



Northwest Under-served Energy Efficiency Markets Assessment

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EXECUTIVE SUMMARY

The Northwest Power and Conservation Council (Council) published its Seventh Northwest Conservation and Electric Power Plan (Seventh Plan) in February 2016. The Seventh Plan provides the Northwest with a regional electric power demand forecast and a resource strategy for meeting this demand through the deployment of energy efficiency and other generation resources. Along with the resource strategy, the Seventh Plan includes a variety of action items for the region to carry out in meeting the Plan objectives, including a significant number related to achieving energy efficiency goals.

This report summarizes the results of the initial phase of action item “MCS-1 - Ensure All Cost Effective Measures Are Acquired” (MCS-1).¹ The essence of MCS-1 is to improve the region’s ability to provide all cost-effective energy efficiency by ensuring programs secure proportional savings from hard to reach populations (described in more detail below).

MCS-1 is composed of two parts: 1) conducting data analysis to identify any proportionally underserved markets or populations, and 2) create or improve utility programs to increase participation in those identified segments. This report summarizes data analysis conducted by a working group of Northwest utilities in support of the first part of this action item (including the Northwest Energy Efficiency Alliance and the Energy Trust of Oregon).² The report also provides a template for conducting these analyses, including both methods and data sources that could be used by other entities.

This report includes findings and observations made by the individual organizations who conducted the research. It represents a first step in developing a methodology to identify under-served energy efficiency markets in the Pacific Northwest. There are many caveats to the research and much more that can be done to ensure the benefits of energy efficiency are equitably distributed throughout the region.

Analysis Method

The research was conducted during the second half of 2017. Each of the working group members conducted an analysis within their own service territory and provided the results to Council staff who then compiled them into this report. The results are specific to each utility or organization and may not be indicative of the region as a whole.

In order to conduct the analyses, two key data sets are needed: energy efficiency participant (e.g., utility program) data and demographic (or firmographic) data. A utility often has detailed information about its energy efficiency program participants. However, a utility does not typically know household income and other demographic or firmographic characteristics of these participants. In

¹ MCS is an abbreviation for Model Conservation Standard. The full text of MCS-1 is in Appendix B.

² Working group members included: Bonneville Power Administration, Idaho Power, Energy Trust of Oregon, Ravalli Electric, Puget Sound Energy, Seattle City Light, Snohomish County PUD, and Tacoma Power



many cases, this information can be purchased from third party sources and matched to the utility program data. Making this connection between utility participant and third-party demographic data is the key to conducting this analysis.

MCS-1 calls for looking at proportionality in program participation. The general approach used in these analyses was to assess participation data in two ways:

- (1) *Participant distribution analyses* that looked at program participant distribution relative to the population. Using the participant distribution analysis, a utility might find that 80% of their program participants were single family households compared to 50% of their customers – a finding that would suggest single family households were overrepresented among program participants.
- (2) *Participation rate analyses* that looked at participation rates relative to the population or demographic of interest in the service-territory customers. Using the participation rate analysis, a utility might find that they served 1% of single family households, 3% of multi-family households, and 5% of manufactured home households – a finding that would show the utility to have reached the largest proportion of manufactured home households of any housing type.

The time period of focus was 2014-2016. This relatively short period was selected because data on both programs and demographics of the population were available. Also, by focusing on the recent past, the goals and activities of efficiency programs are likely similar to current programs. However, the three-year time frame has limitations relative to the more than thirty years of efficiency programs operated in the Northwest and long term trends will not be captured in this limited period snapshot.

Ideally, the analyses would determine proportionality relative to conservation potential, in addition to population. While this is possible for physical structures (e.g., housing types), it is more difficult to track demographics over time relative to potential.

More detail on the methodology and development of the metrics can be found in Section 2 of this report.

Summary of Findings

One of the over-arching findings is that regional energy efficiency programs are generally reaching many of the segments in the Northwest. Utilities have been paying attention to the variety of markets within their territories and often customizing programs to target specific markets. However, some of the segments in some of the utilities could be reached more strongly or consistently. Utility programs include broad-reaching as well as targeted programs. The data also show that when some of the targeted programs are stopped, the targeted segment quickly becomes “underserved”. Some additional findings include:

- The **low income** segments showed a wide range of results ranging from proportionally high participation in lower income brackets to low participation. Often, low cost measures were adopted at above-average rates in the lower incomes while the high cost measures were adopted at below-average rates.
- The **highest income** brackets participated at the lowest rates, in most of the cases.



- **Manufactured housing** residents typically participated at higher rates than single family and multifamily housing residents.
- With one exception, most utilities found the **multifamily** segment to have a lower participation rate relative to other building types. One utility had a strong, targeted multifamily program just prior to the study period. Their analysis showed high participation relative to the population in 2014, but showed a decline in subsequent years after removal of the targeted program.
- **Rural customers** also appear to participate in programs at similar rates as urban customers, and for some utilities participated at greater rates than non-rural customers.
- Snohomish PUD and Tacoma Power evaluated their **commercial sectors** by building type, and PSE by building size. Small business customers were found to participate at lower rates relative to their respective populations. Schools tended to have relatively high participation rates.

Recommendations

With a study as large and diverse as this one, there are many lessons learned along the way and as a result, many enhancements that could be made to this type of effort. The Council staff identified several possible next steps:

- Extend research to look at specific measures or programs
- Identify where single vs. multiple measures were adopted (include total kWh and investment levels(\$))
- Increase participation in this effort to more Northwest utilities
- Improve utility data systems to make this type of analysis easier and applicable to more segments
- Improve and expand energy-efficiency programs for multifamily housing, the most consistently underserved segment in this report
- Continue and improve programs that are successfully targeting individual market segments, such as low-income customers
- Consider the impact of programs that cannot be geographically referenced to customers
- Investigate relative energy efficiency potential in conjunction with underserved segments, especially for structure types (house type, commercial building type)
- Pursue a greater depth of understanding regarding the causal factors behind the results
- Initiate a regional discussion as to what level of underrepresentation is too much
- Utilities should include a range of community interest groups when evaluating and targeting under-served segments

The results contained in this report should not be used to make broad conclusions about programs regionally, but rather are useful to the specific organizations and their own service territories. These utilities can use the results to target specific gaps or underserved segments. To support development of targeted programs, utilities are encouraged to investigate the causal factors behind the results. For example, if a segment (or building type in the case of commercial), appears to be underserved based on proportionality, it's possible this segment also has less potential.



1. BACKGROUND

The Northwest Power and Conservation Council (Council) published its Seventh Northwest Conservation and Electric Power Plan (Seventh Plan) in February 2016. The Seventh Plan provides the Northwest with a regional electric power demand forecast and a resource strategy for meeting this demand through the deployment of energy efficiency and other generation resources.

In addition to the resource strategy, the Seventh Plan includes a variety of action items for the region to carry out in meeting the Plan objectives, including a significant number related to achieving energy efficiency goals. This report summarizes the results of the initial phase of action item “MCS-1 - Ensure All Cost Effective Measures Are Acquired (MCS-1). Appendix B includes the full text of MCS-1.

In order to meet the region’s long-range energy efficiency goals, nearly *all* cost-effective conservation must be achieved. If current energy efficiency programs are not reaching substantial portions of the population, the region may fail to meet its long-term goals. MCS-1 originated from interest in ensuring that all segments of the population receive the benefits of the region’s energy efficiency efforts.

“Bonneville and the regional utilities should determine how to improve participation in cost-effective programs from any underserved segments... Ideally, the customers in the HTR segment should participate in similar proportion to non-HTR customers, assuming similar savings potential.” (MCS-1, first paragraph)

During the development of the Seventh Plan action items, multiple opportunities were given for public stakeholder input, and numerous constituents participated in forming and commenting on the MCS-1 action item. Council members and Council staff worked with advisory committees to review the comments and produce the final version of MCS-1.³

Utilities and other stakeholders involved in this effort offered numerous perceptions regarding possibly underserved market segments, including:

- Low income households
- Middle income households
- Customers in rural regions
- Small business owners and/or business tenants
- Multifamily tenants
- Manufactured home dwellers
- Customers of small and rural utilities

³ https://www.nwcouncil.org/media/7149934/7thplanfinal_chap04_actionplan.pdf#page=10

During the development of the Seventh Plan, the Council staff could find very little data to definitively declare whether any of the above segments were underserved relative to the overall population. Therefore, it was determined that MCS-1 should be comprised of two parts:

1. Conduct data analysis to determine if a particular population segment was, in fact, underserved, and
2. Create or improve utility programs to increase participation among underserved segments.

Timeline of Activity

MCS-1 called for data analysis and reporting to be completed by the end of 2017. To support this effort, Council staff held a Conservation Resources Advisory Committee (CRAC) meeting in November of 2016 to introduce the topic. After that meeting, it became clear that it would be difficult, if not impossible, for a single entity to conduct the necessary research for the entire region. Therefore, in an attempt to keep the effort on track, Council staff recruited and organized a working group of utilities willing to conduct the MCS-1 research in their own service territories.

Working group members dedicated staff time to attending group meetings and conference calls, assembling data sets, and conducting analysis. The working group members demonstrated strong interest in assessing participation in their programs.

MCS-1 Working Group Members

- Puget Sound Energy
- Bonneville Power Administration
- Energy Trust of Oregon
- Seattle City Light
- Snohomish PUD
- Tacoma Power
- Idaho Power
- PacifiCorp
- Northwestern Energy
- Northwest Energy Efficiency Alliance
- Ravalli Electric

Figure 1 shows the timeline of the MCS-1 work in 2017.

Figure 1. MCS-1 Timeline



About this Report

This report summarizes analysis in support of the first phase of MCS-1: the development of a methodological process to assess participation data, the creation of data sets, and the analysis conducted to determine if any populations have been proportionally underserved. Data included in this report were collected and analyzed by the working group members, facilitated by Council staff.

The main body of the report was written by the Council staff and includes a discussion of the methodology used to conduct this research and summaries of the findings compiled by each working group member.

Appendix A contains the data and summaries as provided by each working group member, edited by the Council staff.

Appendix B offers the full text of MCS-1 contained in the Action Plan.



2. METHODOLOGY

Many of the methods and related issues were raised during the working group meeting in May 2017. The meeting was attended by analysts from each of the organizations participating in the working group. At the meeting, working group members established a shared understanding of the methods and issues related to this type of analysis. After May 2017, working group members participated in multiple telephone meetings and communicated via email for the purpose of developing consistent metrics and methods for conducting the analysis.

Working group members took a pragmatic, consensus-based approach to addressing methodological issues, with the goal of ensuring as much consistency as possible. The sections below describe the three components of the methodology: data sources, data fields and definitions, and the analytical approach. As was expected, limitations of time and the availability of data required some working group members to diverge from the agreed-upon approach. These differences are noted in **Chapter 3**, which summarizes the findings of each working group member.

Data Sources

The purpose of the MCS-1 research was to compare the characteristics of two populations within each service territory: **program participants** and the **entire or “general” population** of the territory. Working group members relied on different sources of data for each population.

Program Participants

Most working group members used two types of participant data.

Participating households and businesses (and their programs or measures) were drawn from each organization’s participant records. These varied from simple Excel spreadsheets to Access or SQL databases. For this analysis, each working group member agreed to focus on participants in energy efficiency programs and exclude participants in demand response and renewable energy programs. However, each working group member identified the specific programs or measures from which their participant population could be drawn.

Most working group members used the participant’s street address as the key field identifying the participant. Because members were working with data collected in previous years, most of which was collected without the intention of being used for the present purposes, they encountered challenges with incomplete, missing, and non-conforming data. Mid-stream programs, for example, do not typically result in a list of participants by address. Members often found that programs in which participant addresses *were* recorded often had inconsistent entries, including street names spelled differently or with varying abbreviations for “Street.”

Participant characteristics were drawn from several sources, at each working group member’s discretion. These included the member’s own characteristic data and/or third-party data. Some organizations have developed accurate assessments of one or more characteristics and felt confident in their internal data. Members using third-party data matched to address typically used County Assessor data on building types and/or third-party data from sellers Acxiom, Experian, or CoStar. Organizations matching at the Census block level relied on US Census data.



General Population

Participating organizations drew population data primarily from the US Census and from third-party sellers Acxiom and Experian.

Data Fields and Definitions

MCS-1 listed eight populations that may be underrepresented in Northwest energy efficiency programs, which were developed based on stakeholder input. The included list was not intended to be the definitive list, as they had not been confirmed by participation data at the time MCS-1 was drafted, and the Council recognized that other underserved markets might also exist. In order to conduct a systematic assessment of programmatic service, the working group and the Council did not want to limit the research to the populations listed in MCS-1. The working group developed a list of demographic⁴ and firmographic⁵ characteristics that were hypothesized to influence program participation and, while an ideal scenario would include analysis of participation across every listed characteristic, organizations recognized this was unrealistic in 2017.

A prioritized list of characteristics was created based on the individual rankings of the working group. Table 1 displays the characteristics the working group deemed highest priority and which members aimed to assess in 2017 as well as additional characteristics the group theorized to impact participation but did not prioritize for assessment in 2017.

⁴ “demographics” refers to particular sectors of the population

⁵ “firmographics” refers to sets of characteristics to segment organizations



Table 1. Demographic and Firmographic Characteristics of Interest

	Demographics	Firmographics
Highest priority	Income Own v. rent Home type Urban v. rural	Business type Urban v. rural
Other characteristics of interest	Race/ethnicity Primary language Household age No. of residents in household Highest level of education Years lived in home Remodel in the last 5 years No. of children under 18 yrs Past program participation	NAICS code Race/ethnicity of owner Highest level of education of owner Owner born a US citizen Gender of owner Age of owner Veteran status of owner Disabled status of owner Primary language of owner Lease type (if renter) Place of business owned v. rented No. of employees Year business established Languages used in transactions Gross revenue Past program participation

Analytical Approach

The working group assessed participation using two types of analysis: **participant distribution analysis** and **participation rate**.

Participant Distribution Analysis

The purpose of the *participant distribution analysis* was to compare the distribution of participant characteristics against the distribution of population characteristics, to assess whether there were meaningful differences.

Participant distributions were created using the following calculation:

$$x = \frac{\text{Number of Participants in demographic or firmographic category (e.g., single family homes)}}{\text{Total Participants}}$$

This analysis allowed organizations to calculate the proportion of participants in each category and assess whether the distribution of the participants among the categories was different from the distribution in their service territory population.

Using the participant distribution analysis, a utility might find that 80% of their program participants were single family households compared to 50% of their customers – a finding that would suggest single family households were overrepresented among program participants.



Participation Rate Analysis

The purpose of the *participation rate analysis* was to compare, in each demographic or firmographic category, the proportion of the general population that participated in efficiency programs.

Participation rate was created using the following calculation:

$$x = \frac{\text{Number of Participants in demographic or firmographic category (e.g., single family homes)}}{\text{Total customers in that category}}$$

This type of analysis allowed organizations to calculate the proportion of their service territory population that had participated in their programs.

Using the participation rate analysis, a utility might find that they served 1% of single family households vs. 3% of multi-family households vs. 5% of manufactured home households – a finding that would show the utility to have reached the most manufactured home households of any housing type.

Variations

Working group members generally followed the same methodology and used similar metrics. However, there were a few notable variations.

BPA assessed participants' demographic characteristics at the Census block group level, rather than at the individual household level. Where the other working group members obtained demographic information for each participant, based on the participant's household address, BPA's analysis assumes that the participant's characteristics are equivalent to the median characteristic of the participant's Census block group. For example, a participant's household income is assumed to be equivalent to the median income of the participant's Census block group. In reality, a participant's characteristics may vary from that which is typical of their Census block group. As such, BPA's results must be interpreted as including a higher level of uncertainty than the results of working group members who assessed demographic characteristics at the household level.

PSE went beyond the assessment of participation at the household level to also assess the distribution of kWh savings and incentives. For example, PSE calculated the distribution of kWh savings and incentives by income category, providing an additional perspective on its programs' level of service.

Tacoma Power drew demographic data from surveys it fielded, rather than Census or purchased data as utilized by other working group members. Tacoma noted that one of the surveys it relied on has known biases because it was targeted only to owner-occupied households. Tacoma also took the extra step of comparing some of its population and participant data to conservation potential. This is a valuable addition.



3. SUMMARY OF FINDINGS

This section provides a summary and highlights from the findings submitted by each working group member. The submissions of each member are listed in their entirety in **Appendix A** do represent a substantial portion of the region’s load (86%), customers (89%), and geography (see Table 2). Every working group member investigated program participation by income and housing type, and most also looked into home ownership (owner vs. renter) as well as geography (urban vs. rural). The programs included those with associated addresses and those excluded were those where measures did not have associated address information (such as light bulbs and showerheads).

Table 2. Overview of Working Group Members

Working Group Member	Load Served (MWh)	# of End-Use Customers	HTR Coverage*	Programs included**	Programs excluded
BPA	67,000,000	2,600,000	I, O-R, U-R, HT,	Major measures (higher cost), instant savings measures	Upstream lighting, low-income grants
Energy Trust of Oregon	32,000,000	1,400,000	I, U-R, R-E		
Idaho Power	14,000,000	530,000	I, HT,O-R, U-R	Low cost measures, high cost measures	Upstream lighting, low-income kits, student kits, other giveaways
Puget Sound Energy	22,500,000	1,100,000	I, HT, U-R, C	All measures that could be associated with an address	Lighting, Showerheads
Ravalli Electric	146,000	10,200	I, HT, O-R	Appliances, Heat Pumps, Weatherization	
Seattle City Light	9,000,000	440,000	I, HT, O-R	DHPs, HPWH, Multi-family direct install, Appliance program	
Snohomish PUD	6,200,000	340,000	I, HT, O-R, U-R, C		Light bulbs and fixtures, Showerheads, Power strips
Tacoma Power	4,600,000	177,000	I, HT, O-R, R-E	Weatherization, HVAC	Lighting, Showerheads
Working Group Total	144,000,000	6,000,000			
Regional Total	170,000,000	6,800,000			

* I=Income, O-R=Own vs. Rent, U-R=Urban vs. Rural, HT=Housing Type, R-E=Race/Ethnicity, C=Commercial

**See Appendix A for utility-specific measures and definitions

Data Source: Energy Information Administration 2016.

Limitations on Research

In an ideal world, analysis of program participation would include participation data for all programs, assessed based on every demographic or firmographic characteristic, for the entire duration of a utility or program sponsor's history. The task of the working group was to scope a research project that was feasible given available data, the capacity of each organization to allocate staff time, and the specification of the Seventh Plan that this work be completed in 2017. The results described in this report should thus be understood within the limitations of the overall effort as well as those of the individual working group members.

The limitations include:

- **Time period of analysis limited to 2014-2016.** The working group agreed to focus on the years 2014-2016, primarily because they judged it to be difficult to obtain accurate demographic/firmographic data in prior years. As a result, the findings are a snapshot in time rather than a comprehensive survey of all the members' energy efficiency work. The working group members each have long histories of efficiency program implementation and the findings cannot show the cumulative effects of these programs.
- **Program coverage limited to programs in which participant address was recorded.** The measures and programs covered are only those in which participant address was known. Mid-stream programs that provide incentives at the manufacturer, distributor, or retailer level were not included in these results. Also, different working group members had different interests and different areas of focus, which makes it difficult to extrapolate findings to the region as a whole.
- **Working group members limited to utilities who volunteered to contribute.** The findings represent only those utilities and other organizations that volunteered their staff's time to perform the analyses. To paint a comprehensive picture of the underserved populations in the region, all or nearly all of the organizations that sponsor energy efficiency programs would participate in the working group.
- **Demographic and firmographic analysis limited to available data and time.** The working group brainstormed a long list of possible categories for analysis, but could only attend to those for which data were readily available and for which they had time to conduct analysis in 2017.

Bonneville Power Administration

The Bonneville Power Administration (BPA) is a nonprofit federal power marketing administration that markets wholesale electrical power from 31 federal hydroelectric projects in the Northwest, one nonfederal nuclear plant, and several small nonfederal power plants. BPA provides approximately 28% of the electric power used in the Northwest.

BPA's analysis focused on residential participation and covered the period 2012-2017. BPA's participant data included participants for which BPA had site addresses. This included participants in



BPA's EEI⁶ low-income programs as well as recipients of "major measures" and "instant savings measures" (delivered via direct install or by mail). The analysis excluded recipients of BPA low-income grants. And similar to others, BPA excluded measures for which participant addresses were not available, such as a significant portion of residential lighting.

In contrast to the other working group members, BPA analyzed participant characteristics at the Census block group level, utilizing demographic data from the American Community Survey. Census block groups typically include between 600 and 3,000 people, all of whom live in a geographically contiguous area. In BPA's analysis, a participant's characteristics are assumed to be equivalent to the median characteristic of the participant's Census block group. For example, a participant's household income is assumed to be equivalent to the median income of the participant's Census block group. A participant's characteristics may vary from that which is typical of their Census block group. As such, BPA's results must be interpreted as including a higher level of uncertainty than the results of working group members who assessed demographic characteristics at the household level.

BPA's overall participation rate (the proportion of the population that participated) for the 2012-2017 period was 6.31%. Manufactured home households had the highest participation rate at 13.7% and multifamily households had the lowest participation rate at 0.6%.

When considering Census block groups with the highest rate of participation among all measure types, BPA found that Census block groups in most median household income categories were slightly overrepresented and block groups with median income over \$125,000 were substantially underrepresented, suggesting that households with higher incomes were less likely to participate. The income distribution for participants in major measures was similar. In contrast, the income distribution for participants in "instant savings measures" was more variable, although higher income block groups were also substantially underrepresented (Figures 2, 3).

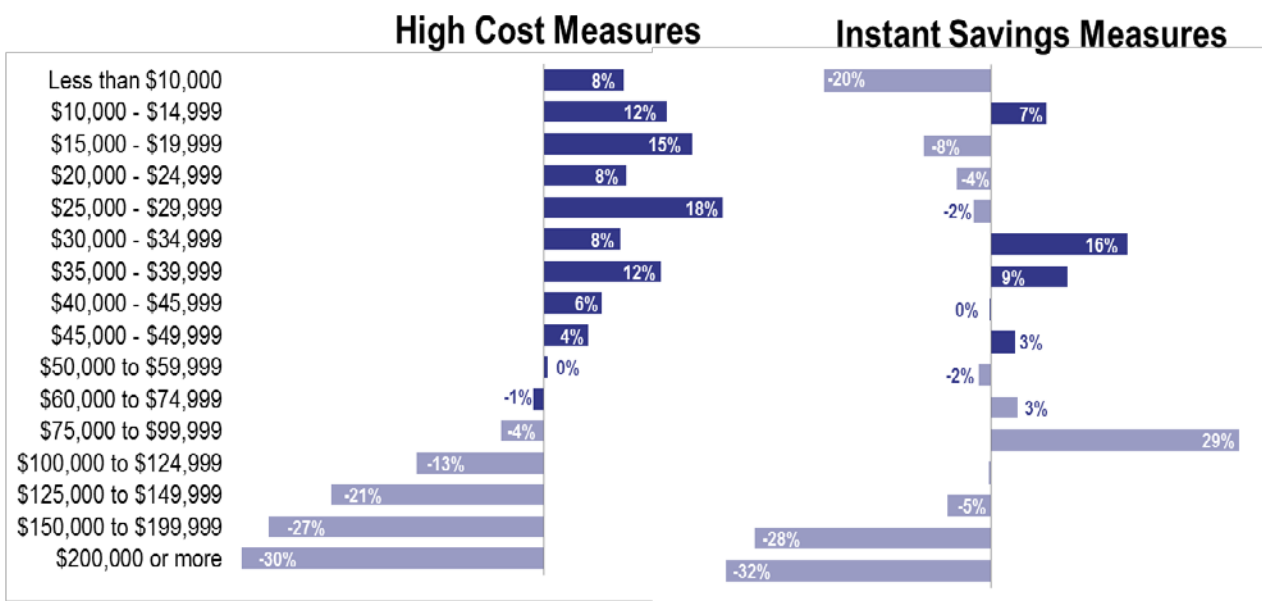
⁶ EEI stands for Energy Efficiency Incentive, which is BPA's overall energy efficiency program.



Figure 2. BPA: Difference between Participants and the General Population in Highest Participating Census Block Groups, by Median Income, for All Residential Measures, 2012-2017



Figure 3. BPA: Difference between Participants and the General Population in Highest Participating Census Block Groups, by Median Income, for "High Cost Measures," and "Instant Savings Measures," 2012-2017



Participation characteristics among BPA’s “small, rural, residential” (SRR) utilities showed similar participation compared with the Non-SRR utilities. However, the SRR utilities differed in some ways from non-SRR utilities. SRR utilities were similar to non-SRR utilities in their overall and “major measure” participation rates. SRR utilities had higher participation in “instant savings measures” and appliance rebates, while the non-SRR utilities had higher participation in low-income weatherization and HVAC programs (Table 3).

Table 3. BPA: Participation Rate by Geography for Appliance Rebates, Low-income Measures, and “Instant Savings Measures,” 2012-2017

	Overall	Appliance rebate	ISMs per household	Low-income Wx and HVAC
Small, rural, residential (SRR) utility	6.9%	16%	0.24	3%
Non-SRR utility	6.2%	6%	0.18	9%

Census block groups with low participation had higher rates of non-English speaking households (19%) than census block groups with high participation (12%).

Energy Trust of Oregon

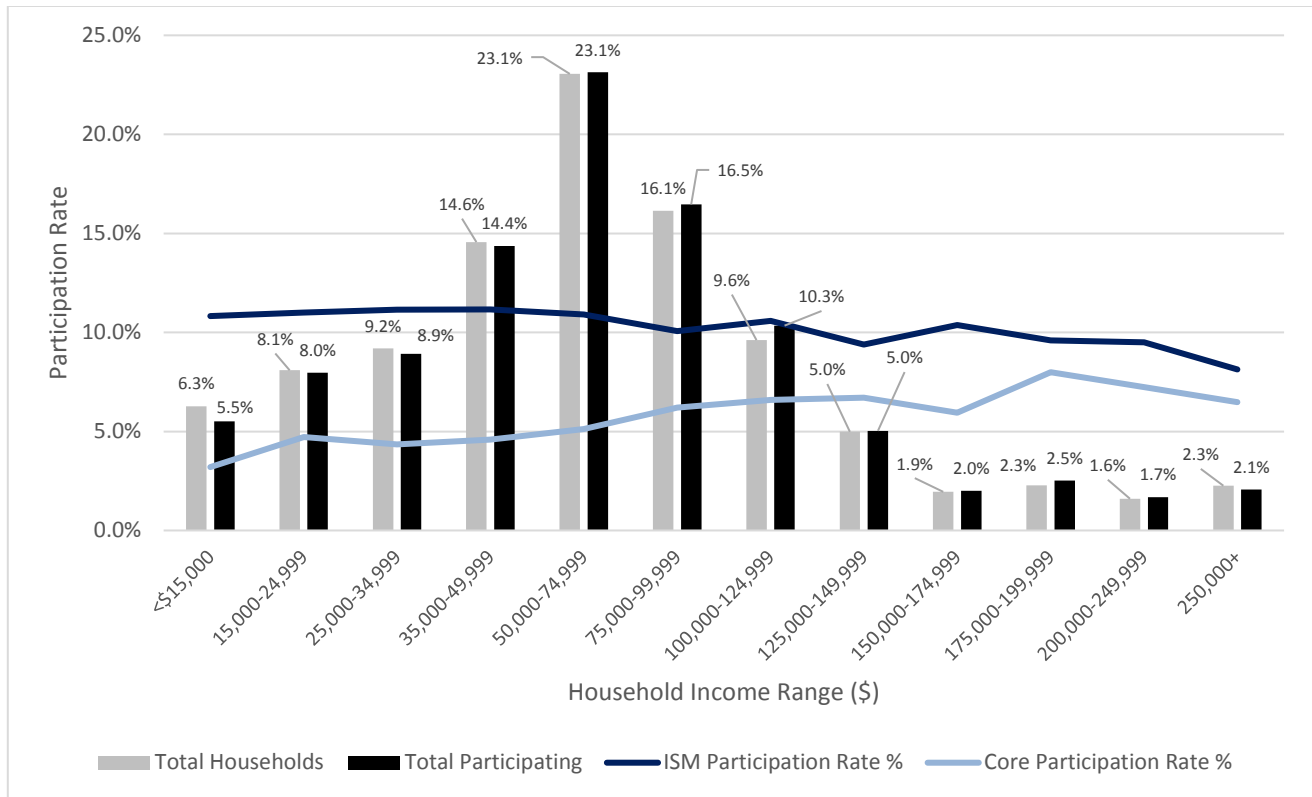
Energy Trust of Oregon is an independent nonprofit organization created to deliver energy efficiency and renewable energy development programs to 1.6 million utility customers of Portland General Electric, Pacific Power, NW Natural, Cascade Natural Gas and Avista in Oregon and southwest Washington.

