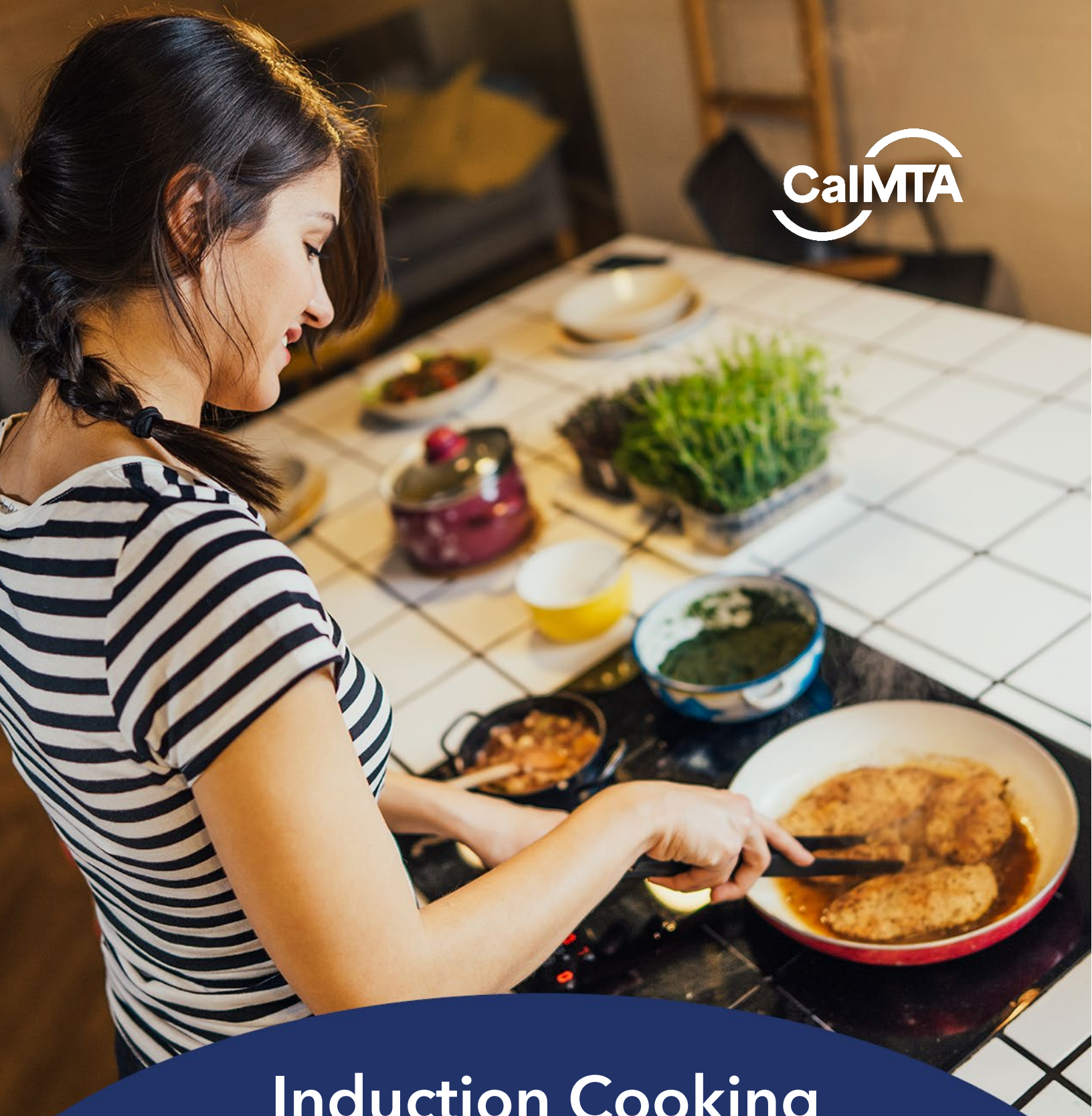

Induction Cooking

Market Characterization Report

CalMTA is a program of the California Public Utilities Commission (CPUC) and is administered by Resource Innovations

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Induction Cooking

Market Characterization Report

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This report is also appended as Appendix D to the Market Transformation Initiative Plan for Induction Cooking.

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List of Abbreviations

Abbreviation	Definition
AC	Air-Conditioning
BEES	Building Energy Efficiency Standards
BUILD	Building Initiative for Low-Emissions Development
CalMTA	California Market Transformation Administrator
CA	California
CCA	Community Choice Aggregation
CEC	California Energy Commission
CPUC	California Public Utilities Commission
D2C	Direct to consumer
DOE	Department of Energy
EPIC	Electric Program Investment Charge
ESJ	Environmental and Social Justice
ETLP	Low-Power-Mode Energy Consumption
eTRM	California Electronic Technical Reference Manual
HEEHRA	High-Efficiency Electric Home Rebate Act
HOMES	Home Efficiency Rebates
IAEC	Integrated Annual Energy Consumption
IAQ	Indoor Air Quality
IOU	Investor-Owned Utility
IRA	Inflation Reduction Act
LBNL	Lawrence Berkeley National Laboratory
LI	Low-income
MT	Market Transformation
MTAB	Market Transformation Advisory Board
MTI	Market Transformation Initiative
MF	Multifamily
NYSERDA	New York State Energy Research and Development Authority
PG&E	Pacific Gas and Electric
RCEA	Redwood Coast Energy Authority
REN	Regional Energy Network
SCE	Southern California Edison
SDG&E	San Diego Gas and Electric
SF	Single-Family
SME	Subject Matter Expert
SMUD	Sacramento Municipal Utility District

1 Executive summary

This Market Characterization report is an output of the Phase II research for the Induction Cooking Advancement Plan, finalized in February 2024.[1] The Advancement Plan outlined a high-level research approach focused on investigating the target market, barriers, and opportunities with the goal of supporting the development of the Induction Cooking Market Transformation Initiative (MTI) Plan. The envisioned long-term market impacts of the MTI are that efficient electric cooktops are required for all newly constructed residential buildings in California, and that in the long-term these cooktops outpace the sale of gas.

With a 70% market saturation, gas ranges are the most prevalent cooking method in California, representing a key opportunity for residential electrification.[2] Additionally, efficient electric cooktops have the added benefit of improving indoor air quality (IAQ) during cooking compared to gas stoves, as electric cooktops don't emit the same pollution generated through combustion of natural gas or propane, and induction cooking offers a safer, cool cooktop that reduces the risk of burns. Consumers who have older, inefficient electric cooktops will also benefit from operational cost savings and improved efficiency when switching to an induction cooktop or ENERGY STAR® electric radiant cooktop.

This report characterizes the California market for residential cooking products, discusses key barriers and opportunities for achieving the envisioned impacts of the MTI from demand and supply-side perspectives, and informs the development of the baseline market forecast of induction and ENERGY STAR-certified radiant cooking products in California.

1.1 Objectives and methods

CalMTA's research objectives were to:

- Characterize the supply-side induction cooking market
- Characterize the demand-side induction cooking market
- Identify sociocultural connections and interventions

[1] https://calmta.org/resources-and-reports/induction-ranges-and-cooktops-advancement-plan/

[2] U.S. Energy Information Administration. (2020). *Highlights for appliances in U.S. homes by state, 2020*. https://www.eia.gov/consumption/residential/data/2020/state/pdf/State%20Appliances.pdf

- Assess opportunities for technology advancement/improvement
- Evaluate policy tools, utility and regulatory landscape
- Characterize the baseline market conditions to inform a market baseline forecast

To inform the market characterization and achieve the research objectives above, CalMTA conducted secondary research and primary research, as summarized in Table 1.

Table 1. Summary of research activities

Audience or task	Research description	Number completed
Secondary research and literature review	Secondary data review and analysis; literature review of evaluation and market reports; regulatory filings; product manufacturer and retailer websites and media	N/A
California stakeholders and subject matter experts (SMEs)	In-depth interviews	21
Manufacturers	In-depth interviews	5
Consumers	Focus groups	6 groups
	Quantitative survey	790
Property managers	In-depth interviews	15
	Quantitative survey	96
Homebuilders and remodelers	In-depth interviews	18
Secret shopping	Retail store visits	8
Delphi panel	A panel of 10 subject matter experts estimated baseline market adoption through a Delphi process, based on market information provided and their market knowledge	1

1.2 Key findings and conclusions

Finding 1: Widespread adoption of efficient electric cooking in the residential sector will require product innovation, panel upgrades, or panel optimization strategies.

Costs associated with panel and other electrical upgrades represent one of the biggest barriers to cooking electrification, according to California stakeholders, manufacturers, property managers, and home remodelers. Studies show that a large proportion of existing households (over 32% of single-family housing units and over 59% of multifamily units) have electric panels with

intermediate capacity (100 amps) or less, posing an immediate obstacle to electrification that either requires panel optimization strategies (for many homes) or panel upgrades (for homes with small capacity panels).[3] Typical panel upgrades range between $2,500 and $5,000 for single-family homes (not including any utility-side service upgrades), with much higher costs for multifamily buildings.[4]

While the vast majority of induction models available to buy today are 240V, there are currently two 120V induction cooking products on the market using battery-equipped technology, which allow for cooking electrification without the cost of electrical upgrades or optimizations while also providing a cooking experience comparable to 240V products. These products, sold by new market entrants, are priced close to $6000 (before any available incentives are applied) and therefore unattractive to most California consumers. When CalMTA asked three large kitchen appliance manufacturers who currently offer 240V induction technology about plans to develop a 120V product to overcome electrification barriers, all three stated that they have no plans to do so. They cited perceived technical issues and performance drawbacks, and cost of research and development. The manufacturers of the 120V battery-equipped solutions do not expect costs to decline substantially in the near term, particularly due to tariffs on battery imports. More support is needed on 120V innovation in order to make this a viable, affordable solution for most Californians, paired with more research and engagement on affordable panel optimization solutions in the short-term, which some stakeholders felt was a viable approach to overcoming electrical panel capacity limitations.

Finding 2: There is an opportunity to build on the interest in induction cooking products among gas users through strategies such as loaner programs and in-person demonstrations.

Fifty-eight percent (n=585) of respondents reported "somewhat" or "very positive" impressions of the technology and 25% of households reported they would prefer induction over other fuels if they were to purchase a new cooktop. Gas cooktop users specifically stated a preference to switch to induction 19% of the time.

Stakeholder interviews and a literature review both support the fact that providing direct experience to cooking with induction cooktops and ranges can mitigate concerns around adoption and support positive experiences with the technology. The majority of stakeholders and

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[3] Fournier, E. D., Cudd, R., Smithies, S., & Pincetl, S. (2024). *Quantifying the Electric Service Panel Capacities of California's Residential Buildings*. *Energy Policy*, 192, 114238. https://www.ioes.ucla.edu/wp-content/uploads/2024/06/2024-Quantifying-the-electric-service-panel-capacities-of-Californias-residential-properties.pdf

[4] Utility-side upgrades could include underground or overhead service connections and new transformers. These costs vary significantly by the service required, and a report by the Association for Energy Affordability and Stopwaste found that utility service upgrades could range between $300 and $80,000.

subject matter experts shared that customers overwhelmingly had a positive response to cooking on induction once they were able to test the technology and became comfortable. Multiple stakeholders cited the power of induction loaner programs and in-person demonstrations to shift customer perceptions of induction. When asked about their interest in this type of program in the CalMTA residential survey, 68% (n=415) of homeowners reported they would be interested in trying out an induction product via a loan program. This concept was particularly appealing to multifamily households. Tailoring loaner programs to environmental and social justice (ESJ) communities may also be helpful for reaching this segment in particular, as low-income households were significantly less likely to say they would purchase an induction cooktop if their current one stopped working compared to their peers. [5]

Finding 3: There is an opportunity to accelerate market adoption of induction cooking products by promoting safety benefits and awareness of induction overall.

There is opportunity to educate Californians on induction cooking products and the benefits that they offer. A large number of survey respondents had either never heard of induction at all (24%), or had heard of them, but didn't know very much about them (60%). Focus group participants were also largely unaware of how induction technology worked, and unaware of the fact that induction cooktop surfaces stay cool as a result of electromagnetic technology instead of radiant heat. When explained, group participants were often heavily drawn to this benefit. Many respondents felt this was particularly appealing for homes with small children or senior citizens.

The reaction to this information among consumers in the focus groups aligned with survey findings: "safety" was cited as a top reason for purchasing the cooktop among induction users surveyed (second only to cooking experience), along with respondents who didn't already have induction but said they would prefer it if they were going to purchase a new cooktop. Over 80% of the customers who stated that induction would be their preferred technology cited safety as a top reason. Property managers also cited safety as a valuable feature, rating the lowered risk of burns as the most important benefit. However, despite this being a strong value proposition for consumers and property managers, CalMTA's secret shopping research found that safety was not promoted as a feature of induction products. The findings instead found most brands touted efficiency, faster cooking time, and easy clean-up.

Additionally, published research on the impacts of cooking with gas, particularly with poor ventilation, concludes that there are significant health benefits from making the switch to electric cooking appliances. A 2023 study estimated 20% of current childhood asthma in California is

[5] 19% of low-income households reported they would be *very likely* compared to 29% of non-low-income households, p <.01.

attributable to gas stove use.[6] Another study by Lawrence Berkeley National Lab (LBNL) found 60% of homes in California that cook at least once a week with a gas appliance can reach pollutant levels that would be illegal if found outdoors.[7] However, CalMTA's focus groups revealed that there is a low awareness of these risks and the corresponding benefits of switching from gas to an efficient electric cooking appliance. Furthermore, the focus group research found a general skepticism about negative impacts on IAQ when participants were asked about this topic. Many participants felt that if there were such health risks, they certainly would have already known about them. Some questioned the credibility of the information.

> "All our generations have been cooking this way for many years and nothing happened. Maybe some people got sick, but it hasn't been proven."
> *–Focus group participant with a gas cooktop*

Survey findings on this topic revealed that health concerns were not a top factor for induction cooktop users in the purchase of their induction cooktop. When gas cooktop users were presented briefly with information about IAQ concerns, this information did not meaningfully change their likelihood to purchase. These results showcase an opportunity for more information and education on the benefits of cooking electrification on IAQ and health, but careful attention should be paid to how these messages are presented and the credibility and the authority of the sources of information about health impacts.

Finding 4: Property managers are interested but cautious about induction.

Multifamily property managers saw benefits to installing induction cooking products and many were open to installing induction in their buildings in the future, with 42% reporting they would be "very likely" to install induction cooking products if undergoing a future renovation or needing to replace an appliance in their managed units. The key benefits of induction technology for property managers were safety and the ability to improve property value and the rentability of their units. However, the research uncovered key barriers for property managers, which included the perception that tenants prefer gas cooking appliances (50% of property managers surveyed stated this). They also expressed concerns about durability and the possibility of repairs, and concern about potential electrical upgrades. In the in-depth interviews, respondents caveated their openness to installing induction with the fact that the cost of doing so would need to be supported by the ability to increase rents, with some mentioning they felt it would only be the right fit in higher-end properties. Property managers were cautious and conservative until

[6] Gruenwald, T., Seals, B. A., Knibbs, L. D., and Hosgood, H. D. "Population attributable fraction of gas stoves and childhood asthma in the United States." International journal of environmental research and public health 20, no. 1 (2023): 75.
[7] https://ehp.niehs.nih.gov/doi/pdf/10.1289/ehp.1306673

knowing more about tenant preferences and what switching to induction cooking products could really mean for their bottom line.

Finding 5: Induction cooking products are underrepresented at brick-and-mortar retail locations and retail sales associates often promote gas.

Across the stores that the CalMTA team visited, approximately 271 total models of cooktops and ranges were on display, 24 of which were induction models (9%). This contrasted with available models of induction cooking products and ranges found online, which represented 24% of all the cooktops and ranges found during webscraping research. Interactions with sales associates in stores revealed many had a strong preference for gas fuel and lacked firm knowledge of induction technology, or potential rebates and incentives for induction, indicating an opportunity for more education and engagement with this sector.

Finding 6: Home builders and remodelers have been slow to switch to induction; increased consumer awareness and demand, increased production, and falling prices could all help improve adoption in the new construction sector.

Due to the barriers to cooking appliance electrification in existing California homes, new construction and home remodeling represent a key opportunity for increasing adoption of induction cooking products. Most homebuilders and remodelers interviewed (two thirds, or 67%), reported that they do install induction cooking products in some of their projects, though 6 out of 18 interviewees stated they do not install or recommend induction at all. Among those who do install, the frequency varied greatly. For example, among the production homebuilders with whom the team spoke (who focus on building homes at scale with consistent designs), two reported installing induction in only 10% of their new homes while another reported induction went in about 50% of the time, and another reported 100% of their homes had induction cooking products.[8] Custom homebuilders and remodelers reported a much lower prevalence of installs; most (four out of six) said induction went in between 10-15% of their projects.

During in-depth interviews, manufacturers reported that builders represent a large portion of their appliance sales, but also that most of the cooking appliances purchased by builders are not induction. One respondent estimated that builder sales make up 25-30% of the industry – but noted that induction occupies a smaller percentage due to its higher price point. Another manufacturer echoed this, saying that induction sales to builders were "minimal," and that builders were "a less progressive channel" and more focused on radiant or gas options. Other feedback noted that overall cost-sensitivity among builders seemed to be increasing.

[8] Research was qualitative in nature and results should be viewed with caution due to small sample sizes.

However, some production builders reported that even if they wanted to install induction, getting induction at the scale they needed was difficult. One respondent stated, "We just couldn't get enough of what we needed to broadly offer it in some areas," making it challenging to offer induction cooking products as a standard feature in their homes. Builders and remodelers also reported cost as a barrier to installing induction cooking products, along with the perception that customers prefer gas.

2 Methodology

2.1 Secondary research and literature review

CalMTA completed a literature review of published research and analyzed available secondary data pertaining to induction cooking. Specifically, the team utilized the U.S. Census and the Energy Information Agency's 2020 Residential Energy Consumption Survey[9] (2020), U.S. Census, and the most recent California Residential Appliance Saturation Study (2019 to 2020) to gain insights into appliance saturation levels, behaviors, and other insights relevant to single-family and multifamily California households.

The team also completed a literature review by reviewing publicly available technical and market research documents, California regulatory filings, dockets, the CA Electronic Technical Resource Manual (eTRM), and conducting searches using tools including Google Scholar, Semantic Scholar, Science.Gov, and general internet research on induction cooking products. Lastly, the team analyzed pricing and product availability by webscraping shopping pages and online retailers.

2.2 CA stakeholders and subject matter expert interviews

The CalMTA team developed research questions to gather information from key stakeholders and subject matter experts to inform the market characterization of induction cooking products. These stakeholders and experts spanned multiple categories, including developers, administrators, and implementers of California programming that promote efficient cooking, organizations conducting research and development, standard setting, and pilot efforts supporting deployment of the technologies, and community organizations and/or recipients of pilot funding or other programming. The team also spoke with two subject matter experts working on induction cooking outside of California. The interview guide is included in Attachment 3: Research Instruments.

9 https://www.eia.gov/consumption/residential/, 2023.

2.3 Manufacturer interviews

CalMTA conducted interviews with five manufacturers of induction cooking products and ranges to understand manufacturing trends and perceptions of market barriers and opportunities. CalMTA reached out to nine priority manufacturers in the cooking appliance sector, which included two start-up companies with a niche focus on battery-equipped induction technology. Contact information was gathered via personal relationships and knowledge, secondary internet research, and snowball sampling – that is, asking respondents to help identify and refer additional participants from their social or professional networks. In one instance, representatives from one manufacturer reached out to CalMTA. Five of the manufacturers engaged took part in in-depth interviews. Generally, interviews were conducted in a group setting, with multiple representatives in the interview spanning company departments such as product development, sales, marketing and public relations, and legal. The interview guide is included in Attachment 3: Research Instruments.

2.4 Consumer focus groups

The CalMTA team hired a California-based focus group facilitator who completed six focus groups for induction cooking products, which were segmented by income and region as shown in Table 2. Groups had an average of seven participants and included both renters and homeowners.

Table 2. Summary of focus group segmentation

Region segment	Income segment	Number of groups	Language
Coastal	Market rate	1	English
Coastal	Low-income	2	English
Inland	Market rate	2	English
Mountains	Low-income	1	English
Total		**6**	

Screener criteria and discussion guide

Low income was defined as at or below 80% of the median area income.[10] Low-income segments were screened using customized income thresholds for each county, as defined by the California Department of Housing and Community Development. Other screening criteria for all segments were that the participants must be between the ages of 35-65 and a joint or primary decision-

[10] According to Assembly Bill 1550, low-income communities and households are defined as those who live in census tracts or households at or below 80% of the statewide median income or meeting the threshold designated as low-income by the California Department of Housing and Community Development's Revised 2021 State Income Limits.

maker in their household for large purchases, had to use their cooktop for cooking meals at home at least three times a week, and had to have a smart phone with ability to install an ethnographic data collection app for use prior to the focus group. The screener and discussion guide are included in Attachment 3: Research Instruments.

