Opinion Dynamics

BUILDING INITIATIVE FOR LOW-EMISSIONS DEVELOPMENT (BUILD) PROGRAM

TIME I MARKET STUDY

FEBRUARY 5, 2025

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I. EXECUTIVE SUMMARY

The Building Initiative for Low-Emissions Development (BUILD) Program is intended to encourage the design and construction of all-electric, energy-efficient buildings by providing incentives for the construction of all-electric, low-income residential housing and offering technical assistance to support project planning and educate new construction professionals, including builders, developers, architects, and engineers (collectively "stakeholders") about electric technologies and all-electric building design.[1] The program's primary goal is to engage with new construction market actors to raise awareness of building decarbonization technologies and encourage the design, development, and construction of all-electric residential housing.

The primary objectives of this study, the Time 1 Market Study, were to assess existing market conditions and update the established baseline for the BUILD Program based on primary and secondary research, where available. Data informing this report were garnered from a variety of sources, including a survey of market actors active in the California residential new construction market and a review of the secondary data resources that were updated after the baseline assessment.

This report provides, where available, an updated overview of market size, summarizes market perceptions of all-electric design and electrification equipment, and characterizes the key cost, technical assistance, and training considerations related to the future of low-emission residential new construction in California. This report also highlights notable differences the evaluation team found between the baseline assessment and the Time 1 Market Study.

I.I KEY FINDINGS AND RECOMMENDATIONS

Based on our research, we offer several key findings and recommendations to ensure the BUILD Program effectively increases low-income all-electric new construction in California.

- **Finding: There has been continuous growth of new stakeholders entering the all-electric new construction market over the last decade.** Over one-half of stakeholders with all-electric construction experience reported first working on an all-electric project in 2020 or later (57%), a significant increase from the 22% who reported first working on an all-electric project in the prior five-year period from 2015 to 2019.
- **Finding: Stakeholder experience working in all-electric design has increased since 2022.** Since the evaluation team conducted our baseline assessment in 2022, the proportion of stakeholders with experience working in all-electric design has increased across all housing types, except for multifamily affordable housing, which was already high. The proportion of single family market rate stakeholders with all-electric design experience increased from 51% to 72%, and this trend was similar in multifamily market rate housing (increased from 44% to 60%) and single family affordable housing (increased from 23% to 44%). The proportion of stakeholders working in the multifamily affordable housing with experience in all-electric design was the same as in the baseline assessment but also was the highest among all housing types (75%). Overall, the proportion of stakeholders with all-electric design experience increased from 66% to 77%.
  - **Recommendation:** The California Energy Commission (CEC) should consider expanding the New Adopter Design Award to single family affordable housing to cover a portion of the design costs for their first all-electric, low-income single family building to create more opportunities for stakeholders to work in single family affordable housing.

[1] The BUILD Program is focused on affordable housing. Current program guidelines restrict participation to builders and developers of properties that meet one of three criteria, designed to focus BUILD Program funds on low-income developments. Eligibility could be expanded in future iterations of the program.

- **Finding: Stakeholder knowledge of all-electric design and technologies has increased since 2022.** Since the evaluation team conducted our baseline assessment in 2022, increases have been seen in knowledge of all-electric design and technologies. Half of all surveyed stakeholders reported being "very" or "extremely" knowledgeable about all-electric design (52% compared to 34% at baseline). Furthermore, almost half of all respondents reported they were "very" or "extremely" knowledgeable about all-electric technologies (46% compared to 39% at baseline).
  - **Recommendation:** The CEC should continue to provide technical assistance and resources to stakeholders regarding all-electric design and technologies to continue to increase stakeholder knowledge on those topics.
- **Finding: Many stakeholders consider all-electric construction practical, but cost concerns remain prevalent.** Most stakeholders felt that building all-electric is practical within each housing type (65% of multifamily affordable housing, n=48; 55% of multifamily market rate, n=77, 59% of single family market rate, n=65, and 50% of single family affordable, n=16). Respondents working in market rate housing who indicated high-efficiency all-electric design and technologies were impractical today generally cited concerns about the higher upfront cost relative to a dual-fuel home (6 of 16 multifamily market rate and 7 of 16 single family market rate), concern regarding the electrical grid's ability to handle the increased load (4 of 16 multifamily market rate and 4 of 16 single family market rate) and the impact on tenants' bills (4 of 16 multifamily market rate and 4 of 16 single family market rate). Furthermore, **most stakeholders surveyed felt building high-efficiency all-electric housing was more expensive than building dual-fuel housing (ranging** from 57% for multifamily market rate housing to 49% for single family market rate housing); however**, the incidence of this sentiment was lower among stakeholders with experience building all-electric. Most stakeholders also agreed that high-efficiency all-electric homes often qualify for incentives and rebates, which is one way to offset costs.**
  - **Recommendation:** The CEC should continue to ensure that cost concerns and ways to offset costs are addressed during technical assistance.
- **Finding: There is an opportunity to increase stakeholder training on all-electric building design.** Half of the respondents never received training on all-electric building design but showed a preference for receiving this type of technical assistance through utility-sponsored programs and manufacturer training. Furthermore, stakeholders were overwhelmingly interested in receiving technical assistance, although a significant portion indicated they were only interested if the technical assistance was free or that their interest was dependent on the cost. The lack of awareness of where to access technical assistance was the largest barrier (40% of those interested in technical assistance, n=96) to stakeholders taking advantage of such resources.
  - **Recommendation:** The CEC should continue to leverage relationships with utilities and incentivized equipment manufacturers as well as consider deploying co-sponsorship training opportunities or technical assistance programs. BUILD's education and outreach should focus on increasing stakeholder awareness of the availability of free or low-cost technical assistance to help increase participation.
- **Finding: There is the potential to recruit more builders, contractors, designers, and developers involved in residential new construction in California into the BUILD Program.** More than half of the surveyed stakeholders were unaware of the BUILD Program, while almost half were interested in participating. Similarly, a third of stakeholders were unaware of any incentive programs that support low-income new construction.
  - **Recommendation:** BUILD's education and outreach should focus on increasing stakeholder awareness of the BUILD Program and its support of low-income new construction.
- **Finding: Stakeholders who were aware of incentive programs that support low-income new construction were most aware of state and utility-sponsored incentive programs, which most commonly support building and construction practices that align with the BUILD Program.** Those incentive programs most commonly support all-electric

appliances, above-code building efficiency, above-code solar, and greenhouse gas (GHG) reduction, all of which are incentivized by the BUILD Program.[2]

  - **Recommendation**: The CEC should continue to coordinate with other frequently utilized funding opportunities to increase awareness of the BUILD Program and explore braiding funding to increase the number of completed BUILD projects.[3]

- **Finding: The feasibility of measuring the market-transforming effects of the BUILD Program is limited due to the rate at which full market characterization studies are updated.** Four of the eight studies used to assess the market conditions and update the baseline have not been updated since 2021.[4] This limits the ability to measure the transformation a new construction decarbonization program is having on the market.

[2] For BUILD specifically, the purpose of incentive monies for incremental solar above code is to meet SB 1477's mandate that building occupants do not incur higher utility bills as a result of electrification.

[3] The BUILD program and its Technical Assistance Provider are currently providing participants assistance with and information about layering funding: https://www.energy.ca.gov/sites/default/files/2024-04/BUILD_Factsheet_Layering_03-19-2024_ada.pdf

[4] This information is provided in section 2.2.2

2. INTRODUCTION

The BUILD Program is an $80 million program that aims to put California on a path to zero-emission homes. The BUILD Program is intended to encourage the design and construction of all-electric buildings. The BUILD Program provides incentives for the construction of new, all-electric residential housing using near-zero-emission building technologies to significantly reduce GHG emissions beyond what would be expected to result from a code-compliant mixed-fuel building. Eligible applicants must demonstrate that their project will result in at least a five percent reduction in residents' utility bills compared to mixed-fuel homes.[5] The BUILD Program also offers technical assistance to support project planning and educate developers, architects, builders, contractors and other stakeholders about new technologies and all-electric building design. The primary goal is to engage with new construction market actors to raise awareness of building decarbonization technologies and encourage them to design, develop, and build all-electric new construction. All program funding is directed toward new low-income housing.

The BUILD Program offers the following incentives:

- **Base GHG incentive**: Base electrification incentive calculated as $150 per metric ton of avoided GHG emissions.
- **Building Efficiency incentive**: Projects built to achieve efficiency beyond the applicable energy code, using the performance method as specified by the Residential and Nonresidential Alternative Calculation Method Reference Manuals,[6] will receive an additional incentive of up to $1,000 per bedroom.
- **Incremental PV incentive**: An incentive per watt of additional photovoltaic (PV) installed beyond what is required by the applicable energy code. This incentive will not be provided for PV installed to meet code or for additional PV beyond what is required to meet the modeled resident energy cost requirement. This incentive is also capped at the cost of the PV system.
- **Kicker incentives**: The program provides kicker incentives for specific high-efficiency technologies, including smart thermostats, JA-13-compliant heat pump water heaters (HPWHs),[7] use of equipment with low global warming potential refrigerants, induction cooktops, heat pump clothes dryers (HPCDs), on-site energy storage, and electric vehicle supply equipment.

Additionally, the BUILD Program offers a New Adopter Design Award,[8] which offers eligible applicants up to $100,000 to cover design costs for their first all-electric, low-income multifamily building.

Opinion Dynamics, with subcontractors Guidehouse and Mitchell Analytics (collectively the "evaluation team"), are serving as the developmental evaluator for the BUILD Program. One of our first evaluation activities was to work with the prime program implementer, the CEC, to create a Program Theory Logic Model (PTLM) that explains the BUILD Program's activities, outputs and intended market and program outcomes. We also developed key program and market metrics that, when measured, can demonstrate whether the intended outcomes are achieved. The market metrics align with the PTLM and tie directly to the market barriers that the BUILD Program is attempting to address (Figure 1).

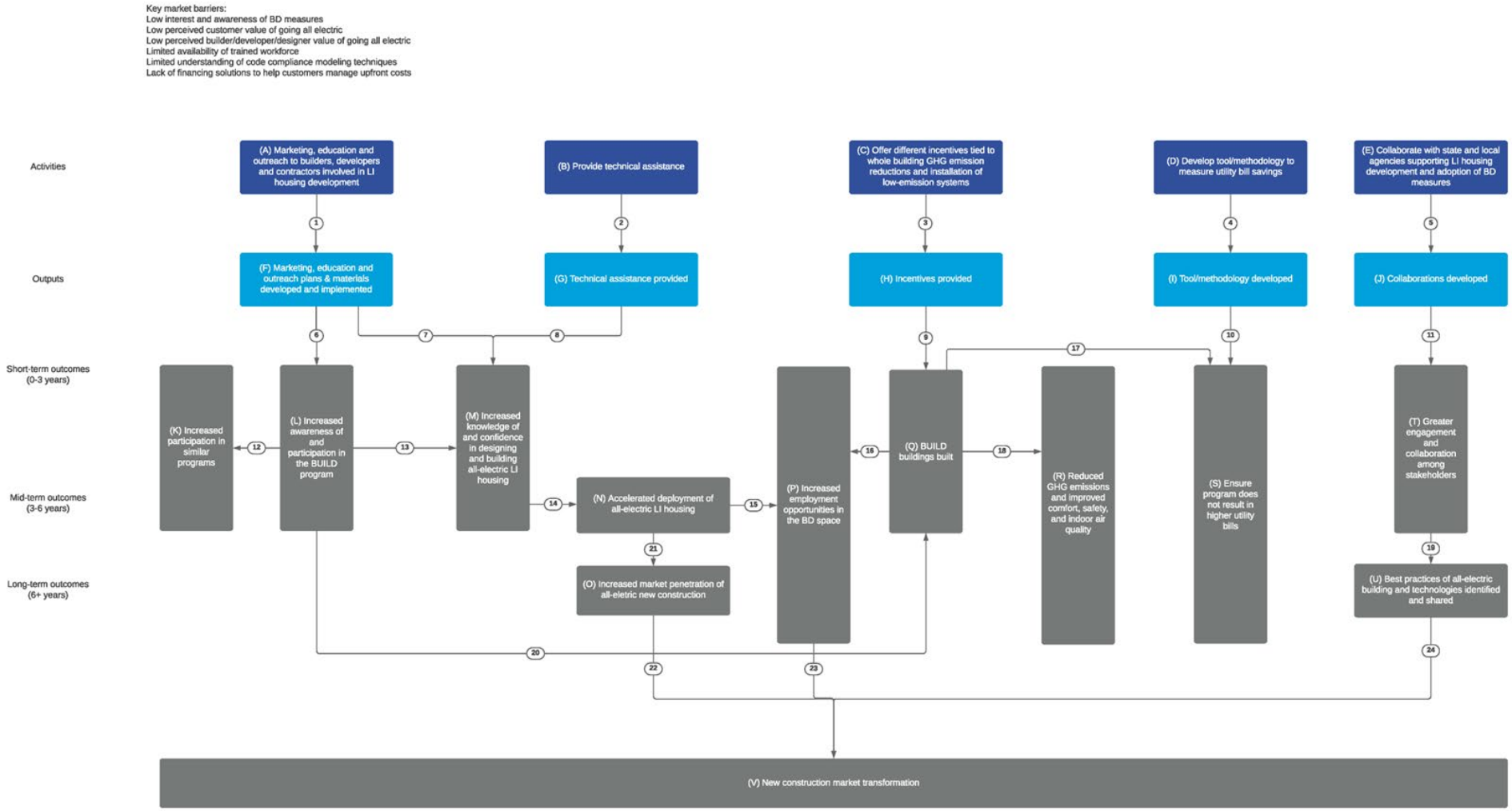
[5] The BUILD Program Guidelines define an eligible applicant as a "private, nonprofit, tribal government, California tribal organization, or public owner developer of an eligible residential building."

[6] Accessible at https://www.energy.ca.gov/publications/2019/2019-nonresidental-alternative-calculation-method-reference-manual

[7] JA-13 compliant heat pump water heater is certified by the CEC as a heat pump water heater demand management system.

[8] BUILD Program Guidelines, First Edition, https://www.energy.ca.gov/publications/2022/building-initiative-low-emissions-development-build-program-guidelines-1st

Figure 1. BUILD PTLM



When evaluating a market transformation program, it is integral to understand the natural market baseline to accurately assess the impacts of the intervention. For the BUILD Program, the baseline is a counterfactual, or what would have occurred in the market absent program intervention, with all other variables remaining equal. The counterfactual considers current practices, impending policy changes and known code updates to equipment standards or building energy codes. In the previous version of this report, we established a snapshot of the residential new construction market by estimating relevant market metrics drawn from the PTLM and supplementing with additional quantitative and qualitative evidence from a baseline survey we conducted with residential new construction market actors in California in 2022. Several years into the implementation of the BUILD Program, the evaluation team has conducted an analogous study to establish a snapshot of the market during program implementation to understand how the market has evolved generally and the specific market changes the BUILD Program may have influenced.

This report provides, where available, an updated overview of market size, summarizes market perceptions of all-electric design and electrification equipment, and characterizes the key cost, technical assistance, and training considerations related to the future of low-emission residential new construction in California. This report also highlights notable differences the evaluation team found between the baseline assessment and the Time 1 Market Study.

2.1 STUDY OBJECTIVES

The primary objectives of this study were to assess existing market conditions and update the established baseline for the BUILD Program based on primary and secondary research, where available. Data informing this report were garnered from a variety of sources, including a survey of market actors active in the California residential new construction market and a review of the secondary data resources that were updated after the baseline assessment. An overview of the secondary data resources and the availability of updated data since the baseline assessment are listed in the section 2.2.2. Specific objectives of this Time 1 Market Study include the following:

- Understand the annual market size/share of market rate and affordable new residential housing that is all-electric
- Ascertain the number of existing all-electric buildings in California
- Determine the number of trade allies with appropriate licenses to construct or alter structures in California, and/or install, service, and maintain low-emission technologies in total and by climate zones, zip code, and Disadvantaged Communities (DACs)[9]
- Assess stakeholders' existing knowledge of all-electric building value propositions and acceptance of all-electric technologies
- Assess stakeholders' existing knowledge of specific all-electric housing technologies and their implementation
- Identify any barriers to receiving technical assistance
- Assess stakeholders' existing knowledge about local governments' all-electric building permit requirements specified in relevant laws, ordinances, regulations, standards, and all-electric building Reach Codes
- Assess stakeholders' knowledge about all-electric funding opportunities and financing requirements, as well as the number of stakeholders who have already taken advantage of funding opportunities
- Determine BUILD Program awareness among new construction stakeholders in California

[9] For this report, we define a DAC as a census tract in the top 25% of census tracts most burdened by pollution per the CalEnviroScreen 4.0 scoring tool. California Public Utility Commission, "Disadvantaged Communities," accessed August 16, 2022, https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/disadvantaged-communities.

- Ascertain the number of available positions within the new construction industry by climate zones, zip codes, and DACs (as available)
- Ascertain the number of workers employed within the new construction industry by climate zones, zip codes, and DACs (as available)

2.2 METHODS

To complete this Time 1 Market Study, the evaluation team relied on an updated survey of new construction stakeholders and a review of the secondary data resources that have been updated since the baseline assessment. Each is described below.

2.2.1 NEW CONSTRUCTION STAKEHOLDER SURVEY

The evaluation team fielded an updated survey with builders, contractors, designers, and developers involved in residential new construction in California. In addition to BUILD-qualified applicants (i.e., builders and developers), the survey sought to understand the sentiments of architects and engineers who play a pivotal role in the design and technology selection for single family and multifamily new construction projects. These stakeholders were selected as they are more likely to have interacted with the BUILD program, work in the markets targeted by the BUILD program, and are closest to the design and efficient technology decisions the BUILD program aims to influence. The goal of the survey was to understand stakeholders' familiarity with and sentiments towards high-efficiency, all-electric residential new construction, as well as to understand any changes in the new construction market since the baseline assessment conducted in 2022. The data collection instrument is provided in Appendix A.

We utilized and augmented the previous sample from the baseline new construction stakeholder survey, which was a purposive sample of stakeholders identified through independent research, previous Opinion Dynamics work, and contacts provided by the program implementation team. Many stakeholders identified as potentially eligible respondents from previous Opinion Dynamics work had participated in other California energy efficiency programs, which may present potential biases in responses toward all-electric construction. Stakeholders were contacted via email up to four times each. The survey was fielded from August to September 2024. We achieved a total of 108 survey completes (Table 1).[10] Respondents received a $100 gift card as a thank you for participating in the survey.

Table 1. Number of Respondents by Stakeholder Type

Stakeholder Type	Number of Respondents	Percent of Respondents
Architect/Design Firm	46	43%
Developer/Real Estate Development Firm	24	22%
Building/Construction Firm	15	14%
Engineering Firm	23	21%
Total	108	100%

[10] We sent the survey to 5,991 email contacts, 1,162 which were undeliverable. We received 176 responses to the survey; however, 68 respondents were screened out due to not operating in California, not working in new or major retrofit construction, only working on large commercial properties, or their company not being BUILD-qualified. This resulted in a 2.3% response rate, according to the American Association for Public Opinion Research Response Rate (RR) 1 methodology.

2.2.2 SECONDARY DATA MARKET ANALYSIS

The evaluation team reviewed the secondary sources used in the baseline assessment report to identify which sources, if any, have since been updated. Four of the eight sources included in the baseline assessment report have been updated, each provided and described in Table 2. The other four studies (Southern California Edison Home Energy Rating System [HERS] Registry Data Summary Analysis,[11] 2019 U.S. Residential Energy Conservation Survey [RECS],[12] 2020 Opinion Dynamics CPUC Group B Heat Pump Market Characterization and Baseline Study[13], and the 2019 California Residential Appliance Saturation Study [RASS][14]) have not been updated.

Table 2. Description and Update Status of Secondary Data Sources

Data Source	Description of Data Source	Last Updated	Used for Updated Analysis
California State Licensing Board (CSLB) Contractor License Data[15]	The CSLB, under the Department of Consumer Affairs, protects California consumers by licensing and regulating the state's construction industry. The CSLB was established in 1929 and currently licenses approximately 290,000 contractors in 44 different licensing classifications. The evaluation team relied on the CSLB data to characterize the trade ally market in California.	2024	✓
United States Energy & Employment Report (USEER)[16]	The USEER report contains information regarding the US labor market concerning energy-related sectors and provides a database of labor market information. USEER relies on employment data collected by the Bureau of Labor Statistics Quarterly Census of Employment and Wages and a supplemental survey, which received responses from over 25,000 business establishments across the country in 2021. The report is a year-over-year analysis that aims to provide "complete definitions and quantifications of energy jobs across all sectors of the economy." The database provides information regarding the difficulty of hiring, in-demand occupations, and the demographic composition of portions of the energy and energy efficiency workforce. The evaluation team used this report to understand the number of available positions in the energy efficiency and new construction workforces as well as the number of workers currently employed in these fields in California.	2024	✓
Home Builders Institute (HBI) Construction Labor Market Report[17]	The HBI report provides an update on the status of the nation's construction labor market, including information on the demand for construction workers, the demographic breakdown of the workforce, and the number of open positions available, among other metrics. The evaluation team used this report to understand the number of available positions in the new construction workforce as well as the number of workers currently employed in this field in California.	2024	✓

[11] The evaluation team relied on the public version of the summary table. The underlying data are confidential.
[12] US Energy Information Administration. Residential Energy Consumption Survey, 2020 RECS Survey Microdata, Accessed at: https://www.eia.gov/consumption/residential/
[13] Opinion Dynamics, "Opinion Dynamics CPUC Heat Pump Market Study Report" (California Public Utilities Commission, May 13, 2022).
[14] California Energy Commission, "2019 Residential Appliance Saturation Study," California Energy Commission (California Energy Commission, 2019), https://www.energy.ca.gov/data-reports/surveys/2019-residential-appliance-saturation-study
[15] Department of Consumer Affairs (DCA), "Contractor State License Board," (State of California, 2024), https://www.cslb.ca.gov/onlineservices/dataportal/
[16] Energy.Gov, "United States Energy & Employment 2024 State Reports," (Department of Energy, 2024). https://www.energy.gov/sites/default/files/2024-09/USEER%202024%20States_0913.pdf
[17] Home Builders Institute, "Spring 2024 HBI Construction Labor Market Report," (Home Builders Institute, October 2024).

