

# UC Berkeley

## Planning & Evaluation

### Title

Phase I Report: Residential New Construction (Single Family Home) Market Effects Study (Final)

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### Authors

KEMA  
Nexus Market Research, Inc.  
Summit Blue Consulting  
[et al.](#)

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**Phase I Report**  
**Residential New Construction (Single Family Home)**  
**Market Effects Study**

*FINAL*



Prepared by  
**KEMA (formerly RLW Analytics)**  
**Nexus Market Research, Inc.**  
**Summit Blue Consulting**  
**Itron, Inc.**  
**The Cadmus Group, Inc.**

For the  
**California Public Utilities Commission**  
**Energy Division**

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## **List of Acronyms**

ACCA: Air Conditioning Contractors Association

AFUE: Annual Fuel Utilization Efficiency

AHP: Analytical Hierarchy Procedure

AMBAG: Association of Monterey Bay Area Governments

ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers

BIG: Build it Green

BPI: Building Performance Institute

BTU: British Thermal Unit

C&S: Codes and Standards

CABEC: California Association of Building Energy Consultants

CAC: Central Air Conditioner

CALHERS: California Association of HERS Raters

CASE: Codes and Standards Enhancement (CASE) Initiative Project

CATI: Computer-Assisted Telephone Interviewing

CBIA: California Building Industries Association

CBPCA: California Building Performance Contractors Association

CEC: California Energy Commission

CEE: Consortium for Energy Efficiency

CEQA: California Environmental Quality Act

CESNHP: California ENERGY STAR New Homes Program

CFL: Compact Fluorescent Lamp

CFM: Cubic Feet per Minute

CHEERS: California Home Energy Efficiency Rating Service

CIEE: California Institute for Energy and Environment

CIRB: Construction Industry Research Board

CPUC: California Public Utilities Commission

CZ: Climate Zone

DEER: Database for Energy Efficient Resources  
DOE: Department of Energy  
DSM: Demand Side Management  
EEM: Energy Efficient Mortgage  
EER: Energy Efficiency Ratio  
EF: Energy Factor  
EFL: Environments for Living  
EM&V: Evaluation, Monitoring and Valuation  
EPA: Environmental Protection Agency  
HERS: Home Energy Rating System  
HVAC: Heating, Ventilating, and Air Conditioning  
IECC: International Energy Conservation Code  
IHACI: Institute of Heating and Air Conditioning Industries  
IMC: Incremental Measure Cost  
IOU: Investor Owned Utility  
LADWP: Los Angeles Department of Water and Power  
LBNL: Lawrence Berkeley National Laboratory  
LEED: Leadership in Energy and Environmental Design  
MECT: Master Evaluation Contractor Team  
M&V: Monitoring and Verification  
NBI: New Buildings Institute  
NC/CS Evaluation: New Construction/Codes and Standards Evaluation  
NOMAD: Naturally Occurring Market Adoption  
NREL: National Renewable Energy Laboratory  
PG&E / PGE: Pacific Gas and Electric  
QII: Quality Insulation Installation  
R&D: Research and Development  
RESNET: Residential Energy Services Network  
RNC: Residential New Construction  
SC: Shading Coefficient

SCE: Southern California Edison

SCG: Southern California Gas

SDG&E / SDGE: San Diego Gas & Electric

SEER: Seasonal Energy Efficiency Ratio

SFH: Single Family Home(s)

SHGC: Solar Heat Gain Coefficient

SMUD: Sacramento Municipal Utility District

TDV: Time Dependent Valuation

TXV: Thermostatic Expansion Valve

UL: Underwriters Laboratory

USGBC: United States Green Building Council

ZEH: Zero Net Energy Homes

## **E. Executive Summary**

The Investor-Owned Utilities (IOUs) in the State of California—Pacific Gas and Electric (PG&E or PGE), San Diego Gas & Electric (SDG&E or SDGE), Southern California Edison (SCE), and Southern California Gas (SCG)—have been operating energy-efficiency programs for many years, with the most recent iteration of these programs having been implemented in 2006 for a three-year program cycle that ended in 2008. The IOUs’ 2006-2008 energy-efficiency programs included residential new construction (RNC) programs, aimed at increasing the efficiency of new homes built in California. There is a separate California Public Utilities Commission (CPUC) evaluation being conducted to estimate the direct impacts, or the energy savings and peak demand reductions, stemming from IOU new construction program participation during the 2006-2008 period (referred to as the New Construction/Codes and Standards, or NC/CS Evaluation).

The California Public Utilities Commission’s (CPUC) Market Effects Evaluation Protocol follows the definition of market effects offered by Eto, Prahl, and Schlegel: “a change in the structure of a market or the behavior of participants in a market that is reflective of an increase in the adoption of energy-efficient products, services, or practices and is causally related to market intervention(s)” (J. Eto, 1996).

The California Impact Evaluation Protocol (California Public Utilities Commission, 2006) is quite explicit about not including market effects and non-participant spillover in savings estimates to avoid counting them toward utility energy efficiency savings goals. However, in an October 2007 Decision (D.07-10-032), the CPUC directed its staff to explore (during 2008-2009) the ability to credibly quantify and credit “non-participant spillover” market effects. The CPUC further directed its staff to report their findings, following the process evaluation and market impact studies of the 2006-2008 program cycle, on the ability of current protocols to measure such “non-participant spillover” savings and to propose possible revisions to market effects protocols, utility savings goals, and/or performance incentive mechanisms for subsequent action by the CPUC. As part of the study effort, the CPUC is examining possible market effects in three areas: RNC, CFLs, and high-bay lighting. Working with the CPUC, the California Institute for Energy and Environment (CIEE) developed Study Plans for (and is assisting in overseeing) each of these market effect studies.

The IOUs’ RNC programs, as laid out in Section 2.2, consist a portfolio of activities designed to increase the adoption of energy efficient equipment and practices in the single family and multifamily building industry. These activities include incentives for meeting efficiency criteria;

Program Plan Check;<sup>1</sup> Research & Development on new technologies and practices; The Codes and Standards Enhancement (CASE) Initiative Project to address energy-efficiency opportunities through development of new and updated appliance (Title 20) and building (Title 24) standards; training of builders and other market actors in new technologies and practices; training (by PG&E only) for building code officials on how to inspect homes for purposes of code enforcement; requirements for HERS ratings to verify proper installation and specified equipment are required for a home to achieve program-specified efficiency levels; and advertising and outreach to increase consumer awareness of efficiency and associated benefits. The programs provide support to encourage high-performance building design that exceeds the 2005 Title 24 energy efficiency requirements by 15% or more, while also aiming to increase the adoption and installation of individual high efficiency measures, such as efficient heating, cooling, lighting, and appliances in residential new construction.

For the Residential New Construction (Single Family Home) Market Effects Study, CIEE and the CPUC chose the New Construction/Codes and Standards Impact Evaluation Team to investigate the effects of California's 2006-2008 RNC programs on the efficiency of new single-family homes sold in the California market. The study has three primary objectives:

1. Understand the market effects of California's utility energy efficiency programs on construction practices for new single-family homes.
2. Quantify the energy savings caused by the above market effects occurring in the years 2006-2008, with special attention to non-participant spillover.
3. Support the CPUC's strategic planning efforts by clarifying whether energy savings from non-participant spillover can be quantified with sufficient reliability to be treated as a resource.

The first work product of this team was a scoping study, to define and understand the California new construction market, develop a market theory, specify a program theory and how it relates to the market, assess data availability for the market effects study, develop a methodology for data collection, and recommend an analysis approach. The Scoping Study outlined a plan for conducting the research in two phases.

Phase I, reported in this document, was designed to assess the historical context of RNC design and construction practices in California; to determine—qualitatively—the extent to which market effects attributable to the 2006-2008 IOU programs have occurred; and to analyze the cumulative

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<sup>1</sup> Program Plan Check is a process in which IOU staff reviews participating builders' plans and Title 24 compliance documentation to ensure accurate modeling. If significant modeling errors are discovered, Program Plan Check staff utilize CEC-approved Title 24 compliance software to correctly model the home. The revised model and revised compliance margins are then provided to the builder and energy consultant. This feedback mechanism is intended to both ensure that applications meet program requirements and to educate energy consultants on proper modeling techniques.

impact of the 1998-2005 IOU programs on the 2005 code change. Phase I addresses Objective 1 of the overall market effects study: to understand the market effects of California's utility energy efficiency programs on construction practices for new single-family homes. Phase I was limited to addressing Objective 1 because of the uncertainty as to whether any market effects would be identified; the team, CIEE, and CPUC thought that determining whether market effects existed logically preceded quantifying them (Objectives 2 and 3).

## **E.1. Research Activities and Data Sources**

The primary research activities conducted in Phase I were an analysis of historical trends, an analysis of expected outcomes, and an analysis of the effects of IOU programs on changes in the efficiency requirements of the Title 24 code. Table E-1 below summarizes the research activities carried out in Phase I.

The purpose of the analysis of historical trends was to reconstruct the historical trends concerning energy efficiency in the RNC market (single-family homes) in California. There were two main subtasks:

- Identifying trends in RNC efficiency practices in California. This involved reporting the use of energy-efficiency measures and practices in single family homes built under the 1995, 1998, 2001, and 2005 standards, including square footage, number of stories, basic equipment saturations, average SEER, average AFUE, types of water heaters, average energy factor of gas-storage water heaters, wall and ceiling insulation, presence of radiant barriers, and average duct leakage. It also included an overview of the number of single-family homes permitted in California between 1998 and 2008 (including homes built through the IOU RNC programs). The information is based on IOU program data tracking, previous IOU and CPUC reports, and other secondary sources, as well as an analysis of the characteristics of new homes from on-site visits conducted in 2008 and 2009 for the CPUC's Residential New Construction Impact Evaluation.
- Identifying trends in incremental costs of efficiency measures, based on IOU estimates from 2003 through 2008.

The analysis of expected outcomes began with program theory, first attempting to determine if each outcome posited by the program theory had in fact occurred, and, if so, then attempting to determine whether the outcome could be linked to IOU program activities, based on the preponderance of evidence.<sup>2</sup> The analysis of expected outcomes relied on the findings from the analysis of market evolution, and additional primary data collected from October of 2008 through January of 2009. The market actors interviewed were those identified in the scoping study as having the greatest influence on and knowledge about efficiency levels in residential construction. The primary data collection efforts contributing to the analysis of expected outcomes were as follows:

- 976 computer-assisted telephone interviewing (CATI) interviews with buyers of new non-program single-family homes in the IOU territories
- 267 on-site visits to non-program homes, recruited through home buyer interviews,
- 32 CATI interviews with builders of non-program homes
- 9 CATI interviews with HVAC contractors
- 45 CATI interviews with Title 24 consultants
- 29 CATI interviews with Home Energy Rating System (HERS) raters
- 17 telephone interviews with window distributors
- 6 telephone interviews with HVAC distributors
- 16 telephone interviews with lighting fixture and control distributors
- 8 in-depth interviews with managers of other voluntary programs aimed at increasing the efficiency of residential new construction in California
- 14 in-depth interviews with building code officials/inspectors
- Web-based estimates of naturally occurring market adoption (NOMAD) trends by 10 residential building experts, with re-estimation of indirect effects of prior IOU programs on NOMAD by 6 experts

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<sup>2</sup> 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.



**Table E-1: Summary of Residential New Construction Market Effects Study—Phase I**

Task	Research Activities
1. Analysis of Market Evolution	<ul style="list-style-type: none"> <li>• Reconstruct historical trends concerning energy efficiency in the RNC market in California               <ul style="list-style-type: none"> <li>○ Identify trends in RNC efficiency practices in California</li> <li>○ Identify trends in builders' awareness, attitudes, and practices</li> <li>○ Identify trends in other market actors' awareness, attitudes, and practices</li> <li>○ Identify trends in home buyers' awareness and attitudes</li> <li>○ Identify trends in incremental costs of efficiency measures</li> </ul> </li> </ul>
2. Analysis of Expected Outcomes	<ul style="list-style-type: none"> <li>• Analyze the possible market effects of IOU RNC programs on homes whose builders did not receive incentives from the IOU programs (from here on, referred to as non-program homes<sup>3</sup>), and on the RNC market for years 2006-2008               <ul style="list-style-type: none"> <li>○ Interview non-participating builders, home buyers, and other market actors</li> </ul> </li> </ul>
3. Analysis of Code Changes	<ul style="list-style-type: none"> <li>• Analyze cumulative impact of utility RNC programs (not C&amp;S programs <i>per se</i>) on 2005 Title 24               <ul style="list-style-type: none"> <li>○ Interview experts in the homebuilding industry.</li> </ul> </li> </ul>
4. Attribution Analysis	<ul style="list-style-type: none"> <li>• Sift through the evidence collected to make a case regarding the role of utility RNC programs in causing the observed market effects.</li> </ul>

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<sup>3</sup> Builders of those homes are referred to as non-participating builders, buyers of those homes are referred to as non-participating home buyers, Title 24 consultants who consulted on those homes are referred to as non-participating Title 24 consultants, etc. Some builders, Title 24 consultants, and others who were interviewed may have worked on both participating and non-participating homes, and are identified and analyzed as such in the body of the report.

## E.2. Key Findings and Recommendations

The key findings and recommendations of this research are summarized in Table E-2 below.

**Table E-2: Key Findings and Recommendations**

Finding	Recommendation
<p>There is evidence for discernible non-participant spillover from the 2006-2008 IOU RNC programs, primarily through the training of builders and other market actors, which helped bring about improved code compliance, increased above-code practices, and market readiness for a code upgrade.</p>	<p>Continue (and as feasible, expand) the successful training of builders and other market actors.</p>
<p>Demand-side effects, such as increasing home buyer awareness and increasing consumer demand/willingness to pay for efficient homes, largely did not occur, owing at least in part to the low volume of IOU program participation.<sup>4</sup></p>	<p>While there were probably good reasons for distinguishing the IOU programs from the national ENERGY STAR® Homes Program, consider realigning with ENERGY STAR and making ENERGY STAR certification mandatory, as there is already considerable equity built up in the brand. Realignment with the ENERGY STAR Homes Program may also benefit from the current revisions to the ENERGY STAR guidelines<sup>5</sup></p> <p>Before pent-up demand for new housing surges as the economy recovers, consider ramping up advertising and promotion of the IOU programs to home buyers so that when potential buyers go to look for new homes, they ask for efficiency and ENERGY STAR certification.</p>
<p>The IOU programs' primary focus on the supply side reflects an orientation toward resource acquisition, although some program elements are intended to address market transformation. While this study makes it clear that there are some market effects resulting from the IOU programs, the program elements stimulating them are not</p>	<p>Since market transformation is a program goal, design the programs to achieve market transformation.</p>

<sup>4</sup> The reader should note that low program participation rates may be partially, but not fully, explained by changes to the CPUC reporting requirements for the IOU RNC programs. Between 2002 and 2005, the number of participant homes was calculated using the number of homes that were committed under the IOU programs, not actually constructed during that time frame. However, for the 2006-2008 program cycle, the CPUC required the IOUs to report only units that had been completed.

<sup>5</sup> [http://www.energystar.gov/index.cfm?c=bldrs\\_lenders\\_raters.nh\\_2011\\_comments](http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_2011_comments)

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systematically aimed at transforming the market.

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This study focused on the 2006-2008 IOU programs, and there had been no market effects research since 2000.

Market effects research needs to occur on a regular basis since market transformation is a program goal; otherwise, program planners cannot know if the goal is being achieved.

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Phase I has provided qualitative evidence of increases in the efficiency of the RNC market—beyond the direct effects of the IOUs’ 2006-2008 programs—that may reasonably be attributed to those programs.

Proceed with the Phase II research in order to quantify the energy savings caused by these market effects, and help to determine whether they can be quantified with sufficient reliability to be treated as a resource.

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### **E.3. Findings**

#### **E.3.1 Program Participation and New Construction Activity**

A major backdrop to the RNC market effects evaluation is the low level of participation in the IOU RNC programs during 2006 to 2008—the period of interest for this study. There were 5,592 new homes whose builders received incentives through the IOU programs in that period, compared to 36,920 from 2003 to 2005. The decrease was partly due to a rules change: as of the 2006-2008 program cycle, IOUs could no longer claim commitments, but only completed homes, so many of the homes claimed as commitments in 2005 were likely completed in 2006. The introduction of a new code in 2005, because it was more difficult to meet, also likely reduced program participation, as did disassociation from the national ENERGY STAR Homes Program—effectively creating a new program. By 2008, homes built through the IOU programs made up 12.1% of all new homes built in the IOU territories, compared to just 0.4% in 2006—but meanwhile, the total market shrank, from 106,479 homes in 2006 to 32,664 in 2008. The low levels of program participation mean that program influence on relatively modest numbers of non-program homes could translate into fairly high levels of spillover. Hence the figure of 5,592 program homes built from 2006 to 2008 should be borne in mind in later discussions of the numbers of non-program homes whose efficiency levels were influenced by the IOU programs.

### E.3.2 Efficiency in the Residential New Construction Market

Another important backdrop to the RNC market effects study is the increasing efficiency of all new single-family homes built in California, spurred at least in part by upgrades to the building code in 1995, 1998, 2001, and 2005. Some of the key trends are as follows:

- Glazing
  - The glazing area<sup>6</sup> in new homes fell from 17% in homes built under the 1995 standards to 14% in homes built under the 2005 standards
  - The percentage of glass that was two-paned vinyl and low-e increased from 5% in homes built under the 1995 standards to 86% in homes built under the 2005 standards
- Space heating
  - The average AFUE<sup>7</sup> for furnaces increased from 80% in homes built under the 1995 standards to 83% in homes built under the 2005 standards
  - The percentage of 90%+ AFUE furnaces increased from 2% in homes built under the 1995 standards to 16% in homes built under the 2005 standards
- Space cooling
  - The average central air conditioner SEER<sup>8</sup> level increased from 10.5 SEER in homes built under the 1995 standards to 13.4 SEER in homes built under the 2005 standards; 13 SEER became the federal minimum standard in January of 2006
  - The percentage of central air conditioners with SEER levels greater than 13 increased from 0% in homes built under the 1995 standards to 47% in homes built under the 2005 standards
- Water heating
  - The percentage of instantaneous water heaters<sup>9</sup> increased from 0% of water heaters in homes built under the 1995 standards to 25% in homes built under the 2005 standards

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<sup>6</sup> Glazing area equals window area divided by exterior wall area.

<sup>7</sup> Annual Fuel Utilization Efficiency. The AFUE number represents how efficiently a furnace converts fuel to energy. The higher the AFUE percentage, the more energy-efficient the furnace, with a maximum possible AFUE of 100%. The U.S. government's established minimum AFUE rating for a furnace is 78 percent.

<sup>8</sup> Seasonal Energy Efficiency Ratio. This is the ratio of the cooling output divided by the power consumption. It is the Btu of cooling output during a central air conditioner's (or heat pump's) normal annual usage divided by the total electric energy input in watt hours during the same period. This is a measure of the cooling performance. The federal minimum for central air conditioners and heat pumps is 13 SEER.

<sup>9</sup> Instantaneous or tankless water heaters heat water directly without the use of a storage tank and are more efficient than most conventional storage water heaters.

- Ceiling insulation
  - The average R-value<sup>10</sup> of ceiling insulation increased from 29.1 in homes built under the 1995 standards to 33.4 in homes built under the 2005 standards
- Radiant barriers
  - The percentage of homes with radiant barriers<sup>11</sup> increased from 2% of homes built under the 1995 standards to 13% of homes built under the 2005 standards
- Duct leakage
  - The average duct leakage<sup>12</sup> decreased from 13.5% in homes built under the 1995 standards to 11.3% of homes built under the 2005 standards
- Code compliance
  - The compliance margin (relative to Prescriptive Package D design) went from an average of 4.8% above code in homes built under the 1995 standards, to 6.2% in homes built under the 1998 standards, to 3.8% in homes built under the 2001 standards. (Results are not yet available for homes built under the 2005 standards.<sup>13</sup>) Of course, standards became progressively more stringent during this time.
  - The percentage of non-compliant homes went from 15.7% of homes built under the 1995 standards, to 14.4% of homes built under the 1998 standards, to 27.0% of homes built under the 2001 standards. (Results are not yet available for homes built under the 2005 standards.) Again, standards became progressively more stringent during this time.

### E.3.3 Outcomes and Linkages to the IOU Programs

A diagram of the logic of the IOU programs, based on interviews with IOU program staff and industry experts conducted during the Scoping Study (and modified during the course of Phase I), appears in Figure E-1. This diagram also summarizes the findings of the analysis of outcomes that were expected according to program theory, showing outcomes that appear to have occurred as green ovals, those that appear not to have occurred as red ovals, and those that have not been measured well enough to draw conclusions as gray ovals. Figure E-1 also shows linkages from

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<sup>10</sup> R-value indicates insulation's resistance to heat flow; the higher the R-value, the greater the insulating effectiveness.

<sup>11</sup> Radiant barriers are materials installed in buildings to reduce summer heat gain and winter heat loss in order to help lower heating and cooling costs. The barriers consist of a highly reflective material that reflects radiant heat rather than absorbing it. They don't, however, reduce heat conduction like thermal insulation materials

<sup>12</sup> Duct leakage is measured as a percentage of supply air flow in an HVAC system and refers to the loss of conditioned air from a duct system due to cracks and gaps in the duct system

<sup>13</sup> Compliance margins are relative to Title 24 building code Package D (set of prescriptive measures) and measure the difference in the energy use of a home compared to Package D in Title 24

program efforts to expected outcomes, or from one outcome to another, that appear to reflect program influence (green arrows), those that appear not to reflect program influence (red arrows), and those that have not been measured well enough to allow such an assessment (gray arrows); thicker arrows reflect greater expected influence. The conclusions drawn from this analysis are largely qualitative. The intent is to examine the available data, and make inferences based on the preponderance of evidence.

In interpreting the evidence as to whether an outcome occurred or whether the IOU programs had an influence, we used the guidelines described below. In this interpretation we gave primacy to the responses of Title 24 consultants because of their focus on efficiency (differing from builders, for example, for whom efficiency is only one of many concerns).<sup>14</sup>

*Strong evidence:* Market actors in more than one group accounting for substantial numbers of non-program homes (i.e., >15%)—with primacy given to Title 24 consultants—said an outcome had occurred (outcomes) or that the IOU programs had a strong influence (linkages). No major contradictory evidence from other groups. In the case of home buyers, statistically significant and substantively important increases over time in indicators related to efficiency in general (outcomes), or substantial numbers (i.e., >30%) tied their knowledge or positive attitudes specifically to the IOUs (linkages).

*Moderate evidence:* Either 1) One market actor group accounting for substantial numbers of non-program homes (i.e., >15%) with primacy given to Title 24 consultants—said an outcome had occurred (outcomes) or that the IOU programs had a strong influence (linkages). No major contradictory evidence from other groups. OR: 2) Market actors in more than one group accounting for moderate numbers of non-program homes (i.e., 5%-15%)—with primacy given to Title 24 consultants—said an outcome had occurred (outcomes) or that the IOU programs had a strong influence (linkages). No major contradictory evidence from other groups. In the case of home buyers, statistically significant but not substantively important increases over time in indicators related to efficiency in general (outcomes), or moderate numbers (i.e., 20%-30%) tied their knowledge or positive attitudes specifically to the IOUs (linkages).

*Weak evidence:* Market actor groups generally accounting for <5% of non-program homes said an outcome had occurred (outcomes) or that the IOU programs had a strong influence (linkages). In the case of home buyers, no statistically significant increases over time in indicators related to efficiency in general (outcomes), or small numbers (i.e., <20%) tied their knowledge or positive attitudes specifically to the IOUs (linkages).

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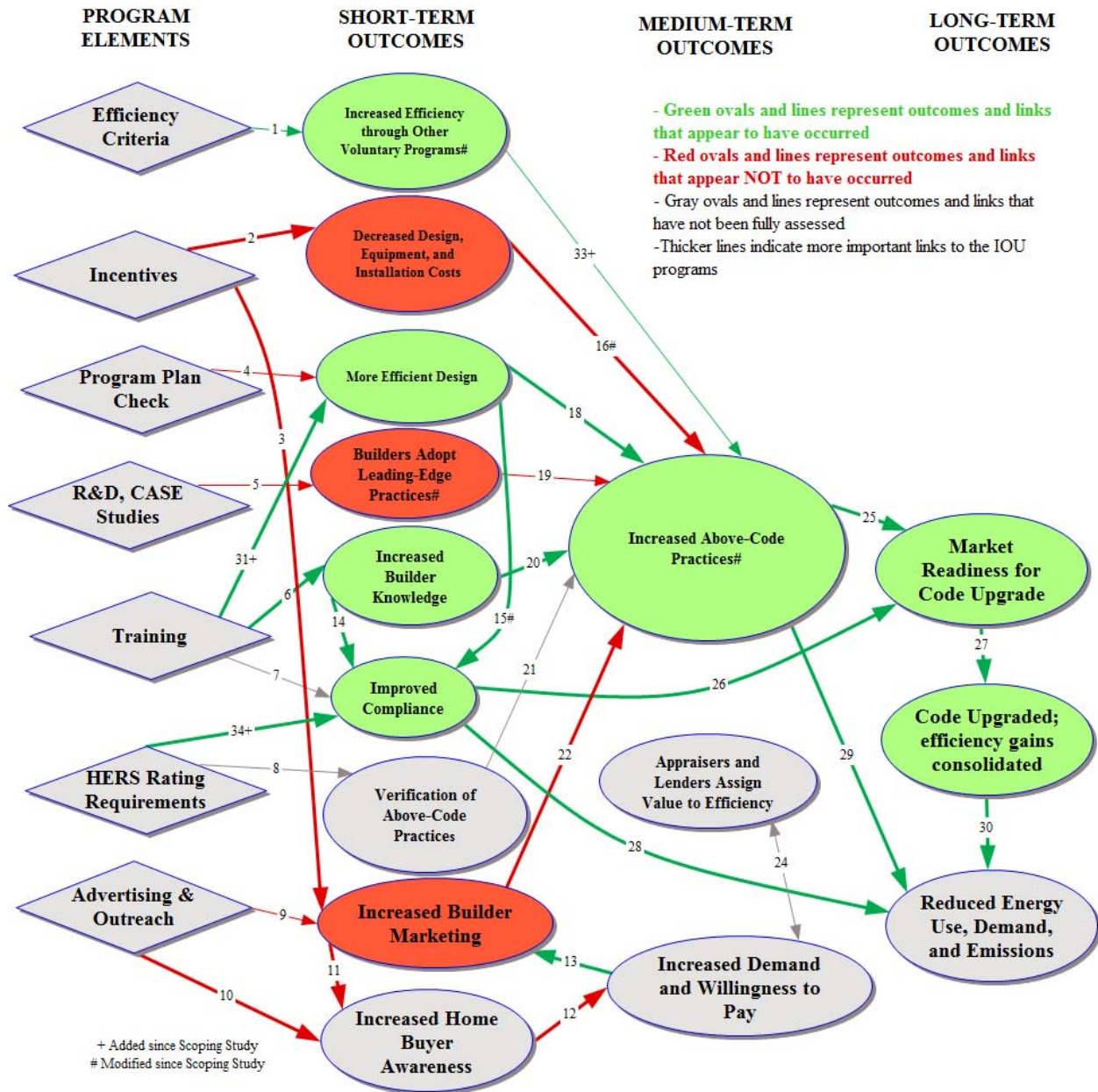
<sup>14</sup> Title 24 Consultants provide calculations and documentation that a home is compliant with Title 24 (the California Energy Efficiency Standards for Residential and Nonresidential Buildings) as well as provide recommendations to improve the energy efficiency of homes. Because of their focus on energy efficiency and Title 24, we place more weight on the responses of Title 24 Consultants than on those of other market actors.

*Insufficient data:* Not enough evidence of change or lack of change to say an outcome occurred, or not enough evidence of linkage or lack of linkage of programs activities to outcomes to say whether or not the IOU programs had an influence.

In this study we have focused on non-participant spillover, or the *indirect* effects of the 2006-2008 IOU programs on the efficiency of non-program single-family homes built during the same period. The IOU programs can also have *direct* effects through participating homes, but those effects are addressed by the NC/CS Evaluation.

Figure E-1 illustrates the three ways in which all IOU programs—not just the RNC programs, but any program affecting the residential new construction market—can lead to the ultimate goal of reduced energy use, demand, and emissions: 1) by improving compliance with existing code, 2) by facilitating construction that is more efficient than required by the current code, and 3) by contributing to code upgrades. Ultimately, program activities are aimed at achieving savings in one of these three ways. This summary begins by addressing these three key outcomes, and in so doing focuses on IOU program elements that appear to have had effects on the market. Many key program elements, however, did not lead to observable market effects, as illustrated in Figure E-1; a discussion of these less effective program elements comes later.

Figure E-1: Outcomes and Links to the IOU Programs



### E.3.4 Improved Code Compliance

The 2006-2008 IOU programs appear to have had discernable effects on improved code compliance in non-program homes, especially through training of builders leading to greater knowledge of how to comply, training of Title 24 consultants leading to improved design, and influencing builders to use HERS raters for Quality Insulation Installation (QII) in non-program homes.



- *Expected outcome: Improved code compliance. Strong evidence that outcome has occurred.* Twenty-five out of 45 Title 24 consultants, representing 55% of non-program homes,<sup>15</sup> and 20 out of 29 HERS raters, representing 82% of non-program homes,<sup>16</sup> said that rates of compliance with Title 24 had increased from 2006 to 2008.
  - *Link 6 (IOU program training leads to increased builder knowledge). Strong linkage of outcome to IOU programs.* Sixteen of 32 builders, responsible for 25% of non-program homes,<sup>17</sup> said they had attended IOU-sponsored trainings in the 2006-2008 period, and 11 builders said they had adopted some energy-efficient building practices or technologies because of the training. Eight of 32 builders, responsible for 17% of non-program homes, rated the training as having a great deal of influence on their adoption of the more energy-efficient building practices or technologies during the 2006-2008 period.
  - *Link 14 (Increased builder knowledge leads to improved code compliance): Strong linkage of outcome to IOU programs.* Thirteen Title 24 consultants, responsible for 25% of non-program homes, said that IOU training had helped to improve code compliance during the 2006-2008 period, while five Title 24 consultants, responsible for 35% of non-program homes, said that other (non-IOU) training had helped to improve code compliance. Fifteen HERS raters, responsible for 92% of non-program homes, said that IOU training had helped to improve code compliance, while 11 HERS raters responsible for 86% of non-program homes said that other (non-IOU) training had helped to improve code compliance. Five of 14 building code officials and inspectors agreed that IOU programs had helped improve compliance, and four of 14 building code officials/inspectors agreed that non-IOU programs had helped improve code compliance. Nine builders, responsible for 26% of non-program homes, said that IOU training had helped to improve code compliance, while five builders, responsible for 11% of non-program homes, said that other (non-IOU) training had helped to improve code compliance.
  - *Link 31+ (IOU training of Title 24 consultants leads to more efficient design) and Link 15 (More efficient design leads to improved code compliance). Strong linkage of*

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<sup>15</sup> That is, 55% of the non-program homes consulted on by the 45 Title 24 consultants interviewed for the study; according to Title 24 consultants' self-reports, they were responsible for 106,809 non-program homes in the 2006-2008 period, or about 50% of all non-program homes in California. Non-program homes refer to those whose builders did not receive incentives from the IOUs in the 2006-2008 period.

<sup>16</sup> That is, 82% of the non-program homes rated by the 29 HERS raters interviewed for the study; according to HERS raters' self-reports, they were responsible for 20,111 non-program homes in the 2006-2008 period, or about 10% of all non-program homes in California.

<sup>17</sup> That is, 17% of non-program homes accounted for by the 32 builders interviewed for the study; according to builders' self-reports, they were responsible for 31,561 non-program homes in the 2006-2008 period, or about 15% of all non-program homes in California.

*outcome to IOU programs.* Twenty-three out of 45 Title 24 consultants said IOU training had had a strong influence on their recommendations of energy-efficient building practices and technologies for 42% of non-program homes built in the 2006-2008 period.

- *Link 34+ (HERS rating requirements for QII leads to improved code compliance).* *Strong linkage of outcome to IOU programs.* Twenty out of 29 HERS raters, responsible for 99% of non-program homes, verified Quality Insulation Installations (QII) to earn energy credits for Title 24 compliance during the 2006-2008 period, and four HERS raters, responsible for 19% of non-program homes, said that the IOU RNC programs had a strong influence on the use of QII in non-program homes during the 2006-2008 period.

### **E.3.5 Increased Above-Code Practices**

The 2006-2008 IOU programs appear to have had observable effects on increased above-code practices, primarily through Title 24 consultants' contributions to more efficient designs, which in turn came in part through IOU program training, and through builders' increased knowledge about above-code practices—again, partly through IOU program training.

- *Expected Outcome: Increased above-code practices. Strong evidence that the outcome has occurred.* Based on onsite visits to newly constructed non-program homes, the efficiency levels of several building measures, such as high-SEER central air conditioners and high-AFUE furnaces, appear to have increased during the 2006-2008 period relative to the pre-2006 period. Title 24 consultants estimated that 24% of non-program homes built during the 2006-2008 period exceeded Title 24 requirements. Eleven of 45 Title 24 consultants estimated that 10% of the non-program homes met program standards—that is, were at least 15% more efficient than Title 24 requirements, not simply above code. Seven out of 45 Title 24 consultants and 12 of 29 HERS raters reported that the number of non-program homes that exceeded Title 24 requirements had increased between 2006 and 2008 (23% of non-program homes for Title 24 consultants and 7% for HERS raters).
- *Link 18 (More efficient design leads to increased above-code practices).* *Strong linkage of outcome to IOU programs.* The IOU programs in general influenced 17 out of 45 Title 24 consultants accounting for 30% of non-program homes to recommend above-code practices and technologies for most of those homes, including duct testing (19% of all non-program homes), duct sealing (18%), water-heating equipment (11%), and high-SEER AC or heat pump (9%). (See above for Link 31+ and Link 6.)
- *Link 20 (Increased builder knowledge leads to increased above-code practices).* *Strong linkage of outcome to IOU programs.* Builders responsible for 22% of non-program homes reported that knowledge gained through utility programs was an important or very important factor in their choice of energy efficiency levels in non-program homes, and eight of 32 builders said the IOU training had a great deal of

influence on their use of above-code practices and technologies in 17% of non-program homes. Five of 29 HERS raters and 14 of 45 Title 24 consultants reported that IOU programs influenced builders to use above-code measures in non-program homes through training and education. Eleven of 32 builders said they employed subcontractors who had worked on program homes and had changed their building or installation practices as a result. In addition, 30 out of 32 builders identified subcontractors as a primary source of information. Nine of 32 builders reported that IOU RNC programs were a primary source of information about new energy-efficient technologies and building practices and eight builders reported that utility training was a primary source of information. Although only one HVAC contractor reported that the adoption of new technologies or practices was directly due to IOU-sponsored trainings, five of nine HVAC contractors reported that the most common source of information on new energy-efficient technologies and building practices was the IOU RNC programs. (See also Link 6 above.)

### **E.3.6 Market Readiness for a Code Upgrade**

The 2006-2008 IOU programs also appear to have had observable effects—both direct and indirect—on market readiness for a future code upgrade (occurring in 2008 and again in 2011), with the indirect effects coming primarily from contributions to improved code compliance and increased above-code practices through builder and Title 24 consultant training, and through promoting the use of HERS raters. In addition, providing a possible indication of the 2006-2008 IOU programs on future code upgrades, the 2003-2005 IOU programs also had a direct effect on the 2005 code upgrade by creating a market for hard-wired CFL fixtures, which became part of the 2005 code.

- *Expected outcome: Market readiness for code upgrade. Moderate evidence that outcome has occurred.* Ten of 45 Title 24 consultants, representing only 5% of non-program homes, said there was adequate knowledge and availability of energy-efficient technologies and practices such that most builders could comply with the proposed 2008 code upgrade within a reasonable time—and the responses from Title 24 consultants may be the most important. However, eleven of 29 HERS raters, representing 66% of non-program homes, said this was the case, as did nineteen of 32 builders, representing 79% of non-program homes. The builder responses are telling, in that they may reflect a willingness to embrace another code upgrade, or at least resignation to the fact that it will happen.
- *Link 26 (Improved compliance leads to market readiness for a code upgrade). Moderate linkage of outcome to IOU programs.* Twenty of 32 builders, representing 22% of non-program homes, agreed that the low end of the market could comply with the proposed 2008 code upgrade within a reasonable time. Twelve of 45 Title 24 consultants, representing 30% of non-program homes said the same thing, as did 12 of 29 HERS raters representing 69% of non-program homes, four of nine HVAC

- contractors representing 82% of non-program homes,<sup>18</sup> and four of 14 building code officials/inspectors.
- *Link 25 (Increased above-code practices lead to market readiness for a code upgrade). Moderate linkage of outcome to IOU programs. (See Outcome.)*
  - *Link 27 (Market readiness for a code upgrade leads to a code upgrade). Moderate linkage of outcome to IOU programs.* While analysis of the effect of the pre-2006 IOU RNC programs on changes in the 2005 Title 24 requirements is backward looking, and while the analysis is not yet finished, it does provide a preliminary indication of the possible effects of the 2006-2008 IOU RNC programs on code upgrades going forward. The IOU lighting programs in effect prior to 2006 created the market for high-efficacy lighting in residential new construction during the time they operated. Since there was no indication that the market adoption of high-efficiency lighting resulting from these programs would have continued after these programs ended without the Title 24 change, it appears that the IOU programs helped prepare the market and make it practicable to include hardwired CFL fixtures in 2005 Title 24 requirements.

### **E.3.7 Demand-Side Effects**

In general, the 2006-2008 IOU program spillover effects that were dependent on program volume largely did not occur. These include demand-side effects, such as increasing home buyer awareness and increasing consumer demand/willingness to pay for efficient homes. This is to be expected given the low volume of homes going through the IOU programs in the 2006-2008 period—only 5,592 out of 206,788 homes built in the IOU territories.

- *Expected outcome: Increased home buyer awareness. Insufficient data to determine whether the outcome has occurred.* Only 26% of non-participating new home buyers interviewed in 2008 said that some homes are more energy-efficient than others, compared to 70% who said so in 2000. However, 47% in 2008 compared to 34% in 2000 said that new homes in their area and price range could be more efficient, suggesting these home buyers recognize that some homes can be more energy-efficient than others. Most non-participating new home buyers surveyed in 2008 said their home was about as efficient as other new homes.
- *Link 10 (IOU program advertising and outreach leads to increased home buyer awareness). Weak linkage of outcome to IOU programs.* Only 3% of non-participating new home buyers interviewed in 2008 said they had heard about

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<sup>18</sup> That is, 82% non-program homes accounted for by the nine HVAC contractors interviewed for the study; according to HVAC contractors' self-reports, they were responsible for 52,997 non-program homes in the 2006-2008 period, or about 25% of all non-program homes in California.

- efficiency from their utility during the home-buying process, although the proportion of new home buyers who had heard about the importance of efficiency from *someone* increased from 21% in 2000 to 27% in 2008. About one-half of non-participating homeowners (49%) said they were aware of the programs sponsored by governments or IOUs that encouraged energy-efficient features in new homes, and 10% said someone mentioned the program when they were buying or building their home. Aided awareness of the ENERGY STAR Homes program was 48% in 2008, while aided awareness of the IOU programs was 19%; the greater recognition of the national program name suggests that home buyer awareness of the IOU programs may at least partially carry over from the pre-2006 programs, when the IOUs used the ENERGY STAR name.
- *Link 11 (Increased builder marketing leads to increased home buyer awareness): Weak linkage of outcome to IOU programs.* Only four percent of non-participating new home buyers said that builders, developers, or realtors emphasized energy efficiency during the buying process. However, of those who said someone mentioned IOU programs (10% of all non-participating new home buyers), about one-half heard about it through the builder or sales agent.
  - *Expected outcome: Increased demand and willingness to pay. Insufficient data to determine whether the outcome has occurred.* Two-thirds (68%) of non-participating new home buyers said energy efficiency was important (7 to 10 on a 0-to-10 scale) in their selection of a new home. One-third (32%) rated it very important (9 or 10 on a 0-to-10 scale). Three-fourths (76%) of non-participating new home buyers expressed strong agreement (7 to 10 on a 0-to-10 scale) with the statement that they were willing to invest in home features that would reduce their monthly energy bills, and about one-half (54%) disagreed (0 to 3 on a 0-to-10 scale) that energy-efficient features in a new home cost more than they are worth. While these are positive numbers, we have no measures of increasing demand over time, and no indications of home buyers actually paying more for more efficient homes when given a choice.
    - *Link 12 (Increased home buyer awareness leads to increased demand and willingness to pay). Weak linkage of outcome to IOU programs.* Only 10% of non-participating new home buyers sought information on the IOU programs during the buying process, about equally through utility representatives, the Internet, and the builder. The small number of IOU program homes completed in 2006 and 2007 is evidence of limited home buyer demand generated by the 2006-2008 IOU programs; insofar as there was demand generated by the IOU programs, it may have been through the pre-

2006 programs, and it is possible but unconfirmed that this translated into sales of efficient homes certified by other programs.<sup>19</sup>

### E.3.8 Supply-Side Effects

The reduced IOU program volume in the 2006-2008 period also largely negated opportunities for some supply-side effects, such as reduced incremental costs for efficient construction, since the volume of efficient measures incentivized through the programs simply was not large enough to induce economies of scale.

- *Expected outcome: Decreased design, equipment, and installation costs. Weak evidence that the outcome has occurred.* Incremental costs for some efficient measures went up, others went down, and others stayed the same. Meanwhile, the code became more stringent and the cost for meeting it, not unexpectedly, went up.
  - *Link 2 (IOU program incentives lead to decreased incremental costs): Weak linkage of outcome to IOU programs.* None of the 32 builders interviewed attributed decreases in incremental costs to the IOU programs. However, IOU program incentives for program homes do decrease the costs of building those (relatively few) homes, if not for the market as a whole. Distributors tended not to attribute price declines to the IOU programs, but rather to wider availability and use of the higher efficiency equipment or materials and manufacturers cutting prices due to the economic downturn.

The supply-side effects of IOU programs on non-program homes that do appear to have occurred were primarily through IOU training (see above). The IOU programs exist in a California market in which building codes—already some of the most stringent in the U.S.—are ratcheted up every three or four years. IOU training helps builders and other market actors prepare for the upgrades and comply after the fact. Hence, the IOU programs appear to be an important element that helps the code upgrade cycle keep happening.

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<sup>19</sup> Other programs include the national ENERGY STAR Homes Program, the state Solar Initiative, and residential new construction programs run by municipal utilities.

### E.3.9 Alternative Explanations for Observed Market Changes

Other factors, outside the IOU programs, could explain observed market changes—but not necessarily to the exclusion of the IOU programs or each other. Some alternative explanations and related findings are as follows:

*Alternative 1: Other programs that are already available in the marketplace could be driving increased efficiency independently of the IOU programs and could have led to the observed market changes.*

The IOU programs coexist in the market with many other programs aimed at increasing the efficiency of new homes. While managers of these other programs give the IOU programs some credit for their efficiency criteria and participation in their 2006-2008 programs (Link 1), it is likely that these other programs also contributed to the success of the IOU programs—especially since the volume of these other programs in 2006 to 2008 was so much greater than that of the IOU programs (about 46,000 homes compared to 5,592, respectively, not counting overlap—although some of these programs count committed homes, whereas the IOU programs count only completed homes). The earlier versions of the IOU programs, when volume was much greater, could have had effects on 2006-2008 participation in the other programs, but the focus here is on market effects from the 2006-2008 IOU programs. Overall, Alternative 1 does not explain observed market changes; while non-IOU RNC programs affected the market, it does not appear that they did so independently of the IOU programs.

*Alternative 2: Outside forces such as gasoline prices, housing market cycles, and global warming could be driving demand for efficiency and could have led to the observed market changes, independently of the IOU programs and other voluntary programs.*

Buyers of non-program homes in California value efficiency and express willingness to pay for it, and the importance they assign to efficiency may have increased over the past few years (Link 12—see above). It is possible that demand could have been partially driven by previous versions of the IOU RNC programs, or by other IOU efforts, such as the Flex Your Power public awareness campaign (which is the focus of a separate impact evaluation). More importantly, there were powerful external forces at work affecting all aspects of the 2006-2008 housing market, including efficiency. There was near universal agreement among market actors interviewed for the Scoping Study that one effect of the building boom was to minimize unit efficiency (beyond code requirements) because nearly any home could sell and buyers had to take what they could get; however, in the housing downturn, there was widespread agreement that builders have used increased efficiency as a way to differentiate, hold on to market share, and minimize price reductions, and buyers could hold out for homes with the features they wanted. Many industry experts interviewed for the scoping study also said that higher gasoline prices were a major driver for increased efficiency—not just for cars, but for efficiency in general—because their high visibility increased awareness; higher gasoline prices could have affected the 2008 market in particular. Finally, while the evidence is not strong, the issue of climate change could have affected demand for efficiency, at least for a minority of buyers of

non-program homes. Overall, demand for efficiency appears to have been more driven by outside forces (confirming Alternative Explanation 2) than by the 2006-2008 IOU programs, as very few buyers sought out IOU program homes.

*Alternative 3: The market could be developing at a “natural” rate and the observed market changes could have happened in the absence of the IOU programs and other voluntary programs; this is highly interrelated with Alternative 2, but could include forces within the market as well as outside the market that led to a “natural” rate of change.*

The 2006-2008 IOU programs appear to have had little effect on home buyer demand for efficiency. However, on the supply side, market actors actually have to be able to *deliver* the efficiency, and the 2006-2008 IOU programs appear to have played an important role in the construction industry’s gearing up to do so; the IOU programs, then, appear to have helped accelerate the natural rate of adoption of efficiency, at least on the supply side, and Alternative 3 does not appear to explain market changes.

#### **E.4. Recommendations**

Four recommendations for IOU program design emerge from the findings of this study.

First, continue (and as feasible, expand) the successful training of builders and other market actors. Second, while there were probably good reasons for distinguishing the IOU programs from the national ENERGY STAR Homes Program, consider realigning with ENERGY STAR and making ENERGY STAR certification mandatory, as there is already considerable equity built up in the brand. Realignment with the ENERGY STAR Homes Program may also benefit from the current revisions to the ENERGY STAR guidelines due to take effect in 2011.<sup>20</sup> Third, before pent-up demand for new housing surges as the economy recovers, consider ramping up advertising and promotion of the IOU programs so that when potential buyers go to look for new homes, they ask for efficiency and ENERGY STAR certification. Many builders will build more efficiently if they perceive it as a customer need; otherwise, demand for housing in general might allow any level of efficiency to sell—as was apparently the case in the most recent boom. Participation in the IOU programs could perhaps be increased with renewed effort on channeling consumer demand for efficiency, thus leveraging the outside forces such as gasoline prices, housing market cycles, and global warming that are already driving demand for efficiency.

The fourth recommendation for IOU program design is as follows: since market transformation is a program goal, design the programs to achieve market transformation. The IOU programs’ focus on the supply side reflects an orientation toward resource acquisition, with an apparent expectation that market transformation will automatically follow—“build it and they will buy.”

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<sup>20</sup> [http://www.energystar.gov/index.cfm?c=bldrs\\_lenders\\_raters.nh\\_2011\\_comments](http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_2011_comments)



While this study makes it clear that there are some market effects resulting from the IOU programs, the program elements stimulating them are not systematically aimed at transforming the market. When the market rebounds, in order to avoid lost opportunities, it will be important for the IOU programs already to have prepared the marketing and building network, reconnect with ENERGY STAR, and apply lessons learned about Zero Net Energy residential new construction learned at the Sacramento Municipal Utility District (SMUD).

This is related to a recommendation for market effects research: it needs to occur on a regular basis since market transformation is a program goal; otherwise, program planners cannot know if the goal is being achieved. This study focused on the 2006-2008 IOU programs, and there had been no market effects research since 2000, giving little opportunity to provide feedback to program planners.

This study marks the completion of Phase I of the Residential New Construction Market Effects Study. Phase I has been largely qualitative, aiming to establish whether or not there is substantial evidence of increases in the efficiency of the RNC market—beyond the direct effects of the IOU programs—that may reasonably be attributed to those programs. If such market effects were identified, the plan was to conduct Phase II in order to quantify those market effects and thus help address the CPUC’s October 2007 Decision (D.07-10-032) directing its staff to explore the ability to credibly quantify and credit “non-participant spillover” market effects. We believe there is sufficient qualitative evidence of market effects to justify such an effort, and therefore recommend continuing with Phase II.<sup>21</sup> Furthermore, much of the data required for Phase II have already been collected during Phase I, or are being collected as part of the Residential New Construction Impact Evaluation, and we believe that quantification of market effects is practicable with these data as a starting point. Determining whether developing estimates of non-participant spillover is practical, and knowing what those levels are, could prove valuable if new construction rebounds and program participation increases in the coming years.

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<sup>21</sup> Phase II will attempt to incorporate the findings of several recent and upcoming lighting studies that may include data on market effects, in particular to avoid any double counting of market effects.

# 1. Introduction

This document presents the results of Phase I of a residential new construction (RNC), single family home programs market effects study, conducted for the California Public Utilities Commission (CPUC) by KEMA (formerly RLW Analytics) and its associates, Nexus Market Research, Inc. (NMR), Summit Blue Consulting, Itron, and The Cadmus Group. The idea for this study was first described in the “Residential New Construction Market Effects Study: Final Study Plan,” (Meyers, 2008) prepared by Stephen Meyers for the California Institute for Energy and Environment.<sup>22</sup> Building on the *Final Study Plan*, KEMA and its associates (NMR, Summit Blue Consulting, Itron, and The Cadmus Group) conducted a scoping study, which included the development of a work plan followed in the research described here (RLW Analytics, Nexus Market Research, Summit Blue, Itron, and the Cadmus Group, 2008).

The California Public Utilities Commission’s (CPUC) Market Effects Evaluation Protocol follows the definition of market effect offered by Eto, Prah, and Schlegel: “a change in the structure of a market or the behavior of participants in a market that is reflective of an increase in the adoption of energy-efficient products, services, or practices and is causally related to market intervention(s).” The Market Effects Evaluation Protocol also follows the Eto, Prah, and Schlegel definition of market transformation: “a reduction in market barriers resulting from a market intervention, as evidenced by a set of market effects, that lasts after the intervention has been withdrawn, reduced, or changed.” (J. Eto, 1996; CPUC 2006)

The objectives of the overall market effects study—including later steps—are as follows:

- Understand the market effects of 2006-2008 California IOU RNC energy efficiency programs on construction practices for new single-family homes built in the 2006-2008 period.
- Quantify the energy savings caused by the above market effects occurring in the years 2006-2008, with special attention to non-participant spillover.<sup>23</sup>
- Assess the effects of pre-2006 IOU programs on the adoption of more efficient technologies and practices in the 2005 Title 24 code.

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<sup>22</sup> Hereafter, referred to as the *Final Study Plan*.

<sup>23</sup> In CPUC Decision 07-10-032 (Oct. 18, 2007), the CPUC directed its staff and consultants to examine non-participant spillover, while the CPUC’s Evaluation, Monitoring and Valuation (EM&V) contractors were directed to evaluate participant spillover. In this decision, the savings from program participants who undertake energy efficiency improvements beyond the scope of the utility’s program are defined as participant spillover. In contrast, the savings from those not directly participating in a utility program who reduce their energy use after being influenced by a utility program are defined as non-participant spillover.

- Support the CPUC’s strategic planning efforts by clarifying whether energy savings from non-participant spillover can be quantified with sufficient reliability to be treated as a resource and, potentially, afforded shareholder incentive treatment.

Additionally, this approach recognizes the following study criteria:

- Being performed in a manner that is consistent with the CPUC protocols for market effects evaluations.
- Being performed primarily as an addition to the scope of work for the New Construction/Codes & Standards (NC/CS) Monitoring and Verification (M&V) team. The main reason for this approach is that there are extensive synergies between the work already being performed by that team and the work needed for the current study. However, the planning, analysis, and reporting for the two projects is separate.
- Being performed on a timeline that roughly coincides with that for the M&V study for New Construction/Codes & Standards because of the overlap between the two studies, the coordinated data collection efforts, and the administrative arrangement described above.

## **1.1. Study Phases**

The study is being performed in two phases. The first phase covers the market and attribution analysis of the California IOU residential new construction (RNC) programs. Phase I, using primarily qualitative methods, aims to establish whether or not there is substantial evidence of increases in the efficiency of the RNC market—beyond the direct effects of the IOUs programs—that may reasonably be attributed to those programs; Phase II, if it occurs, will involve quantifying those market effects. The Phase I activities are outlined in Table 1.1-1.

**Table 1.1-1: Summary of Residential New Construction Market Effects Study—Phase I**

<b>Task</b>	<b>Research Activities</b>
1. Analysis of Market Evolution	<ul style="list-style-type: none"> <li>• Reconstruct historical trends concerning energy efficiency in the RNC market in California <ul style="list-style-type: none"> <li>○ Identify trends in RNC efficiency practices in California</li> <li>○ Identify trends in builders' awareness, attitudes, and practices</li> <li>○ Identify trends in other market actors' awareness, attitudes, and practices</li> <li>○ Identify trends in home buyers' awareness and attitudes</li> <li>○ Identify trends in incremental costs of efficiency measures</li> </ul> </li> </ul>
2. Analysis of Expected Outcomes	<ul style="list-style-type: none"> <li>• Analyze the possible market effects of IOU RNC programs on homes whose builders did not receive incentives from the IOU programs (from here on, referred to as non-program homes<sup>24</sup>), and on the RNC market for years 2006-2008 <ul style="list-style-type: none"> <li>○ Interview non-participating builders, home buyers, and other market actors</li> </ul> </li> </ul>
3. Analysis of Code Changes	<ul style="list-style-type: none"> <li>• Analyze cumulative impact of utility RNC programs (not C&amp;S programs <i>per se</i>) on 2005 Title 24 <ul style="list-style-type: none"> <li>○ Interview experts in the homebuilding industry.</li> </ul> </li> </ul>
4. Attribution Analysis	<ul style="list-style-type: none"> <li>• Sift through the evidence collected to make a case regarding the role of utility RNC programs in causing the observed market effects.</li> </ul>

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<sup>24</sup> Builders of those homes are referred to as non-participating builders, buyers of those homes are referred to as non-participating home buyers, Title 24 consultants who consulted on those homes are referred to as non-participating Title 24 consultants, etc. Some builders, Title 24 consultants, and others who were interviewed may have worked on both participating and non-participating homes, and are identified and analyzed as such in the body of the report.

The work performed under Phase I of the Study will significantly inform the second phase, outlined in Table 1.1-2; in fact, going ahead with Phase II—which involves quantifying the market effects—is contingent on identifying observable market effects (qualitatively) in Phase I. As noted in the executive summary, the KEMA/RLW team recommends that Phase II of the study take place, based on analysis of the evidence gathered in Phase I.

**Table 1.1-2: Summary of Residential New Construction Market Effects Study—Phase II**

<b>Task</b>	<b>Research Activities</b>
Plan	<ul style="list-style-type: none"> <li>• Develop a plan for Phase II</li> </ul>
1. Analysis of Market Effects	<ul style="list-style-type: none"> <li>• Develop a hypothetical baseline of RNC efficiency trends in California<sup>25</sup> <ul style="list-style-type: none"> <li>○ Utilize onsite data from inspection of homes</li> <li>○ Interview non-participating builders and other actors in the homebuilding industry.</li> </ul> </li> <li>• Estimate market effects by comparing actual (from Phase I) and baseline RNC practices.</li> </ul>
2. Attribution Analysis	<ul style="list-style-type: none"> <li>• Sift through the evidence collected to make a case regarding the role of utility RNC programs in causing the observed market effects.</li> </ul>
3. Estimation of Net Energy and Demand Savings	<ul style="list-style-type: none"> <li>• Convert market effects to estimated energy and demand savings. <ul style="list-style-type: none"> <li>○ Systematically analyze the uncertainty surrounding the results.</li> </ul> </li> <li>• Develop recommendations regarding treatment of any RNC market effects savings in next program cycle.</li> </ul>
4. Sustainability Assessment	<ul style="list-style-type: none"> <li>• Assess the extent to which any observed market effects are likely to persist in the absence or reduction of public intervention (necessary for market transformation, but not necessarily for market effects).</li> </ul>

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<sup>25</sup> “Baseline” refers to a hypothetical projection of sales patterns of energy-efficient residential new homes in the complete historical absence of publicly funded energy efficiency programs targeting residential new construction (but including building codes).

## **1.2. Organization of the Report**

The report is organized as follows:

The Executive Summary summarizes the findings, conclusions, and recommendations of the entire document.

Chapter 1, Introduction, describes the study background and methodology.

Chapter 2, The IOUs' Residential New Construction Programs in the Context of the California Market, describes the theory of the residential market and the theory of the IOU programs, based largely on work conducted in the Scoping Study.

Chapter 3 Analysis of Market Evolution, working with data developed in previous studies, describes changes over time in building practices, builder awareness and attitudes, home buyer awareness and attitudes, other market actor awareness and attitudes, and incremental costs of efficiency measures.

Chapter 4, Analysis of Expected Outcomes, ties data collected from the various groups back to the outcomes expected according to program theory, as outlined in Chapter 2, then determines whether each outcome has in fact occurred, and finally assesses the role that the IOU programs appear to have played in each outcome.

Chapter 5, Analysis of Market Effects Related to Code Changes, examines the effects of utility programs prior to 2006 on the market for hardwired energy-efficient lighting and on adoption of efficient lighting requirements in the 2005 Title 24 code.

Chapter 6, The Importance of Networks, assesses the extent to which information about efficiency spreads informally within groups.

Chapter 7, Conclusions, examines all the data in the report to determine the extent to which observed changes toward greater efficiency in the RNC market can be attributed to the IOU programs and explores the significance of the findings for the CPUC and the IOUs.

Chapter 8, Glossary, gives definitions of key terms and acronyms.

Chapter 9, References, lists the external documents referred to in the report.

Appendix A, Questionnaires and Interview Guides, includes the interview and survey instruments.

Appendix B, Historic Trends in Awareness and Attitudes, provides results from previous research conducted by the IOUs on builders', other market actors', and home buyers' awareness and attitudes related to efficiency in new construction.

Appendix C, Additional Analysis for Chapter 4, includes additional analysis and tables supporting the Analysis of Expected Outcomes.

## 2. The IOUs' Residential New Construction Programs in the Context of the California Market

This chapter provides an overview of the single-family, production new home market<sup>26</sup> in California (as if the 2006-2008 utility programs did not exist),<sup>27</sup> an overview of the program theory and logic, a summary of indicators of expected outcomes in the market that are due to program activities, and a summary of alternative explanations for market changes.

### 2.1. Market Theory and Logic

Figure 2.1-1 reflects utility program staffs' and industry experts' views of the single-family, production new home market in California, *as if the 2006-2008 utility programs did not exist*. On the top left of the diagram is the mandatory, low-end side of the market and on the top right is the more efficient side of the market, as stimulated by various voluntary activities. Within the boxes in the diagram, bolded items are more important in the market than non-bolded items. Within some of the boxes are market actors—groups that participate in the market by fulfilling specific roles. Market actors vary according to the market being examined; in the RNC market, examples of market actors include home buyers, builders, subcontractors, manufacturers, distributors, designers, appraisers, lenders, Title 24 consultants, Home Energy Rating System (HERS) raters, and local building code officials.

#### 2.1.1. Requirements

The minimal levels of efficiency in RNC are—at least in principle—determined by various government requirements:

- **Federal Equipment Standards.** There is no Federal residential building energy efficiency code. However, the federal government sets a minimum efficiency standard for many types of energy-using *equipment* that are available in the national marketplace; these include furnaces, air conditioners, and water heaters. If a product is covered by a Federal energy efficiency standard, States and localities are preempted from enforcing a different standard. In California, appliance and equipment energy efficiency standards are promulgated under Title 20 for products not covered by Federal standards.

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<sup>26</sup> This is in contrast to custom-built single-family new homes. Production homes account for about 85% of the market in California.

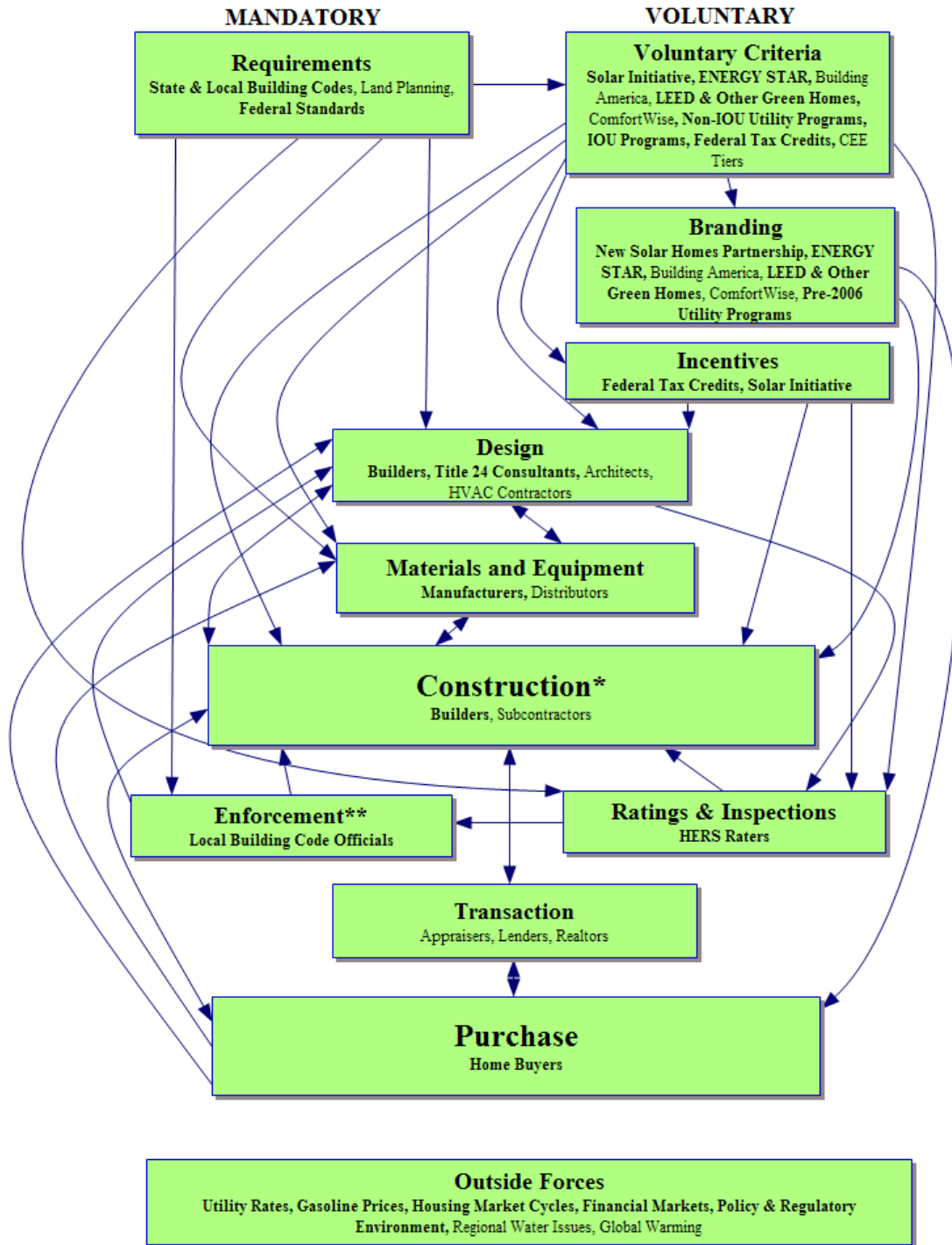
<sup>27</sup> Because the programs are designed to affect the single-family, production new home market in California through the market as it exists, it is important to understand how the market would exist in the absence of the programs.

- **California State Building Code—Title 24.** The revision of Title 24 that became effective on October 1, 2005 includes three general approaches to compliance:
  - The *prescriptive package approach* is the simplest compliance approach, and simply requires a report submitted along with the building permit application showing conformity with Package D of the 2005 Building Energy Efficiency Standards. With this approach, the builder selects a package of insulation and window requirements from a list of packages developed for each of California’s 16 climate zones. Each package specifies insulation levels, glazing areas, glazing U-Factors, duct sealing and insulation, and sometimes heating and cooling equipment efficiency. Once selected, the builder must simply meet or exceed all of the requirements listed in the package to achieve compliance. This approach does not require the calculation of a building’s thermal performance, and the use of computer software is unnecessary. Meeting Title 24 requirements through this approach generally results in more energy savings than is the case with the other two approaches.
  - The *trade-off approach* enables the builder to trade off insulation and window efficiency levels in different parts of the building. In the trade-off approach, the report submitted for the building permit review process must not only include a statement of conformity with Package D, but also include Package C—which specifies which of the pre-approved tradeoff measures are used to achieve Title 24 compliance. By referring to a set of package tables identifying allowable tradeoffs, the builder can trade off ceiling, wall, floor, basement wall, slab-edge, and crawl space wall insulation; glazing and door areas; and glazing and door U-Factors. The trade-off approach is based on calculations as to whether the home as a whole meets the overall code insulation and window requirements.
  - The *performance approach* is more flexible than the prescriptive and trade-off compliance approaches, and through software modeling allows trade-offs between all building envelope components and heating and cooling equipment efficiencies. Under the performance approach, energy performance goals need to be achieved or exceeded (e.g., on a kBtu/ft<sup>2</sup>/year basis with the actual value dependent on the reference house of comparison as defined by Package D in the 2005 Building Energy Efficiency Standards). Even under the performance approach, however, there are still mandatory minimum efficiency levels for specific measures, including insulation and Heating, Ventilating, and Air Conditioning (HVAC). Generally, production builders—those building subdivisions—opt for the performance approach because of the greater flexibility it allows in selecting building components. For the performance approach, Title 24 compliance is achieved by entering the building plans into a California Energy Commission (CEC)-approved Title 24 software program, such as MICROPAS, and generating a passing report before applying for a building permit. The preparer of the Title 24 compliance report does not need to have any particular certification; however, the recently launched New Solar Homes Program does require that the Title 24 consultant



hold a certification with the California Association of Building Energy Consultants (CABEC).