2.5 Residential consumer survey

The team surveyed a sample of California's general population of residential customers to establish baseline saturations of cooktop fuel types and baseline trends such as consumer awareness and attitudes. The survey was offered in Spanish and English and explored consumers' willingness to consider induction cooking and electric radiant products in future purchases, factors that may potentially aid adoption, and barriers. Respondents included homeowners and renters in single-family and multifamily homes.

Sampling plan

The online panel was purchased through Qualtrics, a panel aggregator. CalMTA used a stratified random sampling approach, in which quotas were established for climate region, housing type, and income category to ensure a robust response from key segments and established a total target of 800 completed surveys. The team tracked electric utility territory (Pacific Gas and Electric (PG&E), Southern California Edison (SCE), San Diego Gas and Electric (SDG&E), and others) but did not establish investor-owned utility (IOU) quotas. Upon data review, the team removed 10 responses due to poor response quality, resulting in a total of 790 completed surveys. After a one-week fielding period, quotas were relaxed in order to improve study efficiency and timeliness.

The sampling plan was designed to produce results with 90% confidence ±10% precision at the stratum level.

Table 3 contains the final sample by key segments.

Table 3. Achieved residential sample

Strata	Single-family		Multifamily		Mobile		Total
	Low-income	Non-low-income	Low-income	Non-low-income	Low-income	Non-low-income	
Coastal: All	51	59	78	49	19	6	262
PG&E	31	19	32	18	13	1	114
SCE	5	15	12	15	3	2	52
SDG&E	9	13	21	8	0	1	52
Other	6	12	13	8	3	2	44
Inland: All	111	189	131	55	41	10	528

Strata	Single-family		Multifamily		Mobile		Total
PG&E	41	59	28	7	6	2	143
SCE	36	65	47	21	17	3	189
SDG&E	3	10	4	1	7	4	29
Other	31	46	52	26	11	1	167
Total	**162**	**239**	**209**	**104**	**60**	**16**	**790**

Strata definitions

Consistent with the focus groups, the low-income segment was defined as households at or below 80% of the median area income, where median area income aligned with income thresholds defined for county by the California Department of Housing and Community.

Single-family was defined as single-family detached homes and attached homes with up to three units; Multifamily was defined as condominiums or apartment buildings with four or more units and Mobile was defined as a mobile or manufactured home.

Coastal and Inland were defined by assigning respondent's zip code to the appropriate California Energy Commission (CEC) Building Climate Zone and further categorized. See Attachment 1: Weighting Methodology for more details.

Weighting approach

CalMTA weighted the survey results to the population using statewide population statistics on household income, housing type, climate zone (mapped with zip codes), and IOU customer base. A detailed methodology on the approach is found in Attachment 1: Weighting Methodology.

2.6 Multifamily property manager interviews

CalMTA conducted 15 qualitative interviews with multifamily property owners to understand the considerations and challenges faced by this audience in adopting induction cooking products. (The interviews also explored topics pertaining to heating, cooling, and room heat pumps.) The interviews aimed to provide insight into the nuanced perspectives of building owners or managers within the multifamily sector.

CalMTA targeted property management companies managing buildings in coastal and inland regions and sought to include representation from those serving Priority Populations.[11] The team used the California Apartment Association directory, Zillow, and Apartments.com to build the sample frame, gather contact information, and hone recruitment efforts by region. Participants in the interviews were recruited via a mix of email and phone calls and were offered an incentive to complete an interview. Table 4 contains the number of completed interviews by region and priority population status. The interview guide is found in Attachment 1: Research Instruments.

Table 4. Count of interviews by climate region and priority population status

Climate region	Coastal	Inland	Total
Priority population	5	6	**11**
Not priority population	4	0	**4**
Total	**9**	**6**	**15**

2.7 Property manager survey

The team surveyed a sample of California based multifamily and single-family building owners and property managers who own or manage five or more units. The goal of the survey was to establish baseline saturations of induction technologies and baseline trends such as awareness and attitudes towards induction. The survey was offered in English and explored willingness to consider induction in future purchases, factors that may potentially aid adoption, and barriers to adoption.

Sampling Plan

An online panel was purchased through Qualtrics, a panel aggregator that sources participants from a variety of sample providers to supply a network of diverse, quality respondents for the study. CalMTA used a stratified random sampling approach, in which quotas were established for climate region, housing type, classes of properties in your portfolio, types of units (market rate or affordable housing), and utilities category to ensure a robust response from key segments and

[11] Priority populations, as defined by the California Air Resources Board, are census tracts categorized as either low-income or disadvantaged communities (DACs). See map here: Priority Populations 2023 (ca.gov).

DACs, designated by the California Environmental Protection Agency (CalEPA) as per Senate Bill 535, are defined by CalEnviroScreen 4.0: https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40

According to Assembly Bill 1550, low-income communities and households are defined as those who live in census tracts or households at or below 80% of the statewide median income or meeting the threshold designated as low-income by the California Department of Housing and Community Development's Revised 2021 State Income Limits.

established a total target of 96 completed surveys. The team also tracked electric utility territory but did not use quotas. 100 surveys we completed.

The sampling plan was designed to produce results with 90% confidence ±10% precision at the stratum level. Table 5 contains the final sample disposition by key segments.

Table 5. Sample plan by key segments

Utility	Target (n) Property Managers
PG&E	24
SDG&E	24
SCE	24
Other	24
Total	**96**

2.8 Homebuilders and remodelers interviews

CalMTA conducted interviews with 18 homebuilders and remodelers. The purpose of the interviews was to gain an understanding of the perspectives, experiences, and considerations related to the use and specification of induction cooking products and ranges in residential new construction and remodeling projects.

The sample was a convenience sample, with contacts developed through snowball sampling and compiling best available public information. To develop the sample frame, CalMTA researched industry networks and associations including the National Association of Home Builders and the National Association of Minority Contractors to generate builder and remodeler contact information and worked with the implementers of the California Energy-Smart Homes Program and the California Electric Homes program to leverage their participant lists.

The final sample represented a mixture of remodelers, production, and custom homebuilders who provided feedback on procurement and specification of induction cooking products (Table 6). While the team sought to achieve a diverse sample, no quotas were set.

Recruitment involved email invitations, follow-up phone calls, and a financial incentive in the form of a Visa gift card.

Table 6. Homebuilder and remodeler interviews conducted

Participate in statewide new construction program	Homebuilders	Remodelers	Both homebuilders and remodelers	Total
Participant	2	0	0	2
Non-participant	4	9	3	16
Total	**6**	**9**	**3**	**18**

The interview guide is included in Attachment 3: Research Instruments.

2.9 Retail store visits

CalMTA conducted eight in-person retail visits to big box stores in Northern and Southern California to assess the prevalence of induction cooking products stocked and on display at major retailers, and to assess sales associates' awareness and promotional messaging. The objectives were to qualitatively assess stocking and promotional trends; store visits were not representative of the entire state.

Secret shopping visits were at the following retail chains and locations:

- Two Home Depots (Alameda County and L.A. County)
- Two Best Buys (Alameda County and L.A. County)
- One Lowes (L.A. County)
- One Costco (Alameda County)
- One Sam's Club (L.A. County)
- One Ikea (Alameda County)

2.10 Delphi panel

CalMTA completed a Delphi Panel to inform the BMA. The Delphi process and findings and how they inform the Baseline Market Adoption Forecast are presented in Appendix B Market Forecasting & CE Modeling Approach.

2.11 Federal policy and regulatory landscape

U.S. Department of Energy (DOE) issued a new rule in June 2024, that amends energy conservation standards for consumer conventional cooking products.[12] The rule sets maximum integrated annual energy consumption (IAEC) levels for gas cooktops and "Electric Smooth Element Cooking Tops," which is the category that includes induction and electric resistance. CalMTA's preliminary analysis of the maximum IAEC for the Electric Smooth Element category (207 kWh/year) is that it would allow most smooth top cooktops (including electric resistance) to comply. The rule will affect products manufactured on or after January 31, 2028.

ENERGY STAR

In October 2023, ENERGY STAR released V1 of their Residential Electric Cooking Appliances specification, for which both electric resistance and induction ranges and cooktops are eligible.[13] (The specification was an update to an earlier ENERGY STAR Emerging Technology Award specification, which was created in 2022 to award highly efficient induction cooking products only.)

In their definition of a "Residential Electric Cooking Product," ENERGY STAR excludes gas appliances, combined cooking products that include a microwave oven component, or electric plug-in countertop burners or griddles. The energy use requirements for electric cooking appliances are defined in terms of IAEC for standalone conventional electric cooking tops, and the annual combined low-power mode energy consumption (ETLP) of the conventional electric oven component of a combined electric cooking product (ETLP,O). The requirement for ENERGY STAR certification is an IAEC ≤ 195 kWh/yr for cooktops and ETLP,O ≤ 7 kWh/yr for the oven component of combined products.

As of August 2024, the ENERGY STAR Residential Electric Cooking Products Qualified Product List has 68 Electric Residential Cooktops and Ranges. Of these products, 57% were induction and 43% were electric radiant.[14] Of the cooktops and ranges on the list, 54 were 30" and 14 were 36". LG currently has the largest share of ENERGY STAR-qualified induction cooking products. Bertazzoni followed, with 11 models. All qualified cooktops and ranges are designed as built-in/slide-in, have at least four cooking zones (some have five), and require a 240V outlet.

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[12] Regulations.gov.

[13] ENERGY STAR Residential Electric Cooking Products V1.0 Final Specification (Rev. October - 2023).pdf

[14] https://www.energystar.gov/productfinder/product/certified-residential-electric-cooking-products/results

Figure 1. Share of ENERGY STAR electric cooking products by cooking top technology type in August 2024

Source: ENERGY STAR Residential Electric Cooking Qualified Product List, Accessed Aug. 2024

Inflation Reduction Act (IRA) paths

There are two main paths for efficient cooktops to qualify for financial incentives under the IRA that will be delivered by the State of California: The High-Efficiency Electric Home Rebate Act (HEEHRA) program, which helps low- to moderate-income households "go electric" through rebates for ENERGY STAR appliances, and the Home Efficiency Rebates program (HOMES), which will provide incentives for whole home retrofits that deliver at least 20% savings.

Allocation to California includes $291 million for HOMES and $290 million for HEEHRA. California has submitted its application for HOMES and HEEHRA funding to the DOE and is in the process of submitting further planning documents to DOE. As of August 2024, the CEC had not yet finalized the specific measures that will be eligible through HOMES and HEEHRA, though CEC has proposed a HEEHRA Phase I program that includes rebates of up to $840 for qualifying electric stoves, cooktops, ranges, and ovens for low- to moderate-income households. The CEC has not yet scoped or scheduled HEEHRA Phase II or identified eligible measures for HOMES. [15]

California codes and legislation

The Building Energy Efficiency Standards (BEES), or "Title 24" establishes electric ready requirements that seek to minimize panel and electrical costs in electrification of new

[15] https://efiling.energy.ca.gov/GetDocument.aspx?tn=257986&DocumentContentId=93918 and https://efiling.energy.ca.gov/GetDocument.aspx?tn=257705&DocumentContentId=93602.

construction.[16, 17] Specifically, a mandatory requirement[18] established in the 2022 BEES requires that all single-family new construction be electric ready if not all-electric, stating in its Mandatory Requirements section that there must be a 240V, 50A circuit with termination 3 feet or less from cooktop, and that homes must "reserve and label double pole breaker in main panel" for future electric cooktop installation.[19] Induction is used in example case studies in the Statewide Codes and Standards team's Energy Code Ace reference tool,[20] but is not required by code.

Many local California governments have adopted or are considering adopting reach codes that go beyond the requirements of BEES/Title 24 by banning gas in new construction. Sierra Club tracks 76 cities and counties in California with similar policies that ban or limit gas,[21] however, the future of these local codes is uncertain after the City of Berkeley's ban was overturned by a federal court in 2023.[22]

Recently, a bill was also introduced in the California legislature that would require manufacturers of gas cooking appliances to add a warning label regarding the appliance's indoor pollution and potential impact on health. A version of Assembly Bill 2513[23] has passed in both the state Assembly and the state Senate, and at the time of this report it was awaiting signature from Governor.

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[16] https://www.energy.ca.gov/sites/default/files/2022-12/CEC-400-2022-010_CMF.pdf.

[17] "2022 Building Energy Efficiency Standards (BEES) Summary." California Energy Commission, August 2021. https://www.energy.ca.gov/sites/default/files/2021-08/CEC_2022_EnergyCodeUpdateSummary_ADA.pdf.

[18] "The Energy Code is conceptually divided into three basic sets. First, there is a basic set of mandatory requirements that apply to all buildings. Second, there is a set of performance standards – the energy budgets – that vary by climate zone (of which there are 16 in California) and building type; thus, the Energy Code is tailored to local conditions, and provides flexibility in how energy efficiency in buildings can be achieved. Finally, the third set constitutes an alternative to the performance standards, which is a set of prescriptive packages that provide a recipe or a checklist compliance approach." California Energy Commission website. https://www.energy.ca.gov/publications/2022/2022-building-energy-efficiency-standards-residential-and-nonresidential.

[19] https://www.energy.ca.gov/sites/default/files/2023-04/Single-family_2022_Energy_Code_Significant_Changes_ADA.pdf.

[20] https://www.energycodeace.com/content/reference-ace-2022-tool.

[21] https://www.sierraclub.org/articles/2021/07/californias-cities-lead-way-pollution-free-homes-and-buildings.

[22] Berkeley, California's natural gas ban just got shot down | Grist

[23] Bill Text - AB-2513 Gas stoves and ranges: warning label. (ca.gov)

2.12 California programs and pilots

Numerous programs promote adoption of induction cooking products and/or ranges in California, through monetary incentives and/or financing, technical assistance, workforce education and training, marketing, and education and outreach campaigns.

CalMTA found that induction incentives have been integrated into both energy efficiency programming and Energy Savings Assistance programming – though in stakeholder interviews, program staff communicated that while certain programs make induction eligible, they may not promote it as thoroughly as other measures or they may require that induction be paired with measures providing deeper savings, especially due to concerns about electric bill impacts. One energy efficiency program administrator described induction as a "second tier" in the decarbonization process. Another energy efficiency program administrator shared that it was a newly offered measure, added to pilot deeper electrification, but that they had not yet completed an installation. Several program administrators expressed hesitancy to promote induction as a stand-alone measure, citing the challenge of the relatively small incremental energy savings of upgrades to induction from previous cooking equipment, combined with the higher cost per BTU of electricity vs natural gas, leading to the possibility for upgrades to induction to create utility bill increases. Similarly, the Energy Savings Assistance Building Electrification pilot is specifically structured to require that space or water heating upgrades take place if participating in the program but leaves induction as an optional measure. Another program that CalMTA reviewed prioritizes installing induction measures only if a project is also installing solar. Interviewed energy efficiency program administrators also expressed skepticism about suitability of induction for certain customers due to the barrier of needing panel or wiring upgrades. One program administrator, when asked whether there were market segments best suited to induction, said that given the prevalence of panel and wiring requirements induction was probably best for higher income customers. Another administrator spoke to aligning their induction offerings with Transformative Climate Communities funding, that could be used for repairs or remediations that their energy efficiency-funded program was not able to cover. One administrator mentioned the need for panel or wiring upgrades being an even greater issue when targeting low- to moderate-income customers, which commonly live in residences with deferred maintenance that further complicates and adds cost to electrical work.

Notable programs that promote or incentivize induction are included in Table 7.[24]

[24] The list of programs offering or promoting induction products in CA is not comprehensive. For more information California Programs, see Appendix D of the Induction Cooking MTI Plan, "Stakeholder Engagement Plan."

Table 7. Programs incentivizing induction or efficient radiant cooktops and ranges

	Name	PA	Description	New construction vs remodels
Statewide	California Energy Smart Homes	PG&E	A statewide program launched in 2022 for all-electric new construction and additions/alterations supporting all types of residential throughout IOU territory. Builders must include multiple measures to qualify for incentives.	Both
Statewide	Building Initiative for Low-Emissions Development (BUILD) Program	CEC	Provides incentives and technical assistance to support the adoption of advanced building design and near-zero emission technologies in new all-electric low-income homes.[25]	NC
Statewide	California Electric Homes Program (CalEHP) BUILD Phase 2	CEC, The Research Corporation (TRC)	Provides incentives to builders for the construction of all-electric market-rate residential buildings and installation of energy storage systems to encourage deployment of near-zero-emission building technologies	NC
Statewide	CA EnergyWise Instant Rebates	SCE, SoCalGas, and PG&E	Offers instant rebates (midstream) for qualifying models.[26] Qualifying electric cooktop models must have a cooking energy efficiency of ≥ 81% utilizing ASTM Standard F1521.	Both
	Induction Cooktop Rebate Program	BayREN	$250 downstream rebate to replace gas cooktop with induction	Alteration (Gas)

[25] https://efiling.energy.ca.gov/GetDocument.aspx?tn=242189&DocumentContentId=75680
[26] https://caenergywise.com/

	Name	PA	Description	New construction vs remodels
	Bay Area Multifamily Building Enhancements (BAMBE)	BayREN	Multifamily prescriptive and custom incentives and advisor	Alteration
	Induction Cooktop Rebates	Redwood Coast Energy Authority (RCEA)	Downstream rebates for electric cooking replacing gas or propane [27]	Alteration (Gas)
	Multifamily Electrification Program	Silicon Valley Clean Energy	New program to help existing deed-restricted affordable multifamily properties transition to all-electric at no cost [28]	Alteration
	FutureFit Fundamentals Installation Incentives	Silicon Valley Clean Energy	Offers up to $5,000 in installation incentives for qualified installers to get hands-on experience in installing and using all-electric appliances; participants must complete FutureFit Fundamentals Training Course	Alteration
	Induction Cooktop Rebates	Sacramento Municipal Utility District's (SMUD)	Downstream rebates of $750 rebates for induction cooking products switching from gas; $100 rebates for induction cooking products replacing electric	Alteration

[27] See Electric Cooking Replacing Natural Gas or Propane within the RCEA Catalog: https://redwoodenergy.org/residential-rebate-catalog/.

[28] "Re: Docket 22-Decarb-03 - Silicon Valley Clean Energy Response to The Equitable Building Decarbonization Direct Install Program" November 15, 2023. https://efiling.energy.ca.gov/GetDocument.aspx?tn=253134&DocumentContentId=88338.

Rebate eligibility varies. CalMTA reviewed some programs that require the baseline equipment to be a gas cooktop or range (for example, RCEA[29] and BayREN[30]). Other programs are structured to offer higher rebates for gas replacements than electric (for example, SMUD's incentives[19]). Rebates may also be structured to reflect income: for example, the City of Santa Monica's Electrify Santa Monica Rebate Program offers $800 rebates for induction but increases that to $1400 for qualifying low-income households.[31]

Induction cooking products and ranges are promoted through marketplaces such as PG&E's Energy Action Guide Top Energy Products search option.[32] The statewide outreach and education campaign, The Switch Is On, also promotes induction and provides a searchable database of rebates available across California.

The Golden State Rebate program, an instant discount (midstream) program supported by the four large IOUs, is not rebating induction at this time. In stakeholder interviews, program administrators noted that they defer to guidance from workpapers in the California eTRM to determine what may be eligible for incentives. Based on recent analysis of the CPUC Approved workpaper on Induction Cooking[33] program staff communicated that induction cooking would not be included in the Golden State Rebate program for the time being due to cost-effectiveness (citing specifically that the total system benefit was low) but may be reviewed for consideration in the future.

Induction cooktop loaner programs

Induction cooktop loaner programs have become relatively widespread across California and are operated by utilities and other program administrators, as well as cities and non-profits. Select examples of induction cooktop loaner programs (not representing a comprehensive list) are shared below in Table 8.

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29 https://redwoodenergy.org/residential-rebate-catalog/

30 https://www.bayren.org/homeowners/induction-cooktops.

31 https://www.santamonica.gov/media/OSE/Rebate%20Program%20Guide%202023.pdf.

32 https://guide.pge.com/browse/induction.

33 "Measure Characterization: Induction Cooking with or Without Electric Range, Residential." Committed December 26, 2023. Effective Start Date January 1, 2024. https://www.caetrm.com/panels/core/measure/5688/export-pdf/.

Table 8. Induction cooktop loaner programs

Name	PA	Description
PG&E Induction Cooktop Loaner Program	PG&E	Loaner program operated via Frontier Energy Food Service Technology Center [34]
SCE Induction Cooktop Loaner Program	SCE	Loaner program operated via Foodservice Technology Center [35]
Induction Cooktop Loaner Programs (City-led)	City of San Jose	Loaner program with marketing/FAQ
	City of San Mateo	
	City of Piedmont	
	City of Hayward	
Induction Cooktop Checkout	Sonoma Clean Power	Loaner program operated by Sonoma Clean Power [36]
Sacramento Public Library	Library of Things/SMUD	Loaner program operated by the Library, with support and demonstration offerings by SMUD
Electric Home Cooktop Program	San Diego Green Building Council	Loaner program operated by San Diego GBC and supported by City of Solana Beach, Carlsbad MyGeneration Campaign of the Sierra Club, San Diego 350, Climate Action Campaign [37]

120V Copper Pilot

Battery-equipped 120V solutions are being explored for their potential to serve rural hard-to-reach communities where resiliency is a top concern.

