OREGON ENERGY BURDEN ASSESSMENT

empower dataworks

AVISTA OREGON ENERGY BURDEN ASSESSMENT

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INTRODUCTION

This brief report presents the methodology and findings from Avista's 2022 Oregon energy burden assessment. The results of the assessment are contained in the web dashboard at https://avista-or.empowerdataworks.com.

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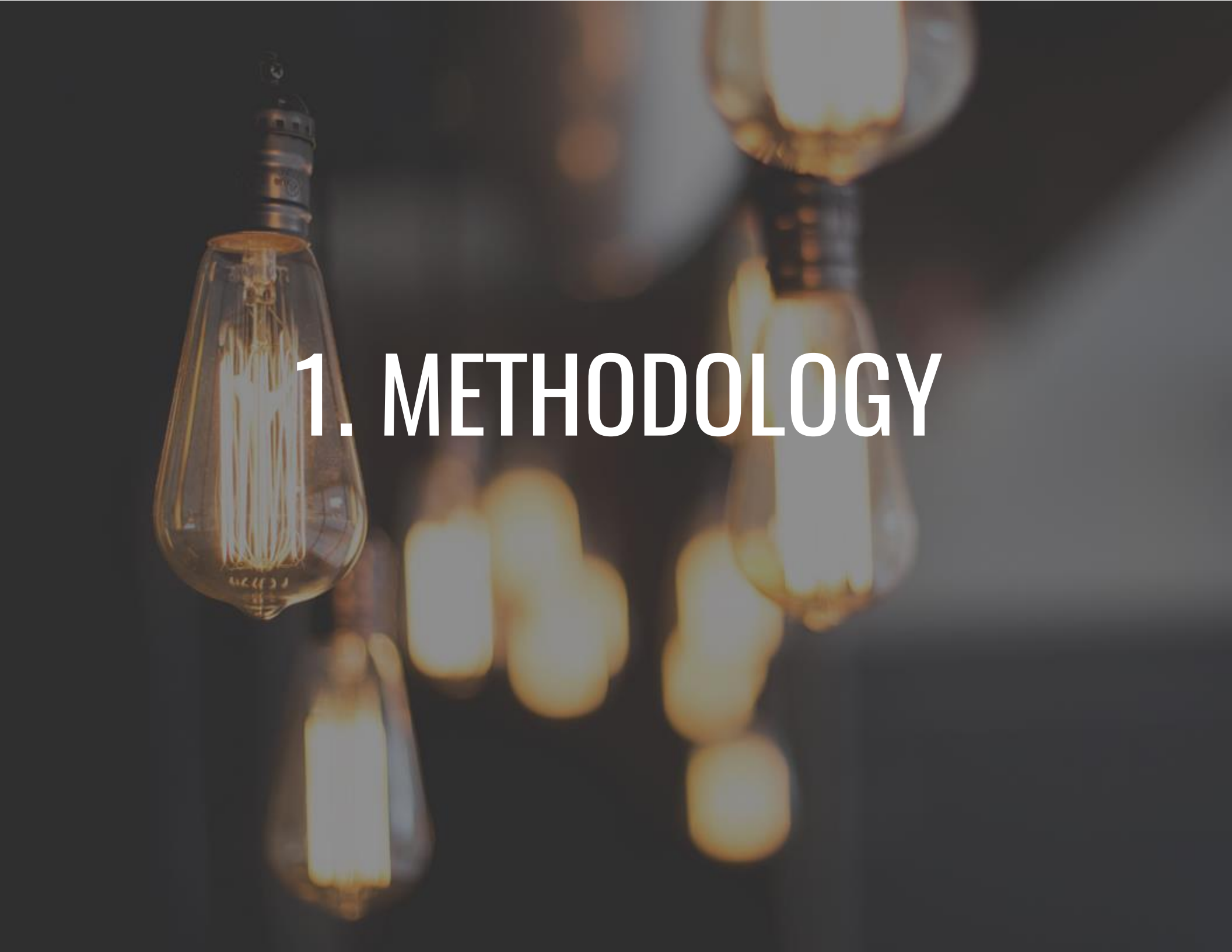

1. METHODOLOGY

1.1 GENERAL APPROACH

This energy burden assessment relies on collecting customer-level data, modeling missing attributes, then aggregating key metrics by geographic, demographic or building variables for analysis. The customer data comes from various sources as described in the rest of Section 1. Some demographic attributes were modeled or inferred using statistical techniques due to lack of primary data in the Customer Information System (CIS) or other sources. American Community Survey data was mainly used to sanity check aggregate statistics of customer-level data at the census tract level.

Three types of metrics were calculated:

- Metrics related to energy burden based on demographic and geographic characteristics
- Participation and funding in Energy Assistance Programs
- Customer energy use characteristics

The final dataset and results were packaged in a web dashboard for Avista staff.

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1.2 DATA SOURCES

The data sources leveraged for the analysis are described in this section.

DATA PROVIDED BY AVISTA

Customer Information System (CIS): This data included monthly electricity bills for 36 months in 2019-21, account numbers and service addresses. A separate data extract included the dates and customer accounts that received late payment notices, allowing us to calculate the on-time payment rate for different customer segments.

Direct Assistance Program Data: We received a list of participating accounts in LIHEAP and the Low Income Rate Assistance Program (LIRAP) program in 2019-21, along with discount amounts and dates. This allowed us to calculate the total assistance funding at the household level.

Energy Efficiency Program Data: We received a list of participating accounts in the low income weatherization program in 2019-21, along with installed measures, estimated therm savings and funding. The deemed therm savings were used to estimate the annual bill impact based on average bill savings of $0.98/therm.

Agency Profiles: Avista provided demographic and program participation profiles for the four community action agencies in its service territory.

