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SJV DAC Data Gathering Plan

Findings Report

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Opinion Dynamics

Subcontractor(s)

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1. Executive Summary

This report presents the results of the Data Gathering Plan as a part of a larger initiative to increase access to affordable energy in disadvantaged communities in the San Joaquin Valley.

1.1 Background

In 2014, Assembly Bill (AB) 2672 "amended the California Public Utilities Code to include Section 783.5, which seeks to increase affordable access to energy for disadvantaged communities (DACs) in the San Joaquin Valley (SJV) and to improve the health, safety and air quality of these communities."[1] Section 783.5 directed the California Public Utilities Commission (CPUC) to identify DACs in the San Joaquin Valley that meet specific income, geographic, and population requirements. Additionally, the CPUC was directed to open a proceeding to evaluate the economic feasibility of extending natural gas pipelines, increasing subsidies, and other options intended to improve access to affordable energy for the identified communities. The statute is particularly focused on low-income households that lack natural gas service and must rely on electricity, propane, or wood burning to fulfill their space heating, water heating, and cooking needs. Section 783.5 defines a San Joaquin Valley DAC as meeting the following criteria:

- At least 25 percent of the residential households with electrical service are enrolled in the California Alternate Rates for Energy (CARE) program pursuant to Section 739.1;
- Has a population greater than 100 persons within its geographic boundaries as identified by the most recent survey;
- Has geographic boundaries no further than seven miles from the nearest natural gas pipeline operated by a natural gas corporation; and
- "San Joaquin Valley" means the counties of Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare.

In 2015, the CPUC initiated Rulemaking (R.) 15-03-010[2] to identify disadvantaged communities eligible under Section 783.5 and approved a list of 170 San Joaquin Valley disadvantaged communities that meet the statutory criteria. Nine communities were subsequently added to the list of DACs in 2018 bringing the current number of DACs to 179. The SJV DAC Pilot Program includes 11 total communities.

1.2 Study Objective and Target Population

The SJV DACs Data Gathering Plan entailed the collection of baseline data to inform an economic feasibility study of various interventions intended to reduce energy costs and mitigate the use of "alternative fuels" (such as propane, wood, and wood pellets) by residential customers residing in designated DACs in the SJV. As outlined in CPUC Decision 18-08-019 (hereafter, "the Decision"),[3] SJV DACs are defined as communities in which at least 25% of the residential households with electrical service are enrolled in the CARE program, have

[1] CPUC San Joaquin Valley Affordable Energy Proceeding, Decision 18-08-019, http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M225/K574/225574950.PDF, August 23, 2018.
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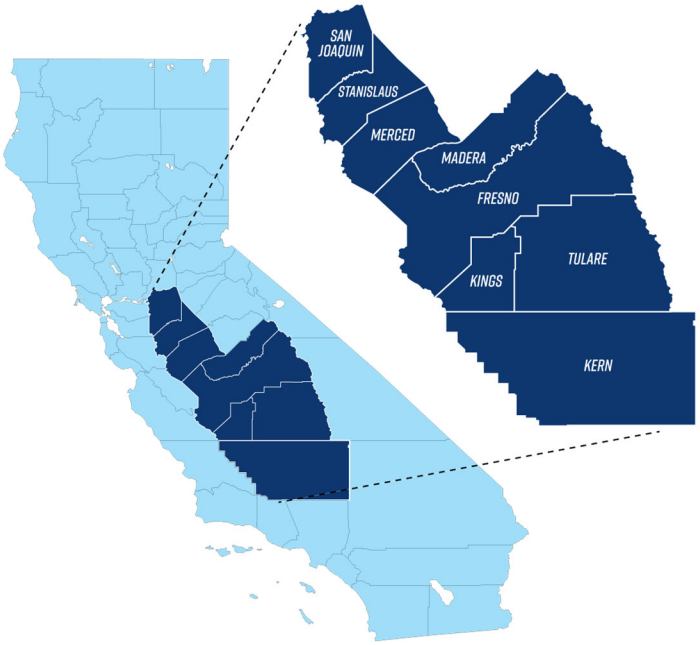
[3] CPUC Decision Approving Data Gathering Plan in San Joaquin Valley Disadvantaged Communities, Adopting Process for Updating the List of San Joaquin Valley Disadvantaged Communities, and Adding Nine Communities to the List, D.18-08-019 (August 2018). Available at: 225574950.PDF (ca.gov)

a population greater than 100 persons within its geographic boundaries as identified by the most recent survey, and have geographic boundaries no further than seven miles from the nearest natural gas pipeline operated by a natural gas corporation. SJV DACs consist of small, medium, and large communities. Small communities are defined as those with fewer than 1,000 households, medium communities as those with 1,000 to 10,000 households, and large communities as any with more than 10,000 households. SJV DACs are located in the counties of Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare (Figure 1).

Figure 1. Counties of the San Joaquin Valley



1.3 Data Collection Methods and Sources

We used numerous sources and data collection methods to conduct this project and address the research objectives. Data collection methods and sources included:

- The IOUs' customer and billing data were used to develop survey samples and calculate energy usage, costs, and burden.
- A quantitative survey with 2,660 customers designed to address multiple research objectives.
  - The survey sample was stratified to include a sufficient number of customers who do not have access to natural gas, live in small communities, and who live in mobile homes.
  - Both pilot and non-pilot DAC residents were invited to complete the quantitative survey. For non-pilot DAC residents, Opinion Dynamics mailed customers invitations to complete the survey online or over the telephone in either English or Spanish. We sent non-responders mailed invitation reminders, email reminders, and also followed up by telephone. Self-Help Enterprise (SHE) supported non-pilot customer outreach through community outreach, invitations to community-based organization (CBO) partners, schools, and local agencies. SHE distributed project fliers, conducted door-to-door canvasing in Kern and Tulare county, and contacted customers via email

and telephone. In addition to supporting data collection for non-pilot DACs, SHE administered and managed pilot community outreach through mailed invitations, emailed invitations, and telephone outreach.

  - The survey was fielded from March through April 2020 and then paused because of the COVID-19 pandemic. Fielding resumed in August 2020 and continued through the end of January 2021.

- Home audits with subsample of 259 survey respondents (156 in-home and 103 virtual), which verified survey responses that are prone to self-reporting error and collected information not suitable for a survey.

  - From September to November 2020, customers were given a choice between a virtual and an in-home audit. Starting in mid-November 2020, due to increased rates of COVID-19, the team switched to only offering virtual audits.

- Qualitative in-depth interviews with a subsample of 60 audit participants to provide a deeper understanding of alternate fuel usage, health and safety considerations, energy burden and perceived burden, as well as customer preferences.

  - The interviews initially took place in-person (albeit socially distanced and outdoors). They were shifted to telephone interviews due to the COVID-19 pandemic.

- Interviews with four propane and five wood suppliers in February 2021. We used the interviews to verify the survey responses on alternative fuel costs.

- A brief review of studies on the indoor air quality (IAQ) and ambient air quality impacts of alternative fuel appliances.

1.4 Key Findings

There are twelve research questions outlined as part of the Data Gathering Plan. These research questions are grouped below into five overarching topics. These topics help to organize and outline how these questions relate to each other. We've provided key findings for each research question below. In addition, the detailed baseline results throughout the report support and answer each of these questions.

1.4.1 Baseline Conditions

Original Research Question #1: What are the existing types and conditions of the homes and equipment/appliances in the 179 DACs in the San Joaquin Valley?

The SJV DACs Data Gathering Plan collected baseline data on more than 100 data elements covering home characteristics and conditions, fuels used for major space heating and cooling, water heating, cooking, and laundry, and equipment penetration, age, and efficiency. In Volume I of this report, we provide and interpret results for key data elements, both for SJV DACs overall and by subgroup, with a focus on households that lack access to natural gas. Volume II contains detailed results for all baseline data. Here, we provide results for several key home characteristics and equipment types.

- Single family detached homes are the most common home type in SJV DACS (80%) followed by single family attached homes (16%) and mobile homes (4%). Mobile homes are more commonly found in small communities than medium/large ones (20% vs. 6%).

- Most homes in SJV DACs are newer or middle aged. Just under half of homes (46%) have been built since 1992 with 20% homes having been built since 2005 (20%). Only 15% of homes were built prior to 1950.
- SJV homes tend to be smaller on average. Nearly half of homes in SJV DACs (48%) are smaller than 1,500 square feet. One-quarter of homes (26%) are over 2,000 sq. feet.
- Many homes have roofs in "like new" condition (42%). Half are "fairly good" condition (52%). Few respondents said their roofs leaked (4%) or had areas with missing shingles or panels (4%). The incidence of leaks and missing shingles is higher among renters, CARE eligible customers, and residents of small communities, mobile homes, and single family attached homes without natural gas.
- Just over three-quarters of SJV households (77%) rated the safety in their home as "good" (50%) or "extremely good" (27%). Just one percent of households reported the safety of their homes as "extremely poor." Renters and small community households were more likely to say their homes are less safe in comparison to owners and medium/large community households.
- One-third of SJV DAC residents experienced mold, mildew, fungus, or moisture in their homes in 2019. Few experienced it "all" (1%) or "many" (4%) times with most experiencing it "sometimes" (10%) or "rarely" (18%). Mold is a more common problem for residents of small communities, renters, and those eligible for CARE.
- Nearly three-quarters (73%) of SJV DAC residents had rodents, insects, or spiders in their homes in 2019. Relatively few had pests in their home "all" (4%) or "many" (9%) times with most having pests "sometimes" (23%) or "rarely" (37%). Households without access to natural gas were more likely to have pests in the home for reasons that are unclear. Pests are also more common occurrence for renters and those eligible for CARE.
- Central furnaces are the most common heating system across all SJV DAC homes, present in four out of five homes (86%). Homes with natural gas are somewhat more likely to have a central furnace than homes without natural gas (86% vs. 72%). Homes without natural gas are more likely to use portable space heaters (33% vs. 15%) and wood stoves (20% vs. 1%) than homes with natural gas.
- Most SJV DAC homes have some sort of mechanical air conditioning, typically central air conditioning (87%). Only 1% of homes have no cooling equipment. Compared to homes with natural gas, homes without natural gas are more likely to lack mechanical cooling equipment (8% vs. 1%) and, by extension, central systems (73% vs. 87%).
- Standard programmable thermostats are the most common thermostat type in the SJV DACs, installed in half homes (52%). The newest thermostat type, smart thermostats, are installed in nearly one-quarter of homes (25%). Natural gas customers are more likely to have smart thermostats than non-natural gas customers (25% vs. 15%).
- One-fifth of homes (20%) have a rooftop solar system. Solar is more common in medium communities, single family detached homes, owner-occupied homes, and CARE ineligible SJV residents. There is no difference in use of solar by natural gas access.

Original Research Question #2a: How do residents currently fuel their heating, water heating, clothes drying, and cooking needs?

The majority of households in SJV DACs utilize natural gas and electricity as fuel sources. Although the percentage of customers in SJV DACs without access to natural gas is small (~1%), this equates to roughly 8,200 households.

The vast majority of SJV households use natural gas for space (95%) and water heating (96%), cooking (90%), and clothes drying (70%). Many SJV households use multiple appliances and fuels for space heating and cooking. While the vast majority use natural gas for space heating and cooking, 18% also use electricity for space heating and 24% for cooking.

While nearly two-thirds of households without access to natural gas (72%) use propane for at least one major end-use, propane is not a 1:1 substitute for natural gas. Customers without natural gas are most likely to use propane for space heating (66%), followed by water heating (60%), cooking (46%), and clothes drying (22%). Although a sizable percentage of customers without natural gas use wood for space heating (42%), few use it for cooking (<1%). One-quarter of households without natural gas only use electricity.

1.4.2 Alternative Fuel Use Differences

Original Research Question #10: What, if any, benefits, hardships, and/or demographic differences exist between customers who use these alternative fuels and those who do not (e.g., health/comfort/safety benefits and sacrifices, usage levels, usage patterns, income, demographic profiles of households, etc.)?

The study reveals key demographic differences related to fuel use. Customers who lack access to natural gas and use alternative fuels (i.e., propane and wood) for space heating, cooking, water heating, or laundry are more likely to own their homes and be ineligible for CARE due to their incomes. Customers who instead only use electricity for these end uses are more likely to rent their homes and have lower incomes. While annual energy costs were greater for alternative fuel users compared to all-electric customers, energy burdens are similar suggesting that customers who use alternative fuels tend to be better equipped to afford these costly energy sources. This conclusion is corroborated by comparing the self-reported lived economic hardship index that shows all-electric homes having slightly higher economic hardship ratings compared to alternative fuel users. Income status best explains economic hardship, with CARE eligible customers having the highest self-reported economic hardship. Thus, although a rare scenario, low-income alternative fuel users are likely to experience particularly high energy burden and economic hardship.

Study results are mixed as to whether customers who do not have access to natural gas and rely on alternative fuels experience greater health, comfort, and safety hardships. Slightly under one in five customers who do not have access to natural gas and rely on propane or wood went without one of these fuels for financial reasons at least once in 2019 (17% for propane and 18% for wood). Customers without natural gas are slightly more likely to find their home to be both uncomfortably cool and hot compared to those with natural gas. Even though cooling is not fueled by natural gas, the higher heating costs of customers without natural gas may cause them to keep their homes at higher temperatures on hot days to save money.

Fuel outages and attempts to manage fuel costs are more likely to result in poor health for CARE eligible customers than non-CARE customers. Among non-CARE eligible customers, those who lack access to natural gas and have a household member with a health problem are no more likely than customers with natural gas to attribute this problem to attempting to reduce their energy bills. Similarly, non-CARE customers who lack access to natural gas are no more likely rate to their health poorly based on a health hardship index than customers with natural gas or all-electric customers. In contrast, CARE eligible customers are nearly three times more likely than non-CARE customers to report health hardships due to fuel outages and attempts to manage costs, regardless of fuel type.

We found little difference in various indicators of home safety by fuel access or use.

Original Research Question #11: Within the SJV DAC's what are key differences or similarities between households "served by natural gas" and those "minimally or not served by natural gas"?[4]

Compared to homes with access to natural gas, homes without natural gas are more likely to be owner-occupied, older structures, a single family detached or mobile home, and slightly larger. Residents of homes without access to natural gas are older and less likely to have children in the home and more likely to be Hispanic. Households without access to natural gas are also less likely to have internet service at home and broadband access. There is little meaningful difference between households with and without natural gas in terms of household income, education, and language spoken in the home.

1.4.3 Energy Usage & Burden

Original Research Questions #8, 9: What are the total energy costs including the bills for alternate fuel used by customers? How do these costs compare to those who have access to natural gas and electricity?

AB 2672 sought to increase affordable energy options in the SJV due to concerns about the high energy costs of customers who do not have access to natural gas and rely on alternative fuels. Study results show that these concerns were well-founded. Results confirm that customers who do not have access to natural gas pay more to fuel their homes than customers with natural gas. The annual total energy costs of customers without access to natural gas are 38% higher than customers with access to natural gas ($2,312 vs. $1,671).

Customers without access to natural gas rely on a variety of fuels to meet their needs. All electric customers have the lowest total energy costs on average ($1,687) and are comparable to the total costs of customers with natural gas. Customers whose only alternative fuel is wood have the next highest total fuel costs ($2,029). Propane use increases costs. Customers whose only alternative fuel is propane pay an average of $2,597 in annual energy costs. Customers who use both propane and wood have the highest total energy costs ($2,919).

Study results confirm that propane is a much more expensive fuel than natural gas. Households that do not have access to natural gas and use propane spent nearly three times as much on average for propane than households with natural gas spent on natural gas ($1,177 vs. $403). The average wood user pays less annually ($379), but most wood users only use wood for space heating, and some use wood as a supplemental source. Propane users typically fuel more than one end use with propane.

Original Research Question #3, 4, 5: What is the energy usage and energy burden of households that rely on alternate fuel sources, such as wood, propane, diesel generators, or other fuels for their heating, water heating, clothes drying, and cooking needs? How does usage and burden differ from comparable households in these communities that do not rely on these alternate fuels? What are key issues or drivers of the burden or hardship customers with alternative fuels (i.e., do not have natural gas or use only electricity) experience?

Energy burden is a function of household income and energy costs. As noted above, the average customer who lacks access to natural gas pays 38% more in annual energy costs than customers with natural gas. Customers without natural gas have proportionately higher energy burdens (5.9% vs. 4.5%). Annual household

[4] The original research objective called for a comparison of *communities* with different levels of natural gas service. The sample design for this study was designed to provide results for households with and without access to natural gas rather than characterize communities by their level of natural gas service. We have reworked the wording of this objective to be consistent with the sample design.

incomes do not differ by natural gas access so the difference in energy burden is driven almost entirely by higher energy costs.

However, the increased burden resulting from lack of access to affordable energy is not shared equally across all customers. Lack of access to natural gas has a disproportionately greater impact on lower income customers (indicated by CARE eligibility) than non-low income customers. CARE eligible customers who lack access to natural gas and live in small communities, mobile homes, or own their homes have particularly high energy burdens (11.1%, 10.1%, and 9.4% respectively). CARE eligible owners have higher energy burdens than renters because they are more likely to use expensive alternative fuels whereas renters are more likely to be all-electric. CARE ineligible customers have only slightly higher energy burdens than those with natural gas suggesting they have the financial resources necessary to cope with the higher fuel costs.

1.4.4 Fuel Preferences & Fuel Substitution

Original Research Question #2b, 2c: Is the reason for their current fuel access to other energy sources and if so, what are the constraints? Is their current fuel a preference, and if so, why the preference?

The main reason SJV DAC customers use alternative fuels is because they lack access to natural gas. Few customers prefer to use propane. When asked why they use propane, the most common responses were associated with fuel availability. Three-quarters of respondents (75%) cited their lack of access to natural gas, 8% said they used propane because it was available, and 7% said it was convenient. Few respondents gave a response that suggests propane is a preference (12% said propane is less expensive). When we asked propane users to provide reasons for not using propane, nearly two-thirds (62%) could provide one or more reasons not to use propane with the most common responses being propane's high cost (53%), inconvenience (20%), safety concerns (10%), and environmental impacts (10%).

SJV DAC customers also use wood due to their lack of access to natural gas, but responses suggest that wood use is more of a preference than propane use. A majority of wood users (51%) said they use wood because they do not have access to natural gas or it was convenient (17%). However, more wood users find their alternative fuel to be affordable than propane users. Slightly over half (55%) said that they used wood because it was more affordable than another fuel source. When we asked wood users to provide reasons for not using wood, approximately half (52%) could provide one or more reasons not to use wood with the most common responses being environmental impacts (32%), inconvenience (31%), high costs (13%), and safety concerns (8%).

Original Research Question #6: What are residents' attitudes and desires associated with their current fuel uses and potentially different ones (e.g., electricity or natural gas) to supplant use of propane, wood, diesel generators, or other fuels?

Overall, customers would be willing to switch to a less expensive energy source, especially when it comes to space heating or water heating equipment. Customers are more open to switching to natural gas systems than electric ones. Electric equipment, especially electric cooktops, will require more customer education. While new electric induction cooktops provide better temperature control, past experiences that customers have when cooking with a flame versus an electric cooktop will need to be overcome. Below, we provide specific results to support these conclusions.

When we asked SJV customers who currently heat with propane or wood if they would have any concerns switching to a natural gas heating system if it were provided and installed for free, two-thirds (68%) have no concerns. Availability of natural gas was the biggest concern cited (16%).

Fewer customers who heat with propane or wood have no concerns (56%) about switching to an electric heating system if it were provided and installed for free. Among those with concerns, the cost of electricity was the largest concern (18%). In-depth interviews revealed that customers already experience high electricity bills in the summer with their cooling systems, and they were concerned that the cost of electricity for heating may be prohibitively expensive.

While willingness to switch out heating systems is relatively high, the strongest preferences, and in turn the biggest barriers, are associated with cooking equipment. Over half of customers who do not have access to natural gas prefer cooking with a flame (48% strongly, 11% somewhat) while only 18% prefer cooking with an electric cooktop (10% strongly, 8% somewhat). The remaining 21% do not have a preference and 2% are unsure. Among households who currently use a propane stove or range for cooking, 85% prefer cooking with a flame (73% strongly, 12% somewhat). Even those that currently cook with electric cooktops are more likely to prefer cooking with a flame (45%) than electric (26%).

The main reasons customers provide for cooking with a flame include the ability to control and adjust the heat (39%), as well as the time it takes to heat up and cool the burner (23%). In addition, customers have traditions they associate with flame cooking (11%). During the in-depth interviews, customers expanded on these traditions and preferences. Customers noted that there are specific types of food that they cook on a flame (e.g., tortillas or peppers), and they also believe food tastes better when cooked over a flame.

Original Research Question #7: What factors (e.g., physical home, location, ownership status, attitudes, cultural/lifestyle beliefs) hinder individual households OR communities from replacing propane and wood with electricity or natural gas?

A majority of customers who currently heat with propane or wood would not be concerned about switching to a natural gas or electric system, though more have concerns about an electric system. The biggest concerns are fuel costs and access.

Only 32% of customers who heat with propane or wood would be concerned with switching to a free natural gas system. The biggest concern is the availability of natural gas (16%), presumably because customers have a hard time believing they would get access. A small number of customers said they were concerned with the costs of natural gas (6%) or that they did not trust a free offer (3%). Only 4% said they prefer their current system and fuel source.

A slightly higher percentage of customers who currently heat with propane or wood (44%) have concerns about switching to a free electric heating system. The biggest concern is the cost of electricity (18%). While all customers have electric service, 9% were concerned about the availability of electricity, which is likely associated with service reliability. Only 5% said they prefer their current system and fuel source.

As previously discussed, customers prefer cooking with a flame and have concerns about the performance of an electric cooktop. Customers do not feel that they will have the same cooking experience, the same taste, or the same control with an electric cooktop versus a flame.

Notably, renters in households without natural gas access do not have as strong of preferences or concerns as owners and have few concerns about fuel switching. Across all fuel switching scenarios presented, renters had the fewest concerns. Three-quarters (75%) of renters had no concerns about switching to an electric heating system while 82% had no concerns about switching to a natural gas heating system. Nearly two-thirds (63%) had no concerns about switching to an electric cooktop. It should be noted that renters also have more uncertainty around their fuel preferences and presumably much less control or decision-making power over equipment selection.

1.4.5 DAC Programs & Participation

Original Research Question #12: What energy programs or tariffs are already available to the disadvantaged communities that are expected to increase the affordability of energy? To what extent do customers take advantage of these?

The CARE program provides bill discounts for income-eligible electric customers in California. Notably, DAC designation was predicated upon at least 25% of the residential electric customers in the community being enrolled in CARE. Study results reveal that an even greater percentage of SJV DAC residents are eligible for CARE (48%), most of whom are enrolled (43% of all respondents are enrolled in CARE). Additionally, the IOUs offer a variety of programs to improve the energy efficiency of customers' homes. About half of SJV DAC households (51%) are aware of IOU energy efficiency programs, although only about one-sixth (15%) reported participating in any of them. Program participation is not significantly different by natural gas access, although owners and CARE ineligible customers are approximately twice as likely to report prior participation compared to renters and CARE eligible households.

2. Study Background – Data Gathering Plan

In 2014, Assembly Bill (AB) 2672 "amended the California Public Utilities Code to include Section 783.5, which seeks to increase affordable access to energy for disadvantaged communities (DACs) in the San Joaquin Valley (SJV) and to improve the health, safety and air quality of these communities."[5] Section 783.5 directed the California Public Utilities Commission (CPUC) to identify DACs in the San Joaquin Valley meeting specific income, geographic, and population requirements and to open a proceeding to evaluate the economic feasibility of extending natural gas pipelines, increasing subsidies, and other options intended to improve access to affordable energy for the identified communities. The statute is particularly focused on low-income households that lack natural gas service and must rely on electricity, propane, or wood burning to fulfill their space heating, water heating, and cooking needs. Section 783.5 defines a San Joaquin Valley DAC as meeting the following criteria:

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[5] CPUC San Joaquin Valley Affordable Energy Proceeding, Decision 18-08-019, http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M225/K574/225574950.PDF, August 23, 2018.
[6] CPUC Rulemaking R. 15-03-010. https://apps.cpuc.ca.gov/apex/f?p=401:56:0::NO:RP,57,RIR:P5_PROCEEDING_SELECT:R1503010. March 26, 2015.

3. Research Questions

There are twelve research questions outlined as part of the Data Gathering Plan. These research questions are grouped below into five overarching topics help to organize and outline how these questions rely on each other. The detailed baseline results throughout the report support and answer each of these questions.

3.1 Baseline Conditions

Original Research Question #1: What are the existing types and conditions of the homes and equipment/appliances in the 179 DACs in the San Joaquin Valley?

Original Research Question #2a: How do residents currently fuel their heating, water heating, clothes drying, and cooking needs?

3.2 Alternative Fuel Use Differences

Original Research Question #10: What, if any, benefits, hardships and/or demographic differences exist between customers who use these alternative fuels and those who do not (e.g., health/comfort/safety benefits and sacrifices, usage levels, usage patterns, income, demographic profiles of households, etc.)?

Original Research Question #11: Within the SJV DAC's what are key differences or similarities between communities "served by natural gas" and those "minimally or not served by natural gas"?

3.3 Energy Usage & Burden

Original Research Question #8: What are the total energy costs including the bills for alternate fuel used by customers?

Original Research Question #9: How do these costs compare to those who have access to natural gas and electricity?

Original Research Question #3: What is the energy usage and energy burden of households that rely on alternate fuel sources, such as wood, propane, diesel generators, or other fuels for their heating, water heating, clothes drying, and cooking needs?

Original Research Question #4: How does usage and burden differ from comparable households in these communities that do not rely on these alternate fuels?

Original Research Question #5: What are key issues or drivers of the burden or hardship customers with alternative fuels (i.e., do not have natural gas or use only electricity) experience?

3.4 Fuel Preferences & Fuel Substitution

Original Research Question #2b,c: Is the reason for their current fuel access to other energy sources and if so, what are the constraints? Is their current fuel a preference, and if so, why the preference?

Original Research Question #6: What are residents' attitudes and desires associated with their current fuel uses and potentially different ones (e.g., electricity or natural gas) to supplant use of propane, wood, diesel generators, or other fuels?

Original Research Question #7: What factors (e.g., physical home, location, ownership status, attitudes, cultural/lifestyle beliefs) hinder individual households OR communities from replacing propane and wood with electricity or natural gas?

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Original Research Question #12: What energy programs or tariffs are already available to the disadvantaged communities that are expected to increase the affordability of energy? To what extent do customers take advantage of these?

4. Methodology

The SJV DACs Data Gathering Plan entailed the collection of baseline data to inform an economic feasibility study of various interventions intended to reduce energy costs and mitigate the use of "alternative fuels" (such as propane, wood, and wood pellets) by residential customers residing in designated DACs in the SJV. As outlined in the Decision,[7] SJV DACs are defined as communities in which at least 25% of the residential households with electrical service are enrolled in the CARE program, have a population greater than 100 persons within its geographic boundaries as identified by the most recent survey, and have geographic boundaries no further than seven miles from the nearest natural gas pipeline operated by a natural gas corporation. SJV DACs consist of small, medium, and large communities. Small communities are defined as those with fewer than 1,000 households, medium communities as those with 1,000 to 10,000 households, and large communities as any with more than 10,000 households. SJV DACs are located in the counties of Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare (Figure 1).

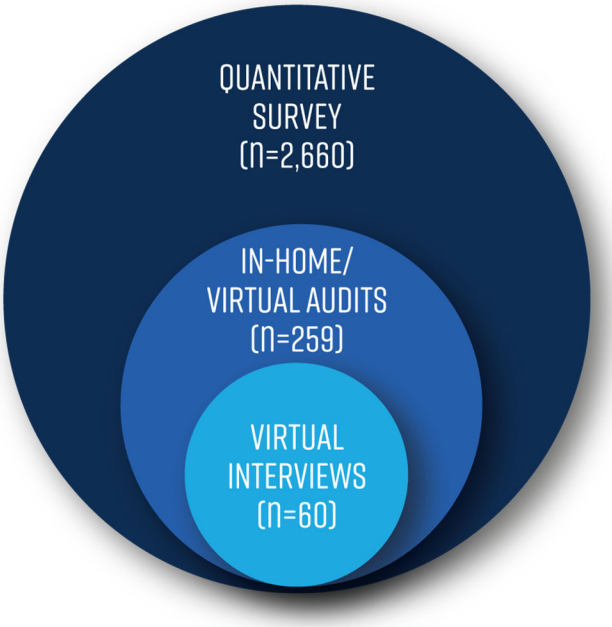
In support of the Data Gathering Plan, Opinion Dynamics conducted surveys, audits, and in-person interviews with a sample of households in SJV DACs. Quantitative survey sample sizes were designed to provide overall study results at a minimum of 90/10 confidence and precision levels.

4.1 Overview of Data Collection Activities

The target population for this study was residential households (excluding multifamily homes from buildings with five or more units) located in the identified 179 SJV DACs. Data collection included pilot and non-pilot DACs. The primary data collection activities utilized a nested sampling design (Figure 2). We completed quantitative surveys with 2,660 customers. We subcontracted with TRC to complete the home audits. The team completed home audits with 259 of the 2,660 customers who completed the survey. We subcontracted with Nichols Research to conduct the in-depth interviews. The team completed in-depth interviews with 60 of the 259 customers who participate in the audit portion of the study.

[7] CPUC Decision Approving Data Gathering Plan in San Joaquin Valley Disadvantaged Communities, Adopting Process for Updating the List of San Joaquin Valley Disadvantaged Communities, and Adding Nine Communities to the List, D.18-08-019 (August 2018). Available at: 225574950.PDF (ca.gov)

Figure 2. Nested Sampling Approach



4.2 Development of Sampling Methodology

4.2.1 Profile of Households in San Joaquin Valley Disadvantaged Communities

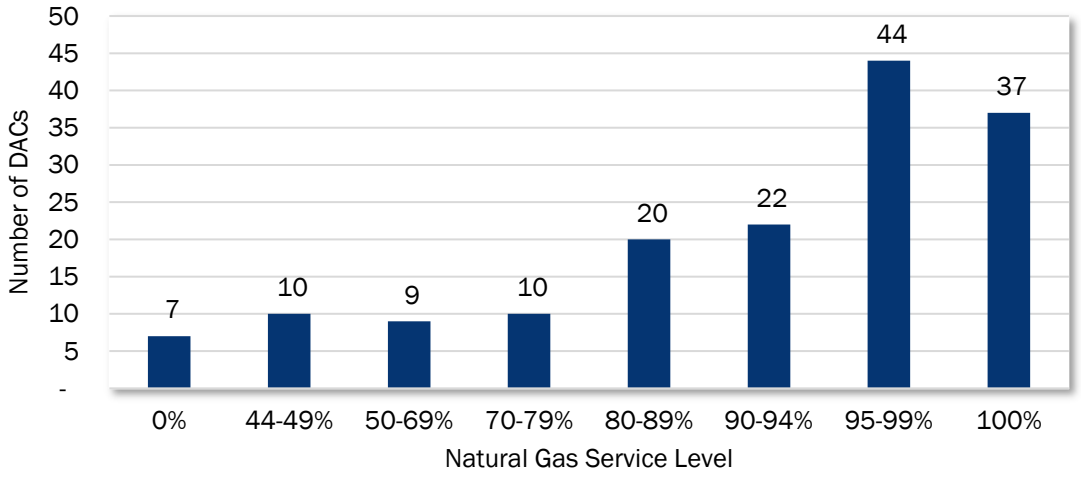
One of the first steps in the study was to develop a sampling methodology. For this effort, the target population varied across metrics critical to the research effort. Of particular importance was ensuring sufficient representation of homes without access to natural gas. Per the Decision, the primary purpose of the Data Gathering Plan "is to collect the information needed to establish baseline conditions in the identified communities and to support an analysis of the economic feasibility of extending affordable energy options to these communities, in particular to dwellings that currently lack access to natural gas."[8] The following section describes population parameters that were considered when developing a sampling plan that fulfills the data needs outlined in the Data Gathering Plan.

As seen in Figure 3, nearly all DACs have at least some access to natural gas. Only seven DACs have no access at all and 29 have "low access" (where 44%–79% of households have access).[9]

[8] Ibid.

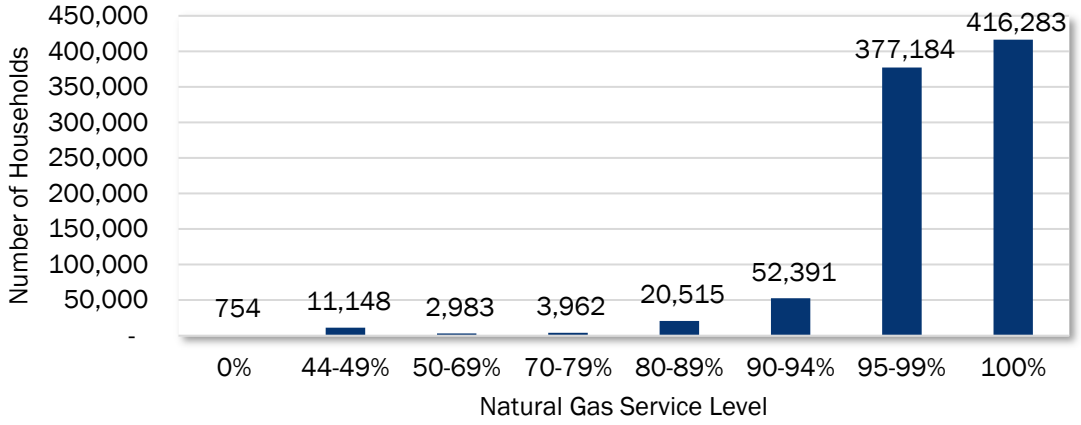
[9] For development of the sampling plan, our analysis included 159 of the 168 non-pilot communities included in the initial "DAC list" provided to the Working Group that detailed the estimated number of households with and without natural gas service in each SJV DAC. Our analysis draws on the data provided in this list and data from the U.S. Census Bureau's American Community Survey at the Census Designated Place level. Due to insufficient data in the DAC list, our initial population analysis presented in this section excludes the nine non-pilot communities that were added the DAC list in 2018.

Figure 3. Number of DACs per Natural Gas Service Level[10]



Further, access to natural gas becomes much more prevalent when we look at household-level access (Figure 4). According to the DAC list, the vast majority of homes in SJV DACs have natural gas access.

Figure 4. Number of Households by Natural Gas Service Level



Given the disproportionate access to natural gas across and within SJV DACs, as well as the Decision's focus on "the expense incurred by low-income households that lack access to natural gas and must rely on electricity, propane or wood for space and water heating," we used household-level fuel access as the primary sampling stratification criteria.[11] Specifically, we relied on the following two strata: (1) households with natural gas access (homes with a natural gas account from Pacific Gas & Electric [PG&E] or Southern California Gas

[10] Natural gas service level indicates the proportion of homes within a given DAC that have natural gas service.

[11] See Footnote 7

[SoCalGas]), and (2) households without natural gas access (homes without a natural gas account from PG&E or SoCalGas).

According to the Decision, community size should be used as a "secondary grouping characteristic," as "the size of a community may constrain the economic viability of future energy options such as community solar."[12] As seen in Table 1, 83 of the 159 SJV DACs are small communities. Although small communities make up over half of all SJV DACs, households in small communities comprise only 3% of all households across the 159 SJV DACs. Thus, if we were to take a simple random sample of the population, we would achieve a sample mostly consisting of households from large communities. In order to achieve a statistically valid representation of small communities, we targeted community size in our sampling design.

Table 1. Distribution of DACs and Households by Community Size

Community Size	DACs		Households	
	N	%	N	%
Small	83	52%	28,341	3%
Medium	60	38%	183,974	21%
Large	16	10%	672,905	76%
Total	**159**	**100%**	**885,220**	**100%**

Relatedly, housing type varies by community size; small communities have more mobile homes, medium and large communities have more single family attached homes (Table 2).[13]

Table 2. Distribution of Households by Community Size and Housing Type

Community Size		Single Family Detached	Single Family Attached	Mobile Home
Small	%	73%	7%	20%
	N	22,565	2,260	6,128
Medium	%	82%	12%	5%
	N	147,571	21,898	9,727
Large	%	66%	31%	3%
	N	429,184	203,706	16,971

4.2.2 Initial Plan for Quantitative Survey Sample Design

Based on the information above, we designed a sampling plan that aimed to complete quantitative surveys with 2,500 residential households (excluding multifamily homes)[14] located in the 168 DACs in the SJV where PG&E, Southern California Edison (SCE), and SoCalGas are not conducting SJV DAC Pilot Programs.[15] Since

[12] Ibid.
[13] Note that these census estimates exclude multifamily homes with five or more units, which are out of scope for the Data Gathering Plan.
[14] The working group decided to exclude multifamily homes located in buildings with five or more units for two reasons: (1) they are a low incidence group that constitute a very small proportion of all residential households in SJV DACs, and (2) they are unlikely to use fuels other than natural gas or IOU-provided electricity and are thus not the focus of this study.
[15] To encourage project efficiency and to minimize customer touch points, SHE facilitated survey recruitment for customers in SJV DAC Pilot Communities during their pilot recruitment outreach efforts. Accordingly, the initial sampling plan presented in this section only includes non-pilot communities. However, these separate data streams were combined during the analysis phase so that reported results would be representative of both pilot and non-pilot communities.

there is considerable variation across communities and households, we developed a stratified random sampling approach.