Energy Trust participated in the first working group meeting but was unable to participate in following meetings due to a staffing change during the period in which the MCS1 research was conducted. Energy Trust was able to perform some analyses following the methods developed by the working group. Energy Trust also provided a summary of qualitative and quantitative data collected in support of the organization’s Diversity, Equity, and Inclusion (DEI) Operations Plan, for which baseline levels of service will be used to measure progress toward DEI goals.

Energy Trust assessed overall participation rate from the organization’s inception in March 2002 to August 2017, finding that 50% of all customers have participated in an Energy Trust program. Participation was substantially higher for residential customers (which included multi-family participants) compared to commercial customers at (48% v. 24% respectively).

Energy Trust assessed participation rate by income for the 2012-2016 period for all measures and high cost v. low cost measures. Among all measures, households with incomes between \$35,000 and \$100,000 had the highest participation rates. The rate of participation in high-cost measures increased as household income increased, with the highest participation rate among households with incomes between \$175,000 and \$200,000. The opposite was true of participation in low-cost measures, which was highest among households with incomes under \$75,000. Energy Trust also found that participation was higher amount households with a college degree or more.

Figure 4. Energy Trust of Oregon Participation by Income



Additional participation research completed by Energy Trust in support of the DEI initiative included a customer insights survey fielded by phone in 2016 and two sets of focus groups in 2017.

Idaho Power

Idaho Power is an investor-owned electric utility serving over 530,000 customers in southern Idaho and eastern Oregon with annual sales of over 15 million kWh and a summer peak load of approximately 3,200 megawatts.

Idaho Power’s analysis covered the 2014-2016 time period. While Idaho Power focused on residential program participation, it also included an assessment of the overall commercial program participation rate. Residential participants included residential households with site addresses that could be matched to addresses in the utility’s Customer Information System (CIS). Participants in four types of programs were excluded: upstream lighting, low-income energy efficiency kits, student energy efficiency kits, and customer giveaways.

Idaho Power used Acxiom to provide participant income and home ownership status at the household level. Both Idaho Power’s own CIS and Acxiom data were used to supply the home type

distribution for the utility’s service territory population. Rural v. urban geographies were assessed at the city level. Idaho Power did not have adequate data to report on race/ethnicity.

During the 2014-2016 time period, Idaho Power made changes to its efficiency offerings that substantially influenced participation rates. In 2014, Idaho Power ended its appliance rebate program and in 2016 initiated a free energy savings kit program.

Idaho Power’s participation rate (the proportion of the population that participated) changed substantially as a result. The overall participation rate in the combined residential and commercial sectors rose dramatically, from just under 1% in 2014 and 2015 (the years without the free kits) to 8% in 2016. The introduction of the free energy saving kits also increased residential participation and participation in “low cost” measures (Figure 5).

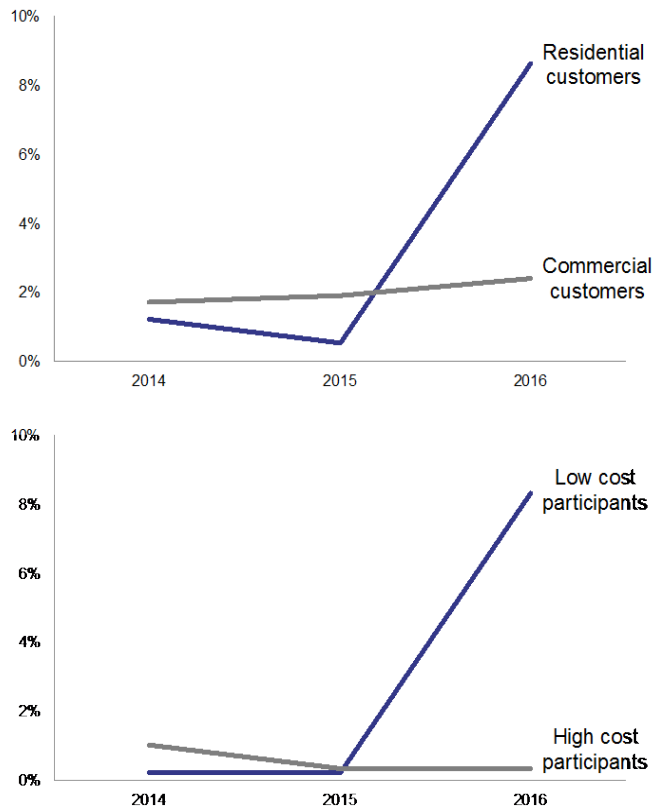
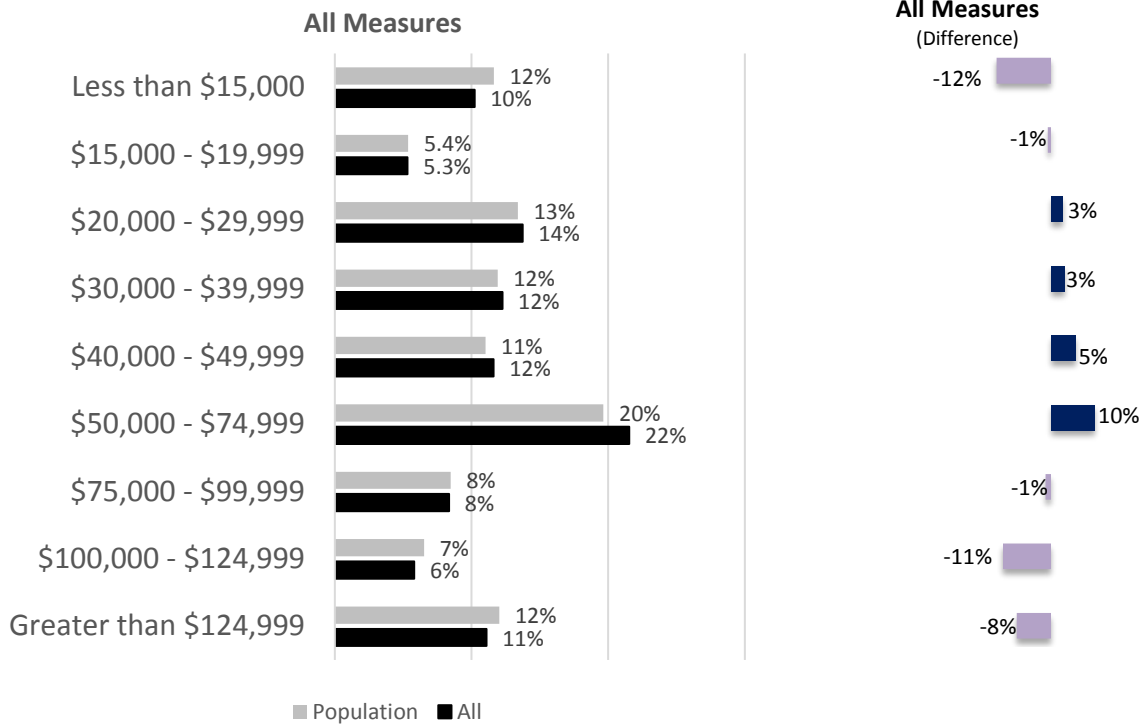


Figure 5. Idaho Power: Participation Rate for Residential vs. Commercial (top) and Low vs. High Cost Measures (bottom), 2014-2016

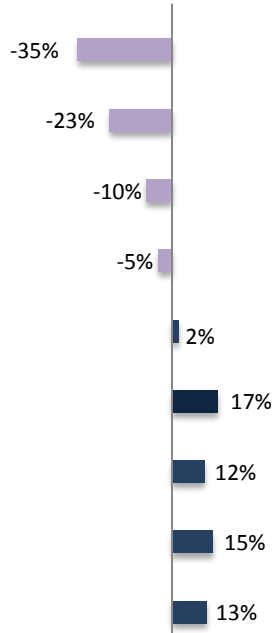
During the period as a whole, for all measure types, manufactured and single family households participated at a similar rate (4.0% and 3.6% respectively) and multifamily households participated at a slightly lower rate (2.3%). Among all residential participants, most were single family households (77%). Manufactured and multifamily households made up a similar, smaller proportion of participants (13% vs. 10%).

When looking at residential participation rates by income, Idaho Power found the participant distribution was comparable to the population when considering all measure types, but differed sharply when high vs. low cost measures were disaggregated. Lower income households were underrepresented in high cost measures (with the exception of participants in the \$15,000-19,000 category, who were substantially overrepresented) and overrepresented in low cost measures (Figure 6).

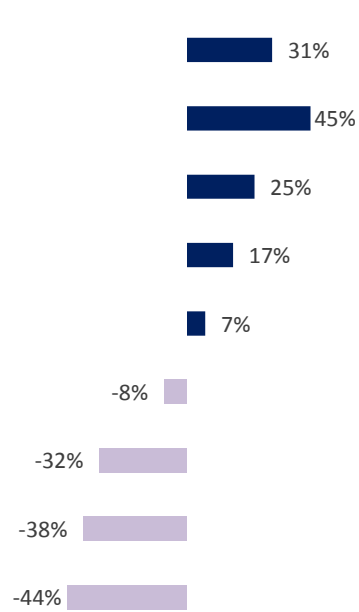
Figure 6. Idaho Power: Difference between Participant and General Population Income Distributions, for All Residential Measures, High Cost Measures, and Low Cost Measures, 2014-2016



High Cost Measures



Low Cost Measures



Other differences Idaho Power found, when considering all measure types, included a slightly higher rate of participation among homeowners than renters (3.6% v. 2.9%), and a substantially higher rate of participation among rural residents compared to urban residents (4.2% v. 0.8%).

Northwestern Energy

NorthWestern Energy provides energy to customers in Montana, South Dakota and Nebraska. It serves more than 709,000 residential and business customers with electricity and natural gas.

NEEA analyzed commercial participation in NorthWestern Energy’s territory by square footage and building use. The analysis suggests that NorthWestern’s participants comprise 5% of the commercial buildings in their territory. These participants tend to be in larger buildings than the general commercial building population, while smaller buildings tend to be under-represented.

It seems likely that the retail sector participated at a higher rate than the general population, given that they were the dominant building type among participants, yet third in terms of the general building population. Hospitals comprised a smaller percentage among participants than the general building population, representing a potentially underserved building segment.

Around 17,000 commercial buildings were identified in NorthWestern’s territory. Participants tend to be disproportionately in the middle to large categories (Table 4). Smaller buildings are disproportionately under-represented.

Table 4: Summary of floor area distribution among buildings with floor area available for analysis

Floor Area (SQFT)	Territory	Participants
< 5,000	51%	24%
5,000 - 50,000	47%	64%
> 50,000	2%	12%

Among the commercial buildings in NorthWestern territory, the largest categories are office buildings (32%), warehouses (21%), and retail (19%). Among participants, the largest categories are retail (32%), office buildings (22%), and warehouses (17%).

Among retail, participant floor areas greater than 50,000 sq-ft. comprised 5% compared to less than 1% of all retail buildings.

Northwest Energy Efficiency Alliance

The Northwest Energy Efficiency Alliance (NEEA) is an alliance of Northwest utilities and energy efficiency organizations working on behalf of more than 13 million energy consumers. Through collaboration and pooling of resources, the region’s utilities and stakeholders have harnessed their



collective influence to drive market adoption of energy efficiency products, services and practices for the benefit of utilities, consumers and the region. Since 1996, the region has cost-effectively delivered over 1,400 aMW of energy efficiency through market transformation - enough energy to power more than 985,000 homes each year.

NEE's Market Intelligence group supported the working group in several ways. NEEA maintains numerous data sets describing buildings, their occupants, and their energy use on behalf of its regional utility members and provided focused expertise to assist with the planning and design of the overall working group efforts. In addition, NEEA's Market Intelligence staff worked directly with several working group members to conduct utility-specific analyses, and offered recommendations for process improvements to facilitate utilities conducting this type of analysis in the future.

PacifiCorp

PacifiCorp serves approximately 1.8 million customers in six states. PacifiCorp consists of two business units: **Pacific Power**, which delivers electricity to customers in Oregon, Washington and California, is headquartered in Portland, Oregon; and **Rocky Mountain Power**, which delivers electricity to customers in Utah, Wyoming and Idaho, is headquartered in Salt Lake City, Utah.

Pacific Power participated in the working group discussions, but was unable to provide data due to legal and confidentiality concerns. Pacific Power provided the following information:

"Pacific Power's original plans to have NEEA combine PacifiCorp manufactured homes data with NEEA third party income and tax assessor data poses challenges with respect consumer protections found in Washington privacy laws specific to investor owned utilities. While we won't be moving forward with this scope, we want to make sure PacifiCorp's on-going energy efficiency program activity with our Washington customers residing in manufactured homes is included in the initial assessment of the region's HTR activity.

PacifiCorp's 2016 annual report includes a section on multi-year manufactured household participation and some high level analysis comparing manufactured household participation to program participation as a whole. The 2016 annual report is available on the Council's web site: http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/2016/2016_WA_DSM_Annual_Report%2BAppendix.pdf.

Puget Sound Energy

Puget Sound Energy (PSE) is an investor-owned electric and gas utility serving approximately 1.1 million electric and 790,000 natural gas customers in Western Washington. PSE's analysis was conducted by its Energy Efficiency Services Division (EES), which creates and maintains data to track energy savings and expenditures for its biennial conservation plan.



PSE's analysis covered the 2014-2016 time period and included the residential and commercial segments. Unlike other working group members, PSE included data on the distribution of energy savings and incentive dollars, in addition to analysis at the customer level.

PSE's analysis included all residential programs and measures that could be attributed to a customer or location and, for this reason, excluded participants in retail lighting and showerhead programs. Participant data were drawn from the utility's internal enterprise data system, which included classification fields for housing type and business type. Experian data were used to estimate household income. Spatial data from the US Census were used to determine urban v. rural areas.

PSE's average residential participation rate (the proportion of the population that participated) for the 2014-2016 time period was 5% and the commercial participation rate was 2% per year (total of 14% and 8% respectively for the three years). Nearly all participants were from the residential sector (94%).

PSE examined income distribution by household, kWh savings, and incentives. In all three approaches, households with middle incomes (between \$50,000 and \$75,000) were overrepresented relative to their incidence in the population. The lowest income households (under \$50,000) were underrepresented in terms of household-level participation, but overrepresented in terms of savings and incentives (Figures 7, 8).



Figure 7. Puget Sound Energy: Difference between Residential Participant and General Population Income Distribution by Households, 2014-2016

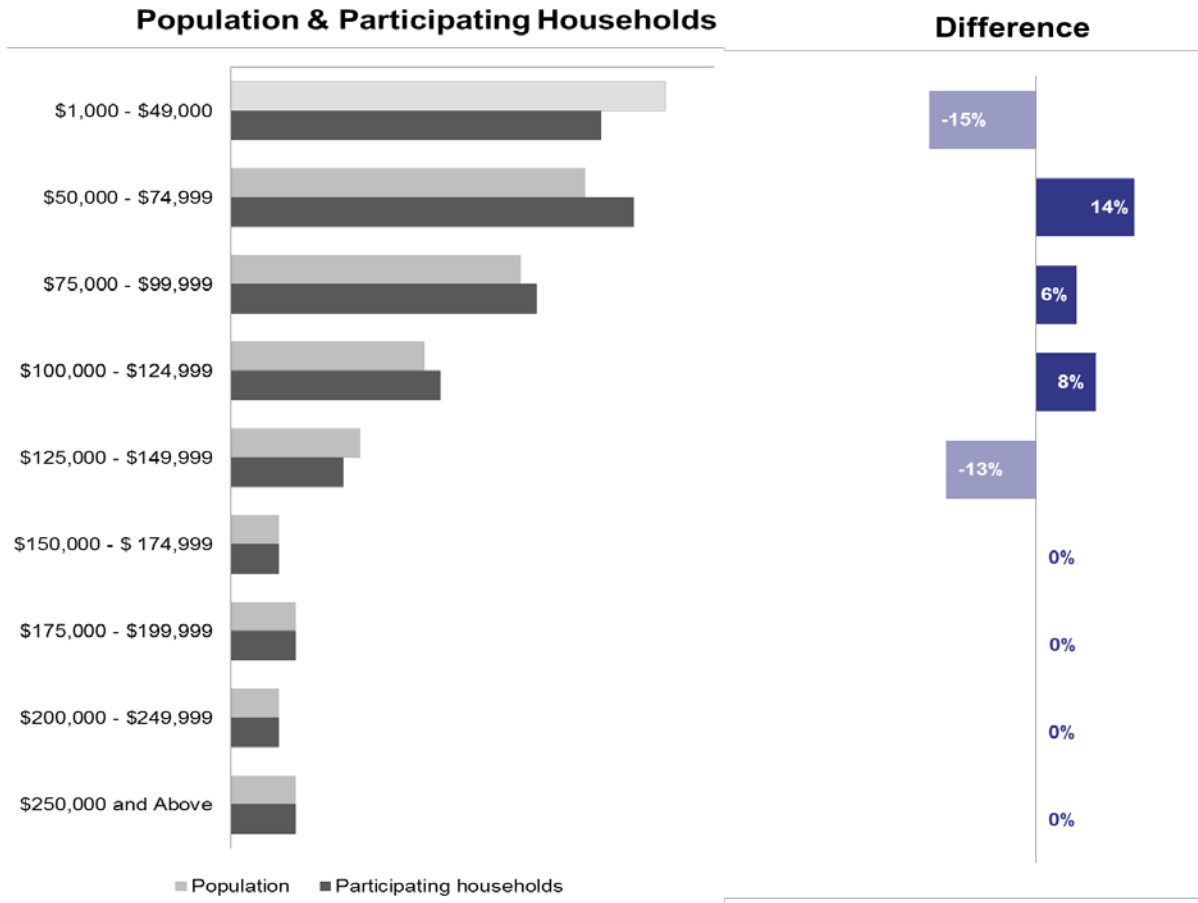
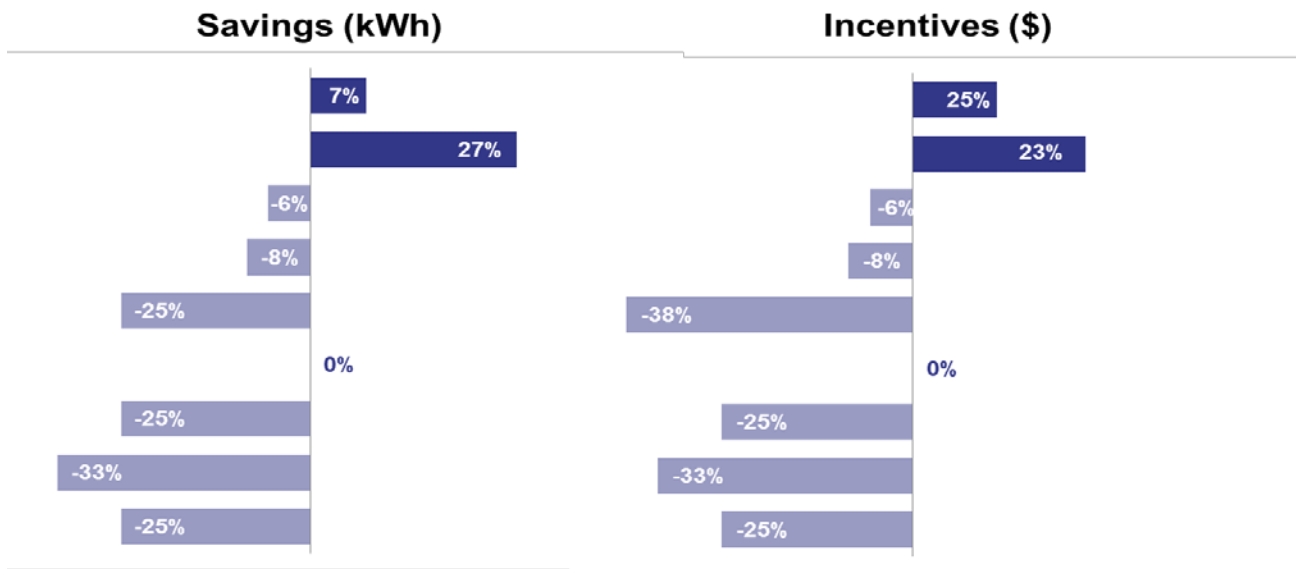


Figure 8. Puget Sound Energy: Difference Between Residential Participant and General Population Income Distribution Savings (kWh) and Incentives (\$), 2014-2016



In terms of housing type, PSE's analysis showed that the participant distribution matched the population exactly. For example, 61% of homes in the PSE service territory are single family homes, and 61% of program participants lived in single family homes. The same is true for multifamily homes at 15% and manufacture homes at 4%. PSE also found that rural participants were overrepresented when looking at households, savings, and incentives.

PSE's analysis of commercial participants showed small businesses participated at a lower rate than large businesses (2% vs. 8%). Large businesses, only 2% of all businesses in PSE's service territory, were substantially overrepresented in terms of savings and incentives.

Ravalli Electric

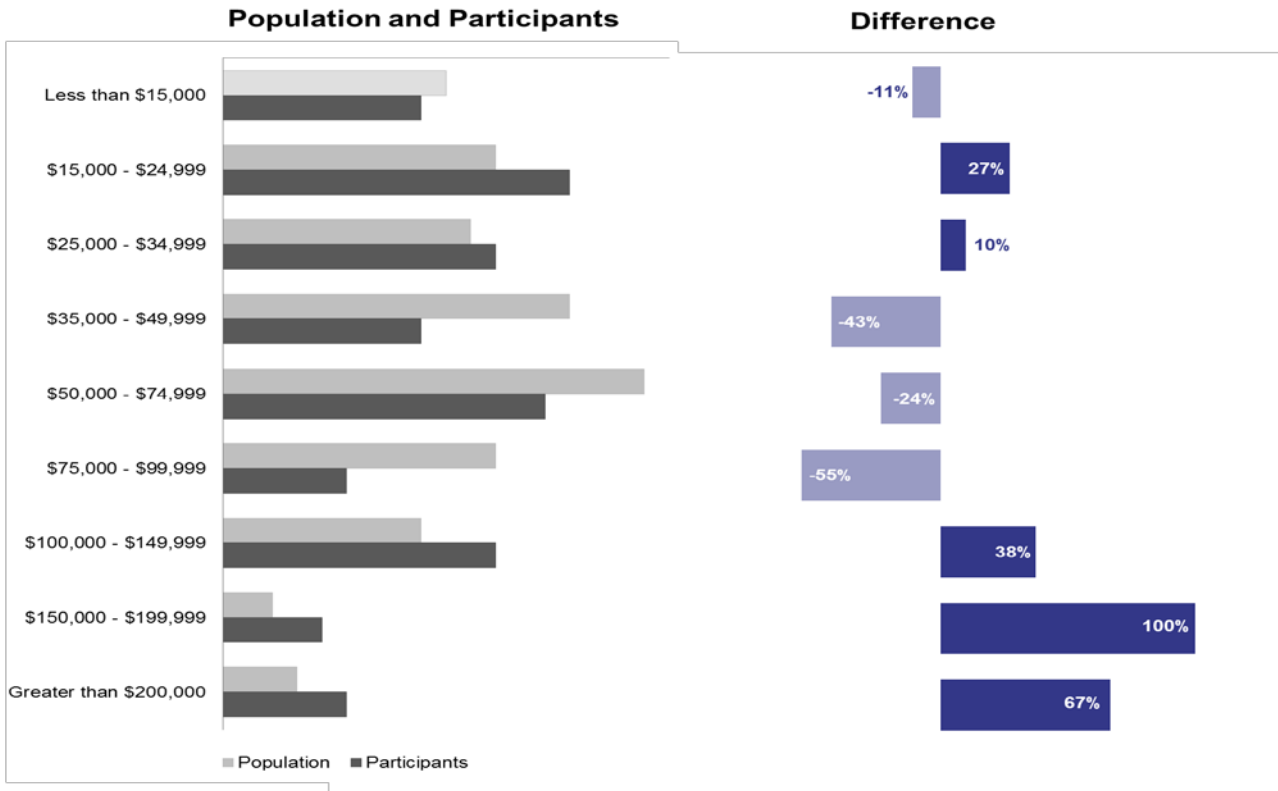
Ravalli Electric is a non-profit co-operative electric company serving approximately 8,000 customers in and around Corvallis, Montana. The Northwest Energy Efficiency Alliance (NEEA) analyzed 2014-2016 participation data provided by Ravalli Electric along with demographic data from Experian, CoreLogic, and the US Census.

Ravalli's residential participation rate (the proportion of the population that participated) from 2014-2016 was 1.3%. Nearly all (98%) residential customers lived in single family homes, making analysis by housing type less relevant for Ravalli than for other working group members.

NEEA's analysis showed that overrepresented households included some with lower incomes (\$15,000-\$34,999) and those with high incomes (equal to or greater than \$100,000). The lowest income households (under \$15,000) and some middle income households (\$35,000-\$99,999) were underrepresented.



Figure 9. Ravalli Electric: Difference between Residential Participant and General Population Income Distributions, 2014-2016



Seattle City Light

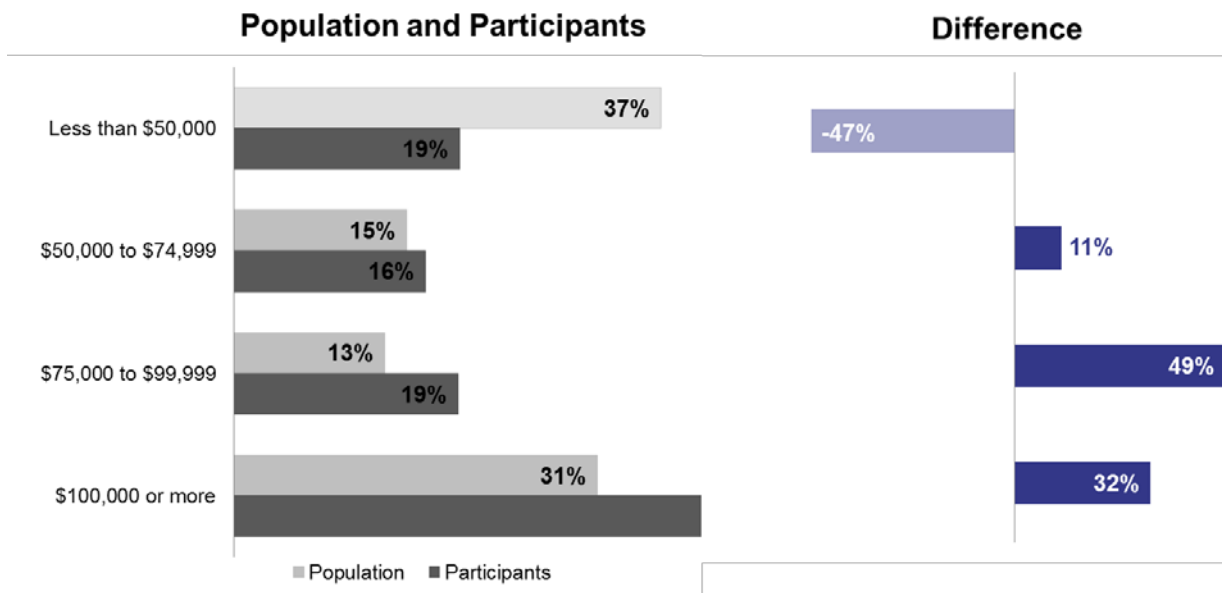
Seattle City Light (SCL) is a public electric utility governed by the City of Seattle. SCL is the 10th largest public power system in the US, serving approximately 400,000 Seattle residents with over nine million megawatt-hours of electricity annually.

SCL worked with NEEA to conduct a demographic analysis of the four residential measures for which SCL had participant addresses for the 2014-2016 time period: ductless heat pumps, heat pump water heaters, multi-family direct install, and the appliance program. Participants in SCL’s program for multi-family building owners, Powerful Neighborhoods, were excluded.

SCL’s participation rate (the proportion of the population that participated) for the period was 3.2%. Single family households had a much higher participation rate than multi-family households (4.3% vs. 0.6%), as did homeowners when compared to renters (5.2% vs. 0.8%).

SCL’s analysis did not include programs targeting low-income households, an important contextual factor for the utility’s findings regarding participant income. The lowest income households (under \$14,999) were dramatically underrepresented among program participants, relative to their incidence in the population. All households under \$50,000 were underrepresented to varying degrees and all households with income over \$50,000 were overrepresented (Figure 10).

Figure 10. Seattle City Light: Difference between Participants and the General Population, 2014-2016



NEEA also analyzed data from an SCL single-family direct mail campaign pilot program. The campaign had a 10% overall response rate. The distributions of participants along 10 segments were analyzed: Experian Mosaic group, income, presence of children, length of residence, mail responder, heating type, homeownership, year home was built, number of stories, and home square footage. The analysis of the direct mail campaign study found that participant segments tracked quite well with the population by income bracket.

