2025 Low Income Needs Assessment

Final Report

Submitted by Evergreen Economics

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1 Executive Summary / Introduction

This is the final report of the 2025 Low Income Needs Assessment (LINA), conducted for the California investor-owned utilities (IOUs) (Pacific Gas and Electric, Southern California Edison, Southern California Gas, San Diego Gas & Electric) and the California Public Utilities Commission (CPUC) (collectively referred to as the study team).

1.1 Background

The California IOUs administer the Energy Savings Assistance (ESA) program for low-income customers to achieve deep energy savings and enhance the health, comfort, and safety (HCS) of customers. The CPUC directed the IOUs during the 2021-2026 ESA program cycle to collect data on customer characteristics to enhance ESA program outreach and services to customers who may most benefit from the program.[1] Given their current focus on achieving deeper energy savings, the IOUs have continued to increase their focus on an energy usage-based approach for program delivery. Evergreen Economics intends for this 2025 LINA to explore the needs and energy consumption behaviors of both high and low energy usage low-income customers to examine how the ESA program benefits customers in these segments and how ESA can more effectively reach and provide services based on customer needs and characteristics.

The study approach included developing a set of hypothesized characteristics of high- and low-usage customers followed by research to test hypotheses and the development of actionable program recommendations for addressing the energy-related needs of income-qualified high- and low-usage customers.

For this study, Evergreen defined high- and low-usage low-income households as the 90th and 10th percentiles of annual electricity and gas consumption by climate zone group. This differs from the definition of high-using households utilized by the IOUs and instead allows for research of the groups in either end of the usage curves, specific to each IOU. This decision was made to ensure we could learn from the highest- and lowest-using households and take into account climate differences within each service territory.

1.2 Research Questions

This research addresses three high-level research questions that pertain to the high and low energy use segments of low-income customers. In order to ensure that the research served each

[1] CPUC Decision 21-06-015 (D.21-06-015, page 205-206) directed the IOUs to report on ESA household treatments and reach out to eligible households by various customer segments, including demographic, financial, location, and health conditions attributes.

IOU service territory with varying climates, we created four categories of heating and cooling needs (high heating need and high cooling need, low heating need and high cooling need, etc.) and looked at high- and low-using customers in each of the four climate groups.

1. What behavioral, household, and property characteristics contribute to relatively high and low energy consumption?
2. What, if anything, do households with high consumption need to realize greater energy savings and low consumption need to realize greater HCS benefits from the ESA program?
3. To what extent does the ESA program as it is currently designed address or not address these needs?

1.3 Research Approach

To answer the research questions, Evergreen Economics conducted the following research:

- **Market Characterization:** Evergreen conducted a comprehensive market characterization using secondary data sources including utility billing, the California Alternate Rates for Energy (CARE) program, the US Census, and appliance surveys to identify and profile high energy usage (top 10%) and low energy usage (bottom 10%) households within the low-income population. The analysis created distinct customer groups stratified by fuel type and usage levels across climate zones to understand geographic distribution and household characteristics driving energy consumption patterns.
- **Customer Survey:** Evergreen conducted a multi-mode survey with the help of Ewald & Wasserman Research Consultants of 1,103 active CARE and Family Electric Rate Assistance (FERA) program participants through web and phone platforms, stratified by climate groups and usage levels, with completions in English (1,031) and Spanish (72). CARE customers qualify if their incomes are 200 percent of the federal poverty level (FPL) or below, which aligns with the requirement to participate in ESA. ESA recently increased the FPL percentage to 250 percent, which more closely aligns with FERA income requirements. The survey gathered information on demographics, home characteristics, energy behaviors, and drivers of high and low energy use, with survey respondents receiving $25 gift cards. Evergreen combined results from the customer survey with usage data to conduct a linear regression model focused on high and low electricity-using households in the summer season.
- **Focus Groups**: Evergreen, with Ewald & Wasserman, commissioned seven in-person focus groups in multiple languages (English, Spanish, Cantonese, and Vietnamese) with separate sessions for high- and low-usage customers to identify qualitative insights beyond the survey findings. Professional moderators led discussions with ESA-eligible high- and low-usage customers (who received $150 for participating) focusing on energy consumption behaviors, comfort trade-offs, and reactions to potential program recommendations. Evergreen has included the focus group results in the report and

noted them as qualitative in nature, and intended these results to complement the more robust customer survey data.

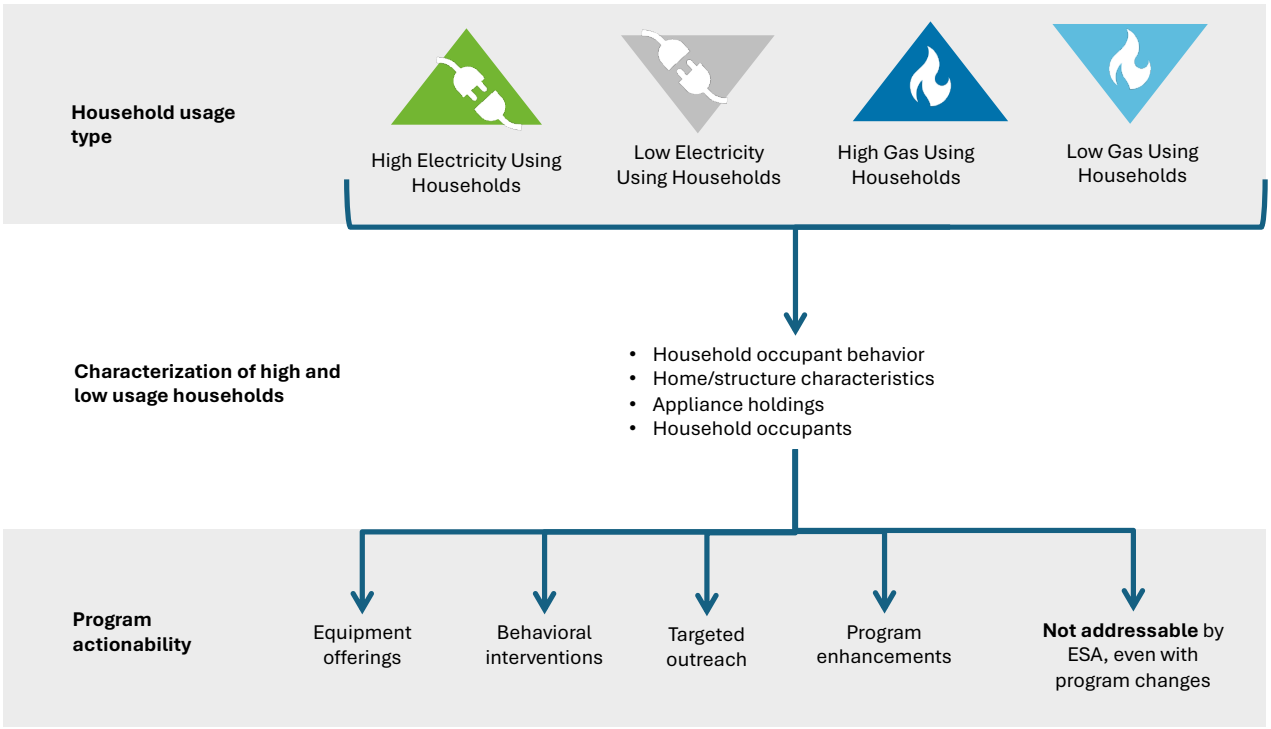
Figure 1 presents a framework for how we present the study findings in this report.

Assignment of households into energy-using groups. The first row is the assignment of households into low- or high-using households groups for both electricity and natural gas. Evergreen conducted study analyses separately for electricity and natural gas (i.e., high electricity-using households were compared to low electricity-using households, and high gas-using households were compared to low gas-using households).

Characterization of energy-using groups. The second row reflects the assessment of how energy-using groups differ across a series of behavioral, household, and property characteristics, many of which align with the demographic, health, financial, and geographic customer segments defined in D. 21-06-015 covering the ESA program. Evergreen followed the characterization with the development of regression models to explain factors that affect electric usage during the summer months (one for high-using households and one for low-using households).

Development of program recommendations to address low- and high energy-using household needs. The third row shows the types of program recommendations that Evergreen developed, reflecting recommendations that can be implemented to the program now as it is currently designed or if modifications would be needed to the program to implement recommendations (e.g., targeting and outreach, education, and offerings).

Figure 1: Household Usage Type, Characterization, and Program Action Pathway



1.4 Summary of Findings and Recommendations

Findings begin with a characterization of high and low gas- and electricity-using households, including how climate may impact these findings, followed by program implications and recommendations.

1.4.1 High- and Low-Using Households Characterization

The study examined characteristics of low- and high-using households among the low-income population including home structure (single-family/mobile homes and multifamily homes), household occupants, appliance holdings, and household occupant behaviors. Program implications differ by these types of characteristics:

- **Home structure and household occupant characteristics** may be predictive of usage (so could be used for targeting customers and/or tailoring offerings), but these are not changeable by the program.
- **Appliance holdings** may change due to upgrades the program provides such as higher efficiency equipment and smart strips.
- **Household occupant awareness, knowledge, attitudes, and behaviors** may change due to education provided by the program that could be tailored to their specific situation.

While we completed analysis by fuel (electric high- and low-using households and gas high- and low-using households), there were many characteristics that were common when comparing high- and low-using households of either fuel (Table 1).

Table 1: High Level Findings For High- and Low-Using Households, Regardless of Fuel

	High-Using Households	Low-Using Households
Regardless of Fuel	**High gas- and high electricity-using households both:** • Live in larger homes and are homeowners; • Have more appliances and electronics; • Are more likely to have children in the home; • Prioritize comfort over conservation (particularly in regions that need more heating or cooling); • Are more likely to be in high fire threat districts; and • Are more likely to have medical equipment and/or be on the Medical Baseline rate.	**Low gas- and low electricity-using households both:** • Live in smaller homes and rent their homes; • Are more likely to practice conservation "always or almost always"; • Are willing to endure discomfort; • Have fewer appliances, overall; • Have fewer people in the home; and • Are more confident about energy saving strategies.
	Both high- and low-usage households are similar in terms of: • Thinking they are doing all they can to save energy; • The presence of veterans or people with disabilities; • Their desire for lower bills; • Their income levels in terms of FPL categories; and • The age of their homes.	

The differences between high and low electricity-using households proved more pronounced than those between gas-using households, which is not surprising given the larger number and variation in electric equipment in homes. In comparing the difference *between* the highest and lowest electricity-using households to the difference *between* the highest and lowest gas-using households, we see (for the electric group over the gas group):

- A stronger connection to climate – with **high-using households being more likely to be in zones with high cooling needs**. This difference is less strong for gas-using households in high heating-need regions. This may be because cooling equipment is always electric whereas heating equipment can be both electric- and gas-fueled. Survey findings also show that high electricity-using households have older cooling equipment compared to low-using

households, whereas gas high-using households and low-using households *both* have older equipment. Again, this may be more pronounced given that all cooling uses electricity.

- A larger gap between high- and low-using households in terms of their reporting of **how environmentally conscious they are.** Low electricity-using households are more likely to be making an effort to unplug appliances and electronics (specific to electric fuel only).
- Environmental concern shows opposite patterns by fuel: low electricity-using households are more likely than high electricity-using households to rate protecting the environment as very important, while high gas-using households report higher importance than low gas-using households. However, once we account for heating and cooling needs (i.e., climate), these differences disappear—pointing to climate-driven energy demand rather than differing self-reported attitudes.
- A **larger gap in terms of health needs** when comparing high and low electricity-using households to high- and low gas-using households (which makes sense given medical equipment is fueled by electricity, not gas).
- A more dramatic difference in the likelihood **of children in the home**. More people in the home likely means a larger set of appliances/electronics, which are often electric.

1.4.2 Implications for Program Design

Findings and recommendations are organized by the following program strategies:

1. Equipment replacement and upgrades
2. Behavioral interventions
3. Targeted outreach

Note that our assessment is focused on the needs of the high- and low-using customers and did not include a process evaluation to look at concrete recommendations for program design. These recommendations do not include estimates of savings or cost to implement though these are sometimes noted as challenges to accepting a recommendation. This may be a useful endeavor as the CPUC and IOUs review recommendations from this customer-focused assessment, given that they may vary in the cost to implement and the amount of energy that may be saved from the program perspective. This may be future research for the CPUC and the IOUs to consider.

Equipment Replacements & Upgrades

Topic	Finding & Recommendation
Primary cooling system replacements for high electricity-using households in high-cooling areas	**Finding:** High electricity-using households have older cooling systems than low electricity-using households, and their inability to buy more efficient cooling equipment is a major barrier to energy savings. Central ACs in high electricity-using households contribute an additional 1,192 kWh in the summer months but only contribute to an additional 175 kWh in low-usage households over the same period. This finding stands even when the regression normalizes for climate, indicating that high-using households are more likely to utilize their cooling systems. It is possible that older systems may be correlated with home characteristics such as poor building envelope though our study only looked at this in terms of home age, and did not find that high users were in older homes necessarily. **Recommendation:** No recommendation given that this is currently included as part of the ESA program. **Challenge:** Likely requires site visits to assess equipment age and operability, though geographic targeting can improve efficiency; new AC units are expensive compared with other ESA measures. The IOUs could look into the feasibility of advanced metering infrastructure (AMI) data analysis along with customer-provided data to assess age and operability.
Pump upgrades for high-using households	**Finding:** High-using households (combining gas and electric high-using households) more frequently have pumps (close to 20% of high-using households and close to 6% of low-using households). This includes freshwater/sump, hot water circulation, well, irrigation, and pool pumps. These differences are statistically significant for pool pumps, but sample sizes are too small to determine if there are true differences in the comparisons between the other types of pumps. Across high gas- and electric-using households, 5 percent of respondents had a well pump. Four percent of low gas-using households had an irrigation pump. **Recommendation:** Expand beyond current pool pump offerings to include efficient irrigation and well pumps for high-using households that use this equipment. The program could also ensure that households know how much energy their equipment uses and how to use it optimally and efficiently. **Challenge:** Given the low percentage of households overall that have rarer forms of pumps (such as well pumps), it may be difficult to identify eligible customers.

Topic	Finding & Recommendation
Dishwashers and clothes dryers for high-using households	**Finding:** High-using households are much more likely to have dishwashers (69% of high-using households vs. 46% of low-using households) and clothes dryers (96% of high-using households vs. 51% of low-using households). The regression analysis highlighted the increased usage associated with having a clothes dryer in high-usage homes. **Recommendation:** Consider adding dishwasher and clothes dryer upgrades across all IOUs for households with existing old/inefficient equipment. **Challenge:** Usage frequency greatly impacts savings; consider limiting to households with minimum occupancy levels. Note that the Energy Division expressed a preference for provisions of an IOU allowance for such upgrades if required by customers or targeting of offering tied to outcomes (such as offering only in high-using or larger households), though we would caution against creating adverse incentives for high usage.
Secondary cooling for high-using households without central ACs in high cooling need areas	**Finding:** The analysis found that households across both low- and high-usage levels frequently employ more than one cooling method—typically a combination of opening windows, using fans, and operating central AC systems (though not necessarily simultaneously). Fewer than 30 percent of respondents reported relying on only one approach to stay cool, and high electricity-using households were especially likely to layer multiple strategies. Even when lower-energy options such as fans or open windows were the primary method, they were often supplemented with higher-consumption devices such as window or portable AC units. Regression results indicated that, even after controlling for climate, high-use households with central AC consumed significantly more electricity than similar high-use households without it. These findings suggest potential opportunities to support residents in optimizing their cooling approaches—through education on energy-efficient practices and upgrading older, less efficient central AC systems. **Recommendation:** ESA contractors should assess non-central AC cooling systems in hot regions to determine if they are in good condition, adequately meeting the household's needs, and being used appropriately. ESA may provide education or replacements of old and inefficient portable cooling equipment. **Challenge:** The ESA program is not currently permitted to provide AC for households that do not have a central system.[2] It may be difficult to track the impact of education regarding how to use household systems.

[2] ESA Installation Standards Manual: https://pda.energydataweb.com/api/downloads/4012/ESAP%20ISv1.4_July%201%2C%202024_s.pdf. V1.4, Section 313, 1, 1.1

Topic	Finding & Recommendation
Smart strip Expansion for high-using households	**Finding:** High-using households are much more likely to have more plug loads (power tools, medical equipment, exercise equipment, dehumidifiers). Some low-using households have concerns about fire risks from plugged items. While all electric IOUs currently offer Tier 2 power strips, current program rules only allow for a single Tier 2 power strip to be installed. **Recommendation:** Add accompanying educational material regarding how to use smart strips with flyer showing multiple applications using items common in high-usage households and savings opportunities. Increase quantity offered per household based on home occupancy and plug loads. **Challenge:** Ensuring that households use additional smart strips in terms of quantifying savings.
Furnace tune-ups and replacements for high-usage households with secondary heating methods	**Finding:** High-usage households most often supplement their furnace with secondary heating equipment regardless of heating need. This may indicate an issue with their primary system and/or an inefficient secondary system. **Recommendation:** Contractors should assess whether the primary heating system works effectively and whether households use secondary systems appropriately. They can then use this information to provide education on optimizing multiple systems for comfort and efficiency, and, when needed, arrange ESA program upgrades for outdated or inefficient primary equipment.
Multifamily heating controls for steam radiators	**Finding**: Low-using households in buildings with steam radiators lack heating system control and sacrifice comfort. **Recommendation:** The ESA multifamily program could include retrofit controls for existing central systems plus property owner education.
Second refrigerator replacements for high electricity-using households	**Finding**: 48 percent of high electricity-using households have second refrigerators compared to 21 percent of low-using households. **Recommendation**: The program should continue offering second refrigerator replacements, as nearly half of high-using households have these energy-intensive appliances.

Behavioral Interventions

Topic	Finding & Recommendation
Tailored conservation education for high-using households	**Finding:** High-using households are less likely to think conservation actions save energy and less likely to take them "always or almost always" (see Section 3.1.1); half already think they use as little energy as possible. High-using households are also more likely to have medical equipment in their homes (28% of high-using households vs. 12% of low-using households), and rates of people on Medical Baseline rates are lower than the rates of people who have medical equipment, suggesting they could benefit from learning about the Medical Baseline rate. While this would not lower usage, it would lower bills for high-usage households. **Recommendation** • Develop targeted materials and case studies showing which actions truly save energy (doing things always vs. sometimes, using central systems at certain setpoints rather than in short bursts at more extreme setpoints, updating older equipment), using matched high/low user profiles (e.g., large homes, children, multiple appliances) to demonstrate practical changes without sacrificing comfort. • Promote Medical Baseline enrollment by clearly listing qualifying equipment/conditions and benefits. • Conduct post-program follow-ups with high-using households, comparing pre- and post-treatment usage, reinforcing earlier education, and offering optional energy-auditor consultations with a review of their billing history. • Encourage educational portion of site visit to include as many residents of the homes as possible. Households with children may benefit from learning cost of running child-oriented electronics, practical ways children can help with household energy conservation, and safety considerations specific to homes with children. **Challenge:** Tailoring education may lengthen the visits. Post-program follow ups could add significant cost to program implementation.

Topic	Finding & Recommendation
Tailored safety & conservation education for low-using households	**Finding:** Some low-using households sacrifice comfort. We also heard examples in focus groups of households making dangerous heating choices (using ovens/stoves, turning off pilot lights). Some unsafe conservation practices may not save as much energy as residents think. **Recommendation – target low-using households and:** • Provide them with education on heating system and stove safety alongside program materials. This may already be included in current educational materials but it may be worth following up with respondents to make sure safety suggestions are followed. • Develop materials helping low-using households understand which behaviors actually save energy and which do not so they can focus on the most impactful behaviors and possibly improve their comfort without sacrificing bill savings. • Flag dangerous behaviors (such as using ovens for heating) that could be problematic for health, comfort, and safety (HCS) and explain why. • Include fact sheet about unsafe conservation practices and their limited energy savings.

Targeted Outreach

Topic	Finding & Recommendation
In-language outreach throughout program for low-using households	**Finding:** While ESA provides multilingual outreach materials, language barriers persist during technical phases of the program. For example, the Cantonese focus group revealed that assessment and installation visits present particular challenges when contractors lack language skills and technical concepts must be communicated accurately. Low-using households with both English and Spanish speakers are more likely to primarily speak Spanish at home. **Recommendation:** The ESA program should continue to include Spanish-language messaging specifically designed for low energy-using household outreach, recognizing that this population may have different communication preferences and conservation motivations than high-using households. **Recommendation**: ESA should revisit in-language considerations throughout the entire program process, with particular attention to assessment and installation phases. This may include: • In-language contractor training or translation services for technical visits (based on example from Cantonese focus group). • Translated technical materials and safety information. • Community outreach specific to tribal lands via tribal partners. • Coordination with the Community Help and Awareness of Natural Gas and Electric Services (CHANGES) Program, which was authorized by the CPUC as part of Decision 15-12-047. If the customer has a history with CHANGES, they may have an in-language case manager who may assist. • Follow-up support in primary languages to ensure customer satisfaction and program completion. Can coordinate with local in-language community-based organizations (CBOs) for community outreach and support during ESA follow-up visits for harder-to-reach non-English speakers. • Enhanced coordination with CBOs for ongoing language support.

2 Methods

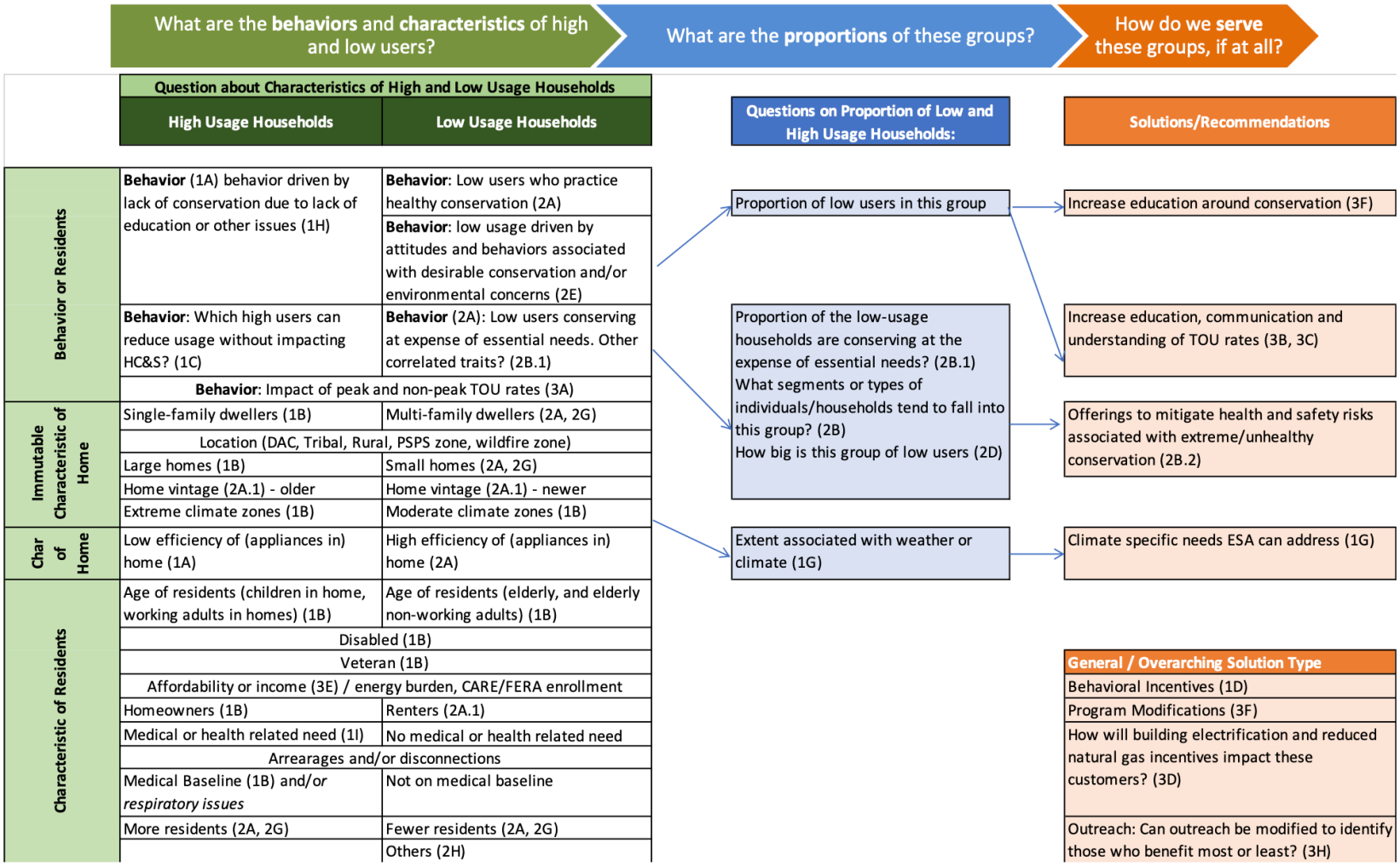
This methods section describes how Evergreen Economics defined high and low energy-usage low-income households by region and conducted research and analysis to support the characterization.

2.1 Approach to Research Questions

The research approach started with the development of a set of hypothesized characteristics of high and low usage groups (shown in the area of Figure 2 in green). Evergreen developed this list of hypothesized characteristics from our review and synthesis of findings from the 2011 Southern California Edison Low Income Energy Efficiency Segmentation Study and prior California Low Income Needs Assessment (LINA) studies along with discussion and input from the study team. Evergreen tested these hypotheses, calculated proportions (blue area of Figure 2), and developed recommendations for how these groups could be served if at all (orange area of Figure 2).

We include the research questions behind the mapping shown in Figure 2 in Appendix F, connected by the alphanumeric information in parentheses.

Figure 2: Study Research Question Mapping



2.2 Definition of High and Low Usage Customers

Table 2 provides a mapping of California's climate zones, their number of heating and cooling degree days (HDDs and CDDs, respectively), which measure the difference between the daily average temperature and a reference temperature and their Evergreen-determined climate zone (CZ) group.[3] Evergreen placed each climate zone into either a high-HDD or low-HDD group and a high-CDD or low-CDD group. This led to four categories based on the combinations of regional HDD/CDD. Those with high-HDDs and high-CDDs are expected to have large heating and cooling loads. Those with low-HDDs and low-CDDs are expected to have low heating and cooling loads and exist in more temperate climates. The IOUs provided an anonymized list of all California Alternate Rates for Energy (CARE) and Family Electric Rate Assistance (FERA) customers, which were assigned to the four CZ groups shown in the last column of Table 2.

Table 2: Climate Zone Mapped to HDD and CDD and Evergreen Categorization

CA Climate Zone	HDD	CDD	Evergreen CZ Group (heating-cooling)
1	4,295	15	High-Low
2	3,144	500	High-Low
3	3,071	183	High-Low
4	2,550	666	High-Low
5	2,654	464	High-Low
6	1,383	742	Low-Low
7	1,497	865	Low-Low
8	1,481	1,072	Low-Low
9	1,460	1,456	Low-High
10	1,685	1,620	Low-High
11	3,149	1,354	High-High
12	2,621	1,226	High-High
13	2,443	1,599	High-High
14	2,422	3,056	High-High
15	1,177	4,760	Low-High
16	5,057	596	High-Low

[3] *The Pacific Energy Center's Guide to California Climate Zones and Bioclimatic Design*. 2006. https://studylib.net/doc/8660820/california-climate-zones---pacific-gas-and-electric-company#google_vignette

For this study, high- and low-usage households are defined as the **90th and 10th percentiles of annual consumption** within a given CZ group, among the subset of homes that have:

1. At least 12 months of billing history;
2. Are not a master-metered account;
3. Are not net energy metered accounts (e.g., onsite solar generation); and
4. Have non-zero annual therm consumption (for gas) OR non-zero monthly kWh consumption (for electric).

Once all of these filters were applied, the investor-owned utilities (IOUs) were asked to rank customers by their annual usage and then identify the high usage customers (90th percentile of annual consumption, right side of Figure 3) and low usage customers (10th percentile, left side).

Figure 3: Ranked Customers to Usage Groups

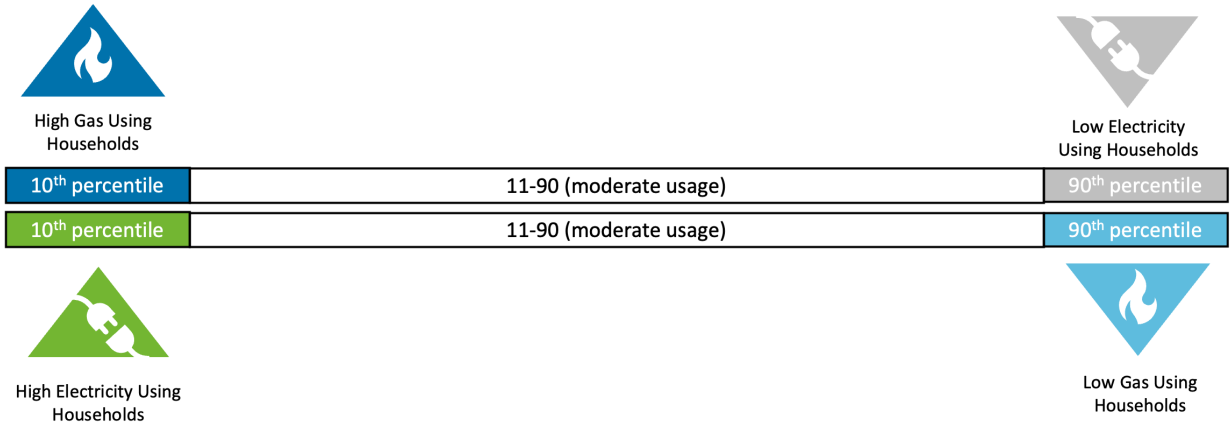


Table 3 provides the population of low-income high-usage customers by CZ group, fuel type, and IOU. Please note that the number of low-income, low-usage customers in each of these categories will be similar.