Data Source	Description of Data Source	Last Updated	Used for Updated Analysis
Construction Industry Research Board (CIRB) Report[18]	The CIRB Report has published statistics on California residential, commercial, and energy-efficient building permit data since 1954. The evaluation team used 2013–2022 CIRB data to develop an understanding of the overall residential new construction single family and multifamily markets.	2024	

Note: While CIRB data were originally used to inform the new construction market size section of the last report, specifically, the number of new housing units in CA built from 2012 to 2022, we were unable to access updated data to inform the penetration of all-electric units. Without data on all-electric units from RASS, RECS, or HERs, it did not make sense to report on this individual non-electric metric, as it only provided ancillary context.

In the baseline assessment report, we included a section on the new construction market size and penetration of all-electric equipment types. For this report, the evaluation team was not able to update that section due to a lack of updates to the necessary datasets utilized in the baseline assessment. A modified section from the baseline assessment is included in this report in Appendix C to provide additional context to the reader.

[18] Construction Industry Research Board (CIRB), "Construction Industry Research Board Annual Building Permit Summary," (California Homebuilding Foundation, 2021).

3. STAKEHOLDER PERCEPTIONS

Increasing stakeholders' knowledge of and confidence in designing and building all-electric affordable housing is a key outcome of the BUILD Program. To effectively assess this outcome, the evaluation team conducted a survey of new construction market actors to characterize stakeholder perceptions of all-electric design and technologies, including perceptions of the practicality, feasibility, costs, and other barriers to all-electric new construction. Understanding barriers to all-electric new construction will also help the implementation team increase the number of BUILD buildings that are built, which is another key outcome included in the PTLM. The survey instrument was largely the same as the one administered to support the baseline assessment, which allows for a direct comparison of many of the current study's results to those from the baseline assessment study. The following section summarizes respondent firmographics, respondent perception of all-electric design, high-efficiency all-electric technologies, relevant financing and incentive programs, and the need for decarbonization technical assistance and trainings.

3.1 NEW CONSTRUCTION STAKEHOLDER FIRMOGRAPHICS

It is important to understand the composition of the respondent pool when interpreting the results of this survey. Certain batteries of questions within the survey focused questions on specific housing types—single family market rate, single family affordable housing, multifamily market rate, and multifamily affordable housing. If a respondent reported any experience in the single family new construction or multifamily new construction, they were included in questions regarding single family market rate or multifamily market rate housing, respectively. If a respondent indicated that at least 25% of their work, by market type (single family vs. multifamily), was in affordable housing, they were also asked questions pertaining to affordable housing in these markets. As a result, a respondent may be included in multiple housing types. Table 3 shows the number of respondents included in analyses specific to each housing type for both the baseline assessment and the current Time 1 Market Study. The current sample has more stakeholders operating in each housing type compared to baseline, especially for single family market rate housing.[19]

Table 3. Number of Respondents by Housing Type

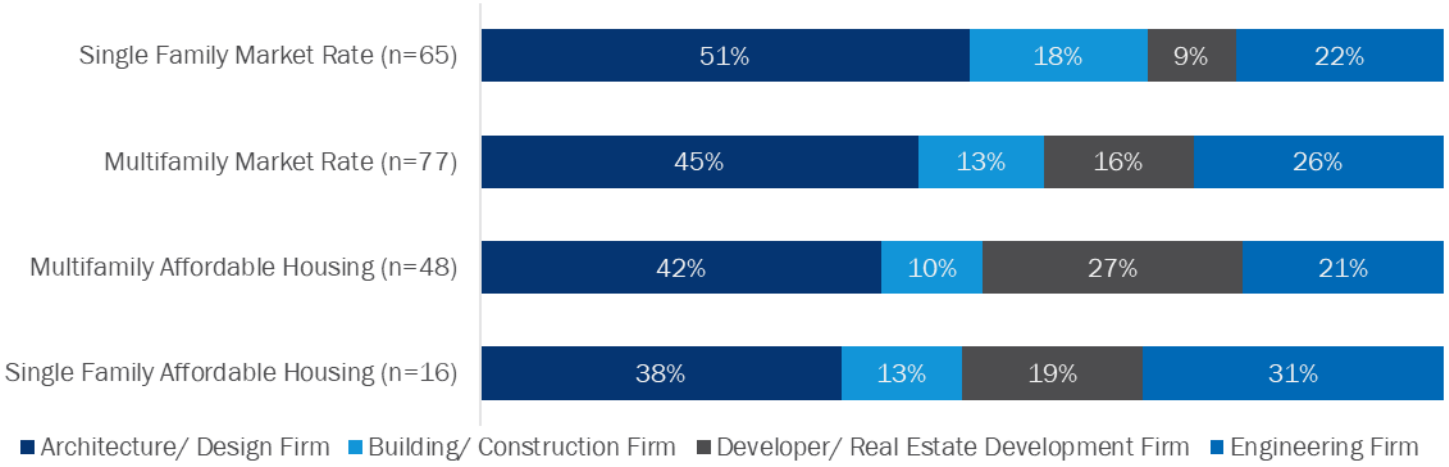
	Baseline Assessment		Time 1 Market Study	
Housing Type	Number of Respondents	Percent of Respondents[a]	Number of Respondents	Percent of Respondents[a]
Multifamily Market Rate	57	49%	77	65%
Single Family Market Rate	26	22%	65	60%
Multifamily Affordable	20	17%	48	44%
Single Family Affordable	14	12%	16	15%
Unique Respondents	117	100%	108	100%

[a] Sums to over 100% because respondents could be included in analyses for multiple housing types.

Figure 2 shows the breakdown of stakeholder types represented within each housing type for survey respondents. Stakeholders from architecture/design firms were the most common stakeholder type to complete the survey, accounting for 38% to 51% of respondents within a housing type. Stakeholders from engineering firms comprised almost a third of the single family affordable housing and multifamily market rate respondents. Overall, stakeholders from engineering firms accounted for a higher proportion of each housing type as compared to the baseline survey (21% to 31% of each housing type now vs. 13% to 19% previously).

[19] This does not necessarily mean that there is an increase in stakeholders working in single family market rate housing but rather could represent biases resulting from purposive sampling.

Figure 2. Stakeholder Type by Housing Type



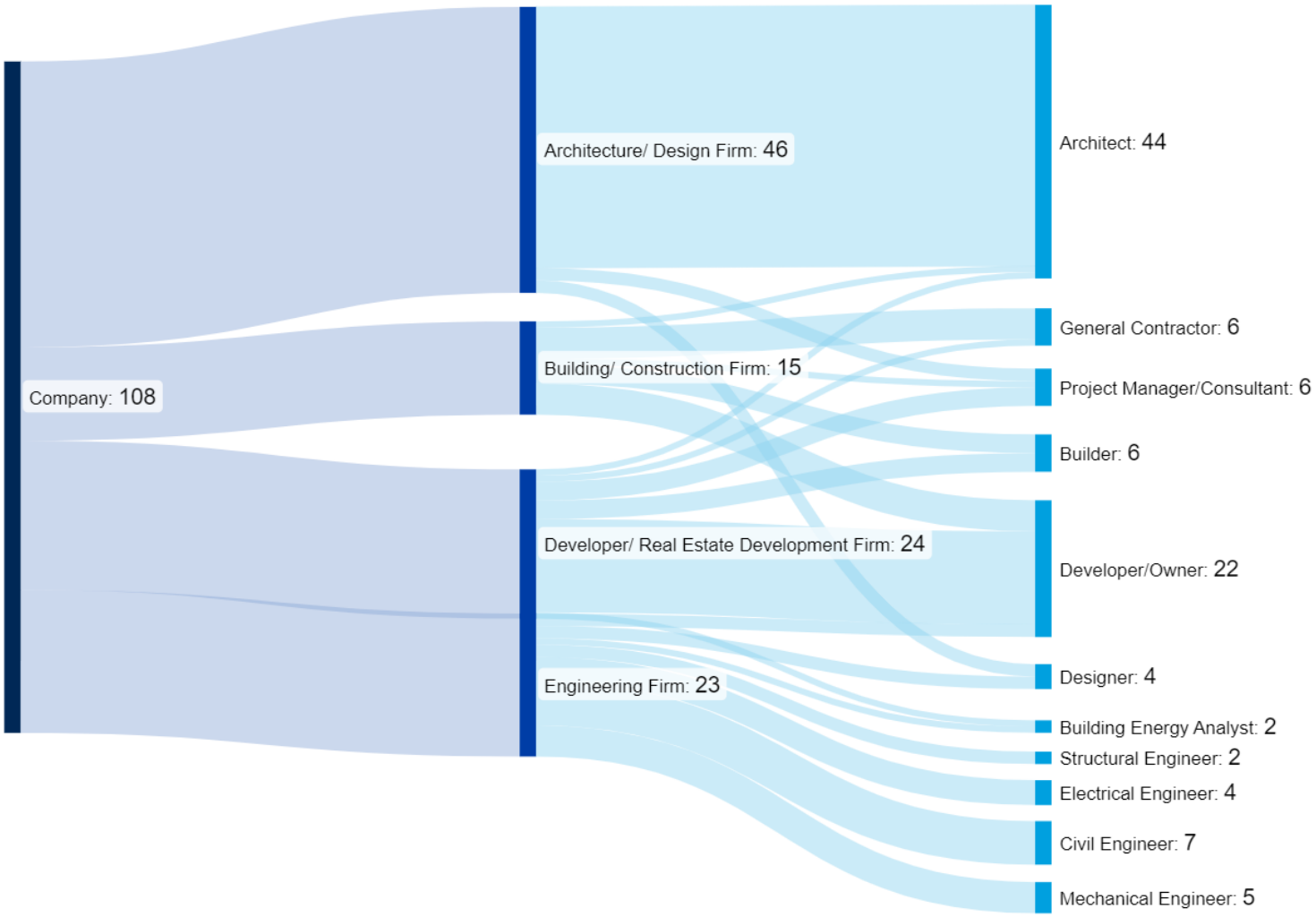
The vast majority of stakeholders focused their work in the Bay Area counties and the urban centers of Southern California. Respondents were asked to select up to three counties where they do most of their residential new construction work. Respondents most frequently worked in the counties of Los Angeles (26%), Alameda (19%), San Francisco (16%), Riverside (14%), and Santa Clara (14%) (Figure 3).

Figure 3. Counties Served by New Construction Stakeholders

Most stakeholders we surveyed worked at architecture and design firms and had the title of architect.

Respondents generally held job titles that aligned with their company's business segment. Figure 4 summarizes the titles of respondents based on their company types. Further, most respondents reported working for small companies with 1–10 employees (44%) or mid-sized companies with 11–100 employees (38%). A small minority of respondents reported working for large companies with over 100 employees (14%).

Figure 4. Summary of Stakeholders Company and Title [a]



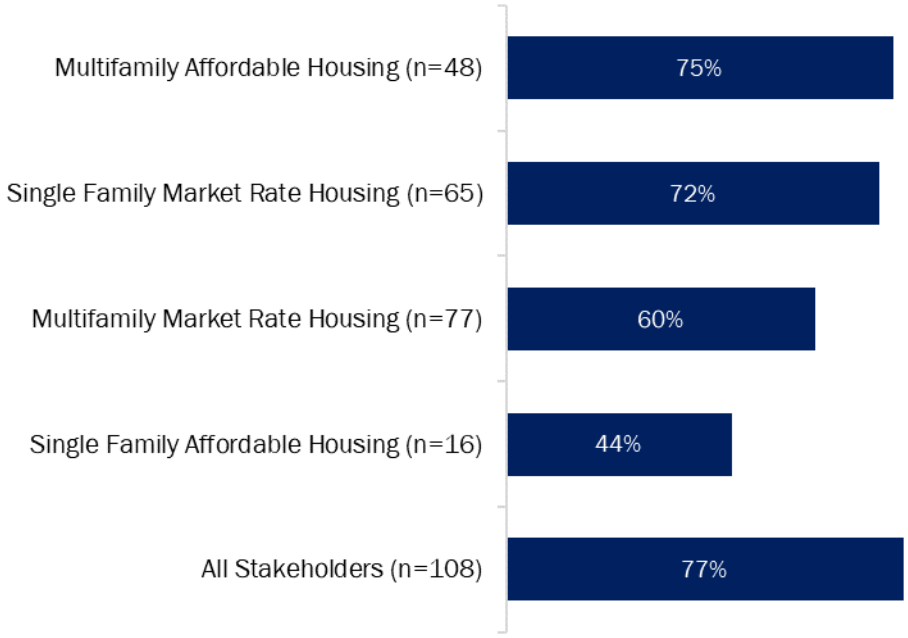
Note: Mechanical Engineer and Project Manager/Consultant were not answer options presented to respondents and are reclassifications of the open-ended "other" answer option.

3.2 OVERALL EXPERIENCE AND PERCEPTIONS

Stakeholders had varying amounts of experience working in all-electric design across each housing type (Figure 5). Three-fourths of stakeholders (77%) we surveyed had experience working on a team that has built or is currently building an all-electric new construction project, although this varies by housing type. Multifamily affordable housing had the highest proportion of respondents with experience building all-electric (75%), compared to less than half (44%) for single family affordable housing.

There have been notable increases in experience working in all-electric design since the baseline assessment across all housing types except for multifamily affordable housing, which was already high. Single family market rate experience increased from 51% to 72%, multifamily market rate increased from 44% to 60%, single family affordable housing increased from 23% to 44%, and overall, all stakeholder experience averaged together increased from 66% to 77%.

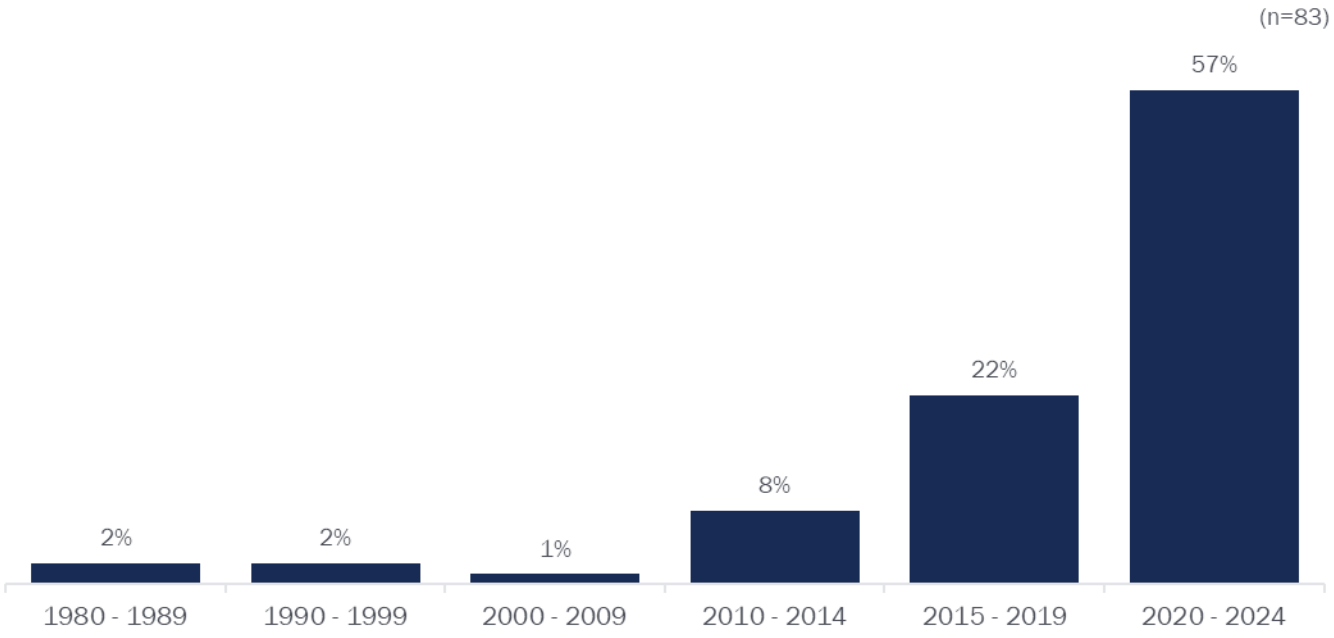
Figure 5. Stakeholders with Experience Working on All-Electric Residential Projects



The majority of respondents with all-electric construction experience built their first all-electric home in the last five years. Over one-half of stakeholders (57%) reported first working on an all-electric project in 2020 or later, a significant increase from the 22% who reported first working on an all-electric project in the prior five-year period from 2015 to 2019. One-eighth of stakeholders (13%) reported building all-electric new construction prior to 2015 (Figure 6).

A similar trend was also present at baseline. The majority of baseline stakeholders (71%) also built their first all-electric home in the last five years prior to survey fielding (2018 – 2022). Each year stakeholders reported first working on all-electric housing can be found in Appendix B, with a comparison to the baseline.

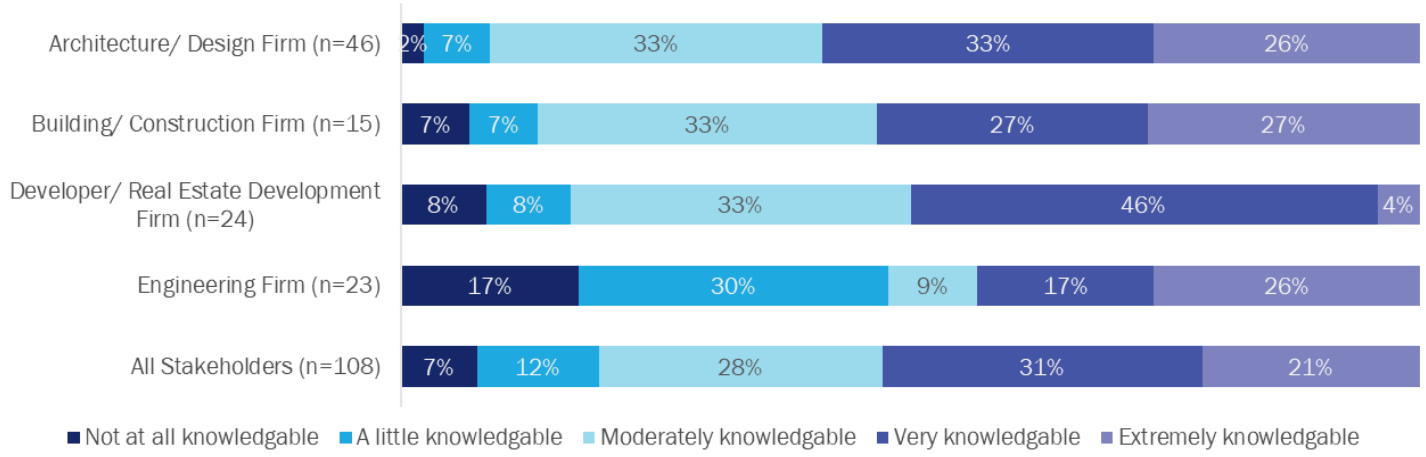
Figure 6. Timeline of Stakeholders First All-Electric New Construction Projects



Note: The sum of percentages does not equal 100 due to rounding of percentages, and seven percent of respondents responded, "Don't know."

Although most stakeholders started building all-electric homes within the last decade, most stakeholders reported being at least "moderately knowledgeable" about all-electric residential building design (Figure 7). Additionally, half of respondents reported being "very" or "extremely" knowledgeable about all-electric design, which is an increase from the baseline assessment (52% compared to 34% previously). Comparing self-rated knowledge between business segments, stakeholders from architecture/design firms reported being the most knowledgeable about all-electric design. In contrast, stakeholders from engineering firms reported being the least knowledgeable. Compared to the baseline assessment, selfrated knowledge building all-electric residential building design increased across all stakeholder types (22 percentage point (pp) increase for architecture/design firm, 24pp increase for building/construction firm, 15 pp increase for real estate firm, and 15 pp increase for engineering firm).

