Final Phase I Report: Baseline Characterization

Market Effects Study of Investor-Owned Utility Multifamily Residential New Construction Programs in California

FINAL

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Abstract

This document presents the Phase I findings of a prospective market effects and market characterization study focused on the California Investor Owned Utilities' (IOUs') New Construction Programs targeting the multifamily market. The key objectives of this Phase I study are as follows:[1]

- Develop a preliminary program and market model to identify the key market actors, market segments and factors affecting energy efficiency in California's multifamily new construction (MFNC) market.
- Conduct a market characterization analysis of California MFNC market segments during the 2010 to 2012 period in order to better understand the structure of the market.

We note several key findings from this Phase I report.

There is a complex array of public programs and policies influencing the energy efficiency of the MFNC market. In addition to the IOUs' new construction programs, notable policies and programs include local reach codes, efficiency requirements of the California Tax Credit Allocation Committee (CTCAC) affordable housing tax credits, Leadership in Energy and Environmental Design (LEED) for Homes program, GreenPoint Rated (GPR) by Build it Green, and the U.S. EPA's ENERGY STAR® Certified Building program. Nearly all affordable housing, representing 38% of all units of MFNC started from 2010 through 2012, is built to exceed Title 24 standards by 15% because of CTCAC tax credit requirements, while 24% of all units were started in localities with reach codes. Statewide, 57% of MFNC units started from 2010 through 2012 were subject to above-code requirements either because of requirements of low-income funding or their location in a reach code locality.

MFNC starts increased from 16,336 units in 2010 to 22,753 units in 2012. The IOU program participants accounted for 38% of MFNC units started from 2010 through 2012, a sizeable portion of the market. There is substantial overlap between the IOUs' program participants and those affected by other programs and policies: 53% of IOU program units that were started from 2010 through 2012 were required to be high efficiency because they were located in a reach code locality or received a CTCAC tax credit.

The MFNC market is concentrated among a relatively small number of builders. From 2010 through 2012, five percent of builders were responsible for 33% of all units; 20% were responsible for two-thirds of all units started from 2010 through 2012.

Geographically, MFNC starts were heavily concentrated in California's major cities and urban areas. Forty-six percent of all starts (by units) were started in five cities (Los Angeles, San Jose,

[1] Objectives of Phase II of the evaluation, which will follow Phase I, include baseline measurements of (i) 2010-2012 MFNC building practices; and (ii) intermediate indicators of expected program market effects.

San Francisco, San Diego, and Irvine) and 81% were started in five broader metropolitan statistical areas (MSAs).[2] High-rise MFNC is even more concentrated in urban areas as 66% of all high-rise starts (by units) were started in the same five cities and 98% were started in the same five broader MSAs.

The affordable housing market appears to be less volatile than market rate MFNC. The market-rate segment has been more responsive to the housing recovery, accounting for the bulk of the increase in MFNC activity from 2010 through 2012, and suggests that the low-income market is less affected by housing market cycles.

New construction permit data suggests a potential trend toward higher levels of MFNC in the residential new construction (RNC) market. Between 2010 and 2012, multifamily units accounted for 52% of units compared to an average of 28% of permitted units from 1993 to 2008. In addition, MFNC may be trending toward high-rise projects. High-rise units increased from 37% of units started in 2010 to 55% of units in 2012.

Developers are the key decision makers for energy efficiency related to MFNC, while architects, Title 24 consultants, HERS raters and others have limited influence; consumer demand for energy efficiency appears to be limited. Development and efficiency decisions are driven by economic and financial considerations, underpinning how developers decide what and where to build and the efficiency level of what is built. Affordable housing developers and some higher-end developers who market for sustainably designed features are in the forefront of designing (and building) projects incorporating advanced energy-efficiency techniques.

[2] The top five cities of Los Angeles, San Jose, San Francisco, San Diego, and Irvine are located in four of the top five MSAs: Los Angeles-Long Beach-Anaheim, San Francisco-Oakland-Hayward, San Diego-Carlsbad and San Jose-Sunnyvale-Santa Clara. The fifth MSA, Riverside-San Bernardino-Ontario, CA, accounts for the smallest amount of MFNC among the top five MSAs and does not include any of the top five cities.

Executive Summary

This document presents the Phase I findings of a prospective market effects and market characterization study focused on the California Investor Owned Utilities' (IOUs') New Construction Programs that target the multifamily market. The key objectives of this Phase I are as follows:[3]

- Develop a preliminary program and market model to identify the key market actors, market segments and factors affecting energy efficiency in California's multifamily new construction (MFNC) market.
- Conduct a market characterization and analysis of California MFNC market segments during the 2010 to 2012 period in order to better understand the structure of the market.

The California IOUs' New Construction Program seeks to transform California's residential and nonresidential new construction markets. The New Construction Program aims to ensure that 1) home builders in California will be encouraged to construct homes that exceed California's Title 24 energy-efficiency standards by at least 15%; and 2) residential new construction will work toward achieving "zero net energy" (ZNE) performance for all single- and multi-family homes by 2020.

The California Advanced Homes Program (CAHP) is the core IOU New Construction program addressing the MFNC market. It promotes the construction of new multifamily buildings that exceed California's 2008 Title 24 standards by at least 15%.[4] CAHP places considerable emphasis on transforming the multifamily new construction market by encouraging development teams to increase their proficiency with energy-efficient measures and construction practices. The program provides builders, HERS raters, and Title 24 consultants working on multifamily projects with energy-efficiency consultation services in the form of design assistance and training, and a sliding incentive scale for builders encourages them to maximize efficiency rather than target specific savings tiers. The program uses a whole-building performance approach to calculating energy savings.

The residential new construction program also includes a Zero Net Energy (ZNE) program element (or pilot program, depending on the IOU). The ZNE program component provides additional guidance and incentives for builders interested in building extremely efficient homes (greater than 45% more efficient than 2008 Title 24 standards). The IOUs can allot additional incentives to these extremely high performance buildings, and these projects can serve as case studies of particularly advanced construction practices.

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[3] Objectives of Phase II of the evaluation, which will follow Phase I, include baseline measurements of (i) 2010-2012 MFNC building practices; and (ii) intermediate indicators of expected program market effects.

[4] Each California IOU implements CAHP in its own service territory; PG&E uses a third-party firm to implement the program under the California Multifamily New Homes Program (CMFNH) name (referred to jointly with CAHP as "program").

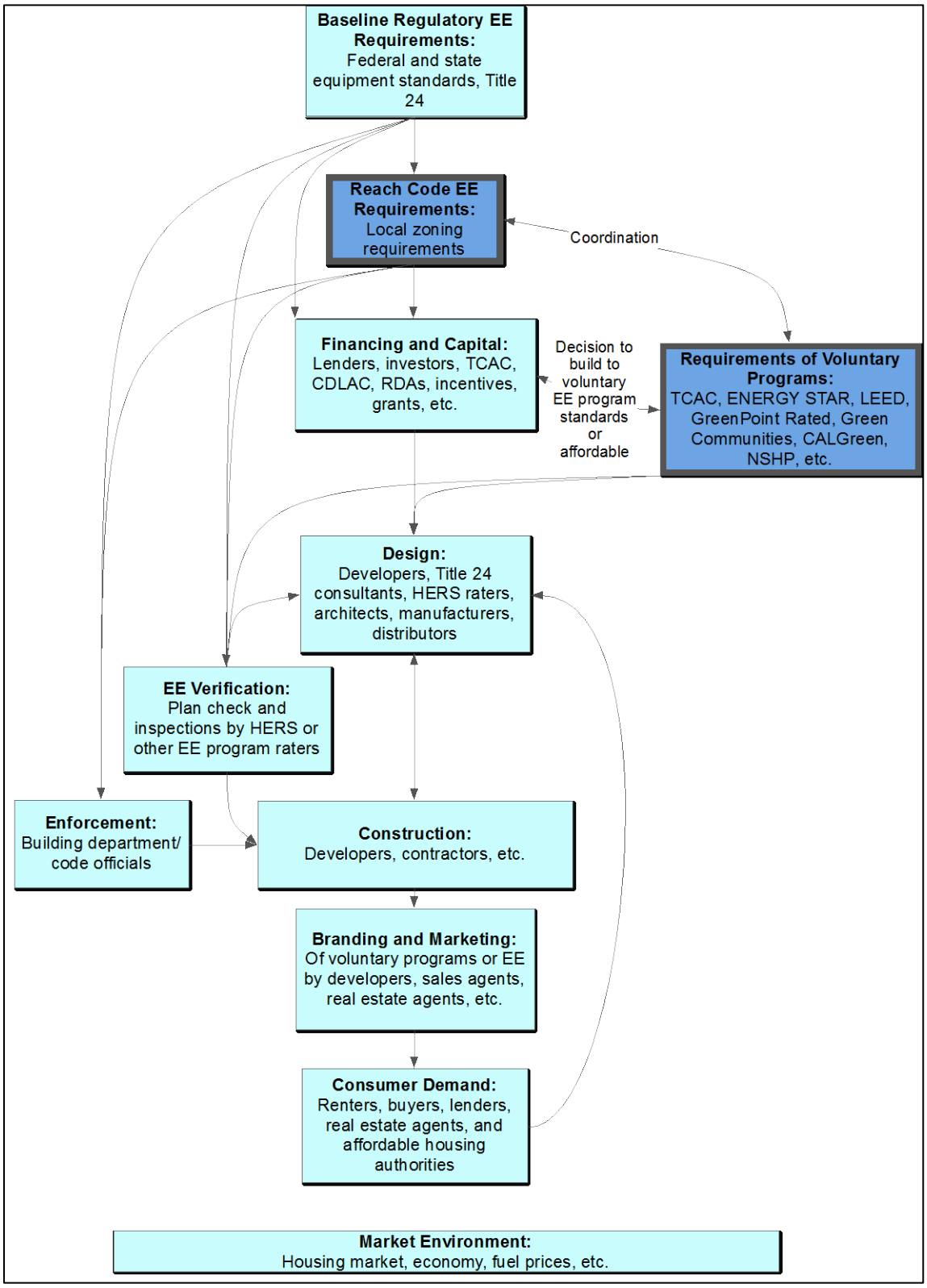
The Savings By Design program (SBD) offered by the utilities functions similarly, but is designed for commercial construction. Some of the IOUs send mixed-use buildings that are majority commercial through the SBD program, though some may also send residential high-rise buildings through the SBD program.

Market Theory and Logic

The market model shows the components of the entire multifamily market (Figure ES-1). Developer teams may build to different efficiency levels depending on the choices made and options available to them at each step in the design and construction process. The base efficiency levels in the market are governed by mandatory building requirements, such as Title 24, from which point developers can choose to follow certain voluntary criteria that trigger changes in their construction practices. For each identified component of the multifamily market, we identify key aspects or market actors and show elements that are more important to the market in boldface. Market actors identified in the multifamily market model include developers, building inspectors, contractors, HERS raters, Title 24 consultants, manufacturers, distributors, lenders, investors, government agencies, and utility programs. Each of these groups plays a different role in the multifamily market.

The market model also includes two dark blue boxes to identify two key factors outside the IOUs' programs that influence the energy efficiency of the MFNC market. The "reach code requirements" box highlights localities that have adopted reach codes, which are efficiency standards that exceed Title 24 (commonly set at 15% above Title 24). The "requirements of voluntary programs" box highlights the role of the California Tax Credit Allocation Committee (CTCAC), which requires recipients of affordable housing tax credits to exceed Title 24 standards by at least 15%, as well as other prominent voluntary programs that the CTCAC accepts as verification of meeting their efficiency requirements, such as Leadership in Energy and Environmental Design (LEED) for Homes program, GreenPoint Rated (GPR) by Build it Green, and the U.S. EPA's ENERGY STAR Certified Building program.

Figure ES-1: Energy Efficiency in the California Residential Multifamily New Construction Market



There are several key finding that arise from the MFNC market theory and model:

1) Title 24 of the California Code of Regulations ("Title 24") is the energy-efficiency portion of the state building code, and governs all new construction in California.[5] Multiple interviewed market actors reported that meeting Title 24 is increasingly difficult as it is more stringent than many other states' efficiency codes, and the efficiency standards are ratcheted up every three years.
2) There is a complex array of public programs and policies influencing the energy efficiency of the MFNC market, including the IOUs' new construction programs, local reach codes, the CTCAC through affordable housing tax credits, LEED for Homes program, GPR by Build it Green, and the U.S. EPA's ENERGY STAR Certified Building program. Because of the complex interactions and in some cases coordination across the programs and policies, attribution of any observed market effects specifically to an IOU program will be difficult; indeed it is possible that interactions among the multiple programs and policies produce effects that are "more than the sum of the parts."
3) Statewide, fifty seven percent of MFNC units started from 2010 through 2012 were subject to above-code requirements either because of requirements of low-income funding or their location in a reach code locality.[6]
4) As of November 2013, 40 cities and towns and 5 counties in California had adopted energy codes that exceed Title 24 standards.[7] The IOUs have played an important role in the adoption of these reach codes in many of these jurisdictions through the Reach Code Subprogram of the Codes and Standards Program. The Reach Code Subprogram provided policy guidance and technical support to local municipalities, including conducting climate-zone specific studies on the cost-effectiveness of implementing reach code.[8] Achieving a 15% threshold above Title 24 is a common goal of these local "reach codes," the same threshold as the IOUs' New Construction Programs. More than four-fifths of the 45 reach codes (82%) govern areas in and around the San Francisco

[5] Full Title 24 regulations are available here: http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF.

[6] Nearly the same percentage, 56%, of MFNC units located in the IOU territories started from 2010 through 2012 were subject to above-code requirements

[7] These reach codes were approved between 2009 and 2012, The current CEC listing of municipalities with above Title 24 energy codes in place is available here: http://www.energy.ca.gov/title24/2008standards/ordinances/.

[8] For more information on the IOUs' efforts to foster the adoption of reach code in California, see the Cadmus Group evaluation of the 2010-2012 Reach Code Subprogram within the Codes and Standards Program. The Cadmus Group, Inc., *Reach Code Subprogram 2010-2012 Process and Pilot Impact Evaluations*, prepared for the California Public Utilities Commission, October 2013. https://www.pge.com/regulation/EnergyEfficiency2015-BeyondRollingPortfolios/Other-Docs/ED/2014/EnergyEfficiency2015-BeyondRollingPortfolios_Other-Doc_ED_20140507_304180Atch01_304181.pdf.

Bay Area. Nearly three of ten permitted units (28%) and one quarter of estimated starts (24%) took place in communities in which reach codes were in effect.[9]

5) Almost all affordable housing in California is regulated by the California Tax Credit Allocation Committee (CTCAC) and must also exceed Title 24 standards by at least 15% to be eligible for CTCAC tax credits.[10] Statewide, 45% of all MFNC projects and 38% of all units received CTCAC awards.
6) Nearly two-fifths (38%) of all units started in the IOU territories from 2010 through 2012 participated in the IOUs' MFNC programs. More than one-half of these IOU program units (53%) were subject to above-code requirements.[11]
7) Developers are the key decision makers. Architects, Title 24 consultants, HERS raters and others have limited influence on decisions pertaining to the energy efficiency of a project.
8) Development and efficiency decisions are driven by financial issues. Financial considerations underpin how developers decide what and where to build and the efficiency level of what is built.
9) Interviewed market actors indicated that energy efficiency does not appear to be a consumer priority. Similarly, market actors indicated that lenders and financiers were concerned about the lack of consumer demand for energy efficiency. Some interviewees reported that providing a way for renters or buyers to compare energy costs could increase consumer demand and in turn lender interest in energy efficiency. In addition, there is a growing number of innovative financing mechanisms, such as PACE loans, designed to overcome the split incentive regarding energy-efficiency investments between building owners and tenants.
10) Within the market-rate segment, some developers who are involved in higher-end developments include energy efficiency as part of their marketing for sustainably designed features, associating energy efficiency and sustainability features with high-end, luxury features.
11) The MFNC market is concentrated among a relatively small number of builders. From 2010 through 2012, five percent of builders were responsible for 33% of all units; 20% were responsible for two-thirds of all units started from 2010 through 2012. However, according to our interviews, the affordable housing market in California has a larger

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[9] If a city or county had enacted a reach code before or in the same year a permit was issued or construction started we assumed the reach code was in effect.

[10] Almost all affordable housing in California is regulated by the California Tax Credit Allocation Committee (CTCAC), in that it must be at least 15% more efficient than Title 24 code to be eligible for CTCAC tax credits.

[11] Projects in reach code communities are permitted to participate in IOU programs. *Source: Southern California Gas Program, Program Implementation Plans: Statewide Programs, Appendix B.2, Section A, April 23, 2013, http://www.socalgas.com/regulatory/documents/A-12-07-003/Appendix%20B.2%20Section%20A%20Statewide%20Programs.pdf, accessed January 28, 2014.*

number of smaller-scale developers compared to the market-rate sector, which involves fewer, larger developers.

12) In some cases, affordable housing developers are at the forefront of designing (and building) projects incorporating advanced energy-efficiency techniques, particularly outside of the high-end construction market, almost serving as a testing ground for market-rate developers to learn about the feasibility of advanced design practice. In some instances the advanced energy-efficiency techniques appear to be driven by the CTCAC funding and efficiency requirements along with the IOU and other efficiency programs whereas in other cases the mission-based approach of the developer appears to play a key role.

Program Theory and Logic

As noted earlier, CAHP is designed to achieve energy savings, but also places considerable emphasis on transforming the multifamily new construction market. This is described in the most recent Program Implementation Plan, in which the California utilities describe how the program's activities are designed to address key market barriers and the various metrics by which they could attempt to identify changes in the new construction market, while noting that they "believe the market transformation evaluation discourse should be focused on the overlapping synergy among all programs and influences in the market."[12]

Figure ES-2 depicts the IOU's MFNC program logic model and the market model. These models were developed based on the evaluation team's thorough reviews of program materials, market research, and interviews with program staff and market actors. The market model is entirely a product of the evaluation team based on this initial research phase. The program theory and logic model incorporate some of the views of the program implementers, but were modified and expanded based on the analysis and judgment of the evaluation team. As such, this program logic model does not perfectly coincide with the program theory as advanced in current program implementation plans, but instead attempts to identify a more exhaustive list of potential program outcomes relevant to market effects. The outcomes and market transformation indicators are thus based on informed theory, but not yet tested.

On the left side of the program portion of the model are the key elements of the utility programs. Branching out to the right are the expected short-, medium-, and long-term outcomes of these program elements, along with the connections between each intermediary step toward the long-term outcomes. The model thus moves from the specific program components to the broader, long-term effects on the market that the program is intended to achieve (i.e., market

[12] Southern California Gas Program, Program Implementation Plans: Statewide Programs, Appendix B.2, Section A, April 23, 2013, http://www.socalgas.com/regulatory/documents/A-12-07-003/Appendix%20B.2%20Section%20A%20Statewide%20Programs.pdf, accessed January 28, 2014, p. 207. Market transformation discussion for RNC program starts on page 202.

effects). A critical medium-term outcome in the model (indicated by its relatively large size) is the increase in above-code practices in the multifamily new construction market; program elements consistently point toward this outcome. The sole long-term outcome of the program efforts would ultimately be progress toward California's goal of ZNE, which would indicate a market transformation and, of course, be accompanied by reduced energy use and GHG emissions. The bold lines in the program model indicate the key links from program elements to outcomes indicating market effects.

Figure ES-2 includes lines from the program elements to the market, showing the aspects of the market that the program elements are designed to affect. The dotted lines represent what the evaluation team hypothesizes to be the key program elements affecting the market: efficiency criteria; incentives; design assistance; training; and advertising, marketing, and outreach.[13]

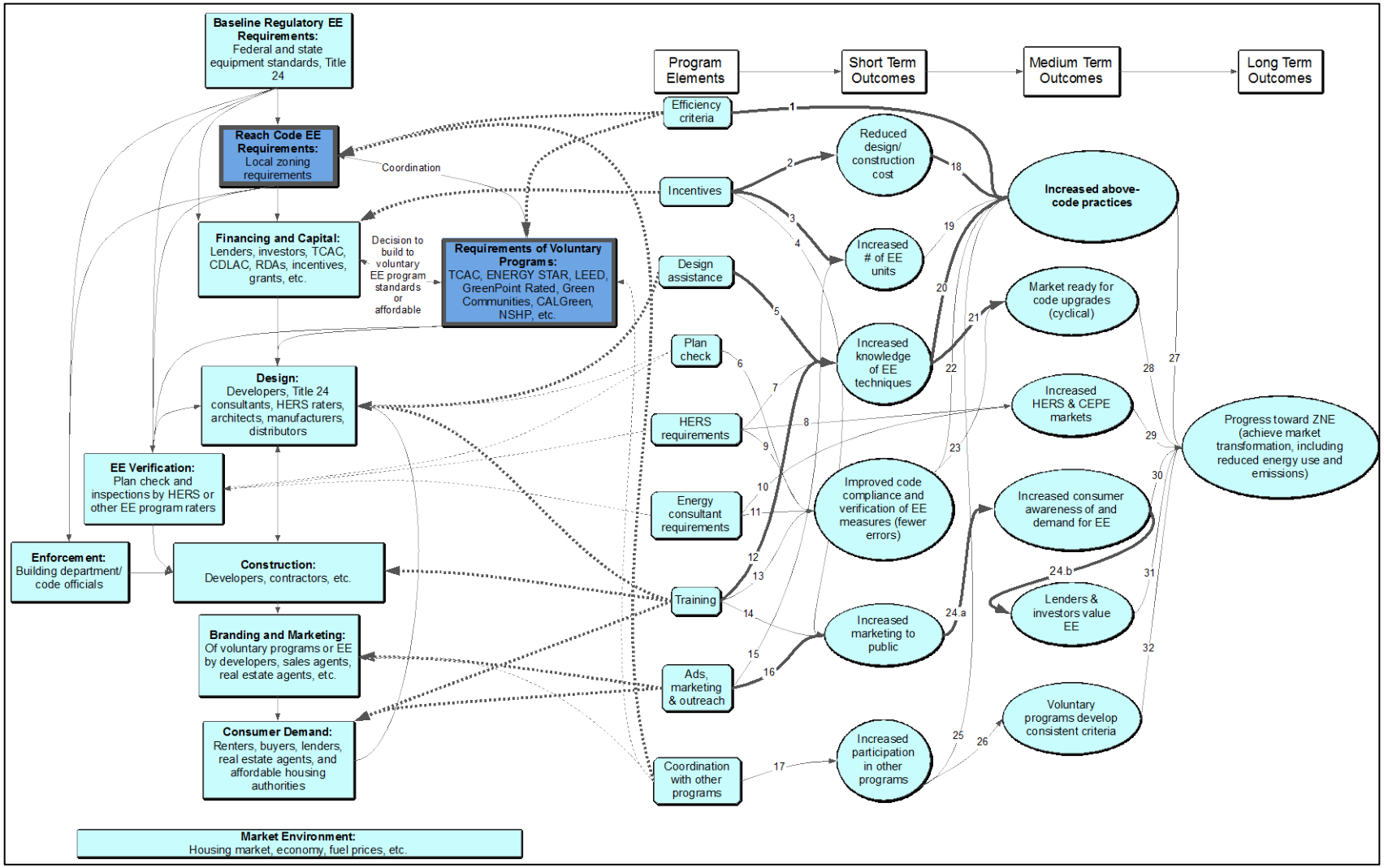
- Efficiency criteria: This is a fundamental component of the IOUs' MFNC programs. As developers build to these higher efficiency standards, manufacturers, and particularly distributors, may be encouraged to stock higher efficiency mechanical equipment, thereby leading to changes in practices even in non-program construction due to the increased availability of high efficiency equipment. These criteria are also important to the extent that they provide a set of consistent efficiency standards that other voluntary efficiency programs (LEED, ENERGY STAR, etc.) or municipalities (in the form of "reach code"[14]) might decide to adopt.
- Incentives: Incentives are a key program mechanism to overcome the barrier of increased costs of energy-efficiency equipment, design and construction costs, and the split-incentive barrier. By decreasing the extra cost for higher levels of efficiency, incentives can help lead to greater acceptance from builders and also increased economies of scale.
- Design assistance: Design assistance, particularly when combined with program-sponsored training and offered through ZNE pilot projects, serves an educational role for market actors, teaching them about—and demonstrating the feasibility of—more advanced building practices and the value of integrated design practices. This aids in overcoming barriers related to builder knowledge, information, or willingness to build efficiently.

[13] The remaining program elements, such as plan check, can also affect the market but not to the same extent as the key elements identified.

[14] The IOUs' Reach Code Subprogram of the Codes and Standards Program contributes directly to this adoption of consistent criteria. "IOUs have and will continue to promote regionally consistent ordinances where possible to reduce the duplication of efforts that results when individual government entities develop the language and technical supporting documentation independently." *Source: Southern California Gas Program, Program Implementation Plans: Statewide Programs, Appendix B.2, Section A, April 23, 2013, http://www.socalgas.com/regulatory/documents/A-12-07-003/Appendix%20B.2%20Section%20A%20Statewide%20Programs.pdf, accessed January 28, 2014.*

- Training: The IOUs offer training opportunities to market actors to increase their ability to meet advanced building requirements cost-effectively. Training should result in increased energy-efficiency knowledge among market actors as well as improved designs and construction processes. Trainings that encourage marketing of energy efficiency can also lead developers to improve or increase their marketing of energy-efficient construction; effective marketing would ideally lead to increased consumer demand for more above-code construction.
- Advertising, marketing, and outreach: The IOUs target their marketing efforts at increasing builder participation in the program. They also encourage developers to market efficiency to homebuyers, thereby increasing consumer awareness and demand for energy efficiency. If lenders and investors perceive a growing demand for energy-efficient construction, they may begin to value energy efficiency as an important characteristic of the buildings in which they invest.

Figure ES-2: IOU Program Model in Context of Market Model, with Key Links in Bold*



* Key links from program elements to outcomes are shown in bold and key links to the market are shown with bold dotted lines.

The key program elements are linked to a number of key outcomes that can be tracked over time that might provide evidence of market effects, recognizing that attribution can be particularly difficult in a complex market environment, particularly when the program is not the sole market intervention:[15]

- Increased above-code practices in non-program homes,
- Reduced design and construction costs
- Increased numbers of above-code, efficient units being constructed,
- Increased knowledge of efficiency building practices among market actors,
- Increased marketing of efficiency to the public,
- Enhanced readiness for code upgrades,
- Increased consumer demand for efficient construction, and
- Increased demand for efficient construction by lenders and investors.

[15] These program elements often have many direct and indirect outcomes discussed in greater detail in section 4.2.2

Table ES-1 summarizes the key program elements and their associated outcomes, indicators for the outcomes, links in the program model, the timing of the expected outcome, and recommended timing of data collection for the expected outcome (Figure ES-2). The indicators can be tracked over time to determine if a given outcome has occurred in the multifamily new construction marketplace, providing evidence of potential market effects from the IOUs' programs. We hypothesize that evidence that short-term outcomes have occurred could emerge in as little as one to three years while evidence of medium-term outcomes will take longer, perhaps three to five years. However, it is important to note that because of the complex array of public programs and policies influencing the energy efficiency of the MFNC market, including reach codes, CTCAC tax credits, Title 24 and other voluntary programs such as LEED and GPR, attribution of any observed market effects specifically to an IOU program will be difficult. For example, affordable housing projects are subject to above-code energy efficiency performance to receive tax incentives from CTCAC, and some municipalities enforce reach codes, also requiring performance above the base Title 24 code requirements. Further complicating attribution is the coordination among different programs and policy initiatives. For example, the IOUs encourage and assist program applicants in working with ENERGY STAR and other voluntary programs while CTCAC has intentionally adopted an above-code efficiency level requirement that is consistent with the IOUs' programs.[16] Tracking overall changes to the market place are critical, but no less critical are the indicators below that would allow evaluators to assess the role of the program in influencing any of the hypothesized market outcomes.

Table ES-1: Program Elements, Expected Outcomes and Indicators

Program Element	Outcome	Indicator	Link	Timing of Outcome	Timing of Data Collection
Incentives	Reduced design and construction costs	Builders and other market actors report that incentives lower the incremental costs for above-code, energy-efficient design and construction.	2	Short-term	Ongoing
	Increased numbers of above-code, efficient units being constructed	Developers report that they would not be able to build the same quantity without IOU funding.	3	Short-term	Ongoing
	Increased above-code practices	Participating and non-participating builders report decreasing incremental costs of energy-efficient technologies and practices as a factor encouraging their use.	18	Med.-term	Ongoing
Efficiency Criteria	Increased above-code practices	On-site inspections confirm increased above-code practices in non-program homes.	1	Med.-term	Every three to four years
		Increased stock/availability of high	1	Med.-term	Ongoing

[16] In fact, one interviewee reported that CTCAC would not have adopted the beyond-code requirements if the IOUs' programs were not available to help cover the costs of building 15% more efficiently that code (see section 4.2.1.9 for more details about coordination among programs).

		efficiency equipment reported by market actors.			
Design Assistance & Training	Increased above-code practices	Market actors report increased awareness of EE practices (including integrated design) from program efforts has changed practices in non-program homes.	20	Med.-term	Ongoing
	Increased knowledge	Market actors report they learned from the IOUs' design assistance offerings, including the value of integrated design.	5	Short-term	Ongoing
		Market actors report that they participated in and learned from trainings.	12	Short-term	Ongoing
	Readiness for code upgrades	Market actors are aware of and ready for coming code changes as a result of the program.	21	Med.-term	Up to one year before every code cycle change
Advertising, Marketing, and Outreach	Increased marketing of efficiency	Builders report increasing their marketing of energy efficiency.	16	Short-term	Ongoing
	Increased consumer demand	Home buyers and renters report increased importance of energy efficiency as a feature and report hearing about it from marketing by the program, builders, and developers.	24.a	Med.-term	Every three to four years
		Builders and developers report increasing homebuyer and renter demand for energy efficiency, thus encouraging builders to increase their adoption of above-code practices.	24.a	Med.-term	Ongoing
	Increased demand for efficient construction by lenders and investors	Lenders and investors require EE measures/criteria in the projects in which they invest.	24.b	Med.-term	Every three to four years
		Lenders to homebuyers increasingly offer and market EE mortgage products.	24.b	Med.-term	Every three to four years

In terms of assessing attribution, we recommend adopting a theory-based approach that focuses on whether an outcome posited by the program theory has in fact occurred, and if so, then attempting to determine whether the outcome can be linked to IOU program activities, based on the preponderance of evidence.[17] Attribution of market effects to the New Construction program will rely on observed changes in building practices as posited by the program and market theories and self-reported attribution of program impacts on the observed changes by key market actors. Attribution of program impacts could also be estimated with a Delphi panel of experts who would use data on observed changes in building practices and the self-reports by market actors to develop attribution factors.

[17] A preponderance-of-evidence approach involves drawing a conclusion that a fact or occurrence is more probable than not based on weighing all available evidence.

The evaluation team does not propose including a comparison area because of three key factors that make the California residential new construction market unique and not readily comparable to control areas: (1) California's multiple and varied climate zones; (2) California's distinctive and continually changing state building codes; (3) California's long-standing new construction programs, which have become an integral part of the market. New construction in California is not readily comparable enough to new construction in any other area—or even a combination of areas—to allow valid comparisons. For example, a recent evaluation of California IOUs' benchmarking initiatives found that concerns about the lack of comparability between California commercial buildings and buildings nationally was a limitation to using ENERGY STAR Portfolio Manager for benchmarking California buildings; and this was an important driver for the development of California-specific benchmarking tools.[18] Moreover, the cost of doing on-site assessments just in California is very expensive; conducting such on-site assessments out of state could be prohibitively expensive.

[18] NMR Group, Inc. and Optimal Energy, Inc. "Statewide Benchmarking Process Evaluation" April, 2012.Submitted to the California Public Utility Commission. Study ID CPU0055.01. Accessed April 23, 2014. http://www.calmac.org/publications/Statewide_Benchmarking_Process_Evaluation_Report_CPU0055.pdf

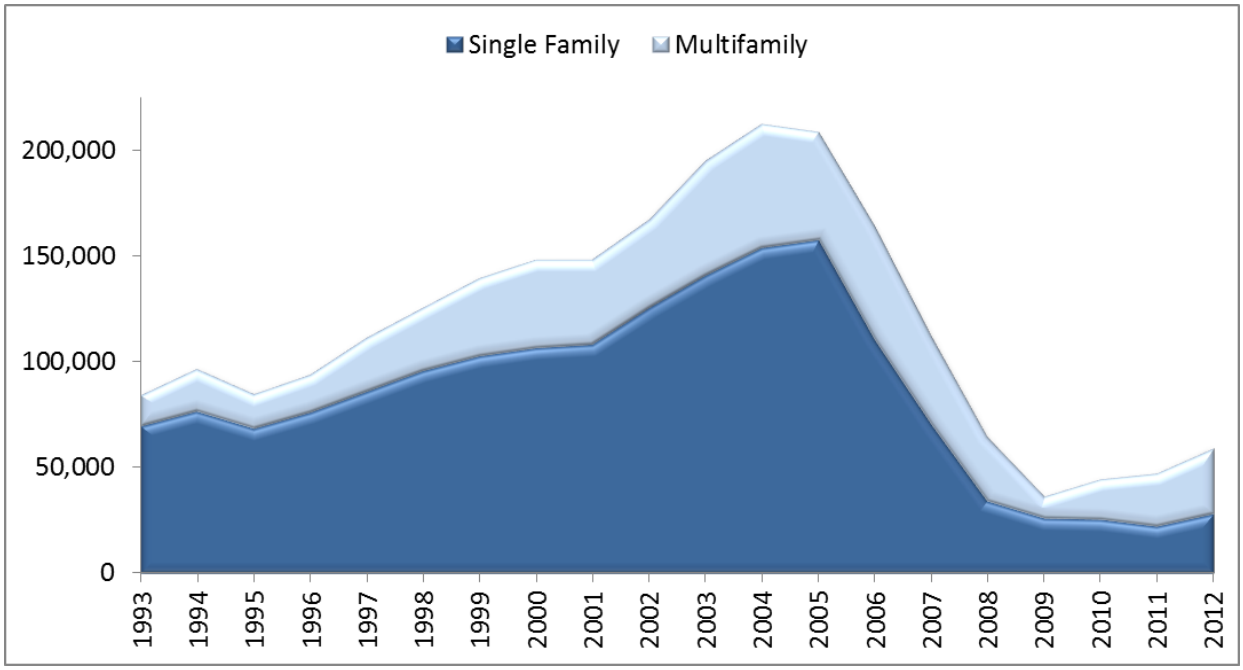
Market Characterization

The market characterization and segmentation analysis included our analysis of secondary data of MFNC starts and permits. We reviewed and analyzed several types of data, including (1) city-level permit data; (2) project-level new construction starts data, (3) IOU program participation data, and (4) other voluntary "green" project new construction data.[19] We also conducted a survey with builders and developers to corroborate new construction starts data and lend additional insight into the market characterization.

New Construction Permits Data

Between 1993 and 2012, California single-family and multifamily home unit permits reached a high of 212,960 units in 2004 and a low of 36,421 units in 2009 (Figure ES-3). The number of housing permits declined substantially between 2005 and 2009 due to the housing crisis and recession of 2007 to 2009. Permits slowly recovered during the 2010 to 2012 period, though the numbers of units permitted have not rebounded to the levels reached between 1993 and 2008. The multifamily market has recovered more quickly than the single-family home market; multifamily units represent 52% of the permits issued in 2012, whereas they represented an average of 28% of the permits issued from 1993 to 2008. Overall, 74,585 multifamily units were permitted from 2010 through 2012.

Figure ES-3: California Permitted Units by Building Type (1993-2012)



[19] Throughout our analysis, when we refer to the permits issued or projects started, we refer to all permits/projects at the state level. In discussions where we are referencing only IOU program or other program projects, we specify that we are only analyzing the respective program's projects.

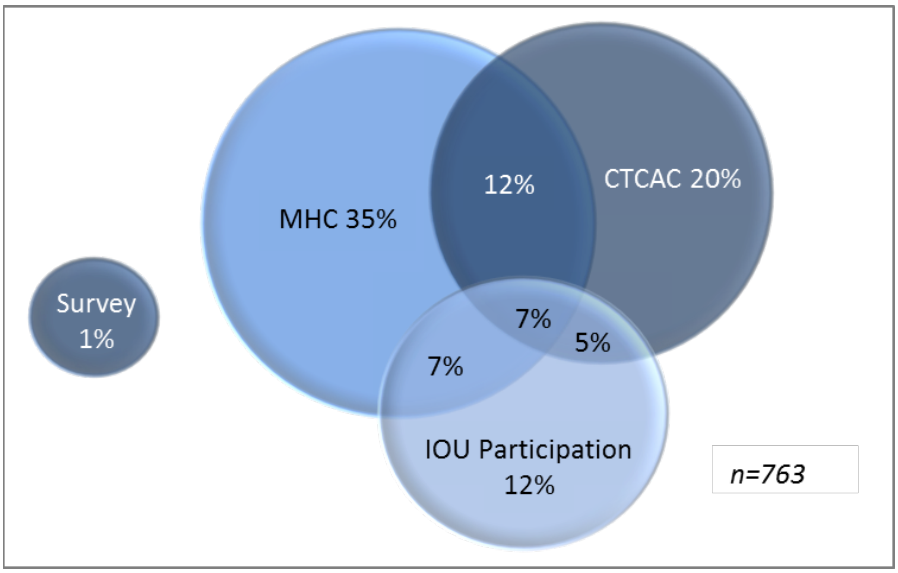
New Construction Starts

The research team analyzed the population of MFNC projects that started construction in California from 2010 through 2012. To conduct an analysis of MFNC starts, the research team developed a database accounting for the population of projects started in California from 2010 through 2012 from four different data sets (see section 5.3 for more details):[20]

- McGraw Hill Construction (MHC) Dodge data
- California Tax Credit Allocation Committee (CTCAC) reports
- IOU program data (CAHP and SBD programs)
- CATI Survey data

Nearly one-third of the 763 MFNC starts projects included in the database (31%) appeared in more than one source. Figure ES-4 illustrates the overlap of project sources.

Figure ES-4: Multifamily Construction-Starts Project-Level Data Sources



[20] In accordance with the IOU MFNC program rules, we did not include projects in our database if they were remodels, additions, mobile homes, residential care facilities, hotels, motels and/or dormitories. We did include senior and retirement housing projects that were independent living developments (defined as each unit having its kitchen and bathroom).

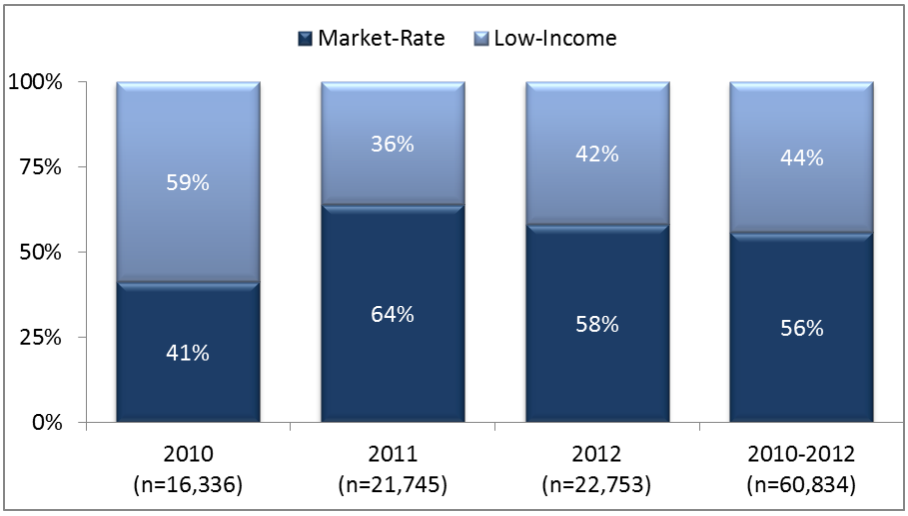
We estimate that there were 60,834 units in the 763 multifamily projects that were started from 2010 through 2012 (Table ES-2). Overall, the number of units increased by 39% from 2010 to 2012, while the number of projects increased by 12% during the same period.

Table ES-2: Multifamily Construction Starts, Projects and Units (2010-2012)

Time Period	Number of Projects	Number of Units*
2010	246	16,336
2011	239	21,745
2012	278	22,753
Total 2010-2012	**763**	**60,834**

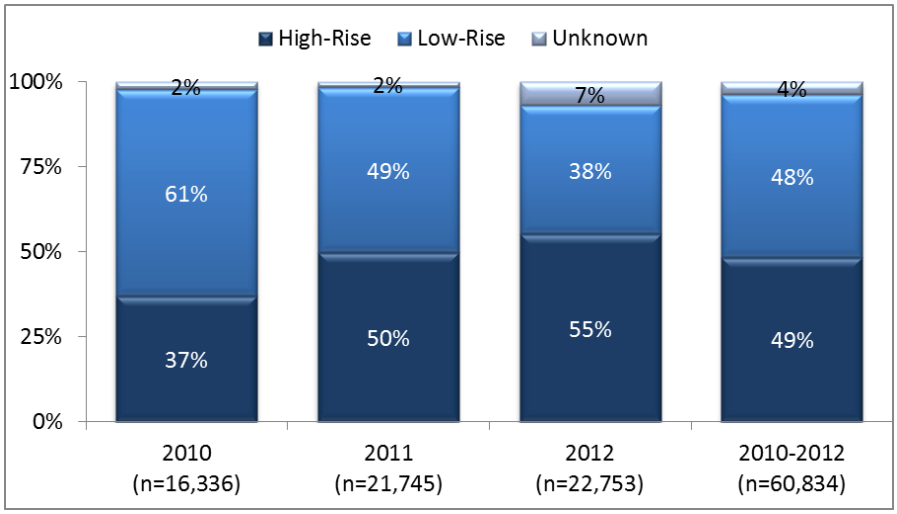
The percentage of market-rate units increased from 41% of units in 2010 to 58% of units in 2012—increasing from 6,751 units in 2010 to over 13,000 in 2011 and 2012—while the number of low-income units remained relatively stable during the same period, ranging from 7,828 units to 9,585 (Figure ES-5). This suggests that the market-rate segment has been more responsive to housing recovery, thus accounting for the bulk of the increase in MFNC activity, and suggests that the low-income market is less affected by housing market cycles.

Figure ES-5: Income Category of MFNC Units (2010-2012)



Approximately half of the estimated units (49%) were in projects with high-rise buildings and low-rise buildings (48%) (Figure ES-6).[21] The percentage of units in high-rise buildings increased from 37% of units in 2010 to 55% of units in 2012. From 2010 through 2012, projects became more likely to include high-rise buildings. In 2010, 24% of projects included high-rise buildings whereas in 2012 35% of projects included high-rise buildings.

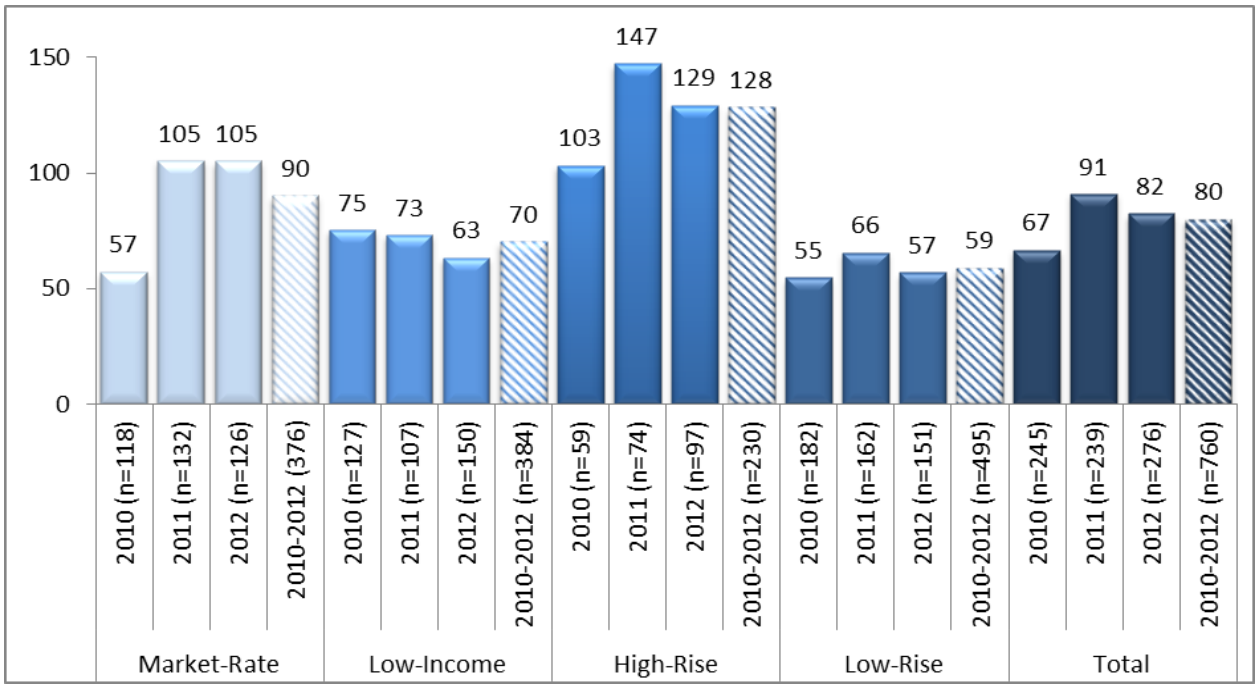
Figure ES-6: Multifamily Project Building Rise (2010-2012)



[21] Low-rise buildings have one to three habitable stories while high-rise buildings have four or more habitable stories.

The average number of units in a given MFNC project increased by 22% from 2010 to 2012 (Figure ES-7). Between 2010 and 2011, the average number of units in market-rate and high-rise projects exhibited a substantial increase. Meanwhile, the average number of units in low-income projects steadily decreased from 2010 to 2012.

Figure ES-7: Average Number of Units, by Income Category and Building Rise (2010-2012)



Using the project addresses and/or IOU participation data, the team identified the IOU and electricity provider for each project. Project addresses were most commonly in the SCG (52%), PG&E (40%) and SCE (28%) service territories (Table ES-3). Nearly all MFNC projects and units started during this period were IOU customers (96% of projects and 97% of units).

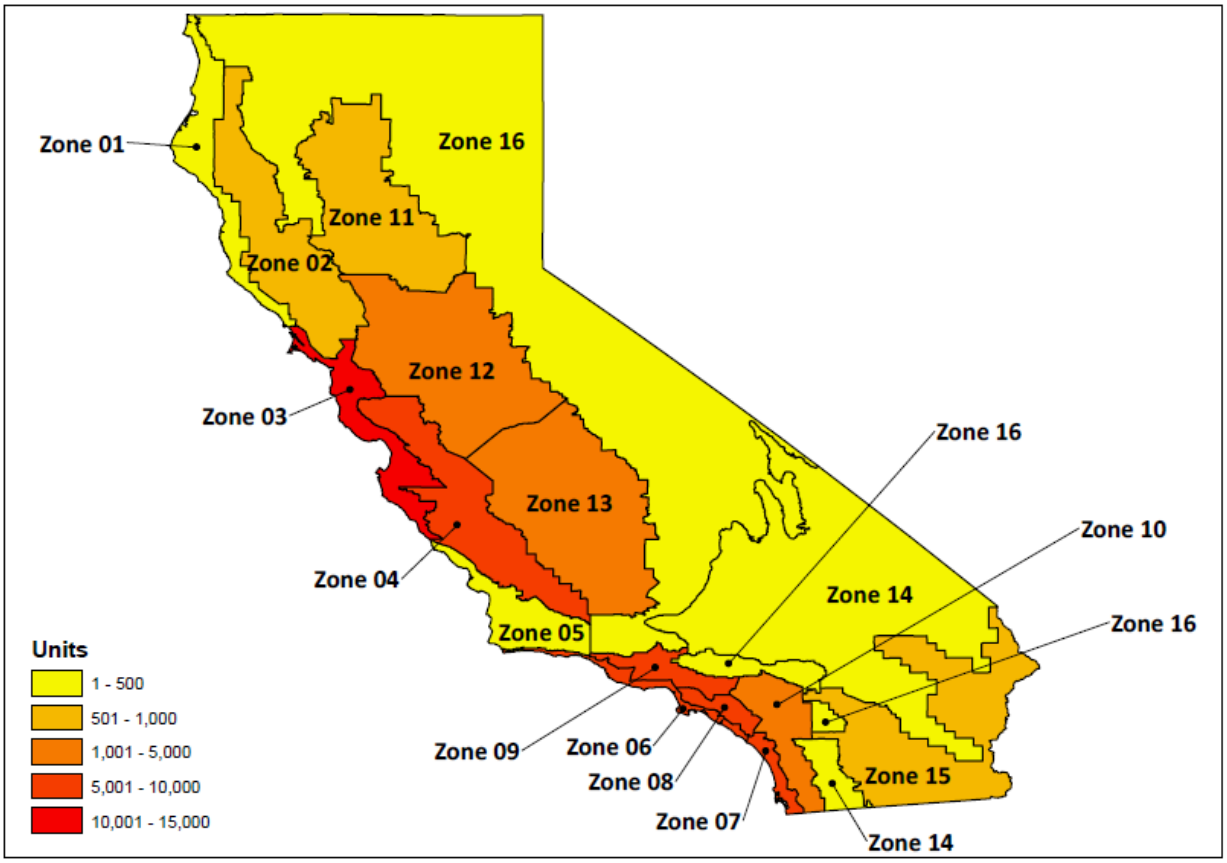
Table ES-3: Utility Service Provider for MFNC Starts (2010-2012)

Utility	Number of Projects*	Percent of Projects*	Number of Units*	Percent of Units*
Southern California Gas	397	52%	28,670	47%
Pacific Gas & Electric Company	309	40%	26,314	43%
Southern California Edison	211	28%	14,173	23%
Los Angeles Department of Water & Power	113	15%	10,194	17%
San Diego Gas & Electric	70	9%	6,201	10%
Sacramento Municipal Utility District	14	2%	1,016	2%
Other	45	6%	2,896	5%
Unknown Location	1	<1%	40	<1%
Total 2010-2012	**763**		**60,834**	

*Because SCG territory overlaps with electric utility providers' territories, the sum of the number of projects and units exceeds the total number of projects and units.

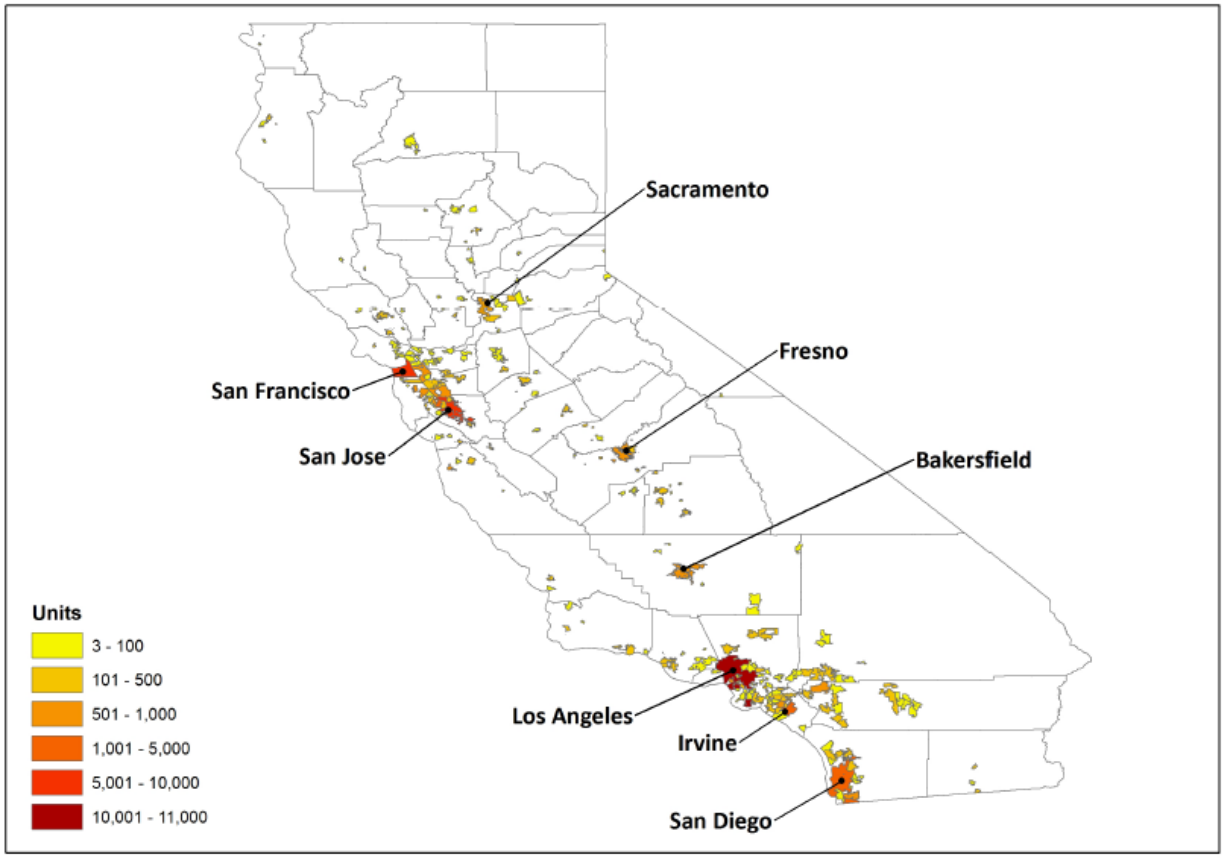
Matching project addresses to the 16 climate zones (CZ) established in California Energy Commission's (CEC) Title 24, the team identified the climate zone associated with each of the 762 projects. Figure ES-8 illustrates that 2010-2012 MFNC starts were concentrated in climate zones along the coast that encompass California's major cities such as Los Angeles, San Francisco, and San Diego. The majority of construction was located in climate zone three (24% of units) and climate zones six through nine (ranging from 9% to 14% of all units).

Figure ES-8: Total Units of MFNC by Climate Zone (2010-2012)



MFNC starts were heavily concentrated in California's major cities and urban areas, as illustrated in Figure ES-9. Forty-six percent of all units were started in five cities: Los Angeles (18% of units), San Jose (9%), San Francisco (8%), San Diego (7%), and Irvine (4%).

Figure ES-9: Total Units of MFNC by City (2010-2012)



Nearly all of the MFNC starts (99%) were located within the boundaries of an MSA.[22] Over the three-year period, the majority of MFNC units (81%) were started in five unique MSAs:

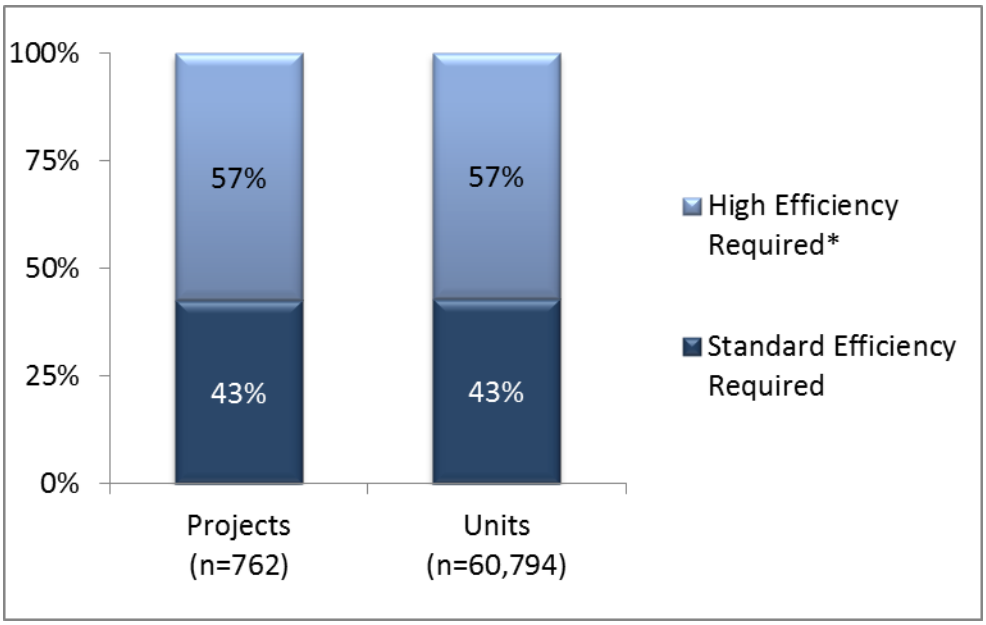
- Los Angeles-Long Beach-Anaheim
- San Francisco-Oakland-Hayward
- San Diego-Carlsbad
- San Jose-Sunnyvale-Santa Clara
- Riverside-San Bernardino-Ontario

[22] Metro-statistical designations are geographic areas delineated by the U.S. Office of Management and Budget (OMB). Metropolitan statistical areas have a single core urban area with a population of 50,000 or more people, Micropolitan statistical areas have a single urban core area with a population equal to or greater than 10,000 people and less than 50,000 people. *Source:* U.S. Census Bureau. "Metropolitan and Micropolitan Statistical Areas Main." Accessed July 4, 2013 from http://www.census.gov/population/metro/.

Slightly more than one-quarter of MFNC projects (26%) and nearly one-third of units (32%) that were started from 2010 through 2012 took place in a city or county that adopted reach codes. Most of these project starts, equal to nearly one-fifth of all project starts (18%) and one-quarter of their units (24%), had been started after the reach code was approved by the CEC. In addition, 45% of projects, equal to 38% of units, received a CTCAC award, meaning that these projects and units were required to exceed Title 24 by at least 15%.

If projects were either CTCAC awardees and/or located in cities or counties with a reach code at the same time or before construction began, we considered the project to be subject to high efficiency requirements. As shown in Figure ES-10, we estimated that more than one-half of MFNC projects (57%) and units (57%) that were started from 2010 through 2012 were required to be high efficiency. This helps illustrate that in addition to the IOUs' programs there is a complex set of programs and policies affecting energy efficiency in the MFNC market. Further evidence of the synergism of these programs was provided by one interviewee who reported that CTCAC would not have adopted the above-code requirements if the IOUs' programs were not available to help cover the costs of building 15% more efficiently that code (see section 4.2.1.9 for more details about coordination among programs).

Figure ES-10: Multifamily Project and Units with High Efficiency Requirements (2010-2012)

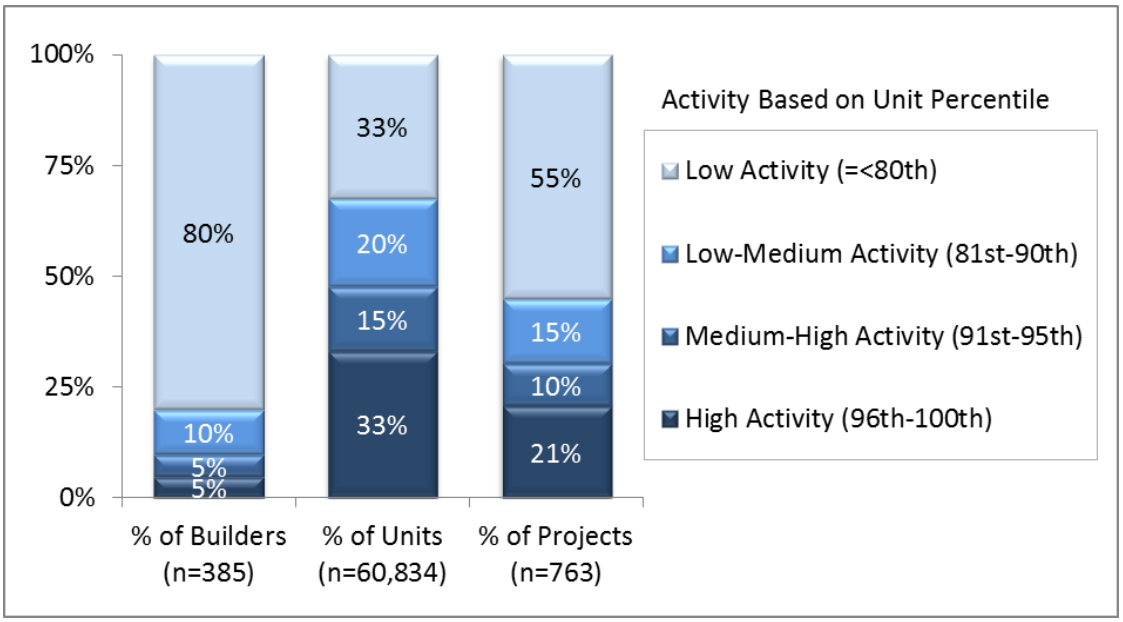


* "High Efficiency Required" refers to projects that received CTCAC awards and/or those that were started at the same time or after a local energy ordinance was put in place. The efficiency status of one project was not included because the team did not have enough information about the project to determine its location

Builders and Developers

The research team identified 385 builders associated with the 763 projects started from 2010 through 2012. On average, the 385 builders started 2projects and 158 units. A small share of builders accounted for a disproportionately large share of projects and units: high activity builders—those found in the 96th to 100th percentiles, representing 5% of builders—were involved with slightly more than one-fifth of projects (21%) and one-third of units (33%). The top 20% of builders were responsible for two-thirds of all units and 46% of all projects (Figure ES-11).

Figure ES-11: Builder Activity Levels Based on Number of Units (2010-2012)



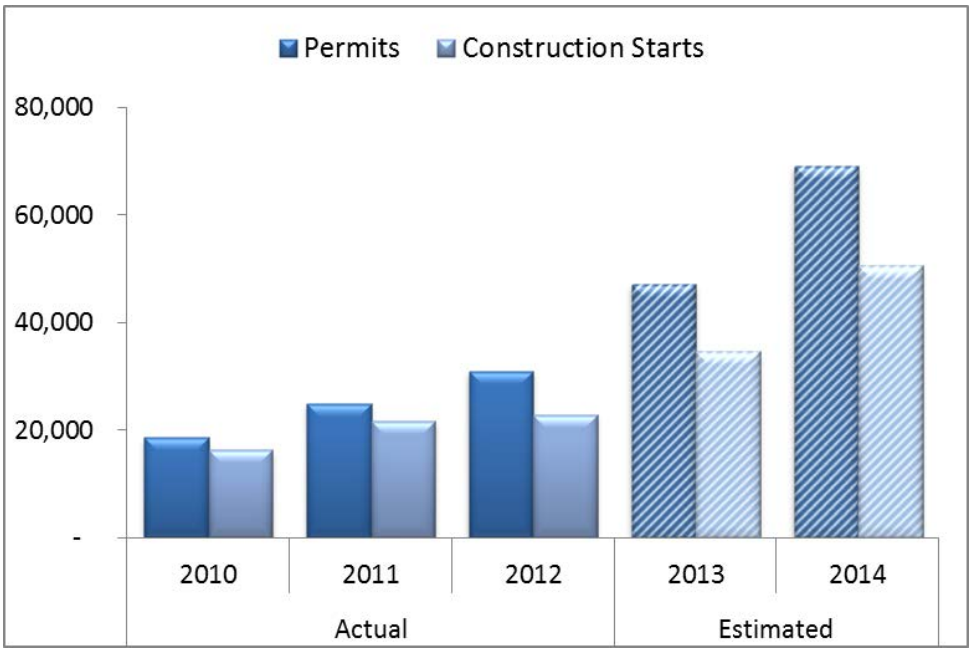
Note: Percentages of units and projects both sum to greater than 100% due to rounding.

Forecast

To make estimates for 2013 and 2014, we extrapolated based on forecasts from the UCLA Anderson Forecast[23] and the results of our permit and new construction data analyses. The UCLA Anderson Forecast predicted there would be substantial growth in the MFNC market in 2014, estimating that in 2014 there would be 69,100 MFNC units permitted in California compared to a projection of 60,200 permitted units of single family homes. This represents a 47% increase from 2013 to 2014 in the number of multifamily permitted units.[24]

Based on the ratio of units of MFNC units started and permitted in 2012, we assumed that slightly less than three-quarters (73%) of permitted units drawn in 2013 and 2014 would be started.[25] Based on this ratio and the number of permits drawn, we estimated that there have been 34,593 units started in 2013 and there will be 50,678 units started in 2014 (Figure ES-12).

Figure ES-12: Units of Projected MFNC Starts, 2013-2014



[23] The UCLA Anderson Forecast prepares economic forecasts for the U.S. (with special emphasis on California).

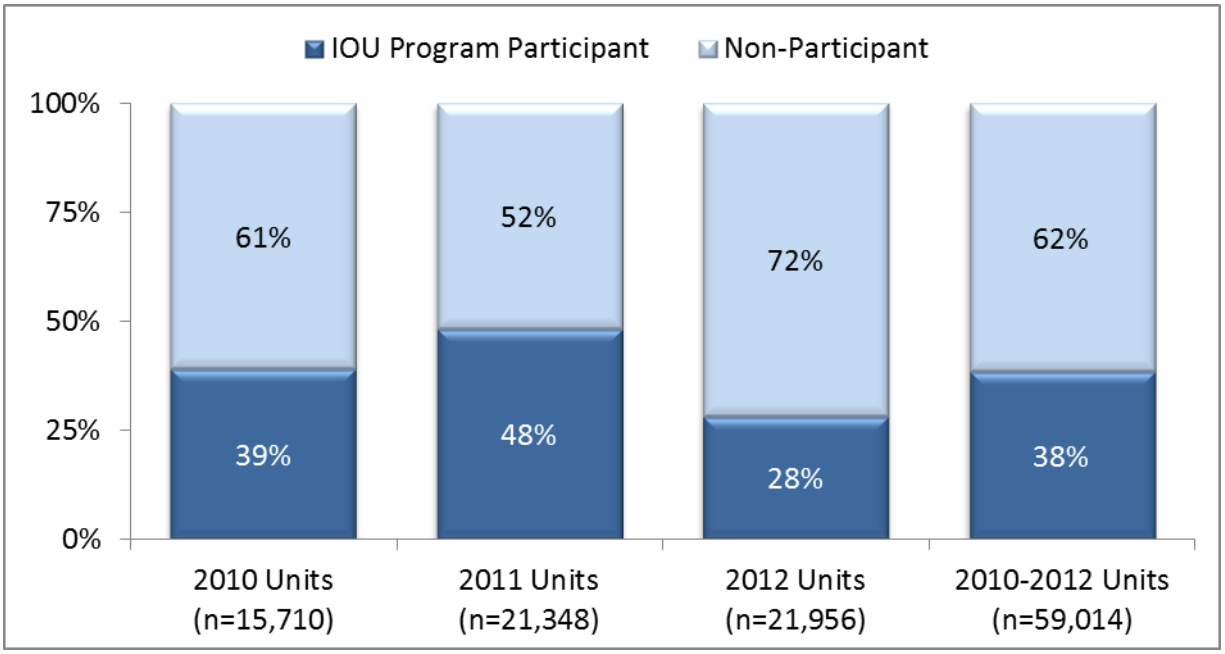
[24] Multifamily Executive, Economic Conditions, "Housing to 'Return to Normal' in 2014, UCLA's Anderson School Says," September 27, 2012, http://www.multifamilyexecutive.com/economic-conditions/housing-to--return-to-normal--in-2014--ucla-s-anderson-school-says.aspx, accessed January 3, 2014. The UCLA Anderson Forecast also predicted a 40% increase in MFNC permits for 2013, which is equal to 43,434 permits. Actual permits exceeded the Anderson Forecast by nearly 3,000 permits, suggesting that the 2014 forecast may be a conservative forecast of MFNC permit activity. UCLA Anderson Forecast, "Sluggish Economy Continues Despite Improvements in the Housing Market," June 20, 2012, http://www.uclaforecast.com/contents/archive/2012/media_62012_1.asp, accessed January 3, 2014

[25] The evaluation team hypothesizes that the discrepancy between the number of permits and number of starts is likely due primarily to (1) the lag between drawing a permit and starting construction and (2) not all permits being built.

IOU Program Market Penetration

Nearly two-fifths (38%) of all units started in the IOU territories from 2010 through 2012 participated in the IOU's MFNC programs (Figure ES-13).[26] A total of 238 MFNC IOU program projects were started from 2010 through 2012, with nearly all (234) enrolled in the CAHP or CMFNH program, while only four were enrolled in the SBD program. Market penetration increased from 2010 to 2011 but dropped noticeably from 2011 to 2012. Program staff suggested that this pattern may be due to a combination of the housing recovery and limited program funds. The increase from 2010 to 2011 may have been due to the recovery in the housing market and the release of pent-up demand in the market from the recession. The decline in 2012 may be due to limited program funds combined with the housing recovery. Program staff from two IOUs noted that the program exhausted all of their MFNC funds before the end of the 2010 to 2012 program cycle, limiting the number of projects and units that could be enrolled in the program as the MFNC market rebounded.

Figure ES-13: Market Penetration of IOU MFNC Programs (2010-2012)



There is substantial overlap between IOU MFNC program participation and both reach codes and CTCAC awards. Thirty-two percent of IOU program units were started in communities that had enacted reach codes at the same time or before construction began, while 28% of program units received a CTCAC award. Overall, 53% of IOU program units that were started from 2010 through 2012 were required to be high efficiency. Small shares of IOU participating

[26] The IOU's MFNC programs accounted for about one-third (32%) of MFNC projects started in the IOU territories from 2010 through 2012

projects (8%) and units (6%) were both CTCAC awardees *and* located in communities where a reach code had been enacted at the same time as or before construction. IOU program units that were required to be high efficiency represented slightly more than one-third of all statewide units that were subject to above-code requirements (34%). This again illustrates the extent to which multiple programs and policies are concurrently seeking to drive increased energy efficiency in the MFNC market.

Figure ES-14 presents the rates of participation among the IOU programs relative to the annual number of units started in the IOU's service territory. PG&E and SDG&E have the highest market penetration rate among the IOUs—52% and 46% of units, respectively, participated in an MFNC program from 2010 through 2012.

Figure ES-14: Market Penetration of IOU MFNC Programs, by IOU (2010-2012)

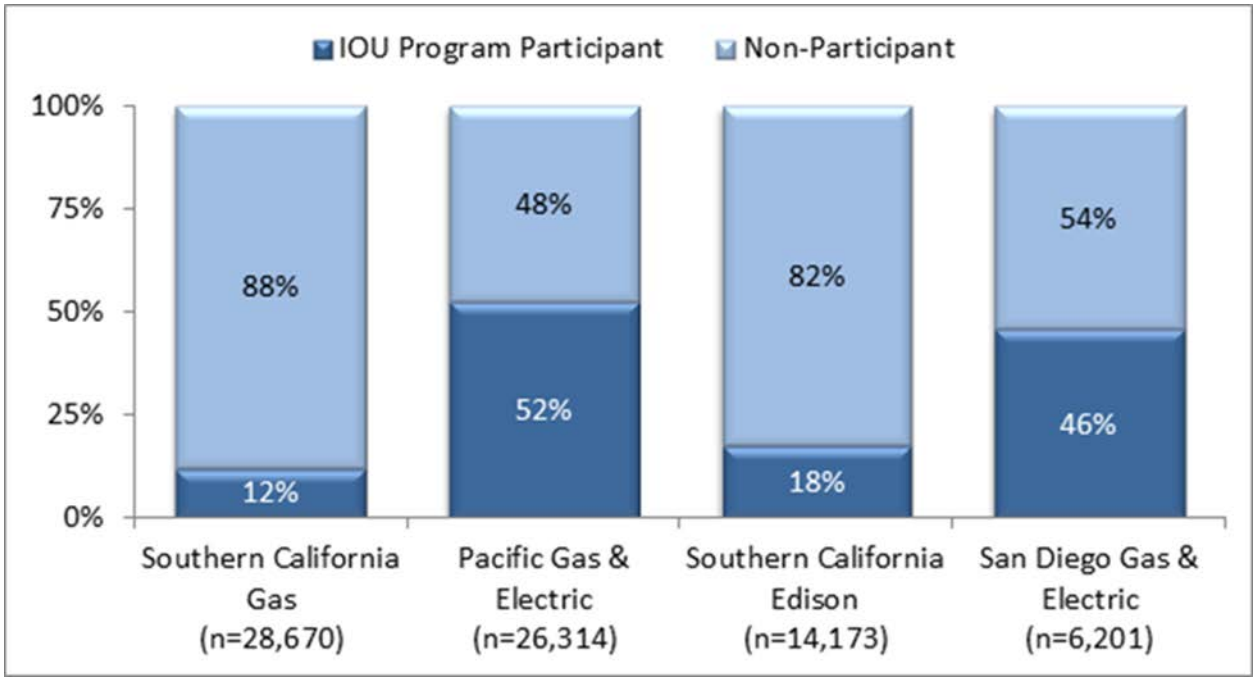
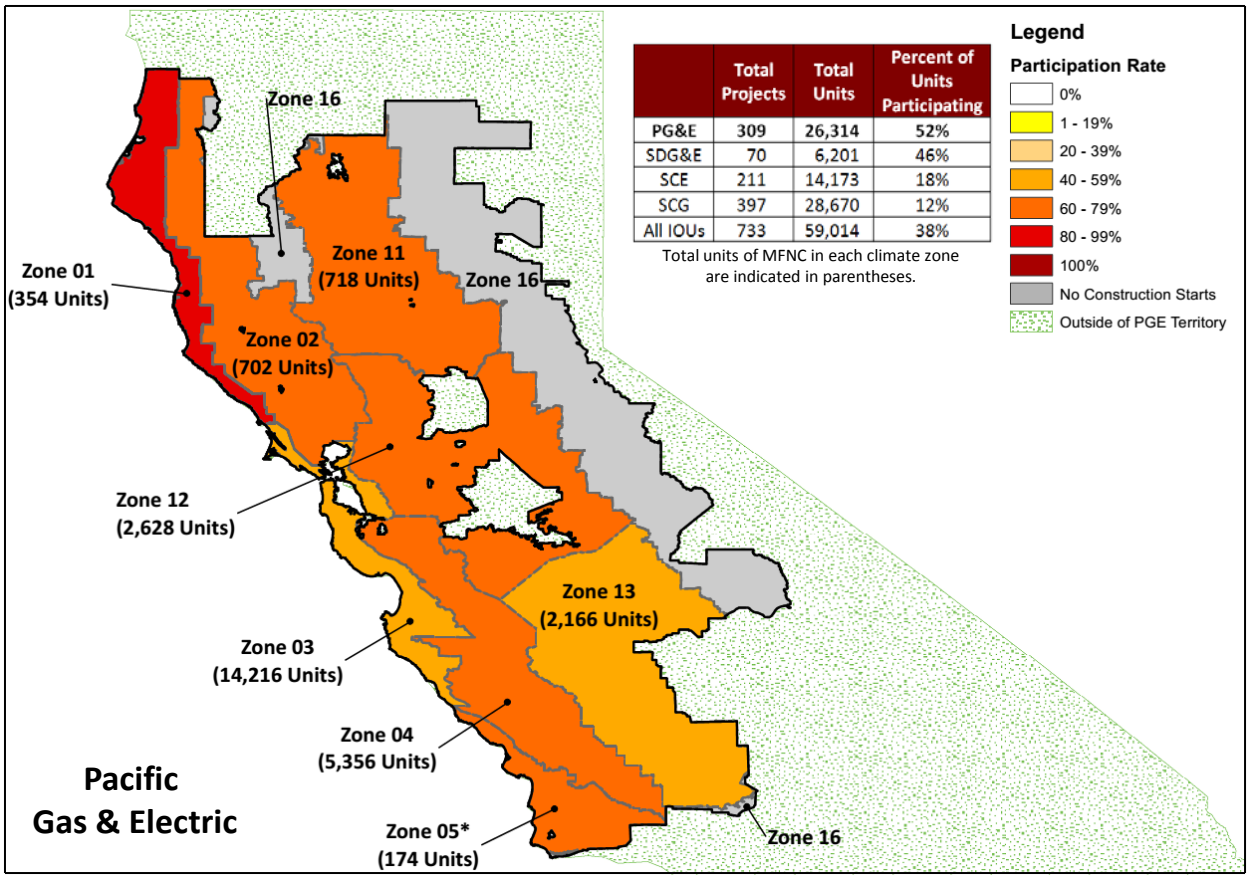


Figure ES-15 through Figure ES-18 present the market penetration of each IOU's program by climate zone. As noted in Figure ES-8, MFNC activity was concentrated along the coast and major urban centers and the IOUs' program activity follows this same pattern. PG&E and SDG&E generally have higher rates of participation across their territories and have sizeable portions of their territories in which there was no MNFC activity (shaded grey).