Table 3: Count of Low-Income High Usage Customers by IOU and CZ Group

CZ Group (heating-cooling)	Electric, Annual kWh				Gas, Annual therms			
	PG&E	SCE	SDG&E	Subtotal	PG&E	SoCalGas	SDG&E	Subtotal
High-High	44,708	13,839	136	58,683	51,571	18,242		69,813
High-Low	40,658	1,999		42,657	30,614	5,435		36,049
Low-High		43,910	5,164	49,074		80,400	956	81,356
Low-Low		38,482	7,547	46,029		49,383	1,711	51,094
Total	85,366	98,230	12,847	196,443	82,185	153,460	2,667	238,312

Table 4: Average Annual Consumption by Low-Income High Usage Customers

CZ Group (heating-cooling)	Electric, Annual kWh				Gas, Annual therms			
	PG&E	SCE	SDG&E	Subtotal	PG&E	SoCalGas	SDG&E	Subtotal
High-High	16,130	18,171	13,890	48,192	742	986		1,728
High-Low	12,203	18,040		30,243	790	1,081		1,871
Low-High		16,955	8,427	25,382		908	417	1,326
Low-Low		13,113	6,767	19,879		851	389	1,239

Table 5: Average Annual Consumption by Low-Income Low Usage Customers

CZ Group (heating-cooling)	Electric, Annual kWh				Gas, Annual therms			
	PG&E	SCE	SDG&E	Subtotal	PG&E	SoCalGas	SDG&E	Subtotal
High-High	1,971	2,869	8,797	13,637	84	143		228
High-Low	1,181	2,094		3,275	58	108		166
Low-High		2,388	5,761	8,149		50	342	392
Low-Low	3,117	1,740	4,745	9,602		50	332	382

2.3 Market Characterization

Evergreen Economics developed the market characterization using a number of data sources, described below. This section also includes an assessment of the relative accuracy of these data sources.

2.3.1 Data Sources

We leveraged various sources to gather data on geography, appliances, and population characteristics, as well as by IOU. The data sources relevant to each of these topic areas are included here.

Geographic Definitions

We used public data sources to identify the following key geographic designations:

- Disadvantaged communities (DACs);
- Rural areas;
- Public safety power shutoff (PSPS) zones;
- High fire threat districts (HFTDs); and
- Tribal lands.

Table 6 outlines each designation with its description, data source, and thresholds we used for classification. For example, for DACs, if 50 percent of the census tract falls within a DAC, the entire census tract was classified as a DAC. We did this to simplify mapping for analysis purposes after identifying the impact of selecting different percentages.

Table 6: Geographic Designations

Geographic Designation	Description	Data Source(s)	Threshold
Disadvantaged Community (DAC)	DACs are the top 25 percent of California census tracts with the most pollution.	CalEnviroScreen 4.0	If 50 percent of the census tract falls within a DAC, the entire tract is classified as a DAC.
Rural	Rural areas are based on housing density.	Census	If 50 percent of the census tract was rural, the entire census tract is classified as rural.
Public Safety Power Shutoff (PSPS) Zone	Public Safety Power Shutoff (PSPS) zones are defined by the California Public Utilities Commission (CPUC) according to their wildfire risk. Homes and businesses in Tier 2	CPUC Fire Threat Map	25 percent - selected bottom quarter

Geographic Designation	Description	Data Source(s)	Threshold
	and Tier 3 wildfire risk areas are more likely to experience a PSPS event. • Tier 2: An area where there is an elevated risk of wildfire. • Tier 3: An area where there is an extreme risk of wildfire.		
High Fire Threat District (HFTD)	HFTDs are areas where there is a higher risk of power line fires igniting and spreading rapidly. HFTDs are made up of two maps: • Tier 1 High Hazard Zones (HHZs) on the US Forest Service-CAL FIRE joint map of Tree Mortality High Hazard Zones. • Tier 2 and Tier 3 fire threat areas on the CPUC Fire Threat Map.	CPUC Fire Threat Map US Forest Service-CAL FIRE joint map of Tree Mortality High Hazard Zones	25 percent - selected bottom quarter
Tribal Lands/ Native Areas	Tribal areas include both legal and statistical American Indian, Alaska Native, and Native Hawaiian entities for which the Census Bureau publishes data. The legal entities consist of federally recognized American Indian reservations and off-reservation trust land areas, state-recognized American Indian reservations, and Hawaiian homelands.	US Census	>0%

Residential Appliance Saturation Survey (RASS)

The market characterization used 2019 California Residential Appliance Saturation Survey (RASS) data on heating, cooling, and ventilation equipment used by income-eligible households. The RASS identified high- and low-usage customers based on their normalized annual electric and gas consumption, calculated from utility bills that were requested from the IOUs directly.

Census American Community Survey (ACS)

Evergreen pulled 2020 Census Public-Use Microdata Samples (PUMS) data for the Public Use Microdata Areas (PUMAs) in California to characterize high and low gas- and electric-usage customers who are eligible for the Energy Savings Assistance (ESA) program.

Evergreen selected or created relevant individual and household-level variables based on logic applied to existing PUMS variables. For example, we selected veteran and disability indicator

variables and defined the multigenerational variable as senior >=1 and working age >=1 and child >=1. For the Federal Poverty Level (FPL) variable, Evergreen compared household income to household size using the 2020 poverty thresholds. We used 2020 thresholds to align with the 2020 Census data, which were the most updated data available at the granularity needed at the time of this research.[4] A list of Census variables we pulled is in Table 7.[5]

Table 7: PUMS Variables Selected and Created

Variable	Definition
Senior	Age > 64
Child	Age < 18
Ownership	Own, Rent
FPL	0 to 100% FPL, 101 to 200% FPL, 201 to 250% FPL
Home Type	Single-family, Multifamily, mobile home
Home Age	Home built before 1940, in the 1940s, 1950s, 1960s, 1970s, 1980s, 1990s, 2000s, 2010s
Energy Burden	(Annual bill $/total annual income) for electric, gas, all fuels
Heating Fuel	Natural gas, electricity, other, no heating
Multi-Generational Household	Senior >=1 and working age (>=18 & <= 64) >=1 and child >=1
Eng_span_good	English spoken “well” or “very well” or Spanish is the language other than English spoken at home
No_eng_span	English spoken “not well” or “not at all” and Spanish is NOT the language other than English spoken at home
Categorical Eligibility	Yearly food stamp/Supplemental Nutrition Assistance Program [SNAP] recipiency=1
Educational Attainment	Less than high school, high school, some college, bachelor’s degree, advanced degree

[4] Retrieved from https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html July 2024

[5] Several variables were selected or created with limited logic applied; we did not list these in Table 7. These include disability, veteran, occupancy, annual dollars spent on other fuels, annual energy bill, annual income, and home value.

Once Evergreen selected or created relevant variables, the data were to include eligible households only. We selected housing units and excluded institutional and non-institutional units. We defined eligible households as those with a household income as reported in the US Census American Community Survey (ACS) less than or equal to 250 percent of the FPL that also pay their own electric bill. These filters resulted in 26,784 selected households (or 741,224 weighted households), which accounted for 28 percent of all California households.

High- and low-usage groups were then classified based on the households' self-reported monthly energy bills. We first excluded households that had been bottom-coded (using a floor to ensure that some usage was present and that the home was likely occupied—at $4/month for electric and $3/month for gas), to ensure that we would be excluding all customers with zero energy costs for that fuel (as $0 will have been recoded as $3 or $4). High-using households had an annual gas or electric cost in the top 10 percent, and low-using households had an annual gas or electric cost in the bottom 10 percent. The self-reported monthly electric and gas costs are recorded in $10 increments, which means that we have many customers with the same self-reported annual energy cost (e.g., $240, $360). This happens more often at the lower end of energy costs than the upper end. For this reason, the number of customers with consumption that falls in the bottom 10 percent will exceed the number in the top 10 percent.

We calculated summary statistics for the eligible low- and high-usage customers. Summary statistics were computed at the household level; we applied the ACS housing-unit weight (WGTP) to obtain weighted household counts, and report percentages as the share of households and averages as household-weighted means.

Utility Data

To characterize the demographic distribution of low-income customers, we analyzed data provided directly by each IOU. These data focused on customers that were either high- or low-using households within each CZ group and included the following for each customer:

- CZ group;
- Energy usage (either high or low within CZ group);
- IOU;
- Preferred language;
- Geographic characteristics (DAC, PSPS, HFTD, etc.); and
- Customer characteristics (time-of-use [TOU] rate, CARE program participation, whether they experienced disconnections, etc.).

The data were used to analyze the prevalence of various characteristics within high and low energy-using populations for each CZ group.

2.3.2 Relative Accuracy of Each Source

The IOU data are the most reliable and comprehensive data for the geographic (e.g., DAC, climate zone) and some energy bill-related customer characteristics (e.g., TOU rate, CARE participation, disconnections) because the IOU data include the full population of low- and high-usage households.

In cases where the data are provided in both the ACS and the Residential Appliance Saturation Survey (RASS), we used the Census data. The Census ACS survey received more responses, had a greater response rate, and provides more language and outreach options than the RASS (Table 8).

Respondents to the Census provide self-reported electric and gas bills in increments of $10 per month. The 2022 Low Income Needs Assessment[6] found that relative to actual bill costs, self-reported energy costs were regularly and significantly overestimated by customers. As such, the self-reported costs identified by the Census survey are less reliable and likely higher than actual costs. Specifically, customers tend to overestimate their average electric bill by $51 and their average gas bill by $40. Although billing data used in analyses for the RASS study were based on actual energy consumption data, which are more granular and reliable, and potentially more precise definitions of high- and low-usage households, Evergreen opted to use Census because of the RASS being small and unrepresentative.

Table 8: Census ACS and RASS Data Details

Variable		Census ACS[7]	RASS[8]
Year		2019	2019
Total completes in California		184,911 housing units	39,682 individually metered 303 master metered
Response rate		88%	11%
Modes of outreach		Paper, online, phone	Paper, online
Languages offered	Cover letter	English, Spanish	English, Spanish
	Paper survey	English (Spanish upon request)	English
	Online survey	English, Spanish	English, Spanish

[6] https://www.calmac.org/publications/2022_LINA_Appendicies_120922_FINAL.pdf
[7] Retrieved from https://www2.census.gov/programs-surveys/acs/methodology/design_and_methodology/2022/acs_design_methodology_report_2022.pdf and https://www.energy.ca.gov/publications/2021/2019-california-residential-appliance-saturation-study-rass
[8] Retrieved from https://www.energy.ca.gov/publications/2021/2019-california-residential-appliance-saturation-study-rass

Variable	Census ACS[7]	RASS[8]
Phone survey	Phone assistance for 15 languages	NA
Electricity consumption	Self-reported $ costs, recorded in $10 increments. These were bottom-coded (using a floor to ensure household was more likely to be occupied) to $3 for gas and $4 for electric.	Normalized annual consumption, calculated from actual electric and gas utility bills.
Natural gas consumption		

2.4 Web and Phone Survey

Evergreen designed the web and phone survey to understand the population of low- and high-usage customers, with an eye towards what may or may not be addressable by the ESA program. The evaluation team prioritized topics that were identified in the market characterization as distinguishing factors (e.g., a driver of high usage) and if they are applicable or not to the ESA program or ESA program actions. The team also considered questions from prior LINAs and other research to aid in longitudinal data collection.

2.4.1 Implementation

Evergreen designed the survey to take 15 minutes to complete, with respondents receiving a $25 e-gift card for their participation. Ewald & Wasserman Research Consultants (E&W) implemented the survey and offered it in English and Spanish to ensure broader participation among California's diverse population.

The evaluation team deployed a multi-mode outreach strategy that included two emails sent to sampled utility customers and physical postcards mailed to customers. The postcards contained a direct URL link to the survey, a QR code, a dedicated phone number, and a contact email for technical support.

To establish credibility and encourage participation, the team provided call center notifications to the IOUs to help legitimize the study. Customers were directed to an official CPUC website for verification, and we provided IOU contact information so participants could confirm the authenticity of the survey.

2.4.2 Sampling and Weighting

Our sample frame was comprised of high- and low-using households on CARE and FERA with an active account, an email address, a compatible primary language (English, Spanish- or unknown, according to IOU data), and who had not been flagged as do-not contact. Between January and February 2025, we also excluded close to 3,000 contacts whose service address zip code was within 15 miles of the Eaton and Palisades fires in the Los Angeles metropolitan area.

Survey responses were weighted by their fuel usage strata (e.g., high gas-using household), IOU, CZ group, and home type (single-family vs. not single-family).[9] We created a separate set of weights for gas and electric service, as some customers provided responses that were relevant to two fuels (e.g., high electricity- and low gas-using household), but others were only relevant to one high or low fuel category (e.g., low electricity- and moderate gas-using household, high electricity using household with no gas service). SDG&E gas respondents were further stratified by the magnitude of their electric usage, to correct for an underrepresentation of high/low gas-using households with moderate electric usage.

2.4.3 Regression Analysis

We estimated two separate linear regression models to examine the predictors of electric energy consumption in the summer months for high-using households (n=311) and low-using households (n=340) from our survey respondent set. In this analysis, summer energy consumption is defined as total kWh used during the months of June, July, August, and September. The models include household occupancy, the presence of certain cooling equipment and other appliances, cooling degree days (CDD), and comfort decision variables as predictors of energy consumption. Table 9 defines all the variables used in these final models.

Table 9: Table of Variable Descriptions Used in the Models

Variable	Description
Summer of 2023 kWh	Total kWh from June through September
Household Occupancy	Household occupancy; grouping households where there were eight or more residents
Central AC	Dummy variable for presence of central AC
Portable AC	Dummy variable for presence of portable AC units (including window AC, swamp cooler, portable AC)

[9] We did not sample on home type but received a lower than expected (per the market characterization) number of responses from customers in single-family homes. The final weights correct for this by increasing the weight for all single-family customers and reducing the weight for non-single-family customers within a given strata.

Variable	Description
No Clothes Dryer	Dummy variable for presence of those with no clothes dryer in the home
Medical Equipment	Dummy variable for presence of medical equipment
Desire for Comfort	Dummy variable for 'a desire to be comfortable is very or extremely important'
CDD	Cooling Degree Day

We considered other predictors of energy consumption, such as the age of the primary cooling equipment, various electricity-consuming appliances, and attitudes and behaviors that align with the profiles for low and high energy-using households, but found these variables did not have a statistically significant impact on energy use.

2.5 Focus Groups

We conducted seven different focus groups, in three different locations, in four different languages, with five different cohorts. The groups are summarized in Table 10.

Table 10: Overview of Focus Groups

Group #	IOU	Language	Cohort
1	SoCalGas/ SCE	English	High electricity-using households that use two cooling strategies OR one non-central cooling system
2		Vietnamese	High and low electricity-using households
3	PG&E	English	High electricity-/gas-using households that use two heating strategies OR one non-central heating system
4		English	Low electricity-/gas-using households that are making uncomfortable or unsafe tradeoffs to keep bills low
5		Spanish	
6		Cantonese	High and low electricity-/gas-using households.
7	SDG&E	English	High electricity-/gas-using households with old heating/cooling equipment

2.5.1 Focus Group Selection Process

We selected the location and themes of each focus group through survey data analysis of 1,088 low-income customers in California. The study team and Evergreen prioritized findings that met each of the following:

1. Characteristics that were differentiated between high- and low-usage households.
2. Findings that are not already well studied (e.g., in previous LINAs or through other reputable research done in California recently); and
3. Actionable items that present an opportunity for program intervention (i.e., the program cannot force people to move into smaller homes, even though smaller homes are shown to consume less energy).

To determine the location and cohorts for the focus groups, all preliminary survey analysis findings were reviewed across electricity and gas usage (high or low) and heating and cooling zones (high or low).

3 High- and Low-Using Household Characterization

Findings are comprised of results from the high- and low-using household characterization, a survey of high and low electricity and gas customers (via phone and email in Spanish and English), and seven focus groups—three of which were in non-English languages. The intent of combining these research activities was to understand which characteristics distinguish high and lower electricity- and gas-using households, which differences may be due to climate, and what the program may be able to modify or change to help high-using households lower their energy usage and to prevent low-using households from sacrificing health and comfort in their attempt to lower energy bills.

Characteristics of high and low-using households are organized into four categories, which make up the four subsections of this section of the report:

1. Household occupant behavior
2. Home/structure characteristics
3. Appliance holdings
4. Household occupants

Findings in this section are presented only for characteristics for which there were significant differences between high and low gas-using households or between high and low electricity-using households. The characteristics that Evergreen Economics researched but did not find to be significantly different (using a two proportion z test or a chi squared test) can be found in Appendix D.

Section 4 utilizes findings from this characterization to make a set of program suggestions and recommendations.

Table 11 and Table 12 summarize characteristics of electric and gas high- and low-using households that are statistically different.[10] Given that single-fuel electric (SCE), single-fuel natural gas (SoCalGas), and dual-fuel (PG&E and SDG&E) administrators implement the ESA program, we present findings separately for each fuel type. We organized the tables by type of low-income household characteristic (in the first column). Evergreen included most of the variables in the regression modeling conducted for this study for electricity usage during the summer months. In

[10] Statistical significance was determined based on a two proportion z test or a chi squared test.

Table 11, asterisks indicate variables that we found to be statistically significant in the electricity usage model.

The research identified many characteristics that transcend fuel type. Residents in high-using households, whether using gas or electricity, are more likely to own their homes and live in larger homes, have more appliances and children in the home, prioritize occupant comfort (which includes household members with health conditions maintaining comfortable temperatures) over conservation, are more likely to reside in high fire threat districts (HFTDs), and require medical equipment. Conversely, low-using households across both fuel types are more likely to rent their homes and live in smaller homes, practice regular conservation habits, accept discomfort in exchange for energy savings, and feel more confident about their knowledge of energy-saving strategies. Interestingly, both high- and low-usage households share similar traits in terms of believing they are already doing everything possible to save energy, and their veteran or disability status, desire for lower bills, income levels (within the low income category of 200 percent of FPL), and home age.

The differences between high and low electricity-using households proved more pronounced than those between high and low gas-using households, which is not surprising given the larger number and variation in electric equipment in homes. High electricity-using households showed stronger correlations with high cooling climate zones and reported being less environmentally conscious compared to low-using households, while also having greater health needs and more children in their households.

The relationship between environmental consciousness and usage patterns revealed a counterintuitive finding: low electricity-using households reported greater environmental concern than high electricity-using households, while high gas-using households claimed stronger environmental motivations than their low-usage counterparts. However, when controlling for heating and cooling needs, these environmental importance differences disappear, suggesting that climate-driven comfort needs may be the primary driver of higher energy usage rather than environmental values.

Table 11: Characteristics of Low Income Household High and Low Electricity-Using Households

	Distinguishing (Stat. sig. differences)		Non-Distinguishing (No stat. sig. differences)
Type of Characteristic	**High Electricity-Using Households**	**Low Electricity-Using Households**	**Both High and Low Electricity-Using Households**
Household Occupant Behavior, i.e.: • Awareness of how to save energy • Conservation behaviors • Concern about the environment • Priorities around energy savings v. comfort	More likely to say saving energy is not a priority. Less likely to say they take energy actions "always." More likely to prioritize comfort over energy savings.* Less willing to be uncomfortable.	More likely to say they use as little as possible and that they are confident in how to save energy. More likely to believe conservation activities contribute to bill savings. More likely to practice conservation "always or almost always." More willing to sacrifice comfort. Place more importance on protecting the environment.	Similar rates of thinking they already use as little energy as possible.
Home Structure Characteristics, i.e.: • Home type (single-family v. multifamily) • Size of home • Home age • Climate zones	More likely to own their home. More likely to be in single-family homes. More likely to be in homes >=1,000 square feet. More likely to be in Public Safety Power Shutoff (PSPS) zones and HFTDs and high cooling need zones. 9% of low-income households in tribal areas are high electricity-using customers.	Homes <1,000 square feet rarely use high amounts of energy. More likely to be in moderate regions that need less cooling in the summer. Less likely to be in PSPS zones and HFTDs. Greater proportion of renters.	Similar home ages.

	Distinguishing (Stat. sig. differences)		Non-Distinguishing (No stat. sig. differences)
Type of Characteristic	**High Electricity-Using Households**	**Low Electricity-Using Households**	**Both High and Low Electricity-Using Households**
	For each additional 100 cooling degree days (which average 2,500 per year across the sample), high-using households will use an additional 90 kWh over the summer (June – September), while low-using households will use an additional 19 kWh.**		
Appliance Holdings • Heating/cooling • Appliances • Electronics/plug load	More likely to have electrical tools and other equipment (like clothes dryers*): 44% have power tools (vs 12%). 34% have medical equipment* (vs. 12%). 20% have exercise equipment (vs. 3%). 40% have central AC (vs. 21%).* Note that these appliance holdings have a range of energy usage that was not evaluated as part of this needs assessment.	Nearly half report no extra equipment beyond "standard" appliances (washer, dryer, fridge, stove, water heater). Less likely to have clothes dryers. Fewer households have washers and dryers. 21% have central AC (vs. 40%).* Low-using households with portable AC units use an additional 110 kWh over the summer compared to high-using households.**	
Household Occupants • Number of occupants • Seniors/children	More likely to have children in the home (53% vs. 23%). More likely to have a larger number of people in home.*	Less likely to have children in home More likely to have 1-2 people in home.*	Similar rates of households that speak both English and Spanish, but different primary language patterns.

	Distinguishing (Stat. sig. differences)		Non-Distinguishing (No stat. sig. differences)
Type of Characteristic	**High Electricity-Using Households**	**Low Electricity-Using Households**	**Both High and Low Electricity-Using Households**
• Medical issues • Language preferences	Survey found more households with seniors (though secondary data showed more households with seniors in low usage homes). If both English and Spanish are spoken in home, more likely to primarily use Spanish. More likely to be on Medical Baseline rate. 35% have health issues requiring more heating/cooling vs. low-using households (20%).		

*Variable was found to be statistically significant in the regression model for electricity usage during summer months.
**Finding derived from regression analysis exclusively.

Table 12: Characteristics of Low Income Household High and Low Gas using households

Type of Characteristic	Distinguishing (Stat. sig. differences)		Non-Distinguishing (No stat. sig. differences)
	High Gas-Using Households	Low Gas-Using Households	Both High and Low Gas - Using Households (Non-Distinguishing)
Household Occupant Behavior, i.e.: • Awareness of how to save energy • Conservation behaviors • Concern about the environment	Less likely to say they take energy actions "always." More likely to prioritize comfort over energy savings. Less willing to be uncomfortable.	More likely to say they use as little as possible. More likely to practice conservation "always or almost always." Place less (*different from low electricity-using household findings*) importance on protecting the environment. More willing to endure cold. More likely to believe conservation activities contribute to savings. More willing to sacrifice comfort.	
Home Structure Characteristics i.e.: • Home type (single-family v. multifamily) • Size of home • Home age • Climate zones	More likely to be in single-family homes. Less likely to be in homes <=1,000 square feet. More likely to be in PSPS zones and HFTDs and high cooling need zones.	Homes <1,000 square feet rarely use high amounts of energy. More likely to rent their home. More likely to be in moderate regions that need less heating. Less likely to be in PSPS zones and HFTDs.	Similar home ages.
Appliance Holdings • Heating/cooling	Primarily heat with furnaces (39%) and more likely to use secondary heating in colder regions.	Primarily heat with portable space heaters (28%).	Secondary heating is used similarly in temperate regions.

Type of Characteristic	Distinguishing (Stat. sig. differences) High Gas-Using Households	Distinguishing (Stat. sig. differences) Low Gas-Using Households	Non-Distinguishing (No stat. sig. differences) Both High and Low Gas - Using Households (Non-Distinguishing)
• Appliances • Electronics/plug load	More likely to have medical equipment and power tools. (though not as drastic of a difference compared to electric fuel category).	Less likely to have additional equipment. Greater proportion of renters.	Both have older heating equipment (though proportion of high-using households increases with appliance age).
Household Occupants • Number of occupants • Seniors/children • Medical issues • Language preferences	More likely to have children in the home (51% vs. 32%) – though not as drastic of a difference compared to electric comparison. More likely to have larger number of people in home. Survey found more seniors in household. More likely to be on Medical Baseline rate.	Less likely to have children in the home. More likely to have 1-2 people in home.	Similar rates of bilingual households but different primary language patterns. Similar rates of health issues requiring more heating (19-20%).

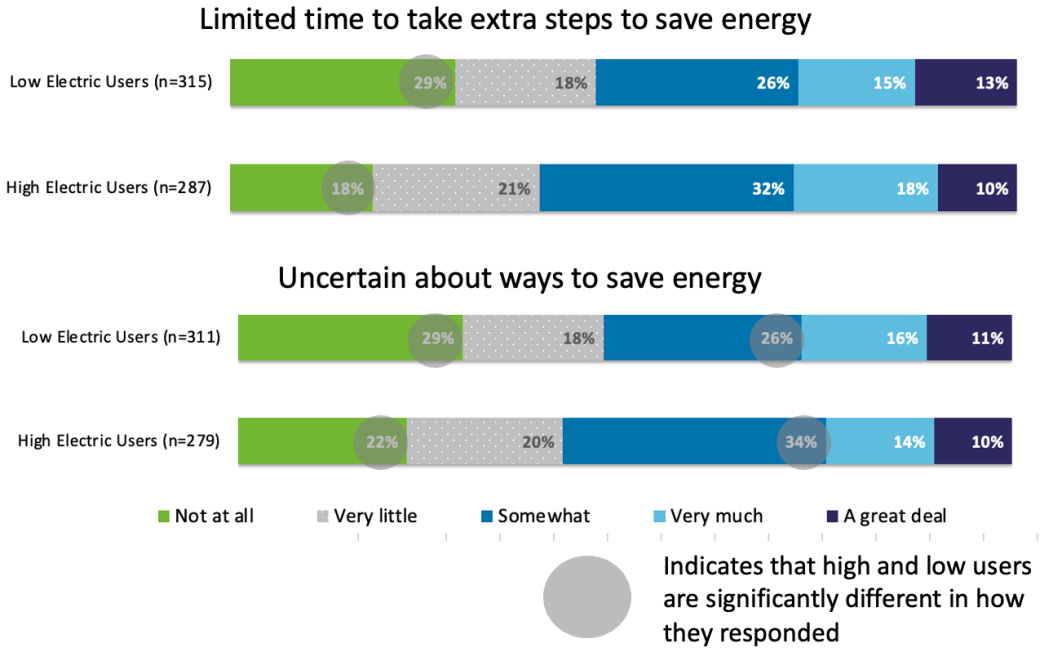
3.1 Household Occupant Behavior

This section focuses on household occupants' awareness, motivations, and behaviors around saving energy. In the survey, we asked about awareness of what types of activities save energy, barriers to saving energy, and the tradeoffs between comfort and bills.

3.1.1 Awareness of Energy Saving Activities

When asked "How much does each of the following impact your household's ability to reduce energy use", **low-using electric households are more confident that they know how to save energy** and that they **have time to take energy saving actions** (Figure 4).

Figure 4: How Each of the Following Response Options Impact Respondent Household Ability to Reduce Energy Use



To better understand if high-using households have a different understanding of what activities save energy *and* to see if these households differ in how often they take on energy-saving activities, we asked survey respondents to report about how much they *think* something saves energy, and how often they act on specific activities (Table 13).

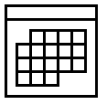
In general, belief that something reduces energy usage lines up with action taken.

Low-using households are **almost always more likely than high-using households** to:

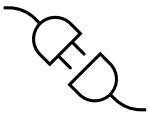
1. Believe that an energy-saving activity will in fact contribute to energy savings; and

2. Report acting on that activity "always or almost always" more frequently than their high-using counterparts. More specific findings related to this line of questioning can be found in Figure 6.

Table 13: Difference in Motivations between High- and Low-Using Households[11]

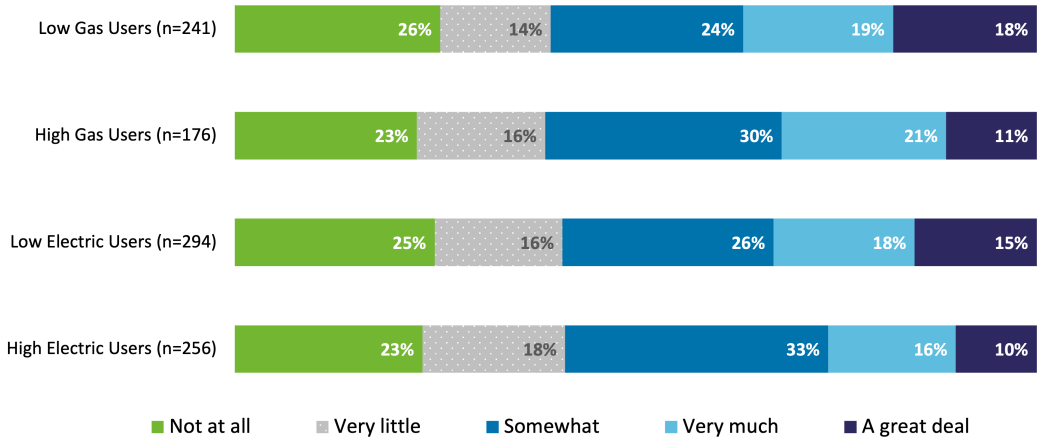
Action		High-Using Households	Low-Using Households
Turning off lights 	Belief		**More likely to say it contributes to saving energy** (electric low-using households).
	Action	Over 80 percent reported doing this often to always.	Even more likely (compared to high-using households) to do this "**always** or almost always."
Adjusting thermostat 	Belief		
	Action	Over 60 percent reported doing this often to always.	Similar when climate differences are not considered. More likely to say they do this "**always** or almost always" **In places that require cooling**. No significant difference between high- and low-using households in places that require more heating (accounting for fuel tied to heating system).
Running appliances less frequently 	Belief		Reported **higher confidence that running appliances less frequently** reduces energy use more than their high-using counterparts.
	Action	Over 50 percent reported doing this often to always.	More likely to say they do this "**always** or almost always."

[11] The response option "Keeping up with appliance maintenance (e.g., replacing air filters, HVAC service)" did not reveal statistically significant differences between high- and low-using households, and was excluded from this table.

Action		High-Using Households	Low-Using Households
Unplugging chargers, appliances, or other items when not in use 	Belief		Reported **more confidence that unplugging things reduces energy** use more frequently than their high-using counterparts.
	Action	Over 40 percent reported doing this often to always.	More likely to say they do this "**always** or almost always."

Participants were asked, "How does each of the following impact your household's ability to reduce energy use?" While low-using households were more likely to take energy saving actions, when participants were asked, "How does each of the following impact your households' ability to reduce energy use?", high- and low-using households were similar in their belief that there is nothing more they can do to save energy (Figure 5).

