BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

In the Matter of	
PUGET SOUND ENERGY	**Docket UE-210795**
Clean Energy Implementation Plan Pursuant to WAC 480-100-640	

FOURTH EXHIBIT
TO THE PREFILED REBUTTAL TESTIMONY OF

GILBERT ARCHULETA

ON BEHALF OF PUGET SOUND ENERGY

DECEMBER 12, 2022

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PSE Low-Income Household Needs Assessment

FINAL REPORT

October 2020

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Acronyms, Terms, and Definitions

Acronym/Term	Definition
ACS	American Community Survey
CETA	Clean Energy Transformation Act
EA	Energy Assistance program
FPL	Federal Poverty Level
GIS	Geographic Information System
HELP	Home Energy Lifeline Program
LIHEAP	Low-Income Home Energy Assistance Program
LIW	Low-Income Weatherization program
MW	Megawatt
PSE	Puget Sound Energy
PUMA	Public Use Microdata Area; referencing the geographic area for considering PUMS data
PUMS	Public Use Microdata Sample; referencing the source of data
SMI	State Median Income

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Executive Summary

The 2019 *Macquarie Transfer Multiparty Stipulation Agreement* (Docket U-180680) required Puget Sound Energy (PSE) to conduct a low-income needs assessment study to "…provide a better understanding of the needs related to energy affordability of low-income households in PSE's service territory, including data related to energy efficiency, specifically weatherization needs and opportunities."[1]

To satisfy these requirements, PSE assembled a group of interested stakeholders and contracted with Cadmus to develop a study supporting these research objectives. Specifically, this study sought to identify the current need for PSE's weatherization and energy assistance programs. This involved identifying gaps in historical program coverage, characterizing underserved communities, and considering the geographic distribution need across PSE service territory. The main objective is to assist in identifying opportunities to better inform future policy, strategy, and marketing and outreach tactics.

Though initiated based on the Macquarie Transfer Agreement, this study will also provide PSE and its community partners resources to support similar objectives under Washington State's 2019 Clean Energy Transformation Act (CETA).[2] This legislation outlines a plan for electric utilities to decarbonize energy production with provisions to ensure clean energy benefits are equitably distributed.[3]

This needs assessment serves as foundational research and provides a set of tools to continue building upon this study as new data, assumptions, and strategies are considered going forward. Economic impacts from COVID-19 have substantially changed the current landscape, including the size and level of need of the eligible customer population. While this assessment has relied on historical data prior to COVID-19, the analytic framework will allow PSE to continue to update these underlying estimates, produce new maps and distributions, and gain context for the magnitude of these impacts as new data are incorporated into future revisions.

Approach and Key Findings

Cadmus incorporated various datasets to develop geographic information system (GIS) layers, which yielded numerous maps of income-eligible customers within PSE's service territory. Cadmus used these layers to identify historically underserved areas and summarize their key features for potential future delivery of services. Data are available and presented at two levels – by Public Use Microdata Area

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1   Washington Utilities and Transportation Commission. March 11, 2019. Final Order 06 (DOCKET U-180680). https://www.utc.wa.gov/_layouts/15/CasesPublicWebsite/GetDocument.ashx?docID=1456&year=2018&docketNumber=180680

2   State of Washington. 66th Legislature. 2019 Regular Session. Senate Bill 5116 (Chapter 288). https://lawfilesext.leg.wa.gov/biennium/2019-20/Pdf/Bills/Session%20Laws/Senate/5116-S2.SL.pdf

3   Washington State Department of Commerce. 2019. Clean Energy Transformation Act (Version 08112020). https://www.commerce.wa.gov/wp-content/uploads/2020/08/CETA-section-48-draft-narrative-2020-04-14.docx

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(PUMA) and by Census Block Group (see Research Approach section for more details). This report presents an excerpt of these maps. Cadmus will provide the full analytic code and shapefiles to PSE to use for future research.

Cadmus conducted an exercise to characterize underserved areas using various criteria that define need and impact earning potential. High-need criteria used for this assessment include a combination of the following:

- Households with children under 18 years of age

- Residents over 65 years of age

- Residents with a disability

- High energy burden

- Race/Ethnicity (i.e., non-white residents)

- Language (i.e., households with limited English proficiency)

This composite need scoring approach ranked geographies of income-eligible customers (at 200% of the Federal Poverty Level [FPL]) based on several distinct factors. For each criterion, we assigned Public Use Microdata Areas (PUMAs) scores based on the decile of the distribution (e.g., income-eligible households with children), and then summed scores to create a composite ranking. We determined composite need scores for two scenarios, scoring across different sets of criteria to identify high need geographies, as illustrated in Figure 1.

Figure 1. Distribution of PUMAs by Composite Need Score – Scenario Comparison
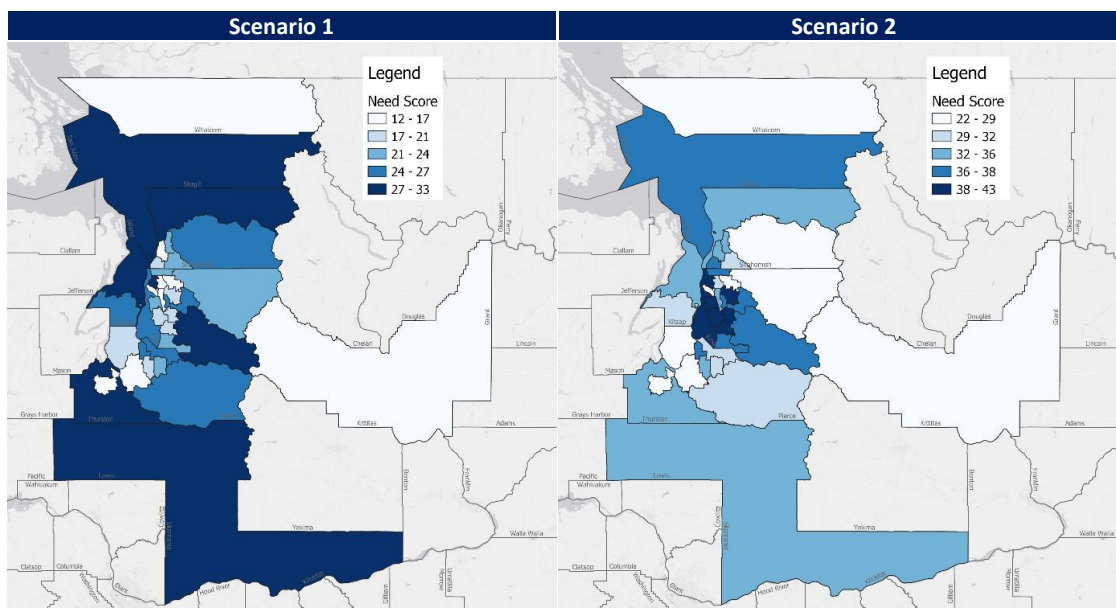
Note: Composite Need Scoring for Scenario 1 includes the following need criteria: households with children (under 18 years), age (residents over 65 years), disability, and energy burden (consistent with WA State Department of Commerce Weatherization Manual prioritization criteria). Scenario 2 includes the criteria from Scenario 1, as well as race/ethnicity (non-white) and limited English proficiency.

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For each scenario, the quintiles of the distribution are presented to compare geographies with higher need scoring (shown in dark blue, representing those areas with highest need). The scoring approach is detailed under the *Composite Need Scoring* subsection in *Approach and Assumptions* section

Figure 2 shows the intersection of the top 20% of underserved Census block groups (i.e., highest concentration of unserved households at the 200% FPL) and PUMAs territories with the highest composite need score (top 20%) for each scenario. Approximately 95 Census block groups meet these criteria for Scenario 1 and 140 Census block groups for Scenario 2. Differences in need scoring criteria between scenarios clearly shape the geographic distribution and focus of how underserved customers can be prioritized in the future for energy program services.

Figure 2. Underserved Census Block Groups with Highest Composite Need Scores by Scenario
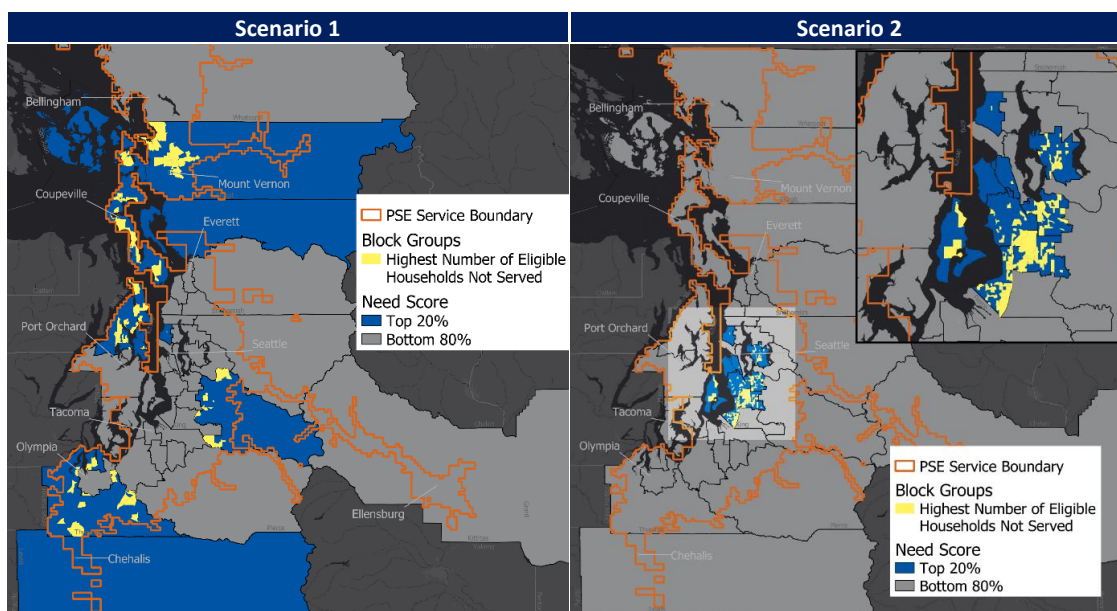
Note: Underserved households reflect those that are income-eligible at the 200% FPL and not previously served through PSE's energy assistance (EA) or Low-Income Weatherization (LIW) programs

We present findings based on the counts of eligible unserved households for both energy assistance and weatherization, respectively, focusing on high concentrations of absolute numbers of homes. Concentration of potential households allows for targeting that benefits from *efficiency in delivery*, such as through neighborhood-based campaigns. Using the proportion of eligible, unserved homes relative to the total eligible population provides an opportunity for *equity in delivery*—that is, to identify areas with historically higher proportions of unserved populations. This may speak to historic gaps in delivery due to limitations in implementation, such as funding or agency capacity, or it may relate to underserved customer groups that observe other barriers to participation.

Suggested Next Steps

With the tools developed through this study, PSE can begin directing future research to drill deeper into an understanding of the drivers for underserved communities, methods of overcoming those barriers,

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and continue pursuing ways to work closely with agency partners, particularly from a marketing and outreach perspective, to address local-level solutions.

We recommend PSE consider the following steps to apply this research and work with local partners to refine low-income program services:

- Consider further inquiries to better understand the factors contributing to underserved areas and populations, including barriers contributing to lack of participation of underserved groups
- Conduct deeper analysis and customer segmentation to better understand characteristics of identified underserved communities
- Develop strategies to inform targeted outreach, including messaging based on demographic profiles targeted to high-need areas
- Determine how these tools can support piloting new program designs, as well as CETA reporting requirements

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Study Objectives and Approach

In collaboration with PSE and other regional stakeholders, Cadmus developed a scope of research that covered several topics, with the primary goal of using secondary data to assess the coverage and need of income-eligible customer populations. Cadmus used a combination of PSE program participation and publicly available data to develop a series of maps to illustrate the distribution of underserved communities, considering different metrics, eligibility criteria, and demographic characteristics.

Based on this study's findings, PSE will consider how best to orient future research to better understand drivers for customer need and underserved areas, and how to develop program strategies to overcome these barriers going forward.

The current scope of research is detailed below:

- **Identify participation gaps:** To identify gaps in historic delivery and highlight concentrations of remaining eligible/served customers, Cadmus mapped households previously served by PSE programs and compared them to concentrations of eligible households throughout the service territory.

- **Assess characteristics of underserved communities:** Using the secondary data available, Cadmus conducted several assessments to help characterize eligible populations:

  - *Composite need scoring:* In an effort to characterize underserved populations and highlight areas with the highest need, Cadmus mapped distributions of eligible customers based on several factors that contribute to need of service and may impact earning potential (including several criteria currently used to prioritize weatherization service delivery). Using a scoring approach to rank geographies based on the distribution of eligible customers by each high-need factor, we developed a composite score by summing all factors within each geography to consider the prioritization of high-need areas.

  - *Top-down energy efficiency potential:* Using evaluated whole-house savings from PSE's Low-Income Weatherization program as a proxy for economic achievable potential, Cadmus developed a map showing the distribution of energy savings potential by Census block group based on geographic densities of eligible, unserved customers by PSE.

- **Provide PSE and partners a set of tools:** Cadmus' main objective was the creation of an approach that is flexible, replicable, and transparent. PSE and its community partners will have the tools to continue building on this assessment. Cadmus will provide PSE a set of annotated code used to process all underlying data, apply study assumptions, and develop GIS outputs for various assumptions and definitions of need.

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Research Approach

Development and Stakeholder Engagement

As noted, Cadmus and PSE developed this research approach in response to the Macquarie Transfer Agreement. We presented the work plan to stakeholders early in the process (April 2020) to gain consensus and consider initial feedback. Stakeholders included staff from the Washington State Department of Commerce, Washington Utilities and Transportation Commission, Washington State Attorney General, the Energy Project, and NW Energy Coalition. We reconvened the original stakeholder group in August 2020 to present initial study findings and expanded it to include staff from community organizations currently serving as PSE partners in administering low-income programs. Based on feedback from this presentation, Cadmus and PSE made several revisions to the assessment, which are included in this report.

Data Sources

To conduct a geospatial analysis and quantify eligibility and unmet needs for PSE's low-income programs, Cadmus reviewed a variety of available data sources including the following:

1. PSE historical participation data (Low-Income Weatherization [LIW] and Energy Assistance [EA])

2. PSE territory shapefiles

3. U.S. Census Bureau American Communities Survey and Public Use Microdata Sample (PUMS) data

4. Average LIW kilowatt-hour and therm household savings (from Cadmus' 2018 LIW evaluation)

Each of the data sources is discussed in more detail below.

PSE Historical Participation Data

This study considered historical participation regarding two PSE low-income programs:

*   **LIW program:** PSE's weatherization assistance program seeks to reduce customers' energy burden by providing holistic energy efficiency and education services to reduce energy use and associated costs. This program provides services to customers who meet income eligibility criteria of 200% of the FPL or 60% of the state median income (SMI), whichever is greater based on household size.[4] This study uses historical LIW participation for projects completed from January 2012 through March 2020 (N=8,547).

*   **EA program:** PSE's bill assistance program, Home Energy Lifeline Program (HELP), provides electricity and gas bill payment assistance for customers meeting income eligibility of approximately 150% FPL. While PSE HELP provides the majority of funding for this program, customers receiving funding from the Low-Income Home Energy Assistance Program (LIHEAP),

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[4]   The SMI criteria range from 237% of FPL for a single-person household to 218% of FPL for a six-person household. For households with seven or more inhabitants, PSE uses the 200% FPL threshold.

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Salvation Army, and other small funding sources were included in the study. Note, these other funding sources may differ regarding income eligibility, such as LIHEAP at 125% FPL. Since the EA program requires annual enrollment, Cadmus used data for participants who received assistance from October 2018 through September 2019 (N=34,167).