Through CalNEXT, a 120V pilot is moving forward with the goal to replace propane fueled stoves in the Cher-Ae Heights Indian Community of the Trinidad Rancheria with battery-equipped 120V induction stoves (the "Charlie" product manufactured by Copper). The results of the project will provide CalNEXT and the IOUs with electrical operational data, customer testimonials, and program development recommendations. (At the time CalMTA completed stakeholder interviews in February 2024, the units supported by the pilot had not yet been deployed.)

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[34] https://redwoodenergy.org/residential-rebate-catalog/

[35] https://www.sce.com/factsheet/InductionCookingFactSheet.

[36] https://sonomacleanpower.org/induction-cooktop-check-out

[37] https://www.sd-gbc.org/electric_home_cooktop_program_launch

2.13 Health benefits of cooking electrification

Cooking with gas stoves creates pollutants like nitrogen oxides, particulate matter (PM2.5), carbon monoxide, and other pollutants, many of which are lung irritants. The CalMTA team completed a literature review of published studies on the health impacts of gas cooking and the associated health benefits of electrifying. The review found that the link between nitric oxide and nitrogen dioxide (collectively known as nitrogen oxides, or NOx) and childhood asthma has become a visible health issue, affecting Californians in particular.

A 2023 study estimated 20% of current childhood asthma in California is attributable to gas stove use, which is the second highest among the states with available data (Illinois is highest with 21.1%, and the US-wide estimate is around 12.7%).[38] However, this problem isn't new: in 2013, another team of scientists estimated that children living in households that use gas stoves for cooking are 42% more likely to have asthma than without gas stoves.

A 2022 study[39] found that families who don't use their range hoods or who have poor ventilation can surpass the national standard of nitrogen dioxide concentration (100 ppb) within a few minutes of cooktop or stove usage. On the topic of ventilation, studies have shown that less than 35% of California residents use range hoods when cooking, and many homes in the U.S. lack range hoods or ventilation altogether,[40, 41] a fact that further raises concerns about the health threats of gas cooking. A study by LBNL found that 60% of homes in California that cook at least once a week with a gas cooktop can reach pollutant levels that would be illegal if found outdoors.[42]

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[38] Gruenwald, T., Seals, B. A., Knibbs, L. D., and Hosgood, H. D. "Population attributable fraction of gas stoves and childhood asthma in the United States." International journal of environmental research and public health 20, no. 1 (2023): 75.

[39] Lebel, E. D., Finnegan, C. J., Ouyang, Z., and Jackson, R. B. "Methane and NO x emissions from natural gas stoves, cooktops, and ovens in residential homes." Environmental science & technology 56, no. 4 (2022): 2529-2539.

[40] Zhu, Y., et al. "Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health in California." Center for Occupational & Environmental Health, 2020. Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health in California – Center for Occupational & Environmental Health (ucla.edu)

[41] Singer, B. C., Chan, W. R., Kim, Y. S., Offermann, F. J., and Walker, I. S. "Indoor air quality in California homes with code-required mechanical ventilation." Indoor air 30, no. 5 (2020): 885-899.

[42] https://ehp.niehs.nih.gov/doi/pdf/10.1289/ehp.1306673

In a randomized experiment conducted in 2014,[43] scientists found that the replacement of a gas stove with an electric stove resulted in a 51% decrease in median nitrogen dioxide concentration in the kitchen and a 42% decrease in the bedroom. The same study found that use of air purifiers with high-efficiency particulate air (HEPA) and carbon filters resulted in a 27% and 22% decrease in median nitrogen dioxide concentration in the kitchen and bedroom, respectively.

In addition to indoor pollution, use of gas stoves as well as other gas-based appliances, including water heating and furnaces, affects outdoor (ambient) air quality from gas transmission into the home. Modeling by Zhu et al. (2020) concluded that if all residential gas appliances were replaced with electric alternatives, the reduction of outdoor NOx and PM2.5 would result in 354 fewer deaths, as well as 596 fewer cases of acute bronchitis and 304 fewer cases of chronic bronchitis annually in California. They estimate annual health benefits of $3.5 billion.

A study for the Massachusetts Programs Administrator quantified the annual benefits of reduction in indoor pollutants due to electrification of cooking at $105.95 per household.[44] With around 6.8 million households in California using natural gas for cooking, CalMTA extrapolated the state-wide annual health cost of indoor exposure to gas cooking at around $720 million. The study only quantified a subset of health impacts from gas cooking, so that is a conservative estimate.

Research to quantify the health costs and opportunities to improve IAQ is ongoing. Through the Electric Program Investment Charge (EPIC) grant EPC-21-033, the CEC is currently funding a study to inform state policies related to decarbonization and energy equity by quantifying the IAQ and health benefits of cooking electrification and exposure reduction interventions in the homes of children with asthma.[45]

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[43] Paulin, L. M., Diette, G. B., Scott, M., McCormack, M. C., Matsui, E. C., Curtin-Brosnan, J., et al. "Home interventions are effective at decreasing indoor nitrogen dioxide concentrations." Indoor Air 24, no. 4 (2014): 416-424.

[44] NMR Group, Inc. and Three. (2022). Residential Gas-to-Electric Stovetop Conversion NEIs Study (MA22X03-E-GSCNEI) Interim Report. https://ma-eeac.org/wp-content/uploads/MA22X03-E-GSCNEI_Gas-to-Electric-Stovetop-NEIs-Study-Interim-Report_Final_2022.11.01.pdf

[45] "The Cooking Electrification and Ventilation Improvements for Children's Asthma (CEVICA)." https://www.energizeinnovation.fund/projects/cooking-electrification-and-ventilation-improvements-childrens-asthma-cevica.

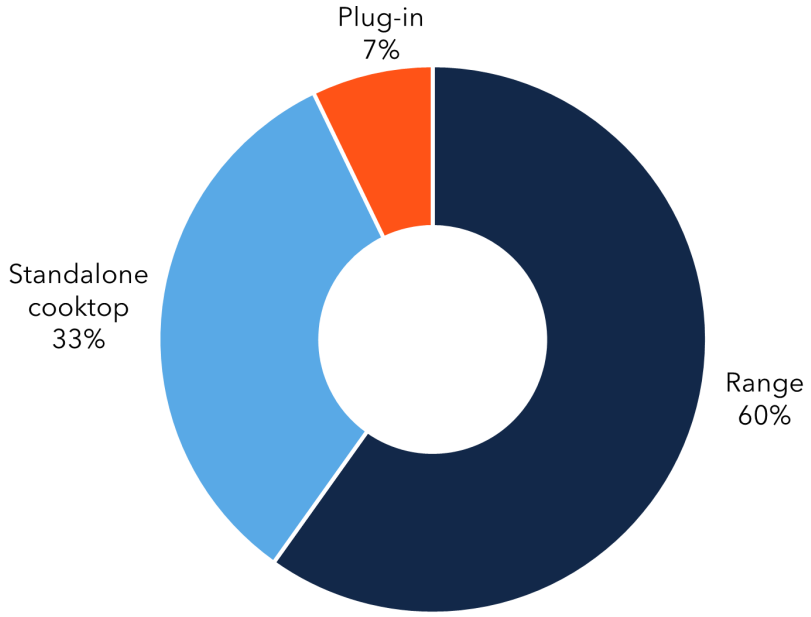
3 Demand-side characteristics

3.1 Target market characteristics and baseline market saturation

Figure 2 presents the types of cooking products used by California residents in their kitchens. CalMTA asked participants to identify their cooktop type, choosing from range, standalone, or plug-in cooktops. If respondents had multiple types, they were asked to indicate which one they used most frequently. Figure 2 below illustrates the primary cooking products used by Californians.

The most common type is a range, which includes an attached oven, used by 60% of survey respondents (n=790). Standalone cooktops, which are installed in the kitchen counter or island without an attached oven, are used by 33% of Californians. Plug-in cooktops, which are portable and typically have only 1-2 burners, are the least common, used by 7% of California residents. Product types in single-family and multifamily homes were similar.

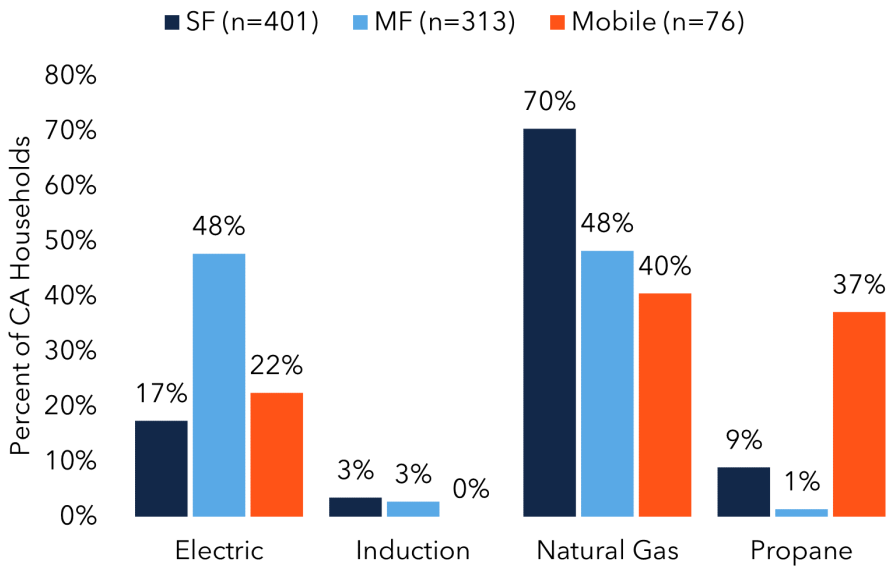
Figure 2. Primary cooking product type among California households



Source: Residential Survey QC1. "First, I'd like to ask you about the type of cooktop you use to prepare your meals. There are several types of cooktops. Please select the type(s) you have in your kitchen from the following list. Select all that apply." (n=790) C2. "It looks like you have more than one type of cooktop. For the purposes of this survey, please select the one you use the most." (n=48). Responses to C1 and C2 were merged so respondents selected their primary cooktop.

Figure 3 details the fuel types used for cooktops across Californian households. Overall, 27% of households use electric (non-induction), 3% use induction, 62% use natural gas, and 7% use propane (n=790). There were significant differences in fuel types across housing types. Electric cooking products are significantly more prevalent in multifamily (MF) households while single-family (SF) households were more likely to use natural gas or propane.

Figure 3. Cooking fuel type among California residents by housing type



Source: Residential Survey QC4. "What type of fuel does your cooktop use?" (n=790). Some percentages may not total exactly 100% due to rounding. Differences in cooktop fuel type across single-family and multifamily segments were statistically significant, $p < 0.05$.

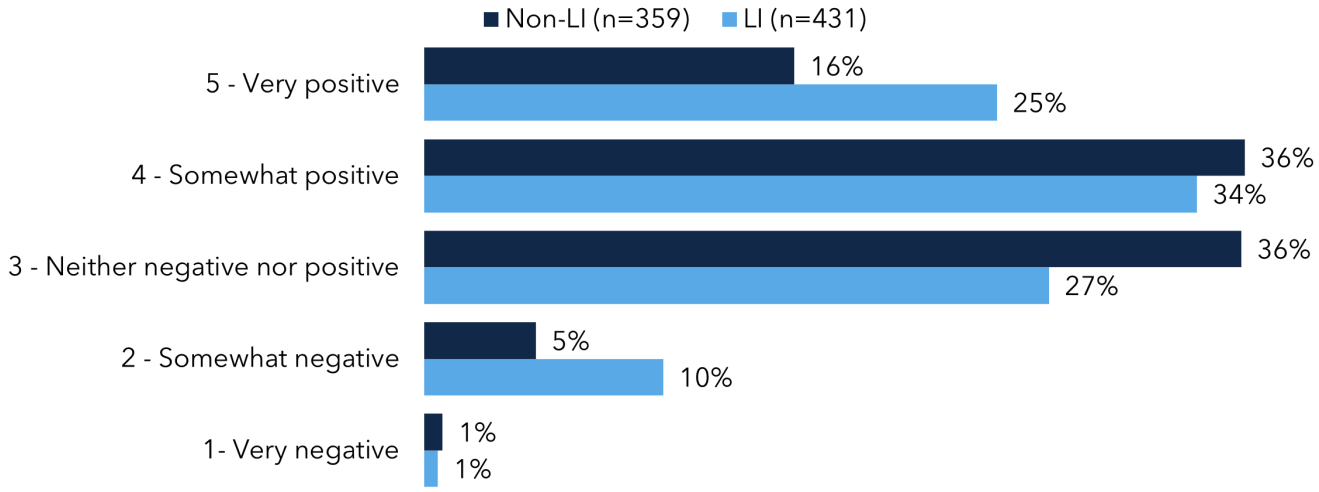
3.2 Consumer barriers and opportunities

Awareness of and attitudes toward induction cooking products

The survey revealed varying levels of awareness and knowledge about induction cooking products. Most respondents (60%, n=790) had heard of induction, but did not know much about it. Another 17% of respondents had heard of induction cooking products and considered themselves knowledgeable about them, while 24% reported never hearing of induction cooking products before participating in the survey. Awareness induction cooking products was not significantly different across income levels, housing types, or home ownership status.

The overall sentiment of Californians toward induction cooking products is positive, with 58% (n=585) of respondents reporting "somewhat" or "very positive" impressions of the technology. This question was asked of all respondents who were aware of induction but did not already own an induction product. There were some differences across income levels, but testing showed they were not significant at the statistical threshold (Figure 4).

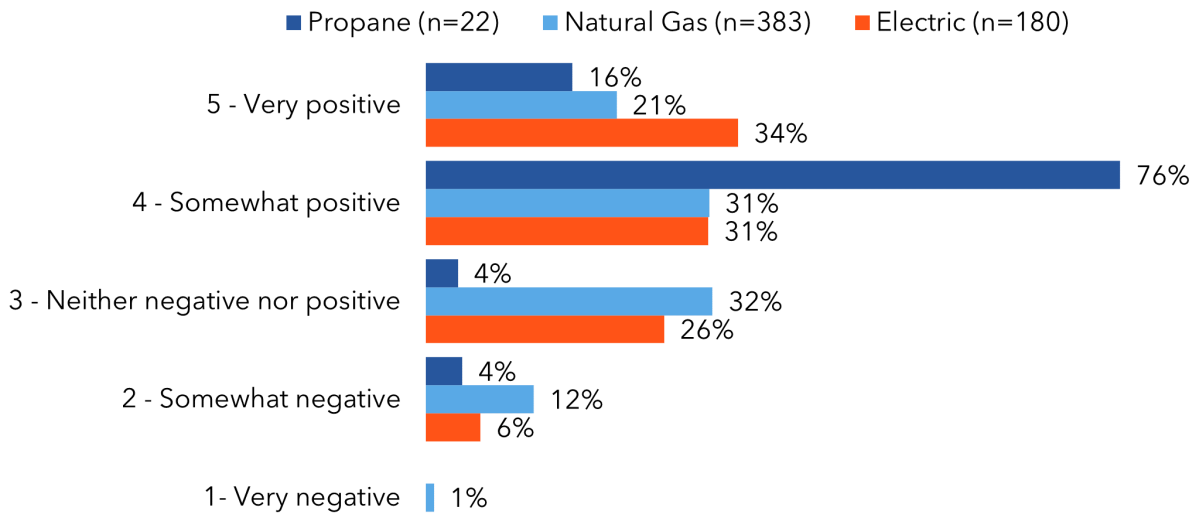
Figure 4. Impressions of induction cooking products by income



LI = low-income. Source: Residential Survey QE2. Based on what you have heard, read, or seen about them, how would you rate your impression of induction cooking products? Please rate your impression on a 5-point scale, where 1 indicates Very negative and 5 indicates Very positive. (n=585) This question was asked of all respondents who were aware of induction but did not already own an induction cooktop.

The team also found that impressions of induction technology varied according to existing fuel type. Electric cooking appliance users were significantly more likely to have a "very positive" impression of induction than gas appliance users, while propane users were more likely to have a "somewhat positive" impression of induction compared to other fuel types. Most electric cooking product owners have positive impressions (65% at least "somewhat positive"). Natural gas users exhibited a more varied range of impressions and while 52% had at least a *somewhat positive* impression, 13% reported either a "somewhat negative" or "very negative" impression.

Figure 5. Impressions of induction cooking products by cooking fuel



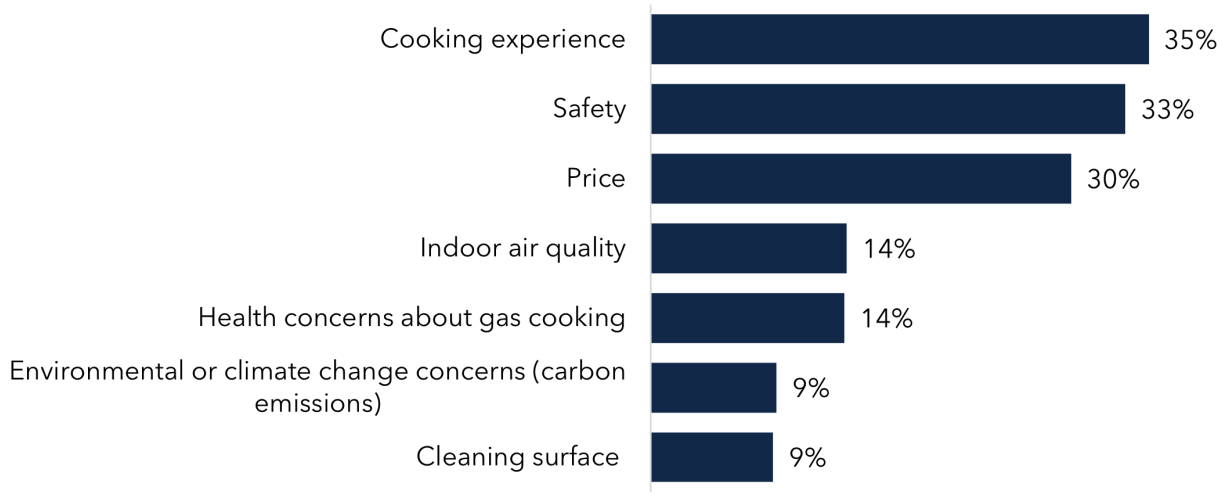
Source: Residential Survey QE2. Based on what you have heard, read, or seen about them, how would you rate your impression of induction cooking products? Please rate your impression on a 5-point scale, where 1 indicates Very negative and 5 indicates Very positive. This question was asked of all respondents who were aware of induction but did not already own an induction cooktop. Electric cooktop users were significantly more likely to have a "very positive" impression of induction than gas cooktop users, p<.05.

Value proposition of induction cooking products

The CalMTA survey found 3% of households already owned an induction cooktop or range (n=790). The survey asked homeowners who had purchased an induction appliance their primary reasons for doing so. Figure 6 illustrates that the top reasons were improved cooking experience (44%) and safety (42%), followed by price for 37% of homeowners.

Health concerns related to gas cooking and IAQ influenced 17% of current induction cooktop owners, while 11% were motivated by environmental or climate change concerns or the ease of cleaning the cooktop surface. Due to the limited sample size (n=14), these results should be interpreted with caution.

Figure 6. Reasons for purchasing induction cooking products among current induction owners

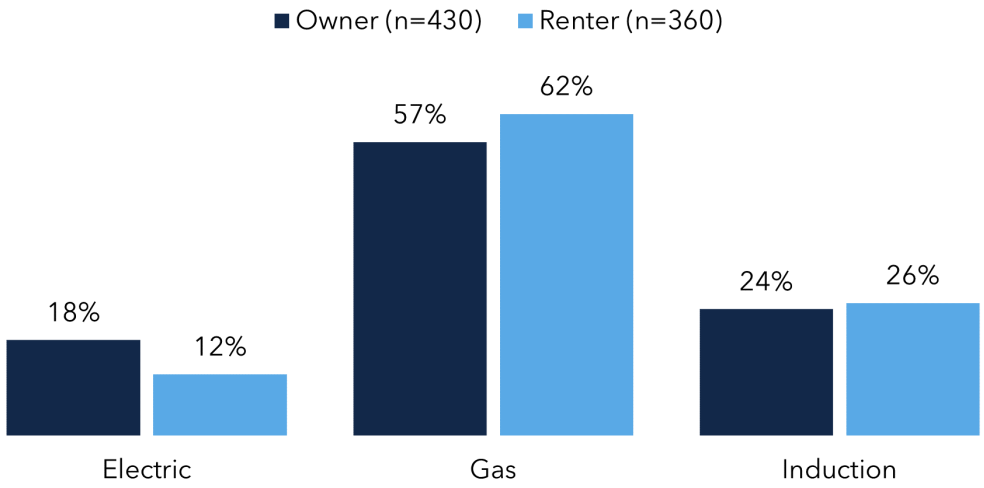


Source: Residential Survey QE4. What were the two most important reasons you chose to purchase an induction cooktop? Select up to two factors in your decision. (n=14). This question was asked of homeowners who own an induction cooktop. Multiple responses allowed; percentages add to over 100%.

