https://www.epa.gov/sites/default/files/2018-07/documents/mbg_2-5_economicbenefits.pdf

IMPROVED PARTICIPATION FROM NAMED COMMUNITIES

Customer benefit indicator categories

As stated earlier, PSE has committed in its CEIP to support customers within highly impacted communities and vulnerable populations and ensure that they receive direct benefits from clean energy programs. These benefits include those described above and include categories including:

- **Burden reduction:** Customer within highly impacted communities and vulnerable populations may currently experience the burden of high-energy cost, or lack of access to clean energy programs. The existing programs may have additional barriers that prevent participation in clean programs as well. By improving participation, customers will see these burdens reduced for them.
- **Non-energy benefits:** Customers specifically in highly impacted communities and vulnerable populations will become more knowledgeable of these programs and be able to access more clean energy options
- **Energy benefits:** Customers may not have clean energy delivered locally or receive the benefits of demand side resources. By improving participation in programs like EE and DER, customers may be able to realize more efficient homes or consume local energy from a community solar or rooftop solar program.

Many of the earlier metrics are designed to be calculated specifically for participants within named populations. This metric is designed to directly measure participation among highly impacted communities and vulnerable populations.

Applicable population

This metric applies to PSE customers within highly impacted communities and vulnerable populations.

Examples

Stakeholder Example Question: Does the program reduce barriers (e.g., financing, rebates or other incentives) for or target participation for Vulnerable Populations, Highly Impacted Communities or renters?

Example: PSE could track any programs that give subsidies to customers to participate in these EE, DR, or DER programs to measure the percentage of participants in this program who are within highly impacted communities and vulnerable populations and the percent of customers within highly impacted communities and vulnerable populations who have engaged in the program.

Metric

This metric can calculate the count and percent of participation by customers within highly impacted communities and vulnerable populations by

- **EE programs participation by all customers, highly impacted communities and vulnerable populations**
- **DR programs participation by all customers, highly impacted communities and vulnerable populations**
- **DER programs participation by all customers, highly impacted communities and vulnerable populations**

PSE is evaluating data availability and options for measuring this metric in future DR programs.

This metric can calculate the number of distributed and community renewable programs and the percentage of electricity generated by distributed renewable energy projects by all customers, highly impacted communities and vulnerable populations.

Expected Program Impact on Metric

This metric should be tracked over time. Ideally, customers within highly impacted communities and vulnerable populations should be able to easily access bill assistance and energy efficiency weatherization programs. However, these customers are

likely to face significant barriers to DER program participation. For example, customers in highly impacted communities and vulnerable populations are more likely to have low- or moderate-income levels that make it difficult for them to afford the equipment purchases that traditional downstream energy efficiency programs target. Over time, as PSE defines DER concept models that are appropriate for customers within highly impacted communities and vulnerable populations and their respective residences, this metric should show an increase in participation among these communities.

IMPROVED HOME COMFORT

Customer Benefit Indicator Categories

Non-energy benefits are the annual dollar savings per year associated with quantifiable non-energy impacts of PSE programs or measures. Improved home comfort encompasses several non-energy impact (NEI) types, and we expect the breadth of this metric to grow as more research is published related to it. For now, we will focus on the NEI values that are quantifiable and defensible for existing PSE energy efficiency measures.