As noted above, households in SJV DACs are predominantly natural gas-heated, single family homes located in large communities with "high" natural gas access. Thus, a simple random sample would result in few mobile homes, homes without access to natural gas, or households from small or medium DACs. A stratified random sample helps resolve this imbalance, thereby ensuring data collection fulfills the Data Gathering Plan objectives. Specifically, we planned to under-sample households with natural gas access, completing a maximum of 400 surveys with households with natural gas service to meet research objectives that focus on comparisons of households that use different fuel types (Table 3). We planned to complete the remaining surveys (2,100) with households lacking natural gas service.

Table 3. Planned Stratified Random Sampling Design by Household Natural Gas Access

Household Natural Gas Access	Survey Sample Size Targets
Natural gas access	400
No natural gas access	2,100
Total	**2,500**

In addition, to ensure residents of small communities were represented, we aimed to further stratify the survey sample regarding community size by oversampling households in small communities. This sample design aimed to ensure sufficient data in all community size groupings, thereby enabling statistical comparisons.[16] Table 4 details our planned overall sampling design for the quantitative survey.

Table 4. Planned Stratified Random Sampling Design by Household Natural Gas Access and Community Size

Community Size	Household Natural Gas Access	Survey Sample Size Targets
Small	Natural gas access	150
	No natural gas access	700
Medium	Natural gas access	125
	No natural gas access	700
Large	Natural gas access	125
	No natural gas access	700

4.2.3 Initial Plan for Home Audit Sample Design

Under the nested sampling design, home audits are sampled from households who complete the quantitative survey. We planned on completing 280 audits. Due to smaller sample sizes, we did not develop nested stratification criteria (e.g., targeting a certain number of audits from households without natural gas access within small communities). Instead, we developed multiple isolated stratification criteria that work in parallel (e.g., the audit targets by natural gas access were independent of targets for various community sizes).

[16] Further, this approach also provides adequate representation of mobile homes, as mobile homes are disproportionately located in small communities.

Since homes not served by natural gas are of particular importance to the Data Gathering Plan, we planned to oversample homes lacking natural gas access. Table 5 exhibits our planned audit sampling approach by natural gas access.

Table 5. Planned Number of Audits by Household Natural Gas Access

Household Natural Gas Access	Audit Sample Size Targets
Natural gas access	50
No natural gas access	230
Total	**280**

For audit sampling purposes, we collapsed medium- and large-sized communities into a single stratum, targeting 155 completed audits across communities of either size (Table 6). We planned to target 125 completed audits with households from small communities, which is near maximum feasibility for that community size.[17]

Table 6. Planned Number of Audits by Community Size

Community Size	Audit Sample Size Targets
Small	125
Medium/Large	155
Total	**280**

We also planned to set audit quotas for housing type (Table 7). Given the nested sampling approach, this survey sampling strategy (namely, oversampling small communities, which have a higher incidence of mobile homes) helps ensure sufficient mobile home audit sample (as there is no reliable way to glean home type from IOU address data, we must rely on achieving sufficient mobile home sample via the aforementioned oversamples). As previously mentioned, larger multifamily households were ineligible for audits as they are not the focus of the study.

Table 7. Planned Number of Audits by Housing Type

Housing Type	Audit Sample Size Targets
Single family detached	180
Single family attached	50
Mobile homes	50
Total	**280**

4.2.4 Initial Plan for In-Depth Interview Sample Design

Continuing with the nested sample design, we planned to recruit a random stratified sample of 60 households for in-person interviews from the audit sample. Due to the overarching research questions for this study and the limited number of interviews being conducted, we focused our interview sampling on households without

[17] Maximum feasibility refers to the maximum number of primary data elements (in this case, audits) that a researcher can expect to collect, given the population size and predicted achievable response rate.

natural gas access. Table 8 exhibits our interview sampling plan, which is stratified by natural gas access. Due to small sample sizes, we did not further stratify the interview targets by community size or housing type.

Table 8. Planned Number of Interviews by Household Natural Gas Access

Household Natural Gas Access	Interview Sample Size Targets
Natural gas access	10
No natural gas access	50
Total	**60**

4.3 Development of Sampling Frame

Before collecting any data, we developed a list of potentially eligible customers from the SJV DAC population with readily available contact information (the "sampling frame"). The SJV DAC non-pilot customer population consists of all residential non-multifamily customers from PG&E, SCE, and SoCalGas located in the identified DACs. PG&E, SCE, and SoCalGas provided physical addresses for each account in these communities.[18] PG&E, SCE, and SoCalGas provided contact information for each account in the SJV DACs.

A critical task was to assign each premise to a natural gas access stratum based on whether PG&E and SCE electric customers also had a natural gas account with either PG&E or SoCalGas, as SJV DAC customers may have accounts with more than one utility. Customers could receive electricity from PG&E or SCE and natural gas service from either PG&E or SoCalGas. To create a master customer list across all utilities that identified each customer's electric and gas providers, we cleaned and standardized customer premise addresses and matched IOU natural gas accounts with electric accounts. The resulting total population for Opinion Dynamics' outreach efforts consisted of 740,501 residential households located in 168 DACs in the SJV where PG&E, SCE, and SoCalGas were not conducting pilot programs.[19] Four percent (N=30,843) of premise addresses were not linked to any natural gas account and were assumed to not have natural gas access and were assigned to the non-natural gas stratum (Figure 5).[20]

[18] For the remainder of this report, each specific service address will be referred to as a "premise."
[19] This count excludes readily identifiable multifamily homes with five or more units and additional premises associated with a single customer. Separately, Self-Help Enterprises (SHE) recruited customers in the 11 pilot communities to take the survey. Although these surveys are included in the analysis and results, they were out of the purview of the sampling plan outlined in this section. Further, since the IOUs did not provide customer records from the pilot communities, our population estimates omit pilot communities.
[20] Data collection revealed that fewer households (~1%) do not have access to natural gas. We provide more detail about our natural gas classification process below in the survey fielding section.

Figure 5. Household Natural Gas Access Among the SJV Population, Per IOU Records (N=740,501)

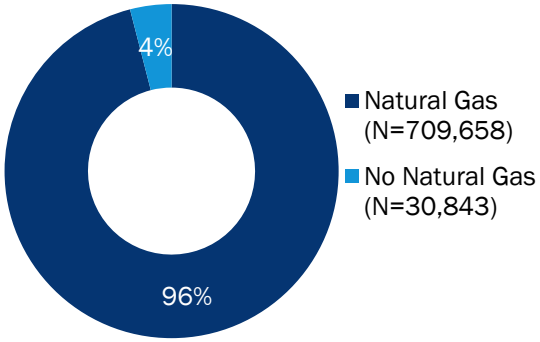
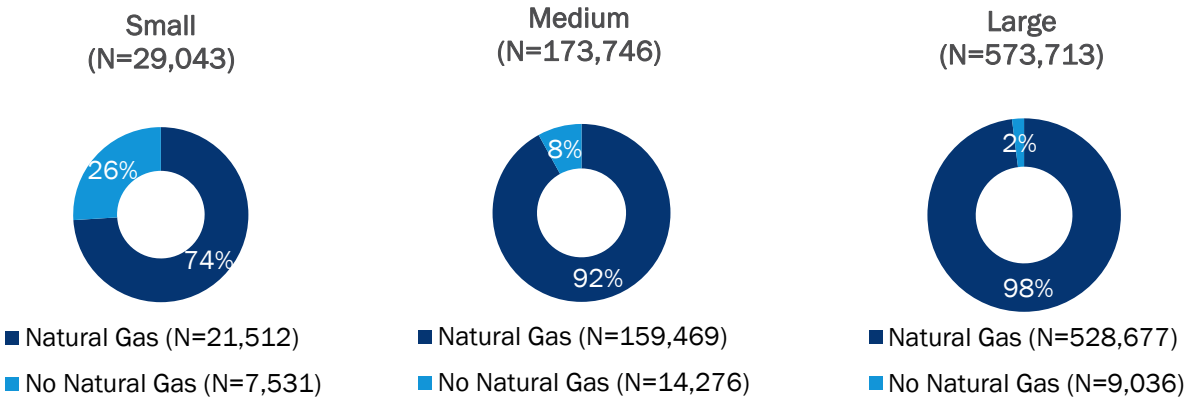


Figure 6 shows distribution of natural gas access within each community size, per IOU records. This data confirmed that customers without natural gas accounts are disproportionately concentrated in small communities.

Figure 6. Household Natural Gas Access by Community Size



4.4 Data Collection

Primary data collection activities included a quantitative survey, home audits, and qualitative in-depth interviews. Opinion Dynamics developed the research instruments for each data collection task. We collaborated with the Working Group to develop and align the data collection instruments with each approved project data element. All recruitment and data collection efforts were conducted in both English and Spanish.

This section details the recruitment and fielding methodology for the quantitative survey, home audits, and qualitative in-depth interviews.

4.4.1 Quantitative Surveys

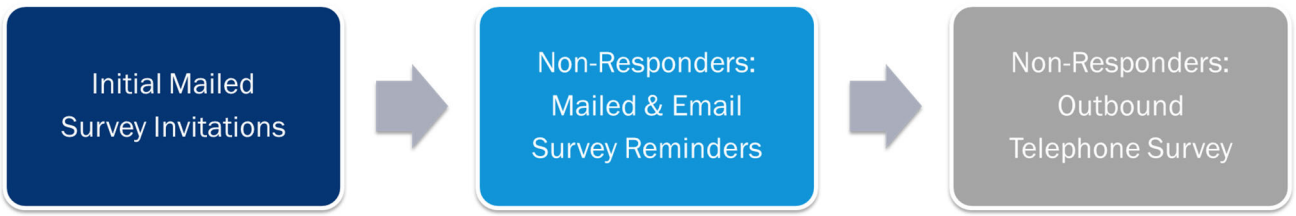
Recruitment

Recruitment outreach for the quantitative survey was conducted in two waves to support scheduling of the home audits. Wave one included the southern-most counties in the San Joaquin Valley (i.e., Kern and Tulare), and wave two included the remaining northern counties (i.e., Fresno, Kings, Madera, Merced, San Joaquin, and Stanislaus).

Opinion Dynamics invited non-pilot customers to participate in the quantitative survey, first through a mailed survey invitation inviting customers to complete the survey over the web or by calling in to take the survey over the telephone with an interviewer. In total, we sent letters to 1,213 customers that were initially flagged as having natural gas and to 29,140 customers flagged as not having natural gas. We sent letters to all households in small/medium communities we had designated as not having natural gas based on data provided by PG&E and SoCalGas.

For non-responders, we followed up with two additional mailed reminders (non-responders revised accordingly between reminder mailers), and two e-mail reminders (when e-mail contact information was available). Finally, we followed up with non-responders via telephone (when telephone numbers were available), as needed, and attempted to complete telephone interviews (Figure 7). All communications and survey modes were offered in English and Spanish. This approach allowed customers to complete the survey through their preferred mode, either via the web (including personal computer, tablet, or smartphone), or by telephone. We provided an incentive in the form of a $25 Visa® gift card for households that qualified for and completed the quantitative survey.[21] Physical gift cards were distributed by mail to respondents. We also leveraged Self-Help Enterprise's (SHE's) community outreach to support data collection for subgroups where additional survey completes were needed (such as small communities). This first wave of SHE outreach was largely in-person community outreach. SHE conducted door-to-door canvasing in Kern and Tulare counties. SHE reached out to CBO partners, schools, and local agencies to increase messaging in small communities and distributed fliers. SHE reached out by email and telephone (when phone numbers were available) to complete phone surveys as a final outreach effort. Simultaneously, SHE recruited survey respondents across the 11 SJV DAC Pilot Communities and offered both web and telephone survey response modes.

Figure 7. Quantitative Survey Recruitment Process



Fielding

Opinion Dynamics launched quantitative survey fielding in March 2020 for wave one respondents. Opinion Dynamics and the SJV DAC Data Gathering Working Group decided to pause survey fielding in April 2020 due to the COVID-19 pandemic and expected effects it would have on sampled households. Opinion Dynamics and the SJV DAC Data Gathering Working Group adjusted the survey content as needed to account for COVID-19

[21] All product or company names that may be mentioned in this publication are trade names, trademarks, or registered trademarks of their respective owners.

impact(s). For example, Opinion Dynamics added questions regarding customers comfort with in-person or virtual audits. Fielding resumed in August 2020 and continued through the end of January 2021. Some questions were modified to ensure that respondents were answering questions about their typical, pre-pandemic energy use.

Within the first week of fielding, survey responses revealed a greater incidence of natural gas customers in the SJV DACs than originally suggested by IOU data. During data review on day two of fielding, Opinion Dynamics discovered that customers we had flagged as not having access to natural gas based on IOU data were reporting natural gas as a fuel source in the survey. Opinion Dynamics alerted the Working Group. To understand whether customers were mistakenly reporting they had natural gas or whether the issue stemmed from an IOU data request problem, SoCalGas provided all natural gas accounts across a wider geographic area and provided a listing of all customers in a county that contained a targeted DAC. We compared the additional accounts to all customers originally flagged as not having natural gas in the sample. The additional data revealed that PG&E and SCE had used different criteria to pull customer data in identified DACs than SoCalGas, which resulted in customers being incorrectly assigned to the no natural gas stratum.

Because all Wave One survey invitations had been sent, we modified our fielding and sampling approach in the following ways:

- Modified the survey to confirm natural gas access as the first question in the survey and terminated interviews for respondents who reported having natural gas service once we reached the cap for the number of natural gas respondents.
- Sent Wave Two invitations only to premises assumed to not have natural gas, with the assumption that substantial proportions of these households would reclassify themselves as natural gas users given the problems with the IOU data.
- For households presumed to not have natural gas, conducted a census attempt of households in small and medium communities but limited outreach to households in large communities.
- Expanded the caps on the number of natural gas customers that would be allowed to complete the survey.

Table 9 displays the original natural gas targets compared to the number completed. The original target number of completes for households without natural gas access was based on the assumption that a sizable percentage of households in SJV DACs did not have natural gas (our original analysis of IOU data indicated 4% had no gas service). It is likely that our original target for non-natural gas survey completes was unrealistically high given the survey found that only 1% of households did not have access to natural gas. Despite the challenges presented by IOU data and the resulting incorrect classification of households in the sample frame, we completed as many surveys as possible with households that do not have natural gas in small and medium communities. We could have completed additional surveys with customers without natural gas in large communities (at the expense of screening out significant numbers of natural gas customers), but the Working Group agreed to limit outreach to small and medium communities.

Table 9. Natural Gas Access Targets and Survey Completes

Household Natural Gas Access	Original Targets	Survey Completes	% of Target Achieved
Natural gas access	400	1,269	317%
No natural gas access	2,100	1,393	66%
Total	**2,500**	**2,602**	**104%**

In addition to screening out natural gas customers, we disqualified households from taking the survey if they indicated living in multifamily housing with five or more units or if they reported not knowing what types of fuels their household used. Table 10 exhibits the count of survey completes, partial completes, and respondents that were terminated for each screen out condition for both pilot and non-pilot fielding efforts.

Table 10. Survey Completes, Partials, and Terminates

Survey Type	Survey Completes	Partial Completes	Multifamily Terminates	Unsure of Fuels Used Terminates	Natural Gas Terminates	Total # Survey Attempts
Quantitative survey	2,518	474	313	240	1,037	4,582
Pilot community survey	144	35	1	0	0	180
Total	**2,662**	**509**	**314**	**240**	**1,037**	**4,762**

Table 11 exhibits the number of surveys completed in each language for both pilot and non-pilot fielding efforts.

Table 11. Survey Completes by Language

Survey Type	Language		Total Survey Completes
	English	Spanish	
Quantitative survey	2,318	200	2,518
Pilot community survey	91	53	144
Total	**2,409**	**253**	**2,662**

Table 12 exhibits the number of surveys completed in each mode for both pilot and non-pilot fielding efforts.

Table 12. Survey Completes by Response Mode

Survey Type	Mode		Total Survey Completes
	Web	Phone*	
Quantitative survey	2,457	61	2,518
Pilot community survey	105	39	144
Total	**2,562**	**100**	**2,662**

*Includes 21 Spanish language phone surveys

The non-pilot quantitative survey achieved an overall response rate of 7.7%. No response rate is available for the pilot community survey due to the unknown overall sample size contacted by SHE.

4.4.2 Home Audits

Recruitment

Using a nested sampling approach, the team leveraged leads from the quantitative survey to recruit residential customers for the audits—described as "in-home visits" to customers. A question towards the end of the quantitative survey asked customers if they would be interested in participating in an in-home visit, for which they would receive a $100 Visa gift card upon audit completion. On a biweekly basis, Opinion Dynamics provided TRC with a list of interested customers for audit recruitment and scheduling.

Due to COVID-19, the team conducted both in-home and virtual audits. Before launching the virtual audit option, we tested the virtual audit process with 11 respondents to ensure that we could collect sufficient and equivalent data from both modes. From September to November 2020, customers were given a choice between a virtual and an in-home audit. Starting in mid-November 2020, due to increased rates of COVID-19, the team switched to only offering virtual audits.

TRC, with the help of SHE, contacted respondents to schedule home audits. The outreach approach was the same for in-home audits and virtual audits:

1) TRC sent an initial email to customers for whom we had email addresses.
2) TRC then reached out via telephone to customers who did not respond to the email or did not provide an email address.
3) SHE assisted TRC with continued outreach to nonresponsive customers by both email and phone until we received a response from the customer, or until about six outreach attempts yielded no results. For harder to reach customers, we increased the maximum outreach attempts. SHE was instrumental in reaching these hard-to-reach respondents, especially in small communities and mobile homes.
4) TRC and SHE coordinated to schedule a visit (either in-home or virtual) and sent reminders for customers who responded with interest. The recruiter prepared the customer for the visit, including instructing them to ensure there was a clear path to all major appliances in the home and to their electrical panel.

To ensure that we recruited a diverse group of customers, we varied the time of day and day of week of telephone outreach and worked with SHE to recruit small community and Spanish-speaking customers. Additionally, the team offered evening and weekend audits to ensure that customers who were occupied during the day on weekdays could still participate if interested.

Fielding

The team conducted 156 in-home and 103 virtual audits. For the in-home audit, a trained auditor completed the site visit using a mobile-ready application for data entry. The auditor collected building information, major building systems (central cooling and heating, hot water, plumbing, electrical and insulation), and data on key end uses throughout the home. Interior end uses included refrigeration, clothes washers, room heating and cooling, insulation, water-related equipment, and windows and doors. Exterior end uses included pool pumps, roofing, water wells, and other items. The auditor captured information such as nameplates and model numbers by taking photos. Other technical staff captured information from the photos following the audit. This approach was used to limit the amount of time the auditor was in the home to reduce customer burden.

The virtual audit process was essentially the same as the in-home audit, except that the customer showed the auditor their home's equipment through a videoconference as opposed to an auditor capturing equipment information in person. The virtual audit consisted of a live two-way video stream between the home resident and the auditor. The auditor took screenshots of the video stream to capture appliance nameplate, front view of appliance, home systems, and other necessary information. The auditor still made independent assessments, such as rating the condition of an appliance (i.e., good, fair, poor) based on visual assessment and not by asking occupant, but the "visual" aspect was done through video stream.

For the videoconference, the team primarily used the Microsoft Teams™ platform. This platform allowed the auditor to connect to this application on his/her computer, which enabled the auditor to easily take screenshots and enter data into the mobile data collection application while on the videoconference. If needed, the team switched to a different platform to accommodate customers that had difficulty or hesitancy

downloading Teams. Other platforms the team used included Zoom™, Facetime®, WhatsApp®, and Facebook® Messenger.

In some cases, the picture quality of the videoconference was not high enough to capture information such as nameplates and model numbers. This could be due to poor Wi-Fi connection, poor camera quality, poor lighting, or a customer holding the phone unsteadily. In such cases, the auditors typically asked customers to read model numbers out loud so auditors could record them. In a few cases, the team used a combination of telephone interview and a photo survey as opposed to the videoconference.

Table 13 exhibits the count of completed audits per housing type by natural gas access and community size.

Table 13. Audit Completes per Housing Type by Natural Gas Access and Community Size

Housing Type	Non-Natural Gas Customers			Natural Gas Customers			Total
	Small Community	Medium Community	Large Community	Small Community	Medium Community	Large Community	
Single Family Detached	45	82	4	11	10	33	**185**
Single Family Attached	0	0	1	1	10	8	**20**
Mobile Home	31	14	0	5	2	2	**54**
Total	**76**	**96**	**5**	**17**	**22**	**43**	**259**

4.4.3 Challenges and Limitations

Challenges and Limitations Across All In-Home Audits

There are several limitations that existed across all the audits:

- For safety reasons, auditors did not assess equipment that was on a roof or in an unfinished attic. Auditors asked residents about the presence of equipment in these spaces but could not capture equipment plate information such as efficiency or capacity.
- Auditors and customers also did not attempt to identify any asbestos-containing materials for safety reasons. Homes with potential asbestos-containing material were identified through the age of the home.
- For walls, attics, basements, and crawlspaces, the team sought to capture data elements on whether insulation was present, and the R-value of the insulation where present. For in-home audits, the auditor attempted to capture this information by visual observation. If that was not possible (e.g., mobile homes, virtual audits), the team based the insulation determination on the age of the home and the required building code at that time (i.e., home age tables). For mobile homes, the auditor recorded the mobile home nameplate that could be used to determine insulation information.

Virtual-Only Challenges and Limitations

Overall, the data quality of virtual audits was high. Virtual audits had several data quality and recruitment limitations and challenges, however, that only applied to virtual audits:

- It was not possible to capture all data elements in the virtual audit. The primary data elements that the auditor was not able to collect through virtual audits were elements auditors captured via smell during the in-home audits, such as the presence of mold, mildew, and smoke. There were a few

additional items that the team did not capture via virtual audits because of safety concerns and concerns about customer burden, such as insulation.

- The presence of mold was difficult to capture virtually. If an auditor was able to see mold during an audit, they noted it. But because the presence of mold could be a sensitive issue, auditors did not ask customers directly about mold, so the presence of mold may be underreported.
- While the auditors were able to view most of the home during the videoconference, the possibility of missing some aspects of the home was higher because the auditors were not there in person. This was because a camera has a more limited field than a person's vision, but also because auditors did not request that customers go into areas that could be a safety risk or because the auditor was limited to what the customer chose to show the auditor. The team asked customers multiple times about the presence of items such as supplemental heating and cooking equipment by asking whether they had each potential type of heating and cooking equipment and also an open-ended question about whether the customer had any other heating or cooking equipment. Despite these efforts, supplemental equipment may be underreported in virtual audits.

There were also some recruitment limitations. The virtual audit may have resulted in slight coverage bias because the customer needed to have both a smartphone and Wi-Fi. There were a few customers that were not able to participate in the virtual audit because they did not have a smartphone and/or Wi-Fi. Additionally, a few customers noted they did not want to participate in a virtual audit because they lacked confidence in their technical abilities or did not want to be burdened with conducting the audit themselves. Once the team switched to offering only virtual audits, however, the recruitment rate for virtual audits was similar to the previous recruitment rate for in-field. In addition, the team was able to recruit many hard-to-reach customers for virtual audits, including customers in small communities, mobile homes, and Spanish-speaking customers. In addition, SHE worked with customers without access to a smartphone to provide one to borrow, if needed, so that the household could participate in the virtual audit.

4.4.4 In-Depth Interviews

Opinion Dynamics contracted Nichols Research to conduct qualitative in-depth interviews with a subsample of 60 audit participants (50 without natural gas access; 10 with natural gas access) to provide a deeper understanding of alternate fuel usage, health and safety considerations, energy burden and perceived burden, as well as customer preferences. These interviews initially took place in-person (albeit socially distanced and outdoors); however, they were shifted to telephone interviews due to the COVID-19 pandemic. Participating customers received an additional $50 Visa gift card incentive for participation in the interview. Interview participants were recruited via their stated preference (telephone call, text, and/or email), in their preferred language.

4.5 Analysis

4.5.1 Data Cleaning

Quantitative Survey

Opinion Dynamics conducted extensive analysis to identify satisficing survey respondents that may have provided poor survey data. Out of 2,662 survey completes, two surveys were excluded from analysis (as these respondents completed the 20-plus-minute survey in under seven minutes; an unrealistically short time to properly answer all the questions in the survey). This resulted in a final survey sample size of 2,660.

Additionally, we identified nonsensical, unclear, or contradicting answers for a given respondent and recoded these data points to "unknown."

Home Audit

Opinion Dynamics extensively reviewed the audit data to ensure its accuracy for all 259 audited households. In the instances where we identified unclear, contradicting, or missing information, we worked with TRC to remedy potentially these items. Opinion Dynamics also worked with TRC to ensure consistency during data entry to avoid misinterpretation of the data. There were challenges during the data collection process, mainly related to COVID-19, which demanded adaptability from both auditors and respondents, who had to shift to an online environment for about 40% of the audits. As a result, certain characteristics of some technologies were not recorded during the audits and were recorded as "unknown."

4.5.2 Weighting methods

Opinion Dynamics calculated analysis weights for both survey and audit data to correct for over- and under-samples related to housing type, community size, and natural gas access. As seen in Table 14, the achieved survey and audit samples deviated considerably from the population estimates.

Table 14. SJV DAC Population and Unweighted Sample Proportions (Household Level)

Stratification Grouping	SJV DACs Population Estimate[a]	Survey Sample (n=2,660)	Audit Sample (n=259)
Community Size			
Small	4%	26%	36%
Medium	22%	52%	46%
Large	74%	23%	19%
Natural Gas Access			
Natural Gas Service	99%	48%	31%
No Natural Gas Service	1%	52%	69%
Housing Type			
Single Family Detached	80%	72%	71%
Single Family Attached	16%	11%	8%
Mobile Home	4%	16%	21%

[a] IOU data provided the inputs for community size and natural gas population estimates, and US census data provided the inputs to housing type estimates. We used survey data to calculate correction factors to improve population estimates derived from IOU data, as these data did not adequately confirm natural gas service or housing type for a given household.

To ensure that results are representative of the target population (as opposed to being solely indicative of the skewed sample), we calculated and applied statistical weights. Specifically, we used the population estimates in Table 14 to calculate calibrated weights using an iterative raking algorithm for the survey and audit data,

respectively.[22] The weighted samples mirror the population proportions found in Table 14.[23] All analyses are weighted. Thus, overall estimates can be interpreted as generalizable to the overall SJV DAC target population. Since natural gas penetration is so high in the region, we also present results by natural gas access. These natural gas access grouping results are still weighted, effectively correcting for over-representation of mobile homes and small/medium communities within natural gas and non-natural gas subgroups.

4.5.3 Quantitative Analysis of Survey and Audit Data

After cleaning and weighting the survey and audit data, we conducted statistical analysis of the data. Primarily we calculated univariate and bivariate distributions of all items collected in the surveys and audits, testing for significant differences on a given item between relevant subgroups (e.g., non-natural gas owners vs. non-natural gas renters). Because this study has some larger sample sizes for some groups, relatively small group differences can be statistically significant. In addition, studies that make many comparisons, such as this one, have a greater likelihood of finding a significant difference when a true difference in the population does not exist resulting in Type I error (i.e., the multiple comparison problem). We did not make any statistical corrections to reduce the likelihood of Type I error. In the data tables throughout the report, we specify the group differences we tested for statistical significance in table notes. We also use superscripts on data values to identify all significant differences. In the text that accompanies each table and summarizes the results, we only point out group differences that are large enough to be both *substantively meaningful and statistically significant,* which will help to minimize interpretation problems related to Type I error.

When applicable, namely in opinion-based questions, "unsure" responses are reported. In household characteristics and baseline conditions, "unsure" responses are excluded when calculating results as to not artificially deflate incidence estimates.

Key Formulas

This section describes the method Opinion Dynamics used to calculate penetration and saturation rates for appliances and equipment in customer homes, and their associated statistics, including standard deviations (where possible), standard errors, and relative precisions. We calculated results separately for the quantitative survey and for the audits, which were conducted for only a subset of the quantitative survey sample.

We know customers are unable to report some kinds of information accurately (e.g., heating equipment). We used the audits to verify self-reported responses for these items and calculated adjustment factors that allow us to estimate and correct for self-report errors in the quantitative survey and produce results consistent with what we would expect to find had a trained professional collected all data on site. Specifically, our adjustment ratios compare a given result from the audits to the comparable survey result from the same sample of households (that is, those that received an audit). The resulting adjustment ratios reveal the proportion of self-report error associated with a given survey item, which we then use to adjust survey-derived, weighted

[22] Calibrated weights (also known as "raked weights") use a procedure that iteratively adjusts the weight for each respondent until the distribution of the survey sample aligns with the distribution of the population control targets. In this case, we raked on the univariate distribution of natural gas access and the bivariate distribution of community size and housing type (as the latter had considerably greater variation across community size). Raking is used when cross-distributions of the target variables are unavailable, and the analyst must rely on isolated distributions. The procedure ensures the results are representative of the target population.

[23] Additionally, the weighted samples mirror the population's bivariate distribution of community size by housing type and provide a similar bivariate distribution of natural gas access by community size as estimated to exist within the greater SJV DAC population. We were unable to rake on natural gas access by housing type, as there is no *a posteriori* population distribution of the intersection of these two characteristics. For additional information on the weighting inputs, see Appendix A: Raked Weight Inputs.

estimates from all households that took the survey (including those with and without audits). Additional detail on the adjustment ratios is available later in this section and Appendix A.

The Working Group requested that we produce standard deviations of estimates as well as standard errors. We have made every effort to meet that request. We can produce both for means but are unable to produce standard deviations for weighted proportions. The formulas for weighted proportions always produce standard errors directly from the variance estimates, skipping the standard deviation stage. Standard errors were used to estimate confidence intervals and as inputs into statistical significance tests.

Estimating Penetrations and Standard Errors (Proportions)

Estimates of proportions for the web and the audit data were calculated with Equation 1:

Equation 1

$$p = \sum_{i=1}^{n} w_i p_i \quad \text{[Eq 1]}$$

Where:

p = proportion of households reporting having the relevant equipment

w_i= the weight for household i, where the weights sum to 1

p_i= a positive response to whether household i has the relevant equipment

The variance was calculated using Equation 2:

Equation 2

$$Var(p) = p(1-p)\sum_{i=1}^{n} w_i^2 \quad \text{[Eq 2]}$$

The standard error of the weighted proportion was calculated as Equation 3, the square root of Equation 2:

Equation 3

$$SE(p) = \sqrt{p(1-p)\sum_{i=1}^{n} w_i^2} \quad \text{[Eq 3]}$$

Estimating Saturations and Standard Errors (Means)

When using standardized weights, as we did, the weighted mean saturations were calculated by Equation 4:

Equation 4

$$\bar{X}_w = w_i x_i \quad \text{[Eq 4]}$$

Where:

$\bar{X}_w$=weighted mean

w_i=weight for household i

x_i=item quantity in household i

The variance of the weighted mean is calculated as Equation 5:

Equation 5

$$s^2 = \frac{\left(\sum_{i=1}^{n} W_i (X_i - \bar{X})^2\right)}{\left(\frac{n-1}{n}\sum_{i=1}^{n} W_i\right)} \quad \text{[Eq 5]}$$

The standard deviation is the square root of the variance: $s = \sqrt{s^2}$

The standard error of the weighted mean is calculated as the standard deviation divided by the square root of n-1: $se_w = s/\sqrt{n-1}$

Estimating the Adjustment Ratios for Penetrations and Saturations

The adjustment ratio method uses the values from the quantitative survey, the quantitative survey values from the subsample that received the audit, and the audit values. Unique adjustment ratios were calculated and applied separately for natural gas customers and non-natural gas customers. Accordingly, all subgroup results are presented separately for natural gas and non-natural gas customers (such as non-natural gas renters vs. non-natural gas owners). Equation 6 shows the calculation of the adjustment ratio based on the subsample of customers who received the audit. It is the audit result divided by the quantitative survey result for the same subsample.

Equation 6

$$r = \frac{x'}{y'} \quad \text{[Eq 6]}$$

The ratio adjustment estimate of the mean is shown in Equation 7:

Equation 7

$$\bar{y}_r = r\bar{y} = \frac{\bar{x}'}{\bar{y}'}\bar{y} \quad \text{[Eq 7]}$$

The adjusted values were then weighted and were the basis for calculating the variance and associated statistics. The weighted variance of the adjusted estimate is given Equation 8:

Equation 8

$$Var(\bar{y}_r) = \frac{s_r^2}{kn} + \frac{S_x^2 - S_r^2}{n} \quad \text{[Eq 8]}$$

The standard error is the square root of the variance, shown in Equation 9:

Equation 9

$$se(\bar{y}_r) = \sqrt{Var(\bar{y}_r)} \quad \text{[Eq 9]}$$

Where the variance of the ratio was calculated as shown in Equation 10:

Equation 10

$$S_r^2 = R^2 S_y^2 + S_x^2 - 2RCov(x, y) \quad \text{[Eq 10]}$$

Where:

Equation 11

$$Covar(x, y) = s_{xy} = \frac{(x_i - \bar{x})(y_i - \bar{y})}{kn - 1} \quad \text{[Eq 11]}$$

And:

$\bar{y}_w$=weighted mean response for the quantitative survey (where proportions are a special case of means)

$\bar{y}'_w$=weighted mean response from the quantitative survey for the audited subsample

$\bar{x}'_w$=weighted mean response from the audit

n=sample size

kn=subsample (audit) size

S_x^2=weighted variance of the audit values

S_y^2=weighted variance of the quantitative survey values

S_r^2=weighted variance of the ratio

$Covar(x, y)$=covariance between quantitative survey and audit responses

Note that the standard error of the adjusted web estimate is the direct output of the this set of equations. It does not need to be propagated, and this does not assume independence of quantitative and audit samples.

One additional weighting step was required for the penetration calculations that was not required for calculating means. Because each response category is adjusted separately, the total number of responses often does not sum to the sample size (*n*). To correct for this, we developed an additional balancing factor, which is the ratio of the correct *n* and the adjusted *n*. This ratio is multiplied by the adjustment factor for each response category to derive the final adjustment factors for the question.

4.5.4 Subgroup Analysis of CARE Eligibility

A subgroup was created to analyze customers eligible for CARE and those ineligible for the CARE program. CARE eligibility was based on self-reported income and number of residents. Households were mapped to CARE eligibility rules. In addition, customers flagged as CARE in IOU records were flagged as CARE eligible regardless of self-reported income and number of residents. We could not estimate CARE eligibility for customers who did not report income or the number of residents in their household (313 out of 2,660). Survey results reveal that 48% of SJV DAC residents are eligible for CARE, most of which are enrolled (43% of all non-multifamily customers in the studied SJV DACs are enrolled in CARE).

The addition of this subgroup to the analysis was in response to CPUC Workshop questions regarding differences by income level and a desire to see how customers with lower income in the SJV compare to those who do not have lower income. Given the consistent differences by income that we saw in our analysis (operationalized by CARE eligibility), we felt as though it was an important addition to our standard data tables.

4.5.5 Qualitative Analysis of Interview Data

All interviews were transcribed (and, when applicable, translated) and loaded into NVIVO qualitative analysis software. Interview data was coded and thematically analyzed as to extract key themes and how these differed among various subgroups. Interview results provide explanatory content to offer deeper insights into the lived experiences associated with the observations in the survey and audit data.

4.5.6 Energy Costs

Electric and Natural Gas Costs

To calculate the 2019 energy costs of surveyed customers, we requested and received from the IOUs 2019 electric and gas billing data for each customer who completed the survey. We then summed the monthly gas and electric bill amounts and number of billing days to calculate the annual bill amount and total annual billing days for each customer.

Alternative Fuel Costs

We asked customers in the survey to report the total amount they spent on alternative fuels; defined as wood, wood pellets, and propane. Only "non-recreational" use of alternative fuels was included in this calculation (defined as using alternative fuels in primary cooking, space heating, and water heating end uses; recreational or occasional uses were not included, due to numerous reports of occasional propane grill use or fireplace use for recreational purposes, as opposed to those who must rely on these fuels out of necessity for daily living).

We reviewed all self-reported alternative fuel costs and removed two propane costs that were extreme outliers.[24] We did not find any extreme high values of wood costs, but some respondents reported their costs to be $0 because they were using wood taken from their own land. We retained these $0 costs in the analysis.

Because self-reported fuel costs could be subject to reporting error, we conducted an engineering analysis to produce an alternative estimate of propane and wood costs that we could compare to the self-reported data. The self-reported alternative fuel costs were not significantly different from the engineering results, giving us greater confidence in the survey-based fuel costs. Details of this engineering analysis and results are available in Appendix A.

Energy Burden

One of the measures of hardship a customer may experience is energy burden. The standard, basic calculation of "customer energy burden" is the sum of each customer's household energy bills during a given year divided by their household income for that year, notated as:

$$\textit{Customer Energy Burden} = \frac{\textit{Annual IOU Bill Amounts + Annual Alternative Fuel Amount}}{}$$

[24] The two responses were $11,000 and $83,000. The next closest self-reported annual propane cost was $7,000. We examined the size of the homes for all of the larger propane responses and the two that we dropped were unrealistic given the sizes of the homes.

$$\text{Annual Household Income}$$

A weighted average of individual customer energy burden results represent the overall average energy burden metric.