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DATA OBTAINED FROM OTHER SOURCES

Geocoding: All customer addresses were geocoded to a latitude/longitude pair to facilitate geographic analysis. In addition, we mapped the latitude/longitude pairs to census tracts, block groups and blocks in order to pull additional aggregate statistics.

County Assessor Data: We obtained publicly available assessor data from Douglas, Jackson, Josephine, Klamath and Union counties. The assessor data included appraised values for homes, square footage, building year built, building use codes (residential, mobile homes, commercial and industrial), number of buildings on a land parcel, and other minor data points that were useful for performing general QA.

The addresses in this dataset were standardized to US Postal Service format, then matched with addresses in the CIS data. Some addresses existed in the CIS data but not in the assessor data (typically happens when multiple buildings occupy the same land parcel).

Customer Demographics: Data was purchased from a third-party data compiler that aggregates data from public sources and credit bureaus. This data was mapped to the CIS dataset using customer addresses and included total household income, age of occupants, and homeownership status for a little over 77% of residential households. Demographic attributes for some customers were modeled due to lack of primary data in CIS or other sources. The modeling approaches are described in the next section.

American Community Survey (ACS): ACS data (2019 5 year estimates) was primarily used for QA to ensure that aggregate counts for various demographic attributes match the expected distributions from ACS.

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1.3 FINAL ATTRIBUTES AND METRICS

The calculation methods for the metrics and attributes used in this report are described in this section. For all attributes, we also captured metadata related to the source of data and the confidence in the value (for example, data from primary sources has a high confidence, while modeled data has lower confidence). All of the data is robust for aggregate analysis, while high confidence data is better suited to customer-level marketing and program targeting.

Household Income: Income data was only available for 77% of households in Avista's Oregon service territory. To estimate the incomes for the remaining 23%, we used an iterative procedure.

Starting from the households for which we had income data, we applied an imputation model – this is a statistical method for filling in missing data by using the home's location, home value and building type. In other words, each household is assigned an income range based on the incomes of similar households in their area. This is the initial guess for that household's total annual income. Then, an iterative calibration procedure uses those initial guesses and adjusts them to ensure that the overall income distribution within a census tract is similar to the overall income distribution from the ACS. The calibration iteratively takes a small sample of households (under 10%) and bumps them up or down by one income level within certain bounds until the modeled income distribution resembles the ACS income distribution.

Validation: From prior validation analysis, this modeling procedure yields fairly good results - it is able to reproduce the incomes accurately for a hold-out set of data from the original dataset, with errors under $5k/year in household income for 85% of the test set and errors under $20k/year in household income for the other 15%. Larger errors tend to happen for households with a larger income, which are not the focus of this study anyway. More importantly, the aggregate metrics related to energy burden (e.g. energy assistance need and overall burden) are very robust to errors in individual results because we are ensuring that overall distribution of

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income is as accurate as possible, while the energy use does not change dramatically among similar households.

Poverty Status: The number of people living in a household cannot be easily obtained from any public data sources. This makes it difficult to identify a household's poverty status compared to the Federal Poverty Limit or the Area Median Income, both of which are defined by household size. The median household size in the five Avista counties in Oregon varies from 2.3 to 2.4 and household size for income thresholds is a configurable parameter in the data dashboard (for sensitivity analysis).

Building type: Meters were classified into one of five building types: single family, mobile homes, multifamily apartments, commercial or master metered and unoccupied. Commercial meters were those tagged with a specific commercial use by the county assessor or that were on a commercial rate class (unless they were clearly apartments). Additionally, we filtered out meters using in excess of 2,000 therms/year as those are likely associated with commercial uses or are master metered. Meters that showed energy consumption less than 20 therms/year were flagged as potentially unoccupied.

Overall, the number of household meters excluding commercial and unoccupied meters was approximately 94,000. Addresses with multiple units or tagged as multifamily properties by the county assessor were flagged as apartments. Mobile homes were either labelled as such by the county assessor or were sited in a mobile home park. Non-multifamily homes with addresses but without an identified land parcel are usually accessory dwelling units, trailers or mobile homes – these were all included in the "mobile home/other" category.

Validation: The aggregate housing type counts (91% single family, 6% multifamily and 3% mobile/ ADU homes) are similar to data from the DOE's LEAD tool for gas-heated homes in the five Avista counties (87% single family, 8% multifamily and 5% mobile/manufactured/ADU homes), although the LEAD tool only accounts for 67,000 gas-heated households, greatly underestimating the 94,000 actual residential customers in Avista's CIS system.

Homeownership Status: Homeownership status (rent vs. own) was determined using two methods. The demographic dataset included homeownership for approximately 77% of customers. For the other 23%,

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households in multifamily apartments were tagged as "Likely Renters", and households without any account changes during the two year analysis period were tagged as "Likely Homeowners". Households with an account change and an accompanying sales record were also tagged as "Likely Homeowners". This approach can potentially undercount long-term renters and tag them as homeowners. However, the accuracy of the approach seems sufficient for the purposes of large-scale aggregate analysis as in this study.

Validation: The owner-occupied housing rate for gas-heated homes in the DOE LEAD tool is approximately 71% in the five Avista counties. The homeownership rate from this analysis is up to 80% (56% confirmed and up to an additional 24% of either homeowners or long-term renters), so the two estimates fall within each other's margin of error.

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Gas Burden and Energy Efficiency Potential thresholds: These thresholds were set as follows:

- High-burden threshold: Greater than 3%[1]
- High efficiency potential threshold: Greater than 0.4 therms/sq.ft/yr.

Gas Burden: Gas burden for a household is calculated simply by dividing annual gas expenses by gross household income.

$$Gas\ Energy\ Burden = \frac{Annual\ Gas\ Expenses}{Annual\ Household\ Income}$$

Excess Burden: Excess burden is the portion of a household's energy burden in excess of the 3% threshold.

$$Excess\ Burden = \max(0, Gas\ Energy\ Burden - High\ Burden\ Threshold) \times Annual\ Household\ Income$$

On-Time Payment Rate: This is the proportion of all energy bills that did not require a late payment or disconnect notice to be sent out.