**Figure 2.1-1: The California Residential New Construction Market**



- **Local Building Codes.** Some municipalities, such as Davis and Roseville, have additional requirements for efficiency above Title 24.
- **Local and Regional Planning.** Local and regional planning departments pose more potential than actual requirements, and hence are not bolded in the market diagram, unlike the other requirements.
  - Regional planning departments could impact land use patterns and related energy efficiency issues, such as policies to encourage building on the coast where less heating and cooling are necessary than is the case in inland areas.
  - Municipal planning departments could lay out new subdivisions to encourage efficiency, with streets aligned such that nearly all homes would have north-south orientations with narrower streets to provide more shade in order to enhance passive solar design and minimize cooling, and with smaller trees on one side of the street and taller trees on the other to encourage both shading and photovoltaics. According to at least one industry expert, these could be required through the California Environmental Quality Act (CEQA) and the Subdivision Map Act.<sup>28</sup> And some cities, such as Davis, have a long history in including these requirements in their energy plans.

Local and regional code and planning requirements affect voluntary criteria in that they determine the minimum threshold above which the voluntary criteria are set. Requirements also affect design, materials and equipment, enforcement, and voluntary ratings and inspection—which, in turn, affect construction.

### 2.1.2. Voluntary Criteria

There are several programs that have established voluntary energy efficiency criteria above-code minimums:

- The Solar Initiative,<sup>29</sup> encompassing the New Solar Homes Partnership, is promoted by the CEC, and ties incentives for photovoltaic systems with requirements for efficiency above Title 24—15% above Title 24 in the case of Tier 1, and 35% above Title 24 in the case of Tier 2. Both Tier 1 and Tier 2 require that all builder-provided appliances be ENERGY STAR-certified. Both Tier 1 and Tier 2 efficiency levels, if they go through the Solar Initiative, must be verified through solar-certified HERS raters.
- A Federal tax credit of \$2,000 per home, during the 2006-2008 period, was available to builders for every home exceeding the 2004 International Energy Conservation Code (IECC) by at least 50%, which is about the same requirement as exceeding Title 24 by 30%. The

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<sup>28</sup> The Subdivision Map Act is one of the most basic and important statutes governing land use planning in California. (California Government Code Section: 66410-66499).

<sup>29</sup> For more information on the Solar Initiative, see <http://www.gosolarcalifornia.ca.gov/>.

Federal tax credit did not give credit for water heater efficiency; if high-efficiency water heating was added in, the requirements for the Federal tax credit were about the same as those for Tier 2 (exceeding Title 24 by 35%).

- The ENERGY STAR Homes Program<sup>30</sup> was initiated by the U.S. Environmental Protection Agency (EPA) to promote the market adoption of higher levels of energy efficiency in new housing than required by building codes. To earn the ENERGY STAR designation, a home must be designed and built to be at least 15% more energy-efficient than the energy code under which it was permitted; in California, the applicable code is Title 24.<sup>31</sup> Any home three stories or less can earn the ENERGY STAR label if it has been verified to meet EPA's guidelines. ENERGY STAR homes can include a variety of energy-efficient features. These include effective insulation, high-performance windows, tight construction and ducts, efficient heating and cooling equipment, and efficient products (lighting fixtures, compact fluorescent bulbs, ventilation fans, and appliances). ENERGY STAR homes must be inspected by a certified third-party HERS rater. In addition, in California, ENERGY STAR homes must meet several other criteria:
  - Have verification of adherence to the California ENERGY STAR Homes combined with Quality Insulation Installation (QII) and Thermal Bypass Checklist Procedures,<sup>32</sup>
  - Utilize HVAC system sizing calculations that adhere to the latest editions of the Air Conditioning Contractors Association (ACCA) Manuals J and S, the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) 2001 Handbook of Fundamentals, or the equivalent computation procedure;
  - Have ductwork leakage less than six cubic feet per minute (CFM) to outdoors per 100 square feet of conditioned space (duct leakage tests<sup>33</sup> can be waived if ducts and equipment are located in conditioned space and the home's envelope leakage is less than 0.25 CFM50<sup>34</sup> per square foot of building envelope).

All of the additional requirements listed above can be utilized to achieve the 15% above-code performance margin.

The Thermal Bypass Checklist—a set of insulation-related requirements for achieving ENERGY STAR certification—is substantively similar to what is required under Title 24 and

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<sup>30</sup> For more information on ENERGY STAR homes, see <http://www.energystar.gov>.

<sup>31</sup> Homes built under the 2001 Title-24 code had until December 31, 2006 to complete construction. All homes completed on or after January 1, 2007 must be 15% more energy-efficient than the 2005 Title-24 code.

<sup>32</sup> QII and Thermal Bypass Checklist Procedure are procedures for verifying the quality of insulation and thermal barrier installation. QII is a requirement of Title 24, and the Thermal Bypass Checklist Procedure is an additional requirement of ENERGY STAR Homes, but not of the 2006-2008 IOU RNC programs.

<sup>33</sup> A duct leakage test involves pressurizing the duct system with a calibrated fan and simultaneously measuring the air flow through the fan and its effect on the pressure within the duct system.

<sup>34</sup> CFM50 is the airflow (in Cubic Feet per Minute) needed to create a change in building pressure of 50 Pascals.

inspected by code officials. The inclusion of the Thermal Bypass Checklist in ENERGY STAR Homes necessitates additional inspection of the same items by a HERS rater.

- The U.S. Department of Energy's Building America Program<sup>35</sup> conducts building systems engineering research on how to make homes more energy-efficient in a cost-effective way. The program works with interdisciplinary teams of architects, engineers, builders, equipment manufacturers, material suppliers, community planners, mortgage lenders, and contractor trades. All Building America homes meet ENERGY STAR standards and include areas such as mechanics, ventilation, and onsite generation, the last of which is not usually covered by ENERGY STAR. Building America encourages builders to achieve high levels of efficiency, similar to the Tier 2 level of 35% above Title 24 requirements.
- There are a number of "green home" programs, with varying degrees of emphasis on efficiency. One of these is the Leadership in Energy and Environmental Design (LEED) for Homes Program from the U.S. Green Building Council, which was initiated in January of 2008 (it had existed before as a pilot). LEED for Homes provides certificates for new homes based on a point rating system for various green features, one of which is efficiency; to be certified, a home must meet ENERGY STAR specifications.
- The Environments for Living (EFL) Program<sup>36</sup> works with builders to certify homes at Silver, Gold, or Platinum levels. The energy (not cost) used for heating and cooling is guaranteed for two to three years; homeowners receive a refund if they use more energy. The program provides training to builders, subcontractors, and sales organizations, mostly focusing on framing, duct sealing, air sealing, insulation, right-sizing HVAC systems,<sup>37</sup> and ventilation. All Gold- and Platinum-level homes meet ENERGY STAR standards.
- A program that is unique to California is the ComfortWise Program,<sup>38</sup> run by ConSol, Inc. in cooperation with the California Building Industries Association (CBIA). ComfortWise encourages builders to build homes more efficiently than what Title 24 requires. Prior to the 2006-2008 program funding cycle,<sup>39</sup> SCE and SDG&E used ComfortWise as their implementation solution for the RNC market.

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<sup>35</sup> For more information on the Building America Program see [http://www1.eere.energy.gov/buildings/building\\_america](http://www1.eere.energy.gov/buildings/building_america)

<sup>36</sup> More information on the Environments For Living program can be found at [www.eflhome.com](http://www.eflhome.com).

<sup>37</sup> Right-sizing HVAC equipment means using software rather than using rules of thumb to identify the proper size for the unit. With right-sizing, smaller systems can often be specified and, hence, initial cost is reduced. A right-sized system will operate for long periods of time (rather than frequently cycling on and off), resulting in the optimum equipment operating efficiency. Also, proper HVAC sizing can reduce short-cycling of equipment, resulting in longer equipment life and better control over indoor environmental conditions.

<sup>38</sup> For more information on the ComfortWise Program, see <http://www.comfortwise.com>.

<sup>39</sup> The IOU efficiency programs are funded in cycles. The focus of this evaluation is the 2006-2008 cycle; the previous cycle was 2004-2005, and the next cycle is 2009-2011.

- While they do not operate in the IOUs' territories, programs run by other utilities can influence the market. For example, the Sacramento Municipal Utility District (SMUD)'s RNC program has a Zero Net Energy Homes (ZEH) component in which homes are designed to use 60% less energy than required by Title 24; so far, SMUD has more than 4,000 homes signed up, and expects the program to encompass more than 30% of the market. SMUD now has a 75-unit pilot development with homes designed to achieve 80% savings compared to Title 24, and expects to increase the ZEH component to that level.<sup>40</sup>
- Finally, the IOUs ran programs before 2006 that continue to influence the market. These programs provided incentives for new homes exceeding the requirements of Title 24, including the 2001 version of Title 24, and for the last few months of 2005, the 2005 version of Title 24. Before the Thermal Bypass Checklist became part of the ENERGY STAR Homes specification, the California utilities' programs were substantially tied in with ENERGY STAR.

Voluntary criteria establish the basis for branding and incentives, and they affect the design, materials and equipment, and construction of energy-efficient homes.

### **2.1.3. Branding**

Most of the voluntary criteria discussed above are associated with branding, which involves outreach to builders and, in some cases, outreach and advertising to homeowners, to get them to associate the name not only with the criteria themselves, but also with a set of benefits arising from these criteria, including lower operating costs, greater comfort, a healthier living environment, and a more durable home. Current brands of energy-efficient new homes include the New Solar Homes Partnership (through the Solar Initiative), ENERGY STAR Homes, Building America, LEED for Homes and various other "green" home brands, ComfortWise, and Environments for Living. Pre-2006 IOU program brands, which may still resonate in the market, included: (1) programs run by Pacific Gas and Electric (PG&E): "Comfort Home"—later called the "Residential New Construction Program;" (2) programs run by Southern California Gas (SCG) and San Diego Gas and Electric (SDG&E): "ComfortWise"<sup>41</sup> and then "Energy Advantage Program," which is now "Advanced Home;" and (3) programs run by Southern California Edison (SCE): "ComfortWise," which is now "New Homes Program."

Branding can affect the purchasing of energy-efficient homes if home buyers find the messaging persuasive. If builders think home buyers are responding to the brand, then builders will participate in the branding program; in this way, branding can affect construction.

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<sup>40</sup> For more information on SMUD's ZEH program, see <http://www.smud.org/en/homeofthefuture/Pages/default.aspx>.

<sup>41</sup> As mentioned earlier, ConSol, Inc. continues to promote ComfortWise; earlier, ConSol licensed ComfortWise to SDG&E, SCG, and SCE as their implementation program for the RNC market.

#### 2.1.4. Incentives

The Federal government, based on the Energy Policy Act of 2005, provides a tax credit of \$2,000 to builders for each new energy-efficient home that achieves 50% energy savings for heating and cooling over the 2004 International Energy Conservation Code (IECC) and supplements. At least 20% of the energy savings must come from building envelope improvements. In California, the efficiency level required to get the tax credit is ENERGY STAR Tier 2, or 35% better than Title 24. The stimulus package provides additional money for tax credits for energy-efficient and renewable energy technologies.

The CEC's Solar Initiative provides incentives starting at \$2.60 per watt for production homes and \$2.50 per watt for other homes. There is also a volumetric trigger, with the incentive declining 10% based on the original incentive level when pre-specified target installed MW volumes are reached.

The incentives, then, are based on voluntary criteria, and they affect the design and construction of energy-efficient homes. Because the payment of the Federal tax credit and the Solar Initiative incentives hinge on HERS ratings, the incentives also affect ratings and inspections.

#### 2.1.5. Design

In California, market actors involved in the design of new homes as it affects energy efficiency include builders themselves,<sup>42</sup> Title 24 consultants, architects, and a few key design, energy engineering, and HVAC firms.

- Builders typically work interactively with Title 24 consultants to get their homes to achieve efficiency levels that will meet Title 24 requirements (as noted previously, Title 24 requires a certificate of compliance). Most commonly, the role of the Title 24 consultants is to identify the least costly way to meet minimal code requirements, although in some cases they may help builders reach higher levels of efficiency—but again, usually in the least costly way. Production builders are very cost conscious, and their tendency is to repeat a “cookie-cutter design.” But once they get a design approved for its efficiency—and once it starts being built—the design tends to be modified, which can affect the home’s energy use. Title 24 consultants therefore continue to be involved with builders beyond design and through the construction process, so that a given home, after modifications to the original design, will meet Title 24 requirements. As one program manager said, “A lot of them are ‘compliance jockeys’ to ‘beat Title 24’ or ‘get out of Title 24’ rather than looking at a building and delivering recommendations for high-efficiency design.”

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<sup>42</sup> “Builders,” as noted before, include production or merchant builders at about 85% of the market and custom builders making up the other 15%. Categories of employees at production builders include purchasing agents, site supervisors, executives, office staff, architects, engineers, carpenters, and various kinds of building specialists. Custom builders tend to be much smaller operations with more functions subcontracted out.

- Most industry experts view architects as relatively unimportant in their effect on the efficiency of RNC. As one industry expert said, “Architects are surprisingly ineffective. They get consulted in the original design, which the builders modify as they see fit,” as the design is used again in scores or hundreds of additional homes. One expert, however, dissented from this view, saying that architects probably decide on the efficiency of the home half the time, and builders the other half.
- ConSol is a significant and unique market actor because it runs the ComfortWise program (as mentioned above), runs Title 24 compliance software to determine what can and cannot be built under the code, and consults with the California Building Industries Association—a group to which many builders belong.
- There are a few private firms influencing the market through advanced design or through high market share coupled with advocacy for efficiency. These firms include Davis Energy Group and Beutler Mechanical; the reader should note that this list is not meant to be exhaustive, but simply includes firms identified by interviewees from the Scoping Study to define the market and market theory for the residential new construction market in California. Davis Energy Group has been at the forefront of advanced product and standards development in the California residential sector for some time. Davis Energy partnered with Building America (program of the US Department of Energy) to implement several emerging energy saving technologies. Davis Energy also partnered with Grupe Company, PowerLight, and Building America to develop the largest Zero Energy New Home community (144 homes in Carsten’s Crossing) in the Sacramento area. In addition, Davis Energy Group (DEG) was chosen by the United States Green Building Council (USGBC) as a provider for their LEED for Homes Pilot Program in California and Nevada. Beutler Mechanical is another prominent and unique market actor. Among HVAC contractors, Beutler has unparalleled volume, market share, and geographic concentration. It has around 80% share of the new home HVAC market within SMUD territory, nearly as much in Roseville, and around 30%-35% in Stockton and the San Francisco Bay Area. Beutler does design-build engineering including Title 24 consulting, and uses its volume purchase power to get better prices from manufacturers—not just for HVAC equipment, but also for other materials such as windows. Beutler has also recently become a manufacturer as well, making a water-cooled air conditioning system called AquaCool, which is super-high efficient even at high temperatures. SMUD recently installed 30 AquaCool systems as part of a pilot program, and if it works will add it to the SMUD program.

The design of energy-efficient homes is limited by the materials and equipment that are available, but design, through specification of materials and equipment, also affects their availability and cost. Design obviously affects construction, but construction—through feedback on what works well and doesn’t work well—also affects design; that is why builders appear as market actors in the diagram under both design and construction activities. Design is also

affected by requirements and their enforcement, voluntary criteria, incentives, and consumer preferences.

### **2.1.6. Materials and Equipment**

Manufacturers are responsible for the efficiency of materials and equipment available for use in new homes, and distributors are a conduit—although large builders or subcontractors may deal directly with manufacturers. There are also minimum standards that manufacturers must adhere to and voluntary specifications that they may aspire to. Federal standards, and sometimes Title 24 and local building code requirements, provide the floor for efficiency standards for many types of equipment and materials installed in new homes, including air conditioning, furnaces, appliances, and windows.

- On the voluntary side, ENERGY STAR has defined specifications for more efficient equipment (in addition to more efficient new homes), including air conditioning, furnaces, appliances, windows, and lighting.
- The Consortium for Energy Efficiency (CEE) has defined tiers of efficiency above ENERGY STAR levels for central air conditioning/heat pumps and appliances.

Materials and equipment are affected by requirements and voluntary criteria. The efficiency of the design and construction of a home is also limited by the efficiency of the materials and equipment that are available; the availability and cost of materials and equipment are, in turn, affected by their specification in design and their use in construction. Finally, materials and equipment can be affected by consumer preferences.

### **2.1.7. Construction**

Construction is one of the two central activities in the new home market, making builders one of the two key market actor groups (with the other key activity being purchasing and the other key market actor group being home buyers). Most builders are motivated by costs and profits; because they will not be paying the utility bills for the homes that they build, they are not motivated to increase the homes' efficiency unless they can recover (or more than recover) the extra cost, or increase their share of the new construction market. Ultimately, if a home is to be built at efficiency levels above Title 24, builders make most of the construction decisions.

Program managers and other industry experts routinely state that production builders account for more than 85% of the market. Those who were interviewed, however, were divided as to whether the leaders in efficiency in new construction are most often production builders or custom builders. The experts who say that production builders are efficiency leaders say that the cost of analysis is a high percentage of the cost of one home, but that for spec-built (production) homes it can be spread over many homes. For example, it may cost \$1,000 to conduct an analysis for one home, and \$4,000 if the analysis is packaged for multiple homes. (This is in addition to costs for equipment upgrades, which could, for example, amount to \$2,000 per home.) A builder who builds 100 homes with the same design spreads the \$4,000 over 100 homes, and if the effort is



successful, may use the same design on an additional 500 or 1,000 homes. Economies of scale, then, are key.

Other experts, however, say that innovation in efficiency probably happens most commonly with custom homes. Production builders may look to custom builders for examples of new technologies to use, such as foam-integrated concrete walls. The use of a new technology by a custom builder would be persuasive with skeptical production builders.

Particular production builders whom others follow as examples of efficiency, according to experts, include D.R. Horton, Grupe Company, Pulte and SCM Homes. One expert mentioned Premier Gardens as a development that provided an example to many builders (built by Premier Homes in collaboration with Building America, SMUD, National Renewable Energy Laboratory (NREL), and ConSol). Premier Gardens is said to be well known in zero energy home (ZEH) circles, and these homes served as the model for SMUD's Solar Smart program.

Within production builder organizations, two key actor groups who can influence efficiency are purchasing agents and field supervisors/job superintendents. Purchasing agents make buying decisions for builders, affecting multiple subdivisions. They are driven primarily by cost; as one industry expert said, purchasing agents are concerned about “nickel and dime savings on water heaters, or blown vs. batt insulation.”

Field supervisors or job superintendents are responsible for work on a day-to-day basis, catching any problems in installations. They are decision-makers in a limited sense in that sometimes they put in equipment that is less efficient than specified if it meets code; they also can stop a quality installation if it slows down their work.

Being at the center of the new construction process—as indicated by the word itself—construction is linked with every other activity depicted in the market diagram. Most directly, though, construction is affected by design, materials and equipment, enforcement of code, ratings and inspections to assess achievement of voluntary criteria, incentives for achieving those criteria, branding of those criteria through builder recruitment, and consumer responses to homes that are built—both directly and as mediated by appraisers, lenders, and realtors. Construction activity affects design as well materials and equipment through feedback about what does and does not work, and affects purchases and transactions by making houses available for sale.

### **2.1.8. Enforcement**

Local building officials are charged with enforcing the Title 24 requirements developed at the state level, and occasionally enforcing additional requirements developed at the local level. According to industry experts, code enforcement is uneven across municipalities, and one PG&E study in 2002 showed that overall compliance of new homes with existing building standards was 71%, with considerable variation across climate zones (RER, 2002).

Enforcement is affected by the requirements that code officials are meant to enforce, and by ratings and inspections (see below). Enforcement primarily affects design and construction.

### **2.1.9. Ratings and Inspections**

Home Energy Rating System (HERS) raters, who provide field verification of new homes' energy efficiency, are central to the national ENERGY STAR program because meeting a minimal HERS score is required for certification. HERS ratings are also required for builders receiving the federal tax credit, for receiving Tier 2 solar incentives under the Solar Initiative, and for LEED certification. Also, under Title 24 requirements, a HERS rater's QII verification can earn energy credits within Title 24, and the verification is sometimes cheaper than other ways of getting points. According to industry experts, builders perceive the energy credits to have the added value of helping them to avoid callbacks and lawsuits by providing an extra seal of approval and insurance. The California Home Energy Efficiency Rating Service (CHEERS) trains and certifies HERS raters, provides ongoing quality control, and maintains an online registry of raters; HERS raters do not work for CHEERS, as they are independent.

Ratings and inspections, then, are affected by Title 24 requirements, voluntary criteria, design, and incentives. In turn, ratings and inspections affect construction and enforcement.

### **2.1.10. Transaction**

Appraisers, lenders, and realtors are typically intermediaries in transactions between production builders and the home buyers. According to industry experts, realtors have very little influence on the efficiency of new homes—they simply respond to what they think home buyers want to hear. Appraisers have the potential to affect efficiency insofar as they assign value to it—which could help builders recoup their investments in it—but the extent to which this has happened is open to question. Lenders, too, can affect efficiency by offering energy-efficient mortgages (EEMs) and, thus, help home buyers to afford the extra upfront costs for efficiency, although not all lenders do so. A 2000 study conducted for PG&E estimated that there were more than 2,000 EEMs in California in 1999 with the vast majority being issued in PG&E's service territory; however, that number declined considerably during the year 2000 (XENERGY Inc., 2001).

### **2.1.11. Purchase**

Home buyers are central actors in the RNC market—and the reason for its existence. Buyers of custom homes—a small part of the market—can be involved in the design and the choice of materials and equipment. Buyers of production homes—more than 85% of the market—may buy completed homes, may be given some limited choices of certain materials and equipment from a list compiled by the builder, or may be given a budget for certain items that they may select themselves. Buyers' responses, though, provide feedback to design, materials and equipment, and construction, and can affect what is later offered to others.

Home buyers, through demand, have the power to drive the market. The intent of the various brands mentioned above is to get home buyers to drive the market toward greater efficiency. Efficiency competes with many other consumer demands, though, including the location of the home, its size and layout, and granite countertops and other amenities. The cost of greater

efficiency as it competes with other features of the home, then, is a central barrier. Another barrier is the lack of a clear price signal in energy consumption, such that consumers cannot see the direct impact of their behavior. There is also a lack of awareness of cost savings through greater efficiency. There is a lack of perception of value because energy efficiency features are not visible, and do not affect the appearance of the home—they're "reassuring but not sexy;" this is in contrast to photovoltaic panels, which clearly are visible and are becoming increasingly desirable. A final barrier is the lack of a central brand, and a proliferation of labels connoting increased efficiency.

Demand-side drivers for greater efficiency include cost savings and improved cash flow, once consumers are aware of them. Many industry experts interviewed said that higher gasoline prices were a major driver for increased efficiency—not just for cars, but for efficiency in general—because their high visibility increased this awareness. The visibility of photovoltaic panels, as mentioned above, is a driver—at least now that they are seen as desirable. Their desirability derives in part from an increasing "green sensibility"—a desire to "do the right thing" in relation to global warming and to live sustainably. Finally, improved health and comfort, insofar as home buyers perceive them as benefits, can be drivers for greater efficiency in new home construction.

#### **2.1.12. Outside Forces**

The California RNC market does not operate in a vacuum; various outside forces can affect its direction. For example, changes in utility rates can affect the savings potential of efficiency improvements and, in turn, consumers' reactions. Gasoline prices, as mentioned earlier, can affect home buyers' awareness of efficiency. Awareness of global warming can make consumers more willing to pay for efficiency, although some market actors say that the effect is limited. The ups and downs of the housing market can affect prices and competition among builders. There was near universal agreement among market actors interviewed for this study that the effect of the building boom was to minimize unit efficiency (beyond code requirements) because nearly any home could sell, and there was an issue of quality control because of turnover in subcontractor staffs; however, in the current housing downturn, there was widespread agreement that builders are using increased efficiency as a way to differentiate, hold on to market share, and minimize price reductions. In particular, photovoltaics appear to be gaining greater traction as a way to differentiate in the current market downturn.

## **2.2. Program Theory and Logic**

This section reports the utility program staffs' and industry experts' descriptions of the IOUs' RNC programs and their views as to how the programs may affect the single-family, production new home market in California. It should be noted, however, that these programs were not designed as market transformation programs, but as resource acquisition programs, so market effects have been a secondary consideration.

The programs addressed in this evaluation are the following:

- SCG 3502 Advanced Home Program
- SDGE 3007 Advanced Home Program
- SCE 2505 CA New Homes Program
- PGE 2009 Residential New Construction Program
- PGE 2083 Duct & Cover Program

The IOU RNC programs consist of a portfolio of products and services designed to increase the adoption of energy efficient equipment and practices in the single family and multifamily building industry.<sup>43</sup> These products and services include incentives for meeting efficiency criteria; Program Plan Check;<sup>44</sup> The Codes and Standards Enhancement (CASE) Initiative Project to address energy-efficiency opportunities through development of new and updated appliance (Title 20) and building (Title 24) standards;<sup>45</sup> training of builders and other market actors in new technologies and practices; training (by PG&E only) for building code officials on how to inspect homes for purposes of code enforcement; requirements for HERS ratings to verify proper installation and specified equipment are required for a home to achieve program-specified efficiency levels; and advertising and outreach to increase consumer awareness of efficiency and associated benefits. The programs provide support to encourage high-performance building design that exceeds the 2005 Title 24 energy efficiency requirements by 15% or more, while also aiming to increase the adoption and installation of individual high efficiency measures, such as efficient heating, cooling, lighting, and appliances in residential new construction.

Figure 2.2-1, labeled “Utility-Run/CPUC-Approved RNC Programs,” reflects utility program staffs’ and industry experts’ descriptions of the IOUs’ RNC programs. On the left side, under “Program Elements,” in diamond-shaped boxes, are the key elements of the utility programs. To the right of the elements, in oval-shaped boxes, are short-, medium-, long-term outcomes that the utilities expect to occur as a result of their activities. The arrows represent linkages between program elements and expected outcomes, or between one outcome and another; the numbering is explained later in this section.

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<sup>43</sup> The reader should note that the IOU RNC program description focuses on the common elements across the IOU RNC programs. Each IOU has designed and implemented a unique RNC program, though there are many elements that are common across all IOU RNC programs. Those interested in the unique features of a particular IOU RNC program can consult program materials and Websites for more details.

<sup>44</sup> Program Plan Check is a process in which IOU staff review participating builders’ plans and Title 24 compliance documentation to ensure accurate modeling. For more details, see the description of Program Plan Check following Figure 2.2-2.

<sup>45</sup> PG&E’s CASE Initiative programs are part of their Codes and Standards and other programs, not their RNC program.

Figure 2.2-1: Utility-Run/CPUC-Approved RNC Programs and Associated Outcomes

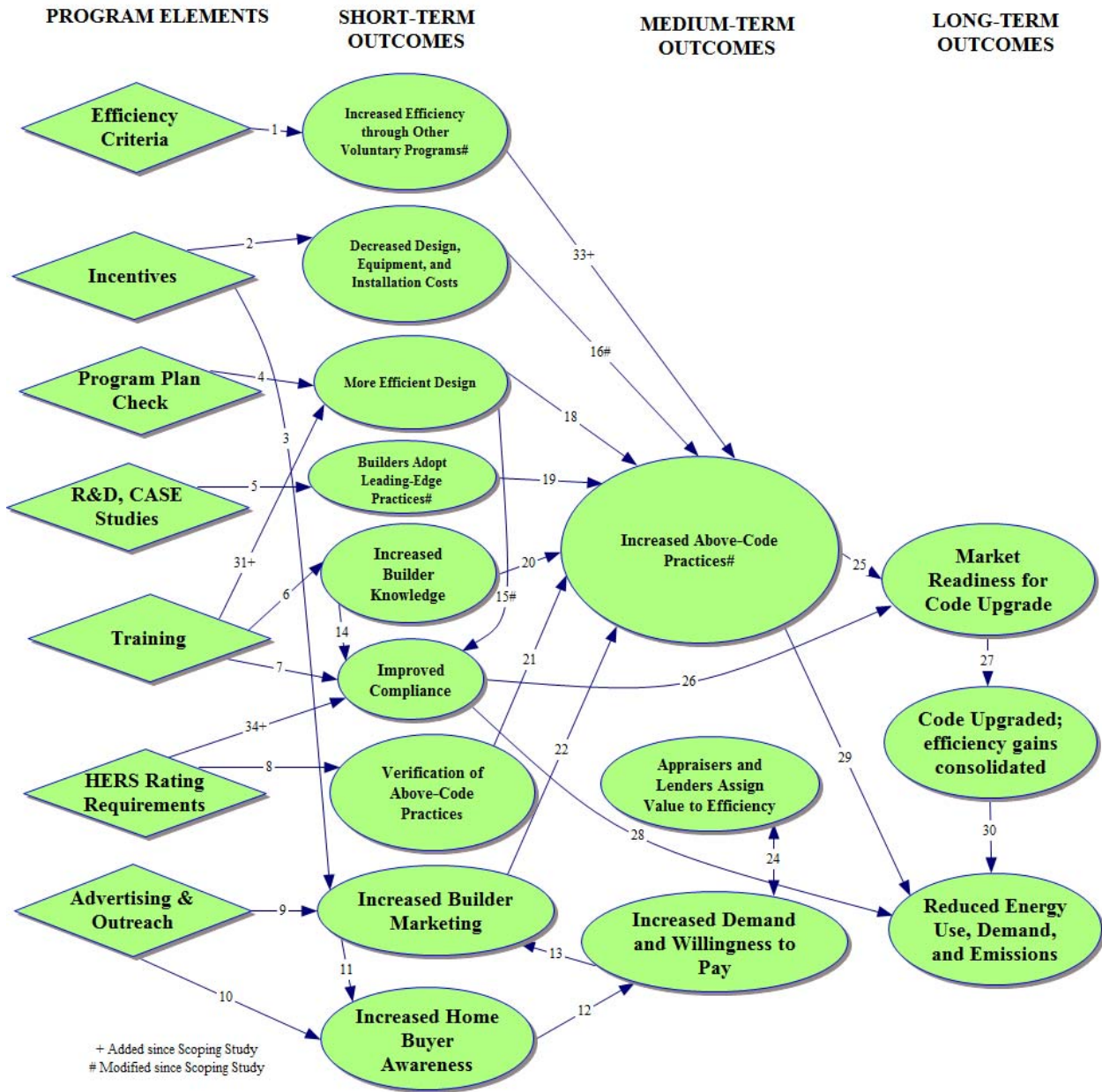


Figure 2.2-2, labeled “Utility Programs in Relation to the Residential New Construction Market,” shows utility program staffs’ and industry experts’ views of how the programs are designed to affect the single-family, production new home market in California. The left side of Figure 2.2-2 is the same as in the market diagram in Figure 2.1-1, and the right side is the same as the program diagram in Figure 2.2-1. Figure 2.2-2 links the two sides to show how the programs are meant to affect the market, working through the market as it exists.

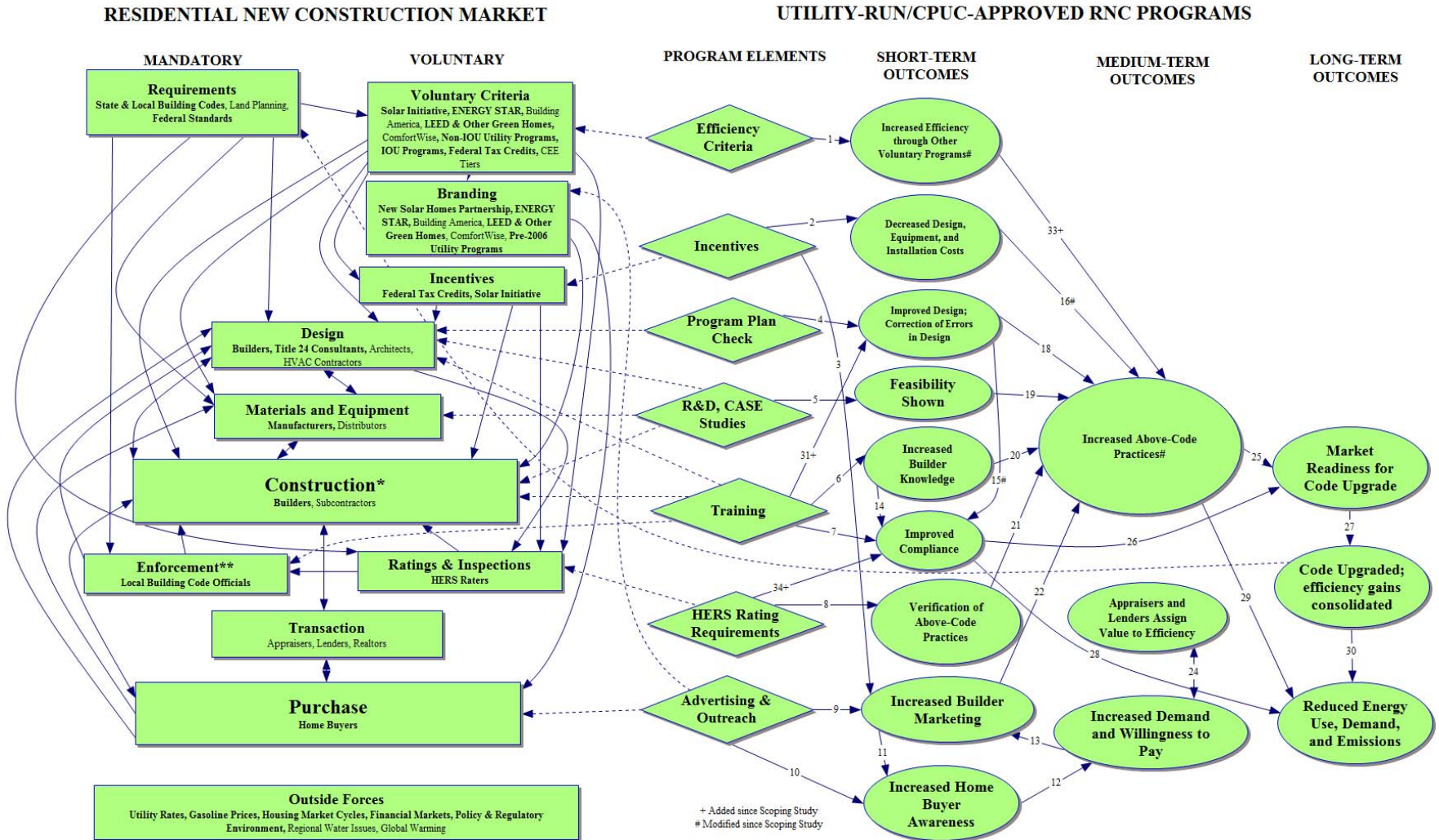
The key program elements, as depicted in Figure 2.2-1, are efficiency criteria, incentives for meeting those criteria, research and development, CASE studies, training, and advertising and outreach. The positioning of these elements next to the market activities indicates that the programs are meant to feed into and leverage activities and relationships that already exist in the market.

- **Efficiency Criteria.** There are different kinds of efficiency criteria associated with RNC programs:
  - PG&E’s RNC Program, SCE’s New Homes Program, and SDG&E’s and SCG’s Advantage Home Program are tied to the Tier 1 (15% above Title 24) and Tier 2 (35% above Title 24) criteria described above under “Voluntary Criteria.” Since the introduction of the Thermal Bypass Checklist to the ENERGY STAR Homes program, the utilities have not consistently tied their programs to ENERGY STAR, but at times have had their own program names added to the plethora of program names outlined above.
  - PG&E’s Duct & Cover Program, administered by ConSol, provides incentives for achieving 20% greater efficiency than required by Title 24, with several mandatory HERS measures including Quality Insulation Installation (QII), an infiltration test, 11 EER<sup>46</sup> minimum central air conditioning, buried ducts, and verified system airflow.
  - For homes in gas utilities’ territories and in municipal electric companies’ territories, the gas utilities’ programs have incentives for furnaces with minimum 92% Annual Fuel Utilization Efficiency (AFUE), and for tankless water heaters. These are measure-specific incentives and are not tied to Title 24.
- **Incentives.** The utilities provide incentives for meeting all of the above criteria. In the case of Tier 1 and Tier 2 criteria, homes with certified photovoltaic systems are also eligible for the state’s Solar Initiative incentive. A builder whose home meets Tier 2 criteria is also likely to be eligible for the Federal tax credit. The expected outcome of the incentives is to decrease the extra cost for higher levels of efficiency, thus leading to more acceptance from builders and greater economies of scale.

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<sup>46</sup> EER (Energy Efficiency Ratio) differs from SEER (Seasonal Energy Efficiency Ratio) in that the latter is a measure of efficiency at 82 degrees outside and 80 degrees inside, while EER measures system efficiency nearer to peak temperatures (for example, 95 degrees outside).

Figure 2.2-2: Utility Programs in Relation to the Residential New Construction Market



An example of how this worked in the past was PG&E's 1993 program promoting 16 SEER central air conditioning, 94% AFUE furnaces, and "green" glass (before the time of "low e" glass). At that time there was only one central air-conditioner manufacturer that made 16 SEER units. PG&E researched the cost, found it cost \$5,000 extra to install, so the rebate was figured at 80% of that, or \$4,000. Because builders were "eating" the \$1,000, it was a tough sell, and very little happened. Then, one key market actor went to the manufacturer, and said that they could sell 1,000 16-SEER units if the price came down—at the time, the manufacturer was only selling about 1,000 units per year in the whole country. As a result, the manufacturer brought the price down from \$2,500 to \$1,800. Meanwhile, the key market actor also talked with some window manufacturers who, because of assurances of volume, brought the cost of "green" glass down from \$2 to \$1 per square foot. As a result, the cost of the upgrade became \$3,200, with a \$4,000 rebate, and the builders were actually making more money. "It went like hotcakes." However, PG&E later refigured the rebate to be 80% of the new incremental costs, and program participation slowed back down. Even so, it does provide an example of how incentives can lead first to decreased costs and increased economies of scale. The incentives also led to an increase in the builders' own marketing of efficiency.

- **Program Plan Check.** Program Plan Check is a process in which IOU staff review participating builders' plans and Title 24 compliance documentation to ensure accurate modeling. If significant modeling errors are discovered, Program Plan Check staff utilizes CEC approved Title 24 compliance software to correctly model the home. The revised model and revised compliance margins are then provided to the builder and energy consultant. This feedback mechanism is intended to both ensure that applications meet program requirements and to educate energy consultants on proper modeling techniques.
- **Research & Development (R&D) and CASE Studies.** As part of their Codes & Standards programs, the IOUs perform R&D of emerging technologies and provide demonstrations through CASE studies. The R&D and CASE studies show that new techniques working with new technologies can be feasible. The Codes and Standards Enhancement (CASE) Initiative Project is the IOU program to address energy-efficiency opportunities through development of new and updated appliance (Title 20) and building (Title 24) standards. Individual reports document information and data helpful to the California Energy Commission (CEC) and other stakeholders in the development of these new and updated standards. The objective of this project is to develop CASE Reports that provide comprehensive technical, economic, market, and infrastructure information on each of the potential standards.
- **Training.** The utilities provide training for builders and other market actors in new techniques of construction working with new technologies, and PG&E (not the other utilities) provides training for building code officials on how to inspect homes for purposes of code enforcement. The training for builders and other market actors increases their knowledge, and the training for building code officials increases the enforcement of Title 24



requirements, primarily among builders not participating in the utility programs (non-participating builders). One market actor who specializes in training local building department officials in code enforcement said that building code officials formerly paid no attention to insulation requirements; as a sign that they had started to pay attention, he had framed on his wall a building inspection “fail” notice for inadequate insulation, which he said was happening more and more, and would not have happened without PG&E’s training.

- **HERS Rating Requirements.** HERS ratings to verify proper installation and specified equipment are required for a home to achieve Tier 1 or Tier 2 efficiency levels. This program element serves to verify that the efficiency criteria (another program element) are being adhered to.
- **Advertising and Outreach.** The utilities advertise their “brands” and the associated benefits, which increases the home buyer’s awareness of efficiency; this would include the “Flex Your Power” campaign run by the IOUs to increase consumer awareness of energy efficiency in general (not just for new homes). Along with incentives, the advertising and outreach encourages the builders’ own marketing in order to associate themselves with the brand and differentiate themselves from competitors; the builders’ own marketing, in turn, contributes to consumer awareness. In time, increased awareness leads to increased demand, which feeds more builder marketing as builders perceive this demand.

Eventually, increased consumer demand, along with economies of scale, demonstrates feasibility, and increased builder knowledge leads to conditions in which the practices the utility is promoting are adopted by a significant minority or even a majority of builders. This means the practices are within the capabilities of builders to achieve, and that the market is ready for a code upgrade. This market readiness contributes to the code being upgraded, which in turn feeds back to the mandatory side of the market and provides a new efficiency floor against which new voluntary criteria can be established. Hence, the utilities’ programs can be viewed as part of the market, not simply as an addition to it.

The three ways that the IOU programs lead to the ultimate goal of reduced energy use, demand, and emissions are through improved compliance with existing code, facilitation of construction that is more efficient than required by the current code, and making the market ready for code upgrades. Ultimately, program activities are aimed at achieving savings in at least one of these three ways.

### **2.3. Indicators of Expected Outcomes and Links to the IOU Programs**

The key elements of the IOUs’ RNC programs are efficiency criteria, incentives for meeting those criteria, research and development, case studies, training, and advertising and outreach. The positioning of these elements next to the market elements in Figure 2.2-2 indicates that the programs are meant to feed into and leverage activities and relationships that already exist in the market.

Table 2.3-1 below shows the links corresponding to the numbered arrows in Figure 2.2-1 and Figure 2.2-2, indicators of expected outcomes, and the sources for measuring the key indicators. There can be more than one indicator of an expected outcome, just as different outcomes can be associated with a single indicator. Outcomes, links, or indicators added since the scoping study are denoted with a + and those modified since the scoping study are denoted with a #.

**Table 2.3-1: Logic Model of Expected Outcomes, Links, Indicators, and Sources for Measurement**

<b>Link/Indicator number</b>	<b>Expected Outcome, Link, Indicators</b>	<b>Sources</b>
<i>Outcome</i>	<i>Increased efficiency through other voluntary programs</i>	
<b>1</b>	<b>IOU programs leverage other voluntary efficiency programs</b>	
1A	Managers of other efficiency programs say that some of their efficiency criteria are based on the IOU program criteria	Interviews with managers of other voluntary programs
1B	Managers of other efficiency programs say that the IOU programs increase participation in their programs	Interviews with managers of other voluntary programs
<i>Outcome</i>	<i>Decreased design, equipment, and installation costs</i>	
<b>2</b>	<b>IOU incentives for builders, leveraging other available incentives, decrease the cost of increased efficiency</b>	
2A	Builders report that the IOU incentives combined with other incentives have significantly decreased the incremental costs for efficient technologies	Interviews with builders
2B	Distributors report that the IOU incentives combined with other incentives have significantly decreased incremental costs for efficient technologies	Interviews with distributors; Historical trends in measure costs
<i>Outcome</i>	<i>Increased builder marketing of efficiency</i>	
<b>3#</b>	<b>IOU incentives for builders induce them to increase their marketing of efficiency</b>	
3A	Builders report increasing their marketing of efficiency because of IOU programs and incentives	Interviews with builders
<b>9</b>	<b>IOUs' advertising and outreach causes builders to increase their own marketing of efficiency</b>	
9A	Many builders market energy efficiency as a feature of their homes because of IOUs' advertising and outreach	Interviews with builders
<b>13</b>	<b>Increased home buyer demand for energy efficiency causes an increase in builder marketing of efficiency</b>	
13A	Builders perceive an increase in home buyer demand for efficiency and, therefore, increase their marketing of it	Interviews with non-participating builders; Historical trends in builder perceptions
<i>Outcome</i>	<i>More efficient design</i>	
<b>4</b>	<b>Program Plan Check catches and corrects modeling errors on participating homes. The feedback educates Title 24 consultants, which improves their modeling</b>	
4A	Title 24 consultants, builders, and HVAC contractors say Program Plan Check catches modeling errors on participating homes	Interviews with Title 24 consultants, builders, and HVAC contractors

<b>Link/Indicator number</b>	<b>Expected Outcome, Link, Indicators</b>	<b>Sources</b>
4B	Title 24 consultants, builders, and HVAC contractors say Program Plan Check has helped improve their modeling of non-participating homes	Interviews with Title 24 consultants, builders, and HVAC contractors
<b>31+</b>	<b>IOU Training of Title 24 consultants leads to more efficient designs</b>	
31A	Title 24 consultants say they have attended IOU training and that it has influenced their recommendations of energy-efficient building practices and technologies	Interviews with Title 24 consultants
<b>Outcome</b>	<b><i>Builders adopt leading-edge practices</i></b>	
<b>5</b>	<b>IOUs' R&amp;D of new technologies and practices and CASE studies on their deployment show builders that the new technologies and practices are feasible</b>	
5A	Builders and Title 24 consultants are aware of IOUs' R&D and CASE studies, leading to adoption of new technologies and practices	Interviews with builders and Title 24 consultants
<b>Outcome</b>	<b><i>Increased builder knowledge</i></b>	
<b>6</b>	<b>IOU training of builders and subcontractors in new technologies and practices leads to increased knowledge</b>	
6A	Many builders and their subcontractors become more knowledgeable about new technologies and practices through IOU training	Interviews with builders, HVAC subcontractors, HERS raters, and Title 24 consultants; Historical trends in builder knowledge
<b>Outcome</b>	<b><i>Improved code compliance</i></b>	Onsite inspections; Training of code officials is to be addressed by the Local Government Impact Evaluation.
<b>7#</b>	<b>IOU-sponsored training of code officials leads to improved compliance with the building code</b>	
7A	The incidence of compliance is higher in municipalities whose code officials have received PG&E-sponsored compliance training	To be addressed by Local Government Program Impact Evaluation
<b>14#</b>	<b>Increased builder knowledge leads to greater code compliance</b>	
14A#	Builders and other market actors say the IOU programs have helped to improve code compliance	Interviews with builders, Title 24 consultants, HERS raters, HVAC contractors, and local building officials
<b>15#</b>	<b>Improved design leads to improved compliance</b>	
15A	Title 24 consultants, builders, and HVAC contractors say the IOU programs have helped them to learn more about modeling and improve the compliance of non-participating homes	Interviews with Title 24 consultants, builders, and HVAC contractors
<b>34+</b>	<b>Use of HERS ratings leads to improved compliance</b>	
34A	HERS raters say the IOU programs have influenced the use of QII in improving the compliance of non-program homes	Interviews with HERS raters

<b>Link/Indicator number</b>	<b>Expected Outcome, Link, Indicators</b>	<b>Sources</b>
<b>Outcome</b>	<b><i>Above code practices in program homes are verified</i></b>	
<b>8</b>	<b>HERS rating requirements for program participation ensure that above-code practices promoted through the program are implemented in program homes</b>	
8A	On-site inspections of participating homes shows that above-code practices are implemented	NC/CS Evaluation
<b>Outcome</b>	<b><i>Increased home buyer awareness of energy efficiency</i></b>	
<b>10</b>	<b>IOUs' advertising and outreach increases home buyers' awareness of energy efficiency and associated benefits</b>	
10A	Home buyers become more aware of energy efficiency as an important feature of new homes, hearing about it from IOUs' advertising and outreach	Survey of non-participating home buyers; Historical trends in home buyer awareness
<b>11</b>	<b>Builders' marketing increases home buyers' awareness of energy efficiency and associated benefits</b>	
11A	Home buyers become more aware of energy efficiency as an important feature of new homes, hearing about it from builders	Survey of non-participating home buyers; Historical trends in home buyer awareness
<b>Outcome</b>	<b><i>Increased home buyer demand and willingness to pay</i></b>	
<b>12#</b>	<b>Increased home buyer awareness causes an increase in home buyer demand for energy efficiency and an increase in willingness to pay</b>	Survey of non-participating home buyers; Historical trends in home buyer attitudes
12A#	Home buyers ask builders about the IOU programs	Survey of non-participating home buyers; Historical trends in home buyer attitudes
12B#	Home buyers seek IOU program homes	Survey of non-participating home buyers; Historical trends in home buyer attitudes
<b>Outcome</b>	<b><i>Appraisers and lenders assign value to efficiency</i></b>	
<b>24</b>	<b>Increased home buyer demand for energy efficiency causes appraisers to assign value to efficiency and lenders to provide energy-efficient mortgages (EEMs), which, in turn, increases home buyer demand</b>	
24A	Appraisers and lenders perceive an increase in home buyer demand for efficiency and, respectively, assign more value to it and make more EEMs available	Not addressed because Scoping Study suggested appraisers and lenders were not influential in efficiency levels of new homes

<b>Link/Indicator number</b>	<b>Expected Outcome, Link, Indicators</b>	<b>Sources</b>
24B	Home buyers are aware of appraisers assigning value to efficiency and lenders providing EEMs, which increases home buyer demand	Not addressed because Scoping Study suggested appraisers and lenders were not influential in efficiency levels of new homes
<i>Outcome</i>	<i>Increased above-code practices#</i>	Onsite inspections; Historical trends in energy-efficiency technologies and practices; Interviews with builders, Title 24 consultants, HERS raters, and HVAC contractors
<b>16#</b>	<b>The decreased cost of energy-efficient technologies and practices leads to their adoption by an increasing number of builders</b>	
16A	Builders and distributors report decreases costs of energy-efficient technologies and practices as a factor encouraging their use	Interviews with distributors and builders
<b>18</b>	<b>Improved design leads to increased above-code practices</b>	
18A#	Title 24 consultants say that they have attended IOU training and that it has influenced their recommendations of energy-efficient building practices and technologies	Interviews with Title 24 consultants
<b>19</b>	<b>The demonstration of feasibility of energy-efficient technologies and practices leads to their adoption by an increasing number of builders</b>	
19A	Builders and Title 24 consultants who are aware of IOUs' R&D and CASE studies are more likely than others to try the new technologies and practices	Interviews with builders and Title 24 consultants
<b>20</b>	<b>Increased knowledge about energy-efficient technologies and practices leads to their adoption by an increasing number of builders</b>	
20A	Builders, Title 24 consultants, HERS raters, and subcontractors who became knowledgeable about new energy-efficient technologies and practices (directly or indirectly) through IOUs' training are more likely than others to try the new technologies and practices	Interviews with builders, Title 24 consultants, and HVAC contractors
<b>21#</b>	<b>Verification of efficiency levels in program homes by HERS raters assures above-code practices in those homes</b>	
21A#	On-site visits show that above-code practices and technologies certified by HERS raters in program homes have in fact occurred	NC/CS Impact Evaluation
<b>22</b>	<b>Increased marketing of efficiency by some builders leads other builders to adopt energy-efficient technologies and practices</b>	
22A	Builders who are aware of increased marketing of efficiency by other builders are more likely than others to try the new technologies and practices	Interviews with builders and HVAC contractors
<b>33+</b>	<b>Other voluntary programs lead to increased use of efficient technologies and practices</b>	
33A	Managers of other voluntary energy efficiency programs say the IOU programs have contributed to an increased use of efficient technologies and practices	Interviews with other program managers
<i>Outcome</i>	<i>The market is ready for a code upgrade</i>	

<b>Link/Indicator number</b>	<b>Expected Outcome, Link, Indicators</b>	<b>Sources</b>
<b>25</b>	<b>Enough builders are using energy-efficient technologies and practices such that the market is prepared for a code upgrade</b>	
25A	The incidence of energy-efficient technologies and practices becomes a significant part of the market	Onsite inspections; Historical trends in energy-efficiency technologies and practices; Interviews with builders, Title 24 consultants, HERS raters, and HVAC contractors
25B	Builders and industry experts indicate that there is enough knowledge and availability of efficient technologies and practices in the marketplace that the code could be upgraded and most builders could comply within a reasonable time	Interviews with builders, Title 24 Consultants, HERS raters, and HVAC contractors
25C+	Builders and industry experts say that utility programs have contributed to market readiness for a code upgrade	Interviews with builders, Title 24 consultants, HERS raters, and HVAC contractors
<b>26</b>	<b>Improved compliance with the current code helps prepare the market for a code upgrade</b>	
26A	Builders, industry experts and local code officials say that compliance with the current code has reached the point where builders at the low end of the market could comply with a new upgrade within a reasonable time	Interviews with builders, Title 24 Consultants, HERS raters, HVAC contractors, and local code officials
26B+	Builders and industry experts say the IOU programs have helped to increase code compliance	Interviews with builders, Title 24 consultants, and code officials/inspectors
26C+	Builders and industry experts say the IOU programs have contributed to market readiness for a code upgrade	Interviews with builders, Title 24 consultants, HERS raters, and HVAC contractors
<b>Outcome</b>	<b><i>Code upgraded; efficiency gains consolidated</i></b>	
<b>27</b>	<b>The market proves ready and the code is upgraded</b>	
27A#	Industry experts attribute code upgrades to the IOU programs	Interviews with industry experts
27B	Utility measures incentivized in the 2006-2008 programs are part of the 2008 code, or are in the draft language for the 2011 code.	Review of program incentives; review of 2008 code and draft language for 2011 code
27C+	Industry experts attribute code upgrades to the readiness of the market	Interviews with industry experts
<b>Outcome</b>	<b><i>Reduced energy use, demand, and emissions</i></b>	<b><i>Phase II of project</i></b>
<b>28</b>	<b>Improved compliance with existing code leads to reduced energy use, demand, and emissions</b>	
28A	Energy use and associated emissions as well as demand in non-program homes are lower than in the baseline, non-program case	Phase II of project

<b>Link/Indicator number</b>	<b>Expected Outcome, Link, Indicators</b>	<b>Sources</b>
<b>29</b>	<b>Increased use of energy-efficient technologies and practices in non-program homes, above the current code, leads to reduced energy use, demand, and emissions</b>	
29A	Energy use and associated emissions as well as demand in non-program homes are lower than in the baseline, non-program case	Phase II of project
<b>30</b>	<b>An upgrade in the building code leads to reduced energy use, demand, and emissions</b>	
30A	Energy use and associated emissions as well as demand in non-program homes are lower than in the baseline case without a code upgrade	Phase II of project

## 2.4. Alternative Explanations for Market Changes

The above program theory explicates the expected outcomes of program activity and indicators to measure those outcomes. Attributing the observed changes to the IOU programs requires an additional step, which is to examine the extent to which other factors, outside the programs, could explain the observed market changes. The following are some additional factors that the team examined in this study:

- Other programs that are already available in the marketplace could be driving increased efficiency independently of the IOU programs and could have led to the observed market changes.
- Outside forces, such as gasoline prices, housing market cycles, and global warming, that could be driving demand for efficiency and which could have led to the observed market changes, independently of the IOU programs and other voluntary programs.
- The market could be developing at a “natural” rate, and the observed market changes could have happened in the absence of the IOU programs and other voluntary programs.

### 3. Historical Trends

The research on historical trends summarized here was conducted outside the RNC Market Effects Study, including research conducted by IOUs, and research conducted as part of the NC/CS evaluation focusing on the 2006-2008 program years. These trends are as follows:

- The use of energy efficient technologies and practices in homes built under the 1995, 1998, 2001, and 2005 standards.<sup>47</sup> The analysis included an overview of the number of single-family homes permitted in California between 1998 and 2008 (including homes built through the IOU RNC programs), and trends in energy-efficient technologies and practices, including: square footage, number of stories, basic equipment saturations, average SEER, average AFUE, types of water heaters, average energy factor of gas-storage water heaters, wall and ceiling insulation, presence of radiant barriers, and average duct leakage. The information was based on IOU program data tracking, previous IOU and CPUC reports, and other secondary sources, as well as on-site analysis of the characteristics new homes conducted in 2008 and 2009 for the CPUC's Residential New Construction Impact Evaluation.
- Historical trends in incremental costs of efficiency measures, based on IOU estimates from 2003 through 2008.

In addition, Appendix B provides historic trends in awareness and attitudes of builders, other market actors, and homebuyers from research conducted by the IOUs in previous years. However, there were seldom enough data from this research for any specific indicators to construct meaningful time series; where possible, findings from past studies are compared with 2008 findings in Chapter 4.

#### 3.1. Historical Trends in RNC Efficiency Practices in California

This section discusses how the installation of energy-efficient measures and practices in newly built single-family homes<sup>48</sup> has evolved over time, including homes built under California's 1995, 1998, 2001, and 2005 building standards. The remainder of the section contains the following elements:

- An overview of the number of single-family homes permitted in California between 1998 and 2007 as well as an estimate of new homes for which rebates were issued for homes

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<sup>47</sup> Title 24 is known as the California Building Standards Code, so specific requirements would be "standards," and the overall requirements, collectively, would be "code."

<sup>48</sup> Homes surveyed include primarily detached single-family homes and some attached single-family homes.



participating in either the California IOU programs (only whole-house participants<sup>49</sup> are shown) or the ENERGY STAR New Homes Program (In 2004-2005, these programs overlapped significantly.)

- How the sample design was developed and the number of complete homes by strata and study
- A high-level summary of what is required under various Title 24 standards over time and reference points for use in comparing measure-specific results contained later in the report
- General and measure-specific trends over time including: square footage, number of stories, basic equipment saturations, average SEER, average AFUE, types of water heaters, average energy factor of gas-storage water heaters, wall and ceiling insulation, presence of radiant barriers, and average duct leakage.

### 3.1.1. Overview

Below is a brief overview of the RNC market over the last ten years as well as the sample frames and number of completed on-sites conducted under the three previous RNC Baseline Studies<sup>50</sup> and the current 2008 Residential New Construction Baseline Study being conducted as part of the New Construction/Codes and Standards (NCCS) Evaluation.

### 3.1.2. Newly Built Single-Family Homes over Time

Table 3.1-1 and Figure 3.1-1 present the total number of single-family homes built in California by year since 1998.<sup>51</sup> Table 3.1-1 (column 3) also presents the number of homes that were rebated by the California IOUs between 2002 and 2007 for reaching at least 15% above the Title 24 standards that were effective at the time the home was permitted. Prior to 2002, the California IOUs primarily rebated prescriptive measures.<sup>52</sup>

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<sup>49</sup> Whole-house participants are those whose builders received incentives for achieving efficiency 15% (Tier 1) or 35% (Tier 2) above Title 24 standards. Homes whose builders received measure-specific incentives are not included.

<sup>50</sup> See RER (2001) for details of the sample design.

<sup>51</sup> Construction Industry Research Board (CIRB).

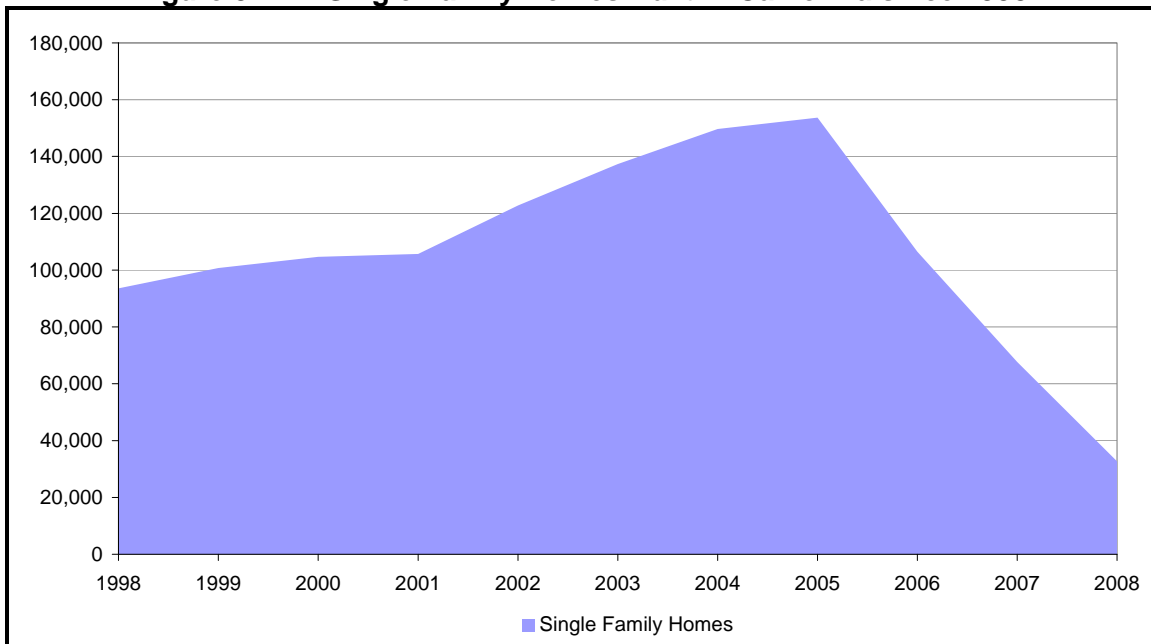
<sup>52</sup> Participant data were collected from the following sources: RLW Analytics, 2006; RLW Analytics, 2007 and California IOU program tracking data for 2006-2007.

The table (column 2) shows the number of homes that were built under the ENERGY STAR Homes program for the same time period. Prior to the 2004, the IOUs worked closely with the EPA to develop the California ENERGY STAR Homes specifications. The IOUs' 2004-2005 RNC programs even incorporated ENERGY STAR in the name of the statewide program: ENERGY STAR New Homes Program (CESNHP). As inferred from the table below, there is a significant overlap between the participants in the ENERGY STAR New Homes Program and participants in the IOU programs' (Harcharik, Wolf, & Blanke, 2006).

When reviewing the table, it is important to point out that there are inherent time lags in the data presented. The CIRB represents permit data, which for single-family homes can have a lag of six months to two years before the home is completed; typically, a six-month lag is assumed.

Regarding the Whole House Participants column, between 2002 and 2005, the numbers represent the number of participant homes that were committed under the IOU programs, not actually constructed during that time frame. However, for the 2006-2008 program cycle, the CPUC required the IOUs to only report units that were completed. Therefore, the decline in the number of Whole House Participants and the decline in the percentage of all new homes built in the IOU Territories that were Whole House Participants in 2006 and perhaps in 2007 may be partially due to changes in reporting requirements.

**Figure 3.1-1: Single Family Homes Built in California since 1998**



**Table 3.1-1: California Single-Family Home Construction and Participation in IOU RNC Programs**

Year	ENERGY STAR Homes	Whole House Participants in IOU RNC Programs	Whole House Participants, % of New Home Market	All New Homes Built in IOU Territories	All New Homes*
1998	38			93,585	94,236
1999	612			100,800	101,615
2000	567			104,673	105,546
2001	1,563			105,727	106,498
2002	6,450	1,043	0.8%	122,741	123,815
2003	15,291	5,807	4.2%	137,407	138,706
2004	14,455	13,461	9.0%	149,676	151,332
2005	18,956	17,652	11.5%	153,667	155,222
2006	18,534	419	0.4%	106,479	107,939
2007	6,365	1,226	1.8%	67,645	68,348
2008	Not Avail.	3,947	12.1%	32,664	33,204

\* Data represents new permits. Data collected from the Construction Industry Research Board (CIRB).

Source for ENERGY STAR Homes: Unpublished data provided by ENERGY STAR for New Homes Team; data for 2007 are through September 2007

The column "Whole House Participants, % of New Home Market" is the ratio of Whole House Participants in IOU RNC Programs to All New Homes Built in IOU Territories.

### 3.1.3. On-Site Sample Frames

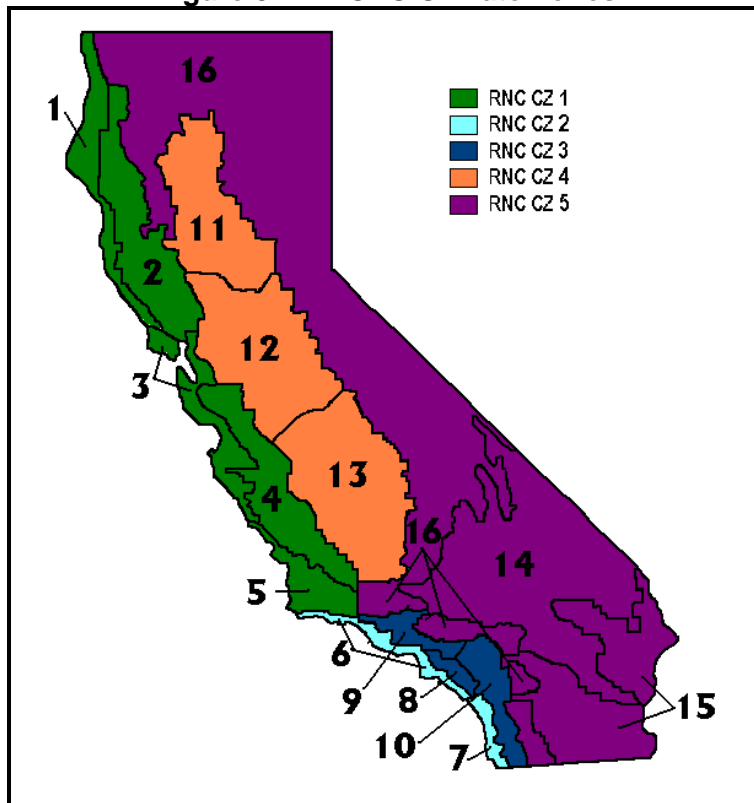
The new construction sample frames were developed using customer frame data provided by the IOUs. For each study, the sample frame was designed to include only homes built under the 1995, 1998, 2001, and 2005 standards. As explained above, there is a lag between when a new Standard goes into effect and when the first homes permitted under that Standard are completed. Therefore, each study has attempted to find a date range where most homes are built under a particular Standard. For example: homes built under the 1995 standards were defined as those first occupied between July 1, 1998 and June 30, 1999. Homes built under the 1998 standards were defined as those first occupied between July 1, 1999 and June 30, 2000. Homes built under the 2001 standards were defined as those first occupied after January 1, 2003, and homes built under the 2005 standards are defined as those first occupied after April 1, 2006.