Cooktop fuel preferences

The survey asked homeowners and renters what type of cooking fuel they would prefer if they were purchasing a new cooktop or range, or if they were a renter looking for a new home or apartment to rent. Renters and owners were consistent in preferring gas (62% and 57%, respectively). About a quarter of all respondents stated induction as their preferred appliance type, as shown in Figure 7.

Figure 7. Preferred appliance type by homeowners and renters

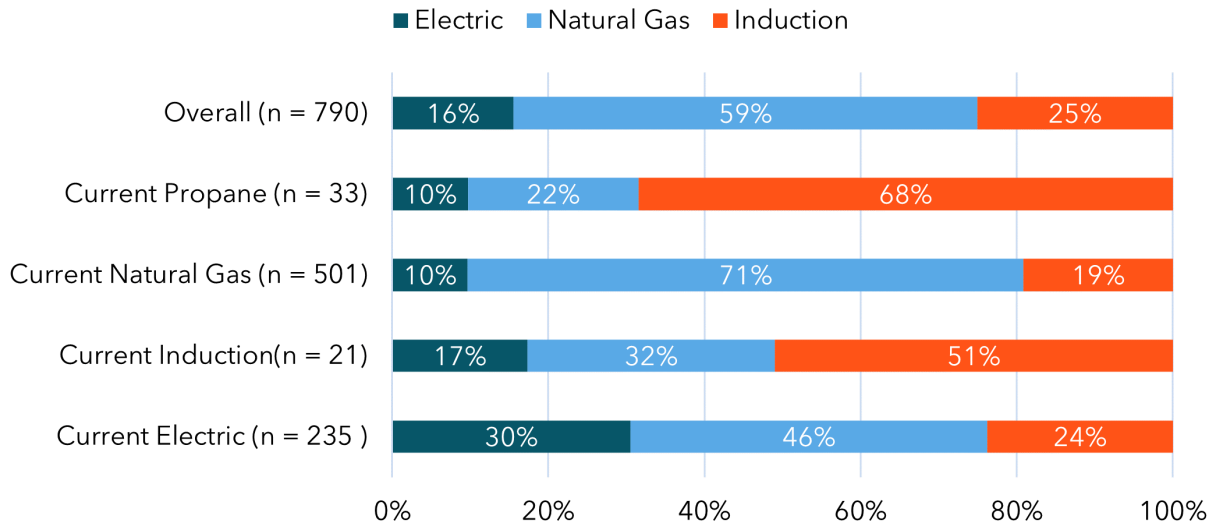


Source: Residential Survey QD1, QD3: "If you were to purchase a new cooktop, which fuel type would you prefer?" "D3: If you were going to rent a new house or apartment, which type of cooktop would you prefer in your new home?"

The team also investigated preferences for fuel type by *current* fuel type. Existing natural gas users were most likely to want to stick with their current fuel, with 71% stating they would prefer a new natural gas cooking appliance. Interestingly, only about half of induction users (n=21) would choose induction again, and 30% of non-induction electric users would choose electric again. Induction users who stated they would want to switch to another fuel type cited concerns about safety, cooking experience, and price.

As for the preferences of the rest of these respondents for their next cooking appliance, the majority stated they preferred to switch to gas. Most propane users, who were not given the choice to stick with propane, stated that they would prefer to switch to induction.

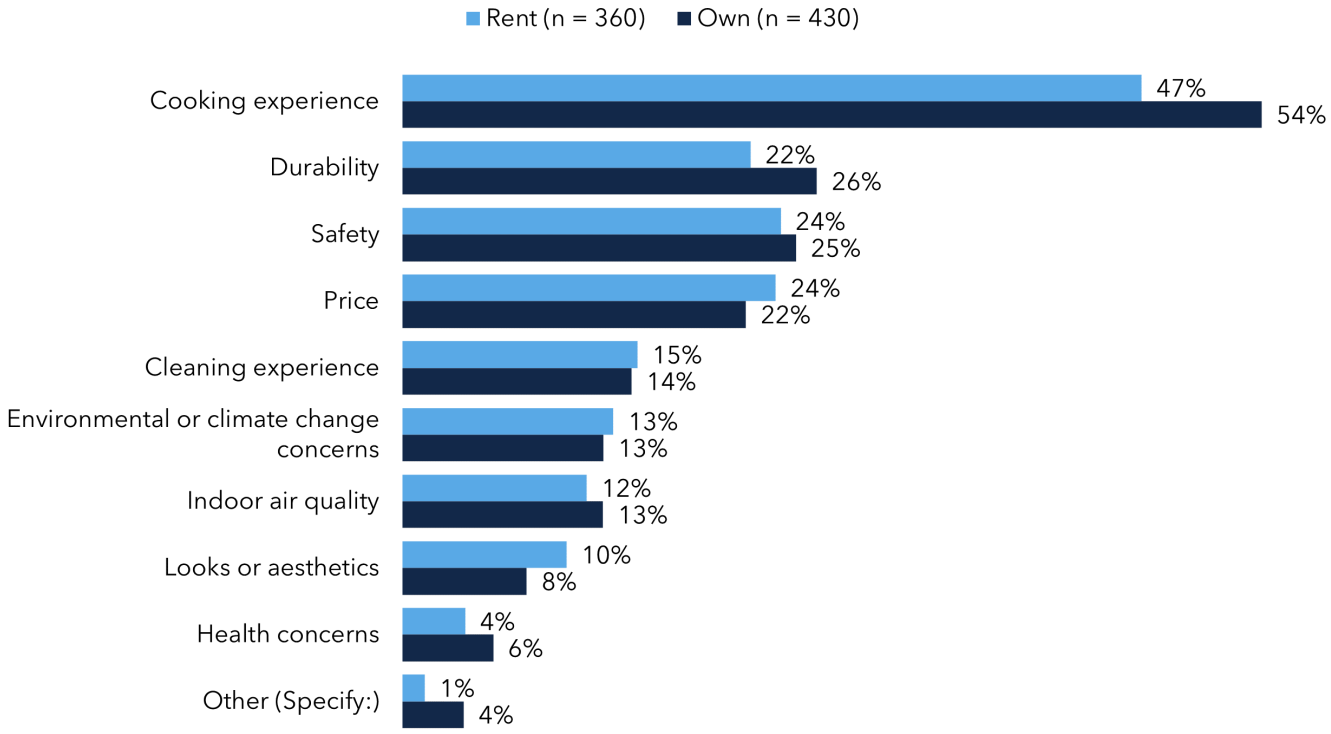
Figure 8. Preference for new cooking appliance type by current type



Source: Residential Survey QD1: "If you were to purchase a new cooktop, which fuel type would you prefer?" (n=430) Source: QD3: "If you were going to rent a new house or apartment, which type of cooktop would you prefer in your new home?" (n=360) NOTE; Current propane respondents were not given the option to stay with propane in the event of an appliance switch; sample sizes for propane and induction users are small and so should be viewed with caution.

After asking for their preferences, the team asked respondents for up to two reasons on why they chose their preferences. Overall, 51% of households stated that they chose their preferences based on the *cooking experience*. This was followed by both *safety* and *durability,* which 24% of households cited. There was a significant difference between renters and owners. Renters stated that the cooking experience, safety, and price are their top reasons for their preference. In comparison, homeowners stated that the cooking experience, durability, and safety are their top reasons (Figure 9).

Figure 9. Reasons for appliance preference by homeownership



Source: Residential Survey QD5: "What would you say are the two most important reasons for your preference?" (n=790) There was a significant difference between renters and owners, p<0.05.

Respondents who do not currently own an induction cooktop but would prefer one (n=166) gave these reasons for their preference:

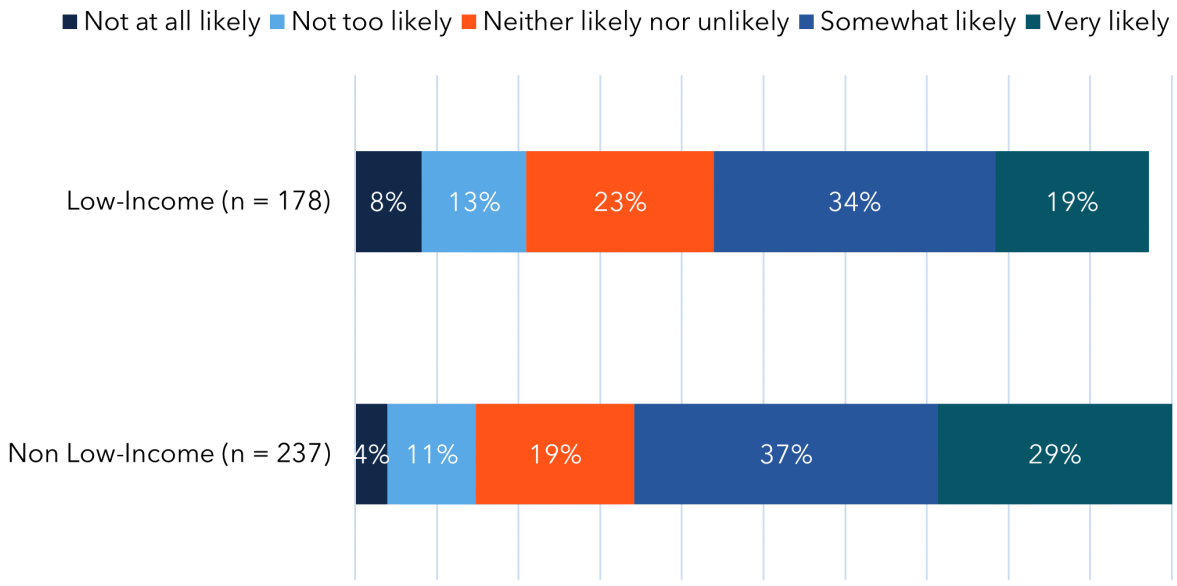
- Safety: 81%
- Cooking Experience: 67%
- Cleaning Experience: 58%
- Environmental or Climate Change Concerns: 43%
- Indoor Air Quality: 37%

Willingness to purchase

After providing respondents with basic information about induction cooking technology and imagery, the survey asked homeowners about their likelihood to purchase an induction product, considering a scenario in which their current cooking appliance needed to be replaced. In total,

28% of homeowners (n=415) said they would be "very likely" to purchase an induction cooktop in this scenario. (An additional 37% said they would be "somewhat likely"). Low-income homeowners (19%) were significantly less likely to want to purchase an induction cooktop than their peers, as shown in Figure 10. Respondents were not provided any cost information or information about electric bill impacts.

Figure 10. Homeowner likelihood to install induction if new appliance was needed, by income



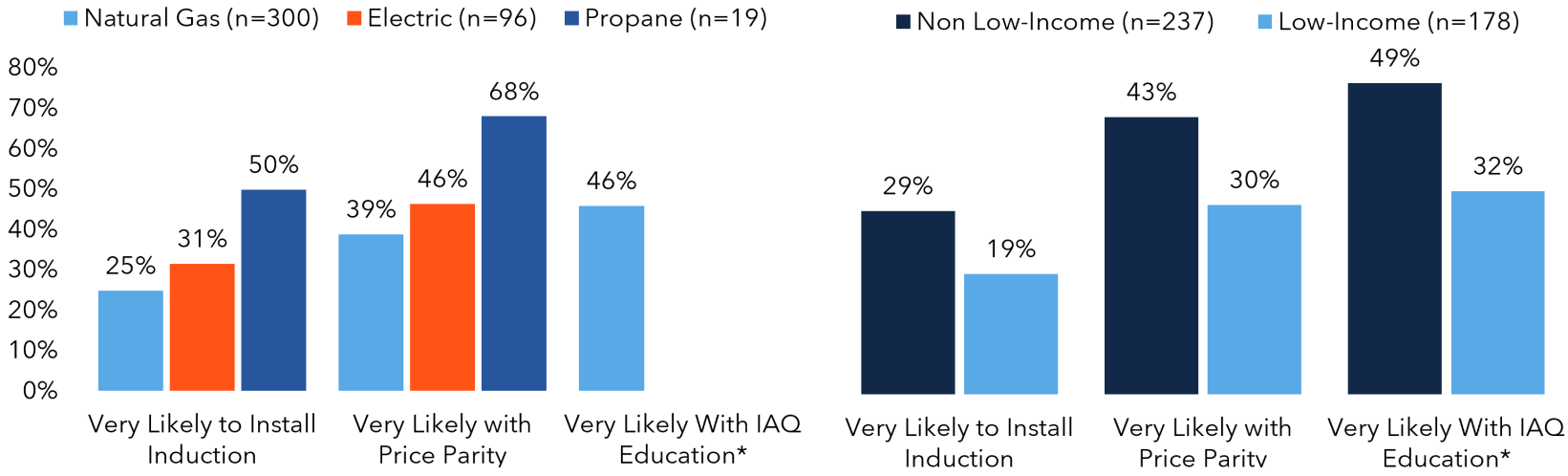
Source: Residential Survey QF1: "Assuming your current cooktop stopped working or you decided to undergo a renovation, how would you rate the likelihood that you would purchase an induction cooktop in the future?" (n=415) Differences between income levels were statistically significant, p<.01. NOTE: Percentages do not add to 100%. A small percentage of respondents answered, "Don't know" and "N/A."

Respondents who provided a response other than "very likely" were next asked follow-up questions to test several opportunities for increasing market adoption. First, these respondents were asked whether their likelihood would change if an induction cooktop were the same or lower price than a similar gas or standard electric model – 68% (n=301) said yes, this would change their likelihood to purchase. Next, gas cooktop respondents were asked, "Studies have shown that the level of pollutants emitted from using gas cooktops when not using ventilation is comparable to that of secondhand smoke. Does this information about the health impacts of cooking with gas change your likelihood to purchase an induction cooktop?" Just over half (51%, n=202) said yes.

Educating respondents on the IAQ impacts of gas stoves led to an additional 6% of non-low-income homeowners with a gas cooktop and an additional 2% of low-income homeowners who stated they would be *very "*likely" to purchase an induction cooktop. Price was more impactful, increasing likelihood to purchase by 11% for low-income and 14% for non-low income-households.

The team also looked at likelihood to purchase induction cooking products by existing cooktop fuel type. Half (50%) of homeowners that use propane as their cooking fuel stated they were *very likely* to purchase an induction cooktop, compared to 31% of electric and 25% of natural gas (Figure 11).[46]

Figure 11. Likelihood to install induction by appliance type and income, with interventions



[46] P < 0.05.

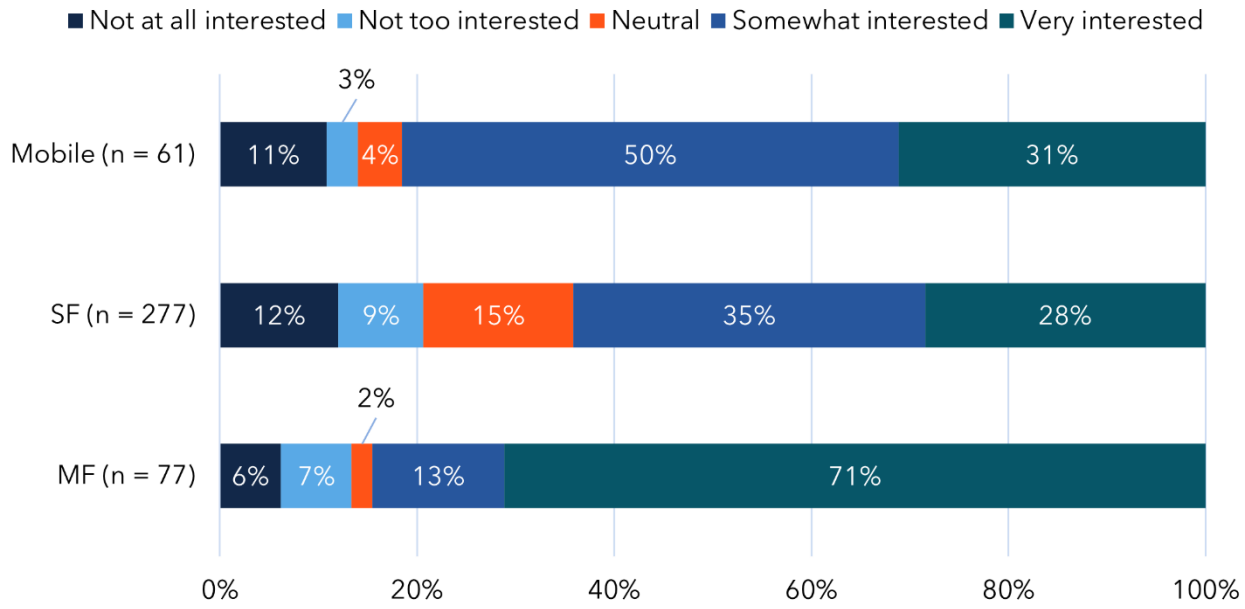
Source: Residential Survey QsF1- QF5: "Assuming your current cooktop stopped working or you decided to undergo a renovation, how would you rate the likelihood that you would purchase an induction cooktop in the future?" (n=415)
**Information about IAQ health impacts and likelihood to install was only presented to current natural gas cooktop owners.*

After asking about induction, the survey also asked homeowners with natural gas cooktops about their likelihood to switch to non-induction electric resistance. Their reported likelihood of switching to non-induction electric was similar to induction, with 21% saying they'd be very likely to purchase a non-induction electric cooktop if their current cooktop stopped working. There were no significant differences across income levels.

Interest in loaner programs

The team also investigated the interest homeowners had in an induction loan program by income and current fuel type. Overall, 68% of homeowners said they were interested in a loaner program (33% said "somewhat interested" and 35% said "very interested," *n=415).* There were no significant differences between income levels or existing cooktop fuel, but there was a significant difference between housing types. Of multifamily homeowners, 71% said they were "very interested" in a loaner program, compared to 28% of single-family homeowners (Figure 12).

Figure 12. Interest in loaner program by housing type

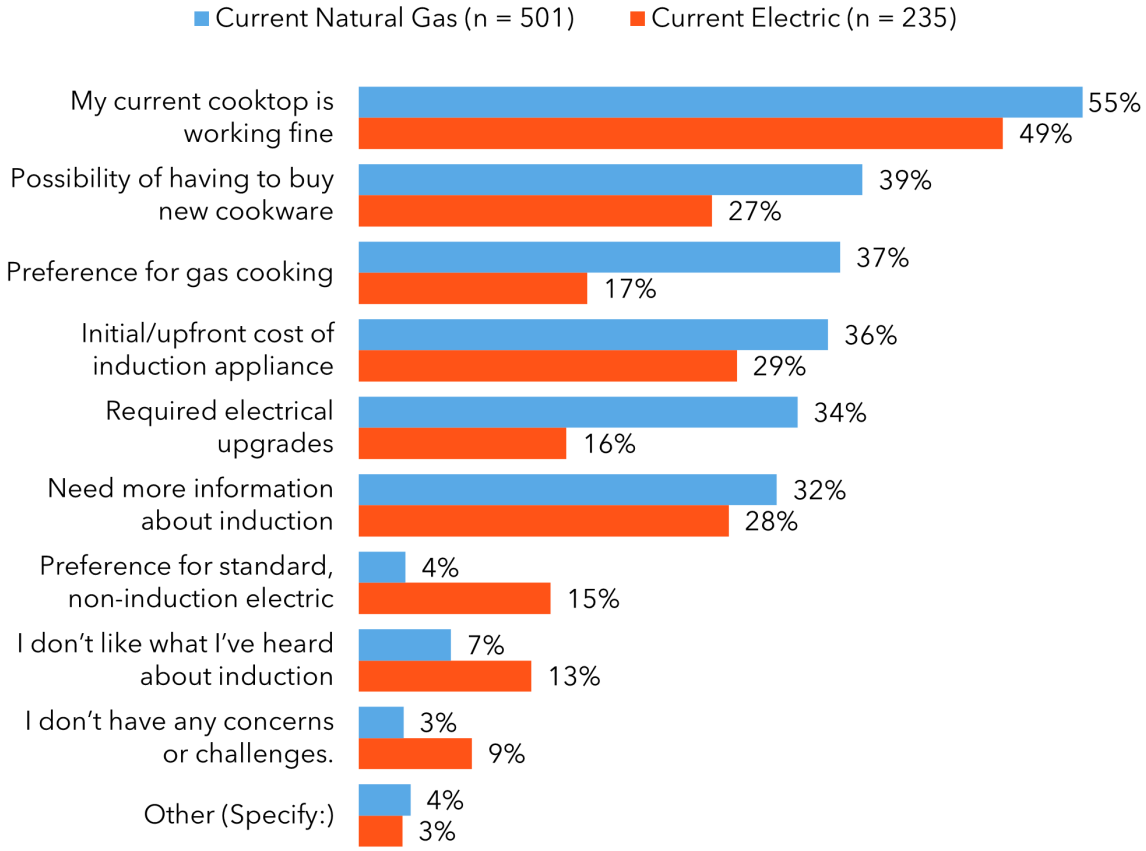


Source: Residential Survey QF7: "Using the same scale of 1 to 5, please rate your interest in trying a new plug-in induction cooktop if it was part of a loaner program that involved borrowing the unit for free temporarily and returning it. The unit would be small, with one-to-two burners, portable, and can be placed on your countertop. How interested would you be to participate in this type of program to try induction cooking, if it were no cost to you?" (n=415) Differences between housing types were statistically significant, p<.01.