Cadmus received PSE participant tracking data files for the LIW and EA programs, including date of assistance and geographic coordinates of the household. Figure 3 breaks down the count of LIW projects used in this analysis by year. The data included projects from January 2012 through March 2020, for a total of 8,547 projects.[5]

Figure 3. Historical PSE Weatherization Assistance Projects by Year *
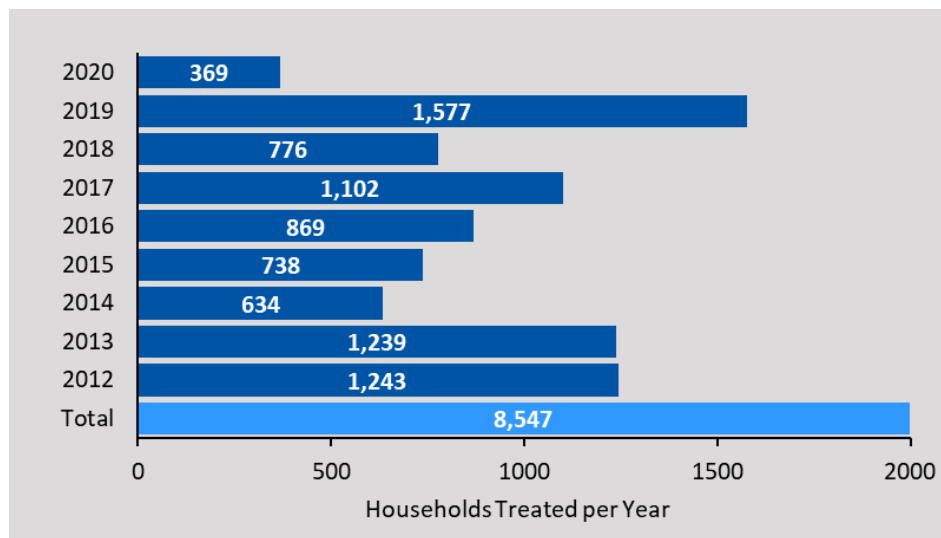
* Note, 2020 participation represents a partial year and is atypical due to COVID-19

Data for PSE's bill assistance program included customers who received assistance from October 2018 through September 2019, totaling 34,167 unique households. PSE's bill assistance dataset was divided into two categories: PSE HELP payments, which are provided by PSE, and non-PSE payments, tracked by PSE but provided by various other sources. Of the 34,167 households, 28,732 received assistance only from PSE and 26,846 received assistance from a combination of other sources.

The PSE data Cadmus used to determine the historically served population did not account for services occurring outside of PSE programs (beyond those assistance payments tracked by PSE, mentioned above) and, thus, understated the served population for both programs. Specifically, for the LIW program, the study data included historical participation beginning in 2012, but did not include projects completed during the American Reinvestment and Recovery Act, which substantially increased funding and associated volume of completed projects from 2009 through 2011. Furthermore, the study excluded

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5   These data contained single-family and multifamily projects. Each unit within a multifamily project was counted as an individual household.

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projects completed during the same time frame that PSE customers may have been served with non-PSE funding sources.[6]

Due to economic impacts associated with COVID-19, the level of PSE customers applying for energy assistance has increased substantially.[7] In light of these changes, we note that the current study is based on historical data under pre-COVID circumstances and reflects a different baseline condition with regard to the current income-eligible population. Going forward, PSE can update this analysis with new data for 2020 to assess the change in level of need associated with these events.

PSE Service Territory Shapefiles

PSE provided Cadmus with a set of shapefiles defining its service area (Figure 4). The service territory extends over 10 counties in Washington, and gas and electric territories are not identical. Historical participants and eligible customers may subscribe to either gas (blue), electric (yellow), or both service types (green).

Figure 4. PSE Service Territory

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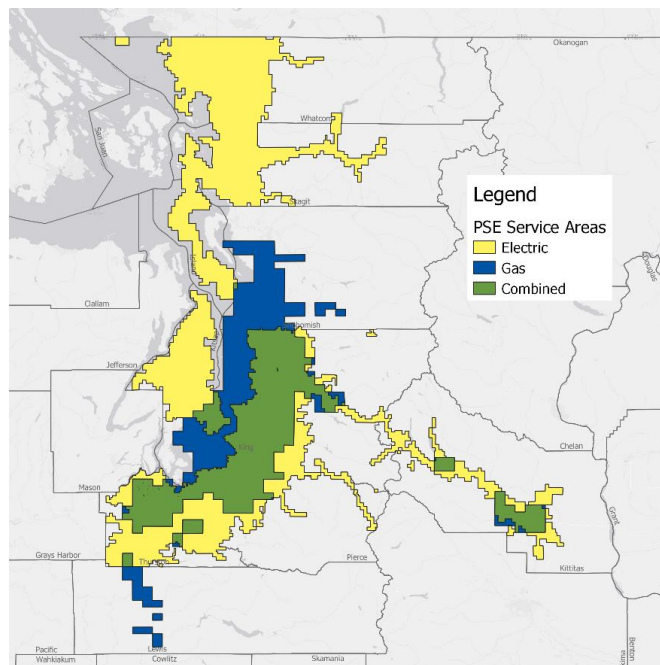
[6] Data provided by Washington State University staff (who evaluate Washington's statewide weatherization program) indicated that between 2009 and 2020, approximately 2,225 units in PSE's territory were completed without PSE funds invested. This reflects a 20% to 25% increase in total projects within PSE's service territory. (Source: Email from Vince Schueler, Energy Program Performance at WSU Energy Extension Program. September 25, 2020).

[7] Note, PSE recently created the Crisis Affected Customer Assistance Program to help customers with employment impacts associated with COVID-19.

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Secondary Data on Income and Demographics

Cadmus used various data sources, including the U.S. Census Bureau American Community Survey (ACS) and PUMS datasets, to create a multidimensional and detailed demographic assessment. From the ACS and PUMS datasets, we used population and number of households below the 150% and 200% thresholds of FPL to estimate the number of eligible households and program participation rates within each Census block group or PUMA. We analyzed additional PUMS fields to characterize need such as the number of households with children under 18, people over age 65, or people with disabilities, as well as income and monthly energy bill amount to calculate energy burden.

Energy Efficiency Potential Assumption

To develop a top-down approach to estimate energy efficiency potential, we used estimated savings from a recent PSE LIW program evaluation.[8] Cadmus conducted a billing analysis to estimate average participants' household energy savings.

Given the broad range of energy efficiency retrofits, health, safety and repair measures, and behavioral changes that occur through low-income weatherization programs, billing analysis is the gold standard for evaluating whole-house energy efficiency program energy savings by capturing the total change in household consumption.

For the current study, we used evaluated household savings to approximate an estimate of economic achievable potential, as it reflects a whole-house approach to energy efficiency contingent upon program cost-effectiveness screening (i.e., saving to investment ratios) under the existing delivery infrastructure and program design for low-income energy efficiency. Changes to the program delivery, measure mix, cost-effectiveness assumptions, and screening criteria all may affect future estimates of energy efficiency potential savings.

Note, this top-down approach is different than bottom-up methodologies used in conservation potential assessments that typically feed into integrated resource plans. Specifically, PSE uses an end-use forecasting approach to build up estimates of technical and technical-achievable potential by various sectors, building segments, and end uses. We used the top-down approach for this study to identify programmatic potential and consider it in relative terms based on geographic densities for this specific residential customer segment within PSE territory.

Study Coverage

The geographic area of this study covers the entirety of PSE's service territory, including its electricity-only, gas-only, and dual-fuel subterritories. The data were broken out by subterritory when relevant to the analysis. PSE's service area includes portions of 10 counties in the state of Washington: Island, King, Kitsap, Kittitas, Lewis, Pierce, Skagit, Snohomish, Thurston, and Whatcom.

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[8]   Cadmus. 2018. *PSE Low-Income Weatherization Evaluation*.
      https://conduitnw.org/Handlers/conduit/FileHandler.ashx?RID=4264

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Demographic data from the U.S. Census Bureau are reported in large geographic areas (PUMAs) and smaller geographic areas (Census block groups). Thirty-seven PUMAs intersect with the PSE service area, typically containing about 40,000 to 90,000 households each. In contrast, 3,066 Census block groups overlap with the PSE service area and typically contain about 600 to 1,000 households. Figure 5 presents each geographic grouping side by side. PUMAs and Census block groups do not align perfectly with the PSE service area, so Cadmus rescaled household counts for areas at the edge of PSE's service area to more accurately estimate the program participation rate in those areas.[9]

Figure 5. PUMAs and Census Block Groups Overlapping PSE Territory
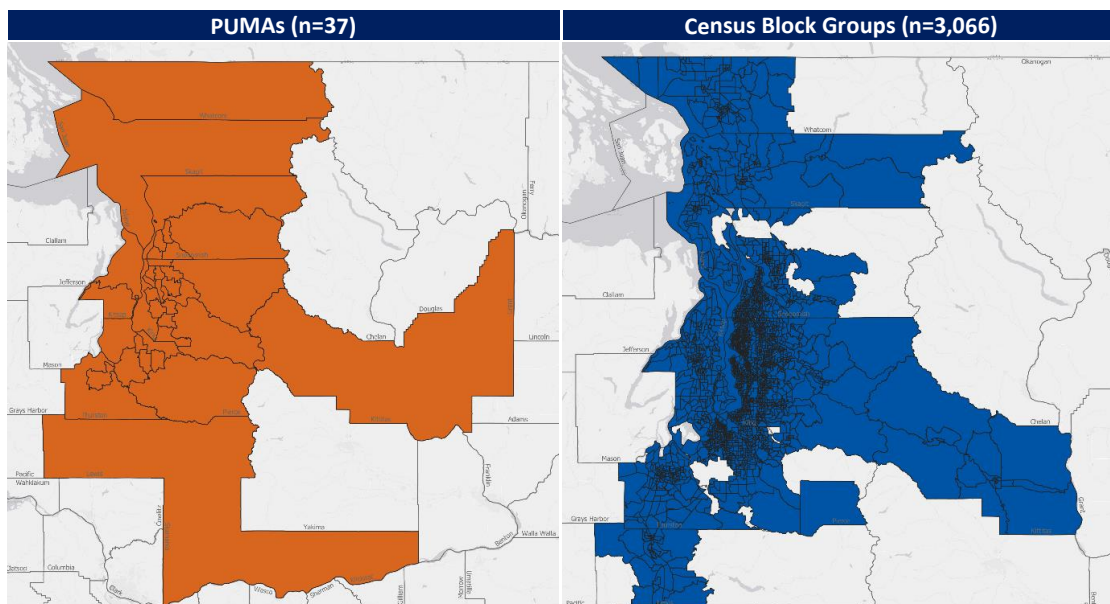
Approach and Assumptions

Income Eligibility and Eligible Populations

When considering populations of eligible households, Cadmus relied on income-eligibility thresholds of 200% FPL for weatherization and 150% FPL for the energy assistance program, which differed slightly from the income eligibility criteria PSE uses for their LIW and EA programs.

Income Eligibility by Program

For energy assistance, the eligibility threshold for PSE's HELP program approximates 147% of the FPL. Cadmus used 150% FPL to approximate this threshold, since the granularity of Census block group data are limited by specific income thresholds. While different funding sources for the EA program have

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[9] For areas that intersected with the PSE territory, the count of households or population was scaled proportionate to the geographic area (Census block group or PUMA) contained by the PSE service area.

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different eligibility thresholds, we used the PSE HELP criterion because it is the largest source of program funding.

The income-eligibility criteria for the LIW program are 200% FPL, or 60% of the AMI, whichever is greatest. For households with six or fewer members, the 200% FPL threshold is greatest, while the 60% AMI threshold is greatest for households with seven or more members. For the purposes of this study, Cadmus used the 200% FPL threshold, since the granularity of the Census block group data was incompatible with the 60% AMI threshold. As a result, the counts of eligible households for houses with fewer members are underestimated using the 200% FPL assumption—the FPL equivalent for those households using the 60% AMI assumption ranges from approximately 218% to 237% FPL.

Determining Eligible Customers

In addition to the income eligibility assumptions, this study relied on several additional assumptions to define the eligible population within PSE service territory:

- **Defining households:** This study focused on *households* as the primary unit of analysis. PUMS provided a variety of demographic and income data at the household level, which easily allows for estimating a discrete count of households by PUMA boundary for different levels of income eligibility. The analysis of Census block group data requires using population as a proxy for household to estimate the percentage of income-eligible households. Cadmus applied this by estimating the population percentage at a specific income threshold (e.g., 200% FPL) and applying that proportion to the count of total households within a given Census block group. This assumption allowed us to calculate an approximation for the program participation rate in these more granular geographic divisions.

- **PSE gas territory adjustment:** For geographies within PSE's gas-only service territory, the total number of eligible households may include those that are not PSE gas customers. To account for this, Cadmus scaled the count of eligible households by the proportion of households within that geography with gas heat. For Census block groups, this was based on the percentage of population meeting the eligibility threshold and the overall percentage of households in the Census block group with gas heat. This may deviate from the percentage of eligible households with gas heat, an intersection not available at the Census block group level. The intent of this adjustment is to reduce the potential to overestimate customers in these gas-only territories.

Using this approach to define income eligibility by program type, Cadmus estimated approximately 290,000 households within PSE territory are at or below 200% FPL and approximately 200,000 households are at or below 150% FPL.

Metrics for Defining Underserved Customers

In considering distributions of underserved areas, characterized by the eligible, unserved households within a given geography, this study used two metrics that highlight different ways to define underserved: (1) the *number* of eligible, unserved households and (2) the *percentage* of eligible, unserved households.

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The number of eligible, unserved households provides a *measure of efficiency* and will help PSE target areas with the largest number potential participants not yet served.

In contrast, the percentage of eligible, unserved households provides a *measure of equity* and will help PSE target areas that may have smaller eligible, unserved populations with particularly low participation rates. This metric may speak to gaps in current delivery, such as eligible customer populations with specific barriers to the current offerings, or resource and capacity issues based on delivery agencies in regard to the reach of current programs. Using percentage as the metric for characterizing underserved populations helps to address potential equity issues with current delivery, and may manifest into strategies to address barriers, such as with marketing or messaging efforts or delivery capacity and reach.

Energy Burden Calculation

Cadmus calculated household energy burden using the PUMS data for inclusion in the composite need scoring assessment. We calculated it as the percentage of a household's income spent on all fuel types (including electricity, gas, and other fuels):

$$100 * \frac{Total\ annual\ fuel\ cost}{Annual\ household\ income}$$

We considered alternative methods for calculating energy burden for this study, such as using PSE customer data for EA participants where income and bill amounts were known. However, we selected the above methodology primarily because PSE data only track those low-income customers that have participated in their programs, rather than the nonparticipants that make up the underserved population.

The accuracy of energy burden within the self-reported PUMS data may be limited at the household level. However, the application of these data is to understand relative trends in energy burden at the PUMA level for the purpose of assessing relative need across PSE's service territory. Cadmus recommends that alternative approaches are considered in future research if the intent is to refine the assessment of energy burden to the level of the individual customer. We also recommend conducting future research to refine the estimates presented here for program targeting or considering alternative factors serving as a proxy for energy burden (e.g., poverty level).

Map Development

The U.S. Census Bureau's TIGER/Line Shapefiles webpage provides GIS layers delineating the geographic area of each Census block group and PUMA for which the Bureau collects demographic data.[10] Cadmus joined the demographic data from the U.S. Census Bureau with the Census block group layer and PUMS data with the PUMA layer. We collected demographic data at the Census block group level to allow small-scale targeting of regions and neighborhoods that might qualify as having high need. We include

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[10] U.S. Census Bureau. 2019. "TIGER/Line Shapefiles." https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-line-file.html

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the following fields in this analysis: the number and percentage of households below 150% and 200% of FPL, children under 18, people over age 65, people with disabilities, energy burden, race/ethnicity, and limited English proficiency.