To estimate annual household income for energy burden calculations, we took the midpoint of the household income range customers selected in the survey (e.g., $8,000 to less than $16,000 = $12,000 midpoint). For the highest income category that respondents could select (above $200,000), we used a value of $200,001. We did not estimate energy burden for customers that refused to provide their household income in the survey, were missing energy cost data, were on master-metered accounts, or had negative energy costs due to net metering.[25]

Modified Energy Burden

A potential shortcoming of the energy burden metric is that it does not account for the value of public assistance benefits that qualified customers receive. Customers receiving public benefits likely have a lower energy burden than reflected by the simple energy burden metric since public benefits enable customers to use more their disposable income toward affording basic needs than would be the case without public benefits.

The value of public benefits is included in the modified energy burden metric, notated as follows:

$$\text{Modified Energy Burden} = \frac{\text{Annual IOU Bill Amounts} + \text{Annual Alternative Fuel Amount}}{\text{Annual Household Income} + \text{Value of Public Benefits Received}}$$

To measure the value of public assistance benefits customers received annually, we first asked customers in the survey who reported receiving any public assistance which specific types of benefits they received during the past year. [26] Customers could choose from

- Housing assistance such as Section 8 or other subsidized housing;
- Food assistance such as CalFresh, Supplemental Nutrition Assistance Program (SNAP), Women-Infant-Children Food Program (WIC), or other programs;
- Medical assistance from MediCal, MediCAID, or Children's Health Insurance (CHIP);
- Energy assistances such as Family Electric Rate Assistance (FERA), California Alternate Rates for Energy (CARE), or Low-Income Home Energy Assistance Program (LIHEAP);
- Financial assistance such as Temporary Assistance for Needy Families (TANF), Supplemental Security Income (SSI), CalWORKs, Aid to Families with Dependent Children (AFDC), or other welfare programs; and
- Government childcare assistance such as Head Start.

[25] Energy burden calculations exclude 276 households that had energy costs but did not provide income, 832 households that were missing energy cost data, 28 accounts that were master-metered and 10 accounts with negative total electricity costs. Only one of the 10 accounts with negative electricity costs resulted in negative total energy costs. Given the small number of accounts with negative electricity costs, study conclusions are not impacted by excluding respondents with negative costs.

[26] We did not include cash-based benefits like Social Security, unemployment compensation, disability, or veterans' benefits since these are issued at regular time-intervals with predictable values, and thus are likely included in self-reported income estimates.

Next, we followed the steps used in the 2016 and 2019 LINA reports,[27] to calculate the estimated dollar value of the public assistance benefits. After we calculated the average dollar value of public assistance benefits, we added them to the annual income of customers who reported receiving the benefits and computed the modified energy burden metric.

Economic Hardship

We also constructed a measurement of "lived economic hardship" as energy costs and energy burden alone fail to demonstrate the lived experience associated with high energy bills. To enable measurement of economic hardship, the survey included questions from previously validated metrics of financial health: the Consumer Financial Protection Bureau's (CFPB) Financial Well-Being Scale.[28] The first question in this battery asks how each item describes the respondent's situation, using a five-point scale from *Not at all* to *Completely*. The three items include:

- Because of my financial situation, I feel like I will never have the things I want in life.
- I am just getting by financially.
- I am concerned that the money I have won't last.

The second set of questions in this battery asks how often each item applies to the respondent, using a five-point scale from *Never* to *Always*. The two items include:

- I have money left over at the end of the month.
- My finances control my life.

We calculated the CFPB index using the five items and the respondent's age, as instructed by the CFPB.[29] Scores range from 19 to 90, where lower scores correspond to higher levels of economic hardship. To ease interpretation and for consistency with prior use of the metric in California studies, we inversed the scale and normalized the values to a 0 to 10 scale, where higher values demonstrate greater levels of economic hardship.

4.5.7 Health, Safety, and Comfort

Health: Indoor and Ambient Air Quality Impacts

Opinion Dynamics conducted a literature review to identify indoor air quality (IAQ) and ambient air quality impacts of alternative fuel appliances to provide qualitative indicators of the health impacts of these alternative fuels on customers who use them. Our literature review focused on IAQ and ambient (outdoor) air quality due to wood-burning appliances given their prevalence in this region and their greater air quality impacts relative to other heating systems. Wood fireplaces and wood stoves release fine particulate matter (PM2.5: particulate matter 2.5 µm in diameter or smaller), which causes respiratory problems such as asthma. While unvented heaters, such as room "buddy" heaters, release combustion gases such as nitrogen dioxide

[27] For further detail on the steps taken, see Opinion Dynamics, *2019 California Low-Income Needs Assessment: Final Report: Volume 1 of 3: Summary of Key Findings*, December 13, 2019.
[28] The Researchers used The CFPB's methods for the abbreviated version of their "Financial Well-Being Scale." See this link for further details on the methodology: https://files.consumerfinance.gov/f/201512_cfpb_financial-well-being-user-guide-scale.pdf
[29] The CFPB provides two scoring charts, depending on age group: one for respondents with ages between 18 to 61, and another for respondents that are at least 62 years old. The scoring chart for older respondents gives comparatively less weight to their responses, as the CFPB found that responses from older respondents skewed towards greater economic hardship thanks to their "shift from working and accumulating savings to exiting the workforce and decumulating savings." CFPB asserts that by taking age-oriented differences into account, the scale is in turn normalized and is thus directly comparable across all age groups.

(NO_2) and carbon monoxide (CO) directly into the rooms where they are used, we did not find any cases of unvented heaters in the survey or audit data. The IAQ and ambient air quality impacts of vented propane appliances (such as a propane furnace or wall heater) are lower and roughly equivalent to vented natural gas appliances. This is supported by the funding structure of the San Joaquin Valley Air Pollution Control District's (SJVAPCD's) Burn Cleaner program, which provides funding to Valley residents to upgrade their current wood-burning devices and open fireplaces to natural gas or propane gas appliances.[30]

Greenhouse Gas (GHG) Impacts

To estimate greenhouse gas (GHG) emissions from homes in the San Joaquin Valley and the GHG impacts of alternative fuels in this region, Opinion Dynamics:

- Estimated energy use for homes based on their home type, type of fuel used, and amount of fuel used. We used data supplied by the IOUs for estimates of electricity and natural gas usage and customer reported values for propane and wood usage.
- Multiplied energy usage under each scenario by annual GHG multipliers. For the GHG multipliers, we used values from the United States Environmental Protection Agency (EPA) GHG Emission Factors Hub.[31] Table 15 shows the GHG multipliers used, as pounds (lbs) of carbon dioxide (CO_2) emitted per million BTU of fuel. The GHG emission factor for electricity is specific to California and reflects California's mix of renewable and nuclear energy.

Table 15. GHG Multipliers by Fuel Type

Fuel	GHG Multiplier – CO_2 (CO_2 equivalent = 1)	GHG Multiplier – CH_4 (CO_2 equivalent = 25)	GHG Multiplier – N_2O (CO_2 equivalent = 298)	Total GHG Multiplier (CO_2)
Natural Gas	117 lb CO_2/MMBtu	0.06 lb CO_2/MMBtu	0.07 lb CO_2/MMBtu	117.1 lb CO_2/MMBtu
Propane	138.6 lb CO_2/ MMBtu	0.2 lb CO_2/MMBtu	0.4 lb CO_2/MMBtu	139.2 lb CO_2/MMBtu
Wood	206.8 lb CO_2/ MMBtu	0.4 lb CO_2/MMBtu	2.4 lb CO_2/MMBtu	209.6 lb CO_2/MMBtu
Electricity	453.2 lb CO_2/MWh	0.8 lb CO_2/MWh	1.2 lb CO_2/MWh	455.2 lb CO_2/MWh

Health Hardship

We constructed a measurement of "health hardship" that operationalizes household health into a quantitative value ranging from 0 (no health hardship) to 10 (high health hardship). It is comprised of two survey questions we developed from the Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance System (BRFSS), as follows:

- **Frequency of poor health**: We asked respondents how often their health and the health of members of their household was not good during the past year, using a five-point scale from *Never* to *Most or all the time*.

[30] "Rule 4901," San Joaquin Valley Air Pollution Control District, Last Updated March 8, 2021, http://www.valleyair.org/rule4901/

[31] "GHG Emission Factors Hub," EPA Center for Corporate Climate Leadership, US EPA, updated April 2021, https://www.epa.gov/climateleadership/ghg-emission-factors-hub

- **Frequency poor health limited usual activities**: We asked respondents who indicated that they and/or members of their household experienced poor health more than never during the past year how often the poor health prevented them from doing their usual activities. We used the same five-point scale from *Never* to *Most of all the time*.

These results were summed (resulting in a range of 2 to 10), which was normalized to a 0 to 10 scale so that interpretation of the health hardship metric was similar to that of the economic hardship metric. To assess reliability of the items in the model, we calculated Cronbach's alpha. The resulting Cronbach's alpha of 0.87 reveals good internal consistency between the items included in the health hardship metric.

4.6 Sources of Uncertainty

Opinion Dynamics utilized a total survey error framework when designing and executing this study in which we attempted to minimize multiple sources of error that can threaten the validity of the results.[32] Although our study design and analytic processes attempted to minimize all types of error, error types are often interrelated so that minimizing one source can increase another. In addition, some types of error pose a more serious threat and require greater attention. Finally, reducing error can be costly with lower marginal benefits once a certain level of error reduction is achieved.

In the next sections, we explain our error minimization strategies across five common types of survey error. The total survey error framework has evolved over time and survey researchers use different organizing principles for the types of error. We are not providing exhaustive discussion of the paradigm in this section. Rather, we focus on the errors that are particularly relevant for this study.

4.6.1 Coverage Error

Survey research can be subject to coverage error when a portion of the study target population is excluded from the sample frame. If those excluded from the sample frame are different in some way from those included – and if those differences are correlated with the study research objectives - then coverage bias is likely.

Mitigation and Assessment

We mitigated coverage bias by ensuring that our survey outreach efforts included all 179 SJV DACS and that our sample frame was comprised of as many households as possible. For the 168 non-pilot communities, Opinion Dynamics requested customer data from PG&E, SCE, and SoCalGas for all residential customers. We created a combined database of all utility customers and identified 9 DACs that did not have any customers. Opinion Dynamics worked with SHE and conducted internet research to identify premises within the missing communities to include in the sample. Residents of the 11 pilot communities were recruited separately. As part of their efforts to recruit customers to participate in the pilots, SHE recruited respondents to complete the survey. Opinion Dynamics does not have any record of these recruitment efforts and cannot assess how exhaustive they were.

As discussed in Section 4.4.1, we determined that the IOU records we received were missing customers from SoCalGas. Fortunately, these customers were not excluded from the sample frame because they receive electric service from PG&E or SCE who had provided customers records for all SJV DACs. The missing SoCalGas

[32] For details on the history and use of the total survey error framework, see "Total Survey Error: Past, Present, and Future", Robert M. Groves and Lars Lyberg. *Public Opinion Quarterly Vol 74, No. 5, 2010, pp. 849-879.*

customer data did not result in coverage bias though it did cause us to wrongly assign some customers to the non-natural gas stratum.

4.6.2 Sampling Error

Sampling error occurs when researchers collected data from a sample of customers rather than all customers that the study results are supposed to represent. Sampling error receives the most attention when reporting survey results because it has well-established methods of quantification related to the methods of sample selection. In fact, most studies only report sampling error and fail to mention other non-sampling errors that are likely to be larger than sampling error but are costly or impossible to quantify.

Several statistics provide estimates of sampling error, including standard errors and estimates of precision at different levels of confidence. In addition, we can use estimates of sampling error to conduct hypothesis tests to determine the likelihood that observed differences between subgroups exist in the population or whether these differences are more likely due to sampling error and would not be observed with a different sample.

Mitigation and Assessment

We mitigated sampling error by collecting data on a large sample of customers for the quantitative survey (n=2,660). For rare subgroups of interest, such as customers without access to natural gas, we surveyed large oversamples (n=1,391 non-natural gas respondents). By attempting to interview all non-natural gas customers in small and medium communities, we effectively conducted a census attempt of these customers.

In confidence and precision terms, the quantitative survey sample satisfies 95/2 confidence/precision for the overall SJV DAC household population and at least 95/5 for most subgroups (e.g., non-natural gas mobile homes).[33] The audit results are less precise due to their smaller samples. The audit sample satisfies 90/5 confidence/precision for the overall SJV DAC household population and at least 90/12 for most subgroups. The confidence level (e.g., 95) means that if we were to have drawn 100 samples and conducted 100 surveys and calculated a confidence interval for each, the true population value would fall within these confidence intervals for 95 of the surveys. Therefore, we can be 95% confident that true population value falls within the confidence interval we calculate for our survey estimate. The precision value (e.g., 2, 5, or 12) provides the +/- confidence interval in percentage points. For example, an estimate with 95/2 confidence/precision could be interpreted as: if the survey finds that 50% of all respondents have an electric clothes dryer, we are 95% confident that the true population value (i.e., all non-multifamily households in SJV DACs) lies between 48% and 52%. For results based on subgroups, the results are less precise, meaning the confidence interval surrounding the estimate is larger. For example, an estimate with 95/10 confidence/precision could be interpreted as: if the survey finds that 50% of mobile homes without natural gas in our sample have an electric water heater, we are 95% confident that the true population value lies between 45% and 55%.

4.6.3 Non-Response Error

Non-response error occurs when the people who participate in a survey are different from those who choose not to participate and this difference is correlated with study research objectives. Though survey response rates have dropped dramatically over the past couple of decades, a low response rate does not automatically mean results are biased. Still, a low response rate does increase the possibility of bias.

[33] These numbers provide the minimum absolute precision values we would achieve when estimating proportions. Absolute precision estimations vary based on the sample size and the proportion of the estimate. When providing the confidence and precision of the overall survey (95/2) or audits (95/5), we assume a proportion of 0.5, which is the minimum precision possible for a given sample size. Precision gets larger the closer the estimated proportion is to 0 or 1.

Mitigation and Assessment

We mitigated non-response bias by providing participation incentives and conducting rigorous non-response follow up using multiple outreach modes. To encourage participation, Opinion Dynamics provided a $25 incentive for completion of the quantitative survey and $100 for completion of home audit. Following the initial mailed survey invitation, we sent reminders by mail and email and followed up by telephone. These efforts resulted in an overall response rate of 7.7%.

It is difficult to assess the presence of non-response bias due to the lack of data on the study's target population and the extreme oversamples used in the study design. The U.S. Census data we used for sampling purposes is an aggregation of data from estimates for Census Designated Places that maps imperfectly to the SJV DACS under study. Our study population also excludes households in multifamily buildings, which are included in many census demographic estimates, such as income or ethnicity, that would be useful for detecting possibly survey non-response error. Finally, the extreme oversamples of households without natural gas, residents of small communities, and mobile homes makes it challenging to compare our sample respondents overall to known population values.

4.6.4 Measurement Error

Measurement error occurs when survey questions do not accurately measure the concept they are intended to measure. There are many possible reasons a specific question may not provide a measure of the desired concept, including: question wording and order, asking respondents questions that are not applicable, survey mode, and interviewer effects.

Mitigation and Assessment

In this study, we needed to collect detailed information about home conditions and energy-using equipment, which can be difficult for people to accurately provide. To minimize sampling error, we would have ideally used the quantitative survey with its large sample size to collect all items. However, some of the data elements, such as the manufacturer, size, and efficiency of heating equipment are difficult if not impossible for respondents to accurately provide and can only be gathered through home audits. Audits are more time consuming and costly to conduct so the audit sample was smaller. In short, we need to accept greater sampling error to reduce measurement error on some items.

The ability of respondents to provide accurate information varies depending on the item. Opinion Dynamics drew on our experience conducting numerous past baseline studies to determine what was reasonable to ask through a self-report survey and what could only be collected through a home audit. Despite this careful division of items as well as including descriptions of energy using equipment and pictures in the online survey, we knew there will still be self-reporting errors. For items that we knew were more prone to error, we verified survey responses during the audits. We compared the audit data and survey responses for the same respondents to assess the degree of error and estimate adjustment ratios to correct for errors in the larger survey sample. This method effectively allows us to still take advantage of the larger survey sample sizes while leveraging the greater accuracy of the home audits.

Using this method, we calculated separate adjustment ratios for customers with and without natural gas for hundreds of data elements. Section 4.5.3 and Appendix A provide details on the estimation of the adjustment ratios.

4.6.5 Data Processing Error

Error mitigation does not end once data collection is complete. Data must still be cleaned, processed, analyzed, and results transferred to the written report and other data outputs. Data processing error can occur during all of these stages without proper processes and established quality control (QC) procedures. Data processing error is a particular risk for a study like this one that includes a large number of complex data elements, data from three different sources (i.e., quantitative survey, home audits, and in-depth interviews), large oversamples, and the need to correct for measurement error through the estimation and application of adjustment ratios.

Mitigation and Assessment

Opinion Dynamics used its well-established data cleaning protocols and QC processes for this study. For baseline studies such as this one, we use custom-built data analysis and reporting tools that can handle large amounts of data. Out-of-the-box statistical software packages are not well-suited to the analytic demands that come with estimating unique adjustment ratios for hundreds of data elements and dozens of subgroups using a combination of survey and audit data, which are then applied to weighted survey data. We export the analytic results to a custom Excel tool that tests specified group differences for statistical significance and outputs results into report-ready data tables. Our custom-built tools provide a systematic process that reduces the opportunity for error and makes QC easier. In Appendix A, we provide a diagram with our analytic process.

5. Fuel Use

A principal purpose of this study was to determine fuel use (fuel penetration) within the 179 SJV DAC communities identified as a part of the Data Gathering Plan. We collected fuel use for electricity, natural gas, propane, wood, wood pellets, and other alternative fuels if present, such as diesel and kerosene. Diesel fuel use was only present for back-up generators, not as a main or regularly used fuel source for the home. We did not find any households that used kerosene. For this reason, we present the fuel penetration of electricity, natural gas, propane, and wood (inclusive of wood pellets). Unless otherwise noted, propane and wood use is restricted to regular use for space heating, water heating, or cooking and does not include occasional use for cooking (e.g., grilling).

5.1 Overall Household Fuel Use

Table 16 displays the percentage of households in SJV DACs that use electricity, natural gas, propane, and wood (inclusive of wood pellets). All households in this study have electric service at their residence. For natural gas, propane, wood, and wood pellets, fuel use is defined when the fuel is used for space heating, water heating, cooking, or laundry and is not used for recreational use such as occasional BBQ use.

- Across all SJV DACs, one percent of households do not have access to natural gas, which is approximately 8,250 households. Overall, propane is used in 2% of households and wood or wood pellets are used in 4% of households.
- Households without access to natural gas rely more heavily on propane, wood, and wood pellets. Nearly three-quarters (72%) use propane and close to one-third (30%) use some form of wood to meet their fuel needs. Very few households with natural gas access rely on these same alternative fuels (2% and 4% for propane and wood, respectively).
- Among households that do not have access to natural gas, use of propane is similar in small versus medium/large communities (74% vs. 71%). Wood is used less frequently in small communities than medium and large communities (26% vs. 38%). There is no difference in fuel use by community size among households with access to natural gas.
- Owners without natural gas access are more likely than renters without natural gas to use propane (78% vs. 50%) and wood (35% vs. 13%). Among households that have access to natural gas, we see no difference in fuel use between owners and renters.
- Households that lack access to natural gas and are eligible for CARE are less likely to use propane and wood than CARE ineligible households (64% vs. 80% for propane and 26% versus 35% for wood).

Table 16. Fuels Used in the Home*

	n	Electric	Natural Gas	Propane†	Wood / Wood Pellets†
Overall	2,660	100%	99%	2%	4%
Natural Gas Access					
No Natural Gas (a)	1,391	100%	N/A	72%[b]	30%[b]
Natural Gas (b)	1,269	100%	100%[a]	2%	4%
Community Size					
Small, No Natural Gas (c)	458	100%	N/A	74%[e]	26%[e]

	n	Electric	Natural Gas	Propane†	Wood / Wood Pellets†
Medium/Large, No Natural Gas (d)	933	100%	N/A	71%[f]	38%[cf]
Small, Natural Gas (e)	229	100%	100%[c]	5%[f]	5%
Medium/Large, Natural Gas (f)	1,040	100%	100%[d]	2%	4%
Home Ownership					
Owner, No Natural Gas (g)	1,082	100%	N/A	78%[hi]	35%[hi]
Renter, No Natural Gas (h)	309	100%	N/A	50%[j]	13%[j]
Owner, Natural Gas (i)	815	100%	100%[g]	2%	4%
Renter, Natural Gas (j)	454	100%	100%[h]	2%	5%
CARE Eligible					
CARE Eligible, No Natural Gas (k)	701	100%	N/A	64%[m]	26%[m]
CARE Ineligible, No Natural Gas (l)	493	100%	N/A	80%[kn]	35%[kn]
CARE Eligible, Natural Gas (m)	778	100%	100%[k]	2%	5%[n]
CARE Ineligible, Natural Gas (n)	375	100%	100%[l]	1%	3%

Note: Multiple selections allowed.
a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn.
*Survey responses adjusted by audit data.
†Excludes occasional, recreational use.

We assigned customers who do not have natural gas into one of four categories based on the combination of alternative fuels they use to better understand how these customers are meeting their major energy needs. The four mutually exclusive fuel categories are: (1) only electricity and no alternative fuels (2) propane only, (3) wood only, and (4) both propane and wood. A customer that we classify as propane user might use propane for space and water heating while using electricity for cooking. Given the number of possible fuel combinations we limited this analysis to combinations of alternative fuels and all electric. Table 17 presents the distribution of customers without natural gas across these four fuel use categories.

- Most customers without natural gas use at least one alternative fuel (72%) while slightly over one-quarter (28%) use only electricity for all their fuel needs.
- Most customers use a single alternative fuel, and the most commonly used fuel is propane (50% of customers without natural gas); only 6% use wood as their single alternative fuel while 17% use both propane and wood.

Table 17. Alternative Fuel Use Categories of Customers Without Natural Gas

	n	Households
Fuel Use		
No Natural Gas	1,269	100%
--All Electric	307	28%
--Alternative Fuels	1,084	72%
-----Propane Only*	746	50%
-----Wood/Wood Pellets Only*	92	6%
-----Propane and Wood/Wood Pellets	246	17%

* Propane only and wood only customers use only one *alternative* fuel. Respondents may also use electricity for a major energy enduse.

5.2 Space Heating

Households can use more than one fuel type to heat their homes. For example, a household may have a natural gas furnace but also use an electric space heater (see Section 12.8 for more information on heating equipment used). Space heating fuel penetration includes all primary and secondary heating fuel sources (Table 18).

- Overall, a majority of households in the SJV have natural gas space heating (95%). Electricity is the next most frequently used heating fuel (18%) while a few households use wood (4%) or propane (2%).
- Households without access to natural gas use a variety of fuel types to meet their heating needs. Two-thirds of households (66%) use propane for space heating while half (51%) use electricity. Slightly less than half use wood or wood pellets (42%).
- Renters without access to natural gas use different fuels for space heating than owners without natural gas. Renters are more likely to use electricity (64% vs. 47%) and are less likely to use propane (40% vs. 72%) and wood (17% vs. 49%). We do not see a similar difference in heating fuel use between renters and owners for households that have access to natural gas.
- CARE eligible households are more likely to have electric space heating than CARE ineligible households, regardless of natural gas access (difference of 10 percentage points for households without natural gas and 8 percentage points for those with natural gas). Among households without access to natural gas, CARE eligible households are less likely to use propane and wood for space heating (53% vs. 78% and 30% vs. 54%, respectively) than CARE ineligible households.

Table 18. Space Heating Fuel Penetration*

	n	Electric	Natural Gas	Propane	Wood / Wood Pellets†
Overall	2,528	18%	95%	2%	4%
Natural Gas Access					
No Natural Gas (a)	1,346	51%[b]	N/A	66%[b]	42%
Natural Gas (b)	1,182	18%	95%[a]	2%	4%
Community Size					
Small, No Natural Gas (c)	445	52%[e]	N/A	61%[e]	27%
Medium/Large, No Natural Gas (d)	901	51%[f]	N/A	67%[cf]	44%
Small, Natural Gas (e)	221	19%	93%[c]	7%[f]	3%
Medium/Large, Natural Gas (f)	961	18%	95%[d]	2%	4%
Home Ownership					
Owner, No Natural Gas (g)	1,057	47%[i]	N/A	72%[hi]	49%
Renter, No Natural Gas (h)	289	64%[gj]	N/A	40%[j]	17%
Owner, Natural Gas (i)	772	17%	96%[gj]	2%	4%
Renter, Natural Gas (j)	410	21%[i]	93%[h]	2%	4%

	n	Electric	Natural Gas	Propane	Wood / Wood Pellets†
CARE Eligible					
CARE Eligible, No Natural Gas (k)	671	58%[lm]	N/A	53%[m]	30%
CARE Ineligible, No Natural Gas (l)	484	47%[n]	N/A	78%[kn]	54%
CARE Eligible, Natural Gas (m)	711	23%[n]	94%[k]	2%	4%
CARE Ineligible, Natural Gas (n)	363	15%	96%[lm]	1%	4%

Note: Multiple selections allowed.
a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn.
*Survey responses adjusted by audit data.
†Excludes occasional, recreational use.

5.2.1 Primary Heating

Customers who use more than one system and, as a result, fuel types to heat their homes often use one system as their primary source of heat. We asked all customers who use multiple heat systems to identify their primary system. The primary heating fuels in Table 19 are the fuels used by these primary systems. A small number of respondents said they use multiple heating systems equally. We allowed this response so that the percentages sum to greater than 100 percent.[34]

- Most households with natural gas use natural gas as their primary heating fuel (82%) with just 15% using electricity. Households without natural gas are more varied in their primary heating fuel use. Propane is the primary fuel for half (49%) while slightly over one-third use electricity (37%) and one-fifth use wood or wood pellets (21%).

Table 19. Primary Space Heating Fuel by Natural Gas Access*

	n	Electricity	Natural Gas	Propane	Wood/Wood Pellets†
Fuel Access					
No Natural Gas (a)	1,323	37%[b]	N/A	49%[b]	21%[b]
Natural Gas (b)	1,169	15%	82%	1%	1%

Note: Multiple selections allowed.
a/b Indicates significant differences at a 90% confidence level between natural gas and non-natural gas.
*Survey responses adjusted by audit data.
†Excludes occasional, recreational use.

[34] The home audits revealed that many customers are unable to correctly identify their heating systems, which results in considerable errors in heating fuel use. We calculated and applied adjustment ratios to all heating systems and fuels used in the home. The Estimates in Table 18 are the audit-adjusted estimates. The auditors did not ask customers to identify their primary heating systems. As a result, the survey-based estimates of primary space heating fuel suffer from measurement error. To correct this error, we applied the audit-based adjustment ratios for the multiple heating fuels used to the survey-reported primary fuels used. Because we are using this adjustment ratio as a proxy, we only report primary-heating fuel for homes with and without natural gas, which is the level at which we estimated the adjustment ratios. Reporting results by smaller subgroups would compound the uncertainty already associated with these smaller samples.

5.3 Water Heating

Table 20 presents the fuels that households in SJV DACs use for water heating (see Section 12.11 for more information on water heating equipment used).

- Overall, most households use natural gas water heaters in SJV DACs (96%). Few households use electricity (3%).
- Households without access rely on both propane and electricity for water heating, although propane is more common (60% vs. 40%).
- There is no difference in water heating fuel use by community size but there is by home ownership and CARE eligibility among customers that lack access to natural gas. Renters and CARE eligible households without natural gas are more likely to use electric water heaters than owners (59% vs. 35%) and CARE ineligible households (48% vs. 33%).

Table 20. Water Heating Fuel*

	n	Electricity	Natural Gas	Propane
Overall	2,502	3%	96%	1%
Natural Gas Access				
No Natural Gas (a)	1,333	40%[b]	0%	60%[b]
Natural Gas (b)	1,169	3%	96%[a]	0.4%
Community Size				
Small, No Natural Gas (c)	447	39%[e]	0%	61%[e]
Medium/Large, No Natural Gas (d)	886	40%[f]	0%	60%[f]
Small, Natural Gas (e)	212	4%	95%[c]	1%[f]
Medium/Large, Natural Gas (f)	957	3%	96%[d]	0.4%
Home Ownership				
Owner, No Natural Gas (g)	1,053	35%[i]	0%	65%[hi]
Renter, No Natural Gas (h)	280	59%[gj]	0%	41%[j]
Owner, Natural Gas (i)	762	3%	97%[gj]	0.4%
Renter, Natural Gas (j)	407	5%[i]	95%[h]	0.4%
CARE Eligible				
CARE Eligible, No Natural Gas (k)	660	48%[lm]	0%	52%[m]
CARE Ineligible, No Natural Gas (l)	483	33%[n]	0%	67%[kn]
CARE Eligible, Natural Gas (m)	713	4%	96%[k]	1%
CARE Ineligible, Natural Gas (n)	352	3%	97%[lm]	0.2%

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests:ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn.
*Survey responses adjusted by audit data.

5.4 Cooking

For each major cooking appliance (i.e., range, stove top, wall oven) in a customer's home, we asked about the fuel used by the appliance (see Section 12.12 for more detail on cooking appliances in homes). Table 21 displays the penetration of fuels for major cooking appliances.

- Natural gas is the most commonly used fuel source for major cooking appliances cross all SJV DACs. A majority of households (90%) have a natural gas fueled appliance while slightly over one-quarter (24%) have an electric appliance.
- Nearly two-thirds of households without access to natural gas use electricity (64%) and slightly under half use propane (46%) to fuel their major cooking appliances. Less than 1% use wood or wood pellets for their cookstove.
- Owners without natural gas access are more likely to use propane for cooking than renters (51% vs. 29%).
- CARE ineligible households without natural gas access are more likely to use propane for cooking than CARE eligible households (53% vs. 38%).

Table 21. Major Cooking Appliance Fuel Penetration

	n	Electricity*	Natural Gas*	Propane*	Wood / Wood Pellets
Overall	2,652	24%	90%	1%	0.001%
Natural Gas Access					
No Natural Gas (a)	1,385	64%[b]	N/A	46%[b]	0.2%[b]
Natural Gas (b)	1,267	24%	90%[a]	1%	0%
Community Size					
Small, No Natural Gas (c)	455	52%[e]	N/A	52%[de]	0.3%
Medium/Large, No Natural Gas (d)	930	65%[cf]	N/A	45%[f]	0.1%
Small, Natural Gas (e)	228	19%	88%[c]	2%[f]	0%
Medium/Large, Natural Gas (f)	1,039	24%[e]	90%[d]	1%	0%
Home Ownership					
Owner, No Natural Gas (g)	1,077	60%[i]	N/A	51%[hi]	0.2%[i]
Renter, No Natural Gas (h)	308	74%[gj]	N/A	29%[j]	0%
Owner, Natural Gas (i)	814	26%[j]	90%[g]	1%	0%
Renter, Natural Gas (j)	453	20%	88%[h]	1%	0%
CARE Eligible					
CARE Eligible, No Natural Gas (k)	696	65%[lm]	N/A	38%[m]	0.2%
CARE Ineligible, No Natural Gas (l)	492	61%[n]	N/A	53%[kn]	0.2%
CARE Eligible, Natural Gas (m)	777	19%	89%[k]	1%	0%
CARE Ineligible, Natural Gas (n)	375	28%[m]	91%[l]	1%	0%

Note: Multiple selections allowed.
a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn.
*Survey responses adjusted by audit data.

5.5 Laundry

Most SJV DAC homes (94% overall) have a clothes dryer (see section 12.14.1 for more detail). We asked customers who have clothes dryers in their homes for the fuel used by that appliance (Table 22).

- Natural gas is the most commonly used fuel source for clothes dryers cross all SJV DACs. Slightly over two-thirds of clothes dryers (70%) are natural gas dryers. Most the remaining dryers are electric (30%).
- Most households without access to natural gas rely on electricity to dry their clothes. Over three-quarters of dryers are electric (78%) while just over one-fifth are propane (22%).
- Owners without natural gas access are twice as likely to use a propane clothes dryer compared to renters (24% vs. 12%).
- CARE ineligible households without natural gas access are more likely to use a propane dryer than CARE eligible households (25% vs. 16%).

Table 22. Clothes Dryer Fuel*†

	n	Electricity	Natural Gas	Propane
Overall	2,341	30%	70%	1%
Natural Gas Access				
No Natural Gas (a)	1,238	78%[b]	0%	22%[b]
Natural Gas (b)	1,103	30%	70%[a]	0.3%
Community Size				
Small, No Natural Gas (c)	416	85%[de]	0%	15%[e]
Medium/Large, No Natural Gas (d)	822	77%[f]	0%	23%[cf]
Small, Natural Gas (e)	196	36%[f]	63%[c]	1%
Medium/Large, Natural Gas (f)	907	30%	70%[de]	0.3%
Home Ownership				
Owner, No Natural Gas (g)	1,006	76%[i]	0%	24%[hi]
Renter, No Natural Gas (h)	232	88%[gj]	0%	12%[j]
Owner, Natural Gas (i)	762	30%	70%[g]	0.3%
Renter, Natural Gas (j)	341	30%	70%[h]	0.4%
CARE Eligible				
CARE Eligible, No Natural Gas (k)	579	84%[lm]	0%	16%[m]
CARE Ineligible, No Natural Gas (l)	473	75%[n]	0%	25%[kn]
CARE Eligible, Natural Gas (m)	647	32%	68%[k]	0.3%
CARE Ineligible, Natural Gas (n)	355	29%	70%[l]	0.3%

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn.
*Survey responses adjusted by audit data.
†Responses among homes with clothes dryers.

6. Fuel Preferences

We asked SJV customers who do not have access to natural gas and use propane or wood to fuel a major appliance (space heating, water heating, or cooking) a series of questions about their use of that alternative fuel. The responses provide a better understanding of the reasons for use of alternative fuels, attitudes associated with their use, and feelings towards other fuels.

6.1 Drivers of Current Fuel Use

6.1.1 Reasons for Using Propane

Table 23 displays the reasons that propane users gave for using the fuel instead of electricity or natural gas.

- The primary reason SJV households give for using propane is because they cannot get natural gas (75%). Far fewer propane users gave other reasons such as affordability (12%), availability (8%), and convenience (7%).
- Renters are less certain about the reasons they use propane; 22% reported being unsure of why they use propane compared to 5% of owners. As indicated by their responses, owners are more likely to understand the fuel options associated with their current residence. A large majority (81%) said they use propane because they cannot get natural gas.
- Like renters, CARE eligible households displayed less certainty about their use of propane than CARE ineligible households (14% vs. 4%). Still, two-thirds of CARE eligible (65%) said their use of propane was due to their inability to get natural gas.

Table 23. Reasons for Propane*

	n	Can't get natural gas	Propane is more affordable	Propane is more convenient	Availability of propane	Propane is better for the environment	Propane is safer	Other	Unsure
Natural Gas Access									
No Natural Gas	981	75%	12%	7%	8%	1%	1%	3%	8%
Community Size									
Small, No Natural Gas (a)	322	72%	13%	9%	8%	2%	1%	2%	9%
Medium/Large No Natural Gas (b)	659	76%	11%	7%	9%	1%	1%	3%	8%
Home Ownership									
Owner, No Natural Gas (c)	814	81%[d]	11%	7%	8%	1%	1%	2%	5%
Renter, No Natural Gas (d)	167	46%	14%	7%	11%	0%	0%	8%[c]	22%[c]

	n	Can't get natural gas	Propane is more affordable	Propane is more convenient	Availability of propane	Propane is better for the environment	Propane is safer	Other	Unsure
CARE Eligible									
CARE Eligible, No Natural Gas (e)	368	65%	13%	9%	8%	1%	1%	4%	14%[f]
CARE Ineligible, No Natural Gas (f)	444	80%[e]	10%	7%	10%	1%	1%	2%	4%

Note: Multiple selections allowed.
a/b/c/d/e/f Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ef.
*Responses among Propane Users, No Natural Gas.

6.1.2 Reasons for Using Wood

Table 24 displays the reasons that wood users gave for using wood instead of electricity or natural gas by subgroup.

- Unlike the reasons for propane use where access to natural gas is the main driver of fuel use, wood users are split evenly between the affordability of wood as a fuel source (55%) and their lack of access to natural gas (51%). A smaller, but still sizable, percentage of households (17%) gave convenience as a reason for using wood.
- There are few differences in reasons for wood use by subgroup.

Table 24. Reasons for Wood Use*

	n	Can't get natural gas	Wood is more affordable	Wood is more convenient	Wood is a preference	Wood is better for the environment	Availability of wood	Wood is safer	Other	Unsure
Natural Gas Access										
No Natural Gas	197	51%	55%	17%	5%	5%	2%	1%	7%	4%
Community Size										
Small, No Natural Gas (a)	59	48%	41%	23%	4%	2%	2%	0%	7%	6%
Medium/Large, No Natural Gas (b)	138	51%	57%[a]	16%	5%	2%	5%	1%	6%	4%
Home Ownership										
Owner, No Natural Gas (c)	176	51%	54%	16%	5%[d]	1%	5%[d]	1%	7%	3%
Renter, No Natural Gas (d)	21	50%	58%	23%	0%	13%	0%	5%	2%	12%
CARE Eligible										

	n	Can't get natural gas	Wood is more affordable	Wood is more convenient	Wood is a preference	Wood is better for the environment	Availability of wood	Wood is safer	Other	Unsure
CARE Eligible, No Natural Gas (e)	77	56%	51%	17%	6%	1%	0%	1%	7%	5%
CARE Ineligible, No Natural Gas (f)	88	48%	57%	15%	3%	1%	1%[e]	1%	7%	3%

Note: Multiple selections allowed.
a/b/c/d/e/f Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ef.
*Responses among Wood Users, No Natural Gas.