- **Residence Type.** Each utility has a residence type indicator in its billing frame. These definitions vary widely and, at best, could be aggregated only into single-family and multifamily designators. This report includes data only for single-family residences.
- **CEC Climate Zone.** As shown in Figure 3.1-2, there are 16 CEC Climate Zones in California. (The 16 CEC Climate Zones used for this analysis are not the CEC Forecasting

Climate Zones; they are the 16 Climate Zones used in the Title 24 standards.)<sup>53</sup> For this report, these zones were collapsed into five regions. The criterion for the aggregation of the climate zones was that the Title 24 requirements across these climate zones be the same or vary in only one component. Figure 3.1-3 presents the normalized heating and cooling degree day ranges (HDD and CDD) for each climate zone.<sup>54</sup> Using this approach, climate zones were aggregated as follows:

- Region 1 encompasses CEC Climate Zones 1, 2, 3, 4, and 5
- Region 2 encompasses CEC Climate Zones 6 and 7
- Region 3 encompasses CEC Climate Zones 8, 9, and 10
- Region 4 encompasses CEC Climate Zones 11, 12, and 13
- Region 5 encompasses CEC Climate Zones 14, 15, and 16

**Figure 3.1-2: CEC Climate Zones**

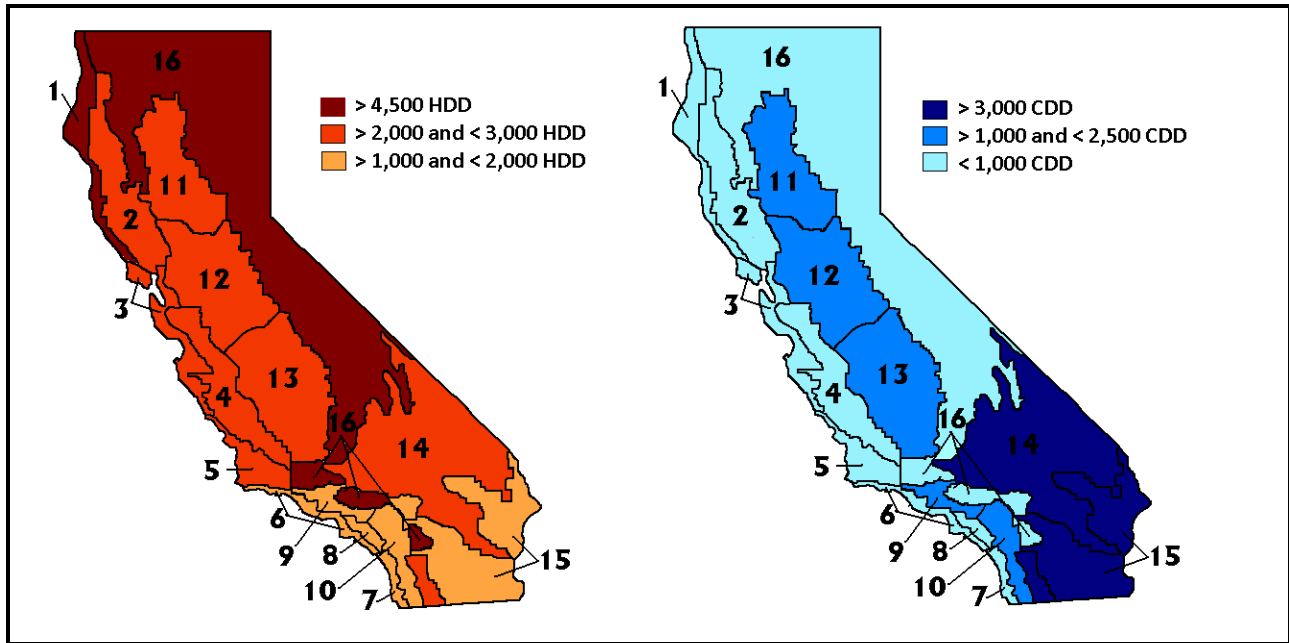


Source: California Energy Commission.

<sup>53</sup> 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.

<sup>54</sup> Normalized weather was developed using the rank-and-average method using ten years of actual weather data (1998-2007). HDDs and CDDs were calculated using a 65° base.

**Figure 3.1-3: CEC Climate Zones by Heating Degree Days and Cooling Degree Days**



In each Baseline Study conducted, attempts were made to visit homes built under specific standards. However, there may be some homes visited in each study that were actually permitted under an earlier standard. This may be the case for homes built in late phases of large tracts where the permits could have been applied for years before the home visited was actually built. The only way to ensure that a home was built under a specific standard is to obtain CF-1R or C-2R forms from the local building department. Since building departments are not required to keep these forms for very long and are typically very short-handed, it is difficult to find the forms for a specific home.

Table 3.1-2 presents a summary of the number of homes surveyed under the last four baseline studies. Each Baseline Study attempted to survey homes built under specific Title 24 standards. However, it is important to point out that it was not possible to ascertain whether every home visited was, in fact, permitted under the standards for which the data were collected. The number of completed on-site surveys of the homes built under the 2005 Title 24 standards in the table below represents on-sites completed to date (267). Approximately 470 on-sites will be completed by the end of the study.<sup>55</sup>

In each Baseline Study conducted, attempts were made to visit homes built under specific standards. However, there may be some homes visited in each study that were actually permitted under an earlier standard. This may be the case for homes built in late phases of large tracts

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<sup>55</sup> While each Baseline Study used a proportional random sample design based on the number of homes built by IOU and Climate Region, some studies additionally oversampled some regions in order to obtain a certain precision.

where the permits could have been applied for years before the home visited was actually built. The only way to ensure that a home was built under a specific standard is to obtain CF-1R or C-2R forms from the local building department.<sup>56</sup> Since building departments are not required to keep these forms for very long and are typically very short-handed, it is difficult to find the forms for a specific home.

**Table 3.1-2: Completed On-Site Surveys of Single Family Homes by Study Year**

<b>Analysis Parameter Description</b>	<b>Statewide</b>	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>
<b>PG&amp;E</b>						
Homes Built under 1995 Standards	<b>286</b>	118	-	-	164	4
Homes Built under 1998 Standards	<b>297</b>	96	-	-	198	3
Homes Built under 2001 Standards	<b>307</b>	44	-	-	260	3
Homes Built under 2005 Standards	<b>77</b>	18	-	-	56	3
<b>SCE</b>						
Homes Built under 1995 Standards	<b>242</b>	-	34	160	16	32
Homes Built under 1998 Standards	<b>193</b>	-	31	126	-	36
Homes Built under 2001 Standards	<b>211</b>	1	25	119	27	39
Homes Built under 2005 Standards	<b>124</b>	-	12	61	9	42
<b>SDG&amp;E/SCG</b>						
Homes Built under 1995 Standards	<b>94</b>	-	78	16	-	-
Homes Built under 1998 Standards	<b>71</b>	-	53	18	-	-
Homes Built under 2001 Standards	<b>84</b>	-	66	18	-	-
Homes Built under 2005 Standards	<b>66</b>	-	39	27	-	-
<b>Total</b>						
Homes Built under 1995 Standards	<b>622</b>	118	112	176	180	36
Homes Built under 1998 Standards	<b>561</b>	96	84	144	198	39
Homes Built under 2001 Standards	<b>602</b>	45	91	137	287	42
Homes Built under 2005 Standards	<b>267</b>	18	51	88	65	45

\* As mentioned above, not every home included was necessarily permitted under the specific Standard, but rather during the time frame for which it assumed that nearly all homes were built under that Standard.

<sup>56</sup> CF-1R and C-2R forms are compliance documentation that contains information on the types and efficiencies of the equipment planned to be installed in a new home. This documentation also contains information on when the permit was filed and which Title 24 Standard it was submitted to comply with. The specific form required to be submitted has changed under various versions of the Residential Title 24 Standards.

### 3.1.4. Reference Basis for Evaluating Energy Efficiency Building Characteristics and Practices

The following sections provide a description of the prescriptive requirements of Title 24 and the different bases that can be used to analyze the data—statewide, CEC climate zones, region, glazing performance groups, and utility service areas. These reference points provide a backdrop for the analysis of typical building characteristics and practices in the RNC sector. Further, as will be discussed in a later section, the statewide, utility, and climate zone breakouts provide useful insights for the compliance analysis.

#### ***Building Shell Prescriptive Requirements by CEC Climate Zone***

Prescriptive Package D values for construction features affecting energy efficiency are presented in Table 3.1-3 and Table 3.1-4 for the 16 CEC climate zones.<sup>57</sup> These values provide a basis for assigning values to the current construction practices. Values are given for ceiling insulation, wall insulation, glazing percentage (versus total conditioned floor area), minimum glazing U-values, maximum allowable Solar Heat Gain Coefficients (SHGC, defined below) for the 1998 and 2001 standards and maximum allowable Shading Coefficient (SCs)<sup>58</sup> for the 1995 standards. Also provided in the table are those CEC climate zones where Prescriptive Package D under the 2001 and 2005 standards required radiant barrier and/or thermostatic expansion valves (TXVs).<sup>59</sup> The 2005 standards included several changes from the 2001 standards, including the hardwired lighting standard,<sup>60</sup> the requirement to use Time Dependent Valuation (TDV) rather than source energy in determining compliance using the performance method,<sup>61</sup> increased standard energy factor for 50-gallon gas water heaters from 0.53 to 0.58, and R-6 and R-8 duct insulation requirements in some climate zones (Harcharik Wolf, & Blanke, 2006).

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<sup>57</sup> Prescriptive Package D is the baseline that the whole-house approach uses. The model compares the modeled usage of the house to the modeled usage of the same house with Package D. The difference is the compliance margin. See section 2.1.1 for more details.

<sup>58</sup> SC is a measure of the ability of a window or skylight to transmit solar heat, relative to that ability for 1/8-inch clear, double-strength, single-pane glass. It is being phased out in favor of the solar heat gain coefficient, and is approximately equal to the SHGC multiplied by 1.15. It is expressed as a number without units between 0 and 1. The lower a window's solar heat gain coefficient or shading coefficient, the less solar heat it transmits, and the greater is its shading ability. Source: <http://www.efficientwindows.org/glossary.cfm>

<sup>59</sup> Air conditioning system performance is dependent on proper refrigerant charge and airflow across the coil. TXVs mitigate the problems of improper refrigerant charge and airflow by making the system operate at its rated efficiency.

<sup>60</sup> The hardwired lighting standard includes more stringent requirement for efficacy of lamps and a requirement that at least 50% of the installed lighting wattage in the kitchen must be high efficacy luminaires, For more information see Chapter 5.

<sup>61</sup> With TDV, high efficiency measures that reduce peak energy (i.e., air conditioners) are favored over those that reduce non-peak energy (i.e., furnaces)

## **Windows**

Two values are used to rate window performance: U-value and SHGC. The U-value is a measure of a window's thermal performance. The lower the U-value, the greater a window's resistance to heat flow and the better its insulating value. SHGC measures how well a product transmits sunlight. SHGC is the fraction of incident solar radiation admitted through a window, both directly transmitted and absorbed and subsequently released inward. The lower a window's SHGC, the less heat transmitted.

Since U-values and SHGCs were not observed during the on-site visits, the analysis of window efficiency focuses on the types of windows installed. Based on a review of every possible combination of window type, the most predominant types of windows were:

- Low-E glass, double pane, vinyl/wood frame<sup>62</sup>
- Low-E glass, double pane, metal frame
- Clear glass, double pane, vinyl/wood frame
- Clear glass, double pane, metal frame

## ***Equipment Minimum Standards***

The parameters used to measure energy efficiency and the current federal energy efficiency standards for furnaces, air conditioners, and water heaters are presented below.

## **Furnaces**

The energy efficiency of furnaces is expressed as a percentage of Annual Fuel Utilization Efficiency (AFUE). Equipment AFUEs increase as energy efficiency increases. The federal minimum AFUE standard for gas furnaces is 78%.<sup>63,64</sup> Units must have at least a 90% AFUE to qualify for the ENERGY STAR label.

## **Air Conditioners**

The cooling-efficiency rating used to rate central air conditioners is the Seasonal Energy Efficiency Ratio (SEER). A higher SEER rating indicates more efficient cooling equipment. Typical SEER ratings range from 10 to 15, but some manufacturers claim to have units above 20 SEER. The federal minimum AFUE standard for central air conditioners was raised to 13 SEER in 2006.

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<sup>62</sup> Low-emittance (Low-E) coating are microscopically thin, virtually invisible, metal or metallic oxide layers deposited on a window or skylight glazing surface primarily to reduce the U-factor by suppressing radiative heat flow. <http://www.efficientwindows.org/lowe.cfm>

<sup>63</sup> Code of Federal Regulations. Title 10, Chapter II, Subpart C, Part 430, Section 430.32.

<sup>64</sup> Required efficiency for residential central gas furnaces that are less than 225 kBtu/hr.



## **Water Heaters**

The energy efficiency of water heaters is expressed as an energy factor rating (EF). Water heater EFs vary by storage tank size and fuel type.<sup>65</sup> Therefore, to standardize for tank size, the standard efficiency was calculated for each gas-storage water heater in the sample. The percent-above-standard was computed for each water heater observed in the on-site surveys. The formula used for these calculations is:

$$\% \text{AboveStd}_i = \frac{(Eff_i - StdEff_i)}{StdEff_i} \text{ }^{66}$$

where

$Eff_i$  = Actual efficiency rating of unit  $i$ , and

For homes built prior to the 2005 standards:

$$StdEff_i = 0.62 - (0.0019 \times (TankVolume_i)).$$

For homes built under the 2005 standards:

$$StdEff_i = 0.67 - (0.0019 \times (TankVolume_i)).$$

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<sup>65</sup> *Ibid.*

<sup>66</sup> This standard efficiency equation is applicable for residential gas water heaters with a tank size of more than or equal to 20 gallons and an input rating of less than or equal to 75,000 Btu/hr.

**Table 3.1-3: Prescriptive Package D Requirements by CEC Climate Zone**

CEC CZ	Glazing Percent		Glazing U-Value		SC	SHGC	
	1995, 1998, and 2001 Standards	2005 Standards	1995, 1998, and 2001 Standards	2005 Standards	1995 Standards	1998 Standards	2001 and 2005 Standards
1	16	20	0.65	0.57		0.66 (All)	
2	16	20	0.65	0.57		0.66 (All)	0.40
3	20	20	0.75	0.67		0.66 (All)	
4	20	20	0.75	0.67		0.66 (All)	0.40
5	16	20	0.75	0.67		0.66 (All)	
6	20	20	0.75	0.67		0.66 (All)	
7	20	20	0.75	0.67		0.66 (All)	0.40
8	20	20	0.75	0.67	0.40 (W/E)	0.40 (W/E) 0.66 (S/N)	0.40
9	20	20	0.75	0.67	0.40 (W/E)	0.40 (W/E) 0.66 (S/N)	0.40
10	20	20	0.65	0.57	0.40 (W/E)	0.40 (W/E) 0.66 (S/N)	0.40
11	16	20	0.65	0.57	0.40 (W/E)	0.40 (W/E) 0.66 (S/N)	0.40
12	16	20	0.65	0.57	0.40 (W/E)	0.40 (W/E) 0.66 (S/N)	0.40
13	16	20	0.65	0.57	0.40 (W/E)	0.40 (W/E) 0.66 (S/N)	0.40
14	16	20	0.65	0.57	0.40 (W/E)	0.40 (W/E) 0.66 (S/N)	0.40
15	16	20	0.65	0.57	0.40 (S/W/E)	0.40 (W/E) 0.66 (S/N)	0.40
16	16	20	0.60	0.55		0.66 (All)	

**Table 3.1-4: Prescriptive Package D Requirements by CEC Climate Zone Cont.**

CEC CZ	Ceiling R-Value	Wall R-Value	Radiant Barrier	TXV	AC Efficiency	Duct Sealing	Duct Insulation
	All Standards	All Standards	2001 and 2005 Standards	2001 and 2005 Standards	2005 Standards	2001 and 2005 Standards	2005 Standards <sup>67</sup>
1	38	21			13 SEER	6%	R-6
2	30	13	Required	Required	13 SEER	6%	R-6
3	30	13			13 SEER	6%	R-6
4	30	13	Required		13 SEER	6%	R-6
5	30	13			13 SEER	6%	R-6
6	30	13			13 SEER	6%	R-4.2
7	30	13			13 SEER	6%	R-4.2
8	30	13	Required	Required	13 SEER	6%	R-4.2
9	30	13	Required	Required	13 SEER	6%	R-6
10	30	13	Required	Required	13 SEER	6%	R-6
11	38	19	Required	Required	13 SEER	6%	R-6
12	38	19	Required	Required	13 SEER	6%	R-6
13	38	19	Required	Required	13 SEER	6%	R-6
14	38	21	Required	Required	13 SEER	6%	R-8
15	38	21	Required	Required	13 SEER	6%	R-8
16	38	21			13 SEER	6%	R-8

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<sup>67</sup> The requirement was R-4.2 prior to the 2005 Standards.

### 3.1.5. Changing Building Practices in the Residential Sector

In the section, “typical construction practices,” as reflected in the survey data from the studies mentioned previously, are compared longitudinally. These comparisons are made at both the state and climate region levels in order to discern region variations in construction practices. Historic construction practices for the following features are summarized below:

- Square footage, number of stories and equipment saturations
- Fenestration
- Space heating systems
- Space cooling systems
- Multiple HVAC systems and thermostat controls
- Water heating
- Shell features (including wall and ceiling insulation and presence of radiant barrier)
- Ducts

#### ***Square Footage and Number of Stories***

Table 3.1-5 presents a summary of the changes in square footage<sup>68</sup> and the number of stories by region for single-family detached homes built under the four different sets of standards. As shown, the average square footage of a single-family home increased between the 1995 and 2001 standards. The largest increase in home size occurred in Region 2, where the average size of a single-family home built under the 2001 standards was 23% larger than the average single-family home built under the 1995 standards. In all regions except for Region 3, the average square footage decreased for homes built under the 2005 standards when compared to homes built under the 2001 standards.<sup>69</sup>

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<sup>68</sup> The square footage reported is for conditioned living spaces and does not include garages.

<sup>69</sup> There are some indications from recent Census Bureau data that the average size of new homes in the U.S. declined slightly in the third quarter of 2008, but there are no clear trends in this decline. <http://www.marketwatch.com/news/story/Say-goodbye-McMansions-homes-getting/story.aspx?guid={AADD01FF-CCEC-4B22-9328-042B81EB6F23}>

**Table 3.1-5: Square Footage and Number of Stories of Single Family Homes**

<b>Analysis Parameter Description</b>	<b>Statewide</b>	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>
<b>Average Square Footage</b>						
Homes Built under 1995 Standards	2,232	2,324	2,353	2,436	1,952	2,179
Homes Built under 1998 Standards	2,329	2,434	2,756	2,502	2,109	2,125
Homes Built under 2001 Standards	2,579	2,542	2,902	2,717	2,473	2,467
Homes Built under 2005 Standards	2,586	2,028	2,496	3,102	2,313	2,398
<b>Average Number of Stories</b>						
Homes Built under 1995 Standards	1.6	1.7	1.9	1.7	1.3	1.2
Homes Built under 1998 Standards	1.5	1.7	1.9	1.7	1.4	1.2
Homes Built under 2001 Standards	1.7	2.0	2.0	1.8	1.6	1.5
Homes Built under 2005 Standards	1.7	2.3	2.3	1.9	1.5	1.3

### ***Fenestration***

Fenestration construction practices for homes built under the four sets of standards, as represented by percent glazing and window type, are discussed in this section.

### **Percent Glazing**

Percent glazing refers to the total glazing area of a home expressed as a percentage of the total conditioned floor area. A lower glazing percentage allows less solar heat gain and less heat loss and is therefore more compliant with the standards. Therefore, “higher performance glazing” is defined as have a lower percent glazing than the amount allowed per Prescriptive Package D.<sup>70</sup> Average percent glazing values are presented in Table 3.1-6 by region. As can be seen, the average percentage of glazing has decreased in all regions for homes built under the 2001 and 2005 standards. (A lower glazing percentage allows less solar heat gain and less heat loss and is therefore more compliant with the standards.)

<sup>70</sup>See Table 3.1-3 for glazing percentages allowed under Prescriptive Package D.

**Table 3.1-6: Percent Glazing of Single Family Homes**

<b>Analysis Parameter Description</b>	<b>Statewide</b>	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>
<b>Percentage of Higher Performance Glazing</b>						
Homes Built under 1995 Standards	64%	62%	65%	96%	44%	39%
Homes Built under 1998 Standards	58%	63%	87%	73%	42%	34%
Homes Built under 2001 Standards	68%	50%	85%	84%	59%	68%
Homes Built under 2005 Standards	91%	83%	81%	98%	91%	91%
<b>Average % Glazing</b>						
Homes Built under 1995 Standards	17.0%	18.0%	19.0%	16.0%	17.0%	17.0%
Homes Built under 1998 Standards	17.4%	18.0%	16.5%	18.0%	16.8%	18.5%
Homes Built under 2001 Standards	15.7%	17.6%	16.3%	15.6%	15.4%	15.0%
Homes Built under 2005 Standards	14.1%	15.5%	15.8%	13.6%	14.2%	13.8%

### **Window Types**

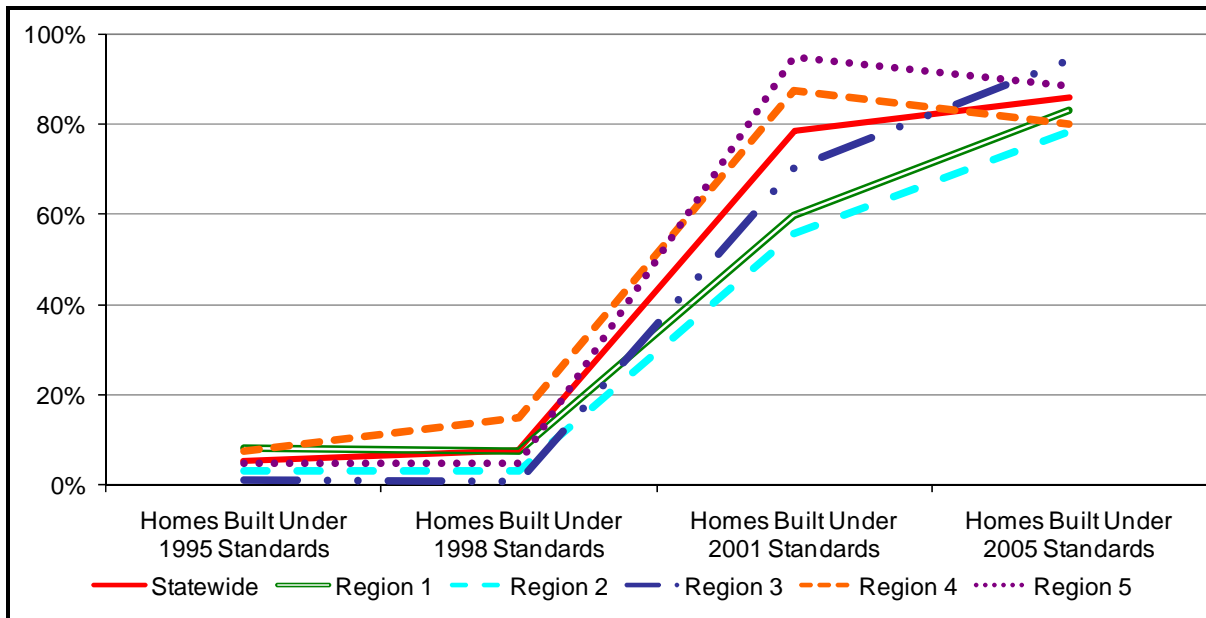
Table 3.1-7 presents the prevalence of vinyl-framed, dual-paned, clear and low-E glass windows for single-family homes built under the four sets of standards. Although there are other types of windows, only these two types are presented because they make up the vast majority of the windows installed in RNC and because they most clearly demonstrate the shift from less efficient to more efficient (low-E) fenestration practices.

**Table 3.1-7: Distribution of Window Types – Detached Single Family Homes**

<b>Window Types</b> (# of panes, frame type, glass type)	<b>Statewide</b>	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>
<b>2-paned Vinyl, Clear Glass</b>						
Homes Built under 1995 Standards	88%	86%	91%	91%	86%	82%
Homes Built under 1998 Standards	75%	86%	99%	97%	48%	97%
Homes Built under 2001 Standards	14%	28%	28%	25%	6%	3%
Homes Built under 2005 Standards	6%	6%	2%	2%	15%	7%
<b>2-paned Vinyl, Low-E</b>						
Homes Built under 1995 Standards	5%	8%	3%	1%	8%	5%
Homes Built under 1998 Standards	8%	7%	-	1%	15%	-
Homes Built under 2001 Standards	79%	60%	56%	70%	87%	95%
Homes Built under 2005 Standards	86%	83%	78%	94%	80%	89%

The percentage of homes built with vinyl-framed, dual-paned, clear glass windows decreased dramatically for homes built under the 2001 standards and then fell again under the 2005 standards, compared to homes built under the two previous standards. Coinciding with the decrease in the vinyl-framed, dual-paned, clear glass windows was an increase in the percentage of vinyl-framed, dual-paned windows with low-E glass. Statewide, only 6% of the homes built under the 2005 standards had clear glass windows, whereas 86% of homes built under the 2005 standards had higher-efficiency windows. The increase in low-E windows is illustrated in Figure 3.1-4.

**Figure 3.1-4: Percentage of Single-Family Homes with Double-Paned Vinyl, Low-E Windows**



### **Fenestration Average U-Values**

As explained above, U-values and SHGCs were not often observed during the on-site visits. Except for the small number of homes where the on-site surveyors found window stickers in other homes being built in the same development, the analysis of window efficiency uses defaults is based on the type of window. Table 3.1-8 presents the defaults used by window type, from which the average U-values were calculated. Results are presented in Table 3.1-9.

**Table 3.1-8: Default Window Thermal Performance Values**

Survey Fields and Descriptions				Default Values	
Frame Type	Number of Panes	Glazing Type	Grids/Muntins	U-Value	SC/SHGC
Vinyl	2	Clear	Yes	0.60	0.88/0.65
Vinyl	2	Low-E	Yes	0.37	0.58/0.41

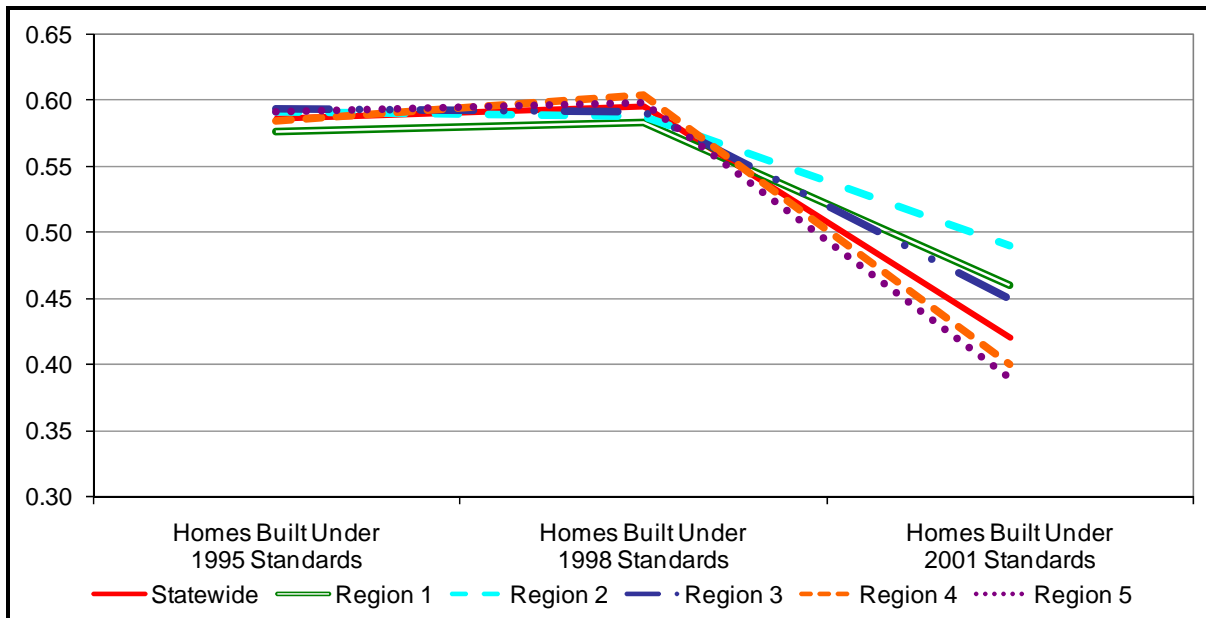
**Table 3.1-9: Average Window U-Values in Single Family Homes**

Analysis Parameter Description	Statewide	Region 1	Region 2	Region 3	Region 4	Region 5
<b>Percentage Higher Performance U-Values</b>						
Homes Built under 1995 Standards	96%	98%	98%	98%	94%	87%
Homes Built under 1998 Standards	85%	95%	100%	99%	68%	90%
Homes Built under 2001 Standards	98%	100%	94%	96%	100%	98%
<b>Average U-Value</b>						
Homes Built under 1995 Standards	0.586	0.576	0.592	0.594	0.584	0.591
Homes Built under 1998 Standards	0.595	0.583	0.589	0.592	0.604	0.598
Homes Built under 2001 Standards	0.420	0.460	0.490	0.450	0.400	0.390



As presented in Table 3.1-9, the average U-value decreased for homes built under the 2001 standards to 0.42 statewide. This can also be seen in Figure 3.1-5. The decrease in the average U-Value is likely due to the increase in the percentage of new home built using vinyl-framed, dual-paned, low-E glass windows, which have a lower U-Value than the less efficient clear glass windows. Unfortunately, average U-values for homes built under the 2005 standards are not yet available.

**Figure 3.1-5: Average Window U-Values in Single Family Homes**



### Space Heating Systems

A summary of space heating system characteristics for units installed in newly constructed homes is discussed in this section. These characteristics include average system efficiencies, system type, and duct location. Efficiency results focus exclusively on gas-fueled systems because there are few electric systems in the sample.

#### Equipment Efficiency

Table 3.1-10 presents a summary of gas space heating system efficiencies for detached single family homes and Figure 3.1-6 shows the average AFUE. Average AFUEs have increased slightly over time. As explained below, this is due to an increase in the installation of high efficiency furnaces (>90 AFUE) in new homes, as opposed to an increase in the installation of mid-range efficiency units (80-90 AFUE).

**Table 3.1-10: Central Gas Space Heating System Efficiency in Single Family Homes**

Analysis Parameter Description	Statewide	Region 1	Region 2	Region 3	Region 4	Region 5
<b>Average Efficiency (AFUE)</b>						
Homes Built under 1995 Standards	80%	80%	80%	80%	81%	80%
Homes Built under 1998 Standards	81%	81%	80%	80%	81%	80%
Homes Built under 2001 Standards	81%	85%	82%	80%	81%	81%
Homes Built under 2005 Standards	83%	84%	82%	81%	84%	83%

**Figure 3.1-6: Average AFUE for Central Gas Space Heating in Single-Family Homes**

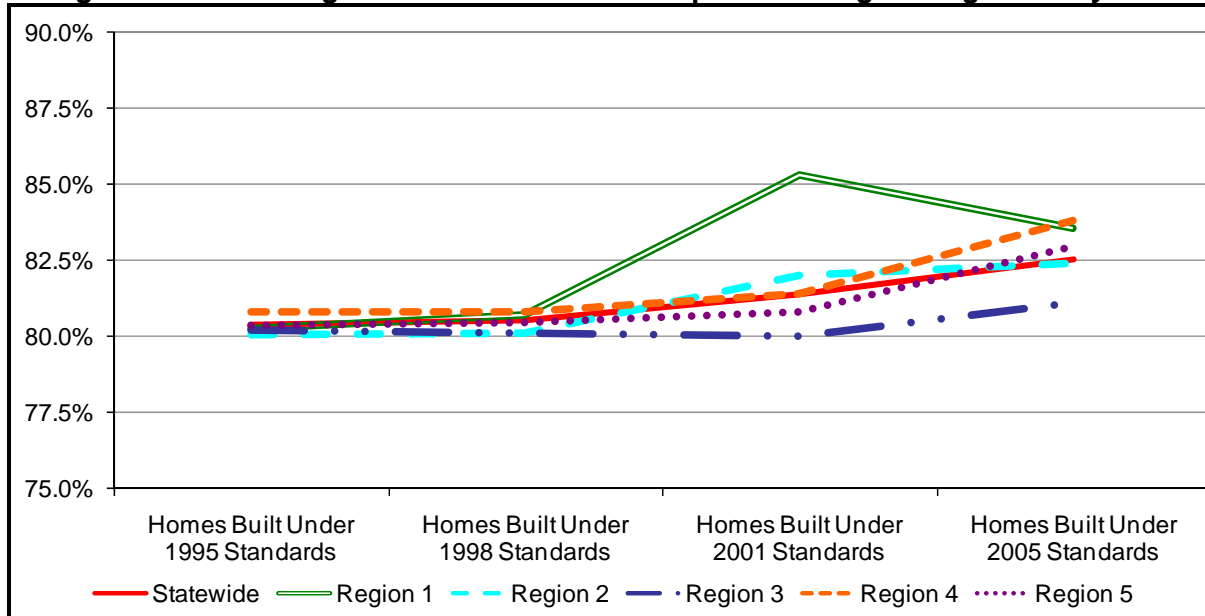


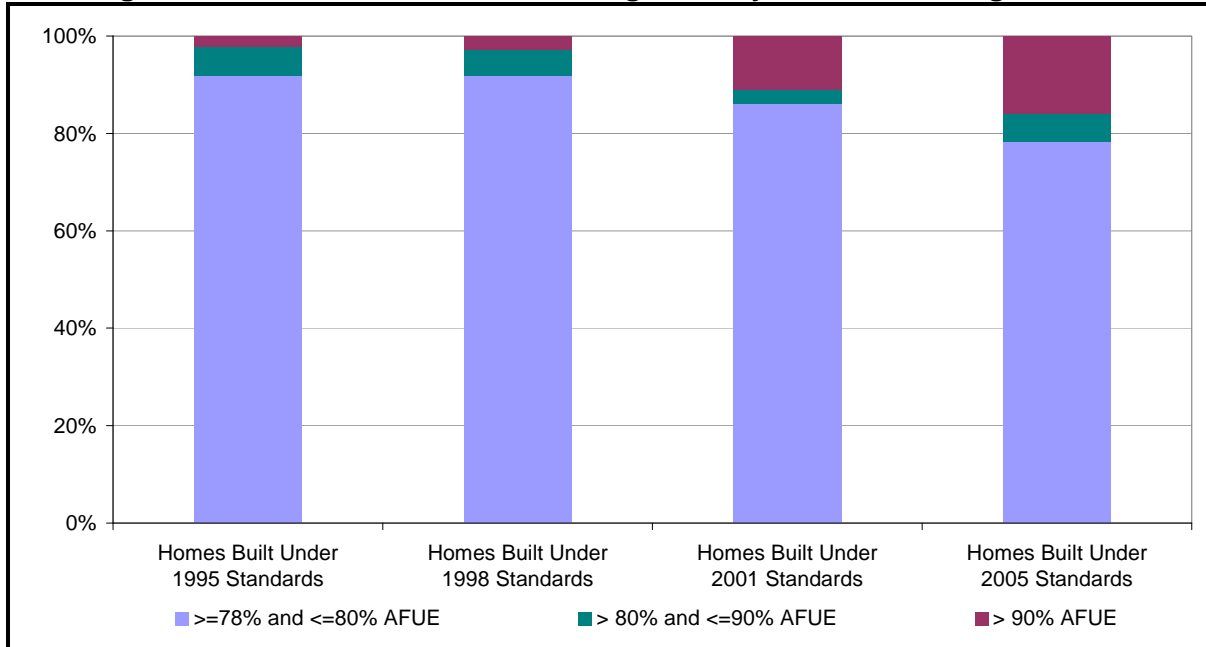
Table 3.1-11 presents the distribution of gas space-heating units by efficiency level. As can be seen, the portion of gas space-heating units with an AFUE of less than 81 has decreased under each set of standards while the percentage with an AFUE greater than 90 has increased statewide and in every Region except for Region 1.

**Table 3.1-11: Percentages of Gas Space Heating System Efficiency in Single Family Homes**

<b>Analysis Parameter Description</b>	<b>Statewide</b>	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>
<b>Homes Built under 1995 Standards</b>						
>= 78% and <= 80% AFUE	92%	96%	94%	93%	87%	88%
> 80% and <= 90% AFUE	6%	2%	6%	5%	8%	10%
> 90% AFUE	2%	1%	-	2%	5%	2%
<b>Homes Built under 1998 Standards</b>						
>= 78% and <= 80% AFUE	92%	91%	92%	96%	90%	89%
> 80% and <= 90% AFUE	5%	6%	8%	4%	5%	10%
> 90% AFUE	3%	4%	-	-	5%	1%
<b>Homes Built under 2001 Standards</b>						
>= 78% and <= 80% AFUE	86%	50%	84%	97%	87%	93%
> 80% and <= 90% AFUE	3%	4%	-	3%	2%	3%
> 90% AFUE	11%	46%	16%	-	10%	4%
<b>Homes Built under 2005 Standards</b>						
>= 78% and <= 80% AFUE	78%	78%	82%	89%	65%	72%
> 80% and <= 90% AFUE	6%	11%	-	4%	9%	9%
> 90% AFUE	16%	11%	18%	7%	26%	19%

Figure 3.1-7 presents the distribution of AFUEs under the four standards for the entire state of California. The portion of space heating with the lowest level of efficiency has fallen, while the highest level of efficiency has increased.

**Figure 3.1-7: AFUE Distribution in Single Family Homes – Average Statewide**



### Space-Cooling System

Space-cooling systems characteristics for units installed in newly constructed homes are discussed in this section. These characteristics include average system efficiencies and system types.

#### Equipment Efficiency

Results for cooling system efficiencies for detached single-family homes are presented in Table 3.1-12 and Table 3.1-13. As can be seen, the average SEER increased significantly for homes built under the 2005 standards and all regional averages are now greater than 13 SEER. This is due to the federal regulation stating that all air-conditioning units manufactured beginning January of 2006 must have a SEER of at least 13. This can also be seen in Figure 3.1-8.

**Table 3.1-12: Average SEER in Single Family Homes**

Analysis Parameter Description	Statewide	Region 1	Region 2	Region 3	Region 4	Region 5
<b>Average Efficiency (SEER)</b>						
Homes Built under 1995 Standards	10.5	10.4	10.2	10.2	11.0	10.9
Homes Built under 1998 Standards	10.6	10.5	10.2	10.2	11.0	10.5
Homes Built under 2001 Standards	10.9	10.5	10.3	10.5	10.9	11.5
Homes Built under 2005 Standards	13.4	13.7	13.4	13.2	13.6	13.5

**Figure 3.1-8: Average SEER in Single Family Homes**

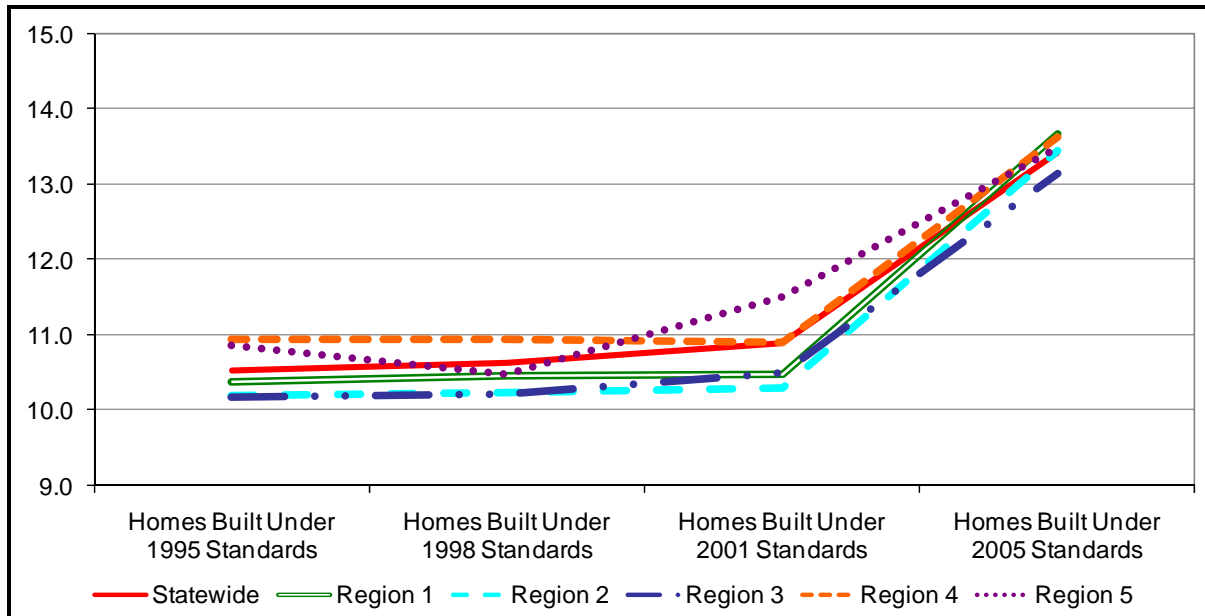


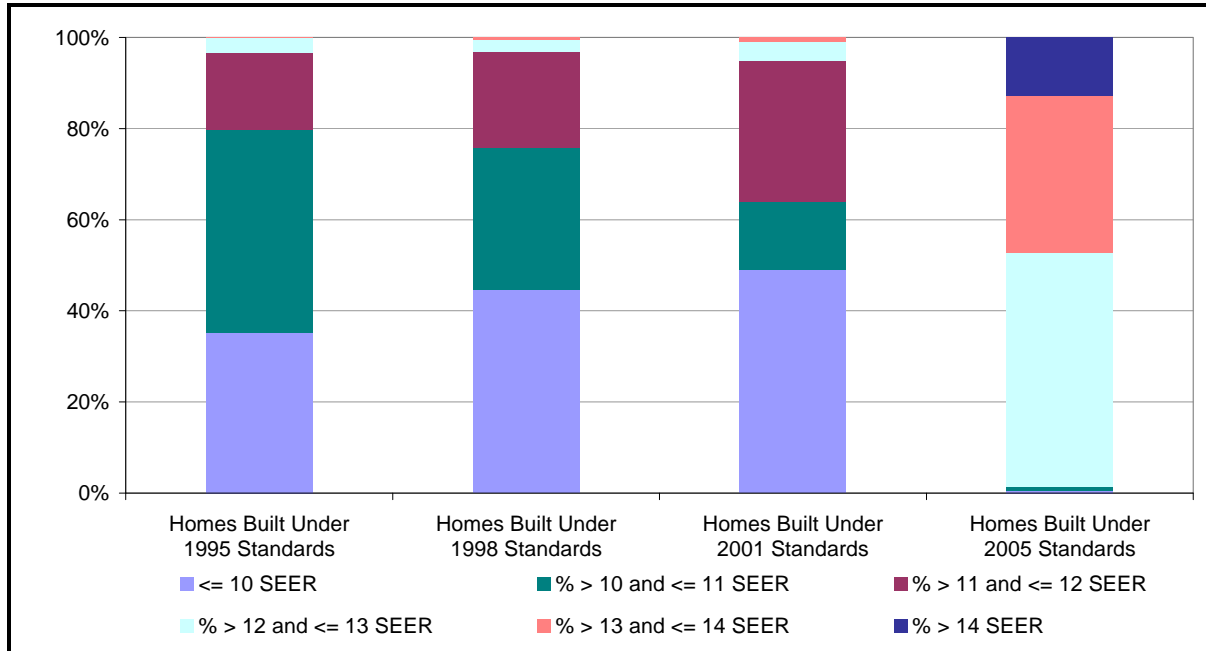
Table 3.1-13 presents the distribution of air-conditioner SEER levels for homes built under the four sets of standards. When comparing the distribution to the minimum SEER levels available at the time, approximately half of the homes built under any given standard had the minimum allowable SEER level installed.

**Table 3.1-13: Central Air Conditioner Efficiency in Single Family Homes**

<b>Analysis Parameter Description</b>	<b>Statewide</b>	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>
<b>Homes Built under 1995 Standards</b>						
<= 10 SEER	35%	28%	55%	35%	34%	37%
> 10 and <= 11 SEER	45%	63%	39%	63%	24%	26%
> 11 and <= 12 SEER	17%	9%	6%	1%	39%	18%
> 12 and <= 13 SEER	3%	-	-	2%	3%	17%
> 13 and <= 14 SEER	0%	-	-	-	-	3%
> 14 SEER	-	-	-	-	-	-
<b>Homes Built under 1998 Standards</b>						
<= 10 SEER	45%	29%	64%	59%	37%	63%
> 10 and <= 11 SEER	31%	61%	30%	39%	23%	15%
> 11 and <= 12 SEER	21%	8%	6%	2%	35%	21%
> 12 and <= 13 SEER	3%	-	-	-	5%	1%
> 13 and <= 14 SEER	1%	3%	-	-	1%	-
> 14 SEER	-	-	-	-	-	-
<b>Homes Built under 2001 Standards</b>						
<= 10 SEER	49%	50%	67%	50%	55%	25%
> 10 and <= 11 SEER	15%	30%	20%	35%	2%	8%
> 11 and <= 12 SEER	31%	20%	13%	12%	37%	54%
> 12 and <= 13 SEER	4%	-	-	2%	3%	13%
> 13 and <= 14 SEER	1%	-	-	-	2%	-
> 14 SEER	0%	-	-	1%	-	-
<b>Homes Built under 2005 Standards</b>						
<= 10 SEER	0%	-	-	1%	-	-
> 10 and <= 11 SEER	1%	-	-	2%	-	-
> 11 and <= 12 SEER	-	-	-	-	-	-
> 12 and <= 13 SEER	52%	44%	57%	62%	39%	48%
> 13 and <= 14 SEER	34%	22%	26%	28%	45%	40%
> 14 SEER	13%	33%	20%	6%	16%	12%

Figure 3.1-9 illustrates the distribution of efficiency levels for air conditioning units statewide. As can be seen, the greatest change occurred in homes built under the 2005 standards. The largest portion of air-conditioning units installed in homes built under the 2005 standards has a SEER of greater than 12 but not greater than 13.

**Figure 3.1-9: SEER Distribution in Single Family Homes – Average Statewide**



### **Multiple HVAC Systems and Thermostat Types**

A summary of the percentage of detached single-family homes with multiple HVAC units is presented in Table 3.1-14. As can be seen in Table 3.1-14 and Figure 3.1-10, this percentage decreased between the homes built under the 1995 standards and the homes built under the 1998 standards, but increased dramatically for homes built under the 2001 and 2005 standards. Typically, larger two-story homes have multiple HVAC systems. While the percentage of two-story homes has increased over the last decade, it is likely that more builders have begun to install separate systems for each story for other reasons. Reasons could include improving homeowner comfort or costs; however, this is pure conjecture.

**Table 3.1-14: Multiple HVAC Systems in Single Family Homes**

<b>Analysis Parameter Description</b>	<b>Statewide</b>	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>
<b>Homes Built under 1995 Standards</b>						
1 HVAC System	86%	91%	88%	77%	93%	74%
2 HVAC Systems	14%	9%	10%	23%	7%	26%
3 HVAC Systems	0%	-	2%	-	-	-
<b>Homes Built under 1998 Standards</b>						
1 HVAC System	90%	90%	78%	86%	94%	100%
2 HVAC Systems	10%	11%	22%	14%	6%	-
3 HVAC Systems	-	-	-	-	-	-
<b>Homes Built under 2001 Standards</b>						
1 HVAC System	72%	73%	63%	62%	85%	59%
2 HVAC Systems	28%	25%	37%	37%	15%	41%
3 HVAC Systems	1%	3%	-	1%	-	-
<b>Homes Built under 2005 Standards</b>						
1 HVAC System	65%	89%	67%	47%	88%	57%
2 HVAC Systems	33%	11%	33%	48%	11%	41%
3 HVAC Systems	1%	-	-	5%	-	-
4 HVAC Systems	1%	-	-	1%	2%	2%



**Figure 3.1-10: Multiple HVAC Systems in Single Family Homes – Statewide Average**

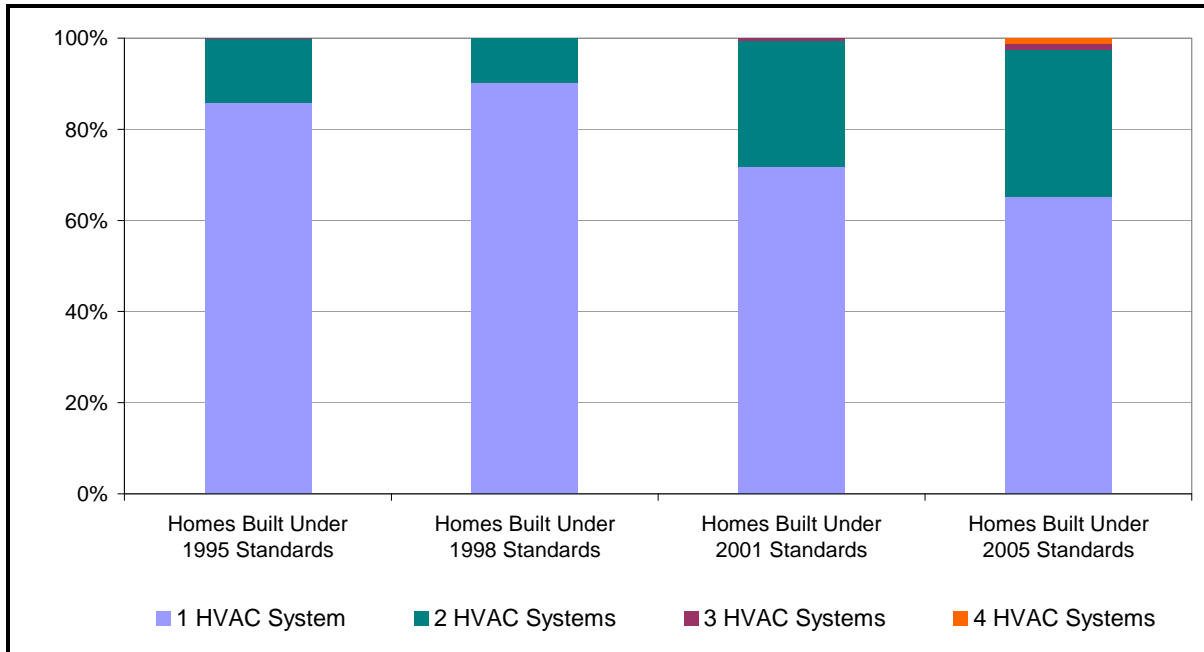


Table 3.1-15 presents the share of electromechanical<sup>71</sup> and digital/programmable thermostats installed in new single-family homes under the different sets of standards. Although there are other types of thermostats, such as hybrid thermostats<sup>72</sup> and homes without thermostats, only the electromechanical and digital varieties were selected because they best represent the change from low efficiency to high efficiency (digital) thermostat-installation practices.

<sup>71</sup> Electromechanical thermostats are the older style thermostats with no setback or programming capability. See <http://www.todaysconcept.com/thermostats-info.html#elman> for more information.

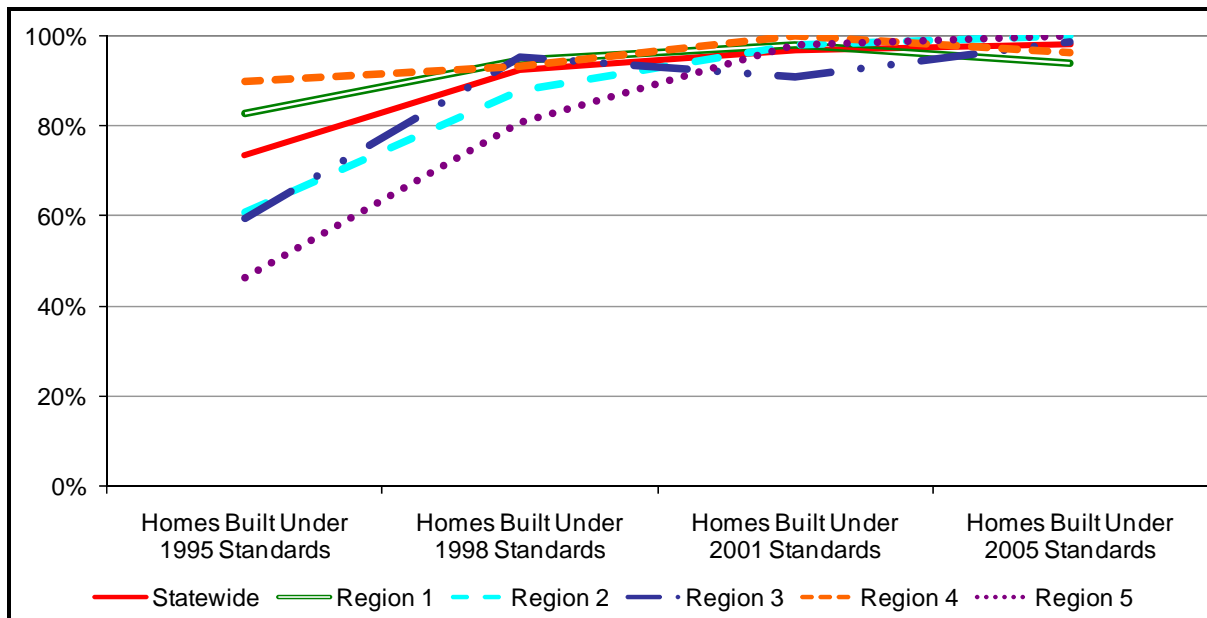
<sup>72</sup> Hybrid thermostats are a hybrid of electromechanical and digital thermostats.

**Table 3.1-15: Thermostat Types in Single Family Homes**

Analysis Parameter Description	Statewide	Region 1	Region 2	Region 3	Region 4	Region 5
<b>Percentage Electromechanical Thermostats</b>						
Homes Built under 1995 Standards	26%	15%	38%	40%	10%	51%
Homes Built under 1998 Standards	5%	5%	12%	5%	2%	19%
Homes Built under 2001 Standards	1%	3%	-	2%	-	-
Homes Built under 2005 Standards	1%	6%	-	1%	2%	-
<b>Percentage Digital Thermostats</b>						
Homes Built under 1995 Standards	74%	83%	61%	60%	90%	46%
Homes Built under 1998 Standards	93%	95%	88%	95%	94%	81%
Homes Built under 2001 Standards	97%	98%	98%	91%	100%	98%
Homes Built under 2005 Standards	98%	94%	100%	99%	97%	100%

Figure 3.1-11 shows the increase in the percentage of new single-family homes with digital thermostats. The greatest increase in digital thermostats occurred between homes built under the 1995 standards, with a statewide average of nearly 74%, and homes built under the 1998 standards, with an average of almost 93%. The percentage of new homes with digital thermostats continued to increase for homes built under the 2001 and 2005 standards.

**Figure 3.1-11: Percentage of Digital Thermostats in Single Family Homes**



## Water Heating

A summary of water heating efficiencies for units installed in newly constructed homes under the four sets of standards are discussed in this section. These characteristics include the prevalence of natural gas water heaters and the average system efficiencies.

Table 3.1-16 presents the saturation of gas water heaters and instantaneous water heaters (both gas and electric) in new homes built under the four sets of standards. The saturation of gas-storage water heaters was consistent for homes built under the first three sets of standards, but decreased for homes built under the 2005 standards. The percentage of homes with instantaneous water heaters increased greatly under the 2005 standards, as can be seen in Figure 3.1-12.

**Table 3.1-16: Natural Gas Storage and Instantaneous Water Heaters in Single Family Homes**

<b>Analysis Parameter Description</b>	<b>Statewide</b>	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>
<b>Percentage Natural Gas Storage Water Heaters</b>						
Homes Built under 1995 Standards	93%	94%	97%	98%	87%	93%
Homes Built under 1998 Standards	93%	90%	98%	97%	92%	92%
Homes Built under 2001 Standards	95%	85%	99%	98%	94%	96%
Homes Built under 2005 Standards	67%	61%	56%	72%	68%	71%
<b>Percentage Instantaneous Water Heaters – Gas and Electric</b>						
Homes Built under 1995 Standards	0%	0%	0%	0%	0%	0%
Homes Built under 1998 Standards	0.2%	0%	0%	0%	0.5%	0%
Homes Built under 2001 Standards	1%	6%	0%	2%	0%	0%
Homes Built under 2005 Standards	25%	33%	44%	16%	23%	20%

**Figure 3.1-12: Percentage of Instantaneous Water Heaters (Gas and Electric) in Single Family Homes**

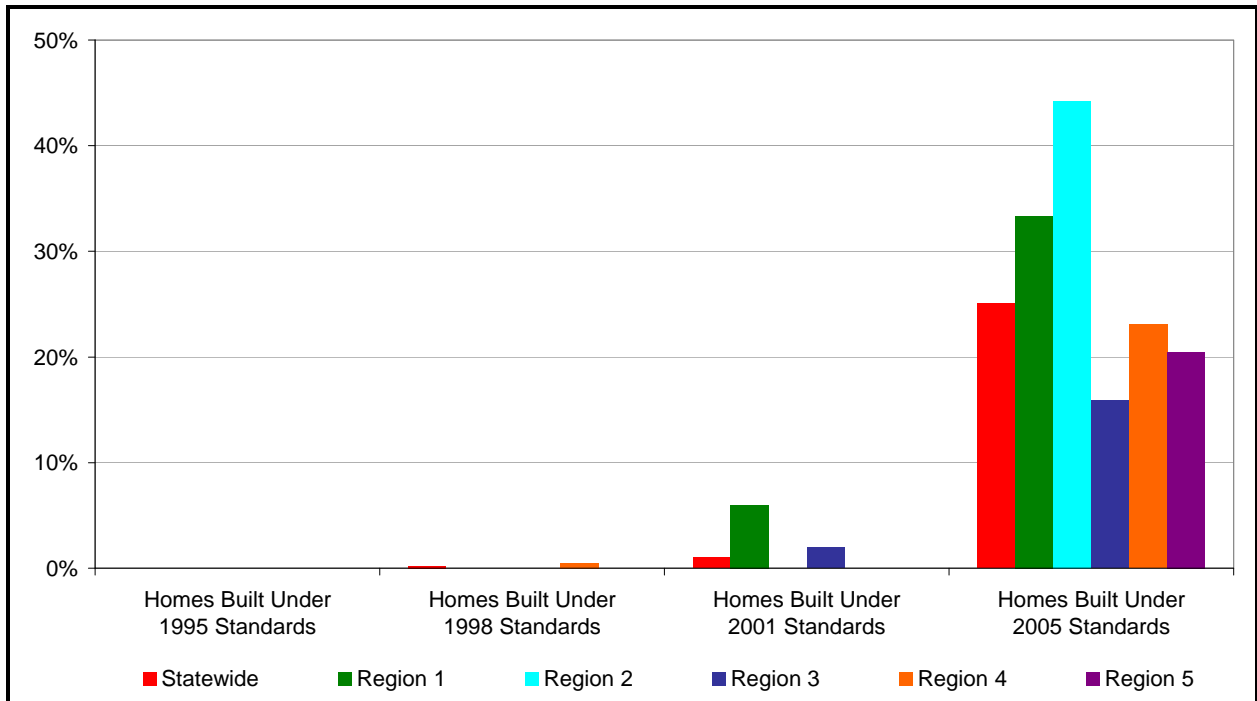


Table 3.1-17 presents the percentage of homes with multiple water-heating units, which increased for homes built under the 2005 standards. These results are also shown in Figure 3.1-13. Approximately two-thirds of the homes with more than one water heater have instantaneous water heaters.

**Table 3.1-17: Multiple Water Heating Systems in Single Family Homes**

Analysis Parameter Description	Statewide	Region 1	Region 2	Region 3	Region 4	Region 5
<b>Homes Built under 1995 Standards</b>						
1 Water Heating System	99%	98%	97%	99%	99%	100%
2 Water Heating Systems	2%	2%	3%	1%	1%	0%
<b>Homes Built under 1998 Standards</b>						
1 Water Heating System	99%	99%	100%	100%	98%	100%
2 Water Heating Systems	1%	1%	0%	0%	2%	0%
<b>Homes Built under 2001 Standards</b>						
1 Water Heating System	100%	100%	99%	100%	100%	100%
2 Water Heating Systems	0%	-	1%	-	-	-
<b>Homes Built under 2005 Standards</b>						
1 Water Heating System	92%	100%	85%	93%	95%	91%
2 Water Heating Systems	7%	-	13%	6%	3%	9%
3 Water Heating Systems	1%	-	2%	1%	2%	-

**Figure 3.1-13: Single Family Homes with More than One Water Heating Unit**

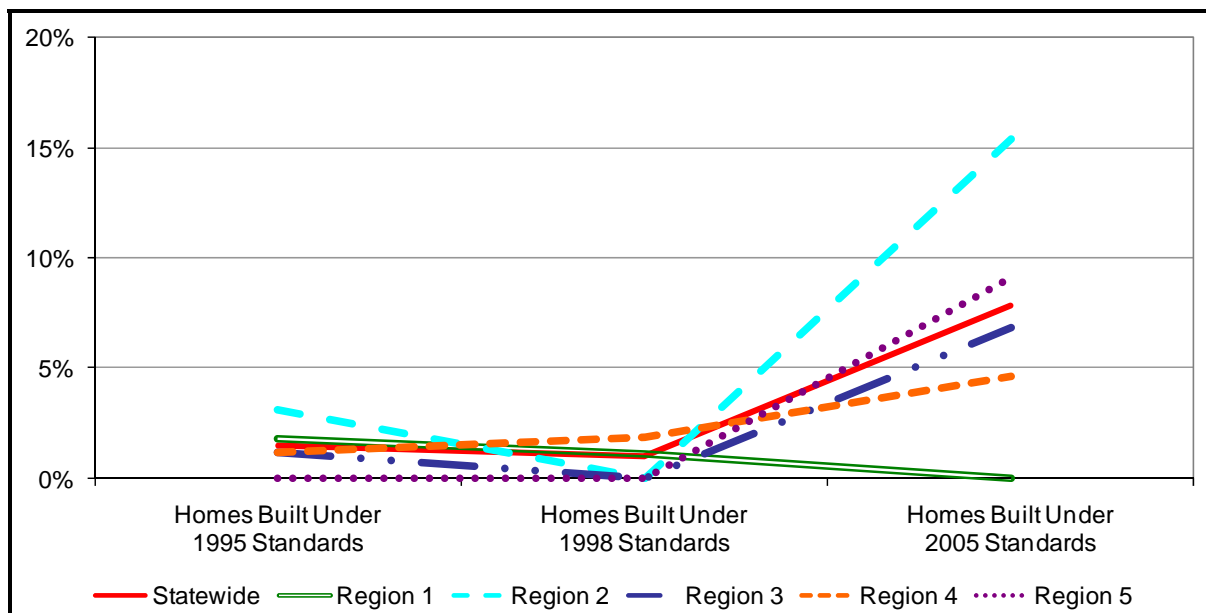


Table 3.1-18 presents the average efficiency levels (as a percentage above the standard) for gas-storage water heaters built under the different sets of standards. As can be seen, the average gas-storage water heater efficiency remained fairly consistent for homes built under the first three sets of standards. As mentioned previously, the water heater standards changed under the 2005 standards. Therefore, in the table below it appears that the average water heater efficiencies decrease, but, comparing under the same standards, the average percentage above standard for homes built under the 2005 standards would have been 20% statewide.<sup>73</sup> These results can also be seen in Figure 3.1-14.

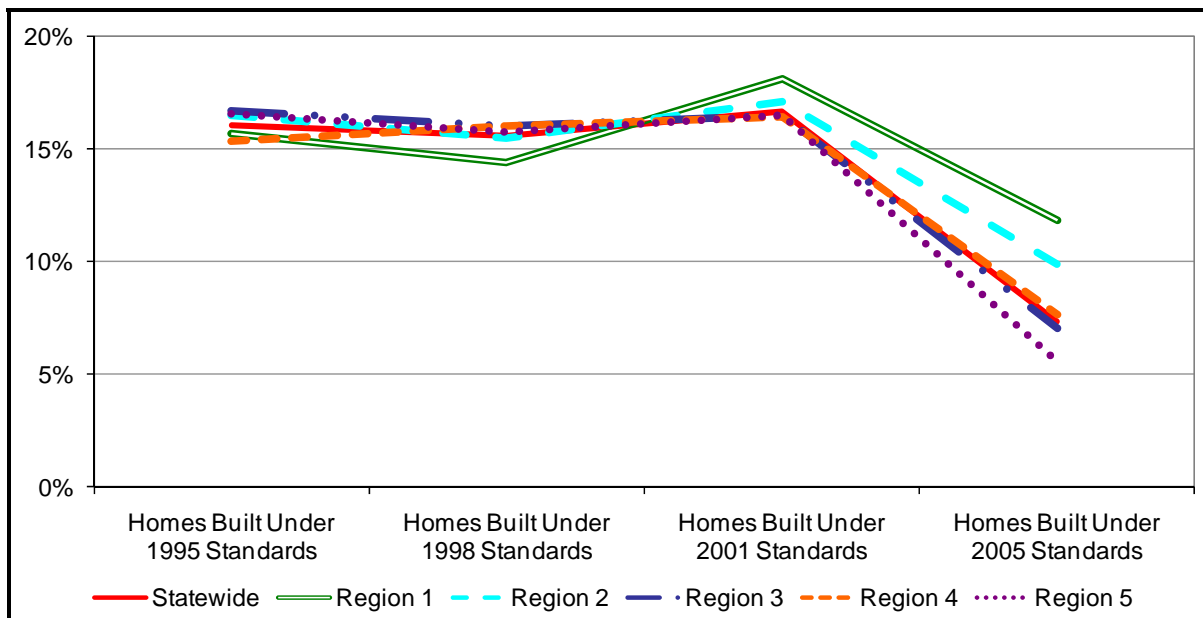
**Table 3.1-18: Gas-Storage Water Heater Efficiency in Single Family Homes**

Analysis Parameter Description	Statewide	Region 1	Region 2	Region 3	Region 4	Region 5
<b>Average % above standard*</b>						
Homes Built under 1995 Standards	16.1%	15.7%	16.5%	16.7%	15.3%	16.6%
Homes Built under 1998 Standards	15.6%	14.4%	15.5%	16.0%	16.0%	15.8%
Homes Built under 2001 Standards	16.7%	18.1%	17.1%	16.5%	16.4%	16.5%
Homes Built under 2005 Standards**	7.3%	11.8%	9.9%	7.1%	7.6%	5.5%

\* Of observed data.