To allow for direct comparisons and calculations with Census data, Cadmus binned historical participants at the Census block group and PUMA levels. We used the geocoded participant data provided by PSE to create a point dataset of historical participants. We then joined this point layer containing billing data and other potentially relevant housing characteristics with the GIS layers to produce GIS datasets for analysis.[11]

Cadmus built GIS map layers using the polygon vector data from PSE. The data included three GIS layers to document PSE's service area: an electricity layer, a gas layer, and a combined electricity and gas (or duel-fuel) layer. We used this service area data to limit the numeric and geospatial data in the analysis to the geographic extent of PSE's service territory.

Additionally, Cadmus built maps showing the relation of tribal block groups to underserved areas. Tribal block groups are defined independently of the standard county-based block group and PUMA regions used in this study. There are 59 tribal block groups within PSE's service area.

Participation Gap Analysis

Assessment of Participation Gaps and Mapping Underserved Communities

Using PSE participant tracking data, Cadmus mapped historical program participants and compared them to the count of eligible households within a given geography. We created different maps to assess a range of various study elements:

- **Program type:** LIW, EA, and both programs combined
- **Income eligibility**: 150% FPL versus 200% FPL
- **Geography**: PUMA versus Census block group

Cadmus developed a series of maps showing distributions of eligible, unserved households across PSE's service territory (binned by quintile). To highlight the top bin of each of these distributions, the findings include a set of final maps that show the top 20% of geographies with highest counts of eligible, underserved customers for future targeting.

Composite Need Scoring

To characterize the underserved populations, Cadmus developed a scoring approach to assess different factors that contribute to need of services and pose impacts on earning potential. The need scoring approach considered the distribution of income-eligible households (defined at the 200% FPL) across

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[11] For display purposes, Cadmus used the NAD83/Washington North geographic projection.

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PSE's territory by PUMA and ranked the geographies based on the proportion of households meeting one of several high-need criteria.

Cadmus identified factors based on several prioritization criteria already in use for delivering weatherization programs in Washington State, as well as other factors determined in discussion with PSE and based on stakeholder feedback.[12] High-need criteria used for this assessment include a combination of the following:

- Households with children under 18 years of age
- Residents over 65 years of age
- Residents with a disability
- High energy burden
- Race/Ethnicity (i.e., non-white residents)
- Language (i.e., households with limited English proficiency)

Once the variables were selected, Cadmus applied the following methodology for scoring:

- **Step 1:** For each PUMA intersecting the PSE service territory, we identified the percentage of income-eligible customers meeting each of the criteria (e.g., proportion of income-eligible households with children under 18 years of age).
- **Step 2:** Based on the above percentages, we calculated the decile ranking of each PUMA for each high-need variable.
- **Step 3:** We used the decile ranking as the score from 1 to 10 for each PUMA for a given indicator variable and repeated it for each variable.
- **Step 4:** We summed the scores for all indicators to produce a composite score for each PUMA.[13]

A variety of demographic and customer characteristics can be compared to look at a combined set of criteria relative to need. This report presents two scenarios for the composite need scoring and underserved Census block groups with the highest need:

- **Scenario 1:** Scoring included four high-need criteria (homes with children, residents over age 65, disability, and energy burden).
- **Scenario 2:** Scoring included all need criteria (including race/ethnicity and limited English proficiency).

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[12] Washington Department of Commerce. 2019. *Weatherization Manual.* Section: *Policy 1.2.1 Prioritizing Eligible Weatherization Clients.* http://www.commerce.wa.gov/wp-content/uploads/2019/07/Wx-Manual-2019-Jul-1-2019.docx

[13] Cadmus applied equal weighting to each of the high-need variable rankings to estimate the composite need score.

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In response to stakeholder feedback, we included race/ethnicity and limited English proficiency as part of a second need scoring scenario. Multiple scenarios provide an opportunity to compare the demographic filters for considering differences in need associated with underserved areas.

Note, scores should only be considered relatively within each scenario, rather than across scenarios, since absolute scores will vary based on the number of need criteria used. For this reason, the distributions between Scenario 1 and Scenario 2 can be compared, rather than absolute scores.

All high-need variables are based on PUMS data, which allowed for consideration of factors within the subset of households that are income-eligible. Future research can investigate alternative weighting scenarios, additional variables to incorporate, and different data sources with more refined information or geographic granularity.

Underserved Block Groups within Highest Need PUMAs

Finally, Cadmus developed a set of maps that showed the intersection of the highest concentrations of underserved households (based on the gap analysis) and those PUMAs with highest composite need scores. We identified underserved Census block groups with the highest need using these criteria:

- The block group was within the top 20% of all Census block groups by number of households not served by either the EA or LIW program.
- The block group was located within the PUMAs within the top 20% of composite need score.

Research Approach Caveats

This section presents caveats to the assumptions Cadmus used in this research:

- **Coverage of historical participation**
  - *Non-PSE services:* While EA program tracking data included payments from some entities other than PSE's HELP, households may have received assistance from additional sources not included in this analysis. There are PSE customers that would have received weatherization services with non-PSE funding sources that are also not included in this analysis.
  - *Service Eligibility:* There are likely homes with income-eligible customers that may already be built to current codes and not require (nor be eligible for) LIW services. Additionally, some customers (e.g., renters in multifamily housing) may meet income eligibility requirements but are not authorized to make decisions on home improvements (e.g., requiring landlord approval) or enroll in PSE LI programs.
  - *Historical period:* The time period of historical data used for the study was limited. This is particularly notable for low-income weatherization, since pre-2012 projects likely included installed measures that have continued effects on energy consumption (e.g., lowering energy burden) that should be considered when assessing the population of served buildings. Additionally, including historically served projects also implicitly assumes that current occupants meet similar income eligibility as the original customers at the time of service.

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- *Account movement:* To account for EA customers who moved, Cadmus used the most recent payment date to find the most current premise (or location) associated with each customer. Relocation was less of an issue for weatherization assistance, since its effect resides with the premise rather than the customer.

- **Units of measurement**

  - *Households versus population:* As noted, this analysis focused on the household as the primary unit of measurement, to approximate potential utility customer homes available to receive energy program services. PUMS data are derived from individual survey responses and often allow for estimates at the household level. Census ACS data on poverty level are based on populations. For this analysis, Cadmus assumed that the percentage of the income-eligible population was applied proportionately to estimate income-eligible households at the block group level.[14]

  - *Actual customer counts:* Additionally, counts of actual PSE customers within given geographies may vary from the estimates of households based on this analysis for the same geography—these are distinctions that PSE will be able to true up through cross-referencing its customer account data.

- **Identifying/characterizing eligible customers**

  - *Income-eligibility assumptions:* The assumptions used to set 200% FPL for LIW participants and 150% FPL for EA participants were driven by data availability and may underestimate and overestimate the eligible customer population, respectively.

  - *Gas service territory adjustment:* Cadmus adjusted the income-eligible customers counts within gas-only service territory since the full eligible population are not necessarily PSE gas customers. We scaled the eligible population based on the proportion of total households with gas heating for each geography.

  - *PSE territory overlap:* PSE's service territory does not perfectly overlap with U.S. Census Bureau geographies. In cases in which Census Bureau geographies extend beyond PSE's service territory, the demographic and other characteristics of the portion within PSE's service territory may differ from that of the entire geographic region quantified. To address this, Cadmus assumed a uniform spatial distribution of households within Census block groups to rescale household counts by the proportion of geographic overlap with the PSE service area. Because Census block group statistics offer the most granularity, we also used

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14   Data for the number of households below the 150% and 200% FPL thresholds are not available at the block group level. At the block group level, Cadmus used the percentage of individuals below a given poverty level threshold as a proxy for the percentage of households below that poverty level threshold. Cadmus found that the difference between percentage of population and percentage of households below 200% of FPL was between -5 and 3 percentage points at the PUMA level. Due to the relatively small difference, percentage of eligible population was determined to be a suitable proxy for the percentage of eligible households at the block group level.

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them to rescale PUMA-level data for all fields except eligible household counts (per the limitation described above) and energy burden (which was not available at the block group level). This approach reduces the overestimation of the number of eligible households within the PSE service area but may still over- or under-estimate statistics within the PSE service area. The magnitude of this error depends on the difference between the densities of households in the portions of the Census block group that overlap and do not overlap the PSE service area.

- *Energy burden:* Cadmus estimated energy burden using PUMS data, which are derived from individual survey respondents' self-reported values for income and energy cost. As such, energy costs estimates may vary by respondent and may not reflect an average monthly cost, but rather the energy cost for a specific month, which may not account for the seasonality of annual energy costs. Additionally, this estimate does not account for other forms of payment assistance that would reduce the actual energy costs required for payment.

- *Scale:* PUMA data are derived from individual survey responses over large geographies while Census block groups provide more granular data.

- *Counts by attribute:* Due to differing sources and methodologies for data collection, PSE customer data may not perfectly align with secondary sources (e.g., PUMS respondent self-reports) regarding specific attributes, such as the number of households by specific building types within a given geography, though we would expect proportions to be similar.

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Findings: Mapping Results

Cadmus created a series of maps to illustrate the distribution and characteristics of underserved communities.

Maps vary by the following characteristics:

- **Program:** LIW, EA, or both
- **Geography:** PUMA or Census block group
- **Metrics***: Count* of eligible, unserved households or *percentage* of eligible, unserved households
- **Income eligibility:** LIW is below 200% FPL and EA is below 150% FPL

Saturation of Eligible Customers

Figure 6 maps the percentage of households at or below 200% FPL. The darkest blue areas show PUMAs, with the highest percentage of households. The histogram in Figure 6 displays the distribution of PUMAs in the associated map. As the histogram shows, the top 19% of PUMAs (seven PUMAs total out 37 in PSE's territory) have the highest saturation of eligible households (between 29% and 43%). These PUMAs are located in Kittitas, Lewis, Whatcom, Pierce, and King counties. Most PUMAs are clustered in the bottom-middle of the distribution, in the 15% to 29% range.

The Census block group-level data provide a clearer picture of the geographic variation in concentrations of eligible customers. As shown in Figure 7, less than 1% of Census block groups (nine block groups total) have 80% to 100% of their population below 200% FPL. The majority of Census block groups (52%) have 0 to 20% of their population below 200% FPL.

Figure 6. Percentage of Households Below 200% FPL by PUMA
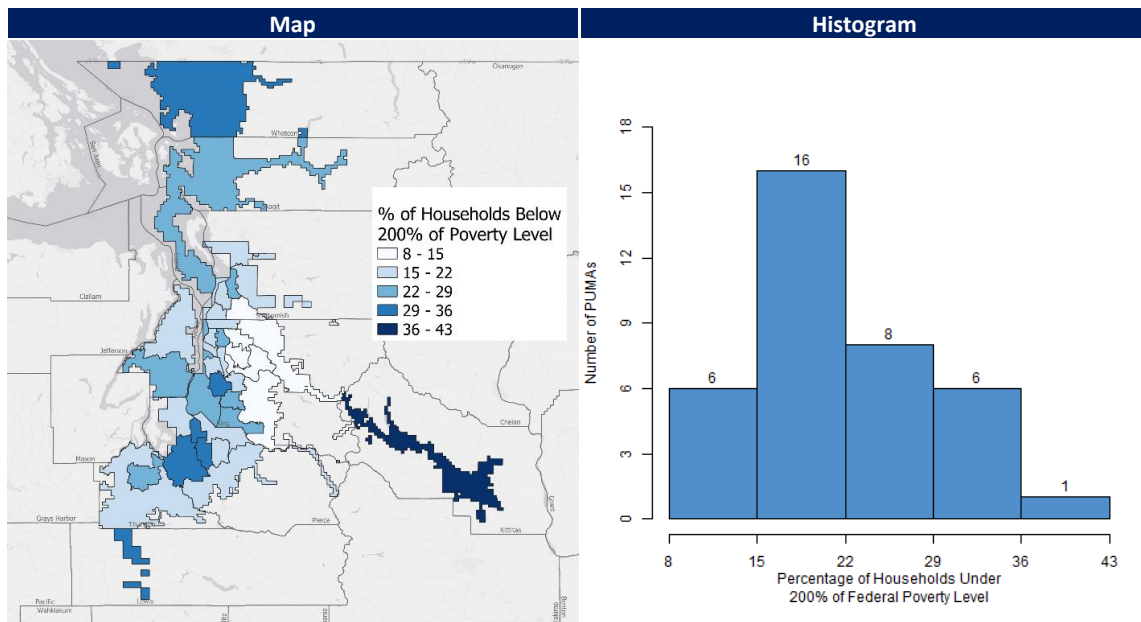
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Figure 7. Percentage of Population Below 200% FPL by Census Block Group
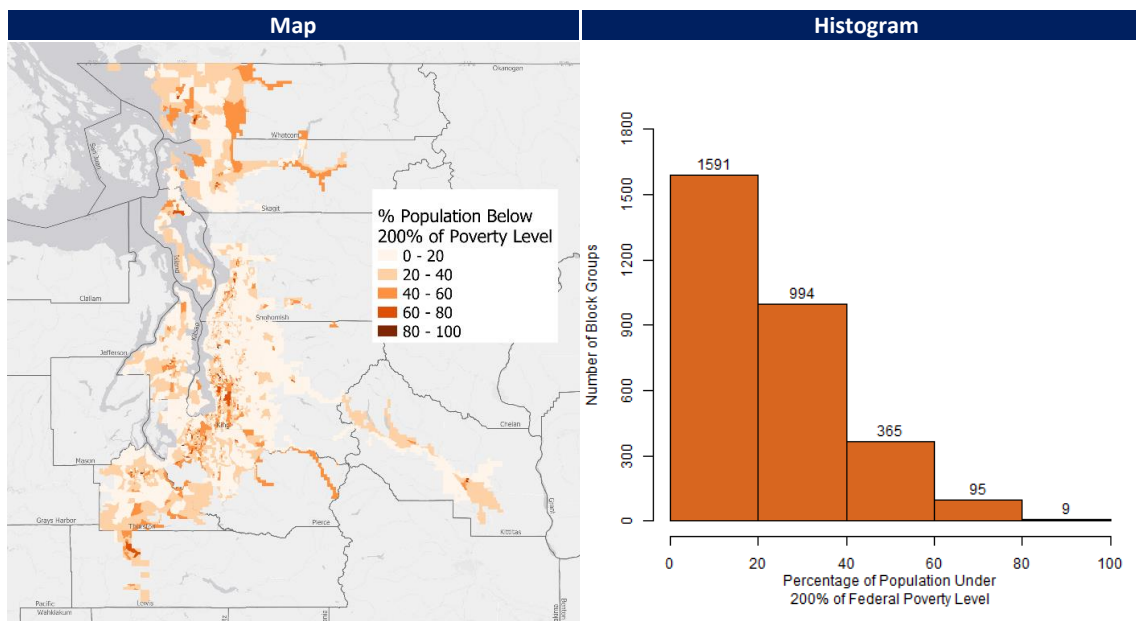
Participation Gaps

To identify gaps in historical program participation, Cadmus used PSE's LIW and EA program tracking data. We geocoded and mapped the individual households served through these programs and compared them against the population of households that met income eligibility for each program. For each geographic area (i.e., Census block group or PUMA), we calculated the number of eligible, unserved households by taking the difference between the historically served customers and the total eligible population. See the *Research Approach* section for details regarding the study parameters in how eligible, underserved customers were estimated.

The next section provides a series of maps presenting the PSE territory distributions for the eligible, unserved populations based on different programs, income-eligibility criteria, comparison metrics, and geographies. PSE and community partners can use this information to identify high concentrations of underserved customers and begin to consider ways to further assess or address these gaps in future research or program strategies.

Appendix A provides additional maps and distributions of income-eligible customers within PSE's service territory.

Low-Income Weatherization

Figure 8 and Figure 9 present the distributions of underserved households eligible for the LIW program, by total number of household and percentage of eligible households, respectively. Income eligibility is set at 200% FPL, and each figure presents the distribution by PUMA and Census block group side by side.