6.2 Reasons for Not Using Propane or Wood

6.2.1 Reasons for Not Using Propane

Table 25 displays the reasons propane users provided for not using propane as a fuel source in their home.

- When asked about reasons not to use propane, many propane users (53%) indicated that propane fuel is expensive, and one-fifth said it was inconvenient (20%). Still, about one-third (32%) of propane users could not think of a reason for not using propane.
- Like the reasons for using propane, renters were less certain about reasons not to use propane than owners (19% vs. 4%). More owners than renters (55% vs. 42%) cite propane costs as a reason for not using the fuel, though it is the top response for both groups. Owners are more likely to say there is no reason not to use propane than renters (34% vs. 22%) suggesting greater satisfaction with the fuel source.

Table 25. Reasons for Not Using Propane*

	n	Propane is expensive	No reason not to use propane	Propane is inconvenient	Propane is not safe	Propane is bad for the environment	No choice	Other	Unsure
Natural Gas Access									
No Natural Gas	981	53%	32%	20%	10%	10%	2%	1%	6%
Community Size									
Small, No Natural Gas (a)	322	55%	28%	21%	15%[b]	14%[b]	3%	2%	7%
Medium/Large, No Natural Gas (b)	659	52%	33%[a]	19%	9%	10%	2%	1%	6%
Home Ownership									
Owner, No Natural Gas (c)	814	55%[d]	34%[d]	20%	9%	10%	3%[d]	1%	4%

	n	Propane is expensive	No reason not to use propane	Propane is inconvenient	Propane is not safe	Propane is bad for the environment	No choice	Other	Unsure
Renter, No Natural Gas (d)	167	42%	22%	16%	14%[c]	13%	1%	1%	19%[c]
CARE Eligible									
CARE Eligible, No Natural Gas (e)	367	56%	23%	21%	14%[f]	16%[f]	1%	1%	11%[f]
CARE Ineligible, No Natural Gas (f)	444	51%	37%[e]	20%	8%	6%	3%[e]	1%	3%

Note: Multiple selections allowed.
a/b/c/d/e/f Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ef.
*Responses among Propane Users, No Natural Gas.

6.2.2 Reasons for Not Using Wood

Table 26 displays the reasons wood users provided for not using wood as a fuel source in their home.

- Almost half (45%) of wood users feel that they have no reason not to use wood. However, nearly one-third (32%) said wood was bad for the environment and that it was inconvenient (31%).
- More CARE eligible customers cite the expense of using wood as a fuel source as a reason for not using wood than CARE ineligible customers (20% vs. 6%, respectively).

Table 26. Reasons for Not Using Wood*

	n	No reason not to use wood	Wood is inconvenient	Wood is bad for the environment	Wood is not safe	Wood is more expensive	Other	Unsure
Natural Gas Access								
No Natural Gas	197	45%	31%	32%	8%	13%	2%	3%
Community Size								
Small, No Natural Gas (a)	59	40%	38%	38%	12%	11%	0%	1%
Medium/Large, No Natural Gas (b)	138	46%	30%	31%	7%	13%	3%[a]	4%
Home Ownership								
Owner, No Natural Gas (c)	176	46%	32%	31%	7%	13%	2%[d]	4%[d]
Renter, No Natural Gas (d)	21	41%	27%	40%	20%	18%	0%	0%
CARE Eligible								
CARE Eligible, No Natural Gas (e)	75	41%	30%	30%	8%	20%[f]	5%	4%

	n	No reason not to use wood	Wood is inconvenient	Wood is bad for the environment	Wood is not safe	Wood is more expensive	Other	Unsure
CARE Ineligible, No Natural Gas (f)	88	43%	37%	39%	9%	6%	1%	1%

Note: Multiple selections allowed.
a/b/c/d/e/f Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ef.
*Responses among Wood Users, No Natural Gas.

6.3 Fuel Preferences

To understand customer preferences for alternative fuels compared to electricity or natural gas, we asked customers to directly compare each alternative fuel they use (i.e., propane and/or wood) to natural gas and electricity as a fuel source.

6.3.1 Fuel Preferences – Propane Users

Table 27 displays propane users' attitudes about natural gas.

- One-third of propane users feel that natural gas is better than propane (32%). The remaining respondents are either unsure (28%), feel the two fuels are equal (26%), or feel that natural gas is worse than propane (14%).
- Renters and CARE eligible customers are less certain about natural gas compared to propane. Nearly half of renters (48%) are unsure which fuel is better compared to one-quarter of owners (25%). A larger share CARE eligible customers are unsure (40%) compared to CARE ineligible customers (21%).

Table 27. Propane vs. Natural Gas, Propane Users*

	n	Natural gas is worse than propane	Natural gas is equal to propane	Natural gas is better than propane	Unsure
Natural Gas Access					
No Natural Gas	981	14%	26%	32%	28%
Community Size					
Small, No Natural Gas (a)	322	13%	24%	31%	32%
Medium/Large, No Natural Gas (b)	659	14%	27%	32%	28%
Home Ownership					
Owner, No Natural Gas (c)	814	14%[d]	27%[d]	34%[d]	25%
Renter, No Natural Gas (d)	167	9%	19%	24%	48%[c]
CARE Eligible					
CARE Eligible, No Natural Gas (e)	367	11%	20%	29%	40%[f]
CARE Ineligible, No Natural Gas (f)	444	16%[e]	28%[e]	34%	21%

a/b/c/d/e/f Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ef.
*Responses among Propane Users, No Natural Gas.

Table 28 displays propane users' attitudes about electricity.

- Slightly over one-quarter of propane users feel that electricity is worse than propane (28%). Just under one-fifth feel that electricity is better than propane (18%). Approximately half of them feel the two fuels are equal (27%) or are unsure (26%).
- Owners are more likely than renters to feel that electricity is worse than propane (31% vs. 13%) whereas renters are more likely to feel electricity is better than propane compared to owners (28% vs 17%).

Table 28. Propane vs. Electricity, Propane Users*

	n	Electricity is worse than propane	Electricity is equal to propane	Electricity is better than propane	Unsure
Natural Gas Access					
No Natural Gas	981	28%	27%	18%	26%
Community Size					
Small, No Natural Gas (a)	322	19%	26%	29%[b]	27%
Medium/Large, No Natural Gas (b)	659	30%[a]	28%	17%	26%
Home Ownership					
Owner, No Natural Gas (c)	814	31%[d]	29%[d]	17%	24%
Renter, No Natural Gas (d)	167	13%	20%	28%[c]	38%[c]
CARE Eligible					
CARE Eligible, No Natural Gas (e)	367	19%	24%	25%[f]	31%[f]
CARE Ineligible, No Natural Gas (f)	444	33%[e]	28%	16%	22%

a/b/c/d/e/f Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ef.
*Responses among Propane Users, No Natural Gas.

6.3.2 Fuel Preferences – Wood Users

Table 29 displays wood users' attitudes about natural gas.

- Just over one-third of wood users feel that natural gas is worse than wood (34%). Slightly over one-quarter feel that natural gas is better than wood (28%). Few feel the two fuels are equal (16%) and approximately one-fifth are unsure (22%).
- Wood users have similar attitudes about natural gas regardless of subgroup.

Table 29. Wood vs. Natural Gas, Wood Users*

	n	Natural gas is worse than wood	Natural gas is equal to wood	Natural gas is better than wood	Unsure
Natural Gas Access					
No Natural Gas	197	34%	16%	28%	22%

	n	Natural gas is worse than wood	Natural gas is equal to wood	Natural gas is better than wood	Unsure
Community Size					
Small, No Natural Gas (a)	59	33%	16%	24%	28%
Medium/Large, No Natural Gas (b)	139	34%	16%	29%	21%
Home Ownership					
Owner, No Natural Gas (c)	176	34%	14%	29%	23%
Renter, No Natural Gas (d)	22	29%	36%c	21%	15%
CARE Eligible					
CARE Eligible, No Natural Gas (e)	75	34%	15%	25%	26%
CARE Ineligible, No Natural Gas (f)	88	35%	15%	33%	17%

a/b/c/d/e/f Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ef.
*Responses among Wood Users, No Natural Gas.

Table 30 displays wood users' attitudes about electricity.

- Half of wood users feel that electricity is worse than wood (49%). One-fifth feel that electricity is better than wood (19%). Equal numbers feel that the two fuels are equal (16%) or are unsure (16%).
- Wood users have similar attitudes about electricity regardless of subgroup.

Table 30.Wood vs. Electricity, Wood Users*

	n	Electricity is worse than wood	Electricity is equal to wood	Electricity is better than wood	Unsure
Natural Gas Access					
No Natural Gas	197	49%	16%	19%	16%
Community Size					
Small, No Natural Gas (a)	59	45%	12%	25%	18%
Medium/Large, No Natural Gas (b)	138	49%	17%	19%	15%
Home Ownership					
Owner, No Natural Gas (c)	176	49%	16%	20%	15%
Renter, No Natural Gas (d)	21	47%	20%	13%	20%
CARE Eligible					
CARE Eligible, No Natural Gas (e)	75	54%	10%	17%	19%
CARE Ineligible, No Natural Gas (f)	88	46%	20%	25%	10%

a/b/c/d/e/f Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ef.
*Responses among Wood Users, No Natural Gas.

7. Fuel Switching

Customers who use alternative fuels for heating or cooking may resist changing to electricity or natural gas for a variety of reasons. We asked several questions to gauge and better understand resistance to switching to a different fuel for space heating and cooking.

7.1 Space Heating

We asked SJV customers who do not have access to natural gas and use propane or wood for space heating whether they would be concerned with using an electric or natural gas heating system if the new system were provided and installed for free. Customers who had concerns were asked to describe them. A few respondents (less than 1%) who do not have heat were also asked these questions.

7.1.1 Switching to an Electric Heating System – Among Households with Alternative Fuels for Heating

Table 31 displays concerns with switching to an electric heating system among customers who currently use propane or wood for space heating.

- Just over half of customers (56%) do not have any concerns about switching to electric heating, if it were provided and installed for free. Among those with concerns, the cost of electricity was the largest concern (18%).
- Renters are less concerned than owners about switching to an electric heating system (75% of renters have "no" concerns compared to 55% of owners). Owners' biggest concern is the cost electricity (19%).

Table 31. Fuel Switching to Electric Heat*

	n	No Concerns	Cost of electricity	I prefer what I have	Electricity is not available	Electricity is not efficient	I do not trust a free offer	Other	Unsure
Natural Gas Access									
No Natural Gas	464	56%	18%	5%	9%	4%	4%	5%	5%
Community Size									
Small, No Natural Gas (a)	97	64%	16%	6%	4%	1%	3%	5%	2%
Medium/Large, No Natural Gas (b)	367	56%	18%	5%	10%[a]	5%[a]	4%	5%	6%
Home Ownership									
Owner, No Natural Gas (c)	424	55%	19%[d]	5%[d]	9%	4%	4%[d]	5%	5%
Renter, No Natural Gas (d)	40	75%[c]	6%	1%	10%	3%	0%	5%	6%
CARE Eligible									
CARE Eligible, No Natural Gas (e)	117	58%	17%	2%	5%	2%	5%	3%	10%[f]

	n	No Concerns	Cost of electricity	I prefer what I have	Electricity is not available	Electricity is not efficient	I do not trust a free offer	Other	Unsure
CARE Ineligible, No Natural Gas (f)	258	58%	18%	5%[e]	9%	5%	2%	4%	3%

Note: Multiple selections allowed.
a/b/c/d/e/f Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ef.
*Responses among households with propane or wood space heating.

"It just also depends because electric could also be high- my house, it's really high sometimes. The AC, whenever we use it in the summer, it's a high bill. Maybe that might, the cost will be only my only concern. That would be my only concern."

-Hardwick CDP Resident

7.1.2 Switching to a Natural Gas Heating System – Among Households with Alternative Fuels for Heating

Table 32 displays concerns with switching to a natural gas heating system among customers who currently use propane or wood for space heating.

- Slightly over two-thirds (68%) of SJV customers that currently heat with propane or wood do not have concerns about switching to a natural gas system, if it were provided and installed for free. Of those with concerns, availability of natural gas was the biggest concern (16%).
- Renters are less concerned than owners about switching to a natural gas heating system (82% of renters have "no" concerns compared to 66% of owners). Owners' biggest concern is the cost natural gas (17%).

Table 32. Fuel Switching to Natural Gas Heat*

	n	No Concerns	Cost of fuel and equipment	Availability of natural gas	I prefer what I have	I do not trust a free offer	Other	Unsure
Natural Gas Access								
No Natural Gas	464	68%	6%	16%	4%	3%	3%	3%
Community Size								
Small, No Natural Gas (a)	97	68%	4%	16%	7%	2%	4%	0%
Medium/Large, No Natural Gas (b)	367	68%	6%	16%	4%	3%	3%	3%[a]
Home Ownership								
Owner, No Natural Gas (c)	424	66%	6%	17%[d]	4%	3%[d]	3%	3%

	n	No Concerns	Cost of fuel and equipment	Availability of natural gas	I prefer what I have	I do not trust a free offer	Other	Unsure
Renter, No Natural Gas (d)	40	82%c	5%	8%	1%	0%	1%	2%
CARE Eligible								
CARE Eligible, No Natural Gas (e)	117	67%	6%	16%	2%	5%	4%	2%
CARE Ineligible, No Natural Gas (f)	258	69%	6%	16%	4%	1%	3%	2%

Note: Multiple selections allowed.
a/b/c/d/e/f Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ef.
*Responses among households without natural gas or electric space heating.

"I just don't want the [natural gas heating system] I know it would be cheaper because it's gas, but I would prefer not to have the gas piped in and one more opportunity for a gas leak or things like that. I just- It's mostly safety of the home."

-China Lakes Acres CDP Resident

7.2 Cooking

People tend to have stronger opinions about their cooking appliances than heating systems given the role that cooking plays in their lives. We asked several questions to fully understand the barriers associated with switching from cooking with a flame to electricity.

7.2.1 Preferences for Electric Cooktops or Cooktops with a Flame

We asked respondents who do not have natural gas about their preference for cooking with a flame versus an electric cooktop (Table 33). The flame could be fueled by natural gas, propane, wood, or charcoal.[35] We broke out results by the fuel source of respondents' existing major cooking appliances.

- All customers, regardless of natural gas access, their current cooking fuel use, and home ownership status, prefer cooking with a flame over electricity. However, the strength of that preference varies with current fuel use being the main differentiator. Customers who currently cook with a flame, be it natural gas or propane, strongly prefer cooking with a flame over electricity. Still, more customers who currently cook with electricity prefer cooking with a flame than prefer an electric cooktop.
- Customers who do not have natural gas are less likely to prefer cooking with a flame (70% vs. 48% strongly prefer).
  - This difference is due to the greater number of customers without natural gas who currently cook with electricity (see Section 5.4) for more detail on cooking fuels used). Customers without natural

[35] The cooking preference questions did not specify whether the electric cooktop was a standard electric cooktop or a newer induction cooktop. Given the low market share for induction cooktops, we assume that the vast majority of respondents were thinking about a standard electric cooktop when they answered the questions.

gas who currently cook with electricity are less likely to prefer cooking with a flame than those who cook with propane (34% vs. 73% strongly prefer).

- The commitment to electricity is relatively weak. Customers without natural gas who cook with electricity still prefer a flame over electricity (34% vs. 15% strongly prefer).

- Customers who do not have natural gas but cook with propane, are as likely as natural gas users to prefer cooking with a flame (73% of propane users and 78% of natural gas users strongly prefer).

Table 33. Cooktop Preferences by Natural Gas Access and Major Cooking Fuel Use

	n	I strongly prefer an electric cooktop	I somewhat prefer an electric cooktop	I have no preference	I somewhat prefer to cook with a flame	I strongly prefer to cook with a flame	Unsure
Overall	2,660	3%	3%	13%	8%	70%	2%
Natural Gas Access							
Natural Gas (a)	1,391	3%	3%	13%	8%	70%[b]	2%
No Natural Gas (b)	1,269	10%[a]	8%[a]	21%[a]	11%	48%	2%
Major Cooking Appliance Fuel Use, Natural Gas							
HHs with Electric Cooking (c)	344	10%[d]	6%	19%[d]	7%	54%	3%
HHs with Natural Gas Cooking (d)	938	0%	1%	10%	8%	78%[ce]	2%
HHs with Propane Cooking (e)	60	3%	0%	21%[d]	14%	62%[c]	0%
Major Cooking Appliance Fuel Use, No Natural Gas							
HHs with Electric Cooking (f)	779	15%[g]	11%	27%[g]	11%	34%	2%
HHs with Propane Cooking (g)	697	2%	2%	10%	12%	73%[f]	1%

a/b/c/d/e/f/g Indicates significant differences at a 90% confidence level between the following tests:
ab,cde,fg

"The change in temperature responds much faster and I have better control. I have also had negative effects from turning on the wrong electric burner without realizing it. With a flame it is easier to see if I accidentally turn a different one on."

- Bear Valley Springs CDP Resident

- Owners who do not have natural gas are slightly more likely to prefer the fuel type they use than renters, likely because they have more control over the appliance and fuel they use (Table 34).

Table 34. Cooktop Preferences by Home Ownership and Major Cooking Fuel Use

	n	I strongly prefer an electric cooktop	I somewhat prefer an electric cooktop	I have no preference	I somewhat prefer to cook with a flame	I strongly prefer to cook with a flame	Unsure
Households with Electric Cooking, No Natural Gas							
Owners (a)	582	19%[b]	11%	24%	11%	33%	2%
Renters (b)	197	5%	10%	35%[a]	10%	37%	2%
Households with Propane Cooking, No Natural Gas							
Owners (c)	583	1%	2%	10%	11%	74%	1%
Renters (d)	114	4%	2%	12%	12%	67%	3%

a/b/c/d Indicates significant differences at a 90% confidence level between the following tests:
ab,cd

"I don't like necessarily cooking on electric stove, although that's the only choice we've ever had in this house. But where I grew up in Southern California, I grew up using a gas stove and it's better for cooking because you can modulate how much heat is actually hitting the pan. When you're cooking on electric stove, when it's time to turn something down from high to simmer, or from high to medium or low, you have to remove the pan from the hot side and wait until the eye cools down, until you reach that temperature. And if you had a gas stove or propane stove, you just have to turn the fire down and there you go."

-Madera Acres CDP Resident

To better understand cooking preferences, we asked customers who do not have access to natural gas and prefer cooking with a flame why they prefer a flame rather than an electric cooktop (Table 35).

- The main reasons for cooking with a flame include the ability to control and adjust the heat (39%), as well as the time it takes to heat up and cool the burner (23%).
- SJV households in small communities, renters, and CARE eligible are less likely to say that they cook with a flame because of adjustability and control reasons.

Table 35. Reasons for Flame Cooking Preference (By Subgroup)

	n	Adjustability control	Speed, Heats up and cools down quickly	Tradition and comfort with gas	Natural Gas is easier/better	Cooking is more even/consistent with gas	Food tastes better and cooks better	Safety	Cost/Gas is less expensive	Other	Unsure
Natural Gas Access											
No Natural Gas	826	39%	23%	11%	6%	7%	7%	2%	4%	11%	2%
Community Size											
Small, No Natural Gas (a)	266	28%	21%	11%	8%	4%	7%	1%	6%	16%[b]	1%
Medium/Large, No Natural Gas (b)	560	40%[a]	23%	11%	5%	8%[a]	7%	3%[a]	4%	10%	3%
Home Ownership											
Own, No Natural Gas (c)	660	42%[d]	23%	10%	5%	7%	7%	2%	4%	12%	3%
Rent, No Natural Gas (d)	166	28%	20%	13%	10%[c]	9%	9%	4%	5%	10%	3%
CARE Eligible											
CARE Eligible, No Natural Gas (e)	318	28%	18%	11%	8%	5%	8%	2%	5%	12%	4%*
CARE Ineligible, No Natural Gas (f)	363	46%[e]	26%[e]	11%	5%	9%[e]	5%	3%	3%	11%	1%

Note: Multiple selections allowed.
a/b/c/d/e/f Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ef.

7.2.2 Switching to an Electric Stove – Among Households without a Natural Gas or Electric Stove

As with the heating fuel switching questions, we asked SJV customers who do not have access to natural gas and use propane or wood for cooking whether they would be concerned with using an electric cooking appliance if the new appliance were provided and installed for free. Customers who had concerns were asked to describe them. A few respondents (less than 1%) who do not have major cooking appliance (e.g., use a microwave or hot plate to cook) were also asked these questions.

Table 36 displays concerns with switching to an electric cooktop among customers who currently use propane or wood for cooking.

- Forty-one percent of SJV customers who currently cook with propane or wood do not have concerns about switching to an electric cooktop, if it were provided and installed for free. Of those with concerns, the most commonly cited were a preference for cooking with a flame over electric (23%) and the temperature control that a flame provides (11%). Some respondents were concerned with the cost of electricity (13%).
- Renters are less concerned than owners about switching to an electric cooktop (63% of renters have "no" concerns compared to 36% of owners). Owners' biggest concern is their preference for cooking with a flame (25%) and the control it provides (12%).

Table 36. Fuel Switching Concerns to an Electric Cooktop*

	n	No concerns	Prefer flame over electric	Cost or energy use	Perform or control	No electric experience	Equipment concerns, wiring	Gas is more reliable	Other	Unsure
Natural Gas Access										
No Natural Gas	598	41%	23%	13%	11%	4%	4%	4%	3%	0%
Community Size										
Small, No Natural Gas (a)	227	31%	15%	14%	10%	3%	4%	2%	5%	2%[b]
Medium/Large, No Natural Gas (b)	371	43%[a]	25%[a]	13%	11%	4%	4%	5%[a]	3%	0%
Home Ownership										
Owner, No Natural Gas (c)	487	36%	25%[d]	14%	12%[d]	4%	4%	5%[d]	3%	1%[d]
Renter, No Natural Gas (d)	111	63%[c]	11%	9%	7%	2%	2%	2%	1%	0%
CARE Eligible										
CARE Eligible, No Natural Gas (e)	248	46%	17%	14%	4%	3%	3%	2%	3%	1%
CARE Ineligible, No Natural Gas (f)	249	40%	26%[e]	12%	14%[e]	3%	5%	6%[e]	2%	0%

Note: Multiple selections allowed.

a/b/c/d/e/f Indicates significant differences at a 90% confidence level between the following tests:

ab,cd,ef.

*Responses among households without natural gas or electric cooktop or stove.

"Easily controllable and cooks my food evenly! Better tasting food and a natural source of energy. I've never had an electric and wouldn't switch! Can't imagine myself even cooking on a electric stovetop. Sounds unnatural!."

-Bakersfield City CDP Resident

8. Energy Costs

Table 37 shows the average 2019 energy costs for all fuels used and by fuel type.

- The total energy costs of customers without access to natural gas are 38% higher than customers with access to natural gas ($2,312 vs. $1,671).
- Households without natural gas spent nearly three times as much on average for propane than households with natural gas spent on natural gas ($1,177 vs. $403).
- Renters and CARE eligible households spent less on fuel.

Table 37. Average 2019 Energy Costs

	n	Total Costs	Electricity Costs	Natural Gas Costs	Propane Costs	Wood Costs
Overall	194-2488	$1,676	$1,304	$403	$1,177	$379
Fuel Access						
No Natural Gas (a)	194-1269	$2,312[b]	$1,496[b]	N/A	$1,177	$379
Natural Gas (b)	736-1209	$1,671	$1,303	$403	N/A	N/A
Community Size						
Small, No Natural Gas (c)	53-416	$2,390[e]	$1,680[de]	N/A	$1,048	$333
Medium/Large, No Natural Gas (d)	141-853	$2,298[f]	$1,465[f]	N/A	$1,210[c]	$385
Small, Natural Gas (e)	111-219	$1,499	$1,218	$385	N/A	N/A
Medium/Large, Natural Gas (f)	625-990	$1,676[e]	$1,307	$403	N/A	N/A
Home Ownership						
Owner, No Natural Gas (g)	175-1008	$2,457[hi]	$1,498[i]	N/A	$1,224[h]	$375
Renter, No Natural Gas (h)	19-261	$1,811[j]	$1,489[j]	N/A	$862	$421
Owner, Natural Gas (i)	448-776	$1,793[j]	$1,383[j]	$443[j]	N/A	N/A
Renter, Natural Gas (j)	288-433	$1,469	$1,156	$335	N/A	N/A
CARE Eligible						
CARE Eligible, No Natural Gas (k)	84-620	$1,999[m]	$1,396[m]	N/A	$1,007	$369
CARE Ineligible, No Natural Gas (l)	81-466	$2,639[kn]	$1,549[k]	N/A	$1,305[k]	$374
CARE Eligible, Natural Gas (m)	478-741	$1,432	$1,118	$356	N/A	N/A

	n	Total Costs	Electricity Costs	Natural Gas Costs	Propane Costs	Wood Costs
CARE Ineligible, Natural Gas (n)	201-359	$1,917[m]	$1,443[m]	$466[m]	N/A	N/A

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn.
*n values range due to several factors: incidence rates of the fuels used, missing cost data, and removing outliers.

Table 38 provides additional energy cost data for customers without natural gas to better understand the cost implications of different options for meeting household energy needs. In Table 17 we presented results for the combination of alternative fuels used by customers who lack access to natural gas, including using only electricity. Here we present results on the costs of these four fuel use scenarios.

- Among customers who lack access to natural gas, all electric customers have the lowest total energy costs on average. Their costs are comparable to the costs of customers with natural gas.
- Customers who use both propane and wood have the highest total energy costs and spend 73% more than all electric customers. Customers who use only propane as an alternative fuel also have higher costs, 54% more than all electric. Both categories of propane users spend more than customers who use wood as their only alternative fuel (between 28% and 44% more).

Table 38. 2019 Energy Costs for Alternative Fuel Use Categories

	n*	Total Costs	Electricity Costs	Natural Gas Costs	Propane Costs	Wood Costs
Fuel Use						
Natural Gas (a)	736-1209	$1,671	$1,303	$402	N/A	N/A
Non-Natural Gas (b)	194-1269	$2,312[a]	$1,496[a]	N/A	$1,177	$379
--All Electric (c)	268-268	$1,687	$1,687[adf]	N/A	N/A	N/A
--Propane Only† (d)	550-677	$2,597[ace]	$1,432[a]	N/A	$1,222[f]	N/A
--Wood/Wood Pellet Only† (e)	47-87	$2,029	$1,545	N/A	N/A	$323
--Both Propane and Wood/Wood Pellets (f)	128-237	$2,919[acde]	$1,375	N/A	$1,049	$395

a/b/c/d/e/f Indicates significant differences at a 90% confidence level between the following tests:
ab,acdef.
* n values range due to several factors: incidence rates of the fuels used, missing cost data, and removing outliers.
†Propane only and wood only customers use only one alternative fuel. Respondents may also use electricity for a major energy end use.

"I would prefer the natural gas [heat] and the reason I say that is because… I've had natural gas heating and my bill was so low. It wasn't all crazy like the way my electric is."

-Inyokern CDP Resident

9. Burden and Hardship

9.1 Energy Costs, Burden, Modified Burden, and Economic Hardship

Table 39 contains the average 2019 energy costs, energy burden, modified energy burden, and economic hardship index for SJC DACs by subgroup.

- Overall, households in SJV DACs spent 4.5% of their 2019 household income on home energy costs.
- On average, households that lack access to natural gas spent more on energy in 2019 and have higher energy burdens than those with natural gas (5.9% vs. 4.5%).
- Residents of small communities, with and without access to natural gas, have higher energy burdens than residents of medium/large communities. Residents of small communities who lack access to natural gas have the highest energy burdens (8.7%).
- Renters, with and without access to natural gas, have lower energy costs but higher energy burdens than owners due to renters' lower incomes. Renters without access to natural gas have higher energy costs and energy burdens than renters with natural gas (7.1% vs. 5.5%).
- Like the relationship between renters and owners, CARE eligible customers have lower energy costs but higher energy burdens than CARE ineligible customers. Having access to natural gas reduces the energy costs and burden of CARE eligible customers, but due to their lower incomes, they still pay a greater share of their incomes in energy than CARE ineligible customers.
- Using modified energy burden, which includes public assistance in household income, reduces burden slightly, but the disparities identified above remain.
- Respondents self-assessed economic hardship is correlated with energy burden across most subgroups. The exception being that energy burden is higher for customers without natural gas than those with natural gas while self-assessed economic hardship is the same for the two groups.

Table 39. 2019 Energy Costs, Burden, and Economic Hardship

	n	Total Costs	Energy Burden	Modified Burden	Economic Hardship
Overall	1452-2660	$1,676	4.5%	3.9%	5.1
Fuel Access					
No Natural Gas (a)	833-1391	$2,312[b]	5.9%[b]	5.3%[b]	5.0
Natural Gas (b)	619-1269	$1,671	4.5%	3.9%	5.1
Community Size					
Small, No Natural Gas (c)	285-458	$2,390[e]	8.7%[de]	7.5%[de]	5.4[d]
Medium/Large, No Natural Gas (d)	548-933	$2,298[f]	5.4%[f]	5.0%[f]	4.9
Small, Natural Gas (e)	97-229	$1,499	5.4%[f]	4.8%[f]	5.3[f]
Medium/Large, Natural Gas (f)	522-1040	$1,676[e]	4.4%	3.8%	5.0
Home Ownership					
Owner, No Natural Gas (g)	639-1082	$2,457[hi]	5.5%[i]	5.1%[i]	4.7
Renter, No Natural Gas (h)	194-309	$1,811[j]	7.1%[gj]	5.9%[gj]	5.9[gj]

	n	Total Costs	Energy Burden	Modified Burden	Economic Hardship
Owner, Natural Gas (i)	368-815	$1,793[j]	3.8%	3.3%	4.7
Renter, Natural Gas (j)	251-454	$1,469	5.5%[i]	4.6%[i]	5.7[i]
CARE Eligible					
CARE Eligible, No Natural Gas (k)	450-701	$1,999[m]	8.8%[lm]	7.7%[lm]	5.8[lm]
CARE Ineligible, No Natural Gas (l)	380-493	$2,639[kn]	3.0%[n]	2.9%[n]	4.3
CARE Eligible, Natural Gas (m)	415-778	$1,432	6.2%[n]	5.2%[n]	5.6[n]
CARE Ineligible, Natural Gas (n)	201-375	$1,917[m]	2.0%	2.0%	4.5

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn
* n values range due to several factors: incidence rates of the fuels used, missing cost data, and removing outliers.

Table 40 provides additional energy costs, energy burden and hardship data for customers without natural gas based on their use of alternative fuels.

- Among customers who lack access to natural gas, the energy burdens are similar across the different fuel use categories despite variation in total energy costs. For energy burdens to be similar, customers with lower energy costs, such as all electric customers, must have lower household incomes.
- Despite all electric customers having similar energy costs to customers with natural gas, their average energy burden is higher (5.6% vs. 4.5%) due to their lower household incomes.

Table 40. 2019 Energy Costs, Burden, and Economic Hardship by Alternative Fuel Use Categories

	n*	Total Costs	Energy Burden	Modified Burden	Economic Hardship	Health Hardship
Fuel Use						
Natural Gas (a)	619-1269	$1,671	4.5%	3.9%	5.1[df]	3.1
Non-Natural Gas (b)	833-1391	$2,312[a]	5.9%[a]	5.3%[a]	5.0	3.2
--All Electric (c)	207-307	$1,687	5.6%[a]	4.9%[a]	5.3[adf]	3.3
--Propane Only (d)	475-746	$2,597[ace]	5.8%[a]	5.3%[a]	4.9	3.2
--Wood/Wood Pellet Only (e)	40-92	$2,029	5.7%	4.7%	5.1	2.9
--Both Propane and Wood/Wood Pellets (f)	111-246	$2,919[acde]	7.0%[a]	6.6%[a]	4.8	3.1

a/b/c/d/e/f Indicates significant differences at a 90% confidence level between the following tests:
ab,acdef.
* n values range due to several factors: incidence rates of the fuels used, missing cost data, and removing outliers.

Table 41 provides the total energy costs and energy burden of customers who have a rooftop solar system compared to those that do not for several types of customers based on fuel use (solar penetration is reported in Table 60).

	n	Total Costs	Energy Burden
Fuel Access			

No Natural Gas with Solar (a)	ranges from 126-144	$1,803[c]	2.8%
No Natural Gas without Solar (b)	ranges from 707-849	$2,416[ad]	6.6%[ad]
Natural Gas with Solar (c)	ranges from 102-118	$1279	2.1%
Natural Gas without Solar (d)	ranges from 518-618	$1,765[c]	5.1%[c]
All Electric / Alternative Fuel			
All Electric with Solar (e)	ranges from 38-42	$1,242	2.2%
All Electric without Solar (f)	ranges from 169-226	$1,779[e]	6.5%[e]
Alternative Fuel with Solar (g)	ranges from 88-102	$2,083[ce]	3.1%
Alternative Fuel without Solar (h)	ranges from 538-623	$2,731[dfg]	6.6%[g]

a/b/c/d/e/f/g/h Indicates significant differences at a 90% confidence level between the following tests: ab,cd,bd,ac,ef,gh,fh,eg,ce,cg,df,dh.

Figure 8 Table 41shows the percent reduction in energy costs and burden for customers who have solar versus those who do not for each customer type in Table 41.

- Customers who have solar have lower energy costs and energy burdens than customers without solar. On average, energy costs are 28% lower and energy burdens 59% lower for customers with solar. The disproportionately lower energy burdens are because customers with rooftop solar have higher incomes.[36]
- Solar customers with and without natural gas experience similar reductions in their energy costs and burden in percentage terms. Rooftop solar reduces the energy costs and burdens of customers without natural gas by 25% and 59% respectively compared to 28% and 59% for those with natural gas. Customers without gas who have solar have roughly the same energy costs as customers with natural gas who do not have solar ($1,803 vs. $1,765). The energy burden of solar customers without natural gas is nearly half as much as customers without solar and natural gas (2.8% vs. 5.1%) due to the higher incomes of customers with solar.
- Among customers who lack access to natural gas, solar has a greater impact on the energy costs and burden of all-electric customers than customers who use at least one alternative fuel (i.e., propane or wood). The energy costs and burdens of all-electric customers with solar are 30% and 66% lower respectively than all-electric customers without solar, which compares to 24% and 53% lower costs and burden for solar customers who use propane and/or wood.

Table 41. Energy Costs and Energy Burden for Households with Solar and without Solar

	n	Total Costs	Energy Burden
Fuel Access			
No Natural Gas with Solar (a)	ranges from 126-144	$1,803[c]	2.8%
No Natural Gas without Solar (b)	ranges from 707-849	$2,416[ad]	6.6%[ad]
Natural Gas with Solar (c)	ranges from 102-118	$1279	2.1%
Natural Gas without Solar (d)	ranges from 518-618	$1,765[c]	5.1%[c]
All Electric / Alternative Fuel			
All Electric with Solar (e)	ranges from 38-42	$1,242	2.2%
All Electric without Solar (f)	ranges from 169-226	$1,779[e]	6.5%[e]
Alternative Fuel with Solar (g)	ranges from 88-102	$2,083[ce]	3.1%

[36] Table 60 shows that CARE ineligible customers are over twice as likely to have solar compared to CARE eligible customers.

Alternative Fuel without Solar (h)	ranges from 538-623	$2,731[dfg]	6.6%[g]

a/b/c/d/e/f/g/h Indicates significant differences at a 90% confidence level between the following tests: ab,cd,bd,ac,ef,gh,fh,eg,ce,cg,df,dh.