\*\* Note change in federal standards. See Section 4.2.2.2.

**Figure 3.1-14: Average Percentage above Standard in Single Family Homes**



<sup>73</sup> As a point of reference, if all of the homes in the analysis had gas-storage water heaters prior to the 2005 Standards, 16% above standard would be equivalent to 0.61 EF, whereas since the 2005 Standards, 7.6% above standard would be 0.62 EF.

## ***Building Shell Characteristics***

Current building practices for ceiling insulation, wall insulation, and radiant barriers are discussed and summarized below.

### **Ceiling Insulation**

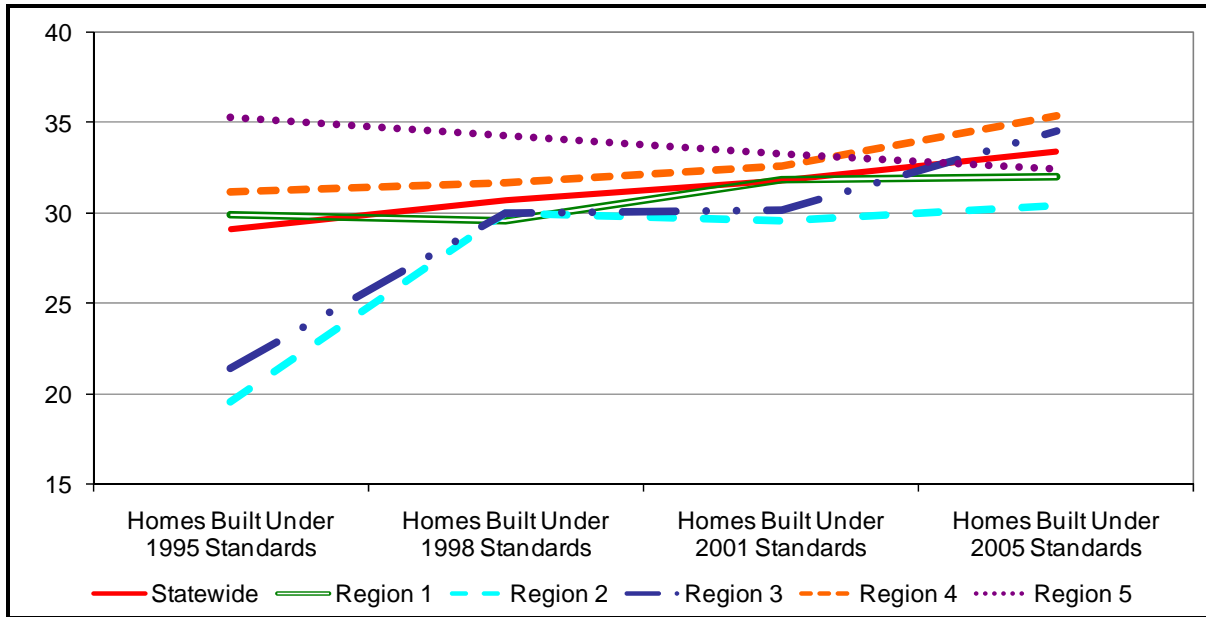
Current ceiling insulation practices for detached single family homes are summarized in Table 3.1-19. Note that these results are presented with respect to performance versus prescriptive values (higher than, equal to and lower than prescriptive levels). The average R-value of the ceiling insulation of a new home has increased consistently statewide for homes built under the different sets of standards. This is also shown in Figure 3.1-15.

**Table 3.1-19: Ceiling Insulation in Single Family Homes**

<b>Analysis Parameter Description</b>	<b>Statewide</b>	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>
<b>Average R-Value*</b>						
Homes Built under 1995 Standards	29.1	29.9	19.6	21.4	31.2	35.3
Homes Built under 1998 Standards	30.7	29.6	30.0	30.0	31.7	-
Homes Built under 2001 Standards	31.8	31.8	29.6	30.2	32.6	33.3
Homes Built under 2005 Standards	33.4	32.0	30.4	34.5	35.4	32.4
<b>Homes Built under 1995 Standards*</b>						
Higher Performance	5%	8%	-	11%	1%	9%
Equal to Prescriptive	48%	82%	6%	7%	31%	54%
Lower Performance	47%	10%	94%	82%	67%	36%
<b>Homes Built under 1998 Standards*</b>						
Higher Performance	1%	2%	-	-	-	-
Equal to Prescriptive	54%	85%	100%	100%	20%	-
Lower Performance	45%	13%	-	-	80%	-
<b>Homes Built under 2001 Standards*</b>						
Higher Performance	5%	40%	-	2%	0%	-
Equal to Prescriptive	50%	48%	99%	98%	17%	24%
Lower Performance	46%	13%	1%	1%	82%	76%
<b>Homes Built under 2005 Standards*</b>						
Higher Performance	3%	11%	2%	3%	3%	
Equal to Prescriptive	66%	83%	98%	95%	6%	52%
Lower Performance	31%	6%	-	1%	91%	48%

\*Of observed data.

Figure 3.1-15: Average Ceiling Insulation R-Value in Single Family Homes





## **Wall Insulation**

Wall insulation practices for detached single family homes under the four different sets of standards are summarized in Table 3.1-20. Not surprisingly, actual wall insulation R-values are not easily obtained while on-site. On-site surveyors attempted to visit other homes in the same development that were still under construction but, partially due to the recent slow-down in construction, this did not yield much more actual data. Over time, on-site surveyors have only been able to gather actual wall insulation R-values for about 10-20% of homes visited. In some regions surveyors were able to gather actual wall insulation R-values for less than 5% of the homes surveyed. Therefore, no conclusions should be drawn from these data. (The results below only include homes where data were collected.)

**Table 3.1-20: Wall Insulation in Single Family Homes**

<b>Analysis Parameter Description</b>	<b>Statewide</b>	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>
<b>Average R-Value*</b>						
Homes Built under 1995 Standards	14.4	13.4	15.7	19.0	14.7	17.0
Homes Built under 1998 Standards	15.6	18.0	19.0	13.0	14.4	19.0
Homes Built under 2001 Standards	14.0	15.9	14.3	13.6	13.6	13.5
Homes Built under 2005 Standards	20.3	19.0	19.0	18.8	23.7	20.0
<b>Homes Built under 1995 Standards*</b>						
Higher Performance	12%	10%	58%	100%	7%	-
Equal to Prescriptive	38%	74%	-	-	12%	-
Lower Performance	50%	16%	41%	-	81%	100%
<b>Homes Built under 1998 Standards*</b>						
Higher Performance	26%	75%	100%	-	2%	-
Equal to Prescriptive	41%	50%	90%	96%	8%	-
Lower Performance	59%	10%	-	-	85%	100%
<b>Homes Built under 2001 Standards*</b>						
Higher Performance	6%	48%	10%	3%	-	-
Equal to Prescriptive	41%	50%	90%	96%	8%	-
Lower Performance	52%	3%	-	1%	92%	100%
<b>Homes Built under 2005 Standards*</b>						
Higher Performance	2%	-	2%	2%	3%	2%
Equal to Prescriptive	61%	89%	96%	98%	15%	2%
Lower Performance	37%	11%	2%	-	82%	95%

\* Of observed data.

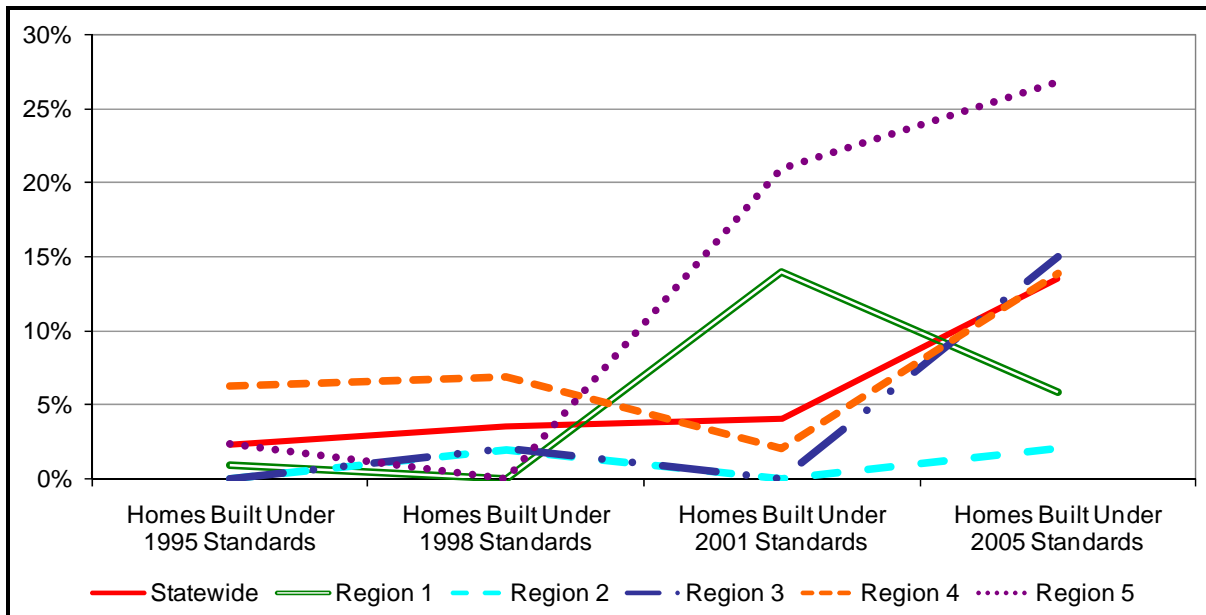
**Radiant Barriers**

Radiant barriers can also reduce energy use. A summary of this information for detached single-family homes is included in Table 3.1-21. As shown in Figure 3.1-16, the percentage of homes with radiant barriers increased for homes built under the 2005 Standards with the exception of those in Region 1 (where the sample size was only 18 at the time of this report).

**Table 3.1-21: Radiant Barriers in Single Family Homes**

Analysis Parameter Description	Statewide	Region 1	Region 2	Region 3	Region 4	Region 5
<b>% with Radiant barriers installed</b>						
Homes Built under 1995 Standards	2%	1%	-	-	6%	2%
Homes Built under 1998 Standards	4%	-	2%	2%	7%	-
Homes Built under 2001 Standards	4%	14%	-	-	2%	21%
Homes Built under 2005 Standards	13%	6%	2%	15%	14%	27%

**Figure 3.1-16: Percentage of Single Family Homes with Radiant Barriers**



## **Percent Duct Leakage**

Duct blaster tests to determine duct leakage rates were conducted for a sub-sample of the sites surveyed for homes built under the 1995, 1998 and 2005 standards. They were not performed on homes built under the 2001 standards. An estimate of percent duct leakage requires that the total supply fan system flow rate be known. Percent duct leakage is the ratio of the measured duct leakage rate over the total supply fan system flow rate.

Test results are contained in Table 3.1-22, which presents the average percent duct leakage by region. The percent duct leakage decreased statewide and in most regions between the homes built under the 1998 and 2005 standards. Of the homes duct tested in the most recent round of on-sites, approximately one-fourth had leakage of 6% or less, which is a code requirement.

**Table 3.1-22: Average Percent Duct Leakage in Single Family Homes**

<b>Analysis Parameter Description</b>	<b>Statewide</b>	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>
<b>Homes Built under 1995 Standards</b>						
Number of Sites	72	16	10	19	20	7
Average % Duct Leakage (valid tests)	13.5%	19.9%	16.6%	11.7%	11.4%	19.3%
<b>Homes Built under 1998 Standards</b>						
Number of Sites	70	14	12	17	22	5
Average % Duct Leakage (valid tests)	13.3%	15.4%	12.4%	12.9%	13.7%	8.9%
<b>Homes Built under 2005 Standards</b>						
Number of Sites	109	6	22	42	20	19
Average % Duct Leakage (valid tests)	11.3%	10.1%	11.9%	12.4%	10.4%	10.3%

## **Compliance Analysis**

### **Overview of the RNC Interface**

The RNC Interface uses the data collected from on-site surveys to create MICROPAS input files. This is accomplished by first manipulating the data then “writing” them to a file in the required MICROPAS input format. The RNC Interface then passes the input file through MICROPAS. The interface produces results in the same format as the C-2R forms used for compliance documentation.

The interface was initially designed to batch-process many sites at one time. During the first year of the project (2000), 800 on-site surveys of low-rise residential buildings were conducted. Instead of using the MICROPAS interface to develop each input file by hand, one at a time, a decision was made to automate the process. Since then, the RNC Interface has been used on two

additional Baseline studies and is now being updated for the current RNC evaluation. The interface was designed to do the following:

- Translate the on-site survey data into MICROPAS input files
- Run MICROPAS in a batch mode
- Facilitate the use of either MICROPAS 4.5, 5.1, 6.0 or 7.1 (1995, 1998, 2001 and 2005 standards, respectively)
- Extract the MICROPAS compliance results
- Provide a platform for the technical potential analysis
- Conduct several other “what if” analyses

### **Compliance Results over Time**

This section summarizes the compliance results found as part of the Baseline Studies conducted since 2000. In order to compare compliance margins over time, this section presents average percentage of compliance margins by climate zone. The % Compliance Margin as calculated for the RNC Interface compliance runs (% Compliance Margin<sub>RNC</sub>) was determined as follows:

$$\% \text{ Compliance Margin}_{i,RNC} = \frac{\text{Standard Design}_{i,RNC} - \text{Proposed Design}_{i,RNC}}{\text{Standard Design}_{i,RNC}}$$

where

*Standard Design*<sub>*i,RNC*</sub> = Total energy use (space heating, space cooling and water heating) for a home with Prescriptive Package D features (standard design) from the RNC Interface (*RNC*)

*Proposed Design*<sub>*i,RNC*</sub> = Total energy use (space heating, space cooling and water heating) for home *i* with proposed construction plan features (proposed design) from the RNC Interface (*RNC*)

Table 3.1-23 presents the average compliance margin for single family homes built under the 1995, 1998, and 2001 standards. Unfortunately, compliance data were not available for homes built under the 2005 standards. The average compliance margin increased statewide for homes built under the 1998 standards, but then decreased for homes built under the 2001 standards. Compliance margins in Regions 1 and 2 increased under both new sets of standards, reaching over 19% in Region 1. These results are also illustrated in Figure 3.1-17. When interpreting the results, one should bear in mind that each successive standard was stricter than the last.

**Table 3.1-23: Average Compliance Margins of Single Family Homes**

Analysis Parameter Description	Statewide	Region 1	Region 2	Region 3	Region 4	Region 5
<b>Average Compliance Margin</b>						
Homes Built under 1995 Standards	4.8%	6.8%	6.7%	10.2%	-1.0%	-0.5%
Homes Built under 1998 Standards	6.2%	11.4%	14.7%	6.1%	4.1%	-6.2%
Homes Built under 2001 Standards	3.8%	19.2%	16.0%	9.4%	-2.9%	-5.7%

**Figure 3.1-17: Average Compliance Margins of Single Family Homes by Region**

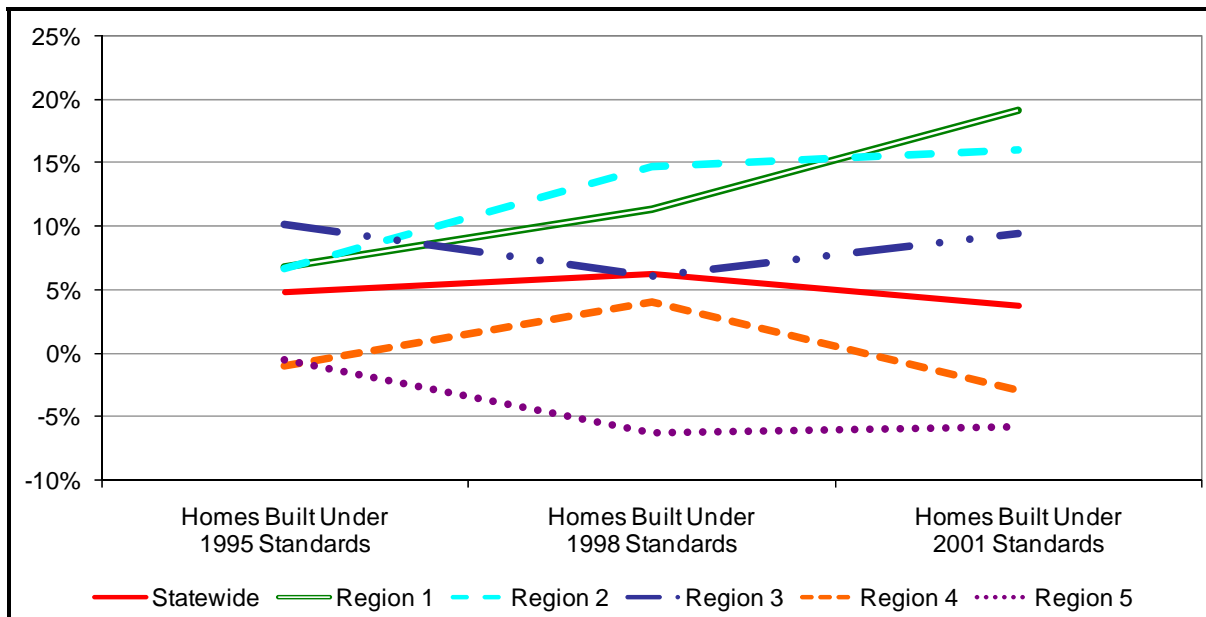
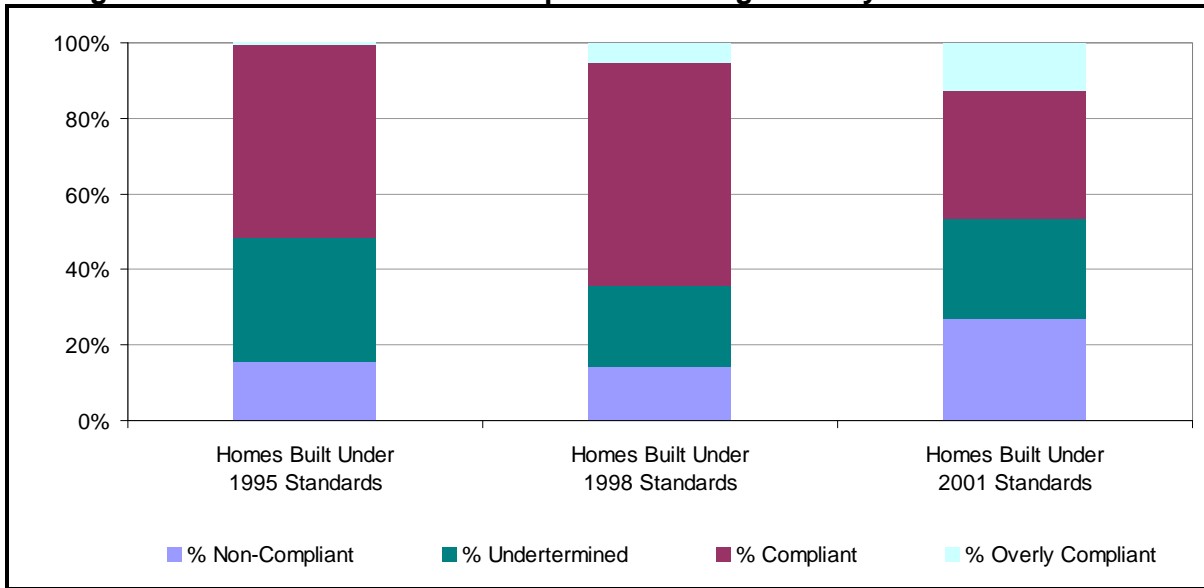


Table 3.1-24 presents the distribution of compliance by region for homes built under the 1995, 1998, and 2001 standards. The table presents the percentage of homes that are compliant, overly compliant, and non-compliant, and homes with undetermined compliance levels. As can be seen, the majority of homes statewide are considered “compliant” under the 1995 and 1998 standards, but the portion of homes considered “compliant” fell for homes built under the 2001 standards. Also, the number of homes considered “overly compliant” increased under the 1998 and again under the 2001 standards. The portion of homes statewide considered “non-complaint” fell under the 1998 standards, but increased under the 2001 standards. The distribution of compliance levels can be seen in Figure 3.1-18 for all homes statewide.

**Table 3.1-24: Compliance of Single Family Homes with Title 24 Standards**

<b>Analysis Parameter Description</b>	<b>Statewide</b>	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>
<b>Homes Built under 1995 Standards</b>						
% Overly Compliant	0.5%	0.9%	0.0%	0.6%	0.0%	2.3%
% Compliant	51.0%	57.5%	59.1%	79.7%	18.1%	20.9%
% Undetermined	32.8%	32.7%	33.3%	13.6%	51.9%	39.5%
% Non-Compliant	15.7%	8.8%	7.5%	6.2%	30.0%	37.2%
<b>Homes Built under 1998 Standards</b>						
% Overly Compliant	5.1%	6.5%	15.5%	5.6%	1.0%	0.0%
% Compliant	59.3%	80.6%	78.6%	56.9%	51.2%	20.0%
% Undetermined	21.2%	9.7%	6.0%	20.1%	30.6%	35.0%
% Non-Compliant	14.4%	3.2%	0.0%	17.4%	17.2%	45.0%
<b>Homes Built under 2001 Standards</b>						
% Overly Compliant	12.5%	48.0%	31.0%	17.0%	1.0%	3.0%
% Compliant	34.1%	45.0%	62.0%	56.0%	16.0%	15.0%
% Undetermined	26.4%	5.0%	6.0%	17.0%	41.0%	28.0%
% Non-Compliant	27.0%	3.0%	1.0%	11.0%	24.0%	55.0%

**Figure 3.1-18: Distribution of Compliance of Single Family Homes – Statewide**



**Summary of Changes in Building Practices**

In summary, some of the key trends in efficiency in the RNC market are as follows:

- Glazing
  - The glazing area in new homes fell from 17% in homes built under the 1995 standards to 14% in homes built under the 2005 standards
  - The percentage of glass that was two-paned vinyl and low-e increased from 5% in homes built under the 1995 standards to 86% in homes built under the 2005 standards
- Space heating
  - The average AFUE for furnaces increased from 80% in homes built under the 1995 standards to 83% in homes built under the 2005 standards
  - The percentage of 90%+ AFUE furnaces increased from 2% in homes built under the 1995 standards to 16% in homes built under the 2005 standards
- Space cooling
  - The average central air conditioner SEER level increased from 10.5 SEER in homes built under the 1995 standards to 13.4 SEER in homes built under the 2005 standards; 13 SEER became the federal minimum standard in January of 2006
  - The percentage of central air conditioners with SEER levels greater than 13 increased from 0% in homes built under the 1995 standards to 47% in homes built under the 2005 standards

- Water heating
  - The percentage of instantaneous water heaters increased from 0% of water heaters in homes built under the 1995 standards to 25% in homes built under the 2005 standards
- Ceiling insulation
  - The average R-value of ceiling insulation increased from 29.1 in homes built under the 1995 standards to 33.4 in homes built under the 2005 standards
- Radiant barriers
  - The percentage of homes with radiant barriers increased from 2% of homes built under the 1995 standards to 13% of homes built under the 2005 standards
- Duct leakage
  - The average duct leakage decreased from 13.5% in homes built under the 1995 standards to 11.3% of homes built under the 2005 standards
- Code compliance
  - The average compliance margin (relative to Prescriptive Package D design) went from an average of 4.8% above code in homes built under the 1995 standards, to 6.2% in homes built under the 1998 standards, to 3.8% in homes built under the 2001 standards. (Results are not yet available for homes built under the 2005 standards.<sup>74</sup>) Of course, standards became progressively more stringent during this time.
  - The percentage of non-compliant homes went from 15.7% of homes built under the 1995 standards, to 14.4% of homes built under the 1998 standards, to 27.0% of homes built under the 2001 standards. (Results are not yet available for homes built under the 2005 standards.) Again, standards became progressively more stringent during this time.

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<sup>74</sup> Prescriptive Package D is the baseline that the whole-house approach uses. The model compares the modeled usage of the house to the modeled usage of the same house with Package D. The difference is the compliance margin.



### **3.2. Historical Trends in Incremental Costs of Efficiency Measures**

There have been a few attempts to estimate incremental measure costs for RNC programs over the last eight years. However, each group involved in those studies that the Study Team has talked with claim that they were underfunded from the point of view of doing a true cost study. Further, incremental costs also can change by climate zone or region based on the availability and how common that measure is in the region. The incremental costs below are also incremental to the baseline efficiency and/or Standard in place at the time. Further, there are also measures for which the studies reported HERS related costs differently. For these reasons, direct comparisons between the incremental costs given before and after the 2005 Standard should not be made without careful examination of the assumptions behind the reported costs.

Table 3.2-1 presents the incremental costs data gathered for several of the high efficiency measures discussed in the previous section of the report. The incremental measure costs are taken from the following sources: an Incremental Measure Cost Study done by RER in 2003, in conjunction with year two of the Residential New Construction Study; 2006 RNC Strategy Assessment Study by RLW Analytics, Inc.; and the 2008 code IMC Estimates collected by PG&E. While a few of the incremental measure costs are the same between the studies presented (radiant barrier and R-38 roof insulation), many of the other costs vary considerably, such as the cost of an instantaneous water heater and wall insulation.

**Table 3.2-1: Incremental Measure Costs<sup>75</sup>**

Measure	Residential New Construction Study (2003)	2006 RNC Strategy Assessment Study	2008 Code IMC Estimates		Units Basis
			Low Cost	High Cost	
Ducts in Conditioned Spaces	NA	\$100* HERS Inspect Only	\$2,386	\$3,183	Per House
Duct Insulation (R-8.0)	\$350	\$150	\$310	\$414	Per House
Roof Insulation					
R-38	\$0.10	NA	\$0.08	\$0.10	Per SqFt
R-49	\$0.30	NA	\$0.19	\$0.25	Per SqFt
Wall Insulation (R-19)	\$0.06	NA	\$0.12	\$0.16	Per SqFt
Higher Efficiency Air Conditioning					
SEER 14	\$200	\$500	NA	NA	Per Unit
SEER 15	\$450	\$1,000	\$488	\$650	Per Unit
SEER 16	NA	\$1,500	NA	NA	Per Unit
EER 13	NA	\$500	NA	NA	Per Unit
EER 14	NA	\$1,000	NA	NA	Per Unit
EER 15	NA	\$2,500	NA	NA	Per Unit
Higher Efficiency Furnace (92% AFUE)	\$700	NA	\$585	\$780	Per Unit
Quality Insulation Installation (Inspection Cost)	NA	\$100	\$216	\$288	Per House
Higher Efficiency Water Heater (0.62 EF)	\$100	NA	\$0	\$0	Per Unit
Instantaneous Water Heating	NA	\$650	\$975	\$1,300	Per Unit
Radiant Barriers	\$0.16	\$0.15	\$0.16	\$0.21	Per SqFt
Low-E Windows	\$1.25	NA	\$0.75	\$1.00	Per SqFt
Super Low-E Windows	\$1.25	\$0.88	\$0.75	\$1.00	Per SqFt

<sup>75</sup> All costs are in nominal dollars not adjusted for inflation.

## 4. Analysis of Expected Outcomes

### 4.1. Introduction

In the analysis of expected outcomes from the IOU RNC programs we first attempt to determine whether a given outcome (market change) posited by program theory has occurred, then examine the links to the program according to program theory, and see whether the indicators associated with those links point to program influence on the market change—that is, a *market effect*.

The data collection for the Analysis of Expected Outcomes in Phase I included on-site visits at non-program homes, interviews with builders of non-program homes, and interviews with other market actors. Some of these data collection efforts have leveraged data collection that was occurring as part of the NC/CS evaluation.<sup>76</sup> These data collection efforts are summarized in Table 4.1-1. All data were collected from October of 2008 through January of 2009.

The sample of home buyers for the telephone survey was based on new meter hookups from the IOUs during the 2006-2008 period, so the sample frame is comprehensive, but it was not always possible to find telephone numbers. There may be non-response bias in the ultimate sample, but there is no reason to think it would be more than is typical. The telephone survey was also used to recruit home buyers for onsite visits, and since not all interviewees ultimately agreed, there is further potential for non-response bias in the onsite results—but again, probably no more than is typical. So that builder interview data could later be matched with onsite data about a particular home, the home buyer telephone survey asked the home buyer to identify the builder of his or her home; not all were able to do so. Also, because builders were called after the economic downturn had begun, many of their offices had closed. For these reasons, then, the builder sample may suffer from non-response bias. In turn, we asked the builders to identify the HVAC contractors they work with, leading to a further source of possible non-response bias in the HVAC contractor survey. The samples of Title 24 consultants, HERS raters, and distributors came from purchased or publicly available lists, which are not necessarily comprehensive, and not all those we called agreed to be interviewed—so again, these surveys may also suffer from non-response bias, but in ways that are typical for surveys.

Some potential non-response bias was avoided by identifying homes through home buyers rather than builders, who could have been motivated to keep less efficient homes from being visited. Builders, HVAC contractors, Title 24 consultants, and HERS raters received \$150 incentives for their participation in the surveys, which probably also helped mitigate non-response bias. Also, these four groups, including some key informants who are major players in the industry,

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<sup>76</sup> This is an impact evaluation being conducted for the CPUC, with the intent of estimating the energy savings in participating new buildings (including homes) that is attributable to the IOU programs.

accounted for very large proportions of new homes built in California in the 2006-2008 period—enough on their own to justify drawing preliminary conclusions about the market. Finally, if Phase II of this research is conducted it would provide the opportunity to quantify some likely non-response bias: The efficiency levels of homes receiving on-site inspections whose builders and HVAC contractors were interviewed could be compared with the efficiency levels of homes receiving site inspections whose builders and HVAC contractors were *not* interviewed.

Responses from builders, HVAC contractors, Title 24 consultants and HERS raters are reported both as n, or number of respondents, as well as the percentage of non-program homes. Weights for percentages of non-program homes were developed from the responses of each builder, Title 24 consultant and HERS rater to questions asking them to estimate the overall number of homes they built, consulted or rated as well as the number of homes they built, consulted or rated through the IOU programs from 2006 through 2008.<sup>77</sup>

The change in rules for claiming savings for IOU program homes probably affected the number of program homes reported by builders and other market actors—for example, an IOU program could have counted a home as committed under the 2004-2005 program, while the builder could have completed it in 2006. This could result in over-reporting numbers of program homes built, but probably not non-program homes. The national ENERGY STAR Homes Program continued to count homes when committed rather than completed—a difficulty of comparing across programs.

The conclusions drawn from this analysis are largely qualitative. The intent is to examine the available data, and make inferences based on the preponderance of evidence.<sup>78</sup>

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<sup>77</sup> It should be noted that for builders, HVAC contractors, Title 24 consultants and HERS raters there are a few respondents who are responsible for disproportionate numbers of non-program homes. For example, one builder built 61% of builder non-program homes, one HVAC contractor installed HVAC equipment into 78% of HVAC contractor non-program homes, one HERS rater rated 58% of HERS rater non-program homes and one Title 24 consultant consulted on 23% of Title 24 consultant non-program homes.

<sup>78</sup> Preponderance of evidence approach: Drawing a conclusion that a fact or occurrence is more probable than not based on consideration and weighing of all available evidence.

**Table 4.1-1: Data Collection Efforts Contributing to Analysis of Expected Outcomes**

<b>Group</b>	<b>NC/CS</b>	<b>Market Effects</b>	<b>Total</b>
Buyers of newly constructed non-program homes	976 computer-assisted telephone interviewing (CATI) interviews, from IOU records	Additional questions on indicators of demand-side outcomes per the program theory	976 CATI interviews with non-participating new home buyers
On-site visits to newly constructed non-program homes	267 on-site visits, recruited through home buyer interviews		267 on-site visits
Builders of non-program homes		32 CATI interviews, with builder names provided by home buyer interviews	32 CATI interviews with builders of non-participating homes
HVAC contractors who worked on non-program homes		9 CATI interviews, with contractor names provided by builder interviews	9 CATI interviews with HVAC contractors
Title 24 consultants		45 CATI interviews, recruited from a list <sup>79</sup>	45 CATI interviews with Title 24 consultants
HERS raters		29 CATI interviews, recruited from a list <sup>80</sup>	29 CATI interviews with HERS raters
Window distributors		17 telephone interviews, recruited from a list <sup>81</sup>	17 interviews with window distributors
HVAC distributors		6 telephone interviews, recruited from a list <sup>8</sup>	6 interviews with HVAC distributors
Lighting fixture and control distributors		16 telephone interviews, recruited from a list <sup>8</sup>	16 interviews with lighting fixture and control distributors
Insulation distributors		5 telephone interviews, recruited from a list <sup>8</sup>	5 interviews with insulation distributors
Managers of other voluntary RNC programs		8 in-depth interviews, selected by judgment	8 in-depth interviews
Building code officials/inspectors	14 interviews with building code officials/inspectors	Additional questions for 14 building code officials/inspectors	14 interviews with building code officials/inspectors

Where data are available and relevant, the 2008 data are compared with previous studies of the RNC market conducted in 1998 (RER, 1998) and 2000 (Quantum Consulting Inc., 2000).

This section follows Figure 2.2-1, in which the oval shapes are expected outcomes, the diamonds are elements of the IOU programs, and the arrows are either causal links between program elements and outcomes, or from one outcome to another. Indicators, first outlined in Table 2.3-1, are ways that linkages are measured. Hence the reader would likely benefit by referring to Figure 2.2-1, and possibly to Table 2.3-1, when reading this section.

<sup>79</sup> California Association of Builder Energy Consultants

<sup>80</sup> California Home Energy Efficiency Rating Services and California Association of Builder Energy Consultants

<sup>81</sup> Dun & Bradstreet

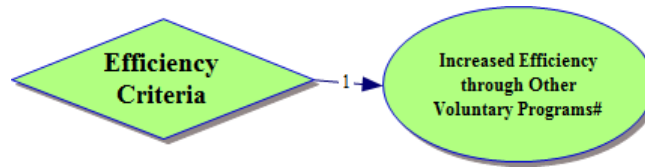
It should be noted, however, that Figure 2.2-1 refers to the whole market, while this study focuses on non-program homes and non-participant (or partial-participant) market actors. The NC/CS evaluation is addressing participating homes and market actors—and while it does not use the same analytical framework, it may provide useful information if Phase II of this market effects study is conducted. Looking at non-program homes sheds light on the degree to which the programs have effects that spill over onto the rest of the market.

The following section begins an analysis of expected outcomes, links to the IOU programs, and associated indicators, as outlined in Section 2.3 and depicted in Figure 2.2-1. Each section also begins with a figure showing only the linkages to the specific outcome. More supporting analysis and tables may be found in Appendix C.

One point to keep in mind during this discussion is that the low levels of program participation, summarized in Table 3.1-1, mean that program influence on relatively modest numbers of non-program homes could translate into fairly high levels of spillover.

## 4.2. Homes Built through Other Voluntary Efficiency Programs

Figure 4.2-1: Linkages to Other Voluntary Efficiency Programs



**Expected Outcome:** *Increased efficiency through other voluntary efficiency programs*

The programs represented by interviews with other program managers certified about 49,000 thousand homes in California as energy efficient from 2006 through 2008. There is some overlap between IOU and non-IOU programs—and among non-IOU programs—but since there were only 5,592 homes participating in the IOU programs from 2006 to 2008, most of these homes were outside the program, including some outside the IOU territories. Also, some of these programs count homes when they are committed rather than when they are built, unlike the IOU programs, so some of the homes were likely not completed in the years in which they were claimed.

**Link 1:** **IOU programs leverage other voluntary efficiency programs**

**Indicator 1A:** **Managers of other efficiency programs say that some of their efficiency criteria are based on the IOU program criteria**

Four of the eight managers of other voluntary energy efficiency programs interviewed—accounting for about 93% of homes certified by these programs but not certified by the IOU programs, or about 43,000 homes—say the IOU programs had a major effect on the efficiency criteria used by their programs. It is likely that some of this effect is from the pre-2006 IOU programs, when overlap with the non-IOU programs was much greater, as was participation in the IOU programs (e.g., 36,920 IOU program homes from 2003 to 2005, compared to 5,592 from 2006 to 2008; see Table 3.1-1). It is also likely that the effects were reciprocal, with the non-IOU programs also affecting the IOU programs' efficiency criteria.

**Indicator 1B: Managers of other efficiency programs say the IOU programs increase participation in their programs**

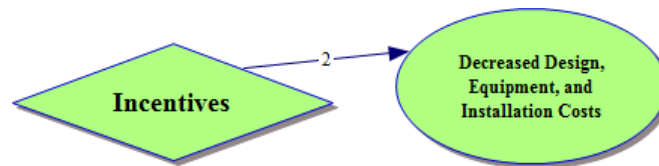
Two of the eight managers of other voluntary energy efficiency programs interviewed—accounting for about 90% of homes certified by these programs but not certified by the IOU programs, or about 42,000 homes—say the IOU programs have increased participation in their programs a lot. Again, it is likely that much of the effect was from the pre-2006 IOU programs, when there was much more overlap between IOU programs and non-IOU programs, and the number of homes participating in the IOU programs was much higher, and it is likely that the effects were reciprocal, with the non-IOU programs also affecting participation in the IOU programs.

*Summary of Findings on Expected Outcome and Links to the IOU Programs: There is strong evidence that other programs certified fairly large numbers of energy-efficient homes outside the IOU programs in California during the 2006-2008 period—much greater than the number of homes certified by the IOU programs. While there is also strong evidence that the IOU programs contributed to these programs by affecting efficiency criteria and increasing participation, it is likely that a big part of these effects are from pre-2006 programs when IOU program participation was much greater. Moreover, the IOU programs should be seen in the context of a new construction market with many, largely reciprocal, programs promoting efficiency; the IOU programs, collectively, were just one of many—and in the 2006-2008 period they were not among the largest.*



### 4.3. Costs of Increased Efficiency

**Figure 4.3-1: Linkages to Decreased Incremental Costs**



***Expected Outcome: Decreased Design, Equipment, and Installation Costs***

Based on self-reporting by respondents, there is mixed evidence that the incremental costs of energy-efficient practices and technologies decreased during the 2006-2008 period, but this occurred in the context of a more stringent code, which, along with inflation, would tend to drive up costs for meeting code. On average, distributors reported decreasing incremental prices for higher efficiency for four types of equipment or materials, increasing incremental prices for two types of equipment or materials, and no change for four types of equipment or materials. Distributors attributed declining incremental costs, when they occurred, to the wider availability of high efficiency equipment and materials. Builders interviewed in 2008 estimated that the incremental cost to exceed Title 24 by ten percent was considerably less than what builders interviewed in 1998 had estimated (8% in the current study compared to 31% in the 1998 study). However, 24 of 32 builders interviewed in 2008, representing 96% of non-program homes, reported that the incremental cost to exceed the efficiency standards of Title 24 had increased over the past five years; given that inflation occurred over this period and code became more stringent, increasing costs would be expected, all other things being equal.

**Link 2:** **IOU incentives for builders, leveraging other available incentives, decrease the cost of increased efficiency**

**Indicator 2A:** **Builders report that IOU incentives combined with other incentives have decreased incremental costs for efficient technologies**

None of the 32 builders interviewed attributed decreases in incremental costs to the IOU programs. However, IOU program incentives for program homes do decrease the costs of building those (relatively few) homes, if not for the market as a whole.

**Indicator 2B:** **Distributors report that the IOU incentives combined with other incentives have significantly decreased incremental costs for efficient technologies**

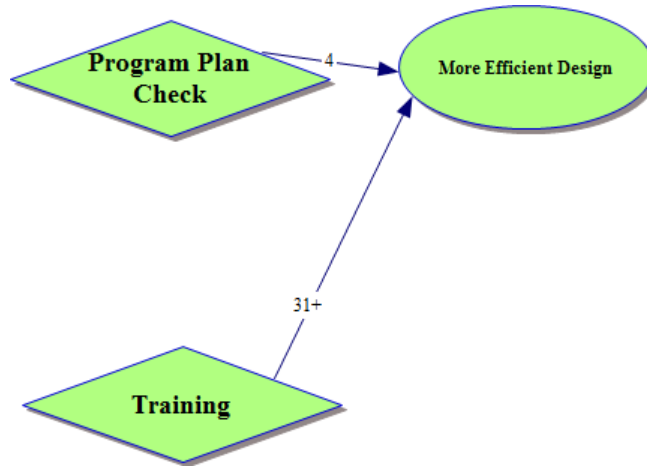
Distributors tended not to attribute price declines to the IOU programs, but rather to the wider availability and use of the higher efficiency equipment or materials and manufacturers cutting prices due to the economic downturn.

***Summary of Findings on Expected Outcome and Links to the IOU Programs: There is weak evidence that the incremental costs for efficient compared to less efficient equipment***

*decreased during the 2006-2008 period. Three-quarters of builders reported that the incremental cost to exceed the efficiency standards of Title 24 had increased over the previous five years (to be expected with inflation and a stricter code). Very few distributors and no builders said the IOU programs had a major influence on any observed decrease in incremental costs. The IOU programs appear to have had minimal, if any, effect on decreasing costs of increased efficiency, which could only be expected given that the IOU incentive programs certified fewer than 6,000 homes in California from 2006 through 2008, out of a total of 207,000 homes built in the IOU territories during that period; the volume of incentivized measures and installations was simply not large enough to help achieve sizable economies of scale.*

#### 4.4. Modeling of Efficiency

Figure 4.4-1: Linkages to More Efficient Design



**Expected Outcome:** *More Efficient Design*

Thirty-eight out of 45 Title 24 consultants recommended at least some above-code practices for non-program homes during the 2006-2008 period, most commonly windows (39% of non-program homes), duct testing (38%), duct sealing (37%), high-EER air conditioners or heat pumps (32%), water heating equipment (28%), insulation installation practices (27%), and insulation R-values (26%).

**Link 4:** **Program Plan Check catches modeling errors on participating homes. The feedback educates Title 24 consultants, which improves the modeling of non-participating homes. (Program Plan Check is a process conducted by the IOUs that corrects modeling errors.)**

**Indicator 4A:** **Title 24 consultants, builders, and HVAC contractors say Program Plan Check catches modeling errors on participating homes**

Almost no Title 24 consultants were aware of Program Plan Check, and consequently, none of them said it helps catch modeling errors on program-supported homes.<sup>82</sup>

**Indicator 4B:** **Title 24 consultants, builders, and HVAC contractors say Program Plan Check has helped improve their modeling of non-participating homes**

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<sup>82</sup> It is possible that Title 24 Consultants and builders are not familiar with the term “Program Plan Check” but familiar with the review process.

Only eight of 32 builders were aware of Program Plan Check, and five builders, responsible for 7% of non-program homes, reported that the program helped a great deal in modeling and building above-code. Nearly all Title 24 consultants (42 of 45) and HVAC contractors (seven of nine) were **not** familiar with Program Plan Check.

**Link 31+:**                    **IOU training of Title 24 consultants leads to more efficient designs**

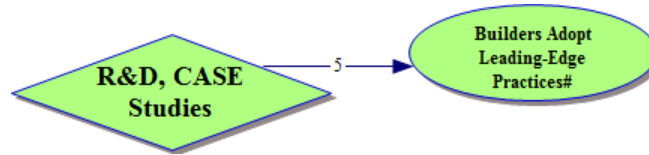
**Indicator 31A:**            **Title 24 consultants say they have attended IOU training and that it has influenced their recommendations of energy-efficient building practices and technologies.**

Twenty-three out of 45 Title 24 consultants said IOU training had had a strong influence on their recommendations for energy-efficient building practices and technologies for 42% of non-program homes built in the 2006-2008 period. The IOU programs in general influenced 17 out of 45 Title 24 consultants accounting for 30% of non-program homes to recommend above-code practices and technologies for most of those homes, including duct testing (19% of all non-program homes), duct sealing (18%), water-heating equipment (11%), and high-SEER AC or heat pump (9%). It is possible that part of this effect is from Program Plan Check, with Title 24 Consultants simply not recognizing the name.

*Summary of Findings on Expected Outcome and Links to the IOU Programs: There is strong evidence that this outcome has occurred, as 38 out of 45 Title 24 consultants recommended at least some above-code practices in the 2006-2008 period. Program Plan Check, at least insofar as market actors recognize the name, appears to have had only a minimal effect on builders modeling and building homes above code and almost no effect on Title 24 consultants in catching modeling errors on participating homes and improving the modeling of non-participating homes. In contrast, IOU training (possibly including the Program Plan Check process) has had a very strong effect, influencing 23 out of 45 Title 24 consultants' recommendations of energy-efficient practices for 42% of non-program homes. On balance, IOU programs appear to have had a strong influence on Title 24 consultants' recommendations of more energy-efficient designs.*

#### 4.5. Adoption of New Technologies and Practices

Figure 4.5-1: Linkages to Adoption of New Technologies and Practices



***Expected Outcome:*** ***Builders Adopt Leading-Edge Practices***

Only four builders, representing just 1% of non-program homes, said they had adopted practices or technologies promoted by the IOUs' R&D and CASE Study Programs in the 2006-2008 period, and 11 Title 24 consultants, representing 12% of non-program homes, said they had recommended some of these practices.

**Link 5:** **IOUs' R&D of new technologies and practices and CASE studies on their deployment show builders that the new technologies and practices are feasible**

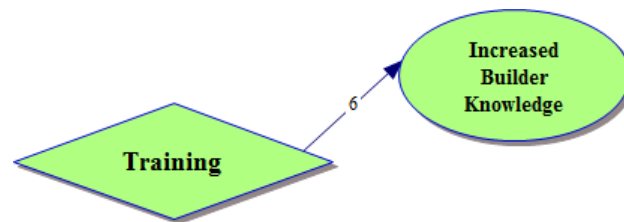
**Indicator 5A:** **Builders and Title 24 consultants are aware of IOUs' R&D and CASE studies, leading to the adoption of new technologies and practices**

Only five of 32 builders were aware of the IOUs' R&D and CASE studies, and only one of 32 said that, as a result, they had adopted any technologies in the 2006-2008 period, in less than 1% of non-program homes. A higher proportion of Title 24 consultants—17 of 45—were aware of the IOUs' R&D and CASE Studies, and as a result, eight of 45 had recommended some technologies, but only for 3% of non-program homes.

***Summary of Findings on Expected Outcome and Links to the IOU Programs: There is weak evidence that the outcome has occurred among builders, and slightly stronger evidence that it has occurred among Title 24 consultants, and in that case affecting relatively few homes in the 2006-2008 period. The IOUs' R&D and CASE studies appear to have had almost no effect on the adoption of new technologies and practices by non-participating builders, and a weak effect on the recommendations for those technologies by Title 24 Consultants. Given that these advanced practices are likelier to be adopted by more advanced builders, it would be reasonable to expect low rates of adoption by non-participating builders, but the small number of program homes would indicate a small impact on the market as a whole.***

## 4.6. Builder Knowledge

**Figure 4.6-1: Linkages to Increased Builder Knowledge**



***Expected Outcome: Increased Builder Knowledge***

Most builders, accounting for a large majority of non-program homes, said they were very aware of most efficient technologies and practices, although only a minority said they were very aware of orientation and shading, duct sealing, and air sealing. Nearly all HVAC contractors rated themselves as “very aware” of all energy-efficient equipment and building practices pertaining to HVAC systems.

**Link 6:** **IOU training of builders and subcontractors in new technologies and practices leads to increased builder knowledge**

**Indicator 6A:** **Many builders and their subcontractors become more knowledgeable about new technologies and practices through IOU training**

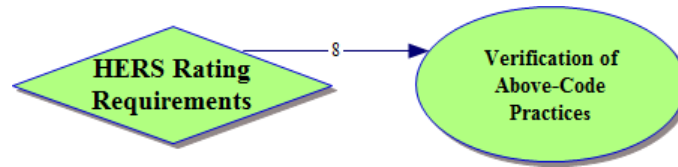
Sixteen of 32 builders, responsible for 25% of non-program homes, said they had attended IOU-sponsored trainings in the 2006-2008 period, and 11 builders said they had adopted some energy-efficient building practices or technologies because of the training. Eight of 32 builders, responsible for 17% of non-program homes, rated the training as having a great deal of influence on their adoption of the more energy-efficient building practices or technologies during the 2006-2008 period. Eleven builders said they employed subcontractors who had worked on program homes and had changed their building or installation practices as a result. In addition, 30 out of 32 builders identified subcontractors as a primary source of information. Nine builders reported that the IOU RNC programs were a primary source of information about new energy-efficient technologies and building practices and eight builders reported that utility training was a primary source of information. Although only one HVAC contractor reported that the adoption of new technologies or practices was directly due to IOU-sponsored trainings, five of nine HVAC contractors reported that the most common source of information on new energy-efficient technologies and building practices was the IOU RNC programs.

Additionally, as discussed more fully in Section 4.11, many Title 24 consultants, HERS raters, and building code officials and inspectors (but not as many HVAC contractors) said that IOU program training helped improve code compliance during the 2006-2008 period.

*Summary of Findings on Expected Outcome and Links to the IOU Programs: There is strong evidence that the outcome occurred among a majority of builders for some efficient measures and practices during the 2006-2008 period, and among a large minority for others. About one-half of builders had attended IOU-sponsored trainings and about one in six had adopted new technologies and practices as a result, while a majority of HVAC contractors reported that the most common source of information on new energy-efficient technologies and building practices was the IOU RNC programs. A sizeable minority of builders became more knowledgeable about new energy-efficient building technologies and building practices through HVAC subcontractors (and thus indirectly from the IOU RNC programs), as nearly all builders (30 of 32) identified subcontractors as a primary source of information on new energy-efficient technologies and practices.*

#### 4.7. Verification of Above-Code Practices

Figure 4.7-1: Linkages to Verification of Above-Code Practices



**Expected Outcome:** *Above-code Practices in Program Homes Are Verified*

**Link 8:** HERS rating requirements for program participation ensure that above-code practices promoted through the program are implemented in program homes

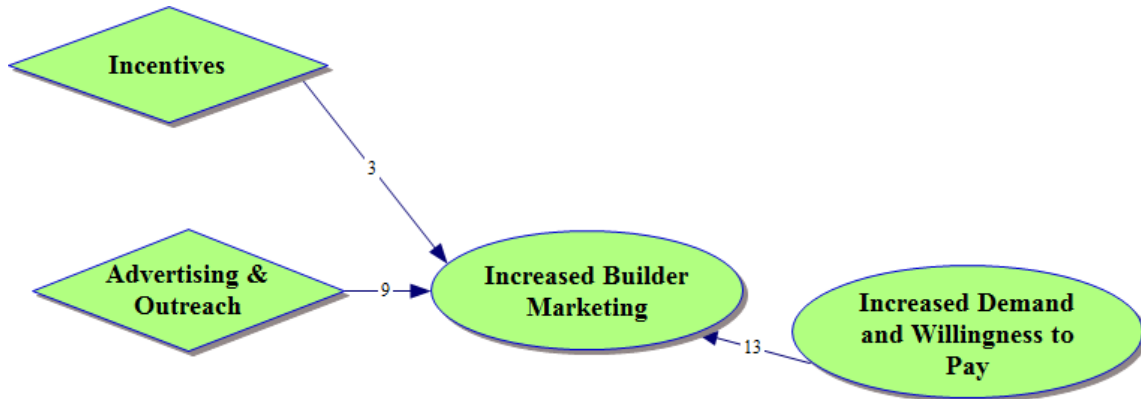
**Indicator 8A:** On-site inspections of program homes shows that above-code practices are implemented

This outcome, expected to occur only for participating homes, was not examined in this evaluation, but is being addressed in the NC/CS Impact Evaluation.



## 4.8. Builder Marketing

Figure 4.8-1: Linkages to Increased Builder Marketing



**Expected Outcome:** *Increased builder marketing of efficiency*

Builders of non-program homes interviewed in 2008 reported the same amount of marketing of energy efficiency as all builders did in 2000 (a mean of 4.0 on a 1-5 scale, in which 1 is “never” and 5 is “always”). (It should be noted that partial participants—that is, those who built both program and non-program homes—were responsible for 83% of non-program homes built in the 2006-2008 period, so comparing the 2008 and 2000 results is largely valid.) Six of ten partial participants reported no difference in the way they market program and non-program homes. Fourteen of 32 builders, representing 79% of non-program homes, said they “always” market energy-efficient features of their new homes. Again, however, this does not represent an increase since 2000.

**Link 3:** **IOU incentives for builders induce them to increase their marketing of efficiency**

**Indicator 3A:** **Builders report increasing their marketing of efficiency because of IOU programs and incentives**

Only two partial participants, responsible for fewer than 1% of non-program homes, said the IOU programs had a great deal of influence on their strong emphasis on energy efficiency—and no aware nonparticipants said the programs had a great deal of influence.

**Link 9:** **IOUs’ advertising and outreach causes builders to increase their own marketing of efficiency**

**Indicator 9A:** **Many builders market efficiency as a feature of their new homes as a result of IOU programs**

See indicator 3A above.

**Link 13:** Increased home buyer demand for energy efficiency causes an increase in builder marketing of efficiency

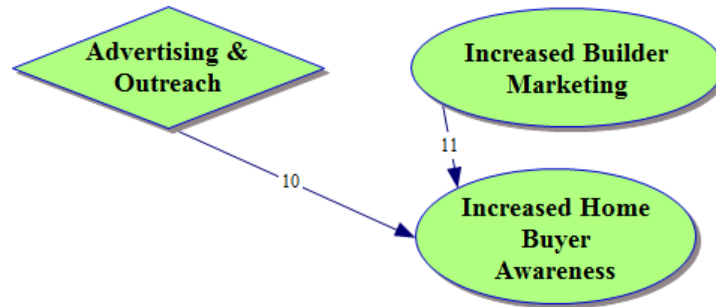
**Indicator 13A:** Builders perceive an increase in home buyer demand for efficiency and, therefore, increase their marketing of it

Thirty-one of 32 builders in the current study, representing nearly all non-program homes, reported that there was “a lot” or “some” demand for energy savings features and reported an increase in demand for energy saving features over the past five years, representing an increase in perceived demand from both the 1998 and 2000 reports. Only seven of 32 builders identified IOU programs as “significant factor” or “one of the most important factors” in the increase in home buyer demand, but 15 of 32 credited the ENERGY STAR Homes Program (which the IOUs ran for several years—but before the 2006-2008 period, which is the focus of this evaluation) with this change, and 14 of 32 credited the Flex Your Power campaign (a separate IOU program, and the focus of the CPUC’s Marketing and Outreach Impact Evaluation). A higher percentage of builders from the current study compared to the 2000 reported that home buyers asked about homes that are more energy efficient than code, and builders in the current study estimated that home buyers are willing to pay a higher percentage of the increased costs than estimated by builders in the 1998 and 2000 studies.

*Summary of Findings on Expected Outcome and Links to the IOU Programs: Most builders of non-program homes marketed efficiency to prospective home buyers in the 2006-2008 period, but this marketing did not increase from 2000, and few builders attributed any influence to the IOU programs. Builder perceptions of consumer demand appeared to increase a lot since the 1998 and 2000 studies, and builders attributed this change, in part, to the IOU programs. On balance, while there is evidence that builders perceived increased home buyer demand and this was at least partially due to the IOU programs, there is not much evidence that builders increased their marketing in response.*

## 4.9. Home Buyer Awareness

Figure 4.9-1: Linkages to Increased Home Buyer Awareness



**Expected Outcome:** *Increased Home Buyer Awareness of Energy Efficiency*

Only 26% of non-participating new home buyers interviewed in 2008 said that some homes are more energy efficient than others, compared to 70% who said so in 2000. However, 47% in 2008 compared to 34% in 2000 said that new homes in their area and price range could be more efficient, suggesting that these home buyers recognize that some homes can be more energy efficient than others. Most non-participating new home buyers surveyed in 2008 said their home was about as efficient as other new homes.

**Link 10:** **IOUs' advertising and outreach increases home buyers' awareness of energy efficiency**

**Indicator 10A:** **Home buyers become more aware of energy efficiency as an important feature of new homes, hearing about it from IOUs' advertising and outreach**

Only 3% of non-participating new home buyers interviewed in 2008 said they had heard about efficiency from their utility during the home-buying process, although the proportion of new home buyers who had heard about the importance of efficiency from **someone** increased from 21% in 2000 to 27% in 2008. About one-half of non-participating homeowners (49%) said they were aware of the programs sponsored by governments or IOUs that encouraged energy-efficient features in new homes, and 10% said someone mentioned the program when they were buying or building their home. Aided awareness of the ENERGY STAR Homes program was 48% in 2008, while aided awareness of the IOU programs was 19%; the greater recognition of the national program name suggests that home buyer awareness of the IOU programs may at least partially carry over from the pre-2006 programs, when the IOUs used the ENERGY STAR name.

**Link 11: Builders' marketing increases home buyers' awareness of energy efficiency**

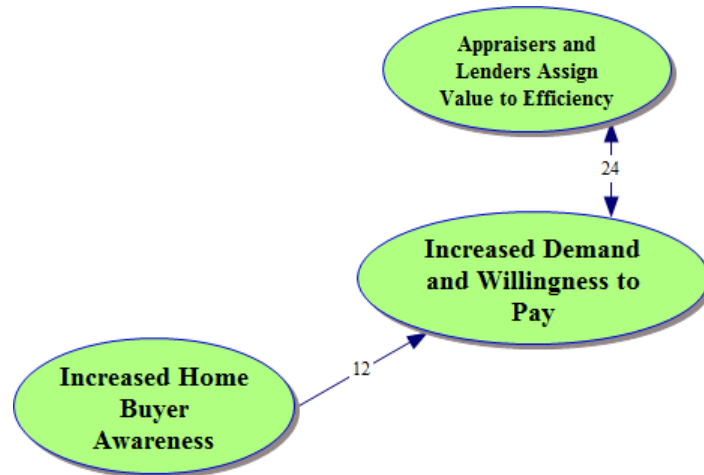
**Indicator 11A: Home buyers become more aware of energy efficiency as an important feature of new homes, hearing about it from builders**

Only four percent of non-participating new home buyers said that builders, developers, or realtors emphasized energy efficiency during the buying process. However, of those who said someone mentioned IOU programs (10% of all non-participating new home buyers), about one-half (5% of all non-participating new home buyers) heard about it through the builder or sales agent.

*Summary of Findings on Expected Outcome and Links to the IOU Programs: There is mixed evidence that this outcome has occurred, and only a weak linkage to IOU programs; insofar as there is a link, it appears that much of it may be from the pre-2006 IOU programs, which were closely associated with the national ENERGY STAR program. Non-participating new home buyers were only somewhat aware of energy efficiency, and few of them recalled hearing about the importance of efficiency from either the utility or the builder, with not much change from 2000 to 2008.*

#### 4.10. Home Buyer Demand and Willingness to Pay

Figure 4.10-1: Linkages to Increased Demand and Willingness to Pay



**Expected Outcome:** *Increased Home Buyer Demand and Willingness to Pay*

Two-thirds (68%) of non-participating new home buyers said energy efficiency was important (7 to 10 on a 0-to-10 scale) in their selection of a new home. In the current study, one-third (32%) rated it very important (9 or 10 on a 0-to-10 scale) compared to 27% in the 2000 study, but the difference is not statistically significant. Three-fourths (76%) of non-participating new home buyers expressed strong agreement (7 to 10 on a 0-to-10 scale) with the statement that they were willing to invest in home features that would reduce their monthly energy bills, and about one-half (54%) disagreed (0 to 3 on a 0-to-10 scale) that energy-efficient features in a new home cost more than they are worth.

**Link 12:** **Increased home buyer awareness causes an increase in home buyer demand for energy efficiency and an increase in willingness to pay**

**Indicator 12A:** **Home buyers ask builders about the IOU programs**

Only 10% of non-participating new home buyers sought information on the IOU programs during the buying process, about equally through utility representatives, the Internet, and the builder.

**Indicator 12B#:** **Home buyers seek IOU program homes**

About two-thirds of non-participating home buyers (64%) were aware of the IOU programs, but IOU program homes made up only 2.7% of homes completed from 2006 to 2008, indicating that there were not large numbers of home buyers seeking them out.

**Expected Outcome:** *Appraisers and lenders assign value to efficiency*

**Link 24:** **Increased home buyer demand for energy efficiency causes appraisers to assign value to efficiency and lenders to provide energy-efficient mortgages (EEMs) which, in turn, increases home buyer demand**

**Indicator 24A:** **Appraisers and lenders perceive an increase in home buyer demand for efficiency and, respectively, assign more value to efficiency and make EEMs more available**

Not addressed in the current study because interviews with industry experts in the scoping study indicated that appraisers and lenders had minimal effect of the efficiency of new homes.

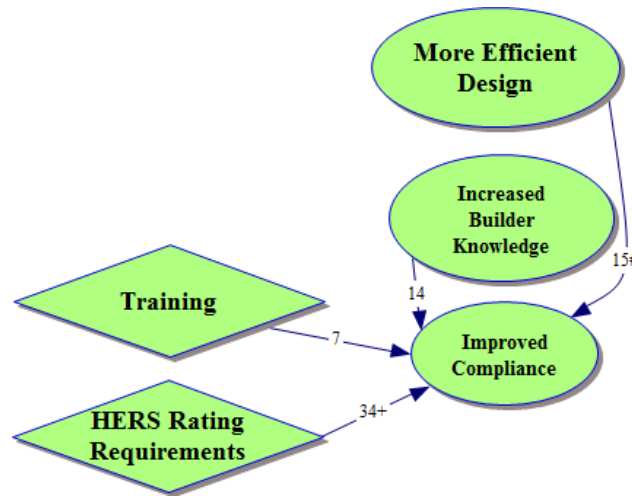
**Indicator 24B:** **Home buyers are aware of appraisers assigning value to efficiency and lenders providing EEMs, which increases home buyer demand**

Not addressed in the current study because interviews with industry experts in the scoping study indicated that appraisers and lenders had minimal effect of the efficiency of new homes.

*Summary of Findings on Expected Outcome and Links to the IOU Programs: There is strong evidence that non-participating home buyers express demand for and willingness to pay for energy efficiency, although it is not clear whether this expressed demand and willingness to pay results in the actual demand for energy-efficient new homes. There is only a weak linkage to the IOU programs. Nonparticipating home buyers tend to say that energy efficiency is important and that they are willing to pay for it, but few of them seek out the IOU programs. Again, the small number of IOU program homes completed from 2006 to 2008—5,592 out of 206,788 total—is evidence of limited home buyer demand generated by the 2006-2008 IOU programs; insofar as there was demand, it may have been generated by the pre-2006 IOU programs, and may have translated into sales of efficient homes certified by other programs.*

## 4.11. Code Compliance

Figure 4.11-1: Linkages to Improved Compliance



**Expected Outcome:** *Improved Code Compliance*

Rates of code compliance were not available from the results of onsite visits to non-program homes conducted for the NC/CS impact evaluation, so this analysis relies on self-reported results. Twenty-five out of 45 Title 24 consultants, representing 55% of non-program homes, and 20 out of 29 HERS raters, representing 82% of non-program homes, said that rates of compliance with Title 24 increased from 2006 to 2008.

**Link 7#:** **IOU-sponsored training of code officials leads to improved compliance with the building code**

**Indicator 7A:** **The incidence of compliance is higher in municipalities whose code officials have received PG&E-sponsored compliance training**

To be addressed by the Local Government Program Impact Evaluation

**Link 14:** **Increased builder knowledge leads to greater code compliance**

**Indicator 14A#:** **Builders and other market actors say IOU programs have helped to improve code compliance**

Thirteen Title 24 consultants, responsible for 25% of non-program homes, said that the IOU training had helped to improve code compliance during the 2006-2008 period, while five Title 24 consultants, responsible for 35% of non-program homes, said that other (non-IOU) utility training had helped to improve code compliance. Fifteen HERS raters, responsible for 92% of non-program homes, said that the IOU training had helped to improve code compliance, while 11 HERS raters responsible for 86% of non-program homes said that other (non-IOU) utility programs had helped to improve code compliance. Five of 14 building code officials and inspectors agreed that the IOU programs had helped improve compliance, and four of 14 building code officials/inspectors agreed that non-IOU programs had helped improve code

compliance. Nine builders, responsible for 26% of non-program homes, said that IOU training had helped to improve code compliance, while five builders, responsible for 11% of non-program homes, said that other (non-IOU) utility training had helped to improve code compliance. Three HVAC contractors, responsible for 1% of non-program homes, said that IOU training had helped improve code compliance, while two HVAC contractors who are responsible for most non-program homes (78%) said that other (non-IOU) training had helped to improve code compliance.

**Link 15#:**                    **Improved design leads to improved compliance**

**Indicator 15A#:**        **Title 24 consultants, builders, and HVAC contractors say that the IOU programs have helped them to learn more about modeling and to improve the compliance of nonparticipating homes**

As discussed in Section 4.4, twenty-three out of 45 Title 24 consultants, representing 42% of non-program homes, said that IOU training had a strong influence on their recommendation of energy-efficient building practices and technologies during the 2006-2008 period. The next section (Section 4.12) shows that Title 24 consultants estimate that 24% of non-program homes exceeded Title 24 requirements; by inference, this would imply that 42% minus 24%, or 18% of non-program homes, were helped to achieve code compliance through IOU program training of Title 24 consultants. Almost no Title 24 consultants were aware of Program Plan Check, while only eight of 32 builders were aware of the process. Only five builders, responsible for 7% of non-program homes, reported that the IOUs' Program Plan Check process helped a great deal in modeling and building above code. It could be that market actors are simply not aware of the name "Program Plan Check," but are aware of the process.