Snohomish Public Utility District

Snohomish County Public Utility District (SnoPUD) is a public utility providing electric service to 325,000 customers in Snohomish County and Camano Island, Washington.

SnoPUD's analysis included residential and business participation from 2014 to 2016. Most participant data were tracked in SnoPUD's internal SAP system. Residential demographic data were provided by Acxiom. Residential measures incented at the retailer level, including light bulbs and fixtures, showerheads, and power strips were excluded from the analysis because participant address was not collected.

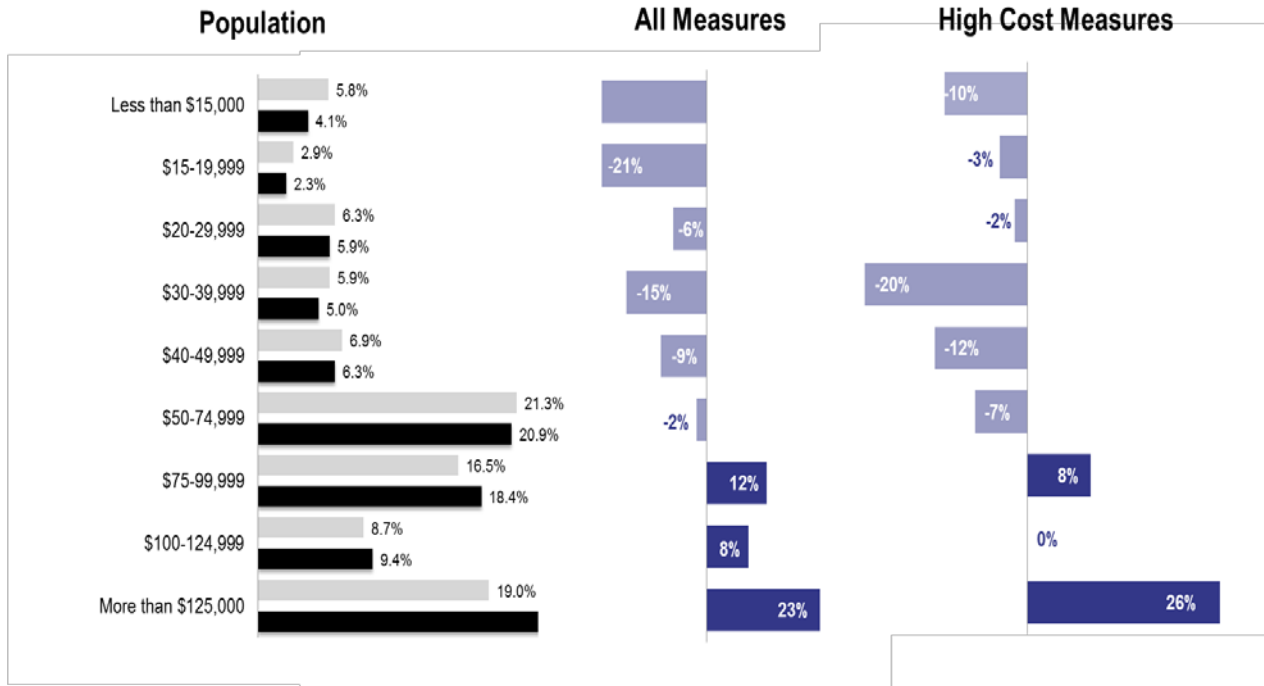
SnoPUD drew population data from several sources, including its own data on premise characteristics. These data have been refined over several years and SnoPUD believes they have a high degree of accuracy. SnoPUD also used its data for NAICS code (for business type) and housing type, in combination with County assessor data. US Census 2000 shape files were used to identify urban vs. rural customers.

SnoPUD was explicit about its approach to counting participation in multifamily buildings. When residential measures were provided to more than one housing unit in multifamily buildings or complexes, each housing unit was counted as a participant. When the measures were implemented in multifamily common rooms, the building or complex was counted as a single participant and classified as a commercial project.

SnoPUD's analysis showed households in the lower income categories (under \$50,000) were underrepresented and households in the higher income categories (over \$75,000) were overrepresented, relative to their incidence in the population. Middle income households (\$50,000-74,999) participated proportionately. The participant and population distributions for high cost measures differed slightly, with the lowest income households (less than \$15,000) and some middle income households (\$30,000-\$49,999) showing the largest degree of underrepresentation (Figure 11).

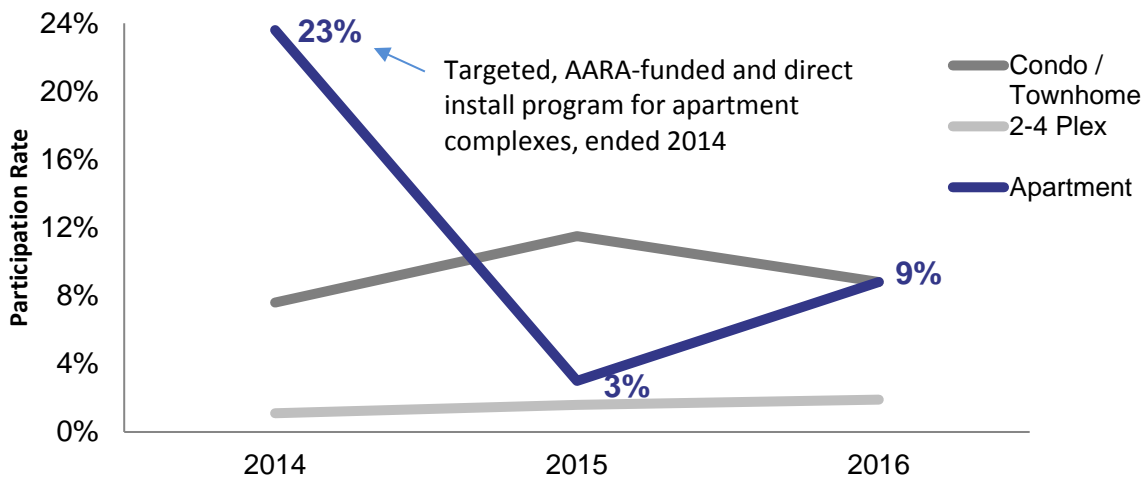


Figure 11. Snohomish PUD: Difference between Participant and General Population Income Distributions, for All Residential Measures and High Cost Measures, 2016



SnoPUD's participant distribution in multi-family housing showed the impact of program offerings on participant characteristics (Figure 12). From 2010 to 2013, and carrying over into 2014, SnoPUD offered grant-funded programs for apartments (including direct install), and participation by households in this housing type was second only to participation by single family households. The grant-funded programs were not active in 2015 and 2016 and participation among apartment households declined substantially.

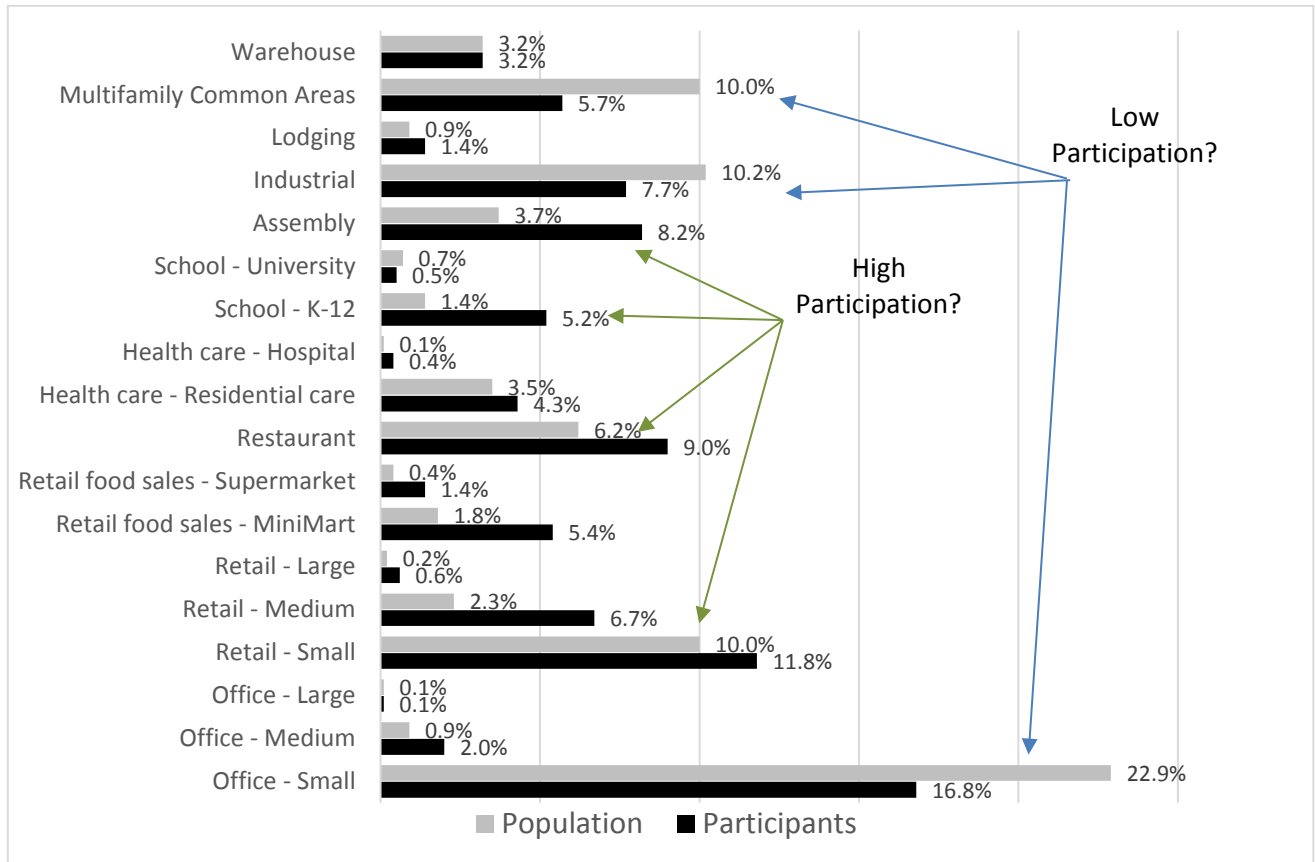
Figure 12. Snohomish PUD: Proportion of Participants in Multi-Family Housing, 2014-2016



In all three program years covered by the analysis, SnoPUD found that rural households were overrepresented in its participant population for both all measure types and high cost measures only.

SnoPUD's analysis of participation among its commercial customers showed substantial variation across business types. Hospitals, K-12 schools, supermarkets and minimarts, assembly, medium and large retail buildings, and medium office buildings were all substantially overrepresented.

Figure 13. Snohomish PUD: Difference between Participant and General Population Business Type Distributions, 2016



Tacoma Power

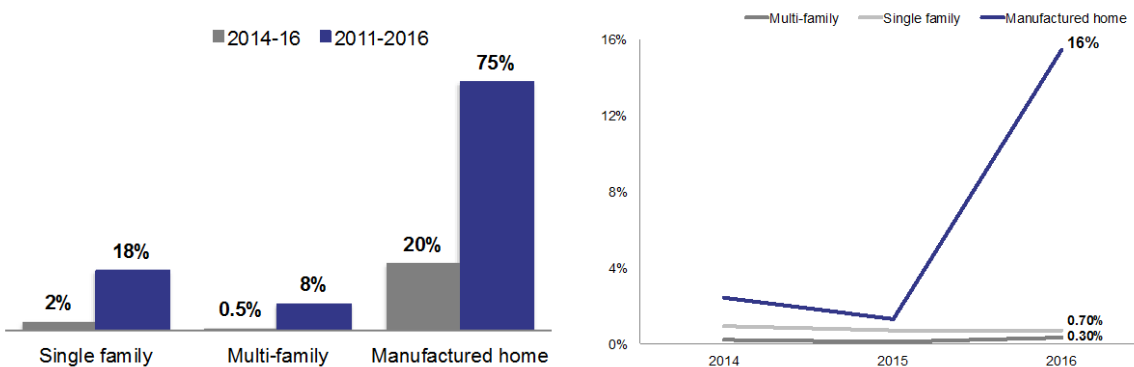
Tacoma Power is a publicly-owned electric utility serving 179,000 customers in the Washington cities of Tacoma, Fircrest, University Place, Fife, parts of Steilacoom, Lakewood, Joint Base Lewis-McChord, and parts of unincorporated Pierce County and Federal Way.

Tacoma Power examined residential participation back to 1981 and commercial participation starting in 2011, the firsts year of data available in its Conservation Database. The utility assessed several demographic and firmographic characteristics, supported by three surveys administered to participants and/or their customer population, including customer satisfaction surveys and post-participation surveys. Although each survey had its own limitations, they did collect race/ethnicity, a variable that would otherwise have been difficult to assess. Tacoma Power also drew on data from the US Census and County assessor.

Tacoma Power defined residential participants as those participating in weatherization, HVAC, or appliance exchange (relevant only for the full period, since no appliance programs ran between 2014 and 2016) programs and excluding participants in lighting and showerhead programs. For the 2014-2016 period, Tacoma Power found a higher participation rate (the proportion of the population that participated) among commercial and industrial customers compared to residential customers (3% vs. 2%). However, when examining the full period for which Tacoma Power had available data (1980-2016), the residential participation rate was substantially higher (17% vs. 9% for commercial/industrial customers).

With regards to housing type, manufactured home households had the highest participation rate in both the 2014-2016 and 1980-2016 time periods. Participation among customers with this housing type increased substantially in 2016 (Figure 14).

Figure 14. Tacoma Power: Cumulative (l.) and Annual (r.) Residential Participation Rates by Housing Type, 2011-2016



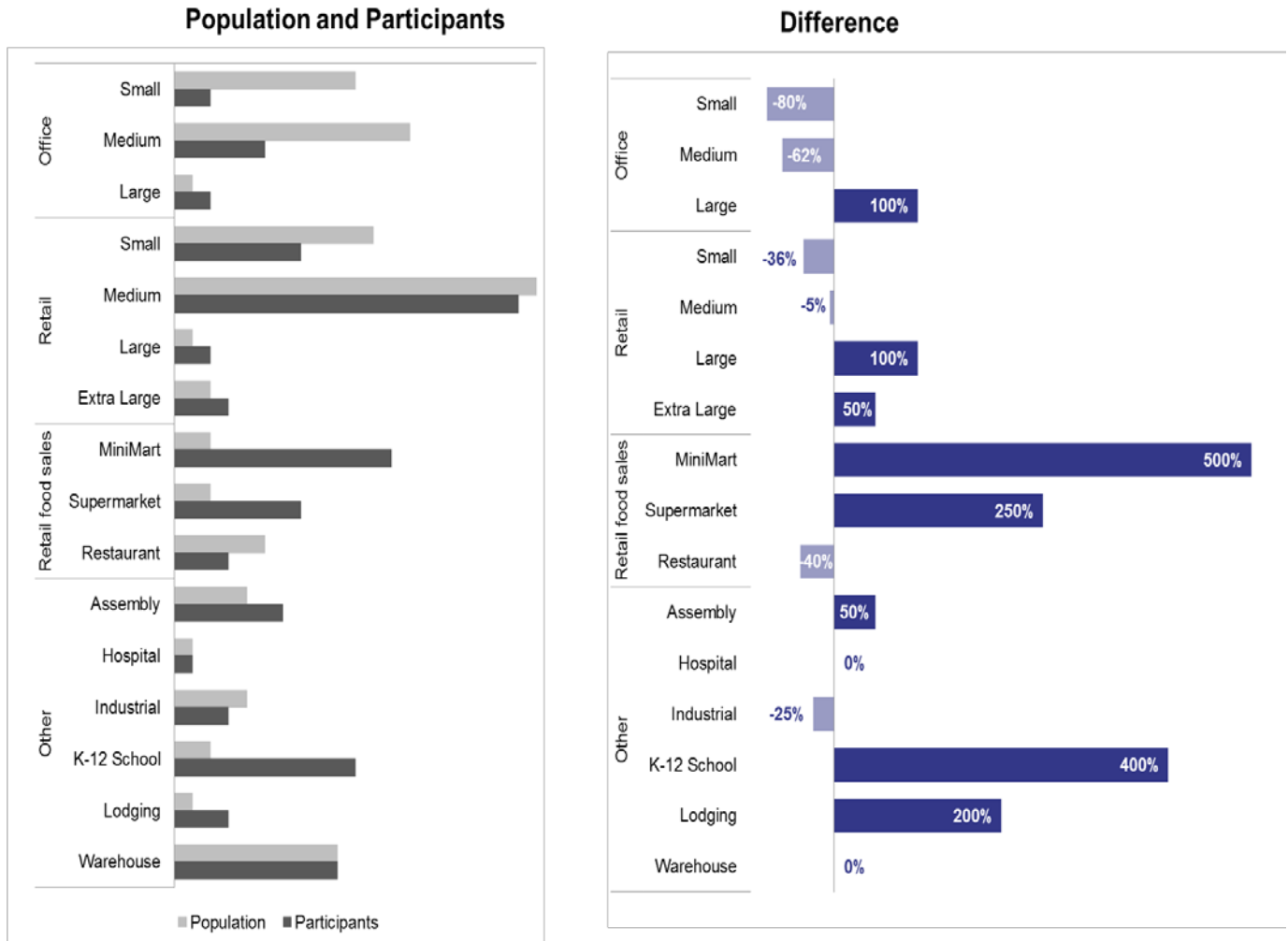
Tacoma Power found that low-income customers were well-represented among participants. Single family households and homeowners made up a majority of participants in each program year. Among homeowners, white participants were overrepresented and African-Americans participated at a lower rate than all other groups except Native American (insufficient data were available to assess participation among Native Americans). Tacoma Power did not assess participation by geography.



In the commercial sector, Tacoma Power found that larger buildings had a higher participation rate than smaller ones. For 2001-2016, programs reached 19% of buildings over 50,000 sqft., 13% of buildings between 5,000 and 50,000 sqft., and 7% of buildings under 5,000 sqft. The pattern was not consistent across all building types. Most notably, rather than participating at a lower rate, small grocery establishments participated at nearly twice the rate of large ones.

Participation differed substantially by building type in the 2014-2016 period. Large office, large and extra-large retail, minimarts and supermarkets, K-12 schools, and lodging were all overrepresented among participants relative to their incidence in the population (Figure 15). Comparing participant and savings distributions to conservation potential rather than the population often yielded a different picture of which building types were under or overrepresented. For example, K-12 schools were overrepresented when compared to the population but underrepresented compared to their conservation potential while office buildings are underrepresented when compared to the population but well represented when compared to their conservation potential.

Figure 15. Tacoma Power: Difference between Participant and General Population Business Type Distributions, 2014-2016



4. SUMMARY AND RECOMMENDATIONS

The MCS-1 action item calls for the Pacific Northwest region to conduct data analysis to help determine and demonstrate possible hard-to-reach, or underserved energy efficiency markets and then develop or improve programs to better reach underserved segments. This report includes results for the data analysis portion of MCS-1.

Initially the goal was to conduct the analysis in such a way that the results could be aggregated to a regional total. However, the analyses needed to be conducted within each utility on their own service territories primarily because of data security and confidentiality concerns. Therefore, this report covers this collection of individual analyses which cannot be aggregated due to different approaches, data sources, etc.

There were some lessons learned throughout the process that should be noted. The first lesson is that to conduct this type of analysis, two significant sources of data need to be identified and combined: 1) EE measure/program data (participant data), and 2) demographic and firmographic data (population data). Some of the larger utilities purchase their own demographic and firmographic data. Other regional utilities have access to these sources through NEEA.

Some of the utility service territories are not easily defined geographically. Therefore, geo-coding and matching of data sets is important and can be time-consuming. Also, working through definitions can be important, especially when trying to compare across jurisdictions. For example, how do you define “low income”, and what constitutes a “rural” customer? The working group attempted definitions for most of these, but often they still vary by service territory.

Summary of Findings

The results demonstrate differences across utilities; however, there are some common themes that can be identified among many of the program operators participating in the study. In general, overall program participation rates are more or less proportional to population demographics considered in the analysis. Where there are differences from proportionality, the differences are not dramatic.

Housing Type

With the exception of PSE, most utilities found the multifamily segment to be somewhat or significantly underserved. Snohomish County PUD had a strong, targeted multi-family program just prior to the study period and 2014 showed high participation relative to the population. In subsequent years, however, the participation rates were significantly lower without the targeted program. Tacoma Power noted that while the multifamily segment appears underserved, the relative energy efficiency potential in that segment is also lower than the single family segment.

Manufactured housing residents typically participated in EE programs at higher rates than single family and multifamily housing residents. For example, Tacoma Power, BPA, and Puget Sound Energy found significantly higher participation rates in manufactured housing than single family housing.



Income

The “low income” segments showed a wide range of results. In some cases, the results show relatively strong participation in lower income brackets while others show the opposite. Seattle, for example found their low income segments to be underserved based on the measures included in the analysis (e.g., ductless heat pumps, heat pump water heaters). Idaho Power found that overall participation did not vary significantly by income level. However, low cost measures were adopted at above average rates in the lower incomes, while the high cost measures were adopted at below average rates.

The highest income brackets participated at the lowest rates, in most of the cases.

Urban/Rural

Rural customers also appear to participate in programs at similar rates as urban customers. BPA found that their small, rural, residential (SRR) utilities participated at an 8 percent higher rate than their non-SRR utilities. For Idaho Power, their rural customers participated in programs at higher rates than their urban counterparts.

Home Ownership

As expected, residents who own their homes participated at higher rates than renters. This was true for most of the utilities, and represent one of the most consistent findings.

Commercial

Snohomish PUD and Tacoma Power evaluated their commercial sectors by building type and Puget Sound Energy by building size. Small business customers were found to be slightly to moderately underserved relative to their respective populations. Schools tended to have relatively high participation rates. Tacoma also compared their participant distribution to energy efficiency potential (future look) and recent achievements.

Recommendations

The results summarized in this report represents a significant undertaking for the region. There were two key aspects to this effort: 1) the efforts of individual organizations (some with support from NEEA), and 2) the combined and coordinated effort to define common metrics, definitions, and methods and then combine all the results into this report.

Despite this significant effort, there is more that could be done. This was essentially a “one-touch” analysis where the participation rate was developed by looking at any measure that was adopted by a participant. This could be extended to look at specific measures or programs, or identify where single vs. multiple measures were adopted. PSE ventured into this area by analyzing total savings and incentives amounts, in addition to just participant adoption. Tacoma Power investigated relative efficiency potential in areas that appeared to be underserved.



Northwest utilities who did not participate in this effort should consider doing so, and this report can be used as a guide to jump-start their own process. NEEA can also be called upon to support local efforts if needed.

Utilities should continue to improve integration of utility data systems in order to make this type of analysis easier and applicable to more segments. It is critical to store measure data associated with site addresses in as much detail as possible. With the availability of third party demographic and firmographic data, it isn't necessary to track and store this information at the utility. NEEA has been developing expertise and data sets to increase availability of third-party demographic data on behalf of Northwest utilities. NEEA and the utilities should continue to work together to develop these data sets and associated analyses.

One of the most consistent results showed that multifamily housing is an underserved segment. Individual utilities and the region as a whole, possibly with guidance from NEEA, should undertake efforts to improve energy efficiency program reach into this segment. There are success stories in the region (e.g., Snohomish PUD), which could serve as a starting point.

Another clear finding from this effort is that Northwest utility programs have been successful and are necessary to reach all segments of the market (e.g., previous SnoPUD multifamily example). The Northwest has a long history of running programs that target low income customers, and the data show the success of these programs. These data indicate the need to continue, and in some cases improve the low income programs. The Idaho Power example clearly showed the impact of the free energy savings kits. Without these programs, there is the potential for markets to be underserved. The SnoPUD multifamily data and Seattle low-income results demonstrate this.

For manufactured housing, the data also show results of strong programs. Most of the results show that participation rates for manufactured homes are on pace, or even participating at higher rates than their single-family counterparts. This result is likely showing the fruits of successful programs. In addition, some of the successful programs have been single-measure programs (e.g., duct sealing), which could leave significant untapped potential for other measures in this segment. Utilities should review these analyses, in conjunction with sector and segment-specific potential assessments, to determine the magnitude of remaining potential and appropriate pace for achieving that potential.

Finally, working group members should spend time to better understand the reasons for some of their results, as well as to understand and share what their successful tactics were so they can be replicated.



APPENDIX A - RESULTS BY ORGANIZATION

Data and write-ups in the following sections were provided by the work group members. The organizations are presented in alphabetical order. While the organizations coordinated their research efforts, each selected its own data sources and reporting format.

In addition to the participating organizations listed below, the Northwest Energy Efficiency Alliance contributed to the development of the research methods and provided data analytics support to participating organizations.

- Bonneville Power Administration
- Energy Trust of Oregon
- Idaho Power
- PacifiCorp
- Puget Sound Energy
- Ravalli Electric
- Seattle City Light
- Snohomish County Public Utility District
- Tacoma Power



BONNEVILLE POWER ADMINISTRATION

Background

This analysis investigates the distribution of residential measures across BPA customer utilities. The analysis attempted to answer the question “do we have hard to reach markets?” It was conducted with a particular focus on the distribution of participation by:

- Income
- Housing type
- Owners vs. renters
- Language
- Small rural vs. urban large

Residential Findings

Summary Findings

BPA had the following summary findings from this research:

- There was no clear evidence of an equity issue in BPA’s residential energy efficiency programs
- Low-income segments were overrepresented in the highest participating block groups in single family and manufactured homes
- Multifamily participation rate was very low, less than 1%
- Manufactured home participation was high due to duct sealing programs
- Mail by request and direct install Instant Savings Measures appeared to have higher participation among census block groups with middle to high median income
- There were more non-English speakers in low participation block groups
- Retail programs were almost non-existent in small rural & residential utility territories
- Participation rates in the small, rural, and residential utilities BPA serves were similar and even slightly higher than larger more urban utilities.

Overall Participation Rate

The overall residential program participation rate from 2012 to 2017 was 6.31%.

Income

BPA’s analysis used the income distribution provided by the US Census for Census block groups. BPA assessed the income distribution of Census block groups in the lowest quartile of participation (bottom 25%) compared to the income distribution of Census Block Groups in the highest quartile (top 25%) of participation rates. BPA compared both these income distributions to the income distribution of all the Census block groups in the BPA customer utility territories.



All Measure Types

Median Income

The median income in block groups is positively correlated with participation rates, however the trend is non-linear. Participation rates in the lowest median income category (< \$13,000 median income) are slightly higher than the next category (\$13,000 - \$23,000), however the highest median income categories have the highest participation rates. While it appears there may be a trend when looking at median income in categories, a scatter plot of participation rate in Figure A-1 by median income reveals that there is barely a trend at all (Figure A-2).