Applicable Population

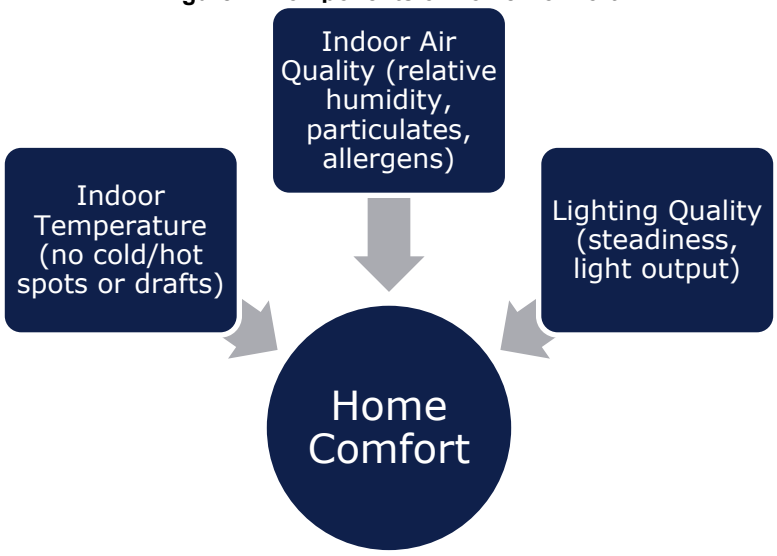
This CBI will be measured only for **program participants**. Participant NEI values are attributable benefits to participating customers, beyond energy savings, gained from installing energy efficient measures. This metric can also be calculated specifically for program participants within named communities.

Examples

Stakeholder Example Question: Does the project improve home comfort for customers including heating and cooling and indoor air quality?

Example: Direct Install Single Family Weatherization Program. The aim of weatherization programs is to improve thermal comfort by adding insulation and sealing building cracks where drafts might occur, or airborne outdoor pollutants could enter. These programs are often accompanied by the direct installation of energy efficient lighting and water saving measures. Program participants have reported feeling more comfortable in their homes after participating in these types of programs, and programs are quantifying and reporting the associated non-energy impacts.

Figure 1: Components of Home Comfort



Metric

This metric measures the estimated lifetime value of the non-energy impacts associated with measures deployed by Energy Efficiency programs, calculated in Net Present Value, by providing an increase in benefits using multiple metrics, Including thermal comfort, noise and lighting quality.

Measurement

Home comfort will be measured as the total dollar in NPV in benefits for program calculated using multiple metrics, including thermal comfort, noise and lighting quality.[5]

Table 14: Measuring Improved Home Comfort

Title	Notes
Total dollar in NPV in benefits for program calculated using multiple metrics, including thermal comfort, noise and lighting quality using indoor air temperature, indoor air quality, and lighting quality for all customers	This amount will be provided in US dollars.
Total dollar in NPV in benefits for program calculated using multiple metrics, including thermal comfort, noise and lighting quality for highly impacted communities	This amount will be provided in US dollars.
Total dollar in NPV in benefits for program calculated using multiple metrics, including thermal comfort, noise and lighting quality for vulnerable populations low	This amount will be provided in US dollars.
Total dollar in NPV in benefits for program calculated using multiple metrics, including thermal comfort, noise and lighting quality for vulnerable populations medium	This amount will be provided in US dollars.
Total dollar in NPV in benefits for program calculated using multiple metrics, including thermal comfort, noise and lighting quality for vulnerable populations high	This amount will be provided in US dollars.

Issues and Data Gaps

Issue with applying previous NEI research: Because the non-energy impact values PSE currently has as a deliverable from a previous project are limited to energy efficiency measures, new research may be necessary. Additionally, the non-energy impact values were developed using a metanalysis to fit the values to the PSE territory. This process follows a conservative approach, so some benefits may be underestimated. These benefits may not be applicable to PSE's DER programs. Additional research and analysis would be necessary to determine whether energy efficiency home comfort non-energy benefits can be translated to DERs.

Data Sources

Table 15 shows the existing sources of data for calculating this metric.