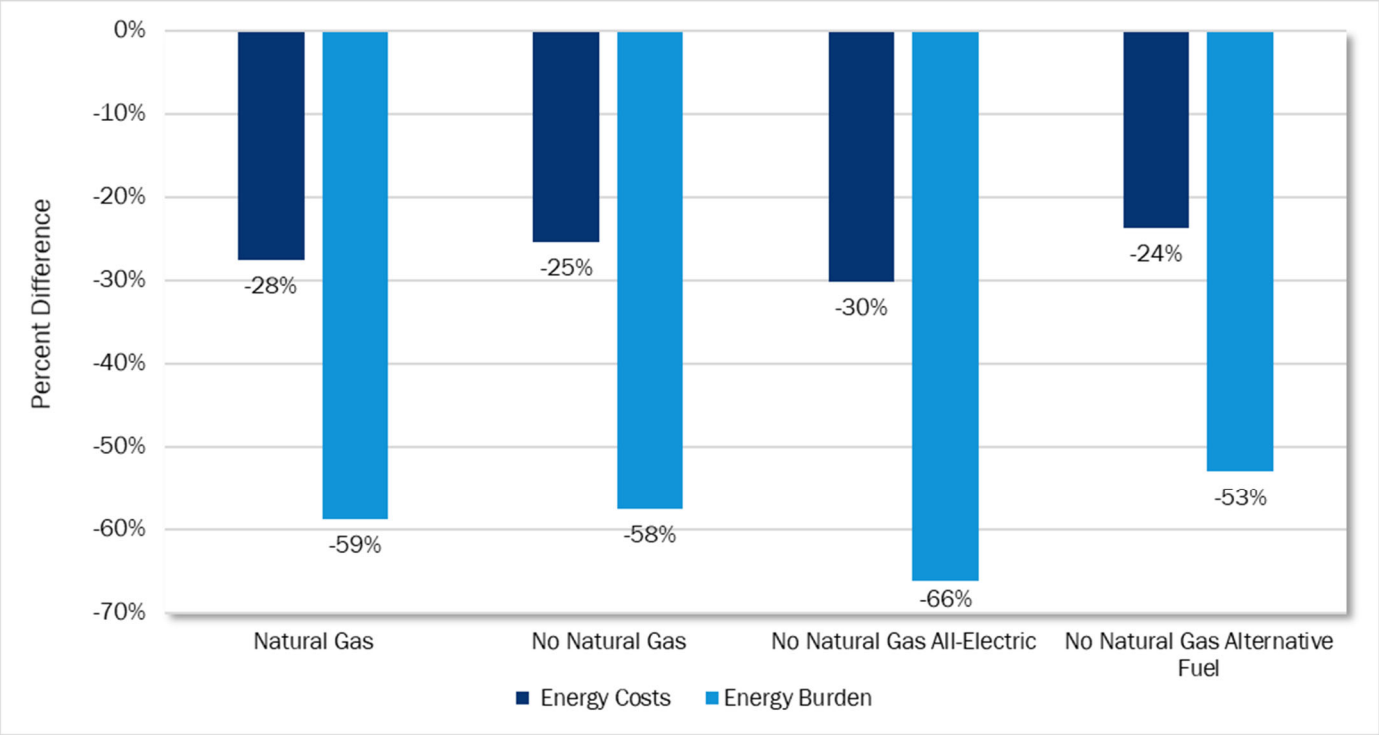
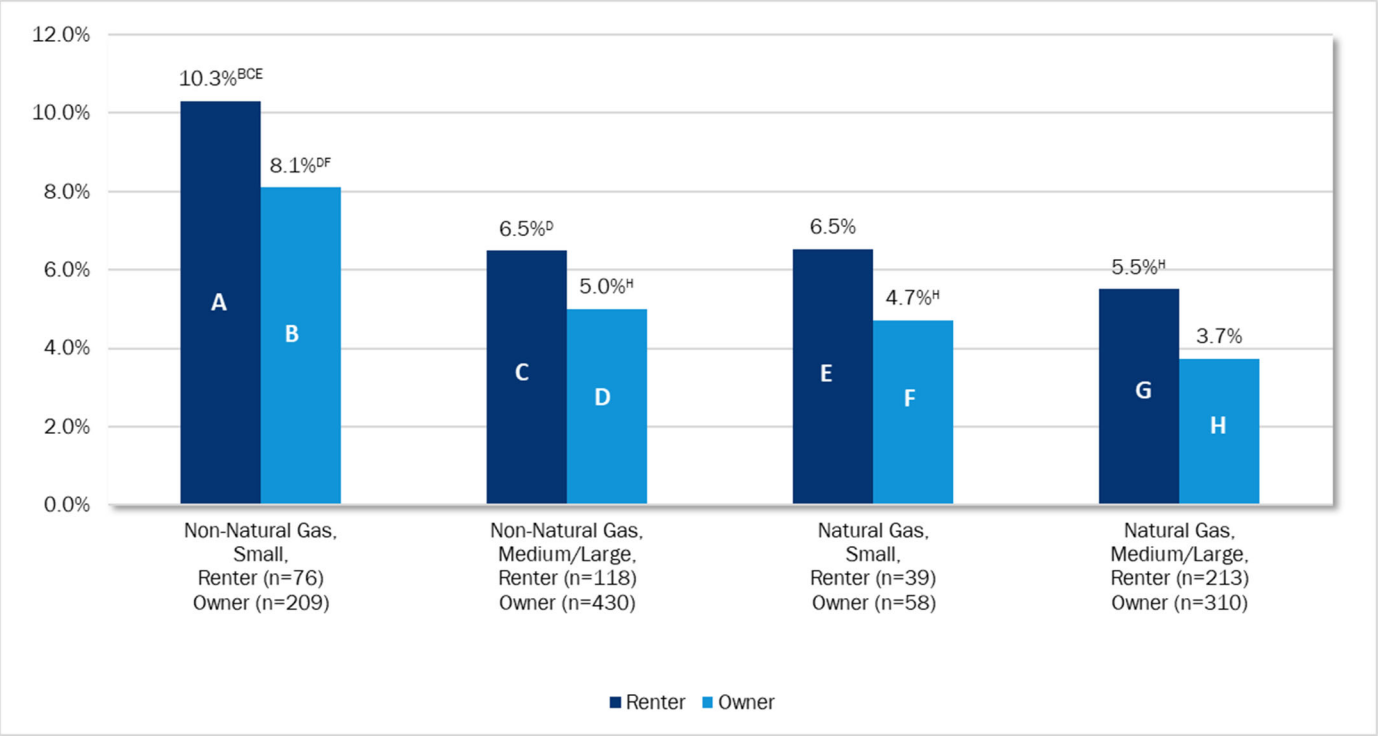


Figure 8. Reduction in Energy Costs and Burden for Households with Solar Compared to Households without Solar

Figure 9 displays the complex relationship between natural gas access, community size, and home ownership when it comes to energy burden.

- Each factor has an independent impact on energy burden. Renters, which is correlated with income, have a consistent impact on burden.
- Renters in small communities that lack access to natural gas have the highest energy burdens (10.3%). Access to natural gas reduces the burden, but renters in small communities with natural gas still have one of the higher energy burdens (6.5%). Outside of small communities without natural gas, owners have lower energy burdens (5.0% to 3.7%).
- Households in small communities without access to natural gas are particularly challenged. These households have higher energy burdens regardless of home ownership. Owners in these communities have the second highest energy burden (8.1%).

Figure 9. Energy Burden, Natural Gas Access, Community Size, and Home Ownership



a/b/c/d/e/f/g/h Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ef,gh,ac,bd,eg,fh,ae,bf,cg,dh.

Figure 10, Figure 11, and Figure 12 display differences in energy burden by income, natural gas access, community size, housing type, and home ownership. Each figure includes CARE eligibility and natural gas access and one additional variable, either community size, housing type, or home ownership. By including CARE eligibility and natural gas access in all figures, the results isolate the independent effects of the other factors, which tend to be correlated with income. The results also show whether lacking access to natural gas has an independent effect on energy burden, controlling for income and other factors.

We first highlight key findings that exist across all figures and then discuss key findings for each figure. The figures just show energy burden. Appendix A contains a data table with energy costs and burden for the same categories.

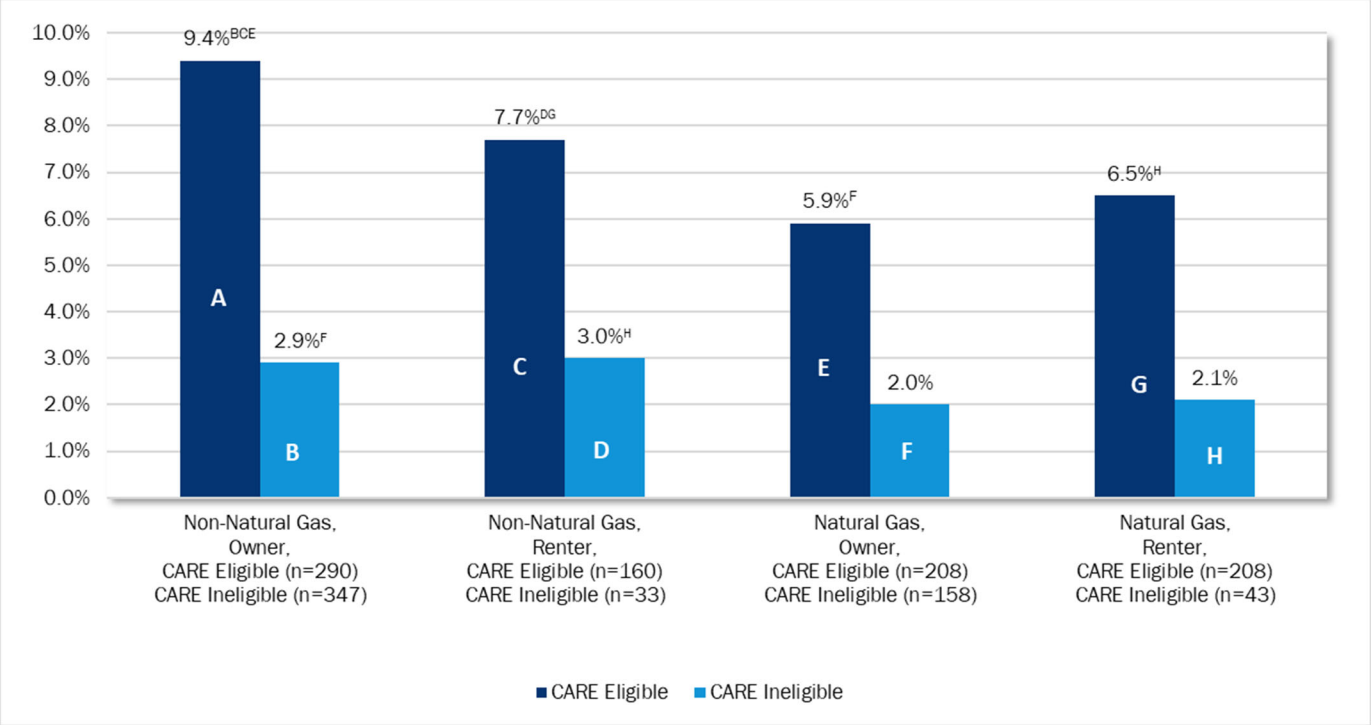
Across all figures:

- The biggest difference in energy burden is between CARE eligible and ineligible customers. This result is not surprising because energy burden is the ratio of energy costs to household income. However, the energy burdens of CARE eligible customers vary by natural gas access and other factors.
- CARE ineligible customers are less affected by not having access to natural gas. Not having access to natural gas has a greater impact on the energy burdens of CARE eligible customers than CARE ineligible customers.

Figure 10 displays difference in energy burden by home ownership in addition to CARE eligibility and natural gas access.

- Most owners and renters have similar energy burdens, controlling for income (i.e., CARE eligibility) and natural gas access.
  - The only substantively and statistically significant difference is between CARE eligible renters and owners who lack access to natural gas. CARE eligible owners without natural gas have higher energy burdens than renters (9.4% vs. 7.7%) because owners are more likely to use expensive alternative fuels to meet their space and water heating needs compared to renters who are more likely to use electricity.
  - The consistent differences in energy burden between renters and owners in Figure 9 are because renters have lower incomes than owners and not something unique about renters or rental properties. But it is still true that the average renter has a higher energy burden than the average owner due to renters' lower incomes, particularly those without access to natural gas. Any efforts to lower the energy costs of these renters will need to involve rental property owners.

Figure 10. Energy Burden, Natural Gas Access, Home Ownership, and Care Eligibility



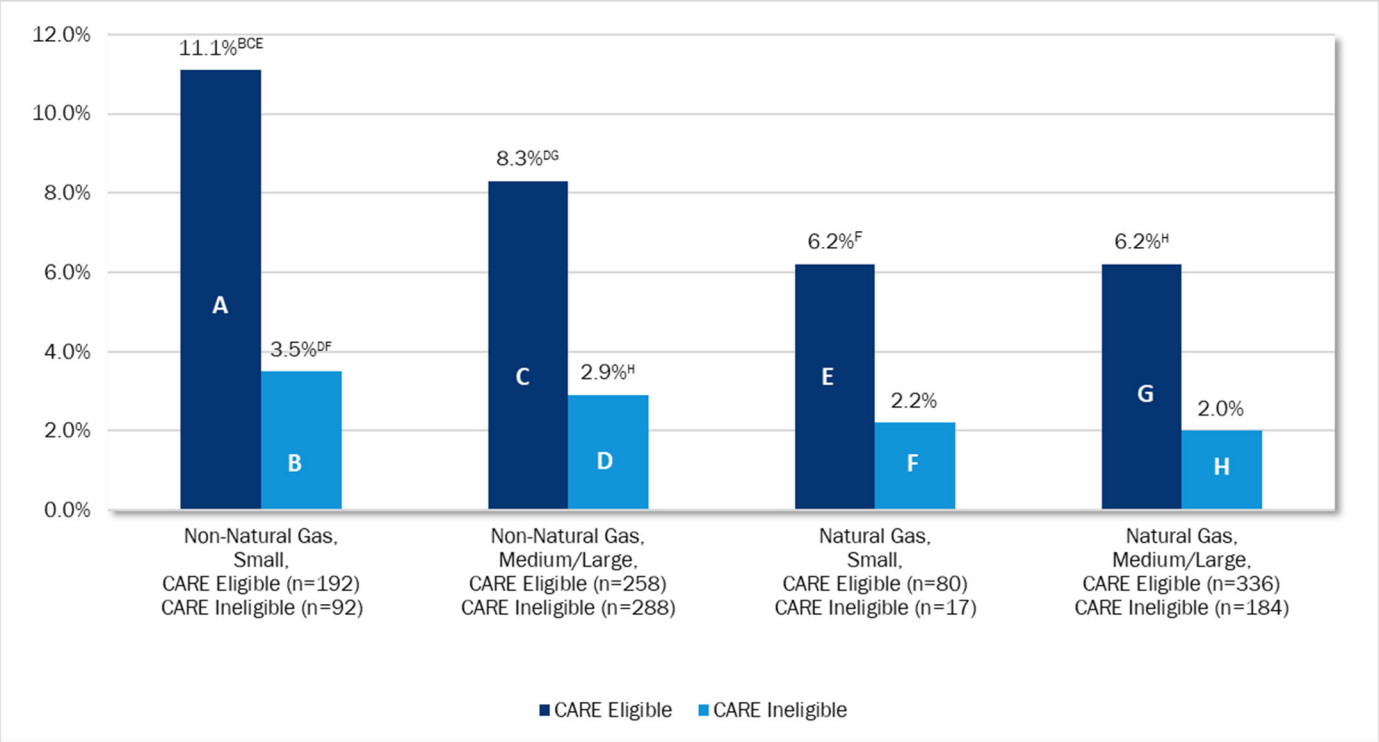
a/b/c/d/e/f/g/h Indicates significant differences at a 90% confidence level between the following tests:ab,cd,ef,gh,ac,bd,eg,fh,ae,bf,cg,dh.

Figure 11 displays the difference in energy burden by community size in addition to CARE eligibility and natural gas access.

- Customers who have natural gas have similar energy burdens regardless of community size, controlling for income (i.e., CARE eligibility) and natural gas access.
- CARE eligible customers without natural gas living in small communities have significantly higher energy burdens than comparable customers living in medium/large communities (11.1% vs. 8.3%).

CARE ineligible customers without natural gas living in small communities have significantly larger energy burdens than those in medium/large communities, but the difference is small (3.5% vs. 2.9%).

Figure 11. Energy Burden, Natural Gas Access, Community Size, and Care Eligibility



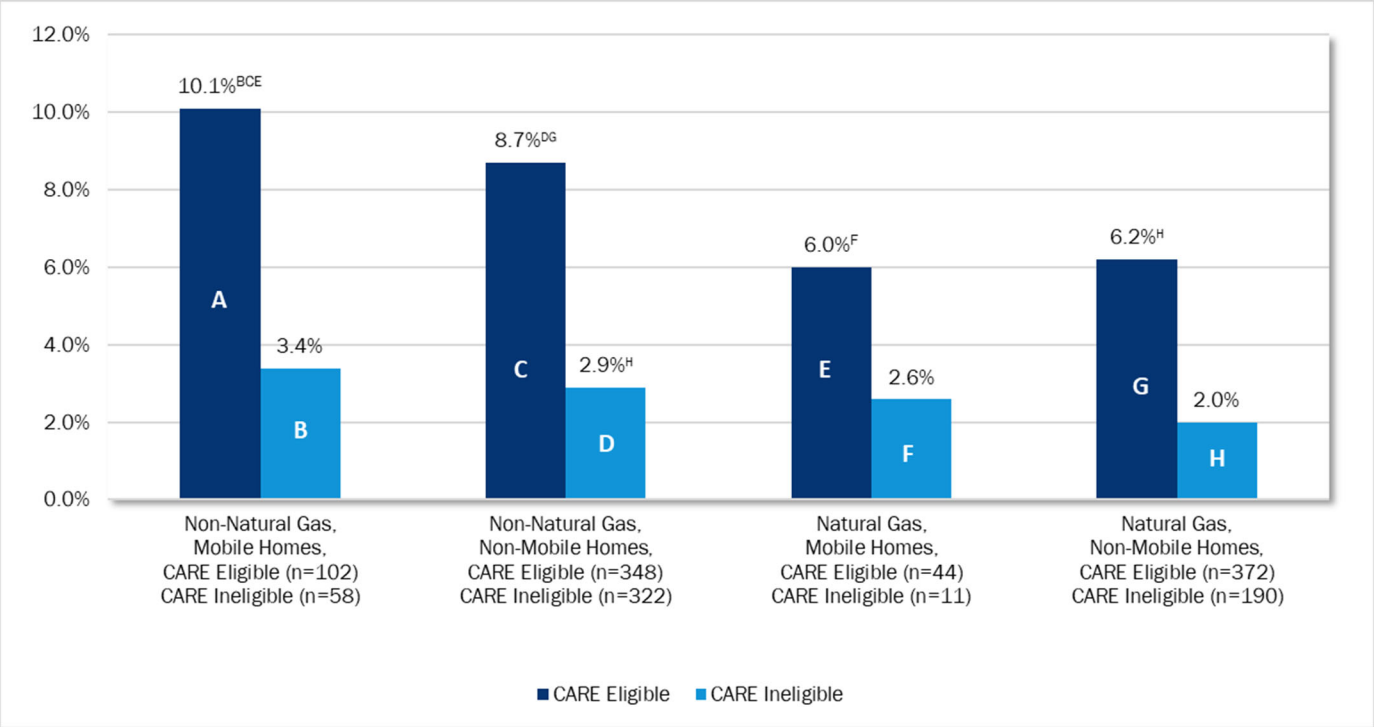
a/b/c/d/e/f/g/h Indicates significant differences at a 90% confidence level between the following tests:ab,cd,ef,gh,ac,bd,eg,fh,ae,bf,cg,dh.

Figure 12 displays the differences in energy burden by housing type in addition to CARE eligibility and natural gas access. In particular, the figure compares the energy burdens of mobile home residents to residents of single family homes (both detached and attached).

- Mobile home residents and residents of single family homes have similar energy burdens, controlling for income (i.e., CARE eligibility) and natural gas access.

CARE mobile home residents without natural gas have somewhat higher energy burdens than comparable single family residents (9.4% vs. 7.7%).

Figure 12. Energy Burden, Natural Gas Access, Housing Type, and Care Eligibility



a/b/c/d/e/f/g/h Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ef,gh,ac,bd,eg,fh,ae,bf,cg,dh.

10. Health, Safety & Comfort

10.1 Health

10.1.1 Air Quality

The particulate matter (PM2.5) and other pollutants released by wood-burning appliances affect both IAQ and ambient air quality.[37] Wood smoke and particulate matter can cause various health effects. According to the SJVAPCD, "Prolonged inhalation of wood smoke contributes to lung disease, pulmonary arterial hypertension, and pulmonary heart disease. Children with the highest exposure to wood smoke show a significant decrease in lung function."[38] The EPA highlights that small particles such as PM2.5 pose the greatest problems, because they can penetrate deep into lungs, and some may even penetrate the bloodstream, and can cause premature death in people with heart or lung disease, nonfatal heart attacks, aggravated asthma, and increased respiratory symptoms.[39] Ultrafine particles (PM0.1) worsens asthma and are linked to diabetes and cancer.[40]

The U.S. EPA states, "When wood isn't burned completely, the smoke it produces contains fine particles along with carbon monoxide and toxic air pollutants. The more efficiently wood burns (e.g., using an EPA-certified wood stove and dry, seasoned wood), the less smoke is created."[41] Wood fireplaces are the dirtiest, pellet stoves are the cleanest, and wood stoves are in between.[42]

In addition to the IAQ impacts for residents with wood-fired appliances in their homes, wood smoke contributes to the continuing ambient (outdoor) air quality problems in the SJV. According to the SJVAPCD, while annual PM2.5 concentrations in the SJV have been declining, they still exceed EPA standards.[43] Studies have indicated that the air quality in neighborhoods with high levels of wood-burning devices may be even worse, particularly for ultrafine particulate matter, PM0.1 (particles 0.1 µm or smaller). A 2011 study of residential wood burning in Cambria, California found high neighborhood concentrations of PM 0.1 from wood smoke even though concentrations of PM2.5 at the nearby ambient monitor met the federal health standard.[44]

Based on the survey and in-home audit data, the use of wood fireplaces and wood stoves as a primary source of heat is relatively low across all SJV households but varies by subgroup (Table 42).

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[37] In this section, air quality impacts are focused on wood-burning appliances as these have the highest impact on air quality and health effects compared to propane and natural gas appliances. Note, for propane and natural gas stoves proper ventilation is a concern and this was a data point captured by this study.

[38] See Footnote 27

[39] "Health and Environmental Effects of Particulate Matter," *Particulate Matter Pollution*, US EPA, Last Updated May 26, 2021, https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm

[40] D. Schraufnagel 2020, "The health effects of ultrafine particles," Experimental and Molecular Medicine: vol. 52, p. 311-317.

[41] "Pollution and Safety Issues," *Frequent Questions about Wood-Burning Appliances*. US EPA, Last Updated March 30, 2021. https://www.epa.gov/burnwise/frequent-questions-about-wood-burning-appliances#pollution

[42] See Footnote 27

[43] San Joaquin Valley Air Pollution Control District. *2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards*. November 15, 2018. http://www.valleyair.org/pmplans/documents/2018/pm-plan-adopted/2018-Plan-for-the-1997-2006-and-2012-PM2.5-Standards.pdf

[44] From http://valleyair.org/pmplans/documents/2018/pm-plan-adopted/04.pdf, based on the study: Thatcher, T. & Kirchstetter, T. (2011). Assessing Near-Field Exposures from Distributed Residential Wood Smoke Combustion Sources. Report prepared for the California Air Resources Board.

- Households without natural gas are more likely than those with natural gas to use a wood burning fireplace (7% vs. 2%) or wood stove (14% vs. 1%) as a primary heating source. This difference holds across communities of different sizes, home ownership, and CARE eligibility.
- Owners without natural gas are more likely to use wood as heating source, either a fireplace (9% vs. 3%) or a wood stove (16% vs. 5%), than renters without natural gas. There is no difference in use of wood heating appliances by community size.

Table 42. Use of a Fireplace as Primary Heating Source by Fireplace Fuel

	n	Wood Fireplace as Primary Heat	Propane Fireplace as Primary Heat	Natural Gas Fireplace as Primary Heat	Wood Stove as Primary Heat
Overall	2,497	2%	0.4%	3%	1%
Natural Gas Access					
No Natural Gas (a)	1,334	7%[b]	1%[b]	0.0%	14%[b]
Natural Gas (b)	1,163	2%	0.0%	3%[a]	1%
Community Size					
Small, No Natural Gas (c)	443	6%[e]	1%	0.0%	12%[e]
Medium/Large, No Natural Gas (d)	891	7%[f]	1%[f]	0.0%	14%[f]
Small, Natural Gas (e)	220	0.0%	2%[f]	0.0%	2%[f]
Medium/Large, Natural Gas (f)	943	2%[e]	0.0%	3%[de]	0.5%
Home Ownership					
Owner, No Natural Gas (g)	1,049	9%[hi]	1%[hi]	0.0%	16%[hi]
Renter, No Natural Gas (h)	285	3%	0.0%	0.0%	5%[j]
Owner, Natural Gas (i)	755	1%	0.0%	4%[gj]	1%[j]
Renter, Natural Gas (j)	408	2%[i]	1%[hi]	2%[h]	0.1%
CARE Eligible					
CARE Eligible, No Natural Gas (k)	664	7%[m]	1%[m]	0.0%	11%[m]
CARE Ineligible, No Natural Gas (l)	481	8%[n]	2%[k]	0.0%	16%[kn]
CARE Eligible, Natural Gas (m)	697	3%[n]	0.0%	2%[k]	0.4%
CARE Ineligible, Natural Gas (n)	359	1%	1%[m]	5%[lm]	0.4%

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

"We have a fireplace, but we haven't used it yet because my husband has COPD. We don't- I want to do it to see if it's going to affect his breathing, but yet I don't want to do it, you know what I mean?"

-Monterey Park Tract CDP Resident

10.1.2 GHG Impacts

GHG emissions from homes in the San Joaquin Valley were estimated based on their home type, type of fuel used, and amount of fuel used. We used data supplied by the IOUs for estimates of electricity and natural gas usage and customer reported values for propane and wood usage.

For all home types combined, the annual GHG emissions ranged from 4,133 pounds of CO2 for all electric homes to 10,854 pounds of CO2 for homes with space heating and propane water heating (Table 43). Given the assumptions made for this analysis in terms of energy usage, the results should be viewed as high level estimates. Overall, the results highlight higher GHG impacts of wood-fueled appliances compared to natural gas.

Table 43. GHG Emissions

Home Description	GHG Total Emissions (CO2e lb)
Natural Gas Households	7,421
No Natural Gas Households (Includes weighted mix of all electric, propane, and wood homes)	7,144
—All Electric Households	4,133
—Propane and Wood Households (Wood space heating and propane water heating)	10,854
--Wood Only Households (Wood space heating and electric water heating)	9,267
--Propane Only Households (Propane for space heating and water heating)	8,390

10.1.3 Health Hardship

We created a health hardship index based on two survey questions that asked respondents about the frequency that they or a household member experienced poor health in 2019 and the limitations poor health placed on their taking part in usual activities. The scale ranged from 0 to 10 with high numbers indicating greater health hardship (Table 44).

- Overall, households in SJV DACs have an average health hardship index of 3.11, revealing that most households tend to have low to moderately low health hardship.
- CARE eligible customers have significantly higher average health hardship scores compared to CARE ineligible customers, including for those with or without natural gas access.
- CARE eligible customers without natural gas access have significantly higher average health hardship scores than CARE eligible customers with natural gas access.

Table 44. Health Hardship

	n	Health Hardship
Overall	2,660	3.1
Natural Gas Access		
No Natural Gas (a)	1,391	3.2
Natural Gas (b)	1,269	3.1

	n	Health Hardship
Community Size		
Small, No Natural Gas (c)	458	3.3
Medium/Large, No Natural Gas (d)	933	3.2
Small, Natural Gas (e)	229	3.3
Medium/Large, Natural Gas (f)	1,040	3.1
Home Ownership		
Owner, No Natural Gas (g)	1,082	3.0
Renter, No Natural Gas (h)	309	3.7[gj]
Owner, Natural Gas (i)	815	3.1
Renter, Natural Gas (j)	454	3.2
CARE Eligible		
CARE Eligible, No Natural Gas (k)	701	3.8[lm]
CARE Ineligible, No Natural Gas (l)	493	2.7
CARE Eligible, Natural Gas (m)	778	3.5[n]
CARE Ineligible, Natural Gas (n)	375	2.7

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

Due to the higher cost of alternative fuels, customers who rely on these fuels may experience poor health due to their attempts to reduce their energy costs. We asked respondents who themselves or a household member had experienced poor health in 2019, how often it was due to trying to reduce their energy (Table 45).

- Overall, 43% of households in SJV DACs have experienced poor health due to their attempts to reduce their energy costs.
- Customers without access to natural gas are not more likely to experience poor health due to their attempts to manage their energy costs than customers with natural gas.
- Poverty is the main driver of poor health due to attempts to manage energy costs. CARE eligible customers are nearly three times as likely than non-CARE eligible customers to report health hardships at least “sometimes” due to attempts to manage energy costs, regardless of natural gas access.
- Renters and residents of small communities, who tend to be lower income, are also more likely than owners and residents of medium/large communities to report experiencing poor health as a result of their attempts to manage their energy costs.

Table 45. Health Implications Due to Reduced Bills

	n	Never	Rarely	Sometimes	Many Times	Most or All the Time
Overall	2,660	57%	21%	16%	5%	1%
Natural Gas Access						
No Natural Gas (a)	1,391	56%	22%	14%	6%	2%
Natural Gas (b)	1,269	57%	21%	16%	5%	1%
Community Size						
Small, No Natural Gas (c)	458	49%	16%	26%[d]	5%	4%[d]
Medium/Large, No Natural Gas (d)	933	57%[c]	23%[c]	12%	6%	2%
Small, Natural Gas (e)	229	46%	25%[cf]	22%[f]	3%	4%[f]
Medium/Large, Natural Gas (f)	1,040	58%[e]	21%	15%[d]	5%	1%
Home Ownership						
Owner, No Natural Gas (g)	1,082	61%[h]	20%	13%	5%	1%
Renter, No Natural Gas (h)	309	43%	26%[g]	19%[g]	9%[gj]	3%[gj]
Owner, Natural Gas (i)	815	61%[j]	20%	13%	4%	1%
Renter, Natural Gas (j)	454	50%[h]	23%[i]	19%[i]	6%[i]	1%
CARE Eligible						
CARE Eligible, No Natural Gas (k)	571	41%	25%[l]	22%[l]	8%[l]	4%[lm]
CARE Ineligible, No Natural Gas (l)	560	69%[k]	20%	9%	3%	0.2%
CARE Eligible, Natural Gas (m)	582	43%	23%[n]	24%[n]	8%[n]	2%
CARE Ineligible, Natural Gas (n)	469	70%[m]	19%	8%	2%	1%[l]

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

"Both my wife and I have COPD. I have a lung condition so if it gets too hot or too cold I've got to go back on oxygen."

-Avenal City CDP Resident

10.1.4 Other Health Issues

The survey asked respondents how often during 2019 they experienced mold, mildew, fungus, or moisture in their homes (Table 46). Mold can cause respiratory issues and exacerbate asthma.

- Overall, one-third (33%) of SJV DAC residents experienced mold, mildew, fungus, or moisture in their homes during 2019. Few experienced it "all" (1%) or "many" (4%) times with most experiencing it "sometimes" (10%) or "rarely" (18%).

- The findings show little difference in the incidence of mold and moisture related problems by access to natural gas but do see differences in other subgroups. Residents of small communities, renters and those eligible for CARE are more likely than residents of medium/large communities, owners, and CARE ineligible customers to have experienced mold and moisture related problems. Roughly half, depending on the subgroup, have had these problems in their homes in 2019 with most experiencing them rarely or sometimes.

Table 46. Presence of Mold, Mildew, Fungus, or Moisture in the Home

	n	Never	Rarely	Sometimes	Many Times	Most or All the Time
Overall	2,660	67%	18%	10%	4%	1%
Natural Gas Access						
No Natural Gas (a)	1,391	65%	20%[b]	10%	4%	1%
Natural Gas (b)	1,269	67%[a]	18%	10%	4%	1%
Community Size						
Small, No Natural Gas (c)	458	51%	21%	21%[de]	5%	2%
Medium/Large, No Natural Gas (d)	933	67%[c]	20%	8%	4%	1%
Small, Natural Gas (e)	229	57%[c]	21%	13%[f]	6%[f]	3%[f]
Medium/Large, Natural Gas (f)	1,040	67%[e]	18%	10%	4%	1%
Home Ownership						
Owner, No Natural Gas (g)	1,082	70%[h]	19%	7%	3%	1%
Renter, No Natural Gas (h)	309	47%	24%[gj]	19%[gj]	8%[g]	2%[g]
Owner, Natural Gas (i)	815	72%[j]	18%	7%	2%	1%
Renter, Natural Gas (j)	454	57%[h]	19%	15%[i]	6%[i]	2%[i]
CARE Eligible						
CARE Eligible, No Natural Gas (k)	571	49%	24%[lm]	17%[l]	9%[lm]	2%[l]
CARE Ineligible, No Natural Gas (l)	560	75%[k]	17%	6%	1%	0.1%
CARE Eligible, Natural Gas (m)	582	57%[k]	20%	15%[n]	6%[n]	2%[n]
CARE Ineligible, Natural Gas (n)	469	73%[m]	18%	6%	3%[l]	0.4%

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

The survey asked respondents how often during 2019 they had pests such as rodents, insects, or spiders in their homes (Table 47).

- Overall, nearly three-quarters (73%) of SJV DAC residents had rodents, insects, or spiders in their homes in 2019. Relatively few had pests in their home "all" (4%) or "many" (9%) times with most having pests "sometimes" (23%) or "rarely" (37%).
- Households without access to natural gas were more likely to have pests in the home for reasons that are unclear. Renters and those eligible for CARE have pests in their homes more frequently than homeowners and CARE ineligible customers.

Table 47. Presence of Pests such as Rodents, Insects, or Spiders in the Home

	n	Never	Rarely	Sometimes	Many Times	Most or All the Time
Overall	2,660	27%	37%	23%	9%	4%
Natural Gas Access						

	n	Never	Rarely	Sometimes	Many Times	Most or All the Time
No Natural Gas (a)	1,391	15%	31%	34%[b]	13%[b]	6%[b]
Natural Gas (b)	1,269	27%[a]	37%[a]	23%	9%	3%
Community Size						
Small, No Natural Gas (c)	458	14%	29%	34%[e]	16%[d]	7%
Medium/Large, No Natural Gas (d)	933	15%	32%	35%[f]	13%[f]	6%[f]
Small, Natural Gas (e)	229	22%[c]	29%	24%	14%[f]	11%[cf]
Medium/Large, Natural Gas (f)	1,040	27%[de]	38%[de]	23%	9%	3%
Home Ownership						
Owner, No Natural Gas (g)	1,082	15%	35%[h]	34%[i]	12%[i]	4%[i]
Renter, No Natural Gas (h)	309	16%	19%	37%[j]	16%[g]	12%[gj]
Owner, Natural Gas (i)	815	28%[g]	42%[gj]	22%	7%	2%
Renter, Natural Gas (j)	454	26%[h]	29%[h]	25%	14%[i]	7%[i]
CARE Eligible						
CARE Eligible, No Natural Gas (k)	571	15%	20%	38%[lm]	16%[lm]	11%[lm]
CARE Ineligible, No Natural Gas (l)	560	13%	40%[k]	31%[n]	13%[n]	4%[n]
CARE Eligible, Natural Gas (m)	582	28%[k]	31%[k]	22%	13%[n]	6%[n]
CARE Ineligible, Natural Gas (n)	469	25%[l]	43%[m]	23%	7%	1%

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

Auditor Assessment: "In one mobile home, the resident had blocked all of the HVAC vents located on the ground to prevent pests from entering the home through the vents. Because the home was on a platform, the area under the platform where the ductwork was located had been infested with squirrels, rats, and snakes. The resident also reported issues with pests entering through large cracks in doors and windows, as well as drafts, so had used a towel to block these cracks. Most homes in the study had little or no visible gap between the door and window and frames, but a few homes, such as this one had large gaps."

-Avenal City CDP Resident

The homes audits also investigated homes for signs of mildew and mold, as well as backdrafting of appliances. Backdrafting introduces dangerous combustion gases into the home.

- The audits identified 17 homes out of 259 (7%) with either visible mold or smells of mold, primarily in the bathroom. This value may be underreported, since one-third of audits were conducted virtually, and it was not possible to assess the smell of mold using that method.

- The audits identified 11 homes out of 259 (4%) with signs of visible backdrafting, with most instances found in water heaters. Auditors informed respondents about this safety concern.

10.2 Safety

The survey asked respondents to assess the overall safety of their homes (Table 48).

- Overall, 77% of SJV households rated the safety in their home as *good* (50%) or *extremely good* (27%). One percent of households reported the safety of their homes as *extremely poor*.
- On average, there is no difference in self-assessed home safety for households with natural gas versus households without natural gas.
- Renters and small community households were more likely to say their homes are less safe in comparison to owners and medium/large community households. These households were more likely to report a *fair* rating of safety than a *good* or *extremely good* rating. Renters without natural gas are slightly more likely than renters with natural gas to rate the safety of their home as *fair* compared to renters with natural gas.

Table 48. Overall Safety of Home (Self-Reported)

	n	Extremely Poor	Poor	Fair	Good	Extremely Good
Overall	2,660	1%	3%	19%	50%	27%
Natural Gas Access						
No Natural Gas (a)	1,391	1%[b]	4%	19%	50%	26%
Natural Gas (b)	1,269	1%	3%	19%	50%	27%
Community Size						
Small, No Natural Gas (c)	458	2%[d]	5%	33%[d]	41%	19%
Medium/Large, No Natural Gas (d)	933	1%	3%	17%	51%[c]	27%[c]
Small, Natural Gas (e)	229	1%	6%[f]	28%[f]	45%	19%
Medium/Large, Natural Gas (f)	1,040	1%	3%	19%	50%[e]	27%[e]
Home Ownership						
Owner, No Natural Gas (g)	1,082	1%[i]	2%	14%	53%[h]	30%[h]
Renter, No Natural Gas (h)	309	2%[g]	9%[gj]	37%[gj]	38%	14%
Owner, Natural Gas (i)	815	0.1%	2%	16%[g]	51%	31%[j]
Renter, Natural Gas (j)	454	2%[i]	6%[i]	25%[i]	49%[h]	19%[h]
CARE Eligible						
CARE Eligible, No Natural Gas (k)	571	3%[lm]	8%[l]	31%[l]	46%	13%
CARE Ineligible, No Natural Gas (l)	560	0.1%	1%	14%	52%[k]	33%[k]
CARE Eligible, Natural Gas (m)	582	2%[n]	6%[n]	28%[n]	46%	18%[k]
CARE Ineligible, Natural Gas (n)	469	0%	1%	15%	50%	35%[m]

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

10.3 Comfort

The survey asked respondents to rate the overall comfort of their home with a focus on the physical characteristics that impact air temperature and quality and energy usage (Table 49).