**Link 34+:**                    **Use of HERS ratings leads to improved compliance**

**Indicator 34A:**        **HERS raters say IOU programs have influenced the use of QII in non-program homes**

Twenty out of 29 HERS raters, responsible for 99% of non-program homes, verified Quality Insulation Installations (QII) to earn energy credits for Title 24 compliance during the 2006-2008 period, and four HERS raters, responsible for 19% of non-program homes, said that the IOU RNC programs had a strong influence on the use of QII in non-program homes during the 2006-2008 period.

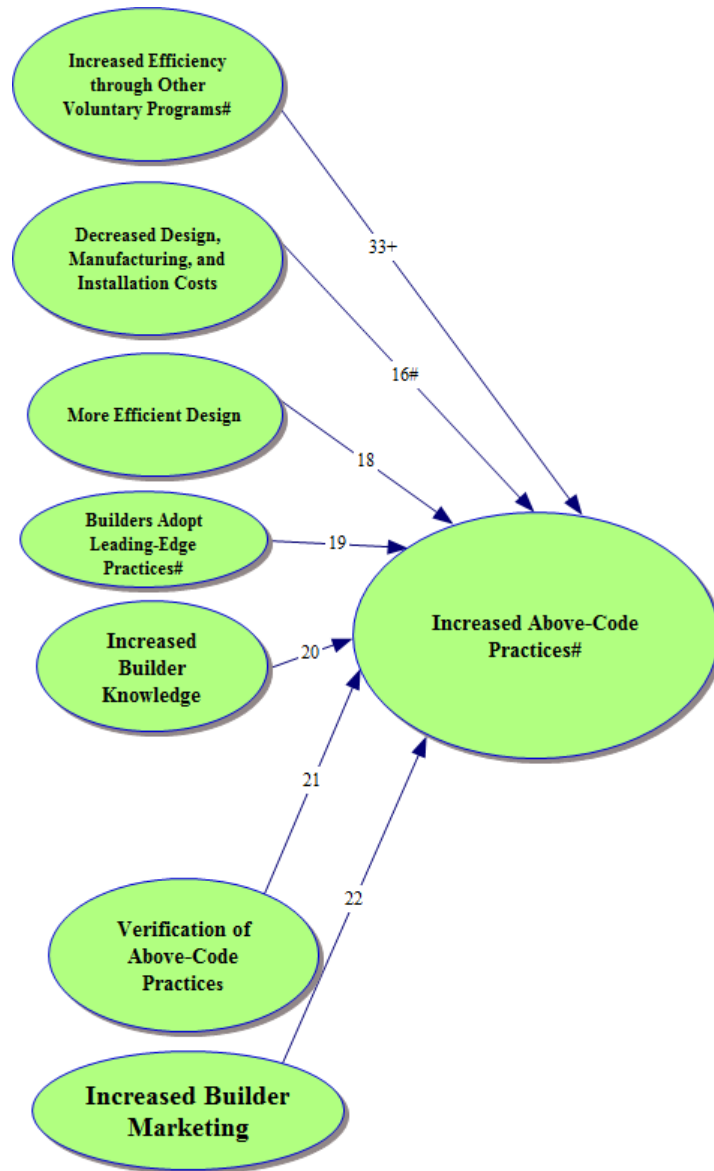
*Summary of Findings on Expected Outcome and Links to the IOU Programs: Title 24 consultants and HERS raters said they observed increased rates of code compliance during the 2006-2008 period. The IOU programs appear to have had a fairly strong effect on improved code compliance, particularly through training. In addition, four HERS raters said that the IOU RNC programs had a strong influence on the use of QII in non-program homes during the 2006-2008 period. During this period, training by IOUs had a strong influence on Title 24 consultants' recommendation of energy-efficient building practices and technologies*



*and thereby on compliance, although the IOUs' Program Plan Check did not appear to have had an effect on improved design and improved compliance.*

#### 4.12. Above-Code Practices

**Figure 4.12-1: Linkages to Increased Above-Code Practices**



**Expected Outcome:** *Increased Above-Code Practices#*

Based on onsite visits to newly constructed non-program homes, the efficiency levels of several building measures, such as high-SEER central air conditioners and high-AFUE furnaces, appear

to have increased in the 2006-2008 period compared to before 2006. Thirty-eight of 45 Title 24 consultants, 17 of 29 HERS raters, 14 of 19 partial participant builders and non-participating builders who were aware of the programs, and all nine HVAC contractors reported that they had recommended, rated, or installed above-code equipment or used above-code practices in non-program homes during the 2006-2008 period.<sup>83</sup> Seventeen of 45 Title 24 consultants estimated that 24% of non-program homes exceeded Title 24 requirements, while 18 of 29 HERS raters estimated that 77% of the non-program homes exceeded Title 24 requirements. (The difference does not necessarily represent a discrepancy, as HERS raters, unlike Title 24 consultants, are not involved with all new homes.) Eleven of 45 Title 24 consultants estimated that 10% of the non-program homes met IOU program standards—that is, were at least 15% more efficient than Title 24 requirements, not simply above code—while 12 of 29 HERS raters estimated that 6% of all non-program homes they had rated were built to IOU program standards. Seven out of 45 Title 24 consultants (responsible for 23% of non-program homes) and 12 of 29 HERS raters (responsible for 7% of non-program homes) reported that the number of non-program homes they consulted on or rated that exceeded Title 24 had increased between 2006 and 2008.

**Link 16#:**                    **The decreased cost of energy-efficient technologies and practices leads to their adoption by an increasing number of builders**

**Indicator 16A:**            **Builders and distributors report decreasing incremental costs of energy-efficient technologies and practices as a factor encouraging their use**

As reported in Section 4.3, there is mixed evidence that incremental costs for efficient compared to less efficient equipment decreased during the 2006-2008 period, although the IOU programs appear to have had minimal, if any, effect on decreasing costs of increased efficiency.

However, builders who were responsible for 28% of non-program homes rated decreasing incremental cost as an important or very important factor. HVAC contractors rated decreasing incremental cost as only a moderately important factor.

Three builders (all partial participants) reported that the way in which the IOU programs influenced the use of above-code practice was by reducing the cost of energy-efficient practices or technologies. One HVAC contractor who estimated that the percentage of above-code central air conditioning systems increased from 2006 to 2008 attributed the shift to reduced cost, and one lighting distributor attributed the increase in the use of pin-based CFL fixtures to the reduced cost of the fixtures (although neither distributor attributed the reduced costs to the IOU programs). Again, the volume of the IOU programs in 2006 to 2008 was simply not large enough to reduce costs across the board through economies of scale.

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<sup>83</sup> We can identify only the number of builders, not the numbers of homes, with above-code practices because respondents reported the number of homes with a specific practice or technology, and there may be overlap between these practices and technologies in individual homes.

**Link 18:** **Improved design leads to increased above-code practices**

**Indicator 18A#:** **Title 24 consultants say they have attended IOU training and that it has influenced their recommendations of energy-efficient building practices and technologies**

As reported in Section 4.4, the IOU programs influenced 17 out of 45 Title 24 consultants accounting for 30% of non-program homes to recommend above-code practices and technologies for most of those homes, including duct testing (19% of all non-program homes), duct sealing (18%), water-heating equipment (11%), and high-SEER AC or heat pump (9%).

**Link 19:** **The demonstration of feasibility of energy-efficient technologies and practices leads to their adoption by an increasing number of builders**

**Indicator 19A:** **Builders and Title 24 consultants who are aware of the IOUs' R&D and CASE studies are more likely than others to try the new technologies and practices**

As reported in Section 4.5, the IOUs' R&D and CASE studies appear to have had almost no effect on the adoption of new technologies and practices by non-participating builders, and a weak effect on the recommendations for those technologies by Title 24 Consultants. No respondents identified the IOUs' R&D and CASE studies in their responses to questions pertaining to above-code practices and technologies. While the R&D and CASE study program are aimed more at participating builders, the volume of participating homes in 2006 to 2008 was too small to have a major effect on the market.

**Link 20:** **Increased knowledge about energy-efficient technologies and practices leads to their adoption by an increasing number of builders**

**Indicator 20A:** **Builders, Title 24 consultants, and HERS raters who became knowledgeable about new energy-efficient technologies and practices (directly or indirectly) through IOUs' training are more likely than others to try the new technologies and practices**

As reported in Section 4.6, IOU-sponsored trainings appear to have had a strong influence on builders and HVAC contractors adopting new energy-efficient technologies and building practices.

Eight of 32 builders said the IOU training had a great deal of influence on their recommendations or use of above-code practice or technology in 17% of non-program homes. Builders responsible for 22% of non-program homes reported that knowledge gained through utility programs was an important or very important factor in their choice of energy efficiency levels in non-program homes.

Increased knowledge from program training or participating in IOU programs was identified by a number of respondents when discussing above-code practices. Five of 29 HERS raters and 14 of 45 Title 24 consultants reported that IOU programs influenced builders to use above-code measures in non-program homes through training and education; one HERS rater added builder participation in the IOU RNC programs influenced builder use of above-code measures. One of nine HVAC contractors reported that a builder he worked with had changed their building practices in non-program homes as a result of participating in IOU programs. Insulation distributors attributed the increase in proper installation of insulation, in part, to training. Four of 32 builders reported that their discussions with other participating builders had a great deal of influence on their use of above-code building practices and technologies.

Only one of 45 Title 24 consultants and one of 29 HERS raters rated the IOU programs as having had a great deal of influence on non-program homes built to program standards in the 2006-2008 period, which would mean at least 15% more efficient than Title 24 requirements, not simply above code; they said the IOU programs had influenced 1% or less of the non-program homes they had worked on. None of the builders and HVAC contractors said IOU programs had a great deal of influence on their decision to build non-program homes to program standards.

**Link 21: Verification of efficiency levels in program homes by HERS raters assures above-code practices in those homes**

**Indicator 21A: On-site visits show that above-code practices and technologies certified by HERS raters in program homes have occurred**

Not addressed; being addressed by NC/CS Impact Evaluation

**Link 22: Increased marketing of efficiency by some builders leads other builders to adopt energy-efficient technologies and practices**

**Indicator 22A: Builders who are aware of increased marketing of efficiency by other builders are more likely than others to try the new technologies and practices**

As reported in Section 4.8, on balance, while there is evidence that builders perceived increased home buyer demand and this was at least partially due to the IOU programs, there was not much evidence that builders increased their marketing in response during the 2006-2008 period.

A number of respondents identified the marketing of energy efficiency as a reason for using above-code practices. For example, builders identified the ability to market their homes as energy-efficient as a primary reason for continuing to use above-code practices in the absence of the IOU programs. Two of 32 builders said they used above-code building practices and technologies because they added value to the home and helped to distinguish the home from competitors, while five builder respondents identified marketing of long-term savings to home buyers as the way that the IOU programs influenced their use of above-code building practices

and technologies. One of nine HVAC contractors said they used above-code practices because of the marketability of energy efficiency.

**Link 33+:**                    **Other voluntary programs lead to increased use of efficient technologies and practices**

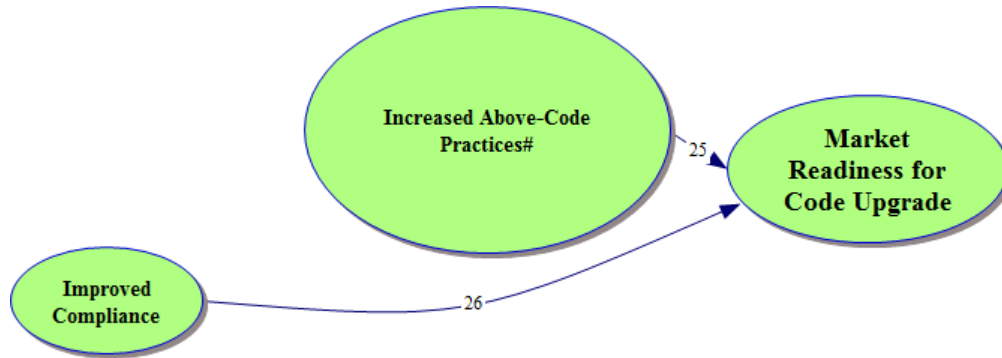
**Indicator 33A:**            **Managers of other voluntary energy efficiency programs say the IOU programs have contributed to the increased use of efficient technologies and practices**

As reported in Section 0, other programs certified fairly large numbers of energy-efficient homes outside the IOU programs in California during the 2006-2008 period—much greater than the number of homes certified by the IOU programs. While the IOU programs contributed to these programs by affecting efficiency criteria and increasing participation, it is likely that a big part of these effects are from pre-2006 programs when IOU program participation was much greater, and that the effects were complementary, with the other programs affecting the IOU programs as well as vice versa.

*Summary of Findings on Expected Outcome and Links to the IOU Programs: There is strong evidence that sizeable numbers of non-program homes built in the 2006-2008 period used above-code practices and technologies, that the level of efficiency increased during this period, and that the IOU programs had an observable effect on the increased use of above-code practices and technology. For example, Title 24 consultants estimated that 24% of non-program homes built during the 2006-2008 period exceeded Title 24, and 17 of 45 Title 24 consultants (a maximum of 19% of all non-program homes for any one practice, and more [but undetermined] cumulatively), ten of 29 HERS raters (a maximum of 15% of all non-program homes for any one practice), eight of 32 builders (a maximum of 9% of all non-program homes for any one practice), and two of nine HVAC contractors (less than 1% of all non-program homes for any one practice) said the IOU programs, in general, had a great deal of influence on their recommendations for or use of at least one above-code practice or technology. Program influence appears to have been primarily through the training of builders and other market actors.*

### 4.13. Code Upgrades

**Figure 4.13-1: Linkages to Market Readiness for Code Upgrade**



**Expected Outcome:** *The Market Is Ready for a Code Upgrade*

See Indicators 25B and 26B below.

**Link 25:** **Enough builders are using energy-efficient technologies and practices such that the market is prepared for a code upgrade**

**Indicator 25A:** **The incidence of energy-efficient technologies and practices becomes a significant part of the market**

As discussed in Section 4.12, there is strong evidence that fairly large numbers of non-program homes built in the 2006-2008 period used above-code practices and technologies.

**Indicator 25B:** **Builders and industry experts indicate that there is enough knowledge and availability of efficient technologies and practices in the marketplace that the code could be upgraded and most builders could comply within a reasonable time.**

Eleven of 29 HERS raters, representing 66% of non-program homes, said there was adequate knowledge and availability of energy-efficient technologies and practices such that most builders could comply with the proposed 2008 code upgrade within a reasonable time, as did six of nine HVAC contractors, representing 82% of non-program homes. However, only ten of 45 Title 24 consultants, representing 5% of non-program homes, said this was the case. Nineteen of 32 builders, representing 79% of non-program homes, said this was the case, which is telling, in that it may reflect a willingness among builders to embrace another code upgrade, or at least resignation to the fact that it will happen.

**Indicator 25C+:** **Builders and industry experts say that utility programs have contributed to market readiness for a code upgrade**

Twelve of 32 builders, representing 28% of non-program homes, said IOU programs had contributed to market readiness for a code upgrade. Eleven of 45 Title 24 consultants,

representing 22% of non-program homes, said the same thing, as did 14 of 29 HERS raters, representing 86% of no-program homes, but only three out of nine HVAC contractors representing 5% of non-program homes.

**Link 26#:** **Improved compliance with the current code helps to prepare the market for a code upgrade**

**Indicator 26A#:** **Builders, industry experts and local code officials say that compliance with the current code has reached the point where builders at the low end of the market could comply with a new upgrade within a reasonable time**

Twenty of 32 builders, representing 22% of non-program homes, agreed that the low end of the market could comply with the proposed 2008 code upgrade within a reasonable time. Twelve of 45 Title 24 consultants, representing 30% of non-program homes said the same thing, as did 12 of 29 HERS raters representing 69% of non-program homes, four of nine HVAC contractors representing 82% of non-program homes, and four of 14 building code officials/inspectors.<sup>84</sup>

**Indicator 26B+:** **Builders and industry experts say utility programs have helped to increase code compliance**

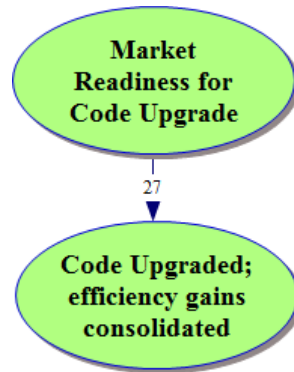
As discussed under Indicator 14A above, comparatively large numbers of Title 24 consultant, HERS raters, and code officials/inspectors say IOU training—along with other training programs—have helped to increase code compliance during the 2006-2008 period.

**Indicator 26C+:** **Builders and industry experts say utility programs have contributed to market readiness for a code upgrade**

See Indicator 25C+.

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<sup>84</sup> The HERS rater responses and especially the Title 24 consultant responses to the questions about “most builders” and “the low end of the market” are seemingly contradictory, indicating that they may not have understood one of the questions.

**Figure 4.13-2: Linkages to Code Upgrades**

***Expected Outcome: Code Is Upgraded; Efficiency Gains Consolidated***

Title 24 code was upgraded in 2005, effective October 1, 2005, and again in 2008, effective August 1, 2009, and another update will occur in 2011. As described in Section 5, the hardwired lighting requirement in the 2005 code change was the one change in which utilities played a significant role that produced the most energy savings. The significance of the changes in the 2008 code has not been fully documented to date and there is no draft language yet for the 2011 code.

**Link 27: The market proves ready and the code is upgraded**

**Indicator 27A: Industry experts attribute code upgrades to the IOU programs**

Section 5 below discusses the effect of the pre-2006 IOU RNC programs on changes in the 2005 Title 24 requirements. While this is backward looking, and while the analysis is not yet finished, it does provide a preliminary indication of the possible effects of the 2006-2008 IOU RNC programs on code upgrades going forward.

The IOU lighting programs in effect prior to 2006 created the market for high-efficacy lighting in residential new construction during the time they operated. Without utility incentives, it appears that very few builders would have incorporated such lighting in the homes they produced during this period. The market adoption of such lighting through these IOU programs appears to have helped prepare the market and make it practicable to include hardwired CFL fixtures in 2005 Title 24 code requirements. The lighting requirements were the primary change affecting residential new construction as a result of the 2005 code updates in which the IOU programs played a significant role. Incentives from IOU programs played an important role in affecting the market in the 2003-2005 period. Because almost all high-efficacy lighting installed in the 2003-2005 period was through the IOU programs, these were direct effects that would be accounted for in impact evaluations of these programs. Based on the data collected in this study, there were virtually no indirect effects from the IOU programs on the market for efficient residential lighting.



**Indicator 27B: Utility measures incentivized in the 2006-2008 programs are part of the 2008 code, or are in the draft language for the 2011 code**

The 2008 code does not differ substantially from the 2005 code for RNC, and there is no draft language yet for the 2011 code for RNC, so that the indirect effects of the 2006-2008 IOU programs cannot yet be determined.

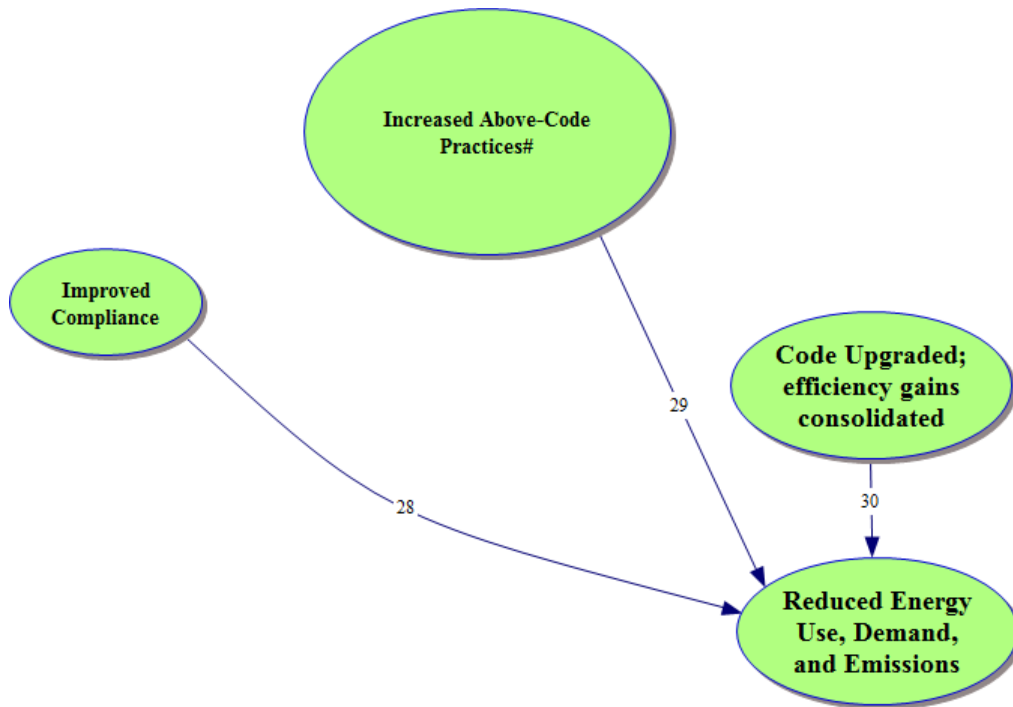
**Indicator 27C+: Industry experts attribute code changes to the readiness of the market**

Not addressed, because indicator was identified after interviews were completed.

*Summary of Findings on Expected Outcomes and Links to the IOU Programs: The IOU programs helped to prepare the market for the 2005 upgrade by creating a market for high-efficacy lighting, which became part of 2005 code requirements. Looking forward, based on market actor interviews, the market appears to be at least somewhat ready for a further code upgrade, and IOU programs appear to have had a moderate effect on this market readiness. Builders, HVAC contractors, and HERS raters responsible for a majority of non-program homes said that most builders could comply with the proposed code upgrade within a reasonable time and a quarter or more said that IOU programs had contributed to market readiness for the upgrade.*

#### 4.14. Energy Use, Demand, and Emissions

Figure 4.14-1: Linkages to Reduced Energy Use, Demand, and Emissions



**Expected Outcome:** *Reduced Energy Use, Demand, and Emissions*

**Link 28:** Improved compliance with existing code leads to reduced energy use, demand, and emissions

**Link 29:** Increased use of energy-efficient technologies and practices in non-participant homes, above the current code, leads to reduced energy use, demand, and emissions

**Link 30:** An upgrade in the building code leads to reduced energy use, demand, and emissions

**Indicator 28A, 29A, 30A:** Energy use and associated emissions as well as demand in non-participant homes are lower than in the baseline, non-program case

This link and the associated outcomes were not assessed in Phase I this evaluation.

## 5. Analysis of Market Effects Related to Code Changes

The Codes and Standards (C&S) Program is a statewide IOU activity designed to enhance both California's building codes (Title 24) and appliance standards (Title 20). These activities were formally implemented as an integrated IOU effort in the early 2000s, but the process for evaluating these efforts as a program and recognizing them in the CPUC's regulatory process was not initiated until the 2006-2008 program cycle. The C&S Program is being evaluated under the New Construction/Codes and Standards (NC/CS) evaluation process.

There are several links between the C&S evaluation of Title 24 residential standards and the market effects study of residential new construction programs. These include the following:

1. *Direct impact of past IOU RNC programs on the "naturally occurring" market adoption (NOMAD) of efficiency measures.* Past IOU RNC programs may have affected the initial market penetration and could have influenced trends in future market penetration of residential efficiency measures if the standards had not been adopted. Because these market trends would have occurred without the standard, they need to be accounted for when evaluating incremental savings due to the standards. For purposes of the C&S evaluation, we refer to these trends as "naturally occurring market adoption," or NOMAD.
2. *Indirect market effects from past IOU RNC programs.* Though this overall study focuses on market effects of IOU RNC programs implemented during the period 2006 through 2008, it was possible to take preliminary steps to expand the direct market penetration analysis described above to conduct a limited assessment of market effects of pre-2006 programs due to indirect participant and non-participant spillover.
3. *Influence of pre-2006 IOU RNC programs on code adoption.* Past IOU RNC programs likely had some effect on the feasibility of adopting new residential codes by demonstrating specific measures, increasing their market acceptance, increasing market actor familiarity with them, etc. This is a market effect in the sense that past RNC programs may have reduced some of the barriers to adopting a standard that, otherwise, the C&S program would have needed to expend resources to overcome. The existing method for attributing savings to the C&S program does not take these effects into account because they are not due to the C&S program; for that reason, it is reasonable to consider them as market effects of the prior RNC programs and analyze them as part of this study.
4. *Influence of 2006-2008 IOU RNC programs on code adoption.* Finally, IOU programs starting in 2006 are producing direct effects on market penetration of measures adopted in the latest (2008) Title 24 and the same types of market effects listed above. These are not analyzed in Phase I of this market effects study, but should be considered for analysis in Phase II.

In conjunction with the impact evaluation of the C&S Program operated by the four Investor-Owned Utilities (IOUs), our team has been collecting information to improve the general understanding of these links. For this market effects study, we were able to assess items 1 and 2 above and develop an approach for analyzing item 3.

Because the only 2005 Title 24 measure estimated to provide significant energy savings through its application in new residential construction was the hardwired lighting standard, our analysis was simplified by focusing on analyses related to market effects of this standard. Key requirements of this standard include:

- More building types (high rise residential) specifically included
- More stringent requirement for efficacy of lamps (higher Lumens per Watt (LPW), increases with watts)
- Requirement that at least 50% of the installed lighting wattage in the kitchen must be high efficacy luminaires
- Some exceptions allowed for dimmers and sensors in certain low burn-hour rooms
- Requirement for Insulated Ceiling Air-Tight (ICAT) fixtures for lights recessed in insulated ceilings (i.e., attics and other plenums at the exterior building envelope)

### **5.1. Direct Impact of Past RNC Programs on Natural Market Adoption**

To understand the relationship between pre-2006 IOU programs and the market for high-efficacy luminaires required under the hardwired lighting standard, we needed to know

- Size of the overall luminaire market
- Volume of product that was incented by the IOU programs
- An estimate of the natural market adoption rate

Note that a luminaire is defined as any hardwired or permanently installed interior or exterior light fixture.

In California, the size of the overall market for luminaires was estimated as part of the original analysis of the gross savings that would result from adoption of the 2005 Title 24 Standard. This estimate was based on assumptions for the number of luminaires per home and on forecasted home construction. The number of luminaires per home is taken from the Eley report on gross savings. (Eley Associates, 2003) The forecast for home construction is provided by the Construction Industry Research Board (CIRB). Based on these assumptions, the total market for luminaires in 2005 was estimated to be 3.93 million units as shown in Table 5.1-1 below.<sup>85</sup>

**Table 5.1-1: Estimated Market for Hardwired Luminaires**

Home Type	New Homes	Luminaires per Home	Total Luminaires
Single-Family	108,470	32	3,471,040
Multifamily	41,730	11	469,030
<b>Total</b>	<b>150,200</b>		<b>3,930,070</b>

To learn more about the impact of the IOU programs conducted prior to implementation of the 2005 Title 24, the evaluation team requested that each IOU summarize their energy-efficiency programs implemented during the period 2003 through 2005. For each measure covered by the programs in the summary, we asked the IOUs to indicate which of the 2005 Title 24 standards would regulate that measure.

We received data from each IOU and it is the best available information on the direct effects of IOU programs. The totals of high-efficacy hardwired luminaires installed through the IOU programs that qualify under the 2005 Title 24 are shown in Table 5.1-2. The detailed descriptions indicate that the totals included a mix with some units installed in single-family homes and some in multifamily buildings. In addition, both interior and exterior luminaires were rebated through these programs.

**Table 5.1-2: Hardwired Luminaires Incented by Utility Programs**

Utility	2003 Units	2004 Units	2005 Units
PG&E		31,032	249,085
SDGE	37,431	156,374	7
SCE	36,116	255,886	248,090
<b>Total</b>	<b>73,547</b>	<b>443,292</b>	<b>497,182</b>

<sup>85</sup> The size of the overall 2005 market was estimated when the original code analysis was done in 2003. At that time, CIRB estimated that 108,500 single family homes would be built and that 41,700 multifamily homes would be built for a total of 150,200. Based on model "average" homes, the single family and multifamily homes would have 32 and 11 luminaires per home respectively. This was the basis for the estimate of an overall market of 3.93 million luminaires in residential new construction.

In the C&S evaluation, estimation of naturally occurring market adoption is important. In the evaluation protocol, energy savings that would have occurred through natural adoption of efficiency measures are deducted from the estimated savings due to the new standards. This takes account of improvements in the efficiency baseline that would have occurred without the standards so the savings are not inappropriately credited to the standards. However, part of the observable market penetration of certain measures could be due to prior IOU programs and the savings from these measures should not be deducted from savings due to the C&S program.

In the C&S evaluation, we used a process of asking experts to estimate the NOMAD trends for each measure in the standards. We considered whether the “natural market” prior to adoption of each standard should or should not include products/measures installed through prior IOU programs. Since the experts based their estimates on what they observed in the market and, without extensive information on each IOU program, it was too complex to ask them to estimate the contribution of prior IOU programs, we decided to ask the experts to make no adjustment for effects of IOU programs. To avoid confusion, we emphasized this point in our plans and in the instructions provided to the experts helping us estimate the NOMAD curves. For all standards, the evaluation team adjusted the final experts’ NOMAD estimate for direct program effects based on the type of IOU data described above.

An online application was developed to collect NOMAD estimates from a group of market experts. For the hardwired lighting standard, seventeen experts were recruited and ten of them provided estimates using the application. We intentionally recruited experts from a range of organizations that included Lawrence Berkeley National Laboratory (LBNL), lighting manufacturers, contractors, and Title 24 consultants. Viewed from the perspective of total (cumulative) volume through 2005, the volume predicted by the final NOMAD estimate was about equal to the program-incented volume reported by the IOUs.

Given that the IOUs reported that nearly 500,000 luminaires were incented through their programs in 2005, our initial conclusion is that the IOU programs represented the entire natural market prior to the adoption of the standard. Comments such as the following from the experts strongly support the idea that few residential builders would have adopted high-efficacy lighting without incentives:

- “There's no reason why anyone would install hardwired high-efficacy lighting in residential buildings unless the building owner has some kind of green policy.”
- “...the residential market does not like fluorescent lighting and would only have adopted fluorescents at a very low rate without the code changes.”
- “Custom home designs usually have an interior decorator involved and the location and look of the hardwired lighting is important but they push back at energy efficient fixtures because they do not provide the look they are after. Most production house developers use the bare minimum to meet code requirements and do not use energy efficient lighting as a selling feature.”

In summary, the IOU programs were responsible for almost all high-efficacy lighting installed in residential new construction through 2005. Without IOU incentives, it appears that very few builders would have incorporated such lighting into the homes they produced. Consequently, the NOMAD curve for residential hardwired lighting was shifted downward in the C&S analysis to avoid improperly discounting energy savings due to the Title 24 standards and the C&S program. (Note that the NC/CS Evaluation Plan describes in more detail how NOMAD and prior IOU program data are being used in that impact evaluation.)

## **5.2. Indirect Market Effects**

We also investigated the possibility that there were indirect effects from the prior IOU RNC programs, although the above discussion indicates that the direct effects of RNC programs accounted for virtually all installations of high-efficacy residential lighting prior to 2006. We did this by preparing a short interview guide emailed to all experts who agreed to help with the NOMAD estimate. We then followed up by calling these experts to discuss our questions. We were successful in reaching six individuals with appropriate knowledge of the California lighting market in 2005.

Although there was some variation in the responses, there was agreement that nearly all of the high-efficacy units installed were the direct result of IOU programs. One former HMG consultant who had worked on an IOU program in 2005 said that incentives were paid on all or nearly all of the units installed. Another consultant who had worked for Southern California Edison during that time stated that some units were installed as part of the ENERGY STAR Homes Programs (for single-family and multifamily homes) and that rebates were not paid directly on these units. In this case, the market was possibly somewhat larger than the 500,000 units on which rebates were paid, but these additional units were still the direct result of IOU programs.

One individual commented that the appearance of the high-efficacy fixtures was a limiting factor that for some time would prevent most custom home builders from adopting them. However, the available designs did improve steadily and became more competitive with other fixtures in 2005.

Our investigation did not find evidence of significant indirect market effects that could be associated with the IOUs' lighting programs. We were unable to find hard data that would show a market for qualifying luminaires beyond those that were incented by the utilities. And the market experts that we interviewed did not have knowledge of builders adopting the lighting without incentives or any other indirect effects on the lighting market.

## **5.3. Influence of Past IOU RNC Programs on Code Adoption**

The third market effect of RNC programs with the building standards is found in the C&S evaluation attribution analysis. Attribution is the process of determining the credit due to the

C&S Program for its contribution to the adoption of building and appliance energy-efficiency standards. Assessing market effects related to attribution involves determining how much effect prior IOU programs had on adoption of energy-efficiency standards. The attribution analysis is one step in the C&S program evaluation and it addresses specifically the effects of the C&S program on eventual code or standard adoption. Conventional IOU DSM programs, however, are not within the scope of the C&S attribution analysis because these programs are not part of the C&S program. Nevertheless, these programs are likely to have an effect on the feasibility of adopting a standard if they help surmount some of the hurdles that must be overcome to adopt a standard. We consider the role prior DSM programs play in influencing standard adoption to be a market effect that is appropriate to evaluate. For purposes of the residential hardwired lighting standard, the effect of prior RNC programs on development and adoption of the Title 24 hardwired lighting standard should be assessed. This section describes the methodology for estimating how market effects of prior DSM programs would be evaluated in terms of their impact on attribution to the C&S program. It was not possible to complete this analysis for the Phase I report; however, it would be worthwhile to complete the analysis during Phase II if this study continues.

### **5.3.1. Effects of Prior Programs**

The attribution analysis conducted in the C&S evaluation encompasses three factors associated with conditions that must be satisfied for the California Energy Commission to adopt a standard (development of compliance methods or special analytic techniques for estimating savings; development of technical and cost information including code language; and demonstration of feasibility of the standard). The evaluation team's C&S program attribution analysis examines each of these factors and assesses the role the C&S program had in satisfying these conditions.

The prior IOU DSM programs can influence the ease of adopting a standard by helping reduce some of the barriers that must be overcome. There are two main ways prior DSM programs can do this:

- First, the programs could increase the readiness of the market for the standard, which was one of the main conditions needed to be met for adoption. For example, incentive programs could expand manufacturing and distribution capacity and, thus, lower market prices as well as increase consumer and builder awareness and acceptance of energy-efficiency measures.
- Second, IOU DSM programs could yield valuable data about the efficacy of measures in proposed standards. For instance, incentive programs typically require data collection and evaluations that advocates of standards can use to demonstrate market readiness, cost-effectiveness, and energy savings. This information is often included in reports prepared for the Codes and Standards Enhancement (CASE) Initiative Project and other studies used to build support for the standard.



### 5.3.2. Methodology

To estimate DSM program market effects, our evaluation team developed a simple attribution model, which is a refinement of the model used to estimate C&S Program credit. The Market Effects model is described in full in the appendix of the Attribution Methodology (Cadmus Group, 2009).<sup>86</sup>

The market effects model has two main assumptions. First, IOU RNC programs (in the case of hardwired lighting) and the C&S Program have positive and independent impacts on standards adoption. Second, if the IOU RNC programs had not been implemented, it would have been necessary for the C&S Program to dedicate additional effort and resources to make up for the missing contribution of the IOU programs toward standards adoption.

Therefore, the model defines market effects of the prior DSM programs to be equal to the difference between the effort required in the C&S Program for standard adoption if the DSM programs had not occurred and the actual contribution of the C&S Program. Because the contribution of the C&S Program in the absence of DSM programs would always be at least as large as the actual contribution, market effects must be equal to or greater than zero.

Typically, program effects evaluations use a control group similar to the treatment (program) group in all respects except for the absence of the program. For the market effects evaluation, a valid control group would be a state or states like California with a codes and standards program, but no DSM programs in place. Because such states do not exist, we use an alternative strategy to estimate market effects. We ask knowledgeable experts to envision the situation where DSM programs likely to have an effect on the effort required to develop a standard were not implemented in the years prior to adoption. The experts are then asked for their estimate of the effort that would have been required through the C&S Program and compare it to their estimate of the effort actually expended in the C&S Program.

We attempt to develop estimates of the counterfactual contributions (no DSM programs) in a straightforward way. In the attribution model, adoption of each standard is the result of effort directed toward three areas or factors: 1) development of compliance methods or special analytic techniques for estimating savings; 2) development of technical and cost information including code language; and 3) demonstration of feasibility of the standard.

To obtain the needed information in the case of the hardwired lighting standard, we asked experts familiar with the adoption of the standard how much additional effort would have been required in each factor area to adopt the standard, if prior DSM programs that possibly affected adoption of the standard had not been implemented. After they provided their estimate of the C&S Program effort required to address each factor, we asked them to provide a quantitative

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<sup>86</sup>Available at <http://www.energydataweb.com/cpuc/topicView.aspx> .

estimate of additional effort required to address each factor if the prior IOU programs had not been conducted and to provide text explaining their logic.

Experts' answers to the question will be analyzed and then used to develop inputs for the market effects analysis. If there are large discrepancies in experts' responses, the evaluation team may follow up with short interviews to understand the differences or, in a Delphi-like process, share the responses and descriptions and administer the survey again in an attempt to form consensus.

To facilitate the process of responding to the market effects question, our team developed a list of IOU DSM programs between 2001 and 2003 that potentially affected adoption of the residential hardwired lighting standard. The list was constructed from information supplied by the utilities about their DSM programs in response to an information request.

### **5.3.3. Status and Next Steps**

In February and March of 2009, we distributed the residential hardwired lighting survey to approximately 15 experts. As of March 5, we had received two responses and were in the process of following up with the remaining experts to solicit their inputs.

The data and analysis will be complete and the results will be reported in the Phase II report if this study phase is authorized.

## 6. The Importance of Networks

Professional networks appear to be important sources of information about new energy-efficient building practices and technologies for builders, HVAC contractors, Title 24 consultants and HERS raters, but not for distributors. An increasing percentage of home buyers said that some party—whether the builder, the media—emphasized energy efficiency during the home buying process (although most home buyers said no one that they interacted with during the home buying process had stressed energy efficiency).

### 6.1. Builders

When asked to identify their primary source of information on new energy-efficient technologies and building practices, builders most commonly identified subcontractors (30 of 32 builders) and other builders (12 of 32 builders) followed by IOU RNC programs (nine of 32 builders) and utilities or utility trainings (eight of 32 builders).

**Table 6.1-1: Primary Sources of Information on New Energy-efficient Technologies and Building Practices**  
(Builders)

	Number of Builders			Total
	Unaware Non-participants	Aware Non-participants	Partial Participants	
n	13	9	10	32
Subcontractors	12	9	9	30
Other builders	0	6	6	12
IOU RNC programs	1	4	4	9
Utilities and utility trainings	1	4	3	8
Title 24 consultants	3	0	3	6
Trade magazines	2	2	0	4
Green building programs and organizations	2	1	1	4
Trade organizations	1	2	1	4
Code / Title 24	3	0	0	3
New equipment; changing equipment standards	2	0	0	2
Architects	1	0	1	2
Internet	0	2	0	2
Industry knowledge	0	0	1	1
Seminars and training	0	1	0	1
CPUC	1	0	0	1
City	1	0	0	1
Homeowners	1	0	0	1
HERS raters	1	0	0	1

Four non-participating builders who were aware of the IOU programs had discussed energy-efficient building practices and technologies with participating builders (Table 6.1-2). They most often discussed building practices and technologies at seminars or workshops and conferences.

**Table 6.1-2: Settings or Locales Where Non-participant Builders Have Discussed Energy-efficient Building Practices and Technologies with Participant Builders**  
(Builders)

	<b>Number of Aware Nonparticipants Builders</b>
n	9
Discussed IOU RNC programs with participating builders (% of all Non-Program Homes)	4 (6%)
Settings or locales discussed energy-efficient building practices and technologies with participant builders	
Seminars; workshops; round table discussions	3
Conferences	2
Phone conversations	1
Via email	1
Builder's office	1

Four builders reported that their discussions with other builders had a great deal of influence on their use of above-code building practices and technologies (Table 6.1-3). For partial participant builders with multiple offices, other offices were most likely to have a great deal of influence on the use of high-SEER air conditioners or heat pumps, HVAC installation techniques, high-AFUE furnaces, duct sealing and testing. Four non-participating builders who were aware of the program had discussed energy-efficient building practices and technologies with participating builders, though only one reported that these discussions had a great deal of influence on their use of above-code building practices and technologies.

**Table 6.1-3: Influence of Other Offices in the Company or Participating Builders on Adoption of Above-Code Practices and Technologies in Non-Program Homes**

(Builders, 0-10 Scale; 0= “No influence at all” and 10= “A great deal of influence”)

	7 to 10 Rating (% of All Non-program Homes)			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	13	9	10	32
Have other offices in company	NA	4 (6%)	6 (82%)	6 (82%)
Discussed IOU RNC programs with participating builders	NA	4 (6%)	NA	4 (6%)
Insulation R-values	NA	0 (0%)	0 (0%)	0 (0%)
Quality of insulation installation	NA	1 (4%)	1 (61%)	2 (65%)
Windows	NA	1 (4%)	1 (9%)	2 (14%)
High-SEER air conditioner or heat pump	NA	1 (4%)	3 (74%)	4 (79%)
High-AFUE furnace	NA	0 (0%)	3 (74%)	3 (74%)
HVAC installation	NA	1 (4%)	3 (74%)	4 (79%)
Water-heating equipment	NA	0 (0%)	0 (0%)	0 (0%)
Lighting	NA	1 (4%)	1 (9%)	2 (14%)
Framing materials and techniques	NA	0 (0%)	0 (0%)	0 (0%)
Orientation and shading	NA	1 (4%)	0 (0%)	1 (4%)
Photovoltaics	NA	1 (4%)	0 (0%)	1 (4%)
Duct sealing	NA	1 (4%)	2 (13%)	3 (18%)
Duct testing	NA	0 (0%)	2 (13%)	2 (13%)
Air sealing	NA	0 (0%)	0 (0%)	0 (0%)
Any influence	NA	1 (4%)	3 (74%)	4 (79%)

## 6.2. HVAC Contractors

HVAC contractors' most common source of information on new energy-efficient technologies and building practices were the IOU RNC programs (five of nine contractors), followed by manufacturers and vendors (Table 6.2-1). The respondent who identified other HVAC contractors as a source of information about new energy-efficient technologies and building practices reported that he learned about the technologies and practices at trade shows, trainings and Air Conditioning, Heating and Refrigeration News,<sup>87</sup> and Airtime 500.<sup>88</sup>

**Table 6.2-1: Primary Sources of Information on New Energy-efficient Technologies and Building Practices**  
(HVAC contractors)

	Number of Builders			Total
	Unaware Non-participants	Aware Non-participants	Partial Participants	
n	2	4	3	9
IOU RNC programs	1	2	2	5
Manufacturers / vendors	1	2	1	4
Trade publications	0	1	1	2
Other HVAC contractors	1	0	0	1
Professional organizations (Refrigeration Engineering Society)	1	0	0	1
Title 24	0	1	0	1
Architectural specs	0	1	0	1
Consultants	0	0	1	1
Personal experience	0	0	1	1

<sup>87</sup> <http://www.achrnews.com/>

<sup>88</sup> <http://www.airtime500.com/>

### 6.3. Title 24 Consultants

Eighteen of 45 Title 24 consultants, responsible for 38% of non-program homes, had discussed energy-efficient building practices and technologies with other Title 24 consultants who had worked with program homes (Table 6.3-1). They most often discussed building practices and technologies at conferences and meetings, classes or seminars, and informally over the phone.

**Table 6.3-1: Discussing Energy-efficient Building Practices and Technologies with Other Title 24 Consultants**  
(Title 24 Consultants)

	Number of Title 24 Consultants (% of All Non-Program Homes)			
	Non- participants	Minority Participants	Majority Participants	Total
n	22	20	3	45
Do not know any Title 24 consultants involved with program homes	14 (27%)	7 (21%)	1 (0%)	22 (48%)
Know Title 24 consultants involved with program homes	8 (4%)	13 (47%)	2 (1%)	23 (52%)
Have NOT discussed technologies and practices with Title 24 consultants involved with program homes	3 (2%)	2 (15%)	0 (0%)	5 (17%)
HAVE discussed technologies and practices with Title 24 consultants involved with program homes	5 (2%)	11 (32%)	2 (1%)	18 (38%)
<b>Venue or setting have discussed technologies and practices with Title 24 consultants involved with program homes:</b>				
Conferences and Meetings (esp., CABEC)	3 (1%)	8 (23%)	1 (<1%)	12 (25%)
Classes, courses, trainings (e.g., Utility, BIG, HERS)	1 (0%)	4 (20%)	0 (0%)	5 (20%)
Informally (phone, socially)	2 (1%)	6 (12%)	2 (1%)	10 (13%)
E-mail	1 (0%)	1 (0%)	1 (1%)	3 (1%)

## 6.4. HERS Raters

Twenty-three of 29 HERS raters, responsible for 93% of non-program homes, had discussed energy-efficient building practices and technologies with other HERS rates involved with program homes (Table 6.4-1). They most often discussed building practices and technologies at classes or seminars, conferences and meetings, and informally over the phone.

**Table 6.4-1: Discussing Energy-efficient Building Practices and Technologies with Other HERS Raters**  
(HERS Raters)

	HERS Raters (% of All Non-Program Homes)			
	Non-participants	Minority Participants	Majority Participants	Total
n	13	10	6	29
Do not know any HERS raters involved with program homes	3 (6%)	1 (<1%)	0 (0%)	4 (6%)
Do know HERS raters involved with program homes	10 (5%)	9 (76%)	6 (13%)	25 (94%)
Have NOT discussed technologies and practices with HERS raters involved with program homes	2 (1%)	0 (0%)	0 (0%)	2 (7%)
HAVE discussed technologies and practices with Title 24 consultants involved with program homes	8 (4%)	9 (76%)	6 (13%)	23 (93%)
Venue or setting have discussed technologies and practices with HERS raters involved with program homes:				
Classes, courses, trainings	4 (3%)	4 (10%)	6 (13%)	14 (26%)
Conferences and Meetings	3 (4%)	6 (67%)	4 (13%)	13 (84%)
Informally (phone, socially)	5 (3%)	3 (59%)	3 (<0%)	11 (63%)
Email	1 (0%)	2 (58%)	2 (<0%)	5 (58%)
Building sites	1 (<0%)	1 (58%)	0 (0%)	2 (58%)

Of all of the distributors interviewed, only two windows had discussed energy-efficient building technologies with other distributors. The window distributors discussed energy-efficient windows with other distributors at conferences, meetings and round table discussions.



## 6.5. Home Buyers

Most non-participating home buyers (73%) reported that no one that they interacted with during the home buying process had stressed energy efficiency (Table 6.5-1). Respondents in Region 1 were the most likely to say that at least someone had emphasized energy efficiency, but the patterns of who did the emphasizing are similar to those reported for other regions. In fact, Region 1 respondents more often said they did not know who emphasized energy efficiency and provided only one response instead of multiple responses to the question.

**Table 6.5-1: People Emphasizing Energy Efficiency to the Home Buyer by Climate Region**

(Consumer Survey, multiple response)

	Region 1	Region 2	Region 3	Region 4	Region 5
No one emphasized energy efficiency	57%	74%	76%	72%	74%
Media, including home building magazines	6	6	5	5%	6%
Builder, developer, or realtor	7	7	5	2%	2%
Model home salesperson	3	3	3	6%	3%
Various retailers (building material, appliance store)	3	5	4	4%	3%
Utility representative or literature	6	3	3	1%	4%
Internet	0	2	3	1%	4%
Friends, Family, Co-workers, etc.	3	3	1	2%	2%
Solar companies, HVAC contractors	2	2	0	2%	0%
Home Show	3	2	1	1%	0%
Someone else	2	1	0	4%	2%
Don't know/refused	6	0	0	0	0
<b>Total</b>	<b>65</b>	<b>107</b>	<b>351</b>	<b>264</b>	<b>188</b>

The percentage of non-participating home buyers who said that someone had emphasized energy efficiency to them increased from 21% in the 2000 study to 27% in the 2008 study, suggesting that energy efficiency is at least something addressed more commonly in conversations about home buying than in the past (Table 6.5-2). (Quantum Consulting Inc., 2000, Exhibit A-2, pg A-4) The 2000 study did not ask respondents who had emphasized energy efficiency to the home buyer, so we cannot provide a comparison of whether or not the sources of information have changed over time.

**Table 6.5-2: Someone Emphasized Energy Efficiency to the Home Buyer over Time**  
**Percentage of Respondents**

2000 study	21%
2008 study	27%

The few people who sought information on IOU programs generally did so from three sources: utility representatives (37%), the internet (32%), and the builder or development sales agent (28%) (Table 6.5-3). The results are not broken down by climate region due to small sample sizes. This question was not asked in the 2000 study.

**Table 6.5-3: Persons from Whom Home Buyers Sought Information on IOU Programs when Making Plans for Building or Buying Home**  
(Consumer Survey)

Persons Mentioning Programs	PG&E	SCE	SCG	SDG&E	Overall
Utility Representatives	40%	46%	24%	19%	37%
Internet	33%	24%	43%	14%	32%
Builder or Development Sales Agent	39%	11%	31%	44%	28%
Architects and Designers	11%	9%	2%	4%	8%
Material Supply Store	9%	11%	0%	10%	7%
Realtors	4%	7%	4%	14%	6%
Friends, Family, Co-workers, etc.	2%	16%	0%	0%	6%
HVAC Contractor	3%	0%	0%	10%	1%
Home Inspector	2%	0%	0%	0%	1%
Solar Company	0%	0%	0%	10%	<1
Lenders	0%	0%	0%	4%	<1
Total	34	21	20	15	90

## 7. Conclusions

### 7.1. Summary of Findings for Individual Outcomes and Links

Section 2.2 lays out IOU program staffs' and industry experts' descriptions of the IOUs' RNC programs and their views as to how the programs may affect the single-family, production new home market in California. Within that section, Figure 2.2-1 graphically depicts expected outcomes and the links to IOU programs. Table 7.1-1 below summarizes the evidence presented in Section 4 as to whether expected outcomes have occurred, and the strength of the links to IOU program efforts. It is important to remember when reviewing these findings that, with its focus on nonparticipant spillover, this evaluation is concerned with homes not participating in the IOU programs. The program theory, however, included hypothesized effects through participating homes; those direct program effects are not addressed here. Also, the data are largely qualitative, and the research team used a preponderance-of-evidence approach<sup>89</sup> in drawing conclusions.

In interpreting the evidence as to whether an outcome occurred or whether the IOU programs had an influence, we used the guidelines described below. In this interpretation we gave primacy to the responses of Title 24 consultants because of their focus on efficiency (differing from builders, for example, for whom efficiency is only one of many concerns).

*Strong evidence:* Market actors in more than one group accounting for substantial numbers of non-program homes (i.e., >15%)—with primacy given to Title 24 consultants—said an outcome had occurred (outcomes) or that the IOU programs had a strong influence (linkages). No major contradictory evidence from other groups. In the case of home buyers, statistically significant and substantively important increases over time in indicators related to efficiency in general (outcomes), or substantial numbers (i.e., >30%) tied their knowledge or positive attitudes specifically to the IOUs (linkages).

We selected 15% as the threshold for “strong evidence” for market actors—Title 24 consultants, Builders, HVAC contractors, and HERS raters—because interviewees in these four groups, including some key informants who are major players in the industry, accounted for very large proportions of new homes built from 2006 to 2008.<sup>90</sup> In addition, the 5,592 program homes represent less than 3% of the 206,788 homes built in the IOU territories during this period; hence percentages over 15% potentially represent fairly high levels of non-participant spillover (as a fraction of direct participant impacts). We selected 30% as a threshold for “strong evidence” for home buyers because that

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<sup>89</sup> Preponderance of evidence approach: Drawing a conclusion that a fact or occurrence is more probable than not based on consideration and weighing of all available evidence.

represents a sizable minority; marketing is not voting, and majority consumer support is not necessary for the success of a product or service, but there are usually a few consumers in every survey response category, so a very small minority is not meaningful.

*Moderate evidence:* EITHER 1) One market actor group accounting for substantial numbers of non-program homes (i.e., >15%)—with primacy given to Title 24 consultants—said an outcome had occurred (outcomes) or that the IOU programs had a strong influence (linkages). No major contradictory evidence from other groups. OR: 2) Market actors in more than one group accounting for moderate numbers of non-program homes (i.e., 5%-15%)—with primacy given to Title 24 consultants—said an outcome had occurred (outcomes) or that the IOU programs had a strong influence (linkages). No major contradictory evidence from other groups. In the case of home buyers, statistically significant but not substantively important increases over time in indicators related to efficiency in general (outcomes), or moderate numbers (i.e., 20%-30%) tied their knowledge or positive attitudes specifically to the IOUs (linkages).

*Weak evidence:* Market actor groups generally accounting for <5% of non-program homes said an outcome had occurred (outcomes) or that the IOU programs had a strong influence (linkages). In the case of home buyers, no statistically significant increases over time in indicators related to efficiency in general (outcomes), or small numbers (i.e., <20%) tied their knowledge or positive attitudes specifically to the IOUs (linkages).

*Insufficient data:* Not enough evidence of change or lack of change to say an outcome occurred, or not enough evidence of linkage or lack of linkage of programs activities to outcomes to say whether or not the IOU programs had an influence.

**Table 7.1-1: Summary of Attribution by Outcome and Linkage to IOU Programs**

<b>Link/ Indicator number</b>	<b><i>Expected Outcome, Link, Indicators</i></b>	<b>Findings</b>
<b><i>Outcome</i></b>	<b><i>Increased efficiency through other voluntary programs</i></b>	<b><i>Strong evidence that the outcome has occurred. Programs whose managers were interviewed provided energy efficiency certifications for about 43,000 homes outside the IOU programs in California from 2006 to 2008.</i></b>

<sup>90</sup> The 106,809 non-program homes accounted for by the Title 24 contractors in the sample amount to about 50% of all non-program homes built in the IOU territories during the 2006-2008 period. The 31,561 non-program homes accounted for by the builders in the sample amount to about 15% of all non-program homes built in the IOU territories during the 2006-2008 period. The 52,997 non-program homes accounted for by the HVAC contractors in the sample amount to about 25% of all non-program homes built in the IOU territories during the 2006-2008 period. The 20,011 non-program homes accounted for by the HERS raters in the sample amount to about 10% of all non-program homes built in the IOU territories during the 2006-2008 period, but HERS ratings are not required for all non-program homes, so this could represent a high percentage of non-program homes that received HERS ratings.

<b>Link/ Indicator number</b>	<b>Expected Outcome, Link, Indicators</b>	<b>Findings</b>
<b>1</b>	<b>IOU programs leverage other voluntary efficiency programs</b>	<b>Strong linkage of outcome to IOU programs. It is likely that some of this effect is from the pre-2006 IOU programs, when overlap with the non-IOU programs was much greater, as was participation in the IOU programs. It is also likely that the effects were complementary, with the non-IOU programs also affecting the IOU programs.</b>
1A	Managers of other efficiency programs say that some of their efficiency criteria are based on the IOU program criteria	Four of the eight managers of other voluntary energy efficiency programs interviewed—accounting for about 93% of homes certified by these programs but not certified by the IOU programs, or about 43,000 homes—said the IOU programs had a major effect on the efficiency criteria used by their programs.
1B	Managers of other efficiency programs say the IOU programs increase participation in their programs	Two of the eight managers of other voluntary energy efficiency programs interviewed—accounting for about 90% of homes certified by these programs but not certified by the IOU programs, or about 42,000 homes—said the IOU programs increased participation in their programs a lot.
<i>Outcome</i>	<i>Decreased design, equipment, and installation costs</i>	<i>Weak evidence that the outcome has occurred. Incremental costs for some efficient measures went up, others went down, and others stayed the same. Meanwhile, the code became more stringent and the cost for meeting it, not unexpectedly, went up.</i>
<b>2</b>	<b>IOU incentives for builders, leveraging other available incentives, decrease the cost of increased efficiency</b>	<b>Weak linkage of outcome to IOU programs—which is to be expected given that the IOU incentive programs certified fewer than 6,000 homes in California from 2006 through 2008, out of a total of 207,000 homes built in the IOU territories during that period; the volume of incentivized measures and installations was simply not large enough to help achieve appreciable economies of scale.</b>
2A	Builders report that the IOU incentives combined with other incentives have significantly decreased the incremental costs for efficient technologies	None of the 32 builders interviewed attributed decreases in incremental costs to the IOU programs. However, IOU program incentives for program homes do decrease the costs of building those (relatively few) homes, if not for the market as a whole.
2B	Distributors report that the IOU incentives combined with other incentives have significantly decreased incremental costs for efficient technologies	Distributors tended not to attribute price declines to the IOU programs, but rather to wider availability and use of the higher efficiency equipment or materials and manufacturers cutting prices due to the economic downturn.
<i>Outcome</i>	<i>Increased builder marketing of efficiency</i>	<i>Weak evidence that outcome has occurred. Builders interviewed in 2008 were no likelier than those interviewed in 2000 to market the efficiency of new homes.</i>
<b>3#</b>	<b>IOU incentives for builders induce them to increase their marketing of efficiency</b>	<b>Weak linkage of outcome to IOU programs</b>

<b>Link/ Indicator number</b>	<b>Expected Outcome, Link, Indicators</b>	<b>Findings</b>
3A	Builders report increasing their marketing of efficiency because of IOU programs and incentives	Only two partial participants, responsible for fewer than 1% of non-program homes, said the IOU programs had a great deal of influence on their strong emphasis on energy efficiency—and no aware nonparticipants said the programs had a great deal of influence.
<b>9</b>	<b>IOUs' advertising and outreach causes builders to increase their own marketing of efficiency</b>	<b>Weak linkage of outcome to IOU programs</b>
9A	Many builders market energy efficiency as a feature of their homes as a result of IOU programs	14 of 32 builders, representing 79% of non-program homes, said they “always” market energy-efficient features of their new homes. However, as summarized above under Indicator 3A, this does not represent an increase since 2000, and few builders attribute their emphasis on efficiency in marketing to the IOU programs.
<b>13</b>	<b>Increased home buyer demand for energy efficiency causes an increase in builder marketing of efficiency</b>	<b>Moderate linkage of outcome to IOU programs</b>
13A	Builders perceive an increase in home buyer demand for efficiency and therefore increase their marketing of it	Thirty-one of 32 builders in the current study representing nearly all non-program homes reported that there was “a lot” or “some” demand for energy savings features and reported an increase in demand for energy saving features over the previous five years, representing an increase in perceived demand from both the 1998 and 2000 reports. Only seven of 32 builders identified IOU programs as “significant factor” or “one of the most important factors” in the increase in home buyer demand, but 15 of 32 credited the ENERGY STAR Homes Program (which the IOUs ran for several years) with this change, and 14 of 32 credited the Flex Your Power campaign (IOU program). A higher percentage of builders from the current study compared to the 2000 reported that home buyers asked about homes that are more energy-efficient than code, and builders in the current study estimated that home buyers were willing to pay a higher percentage of the increased cost than builders from the 1998 and 2000 studies.
<i>Outcome</i>	<i>More efficient design</i>	<i>Strong evidence that outcome has occurred. Thirty-eight out of 45 Title 24 consultants recommended at least some above-code practices for non-program homes during the 2006-2008 period, most commonly windows (39% of non-program homes), duct testing (38%), duct sealing (37%), high-EER AC or heat pump (32%), water heating equipment (28%), insulation installation practices (27%), and insulation R-values (26%).</i>
<b>4</b>	<b>Program Plan Check catches and corrects modeling errors on participating homes. The feedback educates Title 24 consultants, which improves their modeling</b>	<b>Weak linkage of outcome to IOU programs</b>

<b>Link/ Indicator number</b>	<b>Expected Outcome, Link, Indicators</b>	<b>Findings</b>
4A	Title 24 consultants say Program Plan Check catches modeling errors on participating homes	Almost no Title 24 consultants were aware of Program Plan Check, and consequently, none of them said it helped catch modeling errors on program-supported homes.
4B	Title 24 consultants, builders, and HVAC contractors say Program Plan Check has helped improve their modeling of non-participating homes	Only eight of 32 builders were aware of the Program Plan Check process, while five builders, responsible for 7% of non-program homes, reported that the process helped a great deal in modeling and building above-code. Nearly all Title 24 consultants (42 of 45) and HVAC contractors (seven of nine) were <b>not</b> familiar with Program Plan Check.
<b>31+</b>	<b>IOU Training of Title 24 consultants leads to more efficient designs</b>	<b>Strong linkage of outcome to IOU programs</b>
31A	Title 24 consultants say they have attended IOU training and that it has influenced their recommendations of energy-efficient building practices and technologies	Twenty-three out of 45 Title 24 consultants said IOU training had had a strong influence on their recommendations of energy-efficient building practices and technologies for 42% of non-program homes built in the 2006-2008 period. The IOU programs in general influenced 17 out of 45 Title 24 consultants accounting for 30% of non-program homes to recommend above-code practices and technologies for those homes, including duct testing (19% of non-program homes), duct sealing (18%), water-heating equipment (11%), and high-SEER AC or heat pump (9%).
<i>Outcome</i>	<i>Builders adopt leading-edge practices</i>	<i>Weak evidence that outcome has occurred. Only four builders, representing just 1% of non-program homes, said they had adopted practices or technologies promoted by the IOUs' R&amp;D and CASE Study Programs in the 2006-2008 period, and 11 Title 24 consultants, representing 12% of non-program homes, said they had recommended some of these practices.</i>
<b>5</b>	<b>IOUs' R&amp;D of new technologies and practices and CASE studies on their deployment show builders that the new technologies and practices are feasible</b>	<b>Weak linkage of outcome to IOU programs</b>
5A	Builders and Title 24 consultants are aware of IOUs' R&D and CASE studies, leading to adoption of new technologies and practices	Only five of 32 builders were aware of the IOUs' R&D and CASE studies, and only one of 32 had adopted any technologies as a result, in fewer than 1% of non-program homes. A higher proportion of Title 24 consultants—17 of 45—were aware of the IOUs' R&D and CASE Studies, and as a result, eight of 45 recommended some technologies for 3% of non-program homes. Even if the effect occurred through IOU program homes, there were only 5,592 such homes built in the 2006 to 2008 period.

<b>Link/ Indicator number</b>	<b>Expected Outcome, Link, Indicators</b>	<b>Findings</b>
<i>Outcome</i>	<i>Increased builder knowledge</i>	<i>Strong evidence that outcome has occurred. Most builders, accounting for a large majority of non-program homes, said they were very aware of most efficient technologies and practices, although only minorities said they were very aware of orientation and shading, photovoltaics, duct sealing, and air sealing. Nearly all HVAC contractors rated themselves as ‘very aware’ of all energy-efficient equipment and building practices pertaining to HVAC systems.</i>
<b>6</b>	<b>Training of builders and subcontractors in new technologies and practices leads to increased builder knowledge</b>	<b>Strong linkage of outcome to IOU programs</b>
6A	Many builders and their subcontractors become more knowledgeable about new technologies and practices through IOU training	Sixteen of 32 builders, responsible for 25% of non-program homes, said they had attended IOU-sponsored trainings in the 2006-2008 period, and 11 builders said they had adopted some energy-efficient building practices or technologies because of the training. Eight of 11 builders, responsible for 17% of non-program homes, rated the training as having a great deal of influence on their adoption of the more energy-efficient building practices or technologies during the 2006-2008 period. Eleven builders said they employed subcontractors who had worked on program homes and had changed their building or installation practices as a result. Nine builders reported that IOU RNC programs were a primary source of information about new energy-efficient technologies and building practices and eight builders reported that utility training was a primary source of information. In addition, 30 out of 32 builders identified subcontractors as a primary source of information. Although only one HVAC contractor reported that the adoption of new technologies or practices was directly due to IOU-sponsored trainings, five of nine HVAC contractors reported that the most common source of information on new energy-efficient technologies and building practices are the IOU RNC programs. Additionally, as discussed below under the outcome “Improved code compliance,” many Title 24 consultants, HERS raters, and building code officials and inspectors (but not as many HVAC contractors) said that IOU program training helped improve code compliance during the 2006-2008 period.
<i>Outcome</i>	<i>Improved code compliance</i>	<i>Strong evidence that outcome has occurred. Twenty-five out of 45 Title 24 consultants, representing 55% of non-program homes, and 20 out of 29 HERS raters, representing 82% of non-program homes, said that rates of compliance with Title 24 increased from 2006 to 2008.</i>
<b>7#</b>	<b>IOU-sponsored training of code officials leads to improved compliance with the building code</b>	<b>To be addressed by Local Government Program Impact Evaluation</b>



<b>Link/ Indicator number</b>	<b>Expected Outcome, Link, Indicators</b>	<b>Findings</b>
7A	The incidence of compliance is higher in municipalities whose code officials have received PG&E-sponsored compliance training	To be addressed by Local Government Program Impact Evaluation
<b>14#</b>	<b>Increased non-participating builder knowledge leads to greater code compliance</b>	<b>Strong linkage of outcome to IOU programs</b>
14A	Builders and other market actors say IOU programs have helped to improve code compliance	Thirteen Title 24 consultants, responsible for 25% of non-program homes, said that IOU training had helped to improve code compliance during the 2006-2008 period, while five Title 24 consultants, responsible for 35% of non-program homes, said that other (non-IOU) training programs had helped to improve code compliance. Fifteen HERS raters, responsible for 92% of non-program homes, said that IOU training had helped to improve code compliance, while 11 HERS raters responsible for 86% of non-program homes said that other (non-IOU) training programs had helped to improve code compliance. Five of 14 building code officials and inspectors agreed that IOU programs helped improve compliance, and four of 14 building code officials/inspectors agreed that non-IOU programs helped improve code compliance. Nine builders, responsible for 26% of non-program homes, said that IOU training had helped to improve code compliance, while five builders, responsible for 11% of non-program homes, said that other (non-IOU) training programs had helped to improve code compliance. Three HVAC contractors, responsible for 1% of non-program homes, said that IOU training had helped to improve code compliance, while two HVAC contractors who are responsible for most non-program homes (78%) said that other (non-IOU) training programs had helped to improve code compliance.
<b>15#</b>	<b>Improved design and correction of errors leads to improved compliance</b>	<b>Strong linkage of outcome to IOU programs</b>
15A	Title 24 consultants, builders, and HVAC contractors say the IOU programs have helped them learn more about modeling and improved the compliance of non-participating homes	Twenty-three out of 45 Title 24 consultants, representing 42% of non-program homes, said IOU training had a strong influence on their recommendation of energy-efficient building practices and technologies during the 2006-2008 period. Discussion of an outcome appearing later in this table (Increased above-code practices) shows that Title 24 consultants estimated that 24% of non-program homes exceeded Title 24 requirements; by inference, this would imply that 42% minus 24%, or 18% of non-program homes, were helped to achieve code compliance through IOU program training of Title 24 consultants. Almost no Title 24 consultants were aware of Program Plan Check, while only eight of 32 builders were aware of the process. Only five builders, responsible for 7% of non-program homes, reported that Program Plan Check helped a great deal in modeling and building above-code.