3.3 Barriers to adoption of induction cooking

In the CalMTA survey, the most frequently cited barriers to adopting induction cooking products among survey respondents were that respondents thought their current appliance was working fine (50%, n=790) and the perceived upfront cost of induction (35%, n=790). Another key barrier cited by respondents was the possibility of having to buy new cookware (34%, n=790). The data shows that both non-low-income and low-income households cited most barriers similarly, but there were significant differences between current gas and current electric cooktop users, with gas cooktop users reporting more barriers overall. The top barriers for gas users (besides "current cooktop working fine") were the possibility of having to buy new cookware, a preference for gas cooking, initial cost of induction, and concern about electrical upgrades. While there was some overlap in the top barriers reported by electric cooktop users, the proportion of electric users citing these barriers were, in most cases, lower (Figure 13). More electric users stated that they preferred non-induction electric cooktops compared to gas users, and more electric users reported that they didn't like what they'd heard about induction. Meanwhile, they were less concerned about cookware, leaned less toward a preference for gas cooking, and were less concerned about electrical upgrades.

Figure 13. Barriers toward adopting induction by current fuel type



Source: Residential Survey QG1: "What factors would prevent you from choosing an induction cooktop? Please select up to three challenges or concerns you have, if any. (n=790)" Differences between these fuel types were statistically significant, p<0.01

Sociocultural barriers

Food is tightly linked to cultural and national identities. CalMTA reviewed multiple studies that found practices related to preparing, cooking, and consuming food may be closely linked to one's cultural identity, heritage, and even well-being.[47, 48] Ethnic cooking methods and food traditions are particularly relevant for California, because a quarter of the state's population is

[47] Wright, K. E., Lucero, J. E., Ferguson, J. K., Hasty, J., Lewis, D. G., & Snipes, M. M. (2021). The impact that cultural food security has on identity and well-being in the second-generation U.S. American minority college students. Food Security, 13(4), 701-715. https://doi.org/10.1007/s12571-020-01140-w

[48] Hasty, J., Lewis, D. G., & Snipes, M. M. (2022). Food and Cultural Identity. Introduction to Anthropology. https://openstax.org/details/books/introduction-anthropology.

foreign-born, mostly from Latin America and Asia.[49] (This is the highest share of any state and more than double the percentage in the rest of the country.) Certain cuisines or dishes may be associated with a specific cooking method, such as gas, wood, or charcoal, that is considered more traditional or authentic by the people who practice them, or a specific type of cookware. For example, some Chinese dishes are cooked in a wok over a high flame, which creates a distinctive flavor and texture that some might assume cannot be replicated by electric induction stoves. Additionally, one California program administrator reported that Latin families have specific concerns about induction-compatible cookware that is sufficient for holding large quantities of traditional holiday food, such as tamales that are often cooked during Christmas and require a 15–25-gallon pot. Focus group research validated that Asian and Latino households preferred gas for traditional cooking due to the ability to garner high heat and an open flame, though survey results were mixed. The team used survey results to look at cooktop fuel preferences among ethnic groups who preferred to speak a language other than English at home. The analysis found there was no meaningful difference between Spanish speakers and other language speakers with respect to their fuel type preferences, but among households speaking an Asian dialect, 81% reported preferring a gas cooktop in contrast to 57% of other language speakers, a finding which has been corroborated by other research.[50]

> "As a Latina lady, we sometimes cook the chiles on the open flame to burn them and then peel them to make some dishes. We also warm up handmade tortillas on the flames."
> *– Focus group participant*

A history of gas promotion

Research demonstrating the strong tie between cooking and culture is not only important from the perspective of immigrant populations – it's relevant for multi-generational American families who have social-emotional attachments to gas cooking due to their existing cooking experience, and preconceived beliefs and opinions from popular culture or politics.

In relatively recent years in the U.S., gas stoves have become a symbol of wealth and status, as they are often featured in the kitchens of the rich and famous or "designer" kitchens. Celebrities like Gordon Ramsay have endorsed gas stoves on social media platforms, such as Instagram and Pinterest, where they share photos and videos of their dishes cooked on gas stoves, along with

[49] Mejia, Marisol Cuellar, Cesar Alesi Perez, and Hans Johnson. Immigrants in California. Public Policy Institute of California, 2024. Immigrants in California - Public Policy Institute of California (ppic.org)
[50] The finding was significant at the 90% confidence level (p<.10).

recipes and tips. Gas stoves also appeal to the aesthetic and functional preferences of many consumers who like the large size, multiple burners, and visible flame of gas stoves. Adding to this trend, trade groups representing gas utilities hired social media influencers to convince millennials and Gen Xers that gas stoves are the cool and superior way to cook. [51]

Less related to cooking culture but highly relevant to the American sociopolitical environment, recent regulatory developments to support adoption of electric cooking products has led to tensions along political lines, introducing a new barrier to electrification. Some conservative politicians have equated gas stoves and individual rights and freedom. [52]

Source: Time, "How Gas Stoves Became the Latest Right Wing Cause in the Culture Wars," January 14, 2023.

Overcoming gas stove cooking biases and barriers

Stakeholder interviews and literature review both supported the fact that providing direct experience to cooking with induction cooktop and ranges can mitigate concerns around adoption or previously held notions. The majority of stakeholders and subject matter experts shared that customers overwhelmingly had a positive response to cooking on induction, once they were able to test the technology and became comfortable. Multiple stakeholders cited the power of induction loaner programs and in-person demonstrations to shift customer perceptions of induction. Few complaints were heard from users of induction after they had a chance to become familiar with its operation.

Selling points in cooking experience shared by stakeholders include the speed at which water can be boiled, the finer temperature control allowing for activities such as pasteurization, and the lower maximum temperature making it harder to burn a pan, lowering the labor involved in cleanup of both cookware and cooktops.

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[51] Leber, R. (2020, June 17). The gas industry is paying Instagram influencers to gush over gas stoves. Mother Jones. The Gas Industry Is Paying Instagram Influencers to Gush Over Gas Stoves – Mother Jones

[52] Examples: https://thehill.com/homenews/3818572-republicans-thrust-gas-stoves-into-the-culture-wars/ and https://time.com/6247293/gas-stoves-right-wing-memes/

A 2023 study funded through the Statewide Emerging Technologies Program assessed customer perceptions of induction cooking pre and post participation in PG&E's Induction Cooking Lending Program from March to December 2022.[53] Results from this pre- and post-loan survey analysis found that 83% of borrowers reported a "slightly positive" or "extremely positive" impression of the induction cooktop after borrowing one, which was a 30% increase over their impressions of induction reported on the pre-loan survey. The results were similar for gas and electric cooktop users; 82% of gas cooktop users reported a slightly positive or extremely positive impression of induction cooking, compared to 85% of electric resistance cooktop users. Of participants who borrowed the cooktop, 72% said they would be likely to switch to induction cooking in the future.

Program administrators experienced in induction installs shared during interviews that pairing complimentary cookware with induction installations is a best practice that has mitigated customer concerns in some programs, and reduced installation-related burdens or costs. Hands-on marketing and demonstrations have also been used as best practices to encourage adoption. Some programs, such as the San Juaquin Valley Pilots, have paired preparation of and sharing of quesadillas on induction cooking products with stakeholder meetings.

Electrical infrastructure and cost of upgrades

Conventional electric cooktops (not including 120V solutions) require 240V receptacles and a dedicated circuit with an amp rating between 30 to 50 amps. Costs associated with panel and other electrical upgrades represent one of the biggest barriers mentioned during interviews with California stakeholders, manufacturers, and homebuilders. In a review of the literature, CalMTA found varying estimates of the proportions of California homes that require panel upgrades or other optimization strategies in order to electrify.

A 2024 study from UCLA estimates that around 3% of single-family and 10% of multifamily properties in California have electrical panels with capacities less than 100 amps, indicating the need for panel upgrades for comprehensive electrification, while another 32% of single-family housing units and 59% of multifamily units have electric panels with intermediate capacity (100 amps) that the authors deem as candidates for load management systems or panel optimization[54] (such as sub-panels, smart panels, smart circuit breakers, load sharing, or circuit pausers or circuit splitters). Estimates from the CPUC are higher, finding between 27% and 41% of the residential

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[53] https://www.etcc-ca.com/reports/induction-cooktop-lending-program.

[54] Fournier, E. D., Cudd, R., Smithies, S., & Pincetl, S. (2024). Quantifying the Electric Service Panel Capacities of California's Residential Buildings. Energy Policy, 192, 114238. https://www.ioes.ucla.edu/wp-content/uploads/2024/06/2024-Quantifying-the-electric-service-panel-capacities-of-Californias-residential-properties.pdf

units evaluated in their study would require electrical panel upgrades to support electrification, with another 19% to 27% likely to require panel optimization services.[55] A similar finding was reported in a recent white paper from Home Energy Analytics,[56] which showed that 32% of single-family homes in their study had 100-amp panels or less. (The CPUC did not state the saturation of panels by amperage type, so it is not immediately clear how they determined the percentage of panels requiring service upgrades). In the UCLA study, single-family homes in Disadvantaged Communities (DACs) were found to have a greater proportion of small-capacity panels.

Electrical panel service upgrades for single-family properties may average between $2,500 and $5,000, according to recent estimates from state incentive programs.[57] In multifamily housing, two recent studies estimate the cost of electrical panel upgrades for smaller properties at $12,000 to $89,000, and $179,000 to $281,000 for larger properties.[58] These estimates do not include utility-side service upgrades, which could include underground or overhead service connections and new transformers. These costs vary significantly by the service required, and a report by the Association for Energy Affordability and Stopwaste found that utility service upgrades could range between $300 and $80,000.[59]

Alternatives to panel and service upgrades

Due to the significant cost of upgrades, there is an increasing focus on optimization as a more affordable route for electrification. Manufacturers of 120V battery-equipped technology view their products as a key solution. As that emerging technology matures, stakeholders also discussed efforts underway to mitigate the barrier for established 240V products by taking a more critical look at the specific needs of induction cooking technologies in terms of energy draw through

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[55] California Public Utilities Commission, 2024, Fuel Substitution Infrastructure Market Study. https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/building-decarb/cpuc_fsinframs_stakeholderpresentation_20240305.pptx

[56] Schmidt, L., & Schmidt, S. (2024). *Determining Electrical Panel Utilization with Smart Meter Data*. Home Energy Analytics. Retrieved from Home Energy Analytics.

[57] https://techcleanca.com/heat-pump-data/download-data/

[58] Jones, B. (2021, June 15). *Los Angeles Building Decarbonization: Community Concerns, Employment Impacts, and Opportunities*. Inclusive Economics. Oakland, CA.

[59] "Accelerating Electrification of California's Multifamily Buildings." May 2021. https://www.stopwaste.org/accelerating-electrification-of-california%E2%80%99s-multifamily-buildings.

informally collected datasets, [60, 61] reviewing electrical calculations that trigger panel, wiring, and/or service upgrades, and exploration of panel optimizations.

A 2023-2025 effort by the National Renewable Energy Laboratory and LBNL involving utility partners from around the country is reviewing options for affordable and equitable electrification without panel upgrades. A July 2023 presentation of this study policy proposes approaches such as revisions to the National Electrical Code and development of resources for homeowners, code officials, and practitioners. [62]

Durability

Though not raised by survey respondents, program stakeholders and multifamily property owners both raised concerns about durability of induction cooking products. (See Section 4.4 for more on the latter). Subject matter expert discussions revealed that lower-cost cooktops designed for installation in residential properties may use thinner glass surfaces (especially compared to commercial-grade induction), which could shatter if you drop a cast iron pan on them. There were also concerns about the additional electrical components and overall product complexity of induction. While long term repair costs data is not yet available, analysis by Consumer Reports into repair costs by cooktop type found that median repair costs for induction cooking products were significantly higher than electric and gas, at $536 compared to $192 and $153 respectively. [63, 64]

3.4 Multifamily property manager barriers and opportunities

Property characteristics

The team surveyed and interviewed two samples of California's property owners and managers to gain insights into the attitudes, preferences, and use of cooking appliances, such as induction cooking products. The 100 survey respondents represented around 450 buildings located in both

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[60] Two stakeholders mentioned an informal working group that is building a dataset to review just how much power is actually consumed while cooking, with the goal of having this inform electrical requirements and/or manufactured products.

[61] "What's cooking? Design of a Retrofit Ready Induction Stove." Spring 2022, UC Davis Program For International Energy Technologies. https://piet.ucdavis.edu/sites/g/files/dgvnsk8286/files/inline-files/Induction%20Stove%20Team%20Poster%20Final.pdf.

[62] https://www.energy.gov/sites/default/files/2023-07/bto-peer-2023-32645-affordable-electrification-nrel-jin.pdf.

[63] See the CalMTA Induction Cooking Product Assessment Report for more detail.

[64] Consumer Reports. "Should You Repair or Replace Your Broken Cooktop?" Accessed July 31, 2024. https://www.consumerreports.org/appliances/cooktops/should-you-repair-or-replace-your-broken-cooktop-a6490859316/.

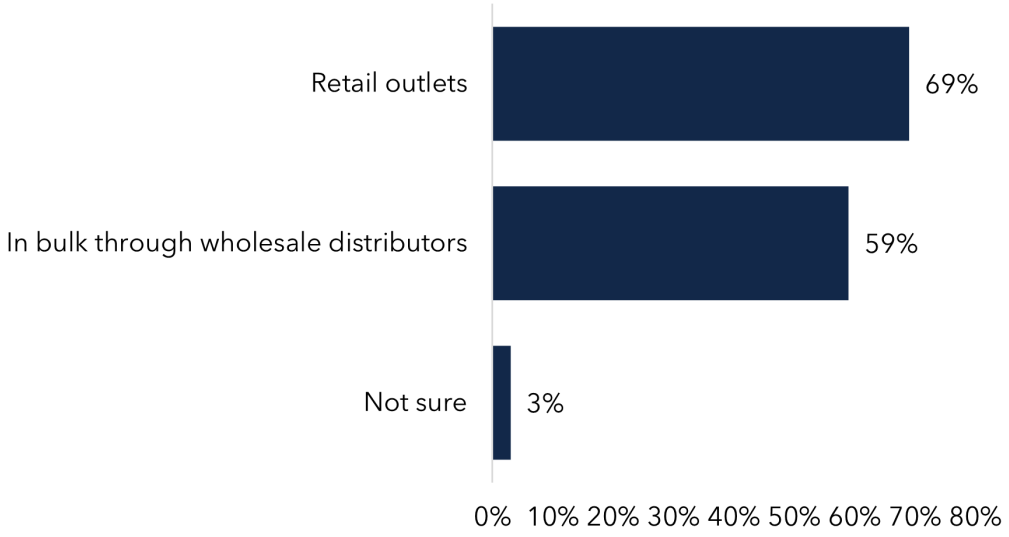
coastal and inland climate areas of California and represented a mix of affordable housing and market rate properties. The 15 interview respondents represented over 211 buildings with a wide range of portfolio sizes: building management varied from one to 105 buildings and between 14 and 4,300 units.

Decision-making

To learn more about the cooktop appliances that property managers install in their buildings, the surveys and interviews asked about their purchasing methods. When replacing old or outdated appliances in their units, 54% (n=100) of survey respondents reported that they replace kitchen appliances like cooktops and ranges when the product breaks or loses its functionality, and 43% reported that they make replacements proactively during renovations. Interviewees added more context to their decisions to do renovations – noting that they often decide to do renovations based on appearance, opportune timing (when a tenant moves out), to capitalize on opportunities for increasing rent, and based on urgency of a problem.

The survey also asked about property managers' main method for sourcing cooking appliances. Figure 14 illustrates the retail and wholesale channels property managers use.

Figure 14. Outlets used to purchase cooktops (property managers)

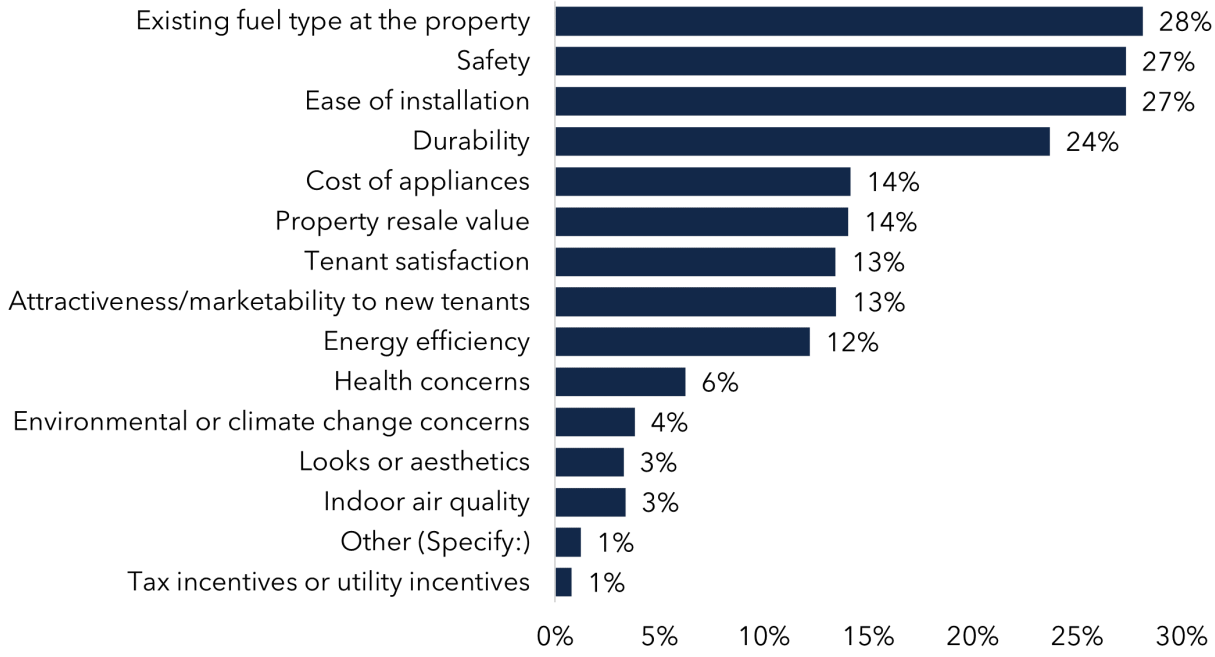


Source: Property Manager Survey Question B3, "When having to replace one or more cooktops, how do you purchase them? Select all that apply." (n=100) Multiple responses allowed; percentages add to over 100%.

Cooktop purchase preferences

To better understand the preferences of property managers, the team investigated the specific kinds of cooktops (or ranges) that they buy and their reasoning for doing so. When asked about preferred fuel type, 52% (n=100) of property managers preferred gas cooktops, 26% preferred electric, and 22% preferred induction. When asked about the reasons behind their preferences, a majority reported that they base their purchase decisions on the existing fuel type at the property, followed by safety, ease of installation, durability, and cost (see Figure 15).

Figure 15. Property mangers' reasons for preferring specific fuel types



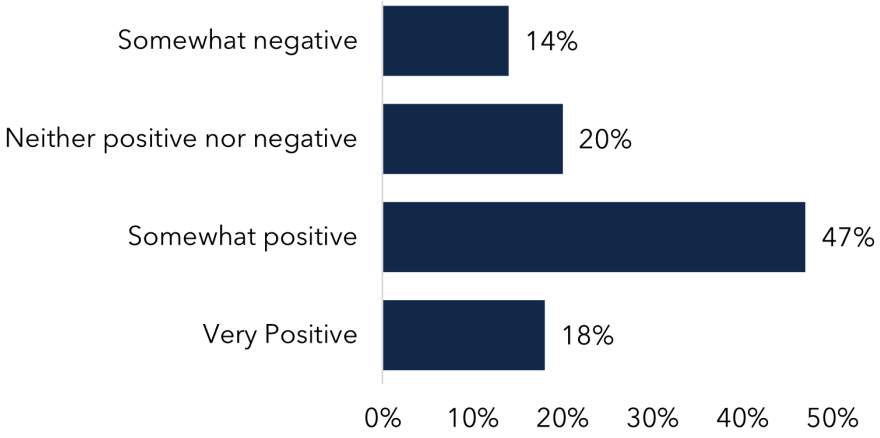
Source: Property Manager Survey Question C3, "What would you say are the two most important reasons for your preference? Select up to two factors." (n=100) Multiple responses allowed; percentages add to over 100%.