Figure 7. Stakeholders Knowledge Building All-Electric Residential Building Design

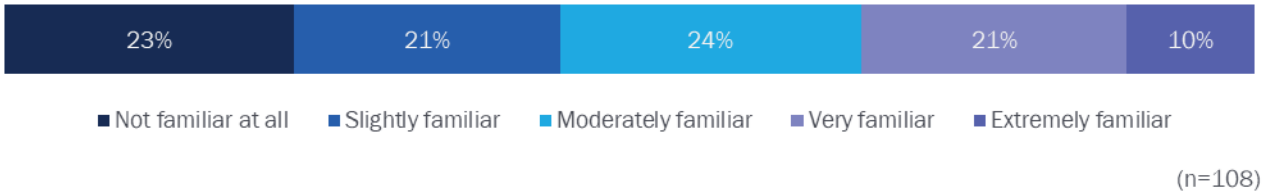


We asked respondents to estimate the percentage of their companies' residential new construction projects that follow a jurisdiction's reach codes, earn a sustainability certification such as LEED, ENERGY STAR®, or GreenPoint rating, or participate in a utility-sponsored new construction energy efficiency program.[20] We found that half of the stakeholders (50%) reported that over 50% of their projects achieve at least one of these sustainability certifications or participate in a utility-sponsored energy efficiency program (n=108). This marks an increase from the baseline assessment of 36%. However, 11% of stakeholders stated that none of their projects meet these requirements.

Among stakeholders with experience in all-electric new construction (n=83), slightly more than half (57%) reported that over 50% of their projects receive a sustainability certification, and only 7% reported that none of their projects receive these certifications.

Stakeholders reported varying levels of familiarity with reach codes. More than half of respondents reported being at least "moderately" familiar with local jurisdictional reach codes set in the counties that they work in (56%); however, 23% reported being "not at all" familiar (Figure 8).

Figure 8. Stakeholder Familiarity with Jurisdictional Reach Codes

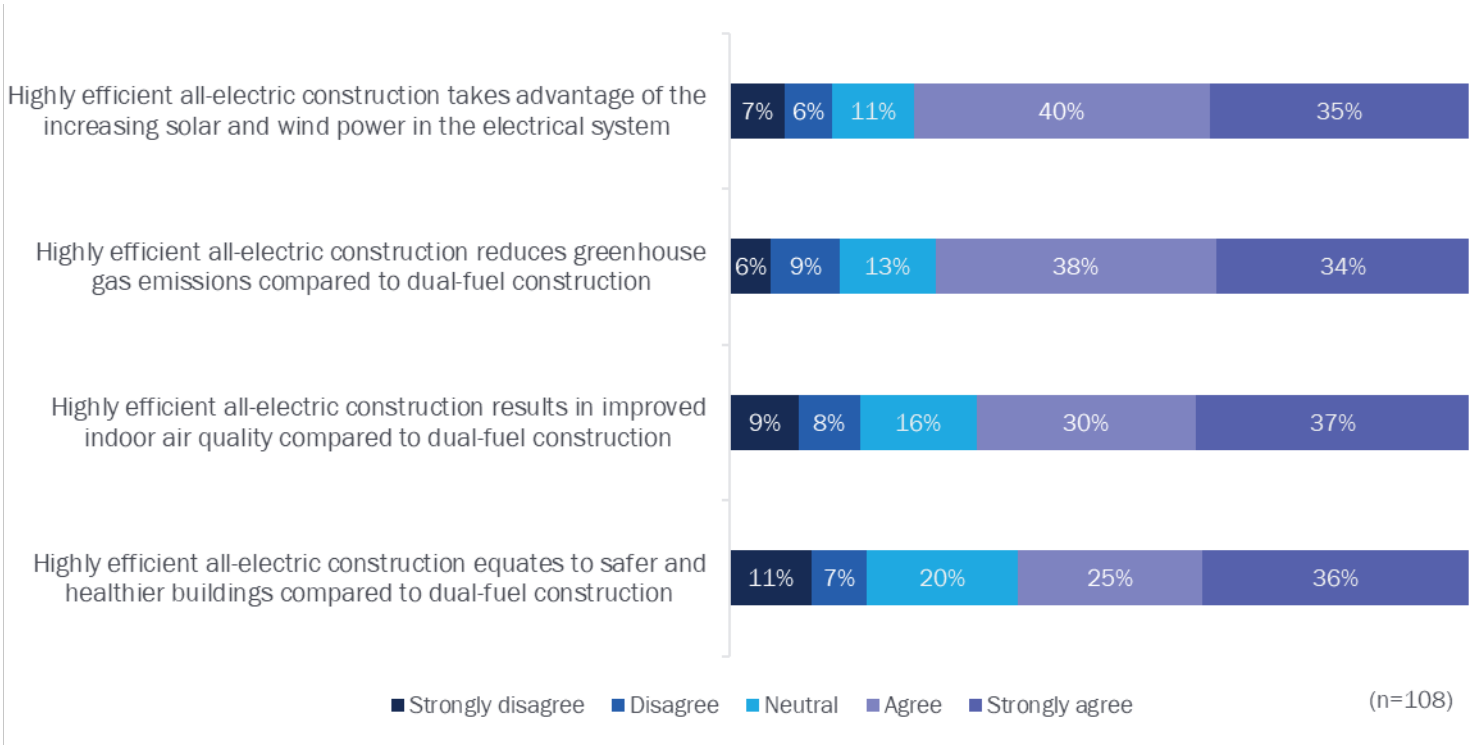


Surveyed stakeholders mostly agreed that high-efficiency, all-electric new construction provided multiple benefits compared to dual-fuel construction. Most stakeholders (75%) "agree" or "strongly agree" that all-electric construction takes advantage of the increasing solar and wind power in the electrical system and produces lower GHG emissions than dual-fuel construction (72%) (Figure 9). The statement that all-electric construction equated to safer

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

and healthier buildings compared to dual-fuel construction received the least agreement, although the majority still agreed with this sentiment (61% of respondents agreed or strongly agreed).

Figure 9. Stakeholders Perceptions of High-efficiency All-Electric New Construction



3.3 TECHNOLOGY CHOICES AND DESIGN

The following section outlines stakeholder sentiments about installing specific electric technologies into single family and multifamily market rate and affordable homes. We split the results into two sections: multifamily all-electric design and single family all-electric design. We highlight findings related to technologies that are eligible for a BUILD Program kicker incentive. Each technology discussed in the following section is introduced in Table 4.

Table 4. Relevant Electric Technologies

Unit Type	Description	Example Image
Induction cooktop (Kicker)	Induction cooktops look similar to standard glass-top electric cooktops; however, they utilize electromagnetic waves to heat cookware. These types of cooktops are highly efficient because they allow for precise heating of cookware, and very little heat energy is lost in the process.	

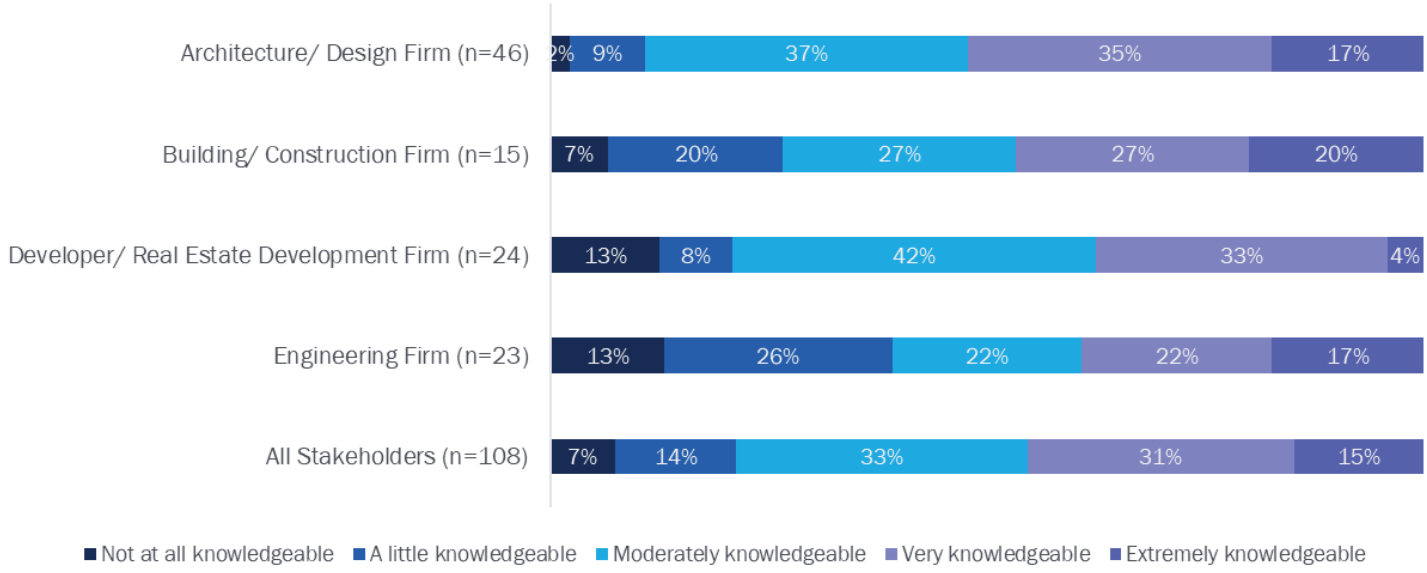
Unit Type	Description	Example Image
Heat pump clothes dryer (Kicker)	HPCDs work as closed-loop systems by heating the air, using it to remove moisture from the clothes, and then reusing it once it is removed. The HPCD uses refrigerant to catch hot air, push it through a compressor to make it hotter than before, and then push that hot air through the dryer drum to dry clothes. Rather than releasing warm, humid air through a dryer vent to the home's exterior as a conventional dryer does, an HPCD sends it through an evaporator to remove the moisture and deposits the water in an accessible compartment.	
Electric clothes dryer	In electric dryers, an electric current is sent through a coil designed to create resistance. This resistance builds up electrons and creates heat. The heat is then transferred to the surrounding air and forced throughout the dryer by a blower or fan. These dryers typically run on a 240V circuit and do not require professional installation. The operating costs of these units tend to be almost twice that of a traditional gas dryer, especially in locations such as California, where gas is more prevalent.	
Heat pump water heaters (Kicker if JA13-compliant)	HPWHs are all-electric, high-efficiency water heaters that, unlike gas-powered water heaters and electric resistance water heaters, heat water by transferring heat from the surrounding air rather than creating new heat. A fan brings air in through an air filter and evaporator coil. The evaporator coil contains refrigerant, which absorbs heat from the air. The refrigerant is then pumped through a compressor, which increases the temperature of the refrigerant. The hot refrigerant is circulated through a closed-loop system from the compressor through a coil that wraps the tank. As the refrigerant passes through the coil, heat is transferred from the refrigerant into the water. Transferring heat rather than creating it allows HPWHs to be up to three times more efficient than gas and electric resistance water heaters, conserving power and reducing energy bills.	

Unit Type	Description	Example Image
Electric resistance water heater	An electric resistance water heater generally consists of an insulated, glass-lined steel tank with two electric resistance elements that heat the water. Electric resistance water heaters are highly efficient; however, they depend upon the unit being well insulated. These types of water heating units can also be installed in locations where a combustion gas vent may not be easily installed.	
Air source heat pump	Air source heat pumps (ASHPs) are an efficient electric heating and cooling option for homes. When properly installed, an ASHP can deliver 1.5 to 3 times more heat energy to a home than the electrical energy it consumes. This is possible because a heat pump moves heat rather than generates heat. An ASHP extracts heat from outdoor air, even in cold weather, and uses that to heat a home. In the summer, an ASHP works in reverse, transferring the inside heat to the outdoor unit. ASHP systems have the capacity for single and multi-zoning.	
Ductless mini-split heat pump	A ductless mini-split heat pump is a heating and cooling system that allows the ability to control temperatures in individual rooms or a combination of rooms. Mini-split systems include a head unit, or multiple head units, mounted on an interior wall or ceiling, with an accompanying unit outside. Similar to an ASHP, a mini-split heat pump extracts heat from outdoor air, even in cold weather, and uses that to heat a home. It works in reverse in the summer, transferring the inside heat to the outdoor unit. Because they transfer rather than generate heat (or cold), mini-splits use up to 60% less energy than traditional heating systems.	

Stakeholder knowledge of all-electric residential building technologies is moderately high, but varies across stakeholder groups, indicating an opportunity for education, training, and possibly technical assistance.

Across all stakeholders (n=108), almost half (46%) reported they were “very” or “extremely” knowledgeable about all-electric technologies, compared to 39% in the baseline assessment. Stakeholders from architecture/design firms (n=46) reported being the most knowledgeable about all-electric technologies, with 52% reporting being “very” or “extremely” knowledgeable, with stakeholders from building/construction firms (n=15) following closely behind (47%) (Figure 10). Both stakeholders from developer/real estate development firms and engineering firms reported being the least knowledgeable (13% reported being “not at all knowledgeable”).

Figure 10. Stakeholder Knowledge of All-Electric Building Technologies by Stakeholder Type

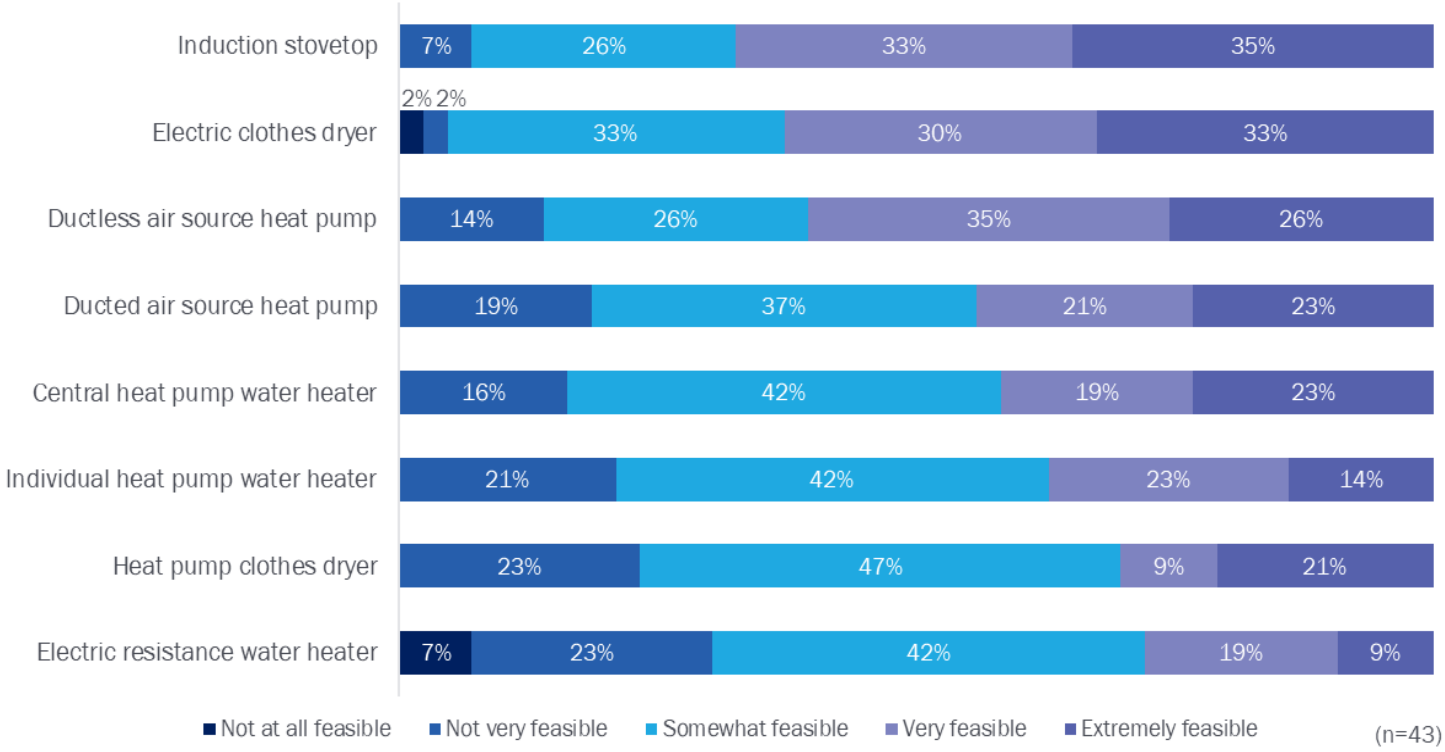


3.3.1 MULTIFAMILY ALL-ELECTRIC DESIGN

Stakeholders who work on multifamily homes overwhelmingly agree that installing all-electric technologies is at least somewhat technically feasible across all end uses. Between 65% and 100% of stakeholders reported that all-electric technologies are at least somewhat technically feasible to install across equipment and multifamily housing types. Stakeholders reported induction stovetops as the most feasible technology to install in the multifamily market rate housing (67% reported "very" or "extremely" technically feasible to install),[21] and electric clothes dryers as the most feasible to install in the multifamily affordable housing (70%) (Figure 11).

[21] Due to rounding, values in Figure 11 add to 68%.

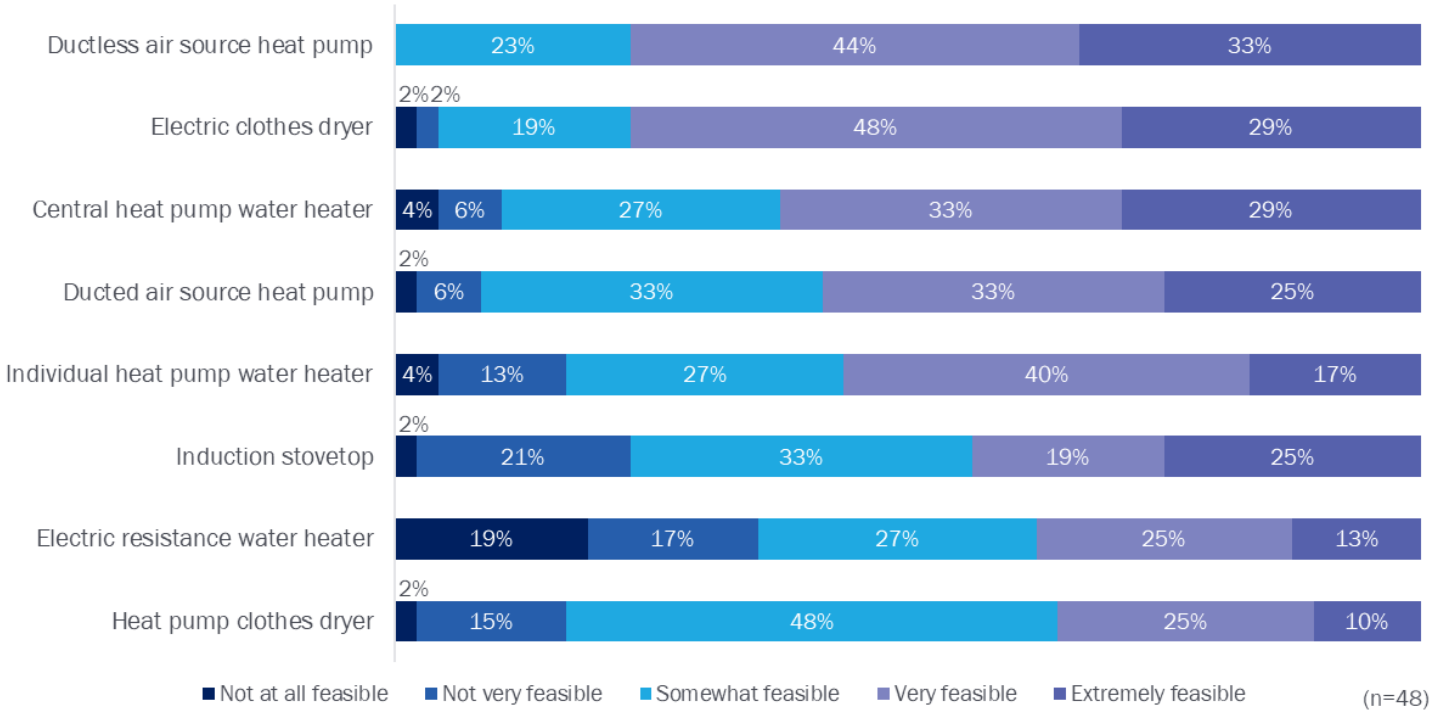
Figure 11. Technical Feasibility of Installing All-Electric Technologies in Multifamily Market Rate Housing



Stakeholders reported technologies eligible for BUILD Program kicker incentives are technically feasible to install in multifamily market rate housing and multifamily affordable housing. Stakeholders working in multifamily market rate housing reported high levels of technical feasibility of installation (reported being "very" or "extremely" technically feasible) for induction stovetops (67%),[22] but lower levels of technical feasibility of installation of central HPWHs (42%), individual HPWHs (37%), and heat pump clothes dryers (30%). Stakeholders working in multifamily affordable housing reported moderate levels of technical feasibility of installation (reported being "very" or "extremely" technically feasible) for central HPWHs (63%), individual HPWHs (56%), and lower levels of technical feasibility of installation for induction cooktops (44%), and heat pump clothes dryers (35%) (Figure 12).

[22] Ibid.