Figure 5: How Respondents Understand "There is nothing more we can do to save energy" as Impacting Their Ability to Reduce Household Energy Use

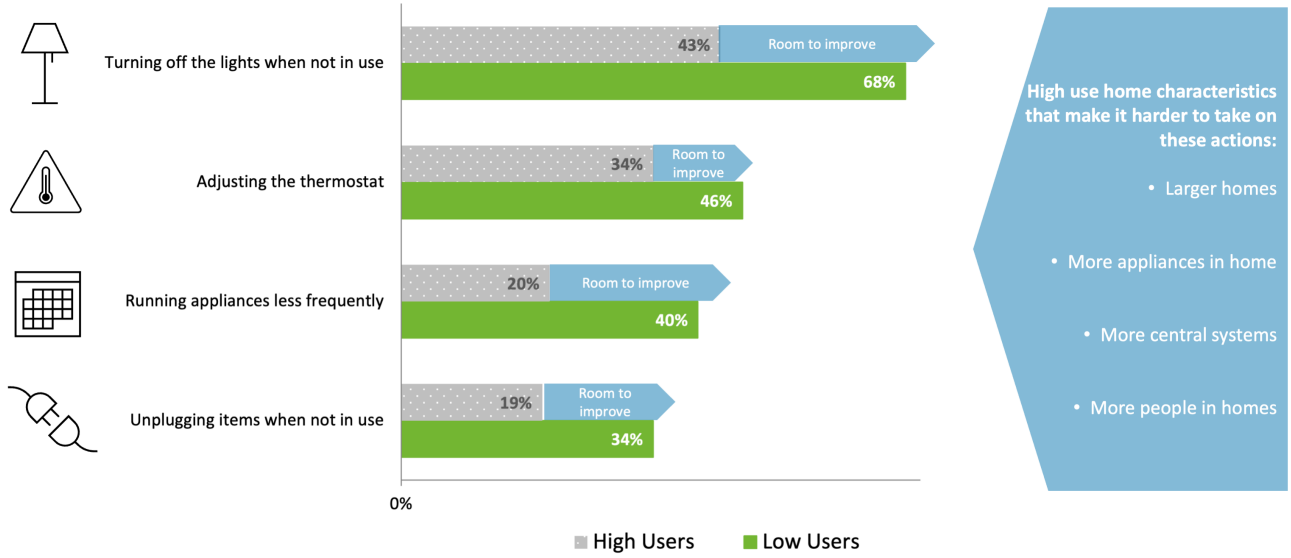


Focus group participants from low-using households underscored these findings. They emphasized the importance of following energy efficiency guidelines in the home. For example, one said, "when I'm going to use a lamp, I only plug it in at night when I'm going to use it. So that's my routine, you know, so if I'm going to use anything electrical, that's when I plug it. When I finish, I unplug it."

Looking just at respondents who reported doing an energy saving action "always or almost always," and comparing high- and low-using households, we see that there is room for high-using households to "improve" (in blue in Figure 6) or become more like the low energy-using

households in how often they turn off lights, adjust the thermostat, etc. This may be an added burden for high-using households given that they often have larger homes, more residents, and more appliances.

Figure 6: Percent of High- and Low-Using Households Who Take Energy Saving Section Always or Almost Always



Focus groups reflected similar findings in that participants from high-using households were less likely to discuss how to save energy compared to low-using participants. High-using participants were more willing to discuss ideas to stay comfortable that included appliance use and were less likely to discuss extreme conservation tips (like turning off pilot lights or hand washing laundry).

High-using households in focus groups were also more likely to report that they had already participated in utility programs and had more recommendations to improve those programs than low-using households. For example, one high-using household focus group attendee had participated in a weatherization program and was dissatisfied with the appearance of the measures that were installed. Another wished there were more brand/aesthetic options in the appliance replacement programs in which they participated.

Time-of-Use Rates

High and low electricity-using households are both on time-of-use (TOU) rates in similar numbers (45 percent of low electricity-using households and 46 percent of high electricity-using households based on provided IOU data). As part of this study, we investigated how high- and low-using households are impacted by peak and non-peak TOU rates, how their understanding of the rates impacts their usage, and how the IOUs can improve customer communication and education on TOU rates.

Impacts of TOU Rates

Prior studies of the impacts of TOU rates reported nuanced findings from low-income customers. A study conducted in 2019 found that once low-income customers were enrolled in TOU rates, they were split on how they adjusted their behavior. Low-income customers were more likely to reduce or shift their usage of office equipment and entertainment systems, but not for more energy intensive and schedule-dependent tasks such as doing laundry, running the dishwasher, or heating/cooling their home.[12] Another study from the American Council for an Energy-Efficient Economy (ACEEE) found that low-income customers were disproportionately affected by TOU rate designs because they have less discretionary energy usage, which limits their ability to respond to changes in energy prices. The same study recognized that there have been conflicting studies in the past that showed that low-income customers actually reduced their peak-load more than non-low-income customers in the sample.[13] The split findings may be indicative of the difference in high and low energy-using households within the low-income respondents.

While we did not ask directly about TOU rates in focus groups, many participants mentioned these rates as a factor in their energy usage, without any prompting. This indicates that there is awareness in this population of TOU rates. Our focus group found that both low- and high-using household groups expressed practical difficulties with shifting their load to off-peak hours, echoing some of the findings in the ACEEE study. They mentioned that peak hours coincide with when they return home from work and need to cook, shower, and use electricity. Others mentioned that in their large households, they cannot control who is using energy and when.

Low-using households we spoke with were also more likely to mention energy saving activities that had lower energy impacts, such as turning off the lights or their TV during peak hours.

Understanding of TOU Rates

The 2019 study found that low-income customers were less aware of TOU rates than non-low-income customers (28% vs. 38%), and that their preference for TOU rates increased with experience on the new rates. Few low-income customers reported that they preferred TOU rates prior to joining a pilot program on the rates (19%). After the first year, however, over a third (34%) said they preferred the rates. Notably, the non-low-income group showed similar findings, with 17

[12] Folks, J. and Z. Hathaway (Opinion Dynamics). 2020. "Assessing Equity in TOU: How Low-Income Customers Fare on Time of Use Rate. Presented at the American Council for an Energy-Efficient Economy Summer Study. https://opiniondynamics.com/wp-content/uploads/2021/06/2020_ACEEE-Summer-Study_Assessing-Equity-How-Low-Income-Customers-Fare-on-TOU_Rates_Folks.pdf

[13] Baatz, B. 2017. *Rate Design Matters: The Intersection of Residential Rate Design and Energy Efficiency*. Washington, DC: American Council for an Energy-Efficient Economy https://www.aceee.org/sites/default/files/publications/researchreports/u1703.pdf.

percent preferring TOU rates prior to joining the pilot program and 36 percent preferring the rates after a year of being on them. This suggests that people may adapt to TOU rates over time.

In the focus groups, we heard that for some, the rate plan options were confusing, and they wished for support from their utility to help them choose the plan that would be best for them. One participant reported that they reached out to their utility to learn more but were told that the utility could only give them the information and could not advise them on which plan to choose. They were frustrated by this and said, "I still am not a hundred percent [sure] that I'm… doing the right thing."

3.1.2 Motivation around Saving Energy

While high- and low-using households all reported a similar desire to keep energy bills low, there were differences in how they responded to survey questions about:

- How they think about their household's energy bills;
- The importance of comfort; and
- Their desire to protect the environment.

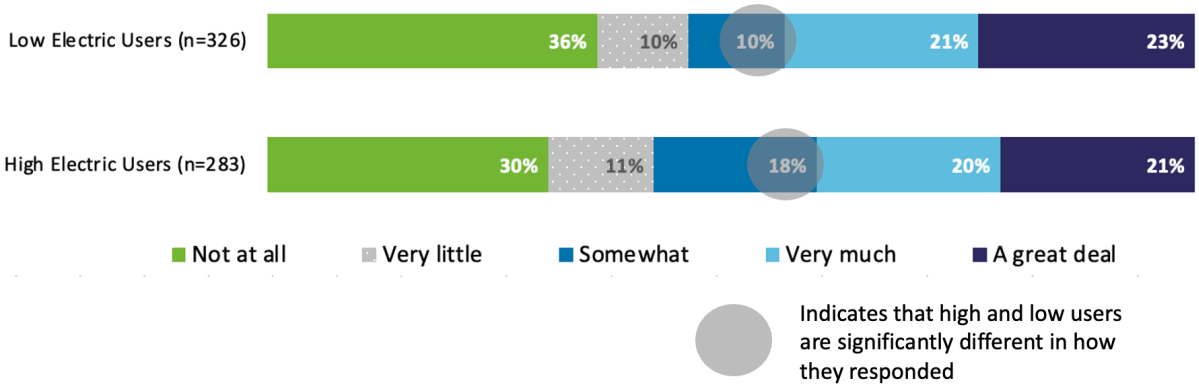
Table 14 details these differences such as low-using households being more likely than high-using households to think that they use as little energy as possible.

Table 14: Differences in Motivations between High- and Low-Using Households

Motivation	High-Usage Households	Low-Usage Households
How they think about household energy bills	Half think they **already use as little energy as possible.**	Even more likely to say they **use as little as possible** (64 to 72%).
The importance of comfort	More likely to **prioritize desire to be comfortable** than low-using households.	
Their desire to protect the environment		Place more importance on **protecting the environment** (true for high electricity-using households, not as significant for high gas-using households).

When asked about barriers to saving energy, high electricity-using households were also more likely to say that **saving energy is somewhat of a priority** in their lives when compared to low electricity-using households (Figure 7). When combined with other response categories, the significance finding disappears, suggesting these groups only differ in the middle ("somewhat") response category.

Figure 7: Reported "Saving Energy is not a Priority" as a Barrier



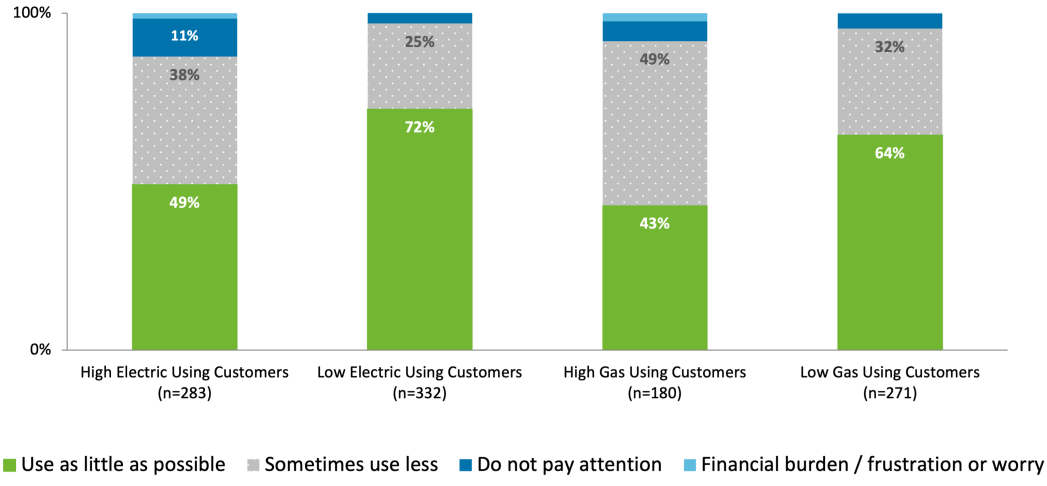
Source: Customer survey

Bill Considerations

While there was no significant difference between low- and high-using households with regards to *a **desire** to keep energy bills low,* there were differences in *how they "think" about their bills.* This identifies an **important distinction between desire and action**.

Low-using households, as expected, **reported using as little energy as possible** much more than their high-using counterparts, a statistically significant difference (Figure 8). Despite this, we still see that **half of the high-using households reported using as little energy as possible, suggesting that they do not see any opportunities to reduce energy usage.**

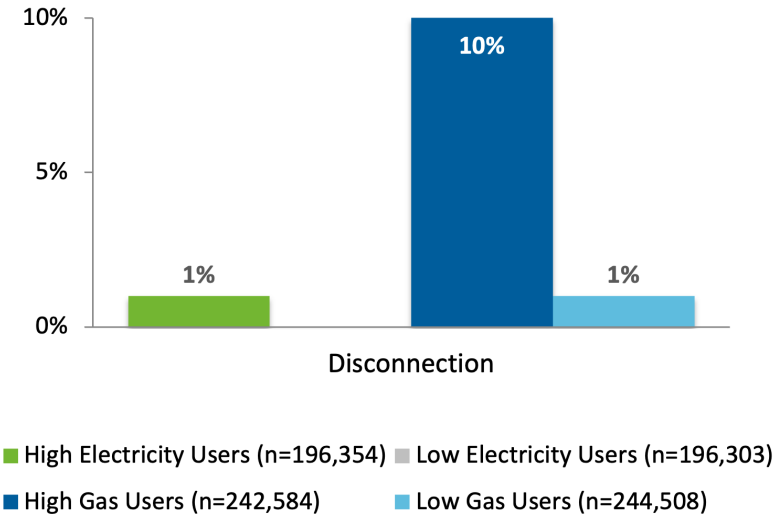
Figure 8: How Households Think About Energy Bills by Usage Type



Source: Customer survey

In the figure above, the light blue portion shows that high gas-using customers were most likely to report that their bills are a financial burden/frustration or worry (2%, though this finding is not statistically significant). We see this reflected in the broader IOU data on high- and low-using households, with high gas-using customers much more likely to experience a disconnection event (Figure 9).

Figure 9: Percentage of Households with a Disconnection Event



Source: IOU Customer Data

Focus group participants echoed these thoughts on bills. Low energy-using groups reported that they all had regular discussions with neighbors about energy costs and strategies to keep their bills low. They were aware of various assistance programs, and some receive and review monthly comparison reports from their IOU. Many participants expressed frustration that despite using energy-efficient appliances and following guidelines to keep their energy low, their bills still remain high due to rate increases that they do not understand.

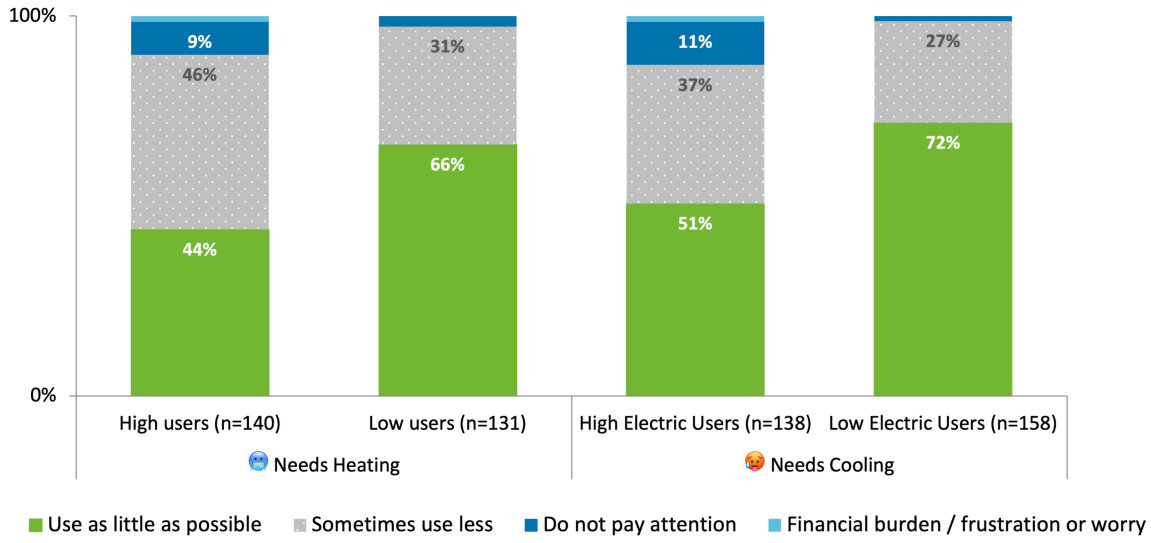
In both low- and high-using household focus groups, participants knew the dollar amounts of their typical electricity bills. There were conversations about exactly how much a specific program saved them on their monthly bills and about when additional line item fees were added to their bills by their utilities. This suggests that both low- and high-using households are highly engaged with their utility bills and see themselves as looking for ways to save.

Climate Considerations

To understand how climate heating and cooling needs factor in motivations around saving energy, we filtered respondents to just those whose primary heating or cooling fuel aligned with their primary heating or cooling technology (Figure 10). When we looked at cooling, we only looked at

electric customers, since all cooling equipment is electric. When we looked at heating, we placed households in the "high-using household" group when they had a heating appliance that used a fuel that matched their high-usage category. For example, a high gas household with a gas furnace would be considered a high-using household, but if the high gas household had an electric space heater, they would not be counted in the high-usage category. **The same findings hold true when accounting for climate and HVAC fuel, with low-using households once again being more likely to say they "use as little as possible."** Low-using households almost never said that they "do not pay attention" to their energy bills, whereas close to 10 percent of high-using households did not pay attention. This was highest amongst electricity-using households in places that needed heating *and* cooling, suggesting that working across multiple seasons to reduce usage was too challenging for some high-using households.

Figure 10: How Households Think About Energy Bills by Usage Type and Heating and Cooling Needs



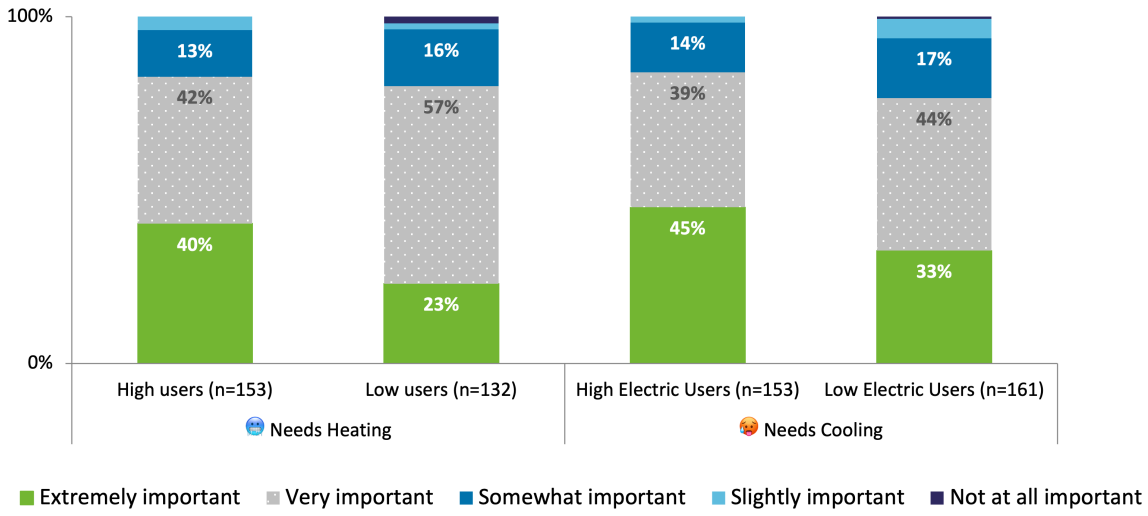
The Importance of Being Comfortable

Comfort can be defined differently by customers and may be different for a healthy adult compared to a senior with health issues. We focus on cooling and heating focused on health when we discuss appliances and in this section we focus on how high and low users differ in how they place importance on comfort. While *electric* high- and low-using households do not differ with regards to comfort**, high gas-using customers were much more likely than low gas-using customers to say that a desire to be comfortable is "extremely important"** (41% vs. 22% of low gas-using households).

Further analysis shows that this also holds true when isolating for heating and cooling needs. To further confirm that **high-using households place more importance on comfort**, Evergreen

filtered respondents to just those whose primary heating or cooling fuel aligned with their primary heating or cooling technology. Figure 11 shows that high-using customers are much more likely to say that being comfortable is "extremely important" compared to their low-using counterparts, even when compared to respondents with similar needs regarding heating and cooling. This statistically significant difference only exists when comparing "extremely" to "very." When those two response options are combined, high- and low-using households look much more similar.

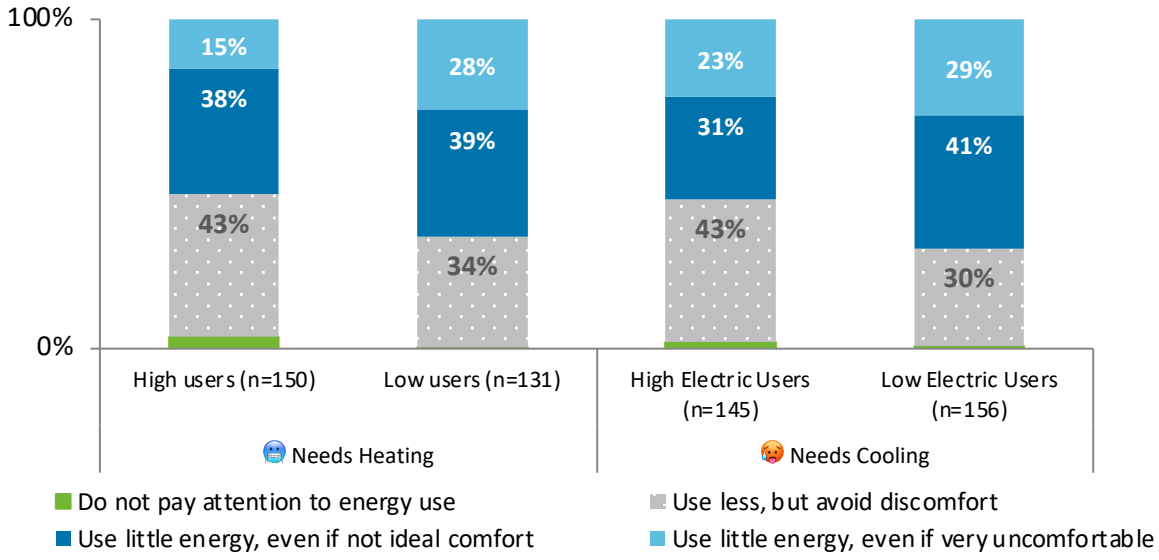
Figure 11: Importance of Being Comfortable by Heating and Cooling Needs and Usage Type



Source: Customer Survey

Figure 12 uses the same classification of high- and low-using households by heating and cooling needs and again supports the finding that customers in the **low-usage group are more likely than their high-using counterparts to say they use little energy, even if they are not at an ideal comfort level** (while this is statistically significant for the cooling group, it is not statistically significant for those who need heating). **The group that needs more heating has low-using households willing to "use little energy, even if very uncomfortable" at higher rates than the high-using counterparts**, suggesting that low-using households are more willing to sacrifice comfort when heating their homes.

Figure 12: How Households Think About Comfort by Heating and Cooling Needs and Usage Type



Source: Customer Survey

Focus group discussions added nuance to the type of discomfort that low-using households reported enduring. Participants in the low-using household focus group reported that they all make decisions that are primarily cost-driven rather than comfort-driven. Participants cited extreme conservation strategies, such as choosing to "heat the person, not the space," enduring the cold, making dangerous trade-offs to stay warm, and avoiding using or rationing energy-using appliances. We heard many stories of constant vigilance on conserving energy. Table 15 provides examples.

Table 15: Focus Group Examples of Low-Using Household Energy Reduction Approaches

Theme	Details	Quotes
Heating the person, not the space	Low-using households opt to warm their bodies rather than the living space. This includes wearing multiple layers of clothing, using electric blankets and heating pads, and creating makeshift warming solutions.	"I take a really hot shower at night and then just bundle up like when I go to bed. I sleep in yoga pants, three flannel pants, fleece top, flannel tops, scarfs, and beanie, plus multiple blankets." "When my granddaughter comes, because it is so cold… I use the two-liter Coke bottle. I put hot water and wrap it and I said, okay, put your feet in here. And my apartment is very cold, very cold. So that's what I do."
Enduring cold/heat	Rather than using heating/cooling systems, they simply tolerate the cold/hot indoor temperatures.	"Oh, I will tolerate the heat. I don't want to pay for the air conditioning." "I just basically just cope with it just bite the bullet."

Theme	Details	Quotes
	Participants accept discomfort as inevitable.	
Potentially unsafe tradeoffs to stay warm	Participants resort to potentially hazardous methods to generate heat. This includes using kitchen ovens and stoves as heaters and blowing out their pilot light. Blowing out a pilot light can cause the gas to stop on newer appliances with thermocouples but will not turn off the gas on older appliances.	"I closed all my windows, all my doors, bathroom door, you know, my door in the bedroom and I turn the oven, wait a little bit, open it up, when the heat comes out, then turn it back out, you know, close it and that's it." "I like doing the burners on the stove" "Well, the pilot's supposed to have a little light here, pilot light. This one is like a little torch, and you can actually hear it. So that's too much gas wasting all day, all week, with that thing going off, it gets expensive. So I just shut it off. I don't need it."
Avoiding or rationing	Participants engage in extreme rationing behaviors, such as using appliances for five minutes at a time or avoiding them entirely (despite owning them).	"I never use my heat hardly ever... Turned on for like 10 minutes. That's it." "So if really super hot I will turn on the AC and drop down the temperature and then I turn off. I don't use that much." "So they did just install air conditioning maybe a couple a month ago... I have not tried the air conditioning."

Steam Radiator Heating System Challenges

Focus group participants from the San Francisco groups revealed significant challenges with **steam radiator heating systems** in older buildings. Many live in historic buildings where radiators are centrally controlled by building management, leaving tenants with no ability to adjust temperatures to their comfort level. This lack of control creates two problematic scenarios:

1. During cold periods when the building heat is not scheduled to run, residents must rely on portable space heaters or other supplemental heating methods. Several participants expressed safety concerns about space heaters, with one participant discontinuing their use entirely due to fire risk, choosing instead to layer clothing and "ride it out" until the scheduled heating times.
2. When radiators are running but apartments become too warm, residents resort to opening windows to cool down—a practice multiple participants admitted to despite its obvious energy waste. One specifically mentioned keeping windows open while using supplemental heating, highlighting the inefficiency of these competing systems.

Additionally, building managers often warn tenants against adjusting radiator controls, claiming it could "mess up the whole system" or damage the boiler. **This creates a barrier where residents feel unable to optimize their comfort or energy use**. As a reminder, the participants who reported radiator concerns were low electricity-using households, and their primary heating source is unlikely to be a part of their bill. These radiator users represent a particularly vulnerable population, forced to choose between discomfort, safety risks from space heaters, or wasteful practices such as heating with windows open—all while having minimal control over their primary heating source. In the survey, less than 2 percent of respondents mentioned having this form of heat, suggesting that it is not a large concern of low- and high-using households that we surveyed. This is likely in part due to our exclusion of master metered customers in our survey recruitment group.[14] This concern may be more specific to low-income customers in places such as San Francisco.

The Multifamily Energy Savings (MFES) program[15] currently supports replacements of central HVAC systems, but a co-payment from the property owner is required. Alternatives to support these steam-heated buildings could include retrofitting modern controls onto the central systems to allow for better individualized controls, or education for property owners on how to improve efficiency and comfort while using steam heat systems. In the state of New York, which has a high prevalence of steam-heated buildings, National Grid provides incentives for thermostatic radiator valves and boiler controls. It also offers services such as steam system balancing, steam trap repair, and properly insulating steam pipes. A study conducted for the National Renewable Energy Laboratory (NREL) in 2013 found that simple venting upgrades and new controls showed significant savings on natural gas-heated steam boilers.[16]

A Desire to Protect the Environment

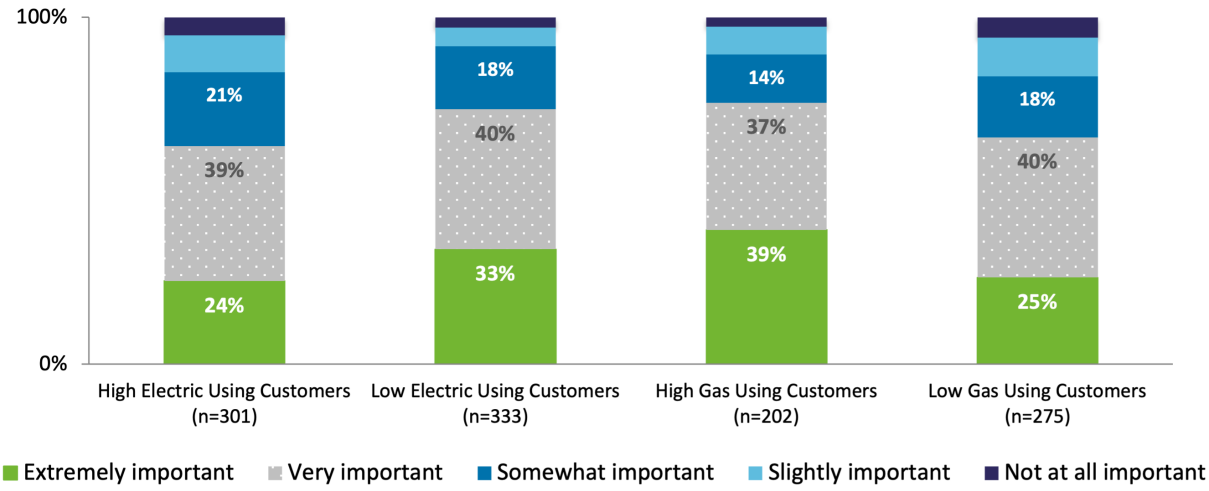
Low electricity-using households reported placing more importance on protecting the environment than their high-using counterparts. The inverse is true when comparing high and low gas-using households—with high-using gas customers being more likely to say that their desire to protect the environment is extremely important (Figure 13). When this is isolated by heating and cooling need, this difference in importance of protecting the environment disappears, suggesting that this is more driven by climate than by environmental perspectives.

[14] Given this type of system is present in multifamily buildings, respondents may not always know that their building uses this type of system, so this may be under-reported.

[15] The MFES program serves deed and non-deed restricted multifamily buildings in IOU service territories with cost-effective energy efficiency and weatherization measures to tenants and property owners.

[16] Choi, J., P. Ludwig, and L. Brand. 2013. *Steam System Balancing and Tuning for Multifamily Residential Buildings in Chicagoland - Second Year of Data Collection*. Washington, DC: US Department of Energy Building Technologies Office. https://docs.nrel.gov/docs/fy13osti/60003.pdf

Figure 13: Importance of Protecting the Environment by Usage Type



In focus groups, we heard examples of environmental consciousness, but they were less important than financial motivations to save money.

3.2 Home/Structure Characteristics

This section focuses on home characteristics that impact energy usage. While many of these characteristics are not treatable by the program, they may impact targeting for specific program features. Given that these are immutable characteristics, we have condensed this discussion and provide expanded information in Appendix G.

Home Type and Size: High energy-using households are predominantly in single-family homes, with a dramatic shift in energy consumption occurring in homes larger than 1,000 square feet. Only 11-12% of high-usage customers live in multifamily buildings, suggesting different program needs for this segment.

Household Composition: Large households (6+ members) are almost exclusively high users, while low-usage households are typically 1-2 person households. High-usage households are more likely to be homeowners rather than renters.

Geographic Patterns: Strong correlation exists between electricity usage and cooling demand, with high-usage customers concentrated in high cooling climate zones (34% vs 18% for low users). High-usage households are also more prevalent in PSPS zones, HFTDs, and tribal areas (9% vs 1% for low users).

Rental Market Challenges: Consistent with 2022 LINA findings, landlord-tenant dynamics remain a significant barrier, with renters citing fears of rent increases, skepticism about free programs, and

minimal landlord communication as ongoing obstacles despite the 2021 creation of separate ESA multifamily programming.