Awareness and attitudes towards induction

The team also investigated the property managers' prior awareness of induction cooking products, and their impression of the product based on what they had heard, read, or seen about them. Most property managers (63%, n=72) had heard of induction cooking products but did not know a lot about them, while 27% of respondents reported that they had heard of induction cooking products and know "a lot about them." A small proportion (10%) had never heard of the product prior to participating in the survey.

Figure 16 represents the property managers' impressions of induction. Most of the respondents reported that they have a "somewhat positive" impression (47%).

Figure 16. Impression ratings of induction cooking products among property managers

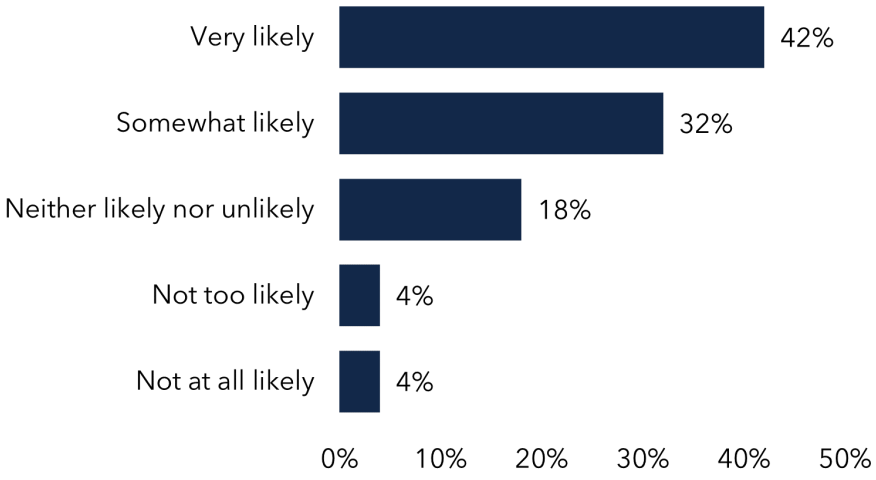


Source: Survey Question D2, "Based on what you have heard, read, or seen about them, how would you rate your impression of induction cooking products? Please rate your impression of a 5-point scale." (n=61).

Likelihood of adoption

Within the survey, property managers were asked how likely they would be to purchase induction cooking products for their units in the future in the event of a renovation. The majority of property managers reported being either "very likely" (42%, n=100) or "somewhat likely" (32%) (see Figure 17).

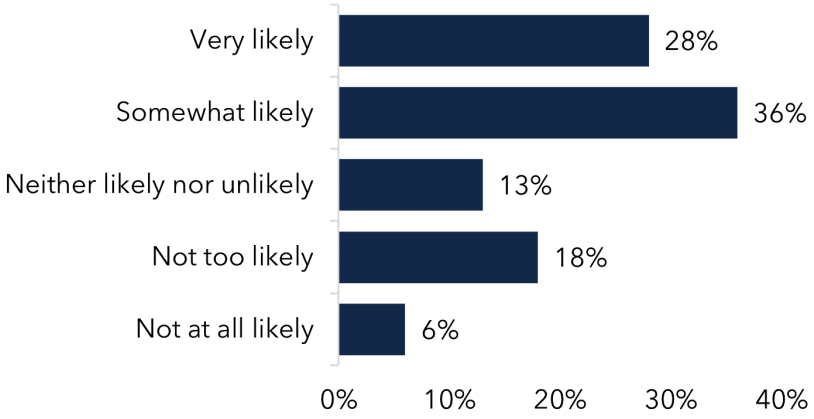
Figure 17. Likelihood of purchasing induction cooking products in the future (property managers)



Source: Property Manager Survey Question E1, "Assuming cooktop(s) on your properties stopped working or you decided to undergo a renovation, how would you rate the likelihood that you would purchase induction cooking products in the future?" (n=100).

Additionally, the survey asked property managers that reported the use of natural gas and/or propane in their properties to rate how likely they would be to switch to a standard electric resistance (non-induction) cooktop in the future. Figure 18 represents ratings given with "somewhat likely" accounting for most of the responses (36%, n=87).

Figure 18. Likelihood of switching from gas/propane to electric cooktops (property managers)



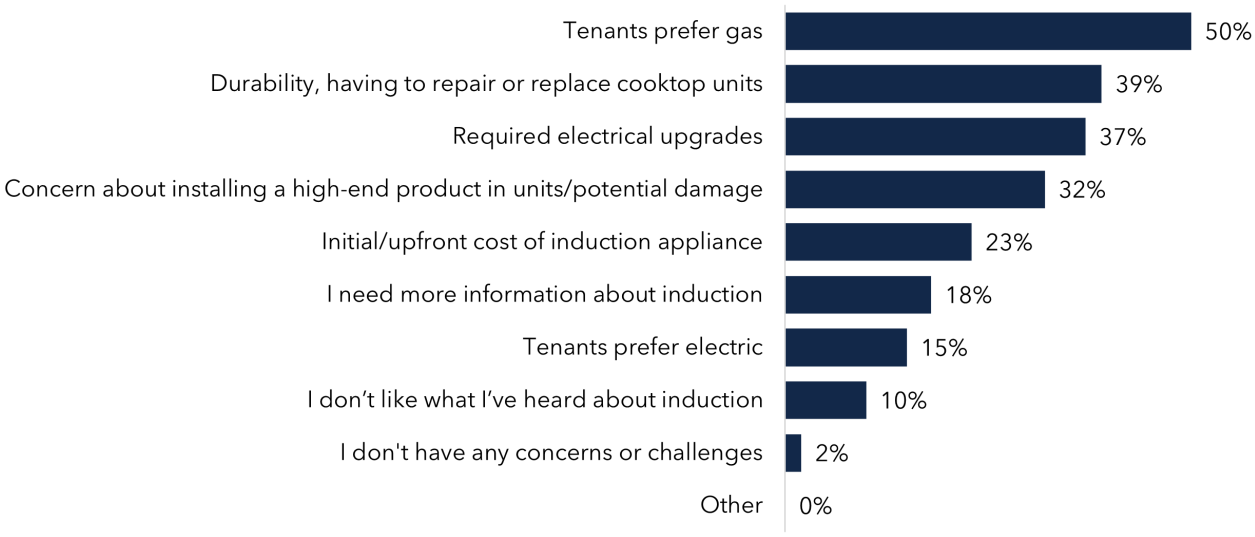
Source: Property Manager Survey Question E6, "How likely would you be to switch out a gas cooktop to a standard electric resistance (non-induction) cooktop in the future?" (n=87).

Barriers

Survey and interview respondents were both asked about what would prevent them from choosing an induction cooking product for their properties in the future. The survey found that the most commonly cited barrier was the perception that tenants prefer gas cooking (50% of property managers cited this concern), which was also reported during the in-depth interviews as a common perception. Additionally, survey respondents cited concern about the durability of cooktops and electrical upgrade requirements (Figure 19). Interviewees raised similar challenges, but expanded on the concern about cost, illustrating the need for investments in induction to "pencil." As one interviewee reported, "[It would] depend on the market rents; if [rent] justifies putting in an induction range because, from what I'm aware of, is they are a little bit pricier than your standard like heating element cooktops."

Concerns about durability were echoed by interview respondents as well, with four property managers sharing specific concerns about maintenance, ease of getting the appliance repaired, and costs of repair. Upon being asked about potential challenges with induction, one interviewee shared, "You know, the cost of repairs if repairs are needed– and if this is a newer technology, are there appliance vendors that we can easily find that can repair these things as needed? That's probably a pretty big factor there.

Figure 19. Barriers to installing induction among California property managers

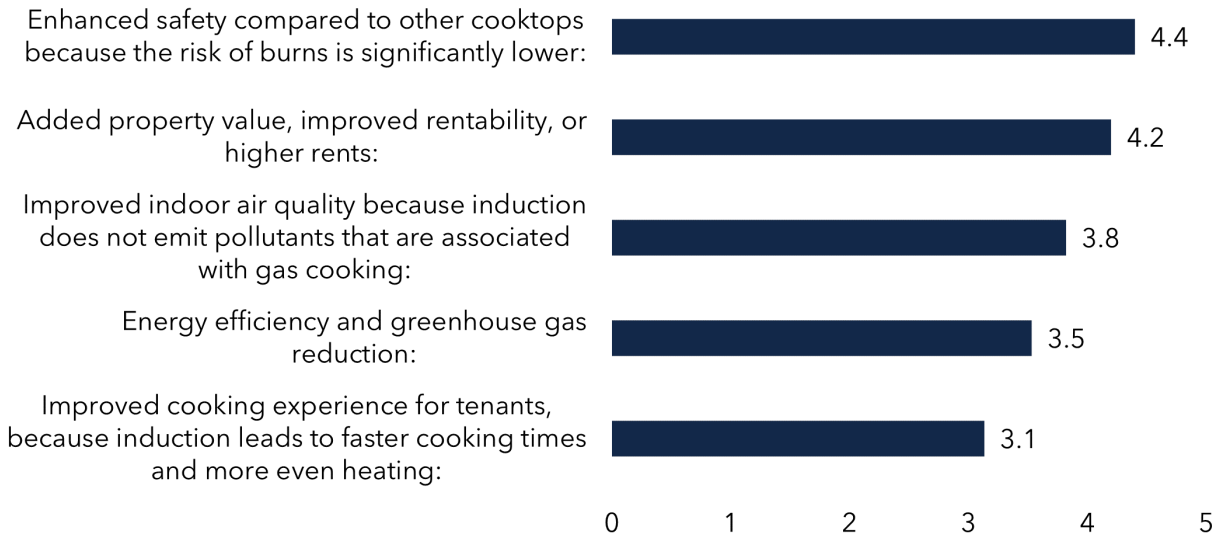


Source: Property Manager Survey Question F1, "What factors would prevent you from choosing induction cooking products? Please select the top three reasons from the list below." (n=100) Multiple responses allowed; percentages add to over 100%.

Benefits of efficient electric cooktops

CalMTA also provided interview respondents with a list of potential benefits of induction cooking technology and asked them to rate how important each benefit was to them on a scale of 1 to 5, where 5 was "very important" 1 was "not important at all." As shown in Figure 20, property managers valued safety, followed by the potential for added property value or higher rents, as the most important benefits.

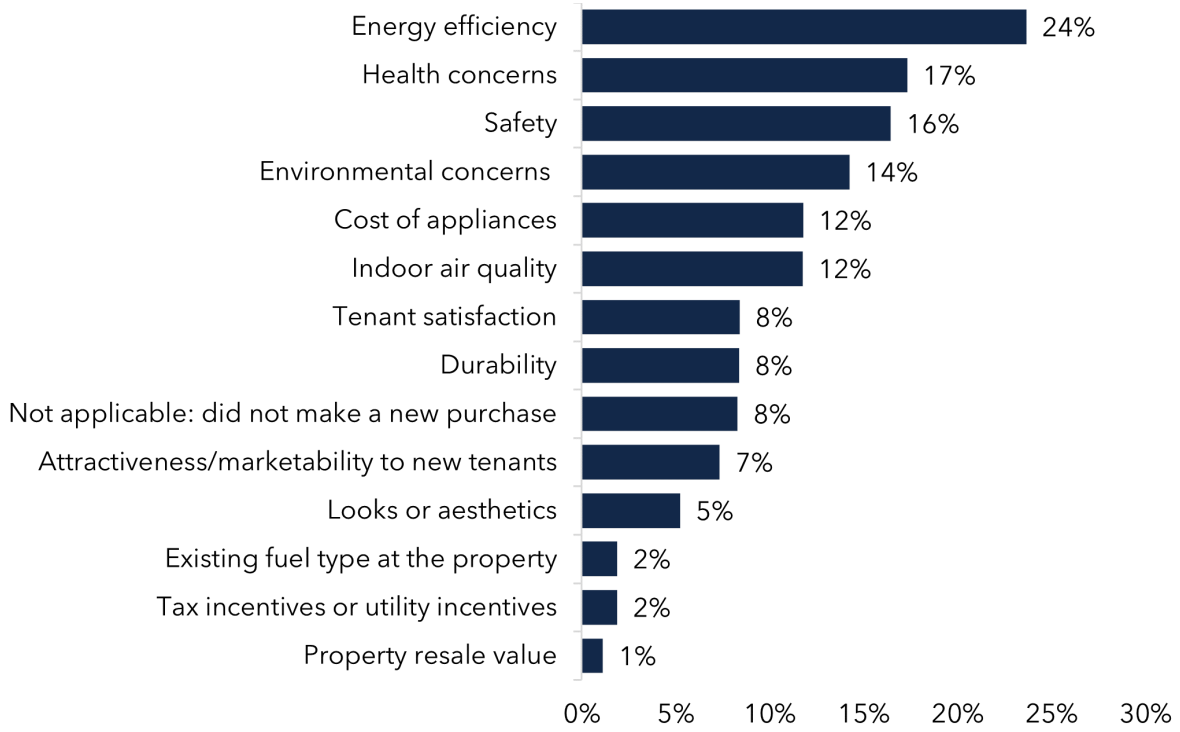
Figure 20. Average property managers' importance rating of induction benefits



Source: In-Depth Interview Guide Question D5. "I'm going to read a list of benefits associated with induction cooking products. Please rate how important each one is to you as a property manager on a 5-point scale, where 5 is very important and 1 is not important at all." n=15.

The survey also asked about the two most important reasons for purchasing electric or induction appliances. Figure 21 illustrates that property managers viewed energy efficiency (24%, n=67), health concerns (17%), and safety (16%) as the top reasons for purchasing electric or induction cooking products. All three of these factors also were reported as benefits by the interviewed property managers.

Figure 21. Reasons for purchasing electric or induction cooking products



Source: Property Manager Survey Question D4, "Earlier, you mentioned you had either electric cooktops or induction cooking products installed in some or all of your units. If you purchased these, what were the two most important reasons for purchasing electric or induction cooking products for your properties? Select the top two factors in your decision." (n=67) Multiple responses allowed; percentages add to over 100%.

3.5 Homebuilders and remodelers

CalMTA completed in-depth interviews with homebuilders and remodelers to understand perspectives, experiences, and considerations related to the use and specification of induction cooking products and ranges in residential new construction and remodeling projects.

Of the nine homebuilders interviewed (including those that also offered remodeling services), five were production builders and four were custom home builders, with the majority of the production builders focusing on single-family homes. Two of the nine homebuilders participated in the California Energy Smart Homes Program.

Table 9 summarizes the interviewees by the IOU territory they primarily built in or served.

Table 9. Count of IOU service territory by role

Territory	Number of production homebuilders	Number of custom homebuilders and remodelers	Total
PG&E	1	4	5
SDG&E	1	4	5
SCE	0	3	3
Other	1	2	3
Unknown*	2	0	2
Total	**5**	**13**	**18**

*Note: The IOU service territory information was not provided by two homebuilders who participated in the California Energy-Smart Homes Program.

Awareness of induction cooking products

Interviewees were asked about their familiarity with induction. Most had heard of it and rated themselves as moderately knowledgeable. On a scale of 1 to 5 where 1 was not familiar at all and 5 was very familiar, homebuilders rated their familiarity with induction cooking products as 2.8 out of 5 on average and remodelers rated their awareness as 2.7 out of 5 on average.

Installation rate of induction cooking products and ranges

Overall, two-thirds (12 out of 18) of the interviewees stated that they install induction. Homebuilders often installed induction cooking products, with 5 out of 6 choosing to do so. Remodelers were split, with 5 out of 9 installing induction.

Table 10 illustrates the comparison between custom homebuilders and remodelers and production homebuilders in terms of their practices surrounding induction cooking products. Eight of 13 interviewed custom homebuilders and remodelers (62%), who often work closely with clients to create personalized projects, installed induction cooking products. Four out of five interviewed production homebuilders (80%), who focus on building homes at scale with consistent designs, installed induction cooking products.

Of the 12 professionals interviewed who specify induction cooking products, 10 were able to provide estimates of the frequency with which these appliances are installed in their projects. Their responses are detailed in Table 10 and ranged from 10% to 100%.

Table 10. Rate of induction installation among builders and remodelers

Estimated % of projects with induction	Production homebuilders	Custom homebuilders and remodelers
10%	2	2
15%	0	2

Estimated % of projects with induction	Production homebuilders	Custom homebuilders and remodelers
20%	0	1
40%	0	1
50%	1	0
100%	1	0
Average	43%	18%

Source: In-Depth Interview Guide QC5.1 About how often would you say these go into your projects? (n=10).

The estimates for the installation rates of induction cooking products show a relatively wide range, reflecting varying levels of adoption among different professionals. On average, custom homebuilders and remodelers estimated that 18% of their projects include induction cooking products, while production homebuilders estimated 43%. Overall, the average estimate across all professionals is 28%.

Motivators for adoption for production homebuilders

Two production builders installed induction cooking products in over 50% of their projects. Their primary motivations for installing induction were environmental commitment, regulatory compliance, market demand, and technological advancements.

Energy efficiency

Both of these production homebuilders highlighted energy efficiency and environmental sustainability as key motivators. One homebuilder focused on constructing homes that generate more energy than they consume to create highly energy-efficient, carbon-negative homes. For them, installing induction cooking products was built into their business model. They explained, "Part of our product philosophy is to build highly energy-efficient, actually carbon-negative homes or homes that generate more energy than they use."

Regulatory compliance

California's regulations influenced these builders to install induction cooking products. One homebuilder noted, "The State of California is mandating going all-electric, and the utility companies are also making it more expensive to go with gas. So, I think more and more projects will expand electric cooktops and appliances and induction cooking products along with it."

Market expectations and consumer demand

Induction cooking products are viewed as modern and desirable, particularly in higher-end markets where customers expect premium features. Additionally, the perceived safety and health benefits of induction cooking, especially concerns about the risks associated with gas appliances, added to their appeal.

Additionally, builders cited the cooking experience and growing acceptance of induction cooking products among chefs as drivers for consumers and therefore their decisions to install induction cooking products. Both builders saw induction as a technological advancement gaining popularity and recognition for its benefits. "Induction cooking products are seen as a better alternative ... the more they're seen as a better alternative, the more you'll see an increase in the option."

Barriers to adoption for production homebuilders

Despite these motivations, other production homebuilders noted several barriers that prevent them from adopting induction cooking products widely. The following insights were shared by the two builders who installed them in only 10% of their projects.

- **High cost:** Induction cooking products are considerably more expensive than traditional gas or electric ranges. One interviewee noted, "Adding an induction cooktop increases the price of a home by no less than $1,000."
- **Market availability:** Builders face challenges in sourcing induction cooking products in sufficient quantities. One respondent stated, "We just couldn't get enough of what we needed to broadly offer it in some areas," making it challenging to offer induction cooking products as a standard or optional feature.
- **Resistance to gas alternatives:** Many customers still prefer gas cooking, and despite the push for electrification, there is hesitation from consumers about switching to electric options. As one builder mentioned, "There's still a lot of customers that are just very attached to gas and still have hesitation around electric cooking in general."

Reasons for not installing induction cooking products

CalMTA asked homebuilders and remodelers about the barriers they face with procuring and installing induction cooking products. Six respondents reported that they do not currently recommend or install induction cooking products in their projects. Their reasons varied from lack of familiarity with the technology to consumer preferences for other types of cooktops.

- **Unfamiliar with technology (n=3):** Three respondents expressed that their unfamiliarity with induction technology has prevented them from recommending or installing induction cooking products. This includes not knowing how to properly install them and not being confident in explaining the benefits to clients.

- **Consumer demand (n=1):** One respondent noted that there hasn't been significant demand from consumers for induction cooking products, which has influenced their decision not to recommend or install them.

> "So, it's just something that we haven't really been, you know, asked for yet. Also, the manufacturers are a little behind in getting the sizes that we need."

- **Manufacturer limitations (n=1):** One respondent mentioned that manufacturers are behind in producing certain sizes of induction cooking products, such as 48" models. This limitation has made it difficult to recommend or install induction cooking products for certain clients.
- **Product availability (n=1):** Related to manufacturer limitations, product availability was cited as an issue, with certain sizes and brands of induction cooking products not being readily available in the market.

Barriers to installation/adoption

The professionals who installed or recommended induction cooking products shared insights on considerations for installing this technology. Respondents reported facing barriers, often related to existing electrical infrastructure or cost issues, that prevented them from installing more induction cooking products.