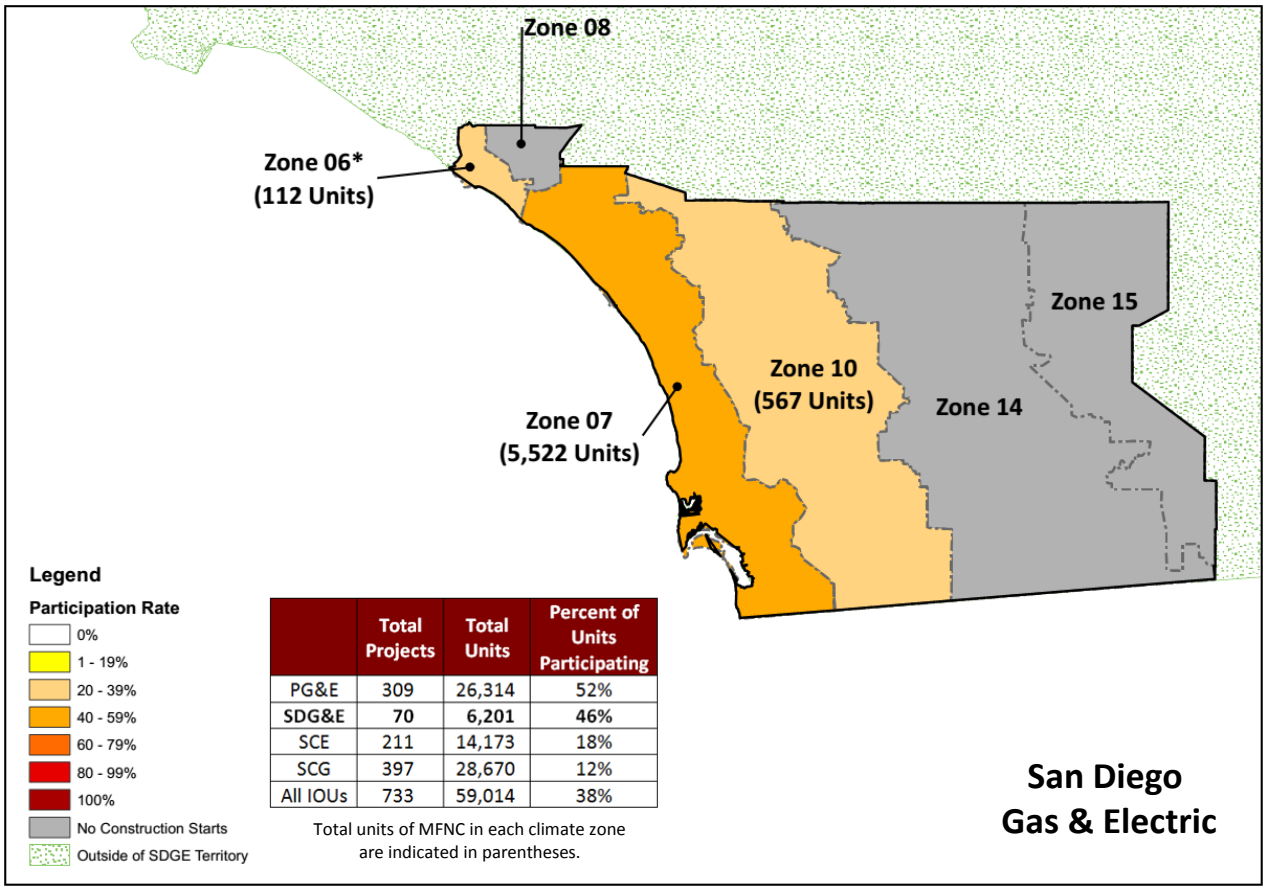
Figure ES-15: Market Penetration of PG&E MFNC Program Units by Climate Zone (2010-2012)



Note: The electric utility boundaries of this map were developed by the California Energy Commission (http://www.energy.ca.gov/maps/serviceareas/electric_service_areas.html).

* The 174 units in climate zone five represent only five projects.

Figure ES-16: Market Penetration of SDG&E MFNC Program Units by Climate Zone (2010-2012)

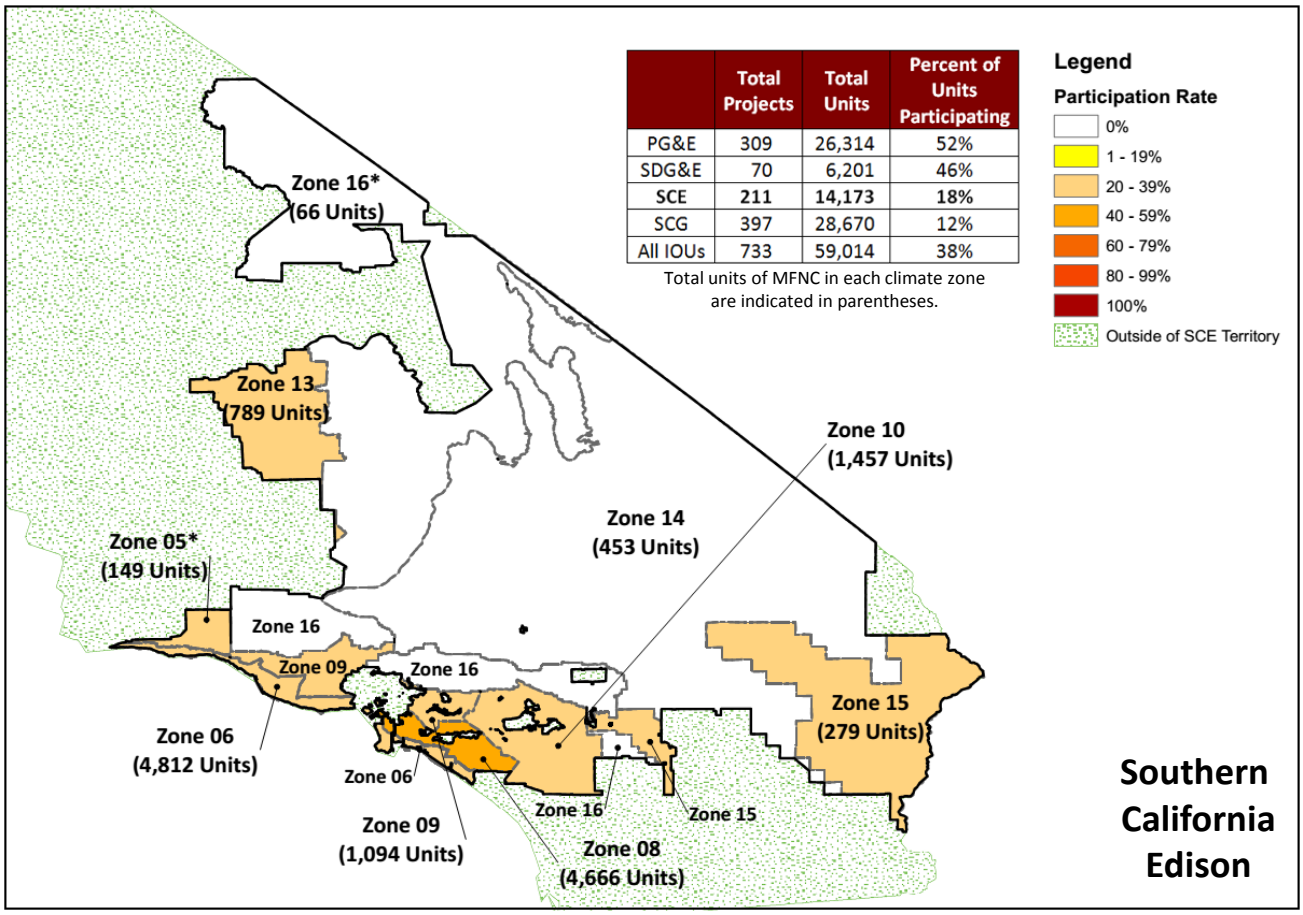


	Total Projects	Total Units	Percent of Units Participating
PG&E	309	26,314	52%
SDG&E	70	6,201	46%
SCE	211	14,173	18%
SCG	397	28,670	12%
All IOUs	733	59,014	38%

Note: The electric utility boundaries of this map were developed by the California Energy Commission (http://www.energy.ca.gov/maps/serviceareas/electric_service_areas.html).

* The 112 units in climate zone six represent only two projects.

Figure ES-17: Market Penetration of SCE MFNC Program Units by Climate Zone (2010-2012)

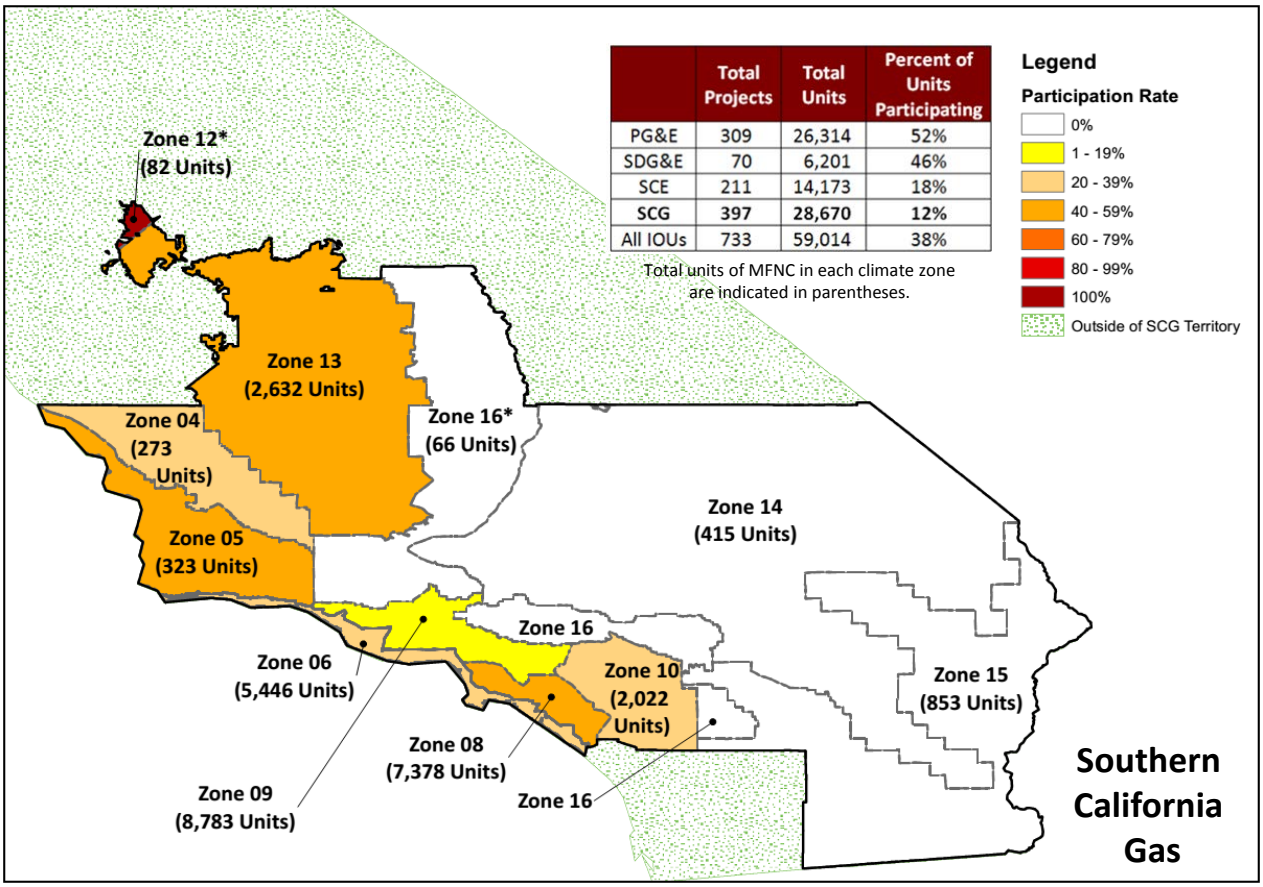


	Total Projects	Total Units	Percent of Units Participating
PG&E	309	26,314	52%
SDG&E	70	6,201	46%
SCE	211	14,173	18%
SCG	397	28,670	12%
All IOUs	733	59,014	38%

Note: The electric utility boundaries of this map were developed by the California Energy Commission (http://www.energy.ca.gov/maps/serviceareas/electric_service_areas.html). The sum of the units displayed in the map is slightly less than the total units in the table: 397 units in climate zone seven, located at the southern, central edge of each of the service territory, are not displayed because the area of climate zone seven was too small to be presented in the map.

* The 149 units in climate zone five represent only four projects and the 66 units in climate zone 16 represent only one project.

Figure ES-18: Market Penetration of SCG MFNC Program Units by Climate Zone (2010-2012)



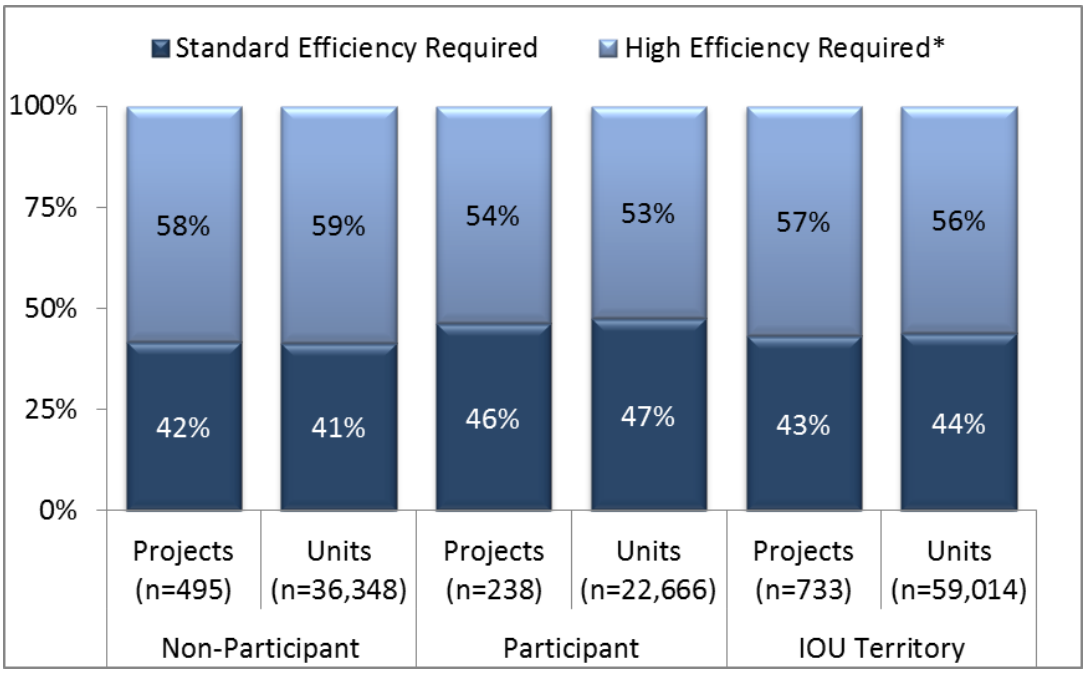
	Total Projects	Total Units	Percent of Units Participating
PG&E	309	26,314	52%
SDG&E	70	6,201	46%
SCE	211	14,173	18%
SCG	397	28,670	12%
All IOUs	733	59,014	38%

Note: The sum of the units displayed in the map is slightly less than the total units in the table: 408 units in climate zone seven, located at the southern, central edge of each of the service territory, are not displayed because the area of climate zone seven was too small to be presented in the map. In addition, due to limitations with GIS mapping, some areas in SCG's service territory are not included within the SCG boundary line in the map above. There were no MFNC projects started from 2010 through 2012 in SCG service territory that fell outside of the mapped SCG boundary line (shown in dotted-shading and labeled as "Outside of SCG Territory").

* The 82 units in climate zone 12 represent only four projects and the 66 units in climate zone 16 represent only one project.

The IOU participating projects (54%) and units (53%) were slightly less likely than non-participating projects (58%) and units (59%) to have been subject to high efficiency requirements as a result of either being a CTCAC awardee and/or located in cities or counties where the local government adopted a reach code (Figure ES-19). While a higher percentage of IOU program units compared to non-participating units were started in reach code communities, a smaller percentage of program units were CTCAC awardees (see sections 5.5.1.6 and 5.5.1.7). This finding appears to contradict some of the interview findings that informed the program and market models which suggested that builders and developers enroll in the IOU programs in order to help meet CTCAC efficiency requirements. This may be related to the limited availability of IOU program incentives, and will be explored in the second phase of this evaluation.

Figure ES-19: High Efficiency Requirements by IOU Program Participation (2010-2012)



Other Voluntary Green Programs

Among the other voluntary programs, the evaluation team analyzed program data from two other programs, LEED for Homes and Build It Green's GreenPoint Rated (GPR) program. From 2002 to 2012, registration of LEED MFNC projects peaked in 2007 and 2008, with 97 and 89 registrations, respectively, and declined during the housing crisis. LEED project registrations have not rebounded during the 2010-12 period, with only 59 total registrations during the three year period. This may be due, in part, to the launching of a new version of the LEED rating system in 2009. According to the Green Building Certification Institute (the organization issuing LEED certifications), it is common for developers to register a "flurry" of projects in anticipation of upcoming LEED rating specification version changes. The decline may also be due to the increasing popularity of the GPR program. GPR MFNC project applications increased steadily over the three-year period, from 19 applications in 2010 to 62 applications in 2012. Similarly, the number of units in MFNC applications nearly tripled from 1,195 units in 2010 to 4,865 units in 2012.

Enrollments of future MFNC projects in green certification programs and Zero Net Energy programs may be increasing according to our survey of builders. Builders who reported future projects plan to apply for Zero Net Energy (ZNE) and green certifications such as LEED, GPR, or ENERGY STAR at higher rates than during 2010-2012.[27] However, it is also important to note that these are self-reported responses about future actions that have not been corroborated, and the reported rates of LEED applications run counter to the trends found in the LEED registration data from 2002 through 2012

Conclusions and Recommendations

We note several key findings and conclusions from this Phase I report.

- **Complex and overlapping programs and policies affecting the energy efficiency of the MFNC market:** There is a complex array of public programs and policies influencing the energy efficiency of the MFNC market. In addition to the IOUs' new construction programs there are local reach codes (encouraged by the IOUs' Codes and Standards Program), efficiency requirements of the CTCAC affordable housing tax credits, LEED for Homes program, GPR by Build it Green, and the U.S. EPA's ENERGY STAR Certified Building program.
    - Statewide, fifty seven percent of MFNC units started from 2010 through 2012 were subject to above-code requirements either because of requirements of low-income funding or their location in a reach code locality.

[27] For example, builders plan to apply for ZNE certification for 16% of their future projects compared to 1% of current projects.

  - Nearly all affordable housing, representing 38% of all units of MFNC, is built to exceed Title 24 standards by 15% because of CTCAC tax credit requirements, and 24% of all units were started in localities with reach codes. There is substantial overlap between the IOUs' program participants and these other programs and policies as 53% of IOU program units that were started from 2010 through 2012 were required to be high efficiency. Because of the complex interactions and in some cases coordination across the programs and policies, attribution of any observed market effects will be difficult.

- **IOU program market penetration:** Nearly two-fifths (38%) of all units started in the IOU territories from 2010 through 2012 participated in the IOUs' MFNC programs and participating projects are larger on average than non-participating projects.
- **A highly concentrated builder market:** The MFNC market is concentrated among a relatively small number of builders. Five percent of builders were responsible for 33% of all units; 20% were responsible for two-thirds of all units started from 2010 through 2012.
- **MFNC construction is clustered in urban areas:** MFNC starts were heavily concentrated in California's major cities and urban areas. Forty-six percent of all starts (by units) were started in five cities (Los Angeles, San Jose, San Francisco, San Diego, and Irvine) and 81% were started in five broader metropolitan statistical areas (MSAs).[28] High-rise MFNC is even more concentrated in urban areas as 66% of all high-rise starts (by units) were started in the same five cities and 98% were started in the same five broader MSAs.
- **Patterns in affordable and market-rate segments:** The affordable MFNC housing market appears to be less volatile than market-rate MFNC. The market-rate segment has been more responsive to the housing recovery, accounting for the bulk of the increase in MFNC activity from 2010 through 2012, suggesting that the low-income market is less affected by housing market cycles.
- **Potential MFNC market trends:** New construction permit data suggests a potential trend toward higher levels of MFNC in the residential new construction (RNC) market. Between 2010 and 2012, multifamily units accounted for 52% of units compared to an average of 28% of permitted units from 1993 to 2008.
  - MFNC is likely to continue to grow in 2014, to over 69,000 permitted units and over 50,000 unit starts.
  - MFNC may be trending toward high-rise projects. High-rise units increased from 37% of units in 2010 to 55% of units in 2012.

[28] The top five cities of Los Angeles, San Jose, San Francisco, San Diego, and Irvine are located in four of the top five MSAs: Los Angeles-Long Beach-Anaheim, San Francisco-Oakland-Hayward, San Diego-Carlsbad and San Jose-Sunnyvale-Santa Clara. The fifth MSA, Riverside-San Bernardino-Ontario, CA, accounts for the smallest amount of MFNC among the top five MSAs and does not include any of the top five cities.

- **Energy efficiency decision makers and factors:** Developers are the key decision makers while architects, Title 24 consultants, HERS raters and others have limited influence on decisions pertaining to the energy efficiency of a MFNC project.
    - Development and efficiency decisions are driven primarily by economic and financial considerations.
    - Energy efficiency does not appear to be a consumer priority.
    - Affordable housing developers and some higher-end developers who market for sustainably designed features are in the forefront of designing (and building) projects incorporating advanced energy-efficiency techniques

Several recommendations for future research and IOU program design emerge from the findings of this study.

- Begin tracking the short-term and medium term outcomes that rely on market-actor self-reports on an ongoing basis. We recommend conducting interviews or surveys during the construction process or as soon after completion as possible in order to assess the influence of the program and other factors on key decision-making in regard to the energy efficiency of the project.
- Conduct follow-up on-site visits and an assessment of building conditions in a few years, perhaps in 2017, on projects started in 2015 and 2016. This would capture MFNC projects designed and built several years after the 2010-2012 program cycle, which should provide enough time to begin to detect early market effects, while also allowing enough time to provide feedback to program staff in order to modify the program if the market is not on target to reach ZNE by 2020.
- The IOUs' programs should attempt to target the largest builders since the market is highly concentrated among a small number of builders, particularly for market-rate projects. By working with the largest builders, the program may realize market effects by influencing the efficiency practices in non-program projects built by the same builders as well as MFNC projects of other builders who may look to emulate the practices of the largest builders.
- The IOUs' programs should coordinate with voluntary programs such as CTCAC, LEED, GPR and ENERGY STAR to provide consistent efficiency standards and to leverage the brand recognition and brand equity of other voluntary programs.
- Benchmark the performance of IOU program participants. Benchmarking could help make the case for efficiency to financial institutions and secondary investor markets, increasing access to capital for high-efficiency projects, as well as to consumers who often cannot compare utility costs between units and builders who may be skeptical of building performance.

1 Introduction

This document presents the Phase I findings of a prospective market effects and market characterization study focused on the California Investor Owned Utilities' (IOUs') New Construction Programs that target the multifamily market. As identified in key literature on the topic—including Sebold et al., [29] Prahl and Keating, [30] Keating, [31] and Rosenberg and Hoefgen[32]—successful market transformation programs often include several key practices:

1. Identifying target markets
2. Characterizing the market
3. Identifying the baseline against which market effects can be compared
4. Developing a market model
5. Developing a program theory and logic model
6. Developing a market transformation story
7. Establishing interim and long-term indicators of market effects
8. Planning for exit or transition from the market
9. Continuing to measure and monitor key indicators after transformation

This document discusses a clearly identified target market (practice 1)—multifamily new construction in California—and focuses on the IOUs' perspectives regarding items two through seven of the above practices. This document is a characterization of the market and program theory and logic based on interviews with IOU program staff and industry experts, a review of the IOUs' program materials, additional research on the multifamily new construction market in California, our analysis of secondary data on multifamily new construction (MFNC) starts and permits in California, a survey of builders and developers, and a review of the MFNC evaluation literature. The evaluation team expects to update and revise the market and program logic models based on further market characterization research through case studies to be conducted in 2014.

Interviews and research focused on determining how efficiency decisions are made in the multifamily new construction market, identifying drivers and barriers to efficient construction

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[29] Sebold, F. D., Fields, A., Skumatz, L., Feldman, S., Goldberg, M., Keating, K. and J. Peters. 2001. "A Framework for Planning and Assessing Publicly Funded Energy Efficiency." Study PG&E-SW040. Accessed July 9, 2013 from http://library.cee1.org/sites/default/files/library/1235/412.pdf.

[30] Prahl, R., & K. Keating. 2011. "Planning and Evaluating Market Transformation: What the Industry has Learned, and Possible Implications for California." Market Transformation Workshop, Consultant Whitepaper Draft, October 17.

[31] Keating, K. 2013. "Guidance on Designing and Implementing Energy Efficiency Market Transformation Initiatives." Draft, March 18.

[32] Rosenberg, M. and L. Hoefgen. 2009. "Market Effects and Market Transformation: Their Role in Energy Efficiency Program Design and Evaluation." California Institute for Energy and Environment. Accessed July 10, 2013 from http://www.calmac.org/publications/Market_Effects_and_Market_Transformation_White_Paper.pdf.

and IOU program participation, understanding how the IOU programs interact with and are designed to affect the market, and identifying potential indicators that could be tracked to demonstrate progress toward market effects outcomes.

The California multifamily new construction market model is presented in Section 3, while the program model is presented in Section 4. The program model includes a summary of barriers and drivers of energy-efficient multifamily new construction in California, program components and strategies designed to help overcome the barriers, and analysis of the program and market models that link program elements to potential indicators of market effects.

Section 5 presents findings from our analysis of secondary data on multifamily new construction (MFNC) starts and permits. We reviewed three types of secondary data: (1) project-level new construction starts data, (2) city-level permit data, and (3) "green" project new construction data (including IOU program data). We also conducted a survey with builders and developers to corroborate new construction starts data and lend additional insight into the market.

2 Methodology: In-Depth Interview Sampling Approach

The evaluation team conducted seven telephone interviews with staff members or third-party program implementers at the four California IOUs (PG&E, SDG&E, SCE, and SCG) representing the Residential New Construction (RNC) or Savings By Design (SBD) programs. Most of these seven interviews were conducted with multiple program representatives at once to obtain multiple perspectives; the evaluation team spoke with fifteen individuals in the course of these seven interviews, ten of whom represented the residential programs, while the remaining five represented the Savings by Design program. In addition, the evaluation team conducted nine interviews with experts in the California multifamily new construction industry (two of which included two respondents participating collaboratively, for a total of eleven individual respondents). These nine interviews included four interviews with developers of market-rate and affordable housing, one with a California Tax Credit Allocation Committee (CTCAC) representative, and four with a mix of Title 24, construction industry, and policy consultants. In addition, the evaluation team also conducted a brief interview with a representative from one of the "green" building programs in California to provide additional information on their program.

Our sample of industry experts was a hybrid of quota and purposive sampling, targeting specific respondent-types based on their knowledge of the multifamily new construction market in California, ensuring that respondents were chosen from diverse geographic regions in California, so that respondents could provide opinions based on their experience throughout the state. In some cases, "snowball sampling" was employed, in which identified market experts told evaluators about other individuals that were experts in this field that could illuminate the research.

3 The Residential Multifamily New Construction Market in California

3.1 Market Theory and Logic

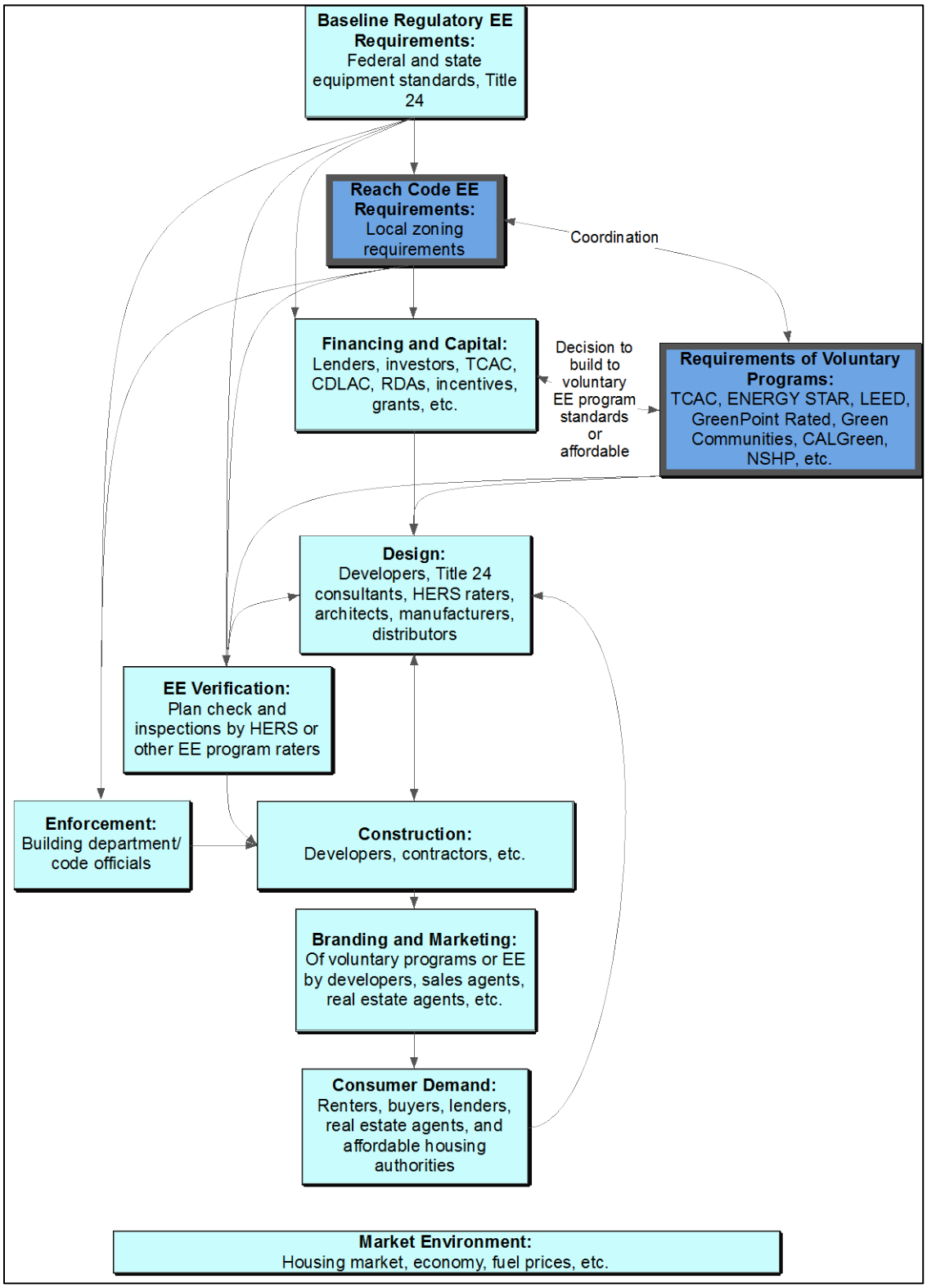
Figure 3-1 below depicts the multifamily new construction market in California, focusing on the key players in the market that have an effect on energy efficiency based on the perspectives of utility program staff and industry experts, including developers and builders[33] of market-rate and affordable housing, California Tax Credit Allocation Committee (CTCAC) representatives, Title 24 consultants, and construction industry consultants and policy advisors.

This model shows the components of the entire multifamily market, including lower-end construction, high-efficiency construction, and also market-rate and affordable housing construction; developer teams may build to different efficiency levels depending on the choices made and options available to them at each step in the design and construction process. Operating in a context of external market forces, the base efficiency levels in the market are governed by mandatory building requirements, from which point developers can choose to follow certain voluntary criteria that trigger changes in their construction practices. For each identified component of the multifamily market, key aspects or market actors are identified; items in bold are more important to the market than non-bolded items. Some of the market actors discussed in the multifamily market model include developers, building inspectors, contractors, HERS raters, Title 24 consultants, manufacturers, distributors, lenders, investors, government agencies, and utility programs. Each of these groups has a different role to play in the multifamily market.

The market model also includes two dark blue boxes to identify two key factors outside of the IOUs' programs which influence the energy efficiency of the MFNC market. The "reach code requirements" box is meant to highlight localities that have adopted reach codes, which are efficiency standards that exceed Title 24 (commonly set at 15% above Title 24). The "requirements of voluntary programs" box is meant to highlight the role of the California Tax Credit Allocation Committee (CTCAC), which requires recipients of affordable housing tax credits to exceed Title 24 standards by at least 15%, as well as other prominent voluntary programs that CTCAC accepts as verification of meeting their efficiency requirements, such as Leadership in Energy and Environmental Design (LEED) for Homes program, GreenPoint Rated (GPR) by Build it Green, and the U.S. EPA's ENERGY STAR Certified Building program.

[33] Recognizing that developers and builders can be distinct entities, this report refers to them interchangeably, in keeping with how they were described by interviewees, where in most cases, but not all, the developer and builder are the same person or work for the same firm. This may vary depending on the size and structure of a company. The IOUs group builders and developers together insofar as either can obtain builder incentives through the IOUs' multifamily new construction program.

Figure 3-1: Energy Efficiency in the California Residential Multifamily New Construction Market



3.1.1 External Market Environment

A number of external market forces set the context for the direction of the multifamily construction market in California. Many of these factors influence the demand for multifamily housing, whether energy-efficient or not. These factors can range from very specifically local concerns about the desirability of multifamily housing in particular neighborhoods to international economic forces such as energy prices and their effect on utility bills and gasoline prices. Market actors noted that public concern about environmental degradation and climate change seems to be increasing in California, which may in turn increase demand for efficient or multifamily housing. However, some of them expressed uncertainty about the extent to which this may be a factor in the short-term rental market or the affordable housing market, where potential occupants are reported to be more concerned with the availability of affordable housing than with the efficiency of that housing.

Though the housing market downturn that was felt nationwide has started to rebound, California was not immune to it; multifamily construction decreased along with single-family construction, though affordable housing construction did not decline as precipitously as did market-rate construction. Changes in the housing market can also affect builder plans and designs and how builders compete for market share. Some experts also noted that the increase in popularity of solar panels being installed on homes has an effect on consumers' demand for efficient housing; photovoltaic panels serve as a strong visual reminder to the consumer about environmental and energy issues, thus affecting builder plans and designs.

3.1.2 Regulatory Energy-Efficiency Requirements

Various government requirements establish the minimum efficiency levels for all multifamily new construction in California. At the federal, state, and local levels, government bodies set legal and regulatory restrictions on the new construction industry, including the efficiency of buildings and the mechanical equipment that builders may install. These minimum standards set the efficiency floor for the new construction industry: to comply with code, all construction must meet these minimum standards, but developers can choose to move beyond them and build to voluntary, higher efficiency standards.

3.1.2.1 Federal and State Equipment Standards

Energy-efficiency building codes are adopted at the state and local levels, not the federal level. The U.S. Department of Energy does, however, set minimum energy-efficiency standards for certain categories of appliances and mechanical equipment, including some residential heating, cooling, and water heating equipment, such as natural gas-fired boilers and furnaces as well as air conditioners. States are legally preempted from adopting minimum equipment efficiency standards that are higher than those set by the federal government. Neither California nor any

other state has ever been granted a preemption waiver to do so.[34] The California Energy Commission (CEC) does, however, promulgate its own energy-efficiency regulations for other appliance and equipment types that are not regulated by the federal government. This occurs under Title 20 of the California Code of Regulations, section 1605.3.[35] The CEC also requires certification that appliances and mechanical equipment meet either federal or state efficiency standards in order to be sold in California. One market actor reported that this testing and approval could take years, thereby creating supply bottlenecks in California for advanced mechanical equipment technologies, even if that equipment was already in use elsewhere in the world or even the U.S. In California, builders only have access to appliances and mechanical equipment that meet or exceed these federal and state standards.

3.1.2.2 California Building Code – Title 24

Title 24 of the California Code of Regulations ("Title 24") is the energy-efficiency portion of the state building code and governs all new construction in California.[36] The 2008 version of Title 24 is still in effect as of the writing of this report; it was implemented on January 1, 2010, and will be replaced by the updated 2013 standards on July 1, 2014.[37] Because the focus of this report is the 2010-2012 period, the following discussion focuses on the 2008 Title 24 requirements that were in place at that time. Title 24 governs residential and nonresidential construction. Low-rise multifamily buildings follow the residential portion of the code. Other than a few exceptions, such as lighting and water-heating requirements,[38] high-rise multifamily buildings (four or more above-grade habitable stories) follow the nonresidential code sections.[39]

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[34] This was confirmed via research and with a discussion with a CEC representative who reported that California has never been granted such a waiver. A group paper from Energy Solutions, McHugh Energy Consultants, and PG&E for the ACEEE 2012 Summer Study, entitled, "Federal Appliance Standards Should Be the Floor, Not the Ceiling: Strategies for Innovative State Codes & Standards," provides more detail on the development of state appliance standards in response to federal standards. Available at: http://www.aceee.org/files/proceedings/2012/data/papers/0193-000415.pdf

[35] This includes some types of freezers, wine chillers, vending machines, ground source heat pumps, certain types of water heaters and heating systems, and so forth. 2010 regulations available at: http://www.energy.ca.gov/2012publications/CEC-400-2012-019/CEC-400-2012-019-CMF.pdf, and the 2012 version: http://www.energy.ca.gov/2010publications/CEC-400-2010-012/CEC-400-2010-012.PDF.

[36] Full Title 24 regulations are available here: http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF.
In addition, the residential and nonresidential compliance manuals provide valuable insight into Title 24 regulations. The residential compliance manual is available here: http://www.energy.ca.gov/title24/2008standards/residential_manual.html, and here for nonresidential: http://www.energy.ca.gov/title24/2008standards/nonresidential_manual.html.

[37] Information on the 2013 standards is available here: http://www.energy.ca.gov/title24/2013standards/index.html

[38] From the residential compliance manual: http://www.energy.ca.gov/2008publications/CEC-400-2008-016/rev1_chapters/RCM_Chapter_1_Intro.pdf. Page 1-7.

[39] From the nonresidential compliance manual: http://www.energy.ca.gov/2008publications/CEC-400-2008-017/rev1_chapters/NRCM_Chapter_1_Introduction.pdf

Title 24 sets ambitious energy-efficiency standards for new construction in California. The low-rise efficiency requirements exceed the 2009 standards of the International Energy Conservation Code (IECC 2009), and the high-rise requirements exceed ASHRAE/IESNA 90.1-2007 for commercial buildings.[40] Due to the complexity of Title 24, developers often hire Title 24 energy consultants to fill out compliance documentation and ensure that building designs and construction comply with Title 24. These consultants may be professionally licensed Certified Energy Plans Examiners (CEPEs),[41] but Title 24 does not require this certification. (This is discussed in more detail in section 3.1.6.1.2 below).[42]

Multiple interviewed market actors reported that meeting Title 24 is increasingly difficult, as it is more stringent than many other states' efficiency codes, and the efficiency standards are ratcheted up every three years. One market-rate developer reported a perception among other market-rate builders that "Title 24 today makes you 30% more efficient than any other state, so all California builders believe they are building efficient because the law mandates it. . . . Nobody believes that efficiency has to be a priority, because efficiency is mandated."

Low-rise buildings can comply with Title 24 on a unit-by-unit basis, with each unit considered separately, or on a whole-building basis, with the entire building treated as one unit.[43] High-rise buildings can comply via the whole-building method.[44] Title 24 also bases energy consumption and savings on a Time Dependent Valuation (TDV) approach, which takes into account not only how much energy is used in a building, but also when it is used, so that a building can be credited for saving energy during high demand periods (on a daily or seasonal basis, depending on the measure being discussed).

3.1.2.2.1 Title 24 Compliance Paths: Prescriptive or Performance

For both low-rise and high-rise multifamily construction, compliance with Title 24 can be attained via prescriptive or performance paths, though there are mandatory minimum standards for certain building components that must be met in all cases.[45] For multifamily buildings, the performance path is by far the most commonly used compliance approach; one market actor

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[40] ACEEE description of California Title 24 standards: http://aceee.org/energy-efficiency-sector/state-policy/California/1575/all/193.

[41] Information on the CEPE certification is available at: http://www.cabec.org/cepeinformation.php.

[42] The IOU programs have stricter Title 24 energy consultant requirements than Title 24 does, discussed in more detail at 4.2.1.6.

[43] From the residential compliance manual: http://www.energy.ca.gov/2008publications/CEC-400-2008-016/rev1_chapters/RCM_Chapter_7_Performance.pdf. Page 7-8.

[44] If a high rise building is constructed in phases and different permits are issued for each phase of construction (envelope or electrical or mechanical, for example), the building may comply based on a review of each component being installed under each permit.

[45] See form MF-1R appended to the 2008 Title 24 residential compliance manual for a list of the mandatory low-rise minimum features based on 2008 standards.

estimated that 100% of multifamily construction complies with Title 24 via the performance path.[46]

The Prescriptive Package Approach. This is the simplest means of complying with Title 24, but it provides the least flexibility for builders. The prescriptive requirements include minimum thresholds for a variety of building components, including insulation levels, glazing areas and U-factors, duct sealing and insulation, and in some cases mechanical equipment efficiencies and roof reflectance. Builders must simply meet these requirements for each building component (and pass any other mandatory third-party HERS verifications, such as measuring duct leakage) for the building to comply with the selected prescriptive package. These stringent prescriptive package requirements are tailored to each of California's 16 different climate zones. In the 2008 Title 24 standards (in effect during the 2010-2012 CAHP program cycle), there were three prescriptive package options for low-rise multifamily buildings (high-rise buildings do not have package options):[47] Package C governed homes with electric resistance space heating, Package D was the standard package for typical homes, and Package E was similar to Package D, but allowed for some trade-offs to compensate for the higher U-values of metal-framed windows.[48] The 2013 standards that will take effect in 2014 have removed these package options, leaving only one prescriptive package with requirements that vary depending on the climate zone.[49]

The Performance Approach. This is more complicated than the prescriptive path because it requires the use of computer modeling software to determine compliance, but it gives builders more flexibility in meeting the Title 24 efficiency standards. The CEC approves the different software programs that builders (or, typically, their Title 24 energy consultants) can use for measuring performance approach compliance.[50] Through the performance approach, builders can make design trade-offs between any modeled building components, as long as the calculated TDV energy consumption of the building is no more than that of a reference home built to prescriptive requirements, and as long as the builder meets any mandatory minimum efficiency levels as defined in Title 24. For example, even if a builder could theoretically reach the targeted energy budget of a building with R-13 insulation in the ceiling, the builder would

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[46] The CEC reports that about 95% of all residential buildings (single- and multifamily) comply via the performance path. From the residential compliance manual: http://www.energy.ca.gov/2008publications/CEC-400-2008-016/rev1_chapters/RCM_Chapter_7_Performance.pdf

[47] See 1.6.2 of the 2008 Nonresidential Compliance Manual for further description of the prescriptive compliance approach for high-rise multifamily buildings.

[48] From the residential compliance manual: http://www.energy.ca.gov/2008publications/CEC-400-2008-016/rev1_chapters/RCM_Chapter_1_Intro.pdf

[49] Full 2013 Residential Compliance Manual available here: http://www.energy.ca.gov/2013publications/CEC-400-2013-001/CEC-400-2013-001-SD.pdf, and discussion of elimination of prescriptive packages available here: http://www.aamanet.org/news/1/10/0/all/766/california-poised-to-issue-2013-title-24-building-efficiency-standards.

[50] Approved compliance software list: http://www.energy.ca.gov/title24/2008standards/2008_computer_prog_list.html

still have had to install R-19 insulation, because that was a mandatory minimum feature in the 2008 standards.[51]

3.1.2.2.2 Title 24 Home Energy Rating System (HERS) Requirements

Title 24 requires that HERS raters verify the correct installation of certain building measures. HERS raters provide third-party verification of measure installation, thus improving code compliance and, in theory, guiding builders and contractors to improve their practices. These HERS verification requirements come into play most frequently with low-rise, rather than high-rise, multifamily buildings, and apply to both prescriptive and performance compliance paths.[52] For low-rise buildings, there are several HERS verification requirements, such as confirming that ducts are sealed, performing diagnostic tests of duct leakage, and checking proper refrigerant charge on AC systems. Title 24 requires HERS verification in high-rise buildings only for duct leakage, and only in specific circumstances (relatively small, air distribution HVAC systems with more than 25% of ducts located in unconditioned space).[53] In some cases, builders can use HERS rater verifications of building components, such as the Quality of Insulation Installation Title 24 option, to gain performance path compliance credit for the confirmation of insulation being installed according to manufacturer specifications.[54] New for the 2008 standards, HERS raters must also register with their HERS provider the compliance documents for each unit they inspect in low-rise and high-rise buildings.[55]

3.1.2.2.3 Title 24 – CALGreen Green Building Standards

Part 11 of Title 24, referred to as CALGreen, includes green building standards for multifamily buildings that became mandatory in January of 2011.[56] Much like other voluntary programs like LEED, the mandatory CALGreen measures are "green" or sustainability focused, addressing such areas as minimizing building construction waste and water use and using low-VOC

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[51] See form MF-1R appended to the 2008 Title 24 residential compliance manual for other mandatory measures.

[52] See section 2.2.7 of the Title 24 2008 Residential Compliance Manual and 4.4.2 in the 2008 Nonresidential Compliance Manual.

[53] See Table RA2-1 in the 2008 Title 24 Reference Appendices for a complete list of all measures in low-rise buildings requiring HERS verification, available here: http://www.energy.ca.gov/2008publications/CEC-400-2008-004/CEC-400-2008-004-CMF.PDF. See section 2.2.7 of the 2008 Nonresidential Compliance Manual for the specific duct testing circumstances for high-rise multifamily buildings.

[54] Compliance forms for QII: http://www.energy.ca.gov/2008publications/CEC-400-2008-016/rev1_appendices/appendix_A_files/Installation_Certificate_CF-6R-ENV-HERS/2008_CF-6R-ENV-22-HERS-QII-InsulationStageChecklist.pdf

[55] See section 2.1 ("Compliance Document Registration") of the 2008 Title 24 Residential Compliance Manual, and the 2008 Title 24 Reference Appendices for more detail.

[56] ICF International memo from 2010 to the Sacramento Green Building Task Force describing the components of CALGreen, available at: http://www.sacgp.org/documents/GBTF_8-17-10_NewDev_ICF-CalGreen-Tier-Comparison.pdf.

materials.[57] CALGreen standards include optional energy-efficiency tiers that buildings can target (Tier I is a 15% savings over Title 24 and Tier II is a 30% savings) or that municipalities can mandate. Initially, the CALGreen standards excluded high-rise residential buildings, but the revised 2013 CALGreen standards that take effect in 2014 will include standards for high-rise multifamily buildings.[58]

3.1.3 Local Requirements (Reach Code, Zoning, Redevelopment Agencies, etc.)

Reach Code. Subject to CEC approval, municipalities in California may enforce efficiency standards that exceed Title 24, commonly referred to as "reach code" communities. Such communities make up a large number of the municipalities in California, and any developer working in these areas is required to meet these local energy efficiency requirements. For example, municipalities are free to adopt Tier I or Tier II CALGreen standards as a part of their local building code, requiring above-code practices.[59] As of November 2013, 40 cities and towns and 5 counties in California have an energy code that exceeds Title 24 standards.[60] San Francisco County, for example, requires all new construction, including low-rise and high-rise multifamily buildings, to exceed Title 24 by 15%.[61] Achieving a 15% threshold above Title 24 is a common goal of these local "reach codes"; this requirement aligns reach codes with a number of other efficiency efforts that have the same 15% threshold, such as the IOUs' incentive programs and efficiency requirements for affordable housing tax credits through CTCAC (see section 3.1.4.2 below for more details about affordable housing tax credits).

The IOUs have played a key role in the adoption of these reach codes. The IOUs' Codes and Standards Program includes a Reach Code Subprogram element that provided both policy guidance and technical support to local municipalities regarding the adoption and implementation of reach code. An important aspect of this assistance came in the form of performing climate-specific studies on the cost-effectiveness of implementing reach code, which municipalities could use in their applications to the CEC.[62]

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[57] In 2010, the Green Building Codes Educational Collaborative (sponsored by Build it Green, the U.S. Green Building Council Northern California Chapter, etc.) put forth guidance comparing CALGreen to other voluntary programs (LEED and GreenPoint Rated) here: http://www.usgbc-ncc.org/index.php?option=com_content&view=article&id=401&Itemid=90.

[58] More details on these updates available here: http://www.documents.dgs.ca.gov/bsc/documents/2013/2013-Green-Residential-Mandatory.pdf.

[59] Discussion available in previously referenced ICF 2010 memo to Sacramento Green Building Task Force.

[60] CEC listing of municipalities with above Title 24 energy codes in place: http://www.energy.ca.gov/title24/2008standards/ordinances/.

[61] An example of a letter indicating a municipality's intention to increase its energy efficiency standards beyond Title 24: http://www.energy.ca.gov/title24/2008standards/ordinances/sanfrancisco/2010-12-29_San_Francisco_Letter_to_CEC.pdf.

[62] For more information on the IOUs' efforts to foster the adoption of reach code in California, see the Cadmus Group evaluation of the 2010-2012 Reach Code Subprogram within the Codes and Standards Program. The

Zoning and Redevelopment Agencies. Local officials and agencies involved in zoning and planning efforts can also affect the energy efficiency of new multifamily building construction, but do not appear to play a particularly influential role, especially after the dissolution of California's Redevelopment Agencies (RDAs). One former green building rater provided a detailed explanation of the way that local officials may have some sway over building efficiency.[63] This expert noted that in the entitlement process, some developers may request minor zoning variances, and local officials or planners sometimes suggest the inclusion of energy-efficient measures in a project as a condition of granting the variance. Local housing authorities are involved in the construction of affordable housing, and local planners may influence the zoning process. California's Redevelopment Agencies—before their disbanding in 2012—also worked to require energy-efficient construction as a part of community redevelopment efforts. This is discussed in more detail in section 3.1.4.4 below. In interviews, several market actors identified these local RDAs as former key players in determining the location and type of affordable multifamily housing that was built in California, but noted that municipalities' ability to influence the new construction market has greatly decreased with the dissolution of the RDAs. RDAs often favored transit-oriented construction and could solicit and encourage developers to build multifamily projects that they thought would improve communities.

Cadmus Group, Inc., *Reach Code Subprogram 2010-2012 Process and Pilot Impact Evaluations*, prepared for the California Public Utilities Commission, October 2013. https://www.pge.com/regulation/EnergyEfficiency2015-BeyondRollingPortfolios/Other-Docs/ED/2014/EnergyEfficiency2015-BeyondRollingPortfolios_Other-Doc_ED_20140507_304180Atch01_304181.pdf.

[63] This was an unofficial phone discussion with a former energy rater who works for a green building organization, not one of the interviewed market experts.

3.1.4 Financing and Capital

Financial and economic considerations are at the heart of the multifamily new construction market for both market-rate and affordable housing. Developers are subject to numerous financial necessities, such as the need to pay for their construction projects, attract investors, achieve a return on investment, or manage operating expenses. The interviewed market actors often pointed to developers as key decision makers in the multifamily housing market, but they repeatedly emphasized that financial considerations underpin how developers decide what and where to build and whether to sell or hold properties. Title 24 consultants can be important to the extent that they help developers understand the cost and payback of various energy-efficiency measures and construction practices, but ultimately the developer is the critical decision maker operating within the consultants' financial constraints.

Market-rate developers can choose to build more efficiently than Title 24 requires, depending on financial considerations such as lender requirements, customer demand, or the desire to obtain incentive payments from utilities. One market-rate developer summarized his motivations for deciding how to build as follows: "It's all about money. It's all about payback period. If I can put something on a building that I'm going to keep for ten years and recover the cost in five, it's attractive—it's an investment; it's not a cost. And that's what these people are trying to do is figure out: is there a real cost to this or is it an investment that will pay returns and dividends in the future?"

Almost all affordable housing, however, is regulated by the California Tax Credit Allocation Committee (CTCAC) in that it must be at least 15% more efficient than Title 24 code to be eligible for CTCAC tax credits. CTCAC administers federal and state tax credits that are designed to encourage private investors to support affordable housing.

Market-rate and affordable housing developers may pursue different funding sources for their projects and be subject to different market and regulatory forces (CTCAC regulations being an important determinant in how affordable multifamily housing is built), but the concerns about obtaining necessary funding and meeting budgetary or return-on-investment considerations are similar.

The following are some of the key financial actors and considerations that can affect the efficiency levels of multifamily new construction, as identified by interviews with market actors.

3.1.4.1 Lenders and Investors

To obtain financing for projects, builders must produce project concepts and plans that appear to be financially viable to lenders or investors; builders or developers may have to piece together funding from multiple such partners to finance a project. The interviewed market actors indicated that lenders are concerned with consumer demand, but the interviewees were not absolutely confident that homeowners and renters are consistently demanding energy efficiency, indicating that the extent to which lenders and investors place a value on energy efficiency

varies. In some cases, specific lenders or investors in the market-rate side of the multifamily market may impose efficiency requirements on their projects, thereby forcing a developer to build accordingly. Large institutional investors, including out-of-state investors, can have substantial influence on the market, particularly among large developers. One market actor interviewed noted that the investor and lender market is particularly influential, as evidenced by the fact that new condo construction decreased during the housing crash of 2009, when lenders tightened restrictions for developers and individual homeowners, particularly for condo buildings.

Although affordable housing developers must also woo lenders and investors, the federal Community Reinvestment Act (CRA) requires banks to invest in the communities where they take deposits, creating a large investor pool. Bank of America and Wells Fargo were both cited by market actors as important affordable housing investors. One respondent noted, "Banks are hugely important because CRA credits are hugely determinative of where affordable housing happens."

In affordable housing, developers and building owners are restricted on the rents they can charge, but they can charge higher rents if they can offset the rent increase with lowered utility bills through use of the CEC's California Utility Allowance Calculator (CUAC).[64] The CUAC is a software program that allows developers (in consultation with qualified energy professionals) to calculate monthly utility costs for affordable housing, which can then be used to justify increases in rents; this can make a project attractive to investors. However, respondents report that this tool is rarely used, even by large developers involved in the affordable housing market.[65]

An affordable housing developer indicated that lenders do not always feel comfortable offering developers larger loans on the grounds that they will be able to charge higher rents due to improved energy performance; lender skepticism or lack of awareness of the performance of energy-efficiency measures in new construction was cited as a barrier to obtaining financing for these measures. (Other barriers to energy-efficient construction are described in section 3.1.10 below.)

Operational benchmarking of large buildings—such as through the ENERGY STAR Portfolio Manager benchmarking software tool, which allows building owners or tenants to compare the tracked energy use of their buildings with comparable facilities—could potentially aid in providing lenders and investors with the performance data to justify such energy-efficiency

[64] Detail on the CUAC available here: http://www.energy.ca.gov/renewables/06-NSHP-1/affordablehousing/CUAC_User_Guide.pdf

[65] Related Companies is an example of one such developer. There are several other such large developers active across California, and works in the affordable and market-rate sectors: http://www.relatedcalifornia.com/OurCompany/.

investments. However, most of the current benchmarking programs seem to be targeted at the commercial building market.[66]

In addition, there is a growing number of innovative financing mechanisms designed to overcome the split incentive regarding energy-efficiency investments between building owners and tenants. An ACEEE study from 2013 describes some of these financing mechanisms designed to overcome split incentive barriers, most of which increase a building owner's ability to obtain financing for energy-efficiency measures through the secondary investor market. The authors note that most of these are typically targeted at retrofit markets, though the authors argue that innovative funding mechanisms such as PACE loans (loans repaid through building property taxes) or on-bill repayment plans may potentially gain popularity in the multifamily market, particularly if accompanied by a growing use of benchmarking data.[67]

One market actor reported that, while lenders are important, the increasingly stringent Title 24 and CTCAC requirements are most influential in driving energy-efficient multifamily housing: "The banks will support efficiency, but the banks and investors are not pushing energy. It's being pushed first by California's code, but then secondly [by] what is being done in addition to code, as pushed by CTCAC."

3.1.4.2 CTCAC: Affordable Housing Tax Credits

The California Tax Credit Allocation Committee (CTCAC) administers federal and state tax credits for the construction of affordable rental housing, most of which is multifamily buildings.[68] These tax credits are tremendously important in the market and fuel both for-profit and nonprofit development in the affordable housing market. Developers raise project equity by selling tax benefits to investors, who can claim dollar-for-dollar reductions in their tax liabilities.[69]

There are two levels of federal tax credits: 9% and 4%. These are approximately the percentages of a project's income-restricted value that investors may annually deduct from their federal taxes. The 4% credits are available for multifamily buildings that are at least 15% more efficient than Title 24. The 9% credits are awarded through competitive scoring; out of 148 possible

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[66] NMR Group, Inc. and Optimal Energy, Inc. *Statewide Benchmarking Process Evaluation Volume 1: Report*, April 2012, submitted to the CPUC, Study ID: CPU0055.01, available at: http://www.calmac.org/publications/Statewide_Benchmarking_Process_Evaluation_Report_CPU0055.pdf, last accessed Nov. 6, 2013.

[67] Bell, Casey, Stephanie Sienkowski, and Sameer Kwatra, "Financing for Multi-Tenant Building Efficiency: Why This Market Is Underserved and What Can Be Done to Reach it," August 2013, ACEEE. Research Report E13E, available at: http://www.aceee.org/research-report/e13e, last accessed Nov. 5, 2013.

[68] A description of this program is available here, http://www.treasurer.ca.gov/ctcac/program.pdf. The full regulations are here: http://www.treasurer.ca.gov/ctcac/programreg/20130515/clean.pdf.

[69] Investors benefit through a reduction in their tax liability for ten years through the federal program (four years for the state program), but the units must remain income-restricted for at least 30 years under federal law; 9% buildings must remain low-income for 55 years under California law.

points for a given development project, a possible 10 are related to green building practices, including energy efficiency. Market actors indicated that attaining the full 10 points for sustainability was critical to winning the highly competitive 9% tax credits. The 9% credits require a project to attain GreenPoint Rated,[70] LEED,[71] or Enterprise Green Communities[72] certification. One expert reported that successful 9% applicants must go beyond the minimum thresholds and build to higher efficiency tiers, such as the LEED Gold, to secure the 9% credits. CTCAC also administers state tax credits which supplement the 9% and 4% federal credits.

Affordable housing developers must build at least to the level of the IOUs' incentive programs to meet CTCAC requirements, which are discussed in section 3.1.5.1 below. This makes IOU incentive dollars a common component of the financing packages that affordable housing developers use to fund their projects.

3.1.4.3 CDLAC: Affordable Housing Tax-exempt Bonds

Similar to CTCAC, the California Debt Limit Allocation Committee (CDLAC) authorizes state and local governments to issue tax-exempt bonds that encourage developers to construct new multifamily buildings, including energy-efficient affordable housing. Market actors report that CDLAC and CTCAC together promote energy-efficient construction by making energy efficiency a requirement for any multifamily projects for which developers seek CTCAC or CDLAC benefits.[73]

3.1.4.4 Redevelopment Agencies

On February 1, 2012, California disbanded its over 400 Redevelopment Agencies (RDAs), previously discussed in section 3.1.3 above. These local agencies were able to capture a percentage of local property taxes and spend it on redevelopment projects in their municipalities, including affordable multifamily construction. Market actors reported that the RDAs and their funding were key players in determining the types of construction at the local level, particularly encouraging transit-oriented and affordable housing developments—but their influence was eliminated when they were disbanded. One market actor summarized a view shared by some of the interviewed actors from the affordable housing sector: "The state took all that money at the beginning of 2012 to balance the state budget, and while there may be a little bit left or some federal money, the cities' power is greatly diminished in the short run now, but in 2010 to 2012 the cities were still big gatekeepers."

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[70] http://www.builditgreen.org/greenpoint-rated-new-home/

[71] http://www.usgbc.org/leed

[72] http://www.enterprisecommunity.com/solutions-and-innovation/enterprise-green-communities/criteria

[73] More detail on CLDAC is available here: http://www.treasurer.ca.gov/cdlac/current.asp.

3.1.4.5 Incentives and Grants for Efficiency and Renewables

Incentives and grants are also options for developers looking to piece together funding for their projects. These are commonly tied to energy performance that is substantially better than Title 24—as are the IOU incentive programs (at least 15% better than Title 24), discussed in more detail in section 4.2.1.2 below; or the New Solar Homes Partnership (NSHP), discussed in section 3.1.5.7 below.[74] Funding in the form of grants through the federal HUD program for affordable housing may also be available for some energy-efficient affordable housing construction. Some interviewed market actors also reported that the U.S. Department of Agriculture's Multi-Family Housing Energy Efficiency Initiative promotes the construction of affordable multifamily housing in rural areas for the Rural Housing Service, and that its grant and loan guarantee programs favor developments that achieve higher efficiency standards, like zero net energy, ENERGY STAR Certified Buildings, LEED, or Enterprise Green Communities.[75]

3.1.5 Requirements of Voluntary Programs

In addition to the IOUs' new construction programs, there are several key programs establishing voluntary energy-efficiency criteria above Title 24 minimums. Builders may participate in these voluntary programs because there are financial or economic benefits to doing so, including direct incentive payments to builders, favorable tax credits that builders can use to attract investors, or increasing a building's attractiveness to potential occupants through branding. Many of these voluntary programs require buildings to save at least 15% more energy than Title 24 standards, enabling cross-participation in multiple such programs.

3.1.5.1 CTCAC Efficiency Standards for Affordable Housing

Developers may choose to pursue the affordable side of the market for a variety of reasons, including the attractive tax credits administered by CTCAC (discussed in 3.1.4.2 above). To qualify for these tax credits, developers must meet CTCAC's efficiency criteria for new construction. Fifteen percent savings beyond Title 24 is the minimum to obtain the 4% tax credits, and the competitive 9% tax credits are awarded to buildings that go substantially beyond this efficiency threshold. CTCAC also requires, as do the IUO programs, that Title 24 compliance documentation be completed by licensed Certified Energy Plans Examiners (CEPEs), whereas Title 24 does not have any such requirement.[76]

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[74] The national ENERGY STAR program through the EPA does not provide direct incentives for program participation, but some of the IOUs do provide bonus incentives through the CAHP for participation in the ENERGY STAR program, discussed in more detail in section 4.2.1.2.

[75] Overview available here: http://www.rurdev.usda.gov/program_details.html, with examples of rural development projects here: http://www.rurdev.usda.gov/Publications/CA-OverviewMFH.pdf.

[76] CTCAC provides the Sustainable Building Method and Energy Efficiency Requirements Workbook to assist affordable housing developers understand the CTCAC energy efficiency requirements. The 2012 version of the workbook is available at: http://www.treasurer.ca.gov/ctcac/sustainable/worksheet.xlsm.

It is important to note that CTCAC intentionally chose to adopt efficiency standards that aligned with the efficiency requirements of existing programs such as the IOU's MFNC programs, GPR, LEED, and Enterprise Green Communities (replacing previous measure-based efficiency requirements). Aligning their requirements with those of existing programs (which happened in 2010, according to a CTCAC representative) ensures that CTCAC efficiency requirements adapt to future, more efficient versions of Title 24 and to leverage builder knowledge of the requirements of existing programs. Further, one interviewee involved in the creation of the original TCAC standards reported that CTCAC would not have adopted the above-code requirements if the IOUs' programs were not available to help cover the costs of building 15% more efficiently than code.

3.1.5.2 ENERGY STAR Certified Buildings

The fundamental component of the U.S. EPA's ENERGY STAR Certified Building program is attaining 15% savings over Title 24, and qualifying buildings must be inspected for compliance by licensed professionals, such as HERS raters.[77] In 2012, the ENERGY STAR Certified Building program began its transition from Version 2 to Version 3, with an updated set of standards that included an adjustment for building size and enforcement of four rigorous inspection checklists: the Thermal Enclosure System Rater Checklist, the HVAC System Quality Installation Rater Checklist, the HVAC System Quality Installation Contractor Checklist, and the Water Management System Builder Checklist.[78]

Until 2011, only low-rise multifamily buildings were able to qualify for the national ENERGY STAR specification,[79] which follows a performance compliance approach.[80] In 2011, ENERGY STAR was opened up to high-rise residential buildings through the ENERGY STAR Multifamily High Rise (MFHR) program, which allows compliance via a prescriptive or performance path.[81] As previously discussed, builders may participate in ENERGY STAR for

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[77] The EPA provides guidance on the ENERGY STAR Version 3 standards applicable to California construction here: http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_v3_california.

[78] There is also a Version 2.5 that covered the transition to Version 3. Version 2.5 required but did not enforce all of the checklists that would be mandatory under Version 3. Version 2.5 only applies to buildings permitted between January and September of 2012, at which point Version 3 became the standard. The timelines for affordable housing are slightly different, and dependent upon the point at which the developer applied for funding through their local low-income housing agencies. http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/California_v3_Guidelines.pdf?48e0-f6f5.

[79] EPA press release "Energy Star Now Available for New Multifamily High-Rise Buildings," Aug. 30, 2011. Available at: http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/69eba6bb753e8499852578fc005571b0!OpenDocument.

[80] Detailed ENERGY STAR program requirements available at: http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/National_Program_Requirements.pdf

[81] Detailed ENERGY STAR high-rise multifamily requirements available at: http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_multifamily_highrise

the incentives offered through the IOUs, for its branding and associated marketing value, and in conjunction with other voluntary criteria such as LEED.

3.1.5.3 LEED

The Leadership in Energy and Environmental Design (LEED) for Homes program from the U.S. Green Building Council (USGBC) is a well-known "green" homes program that also requires 15% savings over Title 24. ENERGY STAR qualification is a requirement for LEED certification. To qualify for the 9% competitive tax credits available through CTCAC, affordable housing developers must attain at least one of three green building certifications approved by CTCAC, one of which is LEED. (The other two efficiency certification options affordable developers can choose to pursue instead are GreenPoint Rated and Enterprise Green Communities.)

Interviewed market actors reported that LEED certification was commonly pursued by builders either to attain competitive affordable housing tax credits from CTCAC or to differentiate and signify a higher-end and "green" building or development. According to interviewees, LEED is typically considered a high-end green certification and, being rather costly, often makes financial sense for high-profile projects that benefit from the name recognition of LEED. While ENERGY STAR qualification is based on quantifiable energy savings, LEED expands on this by scoring whole buildings based on numerous principles of sustainability, such as minimal construction waste, innovative design, and responsible integration into communities. LEED covers low-rise multifamily buildings through the LEED for Homes[82] rating system, four- to six-story multifamily buildings through LEED for Homes Multifamily Mid-Rise (still largely based on the low-rise standards),[83] and high-rise multifamily (and commercial) buildings through LEED for New Construction & Major Renovations.[84]

3.1.5.4 GreenPoint Rated by Built It Green

Build It Green is a California-based nonprofit organization that promotes green building practices and offers the GreenPoint Rated program that, similarly to the LEED certification program, uses a point-based scoring system to credit homes for sustainability attributes, such as energy efficiency, water conservation, minimizing construction waste, improving indoor air quality, community contributions, and so forth, and entails third-party verifications of building

[82] Detailed eligibility requirements for LEED for Homes available at: http://www.usgbc.org/sites/default/files/Scope%20and%20Eligibility%20Guidelines%20for%20LEED%20for%20Homes%20Projects%2001%2018%202013.pdf

[83] Detailed eligibility requirements for LEED for Homes Multifamily Mid-Rise available at: http://www.usgbc.org/sites/default/files/California%20LEED%20Multifamily%20Mid-Rise%202010.pdf.

[84] Detailed eligibility requirements for LEED's high-rise program available at: http://www.usgbc.org/sites/default/files/LEED%202009%20RS_NC_04.01.13_current.pdf.

practices.[85] GreenPoint Rated certification is designed to be more attainable than LEED, which some builders may view as financially out of reach.[86] Unlike LEED, GreenPoint Rated does not require ENERGY STAR qualification, though it does award points for it. GreenPoint Rated requires attaining 15% energy savings above Title 24. Affordable housing developers can choose to pursue GreenPoint Rated (or alternatively, LEED or Enterprise Green Communities) in order to be eligible for the 9% competitive affordable housing tax credits through CTCAC. As noted in section 3.1.5.1, CTCAC aligned their requirements with GPR and other programs in order to ensure their efficiency requirements adapt to future, more efficient versions of Title 24 and to leverage builder knowledge of the requirements of existing programs.

3.1.5.5 Enterprise Green Communities

Like LEED and GreenPoint Rated, Enterprise Green Communities is one of the green-building certification paths that builders must choose to be eligible for the 9% competitive CTCAC tax credits for affordable housing. Enterprise Green Communities, like LEED, requires ENERGY STAR qualification—though, unlike LEED or GreenPoint Rated, it is only available for affordable housing construction, not market-rate construction.[87] It is a national rating standard that the interviewed market actors report is not as commonly used for multifamily projects in California as GreenPoint Rated or LEED, even for affordable housing.

3.1.5.6 CALGreen Voluntary Tiers

As previously discussed in section 3.1.2.2.2 above, CALGreen, Part 11 of Title 24, has mandatory green building requirements, but also includes voluntary energy-efficiency performance thresholds that builders can target or municipalities can adopt as their own reach codes. In the latter case, these performance tiers would no longer be voluntary. Among other measures, Tier I requires a 15% improvement over Title 24, and Tier II is 30% over Title 24. These voluntary tiers are designed to be comparable to LEED or GreenPoint Rated, but without the associated cost, particularly because the CALGreen certification is validated by local building officials rather than raters certified to participate in those programs.[88]

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[85] Details of GreenPoint Rated available at: http://www.builditgreen.org/greenpoint-rated/?utm_source=GreenPost_12.6.12&utm_medium=email&utm_term=GreenPost_12.6.12&utm_content=GreenPost_12.6.12&utm_campaign=GreenPost_12.6.12.

[86] Davis Energy Group's "GreenPoint Rated and LEED for Homes," comparing the two standards, available at: http://www.builditgreen.org/_files/GreenPointRated/GPR-LEED%20FAQs2010.03.10.pdf.

[87] Details of Enterprise Green Communities' rating system available at: http://www.enterprisecommunity.com/servlet/servlet.FileDownload?file=00Pa000000FxwvNEAR.

[88] ICF International memo from 2010 to the Sacramento Green Building Task Force describing the components of CALGreen, available at: http://www.sacgp.org/documents/GBTF_8-17-10_NewDev_ICF-CalGreen-Tier-Comparison.pdf.

3.1.5.7 New Solar Homes Partnership

Incentives also are available for the incorporation of solar photovoltaic panels into multifamily projects, such as through the New Solar Homes Partnership (NSHP), which came into effect in 2007.[89] The California Energy Commission oversees the NSHP. The NSHP provides incentives for both affordable and market-rate multifamily new construction projects that incorporate photovoltaic (PV) panels and surpass Title 24 by at least 15%; market-rate buildings that surpass Title 24 by at least 30% are eligible for a Tier 2 incentive, which is approximately $0.25 per watt higher than the base Tier 1 incentive. The NSHP has a volumetric trigger in which these incentive levels decline in steps as targeted amounts of PV generation are installed by the program. As of 2010, incentives were still at the highest rate—$2.50 per watt for Tier 1 market rate projects and $3.50 per watt for affordable projects. In 2011, the incentive rate was decreased in accordance with the incentive decrease schedule ($2.25 per watt for Tier 1 market rate and $3.15 for affordable).[90] These rates further dropped in January of 2012 to $2.00 per watt and $2.90 per watt for Tier 1 market rate and affordable housing, respectively.[91] At the time of this report, the most recent rate changes occurred in December 2013, with rates dropping to $1.25 per watt for Tier 1 market-rate and $1.85 per watt for affordable.

3.1.5.8 Non-IOU Utility Programs

Non-IOUs such as municipal utilities may also offer various incentives to builders to promote efficient new construction.[92] One interviewee reported participating in a large new construction project with SMUD, for which the developer was provided with incentives for the installation of PV and energy-efficiency measures.

3.1.6 Building Design

The design process includes determinations about how a building should be sited and constructed, such as framing techniques, window orientation, or building size, and also the initial specification of building components such as windows, insulation, appliances, and heating, cooling, and water heating equipment.

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[89] NSHP 2013 Guidebook, 6th edition, available at: http://www.energy.ca.gov/2013publications/CEC-300-2013-009/CEC-300-2013-009-ED6-CMF.pdf.

[90] California Energy Commission, "New Solar Homes Partnership Program Notice of Incentive Decline," Sept. 12, 2011, http://www.energy.ca.gov/renewables/06-NSHP-1/notices/2011-08-12_Notice_of_Incentive_Decline.pdf.

[91] Until 2012, PV installed for the common area of affordable buildings was incentivized at a lower rate than for PV connected to the residential portion of affordable buildings, but still higher than for market rate buildings. In 2012, the affordable housing common area incentive for PV was reduced to the market-rate level. Source: NSHP 2012 Guidebook, 5th edition, available at http://www.energy.ca.gov/2012publications/CEC-300-2012-007/CEC-300-2012-007-ED5-CMF.pdf.

[92] Participation in the non-IOU programs could, theoretically, affect how a developer builds in the IOU territories.

3.1.6.1 Market Actors Affecting Design

Market actors most involved in decisions about the energy-efficiency aspects of the design of multifamily homes include builders and Title 24 consultants—and, to a lesser extent, architects and HERS raters. Manufacturers and distributors are also involved in the design process to the extent that they control the supply of materials and equipment available to these market actors.

3.1.6.1.1 Developers/Builders

Market actors and program staff consistently reported in interviews that developers and builders[93] are ultimately responsible for efficiency decisions in the design (and construction) process of their specific projects. All nine market experts cited the developer or builder (or someone within their firm) as being the ultimate decision maker in this process, but all of the interviewed respondents also indicated that the builders' decisions are generally based on complex factors including economic considerations such as initial vs. long-term costs, return on investment, lender or investor pressures, perceived consumer demand, local zoning requirements, and advice from their design team or consultants. These considerations are extremely important to builders' design decisions; some market actors essentially characterized developers as reactive actors, making design and construction decisions based on their assessment of these factors. One market actor stated, "Sure, the developer is very important, but if one of them falls off a cliff, there are tons more. But what if we took out one of the key financiers? For example, the Redevelopment Agency money, which no longer exists. That was huge. The developer is important, but not key." One interviewee, the director of the development department at a major development firm, emphatically reported that "in our case it [efficiency decisions] rests with us exclusively. We do in some cases have financial partners that have a say, but it's typically us who brings them in once we have a concept of what we want to do."

Developers of market-rate buildings weigh these considerations and determine whether their circumstances require them to design to Title 24 minimums, or whether they should build to higher voluntary levels. One market-rate developer said that his peers make efficiency design decisions "probably based on some economic model. If there's return, then they'll probably do it. If there's no perceived benefit, I doubt they're spending money just for the hell of spending money." Some developers incorporate a goal of energy efficiency or sustainability into their designs because they are mission-driven (especially nonprofit affordable housing developers) or to gain a competitive edge in the market (for-profit developers in the affordable or luxury market-rate sectors, particularly). Builders may make these decisions at the project level, or

[93] Recognizing that developers and builders can be distinct entities, this report refers to them interchangeably, in keeping with how they were described by interviewees, where in most cases, but not all, the developer and builder are the same person or work for the same firm. This may vary depending on the size and structure of a company. The IOUs group builders and developers together insofar as either can obtain builder incentives through the IOUs' multifamily new construction program.

dedicate themselves or specific departments in their firms to building to different sectors of the market.

Affordable housing developers. Developers of affordable housing seeking tax credits through CTCAC must target higher efficiency levels from the start of their design process due to CTCAC requirements that affordable housing be at least 15% more efficient than Title 24. Multiple respondents with affordable housing experience reported that the affordable housing developers are in the forefront of designing (and building) projects incorporating advanced energy-efficiency techniques, almost serving as a testing ground for market-rate developers to learn about the feasibility of advanced design practices. Many affordable housing developers are nonprofit, mission-based organizations, such as Community Housing Works or Mercy Housing. One market actor estimated that these and other similar nonprofits build 80% of affordable construction. However, for-profit companies also have a strong presence in the affordable housing market, which is a testament to the attractiveness of the CTCAC tax credits. Interviewed market actors reported that the affordable housing market in California is dominated by a larger number of smaller-scale developers compared to the market-rate sector, which involves fewer, larger developers. Data from the market characterization support the market actors' assessments as the market rate sector is more heavily concentrated among high activity builders than the low-income sector for projects started from 2010 through 2012 (see section 5.3.13).

Some companies choose to work in both the affordable and the market-rate sectors, but in all nine expert interviews, market actors noted that developers tend to specialize in market-rate or affordable housing, or at least operate departments dedicated to the different market sectors, largely because of the difficulty of successfully navigating the CTCAC regulations and complex funding process associated with affordable housing. Data from the market characterization support the market actors' assessments as only 31 of 385 builders (8%) built both market rate and affordable housing projects from 2010 through 2012 (see section 5.3.13). Only three respondents described there being any overlap in these mostly distinct markets; one additional respondent representing a for-profit, affordable housing developer commented that their firm was trying to break into the market-rate industry, thereby becoming one of those developers operating in both markets. Two respondents explained that when working on large planned communities with market-rate and affordable components, separate developers would handle each building type. One interviewee reported that there is "an awful lot of effort and B.S. you have to go through to qualify for the [affordable housing] tax credit. You're not going to invest the time and effort to hire the people for low-income to go through all that for one or two jobs and then go back to market-rate. To be good at affordable, you have to do it over and over and year after year. That talent commands six-figure salaries, and you're not going to invest in that to only have those people sit around while you do market-rate work."

Related California, part of the national Related Companies development firm, is one such large developer that was described in interviews as focusing on both affordable housing and

extremely high-end luxury multifamily buildings, and building both to higher efficiency standards.[94]

Builders who sell vs. own and operate. The design choices regarding efficiency that builders make in the multifamily market are also tied to whether the building owner or the occupants will be responsible for utility bills. This can become a split incentive barrier to energy efficiency: respondents report that market-rate developers have less incentive to install high-efficiency equipment unless they can market those features successfully in order to increase rents or property values. The adoption of "green leases" as a more common practice in the market-rate rental market may be one potential mechanism for mitigating this split-incentive barrier.[95] Green leases can vary greatly in their focus and content, but generally they are rental agreements between tenants and landlords that include energy or sustainability responsibilities for both parties, such as allowing the landlord to increase the rent to offset the cost of replacing failed equipment with a more efficient model. These arrangements do not appear to be commonplace as of yet and seem to be mostly targeted at the commercial market.[96]

Even developers who own complexes and want to include green components such as solar domestic hot water equipment (DHW) or PV may tie those systems into the common areas rather than for the benefit of the individual units due to this split incentive problem. However, one respondent noted that the rise in virtual net metering may make it more feasible to install solar arrays that can be used for the benefit of the individual units, even if they are only tied to one electric meter.[97] Affordable housing developers have a greater incentive to invest in efficient equipment due to their own social missions, CTCAC regulations, and the ability to adjust rents based on utility costs.

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[94] The evaluation team attempted, but was unable to conduct interviews with Related California (our contact at Related was unfamiliar with the IOUs' programs). The above characterization was made by other interviewed market experts and confirmed by a brief review of the Related California website, which describes their practice areas as focused on affordable, mixed-use, and other multifamily facilities. More information available at: http://www.relatedcalifornia.com/ourcompany/businesses.aspx, last accessed June 18, 2014.