<b>Link/ Indicator number</b>	<b>Expected Outcome, Link, Indicators</b>	<b>Findings</b>
<b>34+</b>	<b>Use of HERS ratings leads to improved compliance</b>	<b>Strong linkage of outcome to IOU programs</b>
34A	HERS raters say IOU programs have influenced the use of QII in improving the compliance of non-program homes	Twenty out of 29 HERS raters, responsible for 99% of non-program homes, verified Quality Insulation Installations (QII) to earn energy credits for Title 24 compliance during the 2006-2008 period, and four HERS raters, responsible for 19% of non-program homes, said that the IOU RNC programs had a strong influence on the use of QII in non-program homes during the 2006-2008 period.
<i>Outcome</i>	<i>Above code practices in program homes are verified</i>	<i>To be addressed in NC/CS Impact Evaluation</i>
<b>8</b>	<b>HERS rating requirements for program participation ensure that above-code practices promoted through the program are implemented in participating homes</b>	<b>To be addressed in NC/CS Impact Evaluation</b>
8A	On-site inspections of participating homes shows that above-code practices are implemented	To be addressed in NC/CS Impact Evaluation
<i>Outcome</i>	<i>Increased home buyer awareness of energy efficiency</i>	<i>Insufficient data to determine whether the outcome has occurred. Only 26% of non-participating new home buyers interviewed in 2008 said that some homes are more energy-efficient than others, compared to 70% who said so in 2000. However, 47% in 2008 compared to 34% in 2000 said that new homes in their area and price range could be more efficient, suggesting these home buyers recognize that some homes can be more energy-efficient than others. Most non-participating new home buyers surveyed in 2008 said their home was about as efficient as other new homes.</i>
<b>10</b>	<b>IOUs' advertising and outreach increases home buyers' awareness of energy efficiency and associated benefits</b>	<b>Weak linkage of outcome to IOU programs</b>
10A	Home buyers become more aware of energy efficiency as an important feature of new homes, hearing about it from IOUs' advertising and outreach	Only 3% of non-participating new home buyers interviewed in 2008 said they had heard about efficiency from their utility during the home-buying process, although the proportion of new home buyers who had heard about the importance of efficiency from someone increased from 21% in 2000 to 27% in 2008. About one-half of non-participating homeowners (49%) said they were aware of the programs sponsored by governments or IOUs that encouraged energy-efficient features in new homes, and 10% said someone mentioned the program when they were buying or building their home. Aided awareness of the ENERGY STAR Homes program was 48% in 2008, while aided awareness of the IOU programs was 19%; the greater recognition of the national program name suggests that home buyer awareness of the IOU programs may at least partially carry over from the pre-2006 programs, when the IOUs used the ENERGY STAR name.

<b>Link/ Indicator number</b>	<b><i>Expected Outcome, Link, Indicators</i></b>	<b>Findings</b>
<b>11</b>	<b>Builders' marketing increases home buyers' awareness of energy efficiency and associated benefits</b>	<b>Weak linkage of outcome to IOU programs</b>
11A	Home buyers become more aware of energy efficiency as an important feature of new homes, hearing about it from builders	Only four percent of non-participating new home buyers said that builders, developers, or realtors emphasized energy efficiency during the buying process. However, of those who said someone mentioned IOU programs (10% of all non-participating new home buyers), about one-half (49%, or 5% of all non-participating new home buyers) heard about it through the builder or sales agent.
<b>Outcome</b>	<b><i>Increased home buyer demand and willingness to pay</i></b>	<b><i>Insufficient data to determine whether the outcome has occurred. Two-thirds (68%) of non-participating new home buyers said energy efficiency was important (7 to 10 on a 0-to-10 scale) in their selection of a new home. One-third (32%) rated it very important (9 or 10 on a 0-to-10 scale). Three-fourths (76%) of non-participating new home buyers expressed strong agreement (7 to 10 on a 0-to-10 scale) with the statement that they were willing to invest in home features that would reduce their monthly energy bills, and about one-half (54%) disagreed (0 to 3 on a 0-to-10 scale) that energy-efficient features in a new home cost more than they are worth. While these are positive numbers, we have no measures of increasing demand over time, and no indications of home buyers actually paying more for more efficient homes when given a choice.</i></b>
<b>12#</b>	<b>Increased home buyer awareness causes an increase in home buyer demand for energy efficiency and an increase in willingness to pay</b>	<b>Weak linkage of outcome to IOU programs. The small number of IOU program homes completed from 2006 to 2008—5,592 out of 206,788 total homes—is evidence of limited home buyer demand generated by the 2006-2008 IOU programs; insofar as there was demand generated by the IOU programs, it may have through the pre-2006 programs, and may have translated into sales of efficient homes certified by other programs.</b>
12A#	Home buyers ask builders about the IOU programs	Only 10% of non-participating new home buyers sought information on the IOU programs during the buying process, about equally through utility representatives, the Internet, and the builder.
12B#	Home buyers seek IOU program homes	About two-thirds of non-participating home buyers interviewed for the survey (64%) were aware of the IOU programs, but IOU program homes made up only 2.7% of homes completed from 2006 to 2008, indicating that there were not large numbers of home buyers seeking them out.
<b>Outcome</b>	<b><i>Appraisers and lenders assign value to efficiency</i></b>	<b><i>Insufficient data to determine whether the outcome has occurred; not addressed because Scoping Study suggested appraisers and lenders were not influential in efficiency levels of new homes</i></b>

<b>Link/ Indicator number</b>	<b>Expected Outcome, Link, Indicators</b>	<b>Findings</b>
<b>24</b>	<b>Increased home buyer demand for energy efficiency causes appraisers to assign value to efficiency and lenders to provide energy-efficient mortgages (EEMs), which, in turn, increases home buyer demand</b>	<b>Insufficient data to determine whether the outcome is linked to IOU programs; not addressed because Scoping Study suggested appraisers and lenders were not influential in efficiency levels of new homes</b>
24A	Appraisers and lenders perceive an increase in home buyer demand for efficiency and, respectively, assign more value to it and make more EEMs available	Not addressed because Scoping Study suggested appraisers and lenders were not influential in efficiency levels of new homes
24B	Home buyers are aware of appraisers assigning value to efficiency and lenders providing EEMs, which increases home buyer demand	Not addressed because Scoping Study suggested appraisers and lenders were not influential in efficiency levels of new homes
<b>Outcome</b>	<b>Increased above-code practices#</b>	<b><i>Strong evidence that the outcome has occurred. Based on onsite visits to newly constructed non-program homes, the efficiency levels of several building measures, such as high-SEER central air conditioners and high-AFUE furnaces, appear to have increased during the 2006-2008 period. Title 24 consultants estimated that 24% of the homes built during the 2006-2008 period exceeded Title 24 requirements. Eleven of 45 Title 24 consultants estimated that 10% of the non-program homes met program standards—that is, were at least 15% more efficient than Title 24 requirements, not simply above code. Seven out of 45 Title 24 consultants (responsible for 23% of non-program homes) and 12 of 29 HERS raters (responsible for 7% of non-program) homes reported that the number of non-program homes they consulted on or rated that exceeded Title 24 had increased between 2006 and 2008.</i></b>
<b>16#</b>	<b>The decreased cost of energy-efficient technologies and practices leads to their adoption by an increasing number of builders</b>	<b>Weak linkage of outcome to IOU programs. While some incremental costs have decreased, the volume of IOU program incentives was too small to make a difference.</b>
16A	Distributors and builders report decreases costs of energy-efficient technologies and practices as a factor encouraging their use	Builders who were responsible for 28% of non-program homes rated decreasing incremental cost as an important or very important factor in choices of efficiency levels. HVAC contractors rated decreasing incremental cost as only a moderately important factor.
<b>18</b>	<b>Improved design leads to increased above-code practices</b>	<b>Strong linkage of outcome to IOU programs</b>
18A#	Title 24 consultants say they have attended IOU training and that it has influenced their recommendations of energy-efficient building practices and technologies	As discussed under Indicator 31A, the IOU programs influenced 17 out of 45 Title 24 consultants to recommend above-code practices and technologies for non-program homes, including duct testing (19% of non-program homes), duct sealing (18%), water-heating equipment (11%), and high-SEER AC or heat pump (9%).

<b>Link/ Indicator number</b>	<b>Expected Outcome, Link, Indicators</b>	<b>Findings</b>
<b>19</b>	<b>The demonstration of feasibility of energy-efficient technologies and practices leads to their adoption by an increasing number of builders</b>	<b>Weak linkage of outcome to IOU programs</b>
19A	Builders and Title 24 consultants who are aware of IOUs' R&D and CASE studies are more likely than others to try the new technologies and practices	As discussed under Indicator 5A, only one builder adopted any technologies as a result of the IOUs' R&D and CASE Study programs in the 2006-2008 period, in fewer than 1% of non-program homes, and eight of 45 Title 24 consultants recommended measures as a result of the R&D and CASE Study programs for 3% of non-program homes.
<b>20</b>	<b>Increased knowledge about energy-efficient technologies and practices leads to their adoption by an increasing number of builders</b>	<b>Strong linkage of outcome to IOU programs</b>
20A	Builders, Title 24 consultants, HERS raters, and subcontractors who became knowledgeable about new energy-efficient technologies and practices (directly or indirectly) through IOUs' training are more likely than others to try the new technologies and practices	Builders responsible for 22% of non-program homes reported that knowledge gained through utility programs was an important or very important factor in their choice of energy efficiency levels in non-program homes. Five of 29 HERS raters and 14 of 45 Title 24 consultants reported that the IOU programs influenced builders to use above-code measures in non-program homes through training and education. However, only one of 45 Title 24 consultants and one of 29 HERS raters rated the IOU programs as having had a great deal of influence on non-program homes built to program standards in the 2006-2008 period, which would mean at least 15% more efficient than Title 24 requirements, not simply above code.
<b>21#</b>	<b>Verification of efficiency levels in program homes by HERS raters assures above-code practices in those homes</b>	<b>NC/CS Impact Evaluation</b>
21A#	On-site visits show that above-code practices and technologies certified by HERS raters in program homes have in fact occurred	NC/CS Impact Evaluation
<b>22</b>	<b>Increased marketing of efficiency by some builders leads other builders to adopt energy-efficient technologies and practices</b>	<b>Weak linkage of outcome to IOU programs</b>
22A	Builders who are aware of increased marketing of efficiency by other builders are more likely than others to try the new technologies and practices	As discussed under Indicator 3A, while there is evidence that builders perceived increased home buyer demand and this was at least partially due to the IOU programs, there was not much evidence that builders increased their marketing in response during the 2006-2008 period.
<b>33+</b>	<b>Other voluntary programs lead to increased use of efficient technologies and practices</b>	<b>Strong linkage of outcome to IOU programs</b>

<b>Link/ Indicator number</b>	<b><i>Expected Outcome, Link, Indicators</i></b>	<b>Findings</b>
33A	Managers of other voluntary energy efficiency programs say the IOU programs have contributed increased use of efficient technologies and practices	As discussed under Indicators 1A and 1B, other programs certified fairly large numbers of energy-efficient homes outside the IOU programs in California during the 2006-2008 period—much greater than the number of homes certified by the IOU programs. While the IOU programs contributed to these programs by affecting efficiency criteria and increasing participation, it is likely that a big part of these effects are from pre-2006 programs when IOU program participation was much greater, and that the effects were complementary, with the other programs affecting the IOU programs as well as vice versa.
<b><i>Outcome</i></b>	<b><i>The market is ready for a code upgrade</i></b>	<b><i>Moderate evidence that outcome has occurred. (See Indicator 25B below.)</i></b>
<b>25</b>	<b>Enough builders are using energy-efficient technologies and practices such that the market is prepared for a code upgrade</b>	<b>Moderate linkage of outcome to IOU programs</b>
25A	The incidence of energy-efficient technologies and practices becomes a significant part of the market	As discussed under the outcome “Increased above-code practices,” above-code practices and technologies were used in appreciable numbers of non-program homes in the 2006-2008 period.
25B	Builders and industry experts indicate that there is enough knowledge and availability of efficient technologies and practices in the marketplace that the code could be upgraded and most builders could comply within a reasonable time	Only ten of 45 Title 24 consultants, representing 5% of non-program homes, said there was adequate knowledge and availability of energy-efficient technologies and practices such that most builders could comply with the proposed 2008 code upgrade within a reasonable time—and the responses from Title 24 consultants may be the most important. However, eleven of 29 HERS raters, representing 66% of non-program homes, said this was the case, as did nineteen of 32 builders, representing 79% of non-program homes, which is telling, in that it may reflect a willingness among builders to embrace another code upgrade, or at least resignation to the fact that it will happen.
25C+	Builders and industry experts say utility programs have contributed to market readiness for a code upgrade	Twelve of 32 builders, representing 28% of non-program homes, said IOU programs contributed to market readiness for a code upgrade. Eleven of 45 Title 24 consultants, representing 22% of non-program homes, said the same thing, as did 14 of 29 HERS raters, representing 86% of no-program homes, but only three out of nine HVAC contractors representing 5% of non-program homes.
<b>26</b>	<b>Improved compliance with the current code helps prepare the market for a code upgrade</b>	<b>Strong linkage of outcome to IOU programs.</b>

<b>Link/ Indicator number</b>	<b>Expected Outcome, Link, Indicators</b>	<b>Findings</b>
26A	Builders, industry experts and local code officials say that compliance with the current code has reached the point where builders at the low end of the market could comply with a new upgrade within a reasonable time	Twenty of 32 builders, representing 22% of non-program homes, agreed that the low end of the market could comply with the proposed 2008 code upgrade within a reasonable time. Twelve of 45 Title 24 consultants, representing 30% of non-program homes said the same thing, as did 12 of 29 HERS raters representing 69% of non-program homes, four of nine HVAC contractors representing 82% of non-program homes, and four of 14 building code officials/inspectors.
26B+	Builders and industry experts say utility programs have helped increase code compliance	As discussed under Indicator 14A above, appreciable numbers of Title 24 consultant, HERS raters, and code officials/inspectors said IOU training—along with other training programs—had helped to increase code compliance during the 2006-2008 period.
26C+	Builders and industry experts say utility programs have contributed to market readiness for a code upgrade	See Indicator 25C+
<b>Outcome</b>	<b><i>Code upgraded; efficiency gains consolidated</i></b>	<b><i>Strong evidence that outcome has occurred. Title 24 code was upgraded in 2005, effective October 1, 2005, and again in 2008, effective August 1, 2009, and another update will occur in 2011. The hardwired lighting requirement in the 2005 code change was the one in which utilities played a significant role that produced the most energy savings. The significance of the changes in the 2008 code has not been fully documented to date and there is no draft language yet for the 2011 code.</i></b>
27	<b>The market proves ready and the code is upgraded</b>	<b>Moderate linkage of outcome to IOU programs</b>

<b>Link/ Indicator number</b>	<b>Expected Outcome, Link, Indicators</b>	<b>Findings</b>
27A#	Industry experts attribute code upgrades to the IOU programs	The IOU lighting programs in effect prior to 2006 created the market for high-efficacy lighting in residential new construction during the time they operated. Without utility incentives, it appears that very few builders would have incorporated such lighting in the homes they produced during this period. The market adoption of such lighting through these IOU programs appears to have helped prepare the market and make it practicable to include hardwired CFL fixtures in 2005 Title 24 code requirements. The lighting requirements were the primary change affecting residential new construction as a result of the 2005 code updates in which the utility Codes & Standards Program played a significant role. It is important to note that the Codes & Standards Evaluation is focusing on the effects of the 2003-2005 IOU programs on the 2005 code upgrade, while the rest of this report focuses on the 2006-2008 IOU programs. Incentives from utility program played an important role in affecting the market in the 2003-2005 period. Because almost all high-efficacy lighting installed in the 2003-2005 period was through the IOU programs, these were direct effects that would be accounted for in impact evaluations of these programs. Based on the data collected in this study, there were virtually no indirect effects from the IOU programs on the market for efficient residential lighting.
27B	Utility measures incentivized in the 2006-2008 programs are part of the 2008 code, or are in the draft language for the 2011 code.	The 2008 code does not differ substantially from the 2005 code, and there is no draft language yet for the 2011 code, so the effects of the 2006-2008 IOU programs cannot yet be determined.
27C+	Industry experts attribute code upgrades to the readiness of the market	Not addressed, because indicator was identified after interviews were completed.
<b>Outcome</b>	<b>Reduced energy use, demand, and emissions</b>	<b>TBD</b>
<b>28</b>	<b>Improved compliance with existing code leads to reduced energy use, demand, and emissions</b>	<b>TBD</b>
28A	Energy use and associated emissions as well as demand in non-participant homes are lower than in the baseline, non-program case	Phase II of project
<b>29</b>	<b>Increased use of energy-efficient technologies and practices in non-participant homes, above the current code, leads to reduced energy use, demand, and emissions</b>	<b>TBD</b>
29A	Energy use and associated emissions as well as demand in non-participant homes are lower than in the baseline, non-program case	Phase II of project
<b>30</b>	<b>An upgrade in the building code leads to reduced energy use, demand, and emissions</b>	<b>TBD</b>
30A	Energy use and associated emissions as well as demand in non-participant homes are lower than in the baseline case without a code upgrade	Phase II of project



## 7.2. Attributing Market Changes to the IOU Programs

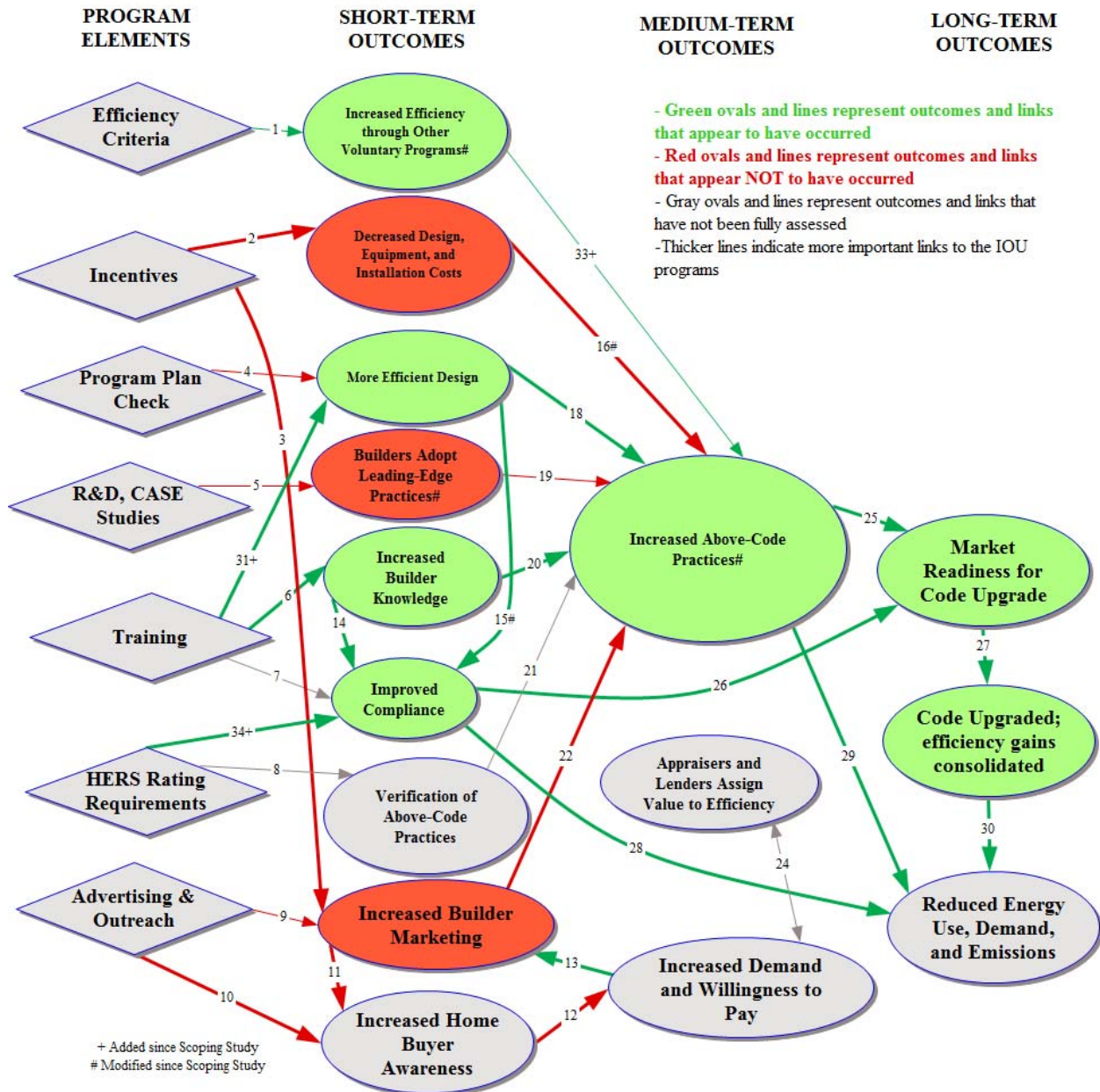
The program logic diagram appears again in Figure 7.2-1, this time showing outcomes that appear to have occurred (green ovals), those that appear not to have occurred (red ovals), and those that have not been measured well enough to draw conclusions (gray ovals). Figure 7.2-1 also shows linkages from program efforts to expected outcomes, or from one outcome to another, that appear to reflect program influence (green arrows), those that appear not to reflect program influence (red arrows), and those that have not been measured well enough to allow such an assessment (gray arrows); thicker arrows reflect greater expected influence.

Figure 7.2-1 illustrates the three ways the IOU programs can lead to the ultimate goal of reduced energy use, demand, and emissions: 1) by improving compliance with existing code, 2) by facilitating construction that is more efficient than required by the current code, and 3) by contributing to code upgrades. Ultimately, program activities are aimed at achieving savings in one of these three ways. In this study we have focused on non-participant spillover, or the effects of the IOU programs on the efficiency of non-program homes. The IOU programs also have direct effects through participating homes (as outlined by program theory), but those effects are addressed by the Residential New Construction Impact Evaluation.

The 2006-2008 IOU programs appear to have had discernible effects on improved code compliance of non-program homes, especially through training of builders leading to greater knowledge of how to comply (Link 14, preceded by Link 6), training of Title 24 consultants leading to improved design (Link 15, preceded by Link 31+), and influencing builders to use HERS raters for QII in non-program homes (Link 34+).

The 2006-2008 IOU programs appear to have had observable effects on increased above-code practices, primarily through Title 24 consultants' more efficient designs (Link 18) which in turn came in part through IOU program training (Link 31+), and though builders' increased knowledge about above-code practices (Link 6)—again partly through IOU program training.

Figure 7.2-1 Outcomes and Links to the IOU Programs



The 2006-2008 IOU programs also appear to have had observable effects—both direct and indirect—on market readiness for a future code upgrade (to occur in 2011), with the indirect effects coming primarily from contributions to improved code compliance and increased above-code practices (Link 25), primarily through builder and Title 24 consultant training (Links 20, 6, 18, and 31+), and through promoting the use of HERS raters (Link 34+). In addition, the 2003-2005 IOU programs also had a direct effect on the 2005 code upgrade by creating a market for hard-wired CFL fixtures, which became part of the 2005 code (Link 27). However, this was a

direct effect through participating homes and would be counted in the evaluations of these prior programs. There was virtually no indication that the IOU programs prior to 2006 had indirect effects on the market for hardwired CFL fixtures.

In general, the 2006-2008 IOU program spillover effects dependent on program volume largely did not occur, including demand-side effects, such as increasing home buyer awareness and demand/willingness to pay for efficient homes. This is to be expected given the low volume of homes going through the IOU programs in the 2006-2008 period—only 5,592 out of 206,788 homes built in the IOU territories.

The reduced IOU program volume in the 2006-2008 period also largely negated opportunities for some supply-side effects, such as reduced incremental costs for efficient construction, since the volume of efficient measures incentivized through the programs simply was not large enough to affect economies of scale. The supply-side effects of IOU programs on non-program homes that do appear to have occurred were primarily through IOU training. The IOU programs exist in a market (depicted in Figure 2.2-2) in which building codes—already some of the most stringent in the U.S.—are ratcheted up every three or four years. IOU training helps builders and other market actors prepare for the upgrades and comply after the fact. Hence the IOU programs are an important element that helps keep the code upgrade cycle happening.

### **7.3. Alternative Explanations for Observed Market Changes**

Section 2.4 outlines some other factors, outside the IOU programs, that could explain observed market changes—but not necessarily to the exclusion of the IOU programs, and with a high degree of overlap with each other. These alternative explanations and related findings are as follows:

- Alternative 1: Other programs that are already available in the marketplace could be driving increased efficiency independently of the IOU programs and could have led to the observed market changes.

The IOU programs coexist in the market with many other programs aimed at increasing the efficiency of new homes. While managers of these other programs give the IOU programs some credit for their efficiency criteria and participation in their 2006-2008 programs (Link 1), it is likely that these other programs also contributed to the success of the IOU programs—especially since the volume of these other programs in 2006 to 2008 was so much greater than that of the IOU programs (about 46,000 homes compared to 5,592, respectively, not counting overlap). The earlier versions of the IOU programs, when volume was much greater, could have had effects on 2006-2008 participation in the other programs, but the focus here is on market effects from the 2006-2008 IOU programs. Overall, Alternative 1 does not explain observed market changes; while non-IOU RNC programs affected the market, it does not appear that they did so independently of the IOU programs.

- Alternative 2: Outside forces such as gasoline prices, housing market cycles, and global warming could be driving demand for efficiency and could have led to the observed market changes, independently of the IOU programs and other voluntary programs.

Buyers of non-program homes in California value efficiency and express willingness to pay for it, and the importance they assign to efficiency may have increased over the past few years (Link 12—see above). It is possible that demand could have been partially driven by previous versions of the IOU RNC programs, or by other IOU efforts, such as the Flex Your Power public awareness campaign (which is the focus of a separate impact evaluation). More importantly, there were powerful external forces at work affecting all aspects of the 2006-2008 housing market, including efficiency. There was near universal agreement among market actors interviewed for the Scoping Study that one effect of the building boom was to minimize unit efficiency (beyond code requirements) because nearly any home could sell and buyers had to take what they could get; however, in the housing downturn, there was widespread agreement that builders have used increased efficiency as a way to differentiate, hold on to market share, and minimize price reductions, and buyers could hold out for homes with the features they wanted. Many industry experts interviewed for the scoping study also said that higher gasoline prices were a major driver for increased efficiency—not just for cars, but for efficiency in general—because their high visibility increased awareness; higher gasoline prices could have affected the 2008 market in particular. Finally, while the evidence is not strong, the issue of climate change could have affected demand for efficiency, at least for a minority of buyers of non-program homes. Overall, demand for efficiency appears to have been more driven by outside forces (confirming Alternative Explanation 2) than by the 2006-2008 IOU programs, as very few buyers sought out IOU program homes.

- Alternative 3: The market could be developing at a “natural” rate and the observed market changes could have happened in the absence of the IOU programs and other voluntary programs; this is highly interrelated with Alternative 2, but could include forces within the market as well as outside the market that lead to a “natural” rate of change.

The 2006-2008 IOU programs appear to have had little effect on home buyer demand for efficiency. However, on the supply side, market actors actually have to be able to *deliver* the efficiency, and the 2006-2008 IOU programs appear to have played an important role in the construction industry’s gearing up to do so; the IOU programs, then, appear to have helped to accelerate the rate of adoption of efficiency, at least on the supply side, and Alternative 3 does not appear to explain market changes.

#### **7.4. Recommendations**

Four recommendations for IOU program design emerge from the findings of this study.

First, continue (and as feasible, expand) the successful training of builders and other market actors. Second, while there were probably good reasons for distinguishing the IOU programs

from the national ENERGY STAR Homes Program, consider realigning with ENERGY STAR, as there is already considerable equity built up in the brand. Third, before pent-up demand for new housing surges as the economy recovers, consider ramping up advertising and promotion of the IOU programs so that when potential buyers go to look for new homes, they ask for efficiency and ENERGY STAR certification. Many builders will build more efficiently if they perceive it as a customer need; otherwise, demand for housing in general might allow any level of efficiency to sell—as was apparently the case in the most recent boom. Participation in the IOU programs could perhaps be increased with renewed effort on channeling consumer demand for efficiency, thus leveraging the outside forces such as gasoline prices, housing market cycles, and global warming that are already driving demand for efficiency. This is underscored by the remarks of a national expert in efficient new construction:

“There are three types of builder [program] partners: 1) partners who join for financial incentives; 2) partners who join to be competitive with other builders; and 3) partners who make the connection between a high-performance building science home and the bottom line. The most successful utility programs get builder partners in the third category—these programs are demand-driven, focused on consumer education, and rebates are quickly phased out. They are not as dependent on rebates, because there is consumer demand. There is no consumer demand in California.”

Fourth, since market transformation is truly a program goal, design the programs to achieve market transformation. The IOU programs’ focus on the supply side reflects an orientation toward resource acquisition, with an apparent expectation that market transformation will automatically follow—“build it and they will buy.” While this study makes it clear that there are some market effects resulting from the IOU programs, the program elements stimulating them are not systematically aimed at transforming the market. When the market rebounds, in order to avoid lost opportunities, it will be important for the IOU programs already to have prepared the marketing and building network, reconnect with ENERGY STAR, and apply lessons learned about Zero Net Energy residential new construction learned at the Sacramento Municipal Utility District (SMUD).

This is related to a recommendation for market effects research: it needs to occur on a regular basis since market transformation is a program goal; otherwise, program planners cannot know if the goal is being achieved. This study focused on the 2006-2008 IOU programs, and there had been no market effects research since 2000, giving little opportunity for feedback to program planners.

This study marks the completion of Phase I of the Residential New Construction Market Effects Study. Phase I has been largely qualitative, aiming to establish whether or not there is substantial evidence of increases in the efficiency of the RNC market—beyond the direct effects of the IOU programs—that may reasonably be attributed to those programs. If such market effects were identified, the plan was to conduct Phase II in order to quantify those market effects and thus help address the CPUC’s October 2007 Decision (D.07-10-032) directing its staff to explore

(during 2008-2009) the ability to credibly quantify and credit “non-participant spillover” market effects. We believe that there is sufficient qualitative evidence of market effects to justify such an effort, and, therefore, we recommend continuing with Phase II. While the CPUC’s Marketing and Outreach Impact Evaluation and Local Government Program Impact Evaluation address the effects of training among groups including builders, Title 24 consultants, and code officials, these evaluations will not include estimates of non-participant spillover, and they do not include on-site visits to identify compliance levels, incidence of above-code measures, or overall home efficiency levels on which to base impact estimates. Nevertheless, insofar as these evaluations develop impact estimates from IOU training for homes whose builders did not receive IOU incentives, any double counting of savings would have to be identified and eliminated.

Much of the data required for Phase II have already been collected during Phase I, or are being collected as part of the RNC Impact Evaluation, and we believe that quantification of market effects is practicable with these data as a starting point. While developing the methodology is itself part of Phase II, it could start with the efficiency levels of measures and homes as observed in on-site visits to calibrate those reported by builders, HVAC contractors, Title 24 contractors, and HERS raters, and with the gross savings associated with those measures from the NC/CS evaluation, DEER<sup>91</sup> and elsewhere. Given that Phase I indicated that the program may have influenced the market primarily through training, Phase II could concentrate on the spillover effects of training, obtaining counts of trainees from the IOUs to calibrate the proportions of survey respondents in each category. The same calibrations could be applied to respondents’ ratings of program influence, and the proportions applied to the gross savings estimates. Another key aspect of Phase II would be to attempt to identify the numbers of non-program homes completed from 2006 to 2008 that had been claimed as committed under the 2004-2005 IOU programs to adjust the number of non-program homes. Finally, the NC/CS evaluation will have completed an assessment of the market effects of the IOU programs on codes and standards adoption, and the relevant results could be included in the Phase II report. Determining whether the development of non-participant spillover estimates is practical, and knowing what those levels are, could prove valuable if new construction rebounds and program participation increases in the coming years.

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<sup>91</sup> Database for Energy Efficient Resources

## 8. Glossary

**Annual Fuel Utilization Efficiency (AFUE):** The AFUE number represents how efficiently a furnace converts fuel to energy. The higher the AFUE percentage, the more energy-efficient the furnace, with a maximum possible AFUE of 100%. The U.S. government's established minimum AFUE rating for a furnace is 78 percent

**Baseline:** Refers to a hypothetical projection of sales patterns of energy-efficient residential new homes in the complete historical absence of publicly funded energy efficiency programs targeting residential new construction (but including building codes).

**CalCERTS:** A private organization that provides service, support, training and certification to HERS raters

**Codes and Standards Enhancement (CASE) Initiative Project.** CASE is the utility program to address energy-efficiency opportunities through development of new and updated appliance (Title 20) and building (Title 24) standards. Individual reports document information and data helpful to the California Energy Commission and other stakeholders in the development of these new and updated standards. The objective of this project is to develop CASE Reports that provide comprehensive technical, economic, market, and infrastructure information on each of the potential standards

**Compliance margins:** Prescriptive Package D is the baseline that the whole-house approach uses. The model compares the modeled usage of the house to the modeled usage of the same house with Package D. The difference is the compliance margin.

**Database for Energy Efficient Resources (DEER):** A California Energy Commission and California Public Utilities Commission (CPUC) sponsored database designed to provide well-documented estimates of energy and peak demand savings values, measure costs, and effective useful life (EUL) all with one data source

**Duct leakage:** Measured as a percentage of supply air flow in an HVAC system, refers to the loss of conditioned air from a duct system due to cracks and gaps in the duct system

**Energy Efficiency Ratio (EER):** EER differs from SEER (Seasonal Energy Efficiency Ratio) in that the latter is a measure of efficiency at 82 degrees outside and 80 degrees inside, while EER measures system efficiency nearer to peak temperatures (for example, 95 degrees outside).

**Flex Your Power:** A California public awareness campaign and information resource on energy efficiency that is run by the IOUs

**Glazing area:** Window area divided by exterior wall area of a home

**Hassle or transaction costs (market barrier):** Indirect costs associated with acquiring energy-efficient technologies and practices, including time, materials and labor needed to acquire and install equipment or learn new practices.

Information search costs (market barrier): The costs associated with the time required to identify and learn about energy-efficient products or services

Instantaneous water heaters: Also called tankless water heaters, water heaters that heat water directly without the use of a storage tank

Luminaire: any hardwired or permanently installed interior or exterior light fixture

Market effects: A change in the structure of a market or the behavior of participants in a market that is reflective of an increase in the adoption of energy-efficient products, services, or practices and is causally related to market intervention(s)

Market transformation: A reduction in market barriers resulting from a market intervention, as evidenced by a set of market effects, that lasts after the intervention has been withdrawn, reduced, or changed.

Non-participant spillover: The *indirect* effects of the 2006-2008 IOU programs on the efficiency of non-program single-family homes built during the same period; the savings from those not directly participating in a utility program who reduce their energy use after being influenced by a utility program.

Organizational practices (market barrier): Behavior or systems of practice that discourage or hamper cost-effective energy efficiency investments and decisions

Participant spillover: The savings from program participants who undertake energy efficiency improvements beyond the scope of the utility's program

Performance uncertainties (market barrier): The challenge of evaluating the claims of future savings and benefits derived from energy-efficient equipment and practices

Preponderance of evidence approach: Drawing a conclusion that a fact or occurrence is more probable than not based on consideration and weighing of all available evidence.

R-value: Indicates insulation's resistance to heat flow. The higher the R-value, the greater the insulating effectiveness

Radiant barriers: Materials installed in buildings to reduce summer heat gain and winter heat loss in order to help lower heating and cooling costs. The barriers consist of a highly reflective material that reflects radiant heat rather than absorbing it. They don't, however, reduce heat conduction like thermal insulation materials.

Right-sizing HVAC equipment: Using software rather than using rules of thumb to identify the proper size for the unit. With right-sizing, smaller systems can often be specified and, hence, initial cost is reduced. A right-sized system will operate for long periods of time (rather than frequently cycling on and off), resulting in the optimum equipment operating efficiency. Also, proper HVAC sizing can reduce short-cycling of equipment, resulting in longer equipment life and better control over indoor environmental conditions



Seasonal Energy Efficiency Ratio (SEER): This is the ratio of the cooling output divided by the power consumption. It is the Btu of cooling output during a central air conditioner's (or heat pump's) normal annual usage divided by the total electric energy input in watt hours during the same period. This is a measure of the cooling performance. The federal minimum for central air conditioners and heat pumps is 13 SEER

Solar Heat Gain Coefficient (SHGC): SHGC measures how well a product transmits sunlight. SHGC is the fraction of incident solar radiation admitted through a window, both directly transmitted and absorbed and subsequently released inward. The lower a window's SHGC, the less heat transmitted.

Title 24 Consultant: Consultants who provide calculations and documentation that a home is compliant with Title 24 (the California Energy Efficiency Standards for Residential and Nonresidential Buildings) as well as provide recommendations to improve the energy efficiency of homes. Title 24 consultants generally use energy analysis software to model and calculate Title 24 compliance and efficiency options.

U-value: A measure of a window's thermal performance. The lower the U-value, the greater a window's resistance to heat flow and the better its insulating value.

## 9. References

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## Appendix A Questionnaires and Interview Guides

### A.1 Builder Interview Guide

#### Nonparticipant Builder Interview Guide for IOU RNC Codes & Standards Programs— Market Effects (Final)

Interviewer:

Date:

Subject Name:

Organization:

Program(s) responsible for:

Hello, my name is \_\_\_\_\_ from Itron, Inc and I am calling on behalf of the California Public Utilities Commission (CPUC). The CPUC has asked us to conduct interviews with builders in order to better understand the residential new construction market, energy efficiency and the California utilities' residential new construction programs. This survey is extremely important to the CPUC's understanding of the new construction market. We are offering \$150 to the appropriate person at your firm to speak with us for about half an hour. May I please speak with the person responsible for making design and construction decisions affecting energy use?

Yes [CONTINUE]

No/DK [TERMINATE]

Refused [TERMINATE]

May I please have the person's name and job title?

[RECORD NAME AND JOB TITLE]

[WHEN CORRECT PERSON IS ON-LINE:]

Hello, my name is \_\_\_\_\_ from Itron, Inc. and I am calling on behalf of the California Public Utilities Commission (CPUC). The CPUC has asked us to conduct interviews with builders in

order to better understand the residential new construction market, energy efficiency and the California utilities' residential new construction programs. Can I confirm that you're the person responsible for making design and construction decisions affecting energy use?

Yes [CONTINUE]

No/DK [ASK TO SPEAK WITH CORRECT PERSON, OR TERMINATE]

Refused [TERMINATE]

This survey is extremely important to the CPUC's understanding of the new construction market. We are offering \$150 if you are the person in your firm who is responsible for making design and construction decisions affecting energy use, and will spend about half an hour sharing with us your insights about the market for energy-saving features in new homes. All your answers are held confidential--that is, we never link any information to a particular person or company.

Is now a good time?

Yes [CONTINUE]

No [SET UP CALLBACK]

DK/refused [TERMINATE]

[IF INTERVIEWEE ASKS ABOUT THE STUDY'S SPONSORSHIP, REFER TO AYAT OSMAN, CPUC, AT (415) 703-5953]

## INTRODUCTION

First I have a few questions about you and about your company's residential construction practices.

1. Which of the following best describes your role within the company? Which other roles do you have within the company? [CHECK AS MANY AS APPROPRIATE]

Purchasing agent

Job superintendent or field supervisor

Executive

Sales agent

Designer

Other [SPECIFY]

DK/refused [TERMINATE]

- 2. Are you aware of the Title 24 requirements for residential new construction in California? {PG&E Q10}

Yes

No

DK/refused

- 3. Do you have a working knowledge of the requirements of Title 24 requirements? {PG&E 10a} [NOTE: WE'RE LOOKING FOR BUILDERS WITH WORKING KNOWLEDGE, NOT NECESSARILY EXPERTS]

Yes [CONTINUE]

No [ASK FOR APPROPRIATE CONTACT AND TERMINATE]

DK/refused [ASK FOR APPROPRIATE CONTACT AND TERMINATE]

Contact with working knowledge of Title 24:

\_\_\_\_\_

Title: \_\_\_\_\_

Phone: \_\_\_\_\_

Other: \_\_\_\_\_

- 4. How many years has your company been in the residential homebuilding industry? {Statewide study Q1; PG&E Q1}

\_\_\_\_ years

- 5. How many newly constructed residential housing units, not buildings but housing units, did your firm complete in 2006 in California? 2007? How many do you expect to complete in 2008? {modified version of Statewide study Q2; PG&E Q4}

A. 2006\_\_\_\_ new housing units in California

- B. 2007\_\_\_\_ new housing units in California
- C. 2008\_\_\_\_ new housing units in California

6. How many of these housing units were tract-built detached single family home, custom built detached single family home, attached single family (Duplex/Townhouse), and condo or apartment (Multifamily unit) {Modified version of Statewide study Q3; PG&E Q6}

- \_\_\_ Tract-built detached single family home
- \_\_\_ Custom built detached single family home
- \_\_\_ Attached single family (Duplex/Townhouse)
- \_\_\_ Condo or Apartment (Multifamily unit)

7. How many newly constructed residential housing units, not buildings but housing units, did your firm complete in 2006 outside of California? 2007? How many do you expect to complete in 2008?

- A. 2006\_\_\_\_ new housing units outside of CA
- B. 2007\_\_\_\_ new housing units outside of CA
- C. 2008\_\_\_\_ new housing units outside of CA

READ: For the rest of the interview I'd like you to talk about single-family attached and detached homes IN CALIFORNIA only—NOT condos or apartments.

8. Does your firm have more than one office?

Yes

No

DK/Refused

9. [IF YES TO Q#8] Does each office have independent responsibility for design and construction, or is responsibility for design and construction centralized?

Independent responsibility

Centralized

DK/Refused

10. [IF “INDEPENDENT RESPONSIBILITY” TO Q#9] How many new single-family units was your office within the firm responsible for in 2006?
11. 2007?
12. 2008? [EXPECTED COMPLETIONS BY END OF YEAR]

[IF “INDEPENDENT RESPONSIBILITY” TO Q#9] Was your office responsible for building homes in [INSERT CITY]? Was your office also responsible for building homes in [INSERT CITY]? How about [INSERT CITY]? [IF NO TO ANY CITY, ASK FOR CONTACT INFORMATION FOR OFFICE THAT WAS RESPONSIBLE. IF NOT TO ALL CITIES, TERMINATE AFTER GETTING CONTACT INFORMATION]

## RNC PROGRAM AWARENESS AND PARTICIPATION

Now I’m going to read you the names of some programs that encourage the installation of energy-efficient features in new homes, and I’m going to ask you if you have heard of them, and if you have participated in them. [RANDOMIZE q#13 -21; ASK Q# A – D FOR EACH PROGRAM UNLESS INSTRUCTED OTHERWISE]

13. [LEED for Homes]
14. [ENERGY STAR Homes]
15. [Solar Initiative]
16. [Environments for Living]
17. [ComfortWise]
18. [Federal Tax Credits]
19. Programs sponsored by municipal utilities such as SMUD and LADWP
20. [Building America] (ASK A-C ONLY, NOT D)
21. [Smart Home]
  - A. Have you heard of [READ PROGRAM NAME]?
  - B. [IF YES TO A] Did you participate in [PROGRAM NAME] before 2006?
  - C. [IF YES TO A] Did you participate in [PROGRAM NAME] from 2006 to 2008?
  - D. [IF YES TO C] How many housing units did your company build with the help of [PROGRAM NAME] from 2006 to 2008?
22. Now I’m going to ask you about some Investor-owned Utility-sponsored programs {Modified statewide study Q10a, 10d; PG&E Q20}
  - A. Have you heard of any Investor-owned Utility programs sponsored by PG&E, SCE, SCG&E or SCG? [IF YES, CONTINUE; IF NO, SKIP TO Q#23]
  - B. Which investor-owned utility-sponsored programs have you heard of? [MULTIPLE RESPONSE]

NO/NONE/DK [SKIP TO Q#23]

PG&E Residential New Construction



SCE New Homes

SDG&E and SCG Advanced Home

Other [SPECIFY]: \_\_\_\_\_

- C. [IF YES TO A] Did your company participate in any of these programs before 2006?
  - D. [IF YES TO C] Which ones?
  - E. [IF YES TO A] Did your company participate in any of these programs from 2006 to 2008? [IF NO, SKIP TO Q#30 ]
  - F. [IF YES TO E] Which ones?
  - G. [IF YES TO E] How many housing units did your company build with the help of [PROGRAM NAME FROM Q#22F] from 2006 to 2008? [SKIP TO Q#24]
23. [IF NO TO Q#22a] Have you heard of any of the following investor-owned utility-sponsored programs? [READ LIST] {Modified statewide study Q9, PG&E Q15 }

PG&E Residential New Construction

SCE New Homes

SDG&E and SCG Advanced Home

[IF YES TO ANY PROGRAM, CONTINUE; IF NO TO ALL PROGRAMS, SKIP TO Q#30 ]

- A. Did your company participate in any of these programs before 2006?
  - B. Which ones?
  - C. Did your company participate in any of these programs from 2006 to 2008? [IF NO, SKIP TO Q#30 ]
  - D. [IF YES TO C] Which ones?
  - E. [IF YES TO D] How many housing units did your company build with the help of [PROGRAM NAME FROM Q#23D] from 2006 to 2008?
24. [IF “INDEPENDENT RESPONSIBILITY” TO Q#9, OTHERWISE SKIP TO Q#30 ]  
How many housing units did your office build with the help of the program before 2006?

Number: \_\_\_\_\_

[Don't know]

25. [IF “INDEPENDENT RESPONSIBILITY” TO Q#9] How about from 2006 to 2008?

Number: \_\_\_\_\_

[>0, CONTINUE]

[0, POSSIBLE PARTIAL PARTICIPANT; SKIP TO Q#30 ]

]Don't know, POSSIBLE PARTIAL PARTICIPANT; SKIP TO Q#30 ]

26. [ASK IF >0 TO Q#24] Did you personally manage any participating projects before 2006?

Yes

No

Don't know

27. [ASK IF >0 TO Q#25] How about from 2006 to 2008?

Yes [CONTINUE]

No [ POSSIBLE PARTIAL PARTICIPANT; SKIP TO Q#30 ]

Don't know [IF NO, SKIP TO Q#30 ]

28. Did you manage projects that were NOT participating in the program before 2006?

Yes

No

Don't know

29. How about from 2006 to 2008?

Yes (CONTINUE, PARTIAL PARTICIPANT)

No (THANK AND TERMINATE, FULL PARTICIPANT)

Don't know

## ENERGY EFFICIENT TECHNOLOGIES AND PRACTICES

Now I would like to ask some questions relating to energy efficient technologies and building practices

How aware would you say you are of each of the following energy efficient equipment and building practices? Are you very aware, somewhat aware, or not aware at all of the latest available energy saving [high efficiency] technologies and building practices? {Modified PG&E Q29} [RANDOMIZE]

30. Types of Insulation
  31. Quality insulation installation techniques
  32. Windows
  33. High-SEER air conditioner or heat pump
  34. High-AFUE furnace
  35. HVAC installation
  36. Water heating equipment
  37. Lighting
  38. Framing materials and techniques
  39. Orientation and shading
  40. Photovoltaics
  41. Duct sealing
  42. Duct testing
  43. Air sealing
44. What is the primary source of your information on new energy efficient technologies and building practices? {Modified PG&E Q30}
45. [IF UTILITY PROGRAM NOT MENTIONED IN Q#44 AND IF YES TO EITHER Q#22A OR AWARE OF ANY PROGRAM IN Q#23 ] Is the investor-owned utility new homes program a source of information on new energy efficient technologies and building practices?
- Yes
- No
- DK/refused
46. [IF UTILITY TRAINING NOT MENTIONED IN Q#44 AND IF YES TO EITHER Q#22A OR AWARE OF ANY PROGRAM IN Q#23] Is the investor-owned utility

sponsored training a source of information on new energy efficient technologies and building practices?

Yes

No

DK/refused

47. [IF SUBCONTRACTORS NOT MENTIONED IN Q#44] Are the contractors you or your company work with a source of information on new energy efficient technologies and building practices?

Yes

No

DK/refused

48. [IF OTHER BUILDERS NOT MENTIONED IN Q#44 AND IF YES TO EITHER Q#22A OR AWARE OF ANY PROGRAM IN Q#23] Are other builders who participate in investor-owned utility programs a source of information on new energy efficient technologies and building practices?

Yes

No

DK/refused

49. On a scale of 1 to 5 with 1 meaning not at all important and a 5 meaning very important, how influential are the following in your choice of energy efficiency levels for homes you build outside of any utility programs? [RANDOMIZE] {1 to 5 scale is used in order to track changes over time; Modified Statewide Q40; PG&E Q30}

- A. Buyer willingness to pay for the incremental cost
- B. The added costs for efficiency improvement are decreasing over time.
- C. Recommendation of Title 24 consultants
- D. Recommendation of subcontractors
- E. Recommendation of product distributors
- F. Recommendation of product manufacturers
- G. Recommendation of architects or designers
- H. Recommendation of sales agents or realtors
- I. Recommendation of lending institutions
- J. Product offerings by competing builders
- K. Marketing by competing builders
- L. [IF "INDEPENDENT" TO Q#9] Practices and technologies used by other offices within your company

M. [IF YES TO Q#22A OR AWARE OF ANY PROGRAM IN Q#23] What you have learned through utility programs

**TITLE 24**

The following questions relate to your company's as well as other builders' building practices relative to California's Title 24 energy efficiency requirements.

50. What method do you typically use to comply with Title 24? [*Interviewer might need to explain methods.*] {PG&E 10b}

\_\_\_ Prescriptive

\_\_\_ Performance

\_\_\_ Trade Off

51. Are you aware of the Time Dependent Valuation, or TDV, requirement in the current Title 24 standard?

Yes

No [SKIP TO Q#54]

52. Who usually decides the best way to meet the TDV requirement? [DO NOT READ LIST]

Title 24 Consultant

Architect

Designer within the company

Respondent

Other [SPECIFY: \_\_\_\_\_]

53. What is the most common way the TDV requirement is met in your homes? [PROBE FOR SPECIFICS]

54. From 2006 to 2008, how have you marketed homes exceeding Title 24 differently from your homes that do not exceed Title 24, if at all? {Statewide Q 21; PG&E Q13}

55. Are you familiar with the utility sponsored “Program Plan Check” that is meant to help model and build above Title 24 requirements?

Yes

No [SKIP TO Q#57]

DK/Refused [SKIP TO Q#57]

56. How much has the feedback from “Program Plan Check” help you and your company with modeling and building above code? Use a scale from 0 to 10, where 0 is “no help at all” and 10 is “a great deal of help.”

57. Now I’m going to read you some statements about code compliance and possible upgrades to Title 24 requirements. I would like you to tell me if you agree or disagree with each statement by using a 10 point scale where 0 is disagree strongly and 10 is agree strongly.

- There is adequate knowledge and availability of energy efficient technologies and practices that most builders could comply with a upgrade to the current code within a reasonable time
- Compliance with the current code is so widespread that builders at the low end of the market could comply with a code upgrade within a reasonable time
- [IF YES TO Q#22A OR AWARE OF ANY PROGRAM IN Q#23] Utility training programs have helped improved code compliance
- [IF YES TO Q#22A OR AWARE OF ANY PROGRAM IN Q#23] Utility programs that encourage code compliance and encourage installation of energy-efficient features in new homes have contributed to market readiness for a code upgrade

[SKIP INSTRUCTIONS FOR PARTIAL PARTICIPANTS, POSSIBLE PARTIAL PARTICIPANTS, NON-PARTICIPANTS AWARE OF THE PROGRAM AND NON-PARTICIPANTS NOT AWARE OF THE PROGRAM:

PARTIAL PARTICIPANTS AND POSSIBLE PARTIAL PARTICIPANTS: IF YES TO Q#22E OR 23C, CONTINUE TO Q#58

NON-PARTICIPANTS AWARE OF THE PROGRAM: IF NO TO Q#22E OR 23C, SKIP TO Q#96]

NON-PARTICIPANTS NOT AWARE OF THE PROGRAM: IF NO TO Q#22A AND NOT AWARE OF ANY PROGRAMS IN Q#23, SKIP TO Q#132 ]

## PARTIAL & POSSIBLE PARTIAL PARTICIPANT SERIES

For the remainder of this survey, when I refer to “the program” or “the utility-sponsored program” I am referring to the [INSERT APPROPRIATE PROGRAM FROM Q#22F OR Q#23D ]

58. Approximately what percentage of the housing units [your company (OR, IF “INDEPENDENT” TO Q#9) your office within the company] completed in 2006 were built with the help of the program? {Statewide Q10j; PG&E Q20D}
59. How about 2007?
60. 2008? [OF TOTAL EXPECTED TO BE BUILT DURING YEAR]

[IF Q#58, 59, AND 60 ARE ALL 0%, SKIP TO NONPARTICIPANT SECTION (Q#96)]

61. What is the main reason [your company (OR, IF “INDEPENDENT” TO Q#9) your office within the company] did not build all homes under the program? [**PROBES:** *Is your company participating in some counties and not in others? If so which ones and why? Is the program more attractive for some developments than for others, and if so why?*] {PG&E Q20D1}

62. Between 2006 and 2008, did [your company (OR, IF “INDEPENDENT” TO Q#9) your office within the company] build any homes in California that exceeded Title 24 but are not part of a utility efficiency program? That is, homes that are not directly supported by incentive dollars but are more energy efficient than required by code? {Statewide Q15}

Yes [SKIP TO Q#64]

No [GO TO Q#63 ]

Don't know [GO TO Q#93]

63. [IF NO TO Q#62] What do you feel are the primary reasons that [your company (OR, IF “INDEPENDENT” TO Q#9) your office within the company] has not used any above-code building practices or technologies in non-program homes? [SKIP TO Q#93 AFTER ANSWERING] {PG&E Q21a}

64. [IF YES TO Q#62] In which of the following areas has [your company (OR, IF “INDEPENDENT” TO Q#9) your office within the company] used above-code practices and technologies in non-program homes from 2006 to 2008? [IF YES] What percent of homes you built from 2006 to 2008 used above code [INSERT FEATURE]? [RANDOMIZE] NOTE: IF RESPONDENT SAYS A GIVEN PRACTICE OR TECHNOLOGY IS NOT SUBJECT TO THE CODE, SAY “PLEASE TELL ME IF

THE PRACTICE OR TECHNOLOGY HELPED THE HOUSE AS A WHOLE  
ACHIEVE ABOVE-CODE EFFICIENCY.”]

- a. Used above code [INSERT FEATURE, Q#65 - 79]?
  - b. [IF YES TO A ] What percent of homes built from 2006 to 2008 used above code [INSERT FEATURE]
- 
65. [IF Q#30 IS VERY AWARE OR SOMEWHAT AWARE] Insulation R-values
  66. [IF Q#31 IS VERY AWARE OR SOMEWHAT AWARE] Quality of insulation installation
  67. [IF Q#32 IS VERY AWARE OR SOMEWHAT AWARE] Windows
  68. [IF Q#33 IS VERY AWARE OR SOMEWHAT AWARE] High-SEER air conditioner or heat pump
  69. [IF Q#34 IS VERY AWARE OR SOMEWHAT AWARE] High-AFUE furnace
  70. [IF Q#35 IS VERY AWARE OR SOMEWHAT AWARE] HVAC installation
  71. [IF Q#36 IS VERY AWARE OR SOMEWHAT AWARE] Water heating equipment
  72. [IF Q#37 IS VERY AWARE OR SOMEWHAT AWARE] Lighting
  73. [IF Q#38 IS VERY AWARE OR SOMEWHAT AWARE] Framing materials and techniques
  74. [IF Q#39 IS VERY AWARE OR SOMEWHAT AWARE] Orientation and shading
  75. [IF Q#40 IS VERY AWARE OR SOMEWHAT AWARE] Photovoltaics
  76. [IF Q#41 IS VERY AWARE OR SOMEWHAT AWARE] Duct sealing
  77. [IF Q#42 IS VERY AWARE OR SOMEWHAT AWARE] Duct testing
  78. [IF Q#43 IS VERY AWARE OR SOMEWHAT AWARE] Air sealing
  79. Other [PLEASE SPECIFY]
- 
80. What reasons or factors determine whether or not you design a particular home or development to exceed Title 24 (without any energy efficiency program support)? What other reasons or factors? {Statewide Q 17}
- 
81. [IF YES TO ANY OF FEATURES Q#65 - 79] How much influence would you say the utility program has had on your adoption of these above-code energy efficient building practices and technologies in non-program homes? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
    - a. [IF YES TO Q.#65 ABOVE] Insulation R-values
    - b. [IF YES TO Q.#66 ABOVE] Quality of insulation installation
    - c. [IF YES TO Q.#67 ABOVE] Windows
    - d. [IF YES TO Q.#68 ABOVE] High-SEER air conditioner or heat pump
    - e. [IF YES TO Q.#69 ABOVE] High-AFUE furnace
    - f. [IF YES TO Q.#70 ABOVE] HVAC installation
    - g. [IF YES TO Q.#71 ABOVE] Water heating equipment
    - h. [IF YES TO Q.#72 ABOVE] Lighting
    - i. [IF YES TO Q.#73 ABOVE] Framing materials and techniques
    - j. [IF YES TO Q.#74 ABOVE] Orientation and shading
    - k. [IF YES TO Q.#75 ABOVE] Photovoltaics
    - l. [IF YES TO Q.#76 ABOVE] Duct sealing



- m. [IF YES TO Q.#77 ABOVE] Duct testing
  - n. [IF YES TO Q.#78 ABOVE] Air sealing
  - o. [IF YES TO Q.#79 ABOVE] [REPEAT WHAT WAS MENTIONED IN Q.#79]
82. [IF POSSIBLE PARTIAL PARTICIPANT AND YES TO ANY OF FEATURES Q#65 - 79] How much influence would you say the other offices in your company that participated in the utility program have had on your adoption of these above-code energy efficient building practices and technologies in non-program homes? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
- a. [IF YES TO Q.#65 ABOVE] Insulation R-values
  - b. [IF YES TO Q.#66 ABOVE] Insulation installation
  - c. [IF YES TO Q.#67 ABOVE] Windows
  - d. [IF YES TO Q.#68 ABOVE] High-SEER air conditioner or heat pump
  - e. [IF YES TO Q.#69 ABOVE] High-AFUE furnace
  - f. [IF YES TO Q.#70 ABOVE] HVAC installation
  - g. [IF YES TO Q.#71 ABOVE] Water heating equipment
  - h. [IF YES TO Q.#72 ABOVE] Lighting
  - i. [IF YES TO Q.#73 ABOVE] Framing materials and techniques
  - j. [IF YES TO Q.#74 ABOVE] Orientation and shading
  - k. [IF YES TO Q.#75 ABOVE] Photovoltaics
  - l. [IF YES TO Q.#76 ABOVE] Duct sealing
  - m. [IF YES TO Q.#77 ABOVE] Duct testing
  - n. [IF YES TO Q.#78 ABOVE] Air sealing
  - o. [IF YES TO Q.#79 ABOVE] [REPEAT WHAT WAS MENTIONED IN Q.#79]
83. [IF ANY OF Q.#81A A-P GT 0, OTHERWISE SKIP TO Q#86] In what way did the program cause your company to implement these changes to non-program homes? [PROBE: Are there features of the program that caused your company to implement these changes to non-program homes?] {PG&E Q21c}
84. [IF ANY OF Q.#81A A-P GT 0] Will you continue to use these above-code practices and technologies in the future even without the program? {Statewide Q10i; PG&E Q21d}
- \_\_\_ Yes
- \_\_\_ No
- \_\_\_ DK/refused
85. Why do you say that?
86. [IF YES TO Q#62] What percent of the non-program homes [your company (OR, IF “INDEPENDENT” TO Q#9) your office within the company] built from 2006 to 2008 met program standards, but were not rated? \_\_\_\_\_%

87. [IF Q#86 >0%, OTHERWISE SKIP TO Q#93] Why did you not seek to qualify the homes that met program standards?
88. [IF Q#86 >0%, OTHERWISE SKIP TO Q#93] What specifically is the program standard that these homes meet? [PROBE FOR SPECIFICS]
89. [IF MORE THAN 0% TO Q#86 ] How much influence would you say the utility program has had on your building non-program homes that meet program standards? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
90. In what way did the program cause your company to build non-program homes that meet program standards? [PROBE: Are there features of the program that caused your company to build non-program homes that meet program standards?] {PG&E Q21c}
91. Would you continue building non-program homes that meet program standards in the future even without the program? {Statewide Q10l; PG&E Q21d}
- \_\_\_ yes
- \_\_\_ no
- \_\_\_ DK/refused
92. Why do you say that?
93. How do you advertise or market program homes differently from non-program homes, if at all? {Statewide Q 10n}
94. How much do you emphasize energy efficiency in your marketing of non-program homes? Use a scale from 0 to 10, where 0 is “not at all” and 10 is “efficiency receives more emphasis than any other home feature.”
95. [IF Q.#94 GT 5] How much influence would you say the utility program has had on your emphasis on efficiency in marketing of non-program homes? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

[SKIP TO Q#132]

## NON-PARTICIPANTS

For the remainder of this survey, when I refer to “the program” or “the utility-sponsored program” I am referring to the [INSERT APPROPRIATE PROGRAM FROM Q#22F OR Q#23D ]

96. What is the main reason [your company (OR, IF “INDEPENDENT” TO Q#9) your office within the company] chose **not** to participate in the utility-sponsored program to encourage the installation of energy-efficient features in new homes? What are any other reasons? {Statewide Q 10c; PG&E Q20}

97. Do you know any builders who have participated in the investor-owned utility-sponsored programs to encourage the installation of energy-efficient features in new homes?

Yes

No [SKIP TO Q#100 ]

DK/refused [SKIP TO Q#100 ]

98. Have you discussed energy efficient building technologies and practices with builders who have participated in the investor-owned utility-sponsored programs?

Yes

No [SKIP TO Q#100 ]

DK/refused [SKIP TO Q#100 ]

99. Where have you discussed energy efficient building technologies and practices with builders who have participated in the investor-owned utility-sponsored programs?  
[MULTIPLE RESPONSE, DO NOT READ]

Phone conversations

Builders’ conferences

Building sites

Other [SPECIFY: \_\_\_\_\_]

100. Did [your company (OR, IF “INDEPENDENT” TO Q#9) your office within the company] used any above-code building practices or technologies from 2006 to 2008?