Energy Assistance Funding: The dollar amount of funding flowing through energy assistance programs (including discount, donation and weatherization programs) through discounts or rebates.

Customer Bill Reductions (**Avoided Burden**)**:** The total bill impact from energy assistance programs. This is the same as the assistance funding for direct assistance programs and is based on measure savings for energy efficiency programs as described in Section 1.2.

[1] The state of New Jersey uses a split high burden threshold by fuel: for customers with natural gas and electric service from different utilities, no more than 3% of income should be devoted to each. We use this as a high-burden guideline for gas heated homes in this assessment, recognizing that there could be different interpretations or methods for designating customers as "high-burden". The dashboard allows for adjusting the gas burden thresholds, in order to test different reasonable thresholds.

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Avoided Need: The total bill impact specifically for customers flagged as "high-burden".

Census Tract Statistics: Since each customer has been mapped to a census tract and block group, we are also able to match customers to census tract average statistics (e.g. highly impacted communities, presence of children, non-English speakers, education level, environmental pollution etc.).

Energy Assistance Need: This is the sum of excess burden across all customers.

DOE Disadvantaged Community Score: The number of community vulnerability criteria (social, health and environmental) that are exceeded in a census tract. This data comes from the Department of Energy's Climate and Environmental Justice Screening Tool.

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1.4 SOURCES OF UNCERTAINTY

- **Household income** is a dynamic piece of data as residents move in and out of homes and income data can become outdated within a year or two.

- **Poverty status.** Since household size cannot be reliably captured through any available data source, household poverty status is subject to uncertainty. The Federal Poverty Limit and Area Median Income both use household size as a scaling factor. So, for any analysis, it is recommended to perform a sensitivity analysis with the household size assumption (this is facilitated through the web dashboard). In general, using 2 and 3 person household assumptions has been found comparable to statistics from income-verified programs.

- **Individual vs. aggregate data usage.** The underlying dataset has customer-level flags for data quality – data from primary sources is considered high quality while modeled data is considered medium or low quality, depending on the availability of supporting sources of information (example, home values and location). Higher quality data can be used for individual program targeting, lower quality data can be used for program design and aggregate reporting.

- **Building types.** There is some uncertainty in the classification of building types as described in Section 1.3. This could results in misclassifying non-residential meters as occupied households or vice versa.

- **Achievable reductions in energy assistance need.** This analysis presents a *technical* energy assistance need based on energy burden. However, in our experience due to a variety of barriers like access to information, application process difficulties, stigma and lack of trust, many customers may not be willing to participate in programs, regardless of program design or available benefits. Understanding the *economically achievable* reduction in energy assistance need through utility programs would require a qualitative research of non-participants in a utility's service area.

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2. AVISTA'S ENERGY BURDEN BASELINE

2.1 AVISTA'S OREGON RESIDENTIAL SECTOR PROFILE

Avista's service territory in Oregon state was composed of approximately **94,000 occupied households** (with a detectable energy use and not designated as shops, garages or commercial properties).

Ethnicity: According to the U.S. Census Bureau, approximately 83% of residents in Avista's service area are non-Hispanic white. Hispanic residents comprise 11% of the population, mostly concentrated in Klamath county.

Household Income: The median household income for residents in Avista's service area is approximately $52,000, well below the state average of $66,000. Approximately **14%** of all households would fall under 100% of the federal poverty limit.

Energy Bills: Avista residential natural gas rates are about average for the region. Annual energy bills in 2019-21 averaged **approximately $670/year with an average annual consumption of 550 therms**. Figure 1 shows the distribution of annual natural gas bills; with about half of households paying more than $640/year on their bills. Customers on the east side of the Cascades (Klamath and Union counties) generally have higher bills ($740 on average) compared to the west side ($650 on average).

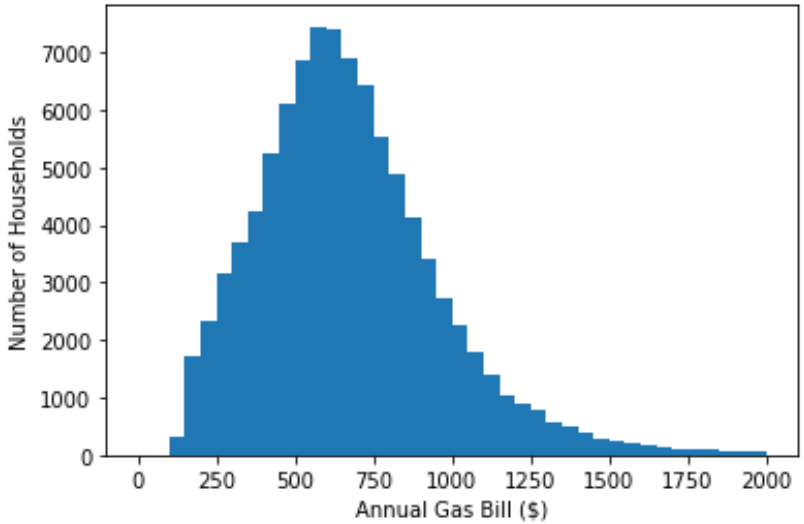

Figure 1. Household natural gas bill distribution for Avista's Oregon residential customers

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2.2 ENERGY BURDEN

Avista customers have an **average and median gas energy burden of 1.2% and 0.7%**, respectively. Figure 2 shows various gas energy burden metrics in the five Avista counties. The proportion of customers who have a high energy burden is relatively low in the Western counties (4-7% of customers) vs. the Eastern counties (9-14% of customers).