These structural factors are largely non-treatable through ESA interventions but provide critical targeting insights for program design, outreach strategies, and identifying households with different service needs across building types and geographic areas.

3.3 Appliance/Electronic Holdings

This section reports on differences in high-using and low-using households by the types of equipment they have in their homes. The study explored the impacts of non-HVAC equipment, medical equipment, and space cooling and heating.

3.3.1 Non-HVAC Equipment

High-using households are more likely to have equipment beyond what might be considered standard (ranges/ovens/stovetops, dishwashers, clothes washers, clothes dryers, water heaters, freezers). Figure 14 shows that nearly half of low electricity-using households reported not having any extra equipment such as second refrigerators, EV chargers, air purifiers, dehumidifiers, medical equipment, projectors, exercise equipment, saunas, power tools, water features, large fishtanks, hot tubs, pools (heated and unheated), and pumps.

Figure 14: Amount of Additional Equipment in Households by Energy Usage

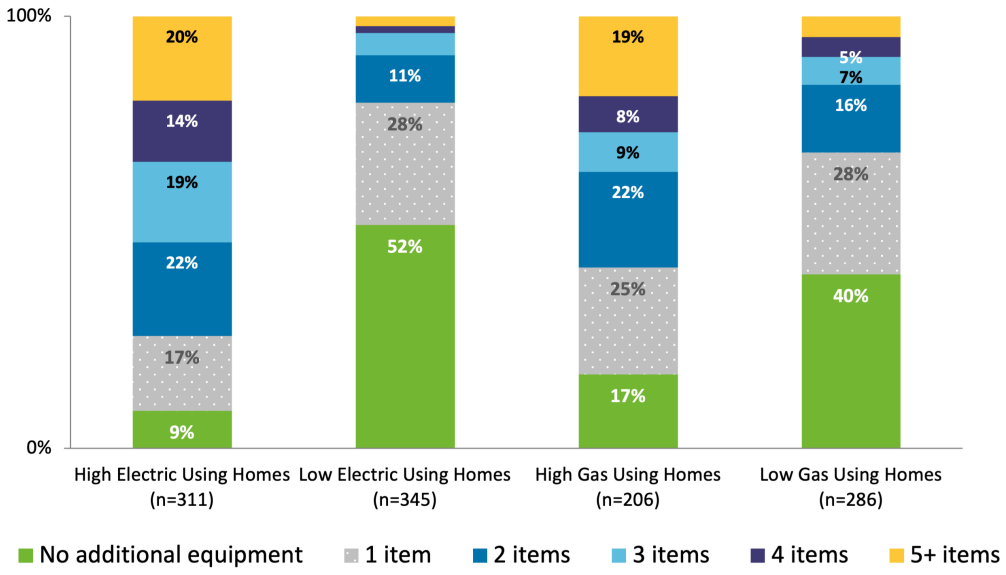


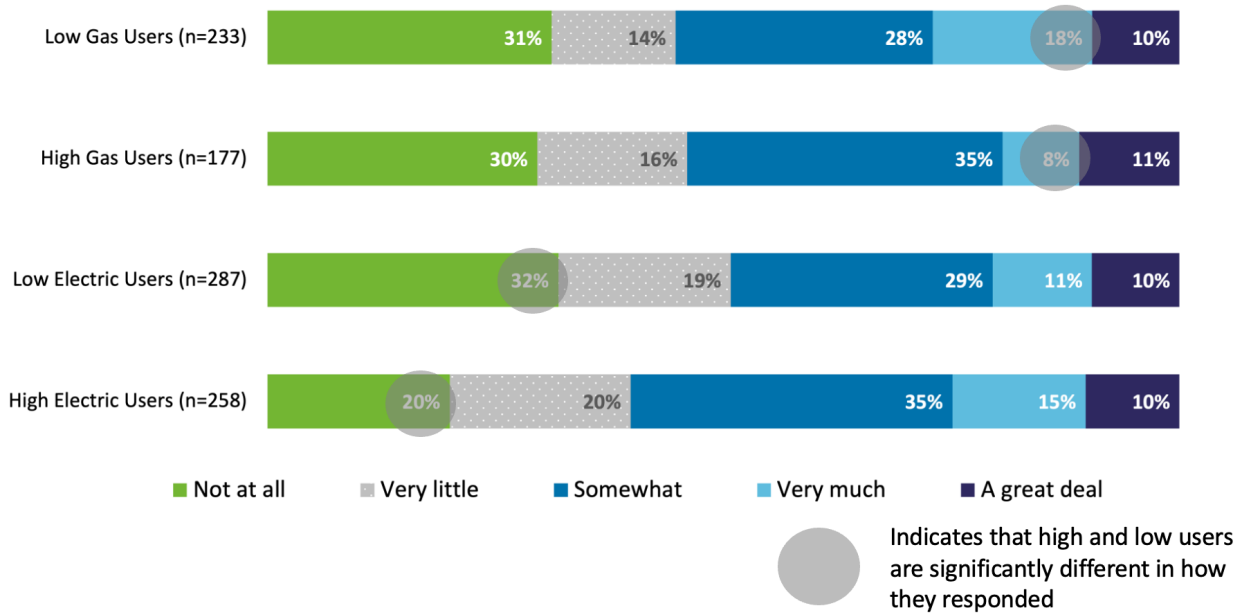
Table 16 maps the prevalence of non-HVAC equipment in each usage group to IOU program offerings, where relevant. In some cases, there are unlikely to be measure upgrades that make sense to offer, and a smart strip may be the best way to manage usage (see plug load category). The table is shaded as a heat map to show where percents are lower (orange) and highest (green).

Table 16: Equipment in Households by Energy Use and Existing IOU Offering

	Equipment	By Usage Type				Offered or Not by IOU Program[17]			
		High Electric Using Homes (n=311)	Low Electric Using Homes (n=345)	High Gas Using Homes (n=206)	Low Gas Using Homes (n=286)	PG&E ESA	SDG&E ESA	SCE ESA	SoCalGas ESA
Appliance/White Good	Oven/Stovetop	98%	95%	99%	97%	No	No	No	No
	Clothes Washer	97%	47%	97%	60%	Yes	Yes	Yes	Yes
	Clothes Dryer	95%	42%	96%	59%	No	No	No	No
	Dishwasher	77%	38%	63%	51%	No	No	No	No
	Freezer	50%	18%	41%	17%	Yes	Yes	No	No
	Second Fridge	48%	21%	52%	26%	Yes	Yes	Yes	No
	Air Purifier	34%	15%	27%	23%	Yes	Yes	No	No
Pump or Pump Adjacent	Pump	21%	5%	17%	7%	Yes	Yes	Yes	No
	Heated Pool	2%	1%	5%	1%	Yes	Yes	Yes	No
	Water Feature	12%	3%	15%	7%	No	No	No	No
	Hot Tub	12%	1%	10%	3%	No	No	No	No
	Large Fishtank	8%	1%	6%	4%	No	No	No	No
Plug Load	Power Tools	44%	12%	37%	18%	Smart strip offered by all electric IOUs. Could benefit from educational pamphlet suggesting types of equipment that are common in high-using households as shown in this list and instructions for using smart strips.			
	Medical Equip.	34%	12%	24%	11%				
	Exercise Equip.	20%	3%	18%	7%				
	Dehumidifier	11%	5%	13%	7%				
	Projector	7%	1%	6%	5%				
	Sauna	1%	1%	4%	1%				
Other	BBQ	36%	10%	33%	17%	N/A			
	Unheated Pool	12%	2%	14%	3%				
	EV Charger	16%	1%	5%	5%				

In Figure 15, we show that low electricity-using households were less likely to report that having inefficient appliances were a barrier to saving energy, though they generally just have fewer appliances. We did not define "inefficient" for the customers but expect that they understood it to be related to age, or high consuming equipment, or non-ENERGY STAR-rated products. Low gas-using households were more likely to report having inefficient appliances as a barrier, meaning they may be opting to use their gas appliances less, given the higher cost of running inefficient appliances. High-using households have more electricity-powered appliances and items, so it is not surprising to see that they were more likely to report that inefficient appliances were more of a barrier compared to their low electricity-using counterparts (who do not have as many appliances).

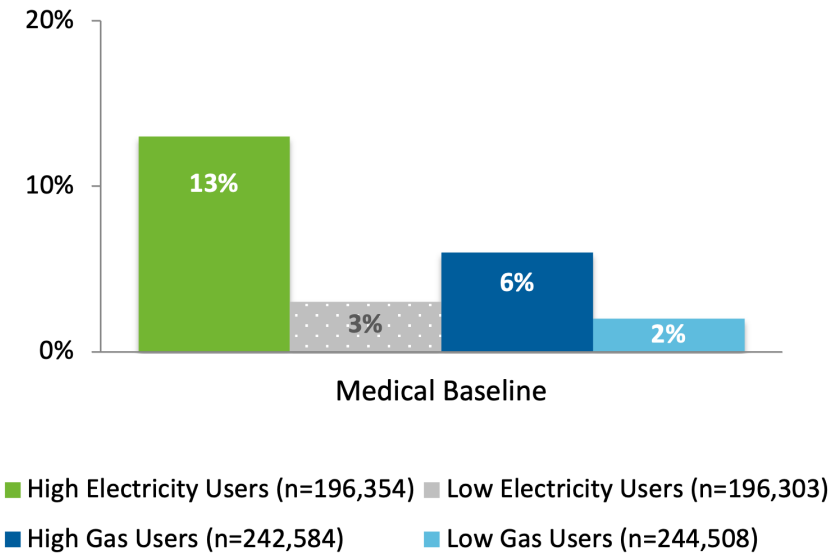
Figure 15: Reported "My Home Has Inefficient Appliances" as a Barrier



3.3.2 Medical Equipment

High-using households (both gas and electric) are more likely to be on the Medical Baseline rate (Figure 16). This aligns with survey findings, with high electricity-using homes reporting the highest rates of medical equipment. There is a relatively low percentage of high electricity-using households enrolled in the Medical Baseline program, despite a high prevalence of medical equipment. This could reflect under-enrollment, lack of awareness, or challenges with eligibility.

Figure 16: Percentage of IOU Customers on Medical Baseline by Usage Category



Source: IOU data

Table 16 showed that more high-using households have medical equipment in their homes. This information is repeated again in Table 17, which adds the *type* of medical equipment in use. CPAP machines are the most common type of medical equipment, with 21 percent of high electricity-using homes having them, with nebulizers/ambulizers coming in second. Participants are already able to receive a reduced rate on their bills for medical equipment through the Medical Baseline rate, though information about vampire energy (energy consumption when items are not in use) for these medical devices may be useful information for customers already on the Medical Baseline rate.

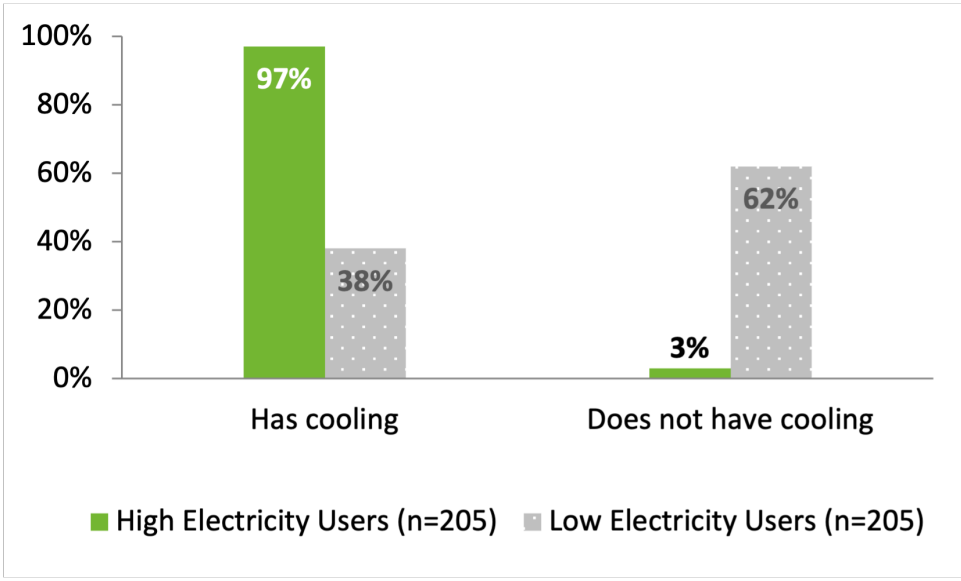
Table 17: Medical Equipment in Households by Energy Use

	High Electricity-Using Homes (n=311)	Low Electricity-Using Homes (n=345)	High Gas-Using Homes (n=206)	Low Gas-Using Homes (n=286)
Medical Equipment	**34%**	**12%**	**24%**	**11%**
CPAP	21%	9%	14%	7%
Nebulizer/Ambulizer	8%	1%	8%	4%
Oxygen Concentrator	6%	1%	5%	1%
Motorized Wheelchair or Scooter	6%	2%	1%	1%
Medical Bed	2%	0%	1%	0%
Misc.	1%	0%	1%	1%

3.3.3 Space Cooling

In Figure 17, we show the relationship between the presence of cooling for high and low electricity-using households.[18] Almost all (97%) high electricity-using households have some type of space cooling, highlighting the significant impact of cooling on overall electricity consumption.

Figure 17: Low and High Energy-Using Households by Presence of Cooling

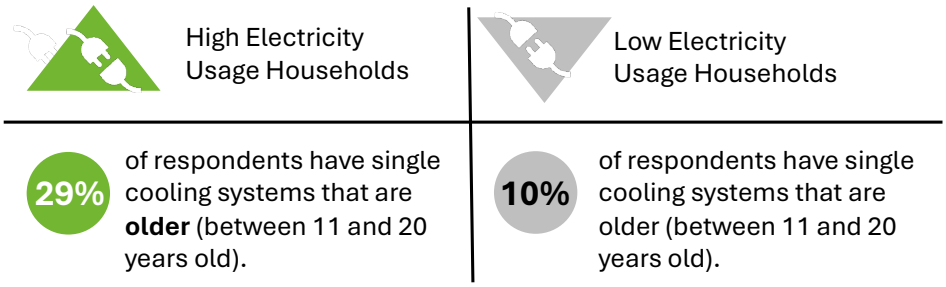


Source: 2019 RASS

High electricity-using households were also more likely to report that they have **older** primary cooling equipment (Figure 18). Across all survey respondents (low and high electricity-using households), respondents have newer equipment in areas that have higher cooling needs. **This could mean that equipment is replaced more often in regions with higher cooling needs**, either because it does not last as long (possibly due to more frequent usage), or because residents have a more difficult time making do with older equipment.

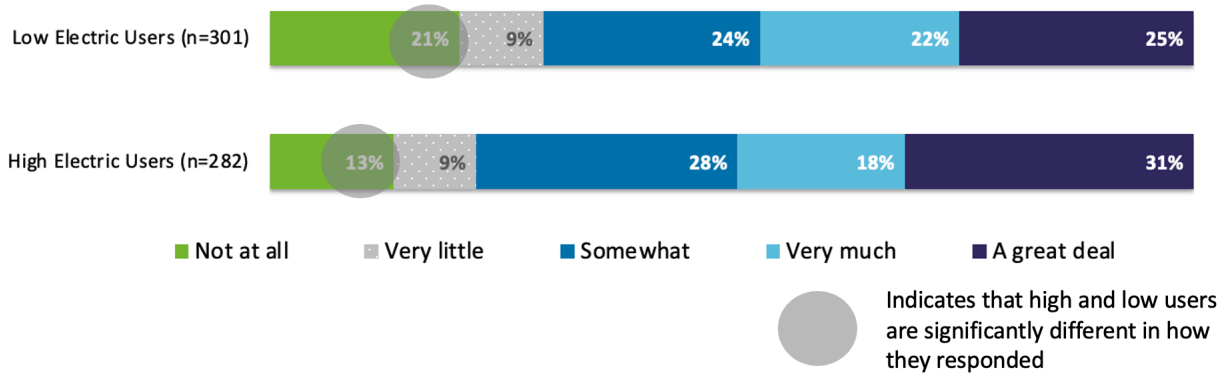
[18] Since cooling is powered by electricity, the figure does not show findings from high and low gas-using households.

Figure 18: Age of Cooling Systems by Electric Usage Category



When respondents were asked about why they think it is difficult to save energy, the prompted barrier that people most identified with (regardless of energy usage level) was an **inability to buy more efficient appliances** (Figure 19). This bodes well for a program's ability to help these customers, given that the program offers no-cost appliances. On the other end of the spectrum, low-using households are more likely to say that the inability to buy more efficient appliances is "not at all a barrier." This may be in part due to the fact that they have fewer appliances overall.

Figure 19: Reported "Inability to Buy More Efficient Appliances" As a Barrier



Primary Systems for Cooling

High electricity-using households are more likely to be using central AC as their primary cooling equipment. This stands true when we compare high- and low-using households isolating just within regions that need a significant amount of cooling and comparing to regions where they need less cooling, suggesting that **central AC is correlated with high electricity usage**, regardless of climate. In contrast, low electricity-using households are more likely to primarily use portable fans compared to the high-using households.

As shown in Table 18, when compared to low electricity-using households, households with high electricity usage are:

- More likely to use central AC or ceiling fans as their **primary** cooling equipment (40% of high electricity usage vs. 21% of homes with low electricity usage for central AC and 13% vs. 6% for ceiling fans, respectively).
- Less likely to open windows or use portable fans as their **primary** source of cooling (20% vs. 35% and 8% vs. 21%, respectively).

Given that the state has various cooling and heating needs, we also compared high- and low-using households within areas with higher cooling needs due to hotter climates (the right two columns in Table 18). Even just considering the areas that **need cooling** (based on a designated level of cooling degree days), these same trends remain, though the difference is only significant between high- and low-using households for central AC and portable fans (designated with shaded boxes).

Considering only those households with high cooling needs, we now see that these households are:

- More likely to use central AC as their primary cooling equipment (53% of high electricity-using homes that need cooling vs. 34% of low electricity-using homes that need cooling)
- Less likely to use portable fans as their primary source of cooling. (4% vs. 15%)

Table 18: Primary Cooling Equipment of High and Low Electricity-Using Homes by Climate

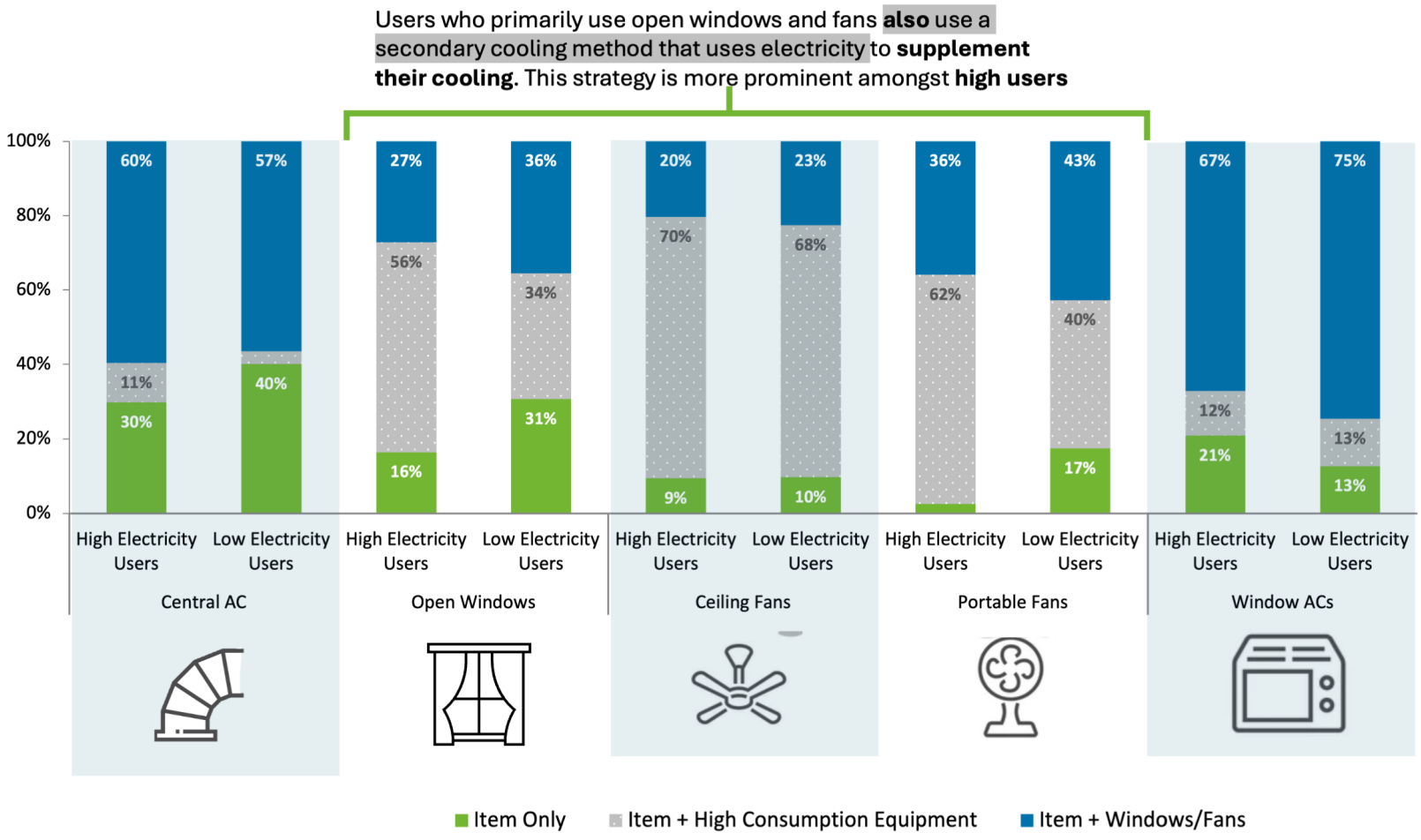
	Irrespective of Climate		🥵 Needs Cooling	
	High Electricity-Using Homes (n=311)	Low Electricity-Using Homes (n=345)	High Electricity-Using Homes (n=154)	Low Electricity-Using Homes (n=164)
Central AC	**40%**	21%	**53%**	34%
Open windows	20%	**35%**	11%	17%
Ceiling fan(s)	**13%**	6%	14%	7%
Portable fan(s)	8%	**21%**	4%	**15%**
Window AC	7%	6%	8%	11%
Swamp cooler	6%	6%	5%	9%
Portable AC	4%	1%	3%	2%
Mini-split/ductless heat pump	2%	2%	2%	3%
No cooling equipment	2%	2%	1%	2%
Ducted/central heat pump	1%	0%	1%	

Comparing households that need more cooling against those that need less cooling (in more temperate climates), we found that **high-using households in warmer regions are twice as likely to primarily rely on central AC** (53% use central AC as their primary cooling strategy in high electricity-using homes in areas that need cooling vs. only 24 percent of high electricity-using homes in areas that do not need as much cooling). **In areas with less of a need for cooling, we see both higher electricity-using households and lower electricity-using households relying on portable fans and open windows at two to three times the rate of those who live in warmer regions.**

Secondary Cooling Strategies

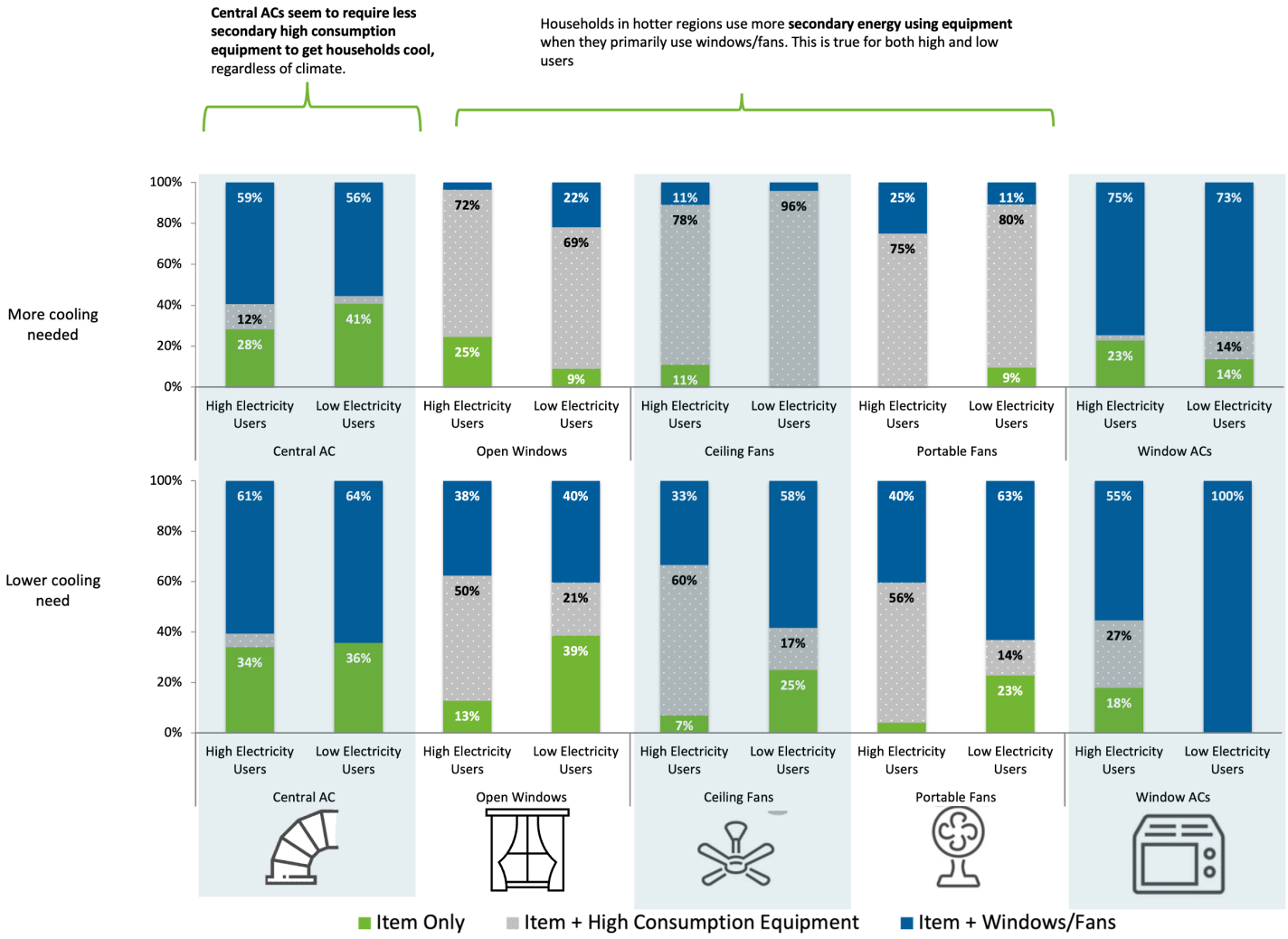
Primary equipment alone does not tell the full story of how people cool their households. **Less than 30 percent of all respondents (high and low electricity-using households) rely on their primary cooling equipment *alone***. Looking just at the most common primary cooling methods, we see that even when respondents primarily use less electricity-intensive strategies, such as opening windows or using fans, **they often supplement cooling** with additional higher consumption cooling equipment (such as central AC or a window AC). Though this is true of all households, this trend is more pronounced in higher electricity-using homes, as shown in the bracketed gray bars in Figure 20.

Figure 20: Cooling Equipment Strategy with Top Cooling Methods, Comparing High and Low Electricity-Using Households



Climate also plays a role in how often households are supplementing their windows and fans with other energy-using equipment. **In warmer regions, both higher- and lower-using homes are more likely to use equipment to supplement their open windows and use of fans,** as shown in the bracketed gray bars in Figure 21. Behavior around central ACs does not vary as much by climate, likely because central ACs do a better job of cooling the entire home.

Figure 21: Cooling Equipment Strategy with Top Cooling Methods, Comparing High and Low Electricity-Using Households, Comparing Households in Regions that Need More vs. Less Cooling



Cooling for Health Reasons

High electricity-using households are more likely to have **health issues that require them to use more heating or cooling than they would otherwise** (35% of high electricity-using households vs. 20% of low electricity-using households). **This is also tied to climate**; households were more likely to report requiring more heating or cooling for health reasons in climates with more extreme temperatures.

3.3.4 Space Heating

Primary Systems for Heating

Unsurprisingly, **furnaces are the most common primary heating equipment reported by high gas- and electricity-using households from the customer survey** (Used by 40% of high-usage households compared to 26% of low-usage homes; Table 19). **Low-using households primarily use portable space heaters** at higher rates than their high-using counterparts, though at least a quarter of low-using households use a furnace as their primary heating source. **In low electricity-using households, wall heaters are equally as common as furnaces and space heaters**. Interestingly, 12 percent of high electricity-using households use a wood or pellet stove/fireplace as their primary form of heating, suggesting that heating need is not the main driver of their high electric bills.

Also of note is that 8 percent of both high gas- and high electricity-using households have "no heating equipment." When isolating just for climates with higher heating needs, we still see high percentages in this category (ranging from 5 to 8 percent). While the sample sizes are too small to confirm statistically significant differences, we see higher rates of reported freezers and hot tubs in the high-using homes that do not have heating equipment, suggesting that these other end uses are more common amongst high-using households.

Table 19: Primary Heating Equipment by High and Low Fuel Usage Levels

	High Electricity-Using Households (n=311)	Low Electricity-Using Households (n=345)	High Gas-Using Households (n=206)	Low Gas-Using Households (n=286)
Furnace	**40%**	26%	**39%**	22%
Portable space heater	14%	**24%**	14%	**28%**
Wall heater	6%	**23%**	13%	16%
Ducted/central heat pump	**9%**	4%	9%	6%
No heating equipment*	8%	10%	8%	13%
Electric or gas fireplace	**5%**	2%	7%	3%

	High Electricity-Using Households (n=311)	Low Electricity-Using Households (n=345)	High Gas-Using Households (n=206)	Low Gas-Using Households (n=286)
Radiant heat	2%	1%	4%	1%
Wood or pellet stove/fireplace*	**12%**	3%	2%	1%
Clothing or blankets*	1%	3%	2%	4%
Unspecified central system*	2%	1%	1%	1%
Baseboard heater	1%	1%	0%	1%
Electric blanket		0%		1%
Mini-split/ductless heat pump	1%	1%		3%
Stovetop or oven		1%		0%
Other	1%	0%	1%	1%

*Heating strategy not associated with gas or electricity. Source: Customer survey

Households can use multiple fuel types for heating, and their needs differ across climate regions. In Table 20, we present the primary heating equipment for households where their heating fuel matches their usage profile. For example, "high-using households" are defined as high gas-using households that primarily heat with gas, and vice versa.

Before accounting for climate differences, we see similar findings with high-using households mostly using furnaces for heating and low-using households using portable space heaters or wall heaters.