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As shown, upper quintiles of the distribution highlight those geographies with the highest concentration of eligible, unserved households. With annual LIW projects limited based on higher cost of service, much of the eligible customer population remains underserved, as noted by the range across the bins of the distribution.

Figure 8. Distribution of Total Underserved Households for LIW (at 200% FPL) by Geography
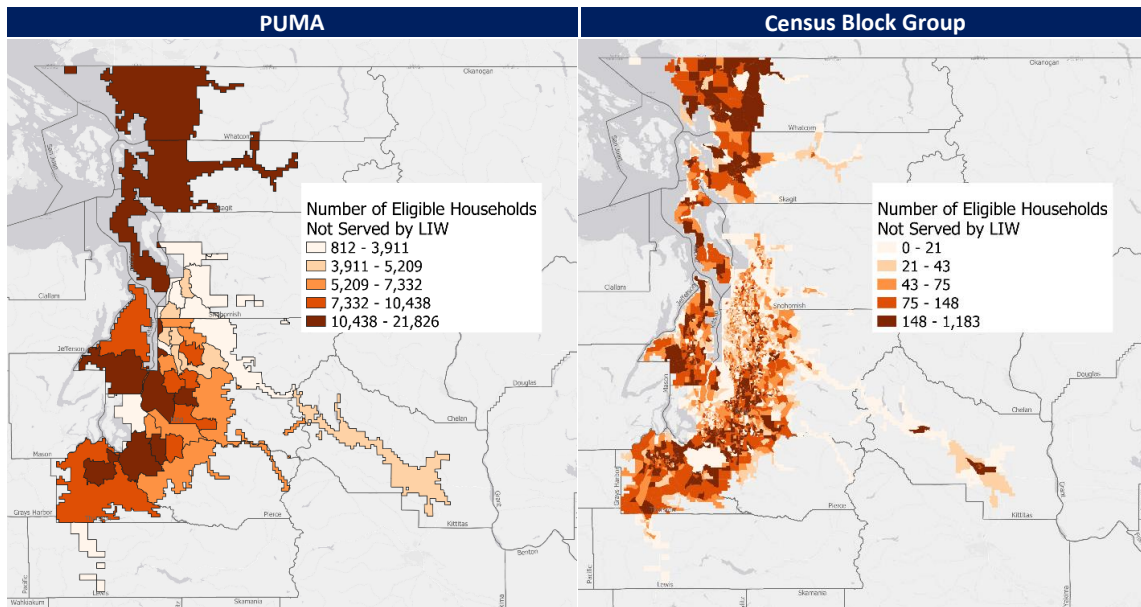
Figure 9. Distribution (%) of Underserved Households for LIW (at 200% FPL) by Geography*
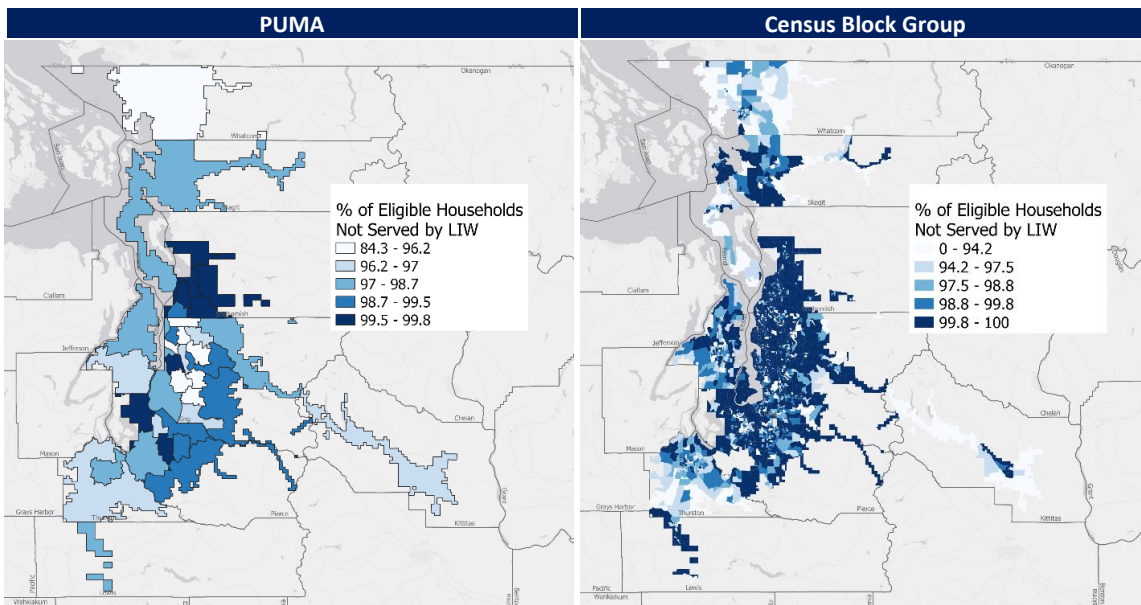
* PUMA percentages were binned by quintile. Because 65% of Census block groups were not served, these were grouped into the first bin, while quartiles were used to bin the remainder.

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From the figures above, Figure 10 highlights the top 20% of PUMAs based on each metric (total count and percentage) quantifying the underserved population. While each metric identifies some differences in geographies by the top quintile of the distribution, the difference between bins in these distributions is marginal given the high level of eligible customers across the territory relative to the historic delivery.[15] Regarding total count, the PSE territories intersecting with Whatcom, Skagit, and Thurston PUMAs contain the highest concentration of unserved, income-eligible households.

Figure 10. Top 20% of Underserved PUMAs for LIW (200% FPL) by Total Count and Percentage
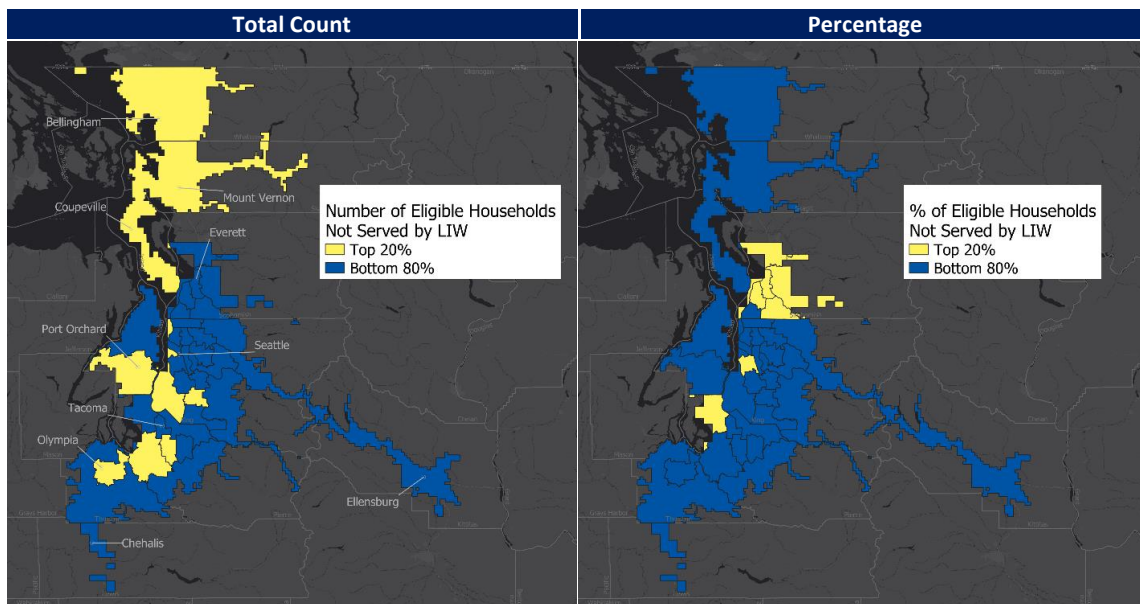
PUMA Name	Households	PUMA Name	% Households
Whatcom County – Bellingham	21,826	Snohomish County (West Central)	99.8
Skagit, Island & San Juan Counties	17,235	Snohomish County (Central & Southeast)	99.8
Thurston County - Olympia	16,260	Seattle (West)	99.7
Pierce County - Tacoma (South)	12,914	Snohomish County (North)	99.7
Kitsap County (South)	12,721	Snohomish County (Central)	99.7

Energy Assistance

Figure 11 and Figure 12 present the distributions of underserved households eligible for the EA program, by total number of household and percentage of eligible households, respectively. Income eligibility is set at 150% FPL, and each figure presents the distribution by PUMA and Census block group side by side.

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[15] Including non-PSE funded weatherization projects and additional years of delivery will help refine the accuracy of this distribution.

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Figure 11. Distribution of Total Underserved Households for EA (at 150% FPL) by Geography
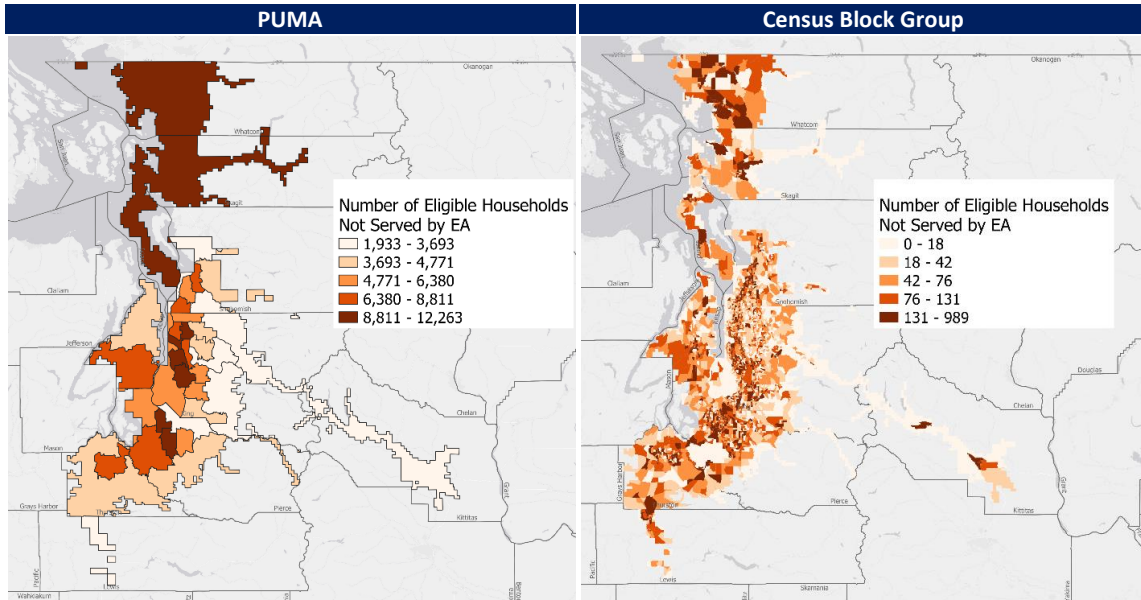
Figure 12. Distribution (%) of Underserved Households for EA (at 150% FPL) by Geography
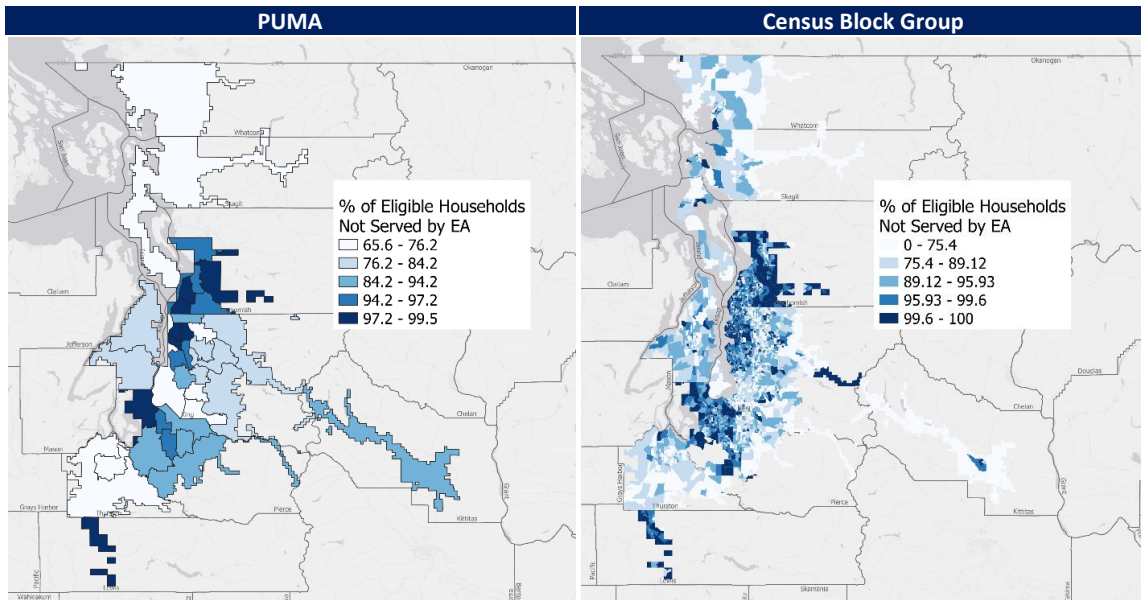
From the figures above, Figure 13 highlights the top 20% of the distribution based on each metric (total count and percentage) quantifying the underserved population. Differences in the top PUMAs between metrics highlight differences in concentrations of eligible, unserved households (by count) compared to higher proportions of underserved customers within each geography (by percentage). Similar to the LIW

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program, the PSE territories intersecting with Whatcom, Skagit, and Thurston PUMAs contain the highest concentration of unserved, income-eligible households.

Figure 13. Top 20% of Underserved PUMAs for EA (150% FPL) by Total Count and Percentage

PUMA Name	Households
Whatcom County - Bellingham	12,263
Skagit, Island & San Juan Counties	9,160
Thurston County - Olympia	8,579
Pierce County - Tacoma (South)	8,254
Kitsap County (South)	7,332

PUMA Name	% Households
Seattle (Northeast)	98.1
Seattle (Downtown) – Queen Anne & Magnolia	98.1
Seattle (Northwest)	97.0
Pierce County (Northwest)	96.0
Pierce County - Tacoma (South)	95.6
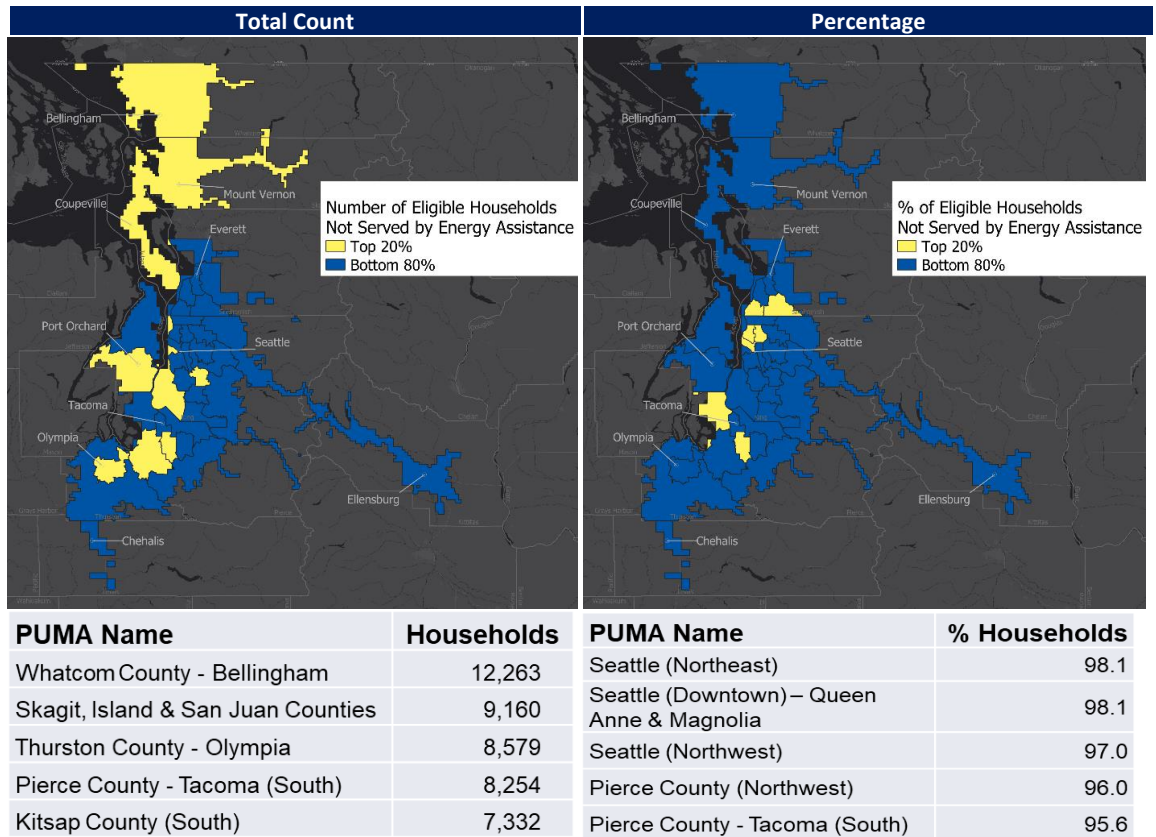
Composite Need Score

The following maps provide the PUMA-level distributions of eligible households (at 200% FPL) by different need criteria (Figure 14 through Figure 19). Each map presents the percentage of income-eligible households meeting each factor, along with an excerpt showing the top eight PUMA territories and associated household percentages by need criteria. These criteria include households with children under 18 years of age, residents over 65 years of age, residents with disability, higher relative energy burden, race/ethnicity (non-white), and limited English proficiency.