Figure A-1. Participation Rate by Median Income Categories

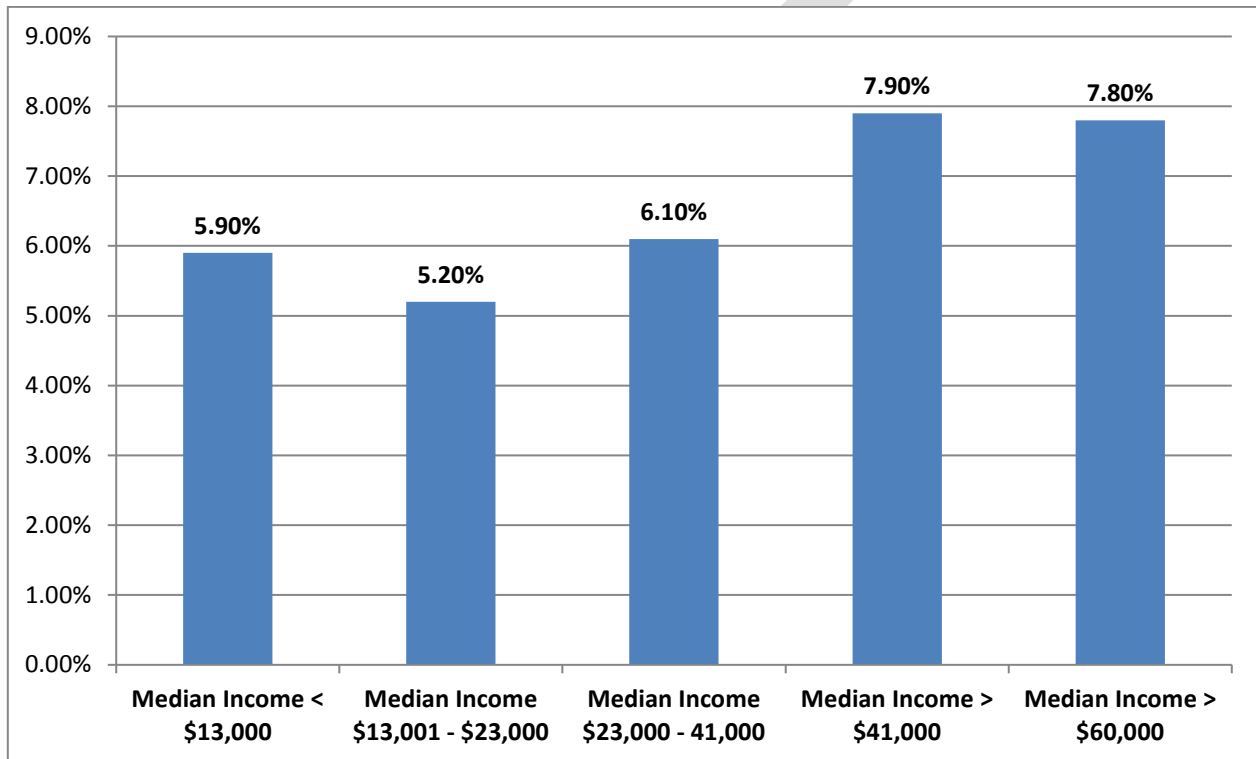
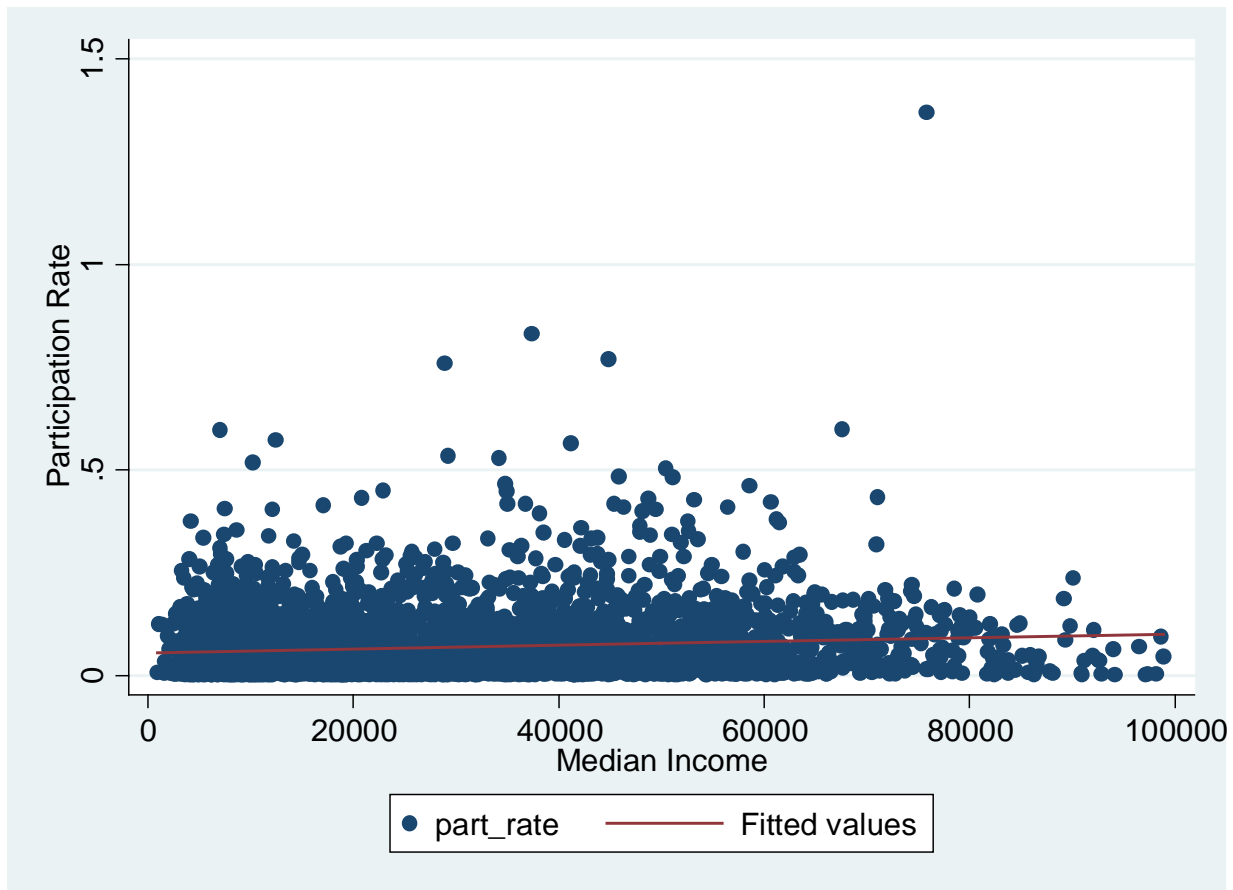


Figure A-2. Scatter Plot of Participation Rate and Median Income



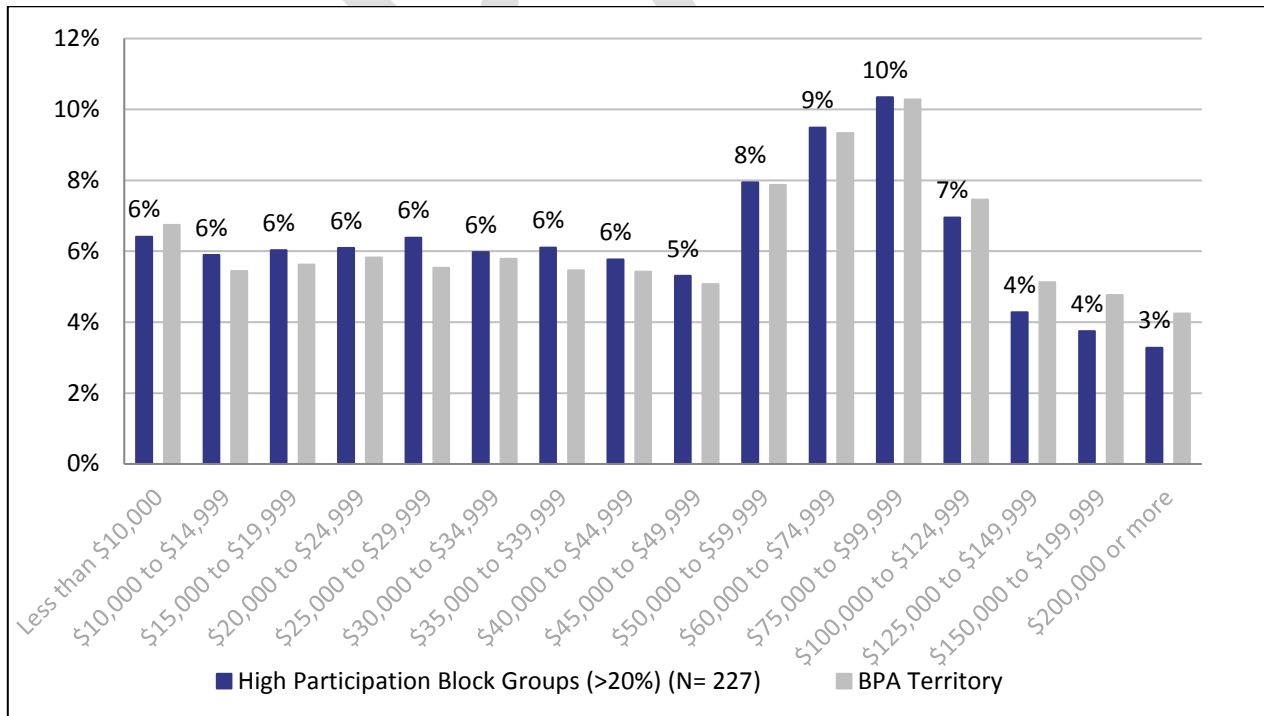
It is useful to look at the income trend in more granularity. In examining the income distribution of Census block groups with the highest residential program participation (in which more than 20% of all households in the block group participated), the representation of the majority of high-participant-rate block groups by median income was proportional to their incidence in the population. Substantially underrepresented block groups include those with a median income over \$125,000. Substantially overrepresented block groups included those with median income between \$25,000 and \$29,999, and between \$35,000 (Table A-1, Figure A-3). This suggests that the lower to middle income segments are being served in a greater proportion than are the higher income segments. This dynamic is partly due to large numbers of manufactured home duct sealing projects in recent years.

Table A-1. BPA: Residential Income Distribution of Census Block Groups with Highest Participation, All Measure Types, 2012-2017

	Participants	Population	Difference
Less than \$10,000	6%	7%	-5%
\$10,000 - \$14,999	6%	5%	8%
\$15,000 - \$19,999	6%	6%	7%
\$20,000 - \$24,999	6%	6%	5%
\$25,000 - \$29,999	6%	6%	15%
\$30,000 - \$34,999	6%	6%	3%
\$35,000 - \$39,999	6%	5%	12%
\$40,000 - \$45,999	6%	5%	6%
\$45,000 - \$49,999	5%	5%	5%
\$50,000 to \$59,999	8%	8%	1%
\$60,000 to \$74,999	9%	9%	2%
\$75,000 to \$99,999	10%	10%	1%
\$100,000 to \$124,999	7%	7%	-7%
\$125,000 to \$149,999	4%	5%	-16%
\$150,000 to \$199,999	4%	5%	-21%
\$200,000 or more	3%	4%	-23%

Note: Includes block groups with participation > 20% of households in the Census block group.

Figure A-3. BPA: Residential Income Distribution of Census Block Groups with Highest Participation, All Measure Types, 2012-2017



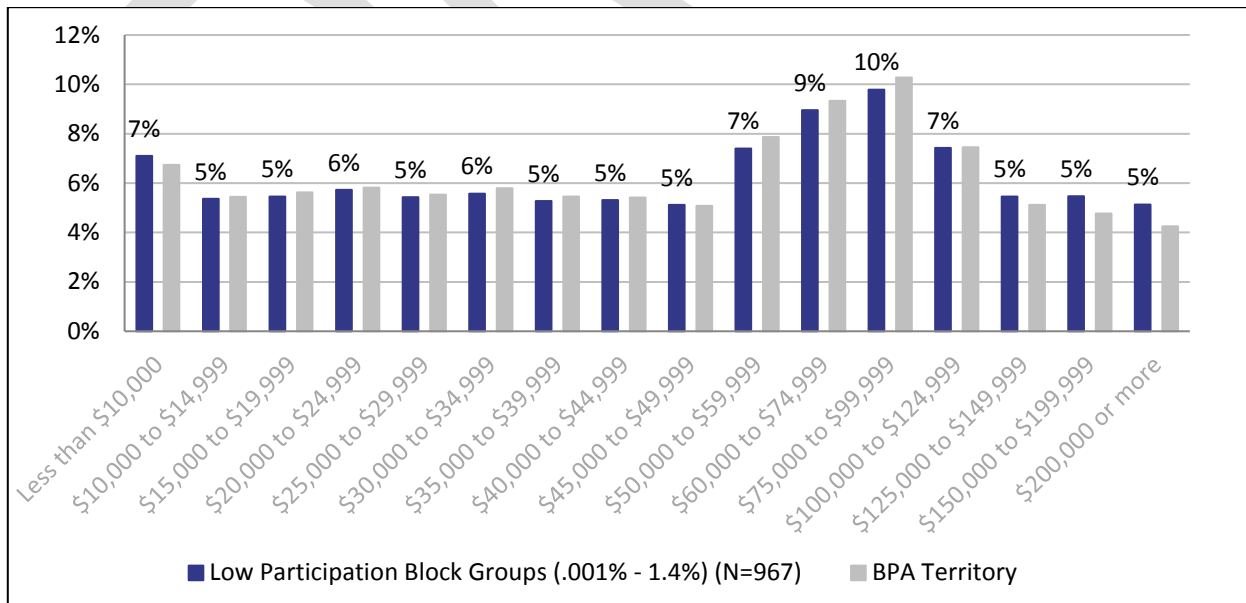
Among Census block groups with the lowest participation rate (.001% - 1.4% of households), high-median-income block groups were overrepresented. This suggests that higher income households may have had a lower rate of participation.

Table A-2. BPA: Residential Income Distribution of Census Block Groups with Lowest Participation, All Measure Types, 2012-2017

	Participants	Population	Difference
Less than \$10,000	7%	7%	5%
\$10,000 - \$14,999	5%	5%	-2%
\$15,000 - \$19,999	5%	6%	-3%
\$20,000 - \$24,999	6%	6%	-2%
\$25,000 - \$29,999	5%	6%	-2%
\$30,000 - \$34,999	6%	6%	-4%
\$35,000 - \$39,999	5%	5%	-3%
\$40,000 - \$45,999	5%	5%	-2%
\$45,000 - \$49,999	5%	5%	1%
\$50,000 to \$59,999	7%	8%	-6%
\$60,000 to \$74,999	9%	9%	-4%
\$75,000 to \$99,999	10%	10%	-5%
\$100,000 to \$124,999	7%	7%	0%
\$125,000 to \$149,999	5%	5%	6%
\$150,000 to \$199,999	5%	5%	15%
\$200,000 or more	5%	4%	21%

Note: Includes block groups with participation between .001% and 1.4% of households in the Census block group.

Figure A-4. BPA: Residential Income Distribution of Census Block Groups with Lowest Participation, All Measure Types, 2012-2017



Instant Savings Measures

Instant Savings Measures (ISMs) included lamps, showerheads, and power strips.

When it came to census block groups with the highest rate of participation in ISMs (> 0.4 ISMs per household), there were differences in several income categories (Table A-3):

- Less than \$10,000, \$15,000 to \$19,999, and \$25,000 to \$29,999 were underrepresented
- \$10,000 to \$14,999, \$30,000 to \$39,999, and \$75,000 - \$99,999 were overrepresented

Table A-3. BPA: Residential Income Distribution of Census Block Groups with Highest Instant Savings Measure Participation, 2012-2017

	Participants	Population	Difference
Less than \$10,000	5%	7%	-20%
\$10,000 - \$14,999	6%	5%	7%
\$15,000 - \$19,999	5%	6%	-8%
\$20,000 - \$24,999	6%	6%	-4%
\$25,000 - \$29,999	5%	6%	-2%
\$30,000 - \$34,999	7%	6%	16%
\$35,000 - \$39,999	6%	5%	9%
\$40,000 - \$45,999	5%	5%	0%
\$45,000 - \$49,999	5%	5%	3%
\$50,000 to \$59,999	8%	8%	-2%
\$60,000 to \$74,999	10%	9%	3%
\$75,000 to \$99,999	13%	10%	29%
\$100,000 to \$124,999	7%	7%	0%
\$125,000 to \$149,999	5%	5%	-5%
\$150,000 to \$199,999	3%	5%	-28%
\$200,000 or more	3%	4%	-32%

Note: Includes block groups with participation > 0.4 Instant Savings Measures per household.

The distribution of census block groups with no participation in ISMs by median income was nearly identical to the population, with the exception of households in block groups with a median income of \$25,000 to \$29,999, which were underrepresented (Table A-4).



Table A-4. BPA: Residential Income Distribution of Census Block Groups with No Instant Savings Measure Participation, 2012-2017

	Participants	Population	Difference
Less than \$10,000	7%	7%	1%
\$10,000 - \$14,999	5%	5%	0%
\$15,000 - \$19,999	6%	6%	0%
\$20,000 - \$24,999	6%	6%	0%
\$25,000 - \$29,999	5%	6%	-1%
\$30,000 - \$34,999	6%	6%	-1%
\$35,000 - \$39,999	5%	5%	-1%
\$40,000 - \$45,999	5%	5%	1%
\$45,000 - \$49,999	5%	5%	0%
\$50,000 to \$59,999	8%	8%	0%
\$60,000 to \$74,999	9%	9%	-1%
\$75,000 to \$99,999	10%	10%	-1%
\$100,000 to \$124,999	7%	7%	0%
\$125,000 to \$149,999	5%	5%	1%
\$150,000 to \$199,999	5%	5%	2%
\$200,000 or more	4%	4%	2%

Note: Includes block groups with no Instant Savings Measures per household.

Major Measures

Participation in major measures, which included HVAC, water heating, appliances, weatherization, new homes, and low-income weatherization and HVAC, showed the opposite trend as the ISM distributions.

Among Census block groups with the highest participation rate in major measures (>20% participation), some lower income block groups (\$10,000 to \$14,999 and \$35,000 to \$45,999) were overrepresented and the highest income block groups were underrepresented (Table A-5).

Table A-5. BPA: Residential Income Distribution of Census Block Groups with Highest Major Measure Participation, 2012-2017

	Participants	Population	Difference
Less than \$10,000	7%	7%	8%
\$10,000 - \$14,999	6%	5%	12%
\$15,000 - \$19,999	6%	6%	15%
\$20,000 - \$24,999	6%	6%	8%
\$25,000 - \$29,999	7%	6%	18%
\$30,000 - \$34,999	6%	6%	8%
\$35,000 - \$39,999	6%	5%	12%
\$40,000 - \$45,999	6%	5%	6%
\$45,000 - \$49,999	5%	5%	4%



\$50,000 to \$59,999	8%	8%	0%
\$60,000 to \$74,999	9%	9%	-1%
\$75,000 to \$99,999	10%	10%	-4%
\$100,000 to \$124,999	7%	7%	-13%
\$125,000 to \$149,999	4%	5%	-21%
\$150,000 to \$199,999	3%	5%	-27%
\$200,000 or more	3%	4%	-30%

Note: Includes block groups with participation > 20% in major measures.

The rate of participation in all measures, major measures and the number of ISMs per household all increased as household income increased.

Table A-6. BPA: Residential Participation Rate by Income, 2012-2017

	All measures	Major Measures	ISMs per household
Median Income < \$13,000	6%	6%	0.05
Median Income \$13,001 - \$23,000	5%	5%	0.03
Median Income \$23,000 - 41,000	6%	6%	0.08
Median Income > \$41,000	8%	8%	0.62
Median Income > \$60,000	8%	7%	0.69

Housing Type

A majority of participants were single family households. Single family and multi-family households were underrepresented among participants, relative to their incidence in the population and manufactured home participants were overrepresented (Table A-7).

Table A-7. BPA: Residential Participant Distribution by Housing Type, 2012-2017

	Participants	Population¹	Difference
Single family	68.5%	76.5%	-10%
Multi-family	1.4%	14.9%	-91%
Manufactured home	18.7%	8.6%	117%
Non-specified sites	11.4%	--	--

Manufactured home households had the highest participation rate and multi-family participants had the lowest participation rate (Table A-8).



Table A-8. BPA: Residential Participation Rate by Housing Type, 2012-2017

	Participants
Single family	5.65%
Multi-family	0.59%
Manufactured home	13.73%
Non-specified sites	0.72%

Geography

BPA serves 84 small, rural, residential (SRR) utilities, defined as those with a forecast net requirement of less than 10 aMW, fewer than 10 customers per line mile, and more than 66% residential load.

SRR utilities showed some demographic differences from non-SRR utilities in housing types and the rate of non-English speaking residents (Table A-9).

Table A-9. BPA: Comparison of SRR v. non-SRR Utilities by Housing Type, 2012-2017

	Single family households	Multi-family households	Manufactured homes	Rate of non-English speaking customers
Small, rural, residential (SRR) utility	58%	0%	19%	10.0%
Non-SRR utility	71%	2%	19%	16.2%

Table A-10. BPA: Comparison of SRR v. non-SRR Utilities by Income Distribution, 2012-2017

	SRR utility	Non-SRR Utility	All BPA
Less than \$10,000	6.7%	6.8%	6.7%
\$10,000 - \$14,999	5.4%	5.8%	5.4%
\$15,000 - \$19,999	5.6%	5.9%	5.6%
\$20,000 - \$24,999	5.8%	6.1%	5.8%
\$25,000 - \$29,999	5.5%	6.0%	5.5%
\$30,000 - \$34,999	5.7%	6.1%	5.8%
\$35,000 - \$39,999	5.5%	5.5%	5.5%
\$40,000 - \$45,999	5.4%	5.3%	5.4%
\$45,000 - \$49,999	5.1%	5.2%	5.1%
\$50,000 to \$59,999	7.8%	8.1%	7.9%
\$60,000 to \$74,999	9.3%	9.7%	9.3%
\$75,000 to \$99,999	10.3%	10.3%	10.3%
\$100,000 to \$124,999	7.5%	7.0%	7.5%
\$125,000 to \$149,999	5.3%	4.4%	5.1%
\$150,000 to \$199,999	4.9%	4.1%	4.8%
\$200,000 or more	4.3%	3.8%	4.2%



Participation among SRR utilities was higher than non-SRR utilities across all metrics, including overall participation rate (8% higher among SRR utilities), major measure participation, and ISMs per household. (Table A-11).

Table A-11. BPA: Residential Participation Rate by Geography, 2012-2017

	All participants	Major measures	Single family & major measures	ISMs per household
Small, rural, residential (SRR) utility	6.9%	6.4%	8.0%	0.25
Non-SRR utility	6.2%	6.0%	8.0%	0.18

There were some notable differences in the utilities' measure mixes (Table A-12):

- SRR utilities fulfilled nearly three times more appliance rebates and nearly two times more water heating rebates/pipe wrap than non-SRR utilities
- Non-SRR utilities fulfilled nearly three times more low-income measures and 21% more weatherization measures.

Table A-12. BPA: Measure-level Participation Rate by Geography, 2012-17

	Appliance rebate	HVAC	New homes	Water heating rebate or pipe insulation	Wx	Low-income Wx or HVAC
Small, rural, residential (SRR) utility	16%	51%	2%	6%	25%	3%
Non-SRR utility	6%	51%	2%	4%	27%	9%

Data Sources

The primary data source used in the analysis were BPA residential participation data (IS 2.0) and the American Community Survey Census data with a rolling 5-year sample by Census Block Group. BPA does not have addresses for customers of the utilities it serves, therefore in order for a census block group to be included as part of a BPA customer utility territory it needs to have at least one address as a participant in BPA participation data. Because of this the BPA data does not include block groups with no participation and therefore under represents the actual customer utility territories and number of households served by BPA customer utilities.

In regards to participant data, the analysis included only data from 2012 to 2017 and did not include the more than 30 years of BPA program activity. Participants were widely defined as residential



households tied to any measure with an address. Participant data included BPA EEI low-income participants, but excluded the BPA low-income grant program.⁷

Two categories of measures were used in the analysis: Instant Savings Measures (ISM) and Major Measures. The ISMs were delivered via direct install or mail-by-request.

Major measures

- Heat pump conversions and upgrades
- Ductless heat pumps
- Duct sealing
- Insulation
- Air Sealing
- Windows
- Energy Star / Built Green/ Montana House / NEEM
- Clothes washers, Clothes dryers
- Fridge and freezer decommissioning
- Fridges and Freezers
- Heat pump water heaters
- Pipe insulation
- Thermostats
- Direct install or mail-by-request lamps, showerheads, power strips

Instant savings measures

- Lamps & fixtures
- Showerheads and thermostatic shut-off valves
- Power strips

The unit of analysis used for demographic characteristics was the Census Block Group.⁸ The analysis thus reports the characteristics of block groups, not the characteristics of individual households. Utility program participants may or may not have characteristics similar to that of their block group. Participation rates per census block group are calculated based on the following formula: Program Participants/Number of Households

⁷ BPA EEI low-income participants must be at or below 200% of federal poverty level which is \$40,840 for a family of three in 2017.

⁸ There are 3,806 block groups in BPA utility territories that have claimed at least one residential measure associated with an address. The average number of housing units in a BPA block group is 542; minimum is 11, and maximum is 3,147.

ENERGY TRUST OF OREGON

Background

Energy Trust of Oregon is an independent nonprofit organization created to deliver energy efficiency and renewable energy development programs to 1.6 million utility customers of Portland General Electric, Pacific Power, NW Natural, Cascade Natural Gas and Avista in Oregon and southwest Washington. Cost-effective energy efficiency and clean renewable energy are the most important energy resources available to Oregon's utility customers. Our work to deliver these resources helps keep costs low for customers and builds a more sustainable energy future for our communities. Since 2002, Energy Trust's services, cash incentives and energy solutions have helped participating customers save nearly \$2.7 billion on their energy bills.

Energy Trust assesses the effectiveness of its efficiency and renewable energy programs by applying a range of evaluation tools and practices. In recent years, Energy Trust has increased its use of market research to learn more about its customers and identify potential gaps in utilization of offers and services. This research has spanned qualitative and quantitative analysis.

The goal of this expanded market research is to support Energy Trust's efforts to ensure that all eligible customers are aware of offers and able to participate. Energy Trust plans to do additional market research and acquire additional data in 2018 to establish baselines for goals in its Diversity, Equity and Inclusion Operations Plan. Energy Trust drafted the DEI operations plan in late 2017 to guide the organization's efforts to reach and serve all eligible customers in order to accomplish energy efficiency and renewable energy goals.

Provided for this report is a summary of recent market research and analysis conducted by Energy Trust to identify opportunities to reach specific customer groups, by demographic characteristics. The summary will include four market research projects, two qualitative studies and two quantitative studies.

Qualitative Market Research Customer Insights Survey (2016), Focus Groups (2016-2017)
Quantitative Market Research External Data Overlay (2016), Participation Analysis (2017)

Definition of Terms

Energy Trust's DEI Operations Plan helped to shape recent market research efforts. In addition to seeking demographic information on residential customers, Energy Trust has been collecting and analyzing firmographic data that will identify attributes common among underserved businesses. Below is a statement from the plan that describes Energy Trust's understanding of the characteristics of potentially underserved markets.

"We developed the Diversity, Equity and Inclusion (DEI) Operations Plan to better understand if and where gaps exist, and to achieve energy efficiency and renewable energy program participation outcomes across a broad range of customer characteristics, including communities of color, rural



communities, and people with low and moderate incomes in all areas of our programs and operations.” – Energy Trust DEI Operations Plan

Qualitative Market Research

Customer Insights Survey

In 2016, Energy Trust conducted a phone survey, using both landline and cell phone numbers, to examine the demographics of participants and non-participants in certain residential offers, in addition to other research objectives. The survey sample was a list of participants who spent over \$3,000 on weatherization measures, and those who received Energy Saver Kits in the prior year.

Findings

- Participant respondents were more likely to be older and have a household income of over \$75,000. Because the sample included people who had spent over \$3,000 on weatherization, this finding is not surprising. *Implications for future research:* Each research method has limitations, and by using a phone survey, this survey was more likely to reach people who have time to talk – either retired or not working multiple or demanding jobs.
- The sample size was too small to draw any conclusions about participation disparities based on race or ethnicity. *Implications for future research:* To gain a larger sample size, Energy Trust decided to oversample in zip codes with higher concentrations of African-American and Latino households for the next study.
- Respondents with lower incomes who had no college experience received their information from different sources, than those with at least some college experience. *Implications for future research:* Focus groups were held with this customer segment in follow-up to learn more about how to reach them.

Focus Groups

Energy Trust has used focus groups to gain deeper insights about motivations and barriers for specific audiences. Focus groups were conducted with small business owners and decision makers in 2016 and 2017, and with older adults in 2017. Also in 2017, focus groups were conducted with moderate-income homeowners and renters who had high school diplomas.

Findings

- For the most part, small business owners and decision makers were aware of Energy Trust, but were uncertain how to always access services. *Implications for future research:* Energy Trust staff are seeking ways to further connect our offers to smaller businesses that can use them.
- Older adults were concerned about major costs, and wanted to maintain their homes, rather than upgrade. They were also less likely to trust information found on the internet. *Implications for future research:* Energy Trust staff plan to analyze web usage by age group, depending on data available within Google Analytics.
- Moderate-income focus groups indicated that there is a barrier in knowledge and trust of energy efficiency. *Implications for future research:* Energy Trust staff plan to test education messages using public service announcements online



- Among the moderate-income groups there was great reliance on friends and family to help with home upgrades. They were much more likely to do something themselves, or have a friend or family member do the work. They were also very likely to know exactly what they were paying for energy. *Implications for future research:* There is an opportunity to test messaging in do-it-yourself channels

Quantitative Analysis

External Data Overlay

Description

In 2016, Energy Trust pulled a list of past participants and provided it to a contractor to overlay with Experian data, in an effort to build information on common demographics among participants. This analysis included information on income levels across measures within the residential program.

Findings

As it relates to participation in residential measures, this research found that total residential participation rates increase as income increases (Figure A-5). For higher-cost measures, the participation rate is highest for households with incomes between \$175k and \$199k. Participation rates were higher among customers with a college education (bachelor’s degree or higher) than those with a high school education or less.

For lower-cost measures, participation rates begin to decrease as household income increases, starting at a \$75,000 household income.