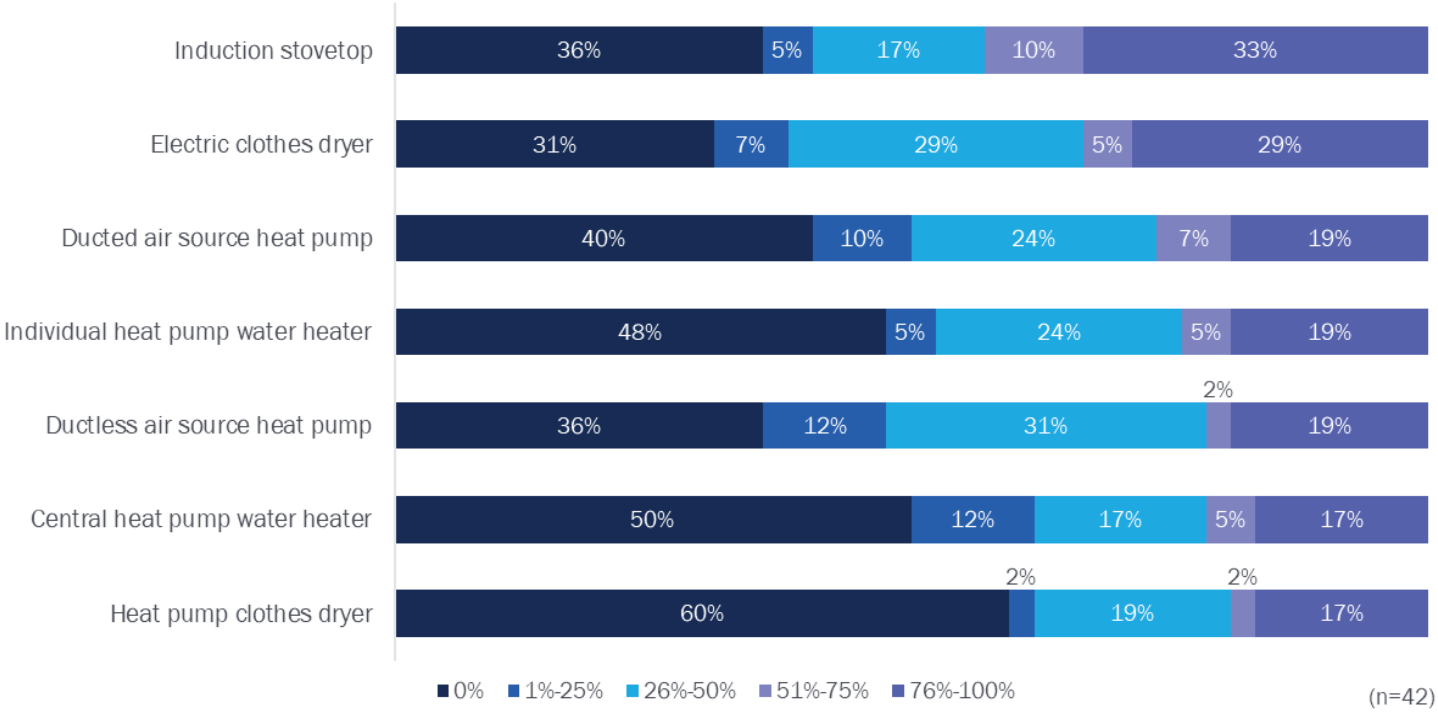
Figure 12. Technical Feasibility of Installing All-Electric Technologies in Multifamily Affordable Housing



The rate at which stakeholders recommend installing all-electric technologies in their projects is low across multiple technologies such as heat pump clothes dryers, central and individual heat pump water heaters, and ductless air source heat pump. However, stakeholder rating of technical feasibility of installation aligns with the frequency at which they recommend installing electric technologies in their projects. The more feasible the technology is perceived to be, the more likely it is to be recommended for installation, compared to technology that is perceived to be less feasible. For example, the induction cooktop was the most feasible technology for installation in market rate multifamily housing, and it was also the most likely to be recommended by stakeholders working in market rate multifamily housing (Figure 13).

While it is true that stakeholders' ratings of the technical feasibility of installation align with the frequency at which they recommend installing electric technologies in their projects, it is also important to note that for all of the technologies it was most common for stakeholders to report they never recommended the technology ever, specifically heat pump clothes dryers (60% would never recommend) and central HPWH (50% would never recommend).

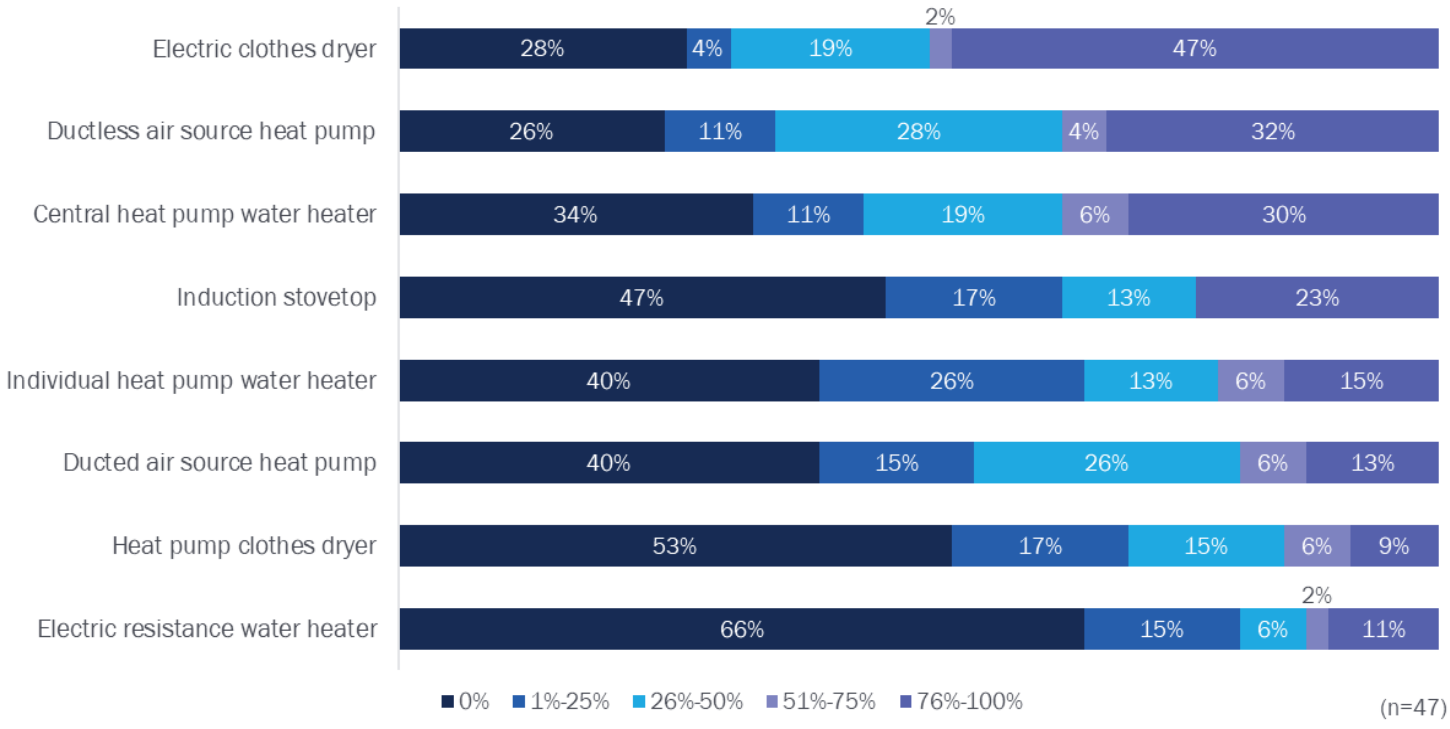
Figure 13. Percentage of the Time Stakeholders Recommend Installing All-Electric Technologies in Multifamily Market Rate Housing



Similar to multifamily market rate stakeholders, stakeholders working in multifamily affordable housing followed the same pattern of reporting that all-electric technologies that are often "very" or "extremely" feasible to install are usually recommended technologies in their projects. Over two-thirds of multifamily affordable housing stakeholders (77%) reported that electric clothes dryers and ductless ASHPs were "very" or "extremely" feasible to install, and these same technologies had the highest incidence of being recommended in their new construction projects (49% and 36%, respectively) (Figure 14).

Some technologies are not likely to be recommended for multifamily affordable housing, specifically electric resistance water heaters (66% would never recommend) and heat pump clothes dryers (53% would never recommend).

Figure 14. Percentage of the Time Stakeholders Recommend Installing All-Electric Technologies in Multifamily Affordable Housing



MULTIFAMILY ALL-ELECTRIC MAJOR DIFFERENCES

This section covers the major differences[23] in Multifamily all-electric design and technologies between the baseline assessment and the Time 1 Market Study.

- Rating of technical feasibility of very and extremely feasible of installing ductless air source heat pumps *increased* from 42% to 51% in multifamily market rate housing and *increased* from 66% to 77% in multifamily affordable housing.
- Rating of technical feasibility of very and extremely feasible of installing ducted air source heat pumps in multifamily market rate housing *decreased* from 54% to 44% compared to the baseline assessment.
- Rating of technical feasibility of very and extremely feasible of installing heat pump clothes dryers in multifamily market rate housing *decreased* from 42% to 30% compared to the baseline assessment.
- Rating of technical feasibility of very and extremely feasible of installing induction stovetops in multifamily affordable housing *decreased* from 64% to 44% compared to the baseline assessment.
- Rating of technical feasibility of very and extremely feasible of installing electric resistance water heaters in multifamily affordable housing *decreased* from 48% to 38% compared to the baseline assessment.
- The frequency at which stakeholders never recommend installing heat pump clothes dryers in multifamily affordable housing *decreased* from 65% to 53% compared to the baseline assessment.

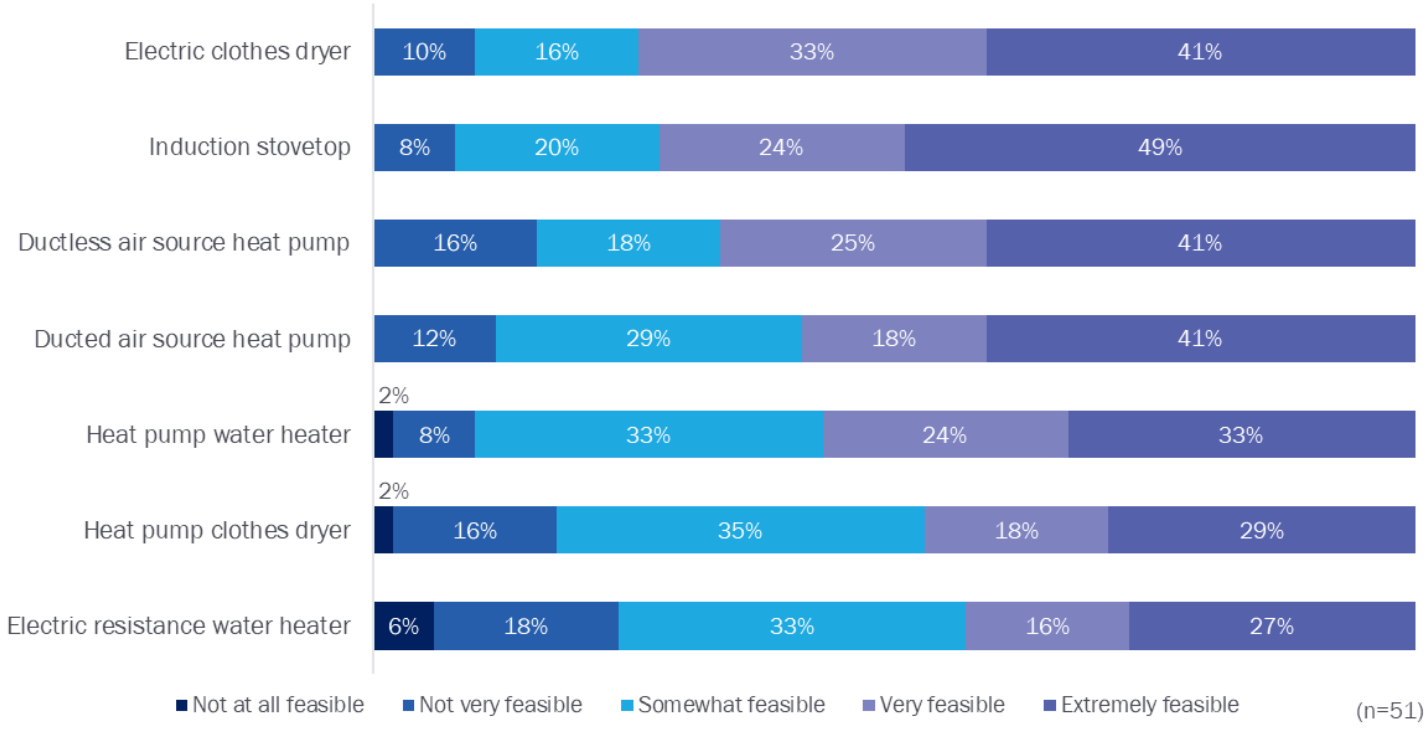
[23] We define a major difference as 10 pp or more. Occasionally, a smaller difference is mentioned when it is relevant to another finding, such as in ductless air source heat pumps.

3.3.2 SINGLE FAMILY ALL-ELECTRIC DESIGN

Stakeholders who work on single family market rate homes overwhelmingly agree that installing all-electric technologies is at least somewhat technically feasible across all end uses. Over 88% of stakeholders reported that installing induction stovetops, electric clothes dryers, HPWHs, and ducted ASHPs were all at least somewhat feasible in single family market rate homes (Figure 15). The least feasible technology in this market was electric resistance water heaters, with 24% of stakeholders reporting that they are "not very" or "not at all" feasible to install. Stakeholders reported that all kicker technologies are technically feasible in single family market rate housing. Stakeholders report moderately high levels of technical feasibility of installation (reported being "very" or "extremely" technically feasible) for induction cooktops (73%), HPWHs (57%), and heat pump clothes dryers (47%).

Perceptions on the technical feasibility of installing electric technologies in **single family market rate** housing are shown in Figure 15.

Figure 15. Technical Feasibility of Installing All-Electric Technologies in Single Family Market Rate Homes



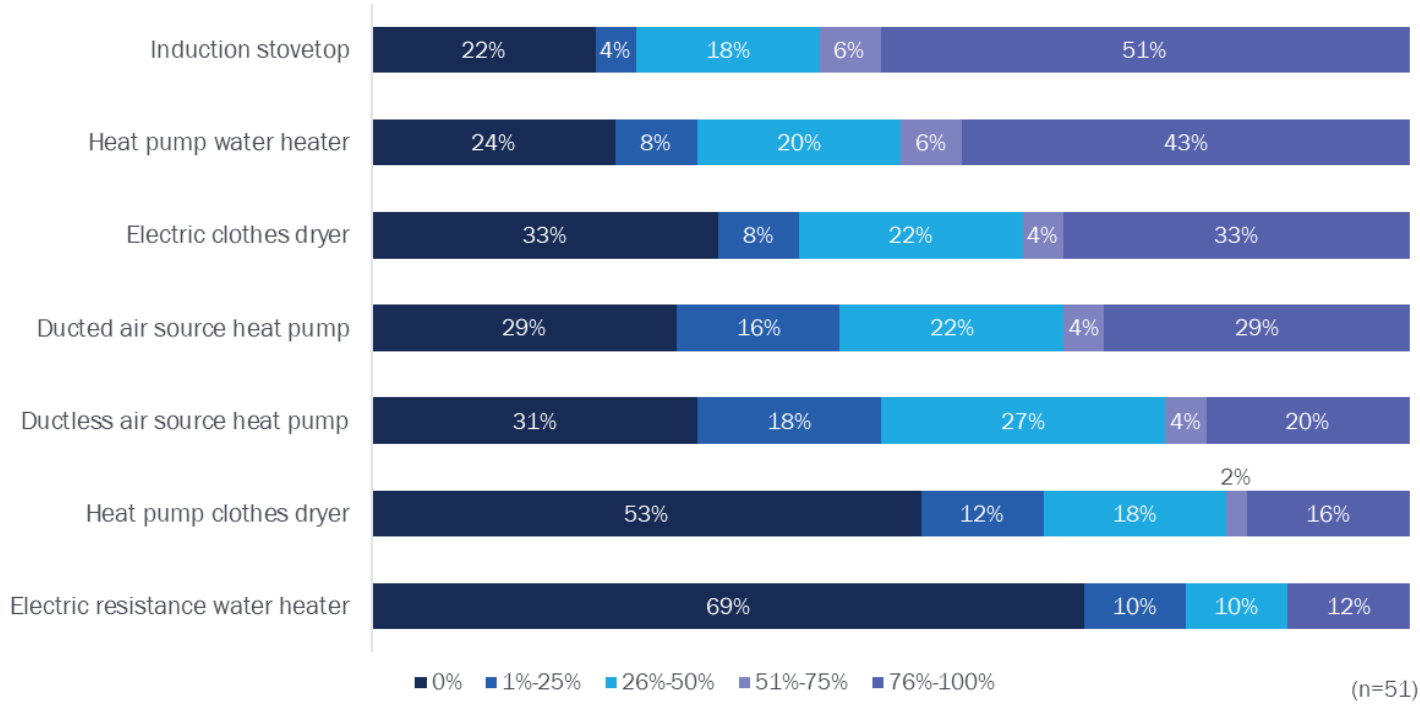
Few stakeholders reported working in single family affordable housing (n=16); however, sentiments were generally the same compared to single family market rate stakeholders. One key difference between the two markets is that single family affordable housing respondents felt induction cooktops were far less feasible to install than those who worked in market rate housing. Due to the low number of stakeholders who reported working in single family affordable housing, the figure for the technical feasibility of installing all-electric technologies in single family affordable housing is not presented.

As with multifamily, stakeholder rating of technical feasibility of installation aligns with the frequency at which they recommend installing electric technologies in their projects. The more feasible the technology is perceived to be, the more likely it is to be recommended for installation, compared to technology that is perceived to be less feasible. For example, the two technologies rated as most feasible for installation (induction cooktops and heat pump water heaters) were also the most likely to be recommended by stakeholders working in single family market rate housing (Figure 16). Due to the low number of stakeholders who reported working in single family affordable housing,

the percentage of the time stakeholders recommend installing all-electric technologies in single family affordable housing is not presented.

While it is true that stakeholders' ratings of the technical feasibility of installation align with the frequency at which they recommend installing electric technologies in their projects, it is also important to note that some of the technologies are likely not to be recommended at all, specifically electric resistance water heaters (69% never recommended) and heat pump clothes dryers (53% never recommended). These technologies are more likely to never be recommended than recommended.

Figure 16. Percentage of the Time Stakeholders Recommend Installing All-Electric Technologies in Single Family Market Rate Housing



SINGLE FAMILY ALL-ELECTRIC MAJOR DIFFERENCES

This section covers the major differences in single family all-electric design and technologies between the baseline assessment and the Time 1 Market Study. We only describe differences for single family market rate, as the sample size is too small for single family affordable housing to allow for meaningful comparisons.

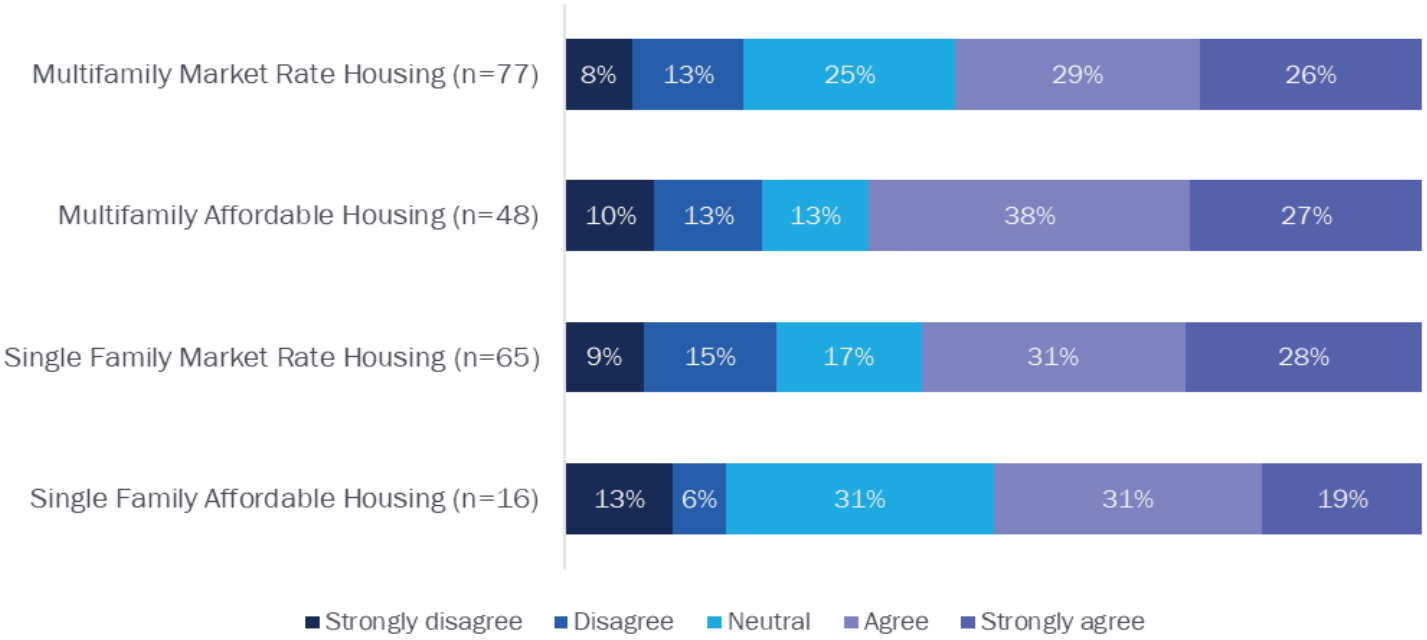
- Rating of technical feasibility of very and extremely feasible of installing heat pump clothes dryers in single family market rate housing *decreased* from 58% to 47% compared to the baseline assessment.
- The frequency at which stakeholders never recommend installing heat pump clothes dryers in single family market rate housing *increased* from 32% to 53% compared to the baseline assessment.
- The frequency at which stakeholders never recommend installing heat pump water heaters in single family market rate housing *decreased* from 66% to 24% compared to the baseline assessment.
- The frequency at which stakeholders never recommend installing induction stove tops in single family market rate housing *decreased* from 42% to 22% compared to the baseline assessment.
- The frequency at which stakeholders never recommend installing ductless heat pumps in single family market rate housing *decreased* from 42% to 31% compared to the baseline assessment.