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Figure 14. Distribution of Eligible Households (200% FPL) by High Need Criteria – Children Under 18

PUMA Name	% Households
King County (Southwest Central)	54.8
Pierce County (West Central)	49.6
King County (Far Southwest)	47.6
King County (Southwest)	47.0
Pierce County (Southeast)	45.5
King County (West Central)	44.1
King County (Central)	43.9
Snohomish County (West Central)	43.8
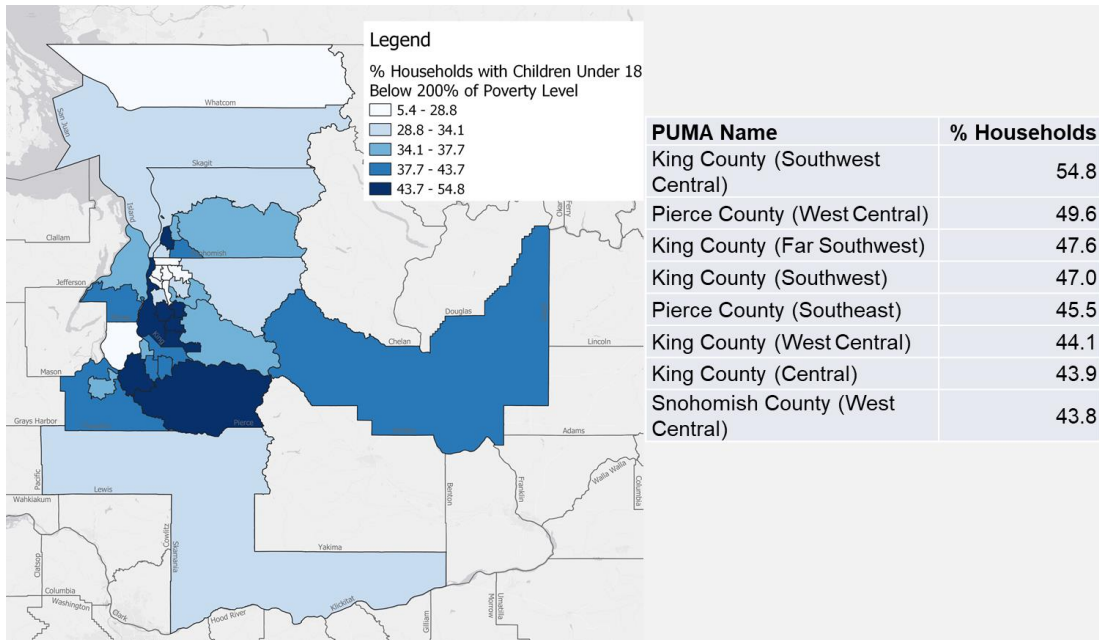
Figure 15. Distribution of Eligible Households (200% FPL) by High Need Criteria – Adults Over 65

PUMA Name	% Households
King County (Southeast)	42.6
Seattle (Northwest)	39.0
King County (Northeast)	38.8
Snohomish County (North)	37.9
King County (Central)	37.9
King County (Northwest)	37.1
Snohomish County (South Central)	37.0
Snohomish County (Southwest)	36.7
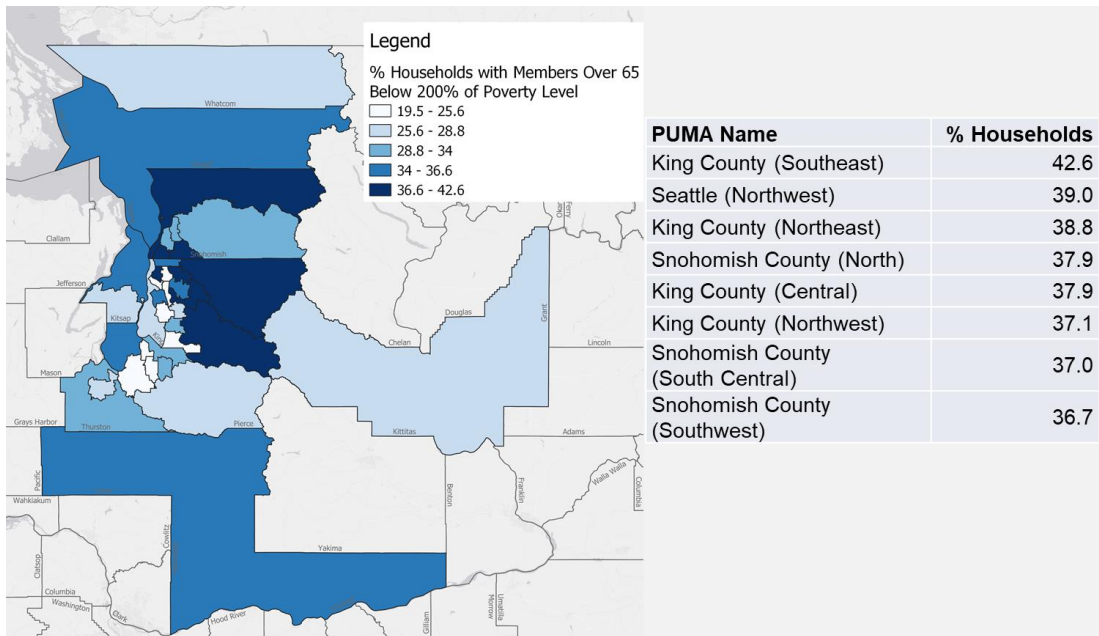
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Figure 16. Distribution of Eligible Households (200% FPL) by High Need Criteria – Disability

PUMA Name	% Households
Snohomish County (North)	48.5
Kitsap County (South)	48.0
Lewis, Klickitat & Skamania Counties	45.1
Snohomish County (Central)	42.0
Pierce County - Tacoma (Central)	41.2
King County (Southwest)	39.7
Seattle (Northwest)	39.3
King County (Far Southwest)	38.5
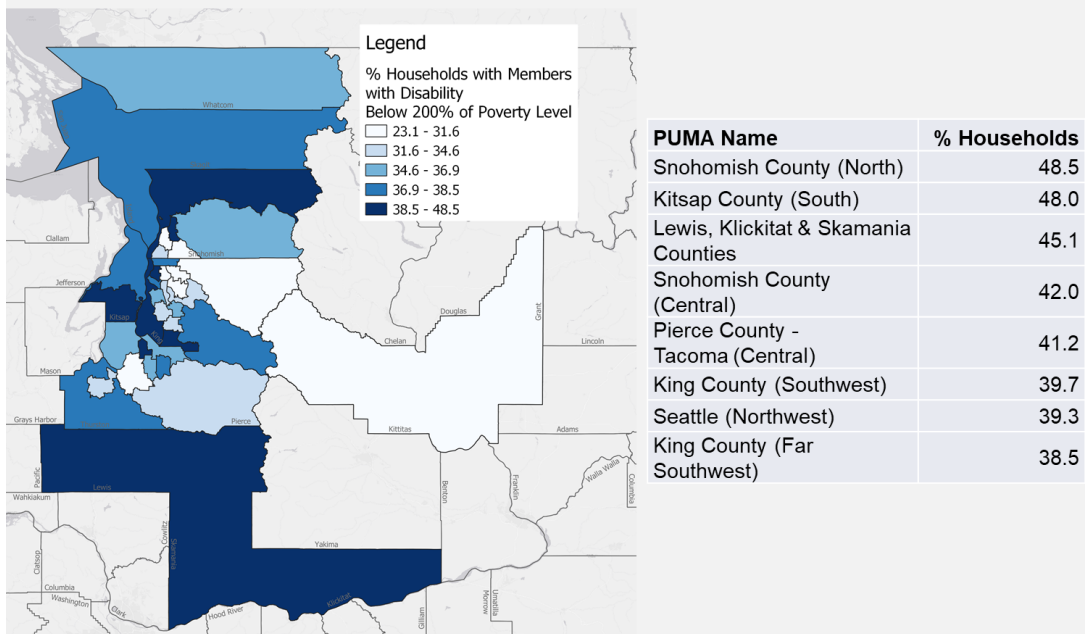
Figure 17. Distribution of Eligible Households (200% FPL) by High Need Criteria – Energy Burden

PUMA Name	Average Energy Burden (% Income)
Seattle (Northeast)	16.0
King County (Southeast)	16.0
Thurston County (Outer)	14.0
Seattle (Northwest)	13.6
Pierce County (Southeast)	13.4
Skagit, Island & San Juan Counties	13.2
Lewis, Klickitat & Skamania Counties	13.0
Kitsap County (North)	12.7
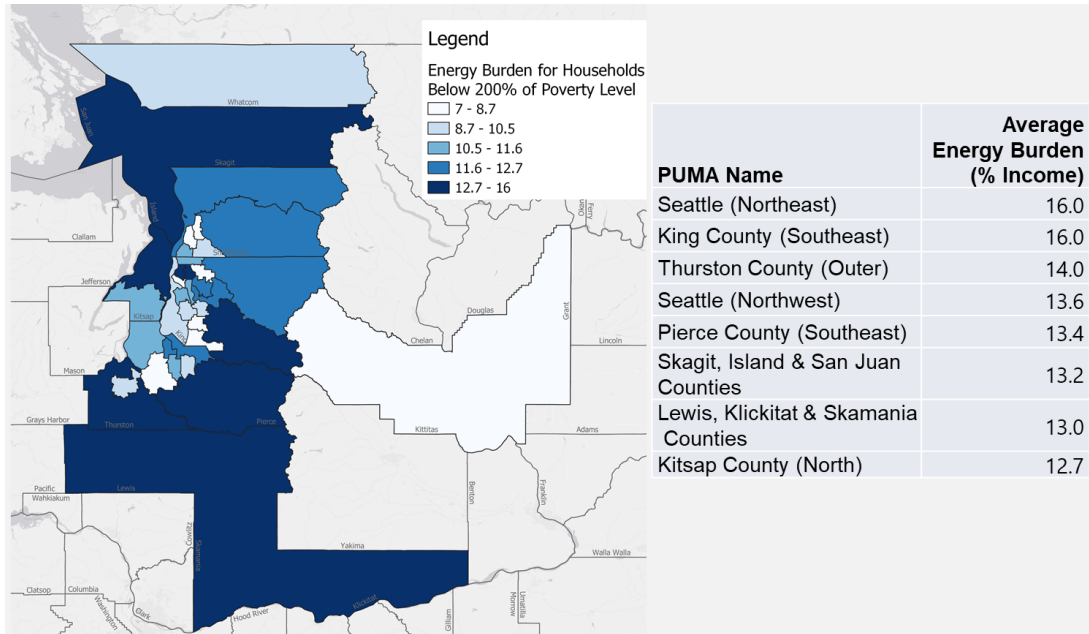
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Figure 18. Distribution of Eligible Households (200% FPL) by High Need Criteria – Race/Ethnicity

PUMA Name	% Population
Seattle (Southeast)	72.5
Seattle (West)	68.4
King County (West Central)	66.1
King County (Central)	65.9
King County (Southwest Central)	60.2
King County (Far Southwest)	59.6
Seattle (Northeast)	50.2
King County (Northwest Central)	48.0
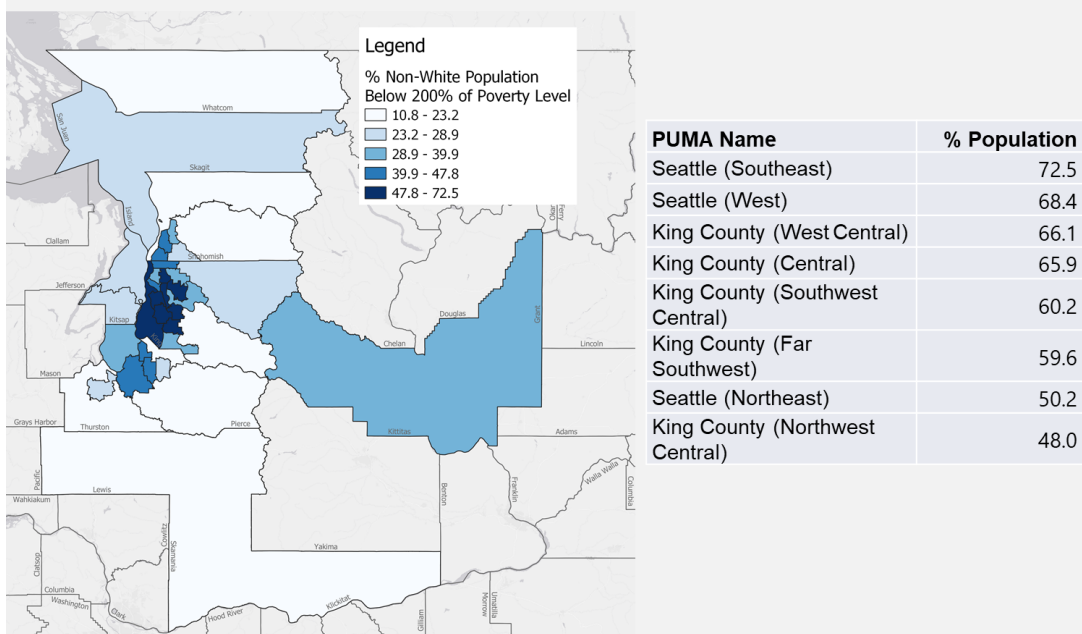
Figure 19. Distribution of Eligible Households (200% FPL) by High Need Criteria – Limited English Proficiency

PUMA Name	% Households
King County (West Central)	23.3
Snohomish County (West Central)	21.7
King County (Northwest Central)	21.6
Seattle (West)	18.6
King County (Southwest Central)	18.4
Seattle (Northeast)	17.2
King County (Central)	15.6
King County (Southwest)	14.1
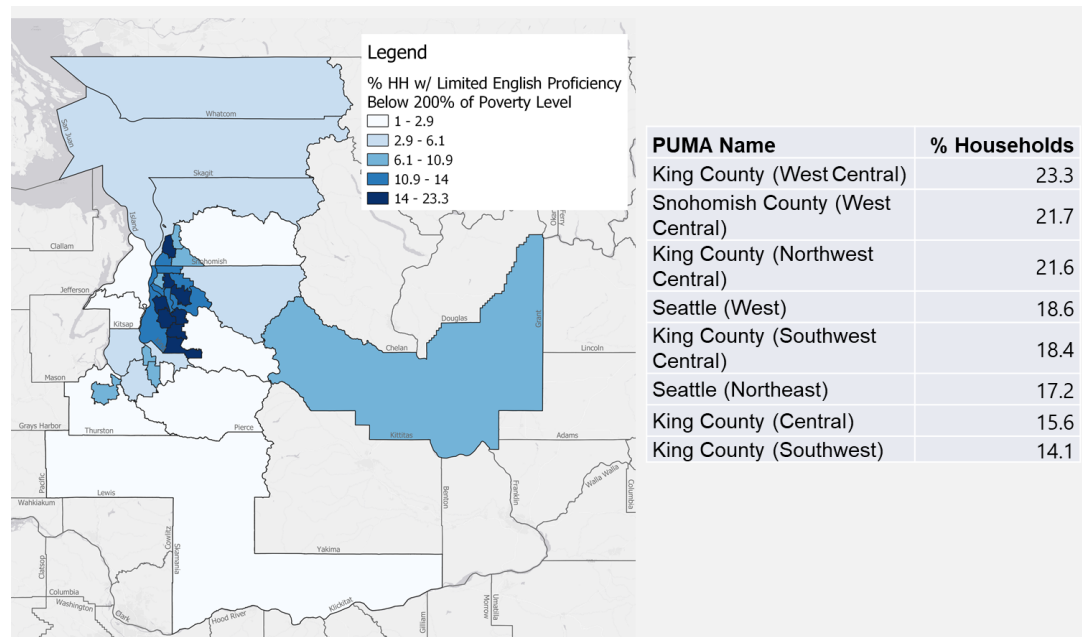
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Figure 20 shows Scenario 1, which includes scoring from distributions of four high need criteria: households with children under 18, residents over 65, residents with disabilities, and energy burden. Figure 21 shows Scenario 2, which includes all former need criteria, with the addition of race/ethnicity (non-white) and limited English proficiency.