- Most residents in the SJV find their homes to be comfortable with 23% rating it as *extremely good* and 49% *good*.
- On average, access to natural gas has little impact on perceived home comfort.
- Home ownership and household income has the biggest impact on home comfort. Renters rated the comfort of their home lower than owners, as do CARE eligible customers relative to CARE ineligible customers and residents of small communities relative to medium and large communities.
- The differences by home ownership and CARE eligibility are accentuated by lack of natural gas access. More renters and CARE eligible customers without natural gas rate the comfort of their homes as "fair" compared to their counterparts with natural gas.

Table 49. Overall Comfort of Home (Self-Reported)

	n	Extremely Poor	Poor	Fair	Good	Extremely Good
Overall	2,660	1%	4%	23%	49%	23%
Natural Gas Access						
No Natural Gas (a)	1,391	2%[b]	5%	27%[b]	45%	21%
Natural Gas (b)	1,269	1%	4%	23%	49%[a]	23%
Community Size						
Small, No Natural Gas (c)	458	2%	12%[d]	36%[d]	35%	15%
Medium/Large, No Natural Gas (d)	933	2%[f]	4%	26%[f]	46%[c]	22%[c]
Small, Natural Gas (e)	229	3%[f]	11%[f]	31%[f]	36%	20%[c]
Medium/Large, Natural Gas (f)	1,040	1%	4%	22%	50%[de]	23%
Home Ownership						
Owner, No Natural Gas (g)	1,082	1%	4%[i]	22%[i]	47%[h]	26%[h]
Renter, No Natural Gas (h)	309	4%[gj]	8%[g]	44%[gj]	38%	6%
Owner, Natural Gas (i)	815	1%	2%	19%	51%[gj]	27%[j]
Renter, Natural Gas (j)	454	2%[i]	7%[i]	29%[i]	47%[h]	16%[h]
CARE Eligible						
CARE Eligible, No Natural Gas (k)	571	4%[lm]	9%[l]	40%[lm]	40%	8%
CARE Ineligible, No Natural Gas (l)	560	0.1%	2%[n]	18%	50%[k]	30%[k]
CARE Eligible, Natural Gas (m)	582	2%[n]	7%[n]	33%[n]	42%	15%[k]
CARE Ineligible, Natural Gas (n)	469	0.0%	1%	16%	53%[m]	30%[m]

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

"We have a hard time keeping warm. Today it's kind of nice since I'm baking because once I bring the bread out of the oven, I just leave the oven open and it warms the room. We just had a wall heater in the bathroom and a wall heater in the living room. We shut the door to this space so that we're not heating up the whole house. The rest of the house is cold. It's really cold."

-Stevinson CDP Resident

The survey asked respondents how frequently their home was uncomfortably cool on cold days or nights (Table 50) and uncomfortably hot on hot days and nights (Table 51).

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- Two-thirds of SJV DAC residents (67%) said their home was never or rarely uncomfortably cold (32 % and 35%, respectively). Few said it was cool *all the time* or *many times* (9%).
- Just over half (53%) said their home was *never* (23%) or *rarely* (32%) uncomfortably warm on hot day.
- Customers without natural gas are slightly more likely to find their home to be both uncomfortably cool and hot compared to those with natural gas. Even though cooling is not fueled by natural gas, the higher heating costs of customers without natural gas may cause them to keep their homes at higher temperatures on hot days to save money.
- Renters and CARE eligible customers more frequently find their homes to be both uncomfortably cool and hot compared to owners and CARE ineligible customers. The difference is accentuated for those without natural gas.
- Residents of small communities without natural gas are also more likely to find their homes both uncomfortably cool and hot relative to medium/large community residents without natural gas or small community residents with gas.

Table 50. Uncomfortably Cool Temperatures on Cold Days or Nights

	n	Never	Rarely	Sometimes	Many Times	Most or All the Time
Overall	2,660	32%	35%	24%	6%	3%
Natural Gas Access						
No Natural Gas (a)	1,391	23%	30%	31%[b]	11%[b]	5%[b]
Natural Gas (b)	1,269	32%[a]	35%[a]	24%	6%	3%
Community Size						
Small, No Natural Gas (c)	458	19%	24%	34%[e]	17%[de]	6%
Medium/Large, No Natural Gas (d)	933	24%[c]	31%[c]	31%[f]	10%[f]	5%[f]
Small, Natural Gas (e)	229	27%[c]	32%[c]	28%[f]	9%[f]	4%
Medium/Large, Natural Gas (f)	1,040	32%[de]	36%[d]	24%	6%	2%
Home Ownership						
Owner, No Natural Gas (g)	1,082	26%[h]	30%	31%[i]	9%[i]	4%[i]

	n	Never	Rarely	Sometimes	Many Times	Most or All the Time
Renter, No Natural Gas (h)	309	14%	28%	33%[j]	17%[gj]	7%[gj]
Owner, Natural Gas (i)	815	34%[gj]	37%[gj]	23%	5%	2%
Renter, Natural Gas (j)	454	28%[h]	33%[h]	26%[i]	8%[i]	4%[i]
CARE Eligible						
CARE Eligible, No Natural Gas (k)	571	14%	22%	40%[lm]	16%[lm]	9%[lm]
CARE Ineligible, No Natural Gas (l)	560	29%[k]	35%[k]	27%[n]	7%[n]	1%
CARE Eligible, Natural Gas (m)	582	25%[k]	30%[k]	29%[n]	10%[n]	5%[n]
CARE Ineligible, Natural Gas (n)	469	36%[lm]	39%[lm]	21%	2%	1%

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

Table 51. Uncomfortably Warm Temperatures on Hot Days or Nights

	n	Never	Rarely	Sometimes	Many Times	Most or All the Time
Overall	2,660	23%	30%	32%	11%	4%
Natural Gas Access						
No Natural Gas (a)	1,391	18%	28%	34%	15%[b]	5%
Natural Gas (b)	1,269	23%[a]	30%[a]	32%	11%	4%
Community Size						
Small, No Natural Gas (c)	458	16%	20%	35%	21%[de]	8%[d]
Medium/Large, No Natural Gas (d)	933	18%	29%[c]	34%	14%[f]	5%
Small, Natural Gas (e)	229	19%	29%[c]	31%	16%[f]	6%
Medium/Large, Natural Gas (f)	1,040	23%[de]	30%	32%	11%	4%
Home Ownership						
Owner, No Natural Gas (g)	1,082	20%[h]	29%[h]	32%	15%[i]	4%[i]
Renter, No Natural Gas (h)	309	13%	22%	40%[gj]	17%	8%[g]
Owner, Natural Gas (i)	815	23%[g]	34%[gj]	31%	9%	3%
Renter, Natural Gas (j)	454	23%[h]	22%	33%	15%[i]	6%[i]
CARE Eligible						
CARE Eligible, No Natural Gas (k)	571	15%	18%	38%[lm]	20%[lm]	9%[lm]
CARE Ineligible, No Natural Gas (l)	560	20%[k]	35%[k]	32%	12%[n]	1%
CARE Eligible, Natural Gas (m)	582	19%[k]	24%[k]	35%	16%[n]	6%[n]
CARE Ineligible, Natural Gas (n)	469	26%[lm]	32%[m]	31%	8%	2%[l]

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

The survey asked respondents how frequently they experienced drafts coming in around their windows and doors (Table 52).

- Overall, SJV DAC residents infrequently experience drafts (44% *never* and 30% *rarely*).
- Customers without natural gas experience drafts slightly more frequently than customers with natural gas, but the differences are small and likely due to differences in the quality of the homes that happen to have access to natural gas.

- We see these differences reflected in the responses of renters who experience drafts a bit more frequently than owners. We see a similar difference in the responses of CARE eligible customers compared to CARE ineligible.

Table 52. Drafts Around Windows and Doors

	n	Never	Rarely	Sometimes	Many Times	Most or All the Time
Overall	2,660	44%	30%	18%	6%	3%
Natural Gas Access						
No Natural Gas (a)	1,391	35%	30%	23%[b]	8%[b]	4%
Natural Gas (b)	1,269	44%[a]	30%	18%	6%	3%
Community Size						
Small, No Natural Gas (c)	458	30%	26%	26%[d]	11%[de]	6%[d]
Medium/Large, No Natural Gas (d)	933	36%[c]	31%[c]	22%[f]	8%[f]	3%
Small, Natural Gas (e)	229	35%	28%	23%[f]	8%[f]	6%[f]
Medium/Large, Natural Gas (f)	1,040	44%[de]	30%	17%	6%	3%
Home Ownership						
Owner, No Natural Gas (g)	1,082	38%[h]	30%	21%[i]	7%[i]	3%[i]
Renter, No Natural Gas (h)	309	25%	29%	29%[gj]	13%[gj]	5%
Owner, Natural Gas (i)	815	49%[gj]	30%	15%	5%	1%
Renter, Natural Gas (j)	454	35%[h]	29%	23%[i]	8%[i]	6%[i]
CARE Eligible						
CARE Eligible, No Natural Gas (k)	571	26%	25%	29%[lm]	14%[lm]	6%[l]
CARE Ineligible, No Natural Gas (l)	560	42%[k]	33%[k]	17%	6%[n]	2%
CARE Eligible, Natural Gas (m)	582	35%[k]	28%	23%[n]	10%[n]	5%[n]
CARE Ineligible, Natural Gas (n)	469	49%[lm]	32%	15%	3%	1%

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

"It was built in the forties. And it leaks a lot. It has a lot of leaks in it. And the cold comes up through the floor. You can feel that. So I need some more rugs. Even through the rugs. Even in the bedrooms where the carpet is it still comes through. So we've tucked around the windows and we do different things."

-Easton CDP Resident

10.4 Outages

We asked respondents who do not have access to natural gas and use either propane or wood how many times they went without propane or wood in 2019 due to financial reasons (i.e., missed a payment or could not afford a delivery). Table 53 and Table 54 provide the results for propane and wood, respectively.

- Overall, slightly under one in five customers who do not have access to natural gas and rely on propane or wood went without one of these fuels for financial reasons in 2019 (17% for propane and 18% for wood). Most customers went without fuel once or twice in 2019 (12% propane and 10% wood).
- Residents of small communities, renters, and CARE eligible customers are more likely to have gone without propane or wood than their counterparts.

Table 53. Propane Outages*

	n	No Outages	1 or 2 times	3 or 4 times	5 or more times	Unsure
Natural Gas Access						
No Natural Gas	984	83%	12%	2%	1%	2%
Community Size						
Small, No Natural Gas (a)	322	77%	16%[b]	4%[b]	1%	2%
Medium/Large, No Natural Gas (b)	662	84%[a]	11%	2%	2%	2%
Home Ownership						
Owner, No Natural Gas (c)	817	86%[d]	9%	2%	1%	2%
Renter, No Natural Gas (d)	167	64%	25%[c]	5%[c]	4%[c]	1%
CARE Eligible						
CARE Eligible, No Natural Gas (e)	369	65%	24%[f]	5%[f]	4%[f]	2%
CARE Ineligible, No Natural Gas (f)	444	90%[e]	6%	1%	0.0%	2%

a/b/c/d/e/f Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ef.
*Responses among Propane Users, No Natural Gas

Table 54. Wood & Wood Pellet Outages*

	n	No Outages	1 or 2 times	3 or 4 times	5 or more times	Unsure
Natural Gas Access						
No Natural Gas	234	82%	10%	4%	4%	1%
Community Size						
Small, No Natural Gas (a)	69	75%	9%	11%[b]	2%	3%
Medium/Large, No Natural Gas (b)	165	83%[a]	10%	3%	4%	1%
Home Ownership						
Owner, No Natural Gas (c)	206	83%[d]	9%	4%	3%	1%
Renter, No Natural Gas (d)	28	66%	15%	8%	10%[c]	2%
CARE Eligible						
CARE Eligible, No Natural Gas (e)	94	64%	16%[f]	8%[f]	10%[f]	2%[f]
CARE Ineligible, No Natural Gas (f)	100	92%[e]	6%	2%	0.0%	0.0%

a/b/c/d/e/f Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ef.
*Responses among Wood & Wood Pellet Users, No Natural Gas

11. Program Awareness and Engagement

We asked respondents about their awareness of and participation in utility programs that provide rebates and incentives for energy efficient appliances, HVAC equipment, and light bulbs (Table 55).

- Approximately half of all SJV DAC households are aware of utility program rebates and incentives and 15% report that they have received an incentive or rebate as part of a program.
- There are few differences in program awareness and participation across natural gas access and community size.
- Fewer renters and CARE eligible customers are aware of utility programs and participate than owners and CARE ineligible customers.

We also asked respondents if they were aware of the SJV Affordable Energy Proceeding, which is exploring how to make energy more affordable for DAC residents.

- Few SJV DAC customers were aware of the SJV Affordable Energy Proceeding (16%).
- Customers across all subgroups were equally unaware of the proceeding.

Table 55. Awareness of the SJV Affordable Energy Proceeding

	n	Aware of SJV Proceeding	Aware of EE Programs	Participated in any EE Program
Overall	2,660	16%	51%	15%
Natural Gas Access				
No Natural Gas (a)	1,391	16%	53%	14%
Natural Gas (b)	1,269	16%	51%	15%
Community Size				
Small, No Natural Gas (c)	458	20%[d]	56%[e]	13%
Medium/Large, No Natural Gas (d)	933	16%	53%	14%
Small, Natural Gas (e)	229	20%[f]	48%	11%
Medium/Large, Natural Gas (f)	1,040	16%	51%	15%[e]
Home Ownership				
Owner, No Natural Gas (g)	1,082	14%	55%[h]	16%[h]
Renter, No Natural Gas (h)	309	21%[gj]	46%	10%
Owner, Natural Gas (i)	815	17%[gj]	55%[j]	19%[gj]
Renter, Natural Gas (j)	454	14%	44%	9%
CARE Eligible				
CARE Eligible, No Natural Gas (k)	571	19%[l]	47%	11%
CARE Ineligible, No Natural Gas (l)	560	15%	60%[k]	19%[k]
CARE Eligible, Natural Gas (m)	582	17%	43%	11%
CARE Ineligible, Natural Gas (n)	469	14%	60%[m]	18%[m]

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

12. Baseline Conditions

This section describes the baseline conditions of the single family attached, single family detached, and mobile homes in the SJV DACs.

12.1 Housing Type

Table 56 presents the distribution of home types in SJV DACs. This study focused on single family detached homes, mobile homes, and single family attached homes and excluded multifamily properties with five or more units.

- Overall, single family detached homes are the most common home type in SJV DACS (80%) followed by single family attached homes (16%).
- Customers who lack access to natural gas are slightly more likely to live in mobile homes compared to customers with natural gas (8% vs. 4%) and slightly less likely to live in single family attached homes (9% vs. 16%).
- Mobile homes are more commonly found in small communities than medium/large ones. Medium/large communities have more single family attached homes than small communities.
- More owners and CARE ineligible customers live in single family homes than renters and CARE eligible customers.

Table 56. Housing Type

	n	Single Family Detached	Mobile Home	Single Family Attached
Overall	2,660	80%	4%	16%
Natural Gas Access				
No Natural Gas (a)	1,391	83%[b]	8%[b]	9%
Natural Gas (b)	1,269	80%	4%	16%[a]
Community Size				
Small, No Natural Gas (c)	458	75%	20%[d]	5%
Medium/Large, No Natural Gas (d)	933	85%[cf]	6%[f]	10%[c]
Small, Natural Gas (e)	229	72%	20%[f]	8%[c]
Medium/Large, Natural Gas (f)	1,040	80%[e]	4%	16%[de]
Home Ownership				
Owner, No Natural Gas (g)	1,082	89%[h]	7%[i]	4%
Renter, No Natural Gas (h)	309	67%	9%[gj]	24%[g]
Owner, Natural Gas (i)	815	89%[j]	5%[j]	6%[g]
Renter, Natural Gas (j)	454	62%	3%	35%[hi]

	n	Single Family Detached	Mobile Home	Single Family Attached
CARE Eligible				
CARE Eligible, No Natural Gas (k)	571	74%[m]	11%[lm]	15%[l]
CARE Ineligible, No Natural Gas (l)	560	89%[k]	6%[n]	5%
CARE Eligible, Natural Gas (m)	582	67%	7%[n]	26%[kn]
CARE Ineligible, Natural Gas (n)	469	90%[m]	2%	8%[l]

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

12.2 Age of Home

Table 57 presents results on the age of homes in SJV DACs.

- One in five homes in SJV DACs were built since 2005 (20%).
- Homes with natural gas access tend to be newer than homes without, with 20% having been built since 2006 compared to 8% of homes without natural gas.
- Natural gas access is a greater predictor of a home's age than ownership status. Owners and renters within in the same natural gas category live in homes of a similar age. Owners with natural gas live in the newest homes with nearly half of these homes having been built since 1992.
- CARE eligible customers tend to live in older homes than CARE ineligible customers.
- Housing type does not predict the age of a home. Across all housing types, there is a mix of older, middle aged, and newer homes, though few mobile homes were built prior to 1950.

Table 57. Age of Home*

	n	Before 1950	1950–1978	1979–1991	1992–2005	2006+
Overall	2,336	15%	21%	19%	26%	20%
Natural Gas Access						
No Natural Gas (a)	1,262	7%	31%[b]	34%[b]	19%	8%
Natural Gas (b)	1,074	15%[a]	21%	19%	26%[a]	20%[a]
Community Size						
Small, No Natural Gas (c)	410	15%[d]	31%	32%[e]	15%[e]	7%

	n	Before 1950	1950–1978	1979–1991	1992–2005	2006+
Medium/Large, No Natural Gas (d)	852	6%	31%[f]	35%[f]	19%[c]	9%
Small, Natural Gas (e)	179	33%[cf]	33%[f]	17%	9%	9%
Medium/Large, Natural Gas (f)	895	14%[d]	20%	19%	27%[de]	20%[de]
Home Ownership						
Owner, No Natural Gas (g)	1,047	6%	29%[i]	37%[hi]	20%[h]	9%
Renter, No Natural Gas (h)	215	16%[g]	44%[gj]	19%	13%	8%
Owner, Natural Gas (i)	780	13%[g]	19%	18%	28%[gj]	22%[gj]
Renter, Natural Gas (j)	294	19%[i]	25%[i]	20%	21%[h]	15%[h]
CARE Eligible						
CARE Eligible, No Natural Gas (k)	597	12%[l]	39%[lm]	29%[m]	14%	6%
CARE Ineligible, No Natural Gas (l)	479	3%	23%[n]	40%[kn]	24%[k]	10%[k]
CARE Eligible, Natural Gas (m)	617	17%[kn]	27%[n]	18%	20%[k]	17%[k]
CARE Ineligible, Natural Gas (n)	353	12%[l]	14%	18%	34%[lm]	22%[lm]
Housing Type						
SF Detached, No Natural Gas (o)	946	7%[q]	32%[qr]	34%[pr]	19%	8%
SF Attached, No Natural Gas (p)	79	13%[oq]	35%[q]	23%	17%	12%
Mobile Home, No Natural Gas (q)	237	3%	27%	42%[opt]	21%	8%
SF Detached, Natural Gas (r)	805	16%[ot]	19%	18%	27%[os]	21%[ot]
SF Attached, Natural Gas (s)	129	13%[t]	31%[r]	22%	18%	16%[t]
Mobile Home, Natural Gas (t)	140	4%	33%[qr]	28%[r]	24%	10%

a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q/r/s/t Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn,opq,rst,or,ps,qt
*Survey responses adjusted by audit data.

12.3 Size of Home

Table 58 presents results on the square footage homes in SJV DACs.

- Nearly half of homes in SJV DACs (48%) are smaller than 1,500 square feet.
- Homes within the same subgroups tend to be of similar size regardless of natural gas access.
- Homes in small communities are smaller than those in medium/large communities.
- Owners tend to live in larger homes than renters.
- CARE ineligible customers tend to live in larger homes than CARE eligible customers.

- Single family detached homes tend to be larger than other housing types while single family attached are the smallest.

Table 58. Home Square Footage*

	n	1,000 sq. ft. or less	1,001–1,500 sq. ft.	1,501–2,000 sq. ft.	2,000 sq. ft.+
Overall	2,323	10%	38%	27%	26%
Natural Gas Access					
No Natural Gas (a)	1,257	10%	33%	26%	31%[b]
Natural Gas (b)	1,066	10%	38%[a]	27%	26%
Community Size					
Small, No Natural Gas (c)	403	15%[d]	44%[d]	26%[e]	15%
Medium/Large, No Natural Gas (d)	854	9%	31%	26%	33%[cf]
Small, Natural Gas (e)	184	24%[cf]	45%[f]	18%	13%
Medium/Large, Natural Gas (f)	882	9%	37%[d]	27%[e]	26%[e]
Home Ownership					
Owner, No Natural Gas (g)	1,026	5%	31%	28%[h]	36%[hi]
Renter, No Natural Gas (h)	231	35%[gj]	40%[g]	15%	10%
Owner, Natural Gas (i)	749	4%	36%[g]	30%[j]	30%[j]
Renter, Natural Gas (j)	317	26%[i]	42%[i]	18%	14%[h]
CARE Eligible					
CARE Eligible, No Natural Gas (k)	584	19%[l]	44%[l]	23%	14%[m]
CARE Ineligible, No Natural Gas (l)	489	4%	23%	28%[k]	46%[kn]
CARE Eligible, Natural Gas (m)	593	18%[n]	49%[kn]	23%	10%
CARE Ineligible, Natural Gas (n)	367	3%	28%[l]	31%[m]	37%[m]
Housing Type					
SF Detached, No Natural Gas (o)	948	7%[r]	32%[p]	26%[p]	34%[pqr]
SF Attached, No Natural Gas (p)	76	54%[oqs]	23%	17%	6%
Mobile Home, No Natural Gas (q)	233	17%[o]	48%[op]	25%[pt]	10%[t]
SF Detached, Natural Gas (r)	787	5%	37%[o]	29%[st]	29%[st]
SF Attached, Natural Gas (s)	145	41%[rt]	39%[p]	12%	7%
Mobile Home, Natural Gas (t)	134	31%[qr]	47%[rs]	17%	5%

a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q/r/s/t Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn,opq,rst,or,ps,qt
*Survey responses adjusted by audit data.

Table 59 presents results on the average number of bedrooms in SJV DACs.

- Overall, homes in SJV DACs have three bedrooms, on average.
- Consistent with square footage results, renters and CARE eligible customers have slightly fewer average bedrooms than owners and CARE ineligible customers.
- Single family attached homes tend to have one fewer bedroom than single family detached homes.

Table 59. Number of Bedrooms

	n	Average number of bedrooms
Overall	2,660	3.1
Natural Gas Access		
No Natural Gas (a)	1,391	3.0
Natural Gas (b)	1,269	3.1[a]
Community Size		
Small, No Natural Gas (c)	458	2.9
Medium/Large, No Natural Gas (d)	933	3.0[c]
Small, Natural Gas (e)	229	2.9
Medium/Large, Natural Gas (f)	1,040	3.1[ed]
Home Ownership		
Owner, No Natural Gas (g)	1082	3.1[h]
Renter, No Natural Gas (h)	309	2.6
Owner, Natural Gas (i)	815	3.3[jg]
Renter, Natural Gas (j)	454	2.7[h]
CARE Eligible		
CARE Eligible, No Natural Gas (k)	701	2.8
CARE Ineligible, No Natural Gas (l)	493	3.2[k]
CARE Eligible, Natural Gas (m)	778	2.9[k]
CARE Ineligible, Natural Gas (n)	375	3.3[ml]
Housing Type		
SF Detached, No Natural Gas (o)	1,030	3.1[pq]
SF Attached, No Natural Gas (p)	100	2.3
Mobile Home, No Natural Gas (q)	261	2.8[pt]

	n	Average number of bedrooms
SF Detached, Natural Gas (r)	894	3.3[sto]
SF Attached, Natural Gas (s)	198	2.3
Mobile Home, Natural Gas (t)	177	2.6[s]

a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q/r/s/t Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn,opq,rst,or,ps,qt

12.4 Solar and Energy Storage

Table 60 presents results on the on the penetration of rooftop solar and battery storage in SJV DACs.

- One-fifth of SJV DAC (20%) homes have rooftop solar. Battery storage is still rare (1%) and not found in a meaningful number of homes, regardless of customer or home type.
- Homes with and without natural gas are equally likely to have rooftop solar.
- Solar is more common in medium/large communities, owner occupied homes, CARE ineligible homes, and single family detached homes.

Table 60. Rooftop Solar and Battery Storage

	n	Solar Panels*	Whole Home Battery
Overall	2,660	20%	1%
Natural Gas Access			
No Natural Gas (a)	1,391	20%	2%[b]
Natural Gas (b)	1,269	20%	1%
Community Size			
Small, No Natural Gas (c)	458	11%	1%
Medium/Large, No Natural Gas (d)	933	21%[c]	2%[c]
Small, Natural Gas (e)	229	10%	1%
Medium/Large, Natural Gas (f)	1,040	21%[e]	1%
Home Ownership			
Owner, No Natural Gas (g)	1,082	24%[h]	2%[i]
Renter, No Natural Gas (h)	309	7%[j]	1%

	n	Solar Panels*	Whole Home Battery
Owner, Natural Gas (i)	815	29%gj	1%
Renter, Natural Gas (j)	454	4%	2%
CARE Eligible			
CARE Eligible, No Natural Gas (k)	701	13%	1%
CARE Ineligible, No Natural Gas (l)	493	28%k	3%kn
CARE Eligible, Natural Gas (m)	778	12%	2%k
CARE Ineligible, Natural Gas (n)	375	32%m	1%
Housing Type			
SF Detached, No Natural Gas (o)	1,030	22%pq	2%r
SF Attached, No Natural Gas (p)	100	13%qs	3%
Mobile Home, No Natural Gas (q)	261	5%	3%o
SF Detached, Natural Gas (r)	894	24%st	1%
SF Attached, Natural Gas (s)	198	6%	4%rt
Mobile Home, Natural Gas (t)	177	6%	1%

a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q/r/s/t Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn,opq,rst,or,ps,qt
*Survey responses adjusted by audit data.

12.5 Generators

Table 61 presents results on the on the penetration of generators in SJV DACs, both whole home and portable generators.

- Overall, few residents in SJV DACs have a generator. Only 7% of SJV DAC residents have a portable generator. Whole home generators are particularly rare (2%).
- Customers without natural gas are much more likely to have a generator, mainly a portable one, across nearly all comparison categories. The higher penetration of generators in homes without natural gas suggests that their alternative fuel sources are less reliable than natural gas.
- Among customers without natural gas, generator penetration is highest among residents of medium/large communities and single family homes, home owners, and CARE ineligible customers.

Table 61. Generators in Home

	n	Whole Home / Standby Generator	Portable Generator
Overall	2,660	2%	7%
Natural Gas Access			
No Natural Gas (a)	1,391	3%[b]	23%[b]
Natural Gas (b)	1,269	2%	7%
Community Size			
Small, No Natural Gas (c)	458	1%	10%
Medium/Large, No Natural Gas (d)	933	4%[cf]	25%[cf]
Small, Natural Gas (e)	229	1%	11%[f]
Medium/Large, Natural Gas (f)	1,040	2%	7%
Home Ownership			
Owner, No Natural Gas (g)	1,082	4%[hı]	27%[hı]
Renter, No Natural Gas (h)	309	1%	9%[j]
Owner, Natural Gas (i)	815	2%	9%[j]
Renter, Natural Gas (j)	454	2%	3%
CARE Eligible			
CARE Eligible, No Natural Gas (k)	701	2%	12%[m]
CARE Ineligible, No Natural Gas (l)	493	5%[kn]	35%[kn]
CARE Eligible, Natural Gas (m)	778	2%	5%
CARE Ineligible, Natural Gas (n)	375	1%	8%[m]
Housing Type			
SF Detached, No Natural Gas (o)	1,030	3%[r]	25%[pqr]
SF Attached, No Natural Gas (p)	100	5%[q]	10%[s]
Mobile Home, No Natural Gas (q)	261	2%	18%[pt]
SF Detached, Natural Gas (r)	894	1%	7%[s]
SF Attached, Natural Gas (s)	198	3%[r]	4%
Mobile Home, Natural Gas (t)	177	3%[r]	9%[s]

Note: Multiple selections allowed.
a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q/r/s/t Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn,opq,rst,or,ps,qt

12.6 Roof Conditions

We asked respondents to assess the condition of their homes' roofs (Table 62).

- Many homes have roofs in *like new* condition (42%) with half reporting it was in *fairly good* condition (52%). Few said their roofs leaked (4%) or had areas with missing shingles or panels (4%).
- The incidence of leaks and missing shingles is higher among renters, CARE eligible customers, and residents of small communities, mobile homes, and single family attached homes without natural gas. The overall condition of these customers' roofs was also less likely to be in *like new* condition.

Table 62. Roof Condition

	n	Has areas that leak	Missing panels/shingles	In fairly good condition	In new or like new condition
Overall	2,536	4%	4%	52%	42%
Natural Gas Access					
No Natural Gas (a)	1,333	6%[b]	6%[b]	53%	37%
Natural Gas (b)	1,203	4%	4%	52%	42%[a]
Community Size					
Small, No Natural Gas (c)	435	9%[d]	10%[d]	55%	29%
Medium/Large, No Natural Gas (d)	898	6%[f]	5%	52%	39%[c]
Small, Natural Gas (e)	213	9%[f]	11%[f]	53%	31%
Medium/Large, Natural Gas (f)	990	3%	4%	52%	42%[de]
Home Ownership					
Owner, No Natural Gas (g)	1,053	4%	5%[i]	50%[i]	42%[h]
Renter, No Natural Gas (h)	280	14%[gj]	6%	60%[g]	22%
Owner, Natural Gas (i)	791	3%	3%	46%	49%[gj]
Renter, Natural Gas (j)	412	4%	6%[i]	65%[i]	27%[h]
CARE Eligible					
CARE Eligible, No Natural Gas (k)	657	10%[lm]	9%[lm]	58%[l]	26%
CARE Ineligible, No Natural Gas (l)	485	3%	2%	47%	48%[k]
CARE Eligible, Natural Gas (m)	719	5%[n]	6%[n]	58%[n]	32%[k]
CARE Ineligible, Natural Gas (n)	369	2%	2%	44%	54%[lm]
Housing Type					

	n	Has areas that leak	Missing panels/shingles	In fairly good condition	In new or like new condition
SF Detached, No Natural Gas (o)	996	5%r	6%	51%	40%pq
SF Attached, No Natural Gas (p)	89	13%os	5%	63%o	24%
Mobile Home, No Natural Gas (q)	248	15%o	6%t	58%o	26%
SF Detached, Natural Gas (r)	863	3%	4%t	50%	44%ost
SF Attached, Natural Gas (s)	174	3%	5%t	60%r	33%pt
Mobile Home, Natural Gas (t)	166	12%rs	2%	66%qr	22%

Note: Multiple selections allowed.
a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q/r/s/t Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn,opq,rst,or,ps,qt

12.7 Sun Exposure

We asked respondents to report on how much sun their home receives during the day (Table 63).

- Over two-thirds of SJV DAC homes have full sun exposure (69%). Few respondents (2%) reported their homes are mostly shaded.
- Fewer renters and CARE eligible customers have full sun exposure compared to their owner and CARE ineligible counterparts. Single family attached homes also have less sun exposure than single family detached and mobile homes.

Table 63. Home's Sun Exposure

	n	Full sun exposure	Partial sun exposure	Home is mostly shaded
Overall	2,618	69%	29%	2%
Natural Gas Access				
No Natural Gas (a)	1,370	72%b	27%	2%
Natural Gas (b)	1,248	69%	29%a	2%
Community Size				
Small, No Natural Gas (c)	452	71%	27%	2%
Medium/Large, No Natural Gas (d)	918	72%f	27%	2%
Small, Natural Gas (e)	225	69%	29%	2%
Medium/Large, Natural Gas (f)	1,023	69%	29%	2%
Home Ownership				
Owner, No Natural Gas (g)	1,069	74%h	25%	1%
Renter, No Natural Gas (h)	301	63%	33%g	4%g

	n	Full sun exposure	Partial sun exposure	Home is mostly shaded
Owner, Natural Gas (i)	802	72%[j]	27%	1%
Renter, Natural Gas (j)	446	62%	34%[i]	4%[i]
CARE Eligible				
CARE Eligible, No Natural Gas (k)	689	67%	30%[l]	3%[l]
CARE Ineligible, No Natural Gas (l)	490	77%[k]	23%	1%
CARE Eligible, Natural Gas (m)	758	64%	33%[n]	3%[n]
CARE Ineligible, Natural Gas (n)	375	74%[m]	25%	1%
Housing Type				
SF Detached, No Natural Gas (o)	1,015	74%[pr]	25%	1%
SF Attached, No Natural Gas (p)	96	50%	45%[oq]	5%[oq]
Mobile Home, No Natural Gas (q)	259	74%[p]	24%	2%
SF Detached, Natural Gas (r)	881	71%[s]	27%	2%
SF Attached, Natural Gas (s)	192	57%	39%[rt]	4%[r]
Mobile Home, Natural Gas (t)	175	70%[s]	26%	4%[qr]

a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q/r/s/t Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn,opq,rst,or,ps,qt

12.8 Space Heating

Table 64 presents results on the penetration of space heating systems in SJV DAC homes. Homes could have more than one heating system.

- Central furnaces are the most common heating system across all SJV DAC homes, present in four out of five homes (86%).
- Homes with natural gas are somewhat more likely to have a central furnace than homes without natural gas (86% vs. 72%). Homes without natural gas are more likely to use portable space heaters (33% vs. 15%) and wood stoves (20% vs. 1%) than homes with natural gas.
- Small community members, renters, and CARE eligible customers are less likely to have central furnaces than their medium/large community, homeowner, and CARE ineligible counterparts; the difference is largely driven by comparatively greater incidences of wall furnaces among the aforementioned groups with lower rates of central furnaces. Wall furnaces are more likely to be present in single family attached homes as well.

Table 64. Space Heating Equipment

	n†	Furnace*	Electric Baseboard	Fireplace	Wood Stove*	Portable Space Heater	Wall Furnace*	Floor Furnace	Electric Wall Heater*	Buddy Heater	Boiler	Heat Pump*	Other	Unclear	No Heating System*
Overall	2407–2655	86%	1%	28%	1%	15%	10%	1%	0%	1%	6%	3%	0%	7%	0%
Natural Gas Access															
No Natural Gas (a)	1290–1389	72%	2%[b]	29%	20%[b]	33%[b]	9%	0.3%	2%[b]	4%[b]	4%	7%[b]	1%[b]	5%	0%
Natural Gas (b)	1116–1269	86%[a]	1%	28%	1%	15%	10%	1%[a]	0%	1%	6%[a]	3%	0.3%	7%[a]	0%
Community Size															
Small, No Natural Gas (c)	432–458	61%	3%[de]	15%	16%[e]	38%[de]	18%[d]	1%[d]	2%[e]	3%[e]	4%	6%[e]	1%[e]	4%	0%
Medium/Large, No Natural Gas (d)	857–932	74%[c]	1%	31%[c]	21%[cf]	32%[f]	7%	0.2%	2%[f]	4%[f]	4%	7%[f]	1%	5%	0%
Small, Natural Gas (e)	216–229	76%[c]	1%	12%	2%[f]	23%[f]	29%[cf]	3%[cf]	0%	1%	7%[c]	2%	0%	5%	0%
Medium/Large, Natural Gas (f)	899–1040	86%[de]	1%	29%[e]	1%	14%	9%[d]	1%[d]	0%	1%	6%[d]	3%	0.3%	7%[d]	0%
Home Ownership															
Owner, No Natural Gas (g)	1012–1081	76%[h]	2%[i]	34%[h]	24%[hi]	32%[i]	7%	0.3%	2%[i]	4%[i]	3%	7%[i]	1%	5%	0%
Renter, No Natural Gas (h)	278–308	56%	2%	11%	7%[j]	38%[gj]	15%[g]	0.2%	3%[gj]	3%[j]	6%[g]	6%[j]	1%[j]	5%	0%
Owner, Natural Gas (i)	723–815	89%[gj]	1%	34%[j]	1%[j]	14%	6%	1%[g]	0%	1%	5%[g]	3%	0.4%[j]	7%[g]	0%
Renter, Natural Gas (j)	392–454	78%[h]	2%[i]	18%[h]	0.2%	16%	18%[i]	2%[hi]	0%	1%	7%[i]	2%	0%	7%	0%
CARE Eligible															
CARE Eligible, No Natural Gas (k)	645–700	58%	2%[l]	19%	15%[m]	37%[lm]	12%[l]	0.4%	2%[m]	4%[m]	7%[l]	7%[m]	1%[m]	4%	0%
CARE Ineligible, No Natural Gas (l)	461–493	83%[k]	1%[n]	38%[kn]	25%[kn]	33%[n]	3%	0.1%	2%[n]	4%[n]	2%	7%[n]	1%	6%	0%
CARE Eligible, Natural Gas (m)	671–778	79%[k]	2%[n]	23%[k]	1%	19%[n]	15%[n]	2%[kn]	0%	1%	9%[kn]	3%	0.1%	9%[kn]	0%
CARE Ineligible, Natural Gas (n)	345–375	91%[lm]	0.1%	32%[m]	1%	9%	3%	1%[l]	0%	1%[m]	3%	3%	0.5%	4%	0%
Housing Type															
SF Detached, No Natural Gas (o)	947–1028	73%[p]	2%[r]	31%[pq]	22%[pr]	33%[r]	8%	0.3%	2%[qr]	3%[r]	4%	7%[qr]	1%	5%[q]	0%

	n†	Furnace*	Electric Baseboard	Fireplace	Wood Stove*	Portable Space Heater	Wall Furnace*	Floor Furnace	Electric Wall Heater*	Buddy Heater	Boiler	Heat Pump*	Other	Unclear	No Heating System*
SF Attached, No Natural Gas (p)	90–100	60%	1%	17%	5%^{s}	32%^{s}	11%	0.1%	2%^{s}	4%	2%	10%^{qs}	1%	4%^{q}	0%
Mobile Home, No Natural Gas (q)	252–261	74%^{p}	1%	12%	21%^{pt}	41%^{opt}	9%	1%^{o}	1%	6%^{ot}	3%	3%	1%	1%	0%
SF Detached, Natural Gas (r)	780–894	86%^{os}	1%	32%st	1%	15%	9%	1%^{o}	0%	1%	6%^{o}	3%	0.3%	6%^{t}	0%
SF Attached, Natural Gas (s)	166–198	79%^{p}	3%^{rt}	13%	0%	13%	14%^{r}	3%^{pr}	0%	2%	7%^{p}	3%	0%	11%^{prt}	0%
Mobile Home, Natural Gas (t)	169–177	90%^{qs}	0.3%	10%	1%	16%	13%^{r}	8%^{qrs}	0%	1%	5%	2%	1%^{rs}	1%	0%

Note: Multiple selections allowed.
a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q/r/s/t Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn,opq,rst,or,ps,qt
*Survey responses adjusted by audit data, except for electric baseboard, buddy heater, boiler, and unclear responses.
†n values range due to varying counts of unclear answers per column.