When we take climate into account, the difference between low- and high-using households with regards to portable space and wall heater usage shrinks and is no longer statistically significant, indicating that **in areas where there is a higher heating need, households are less able to rely on smaller heating systems (portable space heaters and wall heaters) to be their primary form of heating in both the high and low usage groups**.

Table 20: Top Six Types of Primary Heating Equipment of High and Low Electricity-Using Homes by Climate

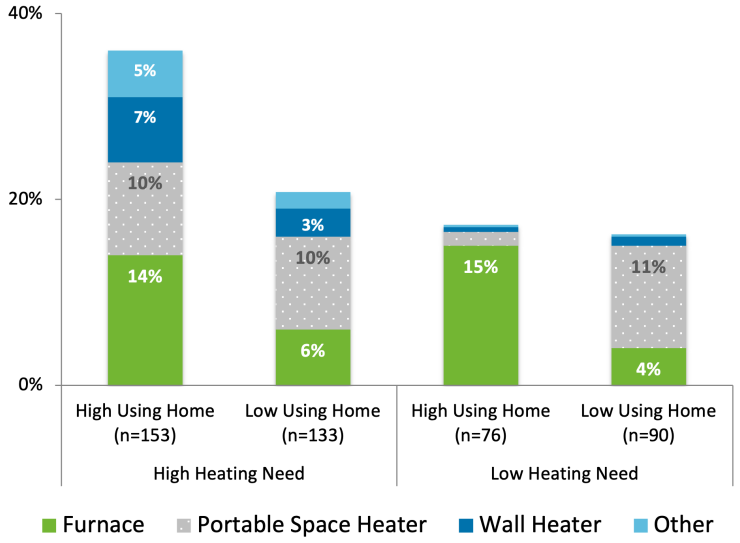
	Irrespective of Climate		🥶 Needs Heating		Lower Heating Need	
	High-Using Households (n=229)	Low-Using Households (n=223)	High-Using Households (n=153)	Low-Using Households (n=133)	High-Using Households (n=76)	Low-Using Households (n=90)
Furnace	**50%**	**31%**	**43%**	30%	58%	31%
Portable space heater	15%	33%	19%	28%	11%	36%
Wall heater	14%	24%	19%	22%	7%	26%
Ducted/central heat pump	9%	5%	9%	7%	9%	3%
Electric or gas fireplace	7%	2%	5%	2%	9%	2%
Mini-split/ductless heat pump	1%	1%	2%	2%		0%
Radiant heat	3%	1%	1%	3%	5%	0%
Baseboard heater	1%	2%	1%	4%	1%	

Source: Customer survey; grey indicates that differences between high and low groups are statistically significant.

Secondary Heating

In areas where there is more heating need, high-using households are more likely to use a secondary form of heating along with their primary equipment. High-using households and low-using households in more temperate climates are more likely to use secondary heating strategies at similar rates to each other (Figure 22).

Figure 22: Percent of Households that Use Secondary Equipment to Supplement Heating from Listed Primary Equipment by Heating Need (Region) and Usage (High vs. Low)

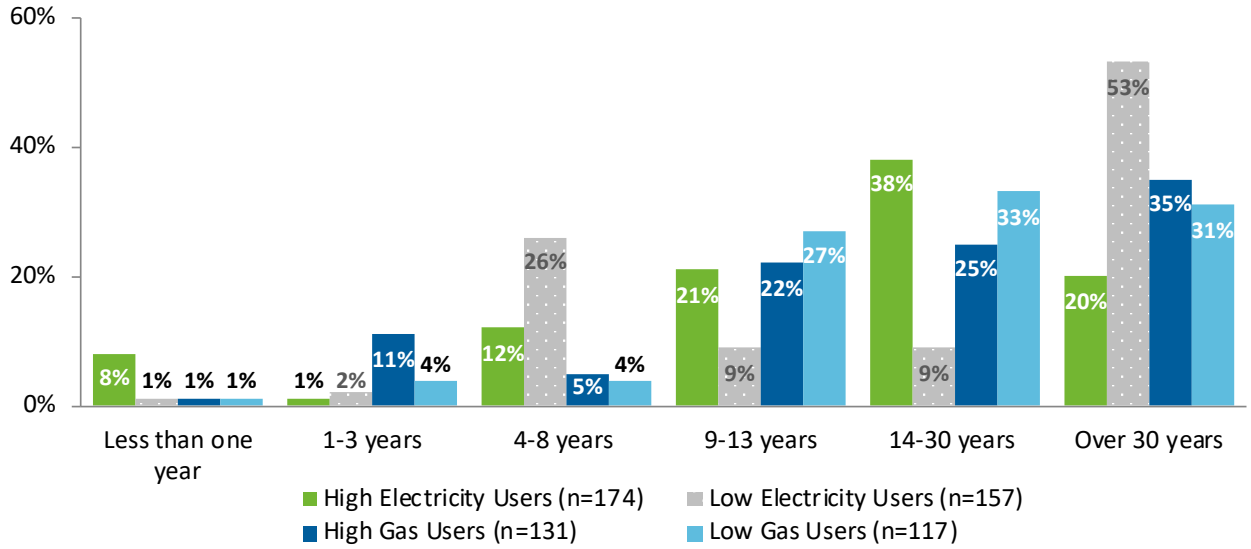


Regardless of heating need, furnaces are the most often supplemented systems in high-using households. If the program could improve the operation/efficiency of furnaces, they could help lower usage in these households though there remains the challenge of location of furnaces. We did not ask specifically about furnace location in the survey.

Age of Heating Appliance

High electricity-using households generally have older heating equipment; however, **53 percent of low electricity-using households have heating equipment over 30 years old** (beyond useful life). These households may be in more mild climate zones that do not require much heating, have other non-electric heating, or could be making health and comfort sacrifices to reduce their bills (Figure 23). The proportion of high gas-using households increases as the age of heating appliances increases. Additionally, both high and low gas-using households are likely to have older heating equipment.

Figure 23: Percent of Energy-Using Households (by high and low fuel types) with Heating Appliances of Certain Ages



Source: 2019 RASS

3.4 Household Occupants

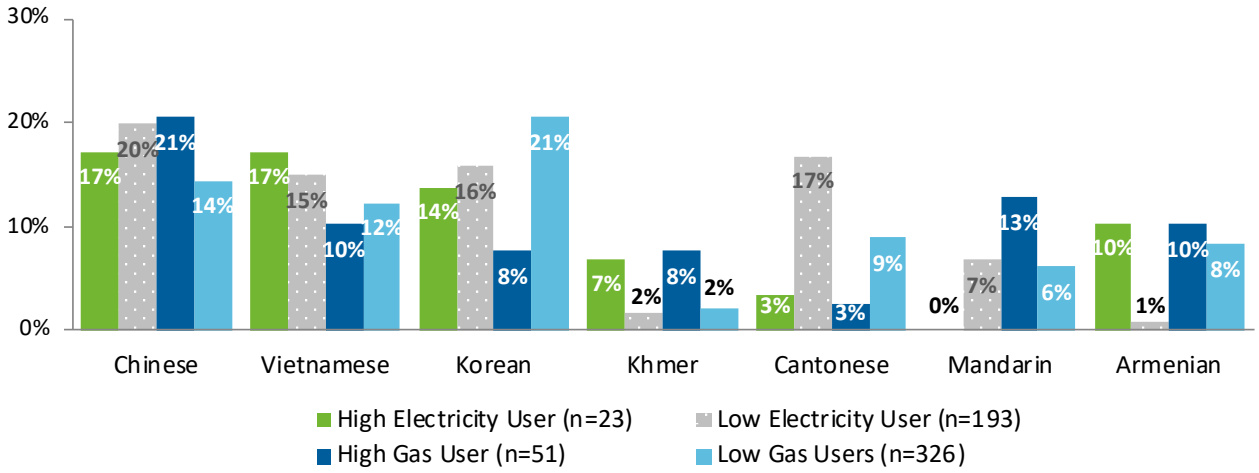
This section discusses household occupant characteristics and how different characteristics impact energy usage.

3.4.1 Language Spoken

Our market characterization assessed what languages other than English our survey should be offered in and what in-language focus groups we should offer. Ultimately, Evergreen conducted the survey in both English and Spanish (with everyone receiving the option to take it in either language) and conducted three focus groups in non-English languages: Cantonese, Vietnamese, and Spanish.

To determine which languages to offer, we analyzed Census data to find the proportion of high- and low-using households that do not speak English or Spanish and which language they *do* speak. Figure 24 lists the top non-English and non-Spanish languages rather than *all* languages. **Between 10 and 21 percent of electric and gas high- and low-usage households speak Vietnamese or Chinese** (Mandarin/Cantonese).

Figure 24: Low- and High-Using Households by Languages Spoken in Households that Do Not Speak English or Spanish[19]



Source: 2019 Census ACS

Spanish Speakers

The customer survey identified that while a similar proportion of high- and low-using households have both English and Spanish speakers, low energy-using households that have both English and Spanish speakers were more likely to have residents who primarily speak Spanish in their homes compared to their high-using counterpart households with residents who speak both languages in their home.

Cantonese Speakers

The focus group conducted in Cantonese revealed that there are many cascading language barriers to receiving help with their energy bills and participating in utility programs. Participants were not aware that they could request utility bills in Chinese, or that there was a Chinese version of their utility website. This has led to customers relying on word-of-mouth to understand their bills and rate plan options, and to learn about programs that may benefit them.

Once Cantonese speakers are aware of programs, they still encounter challenges with English-only application materials and contractors/technicians. They often rely on translation apps that have led to missing important program requirements and details, resulting in them not being able to participate in the programs.

For example, one focus group attendee participated in the ESA program and was approved to receive a new refrigerator. However, when the technician arrived with the refrigerator, they

[19] Mandarin and Cantonese are both Chinese languages, but the Census collects all three categories: Chinese, Mandarin, and Cantonese, so we report on all three.

identified that her apartment did not have a grounding wire in the electrical outlet, making the refrigerator installation impossible. She had to send the refrigerator back and reapply for the program. This incident occurred within the context described above, where participants struggled with English-only materials and contractors, with many agreeing that communicating via translation apps often led to missing important details and requirements.

Finally, respondents in the focus group mentioned that there are hurdles with digital literacy that are exasperated by the language barrier. Online applications were reported to be challenging to navigate, and they are only in English. Finding the translate button on a utility website can be a challenge for older members of the community.

Vietnamese Speakers

The Vietnamese focus group did not emphasize the cascading challenges with participation, but all participants in the group agreed that in-language materials were necessary for them to consider participating in any energy programs. In addition to language barriers, participants in the Vietnamese focus group also had lower program awareness than other groups. Only one had heard of the ESA program, and the group agreed that advertising energy programs on the Vietnamese radio channel and flyers at Vietnamese sandwich shops, which often serve as neighborhood gathering places, would be a great way to get the word out to their community.

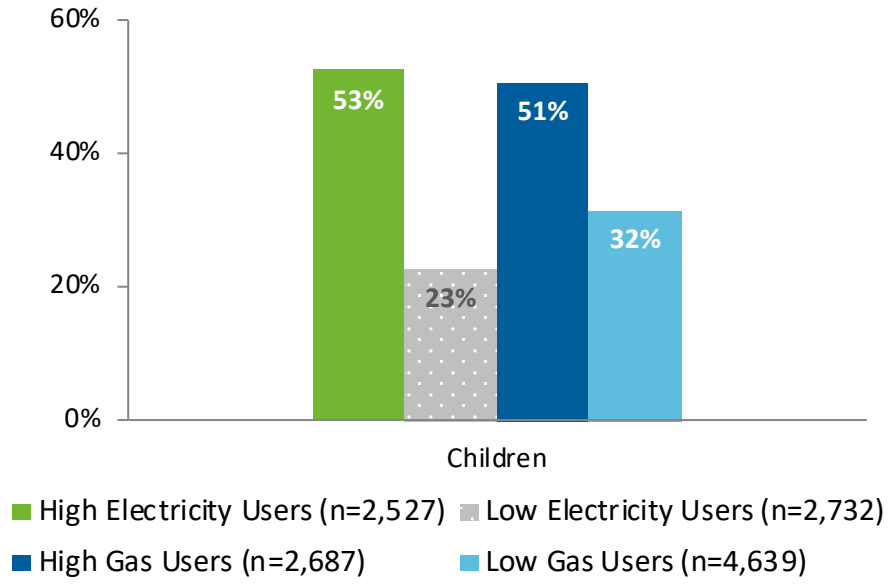
The 2016 LINA[20] also emphasized these findings. In featured ride-alongs with community-based organizations (CBOs) conducting outreach to similar communities, the study found that providing communications in customers' languages is essential, not just during initial contacts, but also throughout the customers' participation.

3.4.2 Children in Home

Figure 25 shows that **more than half of high electricity-using households have children compared to less than a quarter of low electricity-using households** (53% vs 23%). We see a similar—but less drastic—trend in high and low gas-using households (51% vs 32%).

[20] Evergreen Economics. 2016. *Needs Assessment for the Energy Savings Assistance and the California Alternate Rates for Energy Programs*. https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/energy-efficiency/iqap/2016-linafrvol1.pdf

Figure 25: Low and High Energy-Using Households by Presence of a Child in the Household



Source: 2019 Census ACS

This finding from our market characterization matched our findings amongst survey respondents, though survey respondents from high gas-using households were even more likely to have children (60% in the survey vs. 51% in the figure from the market characterization). **The greater proportion of high-using households with children could be due to increased heating and cooling usage for comfort, more frequent heating and cooling throughout the day, or the presence of additional electronics.**

Focus group participants also echoed these findings and reported that having children in their home led them to use more energy due to additional usage from electronics and needing to keep their home more comfortable by using heat and air conditioning.

Energy Education for Children

In the focus groups, we tested the idea of program materials targeted towards children to help them learn about energy efficiency and conservation. While some participants were interested, most rated the relevance of such material very low and expressed that, "kids don't care" about energy conservation. Instead of materials targeted towards children about energy use, focus group participants suggested parent education on specific child-related energy usage concerns. The participants brainstormed a number of ideas, listed below:

- Real dollar costs of running specific appliances (PlayStation, gaming computers, etc.)

- Monthly cost comparisons in terms kids can understand (running your PlayStation 24/7 = $X = Y number of games you could buy)
- Ways children can help with energy conservation around the home (for parents to distribute)

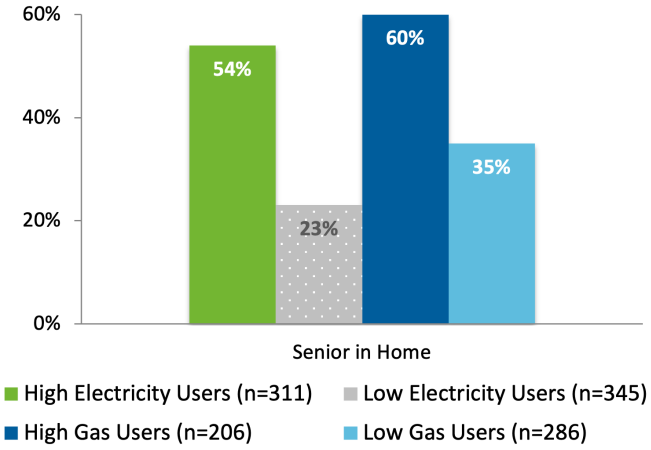
We also heard that households with children, like other households, are worried about safety issues surrounding carbon monoxide poisoning, mold in the home, and other dangerous conditions. Leading with safety benefits instead of energy saving potential could help engage low-income households with children.

Finally, as with other low-income households, IOU programs need to be flexible and build trust with parents. Focus groups participants with children expressed that evening and weekend appointments would help with their more rigid schedules, and they mentioned concerns about strangers coming into their homes when their children are around.

3.4.3 Seniors in the Home

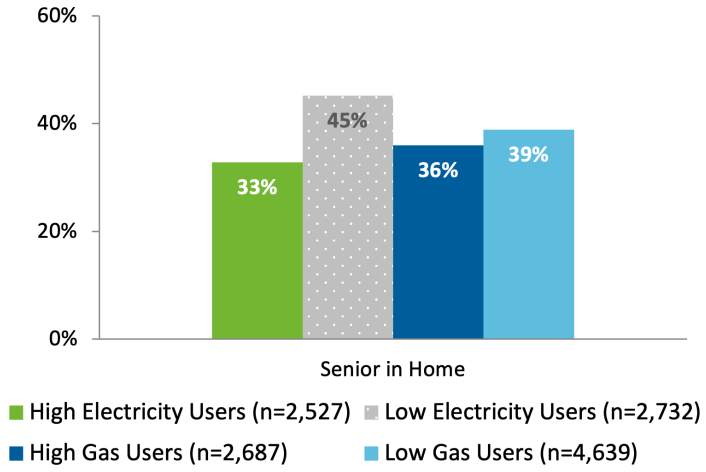
Amongst survey respondents, high gas- and high electricity-using customers were **much more likely to have seniors in the home (**Figure 26). This contradicted the market characterization finding that saw more seniors in low-using households: 45 percent of low electricity-using households have a senior compared to 33 percent of high electricity-using households (Figure 27).This may be due to seniors being in larger homes that often have more appliances and more space to heat and cool. Confirmation of survey response rates indicated that we did not see an oversampling of households with seniors.

Figure 26: Low and High Energy-Using Households by Presence of a Senior in the Household



Source: Customer Survey

Figure 27: Low and High Energy-Using Households by Presence of a Senior in the Household



Source: 2019 Census ACS

In focus groups, we heard that online portals and resources were challenging to navigate for older households, especially if they already need translated materials. Participants with elderly family members also preferring in-person communication where possible to overcome technology barriers.

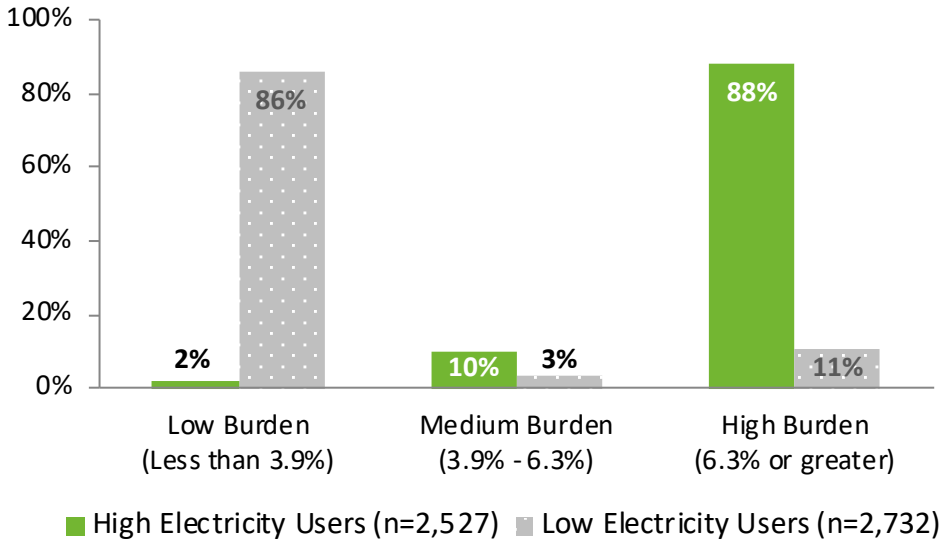
3.4.4 Energy Burden

Energy burden is calculated as the percentage of income that is spent on electricity, gas, or the total energy bill (gas, electric, and bulk fuels) faced by a household. We consider a household with an energy burden of 6.3 percent or higher as having a high energy burden, an energy burden between 3.9 and 6.3 percent as medium energy burden, and an energy burden of less than 3.9 as low energy burden.

Generally, low electricity-using households experience low electricity burden (86%), and high electricity-using households experience high electricity burden (88%) (Figure 28).

However, some low-using homes experience relatively high energy burden. These may be customers who have the lowest incomes, so the burden is driven by income, not usage.

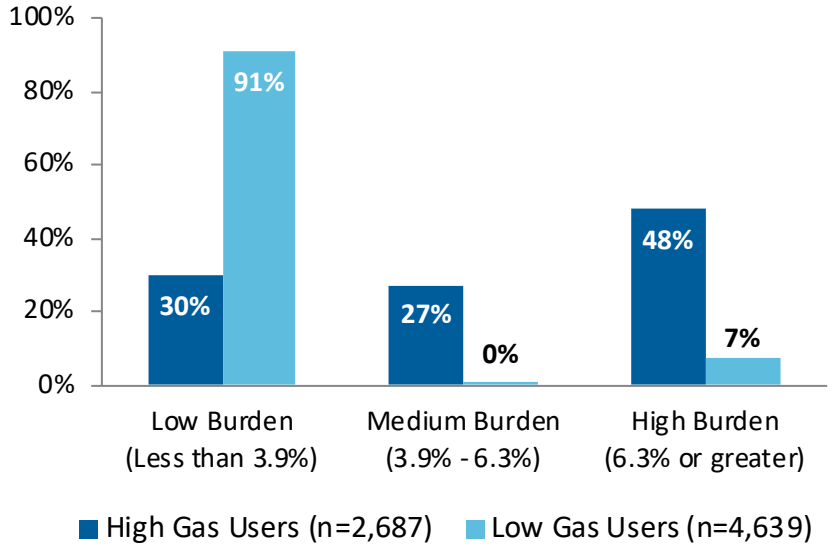
Figure 28: Low and High Energy-Using Households by Electric Energy Burden



Source: 2019 Census ACS

The majority (91%) of low gas-using households also experience low gas energy burden, compared to about a third (30%) of high gas-using households (Figure 29). This relationship between burden and usage is not as strong for gas as it is for electric burden, likely due to lower energy costs and smaller energy bills, driven by the relatively low price of gas.

Figure 29: Low and High Energy-Using Households by Gas Energy Burden



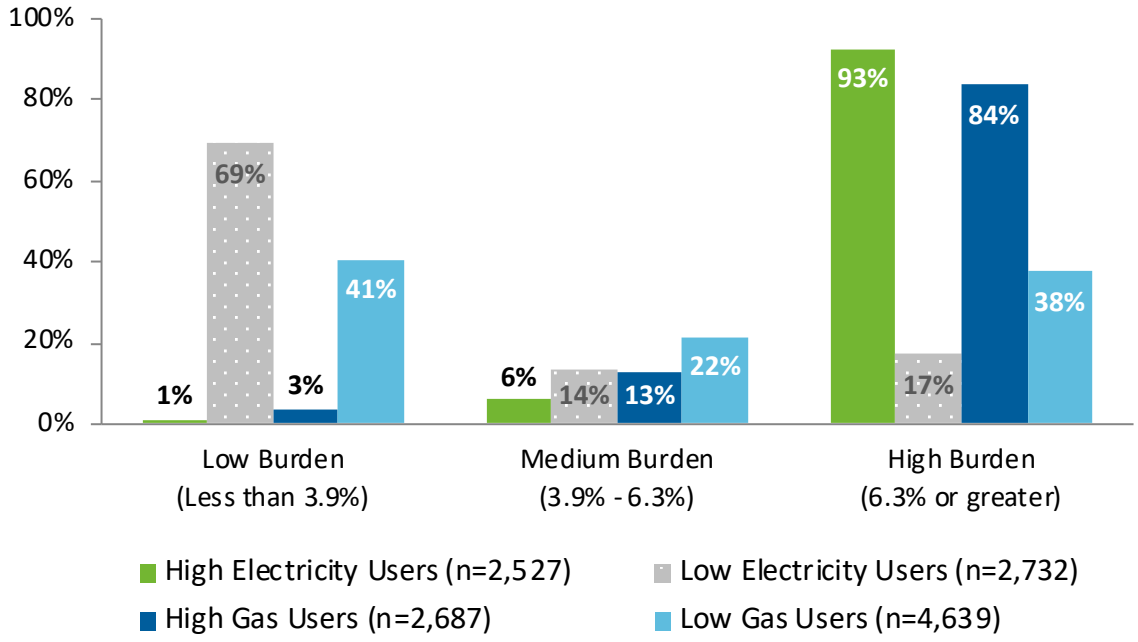
Source: 2019 Census ACS

When looking at energy burden for all fuels, including bulk fuels such as **propane and wood**, generally greater proportions of **high-using households experience higher energy burden**, while greater proportions of low-using households experience lower energy burden.

Households with high energy burden typically have higher energy use, but energy burden can also be driven by income rather than energy use or bill size. Customers who report little or no income, for example, will inherently have high burden regardless of the level of energy use or the size of their bill.

While high-using households are experiencing higher energy burden, **17 percent of low electric-using households and 38 percent of low gas-using households also experience high overall energy burden** (looking at the cost of all fuels, combined, Figure 30)**.** This may be because they are using multiple fuels. If the program were to target high-using households and not engage low-using households, it would not reach all of the households that experience high energy burden.

Figure 30: Low and High Energy-Using Households by Total Energy Burden



Source: 2019 Census ACS

3.4.5 Affordability Ratio

Affordability ratio (AR) describes the impact an essential service bill has on a household budget. AR represents the percent of income that is spent on each type of essential utility service after

housing plus other essential utility services.[21] As demonstrated below, a higher AR indicates that the service is less affordable.

Source: CPUC 2019 Annual Affordability Report

The Annual Affordability Report published by the CPUC analyzes the state of affordability in California and projects how affordability may change over the next few years. The latest report found that many parts of California reflect high AR values across essential services. Overall, they found that affordability concerns are highest in areas with relatively low income levels. This trend is especially concerning for electricity bills in hotter regions and natural gas bills in colder regions.

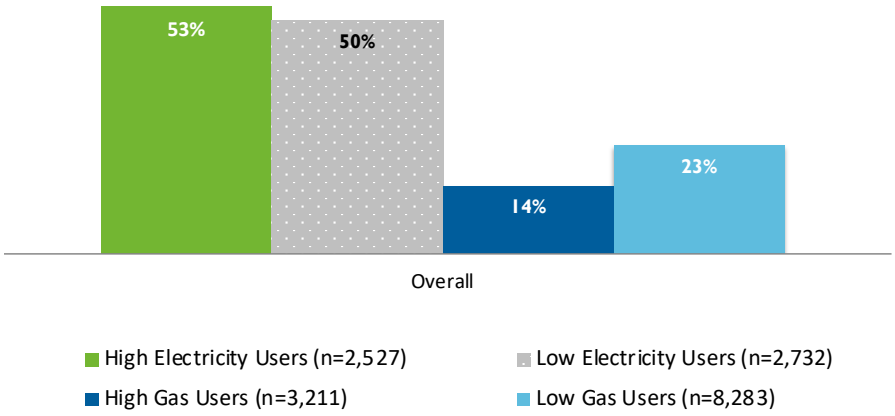
To assess if high- and low-usage households differ in their exposure to areas of affordability concern, we appended the AR value for households at the 20th percentile of local income distribution (referred to as AR_{20}) for electricity and for gas by Public Use Microdata Area (PUMA) (the most granular geography available). We then compared the percentage of high electricity-using households to low electricity-using households that live in PUMAs with high electricity AR_{20}. For gas, we compared the high- and low-using households to the PUMAs with high natural gas AR_{20}.[22] Finally, we analyzed these ratios by climate zone group.

We found that overall, there were no statistically significant differences between high and low electricity-using households. Approximately half of the households were likely to reside in an area with high electricity bill affordability ratios. For natural gas, however, low gas-using households were more likely to be in an area with high gas bill affordability ratios, compared to high gas-using households (23% and 14%, respectively).

[21] CPUC. *2019 Annual Affordability Report*. https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/affordability/affordability-ratio

[22] To align with the census data from 2020, we used AR values from the 2020 calculator. We define high AR_{20} PUMAs as those with an AR_{20} greater than 6.3 percent to align with the energy burden analysis in the previous section.

Figure 31: Households Living in PUMAs with High Affordability Ratios



3.5 Regression Results

Evergreen examined the customer survey data and conducted preliminary statistical analysis to determine what type(s) of multi-variate analysis (including cluster and linear regression) would be most useful for this study. We decided to develop linear regression models for each type of energy-using household (high and low), with electricity usage during the summer as the dependent variable, and the various characteristics of home and household as independent variables. We opted not to conduct a similar model for natural gas because there was much less variation in gas usage, combined with an inconsistent and incomplete view of each sampled household looking only at natural gas usage. Similarly, we focused on the cooling season rather than the heating season, since cooling load is derived from electricity. Heating load may be derived from both electricity and/or natural gas, and for a sizable fraction of the sample (all but customers with both electricity and gas from PG&E), we did not have both of their energy bills.

Evergreen estimated two separate linear regression models to examine the predictors of electric energy consumption in the summer months for high-using households (n=311) and low-using households (n=340). In this analysis, summer energy consumption is defined as total kWh used during the months of June, July, August, and September. The models include household occupancy, the presence of certain cooling equipment and other appliances, cooling degree days (CDDs), and comfort decision variables as predictors of energy consumption. Table 21 defines all the variables used in these final models.

Table 21: Table of Variable Descriptions Used in the Models

Variable	Description
Summer of 2023 kWh	Total kWh from June through September
Household Occupancy	Household occupancy; binning all households with eight or more residents
Central AC	Dummy variable for presence of central AC
Portable AC	Dummy variable for presence of portable AC units (including window AC, swamp cooler, portable AC)
Clothes Dryer	Dummy variable for presence of those with a clothes dryer in the home
Medical Equipment	Dummy variable for presence of medical equipment
Desire for Comfort	Dummy variable for 'a desire to be comfortable is very or extremely important'
CDD	Cooling Degree Day

We considered other predictors of energy consumption, such as the age of the primary cooling equipment, various electricity-consuming appliances, and attitudes and behaviors that align with the profiles for low and high energy-using households, but found these variables did not have a statistically significant impact on energy use. See Appendix E for a list of the variables that we included in the models but were not statistically significant.

3.5.1 Regression Analysis Findings

Table 22 presents the findings from the two regression models we ran for this analysis. The findings below refer to the results in this table. The values in the table represent the parameter estimates for each variable as a driver of summer electricity usage. The asterisks indicate statistically significant levels based on p values.[23] See Appendix E for more detailed regression results. Below, we provide examples of how to interpret each variable:[24]

[23] A p-value (or probability value) measures the probability of obtaining the observed results. P-values range from 0 to 1, with smaller p-values indicating stronger evidence against the null hypothesis of no effect.

[24] For each of the explanatory variables included in the models, the interpretation of each estimated coefficient is based on the condition of "all else held constant".

Occupancy: For each additional household occupant, high-using households will use, on average, an additional 92 kWh, and low-using households will use an additional 26 kWh over the cooling season (June – September).

Central AC: High-using households with central AC use, on average, an additional 1,191 kWh over the cooling season, whereas low-using households with central AC only use an additional 175 kWh over the cooling season.

Portable AC: Low-using households with portable AC units use, on average, an additional 111 kWh over the cooling season. (This variable was not included in the high-using model due to it not being statistically significant.)