The average household paid $670/year in natural gas bills in 2019-21. Of 94,000 identified households, **6,400 were deemed to have a high energy burden**, meaning that annual natural gas bills exceeded 3% of their income. These high-burden customers paid an average of $740 in annual natural gas bills; the higher bill average reflects their higher likelihood to live in less efficient or older homes. The **total energy assistance need for Avista's Oregon customers is approximately $1.8M**—the total reduction that would bring all customer natural gas bills below the 3% high burden threshold.

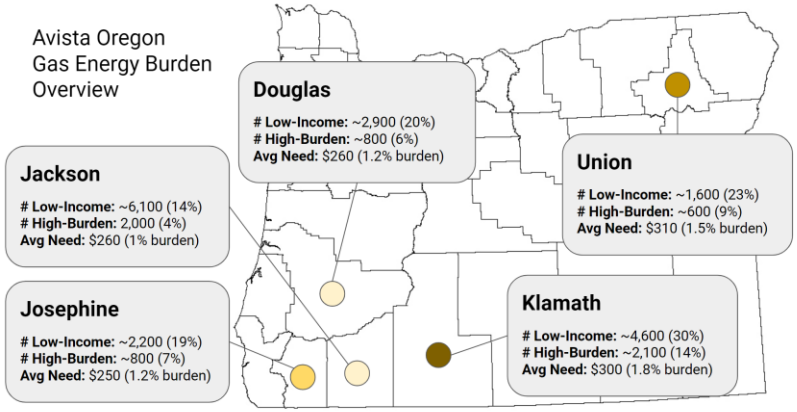

Figure 2. Energy burden benchmarking

Although averages and medians give a general indication of energy burden across a service territory, the reality is that **energy burden is a customer-level metric** and its distribution is a better indicator of the burden that customers experience. The distribution of energy burden among Avista customers is shown in Figure 3.

The goal of an effective energy assistance portfolio should be to prioritize the customers who most need the assistance, i.e. the customers to the right of the 3% threshold.

Approximately 67% of the energy assistance need is borne by single family households, with 16% in mobile

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homes and the remainder in multifamily homes. The highest concentration of need is in mobile homes, requiring more than $316/household in assistance on average, compared to $283/household for single family and $234/household multifamily households.

Approximately 48% of the energy assistance need for Avista customers is among renters, indicating that conservation programs targeted at high-burden customers will need to grapple with the split incentive problem between landlords and tenants, but energy burden among homeowners is equally significant. Other customer segments can be investigated in more detail in the data dashboard.

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Number of Occupied Households

~94k

Low Income Households

Under 60% SMI: **~17k**

Gas Energy Burden

Median: **~0.7%**
Average: **~1.2%**

High Burden Households
~6,400

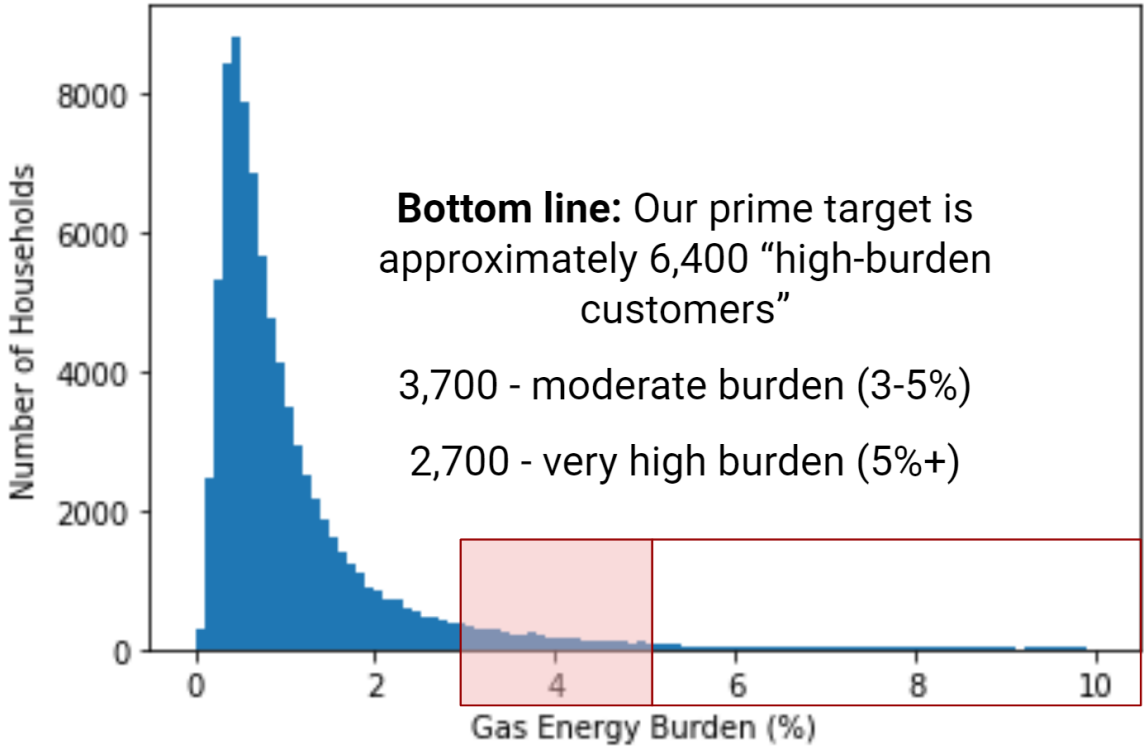

Figure 3. Distribution of energy burden among Avista's Oregon customers.

2.3 CONSERVATION VS DIRECT ASSISTANCE

Figure 4 shows the distribution of energy burden and energy efficiency potential (defined through Energy Use Intensity thresholds) across all low-income residential customers. In a perfect world, the energy assistance portfolio would match these customer segments. For example:

- Conservation programs should primarily serve **high burden, high potential** households
- Direct assistance programs should primarily serve **high burden, low potential** households
- Crisis/emergency programs should primarily serve **low burden, low potential** households
- Traditional conservation programs with financing should serve **low burden, high potential** households

Aligning targeted customers with program strengths results are the most cost-effective pathway to energy burden reduction.