[95] Bell, Casey, Stephanie Sienkowski, and Sameer Kwatra, "Financing for Multi-Tenant Building Efficiency: Why This Market Is Underserved and What Can Be Done to Reach it," August 2013, ACEEE. Research Report E13E, available at: http://www.aceee.org/research-report/e13e, last accessed Nov. 5, 2013.

[96] The California Sustainability Alliance provides a green lease toolkit for commercial landlords and published this 2009 report regarding the use of green leases in the commercial rental market in California: http://sustainca.org/sites/default/files/GreenLeases_report_050509.pdf. The LEED program also focuses on "green leases" as a commercial building rental mechanism: http://www.usgbc.org/courses/green-leasing.

[97] Virtual net metering (VNM) is a CPUC-approved metering arrangement that allows property owners to install one PV array for a multi-meter property, and distribute the benefits of that on-site generation to multiple units. In the absence of these arrangements, single PV systems can easily feed a common area meter or another individual meter, but their generated electricity cannot be distributed across multiple meters equally. In VNM arrangements, the PV array feeds directly into the grid, and each utility account on the property can be credited by a utility for its share of the generated electricity. Source: CPUC, "Virtual Net Metering" webpage, http://www.cpuc.ca.gov/PUC/energy/DistGen/vnm.htm, last accessed Nov. 5, 2013.

Durability of equipment and lowering operating and maintenance costs becomes extremely important to developers who own buildings, either market-rate or affordable housing, and developers factor this into their design decisions, including equipment selection.

3.1.6.1.2 Title 24 Consultants

Title 24 consultants provide builders with specific guidance on their designs so as to achieve energy-efficiency targets cost-effectively. At the least efficient end of the market, these consultants only provide enough guidance for builders to comply with Title 24. Their roles appear to become more important to the design process as builders move beyond Title 24 to meet various voluntary criteria, such as the IOUs' incentive programs or CTCAC's efficiency requirements for affordable housing. One interviewed market actor speculated that there may be a dearth of highly skilled Title 24 consultants and that there are a few key consultants that "everyone is going to" for advanced projects. One developer confirmed that this used to be a problem but it has been mostly resolved; the same developer had found good partners to work with consistently. Three out of four of the developers interviewed, however, strongly indicated that they had not personally experienced a lack of qualified Title 24 consultants. Two respondents even noted that the housing crash had put many of the lesser players out of business, leaving the better consultants (and contractors).

3.1.6.1.3 Architects

Interviewed market actors reported a limited influence of architects on the efficiency of multifamily buildings. One noted that architects may make some design suggestions related to efficiency, but the project is then handed over to the developer, who is free to change things in consultation with a Title 24 consultant.

3.1.6.1.4 HERS Raters

Home Energy Rating System (HERS) raters offer third-party verification of energy-efficiency measures and can create comprehensive energy consumption models of units or whole buildings using computer software programs as well as official HERS ratings incorporating that information.[98] HERS raters may also become more involved in the design process when builders participate in voluntary programs that require full verification of energy-efficiency measures by HERS raters because the basic Title 24 standards do not require full HERS ratings or inspections, only verification of certain measures. Program staff seemed to give more weight to the impact of the HERS rater on the design process than did other market actors, who seldom mentioned HERS raters as players in the efficiency decisions.

3.1.6.1.5 Manufacturers and Distributors

[98] RESNET is the overarching organization that creates the requirements for HERS rater certification, including setting the quality control provisions governing HERS raters, with more information available at: http://www.resnet.us/professional/about.

Manufacturers, of course, are responsible for producing the materials and equipment that are installed in multifamily buildings, and distributors typically serve as the channel through which developers receive this equipment. Manufacturers and distributors can respond to perceived demand from developers and contractors and can control the supply of mechanical equipment to builders by favoring certain types of equipment.

3.1.6.2 Selection of Materials and Equipment

The above market actors all have roles to play in the selection of equipment and efficiency measures installed in multifamily buildings. As previously discussed in section 3.1.2.1 above, minimum standards for mechanical equipment and building components such as windows, air conditioners, furnaces, and boilers can be set by federal regulations, Title 24 building code, Title 20 appliance standards for appliances and mechanical equipment not federally regulated, local building codes (such as "reach codes"), and CEC approval processes that limit the types of equipment that can be sold in California.

The type of multifamily building being constructed also has a large impact on the equipment being selected. For example, large solar arrays are not a preferred option for high-rise multifamily buildings, which have little roof space for arrays; these might be better suited to low-rise buildings that have more roof area. Builders also have different options for mechanical equipment depending on whether they choose to install central mechanical systems or individual mechanical systems for each dwelling unit.

3.1.7 Construction

The construction process itself is, of course, central to the multifamily new construction industry, with builders/developers serving as the key market actors in this process. As previously discussed in the design section (3.1.6.1.1 above), builders are ultimately responsible for efficiency decisions in the design and construction processes and make these decisions in accordance with their budgetary requirements.

Key members of builders' organizations during the construction process include project managers who handle day-to-day decisions (and work most directly with IOU program staff, according to IOU interviewees) and their supervisors in charge of the development departments within construction companies. Purchasing agents may also be involved in making decisions about efficiency during this process, according to IOU program staff.

Market actors reported that large builders, many of whom operate within as well as outside of California, are active in the multifamily construction market. They include, for example:

- Irvine
- Related Companies
- USA Properties Fund
- Bosa
- Sares

- Regis
- Avalon Bay
- KB
- Idaho Pacific West
- ROEM Development Corporation
- Meritage
- Shay

Some of these developers tend to sell their projects, while others tend to hold them and rent them for a long time, like Irvine. Affordable housing-only developers that market actors discussed in interviews as being active in California include:

- MidPen Housing
- Mercy Housing
- Bridge Housing
- Eden Housing
- The Corporation for Better Housing
- Community Housing Partners
- Urban Housing Partners

Some interviewees, particularly those with ties to the affordable housing market, reported that nonprofit affordable housing developers are mostly free to push the envelope in terms of efficiency levels achieved; their mission-driven nature may give them freedom to take more risks by testing technologies and practices that the more conservative market-rate community might be less willing to utilize. Some for-profit developers involved in higher-end developments that are part of sustainably designed (and marketed) communities may also feel more comfortable reaching for higher efficiency levels, particularly when customers associate sustainability features with high-end, luxury features.

In terms of timing, market actors reported that multifamily construction projects can involve years of planning and construction. One market actor reported that 1.5 to 3 years was a common length of design and construction for major projects after financing was arranged.[99] During these long periods, changing circumstances can require builders to adjust their initial designs. For example, the intended type of window or mechanical equipment might be discontinued or replaced with a new version by a manufacturer or distributor. Builders accordingly rely on their Title 24 consultants during the construction phase to price out any adjustments they might have to make to their initial designs and ensure they still can meet their efficiency targets.

Builders must also be able to rely on the skills of their contractors and subcontractors. One nonprofit affordable housing developer noted their importance in achieving efficiency goals:

[99] Our survey of MFNC builders supports this estimate as surveyed builders estimated an average construction time of 1.6 years (18.9 months) (see section 5.7.2)

"Your contractors have to have come up to that level and be aware and know how to get this stuff done and know how to work in an integrated team. And yes, that has happened over the last five or so years, at least in whom we work with and who our colleagues across the state have worked with. I think the tide is rising even on the market-rate, but it is rising a lot faster on the affordable [side]. It's not only the developer and the green advisor; your entire team has to be at that level."

Respondents noted that, after the 2009 market downturn, multifamily construction slowed tremendously (particularly market-rate construction), and some planned market-rate projects were abandoned. Respondents confirmed that the multifamily market has started to rebound; of the five respondents who commented on the frequency of projects being permitted but not completed, all five reported that this happened much more during the housing market crash and recession than it did now. Three of these respondents thought that this was either rare or never happened in the current market; one affordable housing developer reported that it did not happen in the affordable market, but speculated that it might happen more in the market-rate side; and only one consultant thought it was "not uncommon" event. Builders typically start construction almost immediately after receiving permits, market actors reported.

3.1.8 Verification of Efficiency Measures (Plan Check and Inspection)

Verification of energy-efficiency measures, particularly through plan checks and inspections, is a key aspect of ensuring that energy-efficiency measures specified in the design process are installed (and installed correctly) during the construction process. This involves checking the plans for accuracy and completeness and, in some cases, confirming via inspections that the as-built project conforms to those plans. Voluntary energy-efficiency programs tend to have higher verification requirements than are required for basic compliance with Title 24, such as increased use of third-party verification of efficiency measures and less reliance on self-reporting from the developer team. Voluntary efficiency programs seem to be moving toward increased use of third-party verification of efficiency measures.

3.1.8.1 Verification Practices in Title 24

As discussed in section 3.1.2.2 above, to comply with Title 24, developer teams submit Title 24 compliance forms to municipal building departments and use their own contractors to verify the installation of measures, even with systems they themselves installed.[100] Title 24 does not require full HERS ratings or third-party inspection of all efficiency measures in a building (checking insulation, heating system AFUE, etc.), but HERS raters are required to verify and perform diagnostic tests for certain efficiency measures, such as ensuring that duct leakage falls within set limits. Title 24 also awards additional compliance points through the performance

[100] Confirmed from interviews with market actors and IOU program staff, and HMG's California Multifamily New Homes Energy Guidebook for 2010-2012, available at: http://cmfnh.com/documents/CMFNH%20Multifamily%20Guidebook%20v2010_01.pdf.

path for Quality Insulation Installation (QII) verification, which requires HERS rater inspections to confirm that insulation is installed correctly. (However, even if a building does not have any measures subject to HERS inspection under Title 24, and the building is complying via the whole-building performance compliance path, each individual unit must still have compliance documentation submitted to the HERS registry.)[101]

3.1.8.2 Verification Practices in Voluntary Programs

Third-party, on-site inspections to verify installations of efficiency measures are a key component of voluntary efficiency programs and often go hand-in-hand with programs that offer financial incentives for building efficiently or incorporating renewables. For example, ENERGY STAR requires verification of energy-efficiency measures for multifamily buildings. HERS raters must fully inspect low-rise multifamily buildings for ENERGY STAR qualification, and either an architect or an engineer can perform this function for high-rise ENERGY STAR buildings through the ENERGY STAR MFHR program.[102] Achieving ENERGY STAR qualification is encouraged as a component of meeting other voluntary green building programs such as GreenPoint Rated,[103] LEED, and Enterprise Green Communities, making third-party verification of energy-efficiency measures a consistent component of these programs. The GreenPoint Rated green building program also requires its own third-party verification, including plan check and visual inspections to ensure compliance with that program's requirements. Similarly, LEED requires that certified LEED "Green Raters" provide field verification of efficiency measures and ensure compliance with that program's requirements. HERS raters can take Build It Green or LEED training sessions to become qualified to perform these checks along with their responsibilities as HERS raters.[104] Enterprise's Green Communities program does not require hiring a third-party rater to verify efficiency measures, but it does insist on providing design assistance and inspection services for some buildings going through the program and pays for the cost of doing so.[105]

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[101] See Title 24 Residential Compliance manual, page 7-8: http://www.energy.ca.gov/2008publications/CEC-400-2008-016/rev1_chapters/RCM_Chapter_7_Performance.pdf.

[102] The licensed professional providing verification services for ENERGY STAR high rise multifamily buildings could actually be a member of the developer team, and could have been responsible for the design. HERS raters, who check low-rise buildings, are subject to the quality control inspection of outside HERS providers, who check the work of the HERS raters, reducing concern over bias due to self-reporting. Details provided in EPA's ENERGY Star MFHR Testing and Verification Protocols Version 1.0, from June 2012, page 4, available at: http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/mfhr/ENERGY_STAR_MFHR_T_and_V_Protocols_V1.0.pdf.

[103] Details available in Build It Green's Multifamily Green Building Guidelines, 2008-2011 Edition, available at: http://www.builditgreen.org/_files/Admin/Collateral/2008%20Multifamily_Guide.pdf.

[104] GreenPoint Rated rater requirements: http://builditgreen.org/become-a-certified-greenpoint-rater/; LEED rater requirements: http://www.usgbc.org/credentials/certificates/green-raters.

[105] Details of Enterprise Green Communities' inspection requirements available at: http://www.enterprisecommunity.com/servlet/servlet.FileDownload?file=00P30000008rdsqEAA.

Full verification of energy-efficiency measures is also required of affordable housing developers seeking CTCAC tax credits. CTCAC tax credits incorporate third-party verification of measures into their construction processes because participation in GreenPoint Rated, LEED, or Enterprise Green Communities is required to win those credits.[106]

3.1.9 Enforcement

Local building officials are responsible for enforcing the Title 24 building code and any additional efficiency standards required by the municipality, such as those communities that have adopted "reach codes." As discussed in section 3.1.2.2 above, Title 24 compliance requires a plan check by the local building official; completion of numerous forms by the builder and contractors affirming compliance; verification of some measures by HERS raters, such as measuring duct leakage (a requirement of low- and high-rise buildings); and compliance with inspections as required by the local building inspectors.

Because so much of Title 24 compliance relies on builder and contractor affirmation and verification of measures and equipment that they install themselves, one respondent in particular thought that actual Title 24 compliance might be lower than reported. This multifamily consultant with experience working in local building departments reported that building inspectors are more concerned with building safety than energy efficiency and, thus, "Building officials are people who are easy to fool. [It's a] sad commentary, but it's true. Plan checkers [from the IOUs' programs] are good at catching builders playing games. The building inspector who will catch these things is way above average. Efficiency isn't their life; it's not a safety issue in their mind, so they don't pay attention to it, because they look at life safety issues."

3.1.10 Branding and Marketing

Some of the voluntary criteria discussed in section 3.1.5 above are associated with branding and marketing efforts to increase the name recognition and demand for these programs, either among market actors within the residential construction industry or among consumers themselves. Marketers of these programs typically seek to associate their brands not only with energy savings, but also with a suite of potential benefits related to these certification programs, such as increased home comfort, quieter buildings, reduced operations and maintenance costs, more stringent quality control due to third-party inspection requirements, being "green" or sustainable, or contributing to the vitality of a community (particularly for affordable housing programs).

ENERGY STAR Homes (building off the ENERGY STAR branding for consumer electronics and appliances) and LEED for Homes (a well-known name in the residential and commercial

[106] Details of CTCAC verification requirements are available in the Sustainable Building Method and Energy Efficiency Requirements Workbook. The 2012 version of the workbook is available at: http://www.treasurer.ca.gov/ctcac/sustainable/worksheet.xlsm.

green building market) are likely among the most recognizable programs to homeowners and renters. Other popular brands in California, particularly within the builder community, include Build It Green's GreenPoint Rated program and, to a lesser extent because it applies only to affordable housing, the Enterprise Green Communities program. The IOUs' residential new construction program, the California Advanced Homes Program, may also carry name recognition, particularly among market actors in the new construction industry.

One market-rate developer described how the branding of voluntary programs was particularly popular among public officials such as city council members: "They are always impressed with LEED and ENERGY STAR and 'green.' They don't know what energy efficiency means, so there are buzz words for it."

3.1.11 Consumer Demand

Homeowners and renters are central to the multifamily construction market—it exists to provide housing for them. Market demand thus is able to drive energy efficiency in multifamily construction. Consumers also have an opportunity to demonstrate or voice their preferences for energy efficiency during the rental or purchase transaction. However, interviewed market actors reported that energy efficiency does not appear to be at the top of consumers' priorities. This is particularly the case for renters and other consumers of non-luxury units, for which increased energy-efficiency equipment might represent a tradeoff with other amenities, such as a desirable location, size, layout, or granite kitchen counters. Renters or purchasers of more upscale units or those looking at units in heavily branded, master-planned communities may be a self-selecting group that desires more energy-efficient construction along with other amenities. Similarly, the direction of the multifamily market may be affected by demographic preferences; some market actors noted that multifamily housing may appeal to people who are near retirement age and looking to downsize from larger homes, and to younger people who prefer dense, urban environments to neighborhoods with less dense single-family housing and spacious yards.

3.1.11.1 Renters

Market actors reported that renters tend to have a lower demand for energy efficiency than condo buyers. This is true of both the market-rate and low-income rental markets.

3.1.11.1.1 Affordable Housing Renters

Renters of affordable housing are typically most concerned with the availability of the housing itself rather than its energy efficiency. Affordable housing developers interviewed reported that the demand for affordable housing far outstrips the supply, with one noting, "We don't have a market problem. I've got 8 to 10 people in line for every unit I build." Affordable housing occupants also do not typically have to demand efficiency in new construction—builders are mandated to build efficiently to receive CTCAC tax credits. An affordable housing developer noted that low-income renters of affordable housing "do recognize the benefits of energy efficiency, as it results in their lower utility bills. They do appreciate that." This developer continued:

> . . . But for low income, we have poor people living in garages and sharing spaces with other families. When you offer them a brand new apartment at the restricted rent, quite frankly, while they may appreciate its [efficiency], they're not going to turn it down if it's not energy efficient. We don't have to be as aware of our consumer in order to entice people to rent in the affordable market. We're aware of our consumer as doing the right thing for the people that live in our complexes, as opposed to needing to provide the pool to have them come rent. Market-rate builders have to be acutely aware if people are going to come and vote with their checkbook to live. . . . Our residents welcome anything that will reduce their utility bills, but they just want something better than the garage or fleabag they were in.

3.1.11.1.2 Market-rate Renters

Market actors generally reported that energy efficiency is a low priority for market-rate renters as well. In some cases this may be because renters feel less invested in the energy-efficiency aspects of an apartment. An affordable housing developer said, "I'm not sure if [multifamily] rental clientele walking in knows or cares as much [about energy efficiency] because they're not seeing it as a permanent investment."

Some market actors attributed this low demand for energy efficiency among renters to the fact that they do not have a way to readily compare the efficiencies of different apartments, which is an information barrier. Also, in some cases renters may assume that the stringent building code in California provides a reasonable guarantee that all new apartments will be reasonably efficient, to the point that they do not have to demand efficiency specifically.

One consultant reported the following about market-rate renters: "There is no consumer interest [in energy efficiency]. Most people don't shop apartments and ask for the energy bill. . . . Builders always say, 'If the consumer wants it, we'll build it.' That's absolutely a true statement, but it's easier to say in single-family than multifamily. [There is] no way you can tell that one apartment is more efficient than the other. There may be visible solar panels, but the consumer doesn't know if they heat the swimming pool or their hot water. There isn't a real clue for the consumer to understand if they're going to have a low energy bill or not."

A different consultant reported similar experiences and wished there were a way for renters to be able to compare energy costs between different apartments:

> If prospective renters could get reliable information on energy performance, knowing that their energy bills are the second highest cost behind rent itself, they would be able to choose this more energy-efficient apartment than that if the rent plus utilities were going to be lower in one apartment vs. the other. We don't have the info right now. They don't have that ability. There is a lot of benchmarking work right now through ENERGY STAR, but that is targeted at buyers and owners, and that's not where you're going to move the market. You're going to move the market by targeting prospective renters, to get them to ask about energy efficiency when they're shopping, the way people look at cars and mpg. We're not giving people the ability to pay attention to that in this market. If you did that, there is no split incentive. It's just a return on investment.

Another major developer reported that comparing utility bills was just not something that is done in the multifamily rental market: "In theory, if the unit is more efficient, the savings is realized at the tenant level and not at the project level, and if you can educate that tenant that the higher rents are offset by lower [energy] costs, you could charge higher rents because the utility bills would be lower at your building than the less efficient one across the street. I'm not sure in rental rate markets like California whether the tenant would make the connection that the extra $25 that they might save in energy in their utilities could go toward rent instead and they would be in the same place [financially]."

3.1.11.2 Homebuyers (Market-Rate Condos)

There is some increased awareness of energy efficiency among homebuyers, but demand for energy efficiency is inconsistent, according to market actors. One market-rate developer that builds large, urban master-planned developments reported that he had been experimenting with offering condo buyers a large purchase incentive (up to $20,000) that could be put toward solar panels or interior upgrades such as fancier kitchen materials, and "the buyer is choosing those interior upgrades more so than energy efficiency. But that may be a factor that just the underlying codes in California are already pretty stringent on energy efficiency, so they're already buying an energy-efficient house regardless of whether or not we go above and beyond that. People choose to upgrade to something they can touch over something they can't see. That's also because they don't see energy-efficiency savings right away, but they see new counters on day one."

3.1.11.3 Rental and Purchase Transactions

On the market-rate side of the multifamily market, lenders and real estate agents are the typical intermediaries between builders and potential owners. Market actors who were interviewed did not explicitly mention real estate agents as having a role in pushing energy efficiency; past

program evaluation experience indicates that real estate agents emphasize the features that consumers seem to prefer, such as functional and aesthetic amenities, over energy efficiency.[107] Lenders to potential condo purchasers could drive efficiency on the market-rate side of the multifamily market by tying mortgage criteria to the energy performance of a home, or by encouraging buyers to purchase efficient homes. However, interviewed market actors were not confident that these lenders truly value or understand energy efficiency or factor in reduced utility bills as a means of allowing purchasers to leverage a higher mortgage payment. This happens on the affordable housing side, where rents are adjusted to compensate for utility bills, but does not seem to take place in the market-rate mortgage transaction.

On the affordable housing side of the market, local housing authorities are involved in the rental transaction for potential occupants (affordable housing in California are rental units only, not for purchase).[108] The demand for affordable housing exceeds the available supply (respondents noted that there are long waiting lists for available units), so efficiency is not a strong motivator in this rental transaction, but an ancillary benefit to renters.

[107] NMR Group, Inc. "Massachusetts New Homes with ENERGY STAR® Mystery Shopping Final Report. Oct. 29, 2010, available at : http://www.ma-eeac.org/Docs/8.1_EMV%20Page/2010/2010%20Residential%20Studies/2010%20ENERGY%20STAR%20Homes%20Mystery%20Shopping-Final.pdf.

[108] Detail on the CTCAC tax credits and CTCAC affordable housing requirements available at: http://www.treasurer.ca.gov/ctcac/program.pdf.

3.2 Market Barriers and Drivers

3.2.1 Barriers to and Drivers of Energy-Efficient Construction

The following are factors that serve as barriers to energy-efficient multifamily new construction in California, as reported by interviewed market actors and program staff and gathered from a review of IOU program documents.[109] The barriers will be updated if necessary after completing additional interviews with market actors involved in case studies conducted for the Phase II report. For many of the barriers, there are corresponding drivers of efficient construction or other factors that might mitigate the impact of the barrier. In addition, the IOU programs include components and strategies designed to help overcome the barrier. For example, a split incentive, in which the developer incurs the higher cost of an efficiency measure but the occupant receives the benefits of the efficiency improvement, may be mitigated by a potential return on the investment in efficiency through higher rents or sales prices or through reduced costs due to receiving CTCAC tax credits (drivers). The program addresses this barrier through incentives, training, and marketing. Accordingly, the left side of the tables below lists barriers and the right side lists related drivers or mitigating factors and program elements.

[109] For a review of barriers to energy-efficiency market transformation programs in general, see Eto, Joseph, Ralph Prahl, and Jeff Schlegel, *A Scoping Study on Energy Efficiency Market Transformation by California Utility DSM Programs*. Berkeley, CA: Lawrence Berkeley National Laboratory, prepared for the California Demand-Side Measurement Advisory Committee, July 1996. http://emp.lbl.gov/sites/all/files/lbnl%20-%2039058.pdf and Rosenberg, Mitch and Lynn Hoefgen, *Market Effects and Market Transformation: Their Role in Energy Efficiency Program Design and Evaluation*, prepared for the California Institute for Energy and Environment Market Effects Program, March 2009. http://uc-ciee.org/downloads/mrkt_effts_wp.pdf.

Table 3-1 lists key barriers and potential drivers related to developers in the multifamily new construction market. These are barriers and drivers that could potentially play a role in the energy efficiency of multifamily new construction in California, based on the evaluation team's research and interviews with market experts.

Table 3-1: Developer-Related Barriers to and Drivers of Energy-Efficient Construction

Developer Barriers to Energy Efficiency (EE)	Related Drivers/Mitigating Factors
Split incentives • Developer pays for efficiency measures, but occupant benefits, e.g., lower utility bills, increased comfort.	Potential return on investment from: • Higher rents (apartments) o Affordable housing: while rarely used, developers can charge higher rents by demonstrating lower utility bills (CUAC) o Market-rate apartments: in theory, but not in practice • Higher sales prices (condos) o Depends on demand for EE, local real estate market, etc. • Incentives, tax credits, etc. • "Green leases" or other innovative financing mechanisms that might allow recouping cost of EE upgrades Reduced operations costs for developers who hold properties **Program components to overcome barrier:** • Incentives • Training (especially regarding ROI) • Marketing (increased demand for EE)
Limited access to capital for upfront costs (of beyond-code construction)	• Potential return on investment • Developers may be required to build efficiently o Affordable housing regulations o Some lenders/investors require efficient practices o Some municipalities require EE (reach code) **Program components to overcome barrier:** • Incentives • Training (especially regarding ROI)

Developer Barriers to Energy Efficiency (EE)	Related Drivers/Mitigating Factors
Hassle, transaction, decision making, and information costs • Difficulty and risk of adopting new equipment/practices (entrenched habits) • Need proof of feasibility	• Potential return on investment • Rising code forces changes in practices • Values - some builders have commitment to "green" practices • Affordable housing projects demonstrate feasibility for market-rate sector **Program components to overcome barrier:** • Design assistance • Training • Incentives • ZNE pilot/other advanced projects demonstrate performance
Performance uncertainties • Does actual efficiency match rated efficiency? • Reliability and maintenance costs o Key barrier: no databases for builders to research reliability and maintenance data	• Efficiency performance can be quantified by energy consultants/HERS raters • IOU/trade organization trainings available **Program components to overcome barrier:** • Design assistance • Training • Verification (HERS/EC requirements) • ZNE pilot/other advanced projects demonstrate performance
Performance uncertainties and information costs, resulting in perceived lack of demand from tenants and homebuyers • Market-rate housing: EE is lower priority than location, price, amenities, etc. • Affordable housing: demand for EE virtually nonexistent	• Demand may be increasing (market-rate) o Particularly for luxury units o Less so for renters than buyers • EE is *required* by CTCAC regardless of demand • Market differentiation • Ability to market NEIs **Program components to overcome barrier:** • Marketing • Coordination with other programs (with strong brands – LEED, etc.)

Developer Barriers to Energy Efficiency (EE)	Related Drivers/Mitigating Factors
Values and decision making • Uneven commitment to "green" building	• Some builders committed to "green" o Mission-based, affordable housing developers o Some market-rate developers • Consumer demand may be increasing • Code requirements continually increasing • Potential for leadership from key industry leaders • Benchmarking data could convince uncommitted builders **Program components to overcome barrier:** • Incentives • Training • Marketing
Performance uncertainties, decision making and information costs, resulting in limited availability of qualified consultants, engineers, contractors, etc. (supply-side barrier)	• Not a pervasive barrier, according to market actors • After initial learning curve, developers find qualified partners and work with them on future projects • Market downturn weeded out some low-performing contractors **Program components to overcome barrier:** • Training • Design assistance • HERS and CEPE requirements
Availability of EE equipment/measures (supply-side barrier) • Slow to market in CA due to testing requirements	• Not a pervasive barrier, according to market actors • Manufacturers/distributors respond to demand • Performance modeling approaches allow flexibility to choose a variety of specific measures to meet EE goals **Program components to overcome barrier:** • Incentives (encourage increases in supply from increased demand)* • Coordination with other programs (with strong brands—LEED, etc.), leading to more demand
Information costs • Market actors unaware of value of integrated design	• Market actors learn the value of integrated design after participating in voluntary programs **Program components to overcome barrier:** • Design assistance • Training • ZNE pilot/other advanced projects demonstrate performance

* One market actor reported that, in multiple cases, the IOUs' requirements for mechanical equipment had driven distributors to stock only higher efficiency equipment (AC equipment and low-e windows, in these examples), due to the increased expense of stocking multiple versions of a product. One market-rate developer noted, "As more people build efficiently, the manufacturers of drywall, appliances, etc., get more competitive and more manufacturers enter the market and that drives down prices."

Table 3-2 lists key barriers and drivers related to consumers in the multifamily new construction market.

Table 3-2: Consumer-Related Barriers to and Drivers of Energy-Efficient Construction

Consumer Barriers to EE	Related Drivers/Mitigating Factors
Performance uncertainties and information costs, resulting in low demand for/awareness of efficiency • Price, location, amenities, etc., are more important (EE is not as visible) • Market downturn makes upfront price matter more • Low awareness of NEIs	• Consumers realize cost savings through reduced energy costs • Demand may be increasing **Program components to overcome barrier:** • Marketing • Coordination with other programs (with strong brands—LEED, etc.) • Verification (HERS/CEPE requirements)
Low consumer leverage to demand EE • Low vacancy rates in market-rate housing • Long waiting lists for affordable housing • Limited awareness of and access to EE mortgages • Lack of central brand for consumers to demand	• Some builders committed to "green" • CTCAC requires EE, regardless of demand/leverage **Program components to overcome barrier:** • Coordination with other programs (with strong brands – LEED, etc.) • Marketing
Asymmetric information • Market-rate renters cannot compare utility costs between units	• For affordable, CUAC can account for utility costs • Building benchmarking (as it becomes more common) **Program components to overcome barrier:** • Marketing

Table 3-3 lists key barriers and drivers related to lenders and investors in the multifamily new construction market.

Table 3-3: Lender- and Investor-Related Barriers to and Drivers of Energy-Efficient Construction

Lender/Investor Barriers to EE	Related Drivers/Mitigating Factors
Values and decision making • Lack of interest in "green" building	• Some lenders and investors support EE • CTCAC regulations require EE for affordable housing **Program components to overcome barrier:** • Incentives (increase demand for EE) • Marketing (increases demand for EE) • Training for builders (increases demand for EE)
Performance uncertainties • Not convinced of performance of cutting-edge EE measures • Difficult to assess risk of lending to/investing in EE projects	• Performance demonstrated with advanced projects (LEED, GreenPoint Rated, etc.) • Performance demonstrated from benchmarking (ENERGY STAR, etc.) **Program components to overcome barrier:** • ZNE pilot/other advanced projects demonstrate performance • Verification (HERS/CEPE requirements)
Performance uncertainties and information costs, resulting in perception of low consumer demand for EE • Less lending/investment in EE	Demand may be increasing • Particularly for luxury units **Program components to overcome barrier:** • Marketing • Coordination with other programs (with strong brands—LEED, etc.)
Financing restrictions due to market downturn	Market is rebounding

3.2.2 Barriers to and Drivers of Participation in the IOUs' Programs

In addition to the previously discussed barriers and drivers to building more efficiently than required by code, the following factors listed in Table 3-4 are barriers to and drivers for developers to participate in the IOUs' multifamily new construction programs, as reported by interviewed market actors and program staff and gathered from a review of various program documents. This list will be updated if necessary after completing additional interviews with market actors involved in case studies conducted for the Phase II report.

Table 3-4: Barriers to and Drivers of Participation in IOUs' Programs

Barriers to Program Participation	Related Drivers/Mitigating Factors

Demanding EE requirements (hassle, transaction, and information costs)	• Other non-IOU EE programs have similar EE standards/promote participation
	  o LEED, ENERGY STAR, etc.
	  o CTCAC for affordable
	  o Municipalities with reach codes
	• Potential return on investment
	  o Incentives, increasing property values/rents, etc.
	• Perception of consumer demand for EE
	• Performance modeling offers design flexibility
	• Program technical and design assistance
	• Advanced affordable projects demonstrate feasibility for market-rate sector

Program complexity (hassle, transaction, and information costs)[110]
• Paperwork more complicated than other programs
• Communication with utilities
• Program deadlines
  o Big projects take a long time
	• Affordable housing developers used to complexity/regulations
	• Title 24 starting to require similar paperwork
	• Potential return on investment
	  o Incentives, increasing property values/rents, etc.
	• Other voluntary programs, municipalities, etc., may have similar standards, driving participation
	• Potential to treat participating builders as continuing customers, reducing transaction and information costs

Incentive issues (hassle and transaction costs) • Incentives less than cost of EE measures • Uncertainty that funding will be available in the future • Incentives paid at end of project, not when capital is needed • Incentives for gas/electric measures only	• Limited alternative options for funding o Other voluntary programs have similar standards, but may not provide financial incentives (LEED, ENERGY STAR, etc.)
Program variability across program cycles • Incentives/EE requirements change • Program cycles may be shorter than planning/construction for big projects	Limited alternative funding options
Inconsistent program awareness among developers/ builders	• Most market actors think big developers are aware • IOU outreach and marketing
Inconsistent valuing of (integrated) design assistance • Program recommendations too boilerplate for some developers	• Some developers value design assistance • Spillover effects from participants on value of integrated design
Inconsistent program eligibility for mixed-use buildings (SBD vs. CAHP)	May be more of an implementation challenge for IOUs than a problem for builders

[110] One developer of affordable housing who was interviewed did note that they build affordable housing, but do not seek IOU incentives through CAHP. The reasoning given appeared to involve a misunderstanding of the requirements of the program.

4 The California IOUs' Multifamily Residential New Construction Programs

4.1 Program Description

The California Advanced Homes Program (CAHP) promotes the construction of new multifamily buildings that exceed California's 2008 Title 24 standards by at least 15 percent. The key program elements include efficiency criteria, incentives, design assistance, plan check, training of market actors, HERS verification, Title 24 energy consultant requirements, outreach and marketing, and coordination with other programs. The Savings By Design (SBD) program offered by the utilities functions similarly, but is designed for commercial construction. Some of the IOUs send mixed-use buildings that are majority commercial through the program, though some may also send high-rise buildings through the SBD program.

CAHP is designed to achieve energy savings, but places considerable emphasis on transforming the multifamily new construction market by encouraging development teams to increase their proficiency with energy-efficient measures and construction practices. This is described in the most recent Program Implementation Plan, in which the California utilities describe how the program's activities are designed to address key market barriers and the various metrics by which they could attempt to identify changes in the new construction market, while noting that they "believe the market transformation evaluation discourse should be focused on the overlapping synergy among all programs and influences in the market."[111]

The program provides builders, HERS raters, and Title 24 consultants working on multifamily projects with energy-efficiency consultation services in the form of design assistance, and a sliding incentive scale for builders encourages them to maximize efficiency rather than target specific savings tiers. The program uses a whole-building performance approach to calculating energy savings.

Each California IOU implements CAHP in its own service territory;[112] PG&E uses the third-party firm HMG[113] to implement the program under the California Multifamily New Homes

[111] Southern California Gas Program, Program Implementation Plans: Statewide Programs, Appendix B.2, Section A, April 23, 2013, http://www.socalgas.com/regulatory/documents/A-12-07-003/Appendix%20B.2%20Section%20A%20Statewide%20Programs.pdf, accessed January 28, 2014, p. 207. Market transformation discussion for RNC program starts on page 202.

[112] In 2013, SCG began to implement the program in the LA area served by the Los Angeles Department of Water and Power (LADWP). SCG staff reported that they offered the program in in LADWP territory prior to 2013, but participation was low due to the fact that utilities can only offer incentives for savings associated with the fuel type provided to the building, i.e., SCG could only offer incentives related to natural gas savings, not electricity savings.

[113] HMG was recently purchased by TRC Companies and remains the implementer of PG&E's CAHP. http://www.trcsolutions.com/Lists/Recent%20News/ViewRecentNews.aspx?ID=74; http://www.h-m-g.com/News/TRC.htm

Program (CMFNH) name (referred to jointly with CAHP as "the program"). Apart from minor differences (slightly different incentive structures and opportunities for "kicker" incentive bonuses,[114] and some difference in the handling of high rise or mixed-use buildings), the program is implemented relatively consistently across the IOUs' territories.

The residential new construction program also includes a Zero Net Energy (ZNE) program element (or pilot program, depending on the IOU). The ZNE program component provides additional guidance and incentives for builders interested in building extremely efficient homes (greater than 45% more efficient than 2008 Title 24 standards). The IOUs can allot additional incentives to these extremely high performance buildings, and these projects can serve as case studies of particularly advanced construction practices.

4.1.1 Program Eligibility

Eligible buildings include multifamily buildings with three or more attached units. The program's marketing materials and Program Implementation Plans (PIPs) indicate that it is open to buildings of all types, including low-rise and high-rise (four or more habitable stories), and market-rate and affordable buildings. However, SDG&E and PG&E reported in staff interviews that they send high-rise projects through Savings by Design, the IOU's new construction program for commercial buildings, rather than the residential program. Buildings can be eligible for CAHP if served by any of the IOUs for electricity and/or natural gas.[115] Mixed-use buildings may go through the program, but depending on the percentage of square footage devoted to residential space, some IOUs incentivize these buildings through the Savings by Design program rather than CAHP, or they may exclude the nonresidential space from the CAHP building performance analysis.[116]

4.2 Program Model

Figure 4-1 outlines the model of the IOUs' multifamily new construction programs based on the opinions of IOU program staff and market actors as well as a review of program materials. These models were created based on the evaluation team's thorough reviews of program materials, market research, and interviews with program staff and market actors. The market model is entirely a creation of the evaluation team based on this initial research phase. The

[114] Among the IOUs, only PG&E does not offer the kicker incentives.

[115] Incentives are provided based on electricity savings and/or natural gas savings; development teams can receive incentives for both electric and natural gas savings, but are eligible for incentives based only on savings from the energy type provided by the IOU to that building, i.e., a building with PG&E electric service but not natural gas service would only be eligible for incentives based on electricity savings.

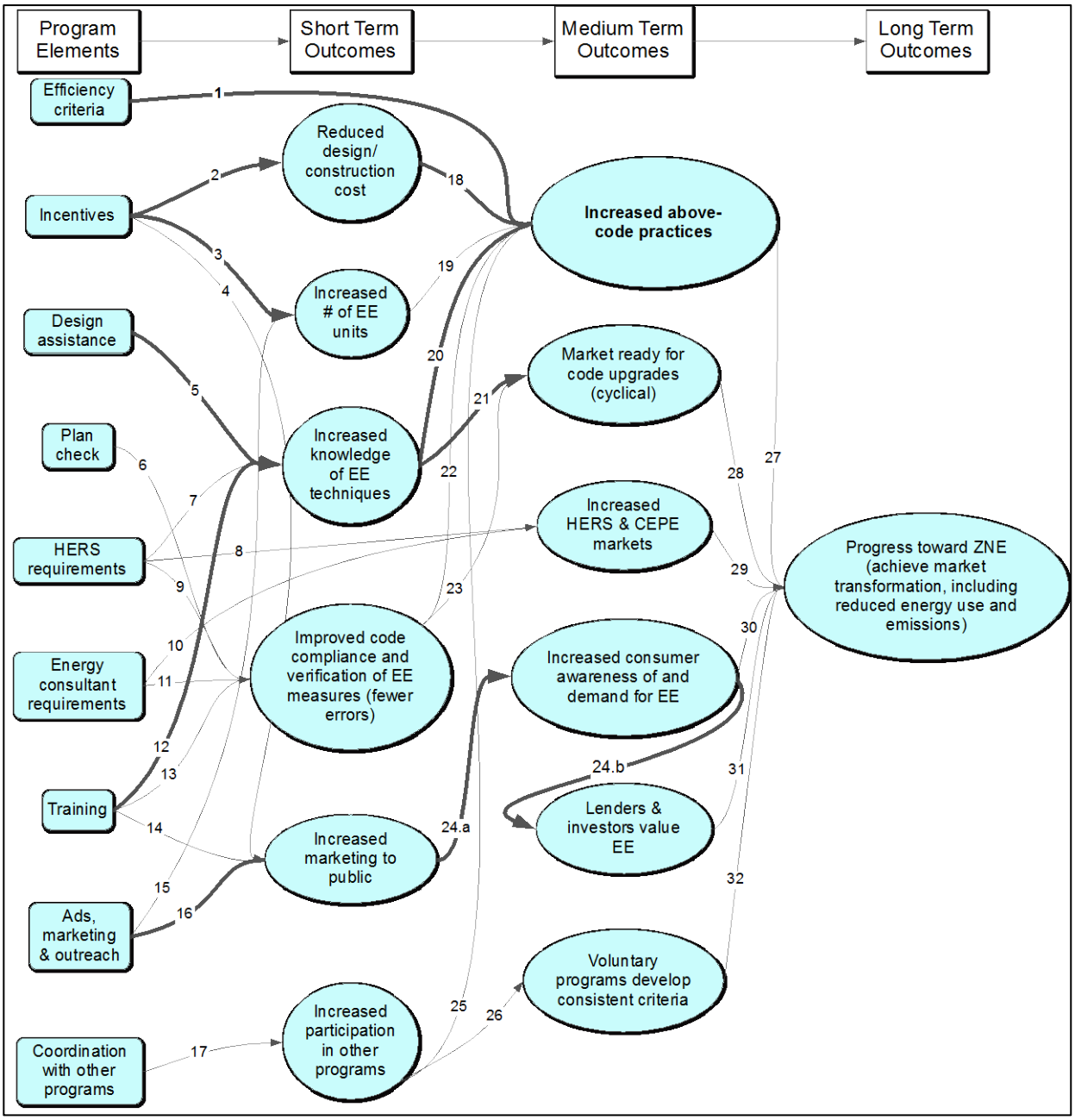
[116] SDG&E, for example, reported following an 80/20 rule. If at least 80% of a building was residential, it went through the residential program, and if at least 80% was commercial, the whole building went through the commercial SBD program; otherwise, the building would be split, with the residential portion and commercial portions going through residential and commercial programs, respectively.

program theory and logic model incorporate some of the views of the program implementers, but were altered and expanded based on the analysis and judgment of the evaluation team. As such, this program logic model does not perfectly coincide with the program theory as advanced in current program implementation plans, but instead attempts to identify a more exhaustive list of potential program outcomes pertaining to market effects. The outcomes and market transformation indicators are thus based on informed theory, but not yet tested.

On the left side of the diagram are the key elements of the utility programs. Branching out to the right side are the expected short-, medium-, and long-term outcomes of these program elements, as well as the connections between each intermediary step toward the long-term outcomes. The model thus moves from the specific program components to the broader, long-term effects on the market that the program is intended to achieve. A critical medium-term outcome in the model (indicated by its relatively large size) is the increase in above-code practices in the multifamily new construction market; program elements consistently point toward this outcome. The sole, long-term outcome of the program efforts would ultimately be progress toward California's goal of ZNE, which would indicate a market transformation and, of course, would be accompanied by reduced energy use and GHG emissions.

The remainder of this section discusses the program theory related to the program elements and their outcomes. Table 4-2 at the end of this discussion describes in greater detail the program theory shown in the logic model, identifying the links between program elements and outcomes, describing the relationship between these links, and identifying potential measurable indicators that could be used to measure market effects from the program elements.

Figure 4-1: IOU Program Model



*Key links from program elements to outcomes are shown in bold.

Figure 4-2 combines the market model with the program model, showing where the various elements of the IOUs' programs fit into the market. Thus, Figure 4-2 is a merging of the market model from Figure 3-1 (on the left) with the program model from Figure 4-1 (on the right). Using dotted lines, Figure 4-2 also shows the aspects of the market that the program elements are designed to affect. The dotted lines represent what the evaluation team hypothesizes to be the key program elements affecting the market: efficiency criteria; incentives; design assistance; training; and advertising, marketing, and outreach.

- Efficiency criteria: This is fundamental component of the IOUs' multifamily new construction programs. As developers build to these higher efficiency standards, manufacturers, and particularly distributors, may be encouraged to stock higher efficiency mechanical equipment, thereby leading to changes in practices even in non-program construction due to the increased availability of high efficiency equipment. These criteria are also important to the extent that they provide a set of consistent efficiency standards that other voluntary efficiency programs (LEED, ENERGY STAR, etc.) or municipalities (in the form of "reach code"[117]) might decide to adopt.
- Incentives: Incentives are a key program mechanism to overcome the barrier of increased costs of energy-efficiency equipment, design and construction costs, and the split-incentive barrier. By decreasing the extra cost for higher levels of efficiency, incentives can help leading to greater acceptance from builders and also increased economies of scale.
- Design assistance: Design assistance, particularly when combined with program-sponsored training and offered through ZNE pilot projects, serves an educational role for market actors, teaching them about—and demonstrating the feasibility of—more advanced building practices and the value of integrated design practices. This aids in overcoming barriers related to builder knowledge, information, or willingness to build efficiently.
- Training: The IOUs offer training opportunities to market actors to increase their ability to meet advanced building requirements cost-effectively. Training should result in increased energy-efficiency knowledge among market actors as well as improved designs and construction processes. Trainings that encourage marketing of energy efficiency can also lead developers to improve or increase their marketing of energy-efficient construction; effective marketing would ideally lead to increased consumer demand for more above-code construction.

[117] The IOUs' Reach Code Subprogram of the Codes and Standards Program contributes explicitly and directly to this adoption of consistent criteria. "IOUs have and will continue to promote regionally consistent ordinances where possible to reduce the duplication of efforts that results when individual government entities develop the language and technical supporting documentation independently." *Source: Southern California Gas Program, Program Implementation Plans: Statewide Programs, Appendix B.2, Section A, April 23, 2013, http://www.socalgas.com/regulatory/documents/A-12-07-003/Appendix%20B.2%20Section%20A%20Statewide%20Programs.pdf, accessed January 28, 2014.*

- Advertising, marketing, and outreach: The IOUs target their marketing efforts at increasing builder participation in the program. They also encourage developers to market efficiency to homebuyers, thereby increasing consumer awareness and demand for energy efficiency. If lenders and investors perceive a growing demand for energy-efficient construction, they may begin to value energy efficiency as an important characteristic of the buildings in which they invest.

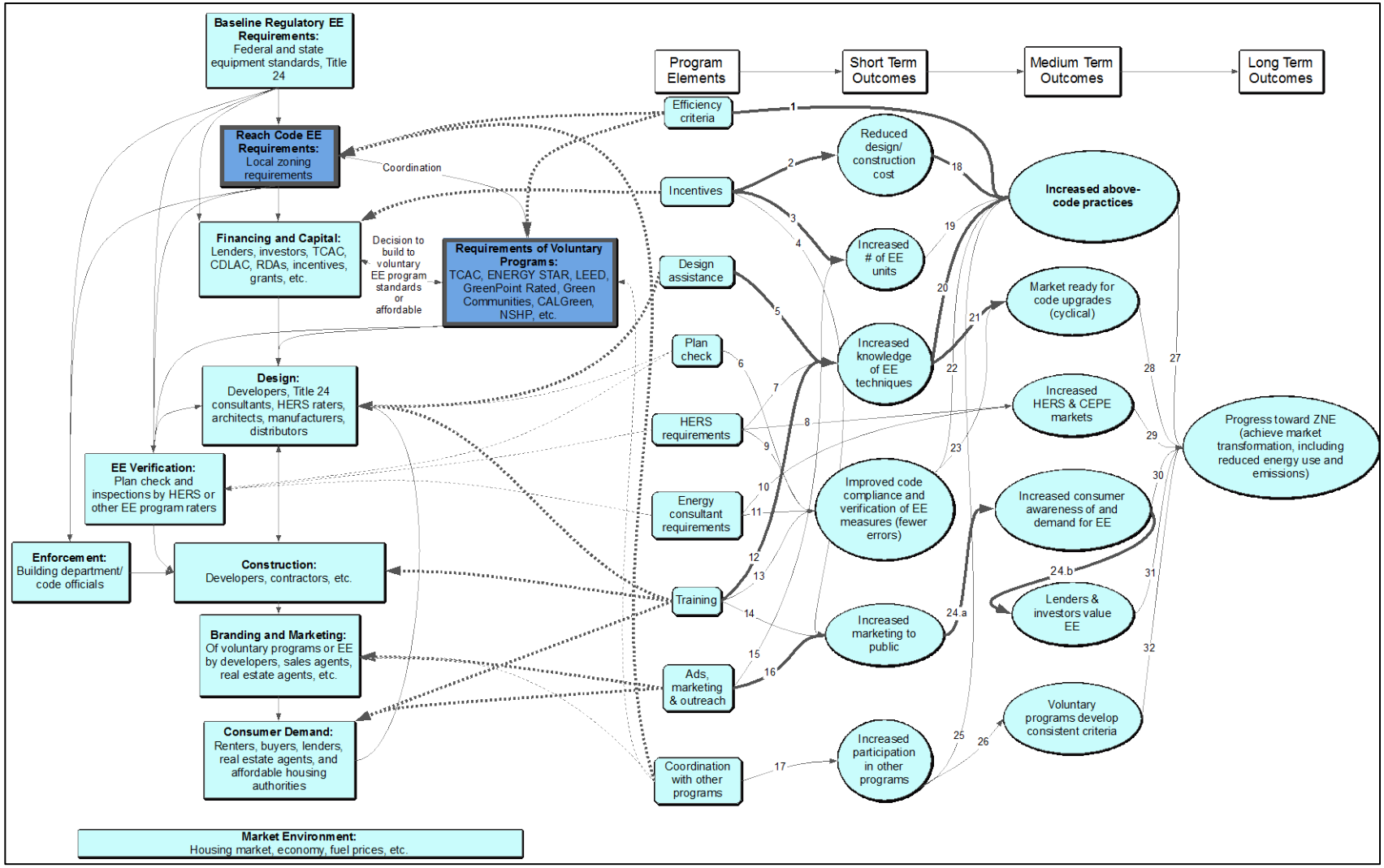
The remaining program elements can also affect the market:

- Plan Check: The additional check by IOU program staff should reduce modeling errors. The feedback on corrections also indirectly educates Title 24 consultants, thus contributing to improved code compliance and above-code practices.
- HERS Verification: Rigorous third-party HERS verification practices serve as an educational tool for developers and may lead to improved code compliance and above-code practices, in turn encouraging the use of integrated design practices by requiring developers to work closely with HERS raters. They could also increase the size of the HERS rater pool due to increased demand for their services.
- Energy Consultant requirements: The requirement of using Certified Energy Plans Examiners (CEPEs)[118] serves as an educational tool for developers. Because developers must work closely with these qualified individuals, it may promote the use of integrated design practices and may also encourage a strong market for CEPEs through this increased demand.
- Coordination with other voluntary programs: Builders who choose to work with the IOUs' new construction program may also participate in other voluntary programs in order to increase consumer appeal (through additional marketing opportunities for the various branded programs) or increase funding options for their projects, thereby leading to increased above-code practices.

The intended effects and outcomes of the program elements are discussed in more detail in section 4.2.1.

[118] Information on the CEPE certification is available at: http://www.cabec.org/cepeinformation.php.

Figure 4-2: IOU Program Model in Context of Market Model



*Key links from program elements to outcomes are shown in bold and key links to the market are shown with bold dotted lines.

4.2.1 Key Program Elements and Outcomes

The key program elements include efficiency criteria, incentives, design assistance, plan check, training of market actors, HERS verification, Title 24 energy consultant requirements, outreach and marketing, and coordination with other programs.

4.2.1.1 Efficiency Criteria

The fundamental component of the IOUs' multifamily new construction programs is the efficiency criteria set by the IOUs that require exceeding Title 24 code by at least 15% using a performance approach to calculate savings, rather than the prescriptive approach available to builders merely complying with Title 24. For the 2013 program year, PG&E increased the minimum performance threshold of eligible buildings to a 20% improvement over Title 24.[119] In 2011, PG&E identified[120] the following as common measures incorporated into participating multifamily buildings to reach the 15% performance threshold:

- High efficiency AC (SEER of 14.0 - 15.0 and EER of 11.99 - 12.72)
- Wall insulation: R-19 or R-21
- Windows (U-factor 0.32 - 0.35; SHGC 0.31 - 0.38)
- Radiant barrier in ceilings
- Water heaters with EF of 0.62 - 0.90
- Tankless water heaters (EF 0.82)
- Point-of-use water heaters
- Solar hot water systems
- Combined hydronic systems (heat and hot water)
- HERS verification: tight ducts and airflow
- Quality Insulation Installation (QII) credit

As developers build to these higher efficiency standards, manufacturers and particularly distributors may be encouraged to stock higher efficiency mechanical equipment, thus leading to changes in practices even in non-program construction due to the increased availability of high efficiency equipment.

4.2.1.2 Incentives

The IOUs offer incentives to help encourage and offset the cost of building more efficiently than Title 24 requires. Incentives are a key program mechanism to overcome the barrier of increased costs of energy-efficiency equipment as well as the split-incentive barrier, where builders who are divorced from utility costs feel less need to invest in more expensive efficiency measures.

[119] Program description available at: http://cmfnh.com/services/.

[120] PG&E's 2010-2012 Energy Efficiency Portfolio Local Program Implementation Plan - Third Party California New Homes Multifamily Program PGE2176, revised Feb. 28, 2011.

Incentives reduce design and construction costs and can increase the efficiency of units that are built as well as increase the number of energy-efficient units that are built.

4.2.1.2.1 IOUs Other than PG&E

Unlike other voluntary efficiency programs that have 15% better than Title 24 as a savings threshold, the programs utilize a sliding incentive scale to encourage builders to maximize efficiency and build beyond the 15% savings threshold rather than to target specific savings tiers. With this sliding scale, the actual rate of the incentive increases as the building demonstrates a greater percentage of savings beyond Title 24. The incentive rate increases linearly from 15% (or 20% in PG&E territory, as of 2013) to 45% savings, at which point the incentive rate plateaus. There are no efficiency "tiers" that tend to encourage buildings to cluster near the efficiency targets. The sliding incentive scale calculates incentives as dollars per energy unit saved (kW, kWh, or therms). The incentives offered to developers are consistent across IOUs, except for PG&E, which has a different incentive structure.

"Kicker" incentive bonuses for also meeting other criteria are available for builders through all of the programs except the PG&E program, which does not offer kicker incentives. During the 2010 to 2012 program cycle, the IOU programs (except for PG&E) offered the following kicker incentives:

- ENERGY STAR qualification: 10% bonus
- Build It Green or LEED certification: 10% bonus[121]
- Compact Home: 15% less square footage than LEED requirements: 15% bonus
- Installing solar PV panels: same $/kW as the sliding scale incentive, paid for each peak kW reduction due to PV system
- New Solar Homes Partnership (NSHP) Tier II: $200 per unit
    - Requires exceeding Title 24 by 30%, and requires solar PV on any incentivized units
- Conducting a design team charrette: 50% of cost up to $5,000
    - This was open to projects of at least ten units and was designed to encourage and offset the cost of integrated design processes. To qualify, the builder needed to hold a roundtable meeting with all the members of the development team (engineers, architect, energy consultant, etc.) and program staff.
- Thermostatic shower restriction valves and low-flow showerheads: $7 per valve, or $15 per installation of both measures

The kicker incentives changed considerably for the 2013 program year, as discussed below and shown in Table 4-1. [122] Several of the above incentives were removed entirely (green

[121] During the 2010 to 2012 program cycle, this was only open to Build It Green and LEED, but the program was open to working with other similar programs. This kicker was removed for the 2013 program cycle, however.

certification, compact home, and solar PV bonuses), and the ENERGY STAR bonus was changed from a 10% incentive bonus to $10 per unit to pay for marketing materials that would be used to increase the branding efforts of ENERGY STAR projects.

- ENERGY STAR qualification: $10 per unit to pay for marketing materials
  - A substantial change from the previous program cycle, which incentivized the cost of qualifying for ENERGY STAR rather than just helping with marketing materials
- Future code preparation: $200/unit
  - Requires exceeding Title 24 by 40%, plus meeting other criteria from future code cycles
- Thermostatic shower restriction valves and low-flow showerheads: $7 per valve, or $15 for installation of both
  - Continued from 2010 to 2012 program cycle
- New Solar Homes Partnership (NSHP) Tier II: $200 per unit
  - Requires exceeding Title 24 by 30%, and requires solar PV on any incentivized units
  - Continued from 2010 to 2012 program cycle

[122] The SCG 2013 Program Implementation Plan discusses these changes at page 200, available at: http://www.socalgas.com/regulatory/documents/A-12-07-003/Appendix%20B.2%20Section%20A%20Statewide%20Programs.pdf.

Table 4-1: Changes to IOU Kicker Incentives from 2010-2013 (Except for PG&E)

	Incentive Levels	
Kicker for:	**2010-2012**	**2013**
GreenPoint Rated or LEED certification	10% bonus	Cancelled
Compact homes (15% smaller than LEED standards)	15% bonus	Cancelled
Solar PV panels	Same $/kW as the sliding scale incentive, paid for each peak kW reduction due to PV system	Cancelled
Conducting a design team charrette	50% of cost up to $5,000	Cancelled
ENERGY STAR qualification	10% bonus	$10/unit for marketing materials
New Solar Homes Partnership (NSHP) Tier II (30% better than Title 24, plus solar PV)	$200/unit	No change
Thermostatic shower restriction valves and low-flow showerheads	$7/valve or $15/set	No change
Future code preparation (40% better than Title 24, plus other criteria)	N/A	New: $200/unit

4.2.1.2.2 PG&E Incentives[123]

PG&E uses a different incentive structure than the other IOUs. PG&E does not offer kicker incentives, and it provides incentives not only to the developer but also to the energy consultant. In PG&E territory, developers are not only paid a sliding scale incentive that increases based on energy savings over Title 24 (the rate is lower per energy of unit saved than the other IOUs), but they also receive a base incentive of $100 per unit and an additional $60 per unit for units requiring HERS verification (up to $12,000 per project are available for the HERS verification incentive). In addition, PG&E pays $50 per unit to the energy consultant used on the project (up to $10,000 per project).[124]

From 2010 through 2012, the PG&E program required at least 15% higher savings than Title 24, and this threshold increased to 20% for 2013,[125] which is beyond the level required by the other IOUs.

[123] Source: CMFNH 2010-2012 Policy and Procedures Manual, HMG.

[124] Source: CMFNH 2010-2012 Policy and Procedures Manual, HMG. P 19

[125] http://cmfnh.com/documents/CMFNH%20Program%20Handbook%20v2013_01.pdf

4.2.1.3 Design Assistance

The program may assist builders and their design teams, including Title 24 consultants and architects, with the energy-efficiency design of their projects by providing feedback on their project applications and suggestions for ways to improve the building's energy efficiency. PG&E specifically reports that it encourages "roundtable" meetings between all members of a developer team (builder, architect, HERS rater, energy consultant, engineer, contractor, etc.) and program staff to improve the energy efficiency of the design and construction processes. Such meetings may encourage integrated design practices, where all parties involved in the construction of a project are aware of the energy-efficiency goals.[126]

Design assistance, particularly when combined with program-sponsored training, serves an educational role for market actors, teaching them about—and demonstrating the feasibility of—more advanced building practices and the value of integrated design practices, thereby overcoming barriers related to builder knowledge or willingness to build efficiently. In this way, developer teams can also prepare for the next code cycle.

The IOUs operate ZNE pilots or program sub-elements to encourage developers to build at 45% more efficient than Title 24. Market actors reported that this may happen in the affordable housing market or possibly the high-end luxury market, where developers are looking to create positive press for their projects. The IOUs' use of ZNE program elements or pilot programs offers even more design assistance, encouraging builders to maximize energy savings and resulting in increased knowledge of advanced techniques among members of a developer's design and construction team.

4.2.1.4 Plan Check

Program staff review the plans, Title 24 compliance documents, and equipment specifications that the developer team submits as a part of the program application and identify errors that need to be corrected. The developer team must also update program staff on any construction changes that would affect Title 24 compliance or require modeling changes. One market actor praised the skill level of the programs' plan checkers as being "good at catching builders playing games."

Under Title 24, compliance forms are checked by local building inspectors and building officials, but the program provides an additional level of review by program staff focused on energy efficiency. This additional check should reduce modeling errors, and the feedback on corrections also indirectly educates Title 24 consultants.

4.2.1.5 HERS Requirements

Title 24 requires HERS verification only for some measures, such as measuring duct leakage, and there are additional compliance points available for Quality Insulation Installation (QII) verification. The IOUs, however, require third-party HERS raters to visually verify all of the

[126] http://cmfnh.com/documents/CMFNH%20Program%20Handbook%20v2013_01.pdf

energy-efficiency measures specified in the submitted Title 24 compliance documents, such as by conducting a visual inspection of insulation, window types, and mechanical equipment to ensure that they are the same as the materials specified in Title 24 documents submitted to program staff.[127] PG&E reports that IOUs require a minimum of two HERS rater inspections for every multifamily building before drywall and after the mechanical systems are installed.[128]

In addition, in PG&E territory, program staff re-inspects 5% of the multifamily units inspected by HERS raters as an additional quality control check. HERS raters' work is always subject to quality assurance reviews by their HERS providers, but PG&E program materials characterize these additional reviews as spot checks that provide an opportunity to identify and remedy any misunderstandings in a project, and if necessary, escalate unresolved issues by alerting the rater's HERS provider or the builder.[129]

Because high-rise buildings fall under commercial code and are not subject to the low-rise HERS requirements of Title 24, program staff report that they send out their own inspectors to perform the visual inspections for high-rise multifamily buildings, which otherwise would not be inspected by a third party other than as required by municipal building code or other voluntary efficiency programs.

These rigorous third-party HERS verification practices serve as an educational tool for developers and may lead to improved code compliance and above-code practices as well as encourage the use of integrated design practices by requiring developers to work closely with HERS raters. They could also increase the size of the HERS rater pool due to increased demand for their services.

4.2.1.6 Energy Consultant Requirements

Title 24 does not legally require a developer to hire a professionally credentialed or licensed energy consultant to fill out the Title 24 compliance forms that they submit to local building departments.[130] Similar to CTCAC requirements for affordable housing, the IOUs' multifamily new construction programs require developers to use a Certified Energy Plans Examiner (CEPE) [131] to prepare their Title 24 compliance forms. This energy consultant must be

[127] http://cmfnh.com/documents/CMFNH%20Program%20Handbook%20v2013_01.pdf;

http://www.californiaadvancedhomes.com/info-builders#8; also based on discussion with SCE program staff.

[128] http://cmfnh.com/documents/CMFNH%20Program%20Handbook%20v2013_01.pdf. p 19

[129] http://cmfnh.com/documents/CMFNH%20Program%20Handbook%20v2013_01.pdf. p 19

[130] Builders may commonly hire some form of licensed energy consultant to fill out this documentation, but they are not legally required to do so under Title 24.

[131] Developers can also use a Certified Energy Analyst, which has requirements including and beyond that of a CEPE. http://www.cabec.org/ceavscepe.php

credentialed to work on low-rise or high-rise buildings, as appropriate to the project. Other voluntary programs also have similar requirements for participation in their programs.[132]

Program staff reported that requiring Title 24 consultants to be certified as CEPEs resulted in higher quality Title 24 documents with fewer errors, thus requiring the IOUs to spend less time making corrections to building plans. The requirement of using CEPEs also serves as an educational tool for developers. Because developers must work closely with these qualified individuals, it may promote the use of integrated design practices and may also encourage a strong market for CEPEs through this increased demand.

4.2.1.7 Training

To varying extents, program staff reported that they offer trainings to developers and other market actors to increase their facility with working through the new construction program. The IOUs offer training opportunities to market actors to increase their ability to meet advanced building requirements cost-effectively and improve their ability to navigate the various building requirements in California, whether related to Title 24 or other voluntary efficiency criteria. As of 2013, IOUs plan to offer trainings to builders' sales agents to improve their ability to market energy efficiency to home buyers, thereby increasing consumer demand for and awareness of energy efficiency.[133] Program staff members also work on individual projects with the developers, energy consultants, mechanical engineers, or HERS raters to provide specific advice in the form of design assistance; this may be viewed as personalized training on energy-efficiency measures, particularly if the design assistance encourages the use of integrated design approaches to energy efficiency. To the extent that these trainings happen regularly and market actors actively participate in them, the trainings should result in increased energy-efficiency knowledge among market actors and improved designs and construction processes.[134] Knowledgeable market actors are also better able to comply with code, meet voluntary criteria, and carry this knowledge into future projects. Trainings that encourage marketing of energy efficiency can also lead developers to improve or increase their marketing of energy-efficient

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[132] In addition, the NSHP and use of the CEC's California Utility Allowance Calculator (CUAC) for determining the expected utility bills of an affordable housing unit also require a CEPE to fill out all Title 24 compliance documents. Discussed in the HMG multifamily guidebook, available at: http://cmfnh.com/documents/CMFNH%20Multifamily%20Guidebook%20v2010_01.pdf.

[133] 2013 SCG PIP, p. 216.

[134] On this point, an affordable housing developer said: "I don't know how much education they [the IOUs] do. I'm trying to think of when I've been to an IOU seminar. The California Center of Sustainable energy has done some great education, and it may have been financed by the IOUs. The SDGE [training] wasn't as effective. We don't go to them, but they do a lot of training of HERS raters and installers, and I think that is very important. I've had subcontractors go south on me and say they can't perform to that level. If we want the California building code to stick --- HERS raters do testing of just some units, but the IOU programs in some cases like the QII programs check every single unit, so you can't hide. They check everything and they can see more systematic issues, and they train them how to do that work. That is breaking down a big barrier. We have to find a way to train people how to do this high level of work, and it can't all be on the nickel of the subcontractor. If we're going to have high standards, we need to find a way to cost effectively train people in the workforce."

construction; effective marketing would ideally lead to increased consumer demand for more above-code construction.

4.2.1.8 Advertising, Marketing, and Outreach

The IOUs use a variety of advertising and outreach mechanisms to encourage builder participation in their programs, including public relations campaigns targeted at market actors, direct and electronic mail, trade advertisements, attendance at trade shows, and so forth. Marketing and outreach activities may be targeted most often at market-rate builders because affordable housing developers would commonly work through the program and have established relationships with program staff. One affordable housing developer in particular reported having a close and fruitful working relationship with IOU staff, saying that his firm had less need for program marketing because he was in frequent contact with IOU staff about program opportunities, but that this is likely not always the case with developers in the market-rate sector.[135]

While the IOUs target their marketing efforts at increasing builder participation in the program, they also encourage developers to market efficiency to homebuyers, thereby increasing consumer awareness and demand for energy efficiency. As discussed in section 4.2.1.2 above, the ENERGY STAR marketing incentives available through the program can encourage builders to market the ENERGY STAR brand, and trainings (discussed in section 4.2.1.7 above) offered to builders' sales agents could encourage them to promote the energy-efficiency features of higher efficiency homes. If lenders and investors perceive a growing demand for energy-efficient construction, they may begin to value energy efficiency as an important characteristic of the buildings in which they invest. Interviewed market actors consistently reported that lenders have a huge amount of power to shift the market should they see that consumers are demanding energy efficiency, and that energy-efficient buildings can allow for greater debt service through higher rents or sales prices.

4.2.1.9 Coordination with Other Voluntary Programs

The IOUs also assist program applicants with working through other voluntary programs—for example, there is a kicker incentive to help pay for ENERGY STAR marketing materials (outside of PG&E territory), and the IOUs assist with participation in NSHP. Because many of the voluntary programs require achieving at least 15% energy savings beyond Title 24, participating in multiple voluntary programs may be appealing to builders, particularly if they are

[135] The affordable housing developer said: "We've had a long term relationship with them [IOU staff], and we see them at events, annual conferences, etc. I'd say they have to do a lot of marketing, particularly for the market-rate community because they really have to sell this as something that they can do. It's more of an equal partnership for low-income. I know the folks [at the IOUs] really well in our case. We just call them up and know how to work with them. We already have that relationship, so they don't need to market hard to us. They have come to us about new programs, but I think they have to do a lot of marketing for the rest of the real estate market, and we're really a niche market."

interested in increasing the marketability or desirability of a project to occupants or potential investors.

The requirements of many other voluntary energy-efficiency programs in California—such as ENERGY STAR, LEED, GreenPoint Rated, and CTCAC affordable housing—require their own participants to at least match the IOU programs' minimum savings requirement of 15% above Title 24 (excepting PG&E's 2013 change to 20%). The NSHP also encourages cross-participation in the IOUs' new construction programs.[136] IOU staff reported that these different efficiency programs tend to establish similar efficiency requirements so as to allow their participants to access IOU incentive money. One interviewed consultant reported, "CTCAC couldn't have put in those regulations requiring high-level efficiencies if not for the program. They wouldn't have done it. The CPUC also thinks that the IOUs shouldn't get savings credits for projects that go through CTCAC because CTCAC has those standards. But if the IOU program wasn't there to cover those costs, CTCAC would not have that requirement. It wouldn't be there."

Builders who choose to work with the IOUs' new construction program may also participate in other voluntary programs to increase consumer appeal (through additional marketing opportunities for the various branded programs) or increase funding options for their projects, thereby leading to increased above-code practices. A respondent from the CTCAC reported that he suspected that, in the absence of the IOUs' programs, market-rate builders would continue to build at these levels only to the extent that they participate in other voluntary programs or build in localities with reach codes.

4.2.2 Program Logic Model Theory with Links and Indicators

Table 4-2 describes the program theory represented graphically in the logic model (Figure 4-1). It identifies the links between program elements and outcomes, describes the relationship between these links, and identifies potential measurable indicators that could be used to measure market effects from the program elements. It is important to recognize that attribution can be difficult in a complex market environment, particularly when the program is not the sole market intervention. We hypothesize that evidence that short-term outcomes have occurred could emerge in as little as one to three years while evidence of medium-term outcomes will take longer, perhaps three to five years, and evidence of long-term outcomes could take six years or longer.

We recommend that the CPUC consider tracking the short-term and medium term outcomes that rely on market-actor self-reports on an ongoing basis. We recommend conducting interviews or surveys during the construction process or as soon after completion as possible in order to assess the influence of the program and other factors on key decision-making in regard to the energy

[136] NSHP 2013 Guidebook, 6th edition, available at http://www.energy.ca.gov/2013publications/CEC-300-2013-009/CEC-300-2013-009-ED6-CMF.pdf.

efficiency of the project. Further, we suggest conducting follow-up on-site visits and an assessment of building conditions in a few years, perhaps in 2017, on projects started in 2015 and 2016. This would capture MFNC projects designed and built several years after the 2010-2012 program cycle, which should provide enough time to begin to detect early market effects, while also allowing enough time to provide feedback to program staff in order to modify the program if the market is not on target to reach ZNE by 2020.

Table 4-2: Program Logic Model Links, Theory, and Indicators, by Program Element (Key Elements in Bold)

Link #	Program Theory	Measurable Indicator	Timing of Data Collection
Program Element: Efficiency Criteria			
1	**Efficiency criteria results in increased above-code practices (and increased availability of energy-efficiency equipment).**	**On-site inspections confirm increased above-code practices in non-program homes.**	**Every three to four years**
		Increased stock/availability of high efficiency equipment reported by market actors.	**Ongoing**
Program Element: Incentives			
2	**Incentives decrease the upfront cost of building efficiently.**	**Builders and other market actors report that incentives lower the incremental costs for energy-efficient design and construction.**	**Ongoing**
3	**Incentives decrease the upfront cost of building efficiently, allowing an increased number of energy-efficient units to be built than would be otherwise.**	**Developers report that they would not be able to build the same quantity without IOU funding.**	**Ongoing**
4	IOU incentives (except for PG&E) result in increased ENERGY STAR marketing.	Developers report that they increase ENERGY STAR marketing due to kicker incentives.	Ongoing
Program Element: Design Assistance			
5	**Design assistance by the IOUs (including ZNE projects and integrated design practices) increases knowledge of various market actors by learning from other members of design team.**	**Market actors report that they learned from the IOUs' design assistance offerings, including the value of integrated design.**	**Ongoing**

Link #	Program Theory	Measurable Indicator	Timing of Data Collection
Program Element: Plan Check			
6	Program plan check results in improved designs with fewer errors for both compliance with Title 24 and above-code program requirements.	Program staff or Title 24 consultants report that program plan check catches modeling errors that would not be corrected otherwise.	Ongoing if possible, or every three to four years
		Title 24 consultants report that they learned from plan reviews and improved their modeling practices, particularly in non-program projects.	Ongoing if possible, or every three to four years
		Building inspectors report that Title 24 compliance documents submitted by consultants who have worked with the program have lower error rates than standard submissions.	Ongoing if possible, or every three to four years
Program Element: HERS Requirements			
7	HERS inspections educate builders or other members of design team, including contractors, about proper installation practices.	Builders, contractors, or Title 24 consultants report that they have learned from the HERS inspectors.	Ongoing
		Builders/contractors report improved installation of measures inspected by HERS raters in non-program projects.	Ongoing if possible, but likely only every three to four years
		HERS raters report higher quality installation of inspected measures in program projects than non-program projects.	Ongoing if possible, but likely only every three to four years
8	The program creates a demand for HERS raters, expanding the HERS rater market (likely a medium-term outcome, to give market time to adjust).	HERS raters or other market actors report an increase in supply of HERS raters due to program.	Every three to four years
		HERS certification data from RESNET indicate an increase in supply of HERS raters.	Every three to four years
9	HERS inspections confirm that EE measures selected in the design phase are installed (and installed correctly), thereby improving compliance with code and above-code program requirements.	HERS raters report that they find that installed measures meet Title 24, program, or manufacturer standards.	Ongoing
		On-sites. (See link 1.)	

Link #	Program Theory	Measurable Indicator	Timing of Data Collection
Program Element: Energy Consultant Requirements			
10	The program creates a demand for licensed CEPEs and CEAs, expanding the market for them (likely a medium-term outcome, to give market time to adjust).	Energy consultants or other market actors report an increase in demand or supply for licensed energy consultants.	Every three to four years
		CEPE certification data from CABEC indicate an increase in supply of licensed CEPE consultants.	Every three to four years
11	The use of licensed CEPEs increases code compliance because they have a better understanding of Title 24 than non-licensed consultants.	On-sites. (See link 1.)	
		Market actors report that licensed consultants produce higher quality Title 24 documents with fewer errors than their non-certified counterparts.	Ongoing if possible, but likely only every three to four years
		Program-participating market actors report that they have learned more from CEPE-certified consultants than non-CEPE consultants about topics including integrated design, and they choose to work with the former.	Ongoing
Program Element: Training			
12	**Trainings in their various forms increase the knowledge of market actors—including developers, contractors, HERS raters, energy consultants, architects, and developers' sales agents—on EE building practices and integrated design.**	**Market actors report that they participated in and learned considerably from trainings.**	**Ongoing**
13	Trained builder teams better able to meet code and above-code requirements.	Market actors report that they are better able to meet code and above-code requirements because of training.	Ongoing (collect at time of trainings)
14	Training of developers' sales agents results in increased marketing of EE to homebuyers and the public.	Homebuyers report hearing about EE from developers' sales agents.	Every three to four years
Program Element: Advertising, Marketing, and Outreach			
15	Program outreach to builders encourages increased builder participation in the programs and construction of more units.	Builders report that they learned of the program through advertising or outreach from the program, and it encouraged them to build more units.	Ongoing if possible, but likely only every three to four years

Link #	Program Theory	Measurable Indicator	Timing of Data Collection
16	**Program support of marketing efforts by participating builders and contractors increases the marketing of energy efficiency to the public.**	**Builders report increasing their marketing of energy efficiency.**	**Ongoing**
Program Element: Coordination with Other Voluntary Programs			
17	Program efforts lead to increased participation in other voluntary programs.	Other programs report that their participation rates would decline with decreased IOU program efforts, and that projects come to them from IOUs.	Every three to four years, or time with code or program cycle changes
		Builders report that IOUs tell them about other available programs.	Ongoing if possible, or every three to four years

Link #	Program Theory	Measurable Indicator	Timing of Data Collection
Intermediate/Medium-Term Outcomes			
A number of intermediate outcomes develop from short-term outcomes and program elements. A key outcome of the program is the increased use of above-code or energy-efficient practices, which is directly tied to and dependent on the accompanying increase in supply of energy-efficient measures resulting from suppliers stocking these products in accordance with demand. Also, educated developer teams that have learned from their experiences with the program are better prepared for future code upgrades, thereby resulting in higher compliance at the beginning of code cycles. As the program requires developers to use certified HERS raters and CEPEs, this could potentially lead to an increased market for these energy-efficiency professionals due to demand from program projects or developers who have come to value their services. Another key intermediate outcome is the potential for increased consumer demand for energy efficiency, to the extent that developers are able to communicate its value based on their increased awareness of their program experiences and training. When consumers demand efficient construction, lenders should respond commensurately and offer increased financing opportunities for the developers and purchasers of energy-efficient construction			
8	Previously identified medium-term outcome of program's HERS requirements increasing HERS rater market.	See link 8.	
10	Previously identified medium-term outcome of program's CEPE requirements increasing CEPE market.	See link 10.	
18	**Reduced design and construction costs lead to increased above-code practices among participating and non-participating builders and developers.**	**On-sites. (See link 1.)**	
		Participating and non-participating builders report decreasing incremental costs of energy-efficient technologies and practices as a factor encouraging their use.	**Ongoing**
19	More developers building an increased number of EE units results in increased above-code practices among participating builders and developers.	See link 3.	
20	**Increased market actor awareness of EE techniques (including integrated design) leads to an increase in above-code practices.**	**On-sites. (See link 1.)**	
		Market actors report that increased awareness of EE practices (including integrated design) from program efforts has changed practices in non-program homes.	**Ongoing**
21	**Increased knowledge of EE techniques among market actors leads to a market readiness for coming code upgrades. (Cyclical process—code cycles are 3 years.)**	**On-sites. (See link 1.)**[137]	
		Market actors are aware of and ready for coming code changes as a result of the program.	**Up to one year before every code cycle change**

[137] In addition: if next-code cycle standards are available before the effective date, on-sites show that buildings are being built to meet next-code cycle standards.