Medical Equipment: High-using households with medical equipment use, on average, an additional 845 kWh over the summer. (This variable was not included in the low-using model due to it not being statistically significant.)

Cooling Degree Day (CDD): For each additional 100 CDDs (which average 1,123 for high-using households and 1,181 for low-using households), high-using households will use, on average, an additional 90 kWh over the cooling season, while low-using households will use, on average, an additional 20 kWh.[25]

Clothes Dryers: High-using households with a clothes dryer use, on average, an additional 998 kWh over the cooling season. (This variable was not included in the low-using household model due to it not being statistically significant.)

Comfort: High-using households that indicate that a desire for comfort is very or extremely important use, on average, an additional 447 kWh per summer. (This variable was not included in the low-using household model due to it not being statistically significant.)

Table 22: Linear Regression Model Results (Electricity Use in Summer, kWh)

Variable	High-Using Household Model	Low-Using Household Model
Household Occupancy	92*	26**
Central AC	1,192***	175***
Portable AC	-	111**
Medical Equipment	845***	-

[25] Note: there are substantial variations in CDD across climate zones. For example, for high-using households in climate zone 11 (California's Central Valley), CDD averaged 1,354 whereas for high-using households in climate zone 3 (Coastal Central California), CDD averaged 183.

Variable	High-Using Household Model	Low-Using Household Model
CDD	0.9***	0.2***
Clothes Dryer[26]	998**	-
Desire for Comfort	447*	-

Note: *p<0.1; **p<0.05; ***p<0.01 (a dash means the variable was not included in the model.)

3.5.2 Predictors Consistent Across Electricity-Using Household Types

Central AC is a strong predictor of high electricity usage in both models, though with dramatically different magnitudes. High-using households with central AC consumed 1,192 additional kWh compared to those without, while low-using households with central AC showed a more modest increase of 174 kwh. **This suggests that while central AC systems increase energy consumption in the home, they have disproportionately larger impacts on high-usage households.**

CDD is also a statistically significant predictor of electricity consumption in both models, but high-using households demonstrated much greater temperature sensitivity. Each additional CDD increases consumption by an average of 0.89 kWh for high-using households compared to 0.19 kWh for low-using households, indicating that **high-consumption households are more responsive to temperature variations.** To validate that this finding was not due to low-using households being located in areas with relatively low CDDs and high-using households being located in areas with relatively high CDDs, we computed average CDD for each level of usage. We found that there was very little difference in average CDD for the two groups—average summertime CDD for high-using households was 1,123 CDDs, while for low-using households, it was slightly higher at 1,181 CDDs.

3.5.3 Differential Predictors by Electricity-Using Household Type

Several variables demonstrated significance only within specific energy-using household segments, highlighting **distinct consumption drivers.**

Medical equipment in the home has a substantial positive impact on electricity consumption among high-using households (845 kWh) but shows no statistically significant impact for low-using households. This **may suggest that there are substantial differences between the medical devices used in low-using and high-using homes or that members of high-using homes use their medical equipment more intensely**. It is important to note that there are many more high-using households with medical equipment in the home (n=93) than low-using households (n=37), and

[26] We are uncertain about the accuracy of the reported fuel of the clothes dryers. While we did ask survey respondents about the fuel used, for clothes dryers in particular, information on the self-reported fuel is unreliable, and electric billing data do not report any indication of fuel.

this, in conjunction with the type of medical equipment, could contribute to its effect in predicting household energy consumption.

The **absence of a clothes dryer significantly reduced energy consumption among high-using households by 998 kWh**, while this variable was not significant for low-using households. This indicates that ownership of a clothes dryer may be more consequential for high-consumption households.

Household occupancy significantly increased energy consumption among low-using households by 26 kWh, a small but notable impact. Household occupancy was not significant for high-using households**, suggesting the addition of a household occupant has a greater impact on low-using households.**

Households whose desire for comfort is very or extremely important significantly increased energy consumption among the high-using households by 447 kWh. This predictor was not significant in the low-using household model and was therefore excluded. This finding emphasizes **that high-using households do take into consideration some metric of comfort when making their energy consumption decisions.**

3.5.4 Implications

The results reveal different consumption patterns between high- and low-using households. High-using households demonstrate greater sensitivity to both temperature changes and appliance ownership, with central AC and medical equipment serving as primary energy consumption drivers. In contrast, low-using households show more consistent, predictable consumption patterns with smaller effect magnitudes. These findings suggest that energy conservation strategies should be tailored differently for each household usage segment. High-using households could potentially benefit from targeted interventions around major appliances and temperature management, while low-using households may respond to different approaches focused on baseline consumption behaviors.

4 Summary of Findings and Recommendations

This section presents a high level overview of the key characteristics of income-qualified high and low usage groups, followed by recommendations to address their energy-related needs.

4.1 Key Drivers of Low and High Usage

Evergreen describes the key characteristics that are highly correlated with high and low usage, based on the characterization (drawn from both primary and secondary data) and the regression results. The characterization examined all possible characteristics, while the regression models explored which characteristics are the key drivers of high and low usage, with a focus on summer electric usage. Note that the high and low energy-using groups were developed by climate zone group in an attempt to normalize climate when identifying low- and high-using households. The regression analysis goes beyond normalizing for climate and examines potential drivers of high and low usage, holding all other potential drivers constant. Evergreen limited the regression analysis to electricity and summer usage based on data availability.

- **Household Occupancy:** The characterization indicated that low energy-using households have fewer occupants compared to high-using households (as would be expected). The regression analysis found that each additional resident in a low-using household adds approximately 26 kWh during the summer, and each additional resident in a high-using household adds approximately 92 kWh.
- **Cooling Equipment:** The study defined high and low usage based on region in an attempt to normalize climate. The regression analysis found that high-using households with central air conditioners use an additional 1,192 kWh over the summer compared to those without central AC, compared to low-using households with central AC only using an additional 175 kWh over the summer. Portable ACs account for an additional 111 kWh in low-usage households. Since climate is normalized by the composition of the energy-using groups by region, this finding reflects distinct usage patterns. Low-using households are much less likely to have central AC and are more likely to use portable fans even when they are located in hot regions. High-using households' cooling equipment is older than low-using households' cooling equipment.
- **Medical Needs:** High-using households are more likely than low-using households (both electric and gas) to be on the medical baseline rate. They are also more likely to have medical equipment in their homes. The regression analysis also found that medical equipment contributed to energy usage in high-usage households and that high-using households with medical equipment saw an additional 845 kWh of usage in the summer months compared to high-using households without this equipment. Having or not having medical equipment was not a key driver of electricity usage for low-using households.

- **Geographic Location:** The study was designed to compare energy-using households within similar geographic (and climate) areas of the state, with four energy-using groups based on the number of heating degree days (HDDs) and cooling degree days (CDDs). The regression results showed that even within similar climate regions, living in an area with hotter summers has a major impact on high-using households. For each additional 100 CDDs (averaging 2,500 hours per year across the sample), high-using households will use an additional 90 kWh over the summer (June – September), while low-using households will use an additional 20 kWh. High-using households are also more likely to be located in areas with Public Safety Power Shutoff (PSPS) events and considered to be in high fire threat regions. We also found higher rates of high electricity-using households on tribal lands.
- **Appliances and Plug Loads:** The characterization showed that high-usage households are much more likely to have appliances such as clothes washers and dryers and non-essential equipment such as second refrigerators, electric vehicle (EV) chargers, air purifiers, dehumidifiers, medical equipment, projectors, exercise equipment, saunas, power tools, and pumps. The regression models indicated that in particular, the presence of a clothes dryer[27] for low-income high electricity-using customers is predictive of much higher usage, all else constant. High-using households with a clothes dryer add on average 998 kWh of electricity usage over the summer compared to high-using households without this appliance. Living in a home with a clothes dryer may indicate a higher likelihood of having more household occupants (needing to do laundry at home) and having more appliances in general.
- **Attitudes/Behaviors and Awareness:** The customer survey asked low-income low- and high-using households about barriers to saving energy. Low-using households were more likely to say they are confident that they know how to save energy and that they have time to take energy-saving actions. Low-using households are also more likely than high-using households to take action in their homes to save energy more frequently. High-using households are more likely to prioritize being comfortable in their home. This finding was confirmed by the regression analysis, which found that a self-reported desire to be comfortable is associated with an additional 477 kWh per summer for high-using households.

Characteristics that were not found to be key drivers of low and high usage were home age, a desire for lower bills, income levels in terms of federal poverty level categories, and household composition in terms of presence of veterans or people with disabilities.

[27] We are uncertain about the accuracy of the reported fuel of the clothes dryers. While we did ask survey respondents about the fuel used, for clothes dryer in particular, information on the self-reported fuel is unreliable, and electric billing data do not report any indication of fuel.

4.2 Recommendations

Based on the comprehensive research conducted through the market characterization, customer surveys, focus groups, and regression analysis, this section presents actionable program recommendations organized by the following program strategies:

- Equipment replacement and upgrades
- Behavioral interventions
- Targeted outreach

4.2.1 Equipment Replacements and Upgrades

Primary Cooling System Replacements for High Electricity-Using Households

High electricity-using households have older cooling equipment compared to their low-using counterparts, with this pattern holding true regardless of climate zone. The customer survey revealed that the most commonly-cited barrier to energy savings across all respondents was the "inability to buy more efficient appliances," indicating strong receptivity to equipment upgrade programs.

High electricity-using households are more likely than low electricity-using households to use central AC as their primary cooling equipment (40% vs. 21% for low-using households), and this difference becomes even more pronounced in high cooling need areas (53% vs. 34%). Importantly, high electricity-using households in warmer regions are twice as likely to primarily rely on central AC compared to high-using households in temperate climates, demonstrating the critical role of cooling equipment in energy consumption patterns.

Recommendation: No recommendation needed. The investor-owned utilities (IOUs) are already including primary cooling replacements in their program offerings.

Implementation Challenge: This approach requires site visits to assess equipment age and operability, and new AC units represent a significant cost compared to other Energy Savings Assistance (ESA) measures. However, the strong correlation between older equipment and high usage, combined with customer-identified barriers around appliance affordability, suggests this investment could help to improve the efficiency of existing equipment. The IOUs could look into the feasibility of advanced metering infrastructure (AMI) data analysis along with customer-provided data to assess age and operability.

Secondary Cooling Measures for Homes Without Central AC

The research revealed that both low- and high-using households often use two cooling strategies (opening windows and using fans, or using central AC and opening windows [not necessarily at the same time]). Less than 30 percent of respondents rely on a single cooling strategy, and high electricity-using households are more likely to use multiple cooling strategies. Even when

respondents primarily use lower energy-intensive methods such as using fans or opening windows, they often supplement with higher-consumption equipment such as portable or window AC units. The regression analysis showed that even normalizing for climate, high-using households that have central AC use much more electricity than high-using households without AC. This could reveal both an opportunity for education on how to best keep the home cool (optimizing cooling strategies) and an opportunity to tune up or replace very old and inefficient central ACs.

Recommendation: When contractors identify a lack of central AC in hot regions, they could assess whether the cooling options are in good condition and able to adequately meet the household's needs, and if the systems are being used appropriately. Customers using multiple strategies could use education on how to best optimize cooling to balance the needs for comfort and energy efficiency. In some cases, the contractor may identify the need to replace old and inefficient portable cooling equipment or window ACs through the ESA program.

Challenge: At this time, the ESA program is not permitted to provide AC units for households that do not already have a central system. It may also be difficult to track the impact of educational efforts covering cooling systems.

Expanded Pump and Water System Upgrades

High-usage households demonstrate significantly higher rates of pump ownership across multiple categories. High-using households are more likely to have freshwater/sump pumps, hot water circulation pumps, well pumps, and irrigation pumps. High-using households are more likely than lower-using households to have water features (12% vs 3%) and hot tubs (12% vs 1%). These differences are statistically significant for pool pumps, but sample sizes are too small to determine if there are true differences in the comparisons between the other types of pumps. Across high gas- and electric-using households, 5 percent of respondents had a well pump. Four percent of low gas-using households had an irrigation pump.

Recommendation: ESA should expand beyond current pool pump offerings to include efficient upgrades for irrigation pumps, well pumps, and hot water circulation systems for high-using households that rely on this equipment. The program could also ensure that households know how much energy their equipment uses and how to use it optimally and efficiently.

Challenge: Given the low percentage of households overall that have pumps that are not pool pumps, it may be difficult to identify eligible customers.

Smart Strip Program Expansion

High-using households are significantly more likely than low-using households to have multiple plug loads including power tools (44% vs. 12%), medical equipment (34% vs. 12%), exercise equipment (20% vs. 3%), and dehumidifiers (11% vs. 5%). These households could benefit from expanded smart strip offerings, but some low-using households expressed concerns about fire risks from plugged items.

Recommendation: The ESA program should enhance smart strip use with educational materials showing multiple applications common in high-usage households as well as savings opportunities. The program should also consider increasing the quantity of smart strips offered per household based on home occupancy and identified plug loads. Implementation should include education on proper use and safety to address fire risk concerns while ensuring households actually utilize additional smart strips. It may help to provide examples of how other households have set up smart strips alongside various media.

Challenge: It may be difficult to confirm that households are using additional smart strips.

Continued Second Refrigerator Offerings

Forty-eight percent of high electricity-using households have second refrigerators compared to 21 percent of low-using households.

Recommendation: The program should also continue offering second refrigerator replacements, as nearly half of high-using households have these energy-intensive appliances.

Dishwashers and Clothes Dryers

The analysis revealed significant disparities in appliance ownership between high- and low-using households. High electricity-using households are much more likely to have dishwashers (77% vs. 38%) and clothes dryers (95% vs. 42%). The regression analysis highlighted the increased usage associated with having clothes dryers in high-usage homes.

Recommendation: IOUs that do not currently offer these upgrades should consider adding dishwasher and clothes dryer upgrades for households with existing old or inefficient equipment. Given that usage frequency greatly impacts savings and that measure costs are high, the program should consider limiting these measures to households with minimum occupancy levels to ensure cost-effectiveness. Note that the Energy Division expressed a preference for provisions of an IOU allowance for such upgrades if required by customers or targeting an offering tied to outcomes (such as offering only in high-using or larger households), though we would caution against creating adverse incentives for high usage.

Furnace Tune-Ups and Replacements for High-Usage Households

High-usage households most commonly use furnaces as their primary heating equipment (40% of high electricity-using households and 39% of high gas-using households use furnaces, compared to 26% of low electricity-using households and 22% of low gas-using households, respectively). Importantly, high-using households frequently supplement their furnaces with secondary heating equipment regardless of climate-driven heating need, suggesting inefficient primary systems.

Recommendation: When contractors identify secondary heating being used, they could assess whether the primary system is in good condition and able to adequately meet the household's needs, and if the secondary systems are being used appropriately. Both of these situations could

benefit from customized education on how to best optimize the use of multiple systems to balance the needs for comfort and energy efficiency. In some cases, the contractor may identify the need to tune up or replace old and inefficient primary equipment through the ESA program while encouraging customers to be less dependent on their space heaters.

Multifamily Heating Controls for Steam Radiator Systems

Focus groups in San Francisco revealed significant challenges with steam radiator heating systems in older multifamily buildings. Residents lack individual control over temperatures, leading to two problematic scenarios: using dangerous supplemental heating (such as space heaters) when buildings are not heated, or opening windows when radiators make apartments too warm. While less than 2 percent of survey respondents reported having steam heat,[28] this represents a particularly vulnerable population with limited control over their energy use.

Recommendation: The ESA multifamily program should include retrofit controls for existing central steam systems, paired with property owner education on efficient steam system operation. This could include thermostatic radiator valves, improved boiler controls, and steam system balancing similar to programs implemented in other states with a high prevalence of steam heating.

4.2.2 Behavioral Interventions

Tailored Conservation Education for High-Using Households

The research identified significant gaps in conservation behavior between high- and low-using households. Low-using households are more likely to believe conservation actions save energy and practice them "always or almost always." For example, low-using households are more likely to turn off lights consistently, adjust thermostats in cooling climates, and unplug appliances when not in use. However, half of high-using households already believe they use as little energy as possible, presenting a substantial barrier to behavior change.

High-using households face unique challenges including larger homes, more appliances, more residents, and children in the home. These immutable characteristics make energy conservation for this group more challenging but not impossible.

High-using households are also more likely to have medical equipment in their homes, and the proportion of people on medical baseline rates are lower than the proportion of people who have medical equipment, suggesting they could benefit from learning about the medical baseline rate.

[28] Respondents in multifamily buildings may not always be aware that their building uses a steam heat system, so this may be under-reported.

Recommendation: ESA should develop targeted educational materials tailored specifically for high-using households that:

- Share information on how to enroll in the medical baseline rate with confirmation of the types of equipment and conditions that make households eligible;
- Develop case studies using typical high-using household profiles (large homes, children, multiple appliances) matched with similar low-using households to show achievable conservation practices (doing things always vs. sometimes, using central systems at certain setpoints rather than in short bursts at more extreme set points) and associated savings;
- Use relatable household profiles to demonstrate conservation strategies that work for families with similar living situations, acknowledging the challenges of larger households while showing practical solutions. This may include offering education regarding possible savings from shifting usage on appliances or setting delays on washing machines, dryers, and dishwashers; and
- Encourage educational portion of site visit to include as many residents of the home as possible. Households with children may benefit from learning the cost of running child-oriented electronics, practical ways children can help with household energy conservation, and safety considerations specific to homes with children.

ESA can also follow up with high-using households after program treatment and compare their usage pre and post participation and remind them of the tailored education and household profiles with which they were provided. They could be offered a phone consultation with an energy auditor to answer questions and offer more tailored input in combination with reviewing their billing history. Note that this may lengthen the time it takes to complete a site visit. Post program follow-up will add cost to program implementation.

Safety and Conservation Education for Low-Using Households

Focus groups revealed that low-using households often make dangerous trade-offs to keep bills low, including using ovens and stoves for heating, turning off pilot lights (which they likely think turns off the gas usage, though it only does this in newer appliances with thermocouples), and enduring uncomfortable temperatures. These practices emerged more clearly in the focus groups than in survey responses, suggesting customers may be reluctant to report unsafe behaviors directly.

Low-using household respondents indicated they incorporate extensive conservation practices, with respondents describing "heating the person, not the space" through wearing multiple layers of clothing, using electric blankets, and enacting makeshift warming solutions. While their commitment to conservation is admirable, some practices may not save as much energy as these respondents believe and can pose safety risks.

Recommendation: The ESA program should develop safety-focused educational materials tailored specifically for low-using households that:

- Provide education on heating system and stove safety alongside program materials; this may already be included in current educational materials, but it may be worth following up with respondents to make sure safety suggestions are followed.
- Help low-using households understand which behaviors actually save energy and which do not, allowing them to focus on impactful behaviors while potentially improving comfort.
- Clearly flag dangerous practices such as using ovens for heating and explain both safety risks and limited energy savings.
- Include fact sheets about unsafe conservation practices and alternative safer approaches to energy savings.

4.2.3 Targeted Outreach

Language/Culturally Specific Outreach Throughout Program Implementation

The research identified important language patterns among low energy-using household residents. While similar proportions of residents in high- and low-using households speak both English and Spanish at home, low energy-using household residents who are bilingual are more likely to primarily speak Spanish at home compared to their high-using counterparts.

Focus groups conducted in Cantonese revealed cascading language barriers that extend beyond initial program outreach. Participants were unaware they could request utility bills in Cantonese or access translated utility websites, leading them to rely on word-of-mouth and translation apps. These tools often resulted in missing important program requirements and details.

Even when customers successfully enrolled in ESA, language barriers continued during the assessment and installation phases. One participant's refrigerator installation failed because translation apps had not conveyed the electrical requirements, forcing her to reapply for the program. Digital literacy challenges compounded language barriers, making online applications particularly difficult to navigate.

We also found much higher rates of high electricity-using households on tribal lands.

Recommendation: The ESA program should continue to include Spanish-language messaging specifically designed for low energy-using household outreach, recognizing that this population may have different communication preferences and conservation motivations than high-using households.

Recommendation: The ESA program should strengthen coordination with local in-language community-based organizations (CBOs) to provide support throughout the entire program process, not just initial outreach. This includes:

- Community outreach in primary languages for program awareness and energy conservation strategies;
- Community outreach specific to tribal lands via tribal partners;
- In-language contractor training and support during assessment and installation visits for non-English speakers;
- Coordination with the Community Help and Awareness of Natural Gas and Electric Services (CHANGES) Program, which was authorized by the CPUC as part of Decision 15-12-047. If the customer has a history with CHANGES, they may have an in-language case manager who may assist;
- Translation assistance for technical requirements and program details; and
- Digital literacy support for online applications and materials.

Appendix A: Survey Guide

Thank you for taking the time to participate in this survey on household energy use. This survey will take between 10 and 20 minutes, and you will receive a $25 e-gift card of your choice as a Thank You for your time.

Survey responses will be reported only as a group and will only be used for improving utility programs and services for Californians. During this survey we may collect personal information. Please be assured that all of your responses will remain confidential. For more details including [utility name from sample] policy on how they use personal information, please visit [utility URL from sample].

By clicking "NEXT" you consent to participate in this survey.

The initial questions provide some background about your household to ensure we are talking to a broad group of utility customers.

1. Do you rent or own your home?
    a. Rent
    b. Own
    c. Don't know
    d. Prefer not to say

2. Do you live in a single-family home or an apartment?
    a. Single-family home, detached
    b. Apartment, duplex, tri-plex, 4-plex, condo, or townhouse
    c. Don't know
    d. Prefer not to say

•

3. [IF Q2 = B] How many units are in your building?
    a. 2 – 4 units
    b. 5 – 10 units
    c. 11 – 39 units
    d. 40 or more units

e. Don't know
f. Prefer not to say

4. Does anyone in your household speak a language other than English?
    a. Yes
    b. No
    c. Don't know
    d. Prefer not to say
•
5. [IF Q4 = A] What are ALL of the languages that are typically spoken in your household? Select all that apply.
    a. English
    b. Spanish
    c. Mandarin
    d. Cantonese
    e. Chinese (not Mandarin or Cantonese)
    f. Tagalog/Filipino
    g. Korean
    h. Vietnamese
    i. German
    j. Japanese
    k. Other, please specify: _____
    l. Don't know
    m. Prefer not to say
•
6. [IF MULTIPLE SELECTED IN Q5] What language would you say is the primary language spoken in your household?
    a. [CARRY FORWARD SELECTED ANSWERS IN Q5]
    b. Don't know
    c. Prefer not to say

The next few questions are about your home and various appliances in your home.

7. What is the approximate square footage of your home/apartment?
    a. Under 1000 sq ft
    b. 1000 – 2000 sq ft
    c. 2001 – 3000 sq ft
    d. More than 3000 sq ft

e. Don't know
f. Prefer not to say

8. During the summer, how do you cool your home? Select all that apply.
    a. Open windows
    b. Ceiling fan(s)
    c. Portable fan(s)
    d. Window AC
    e. Portable AC
    f. Swamp cooler
    g. Central AC
    h. Mini-split/ductless heat pump [click for image]
    i. Ducted/central heat pump (i.e., air source heat pump, ducted heat pump, ground source heat pump)
    j. Something else, please specify: _____
    k. None of the above [make exclusive]
    l. Don't know [make exclusive]
    m. Prefer not to say [make exclusive]

•

9. [IF MULTIPLE SELECTED IN Q8] Of those you mentioned, which one is most often used to cool your home?
    a. [Carry forward selected answers to Q8]
    b. Don't know
    c. Prefer not to say

•

10. [IF MULTIPLE SELECTED IN Q8] You mentioned you mostly cool your home with [selected answer from Q9]. Can you tell us how important each of the following reasons are in why you chose [Q9 response]? [Matrix: Extremely important, Very important, Somewhat important, Slightly important, Not at all important, Don't know/Prefer to say]
    a. It is the cheapest option
    b. It is the most convenient option
    c. It saves energy
    d. It does a better job at cooling my home to my preferred temperature
    e. It is the quickest way to cool down my **whole** home
    f. It is the quickest way to cool down the most used room(s)

11. [SHOW IF MULTIPLE SELECTED IN Q8] Is there any other reason why you chose [Q9 response] to cool your home?
    a. Yes, please specify:
    b. No

c. Don't know
d. Prefer not to say

12. [IF Q11 = 1] How important is [Q11 text] in why you chose [Q9 response]?
    a. Extremely important
    b. Very important
    c. Somewhat important
    d. Slightly important
    e. Not at all important
    f. Don't know
    g. Prefer not to say

[Display if Q8 response count = 1 and Q8 = D, E, F,G, H, I] OR [if Q9 = D, E, F, G, H, I]

13. About how old is your [selected answer from Q8 or Q9]?
    a. Less than one year old
    b. Between 1 and 5 years old
    c. Between 6 and 10 years old
    d. Between 11 and 20 years old
    e. More than 20 years old
    f. Don't know
    g. Prefer not to say

14. During the winter, how do you heat your home? Select **all** that apply.
    a. Furnace (vents that blow warm air)
    b. Wall heater
    c. Mini-split/ductless heat pump [click for image]
    d. Portable space heater
    e. Wood or pellet stove/fireplace
    f. Electric or gas fireplace
    g. Radiant heat (radiators, floor heat)
    h. Baseboard heater
    i. Ducted/central heat pump (i.e., air source heat pump, ducted heat pump, ground source heat pump)
    j. Something else, please specify: _____
    k. Don't know [make exclusive]
    l. Prefer not to say [make exclusive]

15. [IF MULTIPLE SELECTED IN Q14] Of those you mentioned, which is most often used to heat your home?
    a. [Carry forward selected answers to Q14]
    b. Don't know
    c. Prefer not to say
•
16. [IF MULTIPLE SELECTED IN Q14] You mentioned that you mostly heat your home with a [selected answer from Q15]. Can you tell us how important each of the following reasons are in why you chose [Q15 response]? [Matrix: Extremely important, Very important, Somewhat important, Slightly important, Not at all important, Don't know/Prefer not to say]
    a. It is the cheapest option
    b. It is the most convenient option
    c. It saves energy
    d. It does a better job at heating my home to my preferred temperature
    e. It is the quickest way to heat up my **whole** home
    f. It is the quickest way to heat up the most used room(s)

17. [SHOW IF MULTIPLE SELECTED IN Q14] Is there any other reason why you chose [Q15 response] to heat your home?
    a. Yes, please specify:
    b. No
    c. Don't know
    d. Prefer not to say

18. [IF Q17= 1] How important is [Q17 text] in why you chose [Q15 response]?
    a. Extremely important
    b. Very important
    c. Somewhat important
    d. Slightly important
    e. Not at all important
    f. Don't know
    g. Prefer not to say

[Display Q19 if Q14 response count = 1 and Q14 = A, B, C, D, F, G, H, I] OR [if Q15 = A, B, C, D, F, G, H, I]

19. About how old is your [selected answer from Q15 or Q14]?
    a. Less than one year old
    b. Between 1 and 5 years old

c. Between 6 and 10 years old
d. Between 11 and 20 years old
e. More than 20 years old
f. Don't know
g. Prefer not to say

•

20. For each appliance below, please tell us if you have one in your home. [IF Q2 = B] Only include things that you have in your personal unit (i.e., not shared with others in your building or complex). [Yes, No, Don't know, Prefer not to say options for each]
    a. Oven/Stovetop
    b. Dishwasher
    c. Clothes washer
    d. Clothes dryer
    e. [IF Q2 = B] Hot water heater (individual for your unit)
    f. Stand-alone freezer
    g. A second, full-size refrigerator
    h. Plug-in electric vehicle charger
    i. Air purifier
    j. Dehumidifier
    k. Electric or gas BBQ

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21. Next are some less common items you may have in your home. For each, please tell us if you have one in your home. [IF Q2 = B] Only include things that you have in your personal unit (i.e., not shared with others in your building or complex). [Yes, No, Don't know, Prefer not to say options for each]
    a. Medical equipment (e.g., CPAP, electric wheelchair/scooter, ventilators, etc.)
    b. Projector
    c. Treadmill or other exercise equipment that is plugged in
    d. Sauna
    e. Air compressor, power tools, or electric lawn equipment
    f. Water feature
    g. Large Fish tank (20+ gallons)
    h. Jacuzzi, hot tub
    i. Heated pool
    j. Unheated pool
    k. Some type of pump (e.g., pool, well, sump, irrigation)

22. [IF Q20 = Count of Yes > 0|Q21 = Count of Yes > 0] Of the items you mentioned having, roughly how often are each of them used? [Matrix of "Never or rarely," "About once a year or less," "About once a month," "About once a week," "A few times a week," "Daily", "Don't know," "Prefer not to say"]

a. Carry forward Yes answers from Q20 and Q21.

•

23. [IF Q21A = YES & Q22 for Medical equipment != Never/Rarely] What medical equipment do you or someone in your household use that needs to be charged or plugged in? Select **all** that apply.
    a. CPAP/breathing machine
    b. Oxygen concentrator
    c. Nebulizer/ambulizer
    d. Motorized wheelchairs or scooters
    e. Other, please specify:_____
    f. Don't know [Exclusive answer]
    g. Prefer not to say [Exclusive answer]

•

24. [IF Q21L = YES & Q22 for Pump != Never/Rarely] What type of pump do you have in your home? Select **all** that apply.
    a. Freshwater/sump pump
    b. Hot water circulation pump
    c. Well pump
    d. Irrigation pump
    e. Pool pump
    f. Other, please specify:_____
    g. Don't know [Exclusive answer]
    h. Prefer not to say [Exclusive answer]

•

25. Do you have any other appliances or other items that are plugged in or use electricity or gas at your home that we have not yet asked about? (e.g., massage chair, amplifier, kiln, hobby or professional equipment).
    a. Yes, please specify: _____
    b. No
    c. Don't know
    d. Prefer not to say

26. [IF Q14 = A, B, D, F, G, H, J] OR [Q20A, Q20D, Q21I, Q21J = YES] OR [Q21E = YES AND Q2 = A] For all the appliances you told us you have in your home, can you tell us what fuel they use? [Only show appliances they use; matrix with "Electricity," "Natural gas," "Propane," "Wood/pellets", "Solar," "Don't know," "Prefer not to say"]
    a. [IF Q14 = A] Furnace
    b. [IF Q14 = B] Wall heater
    c. [IF Q14 = D] Portable space heater
    d. [IF Q14 = F] Fireplace
    e. [IF Q14 = G] Radiant heat (radiators, floor heat)

f. [IF Q14 = H] Baseboard heater
g. [IF Q14 = J] [Text response from Q14J]
h. [IF Q20A = Yes] Oven/stovetop
i. [IF Q20D = Yes] Clothes dryer
j. [IF Q21I = Yes] Jacuzzi, hot tub
k. [IF Q21J = Yes] Pool heater
l. [IF Q21E = Yes|Q2 = A] Hot water heater

The next few questions are about how energy is used in your home.