Figure 20. Distribution of PUMAs by Composite Need Score – Scenario 1

High Need Variables: Households with Children, Over 65, Disability, and Energy Burden

PUMA Name	Need Score
King County (Southeast)	33
Thurston County (Outer)	32
Snohomish County (North)	31
Kitsap County (North)	30
Lewis, Klickitat & Skamania Counties	30
Seattle (Northwest)	30
Skagit, Island & San Juan Counties	30
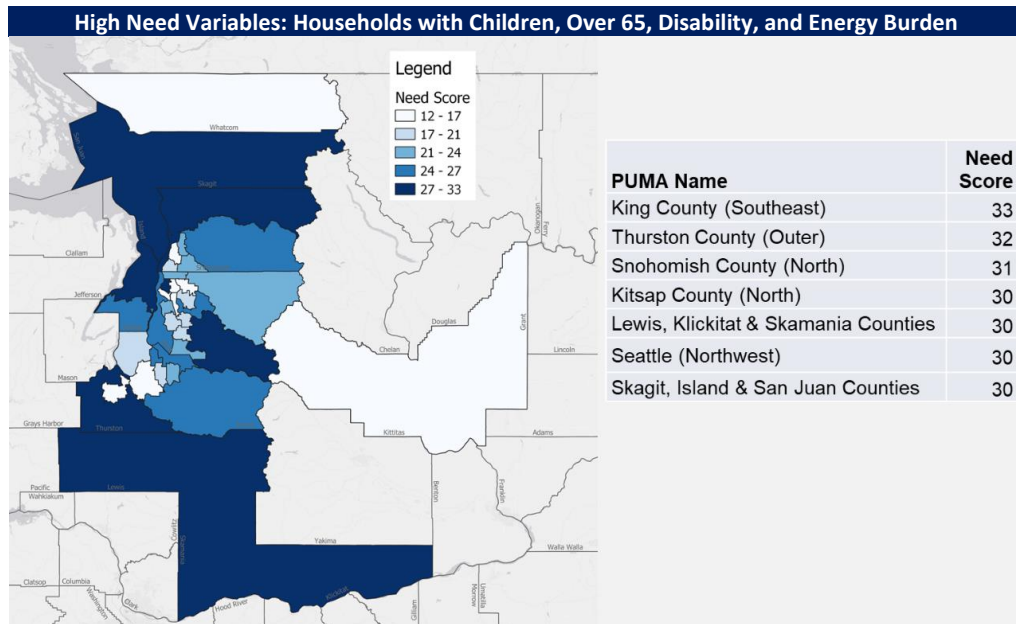
Figure 21. Distribution of PUMAs by Composite Need Score – Scenario 2

High Need Variables: Households with Children, Over 65, Disability, Energy Burden, Non-White, and Limited English Proficiency

PUMA Name	Need Score
King County (Far Southwest)	43
Seattle (West)	42
Seattle (Northwest)	41
King County (Central)	39
King County (Northwest Central)	39
King County (Southwest Central)	39
King County (West Central)	39

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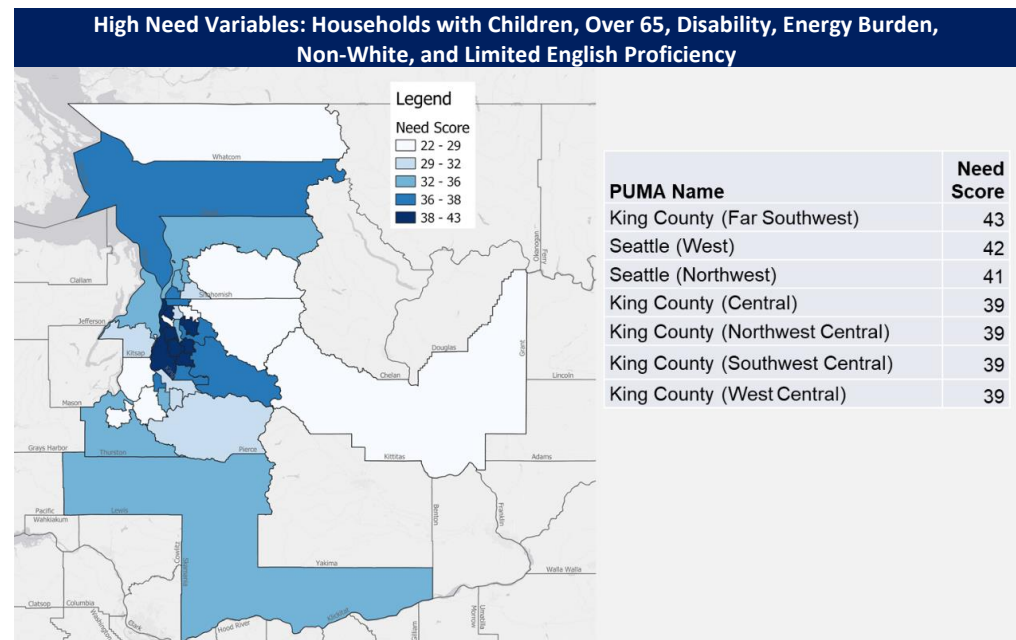
Figure 22 provides a side-by-side comparison of two composite need score scenarios. As shown, differences in composite need scoring scenarios highlight higher concentrations of eligible customers who identify as non-white and/or have limited English proficiency in urban areas around King County. In the absence of those two factors, the need scoring in Scenario 1 highlights a more diverse geography of high need PUMAs (in the top 20% of the distribution) outside of the Seattle area, including Skagit, Thurston, and Pierce counties.

Figure 22. Composite Need Scoring – High Need Scenario Comparison*
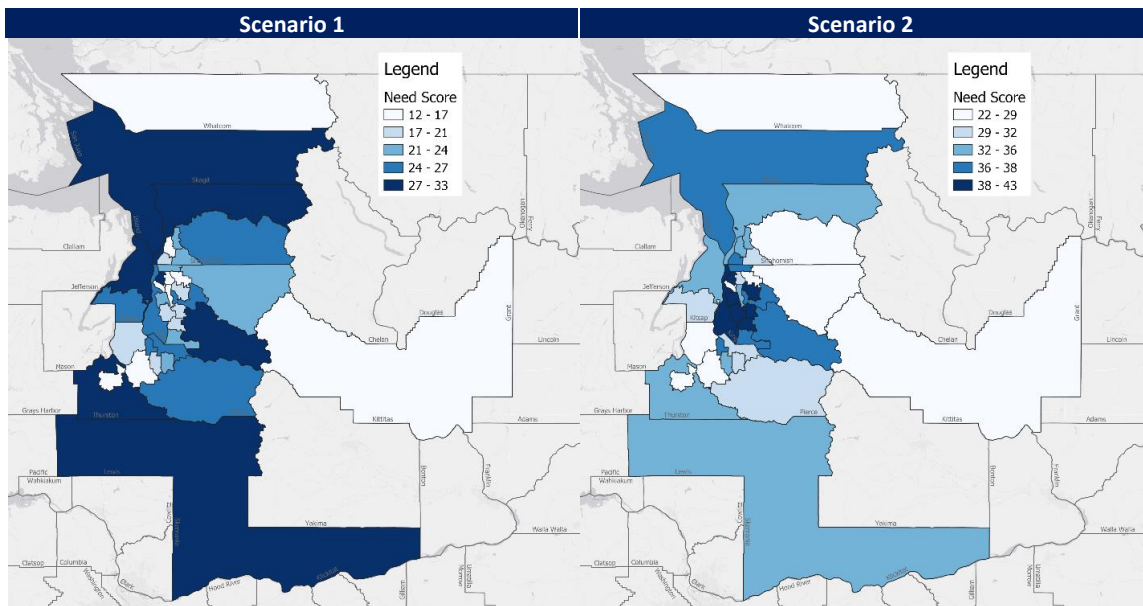
* Note, scores should only be considered relatively within each scenario, rather than across scenarios, since absolute scores will vary based on the number of need criteria used. For this reason, the distributions between Scenario 1 and Scenario 2 can be compared, rather than absolute scores

Underserved Block Groups with Highest Need

To consider an approach to identify underserved geographies with the highest need, Cadmus developed a series of maps presenting the intersection of high-need PUMAs (based on the composite scoring criteria) and underserved Census block groups (based on the gap analysis). Specifically, Figure 23 and Figure 24 present maps with the top 20% of the eligible, unserved block groups (i.e., total concentration of households) which occur within the PUMA territories with the highest composite need score (top 20%). Approximately 95 block groups meet these criteria for Scenario 1 and 140 block groups for Scenario 2.

Additional maps showing the distribution of these high-need block groups relative to key demographics (i.e., race/ethnicity and limited English proficiency) and overlap with tribal block groups are presented in Appendix A.

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Figure 23. Underserved Block Groups with Highest Need – Need Score Scenario 1

Top 10 Census Block Groups by Households Not Served

Block Group	County	Households Not Served	Need Score
530579524023	Skagit	524	30
530579523011	Skagit	501	30
530670120002	Thurston	465	32
530299709002	Island	457	30
530670124121	Thurston	428	32
530579518001	Skagit	415	30
530579523021	Skagit	407	30
530579522002	Skagit	391	30
530579523022	Skagit	339	30
530670124113	Thurston	322	32

Criteria
- Top 20% of number of households not served
- Top 20% of need score

Block groups meeting these criteria: 95

Figure 24. Underserved Block Groups with Highest Need – Need Score Scenario 2

Top 10 Census Block Groups by Households Not Served

Block Group	County	Households Not Served	Need Score
530330292062	King	540	39
530330260021	King	529	39
530330284031	King	520	39
530330300062	King	489	43
530330253023	King	439	39
530330297003	King	439	39
530330253013	King	437	39
530330254002	King	401	39
530330292041	King	369	39
530330295035	King	367	39

Criteria
- Top 20% of number of households not served
- Top 20% of need score

Block groups meeting these criteria: 140

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Weatherization Savings Potential

Figure 25 and Figure 26 show the geographic distribution of energy-efficiency potential for electric and natural gas savings, respectively, at the Census block group level. As noted, this reflects a top-down method to estimate potential that scales the number of eligible, unserved households within PSE's territory by evaluated estimates of whole-house energy savings based on a recent LIW program evaluation. We based the evaluated household-level savings on a billing analysis that captured total changes in consumption attributed to conservation measures, energy education, and other behavioral changes influenced by the program (e.g., take back). The average LIW participant savings serves as a proxy for considering economic-achievable potential, since this reflects programmatic delivery and cost-effectiveness thresholds that guide measure installations.

For electric savings in Figure 25, each Census block group reflects a weighted savings distributions based on the proportion of electric versus non-electric heating (based on total block group population, not specific to income). Average household savings is 2,021 kWh annually based on the full analysis sample, with savings of 3,029 kWh for electrically-heated and 659 kWh for non-electrically heated projects. A snapshot of the top 10 block groups with highest electric potential is also provided, which reflects both the number of eligible, unserved customers and the weighted savings potential based on higher saturations of electric heat.

Figure 25. Distribution of Energy Efficiency Potential by Block Group for Eligible/Unserved Households (at 200% FPL) – Electric Savings (MWh)

Top 10 Block Groups

Block Group	County	Potential Savings (MWh)	% Households with Electric Heat
530730012013	Whatcom	3,050	81%
530379754011	Kittitas	2,737	86%
530530718061	Pierce	2,222	96%
530730001003	Whatcom	2,193	60%
530730012011	Whatcom	2,133	83%
530530716011	Pierce	1,922	85%
530670105101	Thurston	1,907	94%
530330292062	King	1,801	96%
530530717041	Pierce	1,769	99%
530330260021	King	1,607	97%

Annual savings per household: 2,021 kWh

Weatherization Potential Savings (MWh)
- 0 - 30
- 30 - 101
- 101 - 211
- 211 - 393
- 393 - 3,050
- Not in PSE Electric Service Area

Figure 26 shows the gas savings potential occurring in Census block groups within PSE's gas-service territory. Based on the evaluation, average annual gas savings potential is 188 therms per household.

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Figure 26. Distribution of Energy Efficiency Potential by Block Group for Eligible/Unserved Households (at 200% FPL) – Natural Gas Savings (Therms)

Top 10 Block Groups

Block Group	County	Potential Savings (therms)	% Households with Gas Heat
530330302022	King	47,659	83%
530670120002	Thurston	46,994	51%
530330295021	King	45,860	67%
530330110022	King	43,456	50%
530610418121	Snohomish	42,921	46%
530330276002	King	41,876	69%
530530731261	Pierce	39,686	50%
530670122222	Thurston	38,660	66%
530330298026	King	36,769	75%
530610418122	Snohomish	36,040	43%

Annual savings per household: 188 therms

Weatherization Potential Savings (therms)
- 0 - 309
- 309 - 3,618
- 3,618 - 6,738
- 6,738 - 11,148
- 11,148 - 47,659
- Not in PSE Gas Service Area

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Appendix A. Additional Maps and Details

This section provides some additional maps and distributions of income-eligible customer populations in PSE's service territory.

Territory-Level Distributions by Block Group

Figure 27 presents the distribution of block groups within the PSE service territory for two key demographic factors: race/ethnicity (i.e., percentage of non-white population) and language (i.e., percentage of limited-English households). These distributions are not restricted to specific income eligibility and reflect the general distribution across all PSE customers.