Link #	Program Theory	Measurable Indicator	Timing of Data Collection
22	Projects move forward with high code compliance, more verification of EE, and fewer modeling errors, leading to increased above-code practices and energy savings.	Developers report that these higher compliance and verification standards influence their practices in non-program projects.	Ongoing
		Developers report that it is easier to build projects that are above code due to IOU compliance and verification standards.	Ongoing if possible, but likely only every three to four years
23	Developer teams become accustomed to stringent compliance and verification practices, contributing to readiness for code upgrade.	Building inspectors report buildings are being built above current code standards and are able to meet anticipated next code cycle standards before or at the time of code adoption.	Every three to four years
		On-sites. (See link 1.)	
24.a	**The increased marketing for energy efficiency and energy-efficient construction encouraged by the program results in increased consumer demand for energy-efficient construction.**	**Home buyers and renters report increased importance of energy efficiency as an important feature and report hearing about it from marketing by the program, builders, and developers.**	**Every three to four years**
		Builders and developers report increasing homebuyer and renter demand for energy efficiency, encouraging builders to increase their adoption of above-code practices.	**Ongoing**
24.b	**Lenders and investors increasingly value EE based on response to increase consumer demand for EE.**	**Lenders and investors require EE measures/criteria in the projects in which they invest.**	**Every three to four years**
		Lenders to homebuyers increasingly offer and market EE mortgage products.	**Every three to four years**
25	Increased participation in "green" voluntary programs leads to above-code practices in and outside of IOU program.	Increases in participation with voluntary efficiency programs.	Annual tracking if possible, or at least every three to four years
26	With increased participation in various "green" building programs, these programs adopt consistent energy-efficiency criteria.	Staff from other efficiency programs report that their efficiency criteria are designed to match up to the criteria of the IOUs' program, and that they plan to continue adjusting program criteria to stay in sync.	Every three to four years, or time with code or program cycle changes

Link #	Program Theory	Measurable Indicator	Timing of Data Collection
Long-Term Outcomes			
The ultimate long-term outcome is a transformed market whereby the industry makes progress toward California's ZNE goals, saving energy and reducing emissions outside of the scope of the program, and these practices and conditions are sustained without need for the program intervention.			
27	Building practices become more advanced, and projects move closer to ZNE status.	On-sites. (See link 1.)	
		Improved practices in non-program projects. (See link 20.)	
28	Code cycles move toward ZNE.	Consistently high compliance rates at the beginning of code cycles.	Up to one year after every code cycle change
		Readiness for next code cycle. (See links 21 and 23.)	
29	Strong market of HERS raters and CEPEs are part of all/most construction projects, and encourage ZNE practices.	HERS raters and CEPEs are used regardless of project type.	Every three to four years
30	Consumers demand advanced EE without program intervention, and demonstrate demand for ZNE.	Consumers demand EE in the absence of program marketing efforts.	Every three to four years
		See link 24.a.	
31	Lenders and investors value EE independently of the program and support move toward ZNE.	Lenders and investors promote energy-efficient practices in construction, encourage homebuyers to demand it, and offer EE mortgage products.	Every three to four years
32	Voluntary efficiency programs standardize EE requirements, thus removing fractured and conflicting standards, and move toward ZNE.	Market actors (developers, suppliers, manufacturers, consultants, etc.) report that consistent EE requirements lead to wider participation in voluntary programs and adoption of above-code practices.	Ongoing for developers, otherwise every three to four years
		Increased cross-program participation. (See link 17.)	

4.2.3 Assessing Attribution

In terms of assessing attribution, we recommend adopting a theory-based approach that focuses on whether an outcome posited by the program theory has in fact occurred, and if so, then attempting to determine whether the outcome can be linked to IOU program activities, based on the preponderance of evidence.[138] Attribution of market effects to the New Construction program will rely on observed changes in building practices as posited by the program and market theories and self-reported attribution of program impacts on the observed changes by key market

[138] A preponderance-of-evidence approach involves drawing a conclusion that a fact or occurrence is more probable than not based on weighing all available evidence.

actors. Attribution of program impacts could also be estimated with a Delphi panel of experts who would use data on observed changes in building practices and the self-reports by market actors to develop attribution factors.

The evaluation team does not propose including a comparison area because of three key factors that make the California residential new construction market unique and not readily comparable to control areas: (1) California's multiple and varied climate zones; (2) California's distinctive and continually changing state building codes; (3) California's long-standing new construction programs, which have become an integral part of the market. New construction in California is not readily comparable enough to new construction in any other area—or even a combination of areas—to allow valid comparisons. For example, a recent evaluation of California IOUs' benchmarking initiatives found that concerns about the lack of comparability between California commercial buildings and buildings nationally was a limitation to using ENERGY STAR Portfolio Manager for benchmarking California buildings; and this was an important driver for the development of California-specific benchmarking tools.[139] Moreover, the cost of doing on-site assessments just in California is very expensive; conducting such on-site assessments out of state could be prohibitively expensive.

[139] NMR Group, Inc. and Optimal Energy, Inc. "Statewide Benchmarking Process Evaluation" April, 2012.Submitted to the California Public Utility Commission. Study ID CPU0055.01. Accessed April 23, 2014. http://www.calmac.org/publications/Statewide_Benchmarking_Process_Evaluation_Report_CPU0055.pdf

5 Multifamily New Construction Market Characterization

In this section of the report, we present the findings from our analysis of secondary data on multifamily new construction (MFNC) starts and permits. We reviewed three types of secondary data: (1) project-level new construction starts data, (2) city-level permit data, and (3) "green" project new construction data (including IOU program data). We also conducted a survey with builders and developers to corroborate new construction starts data and lend additional insight into the market.

5.1 Methodology

In our analysis of the secondary data, we examined the project data on the following parameters:

- Income category (low-income vs. market-rate)
- Building rise (high-rise vs. low-rise)[140]
- Number of units per project
- Project size (square feet)
- Number of buildings per project
- Service providers
- Climate zones and regions
- Metropolitan Statistical Areas (MSAs)
- Local energy ordinances (reach codes)
- Low income tax credit awards (California Tax Credit Allocation Committee awardees)
- Builder and developer activity

We report the key summary tables and figures in the body of the report and present more detailed cross tabulations in the Appendices.

The parameters in the data we received varied by source. As a result, we needed to adapt and vary the methods used to analyze data from each source. Table 5-1 outlines the data sources, a description of the parameters they included, and how we analyzed the data.

[140] Following the approach of the California Advanced Home Program, the Multi-family New Homes Program, and the Savings by Design sub-program, we identify buildings with one to three habitable stories as low-rise buildings and buildings with four or more habitable stories as high-rise buildings.

Table 5-1: Data Source and Analysis Approach

Source	Data Description		Analysis	
	Data Description	Time Period	Parameters	Memo Section
McGraw Hill (MHC) New Construction Project List *(Purchased)**	Project-level data including project start date, project description, rise, number of units and buildings, project square area, address, and developers/owners/designers	2010 - 2012	Number of projects, income, rise, number of units and buildings, square area, service provider, climate, metro-statistical designation, and local energy ordinance	New Construction Starts
California Tax Credit Allocation Committee (CTCAC)Awardee Lists *(Downloaded from organization website)**	Project-level data including project award year, number of units, city, and developers/owners	2009 - 2011		
Survey of Builders, MHC and CTCAC lists	Respondent confirmed or provided missing details about one of the projects associated with the respondent, other projects, largest other project and future projects	2010 to 2015	Number of projects, timing, building standards and efficiency, ownership, management, financing, and future projects	New Construction Starts – Survey Results
Construction Industry Research Board (CIRB) Permit Data *(Purchased)*	State-level data including number of units by building type and year issued	1993 - 2009	Number of units and building type	New Construction Permits
	City-level data including number of units by building type and year issued	2010 - 2012	Number of units, building type, metro-statistical designation, and local energy ordinance	
IOU CAHP/CMFNH and SBD Program Participation Data *(IOUs provided)*	SDG&E program participant project-level data including project start date, project description, rise, number of units and buildings, project square area, address, and developers/owners/designers	2010 - 2012	Number of projects, income, rise, number of units and buildings, square area, service provider, climate, metro-statistical designation, and local energy ordinance	"Green" Project New Construction
	SCG program participant project-level data including project start date, project description, rise, number of units and buildings, project square area, address, and developers/owners/designers			
	SCE program participant measure-level data including measure installation date, project description, rise, number of units and buildings, project square area, address, and developers/owners			
	PG&E program participant project-level data including project start date, project description, rise, income, number of units and buildings, project square area, address, and developers/owners/designers			

Source	Data Description		Analysis	
	Data Description	Time Period	Parameters	Memo Section
U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED) Project Directory *(Downloaded from organization website)*	Project-level data including program registration date, project description, project square area, address, and owner type	2002 - 2012	Number of projects, service provider, climate, metro-statistical designation, and local energy ordinance	
Build It Green's GreenPoint Rated (GPR) Initially Approved Project Application List *(Organization provided)*	Project-level data including initial program approval date and number of units; summary data of project income category	2010 - 2012	Number of projects and units, and income category	

* In August 2013, the evaluation team conducted 76 telephone surveys with builders and developers involved with at least one of the 663 projects found in MHC and CTCAC (MHC-CTCAC) data set. The survey asked each respondent to confirm or provide missing details about one of the projects associated with the respondent. We used their responses to update the MHC, CTCAC, and IOU participation data set.

5.2 New Construction Permits Data

The California Home Building Foundation's Construction Industry Research Board (CIRB) collects and publishes data cataloguing the number of permits drawn for conducting residential new construction. The research team analyzed two primary sources of CIRB data:

- High-level statewide data counting the number of units permitted for single-family, two-unit, three- to four-unit, and five- or more-unit residences from 1993 to 2012; and
- California city-level data counting the number of units permitted for multifamily homes (buildings with three or more units) from 2010 through 2012.

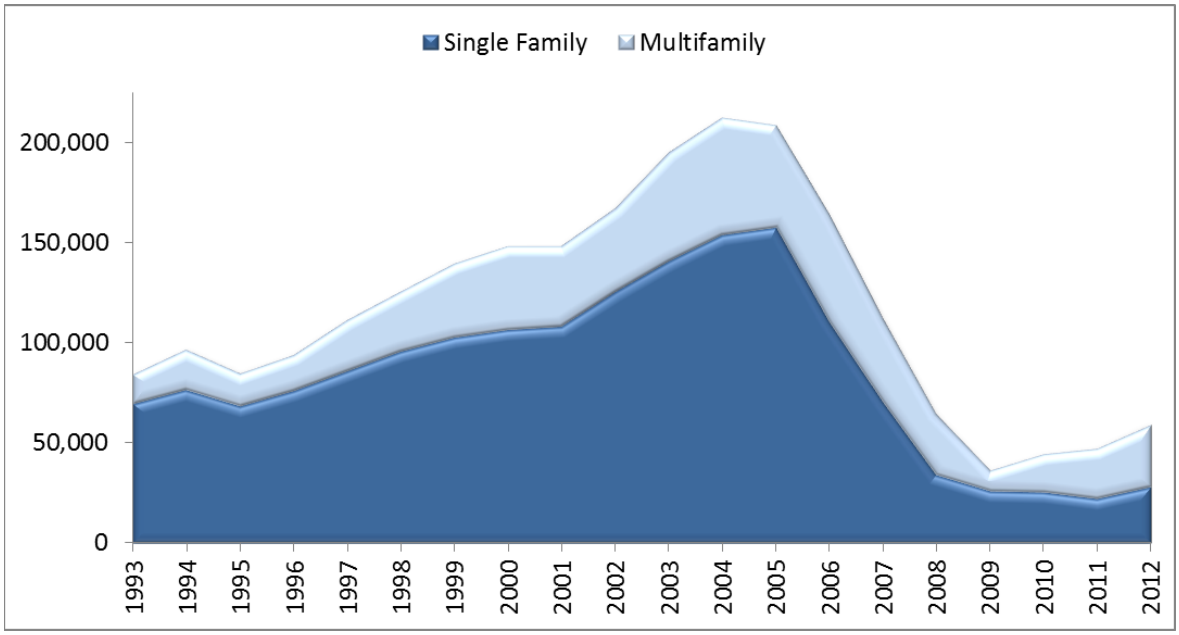
5.2.1 Number of Units

Between 1993 and 2012, California single-family and multifamily home unit permits reached a high of 212,960 units in 2004 and a low of 36,421 units in 2009 (Figure 5-1). The number of housing permits declined substantially between 2005 and 2009 due to the housing crisis and recession of 2007 to 2009. Permits have slowly recovered during the 2010 to 2012 period, though the numbers of units permitted have not rebounded to the levels reached between 1993 and 2008.[141] The multifamily market has recovered more quickly than the single-family home market; multifamily permits represented 52% of the permits issued in 2012, while they represented an average of 28% of the permits issued from 1993 to 2008. Overall, 74,585 multifamily units were permitted from 2010 through 2012.

[141] We included single family permit data to provide greater context for changes in the multifamily market, illustrating the ways the MFNC market has changed in ways that are unique from the broader residential new construction market and/or offering explanations for the MFNC market in relation to the broader residential new construction market.

Figure 5-1 illustrates the number of units permitted from 1993 to 2012 by building type.

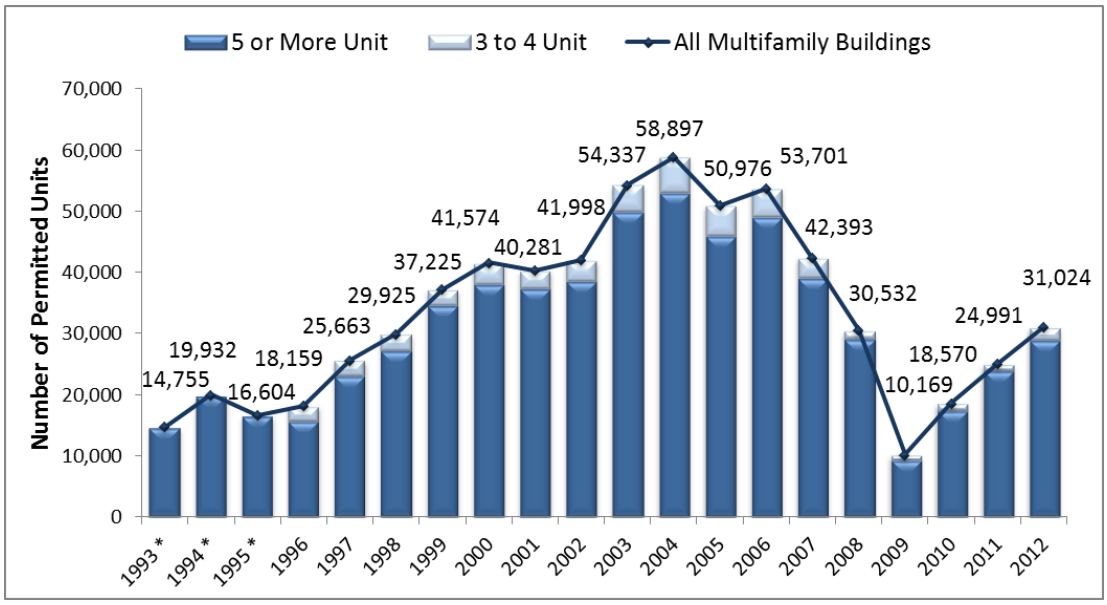
Figure 5-1: Permitted Units by Building Type by Year (1993-2012)



Sources: (1) California Home Building Foundation (CHF), Construction Industry Research Board (CIRB), Annual Building Permit Summaries, California Cities and Counties Data for Calendar Years 2010, 2011, and 2012; (2) CHF, CIRB, Annual Building Permit Summaries for 1993-2009, *NMR Group, Inc., Statewide Unit Report 1993-2009.xls*, Received July 2013.

Figure 5-2 shows the number of multifamily units permitted from 1993 to 2012 by building type. Between 1993 and 2012, California multifamily home unit permits reached a high of 58,897 units in 2004 and a low of 10,169 units in 2009. The number of units permitted declined steadily from 2006 to 2009 during the housing crisis and has increased steadily during the 2010-2012 period. The most substantial cross-year change for all building types occurred among buildings with three to four units from 2011 to 2012, increasing by 96% from 1,067 units in 2011 to 2,096 units in 2012. The second steepest change was among buildings with five or more units from 2008 to 2009, decreasing by 68% from 29,116 units in 2008 to 9,336 units in 2009. As mentioned above, decreases in 2009 are not surprising given the economic crisis. In fact, from 2008 to 2009 the total number of unit permits among all building types (including both single-family and multifamily) decreased by 44%, representing the most substantial cumulative cross-year change over the 20-year period. Table B-6-24 in Appendix B presents annual building unit permit counts by all four building types and the corresponding percentage change from the previous year.

Figure 5-2: Multifamily Permitted Units by Building Type by Year (1993-2012)

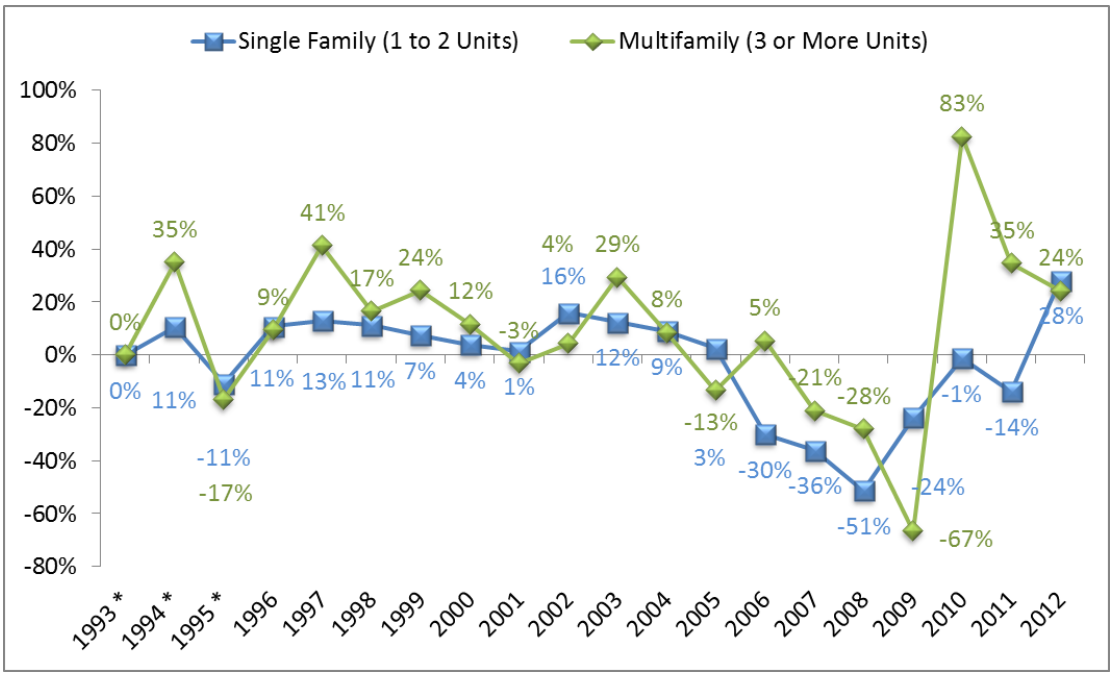


Source: CHF, CIRB, Annual Building Permit Summaries.

* CIRB data did not identify the number of units in non-single family buildings prior to 1995. The *5+ Unit*-category in the chart includes permits in buildings with two to four units from 1993 to 1995 but disaggregates them in all other years. Given that two-unit and three to four-unit building permits comprise such small percentages of all building permits (cumulatively 5% or less in all other years), we estimate that this does not substantially misrepresent the figures from 1993 to 1995.

Figure 5-3 compares annual percentage changes between one- to two-unit and multifamily (three- or more-unit) building permits from 1993 to 2012. In general, multifamily permit counts exhibited larger year-to-year changes than did single-family permit counts. Additionally, multifamily permits rebounded more quickly and more intensely after 2009 (increasing by 83% in 2010), whereas single-family building permits did not begin to increase in permit counts until 2012 and did so more weakly (+18% from 2011).

Figure 5-3: Permitted Units by Building Type by Time Period, Percentage Change (1993-2012)

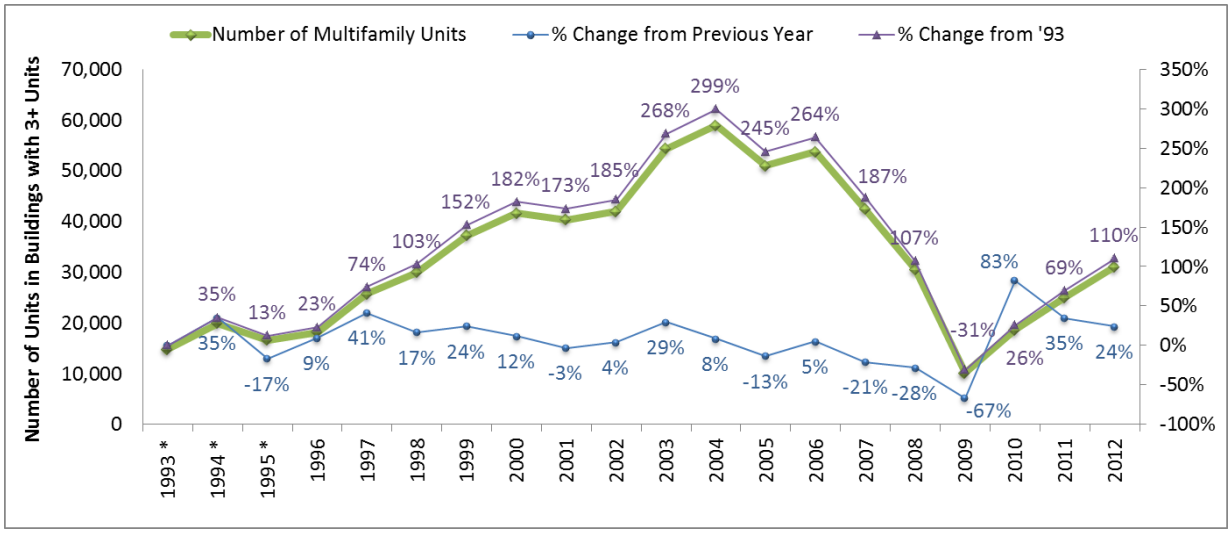


Source: CHF, CIRB, Annual Building Permit Summaries.

* CIRB data did not identify the number of units in non-single family buildings prior to 1995. As a result 1993 through 1995 figures include two-unit building unit permits as multifamily permits, but all other years include two-unit building permits in single-family unit counts. Given that two-unit buildings comprise such small percentages of unit permits (2% or less in all other years), we estimate that this does not substantially misrepresent the figures from 1993 to 1995.

Figure 5-4 charts annual year-to-year percentage changes in the number of multifamily building (buildings with three or more units) unit permits from 1993 to 2012 and annual percentage changes from 1993 as a baseline. On the whole, multifamily unit permit counts steadily increased from 1993 to 2004. By 2004, they had increased to nearly four times 1993 counts (+299%). Multifamily unit permit counts then began to decrease sharply in 2007—decreasing by 21% from 2006 counts—until bottoming out in 2009. From 2010 through 2012, the number of multifamily permits began a rapid rebound: the 2009 multifamily unit permit counts had decreased by 31% from 1993, but by 2012 they had more than doubled 1993 counts (+110%).

Figure 5-4: Multifamily Permitted Units by Building Type by Time Period, Percentage Change (1993-2012)



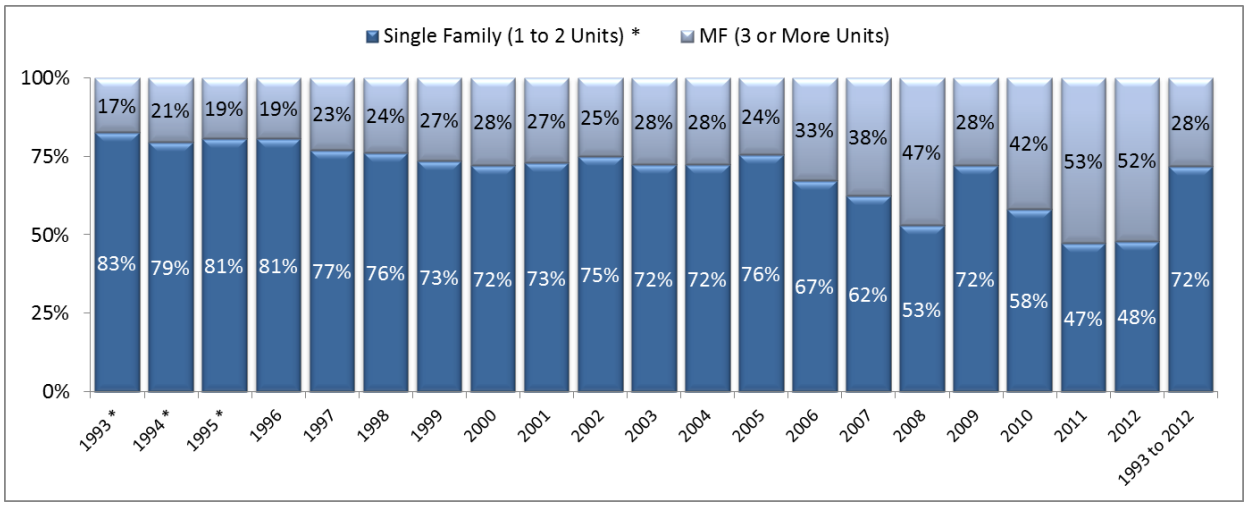
Source: CHF, CIRB, Annual Building Permit Summaries.

* CIRB data did not identify the number of units in non-single family buildings prior to 1995. As a result 1993 through 1995 figures include two-unit building unit permits as multifamily permits, but all other years exclude two-unit building permits from multifamily unit counts. Given that two-unit buildings comprise such small percentages of unit permits (2% or less in all other years), we estimate that this does not substantially misrepresent the figures from 1993 to 1995.

5.2.2 Building Types

From 1993 to 2012, slightly more than one-quarter of unit permits (28%) were in multifamily buildings. Figure 5-5 illustrates a notable trend in the share of the new construction permits over the 20-year period where multifamily units began to comprise greater shares of permits. From 1993 to 1998, multifamily building unit permits consistently represented less than one-quarter of the annual permits. From 1999 to 2006, their shares increased to consistently represent between one-quarter and one-third of the annual permits. With the exception of 2009, after 2007 multifamily unit permits gained even greater market share, accounting for roughly one-half of unit permits each year (ranging from 47% to 53%).

Figure 5-5: Permitted Unit Building Types by Time Period (1993-2012)

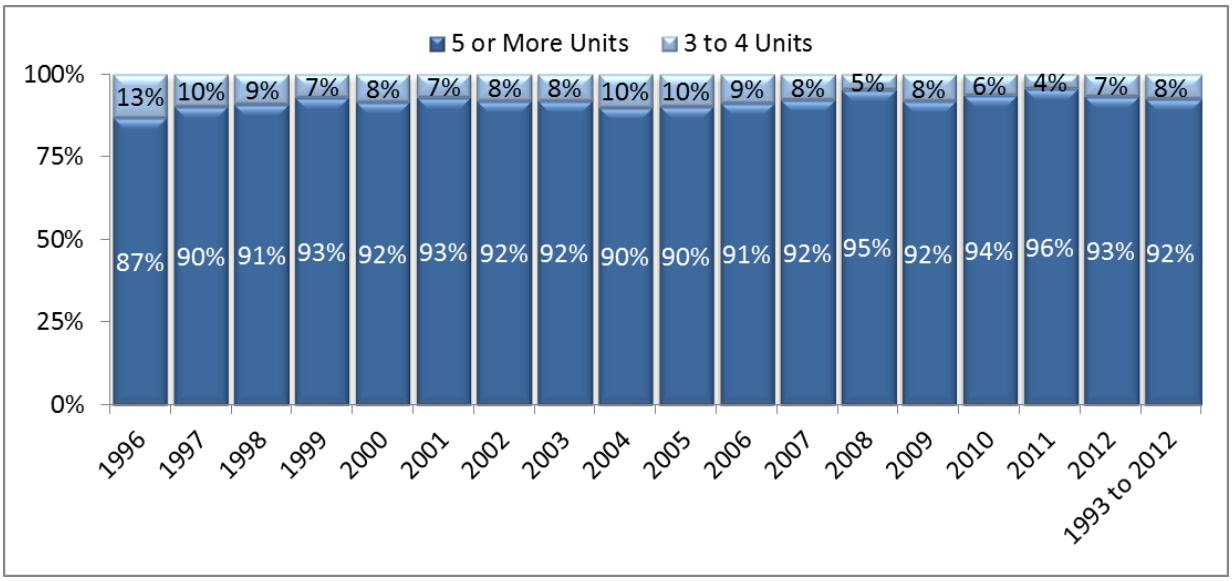


Source: CHF, CIRB, Annual Building Permit Summaries.

* CIRB data did not identify the number of units in non-single family buildings prior to 1995. The multifamily category in the chart includes buildings with two units from 1993 to 1995 but excludes them in all other years. Given that two-unit buildings units comprise such small percentages of all buildings (2% or less in all other years), we estimate that this does not substantially misrepresent the figures from 1993 to 1995.

Not surprisingly, the vast majority of the MFNC units permitted from 1993 to 2012 (92%) were in buildings with five or more units. This proportion did not vary substantially over the 20-year period (Figure 5-6).

Figure 5-6: Multifamily Permitted Unit Building Types by Time Period (1993-2012)



Source: CHF, CIRB, Annual Building Permit Summaries.

Table B-6-24 in Appendix B includes the ratios among all four building types.

5.2.3 Metropolitan Statistical Areas (MSA)[142]

From 2010 through 2012, nearly all multifamily unit permits (99%) were issued in MSAs. This proportion did not vary substantially by year or building type.[143]

Of the 26 total MSAs in California, five MSAs accounted for the large majority of permits issued during the 2010 to 2012 period. Three-quarters of the permitted units in buildings with three to four units were in the following five MSAs:

- Los Angeles-Long Beach-Anaheim
- San Diego-Carlsbad
- San Francisco-Oakland-Hayward

[142] Metro-statistical designations are geographic areas delineated by the U.S. Office of Management and Budget (OMB). Metropolitan statistical areas have a single core urban area with a population of 50,000 or more people, Micropolitan statistical areas have a single urban core area with a population equal to or greater than 10,000 people and less than 50,000 people. *Source:* U.S. Census Bureau. "Metropolitan and Micropolitan Statistical Areas Main." Accessed July 4, 2013 from http://www.census.gov/population/metro/.

[143] See Table B-**1** in Appendix B

- Riverside-San Bernardino-Ontario
- Oxnard-Thousand Oaks-Ventura

Buildings with five or more units were even more concentrated in the top five MSAs. Eighty-eight percent of the units in buildings with five or more units were in the following five MSAs:

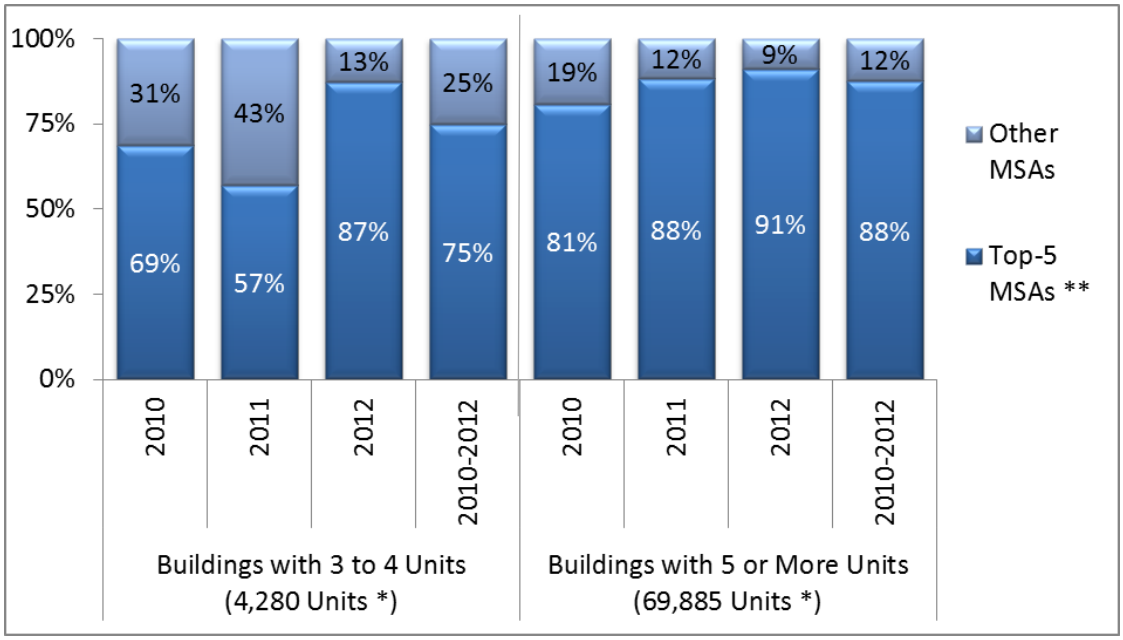
- Los Angeles-Long Beach-Anaheim
- San Diego-Carlsbad
- San Francisco-Oakland-Hayward
- Riverside-San Bernardino-Ontario
- San Jose-Sunnyvale-Santa Clara

These five MSAs are the same as the top five MSAs for new construction starts. However, San Francisco-Oakland-Hayward represents more construction starts than San Diego-Carlsbad, but in permit data San Diego-Carlsbad had more units than San Francisco-Oakland-Hayward (see section 5.3.9).

Figure 5-7 shows the proportions of units in the top five MSAs and all other MSAs by building type from 2010 through 2012:

- The top five MSAs accounted for 69% of units in buildings with three to four units in 2010, dropping to 57% in 2011 and then increasing dramatically to 87% in 2012.
- Permitted units in buildings with five or more units were consistently likely to be in one of the top five MSAs over all three years, increasing from 81% in 2010 to 88% in 2011 and 91% in 2012.

Figure 5-7: Multifamily Permitted Units among Top Five Metropolitan Statistical Areas by Time Period and Building Type
(2010-2012)



Source: CHF, CIRB, Annual Building Permit Summaries.

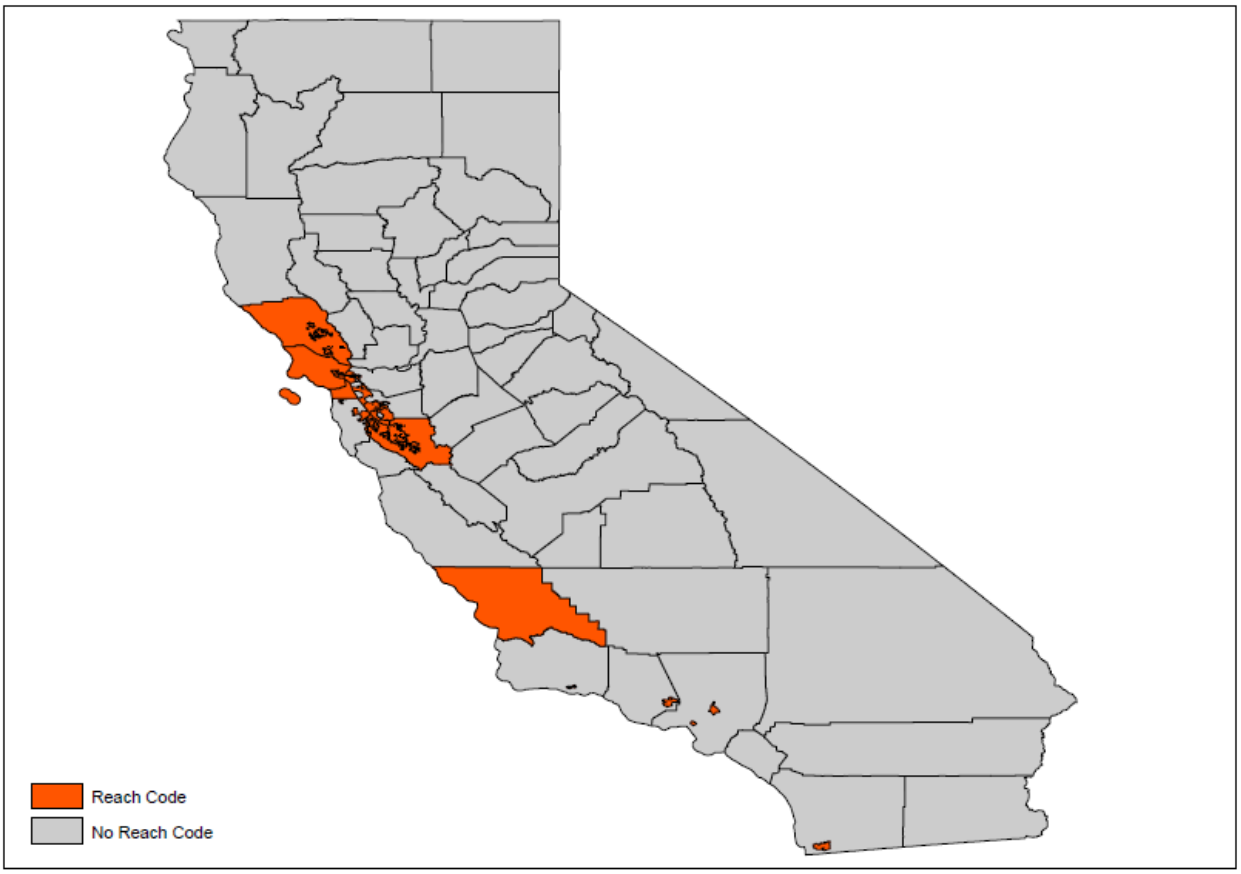
* This chart excludes 76 unit permits for buildings with 3-4 units issued in non-MSA areas and 344 unit permits for buildings with 5 or more units issued in non-MSA areas.

** The five MSAs drawing permits for the greatest number of units in building with 3-4 units cumulatively from 2010 through 2012 include Los Angeles-Long Beach-Anaheim, San Diego-Carlsbad, San Francisco-Oakland-Hayward, Riverside-San Bernardino-Ontario, and Oxnard-Thousand Oaks-Ventura. The five MSAs drawing permits for the greatest number of units in building with 5 or more units cumulatively from 2010 through 2012 include Los Angeles-Long Beach-Anaheim, San Diego-Carlsbad, San Francisco-Oakland-Hayward, Riverside-San Bernardino-Ontario, and San Jose-Sunnyvale-Santa Clara.

5.2.4 Local Energy Ordinances – Reach Codes

In California, local governments are permitted to adopt their own energy standards that are more rigorous or advanced than those of the state (i.e., "reach codes"). As of November 2013, the CEC website listed 40 city and five county government energy ordinances that it approved between 2009 and 2013 (Figure 5-8).[144] Cities and counties with reach codes are most concentrated in and around the Bay Area. For example, more than four-fifths of the 40 cities and five counties with reach codes (82%) are located in the following MSAs: San Francisco-Oakland-Hayward (21), San Jose-Sunnyvale-Santa Clara (7), Santa Rosa (7), Napa (1), and Sacramento-Roseville-Arden Arcade (1). As previously noted, the IOUs' Codes and Standards Program played a strong role in the development and adoption of reach code for many of these municipalities.

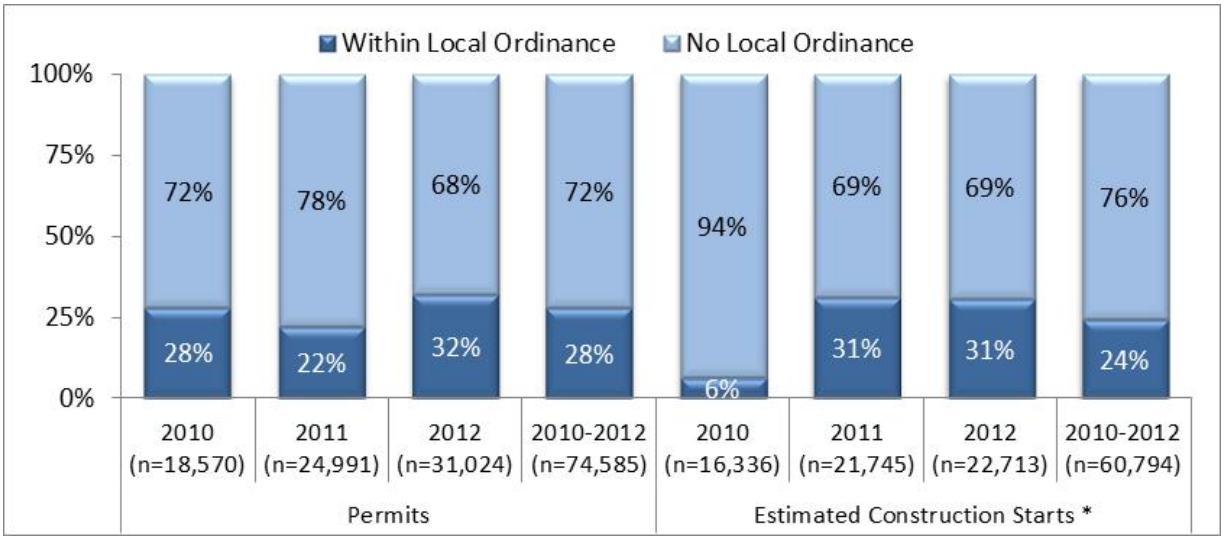
Figure 5-8: Cities and Counties with Approved Reach Codes (2009-2012)



[144] The Public Resources Code Section 25402 and Section 10-106 of the Building Energy Efficiency Standards grants local governments this flexibility. The local governments first must apply to the CEC for approval to enforce these standards. *Source*: California Energy Commission, "Local Ordinances: Exceeding the 2008 Building Energy Efficiency Standards," http://www.energy.ca.gov/title24/2008standards/ordinances/, accessed November 2013.

Nearly three of ten permitted units (28%) and one quarter of estimated starts (24%) were issued in cities or counties that had enacted reach codes before or in the same year that the permit was issued or construction started (Figure 5-9).The bulk of the reach codes were approved in 2010 (16 cities, 4 counties) and 2011 (16 cities).[145] Despite the increase in localities with reach codes in 2011, the percentage of permits issued in reach code communities dropped in 2011. Many of the communities that adopted reach codes in 2011 were smaller communities, such as Healdsburg, or communities such as Sonoma County that experienced a large drop in permits in 2011 followed by a large increase in permits in 2012.

Figure 5-9: Multifamily Permitted and Estimated New Construction Starts Units Local Government Energy Ordinances (2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; (4) Builder and Developer CATI Surveys; and (5) CHF, CIRB, Annual Building Permit Summaries.

* Based on estimates developed for the number of units involved in projects without unit data.

[145] Reach codes were approved for three cities in 2009 and four cities and one county in 2012.

5.3 New Construction Starts, 2010-2012

The research team analyzed the population of MFNC projects that started construction in California from 2010 through 2012. This report section describes the approach and the results of the analysis. We examined changes in market size; income category; building rise; project size indicators including number of units, area, and buildings; service provider, climate zone, and metro-statistical designation distributions; energy ordinances; builder activity levels; low-income tax credit awards; and survey results.

5.3.1 Methodology

To conduct an analysis of MFNC starts, the research team developed a dataset accounting for the population of projects started in California from 2010 through 2012. Table 5-1 in the report methodology presents high-level descriptions of the four data sources that comprise the population of new construction starts. Appendix A provides more details of how we merged, cleaned, and prepared the project-level data from the following four sources to develop the population of the new construction starts dataset:

- **McGraw Hill Construction (MHC) Dodge data.** MHC collects data on new construction starts and provides that data to various market actors involved with building construction.[146] We received MHC project-level data cataloguing the details of California MFNC projects that started from 2010 through 2012.
- **California Tax Credit Allocation Committee (CTCAC) reports.** CTCAC is a committee in the California State Treasurer's Office. Among other roles, it allocates and administers federal and state tax credit programs for low-income housing retrofits and new construction projects. Using the CTCAC website,[147] we downloaded data for their 4% and 9% tax credit awards[148] for construction of low-income multifamily housing allocated between 2009 and 2011. We chose to include projects awarded during those years because, according to CTCAC staff, nearly all projects start construction during the calendar year that follows the year in which they are awarded a tax credit. For example, a project that received an award in 2009 would likely begin construction in 2010.
- **IOU CAHP/CMFNH and SBD program data.** Between July and November 2013, the four IOUs individually provided us with data sets detailing participating projects that had either started construction or entered the respective program from 2010 through 2012.
- **CATI Survey data.** In August 2013, the evaluation team conducted CATI surveys with 76 builders associated with projects found in MHC-CTCAC data (see Section 5.7 for

[146] McGraw Hill Construction. "About McGraw Hill Construction." Accessed September 2013. http://www.construction.com/about-us/.

[147] California Tax Credit Allocation Committee. "Annual Reports." Accessed May 2013. http://www.treasurer.ca.gov/ctcac/annual_reports.asp.

[148] These are the approximate percentage of a project's "qualified basis" that a developer may deduct from their annual federal tax liability in each of ten years.

more details).[149] We began by asking about the details of one of a builder's projects in the MHC-CTCAC data. In addition to asking survey questions about that primary project, we asked survey respondents to identify and answer questions about their largest projects that they started from 2010 through 2012.[150] Responses about their largest projects resulted in the addition of seven new projects that had not appeared in MHC, CTCAC, or participant data.[151]

After merging and removing duplicate projects that appeared in more than one of the data sources, the population data included 763 MFNC projects that started from 2010 through 2012. As reported in Table 5-2, no single data source accounted for the MFNC project starts. MHC data accounted for the majority of the projects (61%) and units (64%), followed by CTCAC data and IOU MFNC program participation data. This is not surprising given that CTCAC data are limited to low-income projects and IOU MFNC program data are limited to IOU program participants. MHC data, in contrast, attempt to capture all statewide projects.

Table 5-2: Multifamily Project Construction-Starts Data Sources

Source	Projects	% of Projects	Units*	% of Units
MHC	467	61%	38,657	64%
CTCAC	341	45%	23,280	38%
IOU MFNC Program	238	31%	22,666	37%
Survey Only	7	1%	730	1%
Total	**763**		**60,834**	

Note: Many projects appeared in more than one data source; as such, percentages sum to greater than 100%.

* For projects that did not include unit data but did include project square footage, the team estimated the number of units by using the mean number of square feet per unit for projects with both square footage and unit data. We were unable to estimate the number of units for three projects: two projects were included in MHC data and the third was described in the builder survey.

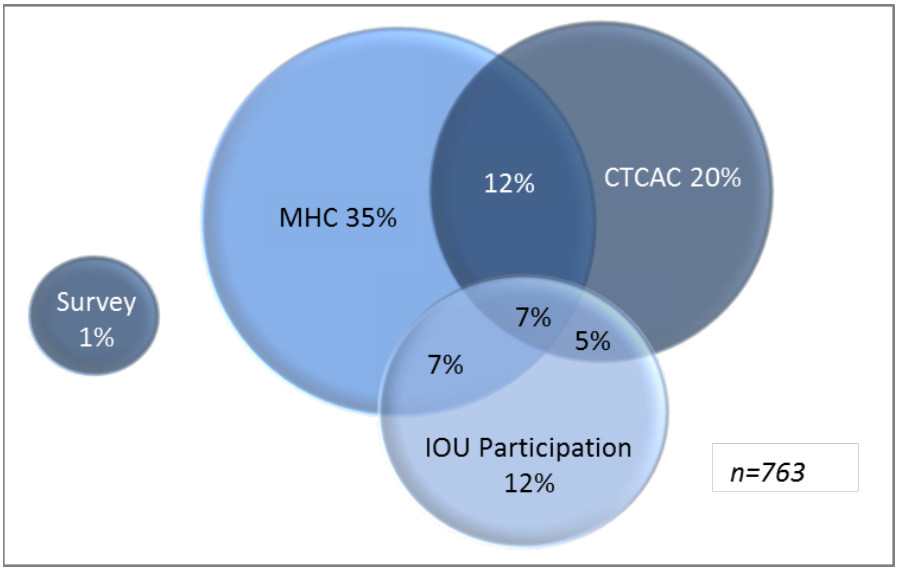
[149] At the time of survey fielding, we only had MHC and CTCAC project lists so IOU program participating projects were not included in the survey sample frame development process.

[150] This also could have been a respondent's second largest projects if the initial project was the largest.

[151] Thirty-one respondents answered questions about a second project. We were able to match eight of these projects to existing projects. There were seven projects where we received enough information to determine that the project was not already in the project population. We added these seven projects to the population. The 16 other respondents did not provide enough details about the other project to determine if those projects were or were not in the existing data, and as a result they were not added to the overall population data set.

Figure 5-10 illustrates that nearly one-third of the 763 MFNC starts projects (31%) appeared in more than one source: 12% of projects appeared in both MHC and CTCAC data only, 7% appeared in both MHC and IOU program participation data only, 7% appeared in all three data sources, and 5% were included in both CTCAC and IOU program participation data only. One percent of projects were solely from the builder survey in which survey respondents described a secondary project. [152]

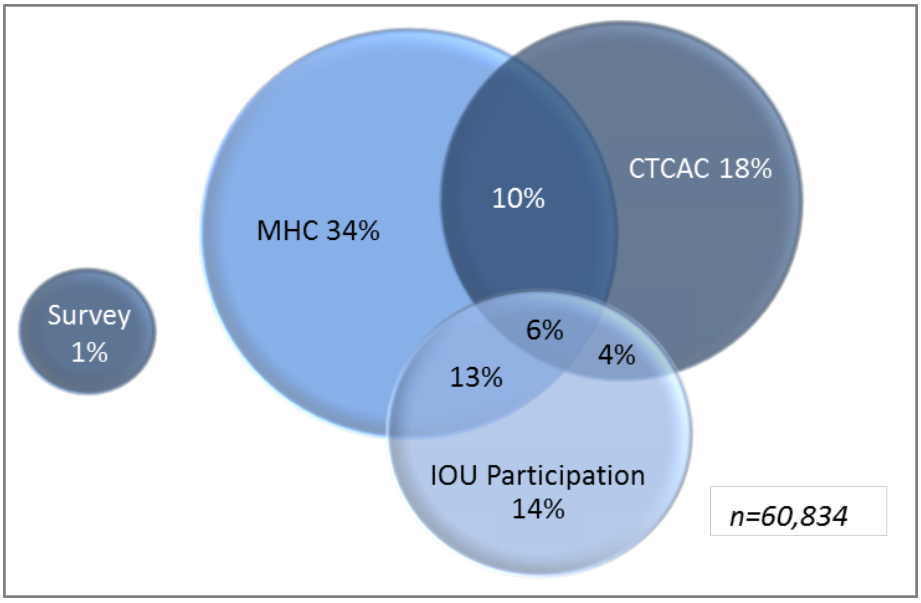
Figure 5-10: Multifamily Construction-Starts Project-Level Data Sources



[152] Some respondents described additional projects during the builder surveys, but they did not provide enough information about their projects that would enable us to determine if they were or were not included in any of the other data sources. Projects with insufficient data for matching were only included in the survey analysis section and were not included in the new construction starts data analysis with the concern that we may double count specific projects.

Figure 5-11 illustrates the project sources in terms of percentages of units.

Figure 5-11: Multifamily Construction-Starts Project-Level Data Sources in Terms of Units



5.3.2 Multifamily Construction Starts, 2010-2012

Table 5-3 reports the annual number of multifamily project and unit construction starts from 2010 through 2012. Overall, the number of units increased by 39% from 2010 through 2012, while the number of projects increased by 12% during the same period.

Table 5-3: Multifamily Construction Starts, Projects and Units (2010-2012)

Time Period	Number of Projects	Number of Units*
2010	246	16,336
2011	239	21,745
2012	278	22,753
Total 2010-2012	**763**	**60,834**

Sources: (1) McGraw Hill Construction (MHC), 2010-2012 Dodge Project Data, *MHC Project List for State of CA Multi 12_12Bid Date.xls*, Received December 2012; (2) California Tax Credit Allocation Committee (CTCAC), 2009-2011 Annual Reports, http://www.treasurer.ca.gov/ctcac/annual_reports.asp, accessed June 2013; (3) IOU Program Project Lists, Received between July 2013 and November 2013; and (4) Builder and Developer CATI Surveys, Conducted August 2013.

* For projects that did not include unit data but did include project square footage, the team estimated the number of units by using the mean number of square feet per unit for projects with both square footage and unit data. We were unable to estimate the number of units for three projects: two projects were included in MHC data and the third was described in the builder survey.

5.3.3 Number of Units

Nearly one-fifth of the 763 projects (18%) did not include data identifying the number of units associated with the project. We therefore estimated number of units for those projects. Using the ratio of the mean of project square feet (sq ft) to number of units (for each project with area and unit data), we estimated the number of units in any projects with known square footage but without unit data. Table 5-4 presents the reported (included in original data) and our estimated number of units for each year.

Table 5-4: Number of Units per Multifamily Project by Construction-Start Period (2010-2012)

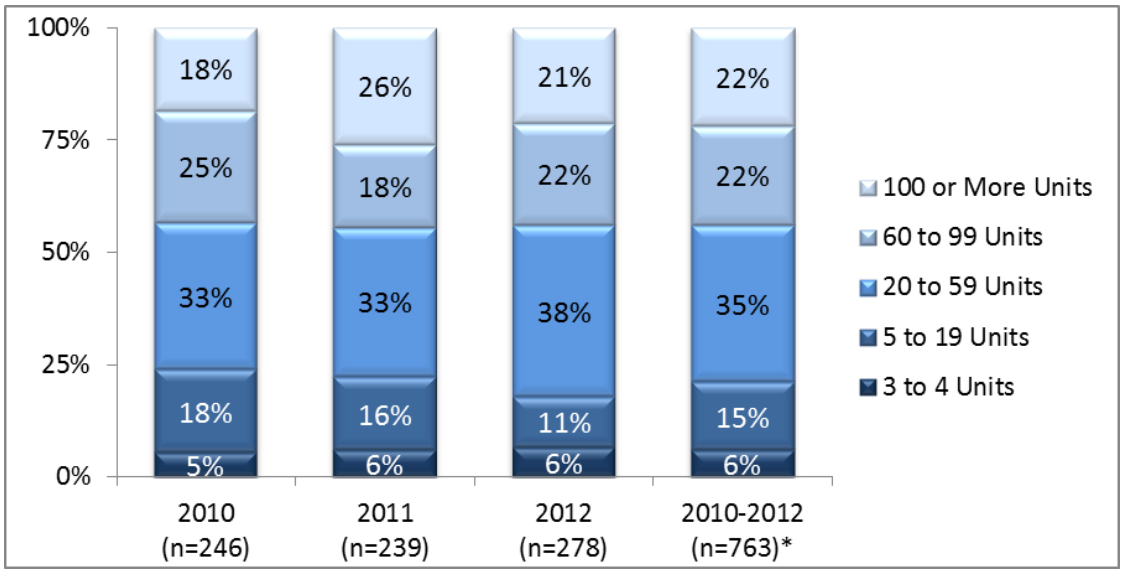
Number of Units per Project	% of Projects (Reported)				% of Projects (Estimated) *			
	2010	2011	2012	2010-2012	2010	2011	2012	2010-2012
Unknown	26%	15%	15%	18%	<1%	0.0%	1%	<1%
3-4	2%	4%	4%	3%	5%	6%	6%	6%
5 to 19	9%	13%	7%	10%	18%	16%	11%	15%
20 to 39	11%	14%	15%	13%	17%	17%	17%	17%
40 to 59	13%	16%	21%	17%	16%	17%	21%	18%
60 to 79	13%	10%	15%	13%	14%	13%	15%	14%
80 to 99	10%	5%	6%	7%	11%	6%	7%	8%
100 to 199	11%	12%	10%	11%	12%	15%	11%	13%
200 or more	4%	9%	8%	7%	6%	11%	10%	9%
Total projects	**246**	**239**	**278**	**763**	**246**	**239**	**278**	**763**

Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* Using the mean number of square feet per unit for projects with square footage and unit data, the team estimated the number of units for projects with square footage data without unit data.

According to our estimates, projects appear to most commonly have between 20 and 59 units across all three years (Figure 5-12); more than one-third of projects (35%) had between 20 and 59 units.

Figure 5-12: Estimated Number of Units per Multifamily Project by Construction-Start Period
(2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* We could not estimate the number of units for 1% of projects and have excluded the unknown category from this chart.

We estimate there were 60,834 units in the projects started from 2010 through 2012. Table 5-5 presents the estimated number of units by year and building type.[153] Note, however, that there were 74,585 multifamily units permitted during the same period (see section 5.2.1), which is considerably higher (+23%) than our estimate of construction starts.

Table 5-5: Multifamily Project Estimated Total Units by Construction-Start Period and Building Type (2010-2012)

Year	Parameter	Estimated Building Type *			
		3-4 Unit Buildings	5 or More Unit Buildings	Unknown Building Type	All Building Types
2010	Estimated Number of Units	967	14,625	744	16,336
	% of 2010 Units	6%	90%	5%	
	Number of Projects	37	202	6	245
2011	Estimated Number of Units	855	20,530	360	21,745
	% of 2011 Units	4%	94%	2%	
	Number of Projects	42	193	4	239
2012	Estimated Number of Units	1,010	21,627	116	22,753
	% of 2012 Units	4%	95%	1%	
	Number of Projects	26	241	9	276
2010-2012	Estimated Number of Units	2,832	56,782	1,220	60,834
	% of Total Units	5%	93%	2%	
	Number of Projects	105	636	19	760

Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* Project-level data do not specifically identify the number of units in each building in the project. The team used the ratio of number of estimated units to number of buildings to estimate building type. Three projects are excluded from the table because we could not estimate the number of units for those projects.

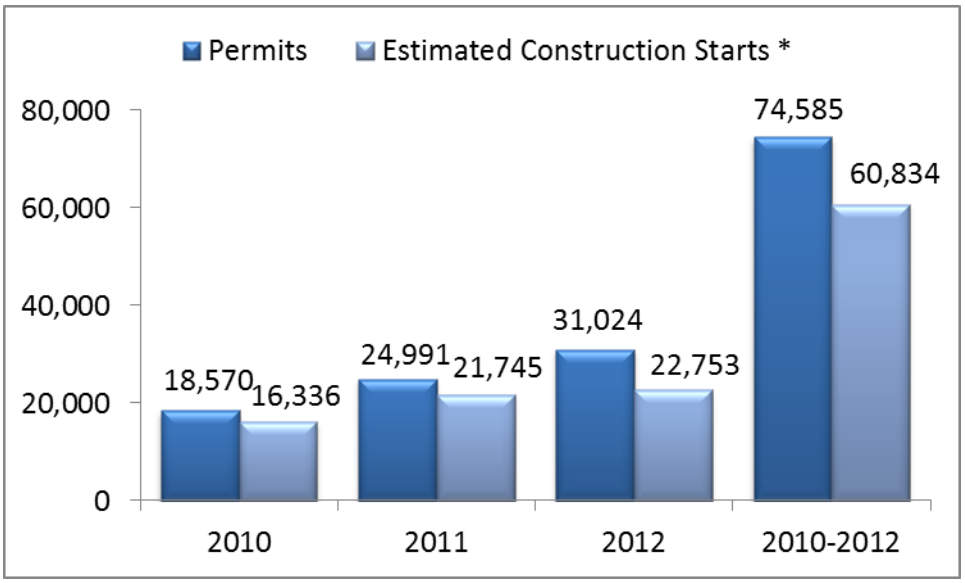
[153] We estimated building type by dividing the number of estimated units in a project by the number of buildings in the project. We were unable to estimate number of units for three of the 763 projects.

As mentioned above, from 2010 through 2012, there were notably fewer units involved in multifamily construction projects than there were units included in MFNC permits (-19%). We hypothesize three reasons behind this discrepancy:

- **Lag time.** It is likely that a lag exists from when a permit is issued and when it starts construction. This lag may have been intensified from 2010 through 2012 as a result of the unusually limited number of permits drawn in 2009.
- **Unused permits.** Even though a construction permit has been drawn, it does not guarantee that the construction will begin.
- **Missing data.** Because our new construction starts data and our permit data came from different sources and the methods used by the different data collection entities are not the same, it is not surprising that the data may not be aligned.

Figure 5-13 shows a year-by-year comparison between permitted units and new construction start units.

Figure 5-13: Multifamily Permitted and Estimated New Construction Starts Units (2010-2012)



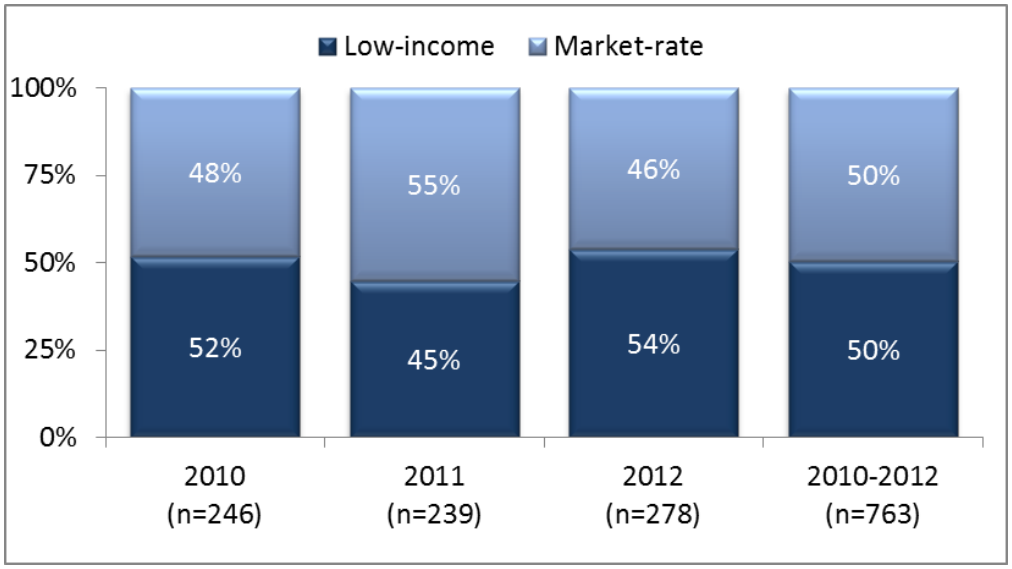
Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; (4) Builder and Developer CATI Surveys; and (5) CHF, CIRB, Annual Building Permit Summaries.

* Based on estimates developed for the number of units involved in projects without unit data.

5.3.4 Income Category and Building Rise

The research team estimates that one-half of projects from 2010 through 2012 (50%) were low-income housing developments. A project was considered a low-income project if it was listed in one of the CTCAC awardee lists, if a survey respondent identified it as low-income, if IOU program data listed it as low-income, and/or if the MHC data project description or project title described it as *affordable* or *low-income*.[154] Figure 5-14 reports the ratio of low-income to market-rate housing projects by year.

Figure 5-14: Multifamily Project Income Category (2010-2012)

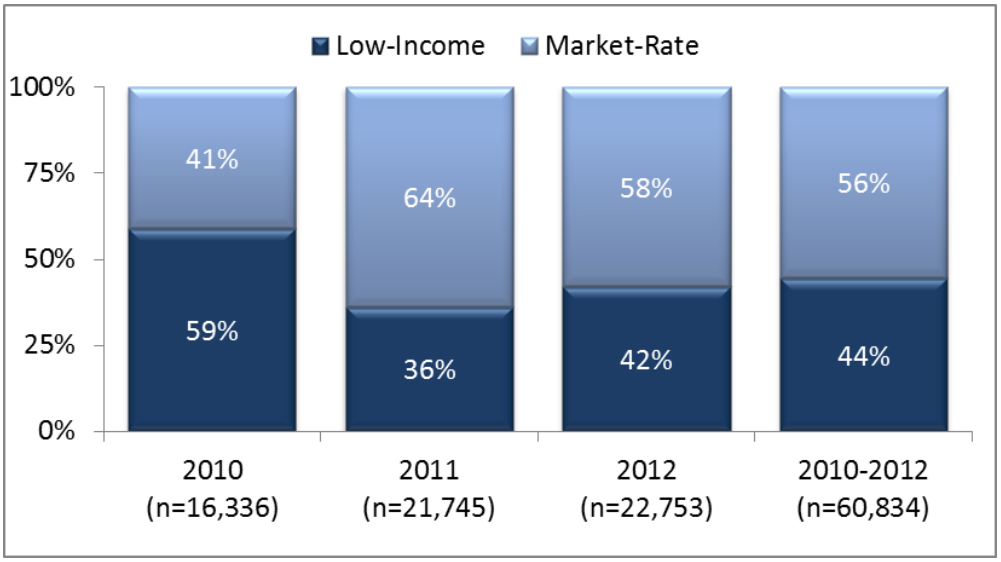


Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

[154] Projects labeled as "low-income" may not have had exclusively low-income housing and may have had some market-rate units. For the purposes of analysis we considered these projects low-income. Further, although we labeled as "market-rate" any projects in the participation or MHC data that were not specifically identified as low-income, it may be possible that some of them were low-income projects. However, we assumed that CTCAC awardees accounted for the vast majority of low-income projects in the state; as such, we think these figures provide a good estimate of the incidence of low-income construction starts.

In terms of units, the percentage of market-rate units increased from 41% of units in 2010 to 58% of units in 2012—increasing from 6,751 units in 2010 to over 13,000 in 2011 and 2012—while the number of low-income units remained relatively stable during the same period, ranging from 7,828 units to 9,585. This suggests that the market-rate segment has been more responsive to housing recovery, thus accounting for the bulk of the increase in MFNC activity, and suggests that the low-income market is less affected by housing market cycles.

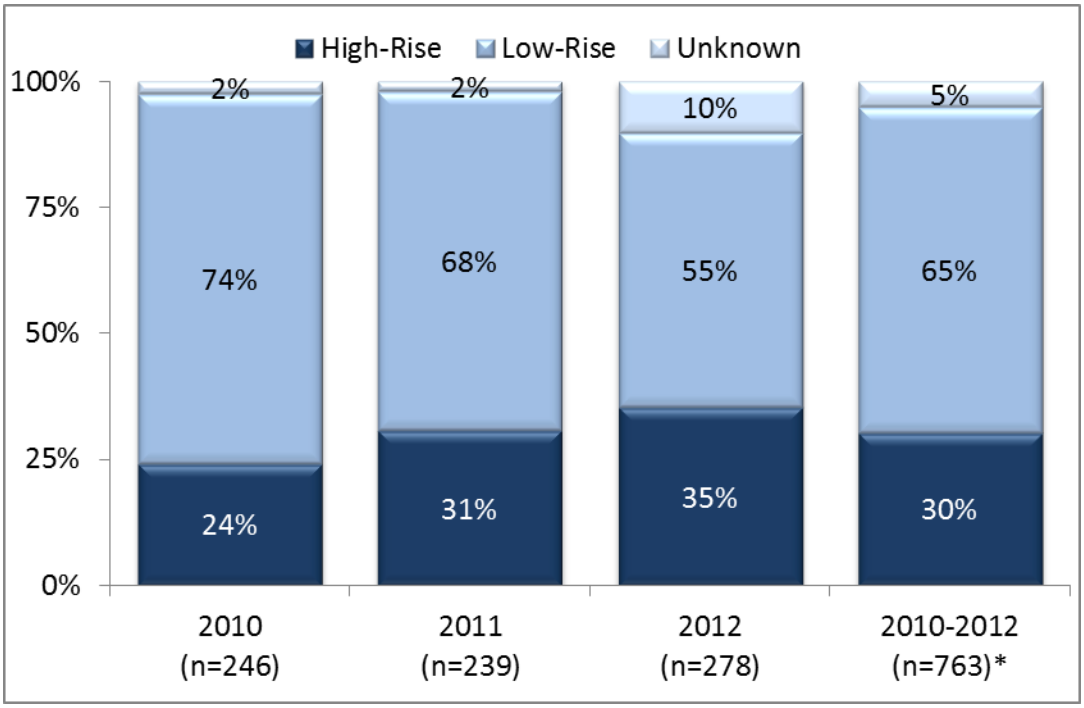
Figure 5-15: Multifamily Unit Income Category (2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Projects were more likely to include low-rise buildings, as nearly two-thirds of projects (65%) included low-rise buildings and slightly less than one-third of projects (30%) included high-rise buildings.[155] Four projects included both high-rise and low-rise buildings. Figure 5-16 shows how from 2010 through 2012, projects became increasingly more likely to include high-rise buildings: in 2010, one-quarter of all projects with known building rise included high-rise buildings (24% of all projects), while in 2012, 39% of all known-rise projects included high-rise buildings (35% of all projects).

Figure 5-16: Multifamily Project Building Rise by Construction-Start Period (2010-2012)



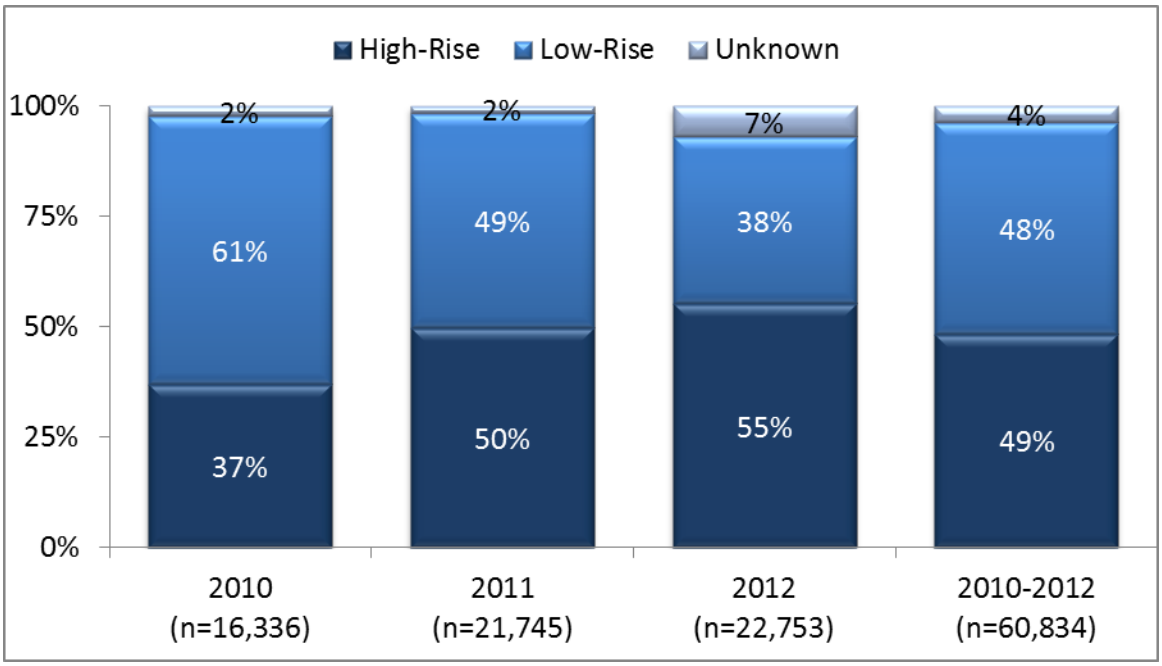
Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* Four projects included both high-rise and low-rise buildings; as such, percentages may total to greater than 100%.

[155] Like the California Advanced Home Program, the Multi-family New Homes Program, and the Savings by Design sub-program, we consider buildings with one to three stories as low-rise buildings and buildings with four or more stories as high-rise buildings.

Approximately half of the estimated units (49%) were in projects with high-rise buildings and low-rise buildings (48%) (Figure 5-17). The percentage of units in high-rise buildings increased from 37% of units in 2010 to 55% of units in 2012.

Figure 5-17: Multifamily Project Estimated Total Units by Building Rise and Construction-Start Period
(2010-2012)

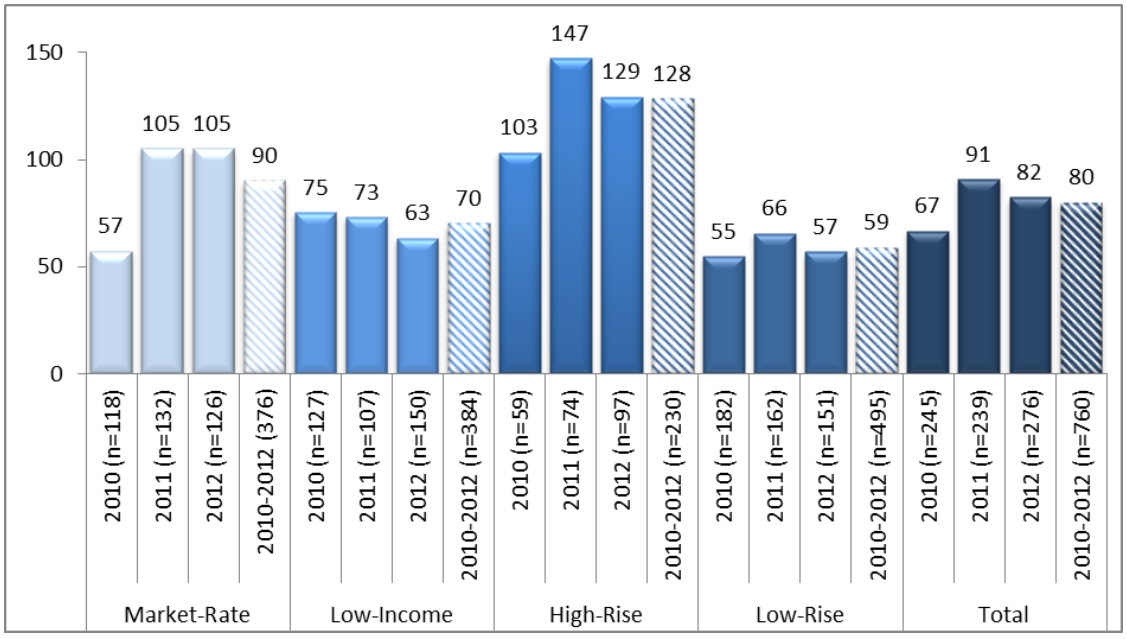


Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: Not all 763 projects are included here either because of missing square footage data or missing story data. Four projects included both high-rise and low-rise buildings; as such, totals may sum to greater than 100%.

Using the estimates of number of units, we found that the average number of units in MFNC project starts increased by 22% from 2010 through 2012. Figure 5-18 presents the mean number of units across all projects in total and by income category and building rise. We estimate that from 2010 through 2012, the 760 projects (for which we were able to estimate unit data) had 80 units on average,[156] with an average of 128 units in high-rise projects and 59 units in low-rise projects. Note that between 2010 and 2011, the estimated number of units in market-rate and high-rise projects exhibited a substantial increase. Meanwhile, the average number of units in low-income projects steadily decreased from 2010 through 2012. Appendix A.3 provides the reported number of unit averages (instead of estimated).

Figure 5-18: Multifamily Project Estimated Average Number of Units, by Income Category, Building Rise, and Construction-Start Period (2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: Not all 763 projects are included here either because of missing square footage data or missing story data. Four projects included both high-rise and low-rise buildings; as such, these may projects appear in both high-rise and low-rise figures.

[156] Our estimated average number of units is nearly identical to the reported average number of units (79 units).

5.3.5 Project Size (Square Footage)

The data did not include project size (in square footage) for nearly one-quarter of projects (24%). In total, projects most commonly occupied 40,000 to less than 65,000 sq ft (15%) (Table 5-6).

Table 5-6: Multifamily Project Size by Construction-Start Period (2010-2012)

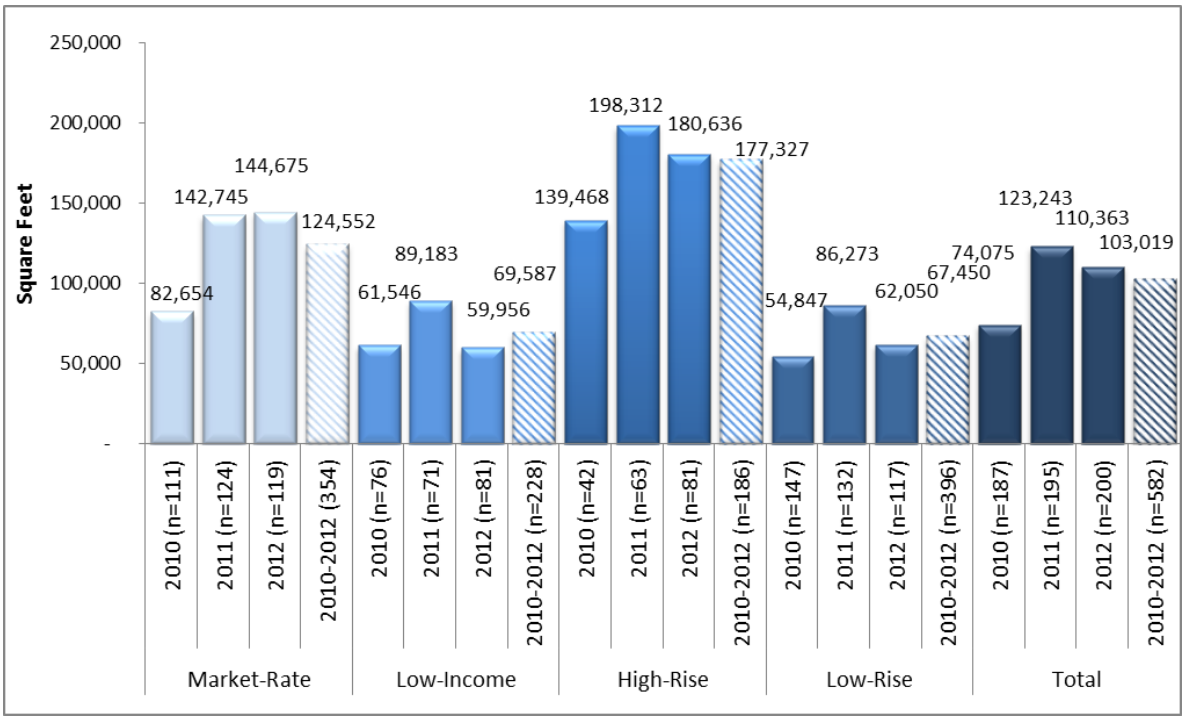
Area (sq ft)	% of Projects per Period			
	2010	2011	2012	2010-2012
Unknown	24%	18%	28%	24%
10,000 or less	11%	8%	7%	8%
More than 10,000 and less than 25,000	13%	10%	12%	12%
25,000 to less than 40,000	10%	9%	10%	10%
40,000 to less than 65,000	13%	19%	14%	15%
65,000 to less than 100,000	16%	9%	9%	11%
100,000 to less than 200,000	8%	10%	8%	9%
200,000 or more	5%	17%	11%	11%
Total projects	**246**	**239**	**278**	**763**

Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Figure 5-19 presents the average project size for the 582 projects with square footage data. The average project size during the three-year period was approximately 100,000 square feet. Average project size was considerably larger in 2011 than in 2010, but then decreased slightly from 2011 to 2012. From 2010 through 2012, the average project size increased by 49%.