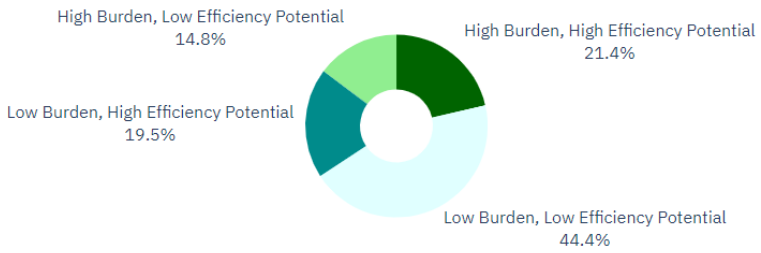

Figure 4. Avista's Oregon low-income customer segments by energy burden and energy efficiency potential.

Approximately 44% of Avista's low-income customers are low-burden and low-efficiency potential. These customers' energy bills may not be a huge expense relative to housing, medical and education expenses, and they should not be prioritized in the more intensive programs, such as weatherization.

21% of high burden customers also have a high efficiency potential indicating that the energy assistance program mix should equally prioritize sustained energy burden reductions through energy efficiency and weatherization.

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3. KEY CUSTOMER SEGMENTS

3.1 OVERVIEW

This section presents statistics and profiles related to key customer segments in Avista's Oregon service area. These customer segments were selected for a combination of reasons:

1. Flagged in this assessment as having high overall burden or high prevalence of energy burden

2. Meets the Department of Energy criteria for vulnerable communities

3. Identified as high priority through interviews with agencies

This analysis is primarily geographic, focusing on specific neighborhoods. The maps in the following sections display the level of energy assistance need in these areas as well as locations of social services for potential outreach.

These customer segments represent a big portion, but not the entirety of the high energy burden among Avista's customers, so they should be targeted for any new programs or initiatives in the future using lists of customers who live in the block groups identified below.

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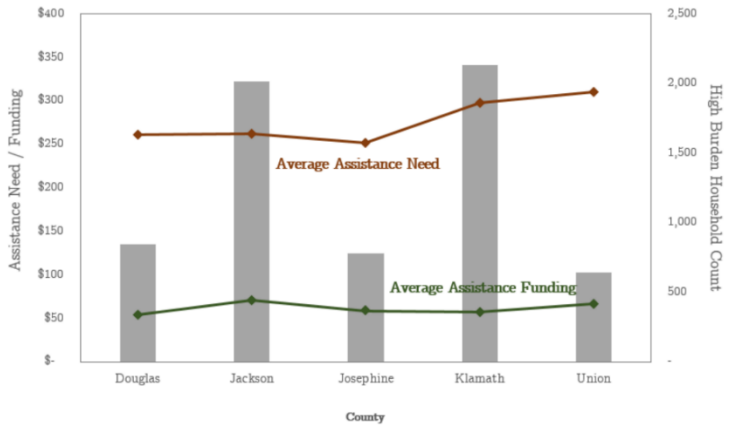
3.2 EASTERN COUNTIES

PROFILE: The figure below shows the energy assistance need and average energy assistance funding in the five counties in Avista's Oregon service area. In general, the energy assistance need is about 30% higher in Klamath and Union counties, east of the Cascades, while the average level of funding is almost equal in all counties. The difference in average need can mostly be explained by the difference in climate. Figure 5 shoes the seasonal average temperatures in Medford and Klamath Falls (which are only 80 miles apart) – areas east of the Cascades experience colder temperatures in winter and the shoulder seasons, resulting in higher gas bills and burden.



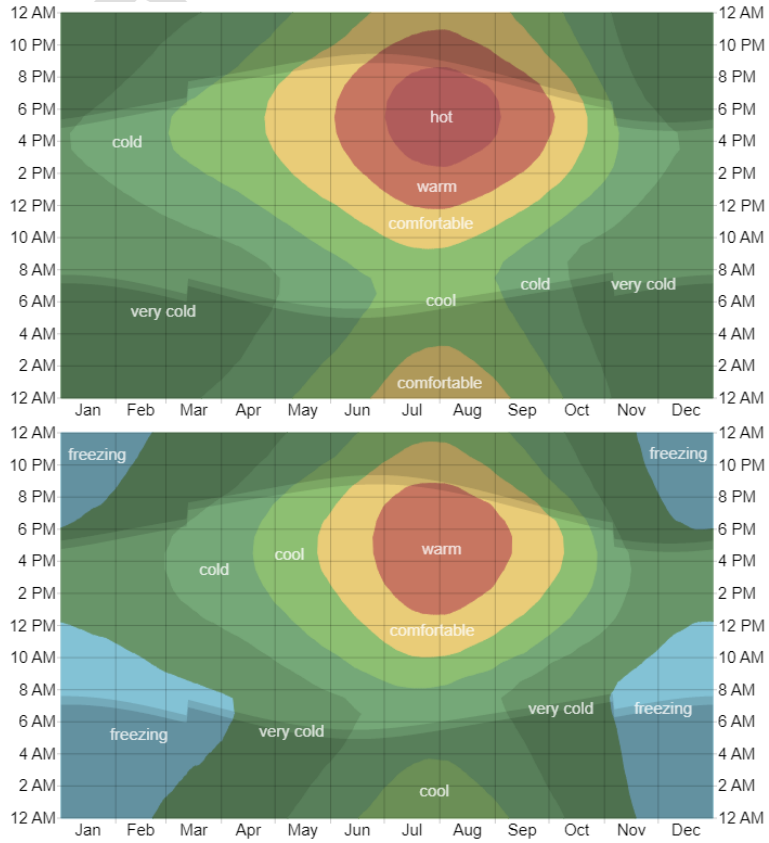


Figure 5. Seasonal average temperatures in Medford (top) and Klamath Falls (bottom) – from WeatherSpark.com.