27. Below is a list of common ways people try to manage their energy use. In general, how much do you think each activity would contribute to saving energy? [Matrix from "Not at all," "A little," "Somewhat," "A lot", "Don't know," "Prefer not to say"]
    a. Turning off lights when not in use
    b. Adjusting thermostat
    c. Unplugging chargers, appliances, or other household items when not in use
    d. Keeping up with appliance maintenance (e.g., replacing air filters, HVAC service)
    e. Running appliances less frequently (i.e., clothes washer/dryer, dishwasher)

28. How often does your household do each of the following activities in your home? [Matrix from "Never or rarely," "Sometimes," "Often," "Always or almost always", "Don't know," "Prefer not to say"]
    a. Turning off lights when not in use
    b. Adjusting thermostat
    c. Unplugging chargers, appliances, or other household items when not in use
    d. Keeping up with appliance maintenance (e.g., replacing air filters, HVAC service)
    e. Running appliances less frequently (i.e., clothes washer/dryer, dishwasher)

•

29. How much does each of the following impact your household's ability to reduce energy use? [Matrix from "Not at all," "Very little," "Somewhat," "Very much," "A great deal", "Don't know," "Prefer not to say"]
    a. Uncertain about ways to save energy
    b. Limited time to take extra steps to save energy
    c. Saving energy is not a priority
    d. There is nothing more we can do to save energy
    e. My home has inefficient appliances
    f. Inability to buy more efficient appliances

30. Is there anything else that impacts your household's ability to reduce energy use?
    a. Yes, please specify:
    b. No
    c. Don't know
    d. Prefer not to say

31. [IF Q30=A] How much does [Q30 response] impact your household's ability to reduce energy use?
    a. Not at all
    b. Very little
    c. Somewhat
    d. Very much
    e. A great deal
    f. Don't know
    g. Prefer not to say

32. Imagine you were able to upgrade one appliance in your home to a higher efficiency. Which of the following appliances do you think would have the biggest impact on your energy bill upgraded? [SELECT ONE]
    a. Heating system
    b. [IF Q8 = B, C, D, E, F, G, H, I, J] Cooling system
    c. [IF Q20E = YES AND Q2 = A] Hot water heater
    d. [IF Q20C = YES] Clothes washer
    e. [IF Q20D = YES] Clothes dryer
    f. [IF Q20B = YES] Dishwasher
    g. Don't know
    h. Prefer not to say

33. When it comes to using and saving energy in your home, how important are each of the following desires? [Matrix from Not at all important, Slightly important, Somewhat important, Very important, Extremely important, Don't know, Prefer not to say]
    a. A desire to keep energy bills low
    b. A desire to be comfortable
    c. A desire to protect the environment

•

34. How does your household think about energy bills? Please select the one that is most like your household.
    a. We use as little energy as possible to keep bills as low as possible
    b. We sometimes use less energy to keep bills lower
    c. We do not pay much attention to energy use and/or bills

d. Something else: _____
e. Don't know
f. Prefer not to say

35. [IF Q34 = A|B] You mentioned that you generally try to keep the energy bills low. Which of the following best describes why you do this? Please select one.
    a. To afford essential needs (e.g., food, medicine, housing)
    b. To afford other priorities (e.g., kids sports, car payment, etc.)
    c. To afford non-essentials (e.g., entertainment, vacations etc.)
    d. To save for long term or unexpected financial needs
    e. Don't know
    f. Prefer not to say

36. How does your household think about comfort in your home? Please select the one that is most like your household.
    a. We use as little energy as possible, even when it is uncomfortably hot or cold inside
    b. We use as little energy as possible, even when it is warmer or cooler than we prefer
    c. We try to use less energy, but are not willing to be uncomfortable
    d. We do not pay much attention to energy use
    e. Don't know
    f. Prefer not to say

37. During the summer, when it is over 85 degrees outside, what temperature do you try to keep your home?
    a. Over 85 degrees
    b. Between 80 and 85 degrees
    c. Between 75 and 79 degrees
    d. Between 70 and 74 degrees
    e. 69 degrees or lower
    f. Don't know
    g. Prefer not to say

•

38. Last summer, roughly how many days was your home over 85 degrees inside?
    a. More than 30 days
    b. Around 16 to 30 days
    c. Around 6 to 15 days
    d. Around 1 to 5 days
    e. Never
    f. Don't know
    g. Prefer not to say

39. [IF Q38 = A|B] You mentioned your home is often over 85 degrees during the summer. Can you tell us in a sentence or two what you do to cool down in the summer?
    a. _____

40. Now, during the winter, when it is 60 degrees or lower outside, what temperature do you try to keep your home?
    a. 59 degrees or lower
    b. Between 60 and 65 degrees
    c. Between 66 and 70 degrees
    d. Between 71 and 75 degrees
    e. Over 75 degrees
    f. Don't know
    g. Prefer not to say

41. Last winter, roughly how many days was your home 60 degrees or lower inside?
    a. More than 30 days
    b. Around 16 to 30 days
    c. Around 6 to 15 days
    d. Around 1 to 5 days
    e. Never
    f. Don't know
    g. Prefer not to say

42. [IF Q41 = A|B] You mentioned that your home is often 60 degrees or lower during winter. Can you tell us in a sentence or two what you do to warm up in the winter?
    a. _____

The next few questions are about **health-related needs** that may impact your household's energy use.

43. Do any members of your household have any health issues that require you to use more heating or cooling than you might otherwise?
    a. Yes
    b. No
    c. Don't know
    d. Prefer not to say

•

44. [IF Q43 = A] How do health issues impact how you heat and cool your home? Select all that apply. [cannot select a&b or c&d]
    a. We always need it cooler during summer
    b. We occasionally need it cooler during summer
    c. We always need it warmer during winter
    d. We occasionally need it warmer during winter
    e. Don't know [Exclusive]
    f. Prefer not to say [Exclusive]

45. In the past three years, has someone's health in the household been impacted because you were trying to use less energy to keep your bill lower? For example, not using sufficient cooling on a very hot day that led to a headache, dizziness, nausea, or heat stroke.
    a. Yes
    b. No
    c. Don't know
    d. Prefer not to say

46. [IF Q45 = A] In the past three years, how ***often*** was someone's health impacted because you were trying to use less energy?
    a. Rarely
    b. Sometimes
    c. Very often
    d. Always or almost always
    e. Don't know
    f. Prefer not to say

47. Have you or a member of your household ever experienced any of the following <u>accidents at your home caused by</u> burning wood, wood pellets, propane, or other fuels in your home? If so, select all that apply.
    a. House fires
    b. Explosions
    c. Skin burns
    d. Some other type of accident. Specify: _____
    e. None, no accidents [exclusive answer]
    f. Don't know [exclusive answer]
    g. Prefer not to say [exclusive answer]

48. Please read the following description of a program before answering the next question.

- Your utility offers the Energy Savings Assistance program to income-qualified customers free of charge. The program provides information on ways to save energy, energy efficiency light bulbs, and low flow shower heads. Some customers also qualify to receive a new refrigerator, repairs or upgrades to your heating, cooling, attic insulation and water heating equipment.

  The process to participate includes several steps. If you sign up for the program, a contractor will visit your home and review your eligibility including relevant income documents and proof of home ownership.

  [IF Q1 = A] If you are a renter, you will receive forms to give to your landlord before approving work that may impact the property.

  At this point the contractor may assist you in filling out the application and look around your home to see what improvements can be made to help you save energy and improve the comfort, health and safety of your home. If you qualify for any larger appliances or work, another contractor will return to install the items in a second and possibly third visit.

  Based on what is involved and what you may receive as described, using a scale from 1 – 5 where 1 means not willing at all and 5 means very willing, how willing would you be to sign up for the program and schedule the first contractor visit to see if your home qualifies?

  a. Score 1 - 5: ____
  b. Don't know
  c. Prefer not to say

Thank you for your participation in this survey. We have some final questions about your household before we collect information to send you your gift card.

-

49. How many people live in your household – including yourself - at least 9 months of the year – in the following age groups?
    a. Less than 6 years old: _____ [Restrict answers to whole number, 0-10]
    b. 6 to 18 years: _____ [Restrict answers to whole number, 0-10]
    c. 19 to 40 years: _____ [Restrict answers to whole number, 0-10]

d. 41 to 65 years: _____ [Restrict answers to whole number, 0-10]
e. More than 65 years: _____ [Restrict answers to whole number, 0-10]

50. Now, we would like to ask about your household's total income to help us understand how different types of households manage their energy use and energy costs. In 2023, was your household's total income, before any taxes, greater than or less than [FPL based on household income]?
    a. Greater
    b. Less
    c. Don't know
    d. Prefer not to say

•

51. [IF Q50 = a or b] Which income bucket best represents your household's total income, before any taxes, in 2023? Please include income from all adult household members.
    a. Less than $5,000
    b. $5,000 to $10,000
    c. $10,001 to $15,000
    d. $15,001 to $20,000
    e. $20,001 to $25,000
    f. $25,001 to $30,000
    g. $30,001 to $35,000
    h. $35,001 to $40,000
    i. $40,001 to $45,000
    j. $45,001 to $50,000
    k. $50,001 to $60,000
    l. $60,001 to $75,000
    m. $75,001 to $100,000
    n. $100,001 to $125,000
    o. $125,001 to $150,000
    p. $150,001 or more
    q. Don't know
    r. Prefer not to say

•

52. [IF Q51 = A, B, C, D] Just to confirm, your household lived off of less than [$5,000, $10,000, $15,000, $20,000] last year. In a sentence or two, could you describe how you managed to pay for food, housing, and other basic necessities?
    a. _____

Thank you for your time and patience.

As a thank you for participating, we would like to send you an electronic $25 Tango card. A Tango gift card is an electronic gift card that you can redeem at a variety of online retailers or restaurants (including Amazon.com, App Store & iTunes, Google Play, CVS, Dunkin' Donuts and more), redeem for an online prepaid card or donate to your choice of charities.

What is the best email to send the gift card to?

Name:

Email:

Confirm Email:

Appendix B: Outreach Scripts

This document contains scripts for the following program outreach:

1. Initial email

2. Follow-up email

3. Response to any incoming calls to Ewald and Wasserman

Initial Email

Subject: Improve California utility service by sharing your experiences

Dear <name>,

We are following up on a post-card invitation we sent you a few days ago. We need your help to understand the opinions and experiences of households like yours.

The California Public Utilities Commission (CPUC) and your utility company are working to improve energy programs and services for Californians. Your household was randomly selected for a study to ensure California households are well-served by the state's utilities. The research firm E&W Research has been hired to conduct this study and provide us with this helpful data.

To thank you for providing feedback, you may select a $25 e-gift card from one of many options after the survey is completed.

The online survey takes about 15 minutes and includes questions about the heating and cooling needs of your household. Your responses will be confidential, and will be combined when reported. No individual responses will be shared.

To access the survey click ***here***.

Following the online survey, you will receive an email with details on how to select and receive your $25 e-gift card.

If you have any questions or if you would like to take the survey by phone, please call E&W Research at 800-392-0131.

If you would like to confirm the validity of this study, please reach out to your utility call center at: [UTILITY NUMBER].

Refer to the "California Household Needs Assessment Study" when you call. You may also go to www.cpuc.ca/gov/validsurvey

La encuesta también está disponible en español.

Thank you for your help with this important study. Understanding your experiences and opinions will help the CPUC and California's utilities provide better service to households across the state.

Follow Up Email

Subject: Reminder to help improve California utility programs and services by sharing your experiences

Dear <name>,

We are following up on our survey invitation from last week. [same as previous email with first sentence replaced with preceding sentence.

Call Backs from Phone Outreach and Answers to Questions from Incoming Calls

Hello, my name is [_____] from Ewald and Wasserman Research, returning your call. We are conducting a survey on behalf of the California Public Utilities Commission and [UTILITY]. Have I reached [account holder]?

[*INTERVIEWER: IF THE RESPONDENT IS UNABLE TO DO THE SURVEY AT THE TIME OF THE CALL, ASK FOR A GOOD TIME TO CALLBACK AND SCHEDULE THE CALLBACK ACCORDINGLY.]*

We are conducting a study to help us better understand the experiences and energy needs of households like yours. As a token of our appreciation, we will send you a $25 e-gift card. You may have received a postcard from the California Public Utilities Commission about a survey.

A1) Did you receive a postcard invitation?
1) Yes --> Can you please provide me with the code printed on that postcard?
2) No
3) Got email

[IF A1 = 2]
The Public Utility Commission is asking for your help with a study to help them improve programs and services for the state's residents. As a token of our appreciation, we will send you a $25 e-gift card.

A2) Do you have time to do the survey over the phone now? This will take about 15 minutes.

[ALL]

Please be assured that what you tell me will be kept completely anonymous and will only be used to improve programs and services for California residents.

[IF NEEDED, SCHEDULE A CALL BACK]

[IF NEEDED:]

- YOURS IS ONE OF ONLY 900 CALIFORNIA HOUSEHOLDS BEING SURVEYED FOR THIS STUDY. YOU WERE CHOSEN AT RANDOM. IT WOULD BE VERY HELPFUL IF YOU COULD HELP BY COMPLETING THE SURVEY.
- THE SURVEY SHOULD TAKE ABOUT 15 MINUTES.
- THE QUESTIONS ARE FOR RESEARCH PURPOSES ONLY. WE ARE NOT SELLING ANYTHING, AND WE WILL NOT GIVE ANY OF YOUR SPECIFIC RESPONSES TO ANYONE OUTSIDE THE RESEARCH TEAM. WE WILL ONLY BE PASSING ALONG STUDY RESULTS THAT WILL BE SUMMARIZED AT A HIGH LEVEL.
- YOU CAN CALL THE CALIFORNIA PUBLIC UTILITIES COMMISION OR YOUR UTILITY DURING BUSINESS HOURS IF YOU HAVE ANY QUESTIONS ABOUT THIS STUDY. (GIVE APPROPRIATE PHONE NUMBERS)
- WE WILL BE SENDING YOU A $25 E-GIFT CARD.

- IF YOU HAVE ANY QUESTIONS ABOUT THIS STUDY, I CAN GIVE YOU A NAME AND PHONE NUMBER AT THE CPUC OR YOUR UTILITY TO CALL. WOULD YOU LIKE ME TO GIVE YOU THAT NUMBER? (IF YES:) PLEASE REFER TO THE "CALIFORNIA HOUSEHOLD NEEDS ASSESSMENT STUDY" WHEN YOU CALL.

Appendix C: Additional Methodology for Focus Groups

Specifics on how we selected the locations and cohorts are detailed in Table 23.

Table 23: Survey Findings by Climate Region

Climate Region	Survey Analysis Finding	Additional Investigation for Focus Groups
Low heating needs/high cooling needs	High-using households are more likely to use central ACs and ceiling fans.	We explored how they make decisions on which cooling strategy to use in focus groups 1 and 2.
High heating needs/high cooling needs	High electricity and high gas-using households used furnaces to stay warm. Lower-using households also have a higher incidence of furnaces in these areas compared to other regions. They also reported using multiple heating appliances.	A key objective of groups 3 and 6 was to understand how they make decisions around heating.
	We also saw that low electricity- and gas-using households in high-high regions were primarily using wall heaters and portable space heaters to stay warm.	Groups 4 and 5 helped us discern if this group is making health, safety, or comfort tradeoffs to stay warm.
Low heating/ low cooling needs	High-using households had much older equipment.	We explored this in focus group 7 to understand how the program can support households with new equipment or other weatherization measures.

Languages

Vietnamese and Mandarin/Cantonese are the third and fourth most commonly-spoken languages among high and low energy usage, low-income households in California.[29] We used Public Use Microdata Areas (PUMAs) to further analyze which Chinese language was most prevalent among high and low energy-using households. PUMA data provide much more detail within a household, but far less geographic specificity compared to Census data. Therefore, we are able to target

[29] Detailed findings were presented as part of the market characterization.

specific types of households only by groups of cities. We found that Cantonese speakers were more common in low-income high and low energy using households than Mandarin speakers.

Groups 2 and 6 engaged these households that did not have an opportunity to respond to the survey in-language to learn directly about their experiences.

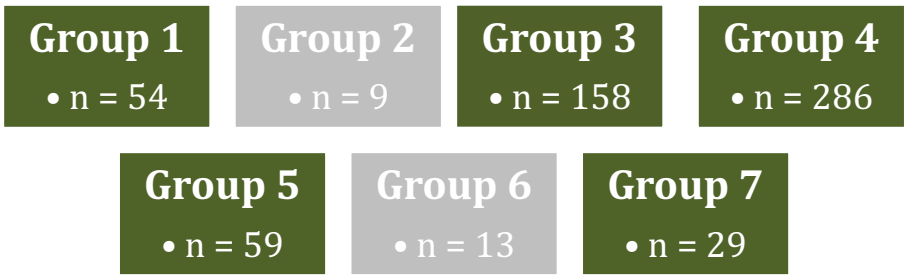
Implementation

Ewald & Wasserman (E&W) implemented the focus groups and provided local facilities with video recordings, in-language moderation, transcripts of sessions, incentives, and light snacks and beverages. Sessions were 90 minutes with 6 to 11 participants per group, and participants were compensated $150 for their time.

Recruitment

For English- and Spanish-speaking groups, we recruited from survey respondents that met the criteria from the themes to be discussed. Figure 32 shows the number of respondents from which we recruited.

Figure 32: Population of English- and Spanish-Speaking Survey Respondents by Focus Group



For Vietnamese- and Cantonese-speaking groups (groups 2 and 6), we utilized a multi-prong approach, summarized in Table 24.

Table 24: Multi-Pronged Recruitment for Vietnamese and Cantonese Speakers

	Prong 1	Prong 2	Prong 3	Prong 4
Population	Survey Respondents	Utility Customers	CBO Lists	E&W Lists
Number of Available Contacts or Participants	9 Vietnamese and 13 Cantonese	2,553, with estimated 272 Vietnamese and 142 Cantonese	Unknown	
Known	Language, energy usage, utility	Energy usage, utility	Language	Language
Unknown		Language	Energy usage, utility	Energy usage, utility
Approach	Email/phone recruitment	Census analysis to home in on regions, then call/email screener	Distribute screeners	
Notes/ Considerations	Most straightforward, but with small N, unlikely to yield many participants	Hard to recruit due to lack of response to the initial survey outreach.	Most unknowns, language and community-based recruitment brought us audiences that did not participate in surveys.	

Prongs 1 and 2

We used the data already collected from survey respondents and non-respondents. From these two groups (prongs 1 and 2 in the table), we already knew their energy usage profile (high or low) and that they are served by an investor-owned utility (IOU).

Through PUMA analysis, we identified that customers in low and high energy-using households that speak Vietnamese are highly concentrated in Central and Northwest Orange County, and Cantonese speakers in Northwest and West Alameda County and West Contra Costa County. In prong 2, this number of 2,553 represents the number of utility customers who are in high-/low-using households for which we already had contact data AND did not already complete the survey that are located in those selected cities. The subsequent numbers of estimated Vietnamese and Cantonese speakers were based on the proportion of customers in high/low energy-using households in those cities that speak the respective language.

Prongs 3 and 4

Since the population of existing contacts was small, we supplemented with prongs 3 and 4. Evergreen worked with community-based organizations (CBOs) to provide in-language recruitment materials to reach customers that did not participate through the survey. We used this

recruitment method in the areas with a high density of the targeted population (described above). Once we compiled the sample for these groups, we screened the population for low-income households with low and high usage using a short survey, translated in-language.

Households that primarily speak Vietnamese or Cantonese were harder to recruit to participate in focus groups due to language barriers and concerns regarding the current political climate. Working with CBOs with established reputations and providing in-language recruitment materials and bi-lingual moderators helped to overcome this barrier.

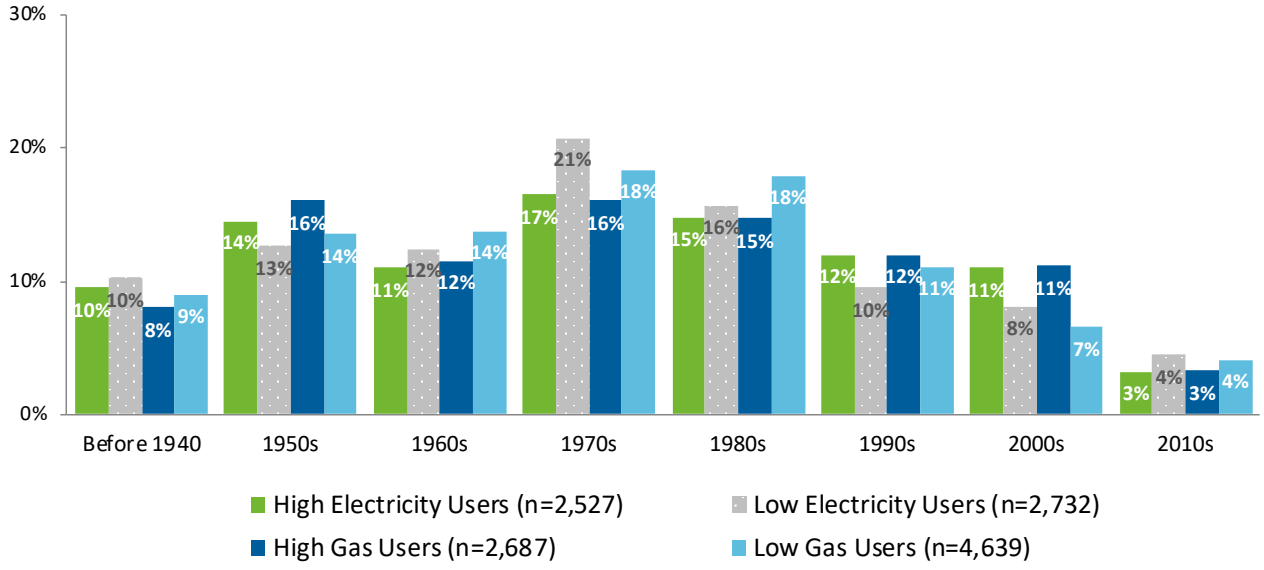
Customers were no different in their levels of importance **of keeping energy bills low.**

Customers only varied slightly regarding how many were on California Alternate Rates for Energy (CARE) vs. Family Electric Rate Assistance (FERA). Three percent of eligible customers shared by the investor-owned utilities (IOUs) were on FERA (with the rest on CARE) whereas low electricity-using households were not on FERA (0%). This is correlated with home size, which is a factor in choosing which rate program customers should utilize. Larger homes, with more people, are more common within the high electricity-using groups.

Home Age

There were no significant differences between high- and low-usage households based on home age (Figure 33). It is feasible that older homes are more likely to have been remodeled, which would make them function more like newer homes.

Figure 33: Low- and High-Energy-Usage Households by Home Age



Source: 2019 Census ACS

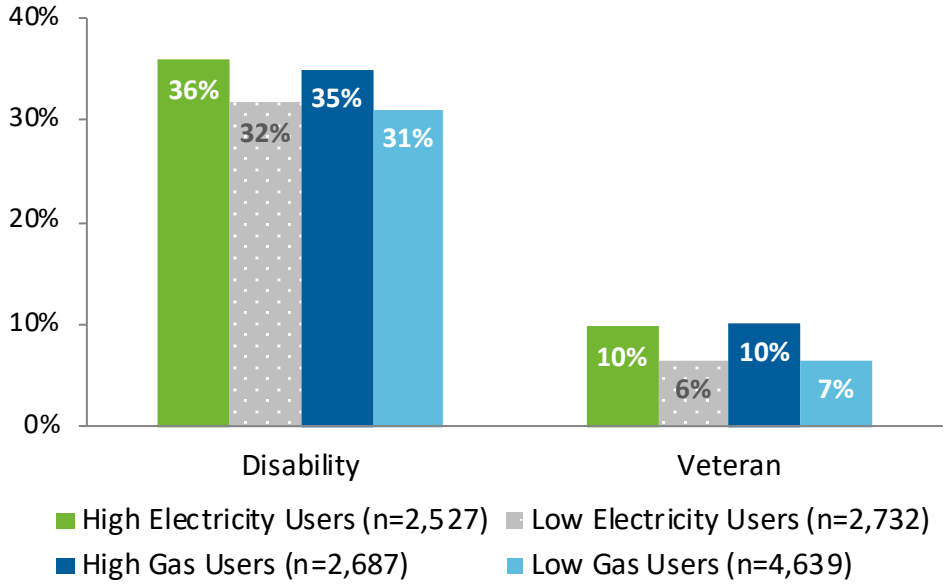
In focus groups, some mentioned that their homes were old and that there were limitations to installing new appliances, such as panel and circuit issues, or worry that the building could not physically support heavier appliances. Finally, even if they were able to install appliances, focus group participants were skeptical that they would save much on their bill due to the more efficient

appliances. They referred to other efficient upgrades they had made with no changes to their bills. For example, one participant's home lacks insulation entirely—despite an AC technician confirming their system works properly, the house cannot maintain temperatures below 80°F even with the AC running continuously all day, often reaching 90°F inside.

Disability Status and Veteran Status

There are no significant differences in proportions of low- and high-usage households for households with someone with a disability and households with a veteran (Figure 34).

Figure 34: Low- and High-Energy-Usage Households by Resident Demographics

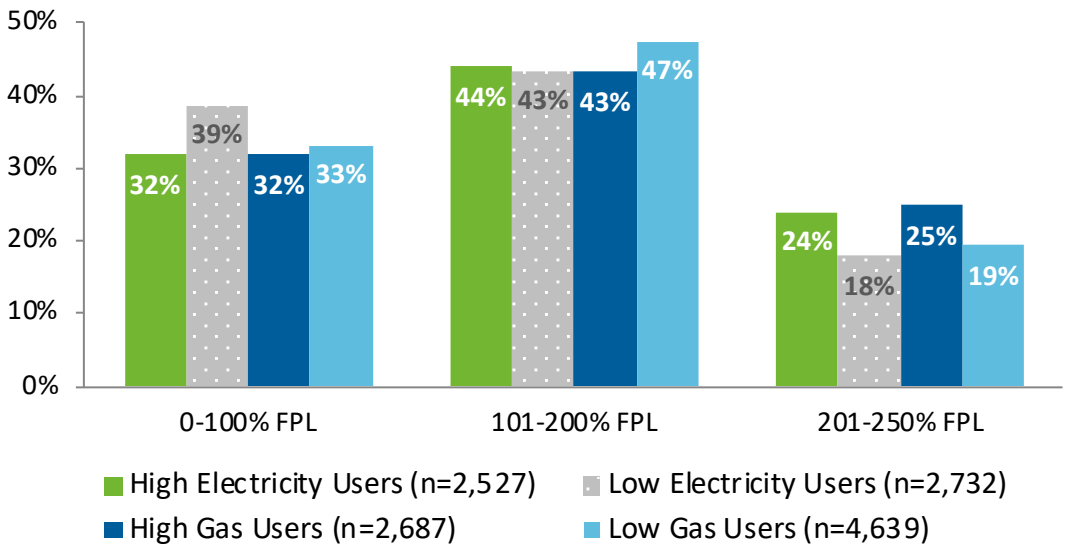


Source: 2019 Census ACS

Federal Poverty Level Bins

The proportion of high and low gas and electricity-using households does not vary significantly by federal poverty level (FPL) bin (Figure 35). There are slightly greater percentages of low-using households than high-using households in the 0-100 percent FPL group, and slightly higher percentages of high-using households than low-using households in the 201-250 percent FPL group.

Figure 35: Low and High Energy-Using Households by FPL Bins

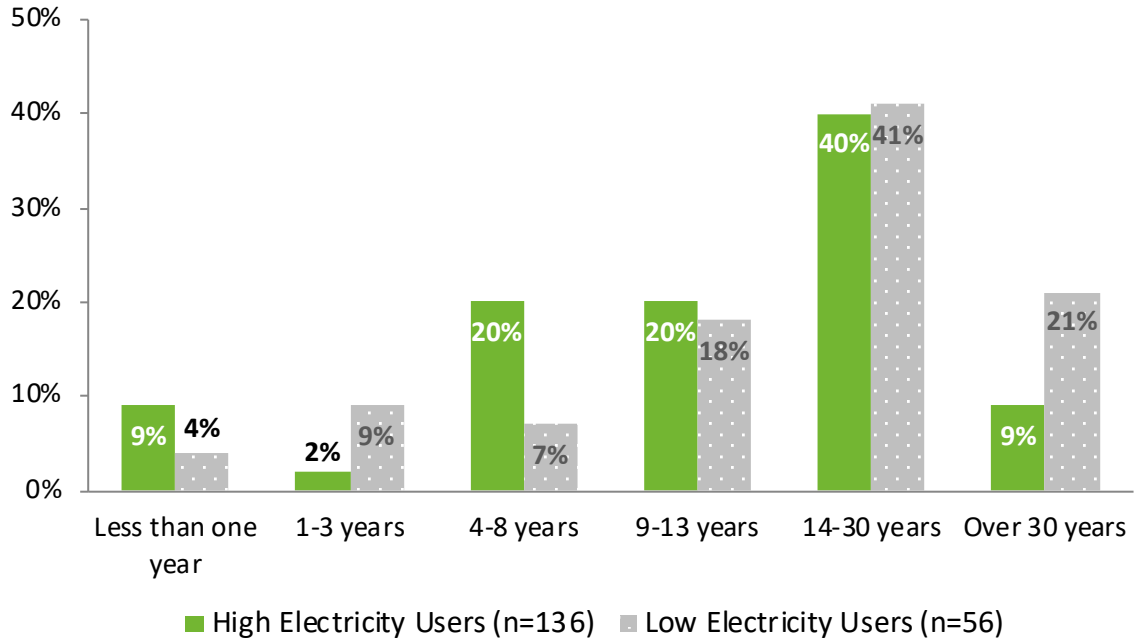


Source: 2019 Census ACS

Cooling Appliance Age

The proportion of high and low electric-using households by cooling appliance age is similar across age bins (Figure 36). The large proportion of high- and low-using households with cooling appliances between 14 and 30 years old could indicate increased usage of less efficient equipment (for the high-using households) and less usage of equipment that is not working or is not working well (for the low-using households).

Figure 36: Low- and High-Using Households by Cooling Appliance Age



Source: 2019 RASS

Appendix E: Regression Details

Two separate linear regression models were estimated to examine the predictors of electric energy consumption in the summer months for high-using households (n=311) and low-using households (n=340). In this analysis, summer energy consumption is defined as total kWh used in the months of June, July, August, and September. The models include household occupancy, the presence of certain cooling equipment and other appliances, cooling degree days (CDDs), and comfort decision variables as predictors of energy consumption.