Not surprisingly, the average area of high-rise buildings (177,327 sq ft) was notably higher than that of low-rise buildings (67,450 sq ft). On average, market-rate projects (124,552 sq ft) were notably larger than low-income projects (69,587 sq ft). Between 2010 and 2011, market-rate projects exhibited a substantial increase in square footage, while low-income, low-rise, and high-rise projects exhibited somewhat less dramatic increases. Market-rate projects were the only project type not to decrease in average area from 2011 to 2012.

Figure 5-19: Multifamily Average Project Area by Income Category, Building Rise and Construction-Start Period
(2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: Not all 763 projects are included here either because of missing square footage data or building story data. Four projects included both high-rise and low-rise buildings; as such, these projects may appear in both high-rise and low-rise figures.

5.3.6 Number of Buildings

Over the three-year period, nearly one-half of projects (47%) were limited to one building. As presented in Table 5-7, this share did not vary across years.

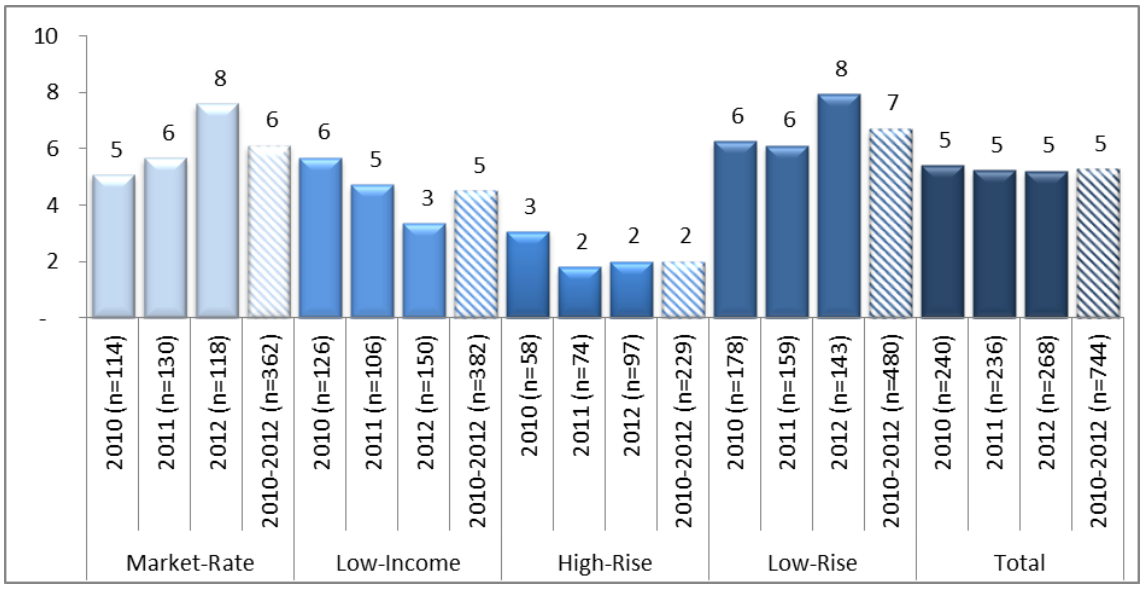
Table 5-7: Multifamily Project Number of Buildings by Construction-Start Period (2010-2012)

Buildings	% of Projects per Period			
	2010	2011	2012	2010-2012
Unknown	2%	2%	4%	3%
1	43%	47%	49%	47%
2	10%	9%	12%	10%
3	7%	5%	7%	6%
4	5%	6%	7%	6%
5 to 9	17%	17%	16%	16%
10 to 19	11%	10%	5%	9%
20 or more	4%	4%	2%	3%
Total projects	**246**	**239**	**278**	**763**

Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

On average, projects included five buildings. Projects with high-rise buildings had an average of two buildings, while projects with low-rise buildings had an average of seven buildings. The high-rise buildings were, however, much larger on average because, as noted previously, the average square footage of high-rise buildings was notably higher than that of low-rise buildings. The average market-rate project had six buildings, while the average low-income project had five buildings. Figure 5-20 shows the average number of buildings by year and project type.

Figure 5-20: Multifamily Project Average Number of Buildings by Income Category, Building Rise, and Construction-Start Period (2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: Not all 763 projects are included here either because of missing building count data or building story data. Four projects included both high-rise and low-rise buildings; as such, these projects may appear in both high-rise and low-rise figures.

5.3.7 Service Providers

Using the project addresses and/or IOU participation data, the team identified the IOU and electricity provider for each project. Project addresses were most commonly in the SCG (52%), PG&E (40%), and SCE (28%) service territories (Table 5-8). Customers' projects in the SCG service territory were most likely to be low-income (18% of all projects) and low-rise (25%) (See Table A-6-10 and Table A-6-11).

Table 5-8: Utility Service Provider for MFNC Starts (2010-2012)

Utility	Number of Projects*	Percent of Projects*
Southern California Gas	397	52%
Pacific Gas & Electric Company	309	40%
Southern California Edison	211	28%
Los Angeles Department of Water & Power	113	15%
San Diego Gas & Electric	70	9%
Sacramento Municipal Utility District	14	2%
Other	45	6%
Unknown Location	1	<1%
Total 2010-2012	**763**	

* SCG territory overlaps with electric utility providers' territories, so the sum of the number of projects exceeds 762 and the sum of the percent of projects exceeds 100%. SCG projects most commonly overlapped with SCE and LADWP service territories. One survey respondent did not report the address of the secondary project described during the survey; as a result, we were unable to determine the service provider(s) for that project

Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Given that the majority of projects were in SCG and PG&E service territories, it is not surprising that the two service territories also accounted for the largest number of estimated units across all three years: we estimate that over the three-year period, construction starts included 28,670 units in SCG service territory (49% of all units) and 26,314 units in PG&E service territory (40% of all units) (see Table 5-9).

Table 5-9: Multifamily Project Estimated Total Units by Service Provider and Construction-Start Period
(2010-2012)

Service Provider	Number of Units per Period							
	2010		2011		2012		2010-2012	
	Count	%	Count	%	Count	%	Count	%
Southern California Gas *	8,015	49%	9,601	44%	11,054	49%	28,670	49%
Pacific Gas & Electric	6,465	40%	10,150	47%	9,699	43%	26,314	40%
Southern California Edison	4,803	29%	5,215	24%	4,155	18%	14,173	29%
Los Angeles Department of Water & Power	1,785	11%	3,239	15%	5,170	23%	10,194	11%
San Diego Gas & Electric	2,097	13%	2,077	10%	2,027	9%	6,201	13%
Sacramento Municipal Utility District	263	2%	397	2%	356	2%	1,016	2%
Other	923	6%	667	3%	1,306	6%	2,896	6%
Unknown location	0	0%	0	0%	40	<1%	40	<1%
Total units **	16,336		21,745		22,753		60,834	

Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

*All of the units in SCG territory overlap with the electric utilities. Most commonly they overlap with SCE (52%) and LADWP (29%).

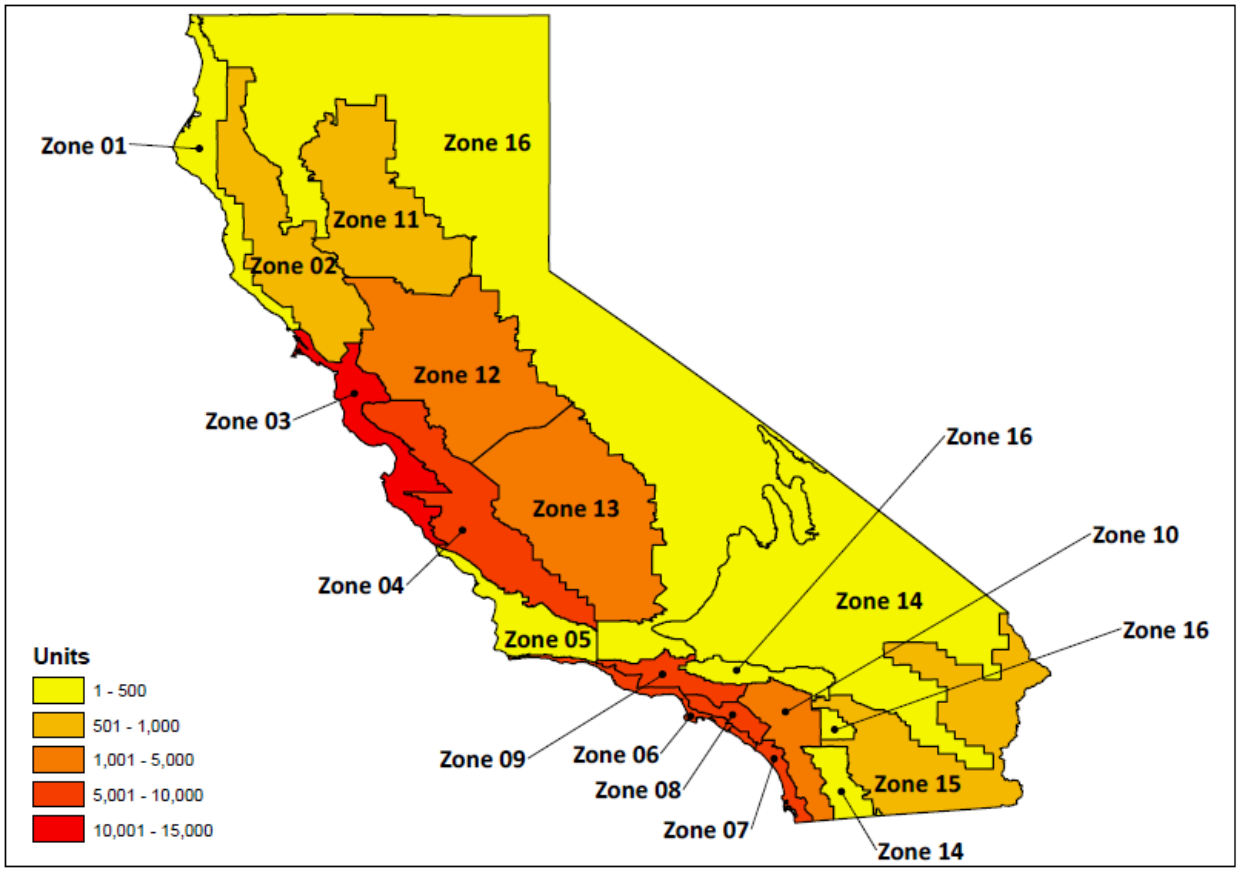
** The sum of the individual utilities exceeds the total because of the overlap between SCG and the electric utilities. An additional 40 units for one project are not included here because the team could not determine the service provider for one project due to missing address information.

5.3.8 Climate Zones and Regions

Matching project addresses to the 16 climate zones established in California Energy Commission's (CEC) Title 24, the team identified the climate zone associated with each of the 762 projects.[157]

Figure 5-21 illustrates that 2010-2012 MFNC starts were concentrated in climate zones along the coast that encompass California's major cities, including Los Angeles, San Francisco, and San Diego.[158] Construction was concentrated in climate zone three (24% of units) and climate zones six through nine (ranging from 9% to 14% of all units).

Figure 5-21: Total Units of MFNC by Climate Zone (2010-2012)

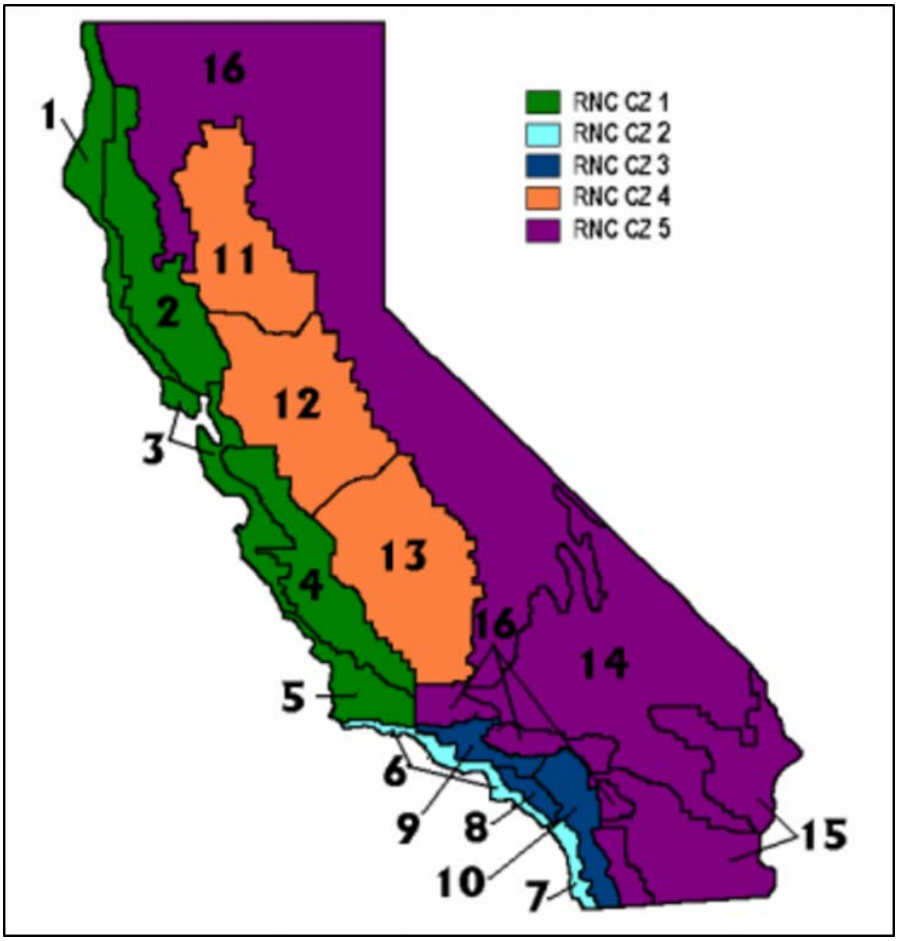


[157] The climate zone for one project was not included because the team did not have enough information about the project to determine its climate zone.

[158] A map of MRNC projects by climate zone is available in the Appendix (see Figure A-4:)

The team further collapsed these data into five climate regions using the standardized method utilized in a 2009 Residential New Construction Market Effects Study (Figure 5-22).[159]

Figure 5-22: Map of California Climate Regions and Zones

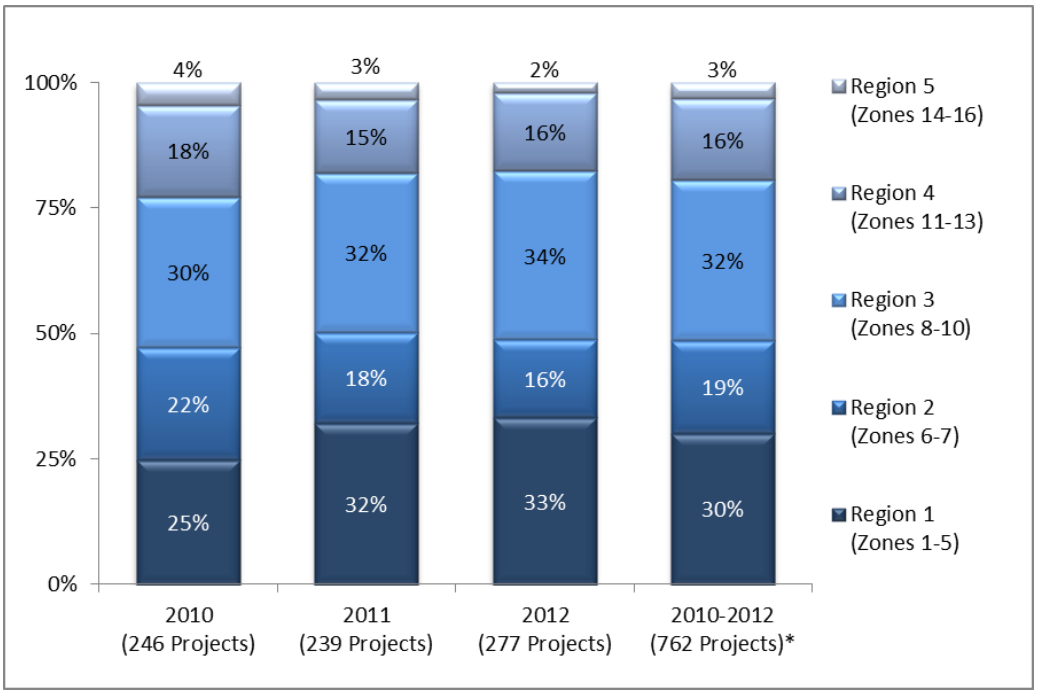


Source: KEMA, Nexus Market Research, Summit Blue Consulting, Itron and the Cadmus Group. 2009. Phase I Report Residential New Construction (Single Family Home) Market Effects Study. Prepared for the California Public Utilities Commission Energy Division Study ID: CPU0030.08.

[159] We aggregated the 16 CEC Title 24 climate zones by matching climate zones that had the same Title 24 requirements or that differed by up to one component. For more details, see: KEMA, Nexus Market Research, Summit Blue Consulting, Itron and the Cadmus Group. 2009. Phase I Report Residential New Construction (Single Family Home) Market Effects Study. Prepared for the California Public Utilities Commission Energy Division Study ID: CPU0030.08
http://www.calmac.org/publications/RNC_Market_Effects_Phase_I_Report_report_May_21_final_v3.pdf

Figure 5-23 illustrates the distribution of projects across climate regions by start year and cumulatively. Over the three-year period, projects were most likely to have been started in climate regions three (32%) and one (30%) and least likely to have been started in climate region five (3%). [160]

Figure 5-23: Multifamily Project Climate Regions by Construction-Start Period (2010-2012)



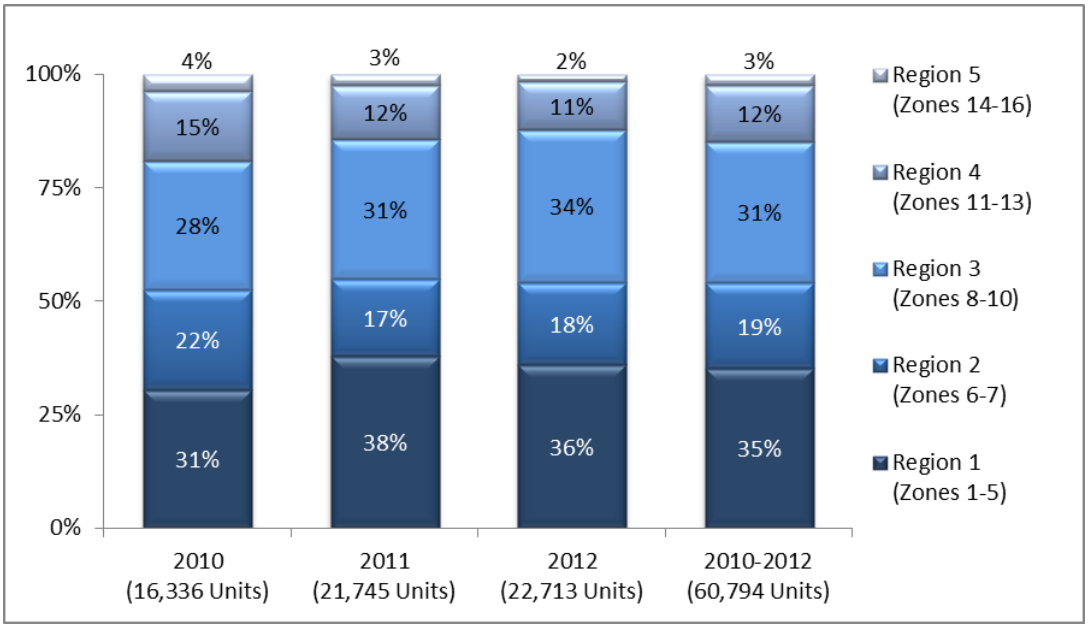
Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* The climate zone for one project was not included because the team did not have enough information about the project to determine its climate zone.

[160] The CEC Climate Zones presented here were not designed to also designate the IOU service territories. However, the following generalizations can be used: Regions 1 and 4 include most of PG&E, Region 2 and 3 include SCE, SCG and SDG&E, and Region 5 spans all four IOUs. There are several minor exceptions to this generalization; one is that SCE's territory includes the southern tip of Region 1.

Given that the majority of projects were in climate regions three and one, it is not surprising that these two climate regions also accounted for the largest shares of estimated units across all three years: we estimated that over the three-year period, climate region one accounted for 35% of units and climate region three accounted for 31% of units (see Figure 5-24).

Figure 5-24: Multifamily Project Estimated Total Units by Climate Region and Construction-Start Period
(2010-2012)



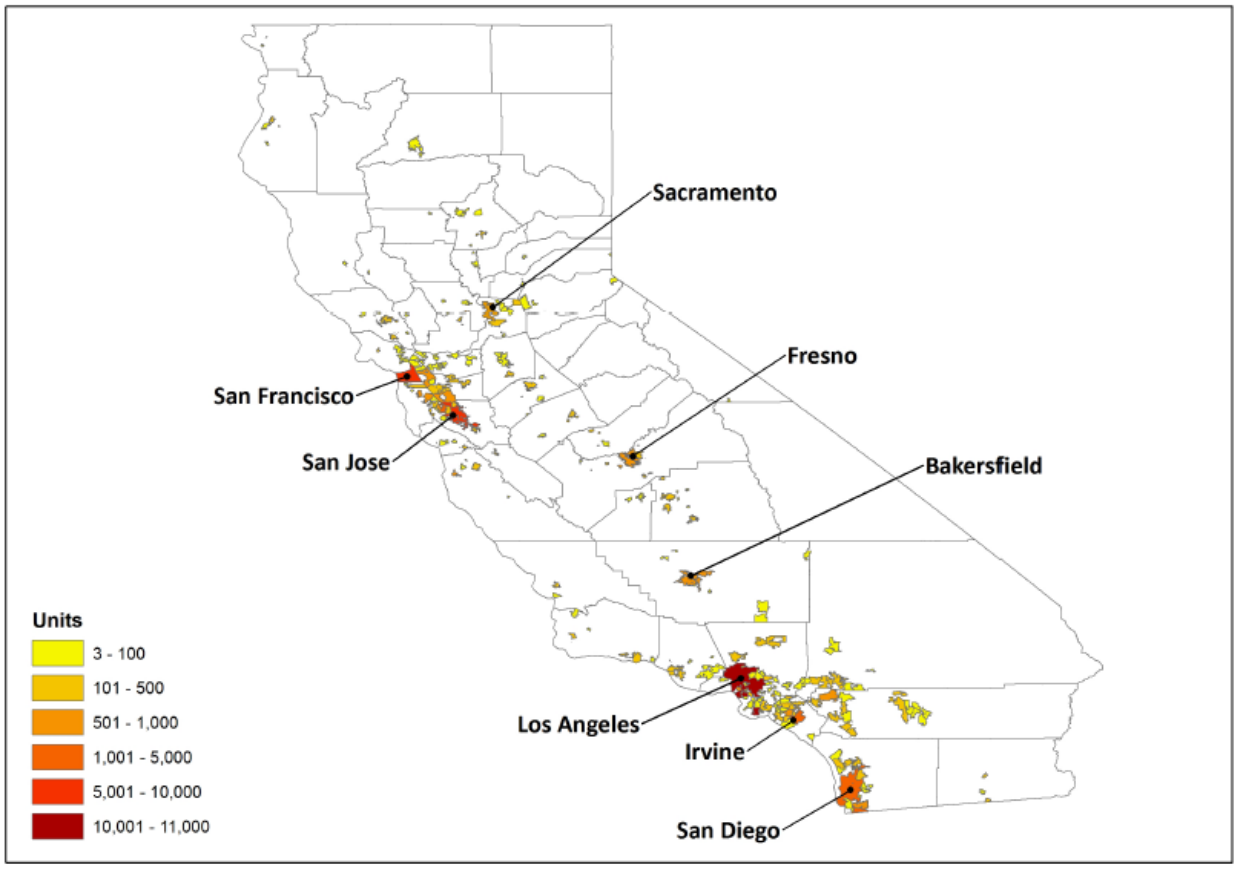
Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: The climate zone for one project, representing 40 units, was not included because the team did not have enough information about the project to determine its climate zone.

5.3.9 Cities, Counties and Metropolitan Statistical Areas

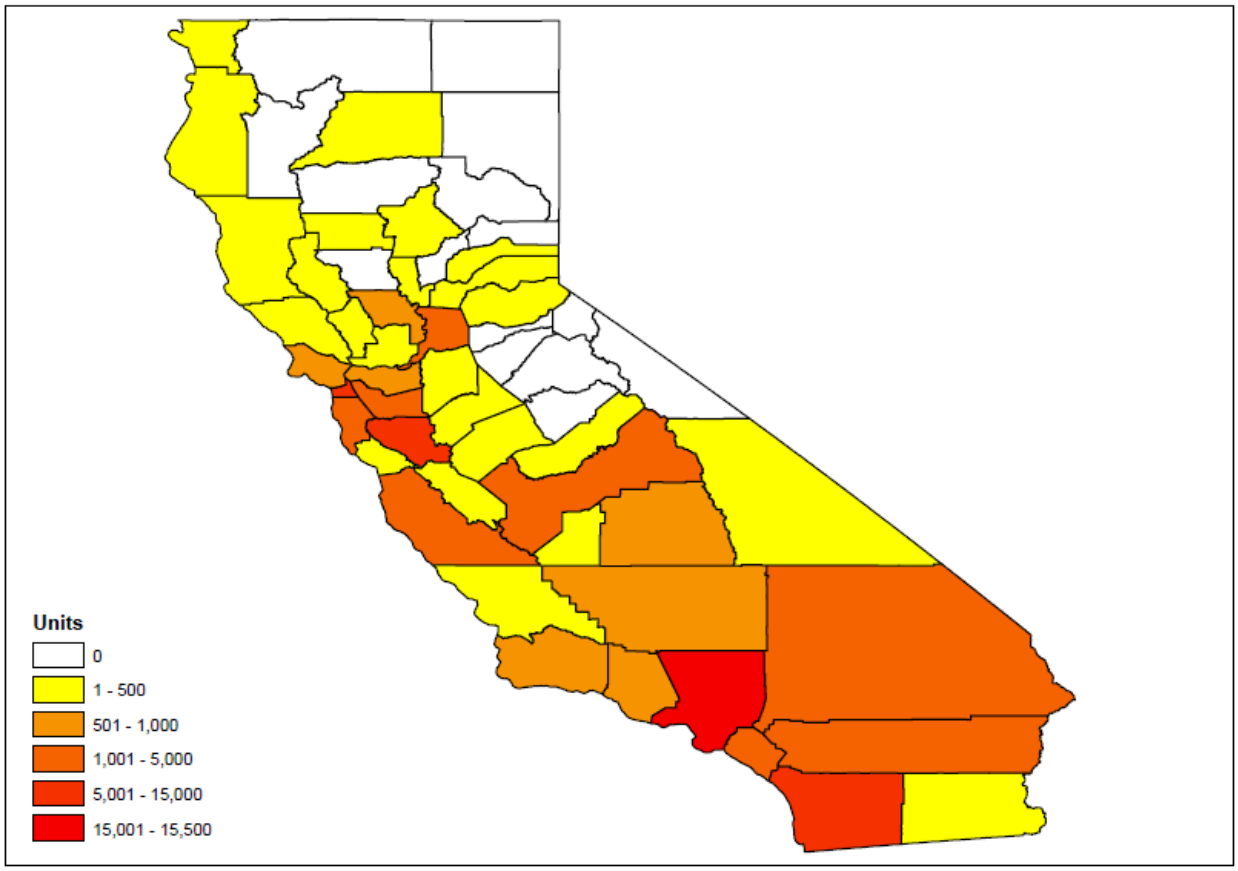
MFNC starts were heavily concentrated in California's major cities and urban areas, as illustrated in Figure 5-25. Forty-six percent of all units were started in five cities: Los Angeles (18% of units), San Jose (9%), San Francisco (9%), San Diego (7%), and Irvine (4%).

Figure 5-25: Total Units of MFNC by City (2010-2012)



Similarly, MFNC starts were heavily concentrated in California's major urban counties (Figure 5-26).[161] Sixty-five percent of all units were started in five counties: Los Angeles (25% of units), Santa Clara (13%), San Diego (10%), San Francisco (8%), and Orange (8%).

Figure 5-26: Total Units of MFNC by County (2010-2012)



Similar to permits, in all three years, nearly all of the MFNC starts (99%) were located within the boundaries of an MSA (see section 5.2.3).

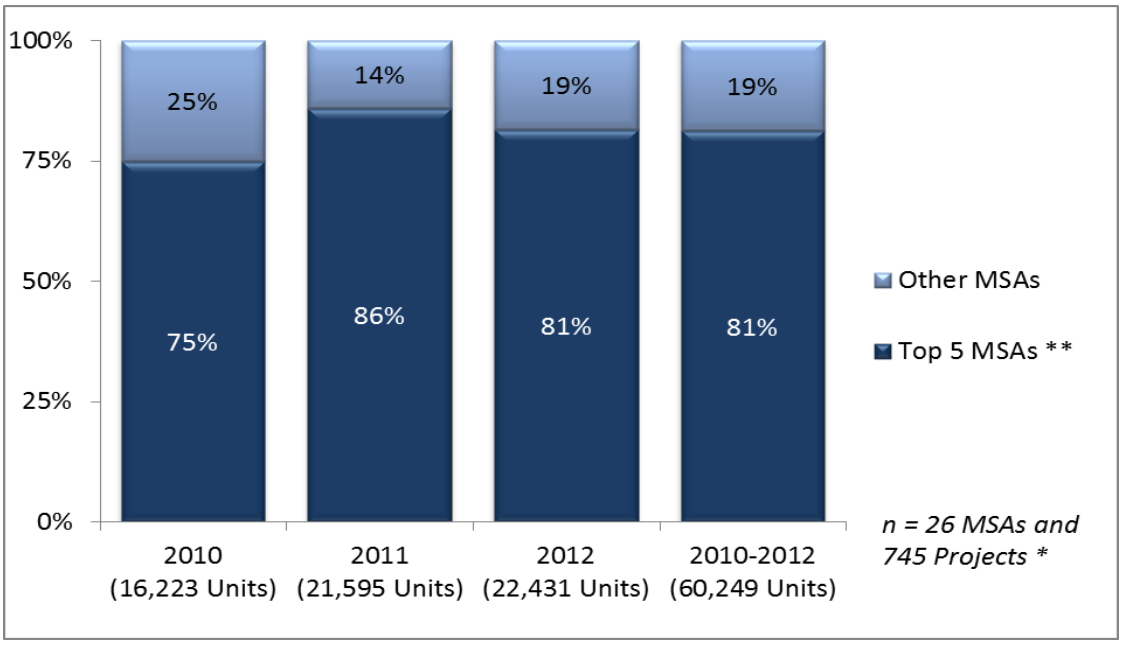
Over the three-year period, the majority of MFNC projects (74%) were started in five unique MSAs. This proportion did not notably vary across years. The top five MSAs for construction project starts were as follows:

- Los Angeles-Long Beach-Anaheim
- San Francisco-Oakland-Hayward
- San Diego-Carlsbad
- San Jose-Sunnyvale-Santa Clara
- Riverside-San Bernardino-Ontario

[161] A map of MRNC projects by county is available in the Appendix (see Figure A-5)

Figure 5-27 illustrates that the top five MSAs also accounted for the majority of estimated units (81%) over the three-year period, with a high of 86% of estimated units in 2011 and a low of 75% of units in 2010.[162] Multifamily units are slightly more concentrated in the top five MSAs than they are for the number of projects—74% of projects are in the top five MSAs (Figure 5-28).

Figure 5-27: Estimated Units among Top-Five Metropolitan Statistical Area Projects by Construction-Start Period
(2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

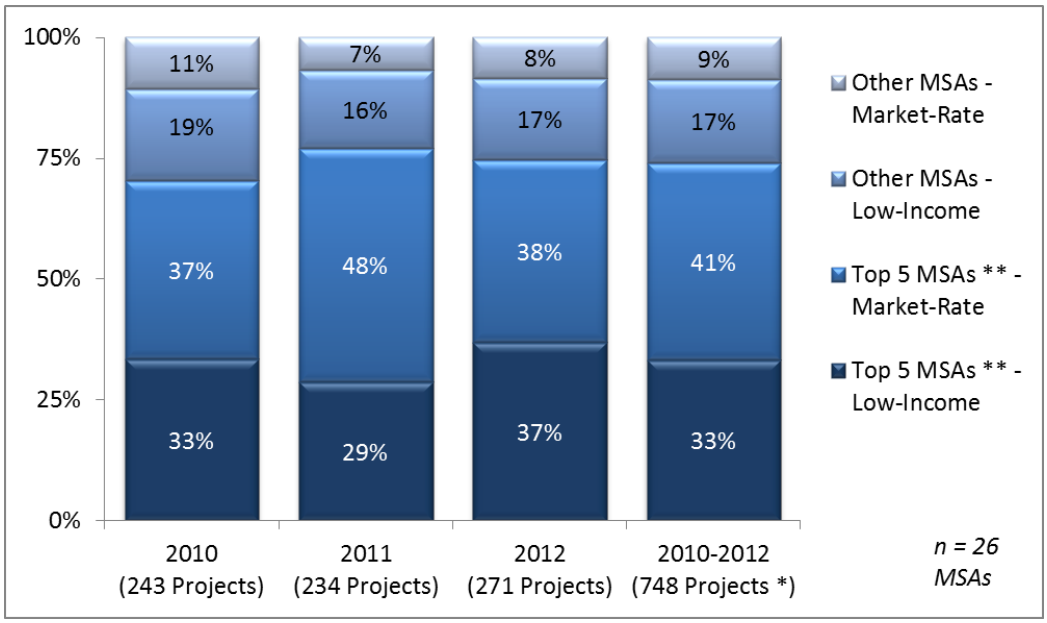
* This chart excludes 15 projects representing 585 units that were started in non-MSA areas or their geographic area was unable to be determined. Three additional projects were excluded because unit count could not be estimated—one project of the three was in a top-5 MSA region.

** The five MSAs including the most construction starts cumulatively from 2010 through 2012 include Los Angeles-Long Beach-Anaheim, San Francisco-Oakland-Hayward, San Diego-Carlsbad, San Jose-Sunnyvale-Santa Clara, and Riverside-San Bernardino-Ontario.

[162] See Figure A-6: for a map of units of MFNC by MSA

Figure 5-28 illustrates the proportion of the low-income and market-rate projects among the top-five MSAs and the other MSAs. As presented in Figure 5-14, low-income and market-rate projects accounted for equal shares of total projects. Yet in the top five MSAs, low-income projects, which account for 33% of all projects, represented a somewhat smaller share of projects than market-rate projects that were in the top five MSAs (41% of all projects).[163]

Figure 5-28: Multifamily Projects among Top Five Metropolitan Statistical Areas by Income and Construction-Start Period (2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* This chart excludes 14 projects started in non-MSA areas and one project with an unknown location.

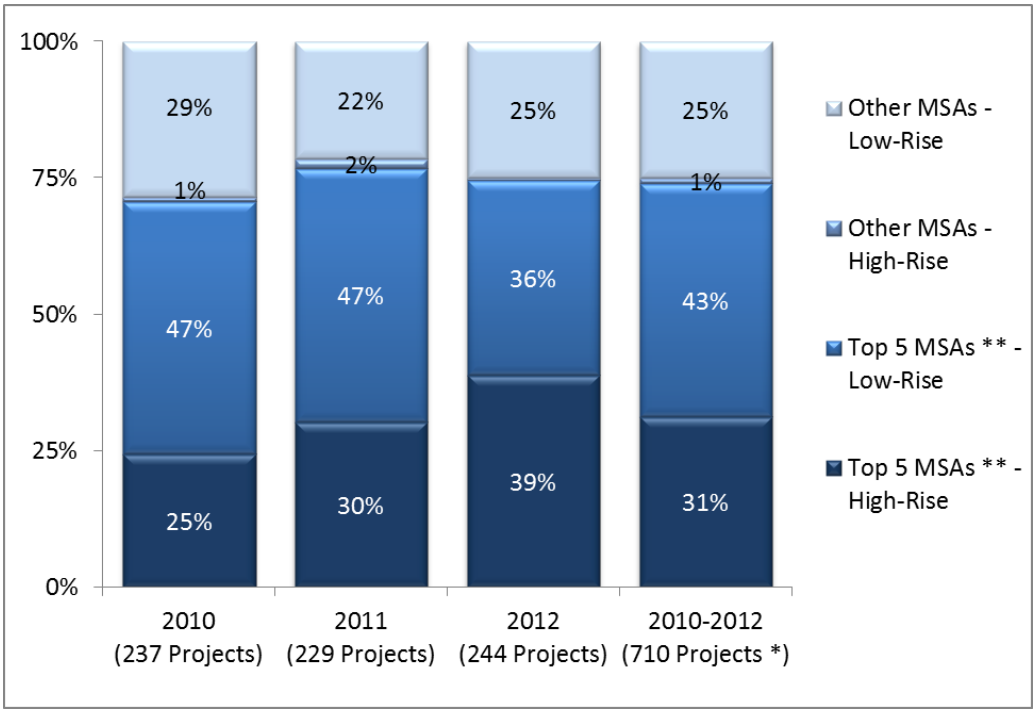
** The five MSAs including the most construction starts cumulatively from 2010- 2012 include Los Angeles-Long Beach-Anaheim, San Francisco-Oakland-Hayward, San Diego-Carlsbad, San Jose-Sunnyvale-Santa Clara, and Riverside-San Bernardino-Ontario.

In terms of number of units, high-rise MFNC is extremely concentrated in urban areas. Ninety-eight percent of all high-rise starts (by units) were started in the top five MSAs and 66% of all high-rise units were started in the top five cities of Los Angeles, San Jose, San Francisco, San Diego, and Irvine.

[163] Among the projects in the top-five MSAs, low-income and market-rate projects represent 45% and 55% of projects, respectively. And among the projects in the other MSAs, low-income and market-rate projects represent 67% and 33% of projects, respectively

Projects most commonly included low-rise buildings located in one of the top five MSAs (43%). In addition, nearly all high-rise buildings were located in the top five MSAs (Figure 5-29).

Figure 5-29: Multifamily Projects among Top Five Metropolitan Statistical Areas by Building Rise and Construction-Start Period (2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* This chart excludes fourteen projects started in non-MSA areas and one project with an unknown location.

** The five MSAs including the most construction starts cumulatively from 2010 through 2012 include Los Angeles-Long Beach-Anaheim, San Francisco-Oakland-Hayward, San Diego-Carlsbad, San Jose-Sunnyvale-Santa Clara, and Riverside-San Bernardino-Ontario.

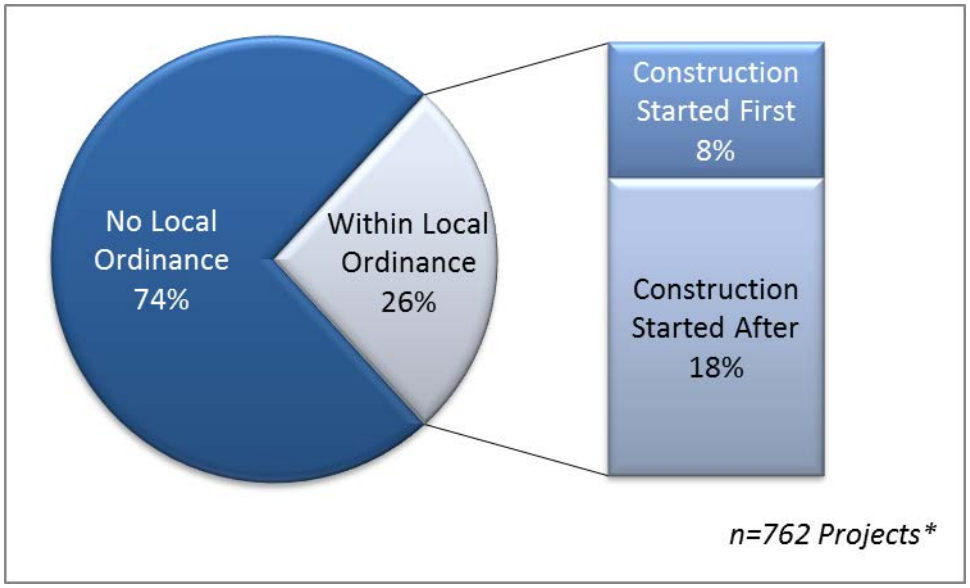
Note: 38 of the 748 projects in MSAs did not have data identifying them as low-rise or high-rise projects. For each year, the team used the ratio of low-rise to high-rise of those projects with rise data to proportionally segment all projects within the given parameter. Some projects have both low-rise and high-rise buildings.

5.3.10 Local Energy Ordinances – Reach Codes

In California, local governments are permitted to adopt their own energy standards that are more rigorous or advanced than those of the state (i.e., "reach codes"). As of November 2013, the CEC website listed 40 city and five county government energy ordinances that it approved between 2009 and 2013.[164]

Figure 5-30 illustrates the proportions of MFNC starts that took place in locations that adopted reach codes. Slightly more than one-quarter of MFNC projects that were started from 2010 through 2012 (26%) took place in a city or county where advanced energy standards were approved. Most of these projects, or nearly one-fifth of all projects (18%) had been started *after* an ordinance was approved for its city or county to enact.

Figure 5-30: Multifamily Project Local Government Energy Ordinances (2010-2012)



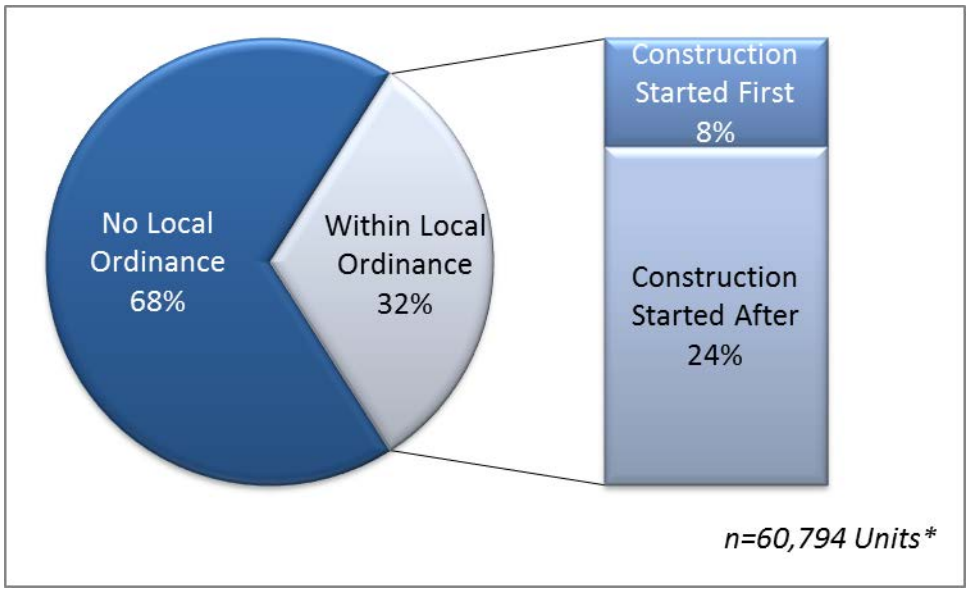
Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; (4) Builder and Developer CATI Surveys; and (5) California Energy Commission (CEC), "Local Ordinances: Exceeding the 2008 Building Energy Efficiency Standards," http://www.energy.ca.gov/title24/2008standards/ordinances, accessed November 2013.

* The ordinance status of an additional project was not included because the team did not have enough information about the project to determine its location.

[164] The Public Resources Code Section 25402 and Section 10-106 of the Building Energy Efficiency Standards grants local governments this flexibility. The local governments first must apply to the CEC for approval to enforce these standards. *Source*: California Energy Commission, "Local Ordinances: Exceeding the 2008 Building Energy Efficiency Standards," http://www.energy.ca.gov/title24/2008standards/ordinances/, accessed November 2013.

Nearly one-third of estimated project units (32%) were started in locations in which the local government adopted its own reach code. The majority of these (24% of all units) started construction after the ordinance was approved (Figure 5-31).

Figure 5-31: Multifamily Project Estimated Units Local Government Energy Ordinances (2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; (4) Builder and Developer CATI Surveys; and (5) CEC, "Local Ordinances: Exceeding the 2008 Building Energy Efficiency Standards."

Note: The ordinance status of one of the 763 projects' units was not included because the team did not have enough information about the project to determine its location.

* Figures represent estimated number of units. We were unable to estimate the number of units for three projects. These projects are excluded here. One of the three projects took place within a local ordinance location.

One-third of market-rate projects (33%) were started in localities with reach codes, while only one-fifth of low-income projects (20%) were started in these locations (Table 5-10). High-rise projects (44%), in comparison to low-rise projects (19%), were more likely to have been started in localities with reach codes. This is due in part because more than one-fifth of high-rise projects (22%) were started in San Francisco, and San Francisco adopted a reach code in December of 2010. Another contributing factor to a larger percentage of high rise projects being subject to reach codes is the fact that high rise projects and MFNC projects located in reach code jurisdictions are more likely to be located in the principal cities of MSAs than low-rise projects. Eighty three percent of high-rise projects are located in the principal cities of MSAs compared to 52% of low-rise projects, while 76% of projects located in reach code communities were located in principal cities.[165]

Table 5-10: Multifamily Project Local Government Energy Ordinances by Income Category and Building Rise
(2010-2012)

Local Energy Ordinance	% Projects by Category				
	Income Category		Building Rise		Total
	% of Low-Income Projects	% of Market-Rate Projects	% of High-Rise Projects	% of Low-Rise Projects	
No Local Ordinance	80%	67%	56%	81%	74%
Within Local Ordinance	20%	33%	44%	19%	26%
Project Started Before	7%	10%	*10%*	*8%*	8%
Project Started After/ Same Time	13%	24%	*34%*	*11%*	18%
Total Projects	**384**	**378**	**231**	**496**	**762**

Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; (4) Builder and Developer CATI Surveys; and (5) CEC, "Local Ordinances: Exceeding the 2008 Building Energy Efficiency Standards."

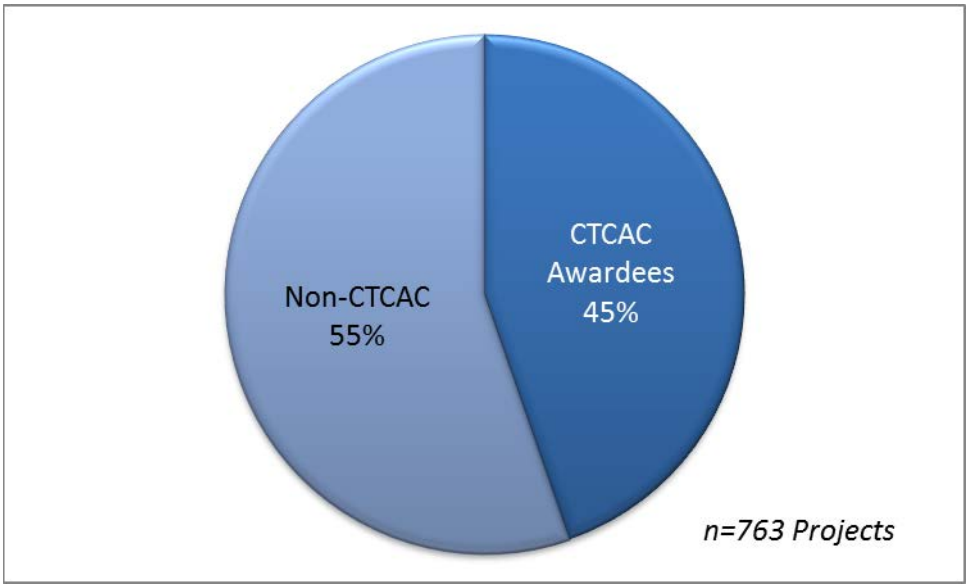
Note: The ordinance status of one project was not included because the team did not have enough information about the project to determine its location. Thirty-nine of the remaining 762 projects did not have data identifying them as low-rise or high-rise projects. Four projects included both high-rise and low-rise buildings; as such, some projects may appear in both high-rise and low-rise columns.

[165] A principal city is defined by the US Census Bureau as follows: "The largest city in each metropolitan or micropolitan statistical area is designated a 'principal city.' Additional cities qualify if specified requirements are met concerning population size and employment." http://www.census.gov/population/metro/about/

5.3.11 CTCAC Awards

In order to be eligible for a CTCAC award, a new construction project must exceed Title 24 requirements by 15% (see Section 5.1 for more details about CTCAC).[166] As such, we used CTCAC awards as an indicator that a project was subject to high efficiency standards. CTCAC awardee lists included nearly one-half of MFNC projects that were started from 2010 through 2012 (45%) (Figure 5-32).

Figure 5-32: Multifamily Project CTCAC Awards (2010-2012)



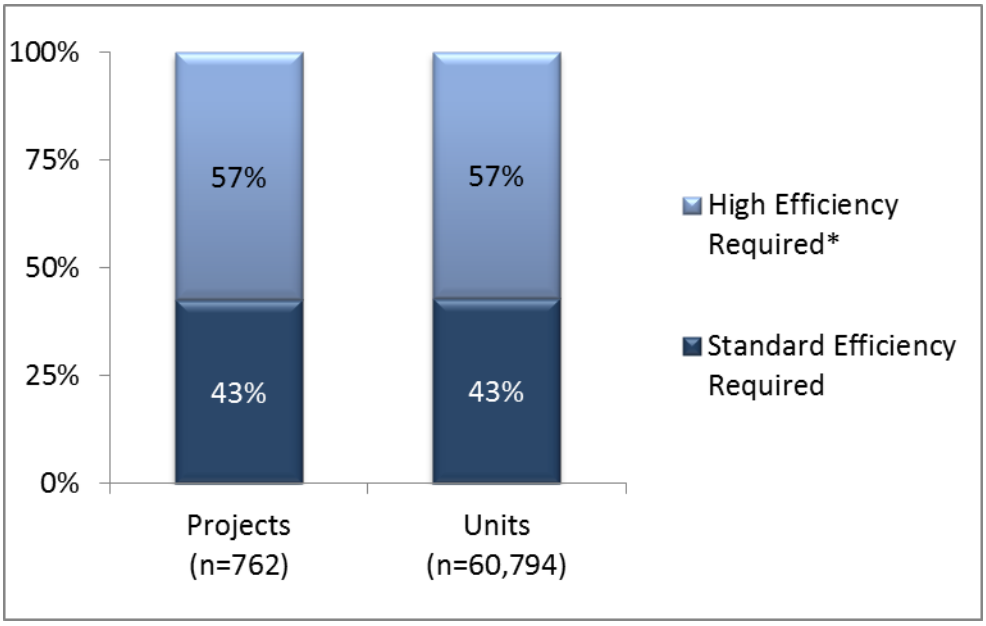
Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

[166] These regulations are set for the energy consumption heating, cooling, and water heating systems. *Source:* CTCAC Regulations Implementing the Federal and State Low Income Housing Tax Credit Laws, California Code of Regulations, Division 17, Chapter 1, January 23, 2013. http://www.treasurer.ca.gov/ctcac/programreg/20130123_regulations.pdf, accessed January 24, 2014.

5.3.12 Above Code Requirements

If projects were either CTCAC awardees and/or located in cities or counties where the local government adopted a reach code at the same time or before construction began, then we deduced that the projects were subjected to high efficiency requirements. As shown in Figure 5-33, we estimated that more than one-half of MFNC projects (57%) and units (57%) that were started from 2010 through 2012 were required to be high efficiency.

Figure 5-33: Multifamily Project and Estimated Units High Efficiency Requirements (2010-2012)



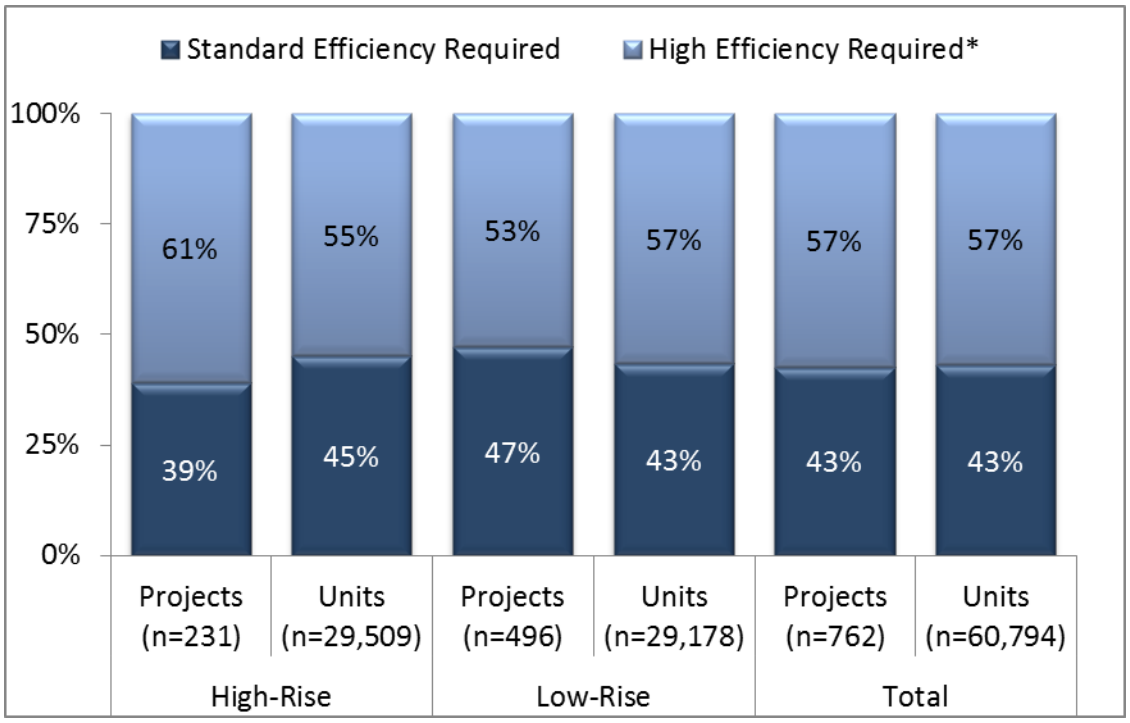
Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* "High Efficiency Required" refers to projects that received CTCAC awards and/or those that were started at the same time or after a local energy ordinance was put in place.

Note: The efficiency status of one project was not included because the team did not have enough information about the project to determine its location and it was not included in a CTCAC award list. Units represent estimated number of units. We were unable to estimate the number of units for three projects. These projects are excluded in the unit-columns.

High-rise projects (61%) were more likely than low-rise projects (53%) to be subject to high efficiency requirements. Estimated units in low-rise projects (57%) were slightly more likely than estimated units in high-rise projects (55%) to be subject to high efficiency standards (Figure 5-34).

Figure 5-34: Multifamily Project and Estimated Units High Efficiency Requirements by Building Rise
(2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* "High Efficiency Required" refers to projects that received CTCAC awards and/or those that were started at the same time or after a local energy ordinance was put in place.

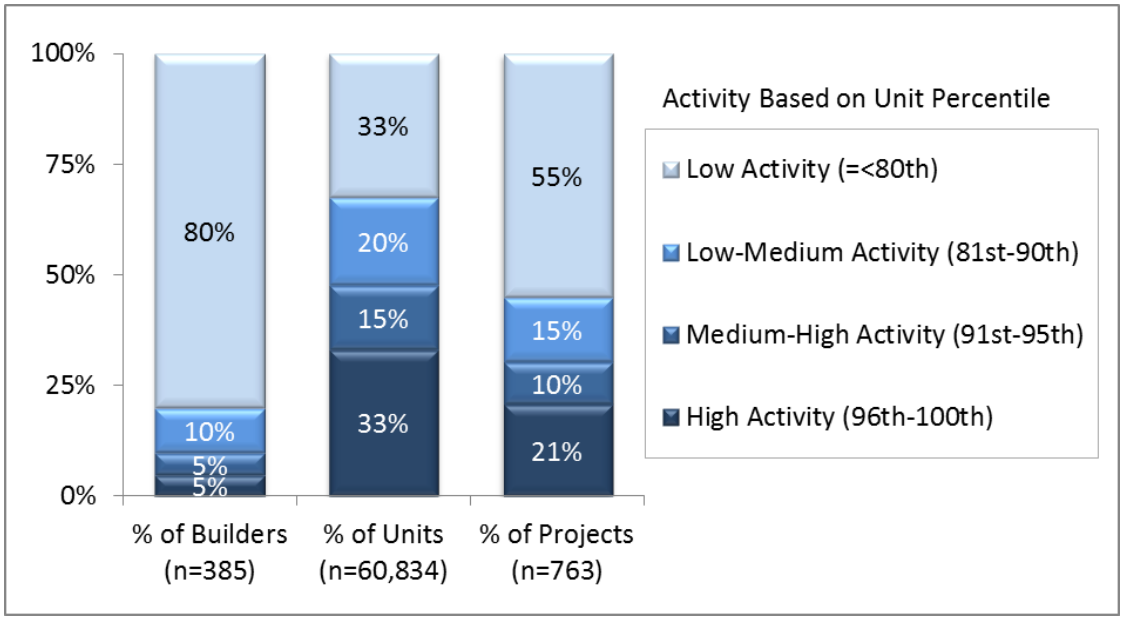
Note: The efficiency status of one project was not included because the team did not have enough information about the project to determine its location and it was not included in a CTCAC award list. Thirty-nine of the remaining 762 projects did not have data identifying them as low-rise or high-rise projects. Four projects included both high-rise and low-rise buildings; as such, some projects may appear in both high-rise and low-rise columns. Units represent estimated number of units. We were unable to estimate the number of units for three projects. These projects are excluded here.

5.3.13 Builders and Developers

The research team identified 385 builders associated with the 763 projects started from 2010 through 2012. On average, the 385 builders started 2.0 projects and 158 units from 2010 through 2012. We analyzed the builder data and found that a small share of builders accounted for a disproportionately large share of projects and units.

We assigned a percentile rank to each builder based on the number of units in that builder's project starts. Next, we segmented builders into four activity groups based on their percentile ranks (Figure 5-35). High activity builders—those found in the 96th to 100th percentiles, representing 5% of builders—were involved with slightly more than one-fifth of projects (21%) and one-third of units (33%). The top 20% of builders was responsible for two-thirds of all units. Low activity builders, in the 80th percentile or lower, were involved with less than three-fifths of projects (55%) and one-third of units (33%).

Figure 5-35: Multifamily Project Builder Activity Levels Based on Number of Estimated Unit Percentiles
(2010-2012)



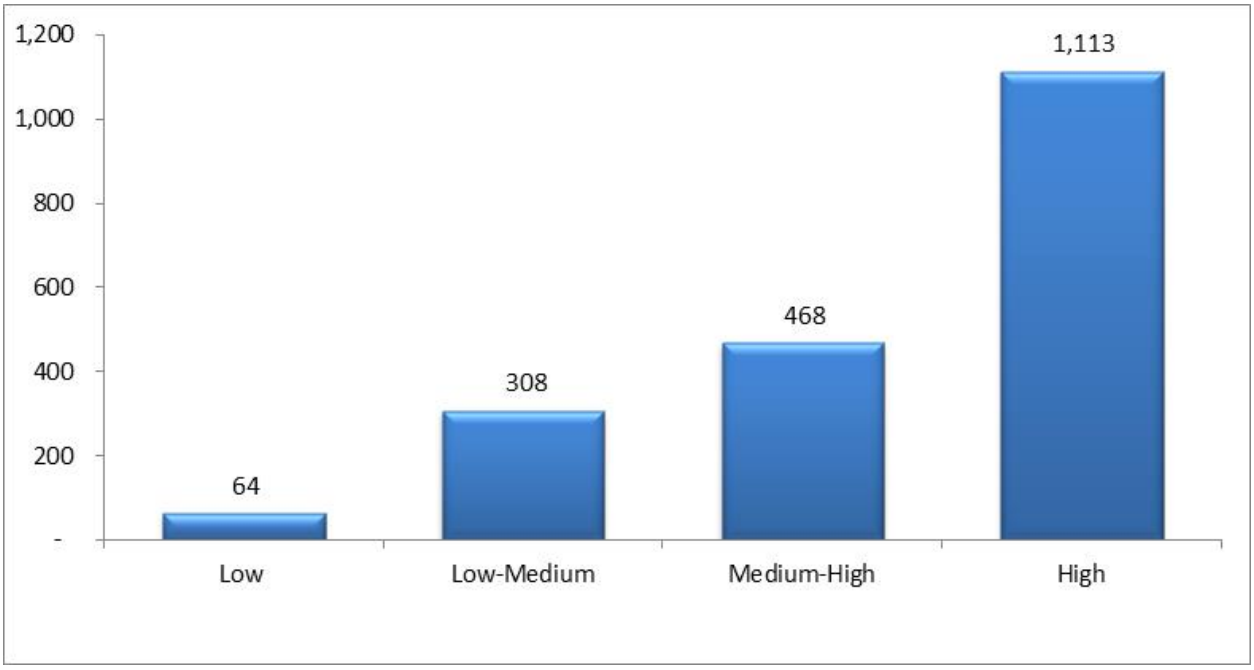
Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: Unit figures include the estimated number of units. We were unable to estimate the number of units for three of the 763 projects. Because one of the three builders that conducted those three projects had conducted other projects that did have unit data, the 60,834 units are represented by 384 builders associated with 760 projects.

Figure 5-36 reports the average number of units per builder by activity level. On average, the high activity builders each started over 1,000 units from 2010 through 2012, while the lowest activity builders started fewer than 100 units.[167]

Figure 5-36: Average Number of Units per Builder by Activity Levels

(2010-2012)



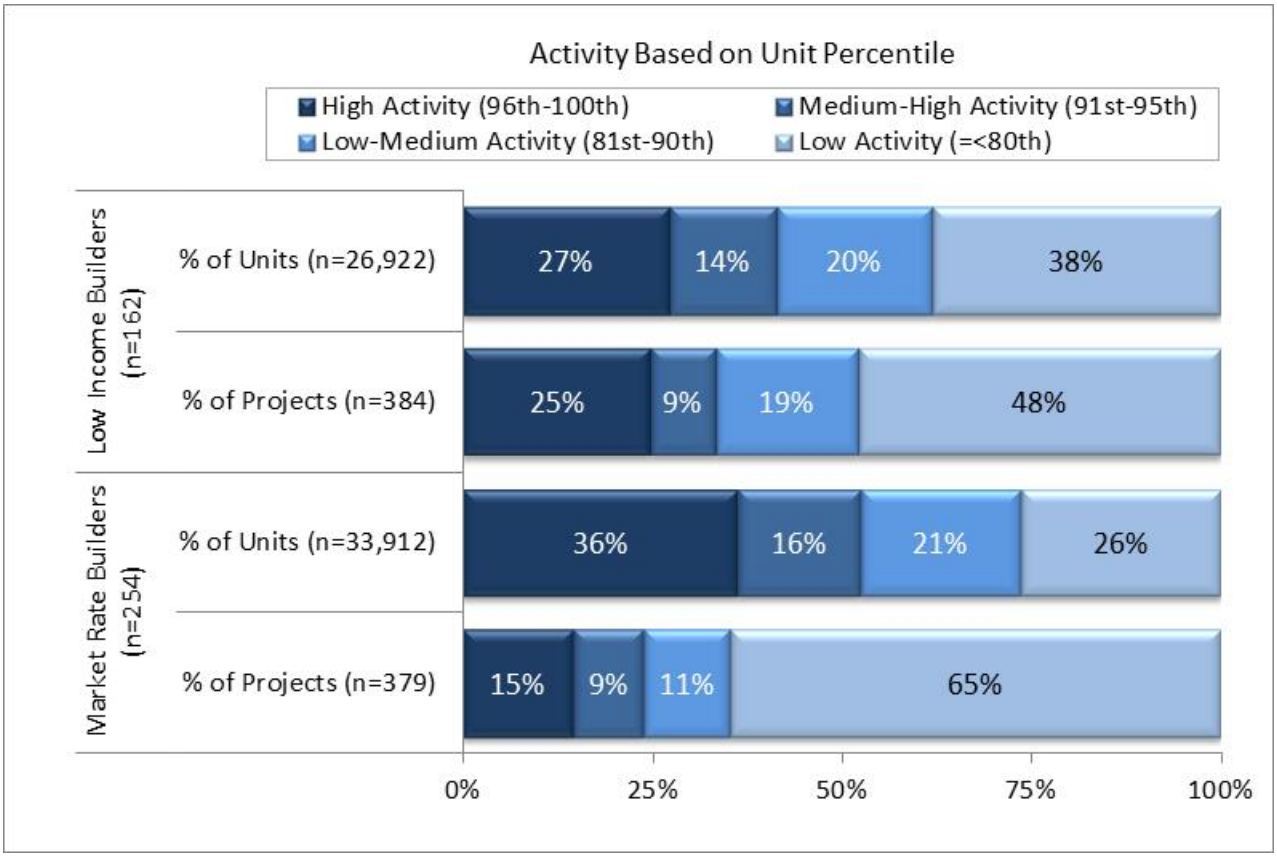
Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* Figures are based on the estimated number of units. We were unable to estimate the number of units for three of the 763 projects.

[167] The low, low-medium and medium high activity groups had relatively similar standard deviations of the average number of units started, 58.1, 54.9 and 54.5, respectively. The high activity group had the largest standard deviation of 830.7, reflecting the larger variation in building activity among this group of builders, ranging from 607 to 4,123 units.

Comparing the construction activity of builders who started market rate projects and low-income projects, we found that the market rate sector is more heavily concentrated among high activity builders than the low-income sector, supporting the findings of the market actor interviews (see Section 3.1.6.1.1). High activity market-rate builders were responsible for 36% of market-rate units started from 2010 through 2012 compared to 27% of low-income units for high activity low-income builders (Figure 5-37).

Figure 5-37: Comparison of Market Rate and Low Income Multifamily Builder Activity Levels (2010-2012)



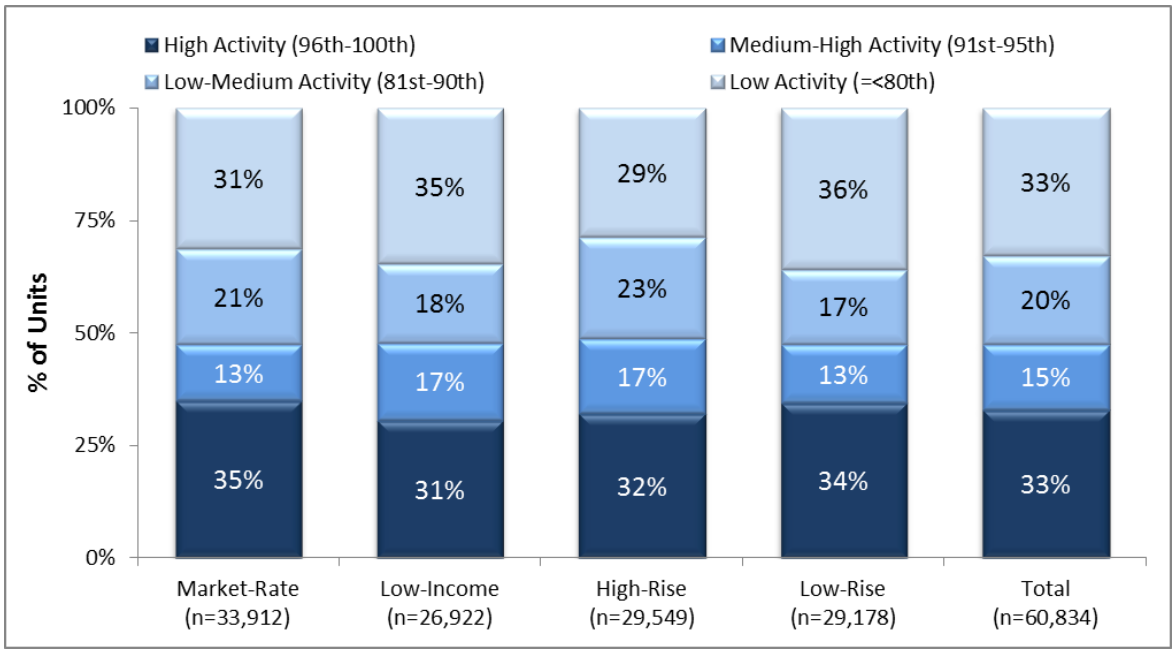
Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: Unit figures include the estimated number of units. We were unable to estimate the number of units for three of the 763 projects. Because one of the three builders that conducted those three projects had conducted other projects that did have unit data, the 60,834 units are represented by 384 builders associated with 760 projects

In addition, builders appear to tend to specialize in market-rate or affordable housing as only 31 of 385 builders (8%) built both market rate and affordable housing projects from 2010 through 2012. Fifty eight percent of builders only started market rate projects and 34% of builders only started low-income projects from 2010 through 2012.

Comparing building rise and income category types by unit percentile-based activity levels, we see limited variation across project types. For example, as shown in Figure 5-38, roughly one-third of units in market-rate (35%), low-income (31%), high-rise (32%), and low-rise (34%) projects were built by high activity builders.

Figure 5-38: Multifamily Project Income-Category and Building Rise by Builder Activity Levels (Based on Estimated Unit Percentiles)
(2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: Four projects included both high-rise and low-rise buildings. Because unit data were not identified as either high-rise or low-rise, these figures are counted for both rise columns. Additionally, 39 projects are excluded from rise columns because they did not have data identifying them as low-rise or high-rise projects.

5.4 Forecasting Market Growth

Based on our secondary data analysis, we estimated changes in the California MFNC market after 2012. Given that data are limited, we chose to confine our projections of permits to 2014 and starts to 2013 and 2014.[168] To make estimates for 2013 and 2014, we extrapolated on forecasts from the UCLA Anderson Forecast[169] and the results of our permit and new construction data analyses presented in the two previous sections.

Table 5-11 presents the estimated percentage changes in the number of MFNC permits from 2013 to 2014. The UCLA Anderson Forecast predicted there would be substantial growth in the MFNC market in 2014, estimating that in 2014 there would be 69,100 MFNC units permitted in California compared to a projection of 60,200 permitted units of single family homes.[170] This estimate represents a 47% increase from 2013 to 2014 in the number of multifamily permitted units.

Table 5-11: Multifamily New Construction Estimated Future Market Changes in Permits

Year	Permits	
	Units	% Change from Prior Year
2009	10,169	
2010	18,570	+83%
2011	24,991	+35%
2012	31,024	+24%
2013	47,167	+52%
2014 (estimated)	*69,100 **	*+47%*

Sources: (1) CHF, CIRB, Annual Building Permit Summaries; (2) UCLA Anderson Forecast, "Sluggish Economy Continues Despite Improvements in the Housing Market," June 20, 2012, http://www.uclaforecast.com/contents/archive/2012/media_62012_1.asp, accessed January 3, 2014; and (3) Multifamily Executive, Economic Conditions, "Housing to 'Return to Normal' in 2014, UCLA's Anderson School Says," September 27, 2012, http://www.multifamilyexecutive.com/economic-conditions/housing-to--return-to-normal--in-2014--ucla-s-anderson-school-says.aspx, accessed January 3, 2014.

* UCLA Anderson Forecast estimated percent increase; we estimated number of units applying this to 2012 number of units.

** UCLA Anderson Forecast estimated number of units; we estimated percent increase applying this to 2013 estimated number of units.

[168] At the time of this report, permit data for 2013 was available from CBIA: http://www.cbia.org/tasks/sites/cbia/assets/File/Residential%202013.pdf

[169] The UCLA Anderson Forecast prepares economic forecasts for the U.S. (with special emphasis on California).

[170] Multifamily Executive, Economic Conditions, "Housing to 'Return to Normal' in 2014, UCLA's Anderson School Says," September 27, 2012, http://www.multifamilyexecutive.com/economic-conditions/housing-to--return-to-normal--in-2014--ucla-s-anderson-school-says.aspx, accessed January 3, 2014. The UCLA Anderson Forecast predicted a 40% increase, to 43,434, in MFNC permits for 2013. Actual permits exceeded the Anderson Forecast by nearly 3,000 permits, suggesting that the 2014 forecast may be a conservative forecast of MFNC permit activity. UCLA Anderson Forecast, "Sluggish Economy Continues Despite Improvements in the Housing Market," June 20, 2012, http://www.uclaforecast.com/contents/archive/2012/media_62012_1.asp, accessed January 3, 2014

Table 5-12 summarizes our estimates for 2013 and 2014 MFNC construction starts. To estimate the number of MFNC starts, we compared the relationship between the number of units permitted and the number of construction starts each year for 2010 through 2012. The annual numbers of construction starts as shares of annual permits were particularly high in 2010 (88%) and 2011 (87%).[171] In 2012, this figure decreased notably: the proportion of construction start units was 73%. We assume that the high percentages of construction starts in 2010 and 2011 were as a result of built up demand during the economic crisis that may have delayed projects that had actually been intended to start in 2009. Given the limitations in available data and unusual circumstances in earlier years, we concluded that the 2012 construction starts were a more realistic estimate of new construction activity; as a result, we used the ratio of construction starts to permits from 2012 to estimate future year construction starts.

Assuming that slightly less than three-quarters (73%) of permitted units drawn in 2013 and 2014 would be started, we estimated that there have been 34,593 units started in 2013 and there will be 50,678 units started in 2014.

Table 5-12: Multifamily New Construction Estimated Future Market Changes in Construction Starts

Year	Permitted Units	Construction Starts		
		Estimated Units *	% of Annual Permits	% Change
2010	18,570	16,336	88%	
2011	24,991	21,745	87%	+33%
2012	31,024	22,753	73%	+5%
2013 (*estimated starts)*	47,167	*34,592*	*73% **	*+52%*
2014 (estimated)	*69,100*	*50,678*	*73% **	*+47%*

Sources: (1) CHF, CIRB, Annual Building Permit Summaries; (2) UCLA Anderson Forecast, "Sluggish Economy Continues Despite Improvements in the Housing Market"; (3) Multifamily Executive, Economic Conditions, "Housing to 'Return to Normal' in 2014, UCLA's Anderson School Says;" (4) MHC, 2010-2012 Dodge Project Data; (5) CTCAC, 2009-2011 Annual Reports; (6) IOU Program Project Lists; and (7) Builder and Developer CATI Surveys.

* In the new construction starts data analysis we estimated the number of units for some projects using their square footage data in the absence of reported data.

** We estimated that the number of construction starts as compared to number of permits in 2012 could be used to calculate 2013 and 2014 starts.

[171] As described in previous sections, construction is not necessarily started in the same year as a permit is drawn, but we chose to use this relationship as an indicator of market activity.

5.5 IOU Program Participation

Nearly one-third (32%) of MFNC projects started in IOU territory from 2010 through 2012 participated in IOU programs. A total of 238 MFNC IOU program projects started from 2010 through 2012, with nearly all (234) enrolled in the CAHP or CMFNH program, while only four were enrolled in the SBD program. Table 5-13 presents the rates of participation among the IOU programs relative to the annual number of projects started in the IOU's service territory; PG&E has the highest market penetration rate among the IOUs, as 44% of all 2010-2012 MFNC projects participated in the program.

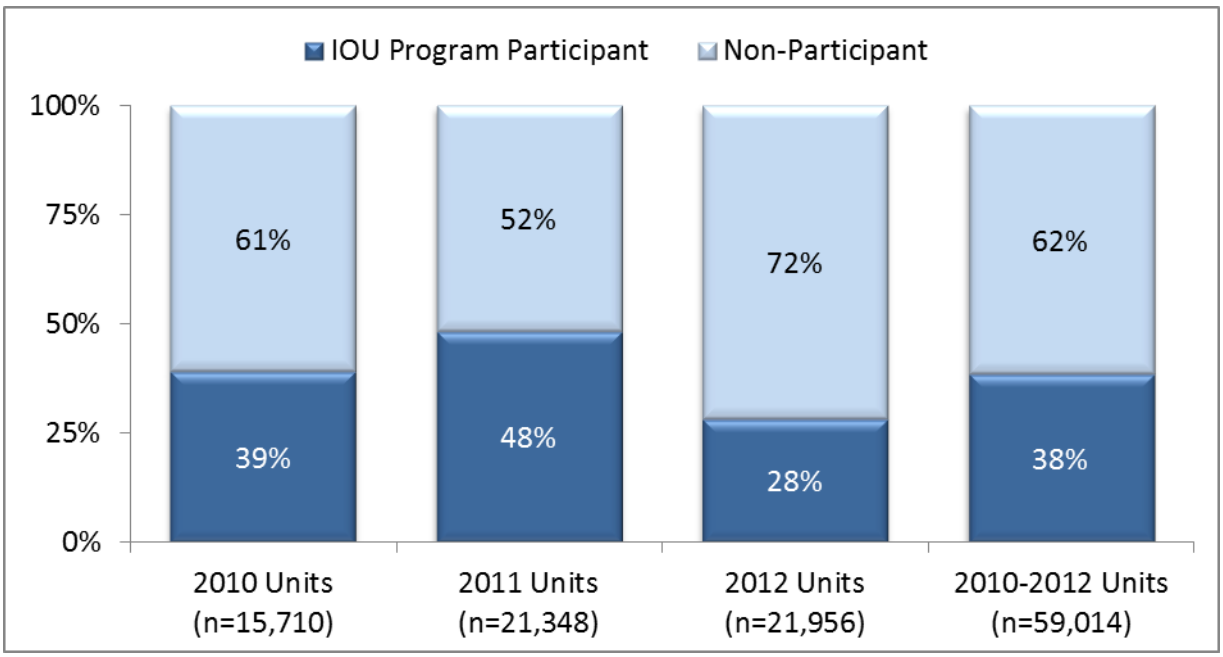
Table 5-13: Multifamily New Construction Projects in IOU Territories and IOU Program Participation Rate (2010-2012)

Investor Owned Utility	Total Project Counts (IOU Territories) and % Participating in IOU Programs			
	2010	2011	2012	2010-2012
Pacific Gas & Electric	87	104	118	309
% Participating	43%	47%	42%	44%
Southern California Edison	84	62	65	211
% Participating	20%	24%	25%	23%
Southern California Gas	146	118	133	397
% Participating	8%	14%	3%	8%
San Diego Gas & Electric	21	22	27	70
% Participating	33%	41%	19%	30%
Total MFNC Projects, IOU Territories	235	236	262	733
% of Projects	31%	38%	29%	32%

Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

The IOU's MFNC programs accounted for nearly two-fifths (38%) of all units started in the IOU territories from 2010 through 2012 (Figure 5-39).[172] Market penetration increased from 2010 to 2011 but dropped noticeably from 2011 to 2012. Program staff suggested that this pattern may be due to a combination of the housing recovery and limited program funds. The increase from 2010 to 2011 may have been due to the recovery in the housing market and the release of pent-up demand in the market from the recession. The decline in 2012 may be due to limited program funds combined with the housing recovery. Program staff from two IOUs noted that the program exhausted all of their MFNC funds before the end of the 2010 to 2012 program cycle, limiting the number of projects and units that could be enrolled in the program as the MFNC market rebounded.