RECOMMENDATIONS: We recommend adding the level of gas assistance need or gas burden as an additional consideration when apportioning program budgets among Avista's partner agencies. Relying on customer counts alone misses the fact that gas energy burden is not evenly distributed among the different counties. This would roughly imply a budget breakdown as follows: a third in Jackson county, a third in Klamath county and the remaining third split evenly between Douglas, Josephine and Union counties. The following table shows that three quarters of Avista's customers are located west of the cascades, but they only shoulder about half of the gas burden.

County	Proportion of gas assistance need	Proportion of current program spending	Proportion of Avista customers
Douglas	12%	11%	16%
Jackson	30%	**43%**	**48%**
Josephine	11%	9%	12%
Klamath	**36%**	28%	17%
Union	11%	9%	7%

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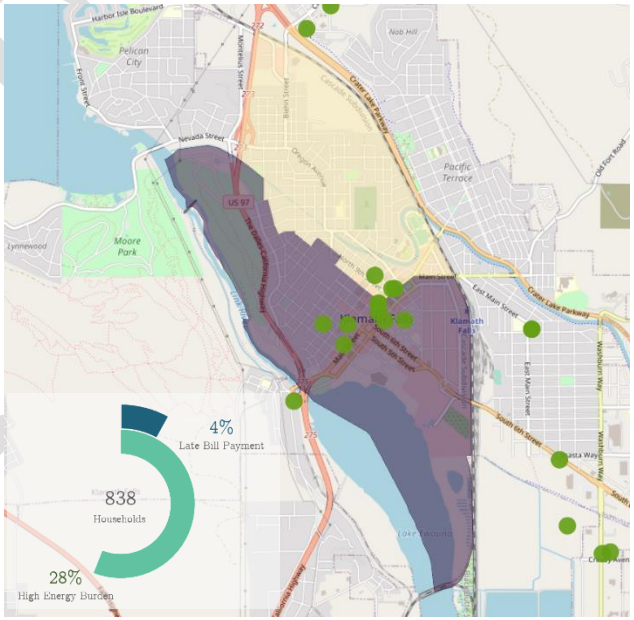
3.3 DOWNTOWN KLAMATH FALLS

Census block groups: **410359718001, 410359718002, 410359718003, 410359719005**

Total Assistance Need: **$68k (4% of total)**

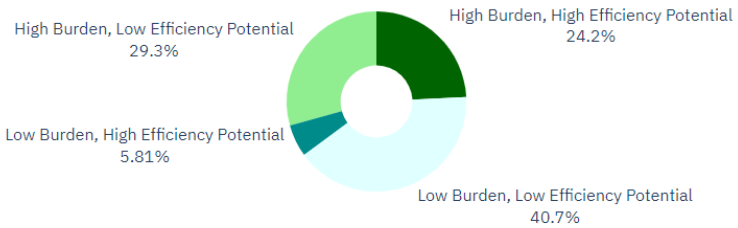
Total Assistance Funding: **$18k (2% of total)**

DOE Disadvantaged Community Score: **2.6**



PROFILE: Customers in downtown Klamath Falls tend to live in older single family homes – about a third of these customers rent their homes. Although 20% of the local population are considered people of color (Hispanic), most customers are bilingual. The area has some light industrial activity and has historically had relatively high rates of unemployment and poverty.

RECOMMENDATIONS: This customer segment is urban but dispersed. KLCAS has primarily relied on word of mouth to recruit program participants. There are numerous social services organizations in the area, which introduces an opportunity to build partnerships with local community organizations.



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3.4 ALTAMONT

Census block groups: **410359712001, 410359715002, 410359716003**

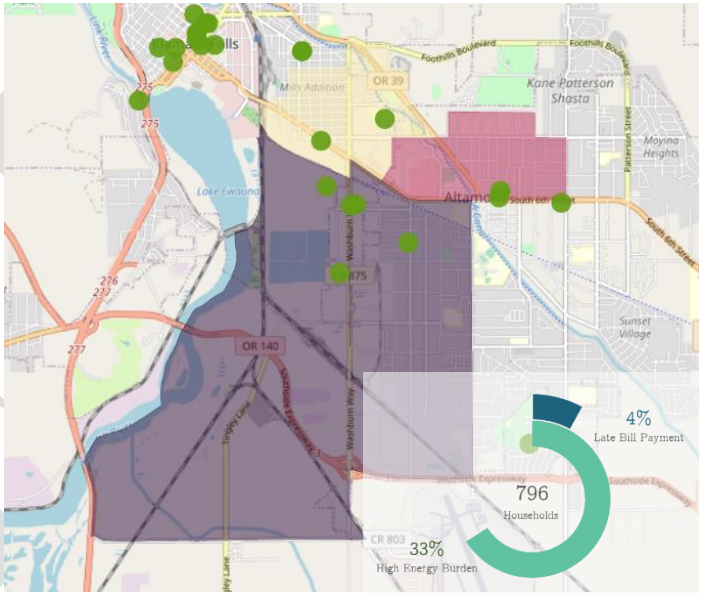
Total Assistance Need: **$88k (5% of total)**

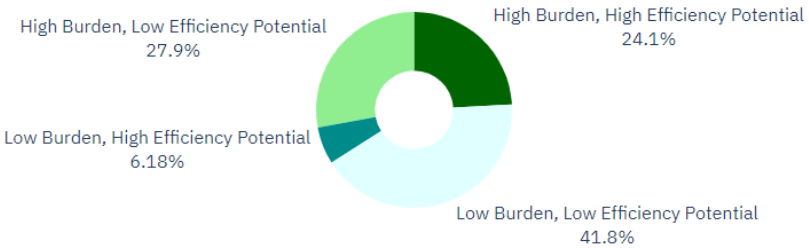
Total Assistance Funding: **$40k (3% of total)**

DOE Disadvantaged Community Score: **4.7**

PROFILE: Altamont is an unincorporated community just south of Klamath Falls. Most homes in the area are smaller, older, stick-built on concrete slabs – more than 90% of homes were built prior to 1980. Almost a third of customers in the area have a gas energy burden higher than 3%, but on-time bill payment rates are still reasonably high. There is a large proportion of senior customers in the area. The area appears to be slightly underserved by existing programs, but the local agency is moving to a new location in summer 2022, which should be more accessible by public transit.