12.8.1 Primary Heating Equipment

Respondents who reported using more than one heating system in the survey were asked to identify the one that was their main source of heating in 2019. Table 65 presents results on the primary space heating system used by homes with and without natural gas.

- Households with natural gas are more likely to use a central furnace as their main source of heating than households without natural gas (75% vs. 53%). Households without natural gas are more likely to use single room heating equipment as their main heating source compared to households with natural gas (i.e., portable space heaters (14% vs. 6%), wood stoves (13% vs. 0%), and fireplaces (9% vs. 5%)).

Table 65. Primary Heating Equipment by Natural Gas Access

	n	Furnace*	Electric baseboard	Fireplace	Wood stove*	Portable space heater	Wall furnace*	Floor furnace	Electric wall heater*	Buddy heater	Boiler	Heat pump*	Other	Unclear	No heating source*
Fuel Access															
No Natural Gas (a)	1,329	53%	1%^{b}	9%^{b}	13%^{b}	14%^{b}	5%	0.2%	1%^{b}	1%^{b}	2%	5%^{b}	1%^{b}	5%	2%^{b}
Natural Gas (b)	1,176	75%^{a}	0.4%	5%	0.3%	6%	8%^{a}	1%^{a}	0.0%	0.1%	3%^{a}	2%	0.0%	7%	0.3%

Note: Multiple selections allowed.
a/b indicates significant differences at the 90% confidence level.
*Survey responses adjusted by audit data.

12.9 Cooling

Table 66 presents results on the penetration of air conditioning equipment in SJV DAC homes. Homes could have more than one cooling system type.

- Most SJV DAC homes have some sort of mechanical air conditioning, typically central air conditioning (87%). Only 1% of homes have no cooling equipment.
- Compared to homes with natural gas, homes without natural gas are more likely to lack mechanical cooling equipment (8% vs. 1%) and, by extension, central systems (73% vs. 87%).
- Central air conditioning is less common in small communities compared to medium/large communities. In addition, fewer renters and CARE eligible customers have central cooling. As a result, these homes rely more on evaporative, window, and portable air conditioners.
- CARE ineligible customers with natural gas access are the most likely to have central air conditioning, with penetration reaching 95%.

Table 66. Air Conditioning Equipment

	n†	Central AC*	Window AC*	Portable AC*	Evaporative or swamp cooler*	Heat pump*	Other	Unclear	No mechanical AC equipment*
Overall	2603–2660	87%	11%	12%	7%	3%	0.05%	0.1%	1%
Natural Gas Access									
No Natural Gas (a)	1344–1391	73%	11%	3%	13%[b]	7%[b]	0.1%	0.4%[b]	8%[b]
Natural Gas (b)	1259–1269	87%[a]	11%	12%[a]	7%	3%	0.05%	0.1%	1%
Community Size									
Small, No Natural Gas (c)	452–458	60%[e]	19%[d]	3%	24%[d]	6%[e]	0%	0.2%	3%
Medium/Large, No Natural Gas (d)	892–933	75%[c]	10%	3%	11%[f]	7%[f]	0.1%	0.4%[f]	9%[cf]
Small, Natural Gas (e)	225–229	51%	29%[cf]	32%[cf]	22%[f]	2%	0%	1%[f]	3%[f]
Medium/Large, Natural Gas (f)	1034–1040	88%[de]	10%	11%[d]	7%	3%	0.05%	0.05%	1%
Home Ownership									
Owner, No Natural Gas (g)	1045–1082	75%[h]	10%[i]	3%	13%[i]	7%[i]	0.1%	0.4%	9%[hi]
Renter, No Natural Gas (h)	299–309	67%	17%[g]	3%	13%[j]	5%[j]	0%	0.5%[j]	4%[j]
Owner, Natural Gas (i)	808–815	90%[gj]	8%	11%[g]	7%	3%	0.1%	0.1%	1%

	n†	Central AC*	Window AC*	Portable AC*	Evaporative or swamp cooler*	Heat pump*	Other	Unclear	No mechanical AC equipment*
Renter, Natural Gas (j)	451–454	80%^{h}	16%^{i}	12%^{h}	9%	2%	0%	0%	2%^{i}
CARE Eligible									
CARE Eligible, No Natural Gas (k)	681–701	69%	17%^{l}	3%	15%^{lm}	7%^{m}	0%	0.3%^{m}	6%^{m}
CARE Ineligible, No Natural Gas (l)	476–493	77%^{k}	8%^{n}	3%	11%^{n}	7%^{n}	0.2%	0.2%	9%^{kn}
CARE Eligible, Natural Gas (m)	770–778	79%^{k}	16%^{n}	15%^{kn}	10%^{n}	3%	0%	0%	1%^{n}
CARE Ineligible, Natural Gas (n)	373–375	95%^{lm}	4%	4%	4%	3%	0.1%	0.2%	0.3%
Housing Type									
SF Detached, No Natural Gas (o)	991–1030	75%^{q}	11%	3%	11%^{pr}	7%^{qr}	0.1%	0.4%^{r}	8%^{qr}
SF Attached, No Natural Gas (p)	96–100	73%^{q}	12%	1%	5%	9%^{qs}	0%	0.3%	14%^{oqs}
Mobile Home, No Natural Gas (q)	257–261	45%	22%^{op}	4%	43%^{opt}	3%	0%	1%	2%
SF Detached, Natural Gas (r)	889–894	88%^{ot}	10%	11%^{o}	7%	3%	0.1%	0.1%	1%
SF Attached, Natural Gas (s)	195–198	85%^{Pt}	11%	13%^{P}	8%	2%	0%	0%	1%
Mobile Home, Natural Gas (t)	175–177	64%^{q}	26%^{rs}	20%^{qrs}	16%^{rs}	2%	0%	0%	1%

Note: Multiple selections allowed.
a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q/r/s/t Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn,opq,rst,or,ps,qt
*Survey responses adjusted by audit data, except for other and unclear.
†n values range due to varying counts of unclear answers per column.

Table 67 presents results on the penetration of different types of fans in SJV DAC homes.

- Most homes in SJV DACs have a ceiling fan (82%). Approximately one-third of SJV DAC homes have a portable fan (31%); few have a whole house fan (5%).
- The penetration of ceiling fans varies somewhat by subgroup though a majority of all groups have a ceiling fan. Renters and CARE eligible households are slightly less likely to have a ceiling fan compared to owners and CARE ineligible customers. Ceiling fan penetration is higher in single family detached homes compared to other housing types.

Table 67. Fans

	n†	Ceiling fan*	Portable fan	Wholehouse fan*
Overall	2656–2657	82%	31%	5%
Natural Gas Access				
No Natural Gas (a)	1388–1389	85%[b]	35%[b]	5%
Natural Gas (b)	1,268	82%	31%	5%
Community Size				
Small, No Natural Gas (c)	457–458	83%[e]	33%[e]	5%
Medium/Large, No Natural Gas (d)	931	86%[cf]	36%[f]	5%
Small, Natural Gas (e)	229	75%	27%	5%
Medium/Large, Natural Gas (f)	1,039	82%[e]	32%[e]	5%
Home Ownership				
Owner, No Natural Gas (g)	1,081	88%[hı]	36%[ı]	5%
Renter, No Natural Gas (h)	307–308	76%	34%	7%[g]
Owner, Natural Gas (i)	814	85%[j]	29%	5%
Renter, Natural Gas (j)	454	76%	36%[ı]	5%
CARE Eligible				
CARE Eligible, No Natural Gas (k)	698–699	79%	33%	6%
CARE Ineligible, No Natural Gas (l)	493	90%[kn]	40%[kn]	5%
CARE Eligible, Natural Gas (m)	778	79%	33%	6%
CARE Ineligible, Natural Gas (n)	374	85%[m]	30%	5%
Housing Type				
SF Detached, No Natural Gas (o)	1,029	87%[pqr]	36%[pr]	5%
SF Attached, No Natural Gas (p)	99–100	70%	29%	8%[q]
Mobile Home, No Natural Gas (q)	260	76%	33%	4%
SF Detached, Natural Gas (r)	893	84%[st]	31%	5%
SF Attached, Natural Gas (s)	198	73%	34%[t]	5%
Mobile Home, Natural Gas (t)	177	73%	27%	3%

Note: Multiple selections allowed.
a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q/r/s/t Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn,opq,rst,or,ps,qt
*Survey responses adjusted by audit data, except for portable fans.
†n values range due to varying counts of unclear answers per column.

12.10 Thermostats

Table 68 presents results on the penetration of different thermostat types SJV DAC homes.

- Standard programmable thermostats are the most common thermostat type in the SJV DACs, installed in half homes (52%). The newest thermostat type, smart thermostats, are installed in nearly one-quarter of homes (25%).
- Natural gas customers are more likely to have smart thermostats than non-natural gas customers (25% vs. 15%).
- Manual thermostats are more common in homes in small communities relative to medium/large, resulting in comparably lower incidences of programmable and smart thermostats.
- Smart thermostats are much more common in owner occupied homes than rental homes, especially those homes with natural gas access.
- CARE eligible customers are less likely than CARE ineligible customers to have a programmable or smart thermostat.

Table 68: Thermostat Type*

	n	Manual thermostat	Programmable thermostat (Not Wi-Fi-Connected)	Wi-Fi-connected smart thermostat	Remote style thermostat	Thermostat with dials	No thermostat
Overall	2,660	20%	52%	25%	0%	0%	3%
Natural Gas Access							
No Natural Gas (a)	1,391	25%[b]	61%[b]	15%	1%[b]	4%[b]	12%[b]
Natural Gas (b)	1,269	20%	52%	25%[a]	0%	0%	3%
Community Size							
Small, No Natural Gas (c)	458	34%[d]	51%[e]	8%	1%	8%[de]	21%[de]
Medium/Large, No Natural Gas (d)	933	24%[f]	63%[cf]	16%[c]	1%[f]	4%[f]	11%[f]
Small, Natural Gas (e)	229	40%[cf]	29%	13%[c]	0%	0%	15%[f]
Medium/Large, Natural Gas (f)	1,040	20%	53%[e]	25%[de]	0%	0%	3%
Home Ownership							
Owner, No Natural Gas (g)	1,082	24%[i]	63%[hi]	18%[h]	0.4%[i]	4%[i]	10%[i]
Renter, No Natural Gas (h)	309	27%	57%	5%	1%[gj]	6%[gj]	20%[gj]
Owner, Natural Gas (i)	815	17%	51%	32%[gj]	0%	0%	2%
Renter, Natural Gas (j)	454	27%[i]	54%	8%[h]	0%	0%	5%[i]
CARE Eligible							
CARE Eligible, No Natural Gas (k)	701	29%[lm]	56%[m]	9%	1%[m]	5%[m]	18%[lm]
CARE Ineligible, No Natural Gas (l)	493	20%[n]	67%[kn]	22%[k]	1%[n]	5%[n]	6%[n]
CARE Eligible, Natural Gas (m)	778	24%[n]	48%	19%[k]	0%	0%	6%[n]
CARE Ineligible, Natural Gas (n)	375	14%	58%[m]	32%[lm]	0%	0%	0.4%
Housing Type							
SF Detached, No Natural Gas (o)	1,030	23%[r]	63%[9r]	16%[9]	0.5%[r]	4%[r]	12%[r]

	n	Manual thermostat	Programmable thermostat (Not Wi-Fi-Connected)	Wi-Fi-connected smart thermostat	Remote style thermostat	Thermostat with dials	No thermostat
SF Attached, No Natural Gas (p)	100	28%	62%qs	15%q	2%oqs	4%s	8%s
Mobile Home, No Natural Gas (q)	261	41%op	43%t	7%	0.5%	8%ot	24%opt
SF Detached, Natural Gas (r)	894	17%	53%t	27%ost	0.0%	0.0%	3%
SF Attached, Natural Gas (s)	198	29%r	52%t	11%	0.0%	0.0%	2%
Mobile Home, Natural Gas (t)	177	43%rs	32%	15%qs	0.0%	0.0%	11%rs

Note: Multiple selections allowed.
a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q/r/s/t Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn,opq,rst,or,ps,qt
*Survey responses adjusted by audit data.

12.11 Water Heating

Table 69 presents results on the penetration of different types of water heaters in SJV DAC homes.

- Most SJV DAC homes have a conventional storage tank water heater (92%).
- Having access to natural gas does not affect the type of water heater installed in a home.
- Although there is some slight variation in the penetration of tankless water heaters by home ownership and CARE eligibility, the vast majority of customers in a given subgroup have conventional storage tank water heaters.

Table 69. Water Heater Type

	n	Conventional storage water heater	Tankless water heater	Heat pump water heater	Solar water heater
Overall	2,588	92%	8%	0%	0.1%
Natural Gas Access					
No Natural Gas (a)	1,357	89%	9%	1%b	2%b
Natural Gas (b)	1,231	92%a	8%	0%	0%
Community Size					
Small, No Natural Gas (c)	451	90%	8%e	1%	2%e
Medium/Large, No Natural Gas (d)	906	88%	9%	1%f	2%f
Small, Natural Gas (e)	222	96%cf	4%	0%	0%

	n	Conventional storage water heater	Tankless water heater	Heat pump water heater	Solar water heater
Medium/Large, Natural Gas (f)	1,009	92%[d]	8%[e]	0%	0%
Home Ownership					
Owner, No Natural Gas (g)	1,064	86%	10%[h]	1%[i]	2%[hi]
Renter, No Natural Gas (h)	293	96%[g]	3%	1%[j]	0%
Owner, Natural Gas (i)	797	89%[g]	11%[j]	0%	0%
Renter, Natural Gas (j)	434	98%[hi]	2%	0%	0%
CARE Eligible					
CARE Eligible, No Natural Gas (k)	675	91%[l]	7%[m]	1%[m]	1%[m]
CARE Ineligible, No Natural Gas (l)	491	85%	11%[k]	1%[n]	3%[kn]
CARE Eligible, Natural Gas (m)	745	96%[kn]	4%	0%	0%
CARE Ineligible, Natural Gas (n)	374	89%[l]	11%[m]	0%	0%
Housing Type					
SF Detached, No Natural Gas (o)	1,013	88%	9%	1%[r]	2%[r]
SF Attached, No Natural Gas (p)	89	90%	7%[s]	3%[oqs]	0%
Mobile Home, No Natural Gas (q)	255	92%[o]	7%[t]	1%	1%[t]
SF Detached, Natural Gas (r)	874	91%[o]	9%[st]	0%	0%
SF Attached, Natural Gas (s)	187	98%[pr]	2%	0%	0%
Mobile Home, Natural Gas (t)	170	97%[qr]	3%	0%	0%

a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q/r/s/t Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn,opq,rst,or,ps,qt
*Survey responses adjusted by audit data.

12.12 Cooking

Table 70 presents results on the penetration of major cooking appliances in SJV DAC homes.

- Most SJV DAC homes have an integrated (stove top and oven) range for cooking (72%) instead of separate stove tops (28%) and wall ovens (20%). Nearly all homes have a major cooking appliance.
- Small community members, renters, and CARE eligible customers are more likely to have ranges than their medium/large community, homeowner, and CARE ineligible counterparts; in turn, there are comparably more stove tops and/or wall ovens among medium/large community members, homeowners, and CARE ineligible customers.

Table 70. Cooking Appliances in Home*

	n	Range	Stove top	Wall oven	No major cooking appliances
Overall	2659–2660	72%	28%	20%	0.3%
Natural Gas Access					
No Natural Gas (a)	1390–1391	73%	24%	27%[b]	1%[b]
Natural Gas (b)	1269–1269	72%	28%[a]	20%	0.2%
Community Size					
Small, No Natural Gas (c)	457–458	81%[d]	15%	16%[e]	2%[de]
Medium/Large, No Natural Gas (d)	933–933	72%	25%[c]	28%[cf]	1%[f]
Small, Natural Gas (e)	229–229	80%[f]	20%[c]	11%	1%
Medium/Large, Natural Gas (f)	1040–1040	72%	29%[de]	20%[e]	0.2%
Home Ownership					
Owner, No Natural Gas (g)	1082–1082	70%[i]	27%[h]	33%[hi]	1%[i]
Renter, No Natural Gas (h)	308–309	84%[g]	14%	6%	1%[j]
Owner, Natural Gas (i)	815–815	67%	34%[gj]	26%[j]	0.3%
Renter, Natural Gas (j)	454–454	83%[i]	17%	8%	0%
CARE Eligible					
CARE Eligible, No Natural Gas (k)	700–701	80%[l]	17%	12%[m]	2%[lm]
CARE Ineligible, No Natural Gas (l)	493–493	67%	30%[k]	39%[kn]	0.2%
CARE Eligible, Natural Gas (m)	778–778	83%[kn]	17%	10%	0.1%
CARE Ineligible, Natural Gas (n)	375–375	63%	37%[lm]	29%[m]	0.5%[m]
Housing Type					
SF Detached, No Natural Gas (o)	1030–1030	72%	25%[pq]	30%[pqr]	1%[r]
SF Attached, No Natural Gas (p)	99–100	89%[oq]	9%	4%	1%[s]
Mobile Home, No Natural Gas (q)	261–261	74%	18%[p]	10%[p]	5%[opt]
SF Detached, Natural Gas (r)	894–894	70%	31%[ost]	22%[st]	0%
SF Attached, Natural Gas (s)	198–198	86%[rt]	16%[P]	8%[P]	0%
Mobile Home, Natural Gas (t)	177–177	75%[r]	25%[qs]	13%[s]	0%

Note: Multiple selections allowed.
a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q/r/s/t Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn,opq,rst,or,ps,qt
*Survey responses adjusted by audit data.
†n values range due to varying counts of unclear answers per column.

Table 71 presents results on the penetration and use of ventilation hoods for cooking in SJV DAC homes.

- Most SJV DAC households have a ventilation hood in their kitchen that they use at least sometimes (88%). Half use a ventilation hood frequently (53%).
- Ventilation hood penetration and use is relatively similar across subgroups. The differences that exist do not appear to be associated with a particular characteristic such as access to natural gas or home ownership.

Table 71. Ventilation Hood Access and Use

	n	Yes, frequently	Yes, sometimes	No, I have a working ventilation hood but I do not use it	No, I do not have a ventilation hood	No, my ventilation hood is currently broken
Overall	2,574	53%	33%	4%	6%	3%
Natural Gas Access						
No Natural Gas (a)	1,337	44%	35%	6%[b]	12%[b]	4%
Natural Gas (b)	1,237	53%[a]	33%	4%	6%	3%
Community Size						
Small, No Natural Gas (c)	436	52%[d]	27%[e]	3%	13%	4%
Medium/Large, No Natural Gas (d)	901	42%	36%[cf]	6%[cf]	12%[f]	4%
Small, Natural Gas (e)	222	52%	20%	4%	19%[cf]	5%[f]
Medium/Large, Natural Gas (f)	1,015	54%[d]	33%[e]	4%	6%	3%
Home Ownership						
Owner, No Natural Gas (g)	1,044	43%	38%[hı]	5%	11%[ı]	3%
Renter, No Natural Gas (h)	293	48%[g]	24%	6%	15%[gj]	7%[gj]
Owner, Natural Gas (i)	801	55%[g]	33%	4%	5%	3%
Renter, Natural Gas (j)	436	51%	31%[h]	4%	9%[ı]	4%
CARE Eligible						
CARE Eligible, No Natural Gas (k)	662	49%[l]	28%	6%[m]	11%[m]	6%[l]
CARE Ineligible, No Natural Gas (l)	486	39%	39%[k]	6%	14%[kn]	2%
CARE Eligible, Natural Gas (m)	756	58%[kn]	26%	4%	7%	5%[n]
CARE Ineligible, Natural Gas (n)	371	48%[l]	40%[m]	5%	5%	1%
Housing Type						
SF Detached, No Natural Gas (o)	1,000	43%	36%[p]	6%	12%[qr]	3%
SF Attached, No Natural Gas (p)	97	46%	29%	7%[s]	15%[qs]	3%

	n	Yes, frequently	Yes, sometimes	No, I have a working ventilation hood but I do not use it	No, I do not have a ventilation hood	No, my ventilation hood is currently broken
Mobile Home, No Natural Gas (q)	240	47%	35%[t]	5%	5%	8%[op]
SF Detached, Natural Gas (r)	878	53%[o]	36%[st]	5%	6%	3%
SF Attached, Natural Gas (s)	187	55%[p]	30%	4%	8%	3%
Mobile Home, Natural Gas (t)	172	58%[q]	25%	3%	8%	5%[r]

a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q/r/s/t Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn,opq,rst,or,ps,qt

12.13 Electrical

Table 72 presents results on the type and voltage of electrical outlets in SJV DAC homes. Auditors collected information on the penetration of two and three prong outlets and 220–240v outlets.

- Nearly all homes have three-prong outlets (98%). Two-prong outlets are relatively rare and were found in only 6% of homes. One-quarter of homes (26%) have a 220–240v outlet. There is little meaningful variation by subgroup.[45]

Table 72. Outlets in Home*

	n	Has two-prong grounding	Has three-prong grounding	Has 220–240v outlets	Average number of 220–240v outlets
Overall	156–259	7%	98%	24%	0.35
Natural Gas Access					
No Natural Gas (a)	87–177	8%	97%	51%[b]	1.17[b]
Natural Gas (b)	69–82	7%	98%	24%	0.35
Community Size					
Small, No Natural Gas (c)	28–76	10%[e]	90%	81%[de]	1.86[e]
Medium/Large, No Natural Gas (d)	59–101	7%	98%[c]	49%[f]	1.07[f]
Small, Natural Gas (e)	13–17	0%	100%[c]	36%	0.76
Medium/Large, Natural Gas (f)	56–65	7%	98%	23%	0.33
Home Ownership					

[45] Because this data was only collected through the home audits, the sample sizes are smaller and some of the differences should be treated with caution.

	n	Has two-prong grounding	Has three-prong grounding	Has 220–240v outlets	Average number of 220–240v outlets
Owner, No Natural Gas (g)	75–141	7%	97%	51%[i]	1.19[i]
Renter, No Natural Gas (h)	12–36	9%	99%	47%	0.99[j]
Owner, Natural Gas (i)	40–47	7%	100%[j]	19%	0.33
Renter, Natural Gas (j)	29–35	6%	95%	31%	0.38
CARE Eligible					
CARE Eligible, No Natural Gas (k)	41–101	10%[lm]	98%	49%[m]	0
CARE Ineligible, No Natural Gas (l)	39–64	4%	98%	52%	0
CARE Eligible, Natural Gas (m)	45–53	4%	97%	19%	0.26
CARE Ineligible, Natural Gas (n)	19–22	14%[lm]	100%	36%[m]	0.57
Housing Type					
SF Detached, No Natural Gas (o)	68–131	8%	97%	49%[r]	0
SF Attached, No Natural Gas (p)	1–1	0%	100%	100%[s]	0
Mobile Home, No Natural Gas (q)	18–45	6%	99%	76%[ot]	0
SF Detached, Natural Gas (r)	45–54	7%	100%[os]	25%	0.34
SF Attached, Natural Gas (s)	17–19	2%	90%	31%	0
Mobile Home, Natural Gas (t)	6–9	0%	100%	10%	0.22

Note: Multiple selections allowed.
a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q/r/s/t Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn,opq,rst,or,ps,qt
*Audit data only.
†n values range due to varying counts of missing outlet data per column.

12.14 Additional Appliances

12.14.1 Laundry Equipment

Table 73 presents results on the penetration of laundry equipment in SJV DAC homes.

- Most homes have a clothes washer (95%) and dryer (94%).
- Renters, CARE eligible customers, and residents of single family attached homes are slightly less likely than their counterparts to have laundry appliances in the home.

Table 73. Clothes Washers and Dryers

	n	Clothes Washer	Clothes Dryer
Overall	2,660	95%	94%
Natural Gas Access			
No Natural Gas (a)	1,391	93%	90%
Natural Gas (b)	1,269	95%[a]	94%[a]
Community Size			
Small, No Natural Gas (c)	458	96%	91%
Medium/Large, No Natural Gas (d)	933	95%	94%[c]
Small, Natural Gas (e)	229	96%	90%
Medium/Large, Natural Gas (f)	1,040	95%	94%[e]
Home Ownership			
Owner, No Natural Gas (g)	1,082	96%[h]	94%[h]
Renter, No Natural Gas (h)	309	82%	77%
Owner, Natural Gas (i)	815	99%[gj]	98%[gj]
Renter, Natural Gas (j)	454	89%[h]	86%[h]
CARE Eligible			
CARE Eligible, No Natural Gas (k)	701	88%	83%
CARE Ineligible, No Natural Gas (l)	493	97%[k]	96%[k]
CARE Eligible, Natural Gas (m)	778	93%[k]	91%[k]
CARE Ineligible, Natural Gas (n)	375	98%[m]	98%[lm]
Housing Type			
SF Detached, No Natural Gas (o)	1,030	95%[pq]	92%[pq]
SF Attached, No Natural Gas (p)	100	69%	67%
Mobile Home, No Natural Gas (q)	261	92%[p]	85%[p]
SF Detached, Natural Gas (r)	894	98%[ost]	97%[ost]
SF Attached, Natural Gas (s)	198	80%[p]	79%[p]
Mobile Home, Natural Gas (t)	177	93%[s]	90%[qs]

a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q/r/s/t Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn,opq,rst,or,ps,qt

12.14.2 Other Household Appliances

Table 74 presents results on the penetration of dishwashers and additional refrigerators and freezers in SJV DAC homes.

- Over two-thirds of SJV DAC homes have a dishwasher (71%). One-third of homes have a second refrigerator (33%) and 20% have a standalone freezer.
- Small community members, renters, CARE eligible customers, and residents of single family attached and mobile homes are much less likely to have a dishwasher in their homes compared to their counterparts. They are also slightly less likely to have a secondary refrigerator or standalone freezer.

Table 74. Other Household Appliances*

	n	Second / Spare Refrigerator	Standalone Freezer	Dishwasher
Overall	2,660	33%	20%	71%
Natural Gas Access				
No Natural Gas (a)	1,391	31%	26%[b]	68%
Natural Gas (b)	1,269	33%[a]	20%	71%[a]
Community Size				
Small, No Natural Gas (c)	458	32%	30%[d]	48%[e]
Medium/Large, No Natural Gas (d)	933	31%	25%[f]	71%[c]
Small, Natural Gas (e)	229	37%	28%[f]	37%
Medium/Large, Natural Gas (f)	1,040	33%	20%	72%[e]
Home Ownership				
Owner, No Natural Gas (g)	1,082	36%[h]	30%[hı]	75%[h]
Renter, No Natural Gas (h)	309	16%	14%	41%
Owner, Natural Gas (i)	815	41%[gj]	24%[j]	76%[j]
Renter, Natural Gas (j)	454	20%	14%	61%[h]
CARE Eligible				
CARE Eligible, No Natural Gas (k)	701	25%	21%[m]	47%
CARE Ineligible, No Natural Gas (l)	493	36%[k]	30%[kn]	85%[k]
CARE Eligible, Natural Gas (m)	778	27%	17%	57%[k]
CARE Ineligible, Natural Gas (n)	375	38%[m]	24%[m]	86%[m]
Housing Type				
SF Detached, No Natural Gas (o)	1,030	33%[pq]	28%[pr]	72%[pq]
SF Attached, No Natural Gas (p)	100	18%	9%	41%
Mobile Home, No Natural Gas (q)	261	27%[pt]	25%[p]	52%[pt]
SF Detached, Natural Gas (r)	894	37%[ost]	22%[s]	74%[ost]

	n	Second / Spare Refrigerator	Standalone Freezer	Dishwasher
SF Attached, Natural Gas (s)	198	16%	12%	59%[pt]
Mobile Home, Natural Gas (t)	177	20%	22%[s]	44%

a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q/r/s/t Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn,opq,rst,or,ps,qt
*Survey responses adjusted by audit data.

12.14.3 Medical Equipment

Table 75 presents results on the penetration of energy-using medical equipment in SJV DAC homes.

- Overall, 13% of residents have at least one medical device that use energy in their homes. The most common device is a sleep therapy machine (7%) followed by a nebulizer (5%).
- Results show relatively small differences in the penetration of energy-using medical equipment across subgroups. The biggest difference exists between residents of small communities without natural gas and those with natural gas (20% vs. 10%). For the rest, a few percentage points separate most subgroups with no clear driver of the differences.

Table 75. Home Medical Equipment

	n	Any Medical Equipment	Nebulizer	Oxygen Concentrator	Sleep Therapy Or CPAP Machine	Powered Lift Chair	Hospital Or Powered Adjustable Bed	Mobility Scooter	Air Purifier, Dehumidifier	Monitor (Heart, Oxygen, Etc.), Pump (Feeding, Air, Etc.), Or Tool (Stimulator, UV Light)	Dialysis	Extra Heating/Cooling/Hot Water	No Energy-Using Medical Equipment	Other Energy Using Medical Equipment
Overall	2,660	13%	5%	2%	7%	1%	1%	1%	1%	1%	0.3%	0.3%	4%	0.001%
Natural Gas Access														
No Natural Gas (a)	1,391	17%[b]	5%	4%[b]	9%[b]	1%	2%[b]	1%[b]	0.1%	1%	0.2%	1%[b]	5%	0.2%[b]
Natural Gas (b)	1,269	13%	5%	2%	7%	1%	1%	1%	1%[a]	1%	0.3%	0.3%	4%	0%
Community Size														
Small, No Natural Gas (c)	458	20%[de]	7%	4%[e]	11%[e]	2%[e]	3%[e]	2%	0%	1%	0.0%	2%	5%	0%
Medium/Large, No Natural Gas (d)	933	16%[f]	5%	4%[f]	9%[f]	1%	2%[f]	1%	0.1%	1%	0.2%	1%[f]	5%	0.2%[f]
Small, Natural Gas (e)	229	10%	6%	1%	4%	0%	1%	1%	0%	1%	0%	1%	5%	0%

	n	Any Medical Equipment	Nebulizer	Oxygen Concentrator	Sleep Therapy Or CPAP Machine	Powered Lift Chair	Hospital Or Powered Adjustable Bed	Mobility Scooter	Air Purifier, Dehumidifier	Monitor (Heart, Oxygen, Etc.), Pump (Feeding, Air, Etc.), Or Tool (Stimulator, UV Light)	Dialysis	Extra Heating/Cooling/Hot Water	No Energy-Using Medical Equipment	Other Energy Using Medical Equipment
Medium/Large, Natural Gas (f)	1,040	13%[e]	5%	2%	7%[e]	1%[e]	1%	1%	1%[de]	1%	0.3%	0.3%	4%	0%
Home Ownership														
Owner, No Natural Gas (g)	1,082	18%[hi]	5%[i]	4%[i]	10%[hi]	2%[h]	3%[i]	1%[i]	0.2%	1%[i]	0.2%	1%[i]	5%	0.1%
Renter, No Natural Gas (h)	309	12%	5%	3%[j]	7%	0.2%	2%[j]	1%	0%	0.4%	0.0%	1%[j]	7%[gj]	0.4%
Owner, Natural Gas (i)	815	13%	3%	2%	8%[j]	1%[j]	1%[j]	0.4%	0.5%[g]	0.4%	0.4%[j]	0.3%	4%	0%
Renter, Natural Gas (j)	454	14%	7%[hi]	2%	5%	0.2%	0.2%	1%[i]	2%[hi]	1%[i]	0%	0.1%	4%	0%
CARE Eligible														
CARE Eligible, No Natural Gas (k)	701	17%	7%[l]	4%[m]	9%	2%[m]	3%[lm]	2%[lm]	0.1%	1%[l]	0.4%[l]	1%[m]	8%[lm]	0.2%
CARE Ineligible, No Natural Gas (l)	493	16%[n]	3%[n]	3%	10%[n]	1%	1%	1%	0.2%	0.4%	0%	1%[n]	3%	0%
CARE Eligible, Natural Gas (m)	778	17%[n]	8%[n]	2%	8%	1%	1%	1%	1%[kn]	1%	0.2%	0.5%[n]	5%	0%
CARE Ineligible, Natural Gas (n)	375	9%	1%	2%	6%	2%[m]	1%	0.3%	0.4%	0.4%	0.4%[l]	0%	4%[l]	0%

Note: Multiple selections allowed.
a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

12.15 Wi-Fi and Cellular Access

Table 76 presents results on home internet access, including type of service in SJV DACs.

- Most SJV DAC customers (87%) have internet service at home, typically broadband (82%). An additional 5% of customers have internet access but only through their cellular data plan.
- Home internet service is less common among small community members, renters, and CARE eligible customers compared to their medium/large community, homeowner, and CARE ineligible counterparts.

- Some of these customers make up for their lack of home access by using their cellular data plan to access the internet, but they still lag other groups in internet access. Just over three-quarters of renters without access to natural gas (78%) and residents of small communities (77%) have internet access of any kind.

Table 76. Home Internet Access

	n	Has internet service at home	Dial-up internet service	High-speed broadband service	Only accesses internet from cellular data plan
Overall	2,660	87%	6%	82%	5%
Natural Gas Access					
No Natural Gas (a)	1,391	78%	6%	72%	8%[b]
Natural Gas (b)	1,269	87%[a]	6%	82%[a]	5%
Community Size					
Small, No Natural Gas (c)	458	66%	7%	60%	11%[d]
Medium/Large, No Natural Gas (d)	933	80%[c]	6%	74%[c]	8%[f]
Small, Natural Gas (e)	229	66%	6%	61%	11%[f]
Medium/Large, Natural Gas (f)	1,040	88%[de]	6%	83%[de]	5%
Home Ownership					
Owner, No Natural Gas (g)	1,082	82%[h]	6%	76%[h]	7%[i]
Renter, No Natural Gas (h)	309	66%	8%	58%	12%[gj]
Owner, Natural Gas (i)	815	91%[gj]	6%	86%[gj]	3%
Renter, Natural Gas (j)	454	79%[h]	6%	74%[h]	8%[i]
CARE Eligible					
CARE Eligible, No Natural Gas (k)	701	69%	9%[l]	60%	11%[lm]
CARE Ineligible, No Natural Gas (l)	493	88%[k]	3%	85%[k]	6%[n]
CARE Eligible, Natural Gas (m)	778	80%[k]	8%[n]	73%[k]	7%[n]
CARE Ineligible, Natural Gas (n)	375	96%[lm]	4%	94%[lm]	2%

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

Table 77 presents results on cell phone use among SJV DAC residents.

- Nearly all SJV DAC households have a cell phone (98%) and most have smartphones (93%).

- Cell phone use is nearly universal with few differences across subgroups.

Table 77. Cell Phone Access

	n	Has cell phone	n	Has smartphone
Overall	2,660	98%	2,634	93%
Natural Gas Access				
No Natural Gas (a)	1,391	97%	1,373	89%
Natural Gas (b)	1,269	99%[a]	1,261	93%[a]
Community Size				
Small, No Natural Gas (c)	458	98%[de]	451	90%
Medium/Large, No Natural Gas (d)	933	97%	922	89%
Small, Natural Gas (e)	229	96%	227	89%
Medium/Large, Natural Gas (f)	1,040	99%[de]	1,034	94%[de]
Home Ownership				
Owner, No Natural Gas (g)	1,082	96%	1,067	88%
Renter, No Natural Gas (h)	309	100%[gj]	306	93%[g]
Owner, Natural Gas (i)	815	98%[g]	810	93%[g]
Renter, Natural Gas (j)	454	99%[i]	451	94%
CARE Eligible				
CARE Eligible, No Natural Gas (k)	701	98%	688	86%
CARE Ineligible, No Natural Gas (l)	493	98%	492	94%[k]
CARE Eligible, Natural Gas (m)	778	98%	772	92%[k]
CARE Ineligible, Natural Gas (n)	375	99%[lm]	374	96%[m]

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

13. Demographics

This section presents results on customer demographic characteristics in the SJV DACs and by subgroup.