Figure 27. Distribution of Block Groups within PSE Territory
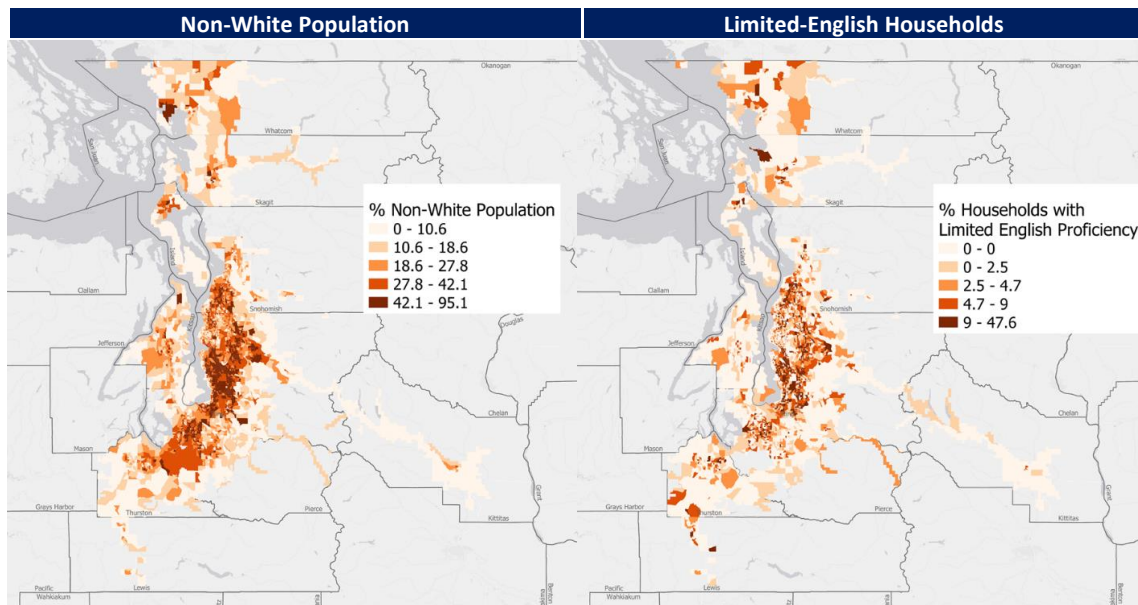
* The bins in the Non-White Population map were calculated using quintiles. Because 44% of block groups contained no limited English proficiency households, those block groups were used to build the first bin in the associated map. Quartiles were used to bin the remainder of block groups by percentage of households with limited English proficiency.

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Underserved Block Groups with Highest Need

Figure 28 through Figure 30 present the distribution of the underserved block groups with highest need for different need score scenarios, demographic categories, and intersection with tribal block groups.

With PSE territory, there are 59 tribal block groups. In Scenario 1, of the 95 Census block groups identified for targeting, 10 overlap with tribal block groups. In Scenario 2, of the 140 Census block groups identified for targeting, two overlap with tribal block groups.

Figure 28. Underserved Block Groups with Highest Need – Intersection with Tribal Block Groups

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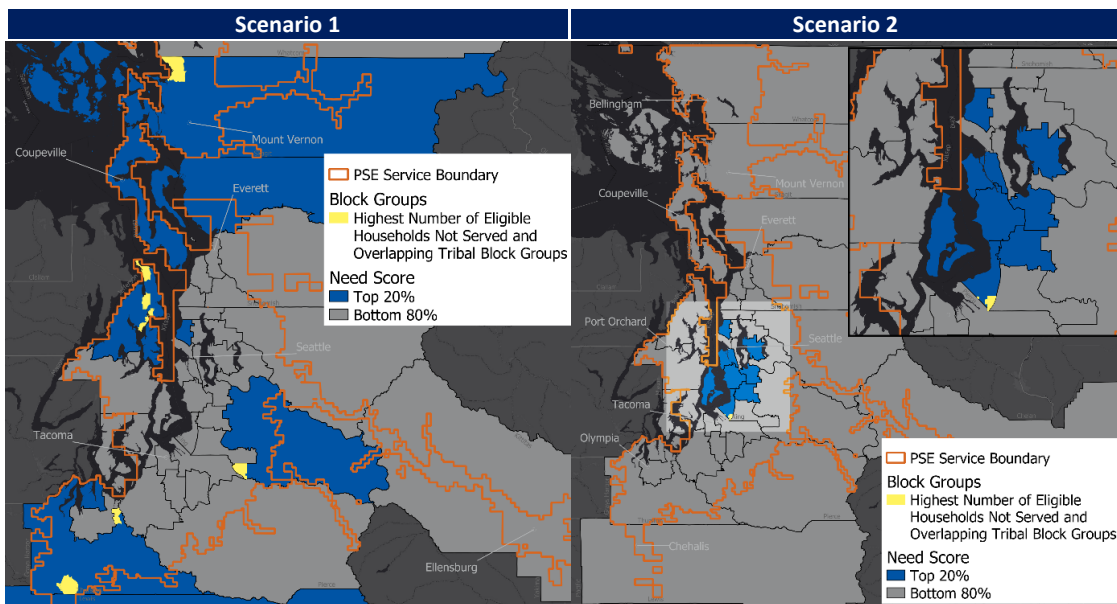
Figure 29. Underserved Block Groups with Highest Need – Distribution by Race/Ethnicity
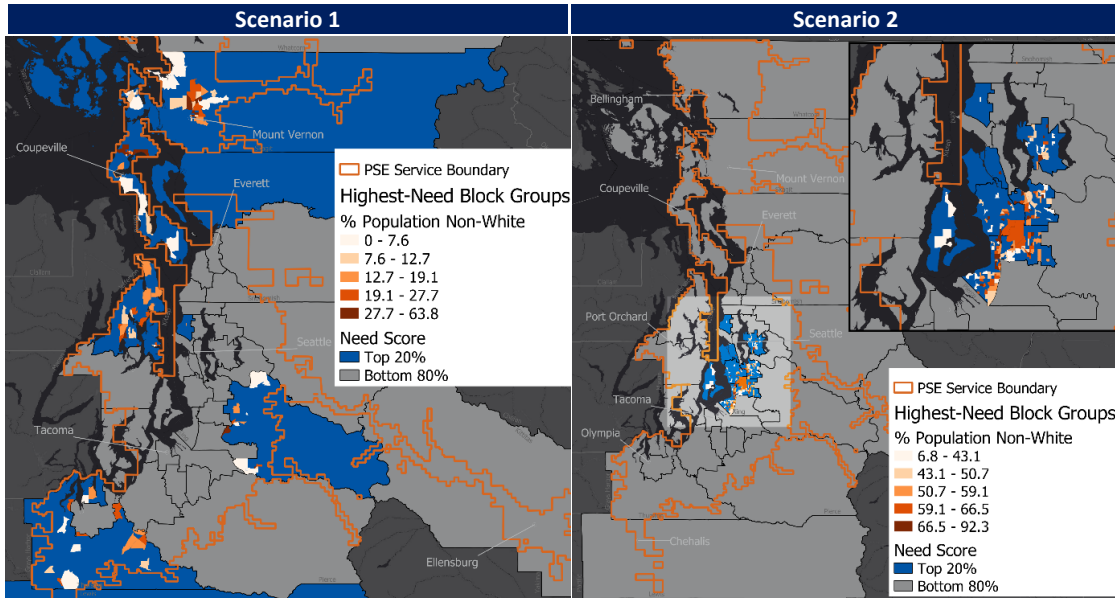
Figure 30. Underserved Block Groups with Highest Need – Distribution by Limited English Proficiency
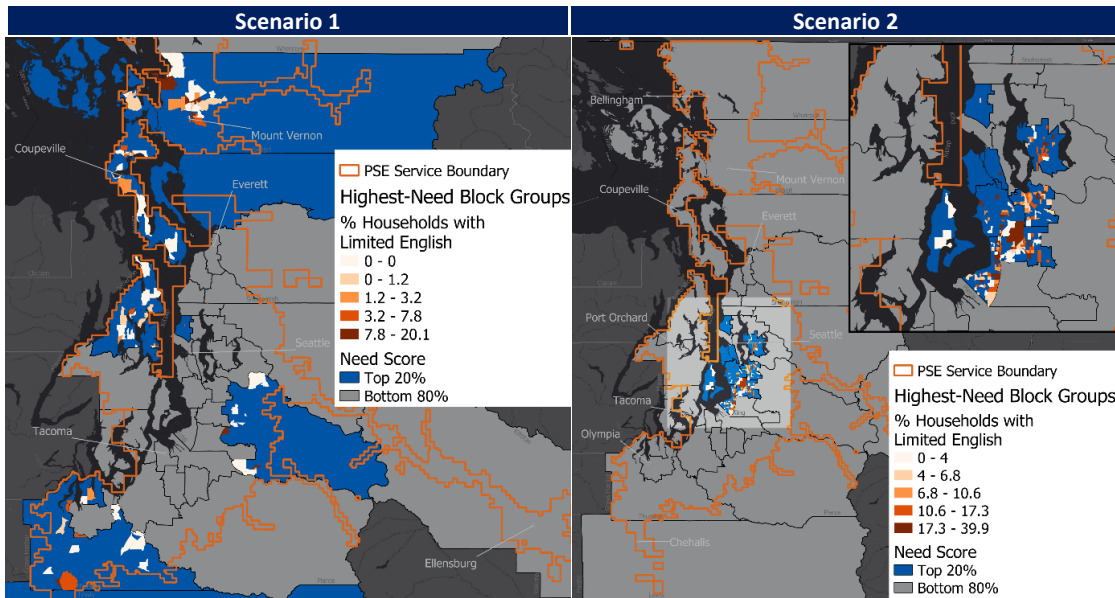
* As in similar cases, the bins for Scenario 1 were calculated as block groups with no limited English proficiency households in the first bin and quartiles for the remainder. In Scenario 2, the highest-need block groups had a non-zero concentration of these households frequently enough that simple quintile binning could be used.

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Tabular Distribution by PUMA

Table 1 and Table 2 provide counts of households summarized by different income thresholds and need criteria. These counts are based on households for the 37 PUMAs overlapping within PSE service territory, which will include non-PSE households that occur outside the utility territory.

Table 1. Distribution of Households by Income and Need Criteria – Total for PUMAs in PSE Territory

Category	Subgroup	Total Households (Overall)	Total Eligible Households (<200% FPL)	% Eligible Households of Total	Total Eligible Households		% of Eligible Households	
					> 6% Energy Burden	> 10% Energy Burden	> 6% Energy Burden	> 10% Energy Burden
Age	With older adults (over 65)	497,399	125,802	25%	66,994	45,184	53%	36%
	Without older adults	1,452,875	293,082	20%	151,728	102,171	52%	35%
Children	With children (under 18)	587,253	145,704	25%	68,995	42,818	47%	29%
	Without children	1,363,021	273,180	20%	149,727	104,537	55%	38%
Disability	With disabilities	458,393	151,206	33%	81,135	55,284	54%	37%
	Without disabilities	1,491,881	267,678	18%	137,587	92,071	51%	34%
Tenure	Renters	761,246	266,564	35%	116,271	75,889	44%	28%
	Owners	1,189,028	152,320	13%	102,451	71,466	67%	47%
Housing Type	Single family	1,285,003	187,882	15%	124,801	87,166	66%	46%
	Multifamily (2-4)	116,012	41,190	36%	19,612	12,390	48%	30%
	Multifamily (5+)	453,529	152,412	34%	51,092	31,494	34%	21%
	Mobile home/other	95,730	37,400	39%	23,217	16,305	62%	44%
Age of Home	Built before 1980	905,046	214,407	24%	119,345	81,790	56%	38%
	Built in 1980 or later	1,045,228	204,477	20%	99,377	65,565	49%	32%
English Proficiency	English Proficiency	1,873,386	379,713	20%	201,028	136,026	53%	36%
	Limited English Proficiency	76,888	39,171	51%	17,694	11,329	45%	29%
Race	White	1,389,427	272,430	20%	145,873	98,848	54%	36%
	Non-White	560,847	146,454	26%	72,849	48,507	50%	33%
Income	< 150% FPL	288,031	288,031	100%	176,045	127,219	61%	44%
	150-200% FPL	130,853	130,853	100%	42,677	20,136	33%	15%
	> 200% FPL	1,531,390	0	0%	144,051	66,695	0%	0%

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Table 2. Distributions of Households by Need Criteria, Income Group, and PUMA

PUMA Name	Income Group	Total Households	Renter		Gas Heat		Electric Heat		Limited English		Children		Seniors		People with Disabilities	
			Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.
Grant & Kittitas Counties PUMA	< 150% FPL	12,355	8,093	66%	613	5%	11,015	89%	1,239	10%	4,851	39%	2,749	22%	3,587	29%
	150% - 200% FPL	5,519	2,964	54%	393	7%	4,768	86%	443	8%	1,995	36%	1,874	34%	2,055	37%
	> 200% FPL	30,780	8,694	28%	3,963	13%	23,339	76%	713	2%	8,386	27%	8,987	29%	7,537	24%
King County (Central)--Renton City, Fairwood, Bryn Mawr & Skyway PUMA	< 150% FPL	7,715	5,382	70%	2,023	26%	5,394	70%	1,221	16%	3,262	42%	2,032	26%	3,061	40%
	150% - 200% FPL	3,741	2,536	68%	1,134	30%	2,433	65%	564	15%	1,762	47%	921	25%	986	26%
	> 200% FPL	41,642	15,635	38%	19,949	48%	20,047	48%	2,490	6%	12,375	30%	9,099	22%	8,002	19%
King County (Central)--Sammamish, Issaquah, Mercer Island & Newcastle Cities PUMA	< 150% FPL	3,689	1,732	47%	1,754	48%	1,791	49%	521	14%	1,359	37%	1,371	37%	1,328	36%
	150% - 200% FPL	1,485	774	52%	696	47%	789	53%	45	3%	516	35%	588	40%	320	22%
	> 200% FPL	49,964	11,201	22%	33,025	66%	15,264	31%	1,948	4%	21,314	43%	10,384	21%	6,654	13%
King County (Far Southwest)--Federal Way, Des Moines Cities & Vashon Island PUMA	< 150% FPL	8,310	5,977	72%	1,855	22%	6,245	75%	1,117	13%	3,971	48%	2,179	26%	3,512	42%
	150% - 200% FPL	4,099	2,637	64%	829	20%	3,003	73%	539	13%	1,937	47%	1,140	28%	1,268	31%
	> 200% FPL	35,957	12,829	36%	16,295	45%	18,136	50%	1,366	4%	9,863	27%	10,231	28%	8,252	23%
King County (Northeast)--Snoqualmie City, Cottage Lake, Union Hill & Novelty Hill PUMA	< 150% FPL	2,583	1,321	51%	563	22%	1,572	61%	180	7%	787	30%	908	35%	821	32%
	150% - 200% FPL	1,654	664	40%	654	40%	825	50%	60	4%	445	27%	738	45%	388	23%
	> 200% FPL	38,068	5,318	14%	23,277	61%	10,884	29%	394	1%	15,430	41%	8,397	22%	5,889	15%
King County (Northwest Central)--Greater Bellevue City PUMA	< 150% FPL	6,135	4,041	66%	1,948	32%	3,977	65%	1,608	26%	1,720	28%	2,054	33%	1,701	28%
	150% - 200% FPL	2,312	1,171	51%	933	40%	1,309	57%	213	9%	1,000	43%	849	37%	741	32%
	> 200% FPL	50,044	20,771	42%	27,041	54%	21,576	43%	2,934	6%	16,251	32%	10,905	22%	6,748	13%
King County (Northwest)--Redmond, Kirkland Cities, Inglewood & Finn Hill PUMA	< 150% FPL	5,293	3,471	66%	1,425	27%	3,686	70%	733	14%	1,621	31%	1,913	36%	1,621	31%
	150% - 200% FPL	1,832	926	51%	710	39%	1,122	61%	87	5%	368	20%	727	40%	526	29%
	> 200% FPL	52,175	20,791	40%	26,045	50%	25,064	48%	2,234	4%	17,248	33%	9,761	19%	6,190	12%