Figure A-5. Energy Trust of Oregon Participation Rate by Income

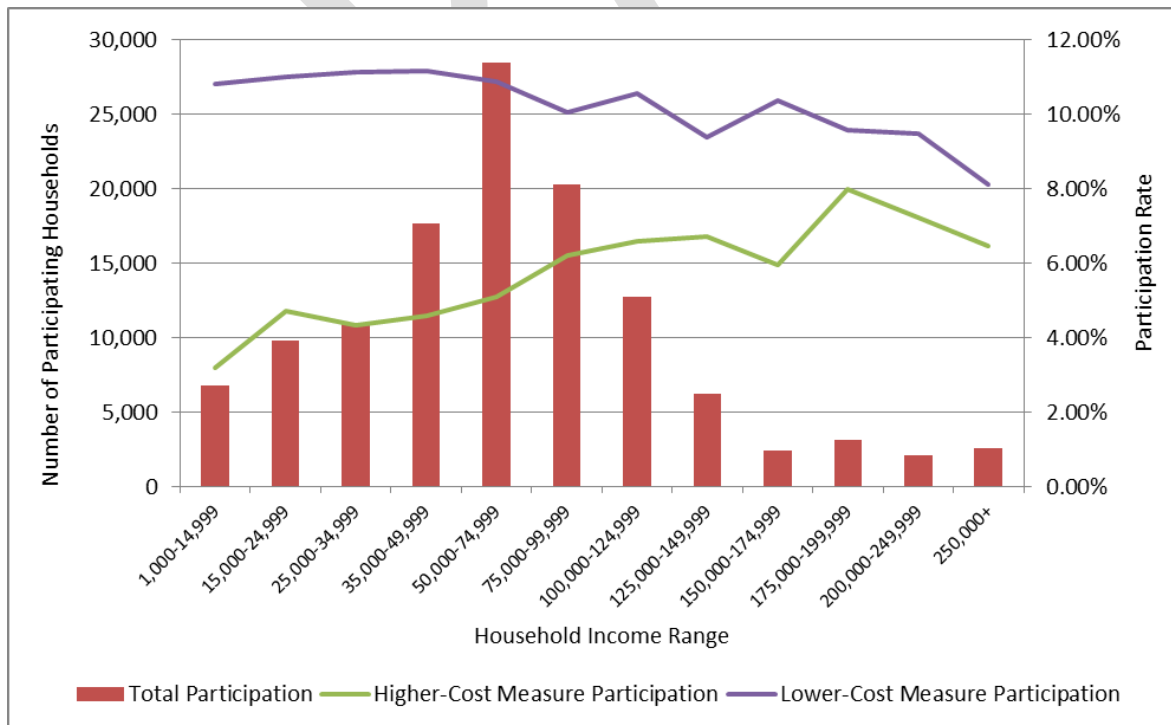


Table A-13. Energy Trust of Oregon Core and ISM Participation by Income

Income Range	Total Households	Total Participating	ISM Participation Rate %	Core Participation Rate %
1,000-14,999	48,455	6,797	10.83%	3.20%
15,000-24,999	62,452	9,826	11.01%	4.72%
25,000-34,999	70,995	10,995	11.14%	4.35%
35,000-49,999	112,444	17,710	11.16%	4.59%
50,000-74,999	178,024	28,505	10.90%	5.12%
75,000-99,999	124,684	20,292	10.07%	6.20%
100,000-124,999	74,222	12,746	10.58%	6.59%
125,000-149,999	38,493	6,198	9.39%	6.71%
150,000-174,999	15,059	2,459	10.38%	5.95%
175,000-199,999	17,633	3,100	9.59%	7.99%
200,000-249,999	12,360	2,068	9.50%	7.23%
250,000+	17,448	2,549	8.13%	6.48%

Energy Trust Energy Programs Participation Rates

In 2017, Energy Trust conducted an analysis of the percentage of eligible customers who participated in an Energy Trust offer. Given data availability and quality concerns common to this type of analysis, assumptions are documented in the tables below, which follow the format of tables provided to the region by NWPCC.

Findings (in relation to data requested by NWPCC)

Table A-14. Percent of Customers Who Participated in Any Program

Customers who participated	50%
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Table A-15. Percent of customers who participated in any program - by segment -

Residential customers who participated	48%
Commercial customers who participated	24%

Note: Multifamily was considered residential for this analysis and participation may be under-estimated.



Table A-16. Percent of Customers Who Participated by Income

Less than \$10,000	0%
\$10,000 to \$14,999	0%
\$15,000 to \$24,999	1%
\$25,000 to \$34,999	8%
\$35,000 to \$49,999	32%
\$50,000 to \$74,999	42%
\$75,000 to \$99,999	14%
\$100,000 to \$149,999	4%
\$150,000 to \$199,999	0%
\$200,000 or more	0%
No answer/unknown	0%

Note: This is median income at the block level for residential participants only and may not accurately represent the income of any individual participant living within that block. US Census, American Community Survey income categories.

Table A-17. Percent of Residential Customers Who Participated - By Geography, at Census Block Level

		Original Definitions
Moderately Urban > 104 - 4,371 households/sq mile	80%	Moderately urban 2,500-50,000 people/Census block OR 104-4,371 households/sq mile at Census block level
Very Urban > 4,371 households/sq mile	10%	Very urban >50k people/Census block OR >4,371 households/sq mile at Census block level
Rural (Non-urban) < 104 households/sq mile	10%	Rural (Non-urban) <2,500 people/Census block OR <104 households/sq mile at Census block level

Table A-18. Percent of Business Customers Who Participated - By Geography, at Census Block Level

		Original Definitions
Moderately Urban >2,500-50,000 people OR 104-4,371 households/sq mile	42%	Moderately urban 2,500-50,000 people/Census block OR 104-4,371 households/sq mile at Census block level
Very Urban >50k people OR > 4,371 households/sq mile	7%	Very urban >50k people/Census block OR >4,371 households/sq mile at Census block level
Rural (Non-urban) <2500 people OR <104 households/sq mile	51%	Rural (Non-urban) <2,500 people/Census block OR <104 households/sq mile at Census block level



Table A-19. Percent of Customers Who Participated - By Building Size

<5,000 sq ft	46%
5,000 - 50,000 sq ft	33%
>50,000 sq ft	21%

Note: From Energy Trust project tracker (PT) and CRM systems for customers who participated in non-residential programs. These numbers only represent 49% of those participants because square footage was missing for 51% of customers. Also, these numbers might represent the total building size or just the size of the building impacted by the project.

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Summary Findings

Overall, the lowest income category (less than \$15,000) had the lowest participation rate in Idaho Power Programs. Incomes just above that range participated in programs relatively proportionally to their respective populations. Program participation dropped off at the higher income levels.

The trends and shifts in participant distributions between 2014 and 2016 were the result of two primary factors:

- 1) Appliance rebates were ended due to increases in standards and declining cost-effectiveness. The Energy Star appliance rebate program was terminated by April 2014 due to increases in manufacturer standards for clothes washers and refrigerators. Prior to 2014, annual participation in appliance programs exceeded 15,000 customers per year.
- 2) Free energy savings kits were added to the program line-up in 2016. In 2016 over 34,000 customers requested free energy savings kits which dramatically raised participation levels from 1% of residential customers to almost 8%. The growth in energy savings kits offset the ramping down of weatherization program.

Next Steps

One obvious drawback of this analysis was the exclusion of over 60% of Idaho Power's savings resulting from the mass-market lighting programs which were not trackable at the customer level. One advantage of excluding lighting participants in the analysis may foreshadow how the program portfolios will look in the near future, after lighting programs are ended.

Another issue for Idaho Power in conducting this analysis was the exclusion of the 28,000 residential demand response customers who would consider themselves as program participants if asked or surveyed. This raised the issue of how to define program participation. For the regional and Idaho Power analysis, we set participation at the premise or service point level, which treated participation in the same way as a potential study. An alternative way to look at participation would be at the account level.

As an example of how this change in participant definition would change program participation analysis, among the 65,000 commercial Idaho Power customers, there were only approximately 24,000 unique communication points of contacts for those sites. Using market actors or the 24,000 points as the denominator, versus total service location sites, program participation rates would more than double.



Residential Findings

Overall Participation Rate

Program participation was just under 1% for 2014 and 2015, and then jumped to almost 8% with the introduction of free mail-out energy savings kits in 2016. The total participation rate in the residential sector was higher than the commercial sector. However, in years without the free energy saver kits (2014 and 2015), the commercial participation rate was higher (Table A-20, 21).

Table A-20. Idaho Power: Participation Rates for all Programs, 2014-2016

	2014	2015	2016	2014-16
All customers	0.70%	0.73%	7.73%	3.05%
Residential customers	1.2%	0.5%	8.6%	3.5%
Commercial customers	1.7%	1.9%	2.4%	2.0%

Table A-21. Idaho Power: Residential Participation Rates, Low Cost v. High Cost Measures, 2014-2016

	2014	2015	2016	2014-16
Low cost measure participants	0.2%	0.2%	8.3%	2.9%
High cost measure participants	1.00%	0.34%	0.33%	0.56%

Income

Participant income distribution tracked closely to the income distribution of the overall population. However, households in the lowest income category (less than \$15,000) were underrepresented among participants, with 10% of participants in this category compared to an incidence of 12% in the population (Table A-22).

Table A-22. Idaho Power: Residential Participant Income Distribution, All Measures, 2014-2016

	Participants				Population ¹	Difference 2014-16 v. Population
	2014	2015	2016	2014-16		
Less than \$15,000	8%	12%	10%	10%	12%	-17%
\$15,000 - \$19,999	5%	6%	5%	5%	5%	0%
\$20,000 - \$29,999	11%	17%	13%	14%	13%	8%
\$30,000 - \$39,999	11%	13%	13%	12%	12%	0%
\$40,000 - \$49,999	11%	12%	12%	12%	11%	9%
\$50,000 - \$74,999	22%	21%	21%	22%	20%	10%
\$75,000 - \$99,999	10%	7%	8%	8%	8%	0%
\$100,000 - \$124,999	7%	5%	5%	6%	7%	-14%
Greater than \$124,999	15%	8%	11%	11%	12%	-8%



The differences between the participant income distribution and the population were substantially larger when comparing low cost vs. high cost measures. Lower income participants were overrepresented and higher income participants were underrepresented, relative to their incidence in the population, when examining only participation in low cost measures (Table A-23).

Table A-23. Idaho Power: Residential Participant Income Distribution, Low Cost Measures, 2014-2016

	Participants				Population	Difference 2014-16 v. Population
	2014	2015	2016	2014-16		
Less than \$15,000	18%	17%	11%	15%	12%	25%
\$15,000 - \$19,999	10%	8%	5%	8%	5%	60%
\$20,000 - \$29,999	16%	20%	14%	17%	13%	31%
\$30,000 - \$39,999	15%	14%	13%	14%	12%	17%
\$40,000 - \$49,999	12%	11%	12%	12%	11%	9%
\$50,000 - \$74,999	15%	17%	21%	18%	20%	-10%
\$75,000 - \$99,999	5%	4%	8%	6%	8%	-25%
\$100,000 - \$124,999	4%	3%	5%	4%	7%	-43%
Greater than \$124,999	5%	5%	11%	7%	12%	-42%

Among participants in high cost measures, three of the four lower income categories were underrepresented, the exception being the \$15,000 to \$19,999 category. Households with incomes over \$50,000 were overrepresented (Table A-24).

Table A-24. Idaho Power: Residential Participant Income Distribution, High Cost Measures, 2014-2016

	Participants				Population	Difference 2014-16 v. population
	2014	2015	2016	2014-16		
Less than \$15,000	6%	9%	7%	8%	12%	-33%
\$15,000 - \$19,999	4%	4%	4%	7%	5%	40%
\$20,000 - \$29,999	9%	15%	12%	12%	13%	-8%
\$30,000 - \$39,999	10%	12%	12%	11%	12%	-8%
\$40,000 - \$49,999	11%	12%	11%	11%	11%	0%
\$50,000 - \$74,999	24%	23%	22%	23%	20%	15%
\$75,000 - \$99,999	11%	9%	9%	10%	8%	25%
\$100,000 - \$124,999	8%	6%	9%	8%	7%	14%
Greater than \$124,999	17%	10%	14%	14%	12%	17%

The overall participation rate by income category ranged from 2.9% to 3.8%. The highest participation rates were in the middle-income ranges of \$30,000 to \$75,000 (Table A-25).



Table A-25. Idaho Power: Residential Participation Rate by Income, All Measures, 2014-2016

	2014	2015	2016	2014-16
Less than \$15,000	0.9%	0.6%	7.7%	3.0%
\$15,000 - \$19,999	1.0%	0.6%	8.7%	3.5%
\$20,000 - \$29,999	1.0%	0.7%	8.6%	3.4%
\$30,000 - \$39,999	1.1%	0.6%	9.3%	3.7%
\$40,000 - \$49,999	1.2%	0.6%	9.4%	3.7%
\$50,000 - \$74,999	1.4%	0.6%	9.4%	3.8%
\$75,000 - \$99,999	1.4%	0.4%	8.3%	3.4%
\$100,000 - \$124,999	1.3%	0.4%	7.0%	2.9%
Greater than \$124,999	1.5%	0.4%	7.8%	3.2%

Free mail-out energy saver kits were introduced in 2016, leading to a substantially higher participation rate in low cost measures in that year, across all income categories. As with all measures, the highest participation rates in low cost measures were in the middle-income ranges of \$30,000 to \$75,000 (Table A-26).

Table A-26. Idaho Power: Residential Participation Rate by Income, Low Cost Measures, 2014-2016

	2014	2015	2016	2014-16
Less than \$15,000	0.3%	0.3%	7.5%	2.7%
\$15,000 - \$19,999	0.4%	0.3%	8.5%	3.1%
\$20,000 - \$29,999	0.3%	0.3%	8.3%	3.0%
\$30,000 - \$39,999	0.3%	0.2%	9.0%	3.2%
\$40,000 - \$49,999	0.2%	0.2%	9.1%	3.2%
\$50,000 - \$74,999	0.2%	0.2%	9.0%	3.1%
\$75,000 - \$99,999	0.1%	0.1%	7.9%	2.7%
\$100,000 - \$124,999	0.1%	0.1%	6.6%	2.3%
Greater than \$124,999	0.1%	0.1%	7.4%	2.5%

Participation rates in high cost measures were lower across all income categories, compared to participation in low cost measures. The highest participation rates in high cost measures were in the income categories over \$50,000 (Table A-27).



Table A-27. Idaho Power: Residential Participation Rate by Income, High Cost Measures, 2014-2016

	2014	2015	2016	2014-16
Less than \$15,000	0.5%	0.3%	0.2%	0.3%
\$15,000 - \$19,999	0.7%	0.3%	0.3%	0.4%
\$20,000 - \$29,999	0.7%	0.4%	0.3%	0.5%
\$30,000 - \$39,999	0.9%	0.3%	0.3%	0.5%
\$40,000 - \$49,999	1.0%	0.4%	0.3%	0.6%
\$50,000 - \$74,999	1.2%	0.4%	0.4%	0.7%
\$75,000 - \$99,999	1.3%	0.3%	0.3%	0.7%
\$100,000 - \$124,999	1.2%	0.3%	0.4%	0.6%
Greater than \$124,999	1.4%	0.3%	0.4%	0.7%

Housing Type

Among all measure types, single family and multifamily households were somewhat underrepresented and manufactured households were substantially overrepresented, relative to their incidence in the population (Table A-28).

Table A-28. Idaho Power: Residential Participant Housing Type Distribution, All Measures, 2014-2016

	Participants				Population	Difference 2014-16 v. Population
	2014	2015	2016	2014-16		
Single family	83%	62%	85%	77%	81%	-5%
Multi-family	6%	16%	7%	10%	11%	-9%
Manufactured home	11%	21%	8%	13%	8%	63%

When examining only participation in low cost measures, the differences between participant and population distributions were in the same direction, but larger, than with all measures (Table A-29).

Table A-29. Idaho Power: Residential Participant Housing Type Distribution, Low Cost Measures, 2014-2016

	Participants				Population	Difference 2014-16 v. Population
	2014	2015	2016	2014-16		
Single family	53%	48%	85%	62%	81%	-23%
Multi-family	6%	4%	7%	6%	11%	-45%
Manufactured home	41%	49%	8%	33%	8%	313%

When examining only participation in high cost measures, the differences between participant and population distributions were in the opposite direction and smaller, compared to both all and low cost



measures. Manufactured home households were underrepresented and single family households slightly overrepresented (Table A-30).

Table A-30. Idaho Power: Residential Participant Housing Type Distribution, High Cost Measures, 2014-2016

	Participants				Population	Difference 2014-16 v. Population
	2014	2015	2016	2014-16		
Single family	89%	71%	92%	84%	81%	4%
Multi-family	7%	24%	3%	11%	11%	0%
Manufactured home	4%	5%	5%	5%	8%	-38%

The overall participation rate by home type ranged from 2.3% to 4.0%. Manufactured home households had the highest participation rate (Table A-31).

Table A-31. Idaho Power: Residential Participation Rate by Housing Type, All Measures, 2014-2016

	2014	2015	2016	2014-16
Single family	1.2%	0.4%	9.1%	3.6%
Multi-family	0.7%	0.8%	5.2%	2.3%
Manufactured home	1.6%	1.5%	8.9%	4.0%

The participation rate by home type for high cost measures ranged from 0.3% to 0.6%. Single family households had the highest participation rate (Table A-32).

Table A-32. Idaho Power: Residential Participation Rate by Housing Type, High Cost Measures, 2014-2016

	2014	2015	2016	2014-16
Single family	1.1%	0.3%	0.4%	0.6%
Multi-family	0.6%	0.8%	0.1%	0.5%
Manufactured home	0.5%	0.2%	0.2%	0.3%

Home Ownership

Overall, homeowners participated at higher rates than renters, relative to their incidence in the population (Table A-33). Among low cost measures, renters participated at a proportionately higher rate than owners (Table A-34). The opposite was true of high cost measures (Table A-35).



Table A-33. Idaho Power: Residential Participant Distribution by Home Ownership, All Measures, 2014-2016

	Participants				Population	Difference 2014-16 v. Population
	2014	2015	2016	2014-16		
Owner	82%	72%	77%	77%	74%	4%
Renter	18%	28%	23%	23%	26%	-12%

Table A-34. Idaho Power: Residential Participant Distribution by Home Ownership, Low Cost Measures, 2014-2016

	Participants				Population	Difference 2014-16 v. Population
	2014	2015	2016	2014-16		
Owner	71%	69%	77%	72%	74%	-3%
Renter	29%	31%	23%	28%	26%	8%

Table A-35. Idaho Power: Residential Participant Distribution by Home Ownership, High Cost Measures, 2014-2016

	Participants				Population	Difference 2014-16 v. Population
	2014	2015	2016	2014-16		
Owner	85%	74%	80%	80%	74%	8%
Renter	15%	26%	20%	20%	26%	-23%

The participation rate by housing type was lower for renters than for owners across all measure types (Tables A-36-38).

Table A-36. Idaho Power: Residential Participation Rate by Home Ownership, All Measures, 2014-2016

	2014	2015	2016	2014-16
Owner	1.4%	0.5%	9.0%	3.6%
Renter	0.8%	0.6%	7.4%	2.9%

Table A-37. Idaho Power: Residential Participation Rate by Home Ownership, Low Cost Measures, 2014-2016

	2014	2015	2016	2014-16
Owner	0.2%	0.2%	8.7%	3.0%
Renter	0.2%	0.2%	7.1%	2.5%



Table A-38. Idaho Power: Residential Participation Rate by Home Ownership, High Cost Measures, 2014-2016

	2014	2015	2016	2014-16
Owner	1.2%	0.3%	0.4%	0.6%
Renter	0.6%	0.3%	0.3%	0.4%

Geography

Among all measure types, rural households were overrepresented compared to their incidence in the population (Tables A-39-41).

Table A-39. Idaho Power: Residential Participant Distribution by Geography, All Measures, 2014-2016

	Participants				Population	Difference 2014-16 v. Population
	2014	2015	2016	2014-16		
Urban	73%	66%	72%	70%	77%	-9%
Rural	27%	34%	28%	30%	23%	30%

¹CIS

Table A-40. Idaho Power: Residential Participant Distribution by Geography, Low Cost Measures, 2014-2016

	Participants				Population	Difference 2014-16 v. Population
	2014	2015	2016	2014-16		
Urban	65%	65%	72%	67%	77%	-13%
Rural	35%	35%	28%	33%	23%	43%

¹Census

Table A-41. Idaho Power: Residential Participant Distribution by Geography, High Cost Measures, 2014-2016

	Participants				Population	Difference 2014-16 v. Population
	2014	2015	2016	2014-16		
Urban	75%	66%	68%	70%	77%	-9%
Rural	25%	34%	28%	29%	23%	26%

¹Census

Rural customers participated at a higher rate than urban customers. The difference was largely driven by the 2016 mail-out program. However, even among high cost measures, rural customers had a slightly higher participation rate (0.7% compared with 0.5% between 2014 and 2016) (Tables A-42 - 44).



Table A-42. Idaho Power: Residential Participation Rate by Geography, All Measures, 2014-2016

	2014	2015	2016	2014-16
Urban	1.2%	0.5%	8.1%	0.8%
Rural	1.4%	0.8%	10.3%	4.2%

Table A-43. Idaho Power: Residential Participation Rate by Geography, Low Cost Measures, 2014-2016

	2014	2015	2016	2014-16
Urban	0.2%	0.2%	7.8%	2.7%
Rural	0.3%	0.3%	9.9%	3.5%

Table A-44. Idaho Power: Residential Participation Rate by Geography, High Cost Measures, 2014-2016

	2014	2015	2016	2014-16
Urban	1.0%	0.3%	0.3%	0.5%
Rural	1.1%	0.5%	0.5%	0.7%

Data Sources

Participant Data

Participant data sources came from energy efficiency program databases, in cases where participants could be matched to Idaho Power’s customer information system (CIS). Program participation was based on service point. Prominent programs excluded from this analysis were:

- Upstream lighting
- Low-income energy efficiency kits
- Student energy efficiency kits
- Customer giveaways

Idaho Power lacked population-based data sources to adequately report race or ethnicity. The race/ethnicity source provided by Acxiom as only available for 76% of our customer base. The customers that Acxiom were unable to match to Idaho Power’s customer database had unique characteristics, different from the overall population, so any analysis based on the partially-matched data was judged to be systematically biased and therefore the analysis was not conducted.

Year over year analysis was challenging because Idaho Power changed demographic data providers in 2016. The previous and current vendors’ demographic categories and methodologies differed, requiring the 2014-2015 demographic data to be proxied by service location with 2016 data. It must be noted that the process of looking back in time means assuming that the prior year resident (of the household address) had similar demographic characteristics to the 2016 resident, even in cases in which occupancy changed.



Idaho Power did not report on commercial program activity by building type because we did not have a population-based estimate of building types for commercial customers nor did we have complete program participation data by building types.

Population Data

Both Idaho Power's CIS and Acxiom data were used to provide population benchmark data for home type distribution. Acxiom demographics were used to run population benchmarks for income and homeownership status distributions. Rural/urban splits were made at the City instead of the census block level using 104 households/square mile as the split between rural and urban.

DRAFT



NORHTWESTERN ENERGY

Summary Findings

As part of the North-West Power Council's hard to reach markets effort, NEEA analyzed commercial participation in NorthWestern Energy's territory by square footage and building use. The analysis suggests that NorthWestern's participants comprise 5% of the commercial buildings in their territory. These participants tend to be in larger buildings than the general commercial building population, while smaller buildings tend to be under-represented.

It seems likely that the retail sector participated at a higher rate than the general population, given that they were the dominant building type among participants, yet third in terms of the general building population. Hospitals comprised a smaller percentage among participants than the general building population, representing a potentially underserved building segment.

Due to the low match rate, presence of records with no floor area available for analysis, and inconsistent building classification among three different fields in the tax assessor's data, these results should be interpreted with some caution. Recommendations for improving this analysis in the future include improving building type mapping among the three fields in the assessor's data, and identifying other third party datasets that may provide more accurate and consistent building attributes and coverage.

Findings

Of the three third-party datasets considered by NEEA, the county tax assessor data had the highest match rate of 62%, followed by Dun and Bradstreet (41%), and CoStar (31%).

Around 17,000 commercial buildings were identified in NorthWestern's territory. Participants tend to be disproportionately in the middle to large categories (Table 1). Smaller buildings are disproportionately under-represented.

Table A-45: Summary of Floor Area Distribution among Buildings with Floor Area Available for Analysis

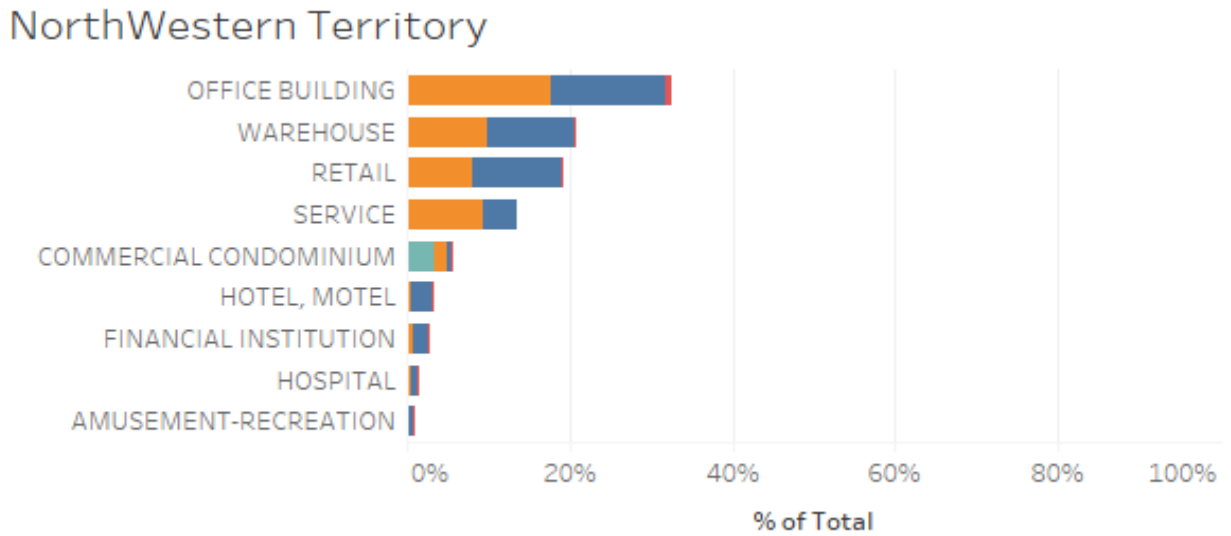
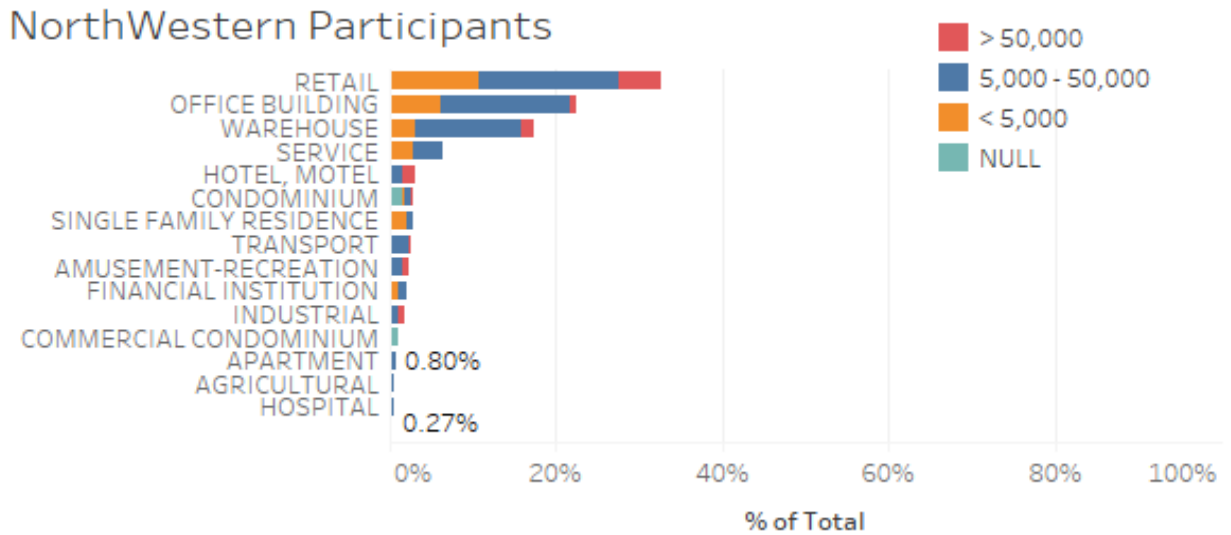
Floor Area (SQFT)	Territory	Participants
< 5,000	51%	24%
5,000 - 50,000	47%	64%
> 50,000	2%	12%

Among the commercial buildings in NorthWestern territory, the largest categories are office buildings (32%), warehouses (21%), and retail (19%). Among participants, the largest categories are retail (32%), office buildings (22%), and warehouses (17%).