13.1 Home Ownership

Table 78 presents results on the rate of home ownership among SJV DAC residents.

- Overall, about two-thirds of customers in SJV DACs own their home (65%).
- Homeownership is most strongly related to CARE eligibility with CARE eligible customers being least likely to own their home. Natural gas access moderates these relationships, with natural gas customers being slightly less likely to own their homes compared to customers without natural gas access.

Table 78. Home Ownership

	n	Owner	Renter
Overall	2,660	65%	35%
Natural Gas Access			
No Natural Gas (a)	1,391	76%[b]	24%
Natural Gas (b)	1,269	65%	35%[a]
Community Size			
Small, No Natural Gas (c)	458	75%[e]	25%
Medium/Large, No Natural Gas (d)	933	76%[f]	24%
Small, Natural Gas (e)	229	61%	39%[c]
Medium/Large, Natural Gas (f)	1,040	65%	35%[d]
CARE Eligible			
CARE Eligible, No Natural Gas (g)	701	60%[m]	40%[l]
CARE Ineligible, No Natural Gas (h)	493	91%[kn]	9%
CARE Eligible, Natural Gas (i)	778	51%	49%[kn]
CARE Ineligible, Natural Gas (j)	375	81%[m]	19%[l]

a/b/c/d/e/f/g/h/i/j Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij

13.2 Household Income

Table 79 presents results on the household incomes of SJV DAC residents.

- Half of SJV DAC households earn less than $50,000 a year (49%); one in five earn over $100,000 a year (21%).
- Household income is not meaningfully different for households with and without access to natural gas.
- Residents of small communities and renters have lower incomes than medium/large community residents and owners. CARE eligibility was based on IOU records or our classification of respondents using their household incomes and household size. Accordingly, over 90% of CARE eligible households have incomes less than $50,000 a year.

Table 79. 2019 Household Income

	n	Less than $25,000	$25,000–$49,999	$50,000–$74,999	$75,000–$99,999	$100,000–$149,999	$150,000 or more
Overall	2,199	24%	25%	18%	13%	13%	8%
Natural Gas Access							
No Natural Gas (a)	1,136	25%	24%	20%	10%	12%	9%
Natural Gas (b)	1,063	24%	25%	18%	13%[a]	13%	8%
Community Size							
Small, No Natural Gas (c)	375	38%[de]	28%[d]	15%	9%	6%	5%[e]
Medium/Large, No Natural Gas (d)	761	23%	23%	20%[c]	10%	14%[c]	10%[c]
Small, Natural Gas (e)	192	32%[f]	40%[cf]	12%	8%	6%	2%
Medium/Large, Natural Gas (f)	871	24%	24%	18%[e]	13%[de]	13%[e]	8%[e]
Home Ownership							
Owner, No Natural Gas (g)	861	17%[i]	21%	21%[h]	12%[h]	16%[h]	13%[h]
Renter, No Natural Gas (h)	275	46%[g]	31%[gj]	15%	4%	3%	1%
Owner, Natural Gas (i)	669	12%	24%[g]	19%	16%[gj]	18%[j]	11%[j]
Renter, Natural Gas (j)	394	43%[i]	26%	16%	7%[h]	4%	3%[h]
CARE Eligible							
CARE Eligible, No Natural Gas (k)	571	54%[l]	39%[l]	7%	0.1%	0.0%	0.0%
CARE Ineligible, No Natural Gas (l)	560	0.0%	11%	30%[k]	18%[k]	23%[k]	17%[k]
CARE Eligible, Natural Gas (m)	582	50%[n]	42%[n]	7%	1%[k]	0.1%	0.0%

	n	Less than $25,000	$25,000–$49,999	$50,000–$74,999	$75,000–$99,999	$100,000–$149,999	$150,000 or more
CARE Ineligible, Natural Gas (n)	469	0.0%	9%	28%[m]	23%[lm]	24%[m]	15%[m]

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

13.3 Language Spoken in the Home

Table 80 presents results on the primary language spoken in SJV DAC homes.

- A majority of residents speak English at home (86%) while 13% speak Spanish. Only 1% speak a language other than English or Spanish.
- On average, primary language is not meaningfully different for households with and without access to natural gas.
- Residents of small communities, renters without natural gas, and CARE eligible customers are more likely to speak Spanish in the home than their counterparts. Renters and CARE eligible customers without natural gas are slightly more likely to speak Spanish than their counterparts with natural gas.

Table 80. Primary Language Spoken in the Home

	n	English	Spanish	Other
Overall	2,625	86%	13%	1%
Natural Gas Access				
No Natural Gas (a)	1,371	84%	15%[b]	1%
Natural Gas (b)	1,254	86%[a]	13%	1%
Community Size				
Small, No Natural Gas (c)	452	73%	26%[d]	0.3%
Medium/Large, No Natural Gas (d)	919	86%[c]	13%	1%[c]
Small, Natural Gas (e)	224	69%	30%[f]	1%
Medium/Large, Natural Gas (f)	1,030	87%[e]	12%	1%
Home Ownership				
Owner, No Natural Gas (g)	1,065	89%[hi]	10%	1%
Renter, No Natural Gas (h)	306	68%	30%[gj]	1%
Owner, Natural Gas (i)	804	87%[j]	11%	1%
Renter, Natural Gas (j)	450	84%[h]	15%[i]	1%
CARE Eligible				

	n	English	Spanish	Other
CARE Eligible, No Natural Gas (k)	571	69%	29%lm	1%
CARE Ineligible, No Natural Gas (l)	560	95%kn	4%	1%
CARE Eligible, Natural Gas (m)	578	79%k	21%n	1%
CARE Ineligible, Natural Gas (n)	467	92%m	7%l	1%

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

13.4 Household Members

Table 81 presents results on the presence of children and senior adults in SJV DAC households.

- Just over half of SJV DAC households (53%) have at least one child under 18 at home while one-quarter have a household member who is 65 or older (25%).
- Households without natural gas are less likely to have children (34% vs. 53%) and more likely to have a senior adult (46% vs. 25%) in the home than households with natural gas.
- Fewer owners have children in the home than renters. Owners are also more likely to have a senior adult at home. CARE eligible households are more likely to have children and less likely to have senior adults than CARE ineligible households. Natural gas access moderates these relationships, with natural gas households being younger and those without natural gas being older.

Table 81. Presence of Children and Seniors in Household

	n	Child in Household	Senior (65+ in Household)
Overall	2,660	53%	25%
Natural Gas Access			
No Natural Gas (a)	1,391	34%	46%b
Natural Gas (b)	1,269	53%a	25%
Community Size			
Small, No Natural Gas (c)	458	35%	38%e
Medium/Large, No Natural Gas (d)	933	34%	47%cf
Small, Natural Gas (e)	229	59%cf	28%
Medium/Large, Natural Gas (f)	1,040	53%d	25%

	n	Child in Household	Senior (65+ in Household)
Home Ownership			
Owner, No Natural Gas (g)	1,082	28%	55%[hi]
Renter, No Natural Gas (h)	309	56%[g]	17%[j]
Owner, Natural Gas (i)	815	47%[g]	31%[j]
Renter, Natural Gas (j)	454	65%[hi]	14%
CARE Eligible			
CARE Eligible, No Natural Gas (k)	701	49%[l]	38%[m]
CARE Ineligible, No Natural Gas (l)	493	23%	51%[kn]
CARE Eligible, Natural Gas (m)	778	61%[kn]	22%
CARE Ineligible, Natural Gas (n)	375	46%[l]	26%[m]

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

13.5 Race and Ethnicity

Table 82 provides the race and ethnicity of SJV DAC residents.

- Overall, half of respondents (50%) identify as Caucasian while just under half identify as Hispanic (45%). The next most common category is Asian or Pacific Islander with 6% of respondents.
- Customers who do not have natural gas are somewhat more likely to be Caucasian (61% vs. 50%) while those with natural gas are more likely to be Hispanic (45% vs. 36%).
- Residents of small communities, renters, and CARE eligible customer are more likely to be Hispanic whereas residents of medium/large communities, owners, and CARE ineligible customers are more likely to be Caucasian.

Table 82. Respondent's Racial/Ethnic Identification

	n	Caucasian	Black	Hispanic	Asian or Pacific Islander	American Indian, Alaskan Native, Native Hawaiian	Other
Overall	2,448	50%	3%	45%	6%	2%	0%
Natural Gas Access							
No Natural Gas (a)	1,264	61%[b]	2%	36%	4%	4%[b]	0.2%
Natural Gas (b)	1,184	50%	3%	45%[a]	6%[a]	2%	0.2%
Community Size							
Small, No Natural Gas (c)	413	48%[e]	3%	50%[d]	3%	3%	0.4%
Medium/Large, No Natural Gas (d)	851	64%[cf]	2%	34%	4%	4%[f]	0.1%
Small, Natural Gas (e)	211	39%	2%	60%[cf]	2%	2%	1%
Medium/Large, Natural Gas (f)	973	51%[e]	3%	45%[d]	6%[de]	2%	0.2%
Home Ownership							
Owner, No Natural Gas (g)	972	69%[hi]	2%	29%	4%	4%[i]	0.2%
Renter, No Natural Gas (h)	292	39%	3%	57%[g]	3%	6%[gj]	0.0%
Owner, Natural Gas (i)	759	54%[j]	2%	41%[g]	6%[g]	2%	0.3%
Renter, Natural Gas (j)	425	44%[h]	5%[i]	53%[i]	5%	3%	0.1%
CARE Eligible							
CARE Eligible, No Natural Gas (k)	543	42%[m]	2%	57%[l]	3%	6%[m]	0.0%
CARE Ineligible, No Natural Gas (l)	523	74%[kn]	3%	23%	5%[k]	4%[n]	0.1%
CARE Eligible, Natural Gas (m)	561	38%	4%[k]	58%[n]	5%[k]	4%[n]	0.1%
CARE Ineligible, Natural Gas (n)	449	63%[m]	3%	34%[l]	6%	2%	0.4%

Note: Multiple selections allowed.
a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

- Education

Table 83 provides the education levels of SJV DAC residents.

- Overall, 39% of SJV DAC residents have graduated college with 11% having a post-graduate degree. Conversely, just over one in ten (12%) do not have a high school degree.
- Educational attainment is not meaningfully different for households with and without access to natural gas.

- Residents of small communities, renters, and CARE eligible customer have lower education levels compared to residents of medium/large communities, owners, and CARE ineligible customers. They are less likely to have a college degree and more likely to lack a high school degree.

Table 83. Respondent's Highest Level of Education

	n	Elementary or middle school (grades K-8)	Some high school (grades 9-12)	High school degree or GED	Some college/trade/vocational school	College graduate	Post graduate degree
Overall	2,530	4%	8%	18%	31%	28%	11%
Natural Gas Access							
No Natural Gas (a)	1,323	5%[b]	6%	19%	34%[b]	22%	14%[b]
Natural Gas (b)	1,207	4%	8%[a]	18%	31%	28%[a]	11%
Community Size							
Small, No Natural Gas (c)	438	11%[de]	11%[d]	22%[d]	32%	17%	7%
Medium/Large, No Natural Gas (d)	885	4%	5%	19%	34%[f]	23%[c]	15%[cf]
Small, Natural Gas (e)	211	7%[f]	16%[cf]	27%[cf]	28%	18%	6%
Medium/Large, Natural Gas (f)	996	4%	8%[d]	18%	31%	29%[de]	12%[e]
Home Ownership							
Owner, No Natural Gas (g)	1,039	3%	5%	14%	36%[hi]	25%[h]	16%[h]
Renter, No Natural Gas (h)	284	11%[gj]	7%	37%[gj]	28%	13%	5%
Owner, Natural Gas (i)	773	4%	5%	13%	32%	31%[gj]	15%[j]
Renter, Natural Gas (j)	434	4%	13%[hi]	26%[i]	29%	24%[h]	4%
CARE Eligible							
CARE Eligible, No Natural Gas (k)	545	12%[lm]	11%[l]	29%[l]	32%	12%	4%
CARE Ineligible, No Natural Gas (l)	557	1%	2%	12%[n]	37%[kn]	29%[k]	19%[k]
CARE Eligible, Natural Gas (m)	559	6%[n]	15%[kn]	27%[n]	29%	20%[k]	3%
CARE Ineligible, Natural Gas (n)	467	2%[l]	3%	9%	33%[m]	34%[lm]	19%[m]

a/b/c/d/e/f/g/h/i/j/k/l/m/n Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ce,df,ef,gh,gi,hj,ij,kl,km,ln,mn

14. Pending Underground Infrastructure Improvements

Natural gas service utilities that are building new underground service lines may benefit from coordinating efforts with other utilities for permitting and other land use considerations, particularly if the projects can be identified in early stages. For that reason, we sought high-level data on pending underground water and wastewater development and system expansion efforts on in San Joaquin Valley DAC community areas.

14.1 Methods

The team sought information on upcoming infrastructure projects from multiple San Joaquin Valley counties through online research and through contacting county water and resource boards.

The research team emailed and telephoned eight individual county water and resource boards to request information on water and wastewater expansion projects. Most of the agencies the team contacted did not respond or were reluctant to disclose information about ongoing and upcoming projects to a third party. While they did not state why they could not disclose information, it is possible that they were not authorized to disclose upcoming project information or thought that TRC was requesting this information to inform a potential bid.[46]

14.2 Findings and Recommendations

Because of the lack of responsiveness from most county water and resource boards, we were unable to comprehensively identify pending water and wastewater projects. However, we identified resources that were not as useful and a few that could be helpful in the future.

- Online research primarily revealed past infrastructure project information and only limited information on future projects.
- Much of the infrastructure planning takes place at the county level, especially for unincorporated areas where many of the DACs are located.
- While most agencies did not provide information about upcoming projects, one exception was Madera County Department of Water and Natural Resources, which gave a high-level account about current projects underway in rural areas of the county, west of the CA-99 highway.
- The most promising approach to identifying opportunities for underground infrastructure coordination appears to be to the State Water Board's Division of Financial Assistance (DFA) or the Rural Community Assistance Corporation (RCAC) Agencies. We contacted the Regionwide Program Manager at the Central Valley Regional Water Quality Control Board, which is part of the State Water Resources Board. While the Program Manager was not able to comment on specific pending underground water or wastewater projects, he noted that many of the infrastructure projects had received financial assistance from either the State Water Board's Division of Financial Assistance (DFA) or the Rural Community Assistance Corporation (RCAC) and recommended contacting the organizations for pending projects. Based on this recommendation, we reviewed the websites of DFA and RCAC and learned about the following upcoming projects:

[46] We used introductory language that cited the CPUC decision and noted that we were contacting the boards on behalf of PG&E but may still have been perceived as a contractor fishing for bidder information.

- The DFA has an upcoming financing program called the "Clean Water State Revolving Fund" for the 2021 fiscal year. The project priorities include small or severely disadvantaged communities. Both wastewater treatment systems and septic-to-sewer projects are included as eligible projects for funding.

- The RCAC offers an "Environmental infrastructure loan" which provides early funds and pre-development costs to small rural communities for water and waste facility projects prior to state and federal funding. Both organizations may be applicable funding sources for infrastructure improvements in the San Joaquin Valley DAC community areas, and therefore good resources for future projects.

While it was beyond the scope of this project to contact these offices, they could be contacted in a future study. If possible, staff from a state agency or utility should make the initial connection, to highlight the legitimacy of the request (i.e., reduce the likelihood that the request has the appearance of a potential bidder looking for information).

- We found a commercial source that listed 346 California municipal water and wastewater facility projects completed over the past five years.[47] The same source also provides leads to construction projects that are out for bid, although there is a fee to obtain this resource. Once projects have reached the bid stage, however, it may be too late for planning coordination of infrastructure.
- We reviewed the San Joaquin County Department of Public Works website's Groundwater Sustainability Plan.[48] The plan included the City of Lodi Water Facility Expansion and Delivery Pipeline Project, which is expected to be implemented from 2030 to 2033. The team could not find further details on this project but reviewed the type of information that may be found for a pipeline extension project at the city level. The City of Lodi has a "Water Master Plan"[49] on their website that includes the existing City of Lodi Water Master Plan from 2012 and the future distribution system they had planned, including a diagram of the pipeline extension. Thus, City plans, if published before a project starts, may serve as a reference for where pipeline extensions are being planned.

[47] Construction Market Data: A ConstructConnect™ company. "Municipal Water and Wastewater Facility Projects: CMD Group Featured Projects in California." https://www.cmdgroup.com/building-types/water-treatment/california/
[48] Eastern San Joaquin Groundwater Authority. (Website). http://www.esjgroundwater.org/
[49] City of Lodi, CA. *Water Master Plan*. August 2012. http://www.lodi.gov/858/Master-Plans-Reports

Appendix A. Additional Detailed Methodology and Analysis

Raked Weight Inputs

The following population estimate were used as inputs into the raked weighting procedure.

Table 84. Natural Gas Inputs in Raked Weighting Procedure

	No Natural Gas Access	Natural Gas Access
Population estimate	0.83%	99.17%
Raked sample size specification	n=22	n=2,638

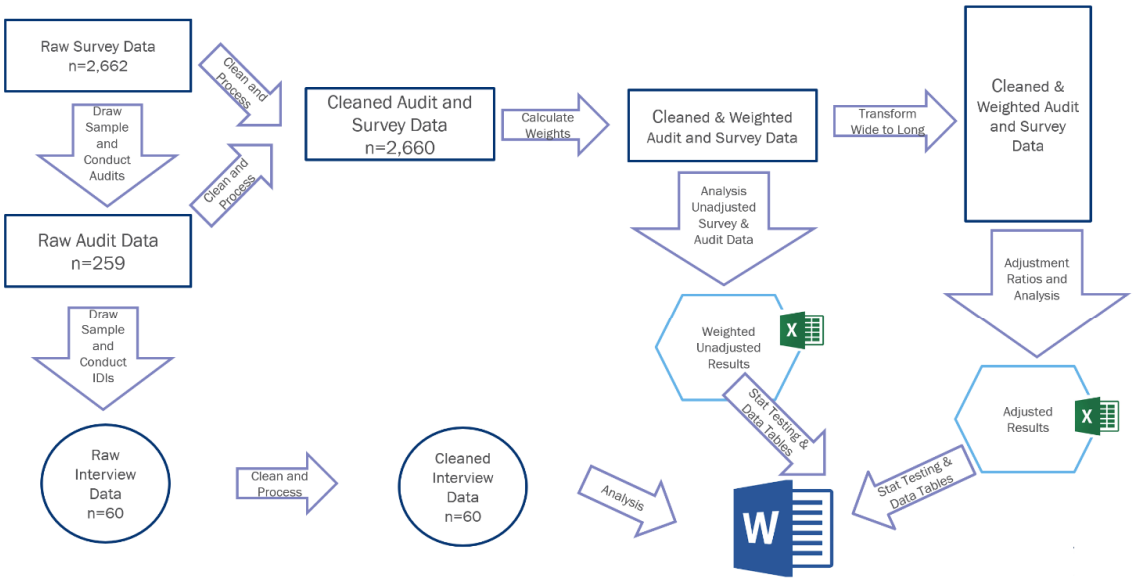
Table 85. Housing Type by Community Size Inputs in Raked Weighting Procedure

	Single Family Detached	Single Family Attached	Mobile Home
Population estimate			
Small Community	2.8%	0.3%	0.8%
Medium Community	18.3%	2.7%	1.2%
Large Community	59.3%	12.5%	2.0%
Raked sample size specification			
Small Community	n=75	n=7	n=20
Medium Community	n=487	n=72	n=32
Large Community	n=1,579	n=334	n=54

Analysis and Adjustment Data Process Flow

This diagram, Figure 13, provides the step-by-step process from data ingestion to adjusted results.

Figure 13. Data Process Flow, Adjusted Results



DAC Outreach and Data Collection Completed Surveys

The Working Group decided to stratify the sample by natural gas access, community size, and housing type. We did not stratify the sample by DAC, nor can we provide DAC level results. In this table, we present the non-pilot outreach and invitations sent by DAC as well as the number of households that responded to this outreach and finished at least the initial quantitative survey. There were more responses than listed here but those households did not complete the survey or were excluded in our screening questions because of closed quotas or multifamily properties.

Table 86. Outreach and Completed Surveys by DAC

DAC	Outreach / Number of Invitations Sent	Number of Completed Quantitative Surveys
Acampo CDP	14	1
Alkal Flats CDP	31	1
Allensworth CDP	Pilot (SHE Outreach)	3
Alpaugh CDP	Pilot (SHE Outreach)	1
Armona CDP	455	2
Arvin City	337	28
Atwater City	213	10
August CDP	65	4
Avenal City	44	3
Bakersfield City	2,151	140
Bear Creek CDP	5	0
Bear Valley Springs CDP	1,421	274
Biola CDP	31	0
Boron CDP	167	6
Bowles CDP	16	0
Buttonwillow CDP	117	2
California City City	Pilot (SHE Outreach)	14
Calwa CDP	32	1
Cantua Creek CDP	Pilot (SHE Outreach)	22
Caruthers CDP	344	9
Cherokee Strip CDP	30	2
China Lake Acres CDP	282	38
Chowchilla City	59	3
Clovis City	351	9
Coalinga City	3,133	173
Collierville CDP	230	26
Country Club CDP	33	1
Cressey CDP	111	12
Cutler CDP	43	4
Del Rey CDP	210	6

DAC	Outreach / Number of Invitations Sent	Number of Completed Quantitative Surveys
Delano City	616	33
Delft Colony CDP	18	0
Denair CDP	6	0
Dinuba City	321	23
Dog Town CDP	18	1
Dos Palos City	39	0
Dos Palos Y CDP	101	12
Ducor CDP	Pilot (SHE Outreach)	17
Dustin Acres CDP	142	9
Earlimart CDP	1,159	15
Earlimart Trico Acres CDP	6	0
East Porterville CDP	239	22
East Tulare Villa CDP	30	3
Easton CDP	99	10
Edmundson Acres CDP	13	4
El Nido CDP	67	5
El Rancho CDP	4	0
Escalon City	35	1
Exeter City	333	27
Fairmead CDP	Pilot (SHE Outreach)	8
Farmersville City	265	18
Fellows CDP	1	0
Firebaugh City	77	2
Five Points	176	0
Ford City CDP	38	3
Fort Washington CDP	5	0
Fowler City	31	2
Franklin CDP	62	5
Frazier Park CDP	612	0
French Camp CDP	58	5
Fresno City	1,155	25
Friant CDP	210	6
Fuller Acres CDP	125	7
Garden Acres CDP	53	2
Goshen CDP	627	15
Grayson CDP	19	0
Greenacres CDP	123	10
Greenfield CDP	24	1
Gustine City	47	2

DAC	Outreach / Number of Invitations Sent	Number of Completed Quantitative Surveys
Hanford City	1,365	29
Hardwick CDP	37	4
Home Garden CDP	78	0
Huron City	30	0
Inyokern CDP	366	17
Ivanhoe CDP	109	8
Johannesburg CDP	109	6
Kennedy CDP	67	1
Kerman City	47	4
Kettleman City CDP	25	1
Kingsburg City	288	4
La Vina CDP	98	19
Lake Of The Woods CDP	167	3
Lamont CDP	164	11
Lanare CDP	Pilot (SHE Outreach)	0
Lathrop City	215	18
Le Grand CDP	Pilot (SHE Outreach)	41
Lebec CDP	256	2
Lincoln Village CDP	17	0
Lindcove CDP	113	22
Lindsay City	409	20
Linnell Camp CDP	49	2
Livingston City	38	2
Lockeford CDP	94	18
Lodi City	34	2
London CDP	131	5
Los Banos City	171	4
Lost Hills CDP	250	2
Madera Acres CDP	2,474	301
Madera City	197	2
Madonna CDP	14	1
Malaga CDP	12	0
Manteca City	167	5
Maricopa City	56	6
Matheny CDP	62	7
Mayfair CDP	13	0
Mcfarland City	173	9
Mendota City	51	0
Merced City	218	8

DAC	Outreach / Number of Invitations Sent	Number of Completed Quantitative Surveys
Mexican Colony CDP	30	4
Mojave CDP	347	34
Monmouth CDP	30	0
Monson CDP	19	1
Monterey Park Tract	29	6
Newman City	44	1
Oakdale City	107	3
Oildale CDP	404	20
Orosi CDP	226	13
Parksdale CDP	91	8
Parkwood CDP	31	0
Parlier City	347	9
Patterson Tract CDP	127	10
Perry Colony CDP	33	2
Pixley CDP	361	18
Plainview CDP	42	2
Planada CDP	35	2
Poplar-Cotton Center CDP	440	3
Porterville City	1,925	70
Raisin City CDP	72	3
Richgrove CDP	362	1
Ripperdan CDP	20	2
Riverbank City	75	3
Rolinda CDP	6	0
Rosamond CDP	1,216	124
San Joaquin City	62	0
Sanger City	59	4
Santa Nella CDP	265	22
Selma City	185	12
Seville CDP	Pilot (SHE Outreach)	14
Shafter City	360	28
Smith Corner CDP	25	2
South Dos Palos CDP	51	0
South Taft CDP	62	6
Springville CDP	307	20
Stevinson CDP	90	10
Stockton City	465	8
Strathmore CDP	240	12
Sultana CDP	48	4

DAC	Outreach / Number of Invitations Sent	Number of Completed Quantitative Surveys
Sunnyside CDP	26	0
Taft City	69	4
Taft Heights CDP	56	10
Taft Mosswood CDP	35	3
Tarpey Village CDP	8	0
Tehachapi City	322	34
Terminous CDP	203	39
Terra Bella CDP	371	16
Teviston CDP	160	4
Thornton CDP	38	0
Three Rocks CDP	6	0
Tipton CDP	291	10
Tonyville CDP	24	1
Tooleville CDP	49	2
Tracy City	133	4
Tranquillity CDP	40	1
Traver CDP	67	3
Tulare City	1,384	74
Tupman CDP	44	4
Tuttle CDP	16	2
Valley Acres CDP	80	9
Valley Home CDP	80	16
Visalia City	2,977	166
Volta CDP	76	8
Wasco City	272	29
Weedpatch CDP	80	6
West Goshen CDP	Pilot (SHE Outreach)	15
West Park CDP	120	16
Westley CDP	18	0
Winton CDP	80	8
Woodlake City	254	16
Woodville CDP	292	6
Yettem CDP	39	1

Energy Burden Detailed Tables

This section presents detailed results tables including total costs and energy burden by natural gas access, home ownership, community size, and CARE eligibility.

Table 87. Total Costs and Energy Burden by Natural Gas Access, Community Size, and Home Ownership

	n	Total Costs	Energy Burden
Natural Gas, Community Size, Home Ownership			
Natural Gas, Small Community, Renter (a)	39-45	$1,468	6.5%
Natural Gas, Small Community, Owner (b)	58-66	$1,518	4.7%[d]
Natural Gas, Medium/Large Community, Renter (c)	213-243	$1,469	5.5%[d]
Natural Gas, Medium/Large Community, Owner (d)	310-382	$1,801[bc]	3.7%
No Natural Gas, Small Community, Renter (e)	76-89	$2,148[ag]	10.3%[afg]
No Natural Gas, Small Community, Owner (f)	209-250	$2,474[be]	8.1%[bh]
No Natural Gas, Medium/Large Community, Renter (g)	118-130	$1,743[c]	6.5%[h]
No Natural Gas, Medium/Large Community, Owner (h)	430-524	$2,454[dg]	5.0%[d]

a/b/c/d/e/f/g/h Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ef,gh,ac,bd,eg,fh,ae,bf,cg,dh.

Table 88. Total Costs and Energy Burden by Natural Gas Access, Home Ownership, and CARE Eligibility

	n	Total Costs	Energy Burden
Natural Gas, Home Ownership, CARE Eligibility			
Natural Gas, Owner, CARE Eligible (a)	208-246	$1,474	5.9%[b]
Natural Gas, Owner, CARE Ineligible (b)	158	$1,952[a]	2.0%
Natural Gas, Medium/Large Community, CARE Eligible (c)	208-232	$1,392	6.5%[d]
Natural Gas, Medium/Large Community, CARE Ineligible (d)	43	$1,786[c]	2.1%
No Natural Gas, Small Community, CARE Eligible (e)	290-322	$2,202[ag]	9.4%[afg]
No Natural Gas, Small Community, CARE Ineligible (f)	347	$2,653[be]	2.9%[b]
No Natural Gas, Medium/Large Community, CARE Eligible (g)	160-170	$1,673[c]	7.7%[ch]
No Natural Gas, Medium/Large Community, CARE Ineligible (h)	33	$2,479[dg]	3.0%[d]

a/b/c/d/e/f/g/h Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ef,gh,ac,bd,eg,fh,ae,bf,cg,dh.

Table 89. Total Costs and Energy Burden by Natural Gas Access, Community Size, and CARE Eligibility

	n	Total Costs	Energy Burden
Natural Gas, Community Size, CARE Eligibility			
Natural Gas, Small Community, CARE Eligible (a)	80-91	$1,409	6.2%[b]
Natural Gas, Small Community, CARE Ineligible (b)	17	$1,791	2.2%
Natural Gas, Medium/Large Community, CARE Eligible (c)	336-387	$1,433	6.2%[d]
Natural Gas, Medium/Large Community, CARE Ineligible (d)	184	$1,919[c]	2.0%
No Natural Gas, Small Community, CARE Eligible (e)	192-206	$2,088[a]	11.1%[afg]
No Natural Gas, Small Community, CARE Ineligible (f)	92	$3,125[beh]	3.5%[bh]
No Natural Gas, Medium/Large Community, CARE Eligible (g)	258-286	$1,977[c]	8.3%[ch]
No Natural Gas, Medium/Large Community, CARE Ineligible (h)	288	$2,588[dg]	2.9%[d]

a/b/c/d/e/f/g/h Indicates significant differences at a 90% confidence level between the following tests:
ab,cd,ef,gh,ac,bd,eg,fh,ae,bf,cg,dh.

Table 90. Total Costs and Energy Burden by Natural Gas Access, Housing Type, and CARE Eligibility

	n	Total Costs	Energy Burden
Natural Gas, Housing Type, CARE Eligibility			
Natural Gas, Mobile Home, CARE Eligible (a)	44-53	$1,315	6.0%[b]
Natural Gas, Mobile Home, CARE Ineligible (b)	11	$1,543	2.6%
Natural Gas, Non-Mobile Home, CARE Eligible (c)	372-425	$1,435	6.2%[d]
Natural Gas, Non-Mobile Home, CARE Ineligible (d)	190	$1,922[c]	2.0%
No Natural Gas, Mobile Home, CARE Eligible (e)	102-111	$1,861[a]	10.1%[afg]
No Natural Gas, Mobile Home, CARE Ineligible (f)	58	$2,658[be]	3.4%
No Natural Gas, Non-Mobile Home, CARE Eligible (g)	348-381	$2,013[c]	8.7%[ch]
No Natural Gas, Non-Mobile Home, CARE Ineligible (h)	322	$2,638[dg]	2.9%[d]

a/b/c/d/e/f/g/h Indicates significant differences at a 90% confidence level between the following tests: ab,cd,ef,gh,ac,bd,eg,fh,ae,bf,cg,dh.

Engineering Analysis – Propane and Wood Cost Estimates

Because self-reported fuel costs could be subject to reporting error, we conducted an engineering analysis to produce an alternative estimate of propane and wood costs that we could compare to the self-reported data. The self-reported alternative fuel costs were not significantly different from the engineering results, giving us greater confidence in the survey-based fuel costs. Here we present further details on the engineering analysis methodology and results.

Methodology

This section provides our methodology and results towards that effort. We estimated annual energy use and bills for homes and for homes with alternative fuels by using the following steps:

a. Analyzed IOU billing data to identify average annual energy usage and bill costs by home type (all homes, single family detached, single family attached, and mobile homes).

b. Estimated costs per unit of fuel, as summarized here:

   i. For natural gas and electricity costs, we used the energy billing data.

   ii. For the alternative fuel costs, we estimated the cost per gallon of propane and cost per cord of wood through online research and phone interviews with vendors in the San Joaquin Valley area.

c. Multiplied the energy use (step 1) by cost (step 2) to determine energy costs of customers that use natural gas and alternative.

Estimated Alternative Fuel Usage

For homes with alternative fuels, we started with the IOU-provided energy usage data for survey respondents that use natural gas for both space and water heating and converted this use to alternative fuels.[50]

Propane Usage

To estimate the energy usage of homes with propane for space and water heating, we assumed that the average energy usage in terms of heat content (BTUs) provided would be the same as natural gas because equipment efficiencies were not expected to differ by fuel type. We converted from therms of natural gas to gallons of propane using energy conversion factors.[51]

Wood Usage

To estimate energy usage of homes with wood space heating and electric water heating, the research team:

- Estimated natural gas energy usage for just space heating based on the billing data and data from the 2009 California Residential Appliance Saturation Survey (RASS). Based on RASS, the team determined that space heating energy usage accounts for about 43% of total natural gas usage in single family homes and 41% in mobile homes.
- Converted natural gas energy usage for space heating to wood energy usage based on the ratio between the wood stove efficiency and furnace efficiency. From the audit data, the median furnace AFUE was 80%. The team assumed that wood stoves had an efficiency of 47%.[52] Assuming that the amount of output heat provided to the occupants would remain the same, the space heating energy needed for wood was calculated to be the natural gas space heating energy usage increased by a factor of 1.71 (80% divided by 47%).
- Used billing data from homes that reported only using wood as their fuel in the survey data to estimate the electricity use for water heating.

Estimated Cost Per Unit of Alternative Fuel

Propane Costs

For propane, the research team contacted four different propane retailers in the San Joaquin Valley to obtain customer propane costs. The team asked each retailer for an estimate of the cost per gallon of propane, delivery charges, and if there were seasonal cost variations or other factors influencing cost. Based on these conversations with retailers, propane costs ranged from $2.52 per gallon to $2.81 per gallon, with an average cost of $2.69 per gallon. Retailers noted that the cost of propane is ever changing based on supply and demand. Retailers also noted that propane costs are higher in the heating season (October through March). The team collected costs in February (during the heating season) so the costs presented are likely at the higher end of annual averages.

Wood Costs

For wood costs, the team contacted five different wood retailers in the San Joaquin Valley. The team asked each retailer regarding the type of firewood available, the cost for a cord of wood, and if the retailer provides delivery services. Based on the phone interviews, wood costs ranged from $265 to $555 per full cord of wood,

[51] 1 gallon of propane = 91,252 Btu, 1 therm = 100,000 Btu. https://www.eia.gov/energyexplained/units-and-calculators/

[52] We estimated wood stove efficiency using EPA data. EPA-certified stoves typically use catalyst, secondary combustion or a combination of the two technologies. Secondary combustion stoves have an efficiency rating from 60% to 80%. The team estimated 70% at the middle range of the combustion stoves. The EPA reports that an EPA-certified stove uses approximately one-third less wood than an old stove. Since most of the homes in the study had older stoves, the wood stove efficiency was reduced by one-third. Wood stove efficiency was therefore assumed to be 47% = 70%*(1-1/3).
https://www.epa.gov/burnwise/brochures-and-flyers-learn-about-burning-wood-right-way
https://www.epa.gov/burnwise/frequent-questions-about-wood-burning-appliances

with an average cost of $352 per full cord of wood. Depending on the business model of the retailer, the delivery fee may be included in the above cost or be a separate cost. The team determined that the two most common wood sold by San Joaquin Valley retailers were oak and almond wood[53], which have an average heat content of 30.48 million Btu per full cord of wood. The heat content was used to determine how many cords of wood would be needed to provide space heating since prices were given per one full cord of wood[54], and the research team used the average cost of $352 per cord.

Engineering Analysis Results

The engineering analysis of propane and wood costs produced similar results to customer reported 2019 total propane and total wood costs. In Table 91, engineering propane estimates are comparable to overall customer reported propane costs for 2019 ($1,064 compared to $1,177). Wood estimates are also comparable overall to customer reported wood costs for 2019 ($273 compared to $379). While the engineering estimates do differ from actual customer reported costs, there are many assumptions that are needed to go into the estimates and the end results are similar, giving us confidence in the customer reported costs.

Table 91. Engineering Estimates for Propane and Wood Costs

Household Description	Propane and/or Wood Cost Estimate
Propane Only Household	$1,064
Wood Only Household (Electric water heating)	$273
Propane and Wood Household (Wood space heating and propane water heating)	$812

[53] Four of the five retailers sold almond wood, two had oak wood, and one sold seasoned citrus wood.
[54] https://firewoodresource.com/firewood-btu-ratings/

Appendix B. Attachments

This section provides the following attachments:

- Finalized Research Plan for the SJV DAC Data Gathering Plan
- Finalized Sampling Plan for the SJV DAC Data Gathering Plan
- Finalized SJV DAC Data Gathering Quantitative Survey Instrument

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