3.4 PRACTICALITY OF HIGH-EFFICIENCY ALL-ELECTRIC DESIGN

Stakeholders generally agreed that constructing high-efficiency all-electric homes across each market type is practical today.

A majority of stakeholders across all housing types felt building all-electric is practical. Across the multifamily market rate, single family market rate, and multifamily affordable housing, a majority (at least 55%) of stakeholders agreed or strongly agreed that all-electric new construction was practical for their housing type. The lowest level of agreement was in the single family affordable housing market, where half of stakeholders "agree" or "strongly agree" that high-efficiency all-electric design is practical, which is a 19 percentage point decrease from the baseline assessment (50% compared to 69%, respectively). (Figure 17).

Figure 17. Practicality of All-Electric New Construction by Housing Type



Note: The n sizes in this chart vary from previous charts because stakeholders were shown response options for every market in which they reported working. In the previous section, stakeholders were only shown the market in which they primarily work (affordable or market rate).

Stakeholders felt that cost and grid concerns impacted the practicality of building all-electric. If respondents strongly disagreed with the statement that building all-electric was practical, they were asked to provide additional information about barriers. Barriers did not materially differ between the multifamily or single family sectors. The most frequent barriers to practicality respondents mentioned were higher upfront cost relative to a dual-fuel home (6 of 16 multifamily market rate and 7 of 16 single family market rate), concern regarding the electrical grid's ability to handle the increased load (4 of 16 multifamily market rate and 4 of 16 single family market rate) and the impact on tenants' bills (4 of 16 multifamily market rate and 4 of 16 single family market rate).

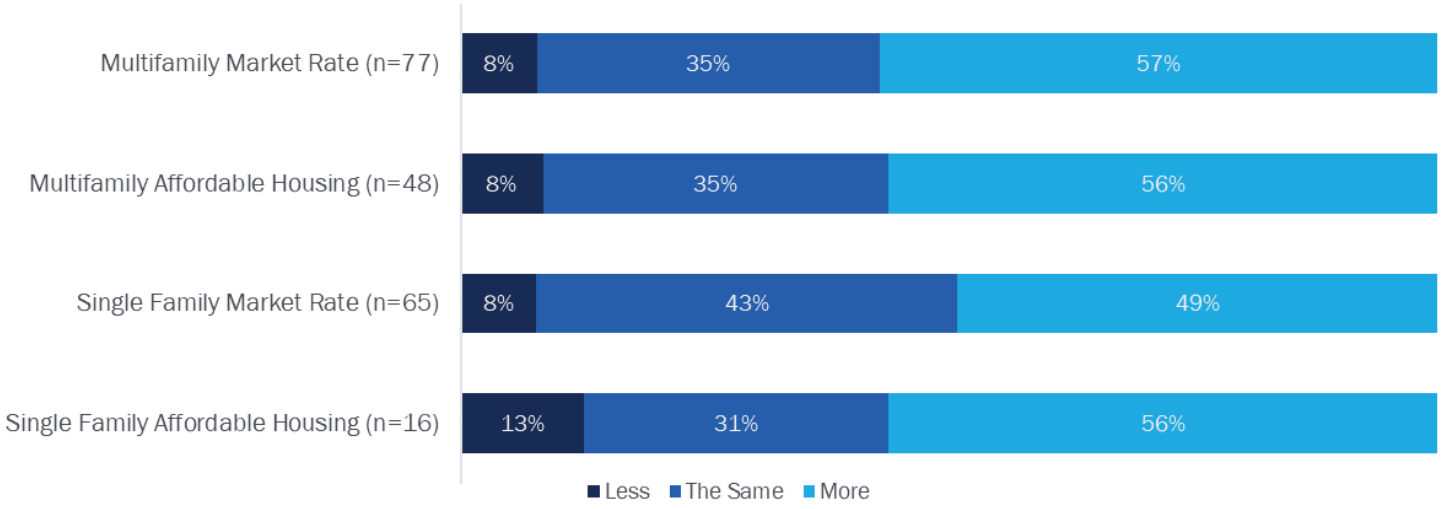
3.5 PROJECT COSTS AND INCENTIVES

In the following sections, we summarize stakeholder perspectives on the cost of building all-electric and their awareness and usage of available funding opportunities.

3.5.1 PROJECT COSTS

Within each housing type, stakeholders most frequently reported that building high-efficiency all-electric housing is more expensive than building dual-fuel housing. The percentage varied within each housing type, ranging from 57% in the multifamily market rate housing to 49% of the single family market rate housing (Figure 18).

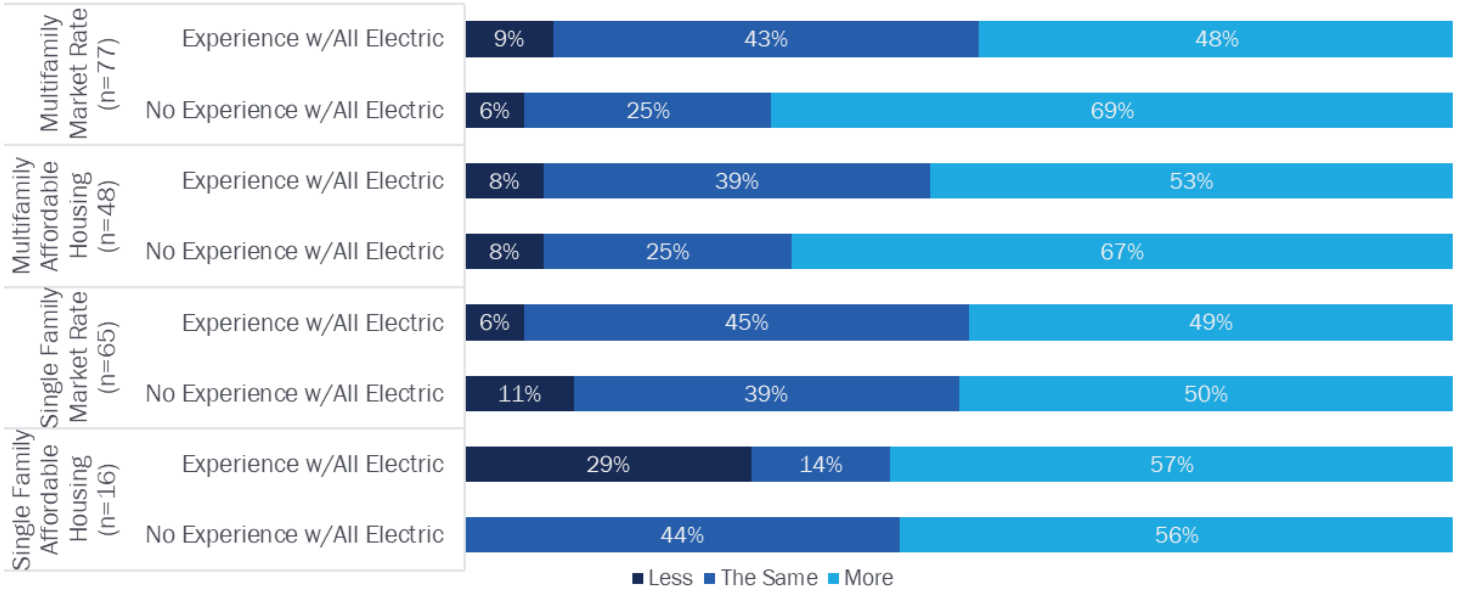
Figure 18. Cost to Build High-efficiency All-Electric Compared to Dual-Fuel



Stakeholders with experience with all-electric new construction were less likely to report that high-efficiency, all-electric new construction is more expensive than dual-fuel construction. Within all housing types, the proportion of respondents who indicated high-efficiency, all-electric new construction costs more than dual-fuel construction was lower or about the same among those with experience building all-electric compared to those with no experience (Figure 19).

Compared to the baseline, a lower percentage of single-family market rate stakeholders who had no experience with all-electric new construction believed building all-electric was more expensive that dual-fuel (50% compared to 70% at baseline). The opposite occurred with stakeholders with experience working in all-electric new construction, who worked in single family affordable housing. More than half (57%) of those stakeholders reported that high efficiency, all-electric new construction is more expensive than dual-fuel compared to a third (33%) of stakeholders in the baseline assessment reported.

Figure 19. Cost to Build High-Efficiency All-Electric Compared to Dual-Fuel, by All-Electric Experience

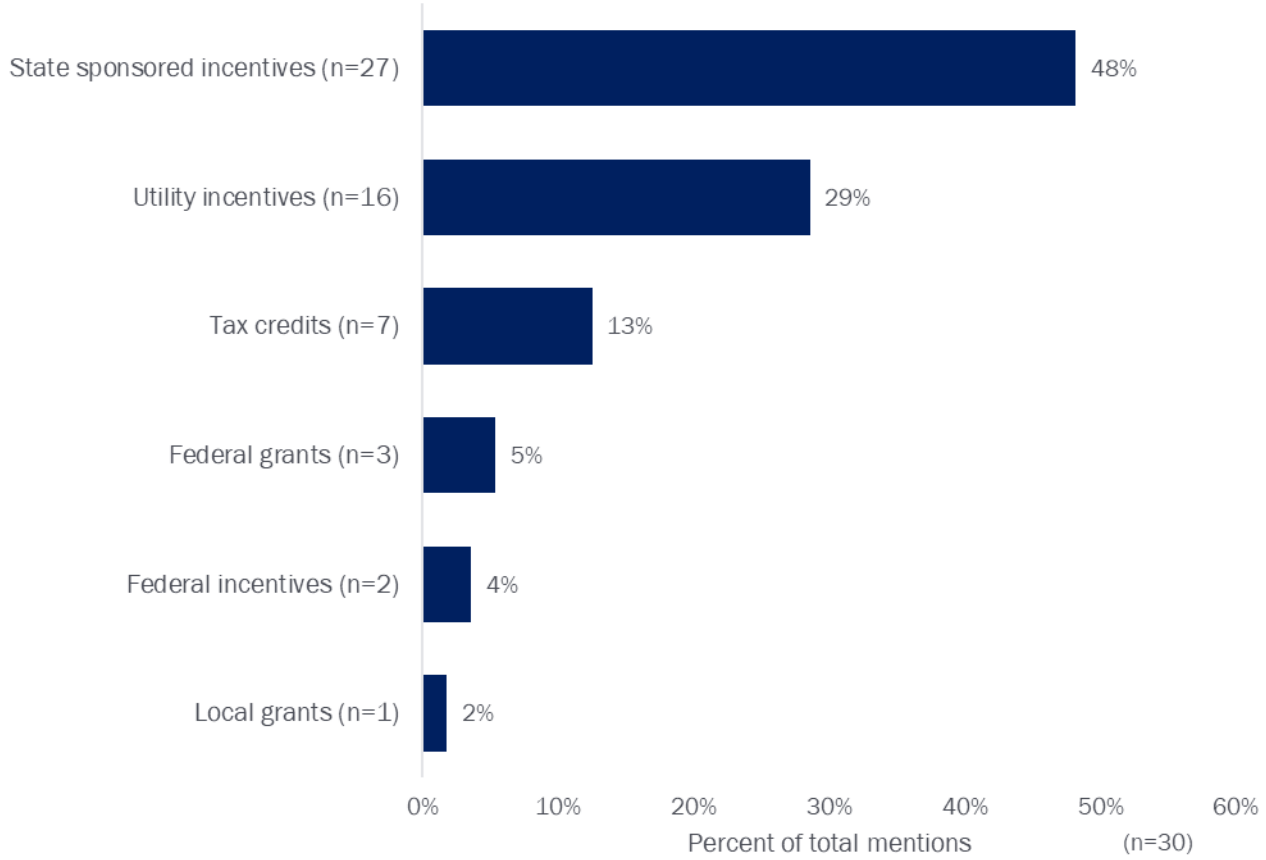


3.5.2 INCENTIVES

We asked respondents who worked in single family or multifamily affordable housing (n=48) what funding opportunities (e.g., incentives, rebates, grants, tax credits, etc.) they were aware of that support affordable new construction. Respondents could write in up to three responses or select that they were not aware of any incentives or funding opportunities. We then coded all responses into six distinct incentive/funding program types: state-sponsored incentives, utility incentives, tax credits, federal grants, federal incentives, and local grants. Almost two-thirds of respondents (63%) reported being aware of at least one type of incentive program other than BUILD; however, more than one third (37%) were unaware of any incentive programs.

The most common incentive programs mentioned for all-electric new construction were state-sponsored incentive programs, followed by utility incentives. Figure 20 shows the number of times each incentive program type was mentioned by stakeholders working in affordable housing and who were aware of funding opportunities (n=30). Respondent mentions of the BUILD program as a funding opportunity were removed from this figure (9 respondents) however 8 of the 9 respondents provided funding opportunities other than BUILD and those other mentions remained in the figure. It is important to note that a respondent can be associated with the same program type more than once, as there are multiple specific programs that fall under the program type. For example, there is more than just one state-sponsored incentive program within California that could have been mentioned by a stakeholder.

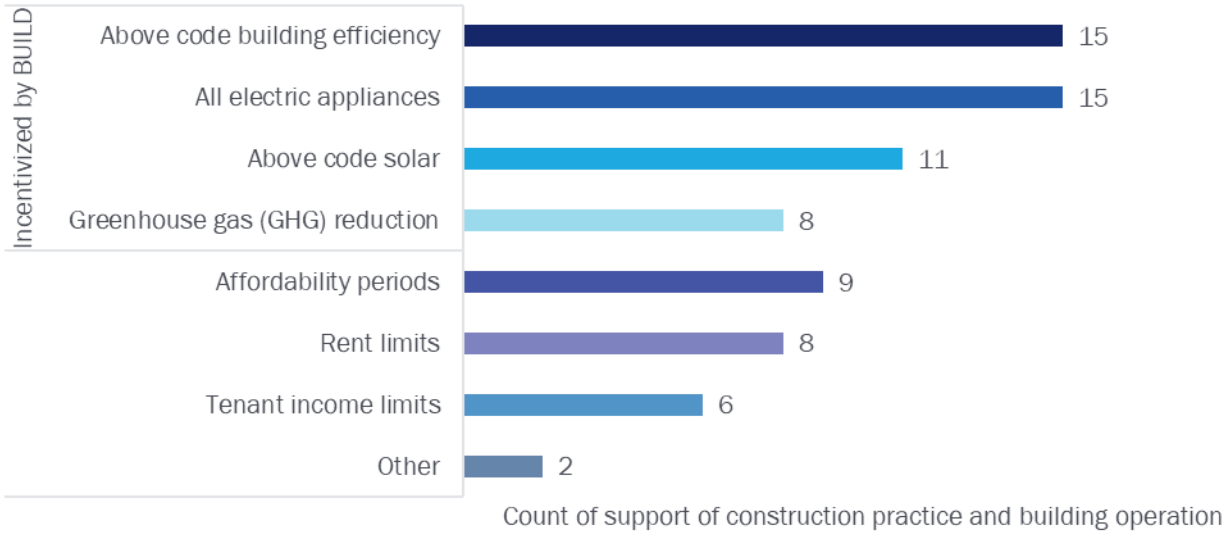
Figure 20. Stakeholder Mentions of All-Electric New Construction Funding Opportunities Other than BUILD



We then asked respondents whether they had utilized the specific program they named, and if so, to indicate if the specific program they named supported any of the construction practices or building operations listed in the response options offered to them. We present data for state-sponsored initiatives which were mentioned by 16 unique respondents 27 times (Figure 21) and utility incentives which were mentioned by 12 unique respondents 16 times (Figure 22).

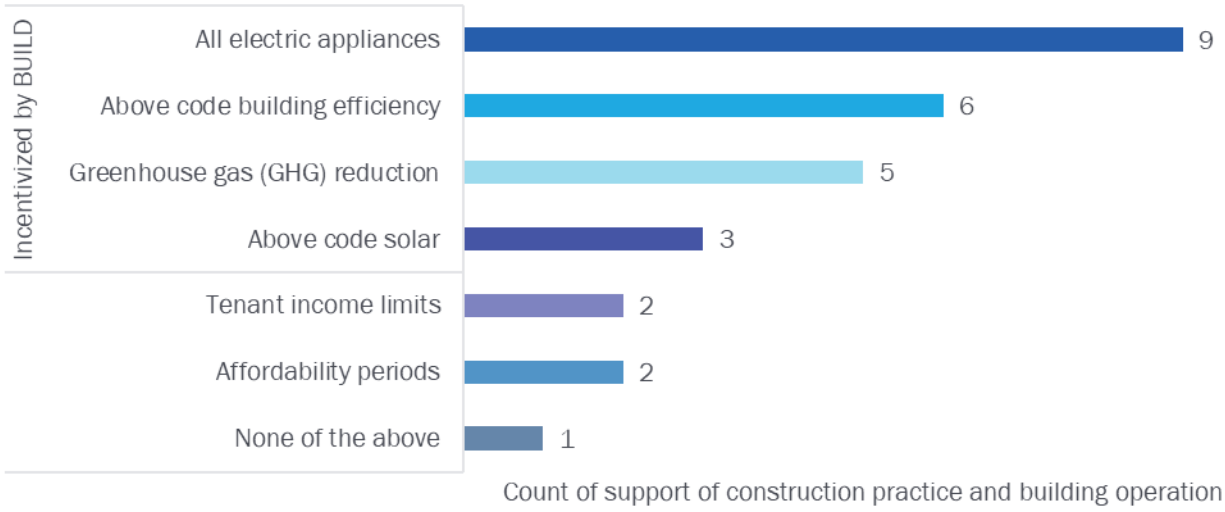
State-sponsored incentive funding opportunities most commonly support electric appliances, above code building efficiency, and above code solar, all of which are incentivized by the BUILD Program (Figure 21).

Figure 21. State-Sponsored Incentives Funding Support of Construction Practices and Building Operations



Utility incentive funding opportunities most commonly support electric appliances, above code building efficiency, and GHG reduction, all of which are incentivized by the BUILD Program (Figure 22).

Figure 22. Utility Incentives Funding Support of Construction Practices and Building Operations

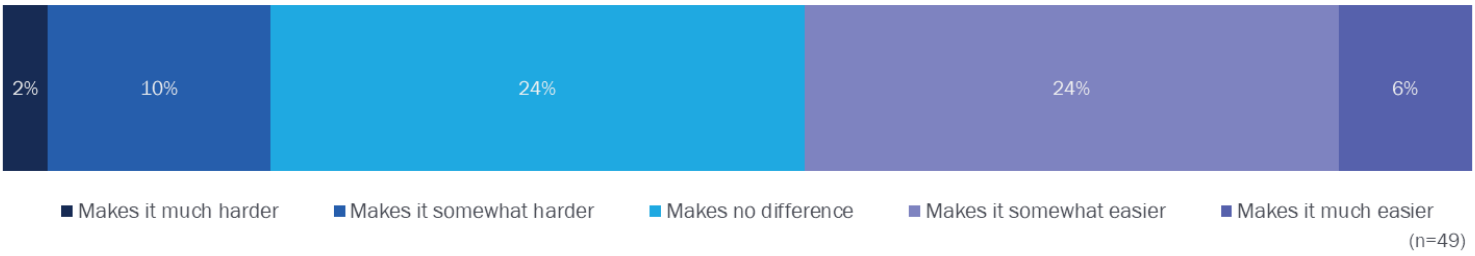


Note: Other funding opportunities supporting construction practices and building operations were not reported due to the low number of mentions of each of the other funding opportunity types.