Among retail, participant floor areas greater than 50,000 sq-ft. comprised 5% compared to less than 1% of all retail buildings (Figure A-6).



Figure A-6. Summary of Building Types by Square Footage for Participants and the General Building Population in NorthWestern's Territory



Methods



Participant Data - Sources

NorthWestern provided NEEA a list of their commercial lighting participants in two files. The first contains facility name. The second provides purchase date and facility address. These were joined together using a unique ID in both files. Participant addresses were then standardized using a CASS engine, and used to join attributes from county assessor data.

Population Data - Sources

NorthWestern provided a shapefile representing NorthWestern accounts. This dataset was used to query the three third party datasets – Dunn and Bradstreet, CoreLogic County Assessor data, and CoStar, all using spatial intersects based on latitude and longitude values to identify buildings and businesses inside NorthWestern’s territory.

Analysis

We attempted to join participant addresses to all three third party datasets. Once joined NEEA calculated percentages of buildings in floor area buckets and building use types for participants and the population for comparison.

Limitations

There are several limitations that complicated this analysis, and warrant calling out for proper interpretation of the results:

1. A low match rate of under three quarters means that we could not calculate participation rates among floor area and building use categories.
2. Not all assessor parcels have a floor area recorded, and the accuracy of the records that do have floor area are uncertain.
3. There are three fields in assessor data that indicate building use. Some are more detailed than others, and in some instances, the fields may contradict themselves, reducing the confidence in the accuracy of the classifications. This can also be seen where some participants are classified as a Single Family Residence or Apartments. There are also instances when properties are either labeled simply ‘commercial’, or are tax exempt, and thus do not have a classification provided. This comprised 20% of participants and 35% of all commercial buildings in NorthWestern’s territory. This analysis used the building use classification that matched up the most closely to the Power Council’s desired categories, and excluded the large number of ‘Commercial’ and ‘Tax Exempt’ categories for analysis.

Recommendations

The analysis of NorthWestern’s commercial participants demonstrated the complexities in accurately characterizing the program participant’s buildings and NorthWestern’s commercial customer base’s buildings. Further work mapping the building use categories in the assessor data may reduce the number of unclassified buildings. A review of other third party commercial datasets may also be beneficial to determine if there are any that have more complete data than those considered in this analysis – e.g. SMR Research (<http://www.smrresearch.com/>).



PUGET SOUND ENERGY

Summary Findings

Conclusions and Next Steps

This research conducted by PSE yielded participation metrics for the defined segments, and a representation of the total population of each segment, although the ability to align readily available data with the defined segments was limited and the results are at best approximations.

A key limitation is that a significant portion of PSE's portfolio energy savings come from programs where participation cannot be attributed to specific customers, such as retail rebates for lighting. Future research on currently non-attributable savings may be warranted.

PSE also notes that customer participation in programs from the time prior to the analysis period (2014 – 2016) may diminish a portion of the non-participating customers in each segment as they may still be enjoying performance from installed measures. Consideration should be given to estimate the portfolio of installed measure life to avoid distorting energy efficiency potential.

Housing stock and cost of living realities are rapidly changing in the region and, while the methods used to gather and report findings for this report are necessarily a snapshot in time, it should be noted that economic factors are having a transformative effect in the region and may be an exogenous force shaping the findings beyond the scope of this analysis.

Lack of identifying characteristics data made quantification of the commercial tenant and industrial segments particularly problematic. Therefore these segments were represented by small commercial and large commercial/industrial classes, respectively, as proxies.

In other research efforts, PSE has had difficulty working with data from 3rd party providers and getting accurate, actionable firmographic data. Perhaps another method/resource can be utilized in order to better understand the commercial tenant segment.

There are qualitative factors to consider with small business customers mentioned at the first working meeting (held May 11, 2017) that influenced the penetration of energy efficiency in this segment. Further stages of this research should keep them in mind with any quantitative findings from this report.

Finally, it should be recognized that number of participants may not be the most appropriate metric to determine whether a particular segment is proportionately served. Alternative metrics, such as energy savings achieved or amount of utility program spending devoted to a particular segment should be explored.



Residential Findings

Overall Participation Rate

Approximately 5% of PSE customers participated in programs in any given year from 2014 to 2016 (Table A-46).

Table A-46. Puget Sound Energy: Participation Rates for all Programs, 2014-2016

	2014	2015	2016	2014-16
Total customer participation	5%	5%	4%	5%
Residential customers	5%	5%	4%	5%
Commercial customers	3%	3%	2%	2%

Most of the program participants were from the residential sector (Table A-47).

Table A-47. Puget Sound Energy: Participant Distribution, by Sector, 2014-2016

	Participants				PSE Service Area
	2014	2015	2016	2014-16	
Residential customers	94%	93%	95%	94%	88%
Commercial customers	6%	7%	4%	6%	12%

Income

For this analysis, PSE used kWh savings, incentive dollars, and households, as the units of analysis.

In terms of the distribution of total kWh savings by income category, the lower two income categories are well represented through the PSE programs. Participants in the lowest income category (up to \$49,000) achieved 29% of the average 2014-2016 savings; these households made up 27% of the PSE population. The next income category (\$50,000 - \$75,000), had an even higher representation, at 28% of average total savings relative to its share of the population (22%). In general, all of the higher income categories accounted for a slightly lower proportion of total average savings, relative to their incidence in the population (Table A-48).



Table A-48. Puget Sound Energy: Residential Participant Income Distribution, by kWh Savings, 2014-2016

	Participants' Percent of total kWh savings				PSE Service Area
	2014	2015	2016	2014-16	
\$1,000 - \$49,000	28%	28%	30%	29%	27%
\$50,000 - \$74,999	28%	28%	27%	28%	22%
\$75,000 - \$99,999	17%	17%	16%	17%	18%
\$100,000 - \$124,999	12%	11%	11%	11%	12%
\$125,000 - \$149,999	5%	6%	6%	6%	8%
\$150,000 - \$ 174,999	2%	3%	3%	3%	3%
\$175,000 - \$199,999	3%	3%	2%	3%	4%
\$200,000 - \$249,999	2%	2%	2%	2%	3%
\$250,000 and Above	2%	3%	3%	3%	4%

The incentive fund distribution by income was similar in proportion to kWh savings, with a slightly higher proportion of funds going to the two lowest income categories, relative to their incidence in the population. It is notable that, from 2014 to 2016, the proportion of incentives paid to participants in the lowest income category increased from 21% to 36% (Table A-49) while their proportion of total savings only increased from 28% to 30%.

Table A-49. Puget Sound Energy: Residential Participant Income Distribution, by Incentives, 2014-2016

	Participants' Percent of total incentives				PSE Service Area
	2014	2015	2016	2014-16	
\$1,000 - \$49,000	21%	32%	36%	30%	27%
\$50,000 - \$74,999	26%	28%	26%	27%	22%
\$75,000 - \$99,999	20%	16%	15%	17%	18%
\$100,000 - \$124,999	13%	10%	10%	11%	12%
\$125,000 - \$149,999	7%	5%	5%	5%	8%
\$150,000 - \$ 174,999	3%	3%	3%	3%	3%
\$175,000 - \$199,999	4%	2%	2%	3%	4%
\$200,000 - \$249,999	4%	2%	2%	2%	3%
\$250,000 and Above	3%	3%	3%	3%	4%

When examining participant income distribution with households as the unit of analysis, participants in the lowest income category and the \$125,000 - \$149,000 category were underrepresented, participants with incomes between \$50,000 and \$124,999 were slightly overrepresented, and participants with household incomes over \$150,000 participated proportionately to their incidence in the population (Table A-50).



Table A-50. Puget Sound Energy: Residential Participant Income Distribution, by Household, 2014-2016

	Participants' Percent of total incentives				PSE Service Area
	2014	2015	2016	2014-16	
\$1,000 - \$49,000	23%	23%	24%	23%	27%
\$50,000 - \$74,999	25%	25%	24%	25%	22%
\$75,000 - \$99,999	19%	18%	18%	19%	18%
\$100,000 - \$124,999	13%	13%	13%	13%	12%
\$125,000 - \$149,999	7%	8%	8%	7%	8%
\$150,000 - \$ 174,999	3%	3%	3%	3%	3%
\$175,000 - \$199,999	4%	4%	4%	4%	4%
\$200,000 - \$249,999	3%	2%	3%	3%	3%
\$250,000 and Above	3%	4%	4%	4%	4%

Housing Type

Residential participation by housing type matched the population distribution exactly.

Table A-51. Puget Sound Energy: Residential Participant Housing Type Distribution, 2014-2016

Percent of customers who participated - by home type						
		2014	2015	2016	2014 - 2016 Average	PSE Service Area Percentage
Percent Savings						
	Multi-Family	33%	37%	39%	36%	15%
	Mobile Home	14%	7%	6%	9%	4%
	Single Family	41%	39%	34%	38%	61%
Percent Incentives						
	Multi-Family	35%	42%	42%	40%	15%
	Mobile Home	14%	12%	8%	11%	4%
	Single Family	42%	42%	34%	39%	61%
Percent Unique Locations						
	Multi-Family	50%	55%	46%	50%	15%
	Mobile Home	6%	5%	2%	5%	4%
	Single Family	40%	36%	36%	38%	61%



Geography

In comparing the geographic distribution participants to the population, rural customers were overrepresented among participants in all three units of analysis: households, kWh savings, and incentives (Tables A-52, 53, 54).

Table A-52. Puget Sound Energy: Residential Participant Distribution by Geography, by Household, 2014-2016

	Percent of Participating Households				PSE Service Area
	2014	2015	2016	2014-16	
Rural	20%	19%	19%	19%	15%
Urban	80%	81%	81%	81%	85%

Table A-53. Puget Sound Energy: Residential Participant Distribution by Geography, by kWh Savings, 2014-2016

	Percent of Total kWh Savings				PSE Service Area
	2014	2015	2016	2014-16	
Rural	27%	26%	24%	26%	15%
Urban	73%	74%	77%	75%	85%

Table A-54. Puget Sound Energy: Residential Participant Distribution by Geography, by Incentives, 2014-2016

	Percent of Total Incentives				PSE Service Area
	2014	2015	2016	2014-16	
Rural	23%	25%	23%	24%	15%
Urban	77%	75%	77%	76%	85%

Commercial Findings

Business Size

Small businesses were underrepresented among program participants across all three units of analysis: unique locations, kWh savings, and incentives (Tables A-55, 56, 57).

Table A-55. Puget Sound Energy: Commercial Participation by Unique Location as a Percentage of Participating Commercial Customers, 2014-2016

	Percent of Participating Businesses				PSE Service Area
	2014	2015	2016	2014-16	
Small business	62%	57%	91%	70%	95%
Large commercial/industrial	3%	2%	5%	3%	2%



Table A-56. Commercial Percentage of kWh Savings, 2014-2016

	Participants' Percent of kWh Savings				PSE Service Area
	2014	2015	2016	2014-16	
Small business	73%	68%	61%	67%	95%
Large commercial/industrial	22%	23%	30%	25%	2%

Table A-57. Commercial Percentage of Incentives, 2014-2016

	Participants' Percent of Incentives				PSE Service Area
	2014	2015	2016	2014-16	
Small business	76%	71%	64%	71%	95%
Large commercial/industrial	18%	22%	27%	22%	2%

The participation rate for large commercial and industrial customers, which averaged 8% for 2014-2016, was higher than for small businesses, which averaged 2% (Table A-58).

Table A-58. Puget Sound Energy: Commercial Participation Rate by Business Size, 2014-2016

	2014	2015	2016	2014-16
Small business	2%	2%	2%	2%
Large commercial/industrial	9%	7%	8%	8%

Data Sources

Participant Data

Participant data included retail lighting and showerhead programs which were not tracked to the individual customer. These savings, incentives, and participation were excluded from the analysis, leaving the **attributable data**, or that which could be identified to a unique customer or location as the basis for making comparisons.

Savings and incentives totals were aggregated by each segment and then divided by the total amount of attributable data to arrive at a percentage to compare to the population. Participation totals were determined by identifying the number of unique locations in the case of income, residential structure, and urban/rural segments. For business segments, participation totals were determined by the number of unique customers as in some cases there could be one to many relationships embedded within the location variable.

The multi-family segment required additional consideration for participation levels, as contractors reported savings and incentive levels aggregated from multiple installations at a given location. Contractors provided additional data for the HTR analysis with the total number of units for each project. The number of units were matched via the project number identifier with the participant data.



Then, the total number of units were summed to determine the participant percentage. Another step in the analysis was to determine which measures were applied to common areas such as hallways, garages, or other non-residential space. These common area savings and incentives were subtracted out of the multi-family segment.

Puget Sound Energy's (PSE) Energy Efficiency Services Division (EES) creates and maintains data to track and report energy savings and expenditures for its biennial conservation plan (BCP). For this analysis, EES provided complete residential and business data for the years 2014 – 2016.

Collection: EES collects and maintains data on its programs to monitor progress towards its BCP goals as well as formally reporting achievements at required milestones.

Storage: EES maintains a database with its program data. During the period 2014 – 2016 EES migrated to a new database system integrating several sources into one platform. Additionally, some data is aggregated by contractors implementing PSE programs.

Formatting: Data was partitioned by segment (Residential and Commercial) and year. Each year had some unique formatting in terms of field naming conventions so analysis was completed on each unique sector and year and then combined in the reporting format.

Challenges: In order to complete the analysis, EES data sets had to be merged with PSE Enterprise data sets to delineate the desired segments, and create the population comparison from PSE's entire customer base.

Population Data

Collection: PSE maintains enterprise data on its customer base. Operational data provided classification fields for housing structure and business segments. Additionally, third party (Experian) data was integrated providing estimated income bins for the customer base. PSE also made use of U.S. Census spatial data delineating urban cluster areas.

Storage: PSE maintains data in an enterprise CIS system.

Formatting: PSE has variables in its enterprise data identifying customers, locations, and one to many relationships between customers and locations.

Defining demographic categories

3. Low-income: 200% Federal Poverty Level or below is considered low-income in the Weatherization Program.
4. Moderate income: PSE used the Energy Trust of Oregon definition of moderate income as 200% to 300% Federal Poverty Level.
5. Rural Customers: Urban clusters are defined based on the same criteria as urbanized areas, but represent areas containing at least 2,500 and less than 50,000 people. "Rural" continues to be defined as any population, housing, or territory outside urban areas. U.S. Census
6. Multi-family: PSE classifies as five plus connected units and flags exist within PSE internal data classifying customers by housing type
7. Manufactured homes: flags exist within PSE internal data classifying customers by housing type



8. Small to Medium Sized business: PSE uses its rate schedules to capture small business as demand less than or equal to 50 KW or between 50 KW and 350 KW.
9. Industrial: PSE classified Industrial customers as those exceeding the 350KW demand thresholds.
10. Commercial tenants: At this time PSE does not have a workable data source for commercial tenants to consider for the analysis. Given the ephemeral nature of some small businesses, that segment serves as a proxy for this one in the present analysis.

Population levels were defined by the available fields in PSE Enterprise Data, integrated purchased 3rd party demographic data, and via classification of PSE Enterprise Data with the U.S. Census Urban Cluster Shapefiles in GIS Software. Participant data was “pinned” to enterprise data via customer or location variables.



RAVALLI ELECTRIC

Summary Findings

Ravalli Electric's participants revealed a small disparity between low and middle income residents, with low income residents consisting of around 10% of all participants between 2014 and 2016. Renters participated less than homeowners. Only 2% of the housing stock in Ravalli Electric's territory consisted of multi-family units, and none of these residents have participated.

Residential Findings

Overall Participation Rate

During the period 2014-2016, 1.3% of Ravalli Electric customers participated in utility sponsored energy efficiency programs (Table A-59).

Table A-59. Ravalli Electric: Residential Participation Rates, 2014-2016

	2014	2015	2016	2014-16
Residential Customers	0.4%	0.5%	0.4%	1.3%

Income

Higher income customers (\geq \$100,000) participated at higher rates than customers in other income categories. Customers with the lowest participation rate were in the \$35,000 to \$99,999 income categories (Table A-60, Figure A-7).

Table A-60. Ravalli Electric: Residential Participation Rate by Income, 2014-2016

	2014	2015	2016	2014-16
Less than \$15,000	0.58%	0.38%	0.19%	1.15%
\$15,000 - \$24,999	0.60%	0.45%	0.45%	1.49%
\$25,000 - \$34,999	0.69%	0.00%	0.69%	1.36%
\$35,000 - \$49,999	0.22%	0.34%	0.11%	0.67%
\$50,000 - \$74,999	0.00%	0.47%	0.47%	0.95%
\$75,000 - \$99,999	0.15%	0.00%	0.44%	0.59%
\$100,000 - \$149,999	0.20%	1.00%	0.40%	1.59%
\$150,000 - \$199,999	1.42%	0.71%	0.00%	2.11%
Greater than \$200,000	0.00%	1.09%	1.09%	2.16%
No answer/unknown	0.55%	0.77%	0.44%	1.74%



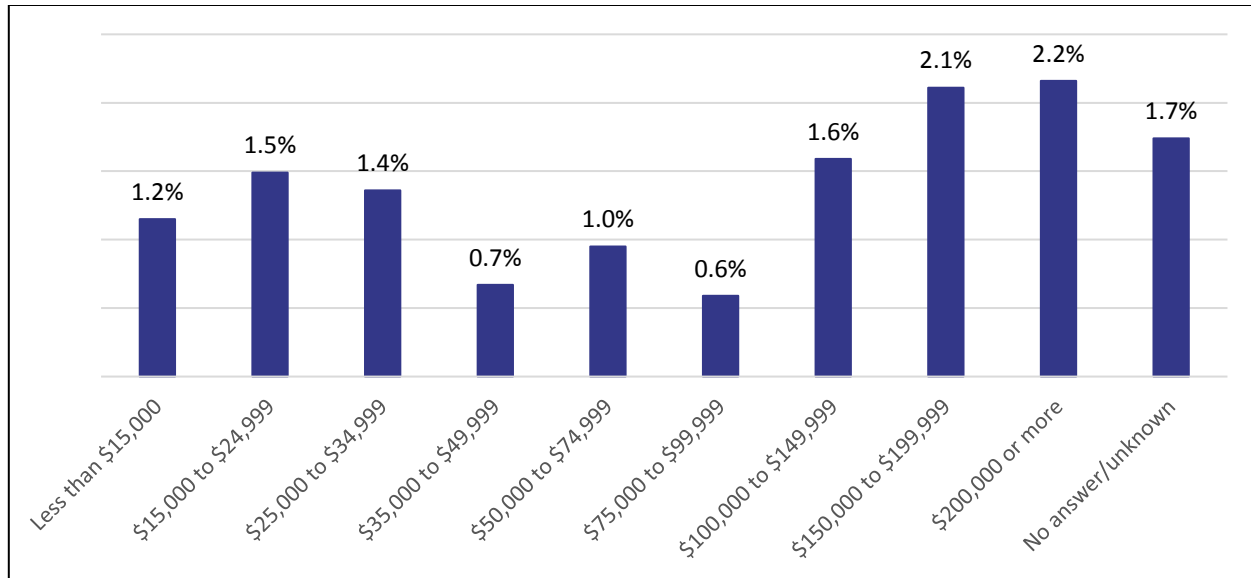


Figure A-7. Ravalli Electric: Residential Participation Rate by Income, 2014-2016

Participants with incomes less than \$15,000 and between \$35,000 and \$99,000 were underrepresented, relative to their incidence in the population. Participants with incomes over \$150,000 were substantially overrepresented. The findings should be interpreted with some caution, given the large proportion of participants for which no income data were available (Table A-61, Figure A-8).

Table A-61. Ravalli Electric: Residential Participant Income Distribution, 2014-2016

	Participants				Population	Difference 2014-16 v. population
	2014	2015	2016	2014-16		
Less than \$15,000	14%	7%	1%	8%	9%	-11%
\$15,000 - \$24,999	18%	11%	12%	14%	11%	27%
\$25,000 - \$34,999	18%	0%	16%	11%	10%	10%
\$35,000 - \$49,999	9%	11%	4%	8%	14%	-43%
\$50,000 - \$74,999	0%	18%	20%	13%	17%	-24%
\$75,000 - \$99,999	5%	0%	12%	5%	11%	-62%
\$100,000 - \$149,999	5%	18%	8%	11%	8%	38%
\$150,000 - \$199,999	9%	4%	0%	4%	2%	100%
Greater than \$200,000	0%	7%	8%	5%	3%	67%
No answer/unknown	23%	25%	16%	21%	15%	40%

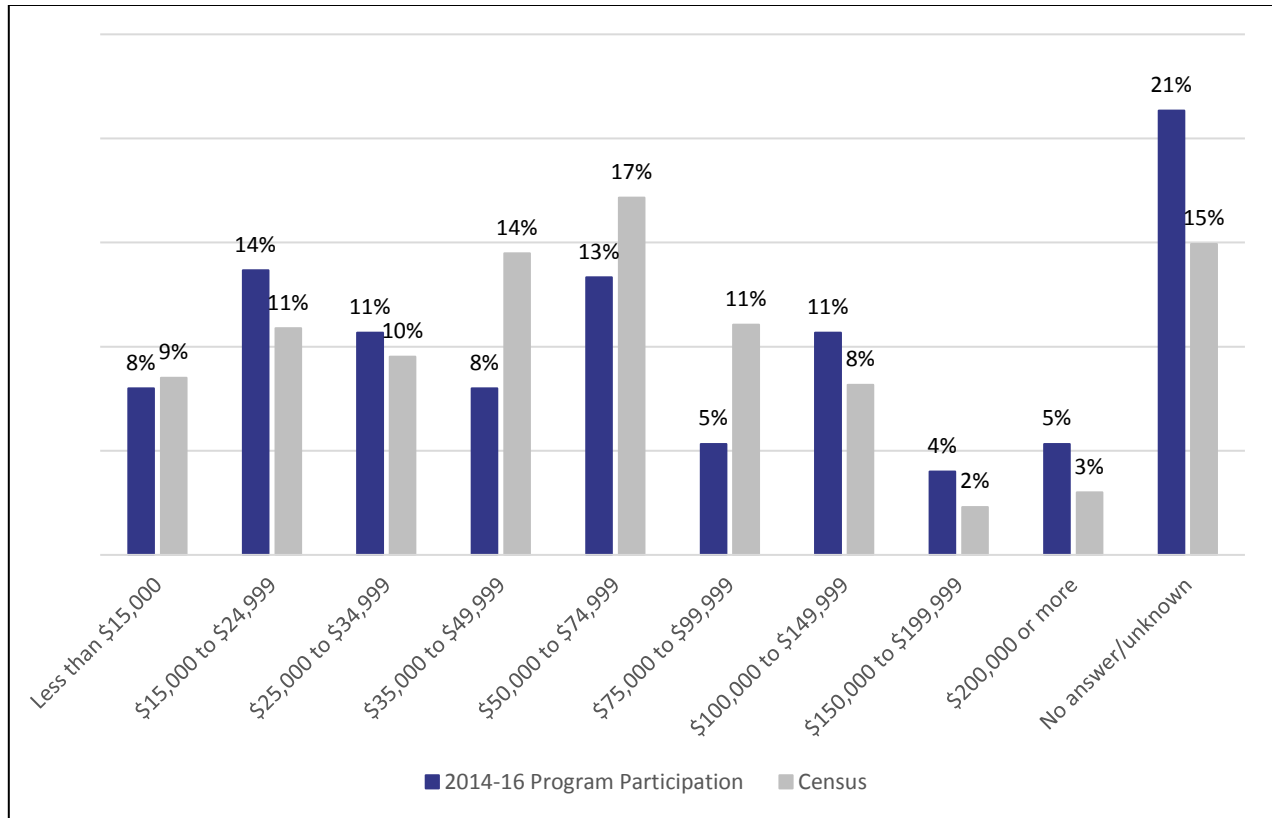


Figure A-8. Ravalli Electric: Participant Income Distribution vs. US Census, 2014-2016

Housing Type

Most of the homes in Ravalli Electric territory are single family (98%), and all of the program participation was from single family homes. In this analysis, manufactured homes were included in the single family category because the Census data did not make a distinction between the two housing types (Table A-62).

Table A-62. Ravalli Electric: Residential Participant Housing Type Distribution, 2014-2016

	Participants				Population	Difference 2014-16 v. Population
	2014	2015	2016	2014-16		
Single family	100%	100%	100%	100%	98%	2%
Multi-family	0%	0%	0%	0%	2%	-100%

Home Ownership

Ravalli Electric's territory was dominated by homeowners rather than renters. However, renters were slightly overrepresented among program participants, relative to their incidence in the population. The large proportion of participants with an unknown ownership status suggests caution in interpreting these findings (Table A-63, Figure A-9).



Table A-63. Ravalli Electric: Residential Participant Distribution by Home Ownership, 2014-2016

	Participants				Population	Difference 2014-16 v. Population
	2014	2015	2016	2014-16		
Owner	64%	66%	57%	63%	69%	-9%
Renter	11%	5%	18%	11%	7%	57%
Unknown	25%	29%	25%	27%	23%	17%

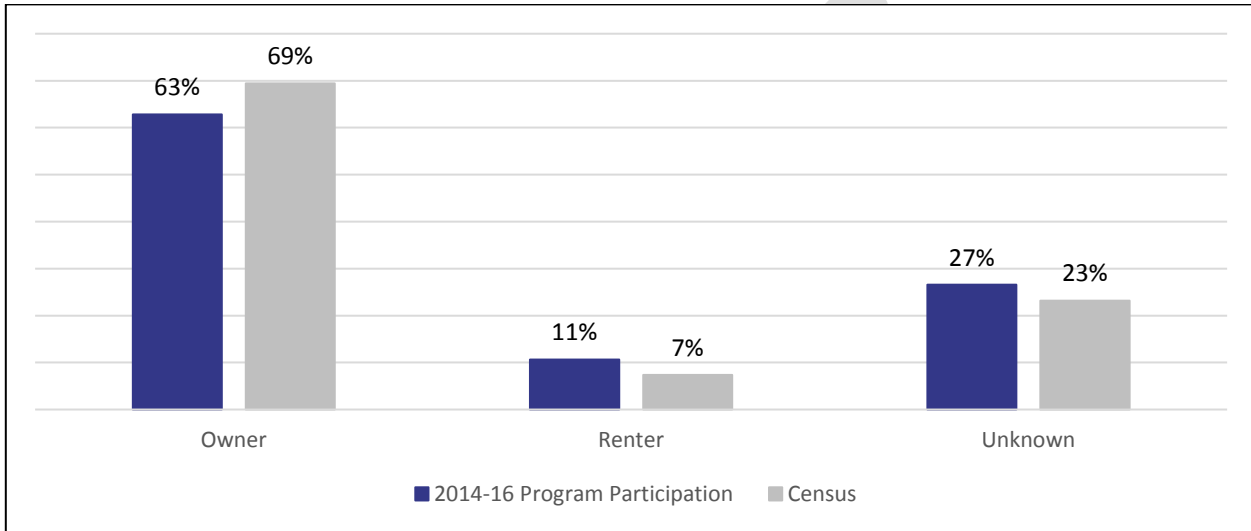


Figure A-9. Ravalli Electric: Residential Participant Distribution by Home Ownership, 2014-2016

Data Sources

Participant data included all programs run directly through the utility, primarily in the form of rebates. The data did not include measures from third-party providers like NEEA or mid-stream measures where the utility (or other entity) provided incentives to the distributor or retailer.

This analysis relies on three primary data sources:

1. Experian: Experian provides demographic and psychographic characteristics at the household and individual level. Specifically, we can get estimates of household income, home ownership, and home type. This dataset was derived using US Census, Community Survey, and other data sources.
2. US Census: The US Census categorizes each census block in the US as either urban or rural using their urban areas classification methodology.
3. CoreLogic: Aggregated county assessor data.



SEATTLE CITY LIGHT

Summary Findings

Although the results of this analysis were not surprising, they did prove useful in terms of confirming information about program participants. Prior to this analysis, City Light had relied largely on ad-hoc analysis and self-reported information from participants. Although program managers could draw conclusions from these data sets, this analysis provided confirmation from third-party data providers. NEEA also shared helpful learnings about City Light’s customer information should City Light choose to embark in similar efforts in the future. Specifically, the unit numbers collected for the multifamily direct install program data was not in a consistent format. This made it difficult, if not impossible, to use this data set in this analysis. This project serves as a helpful example to illustrate the importance of collecting certain customer fields on the front end.