RECOMMENDATIONS: This customer segment is more dispersed than Klamath Falls and physical access to services may be harder. Consider targeted mail campaigns to the area informing customers of programs. KLCAS is introducing a new online application system that could improve program access for these customers.





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3.5 OLD MEDFORD

Census block groups: **410290003002, 410290001001**

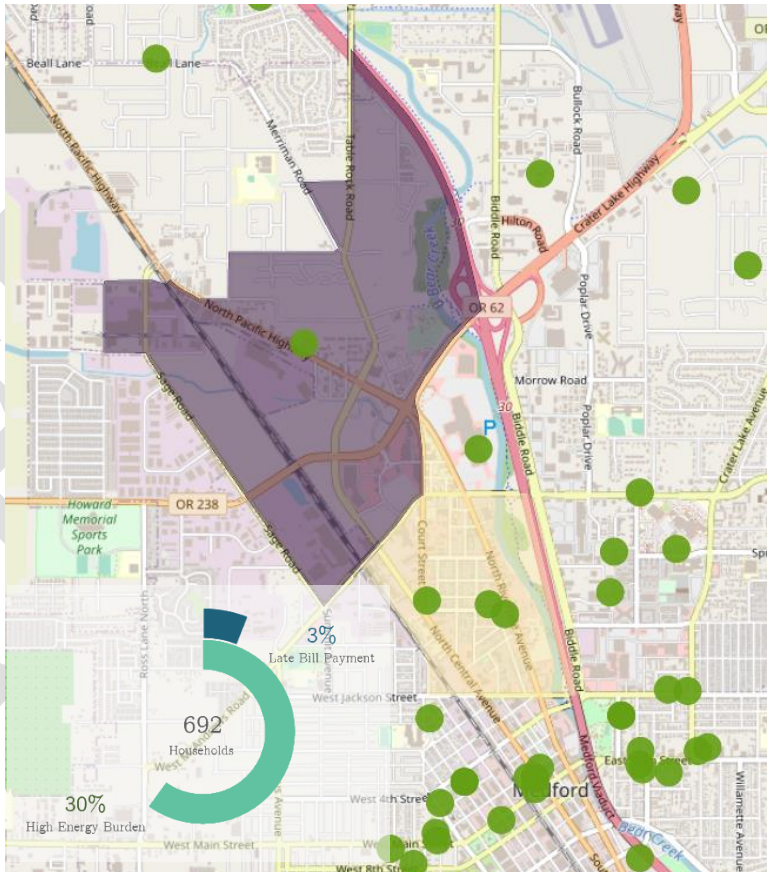
Total Assistance Need: **$66k (4% of total)**

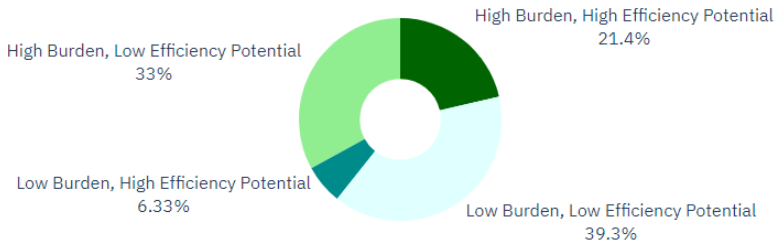
Total Assistance Funding: **$18k (1% of total)**

DOE Disadvantaged Community Score: **2.6**

PROFILE: The area surrounding Northwest Medford is an older part of town and includes several gas-heated mobile home parks that were flagged as having a high gas energy burden. The area has a high rate of property crime and appears to be somewhat underserved by existing programs.

RECOMMENDATIONS: Outreach to trailer park managers can be very effective at recruiting program participants who reside in mobile homes. The area should be prioritized for weatherization or lighter touch energy efficiency (e.g. energy savings kits, thermostats and air sealing), as more than half of customers have a high gas savings potential.





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3.6 NORTHEAST LA GRANDE

Census block groups: **410619704002, 410619704003, 410619705002, 410619707001, 410619707003, 410619708001, 410619708002**

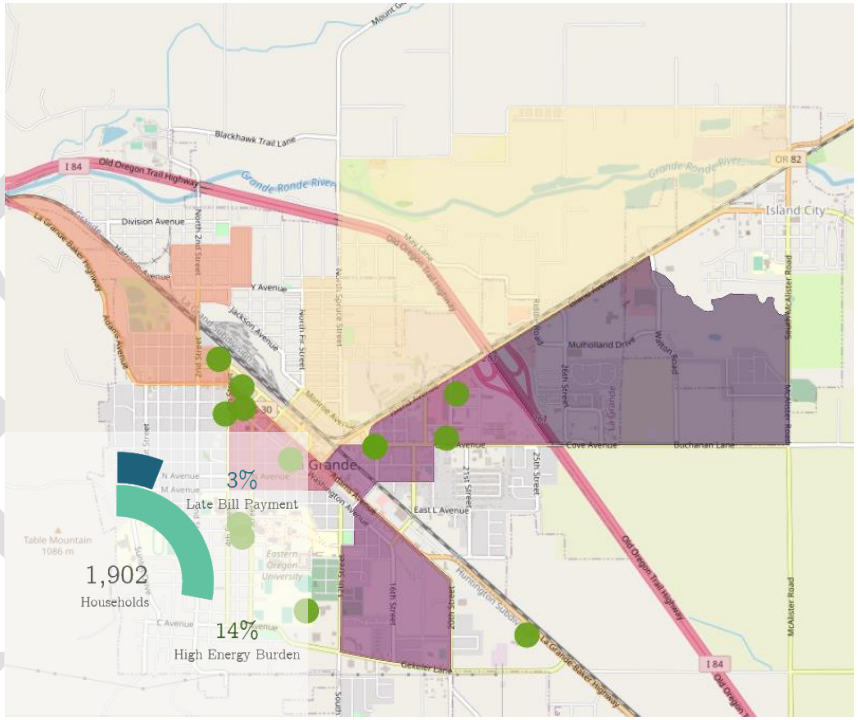
Total Assistance Need: **$82k (5% of total)**