Affordable housing stakeholders had mixed views about whether building all-electric made it harder or easier to apply for affordable housing financing and tax credits. Almost one-third (30%) of respondents with experience in the affordable housing market (n=49) reported building all-electric affordable housing makes it somewhat or much easier to receive a Low Income Housing Tax Credit (LIHTC), qualify for the California Tax Credit Allocation Committee (TCAC), or qualify for the California Debt Limit Allocation Committee (CDLAC). Conversely, 24% thought it made no difference and 12% reported it would be somewhat or much harder to receive these credits when building all-electric. Stakeholders who reported building all-electric would make accessing these programs harder generally cited increased building costs as the primary driving factor (Figure 23).

Compared to baseline, there was a decrease in the perception that building all-electric made it harder to access financing and tax credits (28% compared to 12% in the baseline assessment said it was somewhat or much harder).

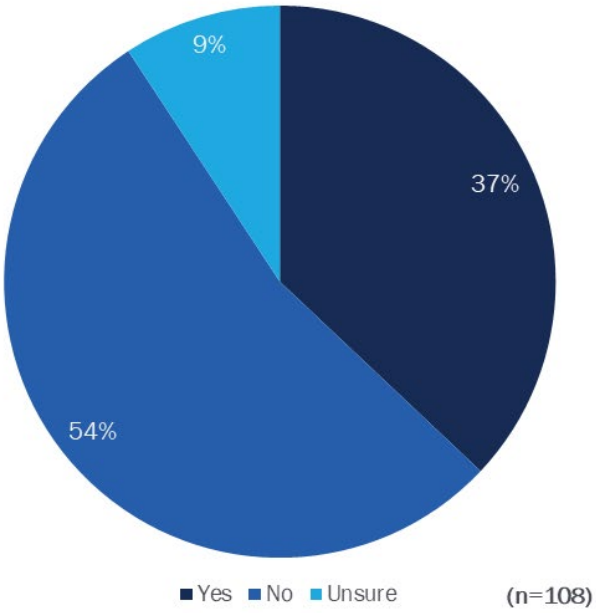
Figure 23. Impact of All-Electric Design on Access to Financing and Tax Credits



Note: The sum of percentages does not equal 100% as 11 respondents (22%) answered "Unsure" and 5 respondents (10%) answered "I don't know what these funding sources are."

Awareness of the BUILD Program increased compared to the baseline assessment from 19% to 37%, but still over half of respondents were not aware of the BUILD Program (54%). While almost half of respondents indicated interest in participating in the BUILD Program (42%), almost one third (31%) were unsure if they were interested in participating and almost one-fifth said they were not interested (18%). A very small minority reported they had already begun participating in the BUILD Program (10%).

Figure 24. Awareness of BUILD Program



3.6 TECHNICAL ASSISTANCE AND TRAINING

Technical assistance is a key component of the BUILD Program. The BUILD Program "provide[s] support to the developers, architects, engineers, energy consultants and staff of an eligible applicant prior to and throughout the BUILD participation process."[24]

In the following sections we summarize stakeholder awareness and usage of available technical assistance and training opportunities, as well as stakeholder recommendations on potential technical assistance topics.

3.6.1 TECHNICAL ASSISTANCE

More than half of stakeholders reported having prior experience with technical assistance and the vast majority would take advantage of technical assistance in the future. More than half of respondents (56%) reported they had taken advantage of technical assistance in the past. Respondents were most likely to report they would take advantage of technical assistance depending on the cost (38%) or only if it were free (43%). Only 11% of stakeholders reported they do not need any kind of technical assistance on their projects.

Those who mentioned that they were interested in taking advantage of technical assistance reported interest in a wide array of topics (Table 5). Most commonly, respondents mentioned they would be interested in receiving technical assistance to support comparative cost analyses of all-electric equipment (61%), general all-electric building design (61%), and code compliance and permitting (57%).

Table 5. Types of Technical Assistance Requested by Stakeholders

Technical Assistance	Percent of Stakeholders (n=93)
Comparative cost analyses for electric equipment choices	61%
General all-electric building design	61%
Code compliance and permitting	57%
All-electric water heating system design	56%
All-electric HVAC system design	54%
Introduction to sources of incentives, financing and other funding opportunities	54%
Help completing the application process for receiving incentives	42%

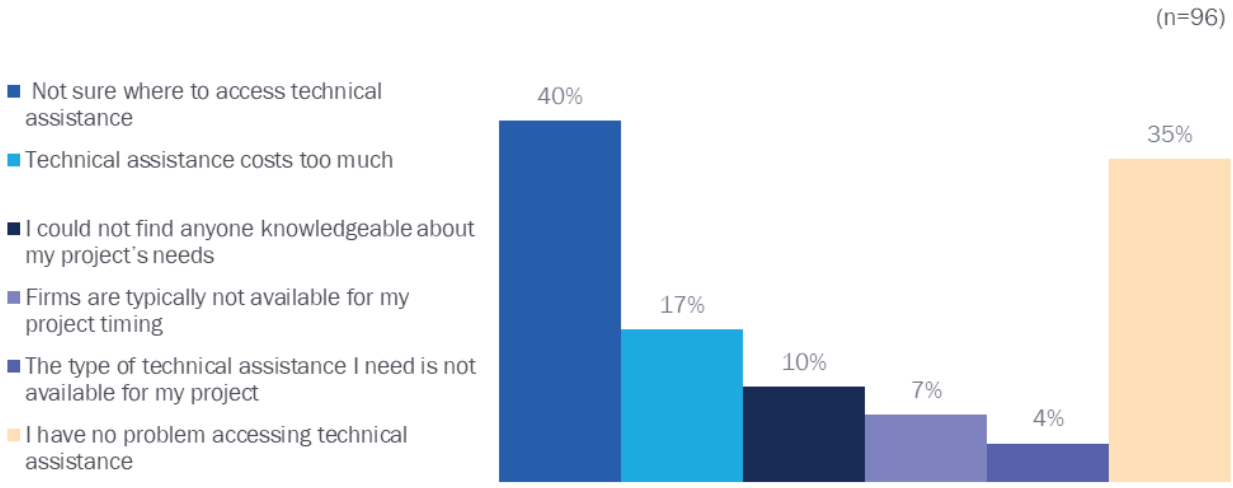
There is a desire for technical assistance among new construction stakeholders; however, most do not know where to seek it out. Among interested stakeholders (n=96),[25] the most common barrier to technical assistance was a lack of awareness about where to access it (40%).[26] Comparatively, just over one-third of stakeholders (35%) reported they had no problem accessing technical assistance (Figure 25). In the baseline assessment, half of stakeholders (51%) reported that they were not sure where to access technical assistance whereas only 40% of stakeholders reported that they were not sure where to access technical assistance in the Time 1 Market Study survey.

[24] BUILD Program Guidelines, First Edition, https://www.energy.ca.gov/publications/2022/building-initiative-low-emissions-development-build-program-guidelines-1st

[25] Stakeholders that indicated interest in technical assistance or indicated "don't know."

[26] The majority of stakeholders who were not sure where to access technical assistance were not aware of the BUILD program (60%) whereas 32% were aware of the BUILD program.

Figure 25. Barriers to Accessing Technical Assistance



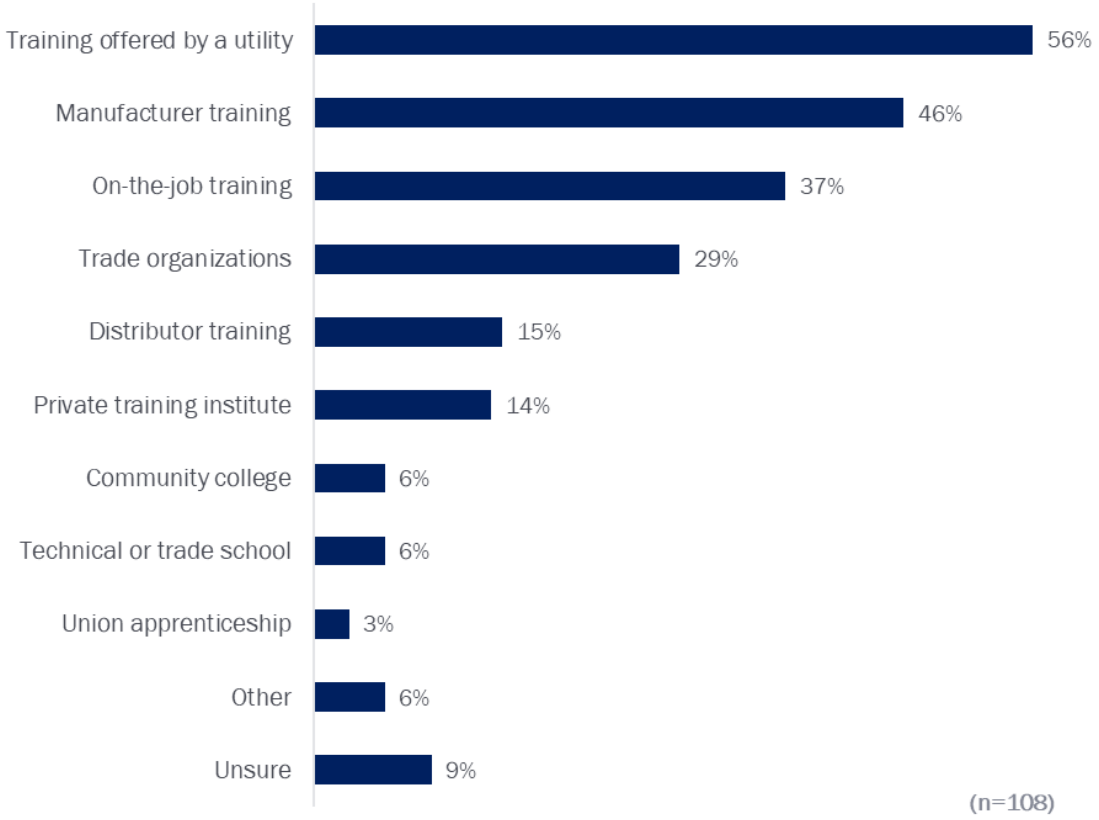
Note: The sum of percentages will not equal 100% as 15% (n=15) of respondents answered "Unsure"

3.6.2 TRAINING

About half of the stakeholders reported never receiving training on all-electric building design. Only 47% reported receiving such training or technical assistance. Of those who mentioned they had participated in all-electric building design training (n=51), the majority reported the trainings were offered by a utility (59%), a manufacturer (37%), or a trade organization (33%). Many of these stakeholders reported being trained on the job as well (43%).

Similarly, most stakeholders would prefer to receive training and technical assistance on all-electric building design from a utility (56%) or a manufacturer (46%). Figure 26 shows stakeholders' preferred sources of all-electric design trainings.

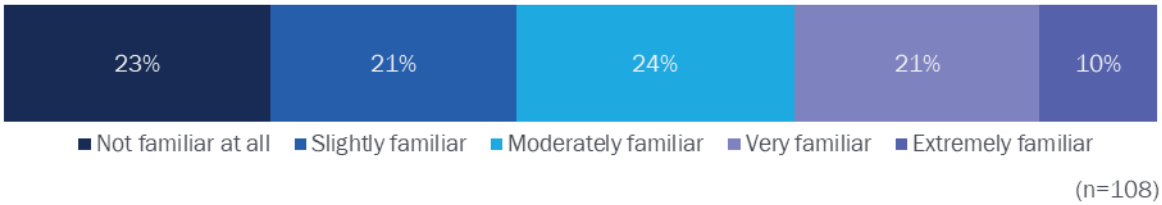
Figure 26. Stakeholder's Training Preferences of All-Electric Design



Most surveyed stakeholders reported never receiving training on reach codes or all-electric building codes. Only 31% of stakeholders reported receiving such training, an increase from the baseline assessment where 17% of stakeholders reported receiving such training. Additionally, 13% of stakeholders were unsure if they had received training. Overall, 31% of stakeholders reported being "very" or "extremely" familiar with these codes as shown in Figure 27.

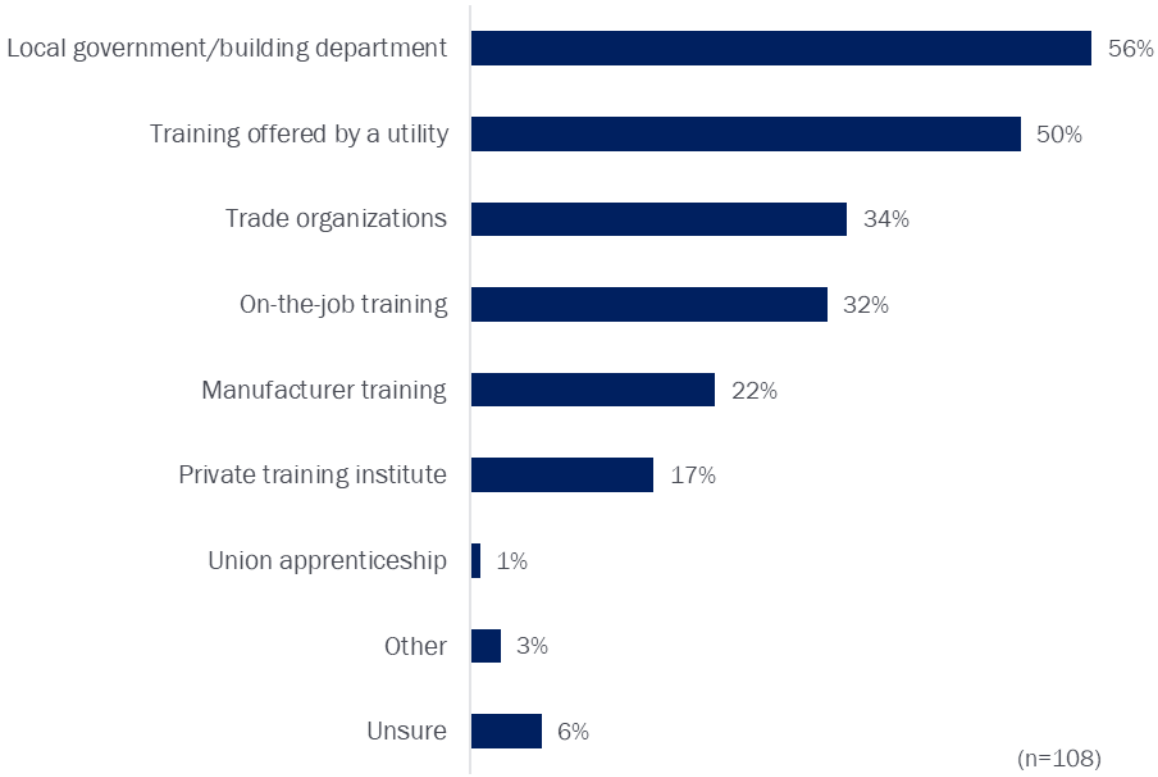
Over half of respondents (60%) have experience working on a team that built a residential new construction project in a jurisdiction with reach codes, and half of those (51%) with experience (n=65) reported being "very" or "extremely" familiar with these codes. Training on all-electric building and reach codes will become increasingly important as more jurisdictions adopt these codes.

Figure 27. All-Electric or Reach Code Familiarity



Most stakeholders would prefer to receive training on all-electric and reach codes from the local government and/or building department or from a utility. Of those who mentioned that they had participated in all-electric or reach code training (n=33), the majority reported receiving it from the local government or building department (56%). Other common sources of technical assistance included trainings offered by a utility (50%), trade organizations (34%), manufacturer trainings (22%), and trainings from private institutions (17%). Many of these stakeholders reported being trained on the job as well (32%). Figure 28 shows stakeholders' preferred sources for reach and all-electric building codes trainings.

Figure 28. Stakeholder's Training Preferences of All-Electric and Reach Codes



4. WORKFORCE TRENDS

Increasing employment opportunities in the building decarbonization space is a potential outcome of the BUILD Program. In the following sections we summarize the current state of the residential new construction workforce in California and the prevalence of contractor licenses relevant to the installation of all-electric technologies.

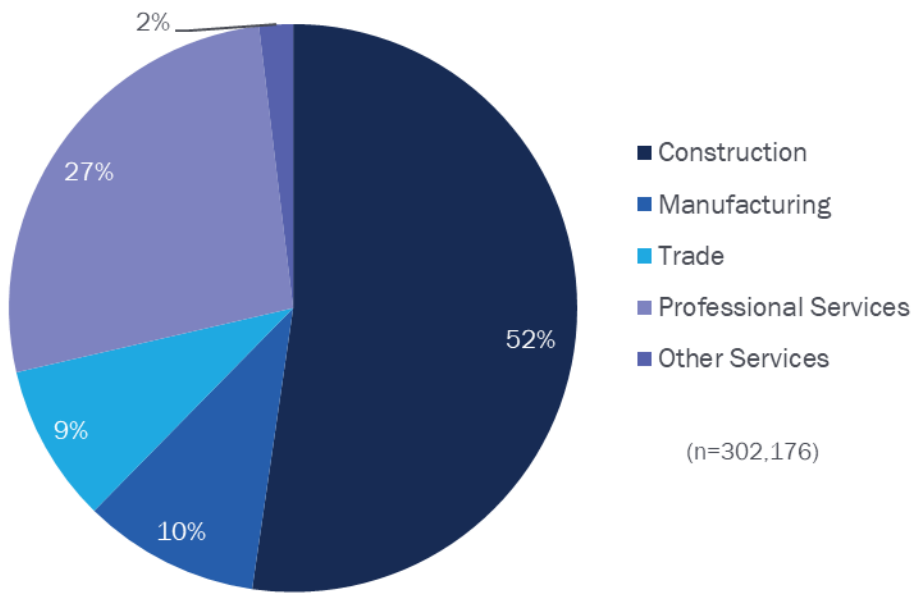
4.1 RESIDENTIAL NEW CONSTRUCTION WORKFORCE

Increasing interest and demand to build all-electric residential buildings in California will require the new construction workforce to adapt and potentially grow over the next decade. In this section we characterize the residential new construction workforce in California, overall and with a focus on energy efficiency–related jobs, and we summarize the status of contractors with the relevant licenses to support building decarbonization.

According to data from the American Community Survey, approximately 650,000 Californians worked in residential new construction in 2022,[27] accounting for 3.4% of the state's employed labor force (compared to 2.9% nationally). [28,29]

According to USEER,[30] California employed over 300,000 people in energy efficiency jobs in 2023.[31] This represents a 2.57% increase relative to 2022. Jobs in the construction industry made up the majority of energy efficiency jobs in California (52%, or just under 160,000 jobs) (Figure 29).

Figure 29. Energy Efficiency Employment by Industry



[27] This estimate only includes workers directly employed by the industry and excludes jobs in related industries (such as design and architecture, furniture, making, building materials, landscaping, etc.).
[28] NAHB.org, "How Many People Work in Residential Construction in Your State?" (NAHB, 2024), https://www.nahb.org/blog/2024/05/residential-construction-workers-by-state
[29] Home Builders Institute, "Spring 2024 HBI Construction Labor Market Report," (Home Builders Institute, October 2024).
[30] Energy.Gov, "United States Energy & Employment 2024 State Reports," (Department of Energy, 2024), https://www.energy.gov/sites/default/files/2024-09/USEER%202024%20States_0913.pdf
[31] As defined by USEER, the energy efficiency workforce includes the manufacture of ENERGY STAR–labeled products, and building design and contracting services that provide insulation, improve natural lighting, and reduce overall energy consumption across homes and businesses.

4.2 TRADE ALLY MARKET

All businesses or individuals who construct or alter any building, highway, road, parking facility railroad, excavation, or other structure in California must be licensed by the CSLB if the total cost (labor and materials) of one or more contracts on the project is $500 or more. Licenses are issued to individuals, partnerships, corporations, joint ventures, and limited liability companies (LLCs). Each license requires a "qualifying individual" who must undergo a background check and meet experience and exam requirements. In addition, the licensee must submit documentation to prove they meet insurance and bond requirements. CSLB licenses are separated into three classifications: Class A (General Engineering Contractor), Class B (General Building Contractor), and Class C (Specialty Contractor). Within the Class C license classification, there are 42 Class C licenses for work that require specialized skills. For example, installing HVAC heat pumps, HPWHs, and solar PV requires specific knowledge and a Class C license.

Depending on specific circumstances, the relevant licenses for building an all-electric new construction residential building could include a B-General Building Contractor license, a C-20 HVAC license, a C-36 Plumbing license, a C-46 Solar Contractor license, a D-34 Prefabricated Equipment license, and a C-10 Electrical license.

There were 142,598 contractors with at least one of the relevant licenses in California in 2023, an increase of 3,261 contractors from 2021. Although the number of licensed contractors decreased by some license types, most notably D-34 Prefabricated Equipment licensed contractors, most license types saw an increase in the number of contractors from 2021 to 2023. A summary of the number of licensed contractors by license type is shown in Table 6. Please note that some contractors hold more than one license and are represented multiple times in the table. Contractors with Class B licenses outnumber the other licenses.

Table 6. Count of Licensed Contractors in California in 2021 & 2023

Classification	Number of Contractors with Active License in 2021	Number of Contractors with Active License in 2023
C-10 Electrical	25,013	26,991
C-20 HVAC	12,316	11,303
C-36 Plumbing	15,795	16,555
D-34 Prefabricated Equipment	1,226	392
C-46 Solar Contractor	1,216	1,203
B General Building	99,222	101,468
Total (unique)	139,337	142,598

Source: State of California. "List by Classification." Contractors State License Board: Public Data Portal.[32] Accessed October 2024.