Next Steps

As mentioned above, City Light is beginning the process of developing a more comprehensive low-income strategy. Although this analysis did not yield any significant new findings for City Light, it will prove useful in confirming the need for pursuing such a strategy. The process has also illustrated the importance of collecting accurate, consistent unit level information in the future, especially as City Light looks at third-party data options.

Residential Findings

Overall Participation Rate

Residential participation ranged from 0.8% to 1.3% (Table A-64). Commercial participation was not included in the analysis.

Table A-64. Seattle City Light: Residential Participation Rate, 2014-2016

Customer type	2014	2015	2016	2014-16
Residential	1.3%	1.1%	0.8%	3.2%
Commercial & industrial	n/a	n/a	n/a	n/a

Income

Households in middle to upper income categories (\$50,000 and higher) had a higher participation rate than lower income households (less than \$50,000). Households in the \$75,000 – \$99,000 income categories had the highest participation rate (2.6%). Households making less than \$15,000 had the lowest participation rate (0.4%) (Table A-65).



Table A-65. Seattle City Light: Participation Rate by Income, 2014-2016

Household income	2014	2015	2016	2014-16
Less than \$14,999	0.2%	0.3%	0.1%	0.6%
\$15,000 to \$24,999	0.6%	0.5%	0.3%	1.5%
\$25,000 to \$34,999	0.7%	0.6%	0.3%	1.6%
\$35,000 to \$49,999	1.0%	0.8%	0.5%	2.3%
\$50,000 to \$74,999	1.5%	1.1%	0.7%	3.2%
\$75,000 to \$99,999	1.8%	1.5%	1.0%	4.1%
\$100,000 to \$149,999	1.7%	1.3%	0.9%	3.7%
\$150,000 to \$199,999	1.4%	1.2%	1.0%	3.5%
\$200,000 or more	1.3%	1.1%	0.8%	3.1%
No answer/unknown	1.5%	1.0%	0.7%	3.1%

Households making less than \$50,000 were underrepresented relative to their incidence in the population and households making more than \$50,000 were overrepresented (Table A-66).

Table A-66. Seattle City Light: Residential Participant Distribution by Income, 2014-2016

	Participants				Population	Difference 2014-2016 v. population
	2014	2015	2016	2014-16		
Less than \$50,000	18.8%	20.5%	17.9%	19.3%	36.5%	-47%
\$50,000 to \$74,999	18.3%	16.8%	15.8%	16.4%	14.8%	11%
\$75,000 to \$99,999	18.8%	19.3%	19.7%	19.2%	12.9%	49%
\$100,000 or more	38.2%	38.7%	41.6%	40.9%	31.1%	32%
No answer	5.8%	4.8%	5.0%	5.1%	4.7%	9%

Housing type

Single family residents participated disproportionately to multi-family residents by more than 20%. Overall, around 4.3% of single family residents participated, and only around 0.6% of multi-family residents participated. It is important to keep in mind that the estimated 35,000 units affected by SCL's Powerful Neighborhoods program for multi-family building owners was not included in this analysis. Including it would increase multi-family participation significantly to 24.5%.

Table A-67. Seattle City Light: Residential Participation Rate by Housing Type

	2014-16
Single family	4.3%
Multi-family	0.6%
Manufactured home	
Other	

Table A-68. Seattle City Light: Residential Participant Distribution by Housing Type



	Population
Single family	76.1%
Multi-family	23.4%
Manufactured home	n/a
Other	

Home ownership

Homeowners had a higher participation rate than renters and were overrepresented relative to their incidence in the population.

Table A-69. Seattle City Light: Residential Participation Rate by Home Ownership

	2014	2015	2016	2014-16
Owner	2.3%	1.9%	1.2%	5.2%
Renter	0.3%	0.3%	0.2%	0.8%

Table A-70. Seattle City Light: Residential Participant Distribution by Home Ownership

	Participants				Population	Difference 2014-2016 v. population
	2014	2015	2016	2014-16		
Owner	80.5%	77.6%	76.9%	78.7%	50.5%	56%
Renter	6.4%	9.3%	9.0%	8.0%	49.5%	-84%

Geography

This variable was not included in the analysis because SCL does not serve any rural residents.

Race/ethnicity

This variable was not included because NEEA does not currently purchase race/ethnicity data from Experian, the demographic data source used in this analysis.

Data Sources

Seattle City Light (City Light) funds the Seattle Office of Housing's HomeWise weatherization program. The HomeWise program directly serves income-qualified residents with weatherization services throughout the City Light service territory. The program serves both single-family and multifamily homes and typically serves between 300 and 600 homes per year.

Over the years City Light has run several efforts to provide free lighting and efficient showerheads to low-income customers, whether through direct neighborhood give-away events, food banks, or at neighborhood service centers.

The Powerful Neighborhoods direct installation effort has served around 90,000 customers since 2010. This program has consistently focused on serving low-income neighborhoods and multifamily



buildings, while being available to all customers with no income screening involved. Over the years, City Light has targeted the program to multifamily low-income buildings and single-family neighborhoods with concentrations of low-income customers, including a direct mail pilot in 2015 targeted to income qualified single-family customers.

City Light's retail lighting buy-down program has consistently focused on bringing efficient lighting to costs that are affordable to anyone. Through this effort, CFLs were often available for under \$1 and now LEDs are available for under \$2. City Light's retail program has pushed to reach all areas of our service territory and into stores frequented by our lower-income customers such as Dollar Tree, Goodwill, and Grocery Outlet as well as supermarkets, home improvement stores, and drug stores.

City Light's recently ended refrigerator and freezer recycling program was available to all customers and provided a \$30 reward for recycling old inefficient appliances.

The Built Smart program provides incentives for the incorporation of energy conservation measures into new construction multifamily projects, including projects developed by affordable housing providers. Built Smart staff work closely with affordable housing developers as early in project timelines as possible to encourage the deepest energy savings possible. While incentive rates and outreach efforts currently do not differ between affordable and market-rate projects, City Light is working to develop a program offering specific to affordable housing projects in 2018. This would likely include targeted marketing and outreach, and premium incentive offerings.

City Light's Small Commercial program, also known as the Smart Business Program, provides financial incentives for retrofit projects in small businesses. Any small business in the City Light services territory on a small general service rate not part of a chain, campus, or institution may participate in the program.

Customer Energy Solutions is currently in the process of developing a more comprehensive strategy for serving our low-income customers.

NEEA collected participant addresses from Seattle City Light (SCL) and compared these participants to the general populations.



Table A-71. Seattle City Light: Summary of Data Sources and Challenges

Participant Data	
Source	Challenge(s)
<p>Participant addresses</p> <p>Seattle City Light provided addresses of participants from 2014 through 2016.</p>	<p>While most addresses were complete and therefore suitable for appending demographic data from Experian, and county assessor data from CoreLogic, the multi-family program participant addresses lacked unit numbers, preventing demographic analysis.</p>
Population Data	
Source	Challenge(s)
<p>Experian</p> <p>Experian provides demographic and psychographic characteristics at the household and individual level. Specifically, estimates of household income, home ownership, and home type. This dataset was derived using US Census, Community Survey, and other data sources.</p>	<p>Ethnicity is a variable provided by Experian, but it is unclear whether it is worth the cost (\$20K/yr).</p> <p>There is a trade-off between using Experian or assessor data for home type analysis. Experian's drawback is it does not recognize mobile homes. The assessor data does recognize mobile homes, but does not track apartment units. Since mobile homes in SCL's territory constitute only 0.2% of household units, or around 500 homes, we decided to exclude mobile homes from our analysis and use Experian data.</p>
<p>US Census</p> <p>The US Census categorizes each census block in the US as either urban or rural using their urban areas classification methodology.</p>	
<p>Dunn and Bradstreet</p> <p>Business listing database</p>	
<p>CoreLogic</p> <p>Aggregated county assessor data</p>	

SNOHOMISH COUNTY PUBLIC UTILITY DISTRICT

Summary Findings

In general, SnoPUD found that most of the assessed markets were well served by SnoPUD energy efficiency programs during the years 2014-2016. Low- and moderate-income residential customers participated at rates roughly equal to their distribution in the customer population. Manufactured home dwellers and rural residential customers had proportionally high participation rates. Multifamily tenants, while well represented in 2014, were underrepresented in 2015 and 2016 due to a gap in program availability. As a group, small business owners, commercial tenants, and industrial customers, as segmented by SnoPUD’s Conservation Potential Assessments (CPAs), participated proportionally to their existence throughout SnoPUD service territory.

Residential Findings

Income

As of July 1, 2016, the US Census estimated the median household income of Snohomish County at \$70,722. For the purposes of this analysis, and to align with the income brackets licensed from Acxiom, SnoPUD defined low-income as <\$50,000 (<70.7% of median income) and moderate income as \$50,000 to \$74,999 (70.7-106% of median income).

All Participants (All Partic): Low-income customers participated at a rate equal to their distribution in the general population in 2014 and at slightly lower rate in 2015 and 2016. Moderate Income customers (\$50-74k) participated essentially equal to their distribution in all years (Table A-72, Figure A-10).

Participants in High Contribution measures (Hi \$ Partic): If we exclude low cost retail lighting measures, fridge/freezer recycling, and measures for which the owner / tenant had no cost (low-income weatherization and multifamily direct install measures), Low-income participation increases and Moderate Income (\$50-74k) participation is only slightly changed.

Table A-72. SnoPUD: Residential Participation Rate by Income, 2014-2016

	2014			2015			2016		
	Total Pop	All Partic	Hi \$ Partic	Total Pop	All Partic	Hi \$ Partic	Total Pop	All Partic	Hi \$ Partic
< \$15k	5.4%	5.3%	5.5%	5.4%	2.8%	2.9%	5.8%	4.1%	5.2%
\$15-19k	2.9%	2.6%	2.4%	2.8%	2.1%	2.5%	2.9%	2.3%	2.8%
\$20-29k	6.3%	6.8%	6.8%	6.4%	6.2%	6.4%	6.3%	5.9%	6.2%
\$30-39k	5.8%	5.9%	6.1%	5.7%	5.4%	5.8%	5.9%	5.0%	4.7%
\$40-49k	7.0%	7.0%	7.4%	7.0%	7.7%	7.9%	6.9%	6.3%	6.1%
Low Inc Total	27.4%	27.7%	28.2%	27.3%	24.2%	25.5%	27.8%	23.7%	25.0%
\$50-74k	22.0%	20.9%	21.5%	21.6%	21.9%	21.4%	21.3%	20.9%	19.9%
\$75-99k	17.8%	17.0%	17.6%	17.0%	19.3%	19.0%	16.5%	18.4%	17.8%



\$100-124k	9.0%	8.5%	9.1%	8.8%	9.4%	9.3%	8.7%	9.4%	8.7%
\$125k +	16.9%	17.8%	18.4%	18.3%	21.9%	21.4%	19.0%	23.3%	24.0%
Unknown	7.0%	8.2%	5.2%	7.1%	3.3%	3.5%	6.8%	4.1%	4.6%
Uniq Customers	303,726	7,524	5,163	305,187	6,545	4,765	308,665	5,019	3,252

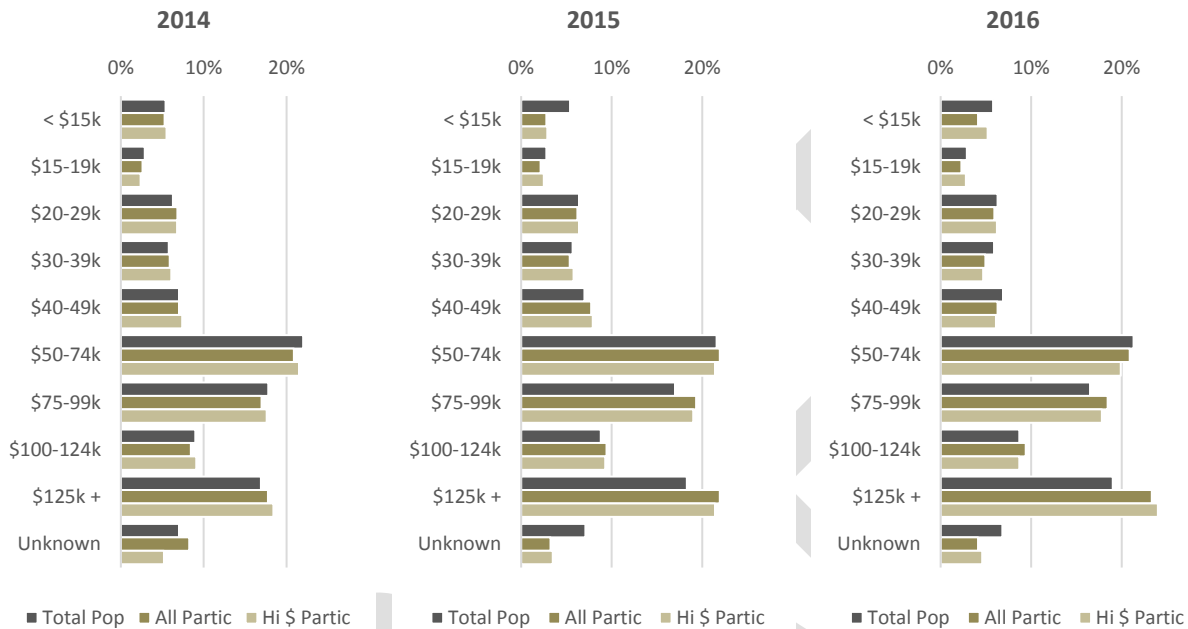


Figure A-10. SnoPUD: Residential Participation Rate by Income, 2014-2016

Housing Type

SnoPUD classifies Residential Premises into the following categories. For the purposes of this analysis, SnoPUD classified only customers in Apartments as Multifamily Tenants due to the difficulty of accurately identifying tenant occupied units in other housing types.

House	Stand-alone housing structure with 1 known living unit.
Condo / Townhome	Classified as Condominium by Assessor.
Manufactured Home	Manufactured or Mobile home on owned or leased property.
Apartment	Classified as Apartment by Assessor.
2-4 Plex	Building classified as Duplex, Triplex, or Fourplex by Assessor or PUD identified as such.
Other / Unknown	Mainly non-housing structures or supplemental service.

It is important to note that the age and heating fuel of a home are important in determining its conservation potential; this analysis does not differentiate between homes that have electric weatherization or heating measure potential from those that do not. If this analysis was done including only homes eligible for specific higher cost measures it is likely that the population and participant distributions by home type would change significantly.

For context, SnoPUD ran aggressive grant-funded programs targeting apartment complexes in 2010-2013 which carried over into significant activity in 2014. The 2014 Multifamily program included



in-unit direct install measures that were free to the tenant and property manager. SnoPUD did not have a Multifamily program from the last quarter of 2014 through most of 2015 while program management re-structured the multifamily approach.

All Participants (All Partic): Manufactured Home customers participated at a rate higher than their distribution in the total population in all three years. Apartments are represented at a higher rate in 2014 and then at a significantly lower rate in 2015 and 2016 (Table A-73, Figure A-11).

Participants in High Contribution measures (Hi \$ Partic): If we exclude low cost retail lighting measures, fridge/freezer recycling, and measures for which the owner / tenant had no cost (low-income weatherization and multifamily direct install measures), the Manufactured Home representation increases in 2014 and 2015 and is only slightly changed in 2016. Apartment representation decreases in 2014, is unchanged in 2015, and increases in 2016.

Table A-73. SnoPUD: Residential Participant Distribution by Housing Type, 2014-2016

	2014			2015			2016		
	Total Pop	All Partic	Hi \$ Partic	Total Pop	All Partic	Hi \$ Partic	Total Pop	All Partic	Hi \$ Partic
House	62.4%	57.8%	64.8%	62.3%	72.1%	70.6%	62.3%	71.9%	72.0%
Condo / Townhome	10.5%	7.6%	10.1%	10.5%	11.5%	12.1%	10.6%	8.8%	7.8%
Manufactured Home	5.9%	9.4%	11.4%	5.9%	10.8%	11.7%	5.8%	7.6%	7.3%
Apartment	17.0%	23.6%	12.3%	17.1%	3.0%	3.0%	17.1%	8.8%	10.6%
2-4 Plex	3.4%	1.1%	1.2%	3.4%	1.6%	1.5%	3.4%	1.9%	1.8%
Other/Unknown	0.8%	0.5%	0.3%	0.8%	0.9%	1.1%	0.8%	1.0%	0.5%
Uniq Customers	303,726	7,524	5,163	305,187	6,545	4,765	308,665	5,019	3,252

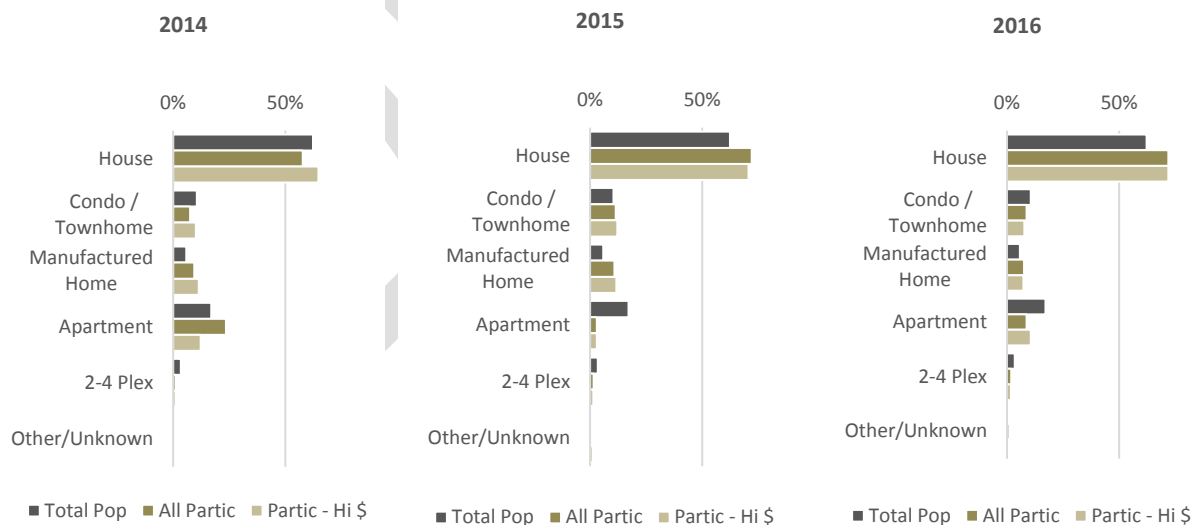


Figure A-11. SnoPUD: Residential Participant Distribution by Housing Type, 2014-2016

Geography

In accordance with the working group’s preferred approach, SnoPUD used the Census 2000 shape files for Urban Areas and Urban Clusters⁹ to classify Residential premises into Urban and Rural. Any premise located inside an Urban Area or Urban Cluster was classified as Urban, all others were classified as Rural. A small number of participating premises were not able to be classified.

All Participants (All Partic): Rural customers participated at a higher rate than their distribution in the general population in all three years (Table A-74, Figure A-12).

Participants in High Contribution measures (Hi \$ Partic): If we exclude low cost lighting measures, both retail and multifamily direct install, fridge/freezer recycling, and low-income weatherization work for which the owner / tenant had no cost, rural participation decreases in 2014 and increases in 2015 and 2016.

Table A-74. SnoPUD: Residential Participant Distribution by Geography, 2014-2016

	2014			2015			2016		
	Total Pop	All Partic	Hi \$ Partic	Total Pop	All Partic	Hi \$ Partic	Total Pop	All Partic	Hi \$ Partic
Urban	85.4%	75.9%	80.5%	84.8%	78.8%	77.5%	83.8%	80.8%	80.2%
Rural	14.6%	23.7%	19.3%	15.2%	20.4%	21.7%	16.2%	18.2%	19.3%
Unknown		0.3%	0.2%		0.9%	0.8%		1.0%	0.5%
Uniq Customers	303,726	7,524	5,163	305,187	6,545	4,765	308,665	5,019	3,252

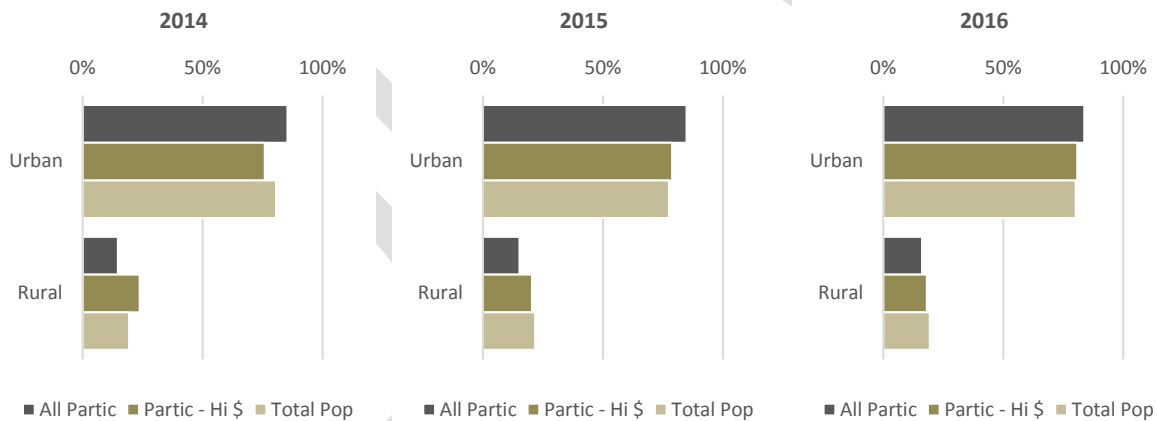


Figure A-12. SnoPUD: Residential Participant Distribution by Geography, 2014-2016

⁹ <https://www.census.gov/geo/reference/ua/urban-rural-2000.html>

Commercial Findings

Ownership structure and tenancy are difficult to ascertain for Commercial & Industrial customers. Those Commercial CPA Classifications most likely to be small business owners and/or tenants are highlighted in green below. Participation varies by customer type, with some under and others over-represented in the participants.

Business Type

Industrial participation was on par with population in 2014 and 2015 and slightly less in 2016 (Table A-75).

Table A-75. SnoPUD: Commercial Participant Distribution by Business Type, 2014-2016

CPA Classification	2014		2015		2016	
	Population	Participants	Population	Participants	Participants	Population
Commercial						
Office - Small	23.9%	19.0%	23.3%	13.6%	16.8%	22.9%
Retail - Small	10.6%	9.5%	10.3%	5.9%	11.8%	10.0%
Retail food sales - MiniMart	1.9%	4.5%	1.8%	11.1%	5.4%	1.8%
Restaurant	6.5%	11.0%	6.5%	4.4%	9.0%	6.2%
Health care - Residential care	3.6%	6.1%	3.6%	1.5%	4.3%	3.5%
Assembly	3.8%	7.5%	3.7%	7.6%	8.2%	3.7%
Other	17.1%	9.4%	17.9%	7.2%	9.1%	19.3%
Likely Small Bus / Tenants Total	67.4%	66.9%	67.1%	51.2%	64.6%	67.3%
Office - Medium	1.0%	1.7%	1.0%	2.6%	2.0%	0.9%
Office - Large	0.1%	0.5%	0.1%	0.7%	0.1%	0.1%
Retail - Medium	2.3%	5.0%	2.3%	7.0%	6.7%	2.3%
Retail - Large	0.2%	0.8%	0.2%	1.1%	0.6%	0.2%
School - K-12	1.4%	4.7%	1.4%	9.2%	5.2%	1.4%
School - University	0.7%	1.2%	0.7%	0.9%	0.5%	0.7%
Warehouse	3.4%	3.5%	3.3%	3.5%	3.2%	3.2%
Retail food sales - Supermarket	0.4%	2.4%	0.4%	4.8%	1.4%	0.4%
Lodging	0.9%	2.7%	0.9%	1.1%	1.4%	0.9%
Health care - Hospital	0.1%	0.7%	0.1%	1.7%	0.4%	0.1%
Multifamily Common Areas	9.6%	2.0%	10.1%	4.4%	5.7%	10.0%
Commercial Total	87.5%	92.2%	87.5%	88.2%	91.8%	87.4%
Industrial	7.3%	7.3%	10.3%	11.6%	7.7%	10.2%
Other	5.1%	0.5%	2.2%	0.6%	0.6%	2.4%
Unique Customers	21,646	1,095	21,911	543	1,396	22,017



Data Sources

Analytic Approach

The population and participation counts included in this analysis and report do not consider or reflect a customer's space or heating fuel type. Nor do they take into account whether a given structure has relevant energy efficiency potential.

SnoPUD chose to conduct its analysis by looking at unique customers who participated in the program rather than by incentives paid or energy savings claimed. Market penetration amongst the assessed segments is better illustrated this way, as population density and load distribution throughout the territory does not remain constant across program participants. Each measure included in the analysis was matched to a specific customer and service location as described below. To estimate participation by a particular segment, each participating customer was counted only once.

Residential Participation Data

The participation data used in this analysis excludes measures that are not tracked to the individual participant. The majority of these excluded measures are purchased by residential customers, incented at the retailer level, and include light bulbs, showerheads, smart power strips, and light fixtures.

With a few exceptions, participation data for programs in 2014, 2015, and 2016 was tracked in SnoPUD's SAP system and assigned to the customer (Business Partner) that received the incentive and the service location (Premise) where it was installed. Where program participation data was tracked outside of SAP, SnoPUD matched the participant record to the Business Partner and Premise at the time of the incentive for the purposes of this analysis.

For measures in apartment or condo complexes that affected more than one residential unit, each premise was counted as participating. Common area projects in apartments and condominium complexes were counted in the commercial rather than the residential participation to avoid double counting and accurately reflect the extent of the work.

A Unique Participant is defined as a unique Business Partner to Premise combination for purposes of this analysis.

Residential Population Data

A single residential customer is defined as a unique Business Partner to Premise combination for purposes of this analysis.

For 2016 analysis, the population is based on active Accounts as of August 2016. For 2015 analysis, the population is based on active Accounts as of July 2015. For 2014 analysis, the population is based on active Accounts as of January 2015.

SnoPUD maintains Premise characteristics such as type of home and primary heating system in its SAP system. SnoPUD also maintains a match, where available, to the corresponding Assessor parcel and structure record for Premises in Snohomish County. The Assessor data is used to



validate the Premise type and heat fuel as well as characteristics such as year built, square footage, and condition.

Residential Demographic Data

SnoPUD licenses residential demographic data from Acxiom at the customer level. SnoPUD does not license demographic records for Business Partners categorized as “Organizations”; this is ~2.5% of the residential customers and they are classified as “Unknown” for income purposes. In addition, for analysis leveraging licensed demographic data, records that were not matched at the household or Zip+4 level are categorized as “Unknown”.

Commercial & Industrial Participant Data

SnoPUD’s Commercial & Industrial (C&I) participation data is stored in multiple systems. Where the data was stored in SAP, the assigned Business Partner and Premise were used. Where program participation data was tracked outside of SAP, SnoPUD matched the participant record to the Business Partner and Premise at the time of the incentive for the purposes of this analysis.

Where projects affected more than one tenant or building, the project is matched to all identified affected customers. Contracts for behavior-based program participation (RCM, EPM, and HPEM) were assigned to the customer’s main service location. Weatherization and Common Area projects in apartments and condominium complexes that have at least one Commercial meter are included in this data set.

Commercial & Industrial Population & Firmographic Data

A customer is defined as a unique Business Partner and Street Address (no supplement) combination for the purposes of this analysis. The total population is based on active Accounts as of July of each year.

SnoPUD maintains North American Industry Classification System (NAICS) code assignments and Snohomish County Assessor parcel and building ID relationships at the meter level for Commercial & Industrial service points. The NAICS codes and building data are used in SnoPUD’s CPAs. For simplicity, SnoPUD used the building type and industry classification schema from its 2017 CPA to categorize the C&I population and participants for the purposes of this analysis.



TACOMA POWER

Tacoma Power is a publicly-owned electric utility serving 179,000 customers in the Washington cities of Tacoma, Fircrest, University Place, Fife, parts of Steilacoom, Lakewood, Joint Base Lewis-McChord, and parts of unincorporated Pierce County.

Summary of Findings

Tacoma has generally been successful in reaching potentially hard-to-reach groups when it has developed programs designed specifically to target these groups. However, the utility tended to find that groups identified as potentially underserved or hard-to-reach were indeed underrepresented when no targeted program was in place.

On the residential side, Tacoma has succeeded in ensuring robust participation from low-income customers thanks to its long-standing low-income conservation program and has reached 20% of manufactured homes over 2014 and 2016 (75% since the 1980's) thanks in large part to its targeted manufactured home duct sealing program. On the other hand, rental units are clearly underserved compared to the population. This disparity in participation between owner-occupied and renter-occupied units may, as a corollary, be resulting in lower participation rates for African-Americans and Native-Americans because ownership rates are approximately 40% lower than the general population among these groups. Tacoma is currently testing out a new program targeted specifically at rental units.