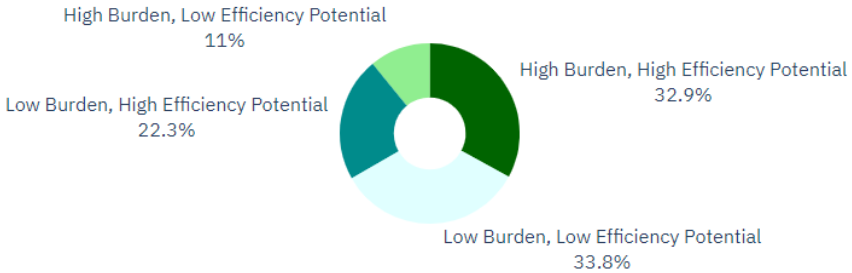
Total Assistance Funding: **$37k (3% of total)**

DOE Disadvantaged Community Score: **0**

PROFILE: The high priority areas in La Grande have predominantly older housing and a relatively large senior/fixed income population. Northeast La Grande is surrounded by agricultural land.

RECOMMENDATIONS: As rural areas, traditional mass communications may not be effective at reaching this customer segment. Collaborating with local schools, churches or community organizations (like Union County Casa) will be more effective. Door-to-door canvassing may also be feasible in collaboration with the local agency.





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3.7 SOUTH GRANTS PASS

Census block groups: **410333612001**

Total Assistance Need: **$22k (1.2% of total)**

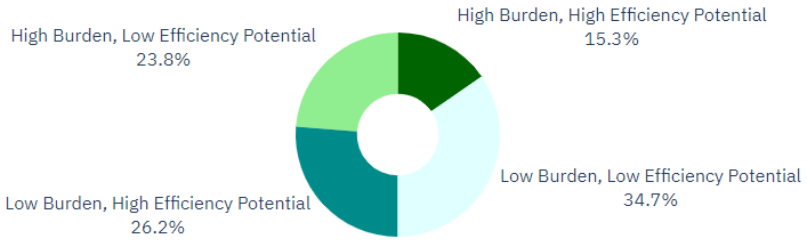
Total Assistance Funding: **$5k (0.4% of total)**

DOE Disadvantaged Community Score: **1**

PROFILE: The area south of Grants Pass has various neighborhoods composed of mobile homes and ADUs. Some of these were affected by wildfires in the past few years.

Old Town Roseburg (410191300001) is also an area of older manufactured homes, with a high level of homelessness due to the availability of social services.

RECOMMENDATIONS: UCANCAP already has a satellite office in Grants Pass that accepts and processes program applicants. Targeted marketing campaigns to these block groups as well as trust building through local partnerships will be essential to reach this customer segment.



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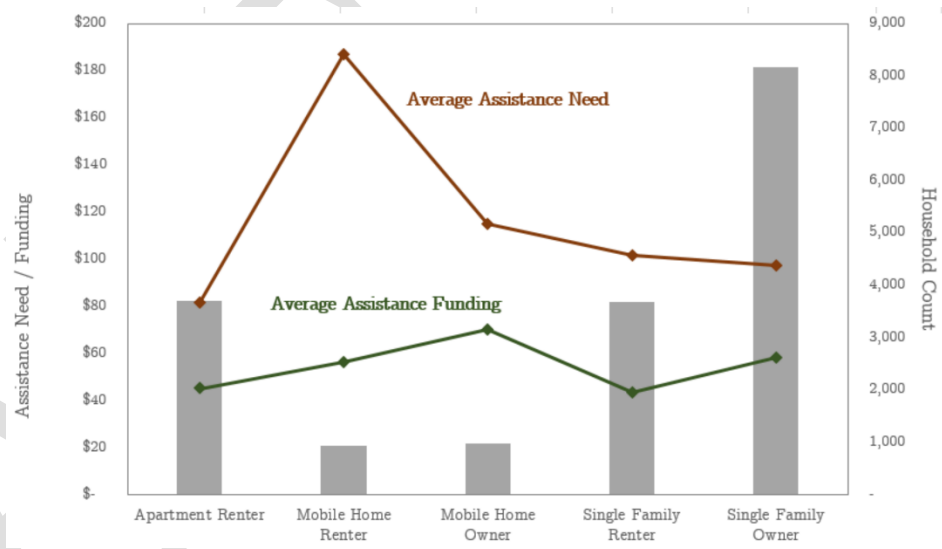
3.8 MOBILE HOME RENTERS

PROFILE: The figure to the right shows the energy assistance need and average energy assistance funding for all low-income customers in Avista's Oregon service area, categorized by housing type and homeownership. In general, it appears that apartment dwellers are relatively well-served by existing programs as the gap between average need and average funding is very small. On the other hand, the least well-served segment appears to be renters living in mobile homes.



RECOMMENDATIONS: Mobile home dwellers can be best reached through outreach to trailer park managers. In addition to building partnerships with local schools, churches and community organizations, it is recommended to develop targeted energy assistance marketing campaigns (direct mail and email) for these customers through the dataset developed in this assessment. Onerous program application requirements are also a big barrier to participation for this customer segment.

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