Figure 5-39: Market Penetration of IOU MFNC Programs (2010-2012)



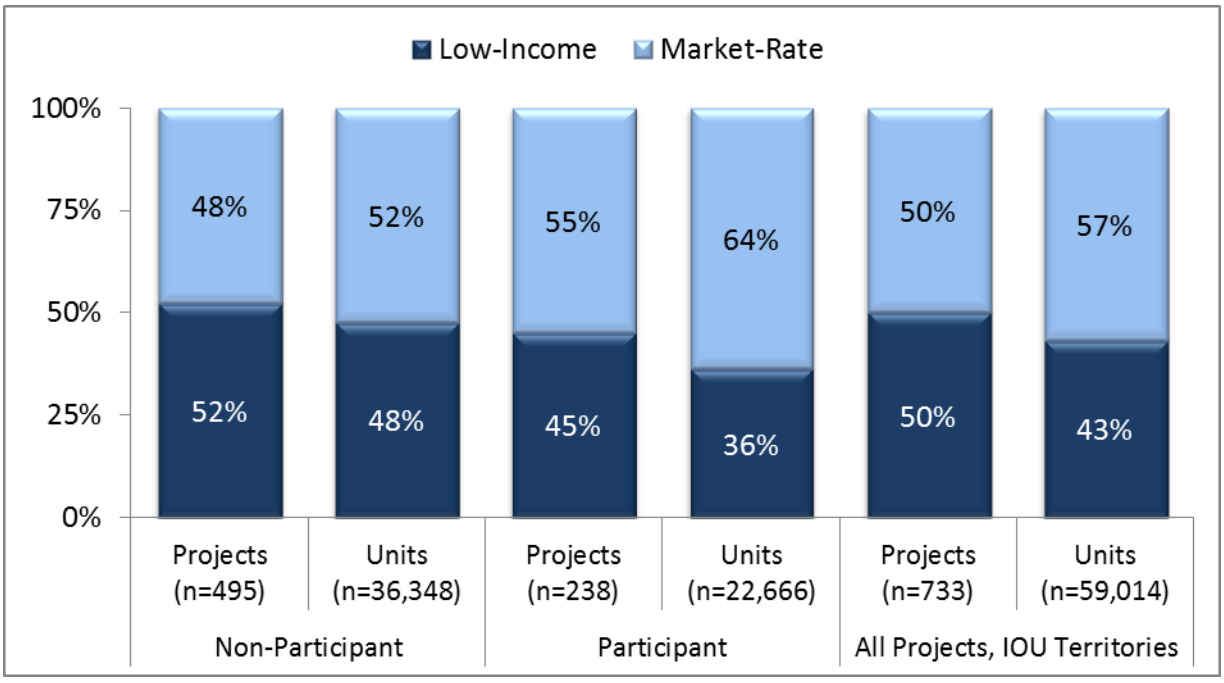
In the following sub-section, we describe the participating IOU program project population and, where relevant, compare it to the non-participating project population in IOU service territories.

[172] The number of units enrolled in the IOUs' programs increased from 6,137 units in 2010 to 10,320 units in 2011 and declined to 6,209 units in 2012.

5.5.1.1 Income Category and Building Rise

Figure 5-40 shows that, from 2010 through 2012, 45% of IOU program projects included low-income housing, accounting for 36% of units. In comparison, slightly more than one-half of non-participating projects in IOU territories (52%) included low-income housing, accounting for 48% of non-program units.

Figure 5-40: Multifamily New Construction Projects in IOU Territories – Income Category by IOU Program Participation (2010-2012)

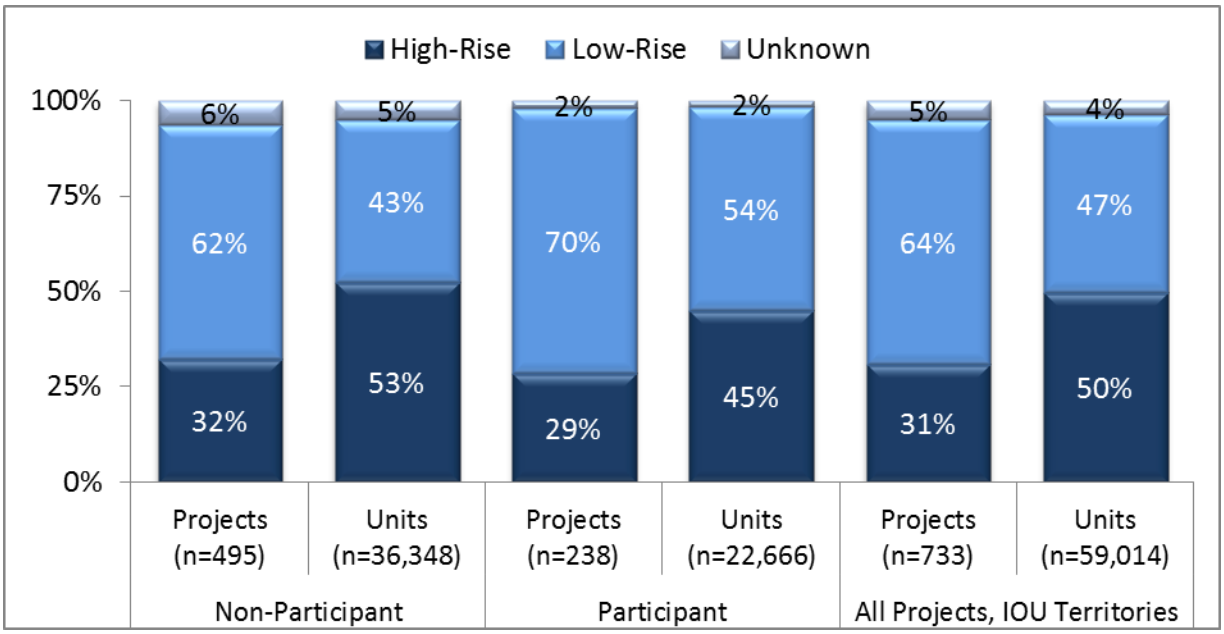


Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Slightly fewer IOU program projects (29%) included high-rise buildings compared to non-participating projects (32%) (Figure 5-41). Forty-five percent of program units were in high-rise buildings compared to 53% of non-participating units.

Figure 5-41: Multifamily New Construction Projects in IOU Territories – Building Rise by IOU Program Participation

(2010-2012)



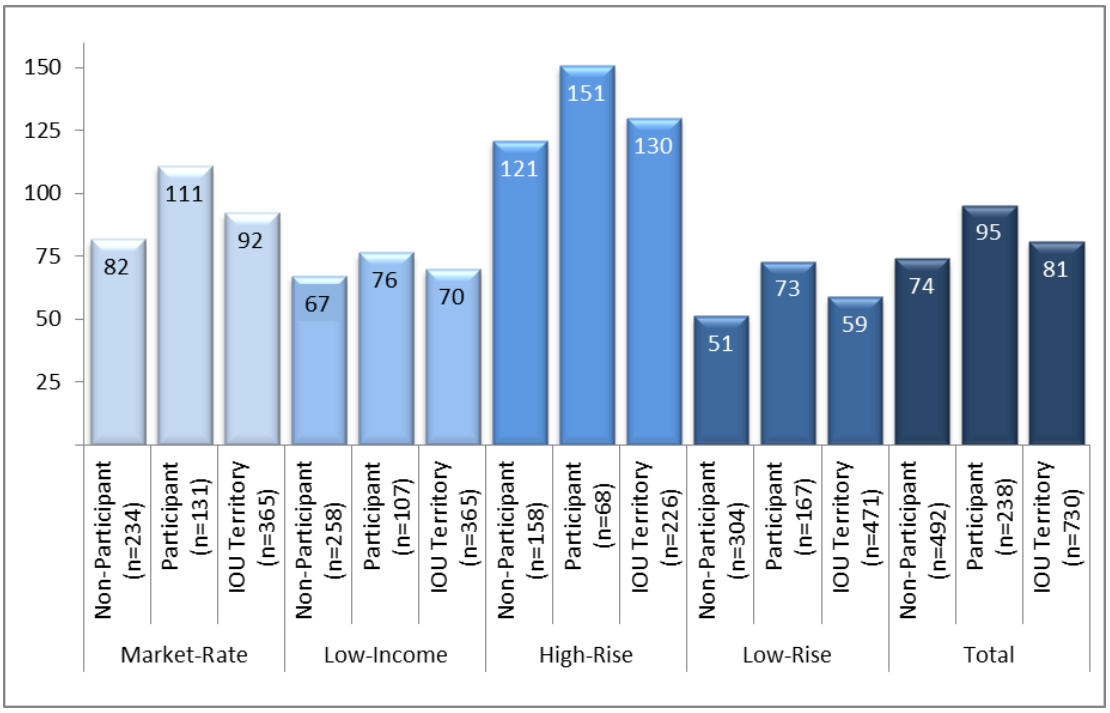
Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.
* Four IOU projects included both high-rise and low-rise buildings; as such, percentages total to greater than 100%.
Note: Includes only projects located in IOU service territories.

5.5.1.2 Number of Units

Figure 5-42 illustrates the mean number of units across IOU program projects, non-program projects, and all projects in IOU territories by income category, building rise, and in total. We estimated that, from 2010 through 2012, the program projects had 95 units on average compared to non-program projects in IOU territory, which had 74 units on average. The larger MFNC projects appear, on average, to be enrolling in the IOUs' programs.

The difference between program and non-program projects' average number of units is least extreme among low-income projects and most extreme among low-rise projects. As with the overall population data, high-rise program projects have the largest average number of units (151 units).

Figure 5-42: Multifamily New Construction Projects in IOU Territories – Estimated Average Number of Units per Project by IOU Program Participation (2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: Includes only projects located in IOU service territories.

Table 5-14 shows the variation in the estimated number of units per project by year and participation in IOU programs. Participating IOU program projects' average estimated number of units increased from 84 units in 2010 to 115 units in 2011, but then decreased to 83 units in 2012. Non-participating projects experienced a more linear increase over the three-year period, with projects having 59 units on average in 2010, 76 in 2011, and 85 in 2012.

Participating IOU program projects were more consistently likely to have 100 or more units per project across all three years compared to non-participating projects. In total, from 2010 through 2012, nearly one-third of participating projects (30%) included 100 or more units, while less than one-fifth of non-participating projects (18%) included 100 or more units.

The difference in number of units between participating and non-participating projects may be attributed to IOU program incentives. A large project may yield a higher incentive, potentially making it more encouraging to go through the participation process. Additionally, a larger project may have more resources to undergo the participation process.

Table 5-14: Multifamily New Construction Projects in IOU Territories – Estimated Number of Units per Project by IOU Program Participation

(2010-2012)

	% of Non-Program Projects				% of Program Projects			
Units per Project	**2010**	**2011**	**2012**	**2010-2012**	**2010**	**2011**	**2012**	**2010-2012**
Unknown	1%	-	1%	1%	-	-	-	-
3-4	7%	10%	8%	8%	1%	-	4%	2%
5 to 19	19%	20%	11%	16%	16%	11%	12%	13%
20 to 39	20%	14%	16%	17%	10%	21%	19%	17%
40 to 59	17%	16%	21%	18%	15%	18%	19%	17%
60 to 79	13%	14%	16%	14%	15%	10%	15%	13%
80 to 99	9%	5%	8%	7%	15%	7%	4%	8%
100 to 199	10%	12%	9%	11%	16%	18%	17%	17%
200 or more	4%	8%	11%	8%	11%	16%	11%	13%
Total projects	**162**	**146**	**187**	**495**	**73**	**90**	**75**	**238**
Average Number of Units	**59**	**76**	**85**	**74**	**84**	**115**	**83**	**95**

Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: Includes only projects located in IOU service territories.

5.5.1.3 Number of Buildings

As shown in Table 5-15, both non-program (54%) and program (30%) projects were most likely to have only one building per project. IOU program projects were more likely to include multiple buildings: more than two-fifths of program projects (42%) included five or more buildings per project, while roughly one-fifth of non-program projects (21%) included five or more buildings per project. As a result, program projects had seven buildings per project, on average, whereas non-program projects had five buildings per project, on average.

Table 5-15: Multifamily New Construction Projects in IOU Territories – Number of Buildings by IOU Program Participation

(2010-2012)

	% of Non-Program Projects*				% of Program Projects			
Buildings	**2010**	**2011**	**2012**	**2010-2012**	**2010**	**2011**	**2012**	**2010-2012**
Unknown	-	1%	5%	2%	8%	2%	-	3%
1	51%	60%	52%	54%	25%	27%	40%	30%
2	13%	9%	10%	11%	5%	10%	16%	11%
3	8%	4%	7%	7%	5%	7%	7%	6%
4	4%	5%	8%	6%	8%	7%	7%	7%
5 to 9	13%	12%	13%	13%	23%	26%	19%	23%
10 to 19	7%	8%	3%	5%	22%	13%	9%	15%
20 or more	4%	1%	2%	2%	3%	9%	3%	5%
Total Projects	**162**	**146**	**187**	**495**	**73**	**90**	**75**	**238**
Average Number of Buildings	**5**	**4**	**6**	**5**	**7**	**8**	**4**	**7**

Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: Includes only projects located in IOU service territories.

5.5.1.4 Climate Zones and Regions

As shown in Table 5-16, over the three-year period, IOU program projects were most likely to have been started in climate region one (42%), which largely corresponds with PG&E territory. IOU program projects were least likely to have been started in climate region five (1%).

Table 5-16: Multifamily New Construction Projects in IOU Territories – Climate Regions by IOU Program Participation

(2010-2012)

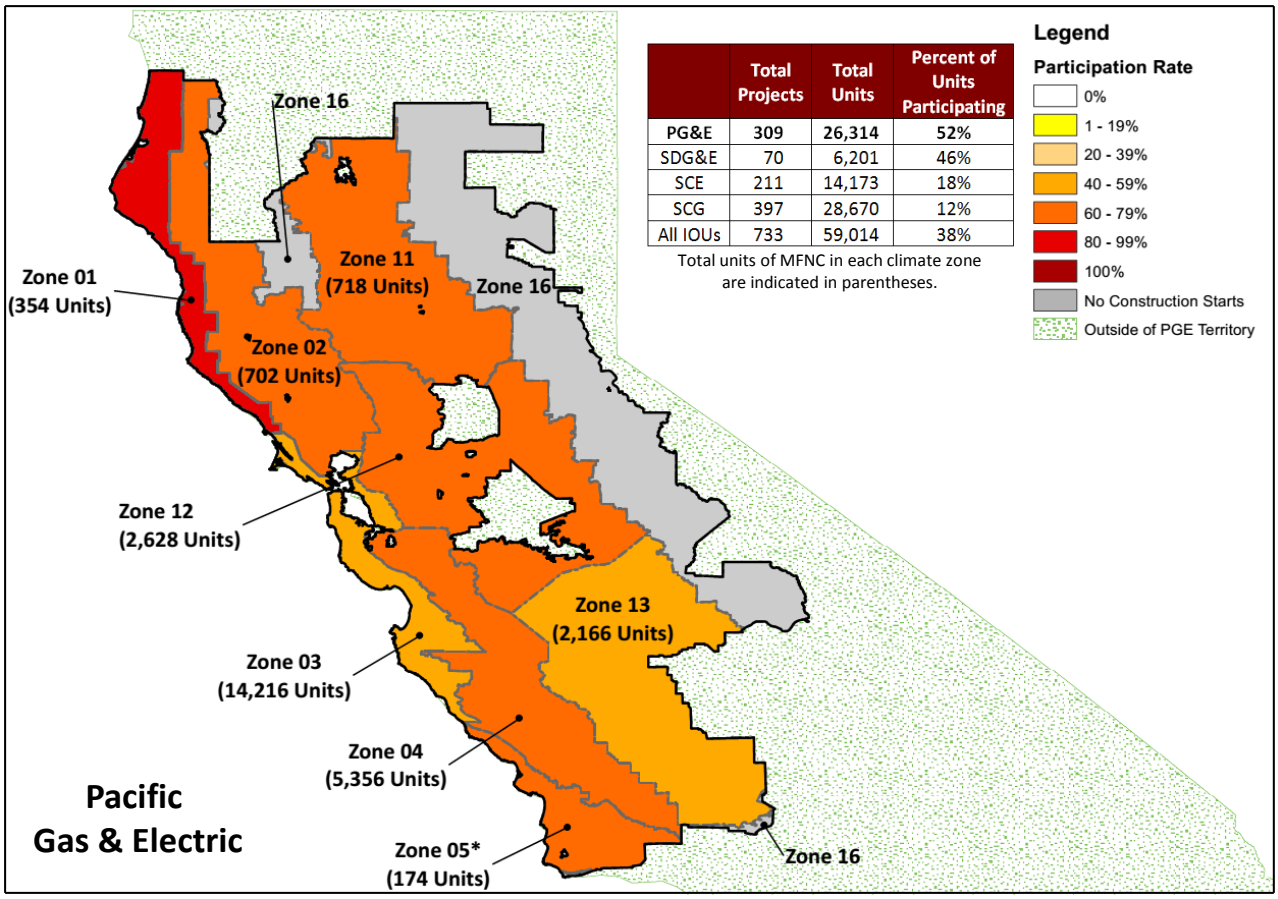
	% of Non-Program Projects				% of Program Projects			
Climate Region	**2010**	**2011**	**2012**	**2010-2012**	**2010**	**2011**	**2012**	**2010-2012**
1	20%	29%	25%	24%	33%	38%	56%	42%
2	27%	17%	18%	21%	15%	20%	13%	16%
3	36%	39%	43%	40%	21%	21%	17%	20%
4	12%	10%	12%	12%	29%	20%	13%	21%
5	4%	5%	3%	4%	3%	1%	-	1%
Total Projects	**162**	**146**	**187**	**495**	**73**	**90**	**75**	**238**

Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: Includes only projects located in IOU service territories.

Figure 5-43 through Figure 5-46 present the market penetration of each IOU's program by climate zone (see also Table A-6-15 in Appendix A). MFNC activity was concentrated along the coast and major urban centers and the IOUs' program activity follows this same pattern. PG&E and SDG&E generally have higher rates of participation across their territories and have sizeable portions of their territories in which there was no MNFC activity (shaded grey).

Figure 5-43: Market Penetration of PG&E MFNC Program Units by Climate Zone (2010-2012)



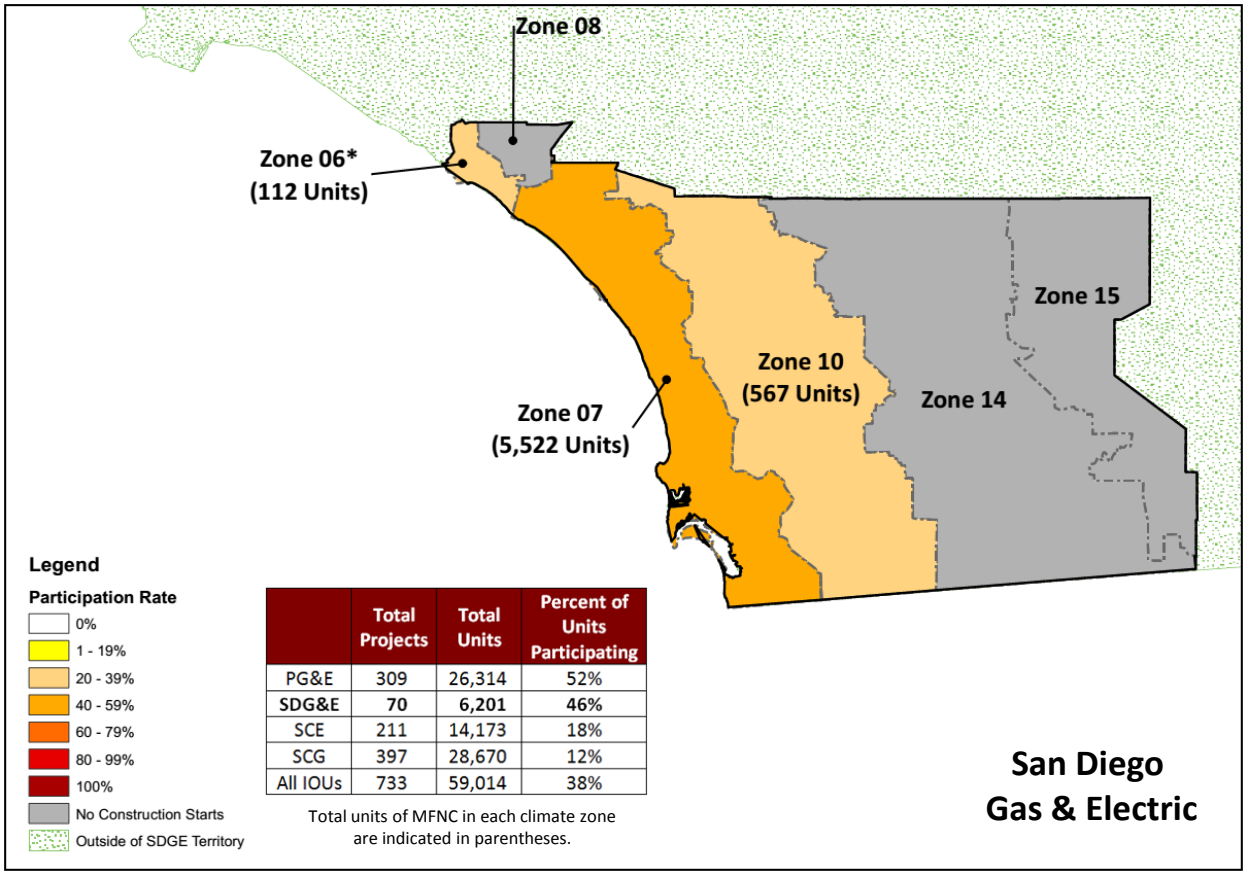
	Total Projects	Total Units	Percent of Units Participating
PG&E	309	26,314	52%
SDG&E	70	6,201	46%
SCE	211	14,173	18%
SCG	397	28,670	12%
All IOUs	733	59,014	38%

Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: The electric utility boundaries of this map were developed by the California Energy Commission (http://www.energy.ca.gov/maps/serviceareas/electric_service_areas.html).

* The 174 units in climate zone five represent only five projects.

Figure 5-44: Market Penetration of SDG&E MFNC Program Units by Climate Zone (2010-2012)



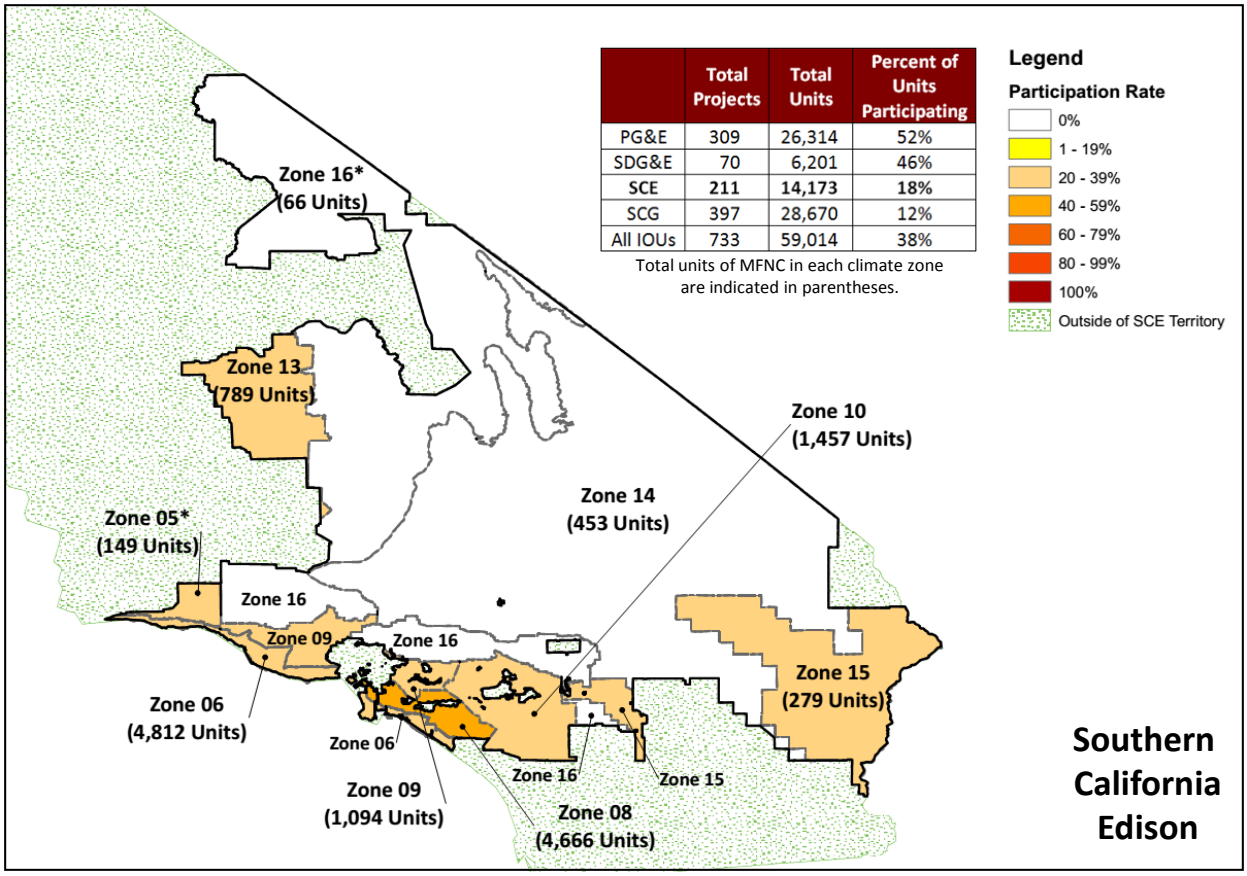
	Total Projects	Total Units	Percent of Units Participating
PG&E	309	26,314	52%
SDG&E	70	6,201	46%
SCE	211	14,173	18%
SCG	397	28,670	12%
All IOUs	733	59,014	38%

Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: The electric utility boundaries of this map were developed by the California Energy Commission (http://www.energy.ca.gov/maps/serviceareas/electric_service_areas.html).

* The 112 units in climate zone six represent only two projects.

Figure 5-45: Market Penetration of SCE MFNC Program Units by Climate Zone (2010-2012)

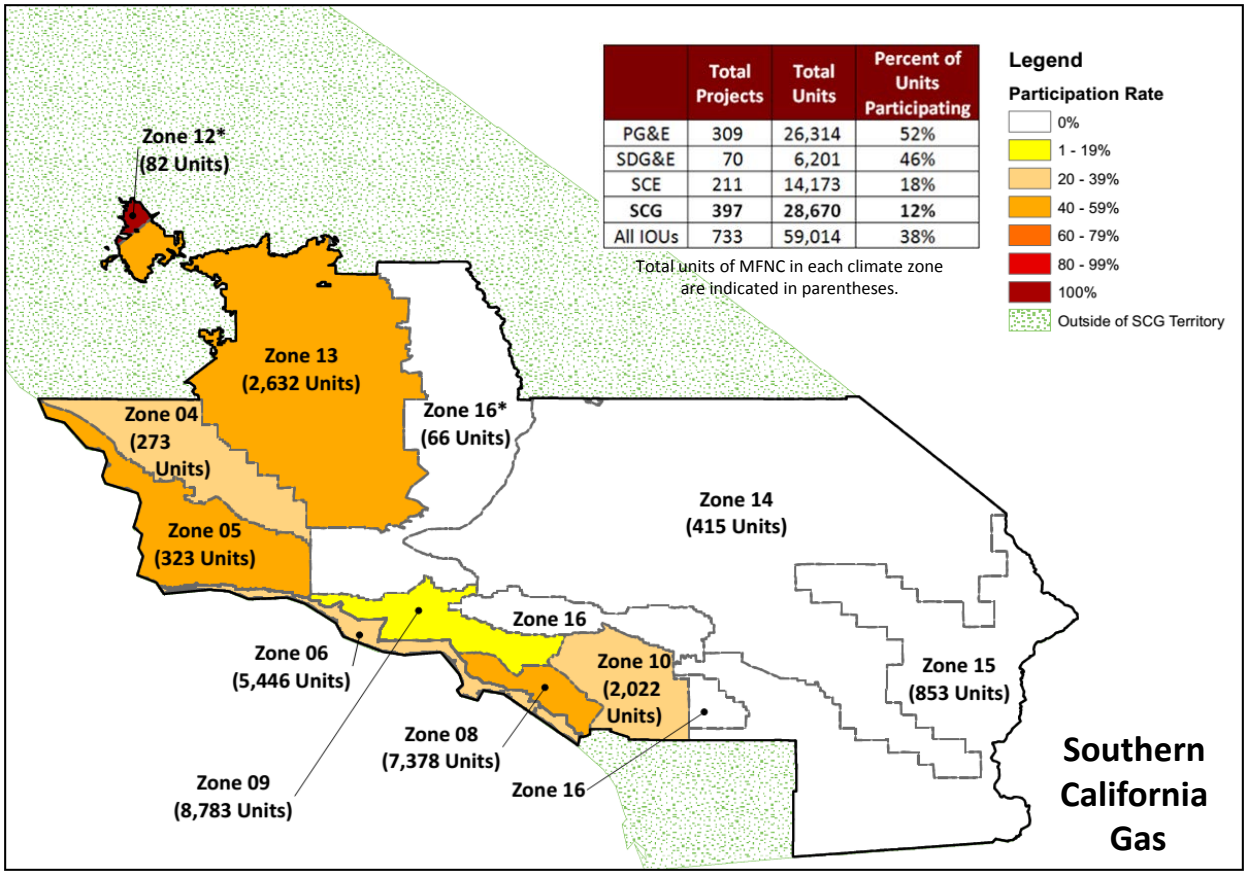


Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Notes: (1) The electric utility boundaries of this map were developed by the California Energy Commission (http://www.energy.ca.gov/maps/serviceareas/electric_service_areas.html); and (2) The sum of the units displayed in the map is slightly less than the total units in the table: 397 units in climate zone seven, located at the southern, central edge of each of the service territory, are not displayed because the area of climate zone seven was too small to be presented in the map.

* The 149 units in climate zone five represent only four projects and the 66 units in climate zone 16 represent only one project.

Figure 5-46: Market Penetration of SCG MFNC Program Units by Climate Zone (2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: The sum of the units displayed in the map is slightly less than the total units in the table: 408 units in climate zone seven, located at the southern, central edge of each of the service territory, are not displayed because the area of climate zone seven was too small to be presented in the map. In addition, due to limitations with GIS mapping, some areas in SCG's service territory are not included within the SCG boundary line in the map above. There were no MFNC projects started from 2010 through 2012 in SCG service territory that fell outside of the mapped SCG boundary line (shown in dotted-shading and labeled as "Outside of SCG Territory").

* The 82 units in climate zone 12 represent only four projects and the 66 units in climate zone 16 represent only one project.

5.5.1.5 Metropolitan Statistical Areas

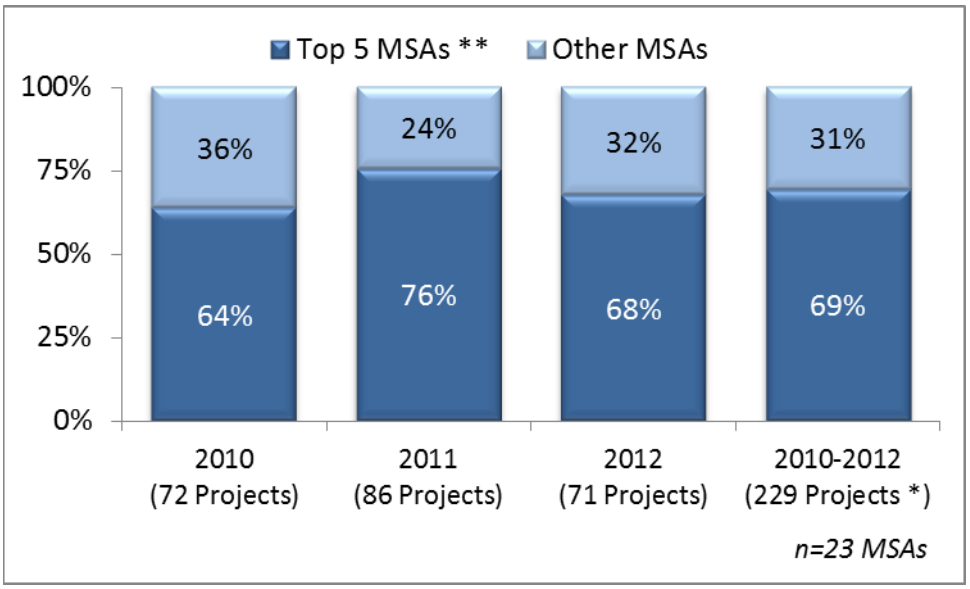
Nearly all IOU program projects (96%) are located in MSAs. Over the three-year period, the majority of multifamily construction projects (69%) were started in five unique MSAs. The top five MSAs for program projects included the following MSAs:

- Los Angeles-Long Beach-Anaheim
- San Francisco-Oakland-Hayward
- San Diego-Carlsbad
- San Jose-Sunnyvale-Santa Clara
- Sacramento-Roseville-Arden Arcade

With the exception of Sacramento-Roseville-Arden Arcade, the top five MSAs among program projects mirror the total population of projects (instead of the Sacramento-Roseville-Arden Arcade MSA, the Riverside-San Bernardino-Ontario MSA was in the top five MSAs among the total population).

As shown in Figure 5-47, projects in the top five MSAs peaked in 2011, with 76% of projects started in the top five MSAs that year.

Figure 5-47: Multifamily New Construction IOU Program Participants – Top Five MSAs (2010-2012)



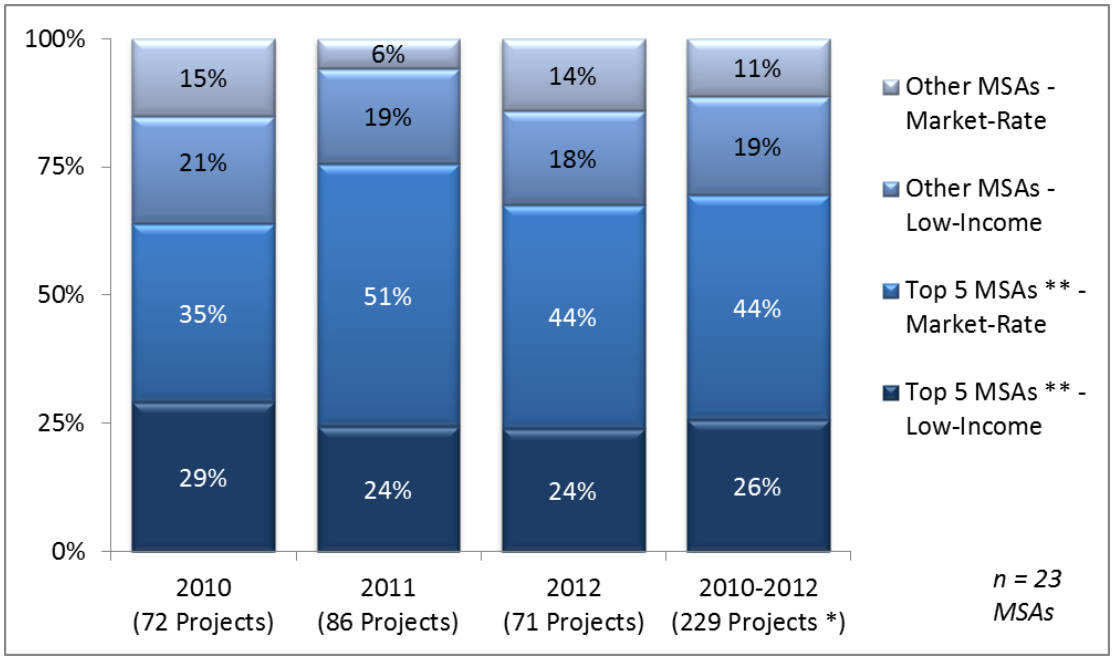
Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* This chart excludes nine projects started in non-MSA areas.

** The five MSAs including the most program projects cumulatively from 2010 through 2012 include Los Angeles-Long Beach-Anaheim, San Francisco-Oakland-Hayward, San Diego-Carlsbad, San Jose-Sunnyvale-Santa Clara, and Sacramento-Roseville-Arden Arcade.

Figure 5-48 illustrates the proportion of IOU program projects among the top five MSAs and the other MSAs that are low-income and market-rate. As presented in Figure 5-14, market-rate projects (44%) accounted for more projects than low-income projects (26%) among the top five MSAs. Projects in all other MSAs are more likely to be low-income projects (19%) than market-rate projects (11%). These proportions follow the same pattern as the overall population of projects (see Section 5.3.9).

Figure 5-48: Multifamily New Construction IOU Program Participants – Top Five MSAs by Income Category and Construction-Start Period (2010-2012)



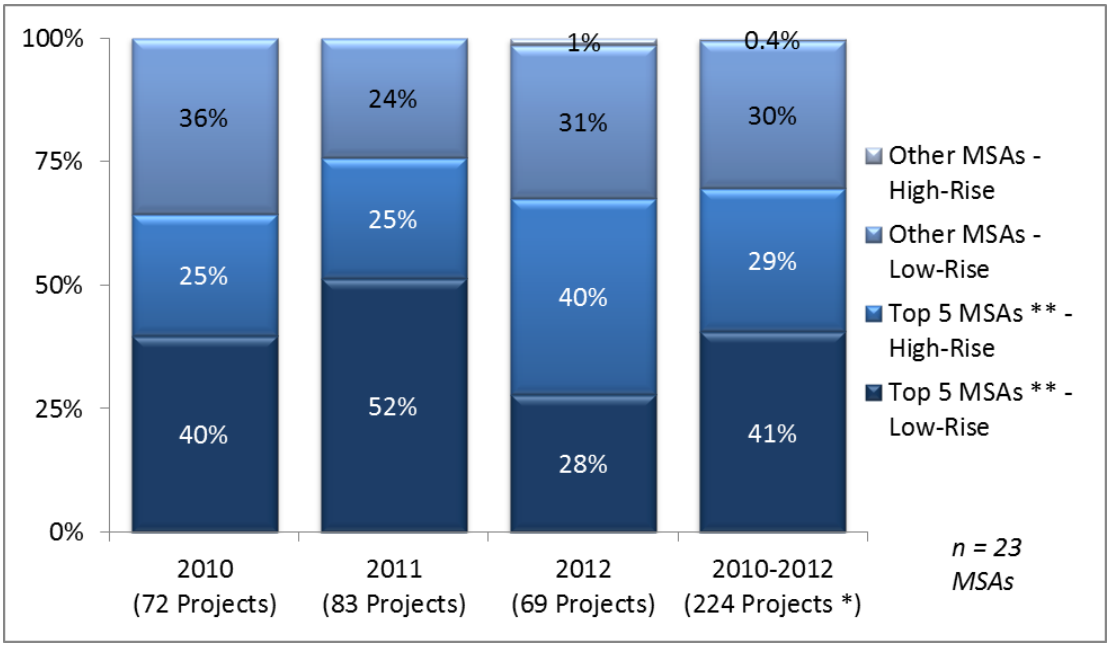
Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* This chart excludes nine program projects started in non-MSA areas.

** The five MSAs including the most program projects cumulatively from 2010 through 2012 include Los Angeles-Long Beach-Anaheim, San Francisco-Oakland-Hayward, San Diego-Carlsbad, San Jose-Sunnyvale-Santa Clara, and Sacramento-Roseville-Arden Arcade.

Like the overall project population (Section 5.3.9), program projects were most commonly low-rise buildings located in one of the top-five MSAs (41%). In addition, nearly all high-rise buildings were located in the top-five MSAs (Figure 5-49).

Figure 5-49: Multifamily New Construction IOU Program Participants – Top Five MSAs by Building Rise and Construction-Start Period
(2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* This chart excludes nine program projects started in non-MSA areas and five other program projects without data identifying them as low-rise or high-rise projects. For each year, the team used the ratio of low-rise to high-rise of those projects with rise data to proportionally segment all MSA projects within the given parameter. Four IOU projects included both high-rise and low-rise buildings; as such, percentages total to greater than 100%.

** The five MSAs including the most program projects cumulatively from 2010 through 2012 include Los Angeles-Long Beach-Anaheim, San Francisco-Oakland-Hayward, San Diego-Carlsbad, San Jose-Sunnyvale-Santa Clara, and Sacramento-Roseville-Arden Arcade.

5.5.1.6 Local Energy Ordinances – Reach Codes

IOU program participating projects (23%) were more likely than non-participating projects (16%) to have been started in communities where local energy standards were approved at the same time or before construction began. Similarly, a higher percentage of IOU program participating units (32%) than non-participating units (20%) were started at the same time as or after reach codes had been approved in their communities. See Table 5-17 for more details. The higher rate of IOU program participation in reach code communities may be because a number of major cities within the top MSAs—including San Francisco, San Jose, and Oakland—have passed reach codes and MFNC is highly concentrated in the MSAs.[173] In addition, developers may be enrolling in the program to offset the costs of complying with the reach codes.[174]

Table 5-17: Multifamily New Construction Projects in IOU Territories – Local Government Energy Ordinances by IOU Program Participation (2010-2012)

Local Energy Ordinance	% of Projects in IOU Territory by Participation			% of Units in IOU Territory by Participation		
	Non-Participants	Participants	Total	Non-Participants	Participants	Total
No Local Ordinance	77%	66%	73%	74%	57%	67%
Within Local Ordinance	23%	34%	27%	26%	43%	33%
Project Started Before Approval of Ordinance	*7%*	*11%*	*8%*	*6%*	*11%*	*8%*
Project Started After/Same Time as Approval of Ordinance	*16%*	*23%*	*18%*	*20%*	*32%*	*25%*
Total	**495**	**238**	**733**	**36,348**	**22,666**	**59,014**

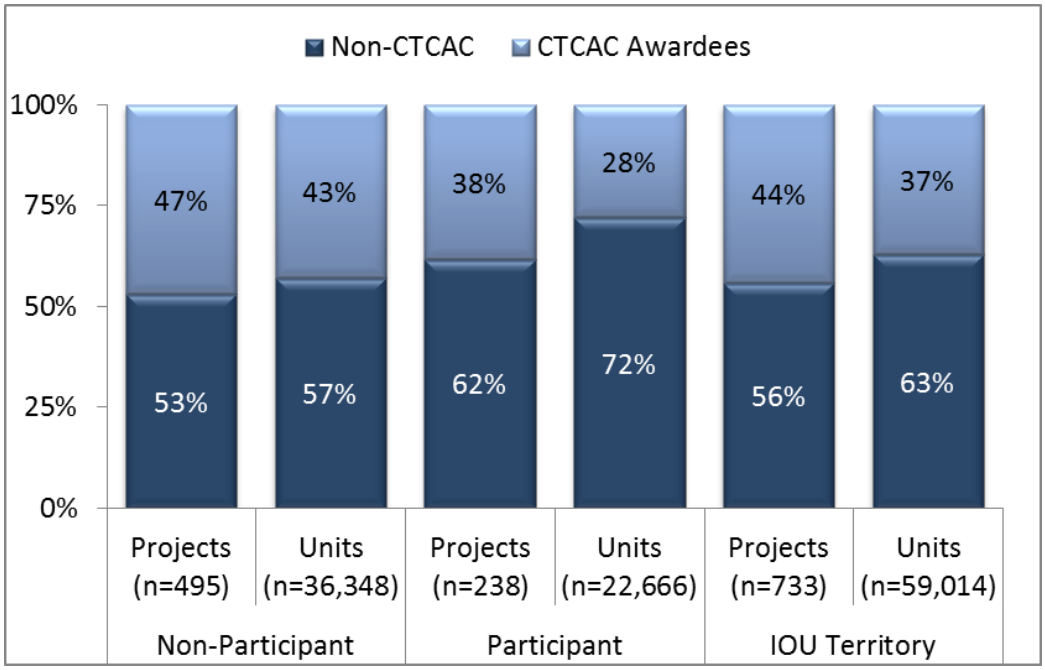
Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; (4) Builder and Developer CATI Surveys; and (5) CEC, "Local Ordinances: Exceeding the 2008 Building Energy Efficiency Standards."
Note: Includes only projects located in IOU service territories.

[173] CEC, "Local Ordinances: Exceeding the 2008 Building Energy Efficiency Standards."
[174] Projects in reach code communities are permitted to participate in IOU programs. *Source: Southern California Gas Program, Program Implementation Plans: Statewide Programs, Appendix B.2, Section A, April 23, 2013, http://www.socalgas.com/regulatory/documents/A-12-07-003/Appendix%20B.2%20Section%20A%20Statewide%20Programs.pdf, accessed January 28, 2014.*

5.5.1.7 CTCAC Awards

There is considerable overlap between the IOU programs and CTCAC awards, as 38% (91 of 238 projects) of IOU participants also received awards from CTCAC. However, as shown in Figure 5-50, IOU program participating projects (38%) were less likely than non-participating projects (47%) to have been CTCAC awardees. In addition, estimated units of IOU program projects (28%) were less likely to have been CTCAC awardees than those of non-participating projects (43%).

Figure 5-50: Multifamily New Construction Projects and Estimated Units in IOU Territories – CTCAC Awards by IOU Program Participation (2010-2012)

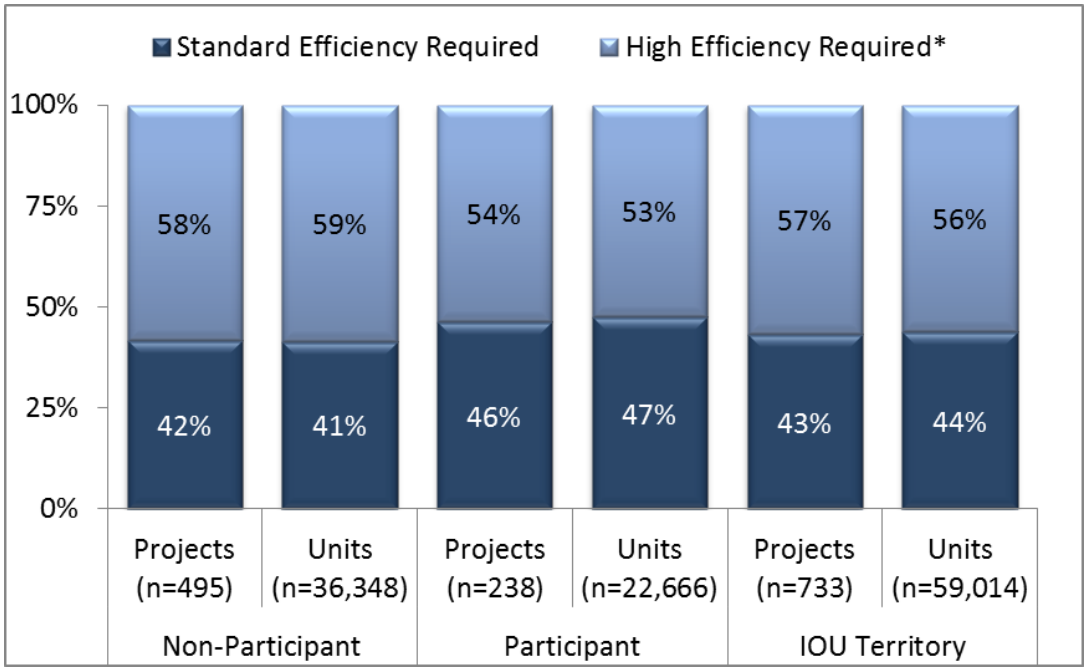


Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: Units represent estimated number of units. We were unable to estimate the number of units for three projects. These projects are excluded in unit-columns. Chart includes only projects located in IOU service territories.

The IOU participating projects (54%) and units (53%) were slightly less likely than non-participating projects (58%) and units (59%) to have been subject to high efficiency requirements as a result of either being CTCAC awardees and/or located in cities or counties where the local government adopted a reach code (Figure 5-51). IOU program units represented slightly more than one-third of all statewide units that were subject to above-code requirements (34%). Small shares of IOU-participating projects (8%) and units (6%) were both CTCAC awardees *and* located in reach code communities. While a higher percentage of IOU program projects and units compared to non-participants were started in reach code communities, a smaller percentage of program projects and units were CTCAC awardees. This finding appears to contradict some of the interview findings that informed the program and market models which suggested that builders and developers enrolled in the IOU programs in order to help meet CTCAC efficiency requirements. This may be related to the limited availability of IOU program incentives, and will be explored in the second phase of this evaluation.

Figure 5-51: Multifamily New Construction Projects and Estimated Units in IOU Territories – High Efficiency Requirements by IOU Program Participation (2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* The term "High Efficiency Required" refers to projects that received CTCAC awards and/or those that were started at the same time or after a local energy ordinance was put in place.

Note: Units represent estimated number of units. We were unable to estimate the number of units for three projects. These projects are excluded in unit-columns. Chart includes only projects located in IOU service territories.

5.6 "Green" Program New Construction Data

In addition to the IOUs' new construction programs, there are several other voluntary programs promoting above-code, energy-efficient MFNC in California. In this section, we report the results of our analysis of data from two programs:

- MFNC projects included in the USGBC's LEED[175] Project Directory; and
- Build It Green's GreenPoint Rated[176] list of project applications filed from 2010 through 2012.

5.6.1 LEED Project Registration Data[177]

The LEED Project Directory includes 352 California MFNC projects registered between 2002 and 2012.[178]

Figure 5-52 illustrates the number of LEED MFNC projects registered each year. Over the 11-year period, the largest number of projects was registered in 2007 (97 projects) and 2008 (89 projects). As discussed in section 5.2, unit permits hit their lowest point in 2009 and after that showed slow but steady increase. Like unit permits, LEED projects experienced a decline in registered projects during the housing crisis in 2008 and 2009: less than one-half (48%) the number of LEED projects registered in 2007 were registered in 2009 (47 projects). However, unlike unit permits, LEED project registrations have not rebounded during the 2010-12 period. For example, 13 projects were registered in 2012. This may be due, in part, to the launching of a new version of the LEED rating system in 2009.[179] According to the Green Building Certification Institute (the organization issuing LEED certifications), it is common for developers to register a "flurry" of projects in anticipation of upcoming LEED rating specification version changes.[180, 181] This may also be due to the increasing popularity of GreenPoint Rated's Build it Green program (see section 5.6.2).

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[175] The USGBC is a nonprofit organization that promotes environmental sustainability through its LEED program. The program certifies building projects that meet the organization's sustainability criteria involving energy and water efficiency, environmental consciousness, sustainable materials, air quality, and other parameters.

[176] Build it Green is a member-based nonprofit organization based in California that promotes healthy, energy- and resource-efficient building practices in California. The organization recognizes homes built to its "green" standards by providing its own GreenPoint Rated label.

[177] LEED for Homes program from the U.S. Green Building Council (USGBC) is a well-known "green" homes program that requires15% savings over Title 24

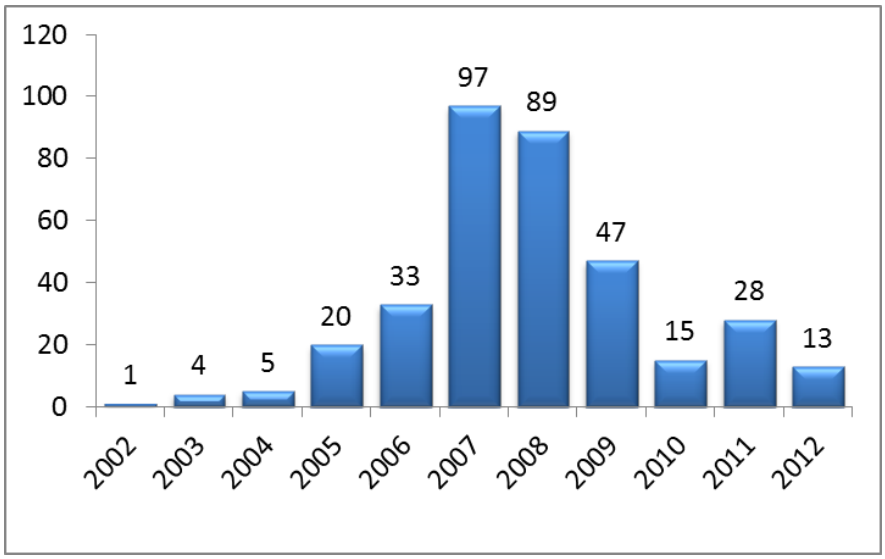
[178] We included projects registered under New Construction, Neighborhood Development, or Core and Shell Development rating systems in our analysis. To be included, projects also needed to be described as multifamily or multi-unit residences, but we excluded any projects that appeared to be dormitories, military bases, or hotels.

[179] USGBC. "LEED 2009". Accessed August 5, 2013 at http://www.usgbc.org/about/leed/current-version.

[180] Email correspondence with Green Building Certification Institute staff: July 24, 2013.

[181] It is also important to note that LEED does not track project construction start dates. Projects can be registered during many stages of the development process, ranging from the design phase until after construction has begun. Therefore, as with unit-permit data, LEED project construction start timing is uncertain.

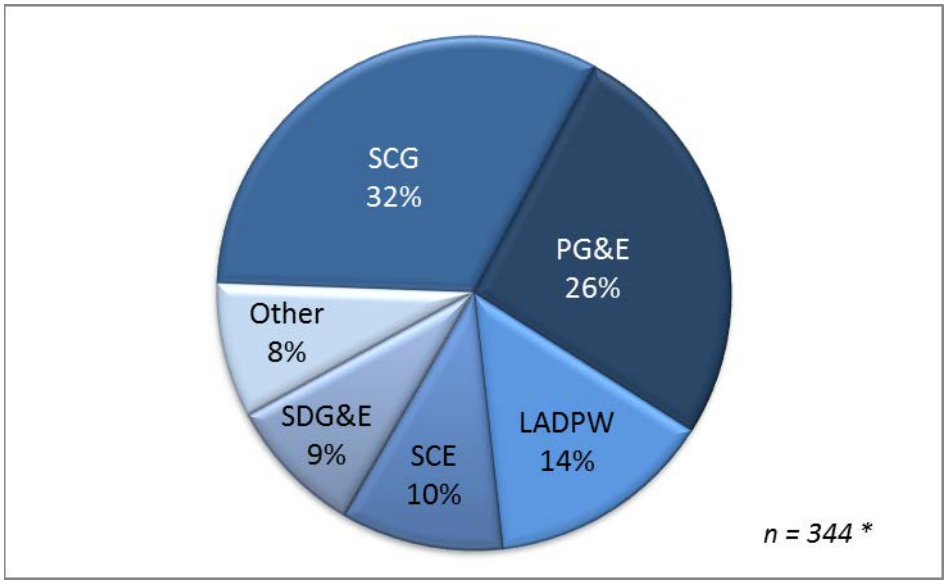
Figure 5-52: California Multifamily LEED New Construction Projects by Year (2002-2012)



Source: (U.S. Green Building Council (USGBC), Public LEED Project Directory, Updated June 27, 2013, Accessed June 27, 2013 at http://www.usgbc.org/projects/list/new-construction

Like new construction starts from 2010 through 2012 (see Section 5.3.7), MFNC LEED projects registered from 2002 to 2012 were most commonly registered in SCG (32%) and PG&E (26%) service territories (see Figure 5-53).

Figure 5-53: Multifamily LEED New Construction Project Service Providers (2002-2012)

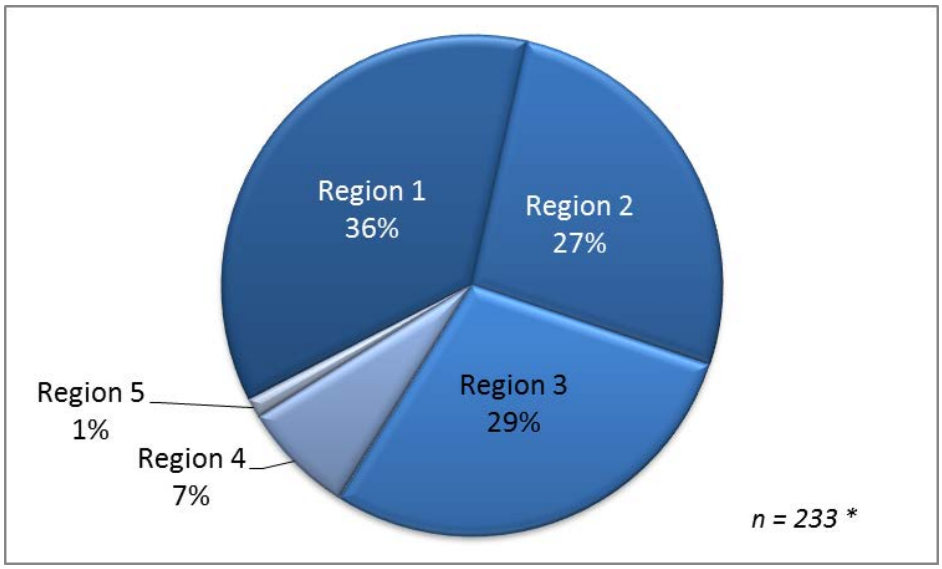


Source: USGBC, Public LEED Project Directory.

* 119 of the 352 LEED projects had "confidential" locations making it impossible for the research team to identify the projects' service territories. One-hundred three of the remaining 233 projects were served by SCG in addition to an electricity provider; as a result, the 233 projects represent 344 customers.

Climate regions one (36%), three (29%), and two (27%) were the most common locations for LEED new construction project registrations from 2002 to 2012 (Figure 5-54).[182] The climate regions for all MFNC starts from 2010 through 2012 were somewhat different than LEED registrations (see section 5.3.8). New construction starts from 2010 through 2012 were most commonly in climate region three (32%) or one (30%), but less frequently in climate region two (19%) and more frequently in climate region four (16%) than in LEED registration data (see Figure 5-23).

Figure 5-54: Multifamily LEED New Construction Project Climate Regions (2002-2012)



Source: USGBC, Public LEED Project Directory.

* One-hundred nineteen of the 352 LEED projects had "confidential" locations making it impossible for the research team to identify the projects' service territories.

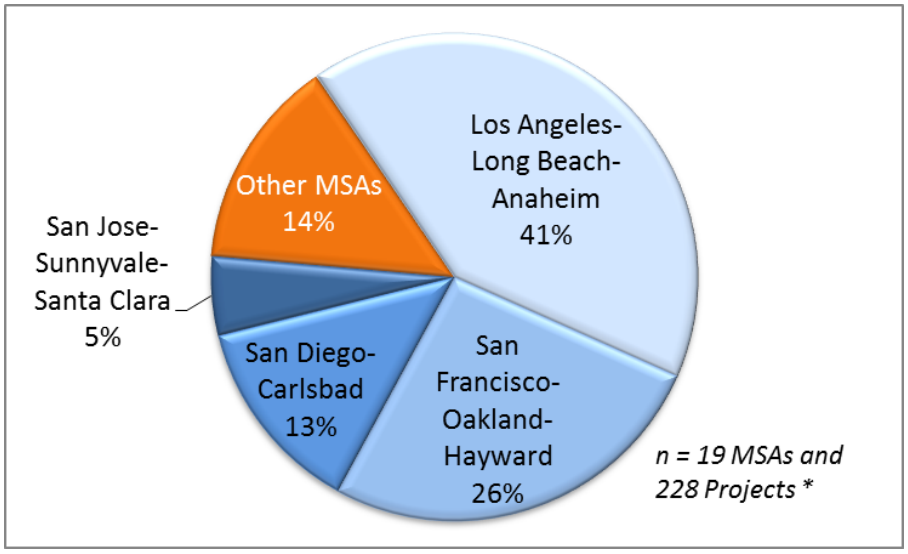
[182] Maps of the California climate zones and regions can be found in section 5.3.8.

From 2002 to 2012, nearly all LEED MFNC project registrations (98%) were located within the boundaries of an MSA (see Table C-6-28 in Appendix C for more details).

Unlike new construction starts (section 5.3.9), unit permits (section 5.2), and IOU program participation (section 5.5.1.5), where five MSAs account for the vast majority of projects and units (from 2010 through 2012), only four MSAs accounted for the majority of LEED project registrations from 2002 to 2012 (86%) (Figure 5-55). However, these four MSAs overlap with the top-five MSAs for new construction project starts, unit permits, and IOU program participation:

- Los Angeles-Long Beach-Anaheim
- San Francisco-Oakland-Hayward
- San Diego-Carlsbad
- San Jose-Sunnyvale-Santa Clara

Figure 5-55: Top Four Metropolitan Statistical Area LEED Projects (2003-2012)



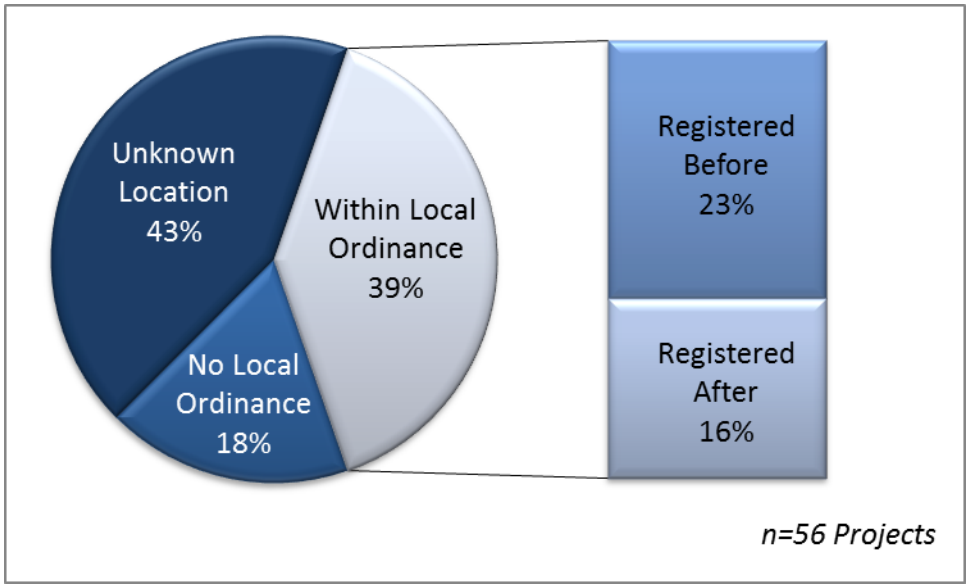
Source: USGBC, Public LEED Project Directory.

* This chart excludes two projects registered in non-MSA areas. Additionally, 119 of the other 350 LEED projects had "confidential" locations making it impossible for the research team to identify the projects' metro-statistical designation. One of these was the only LEED project registered in 2002. As a result, the figure only illustrates projects from 2003 to 2012.

** The four MSAs including the most registrations cumulatively from 2003 to 2012 include Los Angeles-Long Beach-Anaheim, San Francisco-Oakland-Hayward, San Diego-Carlsbad, and San Jose-Sunnyvale-Santa Clara.

From 2010 through 2012, more than one-third of LEED projects registered in California (39%) were located within localities that had reach codes (Figure 5-56). Given that a larger share of LEED projects registered during this period (43%) have undisclosed locations, it is difficult to compare this figure to the overall population with great certainty. Based on available data, it appears that LEED-registered projects are not only more likely to have been in an ordinance location (39%) than not in one (18%), but they are more likely to have been registered prior to approval of local ordinances than the overall MFNC starts project population from 2010 through 2012 (23% vs. 8%).

Figure 5-56: California Multifamily LEED New Construction Projects and Local Government Energy Ordinances (2010-2012)



Sources: (1) USGBC, Public LEED Project Directory; and (2) CEC, "Local Ordinances: Exceeding the 2008 Building Energy Efficiency Standards."

5.6.2 GreenPoint Rated Project Data[183]

Build It Green provided a list of its GreenPoint Rated (GPR) program's MFNC projects with initial application approvals for buildings with three or more units from 2010 through 2012.[184] According to Build It Green staff, initial applications are filed early in a project's construction process. We therefore assumed that a project's initial application approval date is within the same year as the construction start date. Build It Green also provided summary tables of the number of project certifications in a given year for buildings with two or more units.[185]

[183] The "GreenPoint Rated" program that, similar to the LEED certification program, and requires attaining 15% energy savings above Title 24

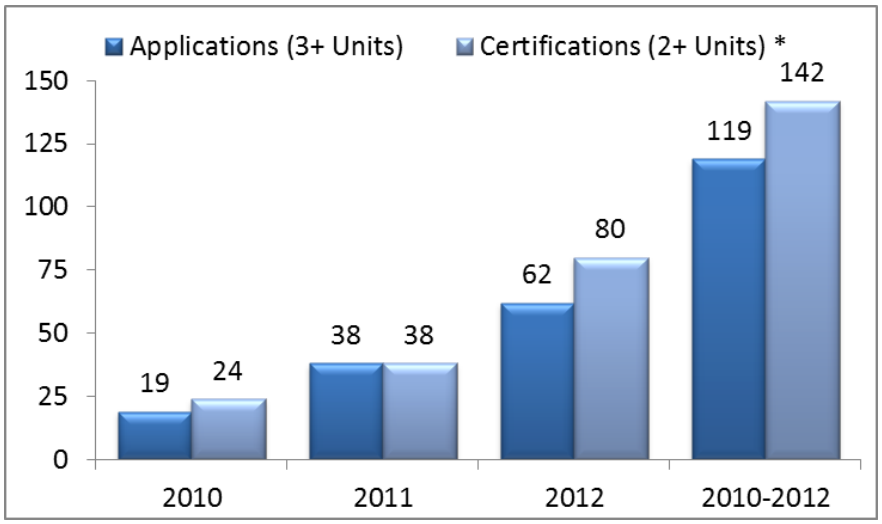
[184] Data were not disaggregated by location. As a result, our analysis of GreenPoint Rated projects is somewhat more limited than our analyses for other data.

[185] While two-unit buildings are typically excluded from multifamily definitions, Build It Green's data do not exclude two-unit buildings from their multifamily total figures.

Figure 5-57 shows that from 2010 through 2012, 119 projects filed initial applications for GPR with Build It Green and 142 projects achieved GPR certification. Both GPR project applications and certifications increased steadily over the three-year period. In particular, from 2010 to 2011, GPR project applications doubled from 19 projects in 2010 to 38 projects in 2011.

A Build It Green staff member explained that the application and certification process for MFNC projects generally lasts from eight to twelve months.[186] As a result, we might assume that, even with a slight amount of attrition from the 19 applications in 2010, we would see fewer certifications in 2011; however, there were 38 certifications in 2011. This discrepancy is likely a result of the fact that certification data include two-unit buildings and application data only include buildings with three or more units.

Figure 5-57: California Multifamily GreenPoint Rated Project Applications and Certifications by Year
(2010-2012)



Sources: (1) Build It Green, GreenPoint Rated Department, Projects Initially Approved from 2010 through 2012, received from GreenPoint Rated staff on August 7, 2013; and (2) Build It Green, GreenPoint Rated Department, 2010-2012 GreenPoint Rated Certifications, received from GreenPoint Rated staff on October 7, 2013.

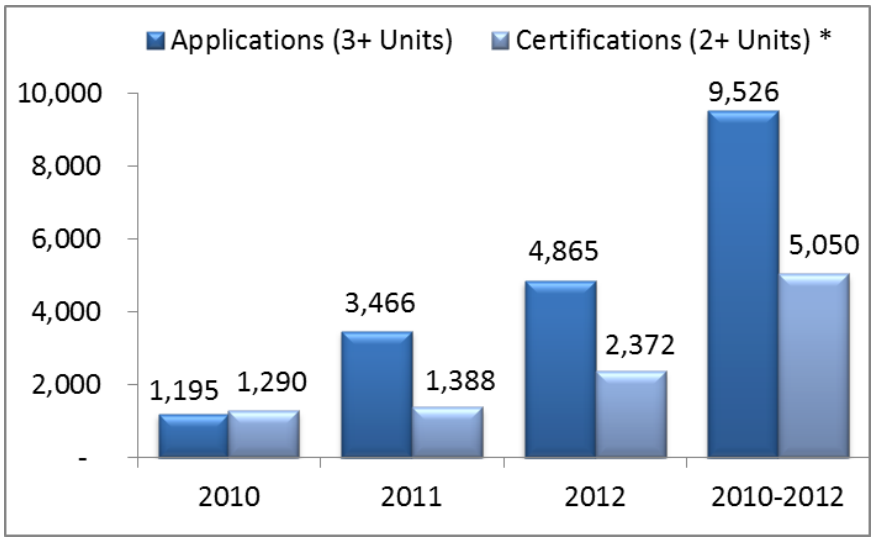
* While the study considers projects multifamily only if they include three or more units, the available Build It Green certification summary data included two-unit buildings with buildings with three or more units.

[186] Email correspondence with Build It Green staff, October 29, 2013.

The 119 GPR project applications from 2010 through 2012 included 9,526 units. As shown in Figure 5-58, similar to the numbers of project applications, GPR units increased steadily over the three-year period (Figure 5-58). For example, from 2010 to 2011, GPR project applications nearly tripled in the number of units they included, increasing from 1,195 units in 2010 to 3,466 units in 2011.

While it appears that more projects have achieved certifications than had applied, the number of units that achieved certification is considerably lower than the number of units that applied. As with the number of projects, this discrepancy is likely a result of the fact that certification data include two-unit buildings and application data only include buildings with three or more units.

Figure 5-58: California Multifamily GreenPoint Rated Project Application and Certification Units by Year (2010-2012)

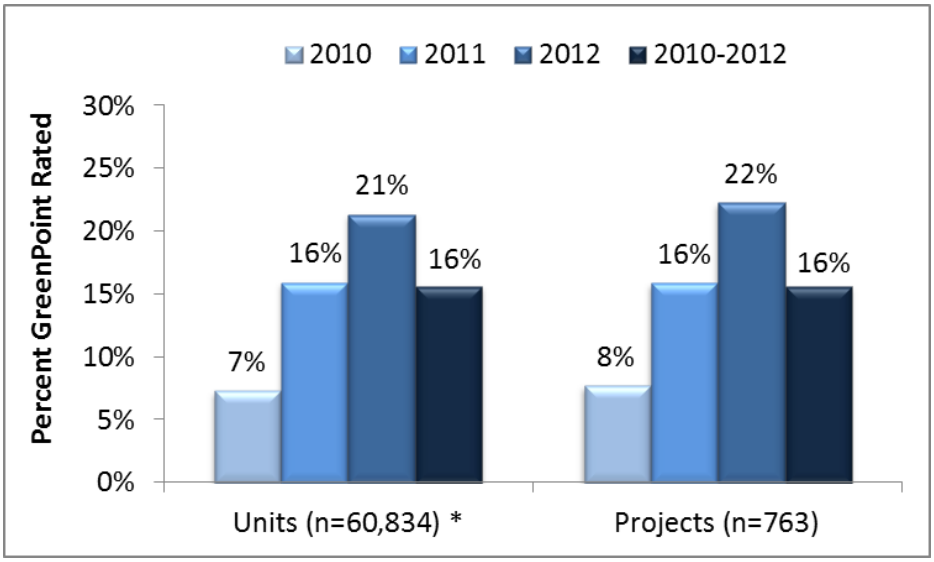


Sources: (1) Build It Green, GreenPoint Rated Department, Projects Initially Approved from 2010 through 2012; and (2) Build It Green, GreenPoint Rated Department, 2010-2012 GreenPoint Rated Certifications.

* While the study considers projects multifamily only if they include three or more units, the available Build It Green certification summary data included two-unit buildings with buildings with three or more units.

Figure 5-59 illustrates the estimated proportions of the 763 statewide MFNC starts that applied for certification as GPR. GPR applications comprised 16% of the total number of estimated units in MFNC starts and 16% of projects from 2010 through 2012. GPR project and unit counts proportionally climbed more steeply than did the overall number of MFNC starts across the three-year period. For example, in 2010, GPR applications made up 7% of estimated units and 8% of projects in 2010; by 2012, GPR application units made up slightly more than one-fifth of estimated units (21%) and projects (22%).

Figure 5-59: California Multifamily GreenPoint Rated Applications as Percentages of Statewide New Construction Starts by Year (2010-2012)

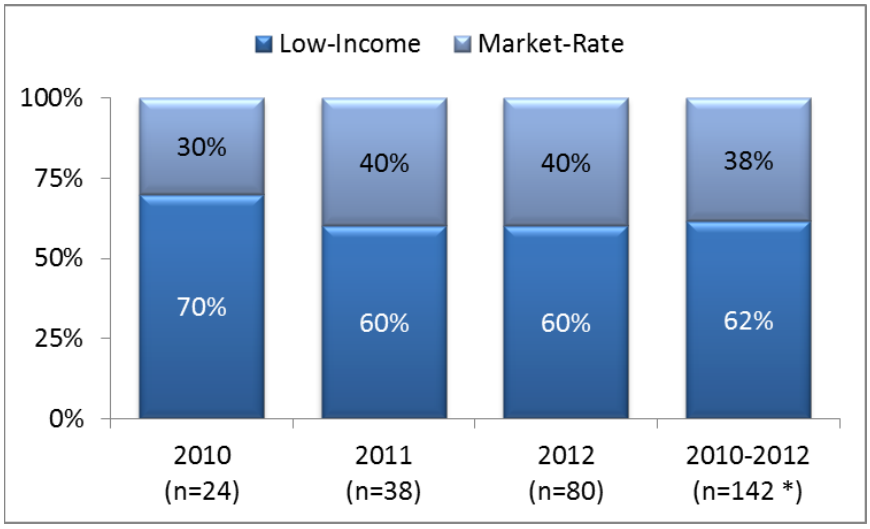


Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; (4) Builder and Developer CATI Surveys; (5) Build It Green, GreenPoint Rated Department, Projects Initially Approved from 2010 through 2012; and (6) Build It Green, GreenPoint Rated Department, 2010-2012 GreenPoint Rated Certifications.

* Unit data from the overall MFNC project population are estimated. Using the mean number of square feet per unit for projects with square footage and unit data, the team estimated the number of units for projects with square footage data without unit data.

GPR-certified projects were more likely to be low-income projects than the general population of MFNC projects started from 2010 through 2012 (50%) (See section 5.3.4). As shown in Figure 5-60, 62% of the GPR projects certified from 2010 through 2012 were low-income, and in 2010 low-income projects comprised an even larger share of GPR-certified projects (70%).[187] [188]

Figure 5-60: California GreenPoint Rated Certified Projects by Income Category and Start Date (2010-2012)



Source: Build It Green, GreenPoint Rated Department, GreenPoint Rated, 2010-2012 Certifications.

* While the study considers projects multifamily only if they include three or more units, the available Build It Green certification data included two-unit buildings with buildings with three or more units

5.6.3 LEED and GPR Comparisons

Table 5-18 compares GPR application and LEED project registration patterns from 2010 through 2012. As mentioned, GPR projects steadily increased over the three-year period: from 2010 through 2012, the number of GPR project applications more than tripled, increasing by 226%. Meanwhile, LEED project registrations had increased considerably from 2010 to 2011 (+87%), but then in 2012 the number of registrations decreased to below 2010 figures, representing a 13% decrease in the number of LEED project registrations from 2010 through 2012.

The discrepancy in participation level patterns could possibly be explained by one of the following factors:

[187] Build It Green includes two-unit buildings within their definition of multifamily buildings. Build It Green staff reported that they advise GreenPoint raters to consider a building multifamily if there is more than one unit and there are shared spaces or commonly metered utilities. Sources: (1) email from Build It Green staff, received Aug. 7, 2013 and (2) "GreenPoint Rated New Home," http://builditgreen.org/greenpoint-rated-new-home/, accessed Oct. 24, 2013.

[188] Income data were not available for project applications.

- The lower cost of GPR makes it a more appealing green certification than LEED. While the two programs collaborate and co-brand, GPR is marketed as being more accessible and flexible for builders than LEED. For example, analysis conducted by Davis Energy Group for GPR and LEED estimates that a multifamily building with 30 units will incur a cost between $3,750 and $5,500 to obtain GPR. That same building is estimated to cost $5,500 or more to obtain LEED verification alone. The cost of LEED certification is compounded by the fact that, unlike GPR, LEED certification requires ENERGY STAR qualification—an endeavor that is estimated to cost an additional $10,000 to $15,000 for a 30-unit building (on top of the $5,500+ cost from LEED).[189]
- Previously, we noted that neither the LEED project registration data nor the GPR data include project start dates. As a result, the patterns in project registration or application date may not hold for project start dates.