Although licensed contractors with a business address outside of DACs outnumbered those contractors with a business address inside of DACs, there has been a significant increase since 2021 in the percentage of total contractors with a business address in DACs. (Table 7). Overall, 33% of licensed contractors have a business address within DACs, up from 16% reported in the baseline assessment. Again, please note that contractors with more than one license type are represented more than once.

[32] Department of Consumer Affairs (DCA), "Contractor State License Board," (State of California, 2024), https://www.cslb.ca.gov/onlineservices/dataportal/.

Table 7. Count of Licensed Contractors by DAC Classification

Classification	Contractors outside of DACs	Contractors in DACs	Total	Contractors outside of DACs (%)	Contractors in DACs
C-10 Electrical	17,139	9,852	26,991	63%	37%
C-20 HVAC	6,451	4,852	11,303	57%	43%
C-36 Plumbing	10,206	6,349	16,555	62%	38%
D-34 Prefabricated Equipment	247	145	392	63%	37%
C-46 Solar Contractor	830	373	1,203	69%	31%
B-General Building	69,476	31,992	101,468	68%	32%
Total (Unique)	94,844	47,754	142,598	67%	33%

5. CONCLUSION

The BUILD Program is intended to encourage the design and construction of all-electric, energy-efficient buildings by providing incentives for the construction of all-electric residential housing and offering technical assistance to support project planning and educate stakeholders about electric technologies and all-electric building design. The primary goal is to engage with new construction market actors to raise awareness of building decarbonization technologies and encourage them to design, develop, and build all-electric new construction. Based on our research, we offer several key findings and recommendations to ensure the BUILD Program effectively increases low-income all-electric new construction in California.

Based on our research, we offer several key findings and recommendations to ensure the BUILD Program effectively increases low-income all-electric new construction in California.

- **Finding: There has been continuous growth of new stakeholders entering the all-electric new construction market over the last decade.** Over one-half of stakeholders with all-electric construction experience reported first working on an all-electric project in 2020 or later (57%), a significant increase from the 22% who reported first working on an all-electric project in the prior five-year period from 2015 to 2019.
- **Finding: Stakeholder experience working in all-electric design has increased since 2022.** Since the evaluation team conducted our baseline assessment in 2022, the proportion of stakeholders with experience working in all-electric design has increased across all housing types, except for multifamily affordable housing, which was already high. The proportion of single family market rate stakeholders with all-electric design experience increased from 51% to 72%, and this trend was similar in multifamily market rate housing (increased from 44% to 60%) and single family affordable housing (increased from 23% to 44%). The proportion of stakeholders working in the multifamily affordable housing with experience in all-electric design was the same as in the baseline assessment but also was the highest among all housing types (75%). Overall, the proportion of stakeholders with all-electric design experience increased from 66% to 77%.
  - **Recommendation:** The California Energy Commission (CEC) should consider expanding the New Adopter Design Award to single family affordable housing to cover a portion of the design costs for their first all-electric, low-income single family building to create more opportunities for stakeholders to work in single family affordable housing.
- **Finding: Stakeholder knowledge of all-electric design and technologies has increased since 2022.** Since the evaluation team conducted our baseline assessment in 2022, increases have been seen in knowledge of all-electric design and technologies. Half of all surveyed stakeholders reported being "very" or "extremely" knowledgeable about all-electric design (52% compared to 34% at baseline). Furthermore, almost half of all respondents reported they were "very" or "extremely" knowledgeable about all-electric technologies (46% compared to 39% at baseline).
  - **Recommendation:** The CEC should continue to provide technical assistance and resources to stakeholders regarding all-electric design and technologies to continue to increase stakeholder knowledge on those topics.
- **Finding: Many stakeholders consider all-electric construction practical, but cost concerns remain prevalent.** Most stakeholders felt that building all-electric is practical within each housing type (65% of multifamily affordable housing, n=48; 55% of multifamily market rate, n=77, 59% of single family market rate, n=65, and 50% of single family affordable, n=16). Respondents working in market rate housing who indicated high-efficiency all-electric design and technologies were impractical today generally cited concerns about the higher upfront cost relative to a dual-fuel home (6 of 16 multifamily market rate and 7 of 16 single family market rate), concern regarding the electrical grid's ability to handle the increased load (4 of 16 multifamily market rate and 4 of 16 single family market rate) and the impact on tenants' bills (4 of 16 multifamily market rate and 4 of 16 single family market rate). Furthermore, **most stakeholders surveyed felt building high-efficiency all-electric housing was more**

expensive than building dual-fuel housing (ranging from 57% for multifamily market rate housing to 49% for single family market rate housing); however**, the incidence of this sentiment was lower among stakeholders with experience building all-electric. Most stakeholders also agreed that high-efficiency all-electric homes often qualify for incentives and rebates, which is one way to offset costs.**

  - **Recommendation:** The CEC should continue to ensure that cost concerns and ways to offset costs are addressed during technical assistance.

- **Finding: There is an opportunity to increase stakeholder training on all-electric building design.** Half of the respondents never received training on all-electric building design but showed a preference for receiving this type of technical assistance through utility-sponsored programs and manufacturer training. Furthermore, stakeholders were overwhelmingly interested in receiving technical assistance, although a significant portion indicated they were only interested if the technical assistance was free or that their interest was dependent on the cost. The lack of awareness of where to access technical assistance was the largest barrier (40% of those interested in technical assistance, n=96) to stakeholders taking advantage of such resources.

  - **Recommendation:** The CEC should continue to leverage relationships with utilities and incentivized equipment manufacturers as well as consider deploying co-sponsorship training opportunities or technical assistance programs. BUILD's education and outreach should focus on increasing stakeholder awareness of the availability of free or low-cost technical assistance to help increase participation.

- **Finding: There is the potential to recruit more builders, contractors, designers, and developers involved in residential new construction in California into the BUILD Program.** More than half of the surveyed stakeholders were unaware of the BUILD Program, while almost half were interested in participating. Similarly, a third of stakeholders were unaware of any incentive programs that support low-income new construction.

  - **Recommendation**: BUILD's education and outreach should focus on increasing stakeholder awareness of the BUILD Program and its support of low-income new construction.

- **Finding: Stakeholders who were aware of incentive programs that support low-income new construction were most aware of state and utility-sponsored incentive programs, which most commonly support building and construction practices that align with the BUILD Program.** Those incentive programs most commonly support all-electric appliances, above-code building efficiency, above-code solar, and greenhouse gas (GHG) reduction, all of which are incentivized by the BUILD Program.[33]

  - **Recommendation**: The CEC should continue to coordinate with other frequently utilized funding opportunities to increase awareness of the BUILD Program and explore braiding funding to increase the number of completed BUILD projects.[34]

- **Finding: The feasibility of measuring the market-transforming effects of the BUILD Program is limited due to the rate at which full market characterization studies are updated.** Four of the eight studies used to assess the market conditions and update the baseline have not been updated since 2021.[35] This limits the ability to measure the transformation a new construction decarbonization program is having on the market.

[33] For BUILD specifically, the purpose of incentive monies for incremental solar above code is to meet SB 1477's mandate that building occupants do not incur higher utility bills as a result of electrification.

[34] The BUILD program and its Technical Assistance Provider are currently providing participants assistance with and information about layering funding: https://www.energy.ca.gov/sites/default/files/2024-04/BUILD_Factsheet_Layering_03-19-2024_ada.pdf

[35] This information is provided in section 2.2.2

APPENDIX A. DATA COLLECTION INSTRUMENT

APPENDIX B. EARLIEST YEAR WORKED ON ALL-ELECTRIC HOUSING

Earliest Year Worked on All-Electric Housing	Percentage of Stakeholders (Baseline Assessment, n=76)	Percentage of Stakeholders (Time 1 Market Study, n=83)
1980	0%	2%
1994	0%	1%
1995	0%	1%
1996	1%	0%
2008	1%	0%
2009	1%	1%
2010	4%	4%
2012	6%	1%
2013	0%	2%
2014	0%	1%
2015	7%	5%
2016	0%	1%
2017	3%	6%
2018	8%	2%
2019	20%	7%
2020	9%	13%
2021	18%	8%
2022	16%	10%
2023	N/A	12%
2024	N/A	13%
Don't know	7%	7%
Total	100%	100%

Note: The percentage for each year reported here for the baseline assessment does not align perfectly with the figure shown in the baseline assessment report. This is due to a previous error in that report which double-counted some stakeholders who reported working in both multifamily and single-family.

APPENDIX C. MARKET OVERVIEW

This section is included as additional context for the rest of the Time 1 Market Study.

California currently faces an extremely tight housing market with demand for homes continuing to soar. New construction of single family and multifamily homes has not kept pace with the growth of California's population. Over the past decade, population growth has outpaced the growth of housing units by 220%.[36] Recently, California has committed to building 2.5 million new homes to address the growing shortage of affordable housing across the state.[37]

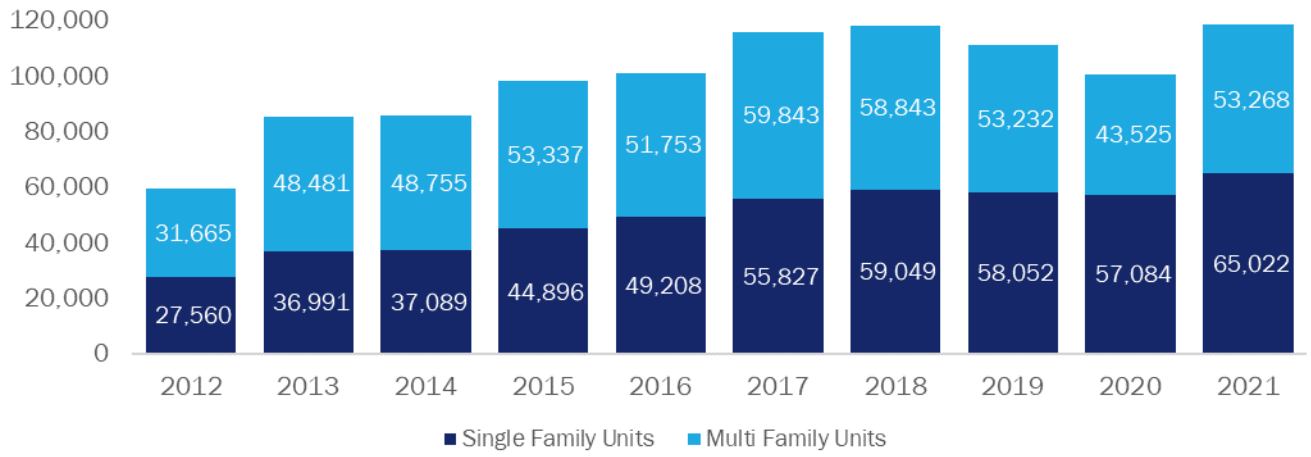
The following section outlines the current size of the new construction market in California as well as the estimated number of all-electric homes based on fuel use of central heating and cooling, water heating, and household appliances such as laundry and cooking equipment. Increasing the penetration of all-electric new construction is a key outcome of the BUILD Program.

NEW CONSTRUCTION MARKET SIZE

TOTAL NEW UNITS

California's residential new construction market has been trending upward over the past decade. According to CIRB, California added an average of almost 100,000 housing units annually between 2012 and 2021,[38] with a record high of 118,290 units added in 2021 (Figure 30). Growth has been similar in single family and multifamily units. Additional information on market size by climate zone and zip code is provided in Appendix D.

Figure 30. New Housing Units Built from 2012 to 2021



[36] Dan Walters, "California Housing Crisis Both Wide and Deep," *CalMatters*, December 7, 2021, sec. Commentary, http://calmatters.org/commentary/2021/12/california-housing-crisis-both-wide-and-deep/.

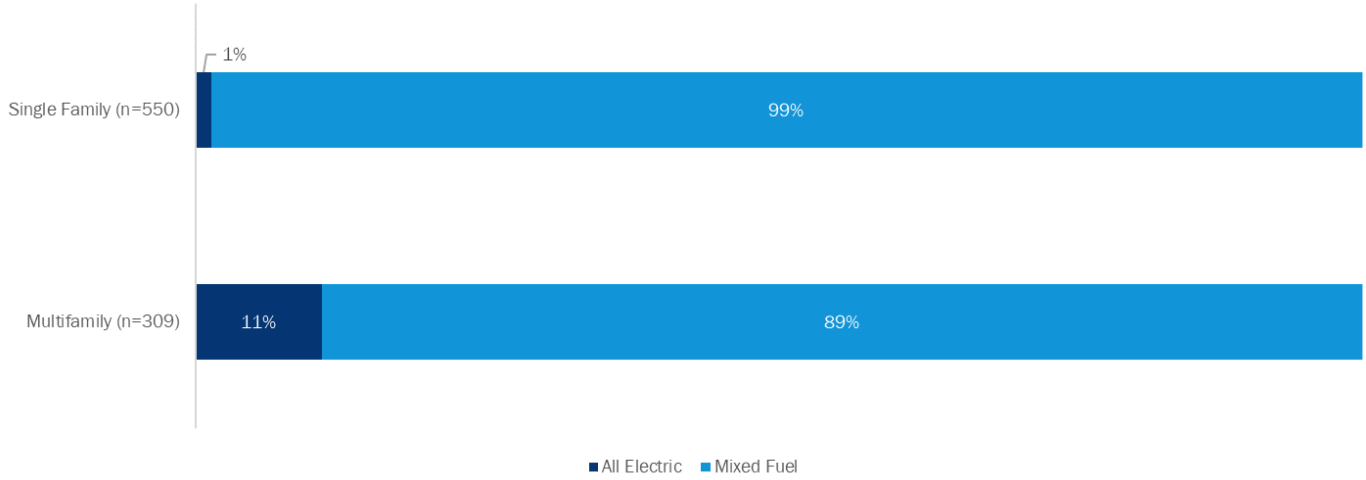
[37] State of California, "Governor Newsom Signs Legislation to Increase Affordable Housing Supply and Strengthen Accountability, Highlights Comprehensive Strategy to Tackle Housing Crisis," (California Governor, September 28, 2021), https://www.gov.ca.gov/2021/09/28/governor-newsom-signs-legislation-to-increase-affordable-housing-supply-and-strengthen-accountability-highlights-comprehensive-strategy-to-tackle-housing-crisis/.

[38] A multifamily building is composed of multiple individual housing units.

PENETRATION OF ALL-ELECTRIC UNITS

New homes in California are predominately dual-fuel. [39] The majority of California residential new construction contains non-electric technologies fueled by natural gas, propane, wood, or other non-electric fuel sources. According to data from the 2019 California RASS study, only 1% of single family homes and 11% of multifamily homes constructed after 2012 were all-electric.[40] The majority of new construction in California is still predominantly mixed fuel homes with 99% of single family households and 89% of multifamily households surveyed in the RASS study reporting that they use at least one non-electric fuel type (Figure 31).[41] Further, 82% of respondents residing in new homes report having natural gas lines or hooks up currently in their home.

Figure 31. Percent of New Homes that are All-Electric



This finding is generally supported by analysis of other relevant data sources, although estimates for the multifamily sector are more divergent. An analysis of recent HERS Registry data estimates all-electric penetration,[42] based on registrations from both the 2013 and 2016 Title 24 code cycles, of 0.48% of new single family units (n= 191,731) and 4.43% of new low-rise multifamily units (n=46,447).[43] Importantly, high-rise multifamily buildings with four or more stories are not included in historical HERS Registry data, and the data do not include registrations under the more recent 2019 code cycle. Similarly, based on analysis of the 2020 US RECS Survey microdata, we estimate the penetration of all-electric units to be 1.9% for single family units (n=739) and 16.1% for multifamily units (n=402). Importantly, the RECS data include the entire building stock in California, not just new construction. Therefore, considering the vintage of the data sources and the various limitations of each, we estimate a penetration rate of all-electric new construction in the range of 0.5% to 1.5% for the single family sector and 7% to 13% for the multifamily sectors.

[39] The Evaluation Team refers to "new homes" several times in this section. We define "new home" or "new construction" as homes built after 2012.

[40] Based on the number of homes with electric space heating, water heating, cooktops, stoves, and dryers. These homes may still have a natural gas hookup.

[41] Other fuel types include natural gas, fuel oil, propane, wood, solar, or other miscellaneous fuels.

[42] A unit is assumed to be all-electric in this calculation if it has electric heating and electric water heating.

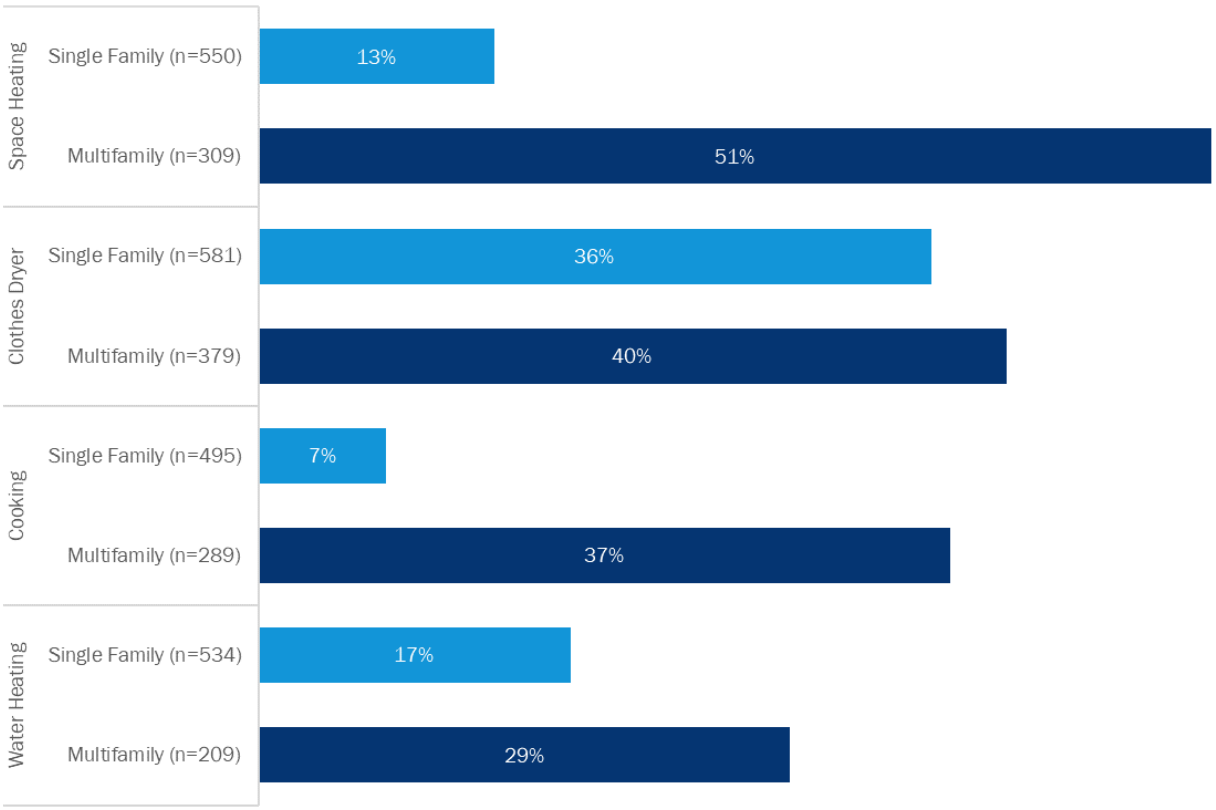
[43] Based on a summary of CF-2R installation certificates for new construction projects.

EQUIPMENT TYPES

While new all-electric homes in California are still rare, the penetration of electric technologies varies significantly by end use. According to data from the 2019 California RASS study, new multifamily homes have higher all-electric penetration rates than single family homes across all end uses. The absolute difference between penetrations rates in multifamily and single family is greatest in the space heating (51% multifamily all-electric penetration compared to 13% for single family) and cooking end uses (37% compared to 7%).

Figure 32 provides the penetration of new homes with all-electric technologies by end use.