A total of 7 interviewees discussed various aspects of electrical requirements. Their feedback can be summarized into three key points:

- **Proper preparation in the design phase (n=6):** Respondents emphasized that selecting the type of appliance that will be installed during the design phase is important, so that planning and design reflect unique requirements of cooking appliances such as wiring and ventilation considerations. One builder noted the importance of early-stage planning involving architects and engineers to align on appliance type and any necessary requirements for gas or electric appliances, stating that proper preparation during the design phase can reduce potential challenges during installation.
- **Electrical panel capacity (n=4):** Builders and remodelers highlighted that the capacity of the electrical panel is a significant consideration. Induction cooking products can demand considerable power, often requiring an upgrade to existing electrical panel to accommodate this load. Two respondents emphasized that keeping the total home electrical load under the panel's rating (often 200-amp) is a critical factor.
- **The addition of a 240V outlet or the installation of dedicated circuitry (n=2):** The need for additional outlets and dedicated circuits was also mentioned. Induction cooking

products may require dedicated circuits, leading to a need for extra outlets in the kitchen. This consideration is especially relevant in kitchen remodels where the existing wiring may not be sufficient to support induction appliances without modifications. "Most cooktop locations won't have that level of wiring, so you'll have to run a new wire which is, potentially a significant cost."

- **Budget constraints (n=1):** One respondent mentioned that budget constraints can sometimes prevent the installation of induction cooking products, particularly when significant electrical panel upgrades are required. However, this issue was noted as rare.

Kitchen appliance specification

Common inquiries among clients of remodelers (n=11)

Remodelers revealed several key themes regarding common inquiries from clients seeking kitchen renovations.

- **Fuel type (n=4)**: Four remodelers stated that clients are interested in the choice between gas and electric (including induction) appliances. They inquire about the benefits and drawbacks of each type and the availability of gas in California due to increasing regulations and trends towards electric appliances. One remodeler mentioned that they try to inform their clients about incentives and rebates when switching from gas to electric. Another remodeler mentioned that clients are not sure if they can still install gas cooking appliances in California.

> "So we're really trying to be forward-thinking with our clients and convert to electric because there are a lot more rebates and incentives associated with that. We tend to go in that direction moving forward."

- **Cost (n=4)**: Cost is another significant concern for clients. Four remodelers noted that clients typically ask for quotes and estimates for various aspects of the renovation, including appliance installation and infrastructure changes. These remodelers noted that their clients are often particularly interested in understanding the cost differences between electric and gas cooking appliances, and any potential energy bill savings.
- **Trends (n=2)**: A few remodelers noted clients want to know about the latest trends in kitchen appliances and designs. They ask for guidance on popular choices and what other homeowners are adopting. Remodelers share insights on current design trends, popular appliance brands, and features that are in demand. They also discuss how design choices may impact the resale value of the home.

- **Energy efficiency, rebates, and incentives (n=3)**: Three remodelers reported that clients ask about energy efficiency ratings and recommendations for the most efficient products, with one interviewee specifically noting that they have observed interest among clients in rebates and incentives, particularly for switching to electric appliances. This particular interviewee was aware of the incentive landscape and reported encouraging clients to consider electric options.
- **Expert opinion (n=1)**: One remodeler mentioned that clients frequently ask for their professional opinion on the best products and designs.

Factors impacting model selection – remodelers (n=11)

Remodelers were asked what factors impact their model selection of a range or cooktop.

- **Price (n=5):** Price was frequently mentioned as a primary consideration. Price constraints influence the choice of appliances, as clients look for options that offer the best value within their financial limits. One remodeler emphasized, "Price is always a major factor because everyone has a budget."
- **Kitchen design (n=3):** The design and size of the kitchen often dictate the choice of appliances. Remodelers mentioned the need to select models that fit well within the kitchen layout, complement the overall aesthetic, and meet the functional needs of the space. This includes considering the size, style, and placement of appliances.
- **Brand preference (n=2):** Some remodelers prefer specific brands due to their perceived quality and reliability. Whirlpool, Samsung, and Wolf were commonly mentioned brands.
- **Energy efficiency (n=2):** Two remodelers again reported that energy efficiency was an important factor, especially for clients who are conscious about energy consumption, environmental impact, and energy savings. One remodeler mentioned how clients are increasingly interested in high-efficiency appliances as part of a broader trend towards sustainability.
- **Regulatory requirements (n=2):** Compliance with local permitting regulations and electric service requirements was mentioned by two remodelers. One remodeler emphasized that adherence to permitting regulations is critical in the decision-making process because failing to adhere can result in project delays or additional costs.

Factors impacting model selection – homebuilders (n=7)

Homebuilders were also asked about the factors that impact their model selection of a range or cooktop.

- **Price (n=4):** Price is a major consideration for homebuilders, but builders reported that a lower price is not always prioritized. The type of project and budget impacts the selection of appliances. For lower-end projects, affordability is prioritized, often leading to the selection of basic models. Conversely, luxury projects require high-end, more expensive models to meet client expectations of quality and sophistication.
- **Brand preference (n=4):** Some builders reported that specific brands are favored due to their perceived quality and reliability. For instance, Whirlpool, GE, and Frigidaire are commonly chosen for their reputation and availability. One production builder mentioned adhering to national appliance agreements with Whirlpool, stating, "We have a national appliance agreement. So, we are working with that particular manufacturer." Some builders have exclusive contracts with suppliers which influences brand preference. In high-end projects, premium brands such as Thermador and Wolf are preferred to align with the luxury market expectations.
- **Energy efficiency (n=3):** Energy efficiency is another important factor for clients. High-efficiency appliances are especially favored by environmentally conscious clients. One custom builder specifically highlighted the importance of ENERGY STAR ratings and overall efficiency in their selection process.
- **Aesthetics (n=2):** The visual appeal of appliances, including their style and color, is crucial for many clients. Appliances need to complement the overall kitchen design and enhance its aesthetic appeal. Factors like finishes and styling play a significant role in the selection process to ensure a cohesive look. Custom builders prioritize aesthetics to ensure appliances complement the overall kitchen design. One custom builder emphasized the importance of finishes and styling in the selection process. Production builders also consider aesthetics but may be more constrained by standardization and cost considerations.
- **Product features (n=2):** Specific product features, such as self-cleaning capabilities and advanced technologies, are also important considerations. These features can enhance the functionality and convenience of the appliances, making them more attractive to clients who value modern, user-friendly options.
- **American made (n=1):** One builder mentioned a preference for American-made products, driven by a desire to support domestic manufacturing, perceived client preferences for American-made, and the perception that American-made appliances are of higher quality and reliability.

Kitchen appliance sourcing

The majority of interviewees (10 respondents) did not report facing any challenges or obstacles in sourcing cooktop products. Two respondents raised challenges with procuring cooktops (of all types, not just induction):

- **Delivery delays (n=2):** Two interviewees highlighted significant challenges related to delivery delays. One respondent noted that in instances where deliveries were late, the project had delayed timelines and increased costs.
- **Last-minute discontinuations (n=1):** One interviewee noted experiencing last-minute discontinuations of cooktop products. This issue arose unexpectedly, forcing adjustments to planned installations and potentially causing delays in project completion.

Opportunities to increase adoption

Participants identified several opportunities to increase the adoption of induction cooking products in California:

- **Regulatory influences (n=3):** Three respondents mentioned they view regulatory changes in California as crucial in driving the adoption of induction cooking products. One builder noted that future building codes will increasingly favor induction cooking products as part of the State's push towards all-electric homes.
    - "With code changes and technological advancements, the direction California is going with hopes to be all-electric will make induction cooking products more predominant."

Increase awareness (n=3): Three participants highlighted that those who have used induction cooking products generally have a positive opinion of the technology, but noted broader consumer education is necessary. One homebuilder raised concerns about the need for specific cookware, which can be a barrier, especially in rental properties.

- "I think it's an education thing; people need to know that induction cooking products are out there and understand their benefits."

- **Superior induction features (n=2):** Two homebuilders and remodelers mentioned that there is not currently strong demand for induction cooking products in California. However, they identified specific product features that could appeal to customers. For example, one participant mentioned the safety and efficiency of induction cooking products as attractive features.
    - "As consumer acceptance goes up, so will the demand for induction cooking products. Features and safety are major selling points."

- "People looking for safer and more efficient cooking options will likely choose induction cooking products."

Findings from Participants of the California Energy Smart Homes Program

Homebuilders shared their perspectives regarding the California Energy Smart Homes program and their challenges in meeting its requirements. Participants were asked to discuss the ease or difficulty of meeting these requirements, yielding insights into several key themes:

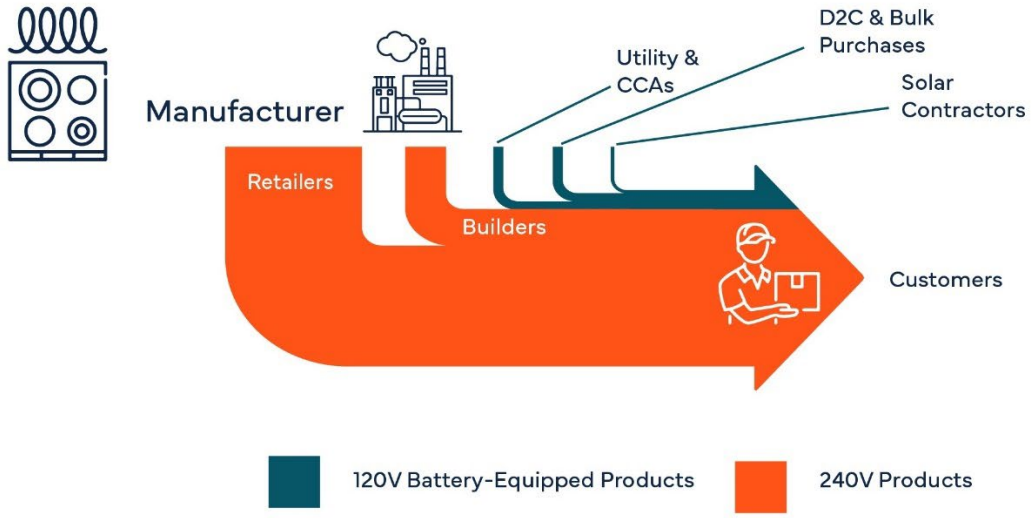
- **Limited availability (n=2):** Both homebuilders cited challenges due to the limited market availability of induction cooking products. This constraint hindered their ability to offer these appliances widely in specific regions of California.
- **Price (n=1):** One participant expressed concerns about the high cost associated with induction cooking products, which posed challenges in terms of affordability for sourcing and installation.
- **Exclusive agreement (n=1):** Another challenge mentioned was an exclusive contract with Whirlpool, restricting access to induction cooking products at scale. This contractual limitation limited the options available to this homebuilder.
- **Customer feedback (n=1):** Lastly, one participant highlighted customer preferences observed in their design studio interactions. Many customers showed a strong preference for gas cooking over induction or electric options.

4 Supply-side characteristics

4.1 Supply chain map

In interviews, manufacturers shared their main sales channels. There was a distinct difference between the channels used by established kitchen appliance manufacturers and start-up firms manufacturing new 120V battery-equipped products, as shown in Figure 22.

Figure 22. Supply chain channels



Interviewees reported the following:

- Sales to homebuilders: Manufacturers asserted the importance of the builder sales channel for cooking appliance sales but noted induction sold less often through this channel. One manufacturer shared that they have a strong builder channel that includes 8 out of 10 of the top builders nationally. Another manufacturer estimated that builder sales make up 25-30% of the industry – but noted that induction may have a smaller percentage moving to builders due to its higher price point. Another manufacturer echoed this, saying that for them induction sales to builders were "minimal," and that builders were "a less progressive channel" and more focused on radiant or gas options.
- Retail: Lowes, Home Depot and Best Buy were mentioned as lead retailers by three manufacturers of 240V products. One manufacturer also mentioned Costco, and asserted that for any large manufacturers, these national retailers likely make up 65-85% of cooking appliance sales. For induction in particular, however, another 240V mainstream manufacturer stated that smaller, independent retailers were a "big part of their induction market," and likely provided more service to consumers and were able to better communicate the benefits of induction (compared to larger national retailers like Home Depot, Best Buy or Lowes), but that the online platforms of larger retailers allowed for research at home, which could also be used to support induction sales.
- Solar contractors: one smaller manufacturer shared that a substantial percent of their business (approximately 40%) came through their relationships with residential solar

installers, stating that solar was the basis on which to build a residential electrification plan.

- Buying Groups: One manufacturer mentioned that buying groups such as Nationwide were a key channel for selling their products to smaller, independent stores.
- Utility and other (i.e., community choice aggregation, or CCA) Program Administrators: one manufacturer mentioned that CCAs have expressed interest in 120V "plug and play" products such as theirs to enable electrification (but did not confirm actual sales to-date).
- Direct to consumer (D2C): all manufacturers interviewed confirmed D2C as a sales channel, through their online stores as well as buyers like developers and property managers. Smaller manufacturers shared the importance of both multifamily developers and property managers as top sales channels (one manufacturer said that property managers represent approximately 40% of their business).

4.2 Pricing and incremental cost

Table 11 provides retail prices of cooking products disaggregated by technology and appliance type based on CalMTA's review of retailer websites (including Home Depot and Lowe's) in Q2 and Q3 2024. Induction cooking products for 120V and ranges with batteries such as those developed by Copper and Impulse Labs are new market entrants, and not yet available in retail stores.

Table 11. Retail prices

Technologies[1]	Application	Median price	Price range
Induction and efficient radiant products			
Induction	Standalone cooktop	$1380	$800-$2000
	Range	$1700	$1400-$1800
120V Induction w/ battery[2]	Standalone cooktop	$6000	N/A
	Range	$6000	N/A
ENERGY STAR certified electric radiant	Standalone cooktop	$1200	NA
	Range	$1300	$1200-$1400
Competing or alternate products			
Electric radiant (not ENERGY STAR-certified)	Standalone cooktop	$1050	$1000-$1300
	Range	$950	$670-$1650
Gas burner	Standalone cooktop	$1329	$740-$1700
	Range	$980	$780-$1170
Electric resistance coil	Standalone cooktop	$370	$330-$380
	Range	$820	$630-$920

[1] Equipment in this table is limited to 30" width, 240V, 4 or 5 heating zones, and built-in or slide-in installation types. Cooktops were rated at 30A, and ranges were rated 40A. This table includes counts from retailers such as Home Depot, Lowe's, Best Buy, IKEA, and AJ Madison. Prices excluded equipment with additional features like smart, air fry, sous vide, or luxury finishes. These prices focus on cooking equipment that offers the corresponding technological value.

[2] Induction cooking products and ranges with batteries are new and not yet available in retail stores.

Manufacturing outlook and price forecasting

Of the five manufacturers interviewed, three manufacturers also produced competing non-induction (natural gas and/or other electric) appliances. Despite induction products being a relatively low (less than 10%) share of their shipments, these respondents were all optimistic about the market for induction and the growth it is seeing, although some were more cautious than others. One of these manufacturers indicated that they felt the future was induction – this interviewee identified their company's competitive positioning as being sustainable while also bringing high-performing products to their customers – noting they have been investing in and promoting induction for a long time. Another indicated they offer induction simply because they want to offer a higher performing product compared to other electric (coil, radiant) options. The third manufacturer indicated that induction was a desirable option for certain (higher income) market segments, but that it was not expected to compete in price against more affordable electrical options and that efficient electric radiant cooking may be a good option for some segments.

Pricing of 240V induction

Manufacturers were asked to share their perception of their product pricing, and projections of price direction. Two manufacturers estimated that the price premium of induction over other electric range options is several hundred dollars; one manufacturer expressed the premium as closer to $500. Three manufacturers shared that induction is a very small percentage of all range sales today, that as induction reaches greater scale there is definitely opportunity for price declines, and that they will seek to price products competitively. One manufacturer suggested that an induction model priced at $999 could be expected within the year, and that could decrease further in five years. Another manufacturer asserted that for prices to truly come down induction would need to occupy 15-20% of the cooking appliance market but they project that induction's share in five years would be closer to 10%.

Yet, as two manufacturers shared, complexities to induction products from a component standpoint are also consistent across manufacturers. One manufacturer estimated that there are around five pounds of additional electrical components with induction compared to other electric range options – copper, coils, lithium (in the glass) and that they are costly. Two out of three manufacturers that discussed these components projected that induction would never fully compete pricewise with simpler electrical options such as radiant due to the material costs. One manufacturer did not share the same viewpoint that induction was a more complex technology than radiant, and, asserting that induction was a superior technology to radiant and would gain market share over the years, suggested that the price of induction would become very similar to the price of radiant appliances and eventually fully replace radiant. One manufacturer specifically mentioned that they were seeking to drive conversion to induction from gas and other electric by lowering induction's incremental price compared to their other electric and gas options.

The responses of several manufacturers suggest that while induction appliances' margin may be considered reasonably healthy, the margin on gas stoves and ranges may be higher. One manufacturer confirmed that the margin on their induction appliances was high "right now" in part because induction is marketed as a premium product.

Pricing of 120V battery-equipped products

One manufacturer of a battery-equipped 120V product shared that they expected their product to decrease in price over time and projected that a significant driver of that would be reduction in battery costs; the manufacturer estimated that batteries would be a fraction of their current cost in five years' time. Another manufacturer of a battery-equipped 120V product shared that while the cost of lithium was coming down, they did not expect changes to high tariffs on imported batteries, which will continue to keep costs for battery technology high. This respondent shared that they anticipated their product price to stay the same for a few years but described their product as a lower cost – and easier – holistic solution than pursuing a 240V electric range and oven requiring electrical panel upgrades, which they estimated as costing typical customers

$2,500 at the lowest but more commonly around $5,000 for single-family, and $10,000 for multifamily.

Both manufacturers offering induction products with integrated battery energy storage discussed the challenge of keeping costs reasonable in the face of tariffs on non-American made battery products. Both manufacturers also shared that American battery manufacturing was not mature and there is no way to procure quality batteries domestically at low cost. One of the manufacturers stated that due to the uniqueness and newness of their product, the United States does not have the supply chains they need to manufacture it.

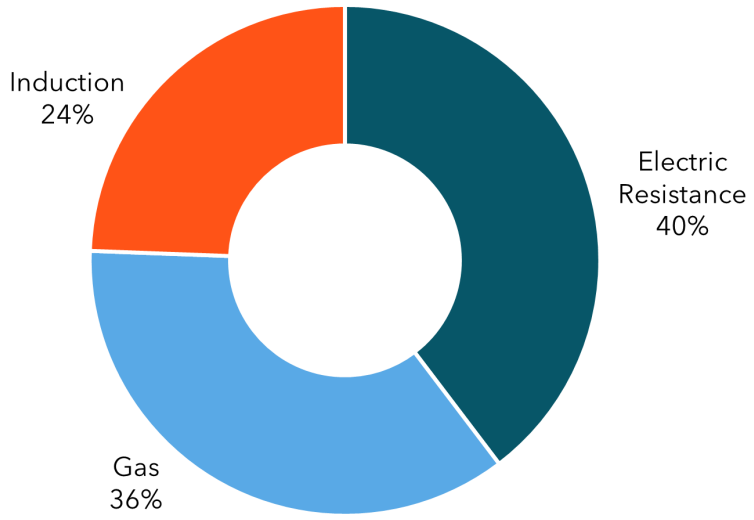
4.3 Retail availability

CalMTA visited brick-and-mortar big box stores and conducted online shopping research to characterize the presence and availability of induction models.

Products online

The CalMTA team conducted webscraping to extract product information from Google shopping. In total, the scrape found 793 cooktops and ranges on the market (which represented availability nationally, not solely in California locations). Electric resistance cooktops and ranges occupied the largest share of available models at 40%. Thirty six percent (36%) of the appliances were natural gas, and 24% were induction (Figure 23).

Figure 23. Cooking appliances available online by technology type



Source: CalMTA webscraping research conducted June 2024. n=793

Products in-store

Shoppers recorded the makes, models, and prices of the products displayed. Table 12 summarizes the total number of available cooktops and ranges and the number of induction models that were in store and on display (there were no stores that had additional inventory in stock that were not on display). Apart from Best Buy in Northern California, brand options were limited. Samsung was the most widely available option for induction, with models available at five out of the eight locations visited. There were far more brand selections available for gas products including Café, Amana, Maytag, ZLine, Midea, as well as all the brands shown in Table 12 that offered induction models.

Table 12. Induction cooktop "shelf space" in brick-and-mortar locations

Store and location	Total cooktops in stock	Induction models in stock	Brands available (induction)
Best Buy (NC)	80	9	Bosch, Samsung, Thermador, Whirlpool, GE, LG, Kitchen Aid
Best Buy (SC)	30	1	Samsung
Home Depot (NC)	39	1	Samsung
Home Depot (SC)	40	1	Frigidaire
Lowes	44	2	Frigidaire, Samsung
Costco	5	2	Samsung, Kitchen Aid
Ikea	32	8	Ikea
Sam's Club	1	0	N/A
Total	**271**	**24**	

Note. SC = Southern California, NC = Northern California

Sales associate knowledge and viewpoints of induction

To assess sales associates' knowledge and promotional messaging, shoppers interacted with one or more associates at each location. Shoppers observed the way they discussed products with customers, asked about feedback on induction they receive from customers, and inquired about available promotions or rebate opportunities. Several key findings emerged from discussions with sales associates, which are detailed in Table 13.