Table 5-18: California Multifamily GreenPoint Rated Applications and LEED Project Registrations by Year (2010-2012)

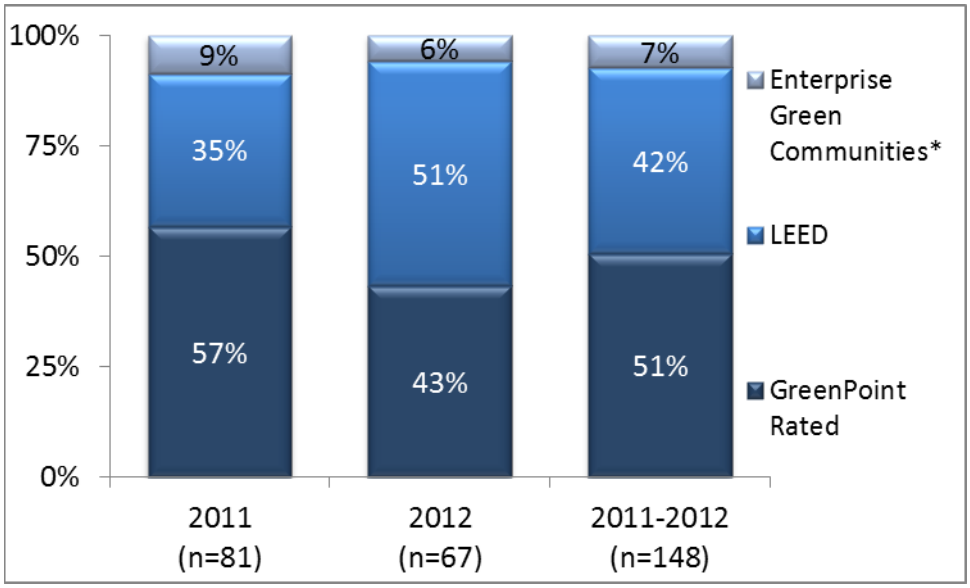
Time Period	GreenPoint Rated Applications			LEED Project Registrations		
	Number of Projects	% Change from Prior Year	% Change from 2010	Number of Projects	% Change from Prior Year	% Change from 2010
2010	19			15		
2011	38	+100%	+100%	28	+87%	+87%
2012	62	+63%	+226%	13	-54%	-13%
Total 2010-2012	**119**			**56**		

Sources: (1) Build It Green, GreenPoint Rated Department, projects with initial application approval dates between 2010 and 2011, received from GreenPoint Rated staff on August 7, 2013; and (2) U.S. Green Building Council, Public LEED Project Directory, Updated June 27, 2013, Accessed June 27, 2013 at http://www.usgbc.org/projects/list/new-construction.

[189] Build It Green. "GreenPoint Rated and LEED for Homes". Accessed September 9, 2013 at http://www.builditgreen.org/_files/GreenPointRated/GPR-LEED%20FAQs2010.03.10.pdf.

Beginning in 2011, CTCAC Annual Reports included summaries of the green certifications to which their 9% awardees had committed. Figure 5-61 shows that, during the 2011 to 2012 period, CTCAC 9% projects were most commonly committed to participate in GPR (51%) and LEED (42%). The 2011 projects were most likely to have been committed to achieving GPR standards (57%), while in 2012 projects were most commonly committed to reaching LEED standards (51%). The increase in LEED program popularity in 2012 is surprising given the decreases in LEED participation and increases in GPR participation patterns from 2010 through 2012 that were discussed above.

Figure 5-61: CTCAC 9% Tax Credit Awardee Sustainable Building Program Commitments (2011-2012)



Source: California Tax Credit Allocation Committee. 2011-2012 Annual Reports.

* Enterprise Green Communities is a national program issuing green building certifications that, like LEED, requires ENERGY STAR qualification. Unlike LEED or GPR, it is only available for affordable housing construction, not market-rate construction. *Source*: Enterprise, "Criteria," http://www.enterprisecommunity.com/solutions-and-innovation/enterprise-green-communities/criteria, accessed October 2013.

Note: This chart may include single-family projects; however, CTCAC projects are generally multifamily projects.

5.7 Survey Results

From August 7, 2013, to September 20, 2013, the evaluation team conducted CATI surveys with 76 builders[190] involved with projects found in MHC-CTCAC population data[191] that started construction during the period from 2010 through 2012. The survey was structured around the following types of projects:

- **Primary Project.** We began by asking details about one of the respondent's multifamily projects that started construction during the three-year period. If a respondent had more than one project in the MHC-CTCAC dataset, we asked him or her about the largest project (referred to as "primary project" from here onward).[192]
- **Other 2010-2012 Projects.** We asked respondents to provide summary statistics about all other multifamily projects that they had started during the 2010-2012 period, including number of projects and total number of units. In addition, we asked more detailed questions about the largest of their non-primary multifamily projects during this period (referred to as "secondary project" from here onward).[193]
- **Future Projects.** Finally, participants described the characteristics of the multifamily projects they have started or plan to start from 2013-2015 (referred to as "future projects" from here onward).

Survey questions collected data on the following topics and served many functions:

- **Revising or Adding to Population Data.** Our questions about primary projects—and secondary projects, if applicable—allowed us to confirm data, supplement missing data, or correct any inaccuracies in the MHC-CTCAC or IOU program participation data. Responses confirming or supplementing existing population data about income category, building rise, number of units, number of buildings, and project square footage are presented in Appendix A.10.

[190] Surveys also targeted building developers. Recognizing that developers and builders can be distinct entities, this report refers to them interchangeably.

[191] We received the full IOU participation data after developing the sample frame and fielding the survey. As such, we developed quotas based on the MHC-CTCAC data. However, after identifying which MHC-CTCAC projects were program participants we were able to revise population data if there were discrepancies between participation data and survey responses. The Appendix A and the Methodology subsection at the start of the New Construction Starts Data include more details of this data revision process.

[192] We identified the largest project based on square footage and number of units.

[193] If respondents' descriptions of their secondary project did not match any projects in the MHC-CTCAC or IOU program participant population data we added those projects to the population data for analysis. Ultimately we added seven additional projects to the population analysis.

- **Supplemental Project Characteristics.** MHC-CTCAC and IOU program data included details about a limited number of project characteristics. We asked about additional project characteristics, such as the 2010-2012 projects' Title 24 building standards (i.e., 2005 or 2008), voluntary green certification applications and attainments, building ownership and management plans, and project timing. These topics provided us with additional insight into the characteristics of the MFNC market.
- **Future Changes.** Questions around future projects provided us with insight into potential future changes in the characteristics of the MFNC market in California, as well as potential growth in the market. In sub-section 5.7.5, we present future projects' characteristics: building rise, income category, usage type (mixed use vs. residential only), and project locations.

5.7.1 Survey – Methodology

We identified 382 unique contacts representing the 663 MHC-CTCAC MFNC projects started from 2010 through 2012.[194] As discussed in section 5.3.13, individual builders were often involved with more than one multifamily project. For those contacts representing more than one project in the MHC-CTCAC data, we identified one primary project in the data to ask about in the survey. We determined the primary project by giving preference to a given builder's projects with more area (sq ft) and greater numbers of units.

We set quotas based on three primary project parameters: service provider territory, income category, and building rise. Table 5-19 compares the MHC-CTCAC project population characteristics with those of the 76 primary projects with which survey respondents were involved. Taking into account that 16% of survey projects had unknown locations,[195] and as a result we were unable to determine their service providers, the primary projects' electric service provider territory distribution among survey respondents was quite similar to that of the project population, with the majority of projects in PG&E territory (32%), non-IOU electric service territories (24%), and SCE territory (22%). Similarly, like the population (54%), roughly one-half of survey respondents' primary projects (48%) were in SCG territory.

[194] At the time of survey fielding our project data did not include IOU program participation data. Prior to the survey, we determined the number of unique contacts by matching builders with the same telephone number, firm name, and/or contact name.

[195] Some respondents with secondary projects that were not in the MHC-CTCAC or participation data did not provide enough information about their projects that would enable us to determine their projects' geographic location and associated service provider(s).

While income category and building rise were notably different between the survey respondent projects and the population, this may be due to a lack of information about the population of projects:

- If MHC data did not identify a project as low-income and the project was not included in a CTCAC awardee list, we assumed the primary project was a market-rate project. As such, it is not surprising that the portion of survey respondents' projects that were low-income (67%) was higher than that of the MHC-CTCAC project population (56%).
- The building rise between survey respondents' projects and the MHC-CTCAC population was somewhat different. Survey respondent projects were relatively more likely to have high-rise buildings (41%) than MHC-CTCAC population projects (31%). This is not surprising given that 1) we asked about the respondent's largest projects and 2) high-rise projects are generally larger in terms of number of units (see Figure A-3: and Figure 5-18) and area (see Figure 5-20) when compared to low-rise projects.

Table 5-19: Multifamily New Construction Project Population and Survey Respondent Primary Project Characteristics

Parameter	% of MHC-CTCAC Project Population	% of Respondents' Primary and Secondary Project Attributes
Service Provider*		
Pacific Gas & Electric	39%	32%
Southern California Edison	27%	22%
Southern California Gas	54%	48%
San Diego Gas & Electric	9%	6%
Other	25%	24%
Unknown	-	16%
Income Category		
Market-Rate	44%	33%
Low-Income	56%	67%
Building Rise**		
High-Rise	31%	41%
Low-Rise	64%	55%
Unknown	6%	5%
Total Projects	**663**	**107**

Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; and (3) Builder and Developer CATI Surveys.

* All of the units in SCG territory overlap with electric utilities. Most commonly they overlap with SCE (44%) and LADWP (included in the *Other* category) (41%). Additionally, some secondary projects had unknown service providers because the respondents did not provide enough information to determine the projects' locations.

** Percentages total to greater than 100% because some projects included both high-rise and low-rise buildings.

Respondents' roles in primary projects were most commonly as builders or developers (74%) and property owners (66%) (Table 5-20). Most frequently, they fulfilled the roles of *both* builders or developers and owners (62%).

Table 5-20: Multifamily New Construction Survey – Respondent Project Roles
(Multiple Response)

Project Role	% of Respondents*
Builder or Developer	74%
Property Owner	66%
Property Manager	26%
General Contractor	24%
Architect or Engineer	21%
Other	8%
Total Respondents	**76**

* Percentages sum to greater than 100% because respondents often fulfilled more than one role in a given project.

5.7.2 Survey – Market Size and Timing

Thirty-one of the 76 respondents indicated that they had started constructing more than one multifamily project from 2010 through 2012. In total, 73 of the 76 respondents that were able to estimate how many projects they had started reported that they had started 148 multifamily projects from 2010 to 212 (Table 5-21). After compiling the full construction starts population data, we found that the 73 respondents were associated with 151 projects, suggesting the overall comprehensiveness of population data.

Forty-seven respondents indicated that they had started or would start MFNC projects from 2013-2015 (Table 5-21). Thirty-seven of these 47 respondents were able to specify their number of future multifamily 2013-2015 projects, indicating that they would start 119 projects in total. The same 37 respondents had indicated that they had started only 74 projects from 2010 through 2012. On average, they reported that they would each start 2.2 more projects from 2013 to 2015 than they reported starting from 2010 through 2012. Thus, while less than two-thirds of survey respondents (62% of 76) expect to build during the 2013-2015 period, those who will be building expect to be more active in the MFNC market.

Table 5-21: Multifamily New Construction Survey Responses – Multifamily Project Starts (2010-2015)

Projects per Survey Respondent	% of Survey Respondents (n=76)*	
	Primary and Other Projects (2010-2012)	Future Projects (2013-2015)
None		*38%*
Unknown	*4%*	*13%*
1	55%	8%
2	17%	13%
3	11%	14%
4 to 6	11%	9%
7 to 10	1%	4%
11 to 20	1%	-
Total Projects	**148**	**119**

*Three of the 76 survey respondents could not identify how many projects that they started from 2010 through 2012. Ten of the 47 respondents that indicated they had started or would start projects from 2013-2015 could not recall how many projects they would build.

Sixty-five respondents were able to confirm or provide start dates for their primary projects and report completion dates for the primary projects. The construction start and completion dates indicated that, on average, the 65 projects had taken or will have taken 1.6 years (18.9 months) to complete. As shown in Table 5-22, projects with high-rise buildings (20.9 months) took significantly longer to build than projects with low-rise buildings (17.3 months).

Table 5-22: Multifamily New Construction Survey Responses – Timing from Primary Project Construction Start to Construction Completion (2010-2012)

Statistic	Income Category		Building Rise		Total
	Low-Income	Market-Rate	High-Rise	Low-Rise	
N	42	23	28	37	65
Average Months	18.3	19.8	20.9†	17.3	18.9
Standard Deviation	*7.91*	*7.09*	*5.42*	*8.66*	*7.61*
Average Years	1.5	1.6	1.7	1.4	1.6
Standard Deviation	*0.66*	*0.59*	*0.45*	*0.72*	*0.63*

† Denotes statistically significant difference at the 95% confidence level.

5.7.3 Survey – Efficiency Standards and "Green" Programs

We asked respondents to identify to which version of the California Title 24 Building Energy Efficiency Standards[196] their 107 primary (n=76) and secondary (n=31) projects were being or had been built. Respondents reported that more than one-half of the 107 projects (56%) were built to 2008 standards.[197]

Respondents also indicated the percent of *all* of their 2010-2012 multifamily *units* built to 2005 Standards and the percent built to 2008 standards. Of the primary projects' units (6,659 units) and all other 2010-2012 projects' units (4,781 units), slightly less than one-half (45%) were built to 2008 standards, and one-fifth (20%) were built to other unspecified standards. Not surprisingly, small percentages of primary and secondary projects (4%) and all 2010-2012 units (5%) were built to 2005 standards. See Table 5-23 for more details.

Table 5-23: Multifamily New Construction Survey Responses – Building Standards (2010-2012)

Standards	% of Primary and Secondary Projects (n=76)	% of Units in Primary and Secondary Projects (n=76; 101 Projects)	% of Units in All Projects (n=76; 124 Projects)
2005 Standards	4%	5%	5%
2008 Standards	56%	58%	45%
Other Standards*	6%	7%	20%
Unknown Standards	35%	30%	30%
Total	**107 Projects**	**8,857 Units**	**11,440 Units**

* Respondents did not provide details explaining what the other standards were.

[196] Title 24 governs the energy efficiency of residential and nonresidential buildings constructed in California. The 2008 version of Title 24 is still in effect as of the writing of this report; it was implemented on January 1, 2010 and will be replaced by the updated 2013 standards on January 1, 2014.

[197] According to Title 24, building permits expire after 180 days if construction has not begun. However, local governments are permitted to modify that rule. San Francisco, for example, removed the requirement to start construction within a given time-period of permitting. They do however include limits on the length of time to complete construction. In some cases, larger projects in San Francisco are permitted to take more than three years to be completed from the time of permit issuance. *Source: Correspondence with San Francisco Department of Building Inspection staff member on November 15, 2013.*

Survey respondents reported participating in the IOU program at a considerably lower rate than the overall MFNC market. Five primary projects (7% of the 73 primary projects started in IOU service territory) were reported by survey respondents to have participated in the program.[198,199] Additionally, the 31 respondents representing 75 other 2010-2012 non-primary projects reported that some (10%) or all (6%) of their non-primary projects participate in one of the IOU programs. In contrast, 32% of the 733 MFNC projects in the overall population located in IOU territory were included in the IOU program participation data. We believe that the difference is due in part to IOU program projects missing from the MHC and CTCAC datasets used to develop the survey sample. Thirty-nine percent of the IOU program projects were not found in the MHC and CTCAC datasets. In addition, respondents may not have been aware that their projects participated in the program—possibly as a result of confusing tax credits or other green programs with IOU program participation.

One-half of all respondents (50%) said that their primary project applied for some type of green certification, and nearly one-half of the 31 respondents with additional projects (48%) said at least one of their additional 2010-2012 multifamily projects had done so. Sixty percent of the 47 respondents with future multifamily projects reported that they were applying for at least one type of certification.

[198] Primary projects built to 2005 Title 24 standards were not asked about program participation because the study is focused on baseline measurements of MFNC built under the 2008 Title 24 standards,

[199] We found all five projects in the program participation data.

When prompted, respondents identified the certifications their multifamily projects applied for and obtained. The 2010-2012 projects were most likely to have applied for LEED (19%) and GPR certification (18%) (Table 5-24). Similarly, future projects were most often applying for LEED (41%) and GPR (38%) certifications. However, in terms of certifications, the 2010-2012 projects were notably more likely to have obtained GPR certification (17%) than LEED certification (9%). The higher rates of GPR certification may be due to the more challenging standards and higher costs involved in obtaining LEED vs. GPR certification (see section 5.6.3 for more details). ENERGY STAR certifications did not trail far behind GPR applications and attainment, with 14% of 2010-2012 projects applying for it and 12% obtaining it. Zero Net Energy (ZNE) certification was the least likely to be applied for with 2010-2012 projects (1%) and future projects (16%). It is worth noting that builders with future projects plan to apply for Zero Net Energy and green certifications such as LEED, GPR, or ENERGY STAR at higher rates than during 2010-2012. However, it is also important to note that these are self-reported responses about future actions that have not been corroborated, and the reported rates of LEED applications are counter to the trends found in the LEED registration data from 2002 to 2012

Table 5-24: Multifamily New Construction Survey Responses – "Green" Project Certifications

Certifications (Prompted)	% of All 2010-2012 Projects (n=76)		% of 2013-2015 Projects (n=37)
	Applied	Obtained	Applying
LEED	19%	9%	41%
GreenPoint Rated	18%	17%	38%
ENERGY STAR	14%	12%	34%
Zero Net Energy	1%	1%	16%
Other - Unprompted*	1%	-	-
Total Projects**	**151**		**117**

*One respondent mentioned applying for "CUAC." This respondent was likely referring to the California Utility Allowance Calculator (CUAC), The CUAC is a tool developed by CTCAC that is used to estimate affordable housing tenants' utility costs (see Section 3.1.4.1 for more details). We assume that this respondent had intended to report applying for a CTCAC award.

** If respondents indicated that their projects had applied for or obtained certification, but could not identify how many projects did so, we removed the projects associated with that respondent from the base number of projects for the specific certifying entity in our calculations. As a result, sample sizes vary.

Table 5-25 presents the income category and building rise attributes of the 2010-2012 primary projects that *applied* for green certifications. Among 2010-2012 primary projects, low-income projects (57%) were notably more likely to apply for any type of green certification than were market-rate projects (37%). Both low-income (29%) and market-rate (19%) projects applied for LEED certification more commonly than they applied for any other type of certification, though low-income projects applied for GPR (27%) and ENERGY STAR (24%) certifications nearly as commonly as they did LEED certification. High-rise projects (56%) were somewhat more likely to have applied for any single type of green certification than were low-rise projects (45%). High-rise projects (38%) were much more likely than low-rise projects (16%) to apply for LEED certification. Additionally, high-rise projects (25%) were relatively more likely than low-rise projects (14%) to apply for ENERGY STAR certification. However, low-rise projects (23%) were more likely to apply for GPR certification than were high-rise projects (19%).

Table 5-25: Multifamily New Construction Survey Responses – "Green" Primary Project Certification Applications by Income Category and Rise (2010-2012)

Certification Applications	% of Primary Projects by Category (n=76)*				
	Income Category		Building Rise		Total
	% of Low-Income Projects	% of Market-Rate Projects	% of High-Rise Projects	% of Low-Rise Projects	
LEED	29%	19%	38%	16%	25%
GreenPoint Rated	27%	11%	19%	23%	21%
ENERGY STAR	24%	7%	25%	14%	18%
Zero Net Energy	4%	-	-	5%	3%
Any Certifications	57%	37%	56%	45%	50%
Total Projects	**49**	**27**	**32**	**44**	**76**

* Respondents had provided the total number of their other 31 projects that applied for certifications, but they did not specify the income category or building rise associated with each of the projects that applied.

Table 5-26 reports the percentages of primary projects that *obtained* green certifications by income category and rise. Considering that 57% of low-income projects applied for at least one certification and 43% obtained at least one, they appear to have had greater success than market-rate projects in obtaining certifications. More than one-third of market-rate projects (37%) applied for at least one certification, but only 11% of market-rate projects obtained at least one. Low-rise projects appeared to have relatively greater success than did high-rise projects, with 45% of low-rise projects applying for at least one certification and nearly one-third (32%) obtaining at least one, whereas over one-half of high-rise projects (56%) applied for at least one and slightly less than one-third (31%) obtained at least one. While low-income projects were most likely to *apply* for LEED certification (29%), they were most likely to *obtain* GPR certification (24%) over other types of certifications. High-rise projects were most likely to apply for LEED certification (38%), but they but were most likely to obtain ENERGY STAR certification (22%). Low-rise projects most commonly applied for and obtained GPR certification compared to any other certification, with all of those applying for GPR certification reportedly obtaining it (23%).

Table 5-26: Multifamily New Construction Survey Responses – "Green" Primary Project Certification Attainments by Income Category and Rise (2010-2012)

Certification Attainments	% of Primary Projects by Category (n=76)*				
	Income Category		Building Rise		Total
	% of Low-Income Projects	% of Market-Rate Projects	% of High-Rise Projects	% of Low-Rise Projects	
GreenPoint Rated	24%	4%	9%	23%	17%
ENERGY STAR	18%	7%	22%	9%	14%
LEED	14%	7%	19%	7%	12%
Zero Net Energy	2%	-	-	2%	1%
Any Certifications	43%	11%	31%	32%	34%
Total Projects	**49**	**27**	**32**	**44**	**76**

* Respondents had provided the total number of their other 31 projects that applied for and obtained certifications, but they did not specify the income category or building rise associated with each of the projects that applied.

5.7.4 Survey – Ownership, Management, and Financing

We asked survey respondents if their 2010-2012 primary and secondary projects' units would be for rent, sale, or both. Respondents said that most primary and secondary projects (83%) would include rental units only. Those projects represented 93% of units (Table 5-27). Of those selling the units in their projects, four of twelve reported that they had identified multiple buyers interested in purchasing their building.

Table 5-27: Multifamily New Construction Survey Responses – Plans for Unit Ownership (2010-2012)

Unit Ownership	% of Primary and Secondary Projects (n=76)					% of Primary and Secondary Units (n=76; 101 Projects)**
	Income Category		Building Rise*		Total	
	Low-Income	Market-Rate	High-Rise	Low-Rise		
Rent Units	92%	66%	86%	81%	83%	93%
Sell Units	6%	34%	11%	19%	15%	15%
Other†	1%	-	2%	-	1%	1%
Don't know	1%	-	-	-	1%	-
Total	**72**	**35**	**44**	**59**	**107**	**8,857**

* Six secondary projects were excluded because respondents did not know the building rise. Additionally, one respondent had a secondary project with high-rise and low-rise buildings; as such, it appears in both columns.

** Six respondents did not know how many units were in their secondary project so the base number of projects does not fully represent the number of units – one of the respondents did not know what the ownership plans were and the five others indicated the units would be rented.

† One respondent indicated that there were "other" plans for unit ownership but they did not specify what those plans were.

Table 5-28 presents developers' plans for building management when construction of their 107 primary and secondary projects is complete. The respondents most commonly reported that their companies would own and manage or lease the buildings (73%) rather than sell the building (12%) or follow some other management plan (5%). Respondents were more likely to indicate that their companies would own and manage or lease the building(s) for low-income projects (88%) and high-rise projects (80%) than other project types. Of those selling their buildings, four of twelve reported that they had identified multiple buyers interested in purchasing their building.

Table 5-28: Multifamily New Construction Survey Responses – Plans for Building Management
(2010-2012)

Building Management	% of Primary and Secondary Projects by Category (n=76)				
	Income Category		Building Rise*		Total
	Low-Income	Market-Rate	High-Rise	Low-Rise	
Own and Manage or Lease	88%	43%	80%	69%	73%
Sell	6%	26%	7%	17%	12%
Other	3%	9%	5%	5%	5%
Don't know	4%	23%	9%	8%	10%
Total Projects	**72**	**35**	**44**	**59**	**107**

* Six secondary projects were excluded because respondents did not know the building rise. Additionally, one respondent had a secondary project with high-rise and low-rise buildings; as such, it appears in both columns.

More than one-half of respondents (61%) said that a bank or investor was responsible for funding their primary project; low-income projects were most commonly reported to be receiving funding (74%) compared to any other project type. Low-rise projects (65%) were more likely than high-rise projects (57%) to be funding recipients (Table 5-29). This discrepancy is not surprising because low-rise survey projects (75%) were more often low-income than high-rise survey projects (57%) (See Appendix A.9).

Table 5-29: Multifamily New Construction Survey Responses – Project Financing
(2010-2012)

Investor Funding	% of Primary Projects by Category (n=67)*				
	Income Category		Building Rise**		Total
	Low-Income Projects	Market-Rate Projects	High-Rise Projects	Low-Rise Projects	
Receiving Investor Funding	74%	38%	57%	65%	61%
No Investor Funding	23%	29%	27%	24%	25%
Unknown/Private	2%	33%	17%	11%	13%
Projects	**43**	**24**	**30**	**37**	**67**

* We did not ask respondents if a bank or investor was funding the primary project if it reportedly had participated in an IOU program and/or had been built to 2005 Title 24 standards.

** Some respondents had primary projects with high-rise and low-rise buildings; as such, some projects appear in both columns.

5.7.5 Survey – Future Project Characteristics and Locations

Respondents most commonly reported that their future MFNC projects include or will include low-rise buildings, with over one-half of projects (59%) and two-thirds of units (67%) reported as being low-rise. Future projects seem slightly more likely to be low-rise compared to projects started during the 2010-2012 period, during which 55% of primary and secondary projects were low-rise, and suggests that the trend towards increasing levels of high-rise projects seen in 2010 through 2012 may not continue in the future and while low-rise projects may increase (see Table 5-19). Nearly one-quarter of future projects (24%) have or will have high-rise buildings—notably less compared to 2010-2012, for which 41% of survey respondents' projects were high-rise (see Table 5-19). When comparing these proportions, it is important to note that respondents were unaware of the building rise for nearly one-fifth of the 119 future projects (17%) compared to only 5% of the 2010-2012 projects.

Table 5-30: Multifamily New Construction Survey Responses – Future Project Building Rise
(2013-2015)

Building Rise	% of Future Projects (n=37)*	% of Future Units (n=30 Respondents; 78 Projects)**
High-Rise	24%	33%
Low-Rise	59%	67%
Unknown-Rise	17%	
Total	**119**	**7,150**

* Ten of the 47 respondents that indicated they had started or would start projects from 2013-2015 could not recall the number of projects.

** Seven respondents were not asked about the number of units in 41 projects because they did not recall the rise of projects (20 projects) or they could not identify the number of units in projects (21 projects).

Almost one-half of future MFNC projects' units (46%) reportedly are or will be low-income units, and slightly more than one-third of them (34%) are or will be market-rate units. Respondents did not identify the income category for the remaining one-fifth of units (20%).

Tables in Appendix A.10 show the income categories and rise of 2010-2012 survey projects.

Comparing these figures to the future project estimates in Table 5-31 below, we see that high-rise units in future projects are less likely to be low-income units (47%) than they were in 2010-2012 high-rise survey project units (59%).

Low-rise projects may be less likely to be low-income in the future as well. Respondents estimated that 45% of future low-rise units will be low-income units (45%) compared to 76% of 2010-2012 low-rise units. It should be noted that nearly one-third of future low-rise projects (30%) had unknown income categories.

Table 5-31: Multifamily New Construction Survey Responses – Future Project Income Category by Building Rise
(2013-2015)

Income Category	% of Future Units*		
	High-Rise (n=13 Respondents; 21 Projects)	Low-Rise (n=25 Respondents; 57 Projects)	All (n=30 Respondents; 78 Projects)**
Low-Income	47%	45%	46%
Market-Rate	53%	25%	34%
Unknown-Rate	-	30%	20%
Total Units	**2,362**	**4,788**	**7,150**

* Ten of the 47 respondents that indicated they had started or would start projects from 2013-2015 could not recall the exact number of projects and as a result were not asked more detailed questions about their projects, such as number of units and number of stories.

** Seven respondents were not asked about the number of units in 41 projects because they did not recall the rise of projects (20 projects) or they could not identify the number of units in projects (21 projects).

6 Conclusions and Recommendations

We note several key findings and conclusions from this Phase I report.

- **Complex and overlapping programs and policies affecting the energy efficiency of the MFNC market:** There is a complex array of public programs and policies influencing the energy efficiency of the MFNC market. In addition to the IOUs' new construction programs there are local reach codes, efficiency requirements of the CTCAC affordable housing tax credits, LEED for Homes program, GPR by Build it Green, and the U.S. EPA's ENERGY STAR Certified Building program.
    - Statewide, fifty seven percent of MFNC units started from 2010 through 2012 were subject to above-code requirements either because of requirements of low-income funding or their location in a reach code locality.
    - Nearly all affordable housing, representing 38% of all units of MFNC, is built to exceed Title 24 standards by 15% because of CTCAC tax credit requirements, and 24% of all units were started in localities with reach codes. There is substantial overlap between the IOUs' program participants and these other programs and policies as 53% of IOU program units that were started from 2010 through 2012were required to be high efficiency. Because of the complex interactions and in some cases coordination across the programs and policies, attribution of any observed market effects will be difficult.
- **IOU program market penetration:** Nearly two-fifths (38%) of all units started in the IOU territories from 2010 through 2012 participated in the IOU's MFNC programs and participating projects are larger on average than non-participating projects.
- **A highly concentrated builder market:** The MFNC market is concentrated among a relatively small number of builders. Five percent of builders were responsible for 33% of all units; 20% were responsible for two-thirds of all units started from 2010 through 2012.
- **MFNC construction is clustered in urban areas:** MFNC starts were heavily concentrated in California's major cities and urban areas. Forty-six percent of all starts (by units) were started in five cities (Los Angeles, San Jose, San Francisco, San Diego, and Irvine) and 81% were started in five broader metropolitan statistical areas (MSAs).[200] High-rise MFNC is even more concentrated in urban areas as 66% of all high-rise starts (by units) were started in the same five cities and 98% were started in the same five broader MSAs.
- **Patterns in affordable and market-rate segments:** The affordable housing market appears to be less volatile than market-rate MFNC. The market-rate segment has been

[200] The top five cities of Los Angeles, San Jose, San Francisco, San Diego, and Irvine are located in four of the top five MSAs: Los Angeles-Long Beach-Anaheim, San Francisco-Oakland-Hayward, San Diego-Carlsbad and San Jose-Sunnyvale-Santa Clara. The fifth MSA, Riverside-San Bernardino-Ontario, CA, accounts for the smallest amount of MFNC among the top five MSAs and does not include any of the top five cities.

more responsive to the housing recovery, accounting for the bulk of the increase in MFNC activity from 2010 through 2012, suggesting that the low-income market is less affected by housing market cycles.

- **Potential MFNC market trends:** New construction permit data suggests a potential trend toward higher levels of MFNC in the residential new construction (RNC) market. Between 2010 and 2012, multifamily units accounted for 52% of units compared to an average of 28% of permitted units from 1993 to 2008.
    - MFNC is likely to continue to grow in 2014, to over 69,000 permitted units and over 50,000 unit starts.
    - MFNC may be trending toward high-rise projects. High-rise units increased from 37% of units in 2010 to 55% of units in 2012.
- **Energy efficiency decision makers and factors:** Developers are the key decision makers while architects, Title 24 consultants, HERS raters and others have limited influence on decisions pertaining to the energy efficiency of a MFNC project.
    - Development and efficiency decisions are driven primarily by economic and financial considerations.
    - Energy efficiency does not appear to be a consumer priority.
    - Affordable housing developers and some higher-end developers who market for sustainably designed features are in the forefront of designing (and building) projects incorporating advanced energy-efficiency techniques

Several recommendations for future research and IOU program design emerge from the findings of this study.

- Begin tracking the short-term and medium term outcomes that rely on market-actor self-reports on an ongoing basis. We recommend conducting interviews or surveys during the construction process or as soon after completion as possible in order to assess the influence of the program and other factors on key decision-making in regard to the energy efficiency of the project.
- Conduct follow-up on-site visits and an assessment of building conditions in a few years, perhaps in 2017, on projects started in 2015 and 2016. This would capture MFNC projects designed and built several years after the 2010-2012 program cycle, which should provide enough time to begin to detect early market effects, while also allowing enough time to provide feedback to program staff in order to modify the program if the market is not on target to reach ZNE by 2020.
- The IOUs' programs should attempt to target the largest builders since the market is highly concentrated among a small number of builders, particularly for market-rate projects. By working with the largest builders, the program may realize market effects by influencing the efficiency practices in non-program projects built by the same builders as well as MFNC projects of other builders who may look to emulate the practices of the largest builders.

- The IOUs' programs should coordinate with voluntary programs such as CTCAC, LEED, GPR and ENERGY STAR to provide consistent efficiency standards and to leverage the brand recognition and brand equity of other voluntary programs.
- Benchmark the performance of IOU program participants. Benchmarking could help make the case for efficiency to financial institutions and secondary investor markets, increasing access to capital for high-efficiency projects, as well as to consumers who often cannot compare utility costs between units and builders who may be skeptical of building performance.

In terms of assessing attribution, we recommend adopting a theory-based approach that focuses on whether an outcome posited by the program theory has in fact occurred, and if so, then attempting to determine whether the outcome can be linked to IOU program activities, based on the preponderance of evidence. Attribution of market effects to the New Construction program will rely on observed changes in building practices as posited by the program and market theories and self-reported attribution of program impacts on the observed changes by key market actors. Attribution of program impacts could also be estimated with a Delphi panel of experts who would use data on observed changes in building practices and the self-reports by market actors to develop attribution factors.

The evaluation team does not propose including a comparison area because of three key factors that make the California residential new construction market unique and not readily comparable to control areas: (1) California's multiple and varied climate zones; (2) California's distinctive and continually changing state building codes; (3) California's long-standing new construction programs, which have become an integral part of the market. New construction in California is not readily comparable enough to new construction in any other area—or even a combination of areas—to allow valid comparisons. For example, a recent evaluation of California IOUs' benchmarking initiatives found that concerns about the lack of comparability between California commercial buildings and buildings nationally was a limitation to using ENERGY STAR Portfolio Manager for benchmarking California buildings; and this was an important driver for the development of California-specific benchmarking tools. Moreover, the cost of doing on-site assessments just in California is very expensive; conducting such on-site assessments out of state could be prohibitively expensive.

Appendix A Additional New Construction Starts Analyses and Tables

This appendix provides more details about the development of the dataset accounting for the population of MFNC projects started in California from 2010 through 2012 as well as additional tables with more detailed analysis of the MFNC starts data.

A.1 Methodology for Developing the Dataset of MFNC Starts

The following section provides the details of how we merged, cleaned, and prepared the project-level data.

While combining data from the four sources into a single project starts population dataset, we undertook numerous steps to ensure that 1) data were as complete as possible, 2) individual projects were not counted more than once if they appeared in more than one data source, and 3) projects were associated with only one value per parameter (where relevant).[201]

Preliminary Data Cleaning and Processing. Prior to merging the data sources we cleaned existing data. Each source varied in the parameters included in the dataset and in the format of the data. In addition, some datasets included data embedded in project descriptions. For example, the MHC data set did not include a variable for the number of housing units or a variable identifying a project as low-income, but these characteristics were often included in the project description. We then manually added both variables to the MHC data set and populated them from the project descriptions when possible.[202] [203] For our analysis, we made these data as comparable and complete as possible across sources.

[201] Projects may have had more than one value for a given parameter because the project data in one source conflicted with the project data in a different source.

[202] If a description did not mention if a project included low-income housing we considered the project as a market-rate project.

[203] As another example, the CTCAC awardee lists did not include parameters such as project addresses and number of buildings. The team reviewed individual CTCAC staff reports to manually extract these data. CTCAC staff also provided us with some supplemental lists cataloguing construction start dates for some projects.

Matching Process. To prevent a single project from appearing in the population data multiple times, we began by comparing project names and addresses to determine if projects matched across data sources.[204] Because the format for project names and addresses is often not consistent across data sets, we conducted manual matches of projects across the data sets.[205]

During the matching process we discovered that that some projects appeared in one data source disaggregated at the site-level or construction phase-stage while in another it was listed as a single project. In these instances, we would consider the project at the project-level, not the site-level or phase-level.

Priority for Overlapping Data. If data for a particular project and variable were present in more than one source and conflicted across sources, we chose one value to use for analysis purposes. Through careful consideration, we prioritized the data sources as follows – survey data, IOU program data, MHC data and CTCAC data:

- *Survey Data.* If projects had been asked about in the builder survey and data were confirmed or provided by the respondent, we used survey response data in the analysis. If a respondent could not provide data for a project parameter we looked to the other sources if available.
- *IOU Program Data.* If survey data for a project parameter were not available and the project was in an IOU program participant project list we used the IOU program data. As with survey data, if IOU program data were missing, we looked to the other sources if possible.
- *MHC Data.* If IOU program or survey data were not present, we deferred to MHC data.
- *CTCAC Data.* If MHC data, IOU program data, and survey data were all unavailable we deferred to CTCAC data.

Given the nature of this data selection process, the values for the characteristics of a project may have been derived from different sources. For example, the number of units may have come from CTCAC data and the number of stories may have come from survey data.

[204] The team also used parameters such as number of stories, number of units, number of buildings, and project square footage to help identify matching projects.

[205] For example, one data set may use an abbreviation of "ST" for street, while another may spell out the word 'Street,' preventing automated matches of addresses. In other cases, project names varied between the data sets. For example, the project name in one data set may have included the project's neighborhood or part of its address while a different data source would use a housing complex name as a project name.

Exceptions to the Rules. We made some deviations from the matching and merging process and decision rules described above:

- **Start Dates.** We prioritized MHC start dates over IOU Program data.[206] Based on survey responses, we found that MHC construction start dates were reliable estimates of construction starts.[207, 208]
- **Income Category.** Regardless of source, if any sources identified a project as low-income, we considered the project low-income. Because much of IOU data and the MHC data did not formally track or include income category, we considered the project low-income if any sources identified them as low-income or if they appeared in a CTCAC awardee list.[209]
- **Internet Searches.** For some key parameters, such as number of stories, if data were not present in any of these sources or we noticed broad discrepancies across sources we conducted internet searches to determine what values to associate with a project. However, given the number of projects included in the data and the number of inconsistencies, it was impractical given the project scope to conduct internet searches to find project data for all parameters and all projects.[210]

[206] In some cases, the IOU program data included project enrollment dates rather than construction start dates.

[207] We asked survey respondents to confirm start dates included in MHC project data. The difference in start dates between MHC project data and survey project data varied by an average of 0.21 months (n=61), indicating the relative reliability of the MHC start date data.

[208] If participant project start dates did not appear in MHC data and program data dates were either missing or were before 2010 or after 2012, we excluded those projects from the analysis.

[209] We assumed that CTCAC awardees accounted for the vast majority of low-income projects in the state; as such, we think these figures give a good indication of the incidence of low-income construction starts.

[210] We conducted internet searches for all projects that were missing zip code and/or building rise data. Zip codes were important to help assign other parameters used for analysis, such as climate zone and reach code communities, and building rise was needed for developing the sampling approach for the onsite visits.

Additional Variables. The project-level data we obtained did not include some additional variables of interest: climate zone, utility service provider, and metro-statistical designation.[211] We used the project address to identify the values associated with the projects.

- **Climate Zones.** To assign climate zones to zip codes, the team used the CEC Siting, Transmission and Environmental Protection Division Cartography Unit's *Climate Zones by Zipcode List*. Because the list does not include all California zip codes, we supplemented it using geographic information system (GIS) mapping that identified the latitude and longitude of the geographic center of the zip code thus allowing us to match it to a climate zone.[212]
- **Service Providers.** GIS mapping also allowed us to associate zip codes with electric service providers. We determined if projects were in SCG territory by using the SCG's *List of Cities and Communities Served.*[213]
- **Metro-Statistical Designations.** We accessed the U.S. Census Bureau's *Core based statistical areas (CBSAs) and combined statistical areas (CSAs)* table. This table matches counties with their metro-statistical designations. Using the county in which the project was located we were able to match projects with their metro-statistical designations and conduct an analysis of projects located within MSAs. [214]

[211] Metro-statistical designations are geographic areas delineated by the U.S. Office of Management and Budget (OMB). Metropolitan Statistical Areas (MSAs) have a single core urban area with a population of 50,000 or more people, Micropolitan Statistical Areas have a single urban core area with a population equal to or greater than 10,000 people and less than 50,000 people. *Source:* U.S. Census Bureau. "Metropolitan and Micropolitan Statistical Areas Main." Accessed July 4, 2013 from http://www.census.gov/population/metro/.

[212] In instances where zip codes were large and the center of their geographic areas were in unpopulated areas (such as in mountains), we manually adjusted the climate zones to reflect the portion of the zip code where customers were located.

[213] Southern California Gas. "List of Cities and Communities Served." Accessed June 13, 2013 from http://www.socalgas.com/regulatory/tariffs/tm2/pdf/CITIES.pdf.

[214] U.S Census Bureau "List 1. Core based statistical areas (CBSAs) and combined statistical areas (CSAs)." February 2013. Accessed May 13, 2013 from http://www.census.gov/population/metro/data/def.html.

A.2 Building Rise and Income Category

The following tables present more detailed analysis of the MFNC starts data.

Table A-1: Multifamily Project Stories by Income Category and Construction-Start Period (2010-2012)

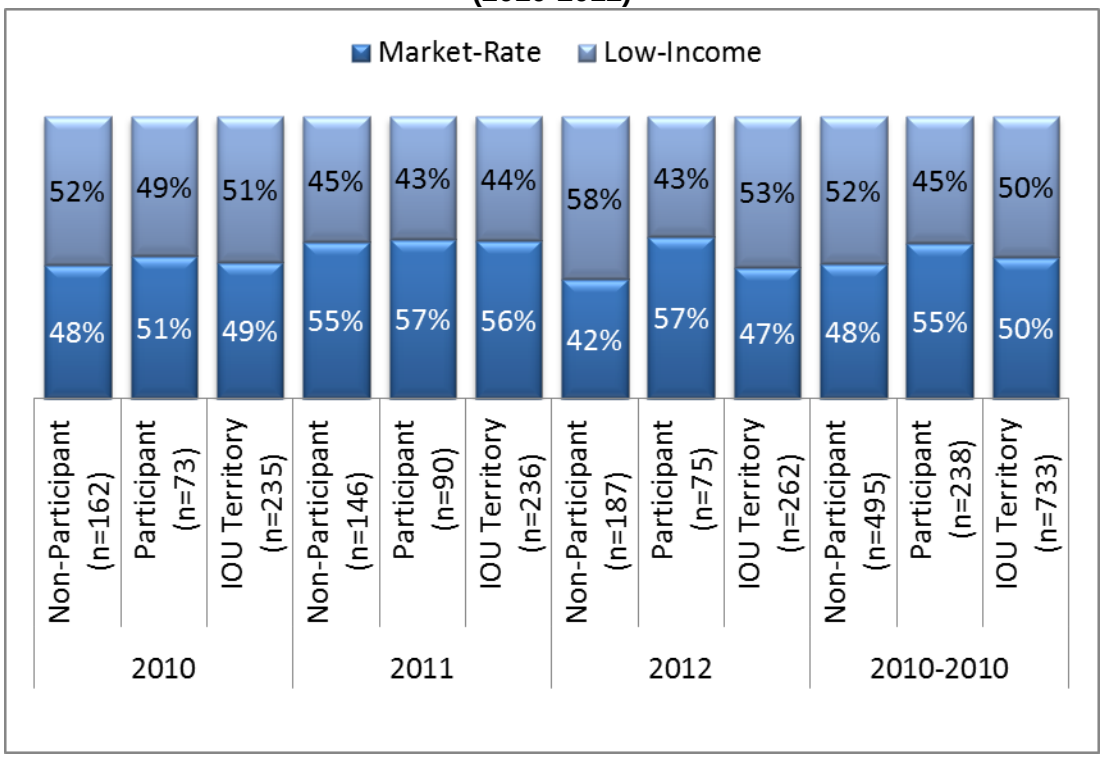
Stories	Income Category	% of Projects per Time Period*			
		2010	2011	2012	2010-2012
Unknown **	Market-Rate	1%	3%	5%	3%
	Low-Income	3%	2%	10%	5%
1	Market-Rate	1%	1%	0%	1%
	Low-Income	2%	3%	0%	2%
2	Market-Rate	24%	15%	9%	16%
	Low-Income	19%	14%	15%	16%
3	Market-Rate	10%	18%	11%	13%
	Low-Income	19%	17%	17%	17%
4	Market-Rate	8%	6%	9%	8%
	Low-Income	7%	6%	7%	7%
5	Market-Rate	4%	8%	4%	5%
	Low-Income	2%	3%	4%	3%
More than 5	Market-Rate	1%	6%	8%	5%
	Low-Income	2%	4%	3%	3%
Total Projects		**246**	**239**	**278**	**763**

Sources: (1) McGraw Hill Construction. Dodge project data for 2010-2012, *MHC Project List for State of CA Multi 12_12Bid Date.xls*, Received December 2012; (2) California Tax Credit Allocation Committee, 2009-2011 Annual Reports, http://www.treasurer.ca.gov/ctcac/annual_reports.asp, accessed June 2013.

* Eighteen projects included buildings with different numbers of stories; as such, percentages total to greater than 100%.

**Some projects were flagged as high-rise or low-rise but did not have precise story data. As such, percentages do not match overall high-rise vs. low-rise data.

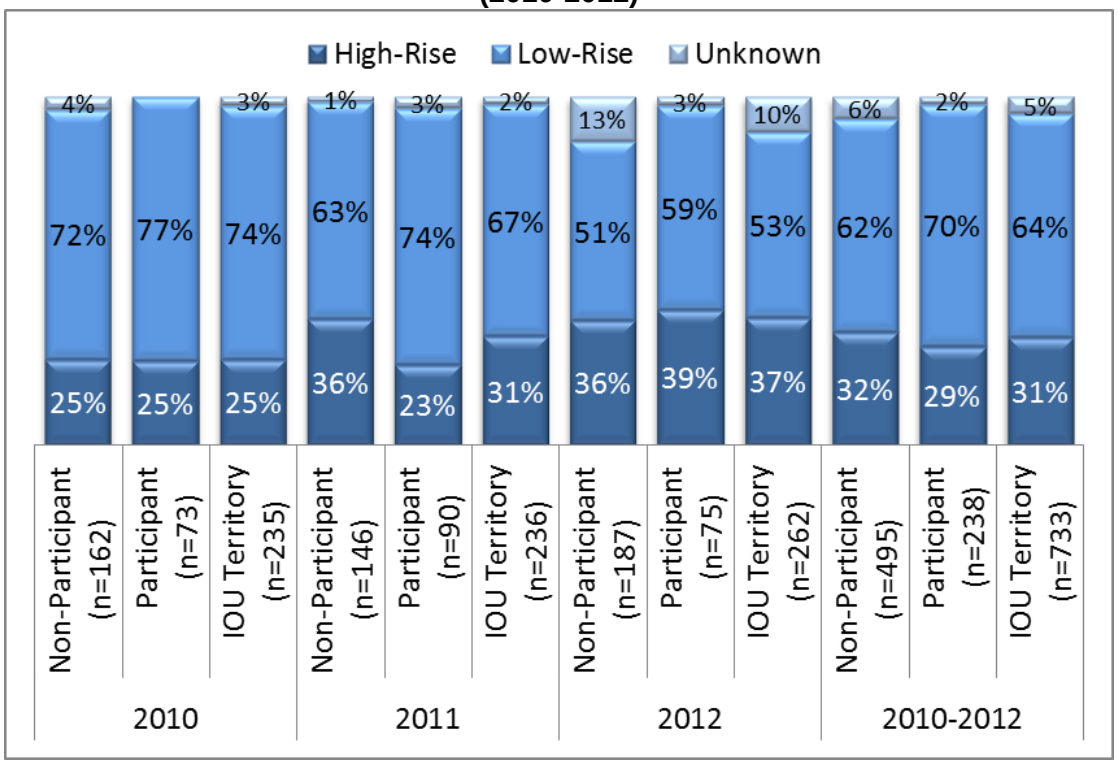
Figure A-1: Multifamily New Construction Projects in IOU Territories – Income Category by IOU Program Participation
(2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Figure A-2: Multifamily New Construction Projects in IOU Territories – Building Rise by IOU Program Participation

(2010-2012)



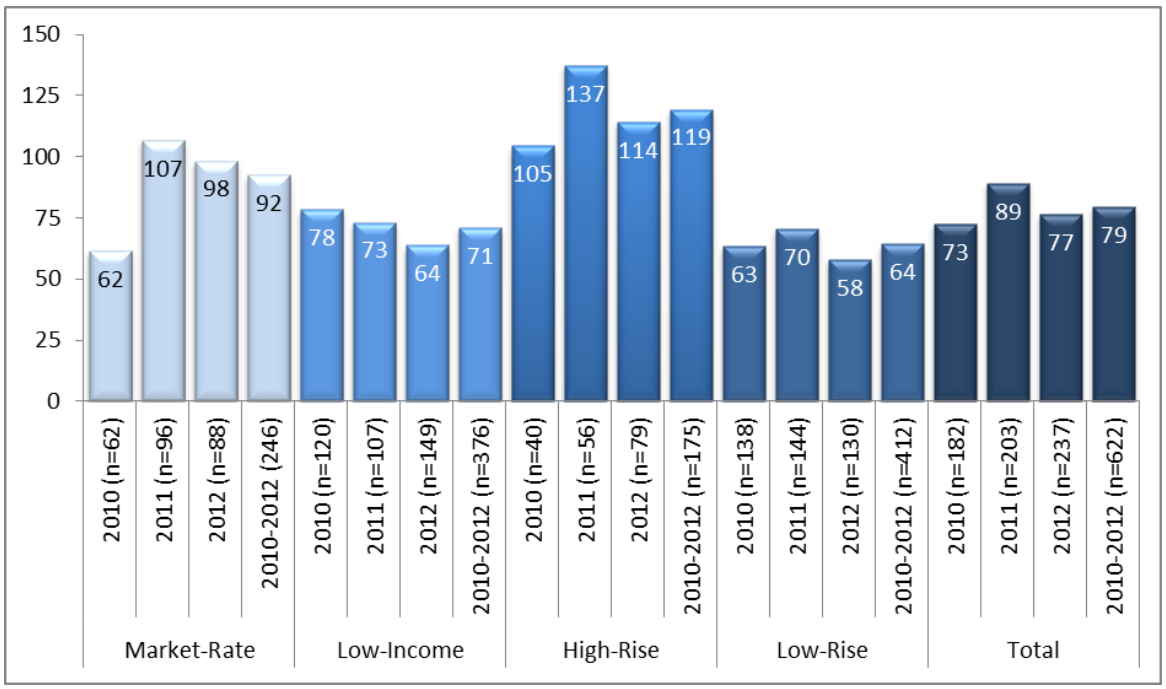
Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* Four IOU projects included both high-rise and low-rise buildings; as such, percentages total to greater than 100%.

Note: Includes only projects located in IOU service territories

A.3 Number of Units

Figure A-3: Multifamily Project Average Number of Units by Income Category, Building Rise, and Construction-Start Period
(2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: Not all 763 projects are included here either because of missing unit data or missing story data. Four projects included both high-rise and low-rise buildings; as such, these projects may appear in both high-rise and low-rise figures.

Table A-2: Multifamily Project Number of Units by Income Category and Construction Start Period (2010-2012)

Units	Income Category	% of Projects per Time Period			
		2010	2011	2012	2010-2012
Unknown	Market-Rate *	23%	15%	14%	17%
	Low-Income	3%	0%	<1%	1%
3 to 4	Market-Rate	2%	4%	3%	3%
	Low-Income	0%	0%	<1%	<1%
5 to 19	Market-Rate	7%	10%	6%	7%
	Low-Income	3%	4%	1%	2%
20 to 39	Market-Rate	2%	8%	5%	5%
	Low-Income	9%	6%	10%	8%
40 to 59	Market-Rate	4%	5%	3%	4%
	Low-Income	9%	12%	18%	13%
60 to 79	Market-Rate	2%	<1%	2%	2%
	Low-Income	11%	10%	13%	11%
80 to 99	Market-Rate	3%	1%	1%	2%
	Low-Income	7%	4%	5%	5%
100 to 199	Market-Rate	4%	5%	5%	4%
	Low-Income	8%	8%	5%	7%
200 or more	Market-Rate	1%	8%	7%	5%
	Low-Income	3%	1%	1%	2%
Total Projects		**246**	**239**	**278**	**763**

Sources: (1) McGraw Hill Construction. Dodge project data for 2010-2012, *MHC Project List for State of CA Multi 12_12Bid Date.xls*, Received December 2012; (2) California Tax Credit Allocation Committee, 2009-2011 Annual Reports, http://www.treasurer.ca.gov/ctcac/annual_reports.asp, accessed June 2013.

* CTCAC awardee lists consistently included the number of units in a given project; however, nearly one-half of the 467 MHC projects (55%) did not have unit data. As a result, it is not surprising that low-income projects, of which the majority came from CTCAC data only, are notably more likely to have a known number of units than market-rate projects.

Table A-3: Multifamily Project Number of Units by Building Rise and Construction-Start Period (2010-2012)

Units	Building Rise	% of Projects per Time Period			
		2010	2011	2012	2010-2012
Unknown	High-rise	8%	8%	7%	7%
	Low-rise	18%	8%	8%	11%
3 to 4	High-rise	<1%	<1%	1%	1%
	Low-rise	2%	3%	3%	3%
5 to 19	High-rise	1%	3%	3%	2%
	Low-rise	9%	11%	4%	8%
20 to 39	High-rise	2%	2%	5%	3%
	Low-rise	10%	12%	10%	11%
40 to 59	High-rise	2%	5%	5%	4%
	Low-rise	11%	12%	16%	13%
60 to 79	High-rise	2%	4%	3%	3%
	Low-rise	11%	7%	12%	10%
80 to 99	High-rise	2%	<1%	2%	2%
	Low-rise	8%	5%	4%	6%
100 to 199	High-rise	6%	5%	6%	6%
	Low-rise	6%	7%	3%	5%
200 or more	High-rise	2%	5%	6%	4%
	Low-rise	2%	4%	1%	2%
Total Projects		**246**	**239**	**278**	**763**

Sources: (1) McGraw Hill Construction. Dodge project data for 2010-2012, *MHC Project List for State of CA Multi 12_12Bid Date.xls*, Received December 2012; (2) California Tax Credit Allocation Committee, 2009-2011 Annual Reports, http://www.treasurer.ca.gov/ctcac/annual_reports.asp, accessed June 2013.

Note: 39 of the 763 projects did not have data identifying them as low-rise or high-rise projects. For each year, the team used the percent of projects that included low-rise buildings and the percent that included high-rise buildings to proportionally segment all projects within the given parameter. Four projects included both high-rise and low-rise buildings; as such, percentages total to greater than 100%.

Table A-4: Multifamily Project Estimated Number of Units by Income Category and Construction-Start Period (2010-2012)

Units	Income Category	% of Projects per Time Period			
		2010	2011	2012	2010-2012
Unknown	Market-Rate	<1%	-	1%	<1%
	Low-Income	-	-	-	-
3 to 4	Market-Rate	5%	6%	6%	6%
	Low-Income	<1%	-	<1%	<1%
5 to 19	Market-Rate	15%	13%	10%	12%
	Low-Income	4%	4%	1%	3%
20 to 39	Market-Rate	7%	10%	7%	8%
	Low-Income	10%	6%	10%	9%
40 to 59	Market-Rate	7%	5%	3%	5%
	Low-Income	9%	12%	18%	13%
60 to 79	Market-Rate	3%	3%	2%	2%
	Low-Income	11%	10%	13%	12%
80 to 99	Market-Rate	4%	2%	2%	2%
	Low-Income	7%	4%	5%	5%
100 to 199	Market-Rate	4%	7%	6%	6%
	Low-Income	8%	8%	5%	7%
200 or more	Market-Rate	3%	10%	9%	8%
	Low-Income	3%	1%	1%	2%
Total Projects		**246**	**239**	**278**	**763**

Sources: (1) McGraw Hill Construction. Dodge project data for 2010-2012, *MHC Project List for State of CA Multi 12_12Bid Date.xls*, Received December 2012; (2) California Tax Credit Allocation Committee, 2009-2011 Annual Reports, http://www.treasurer.ca.gov/ctcac/annual_reports.asp, accessed June 2013.

* Using the mean number of square feet per unit for projects with square footage and unit data, the team estimated the number of units for projects with square footage data without unit data.

Table A-5: Multifamily Project Estimated Number of Units by Building Rise and Construction-Start Period (2010-2012)

Units	Building Rise	% of Projects per Time Period			
		2010	2011	2012	2010-2012
Unknown	High-rise	<1%	-	<1%	<1%
	Low-rise	-	-	<1%	<1%
3 to 4	High-rise	1%	-	1%	1%
	Low-rise	4%	5%	6%	5%
5 to 19	High-rise	2%	3%	4%	3%
	Low-rise	16%	13%	7%	12%
20 to 39	High-rise	3%	3%	6%	4%
	Low-rise	15%	14%	11%	13%
40 to 59	High-rise	3%	5%	5%	4%
	Low-rise	13%	13%	16%	14%
60 to 79	High-rise	3%	4%	3%	4%
	Low-rise	11%	9%	12%	11%
80 to 99	High-rise	3%	1%	3%	2%
	Low-rise	8%	5%	4%	6%
100 to 199	High-rise	6%	7%	7%	7%
	Low-rise	6%	7%	4%	6%
200 or more	High-rise	3%	8%	8%	6%
	Low-rise	3%	4%	2%	3%
Total Projects		**246**	**239**	**278**	**763**

Sources: (1) McGraw Hill Construction. Dodge project data for 2010-2012, *MHC Project List for State of CA Multi 12_12Bid Date.xls*, Received December 2012; (2) California Tax Credit Allocation Committee, 2009-2011 Annual Reports, http://www.treasurer.ca.gov/ctcac/annual_reports.asp, accessed June 2013.

Note: 39 of the 763 projects did not have data identifying them as low-rise or high-rise projects. For each year, the team used the percent of projects that included low-rise buildings and the percent that included high-rise buildings to proportionally segment all projects within the given parameter. Four projects included both high-rise and low-rise buildings; as such, percentages total to greater than 100%.

A.4 Project Area (Square Footage)

Table A-6: Multifamily Project Square Footage by Income Category and Construction-Start Period (2010-2012)

Area (sq ft)	Income Category	% of Projects per Time Period			
		2010	2011	2012	2010-2012
Unknown	Market-Rate	3%	3%	3%	3%
	Low-Income*	21%	15%	25%	20%
10,000 or less	Market-Rate	8%	7%	6%	7%
	Low-Income	2%	1%	1%	1%
More than 10,000 and less than 25,000	Market-Rate	9%	7%	7%	7%
	Low-Income	4%	3%	5%	4%
25,000 to less than 40,000	Market-Rate	6%	5%	6%	6%
	Low-Income	4%	3%	4%	4%
40,000 to less than 65,000	Market-Rate	6%	8%	4%	6%
	Low-Income	7%	12%	10%	10%
65,000 to less than 100,000	Market-Rate	7%	6%	3%	5%
	Low-Income	9%	3%	6%	6%
100,000 to less than 200,000	Market-Rate	4%	6%	6%	5%
	Low-Income	4%	4%	2%	3%
200,000 or more	Market-Rate	5%	14%	10%	10%
	Low-Income	-	3%	1%	2%
Total Projects		**246**	**239**	**278**	**763**

Sources: (1) McGraw Hill Construction. Dodge project data for 2010-2012, *MHC Project List for State of CA Multi 12_12Bid Date.xls*, Received December 2012; (2) California Tax Credit Allocation Committee, 2009-2011 Annual Reports, http://www.treasurer.ca.gov/ctcac/annual_reports.asp, accessed June 2013.

* CTCAC awardee lists did not include project area. As a result, low-income projects, of which the majority came from CTCAC data only, are notably more likely to have an unknown project area.

Table A-7: Multifamily Project Square Footage by Building Rise and Construction-Start Period (2010-2012)

Area (sq ft)	Building Rise	% of Projects per Time Period			
		2010	2011	2012	2010-2012
Unknown	High-rise	8%	5%	9%	8%
	Low-rise	16%	14%	19%	16%
10,000 or less	High-rise	2%	<1%	1%	1%
	Low-rise	9%	7%	6%	7%
More than 10,000 and less than 25,000	High-rise	1%	1%	4%	2%
	Low-rise	12%	8%	9%	10%
25,000 to less than 40,000	High-rise	3%	3%	3%	3%
	Low-rise	8%	6%	8%	7%
40,000 to less than 65,000	High-rise	2%	5%	4%	4%
	Low-rise	12%	15%	10%	12%
65,000 to less than 100,000	High-rise	3%	3%	4%	3%
	Low-rise	13%	7%	5%	8%
100,000 to less than 200,000	High-rise	4%	4%	5%	4%
	Low-rise	4%	6%	3%	4%
200,000 or more	High-rise	3%	10%	9%	8%
	Low-rise	2%	7%	2%	4%
Total Projects		**246**	**239**	**278**	**763**

Sources: (1) McGraw Hill Construction. Dodge project data for 2010-2012, *MHC Project List for State of CA Multi 12_12Bid Date.xls*, Received December 2012; (2) California Tax Credit Allocation Committee, 2009-2011 Annual Reports, http://www.treasurer.ca.gov/ctcac/annual_reports.asp, accessed June 2013.

Note: 39 of the 763 projects did not have data identifying them as low-rise or high-rise projects. For each year, the team used the percent of projects that included low-rise buildings and the percent that included high-rise buildings to proportionally segment all projects within the given parameter. Four projects included both high-rise and low-rise buildings; as such, percentages total to greater than 100%.

A.5 Number of Buildings

Table A-8: Multifamily Project Number of Buildings by Income Category and Construction-Start Period (2010-2012)

Buildings	Income Category	% of Projects per Time Period			
		2010	2011	2012	2010-2012
Unknown	Market-Rate	2%	1%	4%	2%
	Low-Income	<1%	<1%	-	<1%
1	Market-Rate	22%	27%	22%	23%
	Low-Income	21%	21%	27%	23%
2	Market-Rate	6%	4%	8%	6%
	Low-Income	4%	5%	4%	5%
3	Market-Rate	4%	3%	3%	3%
	Low-Income	3%	2%	4%	3%
4	Market-Rate	3%	4%	3%	3%
	Low-Income	2%	2%	4%	3%
5 to 9	Market-Rate	6%	9%	5%	6%
	Low-Income	11%	8%	11%	10%
10 to 19	Market-Rate	4%	5%	1%	3%
	Low-Income	7%	5%	4%	5%
20 or more	Market-Rate	2%	3%	2%	2%
	Low-Income	2%	1%	-	1%
Total Projects		**246**	**239**	**278**	**763**

Sources: (1) McGraw Hill Construction. Dodge project data for 2010-2012, *MHC Project List for State of CA Multi 12_12Bid Date.xls*, Received December 2012; (2) California Tax Credit Allocation Committee, 2009-2011 Annual Reports, http://www.treasurer.ca.gov/ctcac/annual_reports.asp, accessed June 2013.

Table A-9: Multifamily Project Number of Buildings by Building Rise and Construction-Start Period (2010-2012)

Buildings	Building Rise	% of Projects per Time Period			
		2010	2011	2012	2010-2012
Unknown	High-rise	1%	-	<1%	<1%
	Low-rise	2%	2%	3%	2%
1	High-rise	18%	22%	29%	23%
	Low-rise	26%	25%	20%	23%
2	High-rise	2%	3%	6%	4%
	Low-rise	9%	7%	5%	7%
3	High-rise	2%	2%	1%	2%
	Low-rise	5%	3%	6%	5%
4	High-rise	1%	1%	<1%	1%
	Low-rise	4%	5%	7%	5%
5 to 9	High-rise	1%	3%	2%	2%
	Low-rise	16%	14%	14%	15%
10 to 19	High-rise	<1%	<1%	-	<1%
	Low-rise	11%	10%	5%	8%
20 or more	High-rise	<1%	-	-	<1%
	Low-rise	3%	4%	2%	3%
Total Projects		**246**	**239**	**278**	**763**

Sources: (1) McGraw Hill Construction. Dodge project data for 2010-2012, *MHC Project List for State of CA Multi 12_12Bid Date.xls*, Received December 2012; (2) California Tax Credit Allocation Committee, 2009-2011 Annual Reports, http://www.treasurer.ca.gov/ctcac/annual_reports.asp, accessed June 2013.

Note: 39 of the 763 projects did not have data identifying them as low-rise or high-rise projects. For each year, the team used the percent of projects that included low-rise buildings and the percent that included high-rise buildings to proportionally segment all projects within the given parameter. Four projects included both high-rise and low-rise buildings; as such, percentages total to greater than 100%.

A.6 Service Providers

Table A-10: Multifamily Project Service Providers by Income Category and Construction-Start Period (2010-2012)

Provider	Income Category	% of Customers per Time Period			
		2010	2011	2012	2010-2012
Southern California Gas*	Market-Rate	20%	17%	12%	16%
	Low-Income	17%	16%	20%	18%
Pacific Gas & Electric	Market-Rate	9%	17%	15%	13%
	Low-Income	13%	12%	14%	13%
Southern California Edison	Market-Rate	13%	9%	6%	9%
	Low-Income	9%	9%	10%	9%
Los Angeles Department of Water & Power	Market-Rate	4%	6%	4%	5%
	Low-Income	4%	4%	7%	5%
San Diego Gas & Electric	Market-Rate	2%	4%	4%	3%
	Low-Income	3%	2%	3%	3%
Sacramento Municipal Utility District	Market-Rate	1%	-	1%	<1%
	Low-Income	1%	1%	1%	1%
Other	Market-Rate	2%	1%	1%	2%
	Low-Income	2%	1%	3%	2%
	Total Customers	**392**	**357**	**410**	**1,159**

Sources: (1) McGraw Hill Construction. Dodge project data for 2010-2012, *MHC Project List for State of CA Multi 12_12Bid Date.xls*, Received December 2012; (2) California Tax Credit Allocation Committee, 2009-2011 Annual Reports, http://www.treasurer.ca.gov/ctcac/annual_reports.asp, accessed June 2013.

* SCG territory overlaps with other providers' territories. As a result, the 762 projects with address data represent 1,159 customers.

Table A-11: Multifamily Project Service Providers by Building Rise and Construction-Start Period (2010-2012)

Provider	Building Rise	% of Customers per Time Period *			
		2010	2011	2012	2010-2012
Southern California Gas	High-rise	7%	10%	12%	10%
	Low-rise	31%	23%	20%	25%
Pacific Gas & Electric	High-rise	6%	10%	12%	9%
	Low-rise	16%	20%	17%	18%
Southern California Edison	High-rise	3%	3%	4%	3%
	Low-rise	19%	14%	12%	15%
Los Angeles Department of Water & Power	High-rise	4%	7%	8%	6%
	Low-rise	4%	4%	3%	4%
San Diego Gas & Electric	High-rise	2%	1%	2%	2%
	Low-rise	4%	5%	5%	4%
Sacramento Municipal Utility District	High-rise	-	-	-	-
	Low-rise	1%	1%	2%	1%
Other	High-rise	1%	<1%	1%	1%
	Low-rise	4%	3%	3%	3%
Total Customers		**392**	**357**	**410**	**1,159**

Sources: (1) McGraw Hill Construction. Dodge project data for 2010-2012, *MHC Project List for State of CA Multi 12_12Bid Date.xls*, Received December 2012; (2) California Tax Credit Allocation Committee, 2009-2011 Annual Reports, http://www.treasurer.ca.gov/ctcac/annual_reports.asp, accessed June 2013.

* SCG territory overlaps with other providers' territories. As a result, the 762 projects with address data represent 1,159 customers.

Note: The climate zone for one project was not included because the team did not have enough information about the project to determine its service provider. 39 of the 762 projects did not have data identifying them as low-rise or high-rise projects. For each year, the team used the percent of projects that included low-rise buildings and the percent that included high-rise buildings to proportionally segment all projects within the given parameter. Four projects included both high-rise and low-rise buildings; as such, percentages total to greater than 100%.

A.7 Climate Zones and Regions

Table A-12: Multifamily Project Climate Regions and Zones by Construction-Start Period (2010-2012)

Climate Region	Climate Zone	Percent of Total Projects per Period			
		2010	2011	2012	2010-2012
1	1	-	3%	2%	1%
	2	3%	2%	1%	2%
	3	14%	19%	22%	19%
	4	7%	8%	6%	7%
	5	<1%	1%	2%	1%
2	6	13%	9%	10%	11%
	7	9%	9%	6%	8%
3	8	11%	10%	11%	11%
	9	13%	19%	16%	16%
	10	6%	3%	7%	6%
4	11	2%	4%	1%	2%
	12	7%	6%	9%	7%
	13	10%	5%	5%	6%
5	14	1%	2%	<1%	1%
	15	3%	1%	1%	2%
	16	1%	<1%	<1%	1%
Total Projects*		**246**	**239**	**277**	**762**

Sources: (1) McGraw Hill Construction. Dodge project data for 2010-2012, *MHC Project List for State of CA Multi 12_12Bid Date.xls*, Received December 2012; (2) California Tax Credit Allocation Committee, 2009-2011 Annual Reports, http://www.treasurer.ca.gov/ctcac/annual_reports.asp, accessed June 2013.

* The climate zone for an additional project was not included because the team did not have enough information about the project to determine its climate zone.

Table A-13: Multifamily Project Climate Regions by Income Category and Construction-Start Period (2010-2012)

Climate Region	Income Category	% of Projects per Time Period			
		2010	2011	2012	2010-2012
1	Market-Rate	10%	21%	19%	17%
	Low-Income	15%	11%	14%	14%
2	Market-Rate	14%	11%	8%	11%
	Low-Income	9%	7%	8%	8%
3	Market-Rate	15%	18%	14%	16%
	Low-Income	15%	13%	19%	16%
4	Market-Rate	8%	5%	5%	6%
	Low-Income	11%	10%	10%	10%
5	Market-Rate	2%	<1%	-	1%
	Low-Income	2%	3%	2%	2%
Total Projects		**246**	**239**	**277**	**762**

Sources: (1) McGraw Hill Construction. Dodge project data for 2010-2012, *MHC Project List for State of CA Multi 12_12Bid Date.xls*, Received December 2012; (2) California Tax Credit Allocation Committee, 2009-2011 Annual Reports, http://www.treasurer.ca.gov/ctcac/annual_reports.asp, accessed June 2013.

Note: The climate zone for an additional project was not included because the team did not have enough information about the project to determine its climate zone.

Table A-14: Multifamily Project Climate Regions by Building Rise and Construction-Start Period (2010-2012)

Climate Region	Building Rise	% of Projects per Time Period			
		2010	2011	2012	2010-2012
1	High-rise	11%	14%	17%	14%
	Low-rise	14%	18%	16%	16%
2	High-rise	8%	5%	7%	7%
	Low-rise	15%	13%	8%	12%
3	High-rise	6%	11%	14%	11%
	Low-rise	24%	21%	19%	22%
4	High-rise	<1%	1%	-	<1%
	Low-rise	18%	14%	16%	16%
5	High-rise	-	-	-	-
	Low-rise	4%	3%	2%	3%
Total Projects		**246**	**239**	**277**	**762**

Sources: (1) McGraw Hill Construction. Dodge project data for 2010-2012, *MHC Project List for State of CA Multi 12_12Bid Date.xls*, Received December 2012; (2) California Tax Credit Allocation Committee, 2009-2011 Annual Reports, http://www.treasurer.ca.gov/ctcac/annual_reports.asp, accessed June 2013.

Note: The climate zone for one project was not included because the team did not have enough information about the project to determine its climate zone. 39 of the 762 projects did not have data identifying them as low-rise or high-rise projects. For each year, the team used the percent of projects that included low-rise buildings and the percent that included high-rise buildings to proportionally segment all projects within the given parameter. Four projects included both high-rise and low-rise buildings; as such, percentages total to greater than 100%.

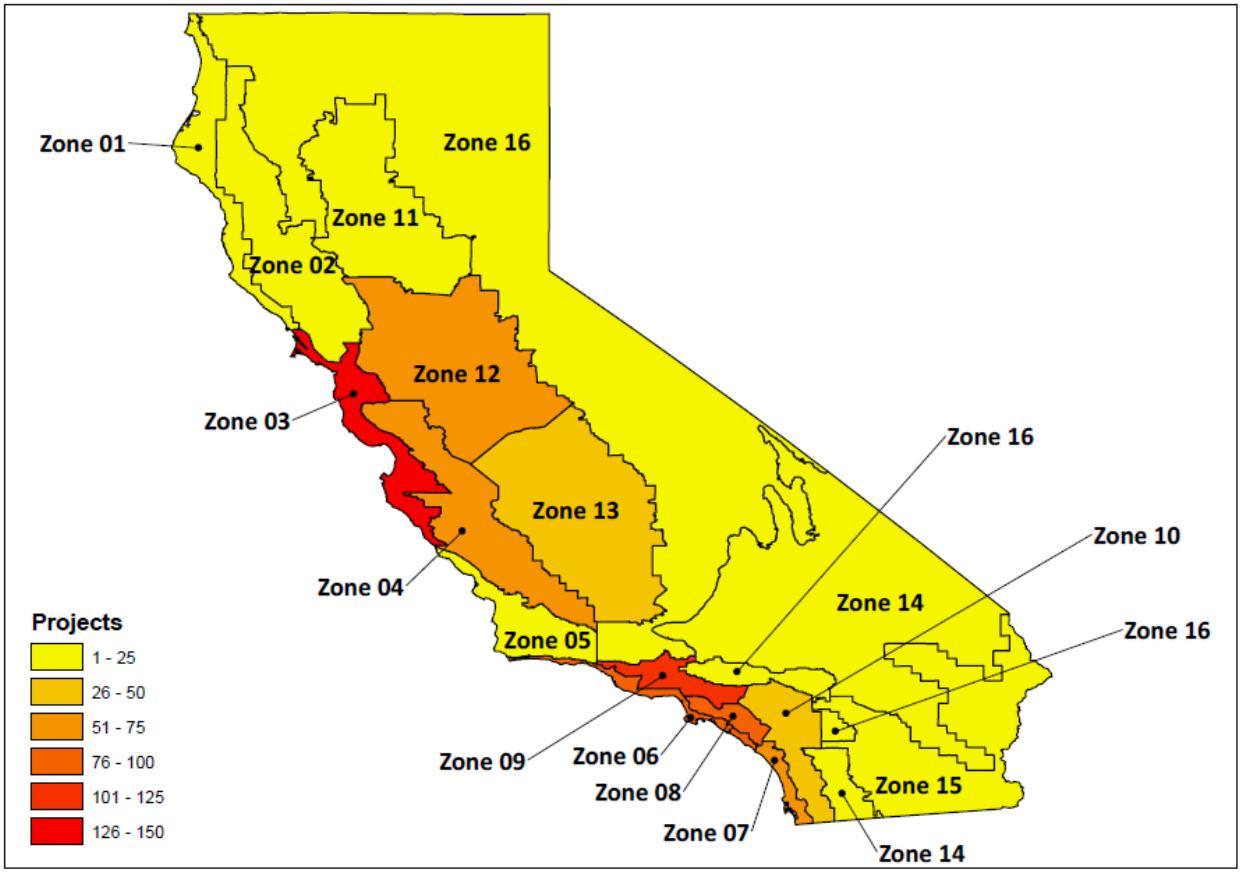
Table A-15: Market Penetration of IOU Program MFNC units by IOU Territory and Climate Zone (2010-2012)

Climate Zone	Number of Projects	Number of Units*	% of Units Participating
Pacific Gas & Electric			
1	10	354	97%
2	14	702	63%
3	139	14,216	47%
4	49	5,356	62%
5	5	174	10%
11	17	718	68%
12	40	2,628	60%
13	35	2,166	43%
Southern California Edison			
5	4	149	22%
6	66	4,812	18%
7	8	408	-
8	53	4,666	14%
9	31	1,094	24%
10	21	1,457	32%
13	14	789	35%
14	7	453	-
15	6	279	-
16	1	66	-
Southern California Gas			
4	7	273	-
5	9	323	27%
6	81	5,446	5%
7	7	397	29%
8	81	7,378	31%
9	120	8,783	2%
10	24	2,022	14%
12	4	82	100%
13	44	2,632	-
14	5	415	-
15	14	853	25%
16	1	66	-
San Diego Gas & Electric			
6	2	112	32%
7	51	5,522	47%
10	17	567	37%

Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* Units represent estimated number of units. We were unable to estimate the number of units for three projects. These projects are excluded in unit-columns. Table includes only projects located in IOU service territories.

Figure A-4: Multifamily Projects by Climate Zone (2010-2012)



A.8 Cities, Counties, and Metropolitan Statistical Areas

Table A-16: Metro-Statistical Designation of Multifamily Projects by Construction-Start Period
(2010-2012)

Time Period	Percent of Total Projects		Total Number of Projects*
	Metropolitan	Micropolitan	
2010	100%	<1%	244
2011	98%	2%	239
2012	98%	2%	276
Total 2010-2012	99%	1%	759

Sources: (1) McGraw Hill Construction. Dodge project data for 2010-2012, *MHC Project List for State of CA Multi 12_12Bid Date.xls*, Received December 2012; (2) California Tax Credit Allocation Committee, 2009-2011 Annual Reports, http://www.treasurer.ca.gov/ctcac/annual_reports.asp, accessed June 2013.

* Three projects were in areas without metro-statistical designations, and the climate zone for another project was not included because the team did not have enough information about the project to determine its metro-statistical designation.