Table 25 presents the findings from the two regression models Evergreen ran for this analysis. The values in the table represent the parameter estimates for each variable as a driver of summer electricity usage, with the standard errors in a second row. The asterisks indicate statistically significant levels based on p values.[30] The last three rows indicate the constant of the regression equation, the number of observations, and two tests of statistical significance (the R squared and F statistic).

Table 25: Linear Regression Model Results

Variable	High-Using Household Model	Low-Using Household Model
Household Occupancy	92*	26**
	(56)	(12)
Central AC	1,192***	175***
	(233)	(48)
Portable AC	-	111**
	-	(52)
Medical Equipment	845***	-
	(236)	-
CDD	0.9***	0.2***
	(0.2)	(0.02)
Clothes Dryer[31]	998**	-

[30] A p-value (or probability value) measures the probability of obtaining the observed results. P-values range from 0 to 1, with smaller p-values indicate stronger evidence against the null hypothesis of no effect.

[31] We are uncertain about the fuel of the clothes dryer. While we did ask the fuel from survey respondents, for clothes dryer in particular the self-reported fuel is unreliable and electric billing data do not give any indication of fuel.

Variable	High-Using Household Model	Low-Using Household Model
	(436)	-
Desire for Comfort	447*	-
	(263)	
Constant	376***	332***
	(505)	(34)
Observations	311	340
Adjusted R^2	0.26	0.34
F statistic	18.9***	44.2***

Note: *p<0.1; **p<0.05; ***p<0.01 (a dash means the variable was not included in the model)

Table 26 lists all the variables tested in this analysis for significance. The variables included in the final model are highlighted here in green and can also be found in Table 9.

Table 26: Regression Analysis Variables

Variable	Description
Summer of 2023 kWh	Total kWh from June through September
Household Occupancy	Household occupancy; binning 8+ households
Central AC	Dummy variable for presence of central AC
Portable AC	Dummy variable for presence of portable AC units (including window AC, swamp cooler, portable AC)
No Clothes Dryer	Dummy variable for presence of those with no clothes dryer in the home
Medical Equipment	Dummy variable for presence of medical equipment
Desire for Comfort	Dummy variable for 'a desire to be comfortable is very or extremely important'
CDD	Cooling Degree Day
Adult Occupancy	Household occupancy of those aged 19-65 years
Senior Occupancy	Household occupancy of those aged greater than 65 years
Child Occupancy	Household occupancy of those aged less than 19 years
Single Family	Dummy variable indicating that a home is a single-family unit

Variable	Description
Multi-Family with 2-4 units	Dummy variable indicating that a home is a multifamily building with 2-4 units
Multi-Family with 5-10 units	Dummy variable indicating that a home is a multifamily building with 5-10 units
Own	Dummy variable indicating that a survey respondent owns their home
English	Dummy variable indicating that English is spoken in the home
1,000-2,000 square foot home	Dummy variable indicating that a home is between 1,000 and 2,000 sq ft
2,001-3,000 square foot home	Dummy variable indicating that a home is between 2,001 and 3,000 sq ft
More than 3,000 square foot home	Dummy variable indicating that a home is greater than 3,000 sq ft
Heat pump	Dummy variable for the presence of a heat pump for cooling equipment
Second Fridge	Dummy variable for the presence of a second fridge
EV Charger	Dummy variable for the presence of an EV charger
Clothes Dryer	Dummy variable for the presence of a clothes dryer
Water Heater	Dummy variable for the presence of a water heater
Pool	Dummy variable for the presence of a heated or unheated pool, as well as a sauna or hot tub
Pump	Dummy variable for the presence of a pump
Water Feature	Dummy variable for the presence of a water feature
Q28a	Dummy variable for turning off lights when not in use always, almost always, or often
Q28b	Dummy variable for adjusting thermostat always, almost always, or often
Q28c	Dummy variable for unplugging chargers, appliances or other household items when not is use always, almost always, or often
Q28d	Dummy variable for keeping up with appliance maintenance always, almost always, or often
Q28e	Dummy variable for running appliances less frequently always, almost always, or often

Variable	Description
Q33a	Dummy variable for a desire to keep energy bills low is very or extremely important
Q34a	Dummy variable indicating that a household uses as little energy as possible to keep bills as low as possible
Q34c	Dummy variable indicating that a household does not pay much attention to energy use and/or bills
Q36a	Dummy variable that a household uses as little energy as possible even when it is uncomfortably hot or cold inside
Q37	Dummy variable that when it is over 85 degrees outside, a household tries to keep their home either between 70 and 74 degrees or 69 degrees and lower
CDD Ratio	A continuous variable that is the ratio of how many days one's home was over 85 degrees inside and CDD

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Appendix F: Full Set of Research Questions

The research questions below come from the request for proposals (RFP) and from discussions with the study team. The study team screened the full list at the outset of the study planning process, identifying which are primary and must be addressed by the study research and which are secondary and may not be fully addressable by this current study and its resources and timeframe.

Secondary research questions are marked with an asterisk (*).

1A. What are the drivers of high usage? Efficiency of home, behavior, etc.?

1B. Are certain customer segments more likely to exhibit high usage? (e.g., single-family dwellers, homeowners; those on Medical Baseline, disabled, veteran, elderly; extreme climate zones; large homes.)

1C. Which high-usage segments are more likely able to reduce usage without impacting their health or safety?

1D. What mix of measures, education, and behavioral incentives might ESA offer to these customers? How big is this group of high-using households? (What % of high-using households fall into this group?)

1E. What "high usage" issues can be addressed by ESA program? (measures offered or education?) How big is this group (what percent of high-using households fall into this group)?

1F. What characteristics/factors of high usage are unlikely mitigated by ESA?

1G. To what extent is high usage associated with weather or climate? What climate-specific needs may be addressed via ESA?

1H. To what extent is high usage driven by lack of conservation due to lack of education or other issues?

1I. To what extent is high usage driven by medical or health related needs?

2A. What are the drivers of low usage? Efficiency of home, housing type, behavior, etc.? Healthy conservation; dangerous conservation, small home, few in the home, etc.?

*2A.1. Are there segments more likely to exhibit low usage? (e.g., multifamily renters, small homes, new homes, homes with few residents, etc.)

2A.2. What are the key characteristics of low-usage customers?

2B. To what extent is low usage driven by extreme conservation at the expense of basic health and safety needs?

2B.1. What proportion of the low-usage households are conserving at the expense of essential needs? What segments or types of individuals/households tend to fall into this group?

2B.2. What, if anything, can ESA offer to mitigate health and safety risks that may be associated with extreme/unhealthy conservation?

2C. What, if any, needs of low usage customers can be accommodated by what ESA offers?

2D. How big is this group of low-using households? (What % of low-using households fall into this group?)

*2E. To what extent is low usage driven by attitudes and behaviors associated with desirable conservation and/or environmental concerns?

*2F. Roughly what proportion of the low-usage households fall into this group?

*2G. To what extent is low usage based on other factors such as size of home, number in home, and/or type of home?

2H. What factor or factors best characterize the low-usage segment of the low-income population?

3A. How are customers impacted by peak and non-peak time-of-use rates?

*3B. How does customers' understanding of TOU rates impact their usage?

*3C. Can we improve IOU communications and education on TOU rates?

*3D. How will building electrification and reduced natural gas incentives impact these customers?

*3E. To what extent does affordability or income correlate with energy use?

3F. What modifications might improve information and education for high energy use households, for low energy use households and for segments with different information needs? How can we increase knowledge re conservation?

*3G. What modifications can improve outreach to identify households that would not benefit significantly from the ESA program? (cost savings)

*3H. What modifications can improve outreach to identify households that would benefit the most from the program? (getting results)

The final question was redefined as a question regarding findings rather than a research question in and of itself by the study team during the review of the work plan:

*3I. Are there modifications that equitably address the needs of both high use and low use customer segments? (e.g., not reward high use with more measures; or penalize low-using households with fewer measure upgrade opportunities)

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Appendix G: Additional Research

Home/Structure Characteristics

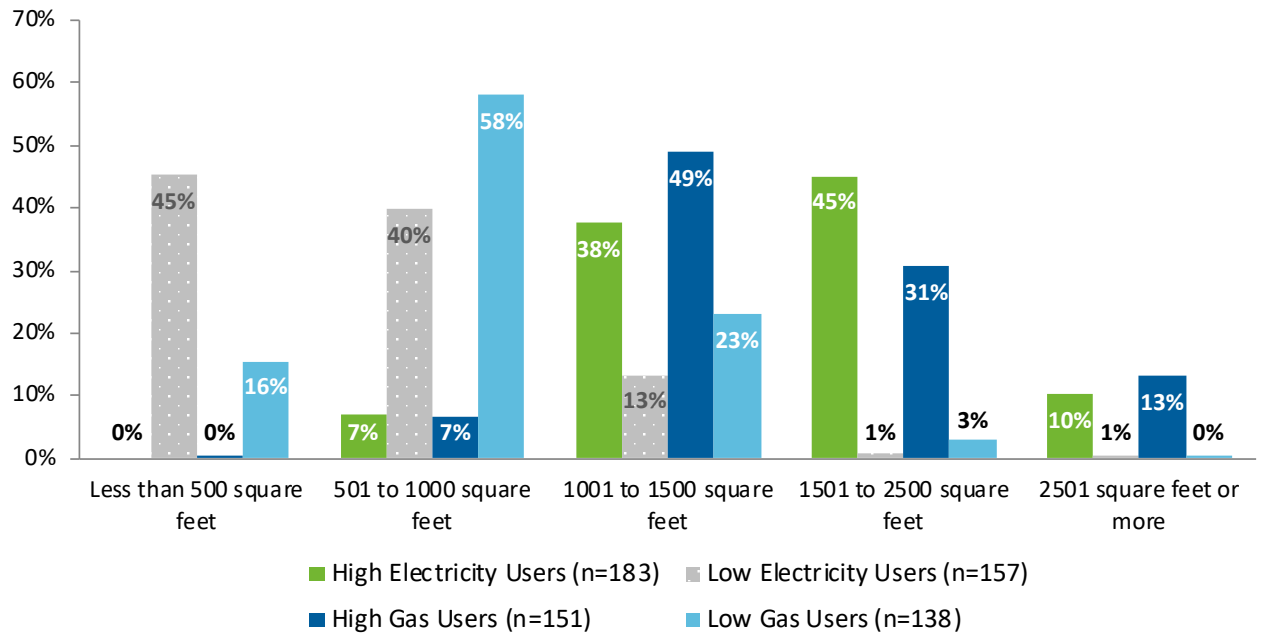
This section focuses on home characteristics that impact energy usage. While many of these characteristics are not treatable by the program, they may impact targeting for specific program features.

Home Type

Both the market characterization and the customer survey identified that **high gas- and high electricity-using households are more likely to live in single-family homes**. This follows logic as there is more space that is needed to heat and cool in a home. This is confirmed by the customer survey finding that low-using households are much more likely than high-using households to live in homes under 1,000 square feet (42 to 59 percent).

Figure 37 shows that the majority of the homes that are physically larger consume higher amounts of energy while households living in smaller homes (less than 1,000 sq ft) rarely use high amounts of energy. **Interestingly, there is a dramatic shift in the amount of energy used by households living in homes greater than 1,000 square feet,** as shown by the increase in the proportions of high electricity- and high gas-using households in the larger homes (green and dark blue bars)**.**

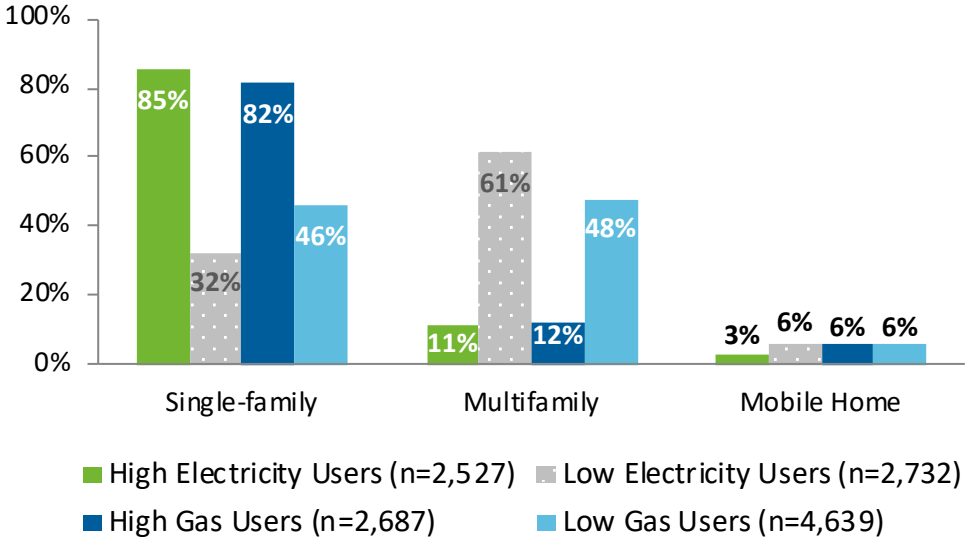
Figure 37: Low and High Energy-Using Households by Home Size



Source: 2019 RASS

The majority of high-using households are in single-family homes (Figure 38). However, **low-using households are not only in multifamily homes**, with 32 percent of low electricity-using households and 46 percent of low gas-using households in single-family homes. As indicated in Figure 38, only **11 percent of high electricity and 12 percent of high gas usage can be found in multifamily homes**, which may have different needs than their single-family counterparts.

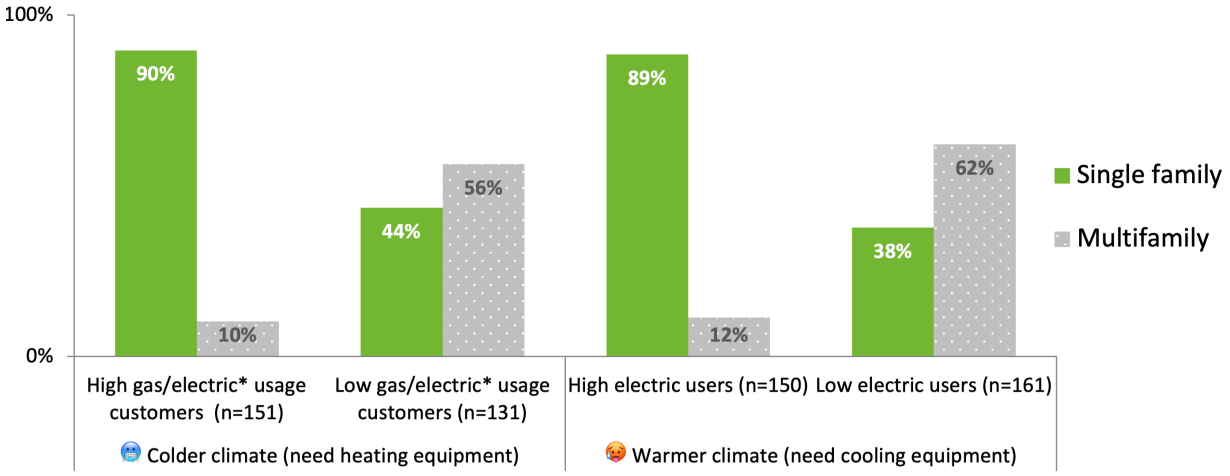
Figure 38: Low and High Energy-Using Households by Home Type



Source: 2019 Census ACS

We categorized customers into high and low energy-using groups based on their heating and cooling equipment fuel where it matches their high or low usage category (Figure 39). As an example, the first two columns show homes where a gas heating method would only be included if they are gas high-using households (where the fuel group matches the primary heating method). Low-using households, however, reside in both multifamily and single-family homes, suggesting that **there may be something that single-family high-using households can learn from their low-using household counterparts.**

Figure 39: Comparison Of High- And Low-Using Customers' Dwelling Type By Climate Needs

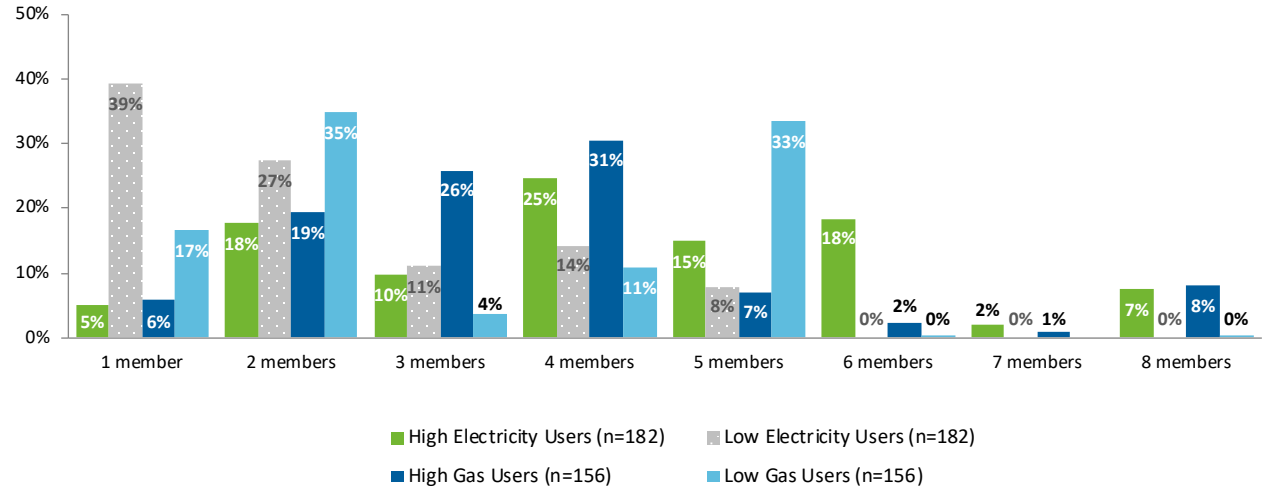


Source: Customer Survey, *high usage is defined by being a high-using household of their primary heating fuel.

Household Size

A large portion of low electricity-using households are households with one or two members (Figure 40). Large households with six, seven, or eight members are almost always high-using households.

Figure 40: Low and High Energy-Using Households by Household Size



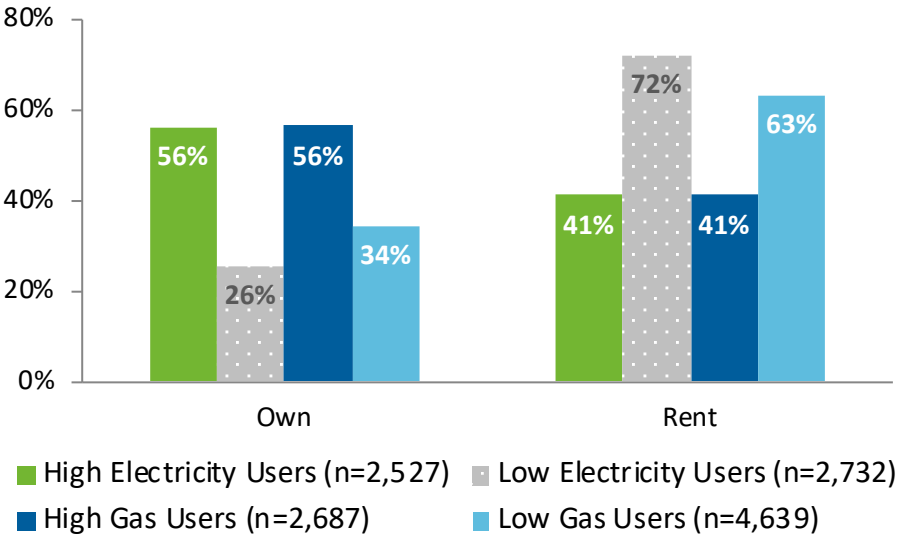
Source: 2019 RASS

Focus group participants in high-using households discussed barriers to taking energy saving actions, such as high occupancy in the home that forces them to keep energy usage high. For example, one participant said their household comprises seven people, and they collectively drive three electric cars, which use a lot of electricity to charge.

Own/Rent

High-using households are more likely to be owners than low-using households for both electricity and natural gas (Figure 41)**.** The inverse is also true—low-using households have a greater proportion of renters.

Figure 41: Low and High Energy-Using Households by Home Ownership



Source: 2019 Census ACS

Landlord and renter relationships were the focus of the 2022 Low Income Needs Assessment (LINA).[32] The study included interviews with renters and landlords to better understand the relationships and barriers for renters to participate in the Energy Savings Assistance (ESA) program. The study found that communication with landlords was minimal (limited to two or three times a year), and that almost half of all renters were unlikely to contact landlords about appliance issues for fear of "annoying their landlords." The 2022 study found that renters also feared that their rents would be raised, they were skeptical that the program is actually free, and they were concerned that landlords would not do anything, even if they asked.

Focus group respondents from this research echoed this. Landlord approval was cited as a barrier for not only participating in the program, but also for upgrading their own appliances. Tenants mentioned that even when they offered to pay for new appliances themselves, their landlord would not allow it. Others mentioned that their landlords are skeptical that the program would truly provide free upgrades. One person was concerned that their landlord would raise their rent, and another feared repercussions for asking for anything.

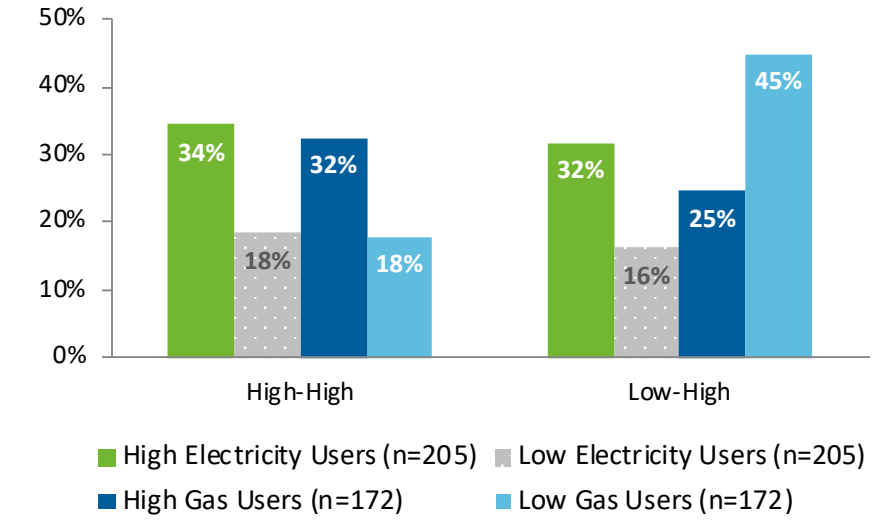
In 2021, CPUC Decision D. 21-06-015 created a separate ESA multifamily program. Part of the intent was to separate and better serve multifamily occupants of ESA, as many of the challenges with landlord relationships were experienced by renters in multifamily buildings.

[32] Evergreen Economics. 2022. *2022 Low Income Needs Assessment*. https://www.calmac.org/publications/2022_LINA_Report_120922_FINAL.pdf

Climate Zone

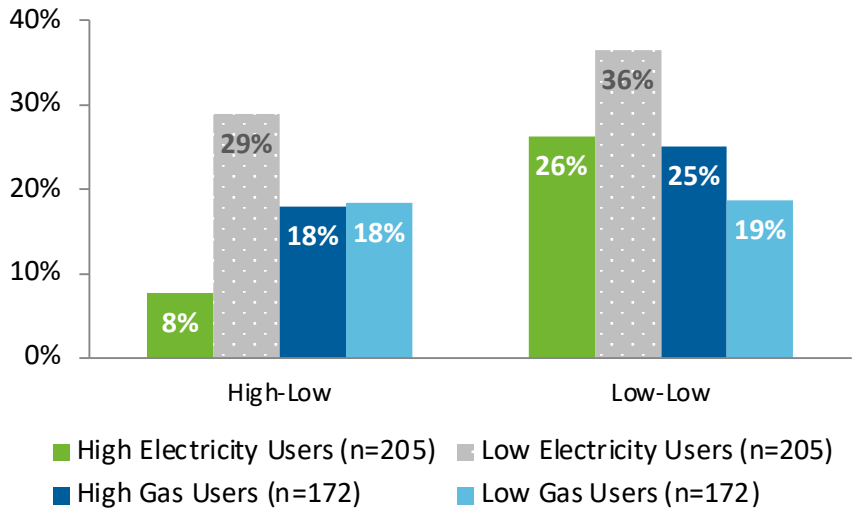
We see a strong **relationship between electricity usage and cooling need** (Figure 42). High electricity-using households are more likely than low electricity-using households to reside in high cooling zones [34% vs 18% in high-high (require high amounts of heating and high amounts of cooling) and 32% vs 16% in low-high (low amounts of heating need and high amounts of cooling need)]. Conversely, households in low cooling climate zones are more likely to be low electricity-using households (Figure 43). The relationship between heating load and gas usage is not as strong or consistent.

Figure 42: The Proportion of Low and High Energy-Using Households by High Cooling Climate Zones



Source: 2019 RASS

Figure 43: The Proportion of Low and High Energy-Using Households by Low Cooling Climate Zones



Source: 2019 RASS

In focus groups, participants in San Francisco mentioned that they do not need air conditioning. One person said, “I'm not worried about the summer. It doesn't stay hot in San Francisco very long. The wind's always looking around.” Participants in San Diego felt similarly. One participant said, “I used to always keep the sliding door open even in the winter because it's not that cold in San Diego."

Geographic Designations

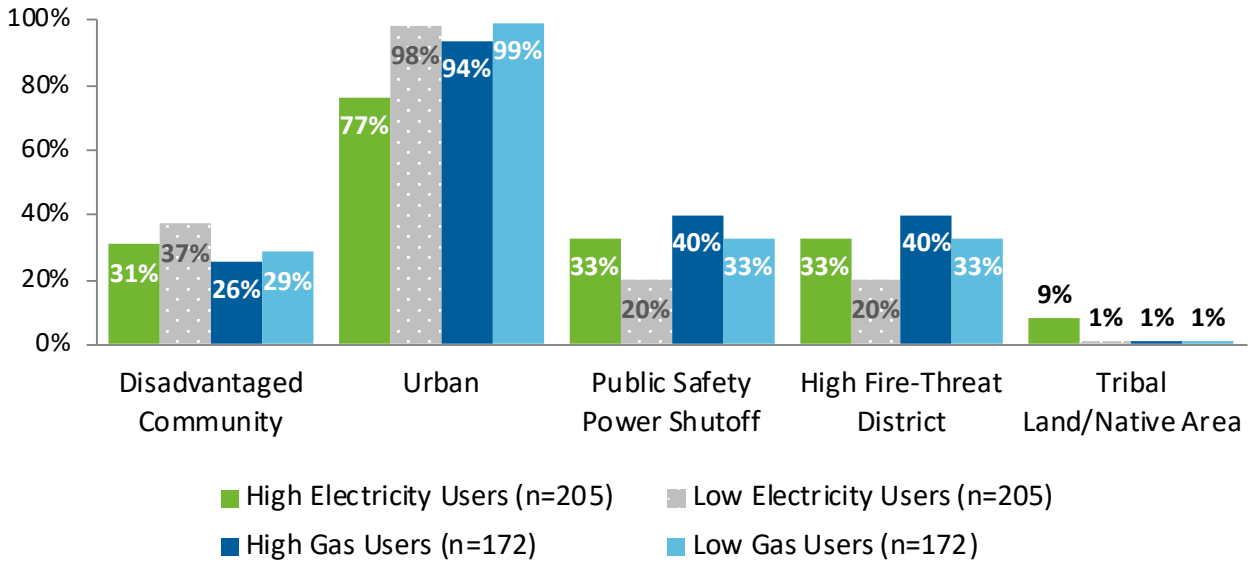
High-using households are more likely to reside in Public Safety Power Shutoff (PSPS) zones and **High Fire Threat Districts** (HFTDs) than low-using households, potentially due to them being in more extreme climates (Figure 44). Note that PSPS and HFTDs often overlap.

Nine percent of high electricity-using households reside in tribal areas, compared to only 1 percent of low electricity-using households. This likely differs across various service territories. The higher percentage of high electricity-using households on tribal lands could be attributed in part to their overlap with rural areas and exposure to more extreme climates. Additionally, the larger percentage of high energy-using customers in tribal lands may be due to the presence of many home-based businesses.[33] These businesses are often hard to identify as businesses because they are on residential rates and instead show up as high electricity-using households. There may also

[33] Hayward, Itzel Berrio, Small Business Utility Advocates. 2025. "Reply Comments of Small Business Utility Advocates on the BEAD Restructuring Policy Notice and Its Impact on California's BEAD Program." https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M571/K254/571254599.PDF, p4

be other contributing factors including lower participation in energy efficiency programs and different housing stock on tribal regions.

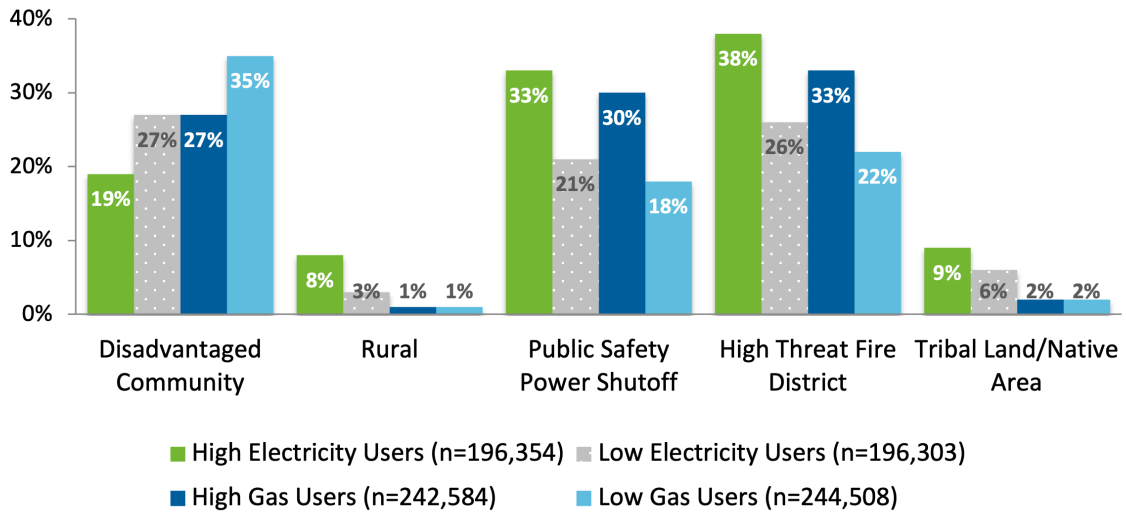
Figure 44: The Proportion of Low and High Energy-Using Households by Geographic Designation



Source: 2019 RASS

Investor-owned utility (IOU) data show similar findings, though the difference between high- and low-using households in disadvantaged communities (DACs) is more pronounced (Figure 45).

Figure 45: The Proportion of Low and High Energy-Using Households by Geographic Designation – IOU Data



Source: IOU Sample