[5]The Northwest Power and Conservation Council's Methodology for Determining Achievable Conservation Potential (https://www.nwcouncil.org/sites/default/files/Methodology.pdf)

Table 2: Data Sources for Measuring Improved Home Comfort

Category	Units	Source	Source Reporting
Total dollar in NPV in benefits for program calculated using indoor air temperature, indoor air quality, and lighting quality for all Customers	US Dollars	Internal PSE Data	Internal PSE EE program
Total dollar in NPV in benefits for program calculated using indoor air temperature, indoor air quality, and lighting quality for Highly Impacted Communities	US Dollars		Internal PSE EE program
Total dollar in NPV in benefits for program calculated using indoor air temperature, indoor air quality, and lighting quality for Vulnerable Populations	US Dollars		Internal PSE EE program

Expected Program Impact on Metric

Poor quality housing can cause new incidences of disease or exacerbate pre-existing health conditions of residents. Infant children, pregnant women, and seniors are especially affected by their housing conditions. Thermal stress from extreme heat or cold can cause death for those in vulnerable populations. We expect programs that improve home comfort to reduce participant's thermal stress and medical costs from poor housing conditions. Improved home comfort should also increase participant's quality of life, including their ability to perform daily activities at home, school, or work. Living in poor environments leads to stress and anxiety, which takes a physical and mental toll on residents of the home.

INCREASE IN CULTURALLY- AND LINGUISTICALLY- ACCESSIBLE PROGRAM COMMUNICATIONS FOR HIGHLY IMPACTED COMMUNITIES AND VULNERABLE POPULATIONS

Customer Benefit Indicator Categories

Reduction of Burdens A barrier to participation or awareness of programs is language and cultural relevance for some customers. By expanding materials and webpages developed in more languages, PSE can reach more customers, especially those who have historically been underrepresented in clean electricity participation, thus reducing the burden on those customers.

Applicable Population

This CBI will be applicable to all PSE customers, including highly impacted communities and vulnerable populations.

Examples

Stakeholder Example Question: Does PSE provide outreach materials in non-English languages?

Example: For the baseline data, PSE is currently performing an audit of its program informational and promotional materials and availability of non-English languages, expected to be completed by January 31, 2022

Metric

This metric measures the outreach material available in non-English languages; outreach material available in English language; outreach material impressions in non-English languages, and outreach material impressions in English language for EE, DER and DR programs and utility scale resources.

Measurement

Increase in accessible program communications will be measured as the total outreach materials in English and non-English as well as outreach material impressions in English and non-English[6].

Table 3: Measuring Increase in accessible program communications

Title	Notes
Outreach material available in non-English languages	This will be provided for EE, DR, and DER.
Outreach material available in English language	This will be provided for EE, DR, and DER.
Outreach material impressions in non-English languages	This will be provided for EE, DR, and DER.
Outreach material impressions in English language	This will be provided for EE, DR, and DER.

Issues and Data Gaps

PSE is currently performing an audit of its programs to set a baseline.

Data Sources

Table 17 shows the existing sources of data for calculating this metric.

[6]The Northwest Power and Conservation Council's Methodology for Determining Achievable Conservation Potential (https://www.nwcouncil.org/sites/default/files/Methodology.pdf)

Table 17: Data Sources for Measuring Improved Home Comfort

Category	Units	Source	Source Reporting
Outreach material available in non-English languages	Number of materials	Internal PSE Data	l PSE Communications Program
Outreach material available in English language	Number of materials		Communications Program
Outreach material impressions in non-English languages	Number of material impressions		PSE Communications Program
Outreach material impressions in English language	Number of material impressions		PSE Communications Program

Expected Program Impact on Metric

Increased communication with PSE customers will allow more customers to participate in DER, DR and EE programs. Customers will be able to gain more knowledge about the opportunities available to them. PSE anticipates that participation will increase due to the additional outreach materials available.

APPENDIX

This section documents the assumptions used to estimate the effort required to track the metrics described in this document. The activities include obtaining the necessary data, performing data checks and data cleaning, and formatting the data to perform the calculations.

Level of Effort	Hours	Cost
Low	10 - 25	$1,600 - $4,000
Medium	25 - 50	$4,000 - $8,000
High	50 - 100	$8,000 - $16,000