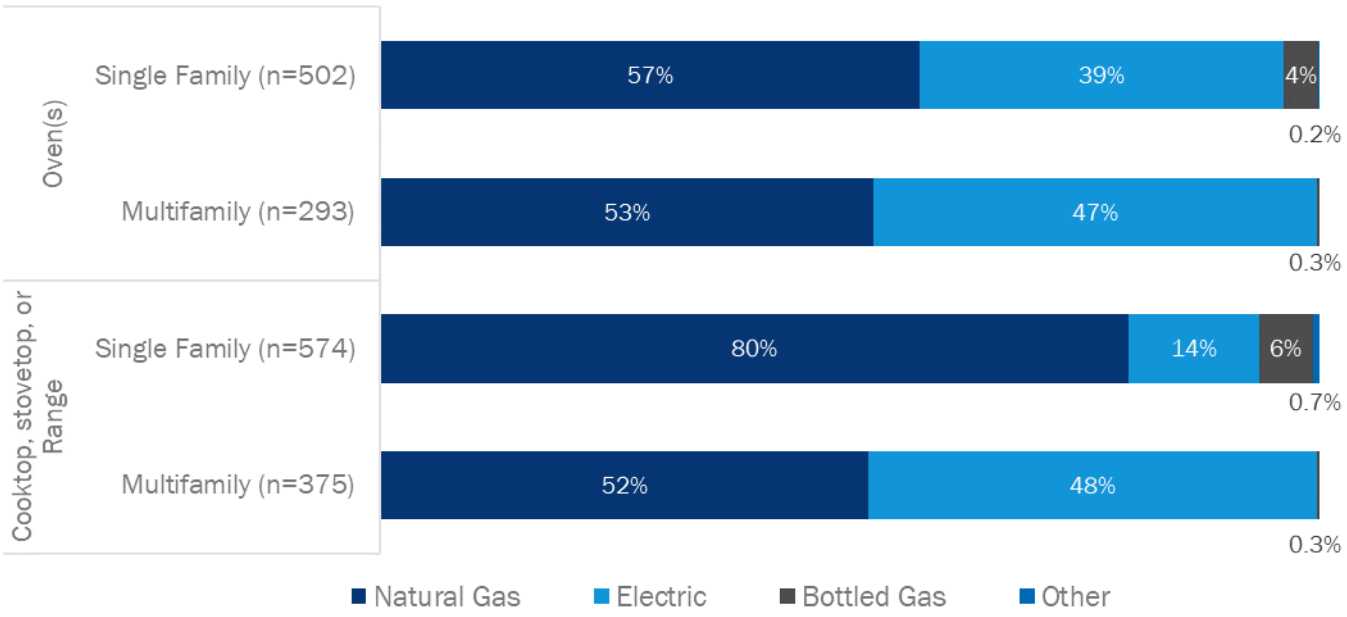
Figure 32. Penetration of Electric Only Technologies by End Use



Ovens and cooktops in new multifamily homes are more likely to be electric, compared to single family homes. Almost half of the ovens and cooktops in new multifamily homes are electric (47% and 48%, respectively). Comparatively, 39% of ovens and just 14% of cooktops are electric in new single family homes.

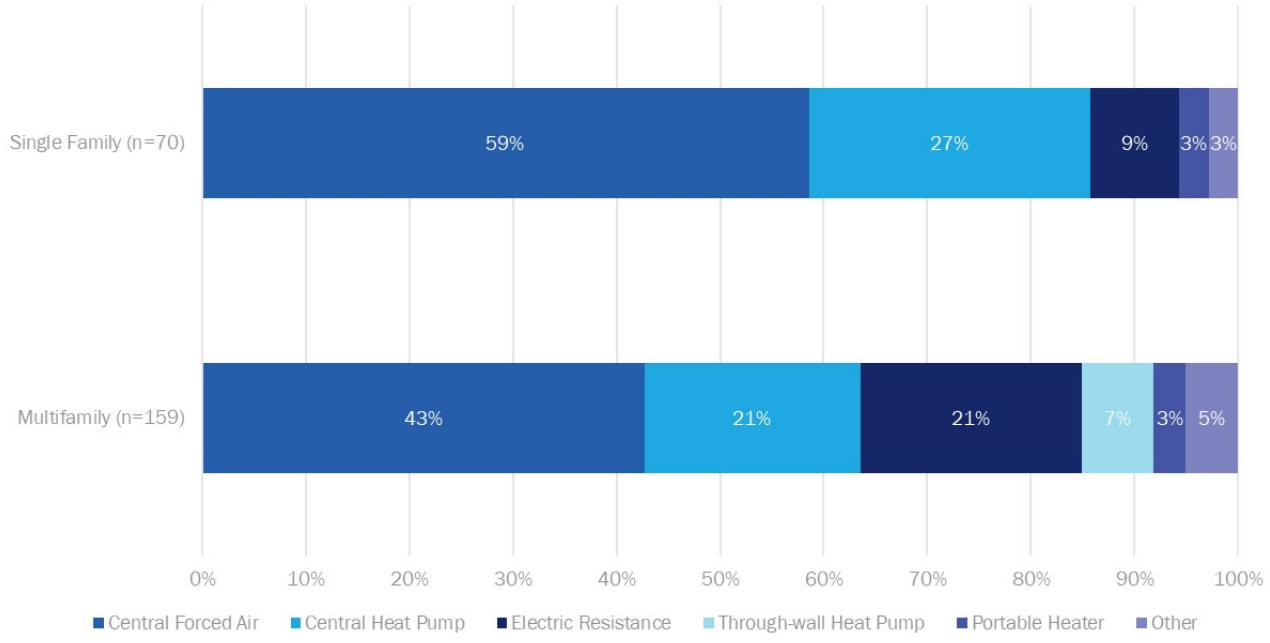
The distribution of cooking fuel for ovens and stovetops in new homes is shown in Figure 33.

Figure 33. Cooking Fuel Types by Equipment Type



In both the single family and multifamily market types, heat pumps account for just over one-quarter of new electrically-heated homes. As shown in Figure 34, almost half of new electrically heated homes primarily use a central forced air furnace (59% of single family and 43% of multifamily) while just over one-quarter use heat pumps (30% of single family and 28% of multifamily).

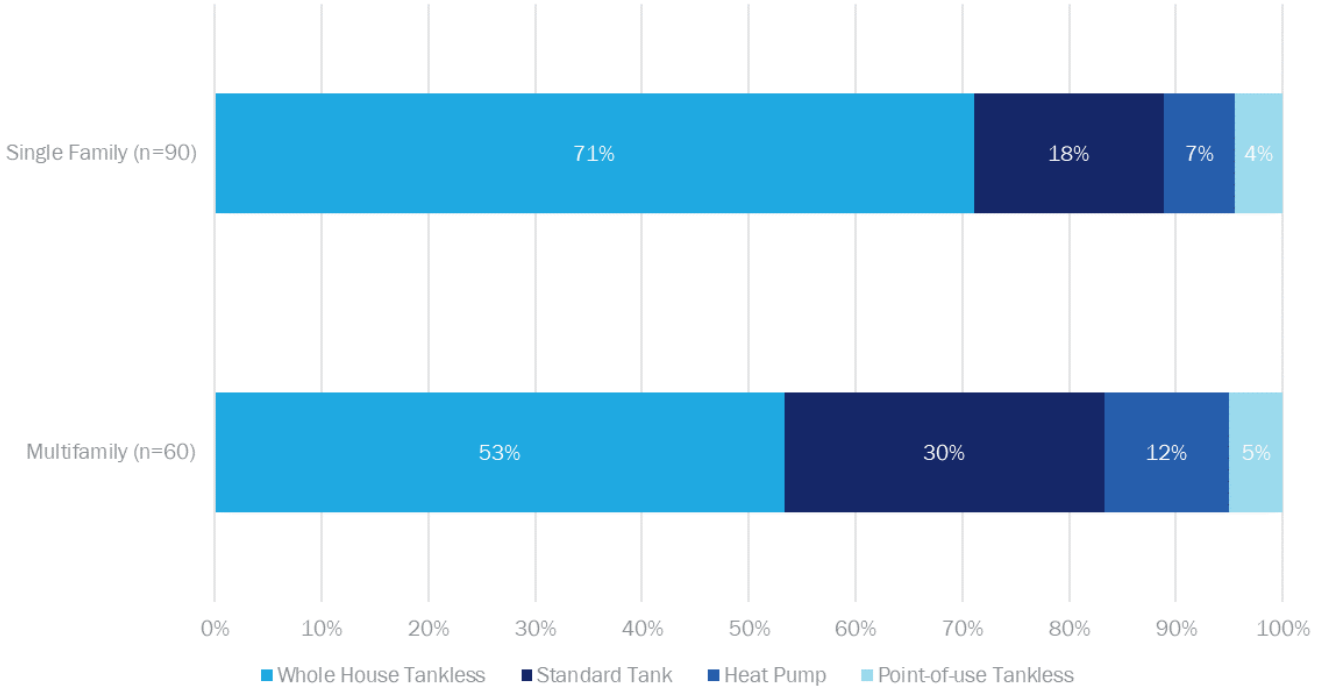
Figure 34. Electric Space Heating Types



Few new homes with electric water heating have a heat pump water heater. Among homes with an electric water heating system, a whole house tankless water heater is the most common (71% of single family and 53% of multifamily) followed by a standard electric tank water heater (18% of single family and 30% of multifamily). Heat pump

water heaters only comprised 7% and 12% of electric systems in new single family homes and multifamily homes, respectively (Figure 35).

Figure 35. Electric Water Heating Types



APPENDIX D. MARKET SIZE BY CLIMATE ZONE AND ZIP CODE

This section is included as additional context for the rest of the Time 1 Market Study.

Figure 36. Distribution of 2021 New Construction Units by Climate Zone

	Count			Percentage		
Climate Zone	Single Family	Multifamily (2–4)	Multifamily (5+)	Single Family	Multifamily (2–4)	Multifamily (5+)
1	211	13	41	<1%	<1%	<1%
2	1,086	70	1,276	2%	2%	3%
3	2,438	255	7,488	4%	6%	15%
4	2,198	92	3,087	3%	2%	6%
5	414	82	196	1%	2%	<1%
6	1,877	444	2,237	3%	10%	5%
7	1,531	308	5,014	2%	7%	10%
8	3,545	688	6,612	5%	15%	14%
9	3,903	1,111	8,983	6%	24%	18%
10	6,776	393	3,630	10%	9%	7%
11	4,726	129	960	7%	3%	2%
12	11,720	198	4,874	18%	4%	10%
13	6,216	154	680	10%	3%	1%
14	2,173	15	827	3%	<1%	2%
15	2,434	26	307	4%	1%	1%
16	392	23	27	1%	<1%	<1%
Unknown	13,381	576	2,454	21%	13%	5%
Total	**65,022**	**4,576**	**48,692**	**100%**	**100%**	**100%**

Figure 37. Distribution of 2021 Single Family New Construction Units by Zip Code

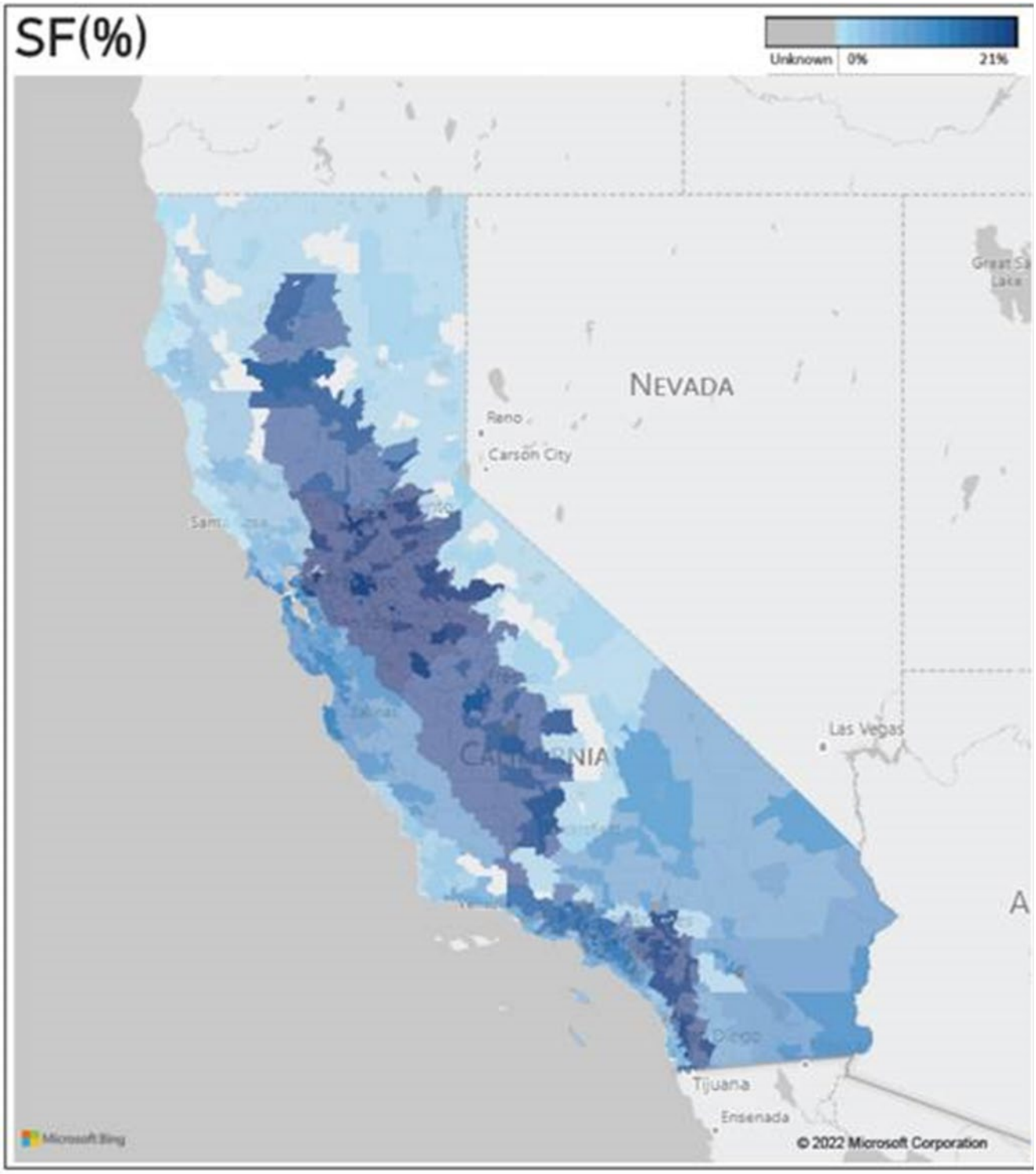


Figure 38. Distribution of 2021 Small Multifamily New Construction Units by Zip Code

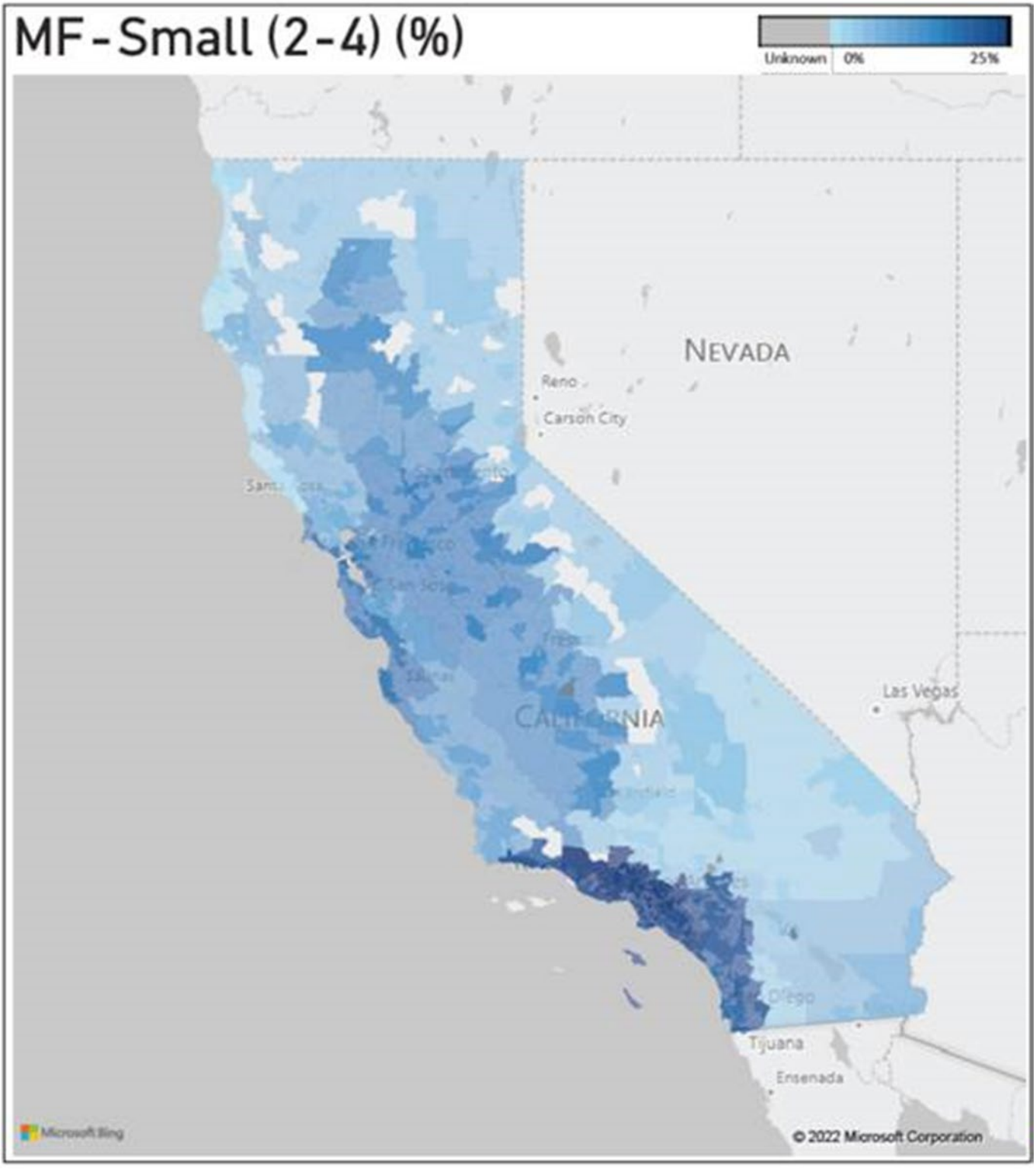
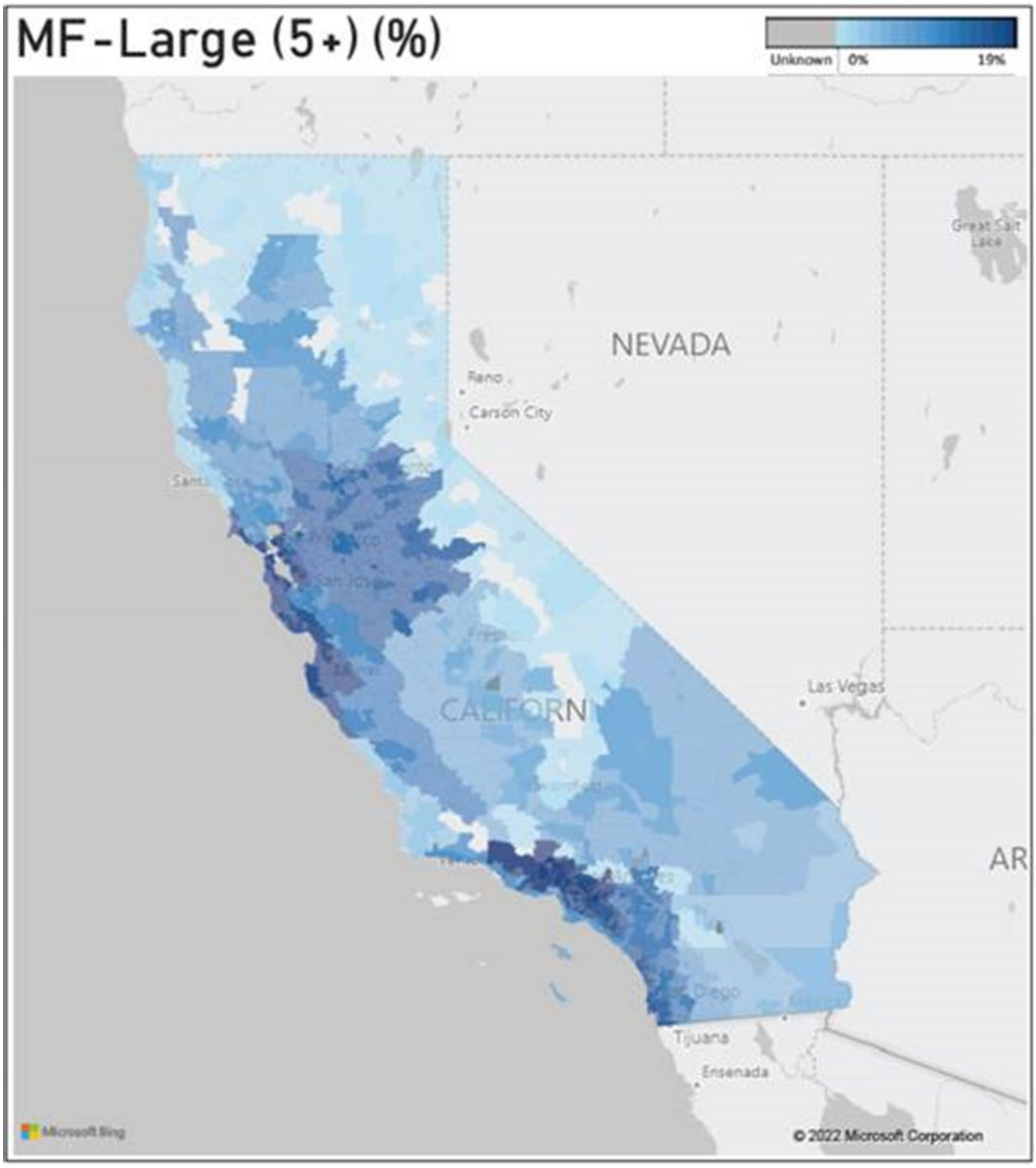


Figure 39. Distribution of 2021 Large Multifamily New Construction Units by Zip Code



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