Figure A-5: Multifamily Projects by County
(2010-2012)

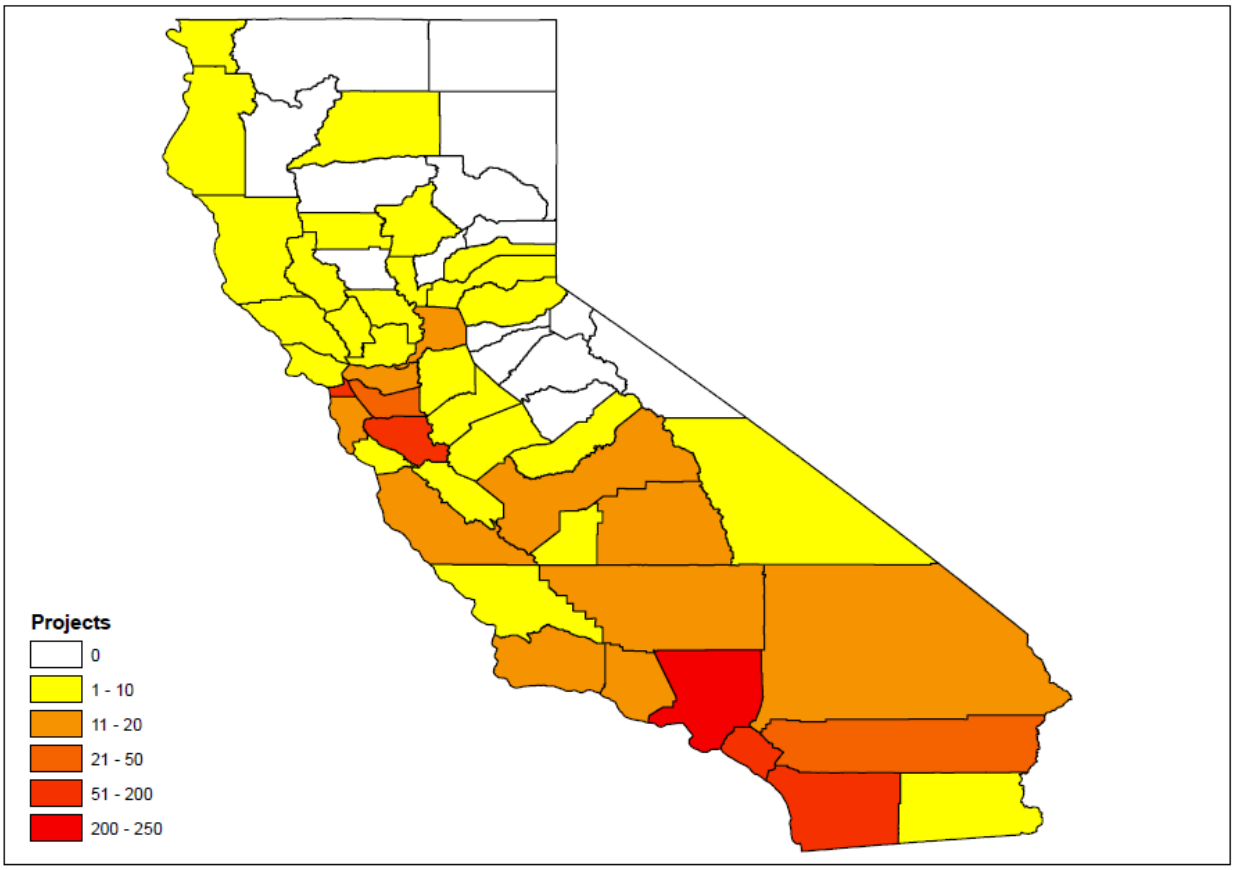
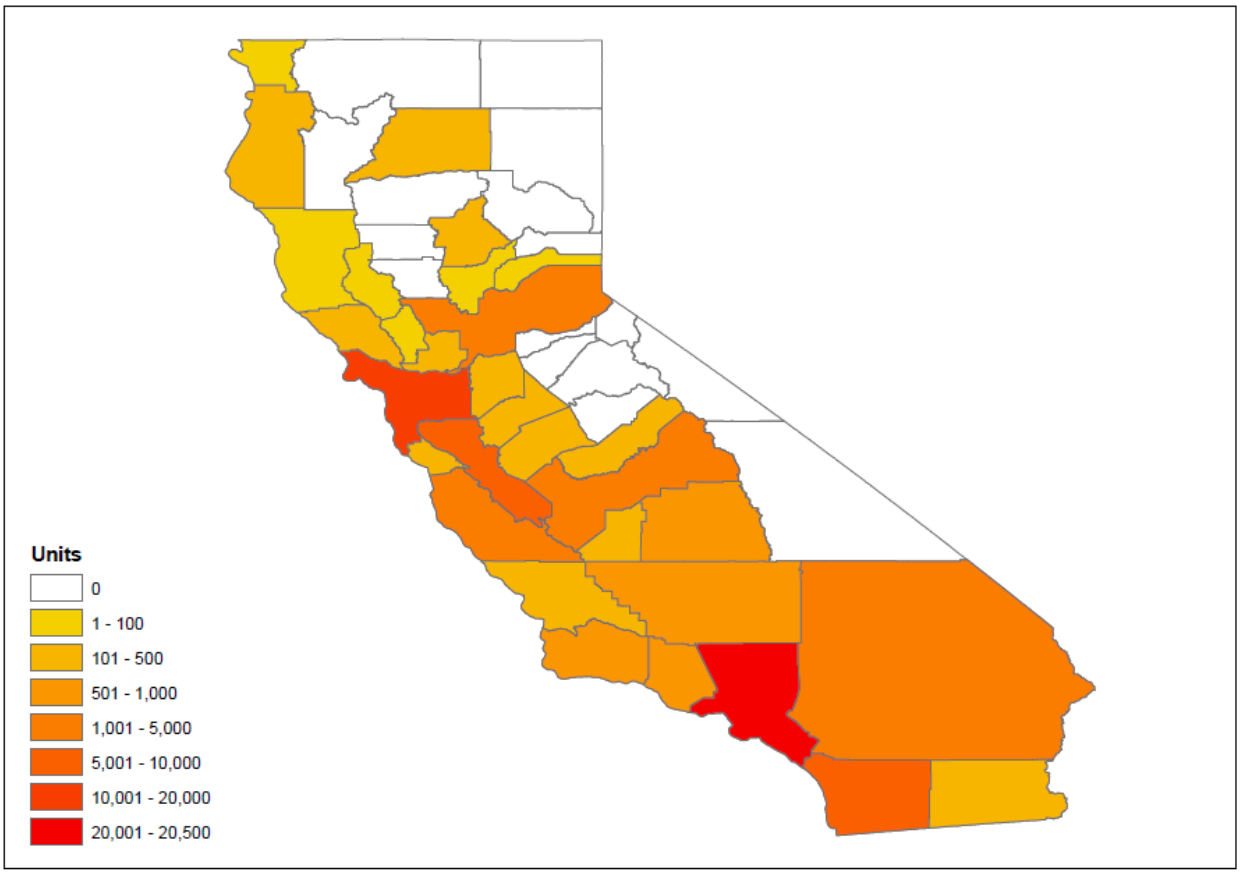


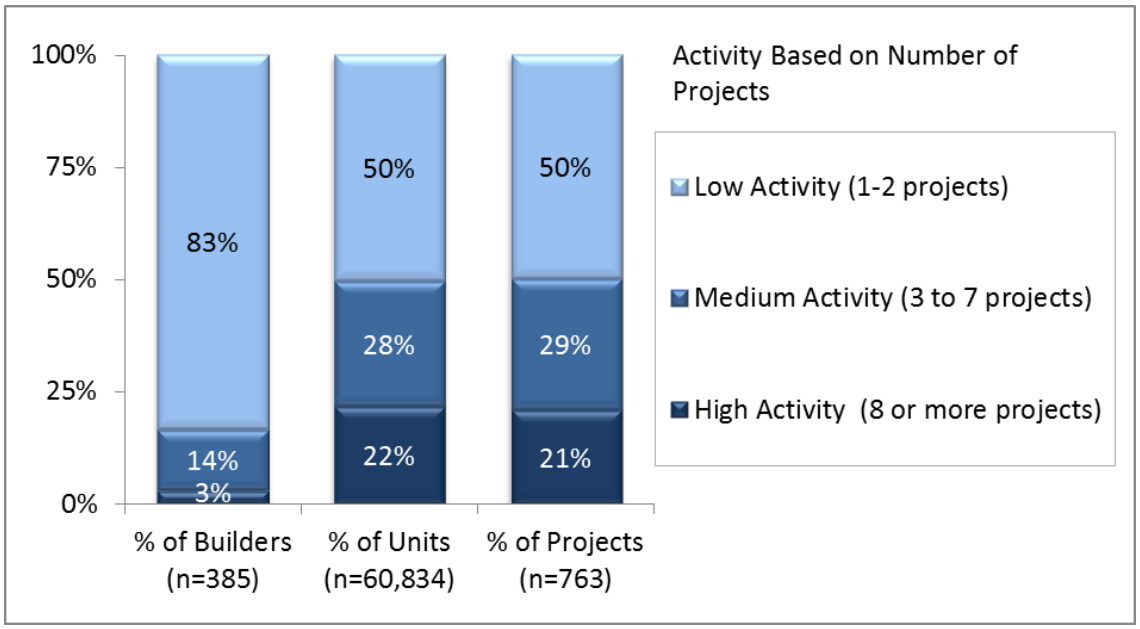
Figure A-6: Total Units of MFNC by MSA (2010-2012)



A.9 Builders and Developers

As an additional analysis of builder activity we categorized builders based on the number of projects that they had completed. We considered builders that had completed one to two projects as low activity, those that had completed three to seven projects as medium activity, and those completing eight or more projects as high activity. Figure A-7: compares builders' activity levels (based on number of projects) with the percentages of projects and units that they represented. We classified most builders (83%) as low-activity builders; low-activity builders were responsible for one-half of projects (50%) and estimated units (50%). While only 3% of builders were high-activity builders, they represented slightly more than one-fifth of projects (21%) and estimated units (22%).

Figure A-7: Multifamily Project Builder Activity Levels Based on Number of Projects (2010-2012)

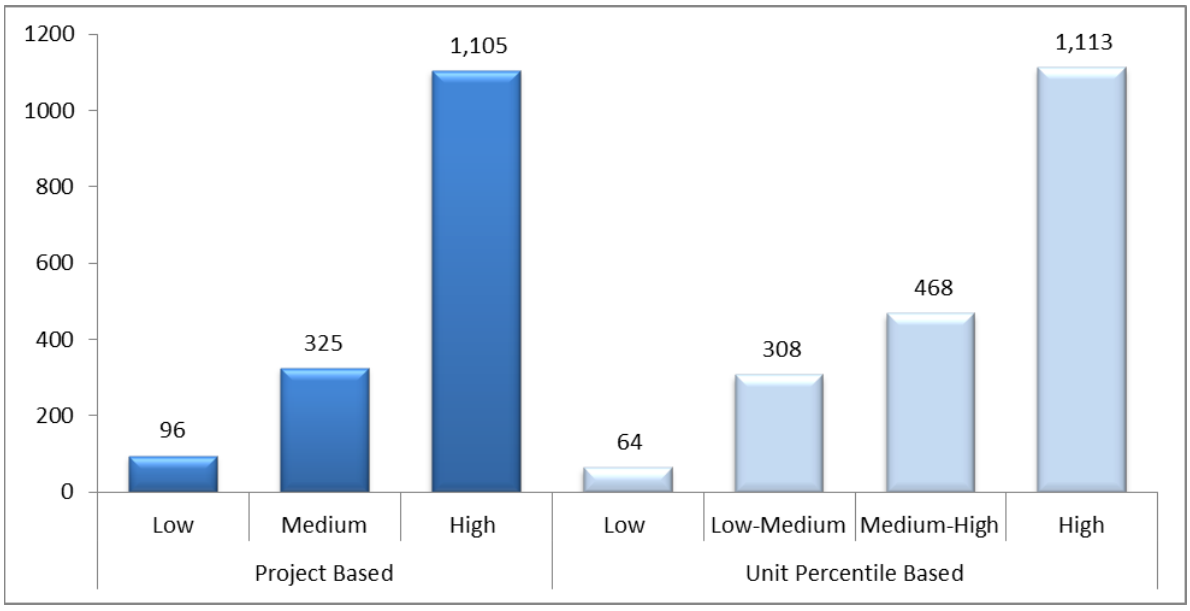


Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: Unit figures include the estimated number of units. We were unable to estimate the number of units for three of the 763 projects. Because one of the three builders that conducted those three projects had conducted other projects that did have unit data, the 60,834 units are represented by 384 builders associated with 760 projects.

Figure A-8: shows the average number of units per builder by both project-based and unit percentile-based activity levels. On average, the high activity builders each started over 1,000 units, while lowest activity builders started less than 100 units.

Figure A-8: Multifamily Project Average Number of Units per Builder by Activity Levels (2010-2012)



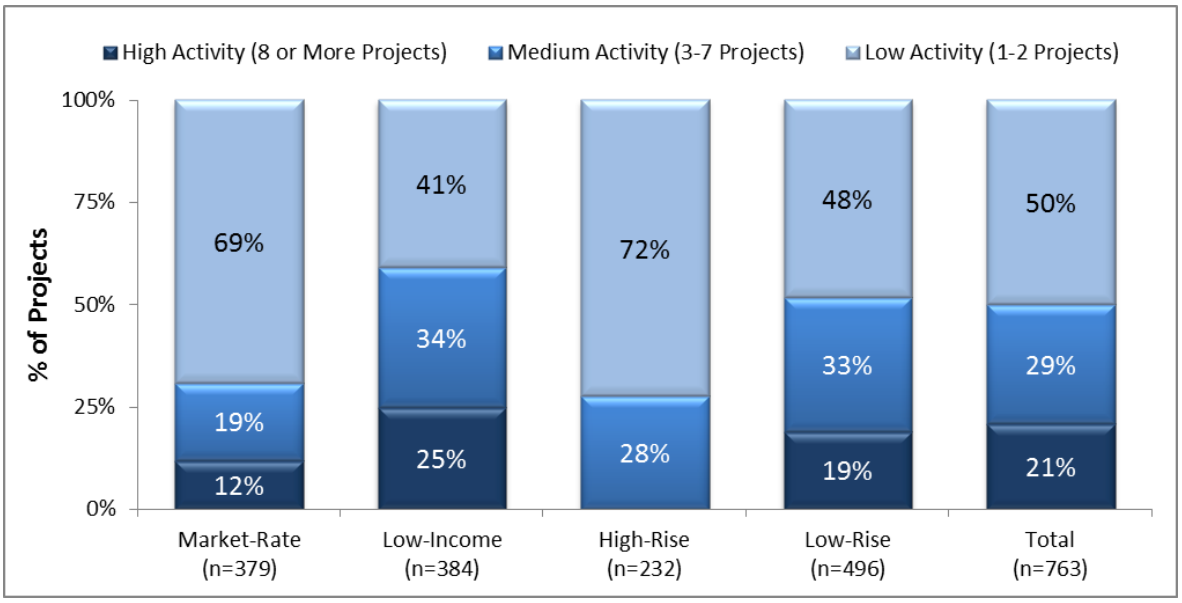
Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* Figures are based on the estimated number of units. We were unable to estimate the number of units for three of the 763 projects.

Comparing the project based activity levels, the low-income projects (59%) were notably more likely than market-rate projects (31%) to have been built by medium and high-activity builders (Figure A-9). This finding is contrary to the findings from our interviews with market actors who reported that the affordable housing market in California is dominated by a larger number of smaller-scale developers, compared to the market-rate sector, which involves fewer, larger developers.

High-rise projects were not associated with any high-activity builders, and nearly three-quarters of high-rise projects (72%) were built by low-activity builders. In contrast, nearly one-fifth of low-rise projects (19%) were constructed by high-activity builders. This may be because high-rise projects are larger in terms of number of units (Figure 5-18) and area (Figure 5-19), thus requiring more resources that might have otherwise been allocated to more projects.

Figure A-9: Multifamily Project Income-Category and Building Rise by Builder Activity Levels (Based on Number of Projects)
(2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

Note: Four projects included both high-rise and low-rise buildings; as such, these projects may appear in both high-rise and low-rise figures. Additionally, 39 projects are excluded from rise columns because they did not have data identifying them as low-rise or high-rise projects.

Table A-17 presents further details. On average, builders associated with market-rate projects built 1.6 market-rate projects and 134 units in market-rate projects from 2010 through 2012 while builders associated with low-income projects averaged building 2.4 low-income projects and 166 low-income units each. Builders involved in high-rise projects started 1.3 projects and 172 units in projects with high-rise buildings, on average, while those involved in low-rise projects built 2.0 projects and 118 units in projects with low-rise buildings, on average.

Table A-17: Number of Multifamily Projects per Builder by Income Category and Building Rise (2010-2012)

Projects per Builder	Income Category				Building Rise			
	Market-Rate		Low-Income		High-Rise		Low-Rise	
	% of Projects	% of Builders	% of Projects	% of Builders	% of Projects	% of Builders	% of Projects	% of Builders
1	53%	80%	24%	57%	61%	83%	34%	68%
2	16%	12%	17%	20%	11%	8%	15%	15%
3	6%	3%	9%	7%	12%	5%	8%	6%
4 to 5	8%	3%	15%	8%	13%	4%	13%	6%
6 to 7	5%	1%	10%	4%	3%	1%	11%	4%
8 to 9	7%	1%	4%	1%	-	-	5%	1%
10 or more	5%	-	20%	3%	-	-	14%	2%
Total Projects/Builders	**379**	**254**	**384**	**162**	**232**	**172**	**496**	**247**
Average Projects per Builder	**1.5**		**2.4**		**1.3**		**2.0**	
Standard Deviation	*1.64*		*3.02*		*0.91*		*2.72*	
Average Units per Builder	**134**		**166**		**172**[†]		**118**	
Standard Deviation	*311*		*217*		*243*		*229*	

Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

A.10 Survey Results

Table A-18: Multifamily New Construction Survey Responses – Project Income Category for Primary and Secondary Projects

(2010-2012)

Income Category	% of Primary and Secondary Projects (n=76)
Low-Income	67%
Market-Rate	33%
Total Projects	**107**

Table A-19: Multifamily New Construction Survey Responses – Project Rise for Primary and Secondary Projects

(2010-2015)

Rise	% of Primary and Secondary Projects (n=76)
High-Rise	41%
Low-Rise	55%
Unknown Rise	5%
Total Projects	**107**

Note: One respondent had a project with high-rise and low-rise buildings; as such, percentages total to greater than 100%.

Table A-20: Multifamily New Construction Survey Responses – Project Rise by Income for Primary and Secondary Projects

(2010-2015)

	Primary and Secondary Projects (n=76)*			
	% Projects		% of Units (n=100 Projects)**	
Income Category	High-Rise	Low-Rise	High-Rise	Low-Rise
Low-Income	57%	75%	59%	76%
Market-Rate	43%	24%	41%	24%
Total	**44**	**59**	**4,926**	**3,905**

* One respondent had a project with high-rise and low-rise buildings; as such, that project appears in all columns.

** Some respondents did not know how many units were in their secondary project so the base number of projects does not fully represent the number of units.

Table A-21: Multifamily New Construction Survey Responses – Number of Units per Project for Primary and Secondary Projects
(2010-2012)

Units per Project	% of Primary and Secondary Projects (n=76)
Unknown	6%
3 to 4	7%
5 to 19	8%
20 to 39	14%
40 to 59	20%
60 to 79	16%
80 to 99	10%
100 to 199	7%
200 or more	12%
Total Projects	**107**

Table A-22: Multifamily New Construction Survey Responses – Number of Buildings per Project for Primary and Secondary Projects
(2010-2012)

Number of Buildings per Project	% of Primary and Secondary Projects (n=76)
Unknown	5%
1	50%
2	11%
3	7%
4	7%
5 to 9	9%
10 to 19	9%
20 or more	2%
Total Projects	**107**

Table A-23: Multifamily New Construction Survey Responses – Project Size per Primary and Secondary Project for Primary and Secondary Projects
(2010-2012)

Area (sq ft) per Project*	% of Primary and Secondary Projects (n=76)
Unknown	6%
10,000 or less	10%
More than 10,000 and less than 25,000	9%
25,000 to less than 40,000	16%
40,000 to less than 65,000	16%
65,000 to less than 100,000	15%
100,000 to less than 200,000	5%
200,000 or more	23%
Total Projects	**107**

* Residential area.

Appendix B Additional New Construction Permit Data Tables

The following tables present more detailed analysis of the MFNC permit data.

Table B- 1: California Permitted Units by Building Type by Time Period, Percentage Change (1993-2012)

Year	Parameter	Building Type				
		Single Family	2 Units	3-4 Units	5 or More Units	All Buildings
1993 *	Number of Units	69,749	14,755			84,504
	% Change from Previous Year	--	--			--
1994 *	Number of Units	77,115	19,932			97,047
	% Change from Previous Year	+11%	35%			+15%
1995 *	Number of Units	68,689	16,604			85,293
	% Change from Previous Year	-11%	-17%			-12%
1996	Number of Units	74,923	1,201	2,363	15,796	94,283
	% Change from Previous Year	+9%	+17%			+11%
1997	Number of Units	84,780	1,273	2,504	23,159	111,716
	% Change from Previous Year	13%	+6%	+6%	+47%	+18%
1998	Number of Units	94,298	1,484	2,701	27,224	125,707
	% Change from Previous Year	+11%	+17%	+8%	+18%	+13%
1999	Number of Units	101,711	1,201	2,646	34,579	140,137
	% Change from Previous Year	+8%	-19%	-2%	+27%	+11%
2000	Number of Units	105,595	1,371	3,497	38,077	148,540
	% Change from Previous Year	+4%	+14%	+32%	+10%	+6%
2001	Number of Units	106,902	1,574	2,886	37,395	148,757
	% Change from Previous Year	+1%	+15%	-17%	-2%	+<1%
2002	Number of Units	123,865	1,898	3,352	38,646	167,761
	% Change from Previous Year	+16%	+21%	+16%	+3%	+13%
2003	Number of Units	138,762	2,583	4,402	49,935	195,682
	% Change from Previous Year	+12%	+36%	+31%	+29%	+17%
2004	Number of Units	151,417	2,646	5,834	53,063	212,960
	% Change from Previous Year	+9%	+2%	+33%	+6%	+9%
2005	Number of Units	155,322	2,674	5,023	45,953	208,972
	% Change from Previous Year	+3%	+1%	-14%	-13%	-2%
2006	Number of Units	108,021	2,558	4,627	49,074	164,280
	% Change from Previous Year	-30%	-4%	-8%	+7%	-21%
2007	Number of Units	68,409	2,232	3,345	39,048	113,034
	% Change from Previous Year	-37%	-13%	-28%	-20%	-31%
2008	Number of Units	33,050	1,380	1,416	29,116	64,962

	% Change from Previous Year	-52%	-38%	-58%	-25%	-43%
2009	Number of Units	25,454	798	833	9,336	36,421
	% Change from Previous Year	-23%	-42%	-41%	-68%	-44%
2010	Number of Units	25,263	666	1,193	17,377	44,499
	% Change from Previous Year	-1%	-17%	+43%	+86%	+22%
2011	Number of Units	21,631	714	1,067	23,924	47,336
	% Change from Previous Year	-14%	7%	-11%	38%	6%
2012	Number of Units	27,558	1,056	2,096	28,928	59,638
	% Change from Previous Year	27%	48%	96%	21%	26%
	% Change from 1993	-60%	117%			-29%
1993-2012	Total number of Units	1,662,514	27,309	49,785	611,921	2,351,529

Source: (1) California Home Building Foundation, Construction Industry Research Board, Annual Building Permit Summaries, California Cities and Counties Data for Calendar Years 2010, 2011, and 2012; (2) California Home Building Foundation, Construction Industry Research Board, Annual Building Permit Summaries for 1993-2009, *NMR Group Inc. Statewide Unit Report 1993-2009.xls*, Received July 2013.

* CIRB data did not identify the number of units in non-single family buildings prior to 1995.

Table B- 2:: California Permitted Unit Building Types by Time Period (1993-2012)

Year	Parameter	Building Type				
		Single Family	2 Units	3-4 Units	5 or More Units	All Buildings
1993 *	Number of Units	69,749	14,755			84,504
	% of Annual Units	83%	17%			
1994 *	Number of Units	77,115	19,932			97,047
	% of Annual Units	79%	21%			
1995 *	Number of Units	68,689	16,604			85,293
	% of Annual Units	81%	19%			
1996	Number of Units	74,923	1,201	2,363	15,796	94,283
	% of Annual Units	79%	1%	3%	17%	
1997	Number of Units	84,780	1,273	2,504	23,159	111,716
	% of Annual Units	76%	1%	2%	21%	
1998	Number of Units	94,298	1,484	2,701	27,224	125,707
	% of Annual Units	75%	1%	2%	22%	
1999	Number of Units	101,711	1,201	2,646	34,579	140,137
	% of Annual Units	73%	1%	2%	25%	
2000	Number of Units	105,595	1,371	3,497	38,077	148,540
	% of Annual Units	71%	1%	2%	26%	
2001	Number of Units	106,902	1,574	2,886	37,395	148,757
	% of Annual Units	72%	1%	2%	25%	
2002	Number of Units	123,865	1,898	3,352	38,646	167,761
	% of Annual Units	74%	1%	2%	23%	
2003	Number of Units	138,762	2,583	4,402	49,935	195,682
	% of Annual Units	71%	1%	2%	26%	
2004	Number of Units	151,417	2,646	5,834	53,063	212,960
	% of Annual Units	71%	1%	3%	25%	
2005	Number of Units	155,322	2,674	5,023	45,953	208,972
	% of Annual Units	74%	1%	2%	22%	
2006	Number of Units	108,021	2,558	4,627	49,074	164,280
	% of Annual Units	66%	2%	3%	30%	
2007	Number of Units	68,409	2,232	3,345	39,048	113,034
	% of Annual Units	61%	2%	3%	35%	
2008	Number of Units	33,050	1,380	1,416	29,116	64,962
	% of Annual Units	51%	2%	2%	45%	
2009	Number of Units	25,454	798	833	9,336	36,421
	% of Annual Units	70%	2%	2%	26%	
2010	Number of Units	25,263	666	1,193	17,377	44,499
	% of Annual Units	57%	1%	3%	39%	
2011	Number of Units	21,631	714	1,067	23,924	47,336

Year	Parameter	Building Type				
		Single Family	**2 Units**	**3-4 Units**	**5 or More Units**	**All Buildings**
	% of Annual Units	46%	2%	2%	51%	
2012	Number of Units	27,558	1,056	2,096	28,928	59,638
	% of Annual Units	46%	2%	4%	49%	
1993-2012	**Number of Units**	**1,662,514**	**27,309**	**49,785**	**611,921**	**2,351,529**
	% of Total Units	**71%**	**1%**	**2%**	**26%**	

Source: (1) California Home Building Foundation, Construction Industry Research Board, Annual Building Permit Summaries, California Cities and Counties Data for Calendar Years 2010, 2011, and 2012; (2) California Home Building Foundation, Construction Industry Research Board, Annual Building Permit Summaries for 1993-2009, *NMR Group Inc. Statewide Unit Report 1993-2009.xls*, Received July 2013.

* CIRB data did not identify the number of units in non-single family buildings prior to 1995.

Table B- 3: Multifamily Permitted Units by Metro-Statistical Designation by Time Period and Building Type (2010-2012)

Year		Percent of Total Permits		Total Number of Permits
		Metropolitan	**Micropolitan**	
2010	3 to 4 Units	99%	1%	1,193
	5 or More Units	99%	1%	17,377
	Total Units	99%	1%	18,570
2011	3 to 4 Units	96%	4%	1,067
	5 or More Units	99%	1%	23,924
	Total Units	99%	1%	24,991
2012	3 to 4 Units	99%	1%	2,096
	5 or More Units	100%	0%	28,928
	Total Units	100%	0%	31,024*
Total 2010-2012	3 to 4 Units	98%	2%	4,356
	5 or More Units	100%	0%	70,229
	Total Units	99%	1%	74,585*

Source: California Home Building Foundation, Construction Industry Research Board, Annual Building Permit Summaries, California Cities and Counties Data for Calendar Years 2010, 2011, and 2012.

* One permit in 2012 was drawn in an area without a metro-statistical designation.

Appendix C Additional IOU Program and "Green" Project New Construction Tables

This appendix provides additional tables as well as more details of the data cleaning and merging of the IOU program data.

The IOUs provided lists of projects that participated in CAHP, CMFNH, and SBD. The four IOU lists included 238 projects that started from 2010 through 2012. We attempted to match the 238 program projects with the 663 MHC-CTCAC projects. We found 145 of the 238 program projects (61%) in the MHC-CTCAC project lists.

As described in Appendix A, we excluded program projects in the analysis if we were unable to identify a construction start date or if the start date was before 2010 or after 2012. If a project matched an MHC-CTCAC project, we associated the project with its MHC-CTCAC start date; otherwise, we associated the project with the construction start date found in the program data.[215] [216] The vast majority of the 238 program projects (99%) that were started during the three-year period had participated in CAHP or CMFNH; only four projects participated in SBD.

[215] We determined that using the MHC-CTCAC start dates for program projects was a reliable method based on the relative accuracy of the start dates as confirmed in the survey we conducted with MHC-CTCAC project representatives.

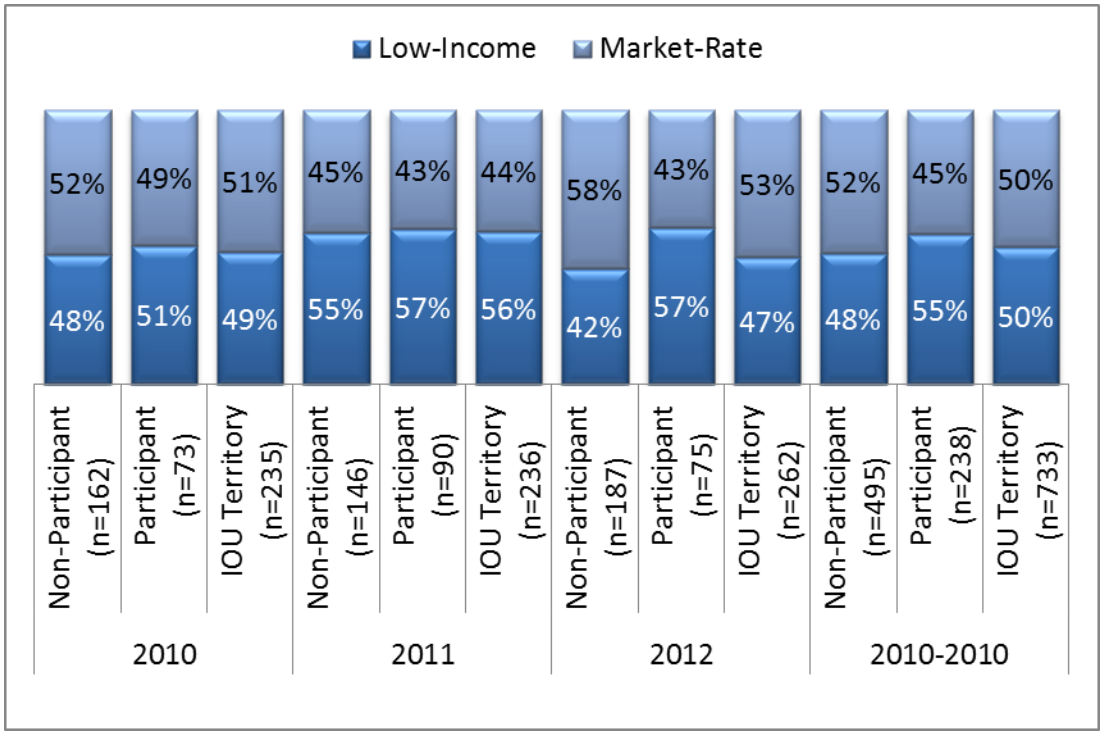
[216] There were a total of 348 unique IOU program projects. We removed program projects if 1) they did not match MHC-CTCAC projects and the project did not include a construction start date between 2010 and or 2) the project was a single family rather than multifamily project: 80 projects included start dates either before or after 2010 through 2012, 24 projects did not include construction start dates, and the remaining six projects were not MFNC projects.

Table C- 1: Multifamily New Construction Projects in IOU Territories – Number of Stories by IOU Program Participation (2010-2012)

Stories	% of Non-Program Projects				% of Program Projects			
	2010	2011	2012	2010-2012	2010	2011	2012	2010-2012
Unknown	6%	5%	19%	11%	-	3%	3%	2%
1	4%	4%	-	2%	-	2%	1%	1%
2	39%	28%	26%	31%	48%	30%	20%	32%
3	28%	27%	21%	25%	30%	44%	37%	38%
4	16%	13%	16%	15%	11%	10%	19%	13%
5	6%	10%	9%	8%	10%	11%	8%	10%
More than 5	3%	13%	12%	9%	4%	4%	12%	7%
Total projects	**162**	**146**	**187**	**495**	**73**	**90**	**75**	**238**

Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

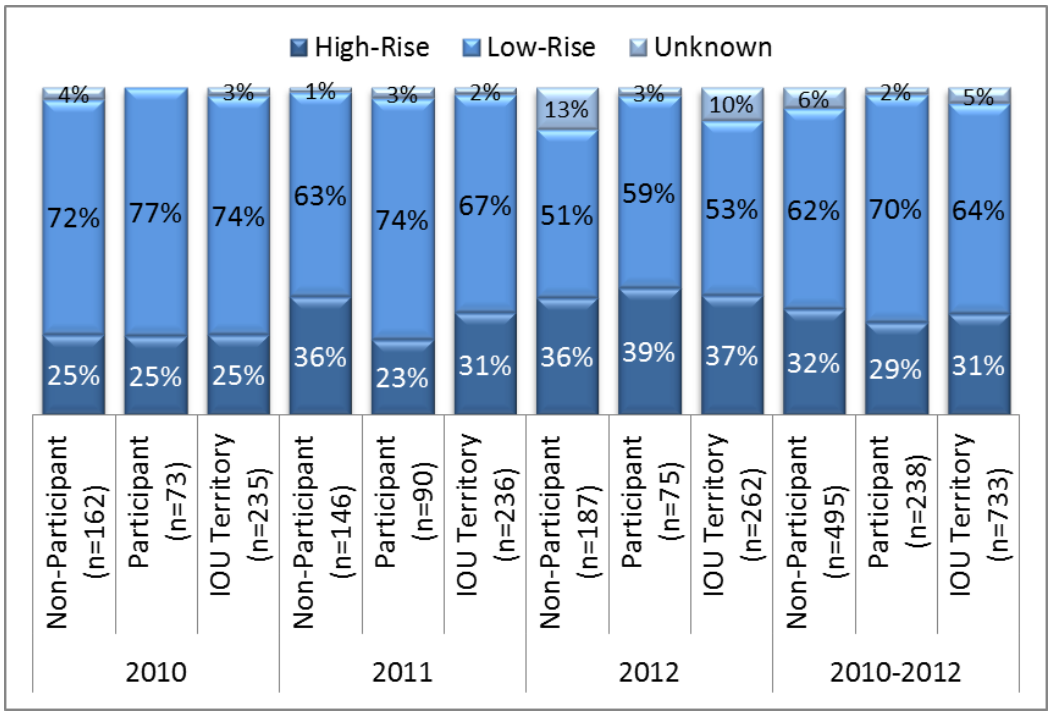
Figure C-1: Multifamily New Construction Projects in IOU Territories – Income Category by IOU Program Participation (2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys

Figure C-2: Multifamily New Construction Projects in IOU Territories – Building Rise by IOU Program Participation

(2010-2012)



Sources: (1) MHC, 2010-2012 Dodge Project Data; (2) CTCAC, 2009-2011 Annual Reports; (3) IOU Program Project Lists; and (4) Builder and Developer CATI Surveys.

* Four IOU projects included both high-rise and low-rise buildings; as such, percentages total to greater than 100%.

Note: Includes only projects located in IOU service territories.

Table C- 2: Metro-Statistical Designation of LEED Multifamily Projects by Registration Date (2003-2012)

Time Period	Percent of Total Projects		Total Number of Projects *
	Metropolitan	Micropolitan	
2003	100%	0%	1
2004	100%	0%	2
2005	92%	8%	13
2006	95%	5%	20
2007 **	96%	1%	69
2008	100%	0%	55
2009	100%	0%	27
2010	100%	0%	14
2011	100%	0%	22
2012	100%	0%	10
2003	100%	0%	1
2004	100%	0%	2
Total 2002-2012	98%	1%	233

Sources: (1) McGraw Hill Construction. Dodge project data for 2010-2012, *MHC Project List for State of CA Multi 12_12Bid Date.xls*, Received December 2012; (2) California Tax Credit Allocation Committee, 2009-2011 Annual Reports, http://www.treasurer.ca.gov/ctcac/annual_reports.asp, accessed June 2013.

* 119 of the 352 LEED projects had "confidential" locations making it impossible for the research team to identify the projects' metro-statistical designation. One of these was in 2002. As a result, the table only shows projects registered from 2003 to 2012.

** In 2007, two of the 69 projects were in areas without metro-statistical designations.

Sixty-five percent of future projects are expected to be for residential use only, whereas 35% of future projects are expected to be mixed-use projects that include both residential *and* commercial uses. As presented in Table C- 3, low-rise projects, in particular, are or will be likely to be used for residential purposes only (79%). Conversely, high-rise projects are more likely to be intended for mixed-use (69%) than limited to residential use. We hypothesize that high-rise projects are likely to be mixed-use because of a couple factors. High-rise buildings likely are more commonly in cities because land area is limited and developers seeking to build commercial and residential spaces may want to maximize the limited space available. Additionally, cities likely have integrated zoning for residential and commercial spaces, making it easier for builders to develop mixed-use buildings.

Table C- 3: Multifamily New Construction Survey Responses – Future Project Use Type by Rise (2013-2015)

	% of Future Projects		
End-Use	**High-Rise (n=15)**	**Low-Rise (n=25)**	**All (n=35)***
Mixed-Use	69%	21%	35%
Residential Only	31%	79%	65%
Total Projects	**29**	**70**	**99**

* Ten of the 47 respondents that indicated they had started or would start projects from 2013-2015 could not recall the exact number of projects and as a result were not asked more detailed questions about their projects. Seven respondents were not asked about the type of usage in 20 projects because they could not recall the rise of those projects (five of the seven could recall information about other projects of theirs, so only two of the seven are omitted from the calculations).

Respondents most commonly indicated that their future MFNC low-rise projects were or would be located in Los Angeles (34%) and Orange (17%) counties and that their high-rise projects were or would be in Los Angeles (five of 15 respondents) and San Francisco (four of 15) counties.

We asked respondents their projections about where MFNC projects in the overall California 2013-2015 market would most likely be located. Respondents most commonly identified Los Angeles (29%) and San Francisco and/or Alameda (18%) counties for future MFNC projects. Table C- 4 provides additional details.

Table C- 4: Multifamily New Construction Survey Responses – Future Project Counties (2013-2015)

County	% of Respondents*		
	Planned or Existing 2013-2015 Projects		2013-2015 Market Projections (n=76)
	High-Rise* (n=15)	Low-Rise (n=29)	
Los Angeles	5	34%	29%
San Diego	3	10%	11%
Santa Clara	3	7%	7%
Kern	-	10%	5%
Orange	-	17%	3%
Santa Barbara	-	7%	3%
Riverside	-	7%	1%
San Luis Obispo	-	7%	1%
Sacramento	-	3%	1%
San Bernardino	-	3%	1%
San Francisco and/or Alameda			18%
Alameda	1	10%	
San Francisco	4	3%	
Other Counties	-	10%	1%
Broader Regions	-	-	1%
Don't know	-	*14%*	*34%*

* Where the sample size is less than 20 we provide counts instead of percentages. Because these were multiple response questions, counts sum to greater than the sample size and percentages total to greater than 100%.

Appendix D Secondary Literature Review

D.1 Introduction

The evaluation team conducted a literature review to contribute to the market characterization and program model for the California multifamily new construction (MFNC) market and the California Investor-Owned Utilities' (IOUs') New Construction Programs that target the multifamily market.[217] The literature review helped identify key market actors, market barriers, and successful program elements found in other MFNC programs. The key research questions considered by the literature review include the following:

- Who are the key actors in the multi-family new construction market?
- What are the characteristics of the multi-family new construction market?
- What other multi-family new construction programs exist?
- What are the key barriers to developers and building owners from incorporating energy efficiency into their building designs?
- What challenges exist for program administrators to increase participation in multi-family new construction programs?
- What are the drivers for developers and building owners to incorporate energy efficiency into their building designs?
- What program elements have been identified as leading to successful programs?

D.1.1 Energy Efficiency in the Multi-family New Construction Market

The following section lays the groundwork for understanding how energy efficiency fits into the multi-family new construction market. It outlines the key market actors and describes how energy efficiency programs are addressing the multi-family new construction market.

D.1.2 Multi-family New Construction Market Actors

The literature we reviewed identified the following key market actors in the multi-family new construction market: building owners and developers, construction contractors and vendors, government-funded programs and agencies, affordable-housing agencies and funders, trade associations, and energy-efficiency programs. We summarize the roles of these market actors as presented in the literature in this subsection.

Building owners and developers. Building owners and developers are the key actors in decisions about incorporating energy efficiency into multi-family building designs. Cadmus Group, Inc. (Cadmus, 2012) found that, in contrast to the single-family home market, the multi-

[217] The IOUs' New Construction Programs that target the multifamily market include the California Advanced Homes Program (CAHP), PG&E's multifamily program, the California Multi-Family New Homes Program (CMFNH), and the Savings by Design (SBD) program.

family home market involves decision-making among businesses as opposed to households; as a result, multi-family decision-making is often made in a "hierarchical" manner among corporate players (The Cadmus Group, Inc. 2012).

In terms of knowledge of energy efficiency, Vaidya and Haggerty (2011) reported size and type of building owners and managers was often predictive of the participants' level of energy efficiency knowledge. Focus group attendees representing high-rise (those with more than three stories) new construction properties were more knowledgeable about energy efficiency than those representing retrofit and low-rise new construction properties (Vaidya and Haggerty 2011).

Construction contractors, designers and vendors. Contractors, designers and vendors can be key sources of information about energy efficiency for building owners and managers. In focus groups with Massachusetts (MA) multi-family property managers, Vaidya and Haggerty (2011) found that all types of building owners and managers "rely heavily" on construction contractors in their decision making processes. Representatives of high-rise (those with more than three stories) new construction and existing buildings appeared to rely on their designers, architects, and engineers for information gathering more than representatives from low-rise properties. The building owners and managers of newly constructed buildings underscored that programs should utilize contractors and consultants as a major channel for informing property managers about energy efficiency programs. From workshops with Massachusetts program administrators, Vaidya and Haggerty (2011) learned that the program administrators can have trouble finding qualified contractors.

Government-funded programs and agencies. Administrators of non-IOU programs, such as the Weatherization Assistance Program (WAP),[218] the Better Buildings Neighborhood Program (BBNP),[219] and various U.S. Department of Housing and Urban Development (HUD)[220] programs, along with state housing finance agencies and local public housing authorities (HFAs), are promising partners for energy efficiency programs.[221] Johnson and Mackres (2013) noted that non-IOU program administrators have pre-existing infrastructure and relationships with builders, developers, and property owners that IOU programs can potentially leverage (Johnson and Mackres 2013).

[218] The Weatherization Assistance Program, funded by the U.S. Department of Energy, "enables low-income families to permanently reduce their energy bills by making their homes more energy efficient." (U.S. Department of Energy Efficiency & Renewable Energy 2012).

[219] Better Buildings Neighborhood Program provided state and local governments with grant funding to develop or expand energy efficiency programs. It is funded by the U.S. Department of Energy.

[220] The Department of Housing and Urban Development programs seek to "provide strong, sustainable, inclusive communities and quality, affordable homes for all Americans" (U.S. Department of Housing and Urban Development, "Greetings from the Secretary").

[221] While some entities, such as WAP, may target existing multifamily buildings the evaluation team concludes that the pre-existing relationships with these entities could support the growth of new construction projects.

Affordable-housing program administrators and funders. HFAs and Community Development Finance Institutions (CDFIs) [222] are often key partners in developing and implementing low-income multi-family energy efficiency programs with utilities and their regulators (Johnson and Mackres, 2013). HFAs generally have pre-existing relationships with building owners and managers that, as Johnson and Mackres suggested, IOUs can leverage while IOUs have funding of which HFAs are often in need. To reach low-income communities, Johnson and Mackres suggested that IOUs partner with local Community Action Agencies (CAAs) (Johnson and Mackres 2013).[223]

Energy efficiency programs. Voluntary energy efficiency programs also play a role in the multi-family new construction market. California Home Energy Retrofit Coordinating Committee's Multifamily Subcommittee (MF HERCC) listed influential performance-based programs for multi-family new construction, including CAHP:

- ENERGY STAR for Homes Multifamily (EPA/statewide IOUs),
- The California Advanced Homes Partnership (Sempra and SCE), and
- Green Building programs such as
    - LEED for Homes (national),
    - GreenPoint Rated (statewide) and
    - Green Communities (national) (California MF HERCC 2011).

D.1.2.1 Other Multi-family New Construction Programs

The evaluation team examined literature on other multi-family new construction programs to review common practices found in other MFNC programs.

Johnson and Mackres (2013) identified three general categories of multi-family programs:

- Measure-level rebates
- Direct install services
- Whole-building comprehensive retrofits or new construction programs

The following are summaries of several multi-family new construction programs found in other states.

Vermont, Ohio, and New Jersey. Brown and Wolfe (2007) described three state approaches to promoting energy efficiency in multi-family new construction. They argued that these program designs can achieve considerable results and should be further developed:

[222] Community Development Finance Institutions are funded by the U.S. Department of the Treasury. They are non-governmental financial institutions that are devoted to community development. They offer financing and development services to underserved communities (U.S. Department of the Treasury, 2014).

[223] Community Action Agencies are private, non-profit organizations that offer human services and advocacy to deal with poverty and enabling self-sufficiency (Massachusetts Association for Community Action, "All about MASSCAP").

- Vermont[224] offers a wide range of services to multi-family new construction projects: construction plan and document review, development of bidding materials, product sourcing, multi-stage construction inspections, and system commissioning. CAHP offers many of the same services.
- The state of Ohio is one of a number of states that has started combining public benefit funds with low-income housing tax credits and tax-exempt bonds. Ohio's Housing Finance Agency offered extra credit when paired with contributions from its energy office for energy-efficient low-income housing. There is a similar, though informal relationship between the California Tax Credit Allocation Committee (CTCAC), which administers federal and state tax credits for the construction of affordable rental housing, and CAHP. Affordable housing developers must build at least to the level of the CAHP requirements to meet CTCAC requirements, making CAHP incentive dollars a common component of the financing packages affordable housing developers use in funding their projects.
- The New Jersey Board of Public Utilities created a joint funding effort with the Housing and Mortgage Finance Agency to fund the entire cost of photovoltaic installations (Brown and Wolfe 2007). Similarly, in California there are incentives available for photovoltaic installations for multifamily projects, though through separate programs, such as through the New Solar Homes Partnership (NSHP).

New York State Energy Research and Development Authority. McKibbin et al. (2012) provided an overview of the New York State Energy Research and Development Authority (NYSERDA) Multifamily Performance Program:

- Unlike CAHP, the NYSERDA program is offered to both existing and new construction buildings. California IOUs offer multifamily retrofit programs, such as the Multi-family Energy Efficiency Rebate Program, but they are administered separately from CAHP.
- NYSERDA program participants are permitted to select their own energy service provider from a group of program-approved consultants. CAHP does not have an approved list, but it does require professionals involved in the program to possess specific certifications.
- NYSERDA's Multifamily Performance Program offers participants a performance-based path similar to that of CAHP, requiring projects to achieve savings of 15% over building code standards.
- Both NYSERDA's program and CAHP require verification of measure installation.
- The NYSERDA Multifamily Performance Program also offers incentives for low-income housing measures (McKibbin et al. 2012). While CAHP does not directly incentivize low-income projects, many recipients of CTCAC tax credits participate in the program.

[224] The authors do not clarify what entity in Vermont they are referencing.

Wisconsin Focus on Energy. Obert and Dedolph (2008) summarized the participation process involved in the Wisconsin Focus on Energy's New Construction Program (as of 2008):

- The Focus on Energy program integrated a multi-family new construction program with a commercial building new construction program. The CAHP design targets residential buildings only.
- Following a preliminary screening, program administrators work with property owners, designers, and technical assistance firms subcontracted by Focus on Energy to determine if the facility should go through a measure-level prescriptive approach, a whole-building comprehensive approach, or a combination of the two. The owners, designers, and the technical assistance firms then work together to conduct energy modeling of a planned project and present the results to Focus on Energy. CAHP similarly offers design assistance and reviews of program participants plans, though the program does not offer a prescriptive measure option.
- Like CAHP, Focus on Energy verifies project implementation during various phases of construction.
- Focus on Energy's incentive payment is capped at $200,000 per project and is issued to the building owner or developer (Obert and Dedolph 2008). CAHP developers do not appear to have a cap on their incentive allowance. CAHP does however issue capped incentives to Home Energy Raters (HERS)[225] verifying measure savings and to energy consultants.

Massachusetts. NMR (2012) reviewed the Massachusetts Residential New Construction Four to Eight Story Multifamily Pilot of 2010-2012. The pilot design, unlike CAHP, was a prescriptive program for mid-rise multi-family buildings. Similar to CAHP, the pilot offered participants the opportunity to work with an approved consultant with the intent of educating developers about building science and performance issues. The pilot, however, modeled its standards around the then developing ENERGY STAR standard for high-rise multi-family buildings (NMR Group, Inc. 2012).

The literature also included examinations of program spending levels as important indicators of the development of programs. McKibbin et al. (2012) reported that the majority of states do not allocate sufficient funds to (retrofit or new construction) multi-family programs. They reported that Massachusetts has the largest effort, and they indicated that California and New York offer the next largest efforts, saying that California and New York's budgets are "*large enough to reach a significant number of multi-family units*" (McKibbin et al. 2012). Johnson and Mackres (2013) found that both retrofit and new construction multi-family program spending levels vary dramatically across metropolitan areas, with a median of $0.72 per residential customer. They estimated that the Boston area utilities had the highest spending on multi-family programs: $8.74

[225] Home Energy Raters are certified professionals that conduct analyses of homes to determine the homes' levels of energy efficiency.

per residential customer. In California, Johnson and Mackres examined the metropolitan areas of San Francisco, San Jose, San Diego, and Sacramento and estimated that the CAHP Program spent $0.24 per residential customer (Johnson and Mackres 2013). This is a notably lower than the median for all metropolitan areas.

D.1.3 Multi-family New Construction Barriers

This section reports the barriers identified in the literature to energy efficiency in the multi-family new construction market and the challenges for programs in encouraging multi-family new construction program participation.

D.1.3.1 Barriers to Energy Efficiency in the Multi-family New Construction Market

The literature identified a number of the same barriers to promoting energy efficiency in the multi-family new construction market as those identified in the program and market models (see section 3.2 - Market Barriers and Drivers). These included performance uncertainties related to both energy savings and the performance of energy efficient technologies, lack of technical knowledge, cost-effectiveness in comparison to retrofitting, financial concerns, and the economic crisis.

Performance Uncertainties. Brown and Wolfe (2007) reported that it is difficult to precisely measure the cost-effectiveness of energy efficiency in multi-family new construction. Ungar, Sobin, Humphrey, et al. (2012) added that a lack of knowledge around buildings' energy performance is "*[A barrier that] makes it difficult for buyers and renters to compare the potential energy costs of buildings, owners to track changes in efficiency, and contractors to look for problems and opportunities. It inhibits demand for energy efficient buildings and for investments to improve efficiency.*"

Vaidya and Haggerty (2011) observed that building owners and managers representing small new construction buildings in Massachusetts focus groups were more likely than those representing high-rise new construction to have reservations about the value of investing in energy-efficiency. One of the primary causes of their concern was skepticism regarding the effectiveness of energy-efficiency measures (Vaidya and Haggerty 2011).

Lack of technical knowledge. In NMR's interviews with Massachusetts Residential New Construction Four to Eight Story Multifamily Pilot stakeholders and participants, interviewees reported that a lack of technical knowledge among multi-family market actors was a barrier to energy efficiency (NMR 2012). The interviewees reported that developers were often wary of new technology, particularly because of inadequate performance data verifying the energy savings of new measures (NMR 2012).

Through in-depth interviews with program administrators from outside of Massachusetts, Vaidya and Haggerty (2011) learned that an inadequate number of skilled and qualified contractors, architects and engineers represent a key barrier to advancing energy efficiency in the multi-family new construction market.

Financing. Vaidya and Haggerty (2011) noted that during focus groups, Massachusetts building owners and managers cited challenges with inadequate financing and concerns about lengthy payback periods as barriers to implementing energy-efficient construction. Similarly, during their interviews program administrators from other states, Vaidya and Haggerty learned that upfront investment costs also are barriers to investments in energy efficiency for multi-family new construction. NMR (2012) heard the same concern—upfront investment costs—mentioned in their focus groups with Massachusetts Residential New Construction Four to Eight Story Multifamily Pilot participants.

Economic climate and housing crisis. In August of 2012, the California Department of Housing and Community Development (CDHCD) reported that like the rest of the residential new construction market in California, the multi-family new construction market has lagged in recent years despite consistent population growth. The CDHCD attributed this to the foreclosure crisis and the great recession of 2007 to 2009. While the number of multi-family new construction permits pulled had increased from 2009 to 2011, they still represented less than one-quarter of the number of multi-family building permits pulled in 2004. However, CDHCD also reported that the UCLA Anderson Forecast estimated there would be a large increase in the number of residential new construction permits pulled in 2013 and they anticipated that the majority of the permits would be for multi-family buildings (CDHCD 2012).

Vaidya and Haggerty (2011) learned from program administrators around the country that the downturn in the housing market has been a barrier to advancing energy efficiency in the multi-family new construction market.

Split incentives. The split incentive[226] is commonly identified as a key barrier to energy efficiency programs in general[227] and multifamily programs in particular (Hynek, Levy, and Smith 2012). Surprisingly, some studies did not identify it as an important barrier. For example, Vaidya and Haggerty (2011) noted that program administrators emphasized the importance of addressing barriers *aside* from split incentives. Similarly, NMR (2012) learned that Massachusetts Residential New Construction Four to Eight Story Multifamily Pilot participants generally did not perceive split incentives as barriers for developers to investing in energy efficient in multi-family new construction.

D.1.3.2 Challenges for Multi-family New Construction Programs

Several studies identified various challenges that may inhibit the success of multi-family new construction programs, including insufficient incentive levels, natural increases in energy efficiency in non-program new construction, and lack of clarity in program eligibility.

[226] Split incentives refer to cases where property managers and owners are responsible for facility improvements but the tenants ultimately pay their own energy bills; these scenarios may reduce the property managers and owners' incentive to invest in energy-efficiency measures in tenants' units.

[227] For a review of barriers to energy efficiency market transformation programs in general, see Eto, Prahl, and Schlegel (1996), and Rosenberg and Hoefgen (2009).

Incentive levels. Hynek, Levy, and Smith (2012) reported that multi-family new construction projects that are both privately capitalized and operated are generally unlikely to integrate energy efficiency, *despite* program incentive opportunities. The authors' reported that developers, given their tight building timelines, are very "risk averse" and that program incentives do not offset these risks. They concluded that the only effective motivation for developers to integrate energy efficiency into their construction projects is policy requiring them to do so (Hynek, Levy, and Smith 2012).

Advances in energy efficiency. Tachibana, Tso, and Romberger (2008) reported that non-program newly constructed multi-family buildings in the Seattle area were becoming more energy efficient as of 2008, reducing Seattle City Light's Built Smart program's ability to claim program-attributable savings. The authors found that from 1994 to 2004, the energy use indexes (EUIs) of non-program multi-family new construction buildings in the Seattle area decreased from 13.26 kWh to 7.36 kWh (a 44% decrease), and among participants in Seattle City Light's Built Smart Program (a multi-family new construction program), the EUIs decreased from 10.26 kWh to 6.66 kWh (a 35% decrease). Tachibana, Tso, and Romberger (2008) cautioned program designers that "pushing the envelope" for multi-family new construction will become harder overtime as multi-family buildings are being built with greater energy efficiency.

Program eligibility. Johnson and Mackres (2013) noted that multi-family building owners and residents may be deterred from program participation by the challenges involved in determining the program they are eligible for. They indicated that these challenges are particularly difficult if program marketing is not promoted *directly* to the multi-family sector. McKibbin et al. (2012) also pointed out that some states do not have consistent rules in classifying multi-family buildings as commercial or residential, thus adding to the confusion of program eligibility.

D.1.4 Multi-family New Construction Opportunities

The evaluation team identified literature describing the drivers of energy efficiency in the multi-family new construction market and suggesting methods for increasing participation in multi-family new construction programs.

D.1.4.1 Drivers for Energy Efficiency in the Multi-family New Construction Market

Drivers advancing energy efficiency in the multi-family new construction market include regulatory mandates, qualified professional networks, cost-effectiveness, limited upfront cost sensitivity among some groups, and marketability.

Regulatory mandates. Brown and Wolfe (2007) reported that some states require new construction that is funded by the state to achieve certain minimum energy-efficiency standards. They concluded that in cases where this requirement exists and is combined with a Qualified Action Plan (QAP)[228] for affordable housing, it acts as an important catalyst for increasing the

[228] A QAP is a system that states utilize to determine to whom to provide tax credits (Brown and Wolfe 2007).

energy efficiency of newly constructed affordable housing (Brown and Wolfe 2007). Tachibana, Tso, and Romberger (2008) attributed the improved energy efficiency of multi-family new construction buildings in the Seattle area in part to enhanced building codes. California's Title 24 energy code sets ambitious energy-efficiency standards for new construction in California. In addition, low-income housing that receives awards through CTCAC is required to exceed Title 24.

Qualified professional networks. According to the California Home Energy Retrofit Coordinating Committee's Multifamily Subcommittee (MF HERCC), the existing network of HERS program raters and energy consultants in California who complete compliance documentation, perform audits and diagnostics, and verify measure installation is well-developed to support multi-family low-rise building new construction (California MF HERCC 2011). Market actors interviewed for this report also noted that this is not a pervasive barrier to increasing energy efficiency in the multifamily new construction market in California.

Cost-effectiveness. Brown and Wolfe (2007) make the case that incorporating energy efficiency into multi-family new construction projects is more cost-effective than implementing energy efficiency retrofits in existing buildings. They explained that having the opportunity to incorporate energy efficiency during the building planning process makes it easier to properly size HVAC equipment, select appropriate levels of insulation and sealing, and select energy-efficient lighting and appliances without the burden of removal of inefficient lighting and appliances. Brown and Wolfe (2007) summarized that, as a result, achieving energy efficiency in new buildings is more cost-effective than retrofitting existing inefficient buildings. In support of this, they cited the findings of Bradshaw et al. (2005) who studied the net-present value (NPV) of low-income *green*[229] multi-family buildings.

Bradshaw et al. (2005) estimated that the cost of building a green multi-family building ranged from being between 18% more expensive to being 9% less than building a standard-efficiency multi-family building for affordable housing. They argued that asserted that the skepticism regarding the feasibility of developing housing that is both affordable and green is unfounded; their study results showed that the benefits of green affordable housing exceeded the economic impacts for most of the market actors involved in building green affordable housing. Based on sixteen case studies of green affordable multi-family building development, they found that:

- End-user residents in all 16 case studies achieved a positive NPV.
- Nearly all owners (14 of 16) achieved a positive NPV.
- Developers' NPVs were more varied. Five of the sixteen developers received positive NPVs, two received NPVs of zero, and the remaining nine received negative NPVs (Bradshaw et al. 2005).

[229] The authors' definition of *green* building involved resource conservation among other components—for the purposes of this literature review, we consider energy efficiency a *type* of resource conservation.

Marketability. New construction building owner and manager focus group attendees largely indicated that they did not advertise by using labeling programs like ENERGY STAR and LEED, reported Vaidya and Haggerty (2011). They suggested that their tenants were more likely to ask about energy efficiency itself than about labeling and certifications. However, Vaidya and Haggerty (2011) cited a 2009 Nexus Market Research and Conant evaluation report that builders thought that ENERGY STAR-qualified homes were more marketable, especially given that customers' awareness in ENERGY STAR homes had increased. Tachibana, Tso, and Romberger (2008) also attributed increases in energy efficiency among the newly constructed multifamily building stock in Seattle to increased public awareness of energy efficiency.

D.1.4.2 Opportunities for Multi-family New Construction Programs

The reviewed literature also offered insights into opportunities that programs like CAHP have adopted or might consider. Opportunities involved using performance-based approaches, enabling and conducting strong communication among stakeholders, and developing partnerships to enhance leverage.

Performance-based approach. As offered by CAHP, we found that the literature commonly cited the value of implementing whole-building or performance-based programs:

- The California Home Energy Retrofit Coordinating Committee's Multifamily Subcommittee indicated that affordable multi-family building developers are attracted to programs that offer incentives for performance-based approaches (California MF HERCC 2011).
- Vaidya and Haggerty (2011) found that building owners and managers representing new construction buildings commonly used whole-building approaches to energy efficiency whereas existing building owners and managers were more likely to take measure level approaches. Nearly all building owners and managers representing new construction buildings at the Massachusetts focus groups said that they had conducted energy modeling for their buildings. Vaidya and Haggerty suggested that the Massachusetts program could reach high-rise (more than 3 stories) multifamily new construction participants through designers that use advanced whole-building approaches. Vaidya and Haggerty (2011) also suggested that the Massachusetts program continue to include simple prescriptive incentives for new construction projects (in addition to retrofit projects)—with the intent to making the program attractive and accessible to small multifamily new construction building developers. CAHP does not offer prescriptive incentives.
- NMR (2012) found that the pilot's implementers and participants of the Massachusetts Residential New Construction Four to Eight Story Multifamily Pilot had positive attitudes towards a performance-based system. The interviewees indicated that a performance-based system would drive the uptake of emerging technologies. NMR determined that performance-based incentive programs for mid-rise multi-family new construction would be less expensive and burdensome than prescriptive programs.

Strong communication and program eligibility. Obert and Dedolph (2008) indicated the importance of strong communication. They emphasized that multi-family new construction programs need to make program eligibility clear. In particular, mixed-use facilities, like multi-family buildings can be challenging to categorize; as a result, it can be confusing for prospective participants to identify the appropriate program.

Johnson and Mackres (2012) underscored the value of conducting marketing campaigns directed at multi-family building owners to inform them about their eligibility and identify program points of contact. Another aspect of communication that they discussed was the necessity of extensive coordination between electric and gas utilities, particularly for whole-building programs.

Design assistance. Obert and Dedolph (2008) also pointed out the importance of enrolling participants during the building design phase and provide design assistance so that energy efficiency can be incorporated. If a program becomes involved during the construction phase it is usually too late to integrate energy efficiency. They underscored that programs communicate with potential participants and encourage early enrollment so there is intervention during the building design phase and energy efficiency will be incorporated (Obert and Dedolph 2008).

Partnerships. Johnson and Mackres (2013) emphasized the importance of developing specific partnerships to achieve program success. They indicated that the administrators of non-IOU programs such as WAP, BBNP, various HUD programs, and HFAs are promising partners for energy efficiency programs, suggesting that programs leverage these organizations' pre-existing infrastructure and relationships with builders, developers, and property owners. Further, to reach low-income communities, they recommended that IOUs partner with local CAAs, HFAs and CDFIs to develop and implement low-income multi-family energy efficiency programs (Johnson and Mackres 2013).

D.2 References

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Appendix E Public Comments and Responses

Table E - 1: Public Comments and Responses

Commenter	Subject:	Section, Page:	Type (Question or comment):	Comment or Question:	Response	Report modified? (Yes / No)
PG&E	Data Presentation	General	Comment	There is a great balance between clarity and quantitative information in the vast majority of the report's graphics (ex: including n in most graphs). However, some of these graphs seem unnecessary (ex: F5-32 and 5-33) and could be condensed into a sentence or two to decrease the length of the report and graph fatigue of readers.	We think the reports' figures succinctly present the findings	no
PG&E	Quantitative Clarity	Executive Summary – Forecast, Page XXVI	Question	Does the term "significant" (first paragraph in the Forecast section) refer to statistical significance? Also seen at the top of Page 17 (3.1.4.5) as "significantly better". Throughout the report, it would be helpful to clarify when differences are statistically significant (including p-value and confidence level).	Neither instance refers to statistical significance. We reviewed the report and replaced 'significant' with other terms when there were no statistical tests conducted	yes
PG&E	Report Structure	Executive Summary, General	Comment	This summary feels less like a high-level overview and more like an introduction chapter. Would it be possible to boil down a few key points and shorten the summary to highlight the key take-away messages?	The abstract provides high-level overview that highlights the key take-away messages while the Executive Summary provides a more detailed summary of the report	no
PG&E	Quantitative Clarity	Methodology, pg 3	Question	How many individual interviewees were included in the 7 IOU interviews and 9 expert interviews? Or, were responses from different individuals within one interview counted as one response?	Most of the seven interviews with program staff were conducted with multiple program representatives at once to obtain multiple perspectives. The evaluation team spoke with fifteen individuals in the course of these seven interviews, ten of whom represented the residential programs, while the remaining five represented the Savings by Design program, For the nine expert interviews we spoke with 11 individuals	yes

Commenter	Subject:	Section, Page:	Type (Question or comment):	Comment or Question:	Response	Report modified? (Yes / No)
PG&E	Title 24 update	3.1.2.2 CA Building Code, pg 7	Comment	The Title 24 updated 2013 standards are listed as going into effect in Jan 1, 2014; should be changed to reflect new July implementation date.	Thank you. We updated the report to reflect the new July implementation date	yes
PG&E	Interview interpretation	3.1.5.1, pg 18	Question	The last sentence of the paragraph at the top of the page reads, "…one interviewee reported that CTCAC would not have adopted the above-code requirements if the IOUs' programs were not available to help cover the costs of building 15% more efficiently than code." Was this interviewee from CTCAC? This is a strong, causal statement about CTCAC's motivations and if it was not made by a CTCAC representative, please clarify that this is an opinion.	We clarified the section. This is the opinion of a knowledgeable industry expert.	yes
PG&E	Interview interpretation	3.1.6.1.1, pg 22 & 23	Question/ General Comment	The first sentence on pg.22 reads, "Market actors and program staff *consistently* reported in interviews…" What are the criteria for "consistent"? Would be good to quantify (i.e., what % of interviewees reported this?) to support the statement. This was also an issue in 3.1.6.1.2, where "most developers interviewed" is noted, but "most" is not quantified. What are our criteria for "most"? Similarly, the paragraph before 3.1.8 includes the qualifier of "rare"; how is "rare" being defined in this context?	We clarified all of these sections, providing frequencies of the respondents providing the responses	yes
PG&E				The first paragraph on pg.23 also discusses market actor estimates; can we verify these? Would be interesting to compare market actor perception to empirical evidence. The first sentence of the 2nd paragraph on pg. 23 mentions "multiple" interviewees; how many of the interviewees is that? What %?	We compared the market actor estimates to the secondary data and found that the secondary data confirm their assessment of the market. Specifically, builders tend to specialize in one sector (market rate or affordable) and that the market rate sector is more heavily concentrated among a small group of builders. We also specified that all nine experts addressed specialization in the market	yes

Commenter	Subject:	Section, Page:	Type (Question or comment):	Comment or Question:	Response	Report modified? (Yes / No)
PG&E				Finally, the 3rd paragraph on pg. 23 discusses Related CA. Did we talk to anyone at Related CA that can verify what interviewees stated about their focus on multifamily buildings?	We did not interview anyone from Related Companies but we were able to confirm that they build both affordable and market rate multifamily projects through the company website	yes
PG&E	Enforcement and Phase II	3.1.9	Question	Will there be any follow-up to this Enforcement issue in Phase II? Would be good to note if there will be plans to address or investigate whether a sample of buildings were actually built according to plan and are performing as planned.	The purpose of the site visits in Phase II is to better understand and characterize the energy efficiency of MFNC construction practices in non-program projects started from 2010 through 2012. It is not meant to be a check on code compliance.	no
PG&E	Phase II notes	3.1.11.3	Question	Will Real Estate agent marketing of EE be considered as a market effects indicator in Phase II? If RE agents emphasize features that customers prefer, might be an effects indicator if RE agents report higher frequencies of pitching EE or more requests for EE homes/apartments from customers.	Real estate agent marketing of energy efficiency will not be part of the Phase II evaluation. But it could be considered as a market effects indicator in future studies.	no
PG&E	Phase II notes	3.2.1, pg 34	Question	The second sentence of this section reads, "This is a preliminary list and will be expanded later through additional interviews…" There are no pages/sections within the report noted here, so is this a reference to Phase II? This sentence is echoed at the bottom of 3.2.2 (pg. 39) and should also be clarified.	Yes, this is in reference to the Phase II report. We have clarified both sections	yes
PG&E	Quality Control	4.2.1.5, pg. 53	Question	"…in PG&E territory, program staff re-inspects 5% of the multifamily units inspected by HERS raters as an additional quality control check." How are those 5% chosen for re-inspection? It would be good to provide readers with this info (ex: are they randomly selected, or do builders/HERS raters know in advance who will be re-inspected?). Also, what are the results of these re-inspections?	PG&E program materials characterize these additional reviews as spot checks that provide an opportunity to identify and remedy any misunderstandings in a project, and if necessary, escalate unresolved issues by alerting the rater's HERS provider or the builder.	yes

Commenter	Subject:	Section, Page:	Type (Question or comment):	Comment or Question:	Response	Report modified? (Yes / No)
PG&E	Missing Data	5.3.3, pg 83	Question	Is there an explanation for 18% of the 763 projects missing unit data? What is necessary for improving data availability, and is this something that will be improved upon in Phase II? Has the model being used to estimate # of units using square footage averages been tested for predictive accuracy? Similar issues in 5.3.5, pg 92.	The MFNC starts data drew upon 4 data sources: McGraw Hill Construction (MHC), CTCAC data, IOU program data and builder survey responses. The unit and square footage data are limited by the quality of the data available from the secondary data sources, which did not include unit or square footage data for a number of projects. We tested the method of estimating the number of units by using per unit square footage averages on data from the survey of builders. From the survey of builders, 24 projects were missing unit data (but included square footage). For these 24 projects we estimated an average of 111 units per project (by dividing number of square feet in the project by the per unit avg. square footage). In the survey, the builders reported an average of 114 units for the 24 projects. In addition we tested the method on the 205 MHC and CTCAC projects that included data for both number of units and square footage of the project. This population of projects had an average of 63 units per project. Substituting the reported number of units with the number of units calculated by dividing project square footage by average square footage per unit (1,311 sq. ft. per unit) resulted in an average of 62 units per project	no
PG&E	Missing Data	5.3.3, pg 86	Question	Is the discrepancy between the two sources of permit data and construction starts data a statistically significant gap?	The permit and construction starts data are population data rather than samples from the population. Therefore we did not conduct statistical tests to estimate the significance of the differences -- the differences reported represent the differences between the two populations.	no

Commenter	Subject:	Section, Page:	Type (Question or comment):	Comment or Question:	Response	Report modified? (Yes / No)
PG&E	Missing Data	5.3.4, pg 89	Question	Is there an explanation for the noticeable increase in Unknown projects in 2012 (2% in 2010/2011, up to 10% in 2012 with only slightly higher n)?	In 2012 a larger portion of projects were found in only CTCAC data and not included in other data sources. Nearly all unknown-rise projects (37 of 39) were CTCAC projects not included in any other data source. CTCAC data do not include rise data in their documentation.	no
PG&E	Significance	5.3.5, pg 93	Question	Are the differences between 2010, 2011, and 2012 statistically significant (vs. "substantial" or "noticeable")? Do the evaluators have evidence-based theories to support these differences?	The data are population data rather than samples from the population. Therefore we did not conduct statistical tests on the differences between 2010, 2011, and 2012 - -- the differences reported represent the differences between the two populations. It appears that market rate segment, particularly high-rise projects, has been more responsive to housing recovery. In contrast, the affordable housing segment was less susceptible to the housing downturn. This may help explain the differences.	no
PG&E	Data Presentation	5.3.11 and 5.3.12, pg 110 & 111	Comment	These graphs display binary outcomes and in order to pare down the number of graphs and make the report more concise, these two graphs (Fig 5-32 and 5-33) could easily be translated to a sentence or two, including respective n's.	We think the figures succinctly present the findings and the multiple data sources used to develop the figures	no

Commenter	Subject:	Section, Page:	Type (Question or comment):	Comment or Question:	Response	Report modified? (Yes / No)
PG&E	Drawing Conclusions	5.3.12, pg 112	Question	Is the frequency of reach codes in MSAs a factor that contributes to high-rise buildings being subject to higher efficiency standards more often? It would be interesting to see these varied market characteristics and results tied together to create a more cohesive picture of how these market features are interacting if those connections can be empirically supported.	We think there are two main factors explaining the differences between high rise and low rise projects and reach codes. First, more than one-fifth of high-rise projects (22%) were started in San Francisco, and San Francisco adopted a reach code in December of 2010. Second, high-rise projects and MFNC projects located in reach code jurisdictions are more likely to be in principal cities. 83% of high-rise projects are located in the principal cities of MSAs compared to 52% of low-rise projects, while 76% of projects located in reach code communities were located in principal cities. A principal city is defined by the US Census Bureau as follows: "The largest city in each metropolitan or micropolitan statistical area is designated a 'principal city.' Additional cities qualify if specified requirements are met concerning population size and employment." http://www.census.gov/population/metro/about/	yes
PG&E	Statistics	5.3.13, pg 113 & 114	Question	What is the standard deviation for the # of projects/units for the 385 builders? Also, are these per-year averages or for 2010-2012? For Figure 5-36, pg 114, what are the standard deviations of these averages? If one group is more variable than another, what is the proposed explanation for that difference? Are the differences between builder activity by level significant?	The number of projects and units for the 385 builders is the total for the entire 2010 through 2012 time period. We clarified this in the section and added standard deviations of these averages.	yes
PG&E	Data Discrepancy	5.5, pg. 118	Question	In the text, it is reported that 46% of all 2010-2012 MFNC projects in PG&E territory participated in the program. The table below (Table 5-13) lists a 44% participation average across 2010-2012. Which is the correct participation percentage?	The text was a typo; it is 44%. We corrected the report	yes

Commenter	Subject:	Section, Page:	Type (Question or comment):	Comment or Question:	Response	Report modified? (Yes / No)
PG&E	Data Presentation	5.5.1.2, pg 123 & 5.5.1.3, pg 124	Comment	For easier interpretation on Tables 5-14 and 5-15, it may be good to clarify on the bottom left that it is either the average number of units per project (T5-14) or buildings per project (T5-15).	We clarified at the bottom left that it is either the average number of units per project (T5-14) or buildings per project (T5-15).	yes
PG&E	Data Presentation	5.6.1, pg 139	Comment	For figures (ex: F5-53) that refer to the Climate Regions, it may be useful to the reader to refer back to the page that includes the map of Climate Regions, or to include that map early in the report and note that it will be referred to on a number of pages in the report.	We added a footnote with a cross reference to the climate zone and climate region maps	yes
PG&E	Data Presentation	5.6.1, pg 140	Comment	This pie chart for LEED Projects across MSAs may be more informative if we could see the proportions for the Top 4 MSAs compared to all others, rather than aggregating the top 4 MSAs into one category.	We revised the figure, reporting the top 4 MSAs individually	yes
PG&E	Survey Respondent Project Roles	Table 5-20, pg 152	Question	Which roles overlap most often?	Most frequently, they fulfilled the roles of both builders or developers and owners (62%). We added this to the report	yes
PG&E	Statistics	5.7.2, pg 153	Question	Project completion time averages are reported at the bottom of pg. 153. What is the variability around project completion time overall? What are the averages and standard errors by project type (high-rise vs. low-rise; affordable vs. market rate)?	We added a table providing more details on the variability in average project completion times. We found significant difference between high-rise and low-rise projects.	yes
PG&E	Typo Correction	Table A-6, pg A12	Comment	In the Table title, change Building Rose to Building Rise.	We updated the title of the table	yes
PG&E	Statistics	Table A-17, pg A29	Question	What are the standard errors for the average projects per builder and average units per builder?	We added the standard deviations of the average projects per builder and average units per builder to the table.	yes

Commenter	Subject:	Section, Page:	Type (Question or comment):	Comment or Question:	Response	Report modified? (Yes / No)
SCE	General	General	Comment	There are casual statements throughout the report that we believe should not be present in this Phase 1 report. We believe as a Phase I market characterization study; it should facilitate Phase II which will explore causal relationships as part of market effects determination. We would like to explore this more in the next PCG meeting For Example, the following SCE feels the following statement from the report exhibits this general tendencies of this study: *Affordable housing developers are in the forefront of advanced energy-efficiency techniques. Nearly all affordable housing, representing 38% of all units of MFNC, is built to exceed Title 24 standards by 15% because of CTCAC tax credit requirements (tax credit of 4%-9%), and 24% of all units were started in localities with reach codes. There is substantial overlap between the IOUs' program participants and these other programs and policies as 53% of IOU program units that were started from 2010 through 2012 were required to be high efficiency. Because of the complex interactions and in some cases coordination across the programs and policies, attribution of any observed market effects will be difficult.* The issue is in the excretion that housing developers are in the forefront of advanced energy-efficiency because of tax and IOU incentives. We believe this is not within the scope of this study	A critical part of the market effects study is understanding the drivers of adopting energy efficient practices in MFNC, such as CTCAC tax credits and IOU incentives. These issues are clearly within the scope of the study.	no

Commenter	Subject:	Section, Page:	Type (Question or comment):	Comment or Question:	Response	Report modified? (Yes / No)
SCE	Comment/ Concern	Abstract, Page I; Section 3.1.3, Page 11; Conclusions & Recommandations, Page 163:	Comment/ Concern	• Comment/Concern: Discussion regarding public programs and policies influencing the energy efficiency of the MFNC market identifies local reach codes as a major driver for MFNC units exceeding code. However, there is no recognition or discussion that these local reach codes were adopted with direct technical assistance from the IOU Codes & Standards program. • Specific Requested Change (if any): Describe how the IOU Codes and Standards Program influenced the MFNC market by directly assisting 35 of the 43 local jurisdictions that adopted reach codes in the 2010-2012 cycle by providing the following technical assistance: o Cost effectiveness study for each of the California climate zones o Policy guidelines for adopting reach code o Reach code ordinance template o Facilitating public workshops that also included New Construction program managers presenting overview of California Advanced Homes Program o Availability to answer technical questions at Public Hearings	We added a discussion of the IOUs Reach Code Subprogram of the Codes and Standards Program.	yes
PG&E	Report Title	Report Title	Comment	Although the text in the Abstract quickly identifies the scope of this report as being predominantly focused on market characterization, the title of this study may mislead the audience into anticipating elements of market effects analysis within this report. In order to set realistic expectations for the reader, it may be beneficial – if possible – to extend the report title to reflect its market characterization content.	We updated the title to include the market characterization elements of the report	yes

Commenter	Subject:	Section, Page:	Type (Question or comment):	Comment or Question:	Response	Report modified? (Yes / No)
PG&E	Length of Executive Summary	Executive Summary	Comment	The Executive Summary for this report is currently 35 pages long and contains extensive background material, followed by a very brief Introduction section. PG&E is concerned that key takeaways from the study results may be difficult for a broader audience to identify within the current Executive Summary; the clarity of the Executive Summary may be better served if the broader background information in the Executive Summary were to be transferred to the Introduction section.	The abstract provides high-level overview that highlights the key takeaways while the Executive Summary provides a more detailed summary of the report	no