Yes [SKIP TO Q#102]

No [GO TO Q#101 ]

Don't know [GO TO Q#132]

101. [IF NO TO Q#100] What do you feel are the primary reasons that [your company (OR, IF "INDEPENDENT" TO Q#9) your office within the company] has not used any above-code building practices or technologies? [SKIP TO Q#132 AFTER ANSWERING] {PG&E Q21a}
102. [IF YES TO Q#100] In which of the following areas has [your company (OR, IF "INDEPENDENT" TO Q#9) your office within the company] used above-code practices and technologies from 2006 to 2008? [IF YES] What percent of homes you built from 2006 to 2008 used above code [INSERT FEATURE]? [RANDOMIZE] [NOTE: IF RESPONDENT SAYS A GIVEN PRACTICE OR TECHNOLOGY IS NOT SUBJECT TO THE CODE, SAY "PLEASE TELL ME IF THE PRACTICE OR TECHNOLOGY HELPED THE HOUSE AS A WHOLE ACHIEVE ABOVE-CODE EFFICIENCY."]
- Used above code [INSERT FEATURE # 103 - 117]?
  - [IF YES TO A] What percent of homes built from 2006 to 2008 used above code [INSERT FEATURE]
103. [IF Q#30 IS VERY AWARE OR SOMEWHAT AWARE] Insulation R-values
104. [IF Q#31 IS VERY AWARE OR SOMEWHAT AWARE] Quality of insulation installation
105. [IF Q#32 IS VERY AWARE OR SOMEWHAT AWARE] Windows
106. [IF Q#33 IS VERY AWARE OR SOMEWHAT AWARE] High-SEER air conditioner or heat pump
107. [IF Q#34 IS VERY AWARE OR SOMEWHAT AWARE] High-AFUE furnace
108. [IF Q#35 IS VERY AWARE OR SOMEWHAT AWARE] HVAC installation
109. [IF Q#36 IS VERY AWARE OR SOMEWHAT AWARE] Water heating equipment
110. [IF Q#37 IS VERY AWARE OR SOMEWHAT AWARE] Lighting
111. [IF Q#38 IS VERY AWARE OR SOMEWHAT AWARE] Framing materials and techniques
112. [IF Q#39 IS VERY AWARE OR SOMEWHAT AWARE] Orientation and shading
113. [IF Q#40 IS VERY AWARE OR SOMEWHAT AWARE] Photovoltaics
114. [IF Q#41 IS VERY AWARE OR SOMEWHAT AWARE] Duct sealing
115. [IF Q#42 IS VERY AWARE OR SOMEWHAT AWARE] Duct testing
116. [IF Q#43 IS VERY AWARE OR SOMEWHAT AWARE] Air sealing
117. Other [PLEASE SPECIFY]
118. [IF YES TO ANY OF Q.# 103 - 117 AND YES TO Q#22A OR AWARE OF ANY PROGRAM IN Q#23] How much influence would you say the utility program has

had on your adoption of these above-code energy efficient building practices and technologies? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

- a. [IF YES TO Q.#103 ABOVE] Insulation R-values
  - b. [IF YES TO Q.#104 ABOVE] Quality of insulation installation
  - c. [IF YES TO Q.#105 ABOVE] Windows
  - d. [IF YES TO Q.#106 ABOVE] High-SEER air conditioner or heat pump
  - e. [IF YES TO Q.#107 ABOVE] High-AFUE furnace
  - f. [IF YES TO Q.#108 ABOVE] HVAC installation
  - g. [IF YES TO Q.#109 ABOVE] Water heating equipment
  - h. [IF YES TO Q.#110 ABOVE] Lighting
  - i. [IF YES TO Q.#111 ABOVE] Framing materials and techniques
  - j. [IF YES TO Q.#112 ABOVE] Orientation and shading
  - k. [IF YES TO Q.#113 ABOVE] Photovoltaics
  - l. [IF YES TO Q.#114 ABOVE] Duct sealing
  - m. [IF YES TO Q.#115 ABOVE] Duct testing
  - n. [IF YES TO Q.#116 ABOVE] Air sealing
  - o. [IF YES TO Q.#117 ABOVE] [REPEAT WHAT WAS MENTIONED IN Q.#87]
119. [IF ANY OF Q.#118 A-P GT 0] In what way did the program cause your company to implement these changes to non-program homes? [PROBE: Are there features of the program that caused your company to implement these changes to non-program homes?] {PG&E Q21c}
120. [IF GT 0 TO ANY OF Q.#118 A-P] Would you continue to use these above-code practices and technologies in the future even without the program? {Statewide Q101; PG&E Q21d}
- Yes
- No
- DK/refused
121. Why do you say that?
122. [IF YES TO ANY OF Q.# 103 - 117 AND YES TO Q#98] How much influence would you say your discussion with builders who participate in the investor-owned utility programs has had on your adoption of these above-code energy efficient building practices and technologies? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
- a. [IF YES TO Q.#103 ABOVE] Insulation R-values
  - b. [IF YES TO Q.#104 ABOVE] Quality of insulation installation
  - c. [IF YES TO Q.#105 ABOVE] Windows
  - d. [IF YES TO Q.#106 ABOVE] High-SEER air conditioner or heat pump

- e. [IF YES TO Q.#107 ABOVE] High-AFUE furnace
  - f. [IF YES TO Q.#108 ABOVE] HVAC installation
  - g. [IF YES TO Q.#109 ABOVE] Water heating equipment
  - h. [IF YES TO Q.#110 ABOVE] Lighting
  - i. [IF YES TO Q.#111 ABOVE] Framing materials and techniques
  - j. [IF YES TO Q.#112 ABOVE] Orientation and shading
  - k. [IF YES TO Q.#113 ABOVE] Photovoltaics
  - l. [IF YES TO Q.#114 ABOVE] Duct sealing
  - m. [IF YES TO Q.#115 ABOVE] Duct testing
  - n. [IF YES TO Q.#116 ABOVE] Air sealing
  - o. [IF YES TO Q.#117 ABOVE] [REPEAT WHAT WAS MENTIONED IN Q.#87]
123. [IF YES TO ANY OF Q#100 AND YES TO Q#22A OR AWARE OF ANY PROGRAM IN Q#23] What percent of the homes [your company (OR, IF “INDEPENDENT” TO Q#9) your office within the company] built from 2006 to 2008 met program standards, but were not rated? \_\_\_\_\_%
124. [IF Q#123 >0%] Why did you not seek to qualify the homes that met program standards?
125. [IF MORE THAN 0% TO Q#123 ] How much influence would you say the utility program has had on your building non-program homes that meet program standards? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
126. [IF Q#125 GT 0] Which feature of the program was the main reason for building non-program homes that meet program standards? {PG&E Q21c}
127. [IF Q#125 GT 0] Would you continue building non-program homes that meet program standards in the future even without the program? {Statewide Q10l; PG&E Q21d}
- \_\_\_\_ yes
- \_\_\_\_ no
- \_\_\_\_ DK/refused
128. Why do you say that?
129. How much do you emphasize energy efficiency in your marketing of homes? Use a scale from 0 to 10, where 0 is “not at all” and 10 is “efficiency receives more emphasis than any other home feature.”

130. [IF Q.#129 GT 0 AND YES TO Q#22A OR AWARE OF ANY PROGRAM IN Q#23 ] How much influence would you say the utility program has had on your emphasis on efficiency in marketing homes? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
131. [IF Q#130 gt 5] Which features of the program were the main reasons for implementing these changes? {Modified PG&E Q17b}

## ALL RESPONDENTS

[FOR PARTIAL PARTICIPANTS AND POSSIBLE PARTIAL PARTICIPANTS: “THE REMAINING QUESTIONS PERTAIN ONLY TO BUILDING PRACTICES FOR HOMES **NOT ENROLLED** IN THE INVESTOR OWNED UTILITY PROGRAM”]

132. [ASK IF ‘YES’ TO Q#22A OR AWARE OF ANY PROGRAM IN Q#23, OTHERWISE SKIP TO Q#136] As far as you know, have the subcontractors you or your company work with worked on any homes enrolled in a utility sponsored program that encourages installation of energy-efficient features in new homes? This would include work on homes for other builders.

Yes

No [SKIP TO Q#136]

DK/refused [SKIP TO Q#136]

133. Have the subcontractors you or your company work with made any changes to their building or installation practices as a result of the program? {Modified PG&E Q23}

Yes

No [SKIP TO Q136]

DK/refused [SKIP TO Q136]

134. [IF YES TO Q133] How so for:? {Modified PG&E Q23a}
- a. Insulation contractors [PROBE: R-value, techniques, types of insulation]

- b. HVAC contractors [PROBE: High-SEER AC, High-AFUE furnaces, installation techniques]
  - c. Duct sealing and duct testing contractors?
  - d. Air sealing contractors?
  - e. Framing subcontractors [PROBE: Framing materials and techniques ]
  - f. Window contractors?
  - g. Electrical subcontractors [PROBE: lighting?]
  - h. Photovoltaic contractors?
  - i. Any other subcontractors? [SPECIFY TYPE OF CONTRACTOR AND CHANGES MADE]
135. [IF YES Q133] Which features of the program were the main reasons for implementing these changes? {Modified PG&E Q23b}

### Trainings

136. From 2006 to 2008, have you attended any utility-sponsored training sessions pertaining to energy efficient new home construction?

Yes [CONTINUE]

No [SKIP TO Q#140]

DK/refused [SKIP TO Q#140]

137. Does [your company (OR, IF “INDEPENDENT” TO Q#9) your office within the company] use more energy efficient building practices or technologies as a result of this training?

Yes

No [SKIP TO Q#140]

DK/refused [SKIP TO Q#140]

138. [IF YES TO Q137] What energy efficient building practices or technologies do you typically use as a result of the training?
- A. Insulation practices [PROBE: R-value, techniques, types of insulation]
  - B. HVAC practices [PROBE: High-SEER AC, High-AFUE furnaces, installation techniques]
  - C. Duct sealing and duct testing practices
  - D. Air sealing practices



- E. Framing practices [PROBE: Framing materials and techniques ]
  - F. Window installations
  - G. Electrical practices [PROBE: lighting?]
  - H. Photovoltaic installations
  - I. Any other? [specify \_\_\_\_\_]
139. [IF YES TO Q#137] How much influence would you say the utility training has had on your adoption of these energy efficient building practices and technologies? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

### **R&D and CASE Studies**

140. Are you aware of any utility-sponsored R&D programs or CASE Studies from 2006 to 2008 pertaining to energy efficient new home construction?
- Yes [CONTINUE]
- No [SKIP TO Q#144]
- DK/refused [SKIP TO Q#144]
141. Has [your company (OR, IF “INDEPENDENT” TO Q#9) your office within the company] adopted any of the energy efficient building practices or technologies that were tested by the R&D program or demonstrated in the CASE studies?
- Yes
- No [SKIP TO Q#144]
- DK/refused [SKIP TO Q#144]
142. [IF YES TO Q#141] What energy efficient building practices or technologies do you typically use that were tested by the R&D program or demonstrated in the CASE studies?
143. [IF YES TO Q#141] How much influence would you say the utility R&D or CASE Studies program has had on your adoption of these energy efficient building practices and technologies? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

## CONSUMER DEMAND FOR ENERGY EFFICIENCY

144. Based on your experience in home construction, how much demand is there **in general** from home buyers for energy-saving features? [READ LIST] {Statewide Q7; PG&E Q34}

A lot [SKIP TO Q#146]

Some [SKIP TO Q#146]

Little [SKIP TO Q#146]

Very little [SKIP TO Q#145]

None [SKIP TO Q#145]

[DO NOT READ:] Don't know [SKIP TO Q145]

145. [IF "VERY LITTLE" OR "NONE" TO Q144] What do you feel are the major factors for such little demand? {PG&E Q34a}

146. Would you say home buyer demand for energy-saving features has increased a lot, increased a little, decreased a lot, decreased a little or stayed the same over the last 5 years? {Statewide Q30; PG&E Q35}

Increased a lot [CONTINUE]

Increased a little [CONTINUE]

Decreased a lot [CONTINUE]

Decreased a little [CONTINUE]

Stayed same [CONTINUE]

DK/refused [SKIP TO Q164]

147. Why do you think that is? {Statewide Q31a; PG&E Q35a}

[IF "INCREASED A LOT" OR "INCREASED A LITTLE"] How much of a factor do you think each of the following has been in the increase in home buyer demand for energy-saving features?

[SCALE: Not a factor at all; A minor factor; A significant factor; One of the most important factors] [RANDOMIZE]

- 148. [IF YES TO Q#13A] LEED for Homes Program
- 149. [IF YES TO Q#14A] ENERGY STAR Homes Program
- 150. [IF YES TO Q#15A] Solar Initiative
- 151. [IF YES TO Q#16A] Environments for Living Program
- 152. [IF YES TO Q#17A] ComfortWise Program
- 153. [IF YES TO Q#18A] Federal Tax Credits
- 154. [IF YES TO Q#19A] Programs sponsored by municipal utilities such as SMUD and LADWP
- 155. [IF YES TO Q#20A] Building America Program
- 156. [IF YES TO Q#21A] Smart Home Program
- 157. [IF YES TO Q#22A OR AWARE OF ANY PROGRAM IN Q#23] Investor-owned utility-sponsored programs
- 158. Increasing utility rates
- 159. Increasing gasoline prices
- 160. Awareness of global warming
- 161. The downturn in the housing market
- 162. Increased builder marketing

163. How much of a factor do you think the “Flex Your Power Program” has been in the increase in home buyer demand for energy-saving features? Please use a 10 point scale where 0 is not a factor at all and 10 is an extremely important factor. [READ IF NECESSARY: “Flex Your Power is a statewide marketing and outreach campaign that encourages residents, builders, businesses, institutions, government agencies, and nonprofit organizations to be energy efficient”]

164. In your opinion, do buyers expect all homes built in the last 5 years to be built to save energy? **{Statewide Q32; PG&E Q37}**

Yes

No

Don't know/don't have direct contact with buyers

165. Have home buyers you've worked with ever specifically asked about homes that were more energy efficient than the state building code requires? **{Statewide Q33}**

Yes

No [SKIP TO Q167]

Don't know/don't have direct contact with buyers [SKIP TO Q167]

166. [IF YES TO Q165 ] About what percentage over the last year or so? \_\_\_\_\_  
{Statewide Q33a}
167. How much, if at all, would you say home buyers associate energy saving features with home quality? Please use a scale of 1 to 5 where 1 is not at all, and 5 is very strongly. [99 = DK/refused] {1 to 5 scale is used in order to track changes over time Statewide Q34}
168. How much, if at all, would you say home buyers associate energy saving features with home comfort? Please use a scale of 1 to 5 where 1 is not at all, and 5 is very strongly. [99 = DK/refused] {1 to 5 scale is used in order to track changes over time; Statewide Q35}
169. Would you say that the added costs for the efficiency improvements that exceed Title 24 has increased, decreased, or stayed the same over the last 5 years?
- Increased [CONTINUE]  
Decreased [CONTINUE]  
Stayed same [CONTINUE]  
DK/refused [SKIP TO Q#172]
170. Why do you think that is?
171. [IF INCREASED OR DECREASED TO Q#169] By what percent has the incremental cost increased/decreased?
172. In general, how willing are home buyers **to pay for the additional costs** that may be associated with these energy-efficient measures that exceed Title 24? Are they ...  
[READ LIST]? {Statewide Q8}
- Extremely willing [SKIP TO Q#174 ]  
Very willing [SKIP TO Q#174 ]  
Somewhat willing [SKIP TO Q#174]  
Not very willing, or

Not at all willing

DK/refused [SKIP TO Q#174]

173. [If “Not very willing” or “Not at all willing” to Q#172] Why are home buyers not willing to pay for the additional costs associated with energy efficiency? [PROBE: lack of awareness of cost savings; cost of efficiency is competing with other home features; lack of awareness of non-energy benefits]

174. Let’s say that you were to build a home that exceeds Title 24 by 10 percent, and you don’t receive any incentives. About how much extra would this cost, in percentage terms, beyond the base cost of the home that meets Title 24? {Modified Statewide Q26; PG&E Q40}

\_\_\_\_\_ %

175. In percentage terms, how much of this extra amount do you think a typical buyer is willing to pay, assuming the buyer is made aware of the features that make the home exceed Title 24 by 10 percent? {Statewide Q27; PG&E Q41}

\_\_\_\_\_ %

176. Let’s assume that buyers would be willing to pay for 100% of the additional cost of exceeding Title 24 by 10 percent. What, if anything, besides the extra cost might prevent your company from providing the energy-efficient features buyers are willing to pay for? {Statewide Q28; PG&E Q42}

177. Other than rebates or incentives, what else could others do to help your company meet buyer demand for more energy-efficient homes? This might include utilities, government, subcontractors, or others who might help meet buyer demand for energy efficiency. {Statewide Q29; PG&E Q43}

## MARKETING ENERGY EFFICIENCY

178. How regularly do you market energy efficiency and energy-efficient features to buyers of new homes in California? Would you say...[READ LIST]? {Statewide Q8c}

Always,

Often,

Sometimes,

Rarely, or

Never

[DNR:] DK/refused

179. Would you say the amount you market energy efficiency and energy efficient features has increased a lot, increased a little, decreased a lot, decreased a little, or stayed the same over the last 5 years?

Increased a lot

Increased a little

Decreased a lot

Decreased a little

Stayed same

DK/refused

180. Do other builders market energy efficiency and energy-efficient features to buyers of new homes in California?

Yes

No [SKIP TO Q#182]

DK/refused [SKIP TO #182]

181. On average, do other builders market energy efficiency and energy efficient features more or less than you? Would you say [READ LIST]

A lot more

More

About the same

Less

A lot less

182. Finally, we would also like to talk to some subcontractors in order to learn more about the residential new construction market, energy efficiency and the California utilities' residential new construction programs. Could you give me the name and contact information for an HVAC contractor you regularly work with?

Company name: \_\_\_\_\_  
Individual contact name: \_\_\_\_\_  
Street Address: \_\_\_\_\_  
Town/city: \_\_\_\_\_  
Telephone Number (office): \_\_\_\_\_  
Telephone Number (cell): \_\_\_\_\_

183. Could you give me the name and contact information for an insulation contractor you regularly work with?

Company name: \_\_\_\_\_  
Individual contact name: \_\_\_\_\_  
Street Address: \_\_\_\_\_  
Town/city: \_\_\_\_\_  
Telephone Number (office): \_\_\_\_\_  
Telephone Number (cell): \_\_\_\_\_

184. Could you give me the name and contact information for an electrical contractor you regularly work with?

Company name: \_\_\_\_\_  
Individual contact name: \_\_\_\_\_  
Street Address: \_\_\_\_\_  
Town/city: \_\_\_\_\_  
Telephone Number (office): \_\_\_\_\_  
Telephone Number (cell): \_\_\_\_\_

185. Could you give me the name and contact information for a framing contractor you regularly work with?

Company name: \_\_\_\_\_

Individual contact name: \_\_\_\_\_  
Street Address: \_\_\_\_\_  
Town/city: \_\_\_\_\_  
Telephone Number (office): \_\_\_\_\_  
Telephone Number (cell): \_\_\_\_\_

186. Could you give me the name and contact information for a duct sealing and testing contractor you regularly work with?

Company name: \_\_\_\_\_  
Individual contact name: \_\_\_\_\_  
Street Address: \_\_\_\_\_  
Town/city: \_\_\_\_\_  
Telephone Number (office): \_\_\_\_\_  
Telephone Number (cell): \_\_\_\_\_

187. Could you give me the name and contact information for a Title 24 consultant you regularly work with?

Company name: \_\_\_\_\_  
Individual contact name: \_\_\_\_\_  
Street Address: \_\_\_\_\_  
Town/city: \_\_\_\_\_  
Telephone Number (office): \_\_\_\_\_  
Telephone Number (cell): \_\_\_\_\_

188. Could you give me the name and contact information for a HERS rater you regularly work with?

Company name: \_\_\_\_\_  
Individual contact name: \_\_\_\_\_  
Street Address: \_\_\_\_\_  
Town/city: \_\_\_\_\_  
Telephone Number (office): \_\_\_\_\_  
Telephone Number (cell): \_\_\_\_\_



189. [ASK IF RESPONDENT IS NOT A PURCHASING AGENT] Could you give me the name and contact information for a purchasing agent in your company?

Individual contact name: \_\_\_\_\_

Title

Telephone Number (office): \_\_\_\_\_

Telephone Number (cell): \_\_\_\_\_

190. [ASK IF RESPONDENT IS NOT A DESIGNER] Could you give me the name and contact information for a designer in your company?

Individual contact name: \_\_\_\_\_

Title

Telephone Number (office): \_\_\_\_\_

Telephone Number (cell): \_\_\_\_\_

191. [ASK IF RESPONDENT IS NOT A JOB SUPERVISOR] Could you give me the name and contact information for a job supervisor in your company?

Individual contact name: \_\_\_\_\_

Title

Telephone Number (office): \_\_\_\_\_

Telephone Number (cell): \_\_\_\_\_

**That concludes our interview, thank you very much!**

## A.2 Title 24 Consultants Interview Guide

### Title 24 Consultants Interview Guide for IOU RNC Codes & Standards Programs— Market Effects

(Final)

Interviewer:

Date:

Subject Name:

Organization:

Program(s) responsible for:

Hello, my name is \_\_\_\_\_ from Itron, Inc. and I am calling on behalf of the California Public Utilities Commission (CPUC). The CPUC has asked us to conduct interviews with Title 24 consultants in order to better understand the residential new construction market, energy efficiency and the California utilities' residential new construction programs. This survey is extremely important to the CPUC's understanding of the new construction market. We are offering \$150 to the appropriate person at your firm to speak with us for about half an hour. May I please speak with a person who has a lot of experience consulting with builders about making design and construction decisions affecting energy use and compliance with Title 24?

Yes [CONTINUE]

No/DK [TERMINATE]

Refused [TERMINATE]

May I please have the person's name and job title?

[RECORD NAME AND JOB TITLE]

[WHEN CORRECT PERSON IS ON-LINE:]

Hello, my name is \_\_\_\_\_ from Itron, Inc. and I am calling on behalf of the California Public Utilities Commission (CPUC). The CPUC has asked us to conduct interviews with Title 24

consultants in order to better understand the residential new construction market, energy efficiency and the California utilities' residential new construction programs. Can I confirm that you have a lot of experience consulting with builders about making design and construction decisions affecting energy use and compliance with Title 24?

Yes [CONTINUE]

No/DK [ASK TO SPEAK WITH CORRECT PERSON, OR TERMINATE]

Refused [TERMINATE]

Since January 2006, has your company consulted on Title 24 compliance for homes NOT participating in any investor owned Utility sponsored programs that encourage the installation of energy-efficient features in new homes? [IF RESPONDENT ASKS, IOU PROGRAMS ARE: PG&E Residential New Construction; SCE New Homes; and SDG&E and SCG Advanced Home

Yes [CONTINUE]

No [TERMINATE]

DK / REFUSED [TERMINATE]

[ASK FOLLOWING SCREENING QUESTIONS IF RESPONDENT IS BOTH A TITLE 24 CONSULTANT AND A HERS RATER]:

Our records indicate that you are both a Title 24 consultant and a HERS rater. Is this correct?

YES [CONTINUE WITH SCREENING QUESTIONS]

NO, just Title 24 consultant [CONTINUE TO INTERVIEW]

[IF YES, BOTH TITLE 24 CONSULTANT AND HERS RATER] Is more of your business related to Title 24 consulting or HERS rating?

Title 24 Consulting [CONTINUE WITH INTERVIEW]

HERS Rating [Recruit for HERS Rater interview]

This survey is extremely important to the CPUC's understanding of the new construction market. All your answers are held confidential--that is, we never link any information to a particular person or company. Is now a good time?

Yes [CONTINUE]

No [SET UP CALLBACK]

DK/refused [TERMINATE]

[IF INTERVIEWEE ASKS ABOUT THE STUDY'S SPONSORSHIP, REFER TO AYAT OSMAN, CPUC, AT (415) 703-5953]

## INTRODUCTION

First I have a few questions about you and your company.

1. How many years have you been a Title 24 consultant? { **Statewide Q1c** }  
\_\_\_\_ Years as Title 24 consultant

2. Do you work independently or as part of a company? { **Statewide Q1d** }

Independently [SKIP TO Q#4]

Part of a company [CONTINUE]

DK/Refused [CONTINUE]

3. How many Title 24 consultants work at your company? { **Statewide Q1e** }  
\_\_\_\_ Title 24 consultants in company

4. How many newly constructed residential housing units, not buildings or developments but housing units, did your firm provide Title 24 consulting for in 2006 in California? 2007? How many do you expect to provide Title 24 consulting for in 2008? [IF NECESSARY:] Your best estimate is fine.  
D. 2006\_\_\_\_ new housing units in California  
E. 2007\_\_\_\_ new housing units in California  
F. 2008\_\_\_\_ new housing units in California

5. About what percent of these housing units were tract-built detached single family homes, custom built detached single family homes, attached single family homes (Duplex/Townhouse), and condos or apartments (Multifamily units)? [FOR 2006-2008] [IF NECESSARY:] Your best estimate is fine.

% \_\_\_ Tract-built detached single family homes

% \_\_\_ Custom built detached single family homes

% \_\_\_ Attached single family homes (Duplex/Townhouse)

% \_\_\_ Condos or Apartments (Multifamily unit)

6. How many different single-family tract home developments did your firm provide Title 24 consulting for in 2006 in California? 2007? How many do you expect to provide Title 24 consulting for in 2008? { **Statewide Q1** } [IF NECESSARY:] Your best estimate is fine.

- a. 2006 \_\_\_ single-family tract home developments in California
- b. 2007 \_\_\_ single-family tract home developments in California
- c. 2008 \_\_\_ single-family tract home developments in California

7. How many different single-family tract home base models did your firm review in 2006 in California across all these tract developments? 2007? How many do you expect to review in 2008? { **Statewide Q1a** } [IF NECESSARY:] Your best estimate is fine.

- a. 2006 \_\_\_ single-family tract home base models in California
- b. 2007 \_\_\_ single-family tract home base models in California
- c. 2008 \_\_\_ single-family tract home base models in California

READ: For the rest of the interview I'd like you to talk about single-family attached and detached homes IN CALIFORNIA only—NOT condos or apartments.

## RNC PROGRAM AWARENESS AND PARTICIPATION

Now I'm going to read you the names of some programs that encourage the installation of energy-efficient features in new homes, and I'm going to ask you if you have heard of them, and if you have provided Title 24 compliance consulting for homes that have participated in them. [RANDOMIZE q#13 -21; ASK Q# A – E FOR EACH PROGRAM UNLESS INSTRUCTED OTHERWISE]

8. [LEED for Homes]
9. [ENERGY STAR Homes]
10. [the Solar Initiative]
11. [Environments for Living]
12. [ComfortWise]
13. [Federal Tax Credits]
14. Programs sponsored by municipal utilities such as SMUD and LADWP
15. [Building America] (ASK A-C ONLY, NOT D-E)
16. [Smart Home]
  - a. Have you heard of [READ PROGRAM NAME]?
  - b. [IF YES TO A] Did your company provide Title 24 compliance consulting for homes participating in [PROGRAM NAME] before 2006?
  - c. [IF YES TO A] Did your company provide Title 24 compliance consulting for homes participating in [PROGRAM NAME] from 2006 to 2008?
  - d. [IF YES TO C] How many housing units for which your company provided Title 24 compliance consulting were built with the help of [PROGRAM NAME] from 2006 to 2008?
  - e. [IF YES TO C] How many base models did this entail?
17. Now I'm going to ask you about some Investor-owned Utility-sponsored programs {Modified Statewide Q9}
  - H. Have you heard of any Investor-owned Utility programs sponsored by PG&E, SCE, SCG&E or SCG? [IF YES, CONTINUE; IF NO, SKIP TO Q#23]
  - I. Which investor-owned utility-sponsored programs have you heard of? [MULTIPLE RESPONSE; DO NOT READ]

NO/NONE/DK [SKIP TO Q#23]

PG&E Residential New Construction

SCE New Homes

SDG&E and SCG Advanced Home

Other [SPECIFY]: \_\_\_\_\_

- J. [IF YES TO A] Did your company provide Title 24 compliance consulting for homes participating in any of these programs before 2006?

- K. [IF YES TO C] Which ones?
  - L. [IF YES TO A] Did your company provide Title 24 compliance consulting for homes participating in any of these programs from 2006 to 2008? [IF NO, SKIP TO Q#23]
  - M. [IF YES TO E] Which ones?
  - N. [IF YES TO E] How many housing units for which your company consulted on Title 24 compliance were built with the help of [PROGRAM NAME FROM Q#22F] from 2006 to 2008?
  - O. [IF YES TO E] How many base models did this entail?
  - P. [IF YES TO E] How did the design approach for these program homes differ from the typical design approach for homes not included in the program, if at all?
18. [IF NO TO Q#22a] Have you heard of any of the following investor-owned utility-sponsored programs? [READ LIST] {Modified Statewide Q9a-d}

PG&E Residential New Construction

SCE New Homes

SDG&E and SCG Advanced Home

[IF YES TO ANY PROGRAM, CONTINUE; IF NO TO ALL PROGRAMS, SKIP TO Q#19]

- F. Did your company consult on Title 24 compliance for homes participating in any of these programs before 2006?
- G. Which ones?
- H. Did your company consult on Title 24 compliance for homes participating in any of these programs from 2006 to 2008? [IF NO, SKIP TO Q#19]
- I. [IF YES TO C] Which ones?
- J. [IF YES TO C] How many housing units did units for which your company provided consulted Title 24 consulting were built with the help of [PROGRAM NAME FROM Q#23D] from 2006 to 2008?
- K. [IF YES TO C] How many base models did this entail? {Modified Statewide Q10c}
- L. [IF YES TO C] How did the design approach for these program homes differ from the typical design approach for homes not included in the program, if at all? {Modified Statewide Q10d}

## TITLE 24 REQUIREMENTS

19. How do you currently report results of your Title 24 compliance review to builders? [PROBE AS NECESSARY:] What software do you use? Do you have a pass/fail checklist or do you estimate the percentage by which the design exceeds Title 24? Do you just report design performance, or do you also provide input on how the design can

be improved? [THIS IS A KEY QUESTION; PROBE FOR AS MUCH DETAIL AS THEY CAN PROVIDE.] { **Statewide Q3** }

20. What method do you and the builders you work with typically use to comply with Title 24?

- Prescriptive
- Performance
- Trade Off
- (Mixed)—[DO NOT READ]

21. Who usually decides the best way to meet the Time Dependent Valuation, or TDV requirement? [DO NOT READ LIST]

- Title 24 Consultant
- Architect
- Designer within the builder's company
- Other [SPECIFY: \_\_\_\_\_]

22. What is the most common way the TDV requirement is met in the homes you are involved with? [PROBE FOR SPECIFICS]

23. Which of the following statements best describes the way you work with builders on Title 24 compliance: [READ A AND B]

- a. I develop a compliance approach for the builder during the design stage and I am not involved in decisions during the construction phase
- b. After I develop the initial compliance approach, I continue to be involved with the builder in making decisions during the construction stage
- c. [ABOUT 50/50 OF EACH—IF MORE ONE THAN THE OTHER, SELECT A OR B]
- d. [SOMETHING ELSE—SPECIFY: \_\_\_\_\_]
- e. [DK/REF]

24. How often do you know whether or not a builder has followed your advice about how to comply with Title 24? Would you say you:



Almost never know if the builder has followed your advice

Usually DO NOT know

Know about half the time

Usually DO know, OR

Almost always know if the builder has followed your advice

[DK/REF]

[ASK Q#57-Q#27 ONLY IF KNOW ABOUT HALF THE TIME, USUALLY DO KNOW, OR ALMOST ALWAYS KNOW TO Q#24]

25. Now I'm going to read you some statements about code compliance and possible upgrades to Title 24 requirements. I would like you to tell me if you agree or disagree with each statement by using a scale from 0 to 10, where 0 is disagree strongly and 10 is agree strongly.

- a. There is adequate knowledge and availability of energy efficient technologies and practices that most builders could comply with the proposed 2008 code upgrade within a reasonable time
- b. Compliance with the current code is so widespread that builders at the low end of the market could comply with the proposed 2008 code upgrade within a reasonable time
- c. [IF YES TO Q#22A OR AWARE OF ANY PROGRAM IN Q#23] Investor-owned utility training programs have helped improve code compliance
- d. [IF YES TO Q#22A OR AWARE OF ANY PROGRAM IN Q#23] Investor-owned utility programs that encourage code compliance and encourage installation of energy-efficient features in new homes have contributed to market readiness for a code upgrade
- e. [IF YES TO Q#22A OR AWARE OF ANY PROGRAM IN Q#23] Other (non-Investor-owned utility) energy-efficiency training programs have helped improve code compliance

26. Speaking about all single-family homes built in California—not just the ones you are involved with—would you say that the rates of compliance with Title 24 have increased, decreased or stayed about the same during the period from 2006 to 2008?

Increased a lot

Increased somewhat

Stayed about the same

Decreased somewhat

Decreased a lot

DK/Refused [SKIP TO Q#28]

27. Why do you say that?

28. Are you familiar with the utility sponsored software “Program Plan Check” that is meant to help model and build above Title 24 requirements?

Yes

No [SKIP TO Q#32]

DK/Refused [SKIP TO Q#32]

29. [IF YES TO Q#17E OR YES TO ANY Q#23C] How much would you say “Program Plan Check” has helped you and your company catch modeling errors on program-supported homes? Use a scale from 0 to 10, where 0 is “no help at all” and 10 is “a great deal of help.”

30. [IF YES TO Q#17E OR YES TO ANY Q#23C] In general, how much has what you’ve learned from “Program Plan Check” helped you and your company with more effective modeling TO MEET CODE for non-program homes? Use a scale from 0 to 10, where 0 is “no help at all” and 10 is “a great deal of help.”

31. [IF YES TO Q#17E OR YES TO ANY Q#23C] In general, how much has what you’ve learned from “Program Plan Check” helped you and your company with more effective modeling for ABOVE CODE non-program homes? Use a scale from 0 to 10, where 0 is “no help at all” and 10 is “a great deal of help.”

32. Between 2006 and 2008, did your company recommend any practices or technologies exceeding Title 24 for any homes in California [IF YES TO Q#17A OR YES TO ANY Q#23 READ: “that are not part of a utility efficiency program? That is, homes that are not directly supported by incentive dollars but are more energy efficient than required by code”]?

Yes [SKIP TO INTRO BEFORE Q#65]

No [GO TO Q#63 ]

Don’t know/refused [GO TO Q#136]

33. [IF NO TO Q#32] What do you feel are the primary reasons that your company has not recommended any above-code building practices or technologies [IF YES TO Q#17A OR YES TO ANY Q#23, READ: “in any non-program homes”]? [SKIP TO Q#136 AFTER ANSWERING]

[IF YES TO Q#32] A. In which of the following areas has your company recommended above-code practices and technologies for [IF YES TO Q#17A OR YES TO ANY Q#23, READ: “non-program”] homes built from 2006 to 2008? B. [IF YES TO A] For what percent of [IF YES TO Q#17A OR YES TO ANY Q#23, READ: “non-program”] homes you consulted on that were built from 2006 to 2008 did you recommend above code [INSERT FEATURE]? C. [IF YES TO A; ASK ONLY IF KNOW ABOUT HALF THE TIME, USUALLY DO KNOW, OR ALMOST ALWAYS KNOW TO Q#24] What percent of [IF YES TO Q#17A OR YES TO ANY Q#23, READ: “non-program”] homes you consulted on that were built from 2006 to 2008 actually ended up using above code [INSERT FEATURE]? [RANDOMIZE, Q#79 LAST] NOTE: IF RESPONDENT SAYS A GIVEN PRACTICE OR TECHNOLOGY IS NOT SUBJECT TO THE CODE, SAY “PLEASE TELL ME IF THE PRACTICE OR TECHNOLOGY HELPED THE HOUSE AS A WHOLE ACHIEVE ABOVE-CODE EFFICIENCY.”]

- c. Used above code [INSERT FEATURE, Q#65 - 79]?
  - d. [IF YES TO A ] For what percent of [IF YES TO Q#17A OR YES TO ANY Q#23, READ: “non-program”] homes you consulted on that were built from 2006 to 2008 did you recommend above code [INSERT FEATURE]?
  - e. [IF YES TO A; ASK ONLY IF KNOW ABOUT HALF THE TIME, USUALLY DO KNOW, OR ALMOST ALWAYS KNOW TO Q#24] What percent of [IF YES TO Q#17A OR YES TO ANY Q#23, READ: “non-program”] homes you consulted on that were built from 2006 to 2008 actually ended up using above code [INSERT FEATURE]?
34. Insulation R-values
35. Quality of insulation installation
36. Windows
37. High-SEER air conditioner or heat pump
38. High-EER air conditioner or heat pump to help meet the TDV target
39. High-AFUE furnace
40. HVAC installation
41. Water heating equipment
42. Lighting
43. Framing materials and techniques
44. Orientation and shading
45. Photovoltaics
46. Duct sealing
47. Duct testing
48. Air sealing

49. In some other area [PLEASE SPECIFY]

[ASK Q.#50 TO Q.#52 ONLY IF KNOW ABOUT HALF THE TIME, USUALLY DO KNOW, OR ALMOST ALWAYS KNOW TO Q#24]

50. [IF YES TO Q#62] What percent of the [IF YES TO Q#17E OR YES TO ANY Q#23C READ: “non-program”] homes your company consulted on that were built from 2006 to 2008 exceeded Title 24 code in any way? \_\_\_\_\_%

51. Would you say that the number of [IF YES TO Q#17E OR YES TO ANY Q#23C READ: “non-program”] homes your company consulted on that exceed Title 24 has increased, decreased or stayed about the same during the period from 2006 to 2008?

Increased a lot

Increased somewhat

Stayed about the same

Decreased somewhat

Decreased a lot

DK/Refused [SKIP TO Q#53]

52. Why is that?

53. What reasons or factors determine whether or not you design a particular home or development to exceed Title 24 [IF YES TO Q#17A OR YES TO ANY Q#23, READ: “without any energy efficiency program support”]? What other reasons or factors? {STATEWIDE Q17}

54. Overall, how influential would you say Title 24 consultants are in determining whether a home is intentionally designed and built to exceed Title 24? {STATEWIDE Q18}

Extremely influential

Very influential

Somewhat influential,

Not very influential, OR

Not influential at all

(DK/Refused)

55. Why do you say that? {STATEWIDE Q18A}

56. And, how influential would you say Title 24 consultants are in determining how a home is designed and built to exceed Title 24? {STATEWIDE Q19}

Extremely influential

Very influential

Somewhat influential,

Not very influential, OR

Not influential at all

(DK/Refused)

57. Why do you say that? {STATEWIDE Q19A}

58. [IF YES TO ANY OF FEATURES Q#65 - 79 AND IF YES TO Q#17A OR YES TO ANY Q#23] How much influence would you say the utility program has had on your recommendation of these above-code energy efficient building practices and technologies in non-program homes? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.” [RANDOMIZE]

- p. [IF YES TO Q.#65 ABOVE] Insulation R-values
- q. [IF YES TO Q.#66 ABOVE] Quality of insulation installation
- r. [IF YES TO Q.#67 ABOVE] Windows
- s. [IF YES TO Q.#68 ABOVE] High-SEER air conditioner or heat pump
- t. [IF YES TO Q.#38 ABOVE] High-EER air conditioner or heat pump to help meet the TDV requirement
- u. [IF YES TO Q.#69 ABOVE] High-AFUE furnace
- v. [IF YES TO Q.#70 ABOVE] HVAC installation
- w. [IF YES TO Q.#71 ABOVE] Water heating equipment
- x. [IF YES TO Q.#72 ABOVE] Lighting
- y. [IF YES TO Q.#73 ABOVE] Framing materials and techniques
- z. [IF YES TO Q.#74 ABOVE] Orientation and shading
- aa. [IF YES TO Q.#75 ABOVE] Photovoltaics
- bb. [IF YES TO Q.#76 ABOVE] Duct sealing
- cc. [IF YES TO Q.#77 ABOVE] Duct testing
- dd. [IF YES TO Q.#78 ABOVE] Air sealing
- ee. [IF YES TO Q.#79 ABOVE] [REPEAT WHAT WAS MENTIONED IN Q.#79]

59. [IF ANY OF Q.#81 A-P GT 7, OTHERWISE SKIP TO Q#86] In what way did the program cause your company to recommend these changes to non-program homes? [PROBE: Are there features of the program that caused your company to recommend these changes to non-program homes?]
60. [IF ANY OF Q.#81 A-P GT 7] How likely would you be to continue recommending these above-code practices and technologies in the future even without the program? Use a scale from 0 to 10, where 0 is “extremely unlikely” and 10 is “extremely likely.” Let’ start with....[RANDOMIZE]
- a. [IF GT 7 TO Q.#81p ABOVE] Insulation R-values
  - b. [IF GT 7 TO Q.#81q ABOVE] Quality of insulation installation
  - c. [IF GT 7 TO Q.# 81r ABOVE] Windows
  - d. [IF GT 7 TO Q.# 81s ABOVE] High-SEER air conditioner or heat pump
  - e. [IF GT 7 TO Q.#81t ABOVE] High-EER air conditioner or heat pump to help meet the TDV requirement
  - f. [IF GT 7 TO Q.#81u ABOVE] High-AFUE furnace
  - g. [IF GT 7 TO Q.#81g ABOVE] HVAC installation
  - h. [IF GT 7 TO Q.#81w ABOVE] Water heating equipment
  - i. [IF GT 7 TO Q.#81i ABOVE] Lighting
  - j. [IF GT 7 TO Q.#81y ABOVE] Framing materials and techniques
  - k. [IF GT 7 TO Q.#81z ABOVE] Orientation and shading
  - l. [IF GT 7 TO Q.#81aa ABOVE] Photovoltaics
  - m. [IF GT 7 TO Q.#81bb ABOVE] Duct sealing
  - n. [IF GT 7 TO Q.#81cc ABOVE] Duct testing
  - o. [IF GT 7 TO Q.#81dd ABOVE] Air sealing
  - p. [IF GT 7 TO Q.#81ee ABOVE] [REPEAT WHAT WAS MENTIONED IN Q.#79]
61. [IF ANY OF Q.#58 A-P GT 7] Are there any outside conditions that would influence whether you would continue recommending these above-code practices and technologies? How so? [IF NECESSARY, SAY, “FOR EXAMPLE, ENERGY PRICES, GLOBAL WARMING, OR THE STATE OF THE HOUSING MARKET.”]

[ASK Q#86-Q#68 ONLY IF KNOW ABOUT HALF THE TIME, USUALLY DO KNOW, OR ALMOST ALWAYS KNOW TO Q#24]

62. [IF YES TO Q#17E OR YES TO ANY Q#23C] What percent of the non-program homes your company consulted on that were built from 2006 to 2008 met program standards, but were not enrolled in the program? \_\_\_\_\_%
63. [IF Q#86 >0%, OTHERWISE SKIP TO Q#69] Why did the builder not seek to qualify the homes that met program standards?

64. What specifically is the program standard that these homes meet? [PROBE FOR SPECIFICS]
65. How much influence would you say the utility program has had on the design and construction of non-program homes that meet program standards? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
66. [IF MORE THAN 7 TO Q#65 ] In what way did the program influence the design and construction non-program homes that meet program standards? [PROBE: Are there features of the program that caused your company to design non-program homes that meet program standards?]
67. [IF MORE THAN 7 TO Q#65] Would you continue designing non-program homes that meet program standards in the future even without the program?
- \_\_\_ yes
- \_\_\_ no
- \_\_\_ DK/refused
68. [IF MORE THAN 7 TO Q#65] Why do you say that?
69. Do you know any other Title 24 consultants who have been involved with homes participating in the investor-owned utility-sponsored new construction programs?
- Yes
- No [SKIP TO Q#136]
- DK/refused [SKIP TO Q#136]
70. Have you discussed energy efficient building technologies and practices with Title 24 consultants who have been involved with homes participating in the investor-owned utility-sponsored programs?
- Yes
- No [SKIP TO Q#136]
- DK/refused [SKIP TO Q#136]

71. Where have you discussed energy efficient building technologies and practices with Title 24 consultants who have been involved with homes participating in the investor-owned utility-sponsored programs? [MULTIPLE RESPONSE, DO NOT READ]

Phone conversations

Conferences

Building sites

Other [SPECIFY: \_\_\_\_\_]

## TRAINING

72. From 2006 to 2008, have you attended any utility-sponsored training sessions pertaining to energy efficient new home construction?

Yes [CONTINUE]

No [SKIP TO Q#75]

DK/refused [SKIP TO Q#75]

73. How much influence would you say the utility training has had on your recommendation of these energy efficient building practices and technologies? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

74. [IF GT 7 TO Q#73] What energy efficient building practices or technologies do you typically recommend as a result of the training?

- a. Insulation practices [PROBE: R-value, techniques, types of insulation]
- b. HVAC practices [PROBE: High-SEER AC, Higher-EER AC, High-AFUE furnaces, installation techniques]
- c. Duct sealing and duct testing practices
- d. Air sealing practices
- e. Framing practices [PROBE: Framing materials and techniques ]
- f. Window installations
- g. Electrical practices [PROBE: lighting?]
- h. Photovoltaic installations
- i. Any other? [specify\_\_\_\_\_]

75. Have you received training from any other organizations concerning pertaining to energy efficient new home construction?



Yes [CONTINUE]

No [SKIP TO Q#140]

DK/refused [SKIP TO Q#140]

76. [IF YES] From which organizations have you received this training? [DO NOT READ RESPONSES]

[CALIFORNIA ENERGY COMMISSION/CEC]

[CALIFORNIA ASSOCIATION OF ENERGY CONSULTANTS/CABEC]

[CALIFORNIA HOME ENERGY EFFICIENCY RATING SERVICES/CHEERS]

[LOCAL GOVERNMENT—SPECIFIC CITY OR TOWN]

[MUNICIPAL UTILITY—E.G. SMUD OR LADWP]

[OTHER: SPECIFY \_\_\_\_\_]

### **R&D and CASE Studies**

77. Are you aware of any utility efforts from 2006 through 2008 that sponsored R&D programs on new home energy-efficient measures or CASE Studies of measures recommended for the latest Title 24 upgrade?

Yes [CONTINUE]

No [SKIP TO END]

DK/refused SKIP TO END]

78. Has your company recommended any of the energy efficient building practices or technologies that were tested by the R&D program or demonstrated in the CASE studies?

Yes

No SKIP TO END]

DK/refused SKIP TO END]

79. [IF YES TO Q#141] What energy efficient building practices or technologies do you typically recommend that were tested by the R&D program or demonstrated in the CASE studies?
80. [IF YES TO Q#141] How much influence would you say the utility R&D program or CASE Studies have had on your recommendation of these energy efficient building practices and technologies? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

**That concludes our interview. Thank you very much!**

### A.3 HERS Rater Interview Guide

#### **HERS Rater Interview Guide for IOU RNC Codes & Standards Programs—Market Effects**

**(final)**

Interviewer:

Date:

Subject Name:

Organization:

Program(s) responsible for:

Hello, my name is \_\_\_\_\_ from Itron, Inc. and I am calling on behalf of the California Public Utilities Commission (CPUC). The CPUC has asked us to conduct interviews with HERS raters in order to better understand the residential new construction market, energy efficiency and the California utilities' residential new construction programs. This survey is extremely important to the CPUC's understanding of the new construction market. We are offering \$150 to the appropriate person at your firm to speak with us for about half an hour. May I please speak with a person who has a lot of experience with HERS ratings in California?

Yes [CONTINUE]

No/DK [TERMINATE]

Refused [TERMINATE]

May I please have the person's name and job title?

[RECORD NAME AND JOB TITLE]

[WHEN CORRECT PERSON IS ON-LINE:]

Hello, my name is \_\_\_\_\_ from Itron, Inc. and I am calling on behalf of the California Public Utilities Commission (CPUC). The CPUC has asked us to conduct interviews with HERS raters in order to better understand the residential new construction market, energy efficiency and the

California utilities' residential new construction programs. Can I confirm that you have a lot of experience conducting HERS ratings in California?

Yes [CONTINUE]

No/DK [ASK TO SPEAK WITH CORRECT PERSON, OR TERMINATE]

Refused [TERMINATE]

Since January 2006, has your company provided HERS ratings for homes NOT participating in any investor owned Utility sponsored programs that encourage the installation of energy-efficient features in new homes? [IF RESPONDENT ASKS, IOU PROGRAMS ARE: PG&E Residential New Construction; SCE New Homes; and SDG&E and SCG Advanced Home

Yes [CONTINUE]

No [TERMINATE]

DK / REFUSED [TERMINATE]

[ASK FOLLOWING SCREENING QUESTIONS IF RESPONDENT IS BOTH A TITLE 24 CONSULTANT AND A HERS RATER]:

Our records indicate that you are both a Title 24 consultant and a HERS rater. Is this correct?

YES [CONTINUE WITH SCREENING QUESTIONS]

NO, just Title 24 consultant [CONTINUE TO INTERVIEW]

[IF YES, BOTH TITLE 24 CONSULTANT AND HERS RATER] Is more of your business related to Title 24 consulting or HERS rating?

Title 24 Consulting [Recruit for Title 24 Consultant interview]

HERS Rating [CONTINUE WITH INTERVIEW] [Recruit for HERS Rater interview]

This survey is extremely important to the CPUC's understanding of the new construction

market. All your answers are held confidential--that is, we never link any information to a particular person or company. Is now a good time?

Yes [CONTINUE]

No [SET UP CALLBACK]

DK/refused [TERMINATE]

[IF INTERVIEWEE ASKS ABOUT THE STUDY'S SPONSORSHIP, REFER TO AYAT OSMAN, CPUC, AT (415) 703-5953]

## INTRODUCTION

First I have a few questions about you and your company.

1. How many years have you been a HERS rater?

\_\_\_\_ Years as HERS rater

2. Do you work independently or as part of a company?

Independently [SKIP TO Q#4]

Part of a company [CONTINUE]

DK/Refused [CONTINUE]

3. How many HERS raters work at your company?

\_\_\_\_ HERS raters in company

4. How many newly constructed residential housing units, not buildings or developments but housing units, did your firm provide HERS ratings for in 2006 in California? 2007? How many do you expect to provide HERS ratings for in 2008? [IF NECESSARY:] Your best estimate is fine.

G. 2006\_\_\_\_ new housing units in California

H. 2007\_\_\_\_ new housing units in California

I. 2008\_\_\_\_ new housing units in California

5. About what percent of these housing units were tract-built detached single family homes, custom built detached single family homes, attached single family

homes(Duplex/Townhouse), and condos or apartments (Multifamily units)? [FOR 2006-2008] [IF NECESSARY:] Your best estimate is fine.

% \_\_\_ Tract-built detached single family homes

% \_\_\_ Custom built detached single family homes

% \_\_\_ Attached single family homes (Duplex/Townhouse)

% \_\_\_ Condos or Apartments (Multifamily unit)

6. How many different single-family tract home developments did your firm provide HERS ratings for in 2006 in California? 2007? How many do you expect to provide HERS ratings for in 2008? [IF NECESSARY:] Your best estimate is fine.

a. 2006 \_\_\_ single-family tract home developments in California

b. 2007 \_\_\_ single-family tract home developments in California

c. 2008 \_\_\_ single-family tract home developments in California

READ: For the rest of the interview I'd like you to talk about single-family attached and detached homes IN CALIFORNIA only—NOT condos or apartments.

7. As far as you know, about what percent of the single family homes built from 2006 to 2008 by the builders you work with did NOT have HERS ratings? [IF NECESSARY:] Your best estimate is fine.

% \_\_\_ single family homes that did NOT have HERS ratings

## RNC PROGRAM AWARENESS AND PARTICIPATION

Now I'm going to read you the names of some programs that encourage the installation of energy-efficient features in new homes, and I'm going to ask you if you have heard of them, and if you have provided HERS ratings for homes that have participated in them.

[RANDOMIZE q#13 -21; ASK Q# A – D FOR EACH PROGRAM UNLESS INSTRUCTED OTHERWISE]

8. [LEED for Homes]
9. [ENERGY STAR Homes]
10. [the Solar Initiative]
11. [Environments for Living]
12. [ComfortWise]
13. [Federal Tax Credits]
14. Programs sponsored by municipal utilities such as SMUD and LADWP
15. [Building America] (ASK A-C ONLY, NOT D-E)
16. [Smart Home]
  - A. Have you heard of [READ PROGRAM NAME]?
  - B. [IF YES TO A] Did your company provide HERS ratings for homes participating in [PROGRAM NAME] before 2006?
  - C. [IF YES TO A] Did your company provide HERS ratings for homes participating in [PROGRAM NAME] from 2006 to 2008?
  - D. [IF YES TO C] How many housing units for which your company provided HERS ratings were built with the help of [PROGRAM NAME] from 2006 to 2008?
17. Now I'm going to ask you about some Investor-owned Utility-sponsored programs
  - Q. Have you heard of any Investor-owned Utility programs sponsored by PG&E, SCE, SCG&E or SCG? [IF YES, CONTINUE; IF NO, SKIP TO Q#23]
  - R. Which investor-owned utility-sponsored programs have you heard of? [MULTIPLE RESPONSE; DO NOT READ]

NO/NONE/DK [SKIP TO Q#23]

PG&E Residential New Construction

SCE New Homes

SDG&E and SCG Advanced Home

Other [SPECIFY]: \_\_\_\_\_

- S. [IF YES TO A] Did your company provide HERS ratings for homes participating in any of these programs before 2006?
- T. [IF YES TO C] Which ones?

- U. [IF YES TO A] Did your company provide HERS ratings for homes participating in any of these programs from 2006 to 2008? [IF NO, SKIP TO Q#23]
  - V. [IF YES TO E] Which ones?
  - W. [IF YES TO E] How many housing units for which your company provided HERS ratings were built with the help of [PROGRAM NAME FROM Q#22F] from 2006 to 2008?
18. [IF NO TO Q#22a] Have you heard of any of the following investor-owned utility-sponsored programs? [READ LIST]

PG&E Residential New Construction

SCE New Homes

SDG&E and SCG Advanced Home

[IF YES TO ANY PROGRAM, CONTINUE; IF NO TO ALL PROGRAMS, SKIP TO Q#19]

- M. Did your company provide HERS ratings for homes participating in any of these programs before 2006?
  - N. Which ones?
  - O. Did your company provide HERS ratings for homes participating in any of these programs from 2006 to 2008? [IF NO, SKIP TO Q#19]
  - P. [IF YES TO C] Which ones?
  - Q. [IF YES TO C] How many housing units did units for which your company provided HERS ratings were built with the help of [PROGRAM NAME FROM Q#23D] from 2006 to 2008?
19. Has your firm provided Qii, or Quality Insulation Installation, verification for homes built from 2006 to 2008 to earn energy credits for Title 24 compliance [IF YES TO Q#17A OR YES TO ANY Q#23 READ: “without the help of a utility efficiency program”]?
- Yes
- No
- Refused/DK
20. [IF YES TO Q#19] From 2006 to 2008, for how many housing units did you provide QII verification to earn energy credits for Title 24 compliance[IF YES TO Q#17A OR YES TO ANY Q#23 READ: “without the help of a utility efficiency program”]?
21. [IF YES TO Q#19 AND {IF YES TO Q#17A OR YES TO ANY Q#23}] How much influence would you say the utility program has had on the use of Qii in non-program homes? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”



22. [IF YES TO Q#19 AND {IF YES TO Q#17A OR YES TO ANY Q#23}] Why do you say that?

23. How often do you know about the energy efficiency technologies and practices used by the builders you work for? Would you say you:

Almost never know

Usually DO NOT know

Know about half the time

Usually DO know, OR

Almost always know

[DK/REF]

[ASK Q#57-Q#27 ONLY IF KNOW ABOUT HALF THE TIME, USUALLY DO KNOW, OR ALMOST ALWAYS KNOW TO Q#24]

24. Now I'm going to read you some statements about code compliance and possible upgrades to Title 24 requirements. I would like you to tell me if you agree or disagree with each statement by using a scale from 0 to 10, where 0 is disagree strongly and 10 is agree strongly.

- A. There is adequate knowledge and availability of energy efficient technologies and practices that most builders could comply with the proposed 2008 code upgrade within a reasonable time
- B. Compliance with the current code is so widespread that builders at the low end of the market could comply with the proposed 2008 code upgrade within a reasonable time
- C. [IF YES TO Q#22A OR AWARE OF ANY PROGRAM IN Q#23] **Investor-owned** utility training programs have helped improve code compliance
- D. [IF YES TO Q#22A OR AWARE OF ANY PROGRAM IN Q#23] **Investor-owned** utility programs that encourage code compliance and encourage installation of energy-efficient features in new homes have contributed to market readiness for a code upgrade
- E. [IF YES TO Q#22A OR AWARE OF ANY PROGRAM IN Q#23] Other (non-Investor-owned utility) energy-efficiency training programs have helped improve code compliance

25. Speaking about all single-family homes built in California—not just the ones you are involved with—would you say that the rates of compliance with Title 24 have increased, decreased or stayed about the same during the period from 2006 to 2008?

Increased a lot

Increased somewhat

Stayed about the same

Decreased somewhat

Decreased a lot

DK/Refused [SKIP TO Q#62]

26. Why do you say that?

27. Between 2006 and 2008, did your company provide HERS ratings for any homes exceeding Title 24 requirements [IF YES TO Q#17A OR YES TO ANY Q#23 READ: “that are not part of a utility efficiency program? That is, homes that are not directly supported by incentive dollars but are more energy efficient than required by code”]?

Yes [SKIP TO INTRO BEFORE Q#65]

No [GO TO Q#63 ]

Don't know/refused [GO TO Q#136]

28. [IF NO TO Q#32] What do you feel are the primary reasons that your company has not provided HERS ratings for any homes exceeding Title 24 requirements [IF YES TO Q#17A OR YES TO ANY Q#23, READ: “that are not part of a utility efficiency program”]? [SKIP TO Q#136 AFTER ANSWERING]

29. [IF YES TO Q#32] Why do you think builders construct homes that exceed Title 24 requirements IF YES TO Q#17A OR YES TO ANY Q#23, READ: “without the help of a utility efficiency program”]?

[IF YES TO Q#32 AND IF ‘KNOW ABOUT HALF THE TIME’ OR MORE TO Q.#24] A. In which of the following areas have above-code practices and technologies been installed in [IF YES TO Q#17A OR YES TO ANY [IF A. Did any of the [IF YES TO Q#17A OR YES TO ANY Q#23, READ: “non-program”] homes rated by your company that were built from 2006 to

2008 use above code [INSERT FEATURE]? B. [IF YES to A] For what percent of [IF YES TO Q#17A OR YES TO ANY Q#23, READ: “non-program”] homes you rated that were built from 2006 to 2008 used above code [INSERT FEATURE]? NOTE: IF RESPONDENT SAYS A GIVEN PRACTICE OR TECHNOLOGY IS NOT SUBJECT TO THE CODE, SAY “PLEASE TELL ME IF THE PRACTICE OR TECHNOLOGY HELPED THE HOUSE AS A WHOLE ACHIEVE ABOVE-CODE EFFICIENCY.”]

- f. Used above code [INSERT FEATURE, Q#65 - 79]?
  - g. [IF YES TO A ] For what percent of [IF YES TO Q#17A OR YES TO ANY Q#23, READ: “non-program”] homes you rated on that were built from 2006 to 2008 used above code [INSERT FEATURE]?
30. Insulation R-values
  31. Quality of insulation installation
  32. Windows
  33. High-SEER air conditioner or heat pump
  34. High-EER air conditioner or heat pump to help meet the TDV target
  35. High-AFUE furnace
  36. HVAC installation
  37. Water heating equipment
  38. Lighting
  39. Framing materials and techniques
  40. Orientation and shading
  41. Photovoltaics
  42. Duct sealing
  43. Duct testing
  44. Air sealing
  45. In some other area [PLEASE SPECIFY]

[ASK Q.#50 TO Q.#52 ONLY IF KNOW ABOUT HALF THE TIME, USUALLY DO KNOW, OR ALMOST ALWAYS KNOW TO Q#24]

46. [IF YES TO Q#62] What percent of the [IF YES TO Q#17C OR YES TO ANY Q#23H READ: “non-program”] homes your company rated that were built from 2006 to 2008 exceeded Title 24 code in any way? \_\_\_\_\_%

47. Would you say that the number of [IF YES TO Q#17C OR YES TO ANY Q#23H READ: “non-program”] homes your company rated that exceed Title 24 has increased, decreased or stayed about the same during the period from 2006 to 2008?

Increased a lot

Increased somewhat

Stayed about the same

Decreased somewhat

Decreased a lot

DK/Refused [SKIP TO Q#53]

48. Why is that?

49. What reasons or factors determine whether or not a particular home or development is built to exceed Title 24 [IF YES TO Q#17A OR YES TO ANY Q#23, READ: “without any energy efficiency program support”]? What other reasons or factors?

50. [IF YES TO ANY OF FEATURES Q#65 - 79 AND IF YES TO Q#17A OR YES TO ANY Q#23] How much influence would you say the utility program has had on the installation of these above-code energy efficient building practices and technologies in non-program homes? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.” [RANDOMIZE]

ff. [IF YES TO Q.#65 ABOVE] Insulation R-values

gg. [IF YES TO Q.#66 ABOVE] Quality of insulation installation

hh. [IF YES TO Q.#67 ABOVE] Windows

ii. [IF YES TO Q.#68 ABOVE] High-SEER air conditioner or heat pump

jj. [IF YES TO Q.#38 ABOVE] High-EER air conditioner or heat pump to help meet the TDV requirement

kk. [IF YES TO Q.#69 ABOVE] High-AFUE furnace

ll. [IF YES TO Q.#70 ABOVE] HVAC installation

mm. [IF YES TO Q.#71 ABOVE] Water heating equipment

nn. [IF YES TO Q.#72 ABOVE] Lighting

oo. [IF YES TO Q.#73 ABOVE] Framing materials and techniques

pp. [IF YES TO Q.#74 ABOVE] Orientation and shading

qq. [IF YES TO Q.#75 ABOVE] Photovoltaics

rr. [IF YES TO Q.#76 ABOVE] Duct sealing

ss. [IF YES TO Q.#77 ABOVE] Duct testing

tt. [IF YES TO Q.#78 ABOVE] Air sealing

uu. [IF YES TO Q.#79 ABOVE] [REPEAT WHAT WAS MENTIONED IN Q.#79]

51. [IF ANY OF Q.#81 A-P GT 7, OTHERWISE SKIP TO Q#86] In what way did the program influence the use of energy-efficiency technologies and practices in non-program homes? [PROBE: Are there features of the program that caused the builder to include these features in non-program homes?]

52. [IF ANY OF Q.#81 A-P GT 7] How likely do you think the builder would be to continue using these above-code practices and technologies in the future even without the program? Use a scale from 0 to 10, where 0 is “extremely unlikely” and 10 is “extremely likely.” Let’ start with....[RANDOMIZE]

- F. [IF GT 7 TO Q.#81p ABOVE] Insulation R-values
- G. [IF GT 7 TO Q.#81q ABOVE] Quality of insulation installation
- H. [IF GT 7 TO Q.# 81r ABOVE] Windows
- I. [IF GT 7 TO Q.# 81s ABOVE] High-SEER air conditioner or heat pump
- J. [IF GT 7 TO Q.#81t ABOVE] High-EER air conditioner or heat pump to help meet the TDV requirement
- K. [IF GT 7 TO Q.#81u ABOVE] High-AFUE furnace
- L. [IF GT 7 TO Q.#81g ABOVE] HVAC installation
- M. [IF GT 7 TO Q.#81w ABOVE] Water heating equipment
- N. [IF GT 7 TO Q.#81i ABOVE] Lighting
- O. [IF GT 7 TO Q.#81y ABOVE] Framing materials and techniques
- P. [IF GT 7 TO Q.#81z ABOVE] Orientation and shading
- Q. [IF GT 7 TO Q.#81aa ABOVE] Photovoltaics
- R. [IF GT 7 TO Q.#81bb ABOVE] Duct sealing
- S. [IF GT 7 TO Q.#81cc ABOVE] Duct testing
- T. [IF GT 7 TO Q.#81dd ABOVE] Air sealing
- U. [IF GT 7 TO Q.#81ee ABOVE] [REPEAT WHAT WAS MENTIONED IN Q.#79]

53. [IF ANY OF Q.#58 A-P GT 7] Are there any outside conditions that would influence whether builders would continue using these above-code practices and technologies? How so? [IF NECESSARY, SAY, "FOR EXAMPLE, ENERGY PRICES, GLOBAL WARMING, OR THE STATE OF THE HOUSING MARKET."]

[ASK Q#86-Q#68 ONLY IF KNOW ABOUT HALF THE TIME, USUALLY DO KNOW, OR ALMOST ALWAYS KNOW TO Q#24]

54. [IF YES TO Q#17E OR YES TO ANY Q#23H] What percent of the non-program homes your company rated that were built from 2006 to 2008 met program standards, but were not enrolled in the program? \_\_\_\_\_%

55. What specifically is the program standard that these homes meet? [PROBE FOR SPECIFICS]

56. How much influence would you say the utility program has had on the design and construction of non-program homes that meet program standards? Use a scale from 0 to 10, where 0 is "no influence at all" and 10 is "a great deal of influence."

57. [IF MORE THAN 7 TO Q#65 ] In what way did the program influence the design and construction non-program homes that meet program standards? [PROBE: Are there features of the program that caused your company to design non-program homes that meet program standards?]

58. [IF MORE THAN 7 TO Q#65] Do you think builders would continue constructing non-program homes that meet program standards in the future even without the program?

\_\_\_ yes

\_\_\_ no

\_\_\_ DK/refused

59. [IF MORE THAN 7 TO Q#65] Why do you say that?

60. Do you know any other HERS raters who have been involved with homes participating in the investor-owned utility-sponsored new construction programs?

Yes

No [SKIP TO Q#136]

DK/refused [SKIP TO Q#136]

61. Have you discussed energy efficient building technologies and practices with HERS raters who have been involved with homes participating in the investor-owned utility-sponsored programs?

Yes

No [SKIP TO Q#136]

DK/refused [SKIP TO Q#136]

62. Where have you discussed energy efficient building technologies and practices with HERS raters who have been involved with homes participating in the investor-owned utility-sponsored programs? [MULTIPLE RESPONSE, DO NOT READ]

Phone conversations

Conferences

Building sites

Other [SPECIFY: \_\_\_\_\_]

## TRAINING

63. From 2006 to 2008, have you attended any utility-sponsored training sessions pertaining to energy efficient new home construction?

Yes

No

DK/refused

64. From 2006 to 2008, have you attended any other training sessions pertaining to energy efficient new home construction?

Yes

No

DK/refused

65. [IF YES TO Q.#64] From which organizations have you received this training? [DO NOT READ RESPONSES]

[CALIFORNIA ENERGY COMMISSION/CEC]

[CALIFORNIA ASSOCIATION OF ENERGY CONSULTANTS/CABEC]

[CALIFORNIA HOME ENERGY EFFICIENCY RATING SERVICES/CHEERS]

[LOCAL GOVERNMENT—SPECIFIC CITY OR TOWN]

[MUNICIPAL UTILITY—E.G. SMUD OR LADWP]

[OTHER: SPECIFY \_\_\_\_\_]

**That concludes our interview. Thank you very much!**

## A.4 HVAC Contractor Interview Guide

### HVAC Contractor Interview Guide for IOU RNC Codes & Standards Programs—Market Effects (Final)

Interviewer:

Date:

Subject Name:

Organization:

Program(s) responsible for:

Hello, my name is \_\_\_\_\_ from Itron, Inc and I am calling on behalf of the California Public Utilities Commission (CPUC). The CPUC has asked us to conduct interviews with HVAC contractors in order to better understand the residential new construction market, energy efficiency and the California utilities' residential new construction programs. This survey is extremely important to the CPUC's understanding of the new construction market. We are offering \$150 to the appropriate person at your firm to speak with us for about half an hour. May I please speak with the person responsible for making design and equipment decisions and recommendations for new homes?

Yes [CONTINUE]

No/DK [TERMINATE]

Refused [TERMINATE]

May I please have the person's name and job title?

[RECORD NAME AND JOB TITLE]

[WHEN CORRECT PERSON IS ON-LINE:]

Hello, my name is \_\_\_\_\_ from Itron, Inc. and I am calling on behalf of the California Public Utilities Commission (CPUC). The CPUC has asked us to conduct interviews with HVAC contractors in order to better understand the residential new construction market, energy



efficiency and the California utilities' residential new construction programs. Can I confirm that you're the person responsible for making design and equipment decisions and recommendations for new homes?