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PUMA Name	Income Group	Total Households	Renter		Gas Heat		Electric Heat		Limited English		Children		Seniors		People with Disabilities	
			Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.
King County (Northwest)--Shoreline, Kenmore & Bothell (South) Cities PUMA	< 150% FPL	5,460	3,618	66%	1,456	27%	3,731	68%	694	13%	1,358	25%	1,880	34%	2,105	39%
	150% - 200% FPL	2,510	1,481	59%	739	29%	1,590	63%	197	8%	897	36%	957	38%	889	35%
	> 200% FPL	40,417	10,596	26%	22,215	55%	15,786	39%	1,126	3%	13,081	32%	10,631	26%	6,935	17%
King County (Southeast)--Maple Valley, Covington & Enumclaw Cities PUMA	< 150% FPL	3,581	1,357	38%	1,022	29%	1,932	54%	132	4%	1,207	34%	1,563	44%	1,219	34%
	150% - 200% FPL	2,413	809	34%	760	31%	1,147	48%	15	1%	880	36%	989	41%	1,004	42%
	> 200% FPL	39,131	5,893	15%	21,497	55%	12,100	31%	433	1%	14,062	36%	8,871	23%	8,072	21%
King County (Southwest Central)--Kent City PUMA	< 150% FPL	8,310	6,263	75%	1,510	18%	6,469	78%	1,775	21%	4,717	57%	2,375	29%	2,921	35%
	150% - 200% FPL	3,234	2,008	62%	903	28%	2,188	68%	350	11%	1,605	50%	947	29%	978	30%
	> 200% FPL	31,546	10,725	34%	15,879	50%	14,637	46%	1,789	6%	9,775	31%	7,300	23%	6,661	21%
King County (Southwest)--Auburn City & Lakeland PUMA	< 150% FPL	6,175	4,192	68%	1,469	24%	4,314	70%	1,108	18%	2,615	42%	1,447	23%	2,572	42%
	150% - 200% FPL	3,338	1,571	47%	1,167	35%	2,080	62%	234	7%	1,853	56%	833	25%	1,202	36%
	> 200% FPL	31,481	9,049	29%	14,618	46%	14,482	46%	1,323	4%	10,027	32%	7,352	23%	6,714	21%
King County (West Central)--Burien, SeaTac, Tukwila Cities & White Center PUMA	< 150% FPL	9,495	7,687	81%	1,463	15%	7,558	80%	2,536	27%	4,466	47%	1,969	21%	3,234	34%
	150% - 200% FPL	4,735	2,977	63%	1,119	24%	3,238	68%	781	16%	1,814	38%	1,343	28%	1,500	32%
	> 200% FPL	33,695	12,706	38%	14,006	42%	16,606	49%	1,588	5%	9,089	27%	8,652	26%	8,104	24%
Kitsap County (North)--Bainbridge Island City & Silverdale PUMA	< 150% FPL	5,604	3,201	57%	659	12%	4,008	72%	232	4%	1,967	35%	1,870	33%	2,173	39%
	150% - 200% FPL	3,424	1,458	43%	473	14%	2,296	67%	16	0%	1,127	33%	1,393	41%	1,263	37%
	> 200% FPL	41,341	9,870	24%	9,565	23%	24,241	59%	235	1%	12,073	29%	13,221	32%	9,890	24%
Kitsap County (South)--Bremerton & Port Orchard Cities PUMA	< 150% FPL	9,305	6,171	66%	1,953	21%	6,010	65%	197	2%	3,514	38%	2,407	26%	5,001	54%
	150% - 200% FPL	4,102	2,347	57%	980	24%	2,430	59%	54	1%	1,733	42%	1,177	29%	1,429	35%
	> 200% FPL	37,887	10,582	28%	12,360	33%	19,387	51%	187	0%	10,215	27%	10,922	29%	11,480	30%
Lewis, Klickitat & Skamania Counties PUMA	< 150% FPL	10,650	5,849	55%	770	7%	7,868	74%	278	3%	3,337	31%	3,333	31%	4,826	45%
	150% - 200% FPL	4,652	1,693	36%	603	13%	3,203	69%	57	1%	1,285	28%	2,240	48%	2,076	45%
	> 200% FPL	28,184	6,348	23%	3,805	14%	18,585	66%	181	1%	7,115	25%	10,245	36%	8,857	31%

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PUMA Name	Income Group	Total Households	Renter		Gas Heat		Electric Heat		Limited English		Children		Seniors		People with Disabilities	
			Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.
Pierce County (Central)--Tacoma City (Central) PUMA	< 150% FPL	11,456	8,732	76%	2,718	24%	8,180	71%	1,233	11%	4,030	35%	2,839	25%	5,156	45%
	150% - 200% FPL	4,354	2,876	66%	1,207	28%	3,009	69%	229	5%	1,811	42%	1,087	25%	1,361	31%
	> 200% FPL	35,286	15,255	43%	13,394	38%	19,867	56%	990	3%	9,177	26%	7,021	20%	7,786	22%
Pierce County (East Central)--Puyallup City & South Hill PUMA	< 150% FPL	6,033	3,752	62%	1,256	21%	4,575	76%	136	2%	2,496	41%	1,783	30%	2,199	36%
	150% - 200% FPL	3,432	1,759	51%	1,011	29%	2,170	63%	127	4%	1,464	43%	1,084	32%	1,317	38%
	> 200% FPL	37,587	10,406	28%	17,899	48%	18,339	49%	325	1%	13,295	35%	8,549	23%	8,942	24%
Pierce County (North Central)--Tacoma (Port) & Bonney Lake (Northwest) Cities PUMA	< 150% FPL	4,158	2,024	49%	983	24%	2,713	65%	179	4%	1,595	38%	1,250	30%	1,476	35%
	150% - 200% FPL	2,509	1,165	46%	505	20%	1,826	73%	68	3%	948	38%	956	38%	884	35%
	> 200% FPL	36,443	9,927	27%	16,384	45%	17,822	49%	489	1%	11,464	31%	8,310	23%	7,035	19%
Pierce County (Northwest)--Peninsula Region & Tacoma City (West) PUMA	< 150% FPL	6,065	4,053	67%	641	11%	4,913	81%	409	7%	1,434	24%	1,948	32%	2,441	40%
	150% - 200% FPL	3,137	1,864	59%	537	17%	2,475	79%	13	0%	958	31%	1,292	41%	895	29%
	> 200% FPL	37,199	9,133	25%	12,489	34%	21,324	57%	456	1%	10,077	27%	13,067	35%	9,043	24%
Pierce County (South Central)--Tacoma City (South), Parkland & Spanaway PUMA	< 150% FPL	9,618	6,555	68%	1,091	11%	8,063	84%	948	10%	3,691	38%	1,951	20%	3,823	40%
	150% - 200% FPL	4,837	2,804	58%	624	13%	3,963	82%	404	8%	2,287	47%	1,052	22%	1,476	31%
	> 200% FPL	32,950	10,709	33%	8,651	26%	22,137	67%	972	3%	10,007	30%	8,024	24%	9,302	28%
Pierce County (Southeast)--Graham, Elk Plain & Prairie Ridge PUMA	< 150% FPL	5,019	2,000	40%	402	8%	3,734	74%	79	2%	1,994	40%	1,463	29%	1,781	35%
	150% - 200% FPL	3,071	836	27%	630	21%	1,909	62%	0	0%	1,689	55%	864	28%	934	30%
	> 200% FPL	31,321	3,876	12%	8,881	28%	16,799	54%	62	0%	10,361	33%	7,566	24%	8,676	28%
Pierce County (West Central)--Lakewood City & Joint Base Lewis-McChord PUMA	< 150% FPL	8,810	7,175	81%	1,845	21%	6,806	77%	414	5%	4,626	53%	1,378	16%	2,922	33%
	150% - 200% FPL	4,506	3,305	73%	1,084	24%	3,332	74%	377	8%	1,973	44%	1,214	27%	928	21%
	> 200% FPL	29,908	13,912	47%	11,499	38%	17,462	58%	751	3%	9,011	30%	7,446	25%	7,028	23%
Seattle City (Downtown)--Queen Anne & Magnolia PUMA	< 150% FPL	9,995	9,155	92%	1,540	15%	7,604	76%	1,215	12%	603	6%	2,345	23%	4,035	40%
	150% - 200% FPL	3,349	2,894	86%	614	18%	2,428	72%	453	14%	115	3%	895	27%	989	30%
	> 200% FPL	68,954	45,961	67%	17,412	25%	46,949	68%	1,395	2%	7,218	10%	9,211	13%	6,488	9%

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PUMA Name	Income Group	Total Households	Renter		Gas Heat		Electric Heat		Limited English		Children		Seniors		People with Disabilities	
			Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.
Seattle City (Northeast) PUMA	< 150% FPL	10,011	8,403	84%	1,498	15%	7,562	76%	1,941	19%	1,282	13%	1,575	16%	2,328	23%
	150% - 200% FPL	2,554	2,015	79%	343	13%	1,893	74%	217	8%	271	11%	908	36%	702	27%
	> 200% FPL	40,378	16,182	40%	17,779	44%	18,483	46%	1,210	3%	10,297	26%	9,263	23%	5,823	14%
Seattle City (Northwest) PUMA	< 150% FPL	7,622	5,266	69%	1,791	23%	5,408	71%	667	9%	1,100	14%	2,968	39%	3,245	43%
	150% - 200% FPL	3,510	2,097	60%	1,155	33%	2,004	57%	366	10%	861	25%	1,369	39%	1,129	32%
	> 200% FPL	62,366	29,404	47%	27,132	44%	30,094	48%	1,231	2%	13,137	21%	10,042	16%	7,491	12%
Seattle City (Southeast)-- Capitol Hill PUMA	< 150% FPL	8,329	6,692	80%	1,528	18%	6,139	74%	1,143	14%	2,295	28%	2,160	26%	2,688	32%
	150% - 200% FPL	2,449	1,698	69%	650	27%	1,556	64%	298	12%	804	33%	595	24%	1,033	42%
	> 200% FPL	43,962	19,659	45%	21,782	50%	19,297	44%	1,063	2%	9,262	21%	8,361	19%	6,312	14%
Seattle City (West)-- Duwamish & Beacon Hill PUMA	< 150% FPL	9,395	6,660	71%	2,395	25%	6,261	67%	1,828	19%	3,231	34%	3,262	35%	3,604	38%
	150% - 200% FPL	3,444	2,118	61%	1,088	32%	2,141	62%	566	16%	994	29%	1,259	37%	837	24%
	> 200% FPL	47,091	16,859	36%	21,417	45%	20,579	44%	1,818	4%	11,294	24%	10,158	22%	7,762	16%
Skagit, Island & San Juan Counties PUMA	< 150% FPL	15,918	8,936	56%	3,743	24%	9,144	57%	869	5%	5,350	34%	5,301	33%	6,580	41%
	150% - 200% FPL	7,184	3,207	45%	2,159	30%	3,124	43%	244	3%	2,497	35%	3,114	43%	2,249	31%
	> 200% FPL	67,225	16,485	25%	21,967	33%	25,598	38%	850	1%	15,705	23%	25,162	37%	17,870	27%
Snohomish County (Central & Southeast)-- Lake Stevens & Monroe Cities PUMA	< 150% FPL	5,019	2,426	48%	1,012	20%	3,153	63%	101	2%	1,728	34%	1,416	28%	1,822	36%
	150% - 200% FPL	3,418	1,486	43%	718	21%	2,278	67%	0	0%	1,180	35%	1,396	41%	1,241	36%
	> 200% FPL	39,159	7,362	19%	14,562	37%	17,244	44%	449	1%	14,541	37%	8,293	21%	8,455	22%
Snohomish County (Central)--Everett City (Central & East) & Eastmont PUMA	< 150% FPL	8,269	6,395	77%	1,339	16%	6,558	79%	1,049	13%	2,633	32%	2,684	32%	3,753	45%
	150% - 200% FPL	3,774	2,273	60%	871	23%	2,853	76%	261	7%	1,578	42%	1,143	30%	1,302	34%
	> 200% FPL	34,859	13,203	38%	14,083	40%	19,535	56%	1,069	3%	9,360	27%	7,246	21%	7,666	22%
Snohomish County (North)--Marysville & Arlington Cities PUMA	< 150% FPL	6,416	3,521	55%	1,190	19%	4,169	65%	209	3%	1,700	26%	2,311	36%	3,251	51%
	150% - 200% FPL	3,491	1,809	52%	537	15%	2,560	73%	113	3%	1,173	34%	1,445	41%	1,555	45%
	> 200% FPL	43,294	9,266	21%	14,473	33%	20,287	47%	380	1%	13,781	32%	11,558	27%	11,249	26%

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PUMA Name	Income Group	Total Households	Renter		Gas Heat		Electric Heat		Limited English		Children		Seniors		People with Disabilities	
			Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.	Count	Pct.
Snohomish County (South Central)--Bothell (North), Mill Creek Cities & Silver Firs PUMA	< 150% FPL	3,133	1,431	46%	1,138	36%	1,751	56%	281	9%	1,319	42%	1,052	34%	764	24%
	150% - 200% FPL	1,830	927	51%	840	46%	971	53%	160	9%	737	40%	785	43%	380	21%
	> 200% FPL	41,409	7,873	19%	25,615	62%	13,539	33%	841	2%	17,336	42%	8,020	19%	6,543	16%
Snohomish County (Southwest)--Edmonds, Lynnwood & Mountlake Terrace Cities PUMA	< 150% FPL	6,542	4,259	65%	1,668	25%	4,527	69%	899	14%	2,126	32%	2,418	37%	2,241	34%
	150% - 200% FPL	2,337	1,184	51%	766	33%	1,546	66%	130	6%	867	37%	840	36%	691	30%
	> 200% FPL	38,284	11,470	30%	19,233	50%	17,417	45%	858	2%	10,103	26%	10,604	28%	7,571	20%
Snohomish County (West Central)--Mukilteo & Everett (Southwest) Cities PUMA	< 150% FPL	6,248	4,637	74%	1,334	21%	4,755	76%	1,631	26%	2,772	44%	1,912	31%	1,893	30%
	150% - 200% FPL	3,000	2,103	70%	868	29%	1,908	64%	385	13%	1,282	43%	806	27%	937	31%
	> 200% FPL	39,256	15,363	39%	18,243	46%	19,459	50%	1,932	5%	11,085	28%	7,662	20%	7,303	19%
Thurston County (Central)--Olympia, Lacey & Tumwater Cities PUMA	< 150% FPL	11,640	8,401	72%	2,555	22%	8,531	73%	798	7%	3,585	31%	3,203	28%	4,137	36%
	150% - 200% FPL	4,992	3,364	67%	1,261	25%	3,615	72%	238	5%	2,117	42%	1,552	31%	1,397	28%
	> 200% FPL	51,024	19,125	37%	24,472	48%	24,098	47%	948	2%	14,259	28%	14,059	28%	11,372	22%
Thurston County (Outer) PUMA	< 150% FPL	5,689	2,565	45%	415	7%	4,059	71%	82	1%	2,426	43%	1,670	29%	2,229	39%
	150% - 200% FPL	3,094	1,284	41%	384	12%	1,966	64%	13	0%	1,368	44%	1,177	38%	1,094	35%
	> 200% FPL	31,632	5,334	17%	6,112	19%	17,619	56%	309	1%	9,030	29%	9,518	30%	7,758	25%
Whatcom County--Bellingham City PUMA	< 150% FPL	17,986	12,171	68%	4,786	27%	11,190	62%	810	5%	4,607	26%	4,771	27%	7,149	40%
	150% - 200% FPL	7,531	3,916	52%	2,624	35%	3,645	48%	362	5%	2,138	28%	2,543	34%	2,051	27%
	> 200% FPL	59,491	16,910	28%	28,936	49%	18,799	32%	378	1%	15,445	26%	17,499	29%	13,727	23%