Table 13. Key findings from discussions with store associates

Key finding	Description	Quotes from associates
1. Biased views toward gas and low awareness about induction	Associates often displayed strong preferences for gas models. On one occasion, a sales specialist attempted to sway in favor of gas. Preconceptions of the type of people who buy induction. On multiple occasions, associates were eager and willing to discuss gas options but when asked about induction, they had to call over a tech expert. Some associates acknowledged the future of electric options but were resistant to change.	*"Why would you want induction? Gas is the best way to go."* *"I guess I'm old, so I'll die using gas."* *"People who buy induction tend to be the tech savvy type. You know, the people who drive electric cars…"* *"California is shifting toward electric, but most people are coming in and buying gas. I hope it doesn't get to the point where they force us to give up gas."* *"I don't know too much about induction. This is a gas market, and most people come in looking for gas."*
Low awareness of rebates	Rebates from BayREN and SCE were available in the communities where all eight stores were located. Two associates in Southern California were aware of rebates available from CA program administrators, others tended to recommend other promotions.	*"There are discounts when you buy the range as part of a package... Other than that, there are no promotions."* *"I don't know about any rebates. You would have to go and talk to the manufacturers for rebates."* *"I believe you can get a rebate from Edison if you replace your gas with an induction model."*
Little customer feedback	Associates commented that there wasn't much feedback reported from customers, but some heard negative feedback when customers didn't realize how expensive new cookware would be.	*"The cookware can be an adjustment for some because you need to buy new stuff, and you can't use a lot of your old cookware."*

Marketing messages

Advertising content tended to be specific to a brand rather than anything that was unique to any given store; that is, the task of advertising the benefits of induction was the responsibility of the manufacturer rather than the store selling them. Content centered on features such as efficiency, faster cooking time, and easy clean up (i.e., "More efficient and faster cooking. More oven space and fingerprint resistant finish. Boils 2x faster, cools quickly and easy clean up."; "induction wipes away cleaning time.") Features such as safety or health were not explicitly promoted. Samsung was offering a rebate for free cookware with the purchase of a cooktop or range.

In-Store Samsung Promotion:
Get an exclusive 6-piece Circulon Steelshield Induction Cookware set FREE (Retail value $430) when you buy any Samsung cooktop or range!

4.4 Supply-side market barriers and opportunities

Interviews with manufacturers revealed barriers and opportunities in the following themes:

Competing with gas as a culturally familiar and premium cooking experience

Several manufacturers shared the viewpoint that given the prevalence of gas and radiant electric cooking historically in the United States, consumers still look to gas as the premium cooking experience, and that greater awareness of induction as a premium cooking experience is needed. Some respondents communicated the sense that cooking is "traditional," and that consumers will need to grow comfortable with the lack of instant feedback from the burner and the tactile experience presented by gas ranges. One manufacturer suggested that perhaps there were product modifications that could ease this transition (for example, having burners light up). Another manufacturer thought that consumer appetite for induction could be grown via exposure – i.e., making it easier for consumers to test, touch, and experience induction prior to purchase. One manufacturer mentioned a grant they had received from a CCA program administrator to place induction demonstrations at farmers markets and asserted that it had great potential due to the community feel and food focus: "if CalMTA said every farmers market [will provide demonstrations of] induction you'd see a lot of adoption."

Supply chain and distribution challenges

All manufacturers interviewed spoke to the relatively small market share of induction keeping prices high, mentioning both higher costs of materials and lower certainty that all retailers and distributors would want to stock induction products.

Price sensitivity in the new construction sector

While several manufacturers mentioned the importance of the builder sales channel, all also identified builders as extremely price sensitive. One manufacturer identified that this was something their company had been watching increase in the last couple of years. Another manufacturer also acknowledged builder and developer price sensitivity, and called out builders as a market segment that could be effectively targeted for market transformation efforts. Manufacturer expressed some concern over whether IRA funds would flow to builders successfully and wanted to make sure that builders could be incentivized per unit built versus per project. Another manufacturer felt that engagement of multifamily developers (and landlords) would be the best way to increase the reach of induction to low-income segments.

Retail slow to promote

Manufacturers commented on the retailers' hesitancy at times to promote induction via retail displays. Two large manufacturers shared that some retailers "have been slow" and do not always display induction models in their locations. They indicated that while this may be shifting slightly, retailers often consider their demographics, and - regarding induction as a premium product – if they think it won't sell in a given region, they will not display it there. These two respondents were not aligned, however, as to which retailers are more willing to display induction, with one manufacturer saying smaller retailers were more likely to display and communicate the benefits, and the other manufacturer saying national retail chains were more likely to communicate the value of induction. CalMTA's research at retail locations found low inventory and availability of induction models in big box stores and product advice from sales associates geared toward gas (see *Retail availability*).

One manufacturer credited their business in Europe and their heavily European supply chain with the reason that they have not seen the same material supply chain issues that other manufacturers have.

Cookware compatibility

Two manufacturers contended the lack of compatibility of certain cookware with induction was one of the biggest barriers to marketing induction appliances to consumers – though they did note that this was changing as compatible cookware is increasingly available in the market and more clearly labeled as induction-ready. Other manufacturers also acknowledged the issue of cookware but did not necessarily identify it as a top barrier.

Concerns with the valuation of efficiency in the new ENERGY STAR specification

Two manufacturers with multiple ENERGY STAR certified products (induction and other electric radiant) suggested the standard's focus on total power output versus the efficiency of the power produced may not give appropriate weight to efficiency per output. One manufacturer said this was a challenge, since this methodology made it challenging for 5-

burner induction stoves to get certified; they shared that less efficient 5-burner radiant stoves would have an easier time getting certified because of their lower total output, and that they thought this was a mistake. One manufacturer of both induction and radiant appliances suggested the ability of radiant appliances to qualify for ENERGY STAR could cause a slowdown of induction sales.

Two manufacturers took issue with how ENERGY STAR measured energy use without consideration of source energy used or peak demand impacts. One manufacturer said that it didn't account for the benefits offered by their product's battery (due to its look at total power draw), noting that the specification's lack of time-of-use reference is problematic for grid stability and emissions, stating, "Our device will use more energy but will use solar, versus a gas peaker plant."

Higher production cost and retail cost

One of the biggest barriers mentioned by all manufacturers interviewed is the higher cost of induction compared to other natural gas and electric options. Some reasons for this (as discussed in *Pricing and Incremental Cost*) include the higher cost of materials and of bringing the product to market due to the lower market share of induction; all manufacturers except one also shared the complexity of the product contributes to its higher price. As discussed previously manufacturers have shared that this is particularly relevant to products moving through builders and developers, who face financial constraints with the rising costs of homebuilding. They also acknowledged that it creates difficulty for low- and moderate-income households to access induction.

Cost of operation/energy

One manufacturer brought up concerns about gas to electric conversions in general, sharing that in some areas gas ranges are less expensive than electric to operate due to rates. They were aware of review of this issue at the state regulatory level but stressed that in the short term this would be a burden for early adopters, and thought that perhaps coil or radiant electric ranges, with lower initial cost premium, and no need to purchase new cookware, could be a valuable bridge solution.

Required electrical upgrades

All manufacturers contended that electrical capacity and required upgrades are a major barrier to 240v induction adoption. One manufacturer of 240v induction ranges considered it to be the biggest barrier, sharing that there was a "need to recognize it's not a drop-in solution." Manufacturers of 120V products communicated that their products were specifically designed to avoid the prohibitively high costs of upgrades that many buildings face. One manufacturer estimated typical electrical upgrades as costing typical customers $2,500 at the lowest but more commonly around $5,000 for single-family, and $10,000 for multifamily. Two manufacturers spoke

to not only the price of electrical upgrades, but also the wait time and lack of transparency in implementing them as major deterrents, with one manufacturer sharing that they knew of cases involving a wait time of up to 18 months for their upgrades. Both manufacturers of 120V-battery equipped induction products shared that while their products had a higher cost than a 240V induction appliance, their products were the most affordable option if panel upgrades made 240V induction cost-prohibitive.

Maturation of 120V product development

Manufacturers (of both 120V battery-equipped and 240V products) shared the following insights into 120V products.

Power limitations

All three interviewed manufacturers of traditional 240V induction ranges shared they have chosen not to pursue a 120V product (despite the mentioned barrier of electrical upgrades) due to technical factors and other barriers, including the concern about providing satisfactory cooking experiences at lower voltages – especially if adding an oven. One manufacturer stated that based on their analysis they would need to design burners that "went to half power" if the oven was on, and that "maybe some folks are willing to make sacrifices" but that this would not be appropriate for mass market deployment or adoption.

Additional costs and value propositions of battery integration

Integration of battery energy storage is a demonstrated method to mitigate the power limitations of lower voltage cooktops and ranges. But the inclusion of batteries does add significant cost to induction products. One manufacturer of a battery-equipped 120V product shared that they had scaled the battery storage of their product to the minimum eligible for IRA incentives (3 kWh), seeking to allow incentives to offset the maximum amount possible of this cost; they also mentioned the ability to participate in demand response and virtual power plant programs for financial benefits and to recoup the incremental cost of their product. One manufacturer shared that they were offering additional capabilities for grid integration. Another manufacturer mentioned that potential customers were interested in their product being able to perform during public safety power shutoffs. Both interviewed manufacturers with 120V battery-equipped products brought up the tariff on non-domestic batteries as a major barrier to price reductions; one manufacturer stated that they would ideally like to purchase domestically, but that American-made batteries are currently 30% more expensive, and lower quality.

One manufacturer asserted that they felt confident in the value proposition of their 120V battery-equipped solution, which they communicated as offering a hassle-free, premium cooking experience that enables electrification, does not require a sacrifice in power, provides resiliency benefits, and does not necessitate costly and time-consuming panel upgrades. The manufacturer stressed that there was no benefit in offering a concessionary model, and that the focus should be leading with technology that will drive a revolution and make people see the future: "If we put a

mediocre product in people's homes right now, we're going to lose. I understand from a public policy perspective that's challenging, but I believe we have to get everyone culturally excited."

Battery integration and safety, codes

Manufacturers shared that with the integration of batteries comes additional regulatory considerations. One manufacturer flagged that advocacy is needed at the state and jurisdictional level to ensure battery storage can be paired with residential cooking, stating that "codes are well-intentioned but not necessarily good fits for the state of the technology." One manufacturer shared that they felt the existing safety protocols were robust and sound and did not need further maturation prior to product adoption. The manufacturer contended that concerns around batteries were focused on batteries of a chemistry distinct to what their product used, which is in server rooms all over the country. The manufacturer shared that they followed the rules of battery safety which included making sure the battery is only accessible for their own device, and that it is not swapable; they also shared that they participate in a National Fire Protection Association 855 working group to ensure coordination on safety developments as relevant.

Opportunities for market growth

The following opportunities were identified from manufacturer feedback:

- **Promotion of induction's health and safety benefits**. Two manufacturers stressed that a key value proposition of their induction product was the ability to move away from gas no matter the residence type, and that this was important to do so for IAQ and health and safety reasons. One manufacturer argued that a shift in cultural norms should be supported to communicate that open gas flames do not belong in/are not safe in homes, although there were mixed viewpoints from manufacturers on this. When asked about health benefits of electric cooking appliances, one respondent (representing a manufacturer of gas, electric, and induction appliances) reported that they preferred to focus on cooking experience and would not, in the future, confirm or support campaigns that targeted natural gas as having negative effects on IAQ.

- **Federal tax incentives, and state, local and utility programs.** All manufacturers saw value in incentives for induction to support growth in market share, and all manufacturers spoke to the importance of incentives through the IRA. One manufacturer shared that a top focus in their business is the implementation of the IRA and making sure that products are available as states kick off new IRA-funded programs, which involved substantial work to get products certified within the new ENERGY STAR program for cooking appliances. Several manufacturers mentioned increased state or utility incentives as top opportunities for growing induction's market share, and mentioned the CCAs MCE Clean Energy, Peninsula Clean Energy, and Ava Community Energy as leaders that could be leveraged to ensure incentives reach the right markets. Another manufacturer suggested leveraging the CEC's Equitable Building Decarbonization program. One manufacturer mentioned

that they are working with an incentive aggregator to make it easier for their customers to benefit from layering federal and state incentives, stating that there is a benefit to making incentives seamless or even, where possible, invisible to the customer. Manufacturers also called out research and development dollars as critical to the development of new products; one manufacturer spoke to the importance of the financial support (federal and state) for research and development that they had received for development of their 120V battery-equipped solution. One manufacturer who had shared that smaller independent retailers were important to their induction sales stressed the importance of making sure that these smaller retailers were connected to incentives; this manufacturer raised the concern that, for example, IRA incentives may be harder for smaller stores to implement. One manufacturer expressed uncertainty that IRA incentives would truly, in practice, be applied to induction sales, stating that IRA incentives are primarily geared to the low- and medium-income market segments and "traditionally buyers of induction are typically the top 25 percent."

- **Technology competitions and bulk purchasing**. New York State Energy Research and Development Authority's (NYSERDA) 120V Cooktop Challenge was discussed as a tool to further design developments and manufacturing of a desirable electric range that would not require building electrical upgrades. Manufacturers responded to questions posed regarding the value of such a challenge to motivate a solution to this barrier, and whether there could be potential for a technology challenge in California. They had mixed responses on the ability of a competition to motivate their development of a technology they were not already engaged with and communicated the need for commitments and financial support to motivate their investment in such a distinct product. Two manufacturers said they had chosen not to pursue development of a 120V range solution due to the need for a greater bulk purchase commitment to motivate expensive product development. Another smaller manufacturer stressed that as a small start-up they found the timeline of the NYSERDA challenge difficult, since small companies live and die in 18-month cycles between series of fundraising – and that knowing an award for a proposed activity were to be granted or not granted within six months would help. The manufacturer also said that support and additional funding to navigate regulatory and UL approvals would be desirable. Two of the three larger manufacturers shared that significant funding support for research and development, and very real commitments to bulk purchases would be needed.

- **Increased controls on natural gas system safety**. One manufacturer stressed the value of policies limiting emissions and checking on gas system safety, sharing that they have the power to motivate investments of multifamily decision makers. The manufacturer shared that New York City's Local Law 97 (which sets emissions limits on buildings larger than 25,000 square feet) and Local Law 152 (which requires most buildings with more than

two units to undergo periodic gas piping inspections and testing) were driving their expansion in the NYC market. This manufacturer shared that when buildings' gas systems are tested for compliance with LL152, they often fail and gas is shut off to the building immediately, leaving multifamily owners and managers with stranded assets; the manufacturer shared that from their perspective, a policy like LL152 could do even more for electrification and moving their product than an incentive program or a competition (both of which they also supported).

- **Publicity and communication of decarbonization goals**. One manufacturer called out the value of setting clear, public goals, citing California's heat pump goals (6 million heat pumps targeted to be installed in residences by 2030) and encouraged a similar goal to be set for induction cooking.

5 Attachment 1: Survey Sample Weighting Methodology

Weighting is a statistical technique used as a means of adjusting the representativeness of the sample to reflect the actual population of interest. The goal of applying weights is to extrapolate results from the sample to the population. CalMTA applied weights to the residential survey and the property manager survey, based on each survey's respective target population and sample target variables. For the residential survey, the goal was to ensure that the survey was representative of all households in California. For the property manager survey, the goal was to ensure that the survey was representative of all rented households in California.

Weighting Variables

Residential Survey

The team selected six target variables to use for weighting for the residential survey, based on available data. The population used for the residential survey was 13,550,586 households, which is the total number of households in California.[1]

Table A1. Population Proportions for Variables used in Weighting for Residential Survey

Variable	Stratum	Population proportion	Source
Homeownership rate	Owner	55.8%	ACS DP04 – Selected Housing Characteristics
	Renter	44.2%	
Climate region	Coastal	34.7%	CA Energy Commission
	Inland	61.0%	
	Desert	4.3%	
Electric utility	SDG&E	9%	EIA: Annual Electric Power Industry Report
	PG&E	36%	
	SCE	33%	
	SMUD	4%	
	LADWP	10%	
	Other	7%	
Single-family vs. multifamily	Single-family	64.6%	ACS DP04 – Selected Housing Characteristics
	Multifamily	31.8%	
	Mobile Homes and Other	3.6%	

Variable	Stratum	Population proportion	Source
Income status - granular	Less than $25,000	13.6%	ACS S1901 – Income in the past 12 months
	$25,000 to $49,999	14.4%	
	$50,000 to $74,999	13.8%	
	$75,000 to $99,999	12.0%	
	$100,000 to $149,999	17.6%	
	$150,000 to $199,999	10.6%	
	$200,000 or more	18.0%	
Income status - broad	Low-income	12.2%	ACS S1901 – Income in the past 12 months
	Not-low-income	87.8%	

Property manager survey

The team used two variables to weight the property manager survey. The population used for the property manager survey was 5,777,597, which is the total number of rental dwellings in the state (CalMTA used rental dwellings as the population for property managers because each respondent represents units that they manage).[2]

Table A2. Population Proportions for Variables used in Weighting for Property Manager Survey

Variable	Stratum	Population proportion	Source
Electric utility	SDG&E	9%	EIA: Annual Electric Power Industry Report
	PG&E	36%	
	SCE	33%	
	SMUD	4%	
	LADWP	10%	
	Other	7%	
Single-family vs. multifamily	Single-family	35%	ACS DP04 – Selected Housing Characteristics
	Multifamily	65%	

Weighting methodology

To apply the weights, CalMTA used a method called raking, or iterative proportional fitting. Like the tool working the soil in alternate directions till it's smooth, the raking method adjusts weights over several iterations to get the distribution of the weighted survey sample to align with the distribution of the population, based on the selected characteristic variables. Raking is relatively

simple to implement, only requiring the population and sampling distributions for each variable chosen for the weighting scheme. According to Pew Research Center, raking is the standard weighting method used by them and many other public pollsters.[3]

The team utilized R to generate the survey weights, specifically the *rake* function from the "*survey*" package. The function takes in the sample distribution (counts) for the target variables along with the population distribution (counts) of the same target variables to generate the final weights. The number of iterations required to generate the weights depends on the number of target variables. Since six target variables were chosen, the team set the maximum iterations to 20 to ensure convergence to weights that most balance out the survey data.

6 Attachment 2: Zip Code and Climate Zone Mapping

CalMTA characterized the residential customer and property manager survey samples by key characteristic variables such as climate zones and regions. To identify the climate zone for the survey sample, we applied the CEC mapping of zip code to California Building Climate Zones.[1]

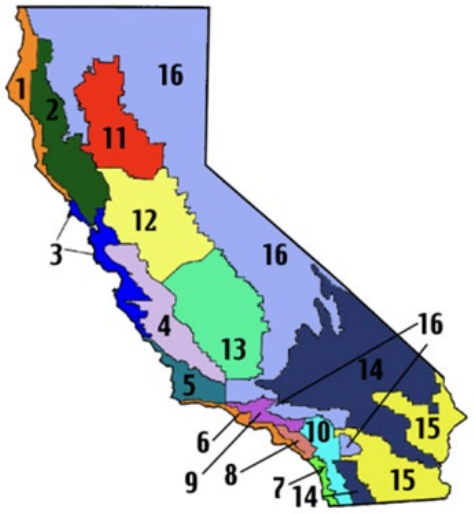
CalMTA then developed broader definitions of climate regions for the survey sample by mapping the CEC climate zones to regions, as identified by the CPUC *Impact Evaluation of Water Heating* Measures report.[2] These climate regions are:

Coastal/Mild Climate Region: Includes CEC climate zones 1, 2, 3, 4, 5, 6, 7, and 16. These areas have moderate temperatures (see Figure C1).

Inland Climate Region: Covers climate zones 8, 9, 10, 11, 12, and 13, where residents experience hotter summers and colder winters.

Desert Climate Region: Includes climate zones 14 and 15.

Figure A1. CEC climate zones [65]



[65] California Energy Commission. (n.d.). Building Climate Zones by Zip Code. https://www.energy.ca.gov/media/3560

7 Attachment 3: Research Instruments

Find the research instruments used here.

About CalMTA

CalMTA is a program of the California Public Utilities Commission and is administered by Resource Innovations. We work to deliver cost-effective energy efficiency and decarbonization benefits to Californians through a unique approach called market transformation. Market transformation is the strategic process of intervening in a market to create lasting change by removing market barriers or exploiting opportunities, accelerating the adoption of identified technologies or practices. CalMTA-developed market transformation initiatives also aim to advance state goals on demand flexibility, workforce development and equity. Learn more at www.calmta.org.