On the commercial and industrial side, Tacoma's targeted grocery program has succeeded in securing strong participation among grocery stores. Most notably, despite the fact that small commercial buildings participate at much lower rates than large buildings overall, the program has been particularly successful at targeting small grocers and minimarts. Small grocery establishments participate at approximately twice the rate of large grocers (though it should be noted that large grocers still participate at a higher rate than most other building types). Tacoma Power does not have similarly targeted programs for small office or small retail, which tend to be under-represented relative to the population.

While a comparison of participants versus the population is an important perspective for assessing who is underserved, it is not the only perspective. It may sometimes be the case that a group appears to be underserved not because it is "hard to reach" but instead because there is little conservation potential available in that group. Therefore, Tacoma Power also chose to examine how the participant distribution of building types compared to conservation potential in both the residential and commercial sectors. This analysis often yielded very different conclusions from the comparison of participant versus population.

Overall Participation Rate

In the 2014-2016 period, a slightly higher rate of commercial/industrial customers participated than residential customers. Note this does exclude retail and distribution lighting programs, which serve primarily residential customers, but does include the commercial lighting program. Over all periods



for which Tacoma Power has participation data, residential customers have participated at a higher rate than commercial/industrial customers (Table A-76).

Table A-76. Tacoma Power: Overall Participation Rate, 2014-2016

Customer Type	2014	2015	2016	2014-16	All periods for which data exist ^{1,2}
All customers	0.8%	0.6%	1.0%	2%	16%
Residential	0.7%	0.6%	1.1%	2%	17%
Commercial & industrial	1.4%	1.1%	0.7%	3%	9%

Note: The customer accounts dataset merged to County Assessor and conservation program data (referred to as Customer Records data for the remainder of this discussion) is the dataset used for this table. Because not all conservation program data could be merged to customer account information, participation rates were calculated by taking the count of relevant participants (all participants, all 2014 residential participants, etc.) divided by the relevant population (all customers, all residential customers, or all commercial customers). Although only information on commercial customers was requested, information on both commercial and industrial customers is provided.

¹ Records on residential conservation program date back to 1980, though only a handful of homes per year participated until 1983. Nearly half of all residential conservation participants participated between 1992 and 1996.

² Records on commercial and industrial program participation date back to 2001.

Residential Findings

Income

Although potentially hard to reach, particularly with high-cost conservation measures, low-income customers in Tacoma have been well-served by the utility’s conservation program. This can be attributed to Tacoma Power’s targeted low-income program that pays for 100% of the cost of weatherization and HVAC measures. Among homeowners, the share of participants in the lowest-income groups (up to \$75,000) is equal to or larger than the population share (Table A-77). Among the lowest-income group (households with income below \$25,000), participants are actually over-represented compared to the population. Households in the highest income group (\$150,000 or more) are over-represented, while those in upper middle-income groups (between \$75,000 and \$149,999) are under-represented. It may be that these customers are participating at lower rates because they make too much to be eligible for Tacoma’s low-income programs but still have a limited enough disposable income that conservation investments are competing with other budget priorities.

Because low-income qualification depends not only on household income but also on how many people are in a household, Tacoma Power also compared the share of participants who qualified as low-income to the share of all customers who qualify as low-income (Table A-78). Over the 2014-2016 period, the share of participants who qualified as low-income (26%) was on par with population shares (27%). However, participant data is likely a lower bound for the total share of participants who are low-income qualified because the program database does not track low-income qualification for Tacoma’s manufactured home duct sealing program or its multi-family program, both of which are believed to serve primarily lower-income customers. It is likely that the share of participants who were low-income is closer to 35%, based on reasonable assumptions about the share of apartment projects and manufactured home duct sealing projects that are being conducted in low-income residences.



Table A-77. Tacoma Power: Residential Participant Distribution by Income

	Participants	Population
	2014 ¹	2014 ¹
Less than \$25,000*	6%	4%
\$25,000 to \$49,999	17%	16%
\$50,000 to \$74,999	21%	22%
\$75,000 to \$99,999*	11%	15%
\$100,000 to \$149,999*	11%	16%
\$150,000 or more*	13%	8%
No answer	21%	20%

* Indicates that participant share is statistically different from population share at the 90% confidence level.

Note: Customer survey of owner-occupied homes (2014) was used for this table. Information on income distribution among all participants was not sufficiently reliable to draw meaningful conclusions. However, results are similar from surveys of the whole population and a post-participation survey of participants.

Table A-78. Tacoma Power: Residential Participant Income Distribution, Low-income v. Non-low-income

	Participants ¹					Population
	2014	2015	2016	2014-16	2017 ²	2015 ³
Low-income⁴	33%	34%	18%	26%	14%	27%

¹ Program tracking data. Note that program tracking data does not consistently identify low-income manufactured homes receiving duct sealing or apartments as low-income, even when residents are low income. Thus, the number in this table is a lower-bound estimate. Actual 2014-2016 share of participants who are low-income is likely closer to 35%, based on reasonable assumptions about the share of apartment projects and manufactured home duct sealing projects that are being conducted in low-income residences but not recorded as low-income in the tracking data.

² The share increased to 22% for early 2018.

³ US Census (2015 American Community Survey 5-year estimates).

⁴ Defined as those eligible for low-income conservation program (at or below 60% of State median income). Among participants, anyone who participated in our low-income program is assumed to be low-income. Those who did not participate in the low-income program are assumed to not be low-income.

Housing type

The manufactured home households participated at a higher rate than single and multi-family households. For all periods for which Tacoma Power has data, 75% of manufactured home households have participated (Table A-79). The high participation is due primarily to a wide-reaching duct sealing program targeted at manufactured homes.



Table A-79. Tacoma Power: Residential Participation Rate by Housing Type

	2014	2015	2016	2014-16	All periods for which data exist
Single family	0.9%	0.7%	0.7%	2.3%	18%
Multi-family	0.2%	0.1%	0.3%	0.5%	8%
Manufactured home	2.4%	1.3%	16%	20%	75%
Other	0.5%	1.0%	3.2%	4.4%	21%

Note: Plexes were counted as “other”

Note: For this table, counts of participants in each housing type category were divided by the estimated count of each housing type in the population. Customer Accounts & Program Tracking linked to Assessor Data (2017) were used to identify housing type. The major challenge faced in identifying home type was with account data that couldn’t be merged to County Assessor records. Rather than ignore unmerged observations, a random sample of these observations was investigated to determine the share that belonged to each housing type. Data were then re-weighted to account for these unknown housing types accordingly.

¹ Records on residential conservation program date back to 1980, though only a handful of homes per year participated until 1983. Nearly half of all residential conservation participants participated between 1992 and 1996.

Single family households have made up a majority of participants in all periods. Single family and manufactured home households were overrepresented and multi-family households were underrepresented, relative to their respective incidence in the population (Table A-80). Part of the reason that multi-family is under-represented compared to the population may be that there is less cost-effective potential in multi-family. Tacoma Power looked into this a little further and found that, although multi-family may be underrepresented compared to the population, the share of participants over 2014-2016 closely matches multi-family contribution to our 2018 TRC-effective residential MWh potential, which was 19% (Table A-84). MWh and units are not equivalent, but since MCS-1 is focused on “cost-effective measures,” it is important to keep in mind how much cost-effective conservation is out there when we consider why certain groups are not being reached.

Table A-80. Tacoma Power: Residential Participant Distribution by Housing Type

	Participants ²					Population	
	2014	2015	2016	2014-16	All periods	2016 ¹	2017 ²
Single family	62%	81%	84%	71%	70%	66%	64%
Multi-family	28%	3%	5%	17%	11%	21%	24%
Manufactured home	7%	8%	4%	7%	13%	4%	3%
Other	3%	8%	7%	5%	6%	9%	9%

Note: The major challenge faced in identifying home type was with account data that couldn’t be merged to County Assessor records. Rather than ignore unmerged observations, a random sample of these observations was investigated to determine the share that belonged to each housing type. Data were then re-weighted to account for these unknown housing types accordingly.

¹ Customer Survey (2016).

² Customer Accounts & Program Tracking + Assessor Data (2017).

Home ownership

Renters participated at a lower rate than homeowners and were underrepresented relative to their incidence in the population (Table A-81, A-82). Like many utilities, Tacoma Power is aware of the challenges in reaching rental properties through its conservation program and has been grappling with how to solve the “split incentives” problem. In 2018, Tacoma is launching a pilot initiative



offering to pay 100% of the cost of weatherization in single family rental properties. It remains to be seen whether the initiative will succeed in significantly increasing participation among owners of rental properties.

Table A-81. Tacoma Power: Residential Participation Rate by Home Ownership

	2014	2015	2016	2014-16
Owner	1.1%	0.9%	1.8%	3.8%
Renter	0.3%	0.1%	0.1%	0.6%

Note: For this table, counts of participant in the owner and renter categories were divided by the estimated count of owners and renters in the population. The Census is assumed to be the primary truth set for the distribution of owners vs. renters in the population and so Census percentage values were multiplied by the total residential customer base to estimate the appropriate denominators.

Table A-82. Tacoma Power: Residential Participant Distribution by Home Ownership

	Participants				Population	
	2014	2015	2016	2014-16	2014 ¹	2015 ²
Owner	80%	91%	96%	90%	60%	56%
Renter	20%	9%	4%	10%	40%	44%

Note: Home ownership among participants is recorded in the conservation program database. While this information has been consistently recorded over the past 5 to 10 years, it is not available for earlier records. Thus, we present only results for the 2014-2016 period and not for all participation years.

¹ Customer Survey (2014). 90% confidence interval is 56.6% to 63.6%.

² US Census (2015 American Community Survey 5-year estimates).

Geography

This information was not easily available and was low priority for Tacoma Power. No data are reported.

Race/ethnicity

According to a survey of homeowners fielded by Tacoma Power, white participants were overrepresented compared to the population. While there were differences in the distribution of participants vs. the population among other race/ethnic groups, none of the other differences were statistically significant (Table A-83). However, based on additional analyses not shown in Table A-83, it is likely that African-Americans and Native Americans are under-represented among participants. First, although the difference in the African-American shares of participants vs. population is not large enough to be statistically significant, a look at participation rates reveals a statistically significant difference between African-American and white participation rates (15% and 20%, respectively). Second, in a population-wide Tacoma survey of homeowners and renters, African American and Native American respondents were both about half as likely as the general population to own their homes (approximately 36% for each of these groups vs. 60% for the whole population, according to Tacoma Power survey data). Because rental units are significantly under-represented in Tacoma Power’s conservation program, it is likely that African Americans and Native Americans are more under-represented among participants than the homeowner survey suggests.



Table A-83. Tacoma Power: Residential Participant Distribution of Owner-occupied Homes by Race/Ethnicity

	Participants	Population
	2014¹	2014¹
Hispanic, Latino, or Spanish origin	4%	3%
Not of Hispanic origin	87%	88%
Refuse	9%	9%
White*	82%	77%
Black or African American	2.8%	3.4%
American Indian or Alaskan Native¹	0.0%	1.2%
Asian - all Asian & Pacific Islander	4.6%	3.8%
Other¹	0.0%	1.2%
Refuse	7%	10%

* Indicates that participant share is statistically different from population share at the 90% confidence level.

Note: All data for this table come from Customer Survey of Owner-occupied Homes (2014).

¹ There were only 7 respondents in each of these racial groups in the survey. Given such small sample sizes, it is impossible to know whether participation among these racial/ethnic groups is truly 0%, though it is unlikely that these racial/ethnic groups are truly not represented at all among participants even if they are under-represented.

Note: Race/ethnicity information was only available from survey data for both participants and the general population. Information on participants was only available from Tacoma’s survey of owner-occupied homes. This same survey provided population-level data for the subset of the population represented in that survey, and true population-level information was available from the 2014 Customer Satisfaction survey. Because the Census reports race somewhat differently (whether someone is just one race or a combination of race categories), Census data downloaded from American FactFinder were not easily translatable into the requested categories and were not reported. Race/ethnicity of participants and population is based on the survey respondent’s race/ethnicity.

Distribution of Residential Participants vs. Conservation Potential

As discussed above, to begin to assess whether multi-family units are underserved because of difficulties in reaching this group or because conservation potential is lower in this group, an additional check was made to compare energy efficiency potential shares to the population and participant shares. This reveals that, even though the participant share may be different than the population, it may still align with potential (Table A-84). While more work needs to be done to better understand the reasons why some groups are underserved, available cost-effective potential for that group is an important piece of the puzzle to keep in mind.



Table A-84. Tacoma Power: Residential Participant Distribution Potential by Housing Type, Compared to Conservation Potential

	Participants	Population	Potential
	2014-16¹	2017²	2018³
Single family	71%	64%	73%
Multi-family	17%	24%	19%
Manufactured home	7%	3%	5%
Other⁴	5%	9%	3%

¹Customer Accounts & Program Tracking + Assessor Data.

²Customer Accounts + Assessor Data.

³Based on 2016 CPA results. Note that Participant information excludes retail measures (lighting and showerheads) while the potential includes these measures. When potential was re-calculated excluding these retail measures, the distribution of potential across housing type changed very little and was even more closely aligned with the distribution of participants.

⁴There may be slight differences in the way the “Other” category was defined in the CPA versus the Customer Accounts + Assessor data.

Commercial Findings

Building size

Participation is higher among buildings over 5,000 sq ft. (Table A-85). Buildings between 5,000 and 50,000 square feet made up the largest proportion of participants, and these were overrepresented relative to their incidence in the population (Table A-86). As Table A-87 demonstrates, the relationship between building size and participation is not universal across all building types. While large office buildings participated at more than eight times the rate of small office buildings, the differential between retail establishments of different sizes was much smaller. Large retail buildings participated at just over three times the rate of small ones, and extra-large retail buildings participated at a slightly lower rate than large ones. The pattern for grocery establishments stands in stark contrast to the general pattern, and small grocers/minimarts participated at a higher rate than large ones.

Table A-85. Tacoma Power: Commercial Participation Rate by Building Size

	2014	2015	2016	2014-16	All periods for which data exist
Less than 5,000 sq ft	1.5%	0.9%	0.2%	2.6%	7%
5,000 - 50,000 sq ft	2.1%	1.6%	0.5%	4.2%	13%
More than 50,000 sq ft	2.9%	3.0%	1.2%	7.1%	19%
Unknown	0.6%	0.5%	0.2%	1.4%	4%

Note: Customer accounts & Program Tracking data were used for this table. The biggest challenge faced was that a large share (34%) of accounts in the population was missing information on building size.

¹ Records on commercial and industrial program participation date back to 2001.



Table A-86. Tacoma Power: Commercial Participation Rate by Building Size

	Participants					Population
	2014	2015	2016	2014-16	All periods for which data exist	2017
Less than 5,000 sq ft	30%	24%	17%	26%	24%	30%
5,000 - 50,000 sq ft	39%	38%	35%	38%	41%	28%
More than 50,000 sq ft	17%	23%	28%	20%	19%	9%
Unknown	14%	15%	20%	15%	17%	34%

Note: Customer accounts data were used for this table. The biggest challenge faced was that a large share (34%) of accounts in the population was missing information on building size because of difficulties merging county assessor data to account information.

¹ Accounts data set

² Records on commercial and industrial program participation date back to 2001.

Building type

The rate of participation by building type showed lower participation among smaller office and retail than larger buildings of those types, and small office and retail buildings are under-represented compared to the population. Buildings classified as K-12 and small grocery had the highest rate of participation (Table A-87). The high participation rate among schools was not a surprise to staff at Tacoma Power. Not only is there relatively large conservation potential in schools (15% of all commercial potential for 2018) but it is often efficient to work with school districts because multiple buildings can be upgraded through a single point of contact. Over 2014 to 2016, around 80% of participating schools were part of a public school district, half of which were from a single district (City of Tacoma). Nor was the high participation rate among grocery establishments a surprise, as Tacoma Power has been running a targeted program for grocery stores and minimarts for well over a decade. Over 2014 to 2016, 85% of grocery participants participated through that program.

As with residential buildings, it may be that some subsets of the commercial population appear to be underserved simply because there is less conservation potential available there. Tacoma looked into the distribution of MWh potential across building type (Table A-84), and it sometimes paints a very different picture than Table A-83.

Table A-87. Tacoma Power: Commercial Participation Rate by Building Type

	2014	2015	2016	2014-16	All periods for which data exist ¹
Office - Small (<5,000 sq ft)	0.6%	0.2%	0.1%	0.8%	3%
Office - Medium (5,000-50,000 sq ft)	0.7%	0.5%	0.1%	1.3%	6%
Office - Large (> 50,000 sq ft)	2.4%	2.5%	2.0%	7.1%	22%
Retail - Small (<5,000 sq ft)	1.0%	0.9%	0.2%	2.2%	7%
Retail - Medium (5,000-50,000 sq ft)	1.5%	1.2%	0.5%	3.2%	10%
Retail - Large (50,000 - 100,000 sq ft)	4.0%	2.6%	0.0%	6.8%	17%
Retail - Extra large (> 100,000 sq ft)	2.3%	2.3%	0.6%	5.3%	11%
School - K-12	12.8%	10.2%	0.3%	21.4%	51%
School - University	5.1%	0.0%	0.0%	4.7%	34%
Warehouse	2.4%	1.4%	0.1%	3.7%	15%
Retail food sales - MiniMart (<5,000 sq ft)	10.8%	7.3%	1.6%	21.6%	53%
Retail food sales - Supermarket (>5,000 sq ft)	3.6%	5.4%	4.5%	12.9%	25%
Restaurant	0.6%	1.0%	0.4%	2.1%	9%
Lodging	2.3%	4.1%	1.0%	7.4%	12%
Health care - Hospital	3.2%	1.1%	0.6%	4.9%	8%
Health care - Residential care	0.0%	3.3%	0.0%	3.0%	11%
Assembly	2.6%	1.7%	1.0%	5.5%	15%
Industrial	1.3%	1.1%	0.4%	2.7%	14%
Other	1.0%	0.5%	0.3%	1.9%	2%

Note: Customer accounts & Program Tracking data were used for this table.

¹ Records on commercial and industrial program participation date back to 2001.



Table A-88. Tacoma Power: Commercial Participant Distribution by Building Type

	Participants					Population
	2014	2015	2016	2014 -16	All periods for which data exist ¹	2017
Office - Small (<5,000 sq ft)	3%	1%	2%	2%	3%	10%
Office - Medium (5,000-50,000 sq ft)	5%	5%	3%	5%	7%	13%
Office - Large (> 50,000 sq ft)	1%	2%	5%	2%	2%	1%
Retail - Small (<5,000 sq ft)	7%	7%	5%	7%	7%	11%
Retail - Medium (5,000-50,000 sq ft)	17%	18%	24%	19%	20%	20%
Retail - Large (50,000 - 100,000 sq ft)	2%	2%	0%	2%	2%	1%
Retail - Extra large (> 100,000 sq ft)	3%	4%	3%	3%	2%	2%
School - K-12	12%	12%	1%	10%	8%	2%
School - University	0%	0%	0%	0%	0%	0%
Warehouse	12%	9%	3%	9%	13%	9%
Retail food sales - MiniMart (<5,000 sq ft)	12%	11%	7%	12%	10%	2%
Retail food sales - Supermarket (>5,000 sq ft)	4%	8%	20%	7%	5%	2%
Restaurant	2%	3%	4%	3%	4%	5%
Lodging	2%	4%	3%	3%	1%	1%
Health care - Hospital	1%	1%	1%	1%	1%	1%
Health care - Residential care	0%	1%	0%	0%	0%	0%
Assembly	6%	5%	9%	6%	6%	4%
Industrial	3%	3%	3%	3%	5%	4%
Other	7%	5%	9%	7%	3%	13%

Note: Customer accounts & Program Tracking data were used for this table.

¹ Records on commercial and industrial program participation date back to 2001.



Distribution of Commercial Participants vs. Conservation Potential

An additional check was made to participant shares not only to the population but also to energy efficiency potential shares. Program savings shares are also presented. Table A-89 reveals that there may be substantial differences between the distribution of the population and the distribution of conservation potential, and looking at it from a different perspective can change one's assessment of which groups are "underserved". For example, while offices appear to be underserved relative to the population, the share of commercial participants that are offices is equal to the share of the potential that is in offices. Further, when looking at the data from the perspective of savings vs. potential rather than participants vs. population, one could even conclude that office buildings are over-represented because the amount of savings acquired in offices over 2014 and 2016 is nearly twice the 2018 potential. Similarly, schools appear to be overrepresented among participants compared to the population but may actually be considered underserved when comparing participant shares or savings shares to their share of the conservation potential.

Table A-89. Tacoma Power: Residential Participant Distribution Potential by Housing Type, Compared to Conservation Potential

	Participants	Population ²	Potential ³	Savings ¹
	2014-16 ¹	2017	2018	2014-16
Office	7%	19%	7%	13%
Retail	28%	31%	15%	14%
School - K-12	10%	2%	15%	9%
School - University & vocational	0.2%	0.2%	4%	0.03%
Warehouse	9%	9%	7%	9%
Grocery	20%	4%	11%	24%
Restaurant	3%	5%	2%	0.7%
Lodging	3%	1%	7%	2%
Hospital	1%	1%	3%	0.5%
Medical Office	2%	5%	4%	1%
Public Assembly	6%	4%	3%	6%
Other Commercial⁴	10%	18%	22%	4%

Note: Only distributions of non-industrial commercial buildings are examined in this table. Industrial participation and potential are excluded from the table. As a result, building type shares look slightly different from those presented in Table A-83.

Note: There are differences in the way the "Other" category was defined in the CPA versus the Customer Accounts + Assessor data. Namely, approximately 60% of buildings classified as other are actually buildings that did not merge to assessor data and could not be assigned a building type. When buildings of unknown type are excluded from the distribution of conservation potential, results change very little for all except the "Other Commercial" category.

¹Customer Accounts & Program Tracking + Assessor Data.

²Customer Accounts + Assessor Data.

³Based on 2016 Conservation Potential Assessment (CPA) results.

Data Sources

In Tacoma Power's analysis, residential participants were defined as those participating in insulation, duct sealing and HVAC programs, as well as a small number of direct-install lighting



projects. This analysis excluded participants in retail and distribution programs for lighting and showerheads because these programs do not track participant-specific information. On the commercial and industrial side, all conservation participants are included.

Table 90. Tacoma Power: Summary of Data Sources and Challenges

Participant Data	
Source	Challenge(s)
<p>Conservation database Data from program application forms, including customer name, measures installed, low-income qualification, owner v. renter</p>	<ul style="list-style-type: none"> • Missing account information on data before 2011 • Repeat participation: required merging of records under most recent participation year • Multifamily participation count: required assessment of number of units retrofitted in each participating building • Low-income customers not always identified for manufactured home duct sealing or apartment projects
<p>Residential post-participation survey (2017) Data from post-participation survey, including income, race/ethnicity</p>	<ul style="list-style-type: none"> • Only available for 2017 participants • Over-represents low-income participants
<p>Conservation-focused residential market research survey (2014) Data from survey, includes income, race/ethnicity, household size</p>	<ul style="list-style-type: none"> • Only available for participation by owner-occupied households in 2014
Population Data	
Source	Challenge(s)
<p>County Assessor data Primarily used for building type</p>	<ul style="list-style-type: none"> • Failure to match address, resulting in unknown building type, an issue for 13% of residential customers and 30% of commercial customers • Need to use multiple fields to identify building type • Identifying correct primary building for multi-building residential sites
<p>Customer satisfaction surveys (2014, 2016) Income, race/ethnicity, low-income status</p>	<ul style="list-style-type: none"> • Raw data only available for 2014 survey
<p>US Census Primarily used for income, at the Census tract level</p>	<ul style="list-style-type: none"> • Census tract boundaries do not match utility boundaries, a visual inspection of tracts served by multiple utilities was used to assign these tracts to the utility serving the largest proportion of customers



APPENDIX B – FULL TEXT OF MCS-1

Source: Seventh Northwest Power Plan. Chapter 4: Action Plan (P. 4-10)

MCS-1 **Ensure all-cost effective measures are acquired.** [Bonneville, Utilities, Energy Trust of Oregon, States] In order to achieve all cost-effective conservation, all customer segments should participate in programs. The Northwest Power Act has required that the Bonneville Power Administration (BPA) distribute the benefits of its resource programs “equitably throughout the region.”¹⁰ Bonneville and the regional utilities should determine how to improve participation in cost-effective programs from any underserved segments. Although low-income customers are often an underserved segment, other hard-to-reach (HTR) segments may include: moderate income customers, customers in rural regions, small businesses owners, commercial tenants, multifamily tenants, manufactured home dwellers, and industrial customers. Ideally, the customers in the HTR segment should participate in similar proportion to non-HTR customers, assuming similar savings potential.

To accomplish this goal, Bonneville and the utilities in their overall data collection should include, to the extent it is readily available, demographic and business characteristic data that helps identify the existence of any HTR segments. Bonneville and the utilities should also coordinate with local and state agencies to leverage available data on various HTR segments. For example, community action programs will have information on low-income customers and program participation. The portion of participating customers in the assumed HTR segments should then be compared against the portion of customers within these segments in the utility’s service area. This will determine which customer segments are indeed underserved. There may be other approaches to determining the HTR segments. For example, utilities may be able to review federal census track data against program participation.

Bonneville and the utilities should report to the Council on the proportion of participation from HTR segments and how these data were collected. The report should occur in 2017, and then annually thereafter. The strategies to improve participation by HTR segments should be considered in BPA’s overall assessment and possible redesign of energy efficiency implementation as described in BPA-6. After the first report, and prior to the completion of the Council’s mid-term assessment, Bonneville and the utilities should devise strategies to improve participation by customers in cost-effective conservation in any underserved HTR segments identified in the report.

¹⁰ Northwest Power Act §6(k), 94 Stat. 2722



Evaluating all HTR sectors is important. In evaluating the sub-sectors highlighted below, considerations should include where data are readily available:

- **Small and Rural Utilities:** One specific segment that has been shown to have special difficulties in implementing energy-efficiency programs is the small and rural utility segment. A study conducted by the RTF in 2012 identified technical support needed by these utilities and infrastructure delivery constraints.¹¹ A series of initiatives have been put in place to remedy some of the problems identified in that report and improve participation, but issues may remain that the assessment should investigate. For example, some utility customers of Bonneville may have limited staff and limited access to contractors to effectively use their Bonneville energy efficiency incentive. Strategies to improve participation should consider arrangements among utilities to share efficiency planning and implementation activities. Product availability and measure uptake may lag in smaller rural markets compared to larger markets. NEEA market transformation initiatives focused on those lagging markets should be considered as possible solutions along with assistance from Bonneville on education, program administration and measures directly tailored toward the small and rural utilities.
- **Low-Income Households:** Existing programs, such as the U.S. Department of Energy Low-Income Home Energy Assistance Program, have provided an infrastructure to increase penetration of energy-efficiency measures into the low-income segment. However, it is not known whether these programs and their current structure are sufficient. The assessment should determine whether the pace of low-income conservation improvements achieved, over the last five years, is sufficient to complete implementation of nearly all remaining cost-effective potential in the low-income segment by 2035. Strategies to improve participation and pace of acquisition should consider further coordination between utility, tribal, and Community Action Programs (CAP) identified by Bonneville's Low-Income Work Group. That work group should continue to seek improvements in program coordination and implementation as a joint effort between utilities, tribes, states and CAP agencies.
- **Moderate-Income Households:** The up-front cost required to purchase or install efficiency measures is often a significant barrier to moderate-income customers. Financial incentives from utilities, Bonneville, and Energy Trust of Oregon usually only cover a portion of measure cost, thus potentially limiting the participation of these customers, who do not qualify for the high incentives offered in programs for low-income households. The assessment should investigate program participation rates among households above the low-income threshold and below median income levels and the reasons for any discrepancy relative to higher income households. The Energy Trust of Oregon has a well established program called Saving Within Reach

¹¹ Small and Rural Utility RTF Technical Support Needs Study.
http://rtf.nwccouncil.org/subcommittees/smallutilities/RTF%20Small_Rural_01-19-12_FINAL.pdf



that could provide helpful guidance on the potential establishment and operation of a moderate income program should a program be needed region-wide.

- **Manufactured Homes:** The manufactured home segment may face special challenges related to income, ownership, building codes, and some difficult-to-implement conservation measures specific to manufactured housing and their heating systems. The assessment should determine whether the adoption of measures in the manufactured home segment is on pace to complete implementation of nearly all remaining cost-effective potential over the next 20 years. Where expected shortfalls appear, specific barriers to implementation should be identified and solutions targeted at those barriers. While this market segment has been successfully targeted with a limited set of conservation measures (e.g. duct sealing), a more comprehensive approach that identifies and implements an entire suite of cost-effective measures during a single visit may be more cost-efficient.