Yes [CONTINUE]

No/DK [ASK TO SPEAK WITH CORRECT PERSON, OR TERMINATE]

Refused [TERMINATE]

This survey is extremely important to the CPUC's understanding of the new construction market. We are offering \$150 if you will spend about half an hour sharing with us your insights about the market for energy-saving features in new homes. All your answers are held confidential--that is, we never link any information to a particular person or company.

Is now a good time?

Yes [CONTINUE]

No [SET UP CALLBACK]

DK/refused [TERMINATE]

[IF INTERVIEWEE ASKS ABOUT THE STUDY'S SPONSORSHIP, REFER TO AYAT OSMAN, CPUC, AT (415) 703-5953]

## **INTRODUCTION**

First I have a few questions about you and about your company's HVAC work in residential new construction.

1. Which of the following best describes your role within the company?

Technician

Installer

Executive

All of the above

Other [SPECIFY]

DK/refused [TERMINATE]

2. Are you aware of the Title 24 requirements for HVAC in residential new construction  
{PG&E Q10; PG&E Q10}

Yes

No

DK/refused

3. Do you have a working knowledge of the HVAC requirements of Title 24 requirements?  
{PG&E 10a}

Yes [CONTINUE]

No [ASK FOR APPROPRIATE CONTACT AND TERMINATE]

DK/refused[ASK FOR APPROPRIATE CONTACT AND TERMINATE]

Contact with working knowledge of Title 24:

\_\_\_\_\_

Title: \_\_\_\_\_

Phone: \_\_\_\_\_

Other: \_\_\_\_\_

4. How many years have you been a residential HVAC contractor? {Statewide study Q1; PG&E Q2 }

\_\_\_\_\_ years

5. In how many newly constructed residential housing units, not buildings but housing units, did your firm install HVAC equipment in 2006 in California? 2007? How many do you expect to complete in 2008? {modified version of Statewide study Q2; PG&E Q7}

J. 2006\_\_\_\_\_ new housing units, California

K. 2007\_\_\_\_\_ new housing units, California

L. 2008\_\_\_\_\_ new housing units, California

6. How many of these housing units were tract-built detached single family home, custom built detached single family home, attached single family (Duplex/Townhouse), and

condo or apartment (Multifamily unit) {Modified version of Statewide study Q3; PG&E Q8 and 9 }

- \_\_\_ Tract-built detached single family home
- \_\_\_ Custom built detached single family home
- \_\_\_ Attached single family (Duplex/Townhouse)
- \_\_\_ Condo or Apartment (Multifamily unit)

READ: For the rest of the interview I'd like you to talk about single-family attached and detached homes only—NOT condos or apartments.

### INSTALLATION PRACTICES

7. How do you go about sizing and selecting the central air conditioning equipment for a new home? [PROBE FOR USE OF SOFTWARE AND WHICH SOFTWARE USED; DO NOT READ RESPONSES] {Modified statewide study Q#5}

(Size based on square footage or cubic footage)

(ACCA Manual J)

(Manufacturer's software based on manual J)

(Other -- SPECIFY: \_\_\_\_\_)

8. How do you go about sizing and selecting furnace equipment for a new home? [PROBE FOR USE OF SOFTWARE AND WHICH SOFTWARE USED; DO NOT READ RESPONSES]

(Size based on square footage or cubic footage)

(ACCA Manual J)

(Manufacturer's software based on manual J)

(Other -- SPECIFY: \_\_\_\_\_)

9. Over the past couple of years, has your firm made any changes in its approach to sizing, installing or testing HVAC equipment or ductwork for new homes? {Modified statewide study Q#5a}

Yes

No [SKIP TO Q#12]

DK / refused [SKIP TO Q#12]

10. Can you please describe those changes? {statewide study Q#5b}

11. What was the main reason you made those changes? What were any other reasons? {statewide study Q#5c}

12. Now I'm going to ask you about four different decisions related to the selection and installation of HVAC systems in new homes. For each one I'll ask you how often these decisions are made by your firm, by the builder, possibly by the buyer, or based on Title 24 Code. In situations where the final decision is up to the builder, but you've actually made the recommendation and they've simply followed it, think of that as your firm making the decision.

The first one is the equipment's rated efficiency level – does your firm always, often, sometimes, rarely, or never make that decision? Does the builder always, often, sometimes, rarely, or never make the decision about the equipment's rated efficiency level? Does the buyer always, often, sometimes, rarely, or never make the decision about the equipment's rated efficiency level? Or is the decision about the equipment's rated efficiency level always, often, sometimes, rarely, or never based on Title 24? [ASK FOR REMAINING DECISION MAKERS (I.E., BUILDER, BUYER, TITLE 24) FOR EACH REMAINING HVAC SYSTEM DECISION] {Statewide study Q#7; PG&E Q5}

[RESPONSE SCALE:]

- Always: 5
- Often: 4
- Sometimes: 3
- Rarely: 2
- Never: 1

HVAC System Decision	Decision Maker			
	HVAC Firm	Builder	Buyer	Title 24
The equipment's rated efficiency level				
System size				
The system design				
Different duct installation methods				
A particular R-value of duct insulation				

13. [ASK FOR EACH HVAC SYSTEM DECISION IN Q#12] over the last year or two, have you noticed any changes in how decisions get made regarding [HVAC SYSTEM DECISION]? {Statewide study Q#7a}

Yes

No [SKIP TO Q#16]

DK / refused [SKIP TO Q#16]

14. [IF YES TO Q#13] what have those changes been? {Statewide study Q#7a}

15. What are the factors behind the shift in decision-making for [ITEM]? What are some other factors? {Statewide study Q#7a}

16. How do you typically define energy efficient or high efficiency HVAC systems, other than high SEER and AFUE ratings? [PROBE FOR SPECIFICS—E.G., HOW IT IS INSTALLED] {modified Statewide study Q#7b}

17. Based on your definition, how often do you place a priority on energy efficiency when you are recommending HVAC systems for new homes? Would you say [READ LIST] {Statewide study Q#7c}

Always

Often

Sometimes

Rarely

Never

[dk/refused]

18. What percentage of the central air conditioning systems you installed in new homes in 2005 were 13 SEER or less? What percent were 14 SEER? What percent were 15 SEER? 16 SEER or higher? What about for 2006? 2007? What about for the homes you expect to complete in 2008? {Statewide study Q#8a; PG&E Q11}

Year	% 13 SEER or less	% 14 SEER	% 15 SEER	% 16 SEER +	Total

2005					<b>100%</b>
2006					<b>100%</b>
2007					<b>100%</b>
2008					<b>100%</b>

19. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008 TO Q.#18 ] What factors are behind the shifts? [PROBE IF NEEDED: “What others?”] {Statewide study Q#8; PG&E Q11c}

20. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006 TO Q.#18 ] What factors are behind the shifts from 2005 to 2006? [PROBE IF NEEDED: “What others?”] {Modified statewide study Q#8; PG&E Q11c}

21. What percentage of the gas furnaces you installed in new homes in 2005 were rated 80% AFUE or below? What percent were rated 81% to 89% AFUE? What percent were rated 90% AFUE or higher? What about for 2006? 2007? What about for the homes you expect to complete in 2008? {Statewide study Q#8d; PG&E Q12}

Year	% 80% or below AFUE	% 81% to 89% AFUE	% 90% to 94% AFUE	% 95% AFUE or higher	<b>Total</b>
2005					<b>100%</b>
2006					<b>100%</b>
2007					<b>100%</b>
2008					<b>100%</b>

22. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008 TO Q.#21 ] What factors are behind the shifts? [PROBE IF NEEDED: “What others?”]

23. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006 TO Q.#21 ] What factors are behind the shifts from 2005 to 2006? [PROBE IF NEEDED: “What others?”]

24. In what percentage of new homes that you worked on in 2005 in California did the duct insulation exceed Title 24 requirements? 2006? 2007? In what percentage of the homes you expect to complete in 2008? {modified PG&E Q15}

- A. 2005\_\_\_\_% of new housing units, California
- B. 2006\_\_\_\_% of new housing units, California
- C. 2007\_\_\_\_ % of new housing units, California
- D. 2008\_\_\_\_ % of new housing units, California

25. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006 TO Q#24] What was the main reason for the change from 2005 to 2006 [PROBE: state standards; consumer demand] {modified PG&E Q15c}

26. Are you responsible for duct installation?

Yes [CONTINUE TO Q#27]

No [SKIP TO Q#30]

Don't know [SKIP TO Q#30]

27. What are your current practices for duct installation? {PG&E Q16}

28. Have these practices changed over since 2005? {modified PG&E Q16b}

29. [IF YES TO Q#28] What are the main reasons for the change? [PROBE: stat standards; consumer demand] { PG&E Q16c}

30. Do you conduct duct blaster tests? { PG&E Q17}

Yes [SKIP TO Q#32]

No [CONTINUE TO Q#31]

Don't know/refused [SKIP TO INTRO BEFORE Q#35]

31. [IF NO TO Q#30] Why not? [SKIP TO INTRO BEFORE Q#35 AFTER RESPONDING] { PG&E Q17}

32. [IF YES TO Q#30] In what percentage of new homes that you worked on in 2006 in California did you conduct duct tests? 2007? In what percentage of the homes you expect to complete in 2008? {modified PG&E Q17A}



- A. 2006\_\_\_\_% of new housing units, California
- B. 2007\_\_\_\_% of new housing units, California
- C. 2008\_\_\_\_% of new housing units, California

33. Was the percentage of homes that you conducted duct tests higher or lower in 2005?  
{modified PG&E Q17B}

Higher

Lower

About the Same

34. [IF HIGHER OR LOWER TO Q#] What was the main reason for the change {PG&E Q17D}

## RNC PROGRAM AWARENESS AND PARTICIPATION

Now I'm going to read you the names of some programs that encourage the installation of energy-efficient features in new homes, and I'm going to ask you if you have heard of them, and if you have installed HVAC systems for homes participating in them.

[RANDOMIZE q#35 -43; ASK Q# A – D FOR EACH PROGRAM UNLESS INSTRUCTED OTHERWISE]

35. [LEED for Homes]
36. [ENERGY STAR Homes]
37. [Solar Initiative]
38. [Environments for Living]
39. [ComfortWise]
40. [Federal Tax Credits]
41. Programs sponsored by municipal utilities such as SMUD and LADWP
42. [Building America] (ASK A-C ONLY, NOT D)
43. [Smart Home]
  - a. Have you heard of [READ PROGRAM NAME]?
  - b. [IF YES TO A] Did your company install HVAC equipment into any new homes participating in [PROGRAM NAME] before 2006?
  - c. [IF YES TO A] Did your company install HVAC equipment into any new homes participating in [PROGRAM NAME] from 2006 to 2008?
  - d. [IF YES TO C] How many housing units did your company install HVAC equipment into with the help of [PROGRAM NAME] from 2006 to 2008?
44. Now I'm going to ask you about some Investor-owned Utility-sponsored residential new construction programs {Modified statewide study Q9 and 9a; PG&E Q18 and Q21}
  - X. Have you heard of any Investor-owned Utility residential new construction programs sponsored by PG&E, SCE, SCG&E or SCG? [IF YES, CONTINUE; IF NO, SKIP TO Q#45]
  - Y. Which investor-owned utility-sponsored residential new construction programs have you heard of? [MULTIPLE RESPONSE; DO NOT READ]

NO/NONE/DK [SKIP TO Q#45]

PG&E Residential New Construction

SCE New Homes

SDG&E and SCG Advanced Home

Other [SPECIFY]: \_\_\_\_\_

[IF RESPONDENT DOES **NOT** NAME ONE OF THE THREE PROGRAMS, SKIP TO Q#45]

- Z. [IF YES TO A] Did your company install HVAC equipment into any new homes built with program assistance before 2006?
- AA. [IF YES TO C ] Which ones?
- BB. [IF YES TO A] Did your company participate in any of these programs from 2006 to 2008? [IF NO, SKIP TO Q#46 ]
- CC. [IF YES TO E] Which ones?
- DD. [IF YES TO E] In how many housing units did your company install HVAC equipment with the help of [PROGRAM NAME FROM F] from 2006 to 2008? [SKIP TO Q#46]
45. [IF NO TO Q#44a] Have you heard of any of the following investor-owned utility-sponsored residential new construction programs? [READ LIST] {Modified statewide Q9 and 9a, PG&E Q18 and Q21 }

PG&E Residential New Construction

SCE New Homes

SDG&E and SCG Advanced Home

[IF YES TO ANY PROGRAM, CONTINUE; IF NO TO ALL PROGRAMS, SKIP TO Q#46 ]

- R. Did your company install HVAC equipment into any new homes built with program assistance before 2006?
- S. Which ones?
- T. Did your company install HVAC equipment into any new homes built with program assistance from 2006 to 2008? [IF NO, SKIP TO Q#46 ]
- U. [IF YES TO C] Which ones?
- V. [IF YES TO D] How In how many housing units did your company install HVAC equipment with the help of [PROGRAM NAME FROM F] from 2006 to 2008] ?

## **ENERGY EFFICIENT TECHNOLOGIES AND PRACTICES**

Now I would like to ask some questions relating to energy efficient technologies and building practices

How aware would you say you are of each of the following energy efficient equipment and building practices? Are you very aware, somewhat aware, or not aware at all of the latest available energy saving [high efficiency] technologies and building practices? {PG&E Q25 } [RANDOMIZE]

- 46. High-SEER air conditioner or heat pump
- 47. High-EER air conditioner or heat pump
- 48. High-AFUE furnace
- 49. HVAC installation for maximum efficiency
- 50. Duct sealing
- 51. Duct testing
- 52. Duct insulation

53. What is the primary source of your information on new energy efficient technologies and building practices? {Modified PG&E (builder) Q30; PG&E Q25a}

54. [IF UTILITY TRAINING NOT MENTIONED IN Q#53 AND IF YES TO Q#44a OR AWARE OF ANY PROGRAM IN Q#45] Is utility sponsored training a source of information on new energy efficient technologies and building practices?

Yes

No

DK/refused

55. [IF OTHER HVAC CONTRACTORS NOT MENTIONED IN Q#53] Are other HVAC contractors a source of information on new energy efficient technologies and building practices?

Yes [GO TO Q#56]

No [SKIP TO Q#57]

DK/refused [SKIP TO Q#57]

56. [IF YES TO Q#55] How have you learned about new energy efficient technologies and building practices from other HVAC contractors?

Phone conversations

HVAC conferences

Building sites

Other [SPECIFY: \_\_\_\_\_]

57. On a scale of 1 to 5 with 1 meaning not at all important and a 5 meaning very important, how influential are the following in your choice of energy efficiency levels for the HVAC systems you typically install into homes built outside of any utility programs?  
[RANDOMIZE] {Modified Statewide (builder) Q40; PG&E (builder) Q30}
- a. Buyer willingness to pay for the added costs for energy efficient HVAC systems
  - b. Builder desire to have the lowest-cost HVAC system
  - c. Decreasing incremental costs of energy efficient HVAC systems
  - d. Recommendation of Title 24 consultants
  - e. Recommendation of builders
  - f. Recommendation of product distributors
  - g. Recommendation of product manufacturers
  - h. Recommendation of architects or designers
  - i. Product offerings by competing HVAC contractors
  - j. Recommendations of other HVAC contractors
  - k. [ IF YES TO Q Q#44a OR AWARE OF ANY PROGRAM IN Q#45] What you have learned through utility programs

## TITLE 24

The following questions relate to your company's as well as other HVAC contractors' practices relative to California's Title 24 energy efficiency requirements.

58. Are you familiar with the utility sponsored "Program Plan Check" that is meant to help model and build above Title 24 requirements?

Yes

No [SKIP TO Q62]

DK/Refused [SKIP TO Q62]

59. How much has the feedback from "Program Plan Check" help you and your company with modeling and building above code? Use a scale from 0 to 10, where 0 is "no help at all" and 10 is "a great deal of help."

60. How influential would you say that HVAC contractors are in assisting builders who want to build to energy efficiency standards that exceed Title 24? {PG&E Q27}

Very influential

Somewhat influential

Not very influential

Not at all influential

Don't know

61. In what ways do you feel HVAC contractors can be influential in assisting builders to exceed Title 24? {modified PG&E Q27a}

62. Now I'm going to read you some statements about code compliance and possible upgrades to Title 24 requirements. I would like you to tell me if you agree or disagree with each statement by using a 10 point scale where 0 is disagree strongly and 10 is agree strongly.

- There is adequate knowledge and availability of energy efficient technologies and practices that most builders could comply with the proposed 2008 code upgrade within a reasonable time
- Compliance with the current code is so widespread that builders at the low end of the market could comply with the proposed 2008 code upgrade within a reasonable time
- There is adequate knowledge and availability of energy efficient technologies and practices that most HVAC contractors could comply with a upgrade to the current code within a reasonable time
- Compliance with the current code is so widespread that HVAC contractors at the low end of the market could comply with a code upgrade within a reasonable time
- [IF YES TO Q Q#44a OR AWARE OF ANY PROGRAM IN Q#45] **Investor-owned utility** training programs have helped improved code compliance
- [IF YES TO Q Q#44a OR AWARE OF ANY PROGRAM IN Q#45] **Investor-owned utility** programs that encourage code compliance and encourage installation of energy-efficient features in new homes have contributed to market readiness for a code upgrade
- [IF YES TO Q Q#44a OR AWARE OF ANY PROGRAM IN Q#45] Other (non-Investor-owned utility) energy-efficiency training programs have helped improve code compliance

[SKIP INSTRUCTIONS FOR PARTICIPANTS, NON-PARTICIPANTS AWARE OF THE PROGRAM AND NON-PARTICIPANTS NOT AWARE OF THE PROGRAM:

PARTICIPANTS: IF YES TO Q#44BB OR 45T, CONTINUE TO Q#58

NON-PARTICIPANTS AWARE OF THE PROGRAM: IF NO TO Q#44BB OR 45T OR, SKIP TO Q#96]

NON-PARTICIPANTS NOT AWARE OF THE PROGRAM: IF NO TO Q#44X AND NOT AWARE OF ANY PROGRAMS IN Q#45, SKIP TO Q#97 ]

## PARTICIPANT SERIES

63. Approximately what percentage of the housing units in which your company installed HVAC equipment in 2006 were built with the help of the investor-owned utility program? {Statewide Q10b; }

64. How about 2007?

65. 2008? [OF TOTAL EXPECTED TO BE BUILT DURING YEAR]

[IF Q#58, 59, AND 60 ARE ALL 0%, SKIP TO NONPARTICIPANT SECTION, Q#99]

66. How would you summarize the program participation requirements that affect HVAC system design, installation, equipment or testing? {Statewide Q10f}

67. How did your involvement in these program homes differ from your typical new home installation, in terms of activities you were involved in, and/or interactions with the builder or other subcontractors? {Statewide Q10g}

68. Have the builders you or your company work with made any changes to their building or installation practices for non-program homes as a result of the program? { PG&E Q24 }

Yes

No [SKIP TO Q#71]

DK/refused [SKIP TO Q#71]

69. [IF YES TO Q#68] How so? {PG&E Q24a}

70. [IF YES Q#68] Which features of the program were the main reasons for implementing these changes? {PG&E Q24b}

71. [ASK IF Q#58, 59, AND 60 ARE <100%] What changes, if any, has your company made in its general HVAC system design, installation, or equipment, or testing practices or recommendations in non-program homes, as a result of involvement with this program? What others? {Statewide Q10k; PG&E Q20}

72. [IF ANY CHANGES IDENTIFIED IN Q#71 ] Will you continue to use these practices and technologies in the future even without the program? {modified Statewide Q10l; PG&E Q24C}

\_\_\_ Yes

\_\_\_ No

\_\_\_ DK/refused

73. Why do you say that? {Statewide Q10m; PG&E Q24C 1}

74. Between 2006 and 2008, did your company install HVAC systems exceeding Title 24 requirements in any homes in California that are not part of a utility efficiency program? That is, homes that are not directly supported by incentive dollars but with HVAC systems that are more energy efficient than required by code? {Statewide (builder) Q15; PG&E Q26}

Yes [SKIP TO Q#64]

No [GO TO Q#63 ]

Don't know

75. [IF NO TO Q62] What do you feel are the primary reasons that your company has not installed above-code HVAC systems in non-program homes? [SKIP TO Q#125 AFTER ANSWERING] {PG&E (builder) Q21a}

76. [IF YES TO Q62] In which of the following areas has your company used above-code practices and technologies in HVAC systems installed in non-program homes from 2006 to 2008? [IF YES] What percent of homes you built from 2006 to 2008 used above code [INSERT FEATURE]? [RANDOMIZE] NOTE: IF RESPONDENT SAYS A GIVEN PRACTICE OR TECHNOLOGY IS NOT SUBJECT TO THE CODE, SAY "PLEASE TELL ME IF THE PRACTICE OR TECHNOLOGY HELPED THE HOUSE AS A WHOLE ACHIEVE ABOVE-CODE EFFICIENCY."]

h. Used above code [INSERT FEATURE, Q#68 - 79]?

i. [IF YES TO A ] What percent of homes built from 2006 to 2008 used above code [INSERT FEATURE]

77. High-SEER air conditioner or heat pump

78. High-EER air conditioner or heat pump

79. High-AFUE furnace

80. HVAC installation for maximum efficiency



81. Duct sealing
82. Duct testing
83. Duct insulation
84. Other [PLEASE SPECIFY]
  
85. What reasons or factors determine whether or not your HVAC system design, installation, or equipment or testing practices or recommendations in non-program homes exceed Title 24 (without any energy efficiency program support)? What other reasons or factors? {Statewide (builder) Q# 17}
  
86. [IF YES TO ANY OF FEATURES Q#68 - 79] How much influence would you say the utility program has had on your adoption of these above-code energy efficient building practices and technologies in non-program homes? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - vv. [IF YES TO Q.#68 ABOVE] High-SEER air conditioner or heat pump
  - ww. [IF YES TO Q.#78 ABOVE] High-EER air conditioner or heat pump
  - xx. [IF YES TO Q.#69 ABOVE] High-AFUE furnace
  - yy. [IF YES TO Q.#70 ABOVE] HVAC installation for maximum efficiency
  - zz. [IF YES TO Q.#76 ABOVE] Duct sealing
  - aaa. [IF YES TO Q.#77 ABOVE] Duct testing
  - bbb. [IF YES TO Q.#83 ABOVE] Duct insulation
  - ccc. [IF YES TO Q.#79 ABOVE] [REPEAT WHAT WAS MENTIONED IN Q.#79]
  
87. [IF ANY OF OR Q.#81 vv- ccc GT 0] Which feature of the program was the main reason for implementing these changes to non-program homes? {PG&E (builder) Q21c}
  
88. Why do you say that?
  
89. Are there any regions within California in which you feel the program has had more of an influence than across the state as a whole in non-program homes?  
  
Yes [CONTINUE TO Q#90]  
No [SKIP TO Q#86]  
Don't know [SKIP TO Q#86]
  
90. [IF YES TO Q#89] Which regions?

91. [IF YES TO ANY OF Q#62] What percent of the non-program homes into which your company installed HVAC equipment from 2006 to 2008 met program standards, but were not enrolled in the program? \_\_\_\_\_%

92. [IF MORE THAN 0% TO Q#86] Did your HVAC system design, installation, or equipment or testing practices contribute to the home meeting program standards?

Yes

No

Don't know

93. [IF YES TO Q#92] How much influence would you say the utility program has had on your HVAC system design, installation, or equipment or testing practices in non-program homes that meet program standards? Use a scale from 0 to 10, where 0 is "no influence at all" and 10 is "a great deal of influence."

94. Which feature of the program was the main reason for your HVAC system design, installation, or equipment or testing practices that meet program standards?

{PG&E(builder) Q21c}

95. Would you continue your HVAC system design, installation, equipment or testing practices in non-program homes that meet program standards in the future even without the program? {Statewide (builder)Q10l; PG&E (builder)Q21d}

\_\_\_ yes

\_\_\_ no

\_\_\_ DK/refused

96. Why do you say that?

97. Do any of the builders your company has worked with specify above code HVAC equipment or follow above-code installation practices because of working with you or your company?

Yes

No

Don't know

98. [IF YES TO Q#97] In which of the following areas have these builders adopted above-code practices and technologies pertaining to HVAC systems?

- a. High-SEER air conditioner or heat pump
- b. High-EER air conditioner or heat pump
- c. High-AFUE furnace
- d. HVAC installation for maximum efficiency
- e. Duct sealing
- f. Duct testing
- g. Duct insulation
- h. Other [PLEASE SPECIFY]

[SKIP TO Q#125]

### NON-PARTICIPANTS

99. What is the main reason your company did **not** install HVAC equipment into any new homes built with the help of the utility-sponsored program to encourage the installation of energy-efficient features in new homes? What are any other reasons? {Statewide (builder) Q 10c; PG&E (builder) Q20}

100. As far as you know, have the builders you or your company work with worked on any homes enrolled in a utility sponsored program that encourages installation of energy-efficient features in new homes?

Yes

No [SKIP TO Q#104]

DK/refused [SKIP TO Q#104]

101. Have the builders you or your company work with made any changes to their building or installation practices for non-program homes as a result of the program? {PG&E Q24}

Yes

No [SKIP TO Q#104]

DK/refused [SKIP TO Q#104]

102. [IF YES TO Q#101] How so? { PG&E Q24a}
103. [IF YES Q#101] Which features of the program were the main reasons for implementing these changes? {PG&E Q24b}
104. Has your company used any above-code building practices or technologies from 2006 to 2008?
- Yes [SKIP TO Q#106]
- No [GO TO Q#101 ]
- Don't know [GO TO Q#101 ]
105. [IF NO TO Q#97] What do you feel are the primary reasons that your company has not used any above-code building practices or technologies? [SKIP TO Q# 125 AFTER ANSWERING] {PG&E (builder) Q21a}
106. In which of the following areas has your company used above-code practices and technologies from 2006 to 2008? [IF YES] What percent of homes you built from 2006 to 2008 used above code [INSERT FEATURE]? [RANDOMIZE] [NOTE: IF RESPONDENT SAYS A GIVEN PRACTICE OR TECHNOLOGY IS NOT SUBJECT TO THE CODE, SAY "PLEASE TELL ME IF THE PRACTICE OR TECHNOLOGY HELPED THE HOUSE AS A WHOLE ACHIEVE ABOVE-CODE EFFICIENCY."]
- c. Used above code [INSERT FEATURE Q# 106 - 117]?
  - d. [IF YES TO A] What percent of homes built from 2006 to 2008 used above code [INSERT FEATURE]
107. High-SEER air conditioner or heat pump
108. High-EER air conditioner or heat pump
109. High-AFUE furnace
110. HVAC installation for maximum efficiency
111. Duct sealing
112. Duct testing
113. Duct insulation
114. Other [PLEASE SPECIFY]
115. [IF YES TO ANY OF Q# 106 - 117 AND YES TO Q#44a OR AWARE OF PROGRAM IN Q#45] How much influence would you say the utility program has had on your adoption of these above-code energy efficient building practices and technologies? Use a scale from 0 to 10, where 0 is "no influence at all" and 10 is "a great deal of influence."
- p. [IF YES TO Q.#106 ABOVE] High-SEER air conditioner or heat pump

- q. [IF YES TO Q.#108 ABOVE] High-EER air conditioner or heat pump
  - r. [IF YES TO Q.#107 ABOVE] High-AFUE furnace
  - s. [IF YES TO Q.#108 ABOVE] HVAC installation for maximum efficiency
  - t. [IF YES TO Q.#114 ABOVE] Duct sealing
  - u. [IF YES TO Q.#115 ABOVE] Duct testing
  - v. [IF YES TO Q.#113 ABOVE] Duct insulation
  - w. [IF YES TO Q.#117 ABOVE] [REPEAT WHAT WAS MENTIONED IN Q.#87]
116. [IF ANY OF Q.#118 A-G GT 0] Which feature of the program was the main reason for implementing these changes to homes? {PG&E (builder) Q21c}
117. [IF GT 0 TO ANY OF Q.#118 A-G] Would you continue to use these above-code practices and technologies in the future even without the program? {Statewide (builder) Q10l; PG&E (builder) Q21d}
- Yes
- No
- DK/refused
118. Why do you say that?
119. Are there any regions within California in which you feel the program has had more of an influence than across the state as a whole in non-program homes?
- Yes [CONTINUE TO Q#120]
- No [SKIP TO Q#121]
- Don't know [SKIP TO Q#121]
120. [IF YES TO Q#119] Which regions?
121. [IF YES TO Q#44a OR AWARE OF PROGRAM IN Q#45] Have any of your competitors adopted above-code energy efficient building practices and technologies because of their work with homes built through the program?
122. [IF YES TO Q#121 and IF YES TO ANY OF Q# 106 - 117 AND YES TO Q#44a OR AWARE OF PROGRAM IN Q#45] How much influence would you say your competitors' practices have had on your adoption of these above-code energy efficient building practices and technologies? Use a scale from 0 to 10, where 0 is "no influence at all" and 10 is "a great deal of influence."

- a. [IF YES TO Q.#106 ABOVE] High-SEER air conditioner or heat pump
  - b. [IF YES TO Q.#108 ABOVE] High-EER air conditioner or heat pump
  - c. [IF YES TO Q.#107 ABOVE] High-AFUE furnace
  - d. [IF YES TO Q.#108 ABOVE] HVAC installation for maximum efficiency
  - e. [IF YES TO Q.#114 ABOVE] Duct sealing
  - f. [IF YES TO Q.#115 ABOVE] Duct testing
  - g. [IF YES TO Q.#113 ABOVE] Duct insulation
  - h. [IF YES TO Q.#117 ABOVE] [REPEAT WHAT WAS MENTIONED IN Q.#87]
123. Do any of the builders your company has worked with specify above code HVAC equipment or follow above-code installation practices because of working with you or your company?
- Yes
- No
- Don't know
124. [IF YES TO Q#123] In which of the following areas have these builders adopted above-code practices and technologies pertaining to HVAC systems?

- a. High-SEER air conditioner or heat pump
- b. High-EER air conditioner or heat pump
- c. High-AFUE furnace
- d. HVAC installation for maximum efficiency
- e. Duct sealing
- f. Duct testing
- g. Duct insulation
- h. Other [PLEASE SPECIFY]

**ALL RESPONDENTS**

**Trainings**

125. From 2006 to 2008, have you attended any utility-sponsored training sessions pertaining to energy efficient HVAC system design, installation, equipment or testing practices? {Statewide Q25; }

Yes [CONTINUE]

No [SKIP TO Q#129]

DK/refused [SKIP TO Q#129]

126. Does your company use more energy efficient HVAC system design, installation, or equipment or testing practices as a result of this training?

Yes

No [SKIP TO Q#129]

DK/refused [SKIP TO Q#129]

127. [IF YES TO Q137] What energy efficient HVAC system design, installation, equipment or testing practices do you typically use as a result of the training? { **Statewide Q25b** }

128. [IF YES TO Q#137] How much influence would you say the utility training has had on your adoption of these energy efficient building practices and technologies? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

129. From 2006 to 2008, have you attended any training sessions not sponsored by IOUs pertaining to energy efficient HVAC system design, installation, equipment or testing practices?

Yes [CONTINUE]

No [SKIP TO Q#182]

DK/refused [SKIP TO Q#182]

130. Who sponsored the training?

131. Does your company use more energy efficient HVAC system design, installation, or equipment or testing practices as a result of this training?

Yes

No [SKIP TO Q#182]

DK/refused [SKIP TO Q#182]

132. [IF YES TO Q#129] What energy efficient HVAC system design, installation, equipment or testing practices do you typically use as a result of the training? {Statewide Q25b }

133. [IF YES TO Q#129] How much influence would you say the training has had on your adoption of these energy efficient building practices and technologies? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

134. Finally, we would also like to talk to some HVAC distributors and manufacturers’ representatives in order to learn more about the residential new construction market, energy efficiency and the California utilities’ residential new construction programs. Could you give me the name and contact information for an HVAC distributors or manufacturer’s representative you regularly work with?

Company name: \_\_\_\_\_

Individual contact name: \_\_\_\_\_

Street Address: \_\_\_\_\_

Town/city: \_\_\_\_\_

Telephone Number (office): \_\_\_\_\_

Telephone Number (cell): \_\_\_\_\_

135. Is there another HVAC distributor or manufacturer’s representative you regularly work with?

Company name: \_\_\_\_\_

Individual contact name: \_\_\_\_\_

Street Address: \_\_\_\_\_

Town/city: \_\_\_\_\_

Telephone Number (office): \_\_\_\_\_

Telephone Number (cell): \_\_\_\_\_

**That concludes our interview, thank you very much!**



## A.5 HVAC Distributor Interview Guide

### HVAC Distributor Interview Guide for IOU RNC Codes & Standards Programs—Market Effects (final)

Interviewer:

Date:

Subject Name:

Organization:

Program(s) responsible for:

Hello, my name is \_\_\_\_\_ from Itron, Inc and I am calling on behalf of the California Public Utilities Commission (CPUC). The CPUC has asked us to conduct interviews with HVAC distributors and manufacturers' representatives in order to better understand the residential new construction market, energy efficiency and the California utilities' residential new construction programs. This survey is extremely important to the CPUC's understanding of the new construction market. Does your firm sell HVAC equipment for installation in new homes in California?

1. Yes [CONTINUE]
2. No [TERMINATE]
3. DK [TERMINATE}
4. Refused [TERMINATE]

May I please speak with the person who knows the most about HVAC equipment your firm sells for installation in new homes in California?

1. Yes [CONTINUE]
2. No [TERMINATE]
3. DK [TERMINATE}
4. Refused [TERMINATE]

May I please have the person's name and job title?

**[RECORD NAME AND JOB TITLE]**

Name \_\_\_\_\_

Job Title \_\_\_\_\_

**[WHEN CORRECT PERSON IS ON-LINE:]**

Hello, my name is \_\_\_\_\_ from Itron, Inc. and I am calling on behalf of the California Public Utilities Commission (CPUC). The CPUC has asked us to conduct interviews with HVAC distributors and manufacturers' representatives in order to better understand the residential new construction market, energy efficiency and the California utilities' residential new construction programs. Can I confirm that you're the person who knows the most about HVAC equipment your firm sells for installation in new homes in California?

1. Yes [CONTINUE]
2. No/DK [ASK TO SPEAK WITH CORRECT PERSON, OR TERMINATE]
3. Refused [TERMINATE]

This survey is extremely important to the CPUC's understanding of the new construction market. All your answers are strictly confidential--that is, we never link any information to a particular person or company.

**[IF INTERVIEWEE ASKS ABOUT THE STUDY'S SPONSORSHIP, REFER TO AYAT OSMAN, CPUC, AT (415) 703-5953]**

**Introduction**

1. I'd like to begin by learning a little more about your company. How many branches do you have for residential HVAC equipment in California?  
Enter number \_\_\_\_\_
2. How many employees do you have in California? How many do you have at this location?  
California: Enter number \_\_\_\_\_

This location: Enter number \_\_\_\_\_

3. **[IF MORE THAN ONE BRANCH TO Q.#1] Which geographic areas of California does your location serve? [MULTIPLE RESPONSES ACCEPTED].**

- a. Northern California
- b. Central California
- c. Southern California
- d. The Bay Area
- e. The LA Area
- f. The San Diego Area
- g. All of California
- h. DK
- i. REFUSED

4. Which brands do you distribute that have residential product lines?  
[CHECK ALL THAT APPLY; DO NOT READ]

- Rheem (Ruud, Weatherking)
- Lennox
- Carrier (Bryant, Day & Night, Payne)
- Trane
- York
- American Standard
- Coleman
- Goodman (Amana)
- International Comfort Products (Heil, Comfortmaker, Tempstar, Arcoaire)
- Nordyne (Intertherm, Miller)
- Consolidated Industries (Quatro, Tech-4)
- Other [SPECIFY: \_\_\_\_\_]

### Segments Served and Sales Data

I now have a few questions about the markets you serve in California.

5. Approximately how many residential cooling and heating systems of the following types did your company sell in 2005 in the single family new construction market California? Your best estimate is fine. **[NOTE: IF THEY SAY THEY CANNOT SPEAK FOR ALL OF CALIFORNIA, ASK THEM TO SPEAK FOR THE GEOGRAPHIC AREAS SERVED BY**

**THEIR OFFICE THROUGHOUT THE REST OF THE INTERVIEW – BUT MAKE SURE TO RECORD WHETHER OR NOT THEY ARE SPEAKING FOR ALL OF CALIFORNIA OR JUST THEIR AREAS.]**

5a Central Air Conditioners  
Enter number\_\_\_\_\_

5b Central Air-source Heat Pumps  
Enter number\_\_\_\_\_

5c Central Gas Furnaces  
Enter number\_\_\_\_\_

5\_1 How many units did your company sell in 2006?

5\_1a Central Air Conditioners  
Enter number\_\_\_\_\_

5\_1b Central Air-source Heat Pumps  
Enter number\_\_\_\_\_

5\_1c Central Gas Furnaces  
Enter number\_\_\_\_\_

5\_2 How many units did your company sell in 2007?

5\_2a Central Air Conditioners  
Enter number\_\_\_\_\_

5\_2b Central Air-source Heat Pumps  
Enter number\_\_\_\_\_

5\_2c Central Gas Furnaces  
Enter number\_\_\_\_\_

5\_3 How many units did you company sell in 2008?

5\_3a Central Air Conditioners  
Enter number\_\_\_\_\_

5\_3b Central Air-source Heat Pumps

Enter number\_\_\_\_\_

5\_3c Central Gas Furnaces

Enter number\_\_\_\_\_

**[IF DO NOT SELL CENTRAL AC, CENTRAL AIR-SOURCE HEAT PUMPS, OR CENTRAL GAS FURNACES, READ FOLLOWING COMMENT AND TERMINATE. ELSE CONTINUE AT \*\*\*.]**

Thank you, that is all the questions I have today.

We are looking for companies that sell Central AC, Central Air-source Heat Pumps and/or Central Gas Furnaces.

### **RNC Program Awareness and Participation**

Now I'm going to read you the names of some programs that encourage the installation of energy-efficient features in new homes, and I'm going to ask you if you have heard of them. [RANDOMIZE Q#. 35-14]

6. LEED for Homes [YES/NO]
7. ENERGY STAR Homes [YES/NO]
8. Solar Initiative [YES/NO]
9. Environments for Living [YES/NO]
10. ComfortWise [YES/NO]
11. Federal Tax Credits for efficient new homes [YES/NO]
12. Programs sponsored by municipal utilities such as SMUD (Sacramento Utility District) and LADWP (Los Angeles Department of Water and Power) [YES/NO]
13. Building America [YES/NO]
14. Smart Home [YES/NO]

**[NOTE: QUESTION BELOW WILL REFER TO THOSE PROGRAMS THAT THE RESPONDENT RECOGNIZED – LIST OF THESE PROGRAMS IS PROVIDED WITH THIS QUESTION FOR EASE OF REFERENCE]**

15. Next I'm going to ask you about some Investor-owned utility-sponsored programs.

- a. Have you heard of any Investor-owned utility programs sponsored by PG&E, SCE, SCG&E or SCG?

**[IF YES, CONTINUE; IF NO, SKIP TO Q#45]**

- b. Which investor-owned utility-sponsored programs have you heard of? [MULTIPLE RESPONSES ACCEPTED; DO NOT READ]

- 1. NONE/DK [SKIP TO Q#45]
- 2. PG&E Residential New Construction
- 3. SCE New Homes
- 4. SDG&E and SCG Advanced Home
- 5. Other [SPECIFY]: \_\_\_\_\_

**[IF RESPONDENT DOES NOT NAME ONE OF THE THREE PROGRAMS, GO TO Q#45; ELSE SKIP TO *Reasons for changes in market* SECTION]**

- 16. [ASK IF NO TO Q#15a] Have you heard of any of the following investor-owned utility-sponsored programs? [READ LIST]

- 1. PG&E Residential New Construction [YES/NO]
- 2. SCE New Homes [YES/NO]
- 3. SDG&E and SCG Advanced Home [YES/NO]

\*\*\*I'd like your help breaking overall residential sales into efficiency levels.

**[SKIP Q.#17-18 IF DO NOT SELL CENTRAL AC OR AIR SOURCE HEAT PUMPS TO Q.#5]**

- 17. Approximately what percentage of the central air conditioners and air source heat pumps you sold in the single family new construction market California during 2006, 2007, and 2008 had SEER ratings of... [READ EACH CATEGORY; FILL IN BLANK FOR EACH]. Your best estimate is fine.

<u>2006 %</u>	<u>2007 %</u>	<u>2008 %</u>	<u>SEER Rating</u>
_____	_____	_____	13 SEER
_____	_____	_____	14 SEER
_____	_____	_____	15 SEER
_____	_____	_____	16 SEER or higher
100%	100%	100%	

18. **[IF THE PERCENTAGES CHANGED FROM 2006 TO 2008]** What factors are behind the shifts from 2006 to 2008? Are there any other factors that come to mind?

**Reasons for changes in the market**

19. **[ASK IF 16+ SEER IN 2008 GREATER THAN 16+ SEER IN 2006 TO Q.#17]** You said that the market share of 16 SEER and higher central air conditioners and air source heat pumps in new single family housing was greater in 2008 than in 2006. **[RANDOMIZE A-G, KEEPING B&C&D TOGETHER]**

a. **[IF YES TO ANY OF Q#. 35-Smart Home [YES/NO]14]**

**[CIRCLE PROGRAM NAMES WITH YES FROM Q#.35-13 FOR REFERENCE]**

- 21. *LEED for Homes*
- 22. *ENERGY STAR Homes*
- 23. *Solar Initiative*
- 24. *Environments for Living*
- 25. *ComfortWise*
- 26. *Federal Tax Credits for efficient new homes*
- 27. *Programs sponsored by municipal utilities such as SMUD (Sacramento Utility District) and LADWP (Los Angeles Department of Water and Power)*
- 28. *Building America*
- 29. *Smart Home*

have/has had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

- b. **[IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16]** Do you think there has been an increase in the market share of 16 SEER and higher systems among homes **not participating** in the [SAY NAMES OF IOU PROGRAMS MENTIONED IN Q.#15b OR 16]?
  
- c. **[IF YES TO B]** How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR 16] have/has had on this increase in market share of 16 SEER or higher systems among homes **not participating** in the programs? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  
- d. **[IF GREATER THAN 5 TO C]** Are there any regions in California where you believe the program has had more influence than in the state as a whole on the market share of 16 SEER or higher systems among homes **not participating** in the programs? [IF YES] Which regions?
  
- e. How much influence would you say changes in building code have had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  
- f. How much influence would you say increasing energy prices have had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  
- g. How much influence would you say the decline in the housing market has had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

**[SKIP Q.#20 -22 IF DO NOT SELL CENTRAL GAS FURNACES TO Q.#5]**

20. Approximately what percentage of the central gas furnaces you sold in the single family new construction market California during 2005, 2006, 2007, and 2008 had AFUE ratings of... [READ EACH CATEGORY; FILL IN BLANK FOR EACH]. Your best estimate is fine.

<u>Rating</u>	<u>2005 %</u>	<u>2006 %</u>	<u>2007 %</u>	<u>2008 %</u>	<u>AFUE</u>
_____	_____	_____	_____	_____	80% or below
_____	_____	_____	_____	_____	81% to 89%
_____	_____	_____	_____	_____	90% to 94%



_____	_____	_____	_____	
100%	100%	100%	100%	95% or higher

21. **[IF THE PERCENTAGES CHANGED FROM 2006 TO 2008]** What factors are behind the shifts from 2006 to 2008? Are there any other factors that come to mind?
  
22. **[IF THE PERCENTAGES CHANGED FROM 2005 TO 2006]** What factors are behind the shifts from 2005 to 2006? Are there any other factors that come to mind?
  
23. **[IF 95+ AFUE IN 2008 GREATER THAN 95+ AFUE IN 2006 TO Q.#20]** You said that the market share of 95% AFUE and higher central gas furnaces in new single family housing was greater in 2008 than in 2006. **[RANDOMIZE A-G, KEEPING B&C&D TOGETHER]**
  - a. **[IF YES TO ANY OF Q#.35-13]** How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q#.35-13] have/has had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  
  - b. **[IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16]** Do you think there has been an increase in the market share of 95 AFUE and higher systems among homes **not participating** in the [SAY NAMES OF IOU PROGRAMS MENTIONED IN Q.#15b OR 16]?
  
  - c. **[IF YES TO B]** How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR 16] have/has had on this increase in market share of 95 AFUE or higher systems among homes **not participating** in the programs? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  
  - d. **[IF GREATER THAN 5 TO C]** Are there any regions in California where you believe the program has had more influence than in the state as a whole on the market share of 95 AFUE or higher systems among homes **not participating** in the programs? [IF YES] Which regions?
  
  - e. How much influence would you say changes in building code have had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

- f. How much influence would you say increasing energy prices have had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
- g. How much influence would you say the decline in the housing market has had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

### Installation Practices

Now I have a few questions about typical installation practices in new single family homes in California.

- 24. How do you typically define energy efficient or high efficiency HVAC systems, other than high SEER and AFUE ratings? [PROBE FOR SPECIFICS—E.G., HOW THEY ARE INSTALLED—REFRIGERANT CHARGE, DUCT SEALING AND TESTING, TESTING AIRFLOW ACROSS THE COIL, SIZING]
- 25. Based on your definition of energy efficient or high energy HVAC systems, about what percentage of the HVAC systems in California single family new construction were high-efficiency installations in 2005, considering things other than SEER and AFUE ratings? Your best estimate is fine. How about in 2006? In 2007? In 2008?  
\_\_\_\_\_ % 2005  
\_\_\_\_\_ % 2006  
\_\_\_\_\_ % 2007  
\_\_\_\_\_ % 2008
- 26. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? Are there any other factors that come to mind?
- 27. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? Are there any other factors that come to mind?
- 28. [IF % 2008 GREATER THAN % IN 2006 TO Q.#25] You said that the percentage of high-efficiency installations, considering things other than SEER and AFUE ratings, was higher in 2008 than in 2006. [RANDOMIZE A-G, KEEPING B&C&D TOGETHER]

- a. **[IF YES TO ANY OF Q#.35-13]** How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q#.35-13] have/has had on this increase in high-efficiency installations? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
- b. **[IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16]** Do you think there has been an increase in high-efficiency HVAC installations among homes **not participating** in the [SAY NAMES OF IOU PROGRAMS MENTIONED IN Q.#15b OR 16]?
- c. **[IF YES TO B]** How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR 16] have/has had on this increase in high-efficiency installations among homes **not participating** in the programs? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
- d. **[IF GREATER THAN 5 TO C]** Are there any regions in California where you believe the program has had more influence than in the state as a whole on the percentage of or higher systems among homes **not participating** in the programs? [IF YES] Which regions?
- e. How much influence would you say changes in building code have had on this increase in high-efficiency installations? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
- f. How much influence would you say increasing energy prices have had on this increase in high-efficiency installations? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
- g. How much influence would you say the decline in the housing market has had on this increase in high-efficiency installations? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

Now I'd like to talk to you about system costs.

**[SKIP Q.#29 -31 IF DO NOT SELL CENTRAL AC OR AIR SOURCE HEAT PUMPS TO Q.#5]**

29. What was the typical increase in the price to a production builder to improve from a 13 SEER **3 Ton** central air conditioner to a 16 SEER unit in 2005? Your best estimate is fine. How about in 2006? In 2007? In 2008?
- \$ \_\_\_\_\_ From 13 SEER to 16 SEER—2005  
\$ \_\_\_\_\_ From 13 SEER to 16 SEER—2006  
\$ \_\_\_\_\_ From 13 SEER to 16 SEER—2007  
\$ \_\_\_\_\_ From 13 SEER to 16 SEER—2008

30. **[IF THE PRICE DIFFERENCE CHANGED FROM 2006 TO 2008]** What factors are behind the shifts from 2006 to 2008? Are there any other factors that come to mind?
31. **[IF THE PRICE DIFFERENCE CHANGED FROM 2005 TO 2006]** What factors are behind the changes from 2005 to 2006? Are there any other factors that come to mind?

**[SKIP Q.#33 -35 IF DO NOT SELL CENTRAL GAS FURNACES TO Q.#5]**

32. **[IF \$ IN 2008 LESS THAN \$ IN 2006 TO Q.#29]** You said that the price difference between a 13 SEER and 16 SEER 3-Ton central air conditioner, for a production builder, was lower in 2008 than in 2006. **[RANDOMIZE A-E]**
- a. **[IF YES TO ANY OF Q#.35-13]** How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q#.35-13] have/has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
- b. **[IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16]** How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR 16] have/has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
- c. How much influence would you say changes in building code have had on this in decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
- d. How much influence would you say increasing energy prices have had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

- e. How much influence would you say the decline in the housing market has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
33. What was the typical increase in the price to a production builder to improve from an 80 AFUE, 80,000 BTU gas furnace to a 95 AFUE unit in 2005? Your best estimate is fine. How about in 2006? In 2007? In 2008?
- \$ \_\_\_\_\_ From 80 AFUE to 95 AFUE—2005
- \$ \_\_\_\_\_ From 80 AFUE to 95 AFUE—2006
- \$ \_\_\_\_\_ From 80 AFUE to 95 AFUE—2007
- \$ \_\_\_\_\_ From 80 AFUE to 95 AFUE—2008
34. **[IF THE PRICE DIFFERENCE CHANGED FROM 2006 TO 2008]** What factors are behind the shifts from 2006 to 2008? Are there any other factors that come to mind?
35. **[IF THE PRICE DIFFERENCE CHANGED FROM 2005 TO 2006]** What factors are behind the shifts from 2005 to 2006? Are there any other factors that come to mind?
36. **[IF \$ IN 2008 LESS THAN \$ IN 2006 TO Q.#33]** You said that the price difference between an 80 AFUE, 80,000 BTU gas furnace and 95 AFUE unit, for a production builder, was lower in 2008 than in 2006. **[RANDOMIZE A-E]**
- a. **[IF YES TO ANY OF Q#.35-13]** How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q#.35-13] have/has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
- b. **[IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16]** How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR 16] have/has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
- c. How much influence would you say changes in building code have had on this in decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
- d. How much influence would you say increasing energy prices have had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

e. How much influence would you say the decline in the housing market has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

37. **[DO NOT ASK IF DO NOT SELL CENTRAL AC OR AIR SOURCE HEAT PUMPS TO Q.#5]** Which distributors would you say account for the greatest market share of central air conditioners and air-source heat pumps installed in single family new homes in California? [MULTIPLE RESPONSE—TRY TO GET NAME AND LOCATION]

38. **[DO NOT ASK IF DO NOT SELL CENTRAL GAS FURNACES TO Q.#5]** Which distributors would you say account for the greatest market share of central gas furnaces installed in single family new homes in California? [MULTIPLE RESPONSE—TRY TO GET NAME AND LOCATION]

39. Do you know any other distributors of HVAC equipment who have been involved with homes participating in the investor-owned utility-sponsored new construction programs?

Yes

No [Thank and end interview]

DK/refused [Thank and end interview]

40. Have you discussed energy efficient HVAC equipment with distributors who have been involved with homes participating in the investor-owned utility-sponsored programs?

Yes

No [Thank and end interview]

DK/refused [Thank and end interview]

41. In what venue or setting have you discussed energy efficient HVAC equipment with distributors who have been involved with homes participating in the investor-owned utility-sponsored programs? [MULTIPLE RESPONSE, DO NOT READ]

Phone conversations

Conferences

Building sites

Via email

Other [SPECIFY: \_\_\_\_\_]

**That concludes the interview. Thank you very much!**

## **A.6 Lighting Fixture and Control Distributor Interview Guide**

### **Electrical Fixtures and Controls Distributor Interview Guide for IOU RNC Codes & Standards Programs—Market Effects (Final)**

Interviewer:

Date:

Subject Name:

Organization:

Program(s) responsible for:

Hello, my name is \_\_\_\_\_ from Itron, Inc and I am calling on behalf of the California Public Utilities Commission (CPUC). The CPUC has asked us to conduct interviews with distributors of lighting fixtures and controls in order to better understand the residential new construction market, energy efficiency and the California utilities' residential new construction programs. This survey is extremely important to the CPUC's understanding of the new construction market. May I please speak with the person who knows the most about electrical fixtures and controls your firm sells for installation in new homes in California?

Yes [CONTINUE]

No/DK [TERMINATE]

Refused [TERMINATE]

May I please have the person's name and job title?

[RECORD NAME AND JOB TITLE]

[WHEN CORRECT PERSON IS ON-LINE:]

Hello, my name is \_\_\_\_\_ from Itron, Inc. and I am calling on behalf of the California Public Utilities Commission (CPUC). The CPUC has asked us to conduct interviews with distributors of

lighting fixtures and controls in order to better understand the residential new construction market, energy efficiency and the California utilities' residential new construction programs. Can I confirm that you're the person who knows the most about electrical fixtures and controls your firm sells for installation in new homes in California?

Yes [CONTINUE]

No/DK [ASK TO SPEAK WITH CORRECT PERSON, OR TERMINATE]

Refused [TERMINATE]

This survey is extremely important to the CPUC's understanding of the new construction market. All your answers are held confidential--that is, we never link any information to a particular person or company.

Is now a good time?

Yes [CONTINUE]

No [SET UP CALLBACK]

DK/refused [TERMINATE]

[IF INTERVIEWEE ASKS ABOUT THE STUDY'S SPONSORSHIP, REFER TO AYAT OSMAN, CPUC, AT (415) 703-5953]

## Introduction

1. I'd like to begin by learning a little more about your company. How many branches do you have for electrical fixtures and controls in California?

Branches \_\_\_\_\_

2. How many employees do you have?

Employees \_\_\_\_\_

3. [IF MORE THAN ONE BRANCH TO Q.#1] Which geographic areas of California does your location serve?

Geographic areas served \_\_\_\_\_



4. Are there any specialty or niche lighting markets that you serve? [IF YES] What are they?

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**Segments Served and Sales Data**

I now have a few questions about the markets you serve in California.

5. Which of the following types of interior lighting fixtures do you distribute or sell for residential use? [INTERVIEWER: MAKE SURE THEY ARE A DISTRIBUTOR OR MANUFACTURER’S REPRESENTATIVE, NOT AN INSTALLER]

Type of lighting fixture	Distribute (Y / N)
a. Pin-based CFL	
b. Fluorescent tube	
c. Screw based	
d. Other [specify: ]	
e. Other [specify: ]	

6. Approximately how many interior residential lighting fixtures did your company sell in 2005 in the single family new construction market in California? Your best estimate is fine. How about 2006? How about 2007? How many do you expect to sell in 2008? [NOTE: IF THEY SAY THEY CANNOT SPEAK FOR ALL OF CALIFORNIA, ASK THEM TO SPEAK FOR THE GEOGRAPHIC ARE SERVED BY THEIR OFFICE THROUGHOUT THE REST OF THE INTERVIEW]

2005 Unit Sales                      2006 Unit Sales                      2007 Unit Sales                      2008 Unit Sales

\_\_\_\_\_ Interior lighting fixtures

7. Which of the following types of exterior lighting fixtures do you distribute or sell for residential use?

Type of lighting fixture	Distribute (Y / N)
a. Pin-based CFL	
b. Fluorescent tube	
c. Screw based	

d.	Other [specify: _____ ]	
e.	Other [specify: _____ ]	

8. Approximately how many exterior residential lighting fixtures did your company sell in 2005 in the single family new construction market California? Your best estimate is fine. How about 2006? How about 2007? How many do you expect to sell in 2008? [NOTE: IF THEY SAY THEY CANNOT SPEAK FOR ALL OF CALIFORNIA, ASK THEM TO SPEAK FOR THE GEOGRAPHIC ARE SERVED BY THEIR OFFICE THROUGHOUT THE REST OF THE INTERVIEW]

2005 Unit Sales                      2006 Unit Sales                      2007 Unit Sales                      2008 Unit Sales

\_\_\_\_\_                      \_\_\_\_\_                      \_\_\_\_\_                      \_\_\_\_\_ Exterior lighting fixtures

[IF DO NOT SELL LIGHTING FIXTURES TERMINATE.]

I'd like your help breaking overall residential sales into types of fixtures.

9. Approximately what percentage of the interior residential lighting fixtures you sold in 2005 in the single family new construction market in California was [INSERT LIGHTING FIXTURE DISTRIBUTED FROM Q#5.a - 5.e]? Your best estimate is fine. [REPEAT FOR ALL LIGHTING FIXTURES DISTRIBUTED FROM Q#5.a - 5.e] How about 2006? How about 2007? How about what you expect to sell in 2008? [NOTE: IF THEY SAY THEY CANNOT SPEAK FOR ALL OF CALIFORNIA, ASK THEM TO SPEAK FOR THE GEOGRAPHIC ARE SERVED BY THEIR OFFICE THROUGHOUT THE REST OF THE INTERVIEW]

Type of lighting fixture	2005	2006	2007	2008
a. Pin-based CFL				
b. Fluorescent tube				
c. Screw based				
d. Other [specify: _____ ]				
e. Other [specify: _____ ]				
TOTAL	100%	100%	100%	100%

10. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?

11. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?

12. Approximately what percentage of the exterior residential lighting fixtures you sold in 2005 in the single family new construction market in California was [INSERT LIGHTING FIXTURE DISTRIBUTED FROM Q#7.a - 7.e]? Your best estimate is fine. [REPEAT FOR ALL LIGHTING FIXTURES DISTRIBUTED FROM Q#7.a - 7.e] How about 2006? How about 2007? How about what you expect to sell in 2008? [NOTE: IF THEY SAY THEY CANNOT SPEAK FOR ALL OF CALIFORNIA, ASK THEM TO SPEAK FOR THE GEOGRAPHIC ARE SERVED BY THEIR OFFICE THROUGHOUT THE REST OF THE INTERVIEW]

Type of lighting fixture	2005	2006	2007	2008
a. Pin-based CFL				
b. Fluorescent tube				
c. Screw based				
d. Other [specify: ]				
e. Other [specify: ]				
<b>TOTAL</b>	100%	100%	100%	100%

13. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?

14. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?

15. Approximately what percentage of the interior residential lighting fixtures you sold in 2005 in the single family new construction market in California were sold with occupant sensors? Your best estimate is fine. How about 2006? How about 2007? How many do you expect to sell in 2008?

	2005 (%)	2006 (%)	2007 (%)	2008 (%)
Interior lighting fixtures sold with occupant sensors				

16. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?

17. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?

18. Approximately what percentage of the exterior residential lighting fixtures you sold in 2005 in the single family new construction market in California had photocontrols and motion sensors? Your best estimate is fine. How about 2006? How about 2007? How many do you expect to sell in 2008?

	2005 (%)	2006 (%)	2007 (%)	2008 (%)
Exterior lighting fixtures with photocontrols and motion sensors				

19. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?
20. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?

**Costs**

Now I'd like to talk to you about lighting fixture costs.

21. Holding all features of a fixture constant, what was the typical increase in the price to a production builder to change from an interior screw based fixture to a pin-based CFL fixture? Your best estimate is fine. How about 2006? 2007? 2008?

Year	Interior Screw-Based and Pin-Based CFL Fixture Price Difference
2005	\$
2006	\$
2007	\$
2008	\$

22. [IF THE PRICE DIFFERENCE CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?
23. [IF THE PRICE DIFFERENCE CHANGED FROM 2005 TO 2006] What factors are behind the changes from 2005 to 2006? What others?

24. Holding all features of a fixture constant, what was the typical increase in the price to a production builder to change from an exterior screw based fixture to a pin-based CFL fixture? Your best estimate is fine. How about 2006? 2007? 2008?

Year	Exterior Screw-Based and Pin-Based CFL Fixture Price Difference
2005	\$
2006	\$
2007	\$
2008	\$

25. [IF THE PRICE DIFFERENCE CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?

26. [IF THE PRICE DIFFERENCE CHANGED FROM 2005 TO 2006] What factors are behind the changes from 2005 to 2006? What others?

27. [ASK Q#27 - 29 IF % OF INTERIOR FIXTURES SOLD WITH OCCUPANT SENSORS IN 2008 GT IN 2005 TO Q#15; OTHERWISE SKIP TO Q#30] Holding all features of a fixture constant, what was the typical increase in the price to a production builder to change from an interior screw based fixture without an occupant sensor to a screw based fixture with occupant sensors? Your best estimate is fine. How about 2006? 2007? 2008?

Year	Interior Fixture with and without occupant sensors Price Difference
2005	\$
2006	\$
2007	\$
2008	\$

28. [IF THE PRICE DIFFERENCE CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?

29. [IF THE PRICE DIFFERENCE CHANGED FROM 2005 TO 2006] What factors are behind the changes from 2005 to 2006? What others?

30. [ASK Q#30 - 32 IF % OF EXTERIOR FIXTURES SOLD WITH PHOTOCONTROLS AND MOTION SENSORS IN 2008 GT IN 2005 to Q#18; OTHERWISE SKIP TO Q#35]  
 Holding all features of a fixture constant, what was the typical increase in the price to a production builder to change from an exterior fixture without photocontrols and motion sensors to a fixture with photocontrols and motion sensors? Your best estimate is fine. How about 2006? 2007? 2008?

Year	Exterior fixture with and without photocontrols and motion sensors Price Difference
2005	\$
2006	\$
2007	\$
2008	\$

31. [IF THE PRICE DIFFERENCE CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?
32. [IF THE PRICE DIFFERENCE CHANGED FROM 2005 TO 2006] What factors are behind the changes from 2005 to 2006? What others?

**RNC PROGRAM AWARENESS AND PARTICIPATION**

Now I'm going to read you the names of some programs that encourage the installation of energy-efficient features in new homes, and I'm going to ask you if you have heard of them. [RANDOMIZE q#35-14]

- 33. LEED for Homes
  - 34. ENERGY STAR Homes
  - 35. Solar Initiative
  - 36. Environments for Living
  - 37. ComfortWise
  - 38. Federal Tax Credits for efficient new homes
  - 39. Programs sponsored by municipal utilities such as SMUD (Sacramento Utility District) and LADWP (Los Angeles Department of Water and Power)
  - 40. Building America
  - 41. Smart Home
42. Now I'm going to ask you about some Investor-owned Utility-sponsored programs.

EE. Have you heard of any Investor-owned Utility residential new construction programs sponsored by PG&E, SCE, SCG&E or SCG? [IF YES, CONTINUE; IF NO, SKIP TO Q#45]

FF. Which investor-owned utility-sponsored residential new construction programs have you heard of? [MULTIPLE RESPONSE; DO NOT READ]

NO/NONE/DK [SKIP TO Q#45]

PG&E Residential New Construction

SCE New Homes

SDG&E and SCG Advanced Home

Other [SPECIFY]: \_\_\_\_\_

[IF RESPONDENT DOES **NOT** NAME ONE OF THE THREE PROGRAMS, GO TO Q#45]

43. [IF NO TO Q#15a] Have you heard of any of the following investor-owned utility-sponsored programs? [READ LIST]

PG&E Residential New Construction

SCE New Homes

SDG&E and SCG Advanced Home

### Reasons for changes in the market

[RANDOMIZE Q.#19-47]

44. [IF % OF INTERIOR, PIN-BASED CFL LIGHTING FIXTURES IN 2008 GT 2006 TO Q.#9] You said that the market share of interior lighting fixtures that were pin-based CFL fixtures in new single family housing was greater in 2008 than in 2006. [RANDOMIZE A-G, KEEPING B & C&D TOGETHER]

- a. [IF YES TO ANY OF Q#.35-13] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q#.35-13] have/has had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
- b. [IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16] Do you think there has been an increase in the market share of interior lighting fixtures that were pin-

- based CFL fixtures among homes **not participating** in the [SAY NAMES OF IOU PROGRAMS MENTIONED IN Q.#15b OR 16]?
- c. [IF YES TO B] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR 16] have/has had on this increase in market share of interior lighting fixtures that were pin-based CFL fixtures among homes **not participating** in the programs? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - d. [IF GREATER THAN 5 TO C] Are there any regions in California where you believe the program has had more influence than in the state as a whole on the market share of interior lighting fixtures that were pin-based CFL fixtures among homes **not participating** in the programs? [IF YES] Which regions?
  - e. How much influence would you say changes in building code have had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - f. How much influence would you say increasing energy prices have had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - g. How much influence would you say the decline in the housing market has had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
45. [% OF EXTERIOR, PIN-BASED CFL LIGHTING FIXTURES IN 2008 GT 2006 TO Q.#12 ] You said that the market share of exterior lighting fixtures that were pin-based CFL fixtures in new single family housing was greater in 2008 than in 2006.  
[RANDOMIZE A-G, KEEPING B & C & D TOGETHER]
- a. [IF YES TO ANY OF Q#.35-13] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q#.35-13] have/has had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - b. [IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16] Do you think there has been an increase in the market share of exterior lighting fixtures that were pin-based CFL fixtures among homes **not participating** in the [SAY NAMES OF IOU PROGRAMS MENTIONED IN Q.#15b OR 16]?
  - c. [IF YES TO B] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR 16] have/has had on this increase in market share of exterior lighting fixtures that were pin-based CFL fixtures among homes **not participating** in the programs? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - d. [IF GREATER THAN 5 TO C] Are there any regions in California where you believe the program has had more influence than in the state as a whole on the market share of exterior lighting fixtures that were pin-based CFL fixtures among homes **not participating** in the programs? [IF YES] Which regions?
  - e. How much influence would you say changes in building code have had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”



- f. How much influence would you say increasing energy prices have had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - g. How much influence would you say the decline in the housing market has had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
46. [IF \$ INTERIOR SCREW-BASED AND PIN-BASED CFL FIXTURE Price Difference IN 2008 LT \$ IN 2006 TO Q.#29] You said that the price difference between an interior screw-based fixture and a pin-based CFL fixture for a production builder, was lower in 2008 than in 2006. [RANDOMIZE A-E]
- a. [IF YES TO ANY OF Q#.35-13] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q#.35-13] have/has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - b. [IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR 16] have/has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - c. How much influence would you say changes in building code have had on this in decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - d. How much influence would you say increasing energy prices have had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - e. How much influence would you say the decline in the housing market has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
47. [IF \$ EXTERIOR SCREW-BASED AND PIN-BASED CFL FIXTURE PRICE DIFFERENCE IN 2008 LT \$ IN 2006 TO Q.#24] You said that the price difference between between an exterior screw-based fixture and a pin-based CFL fixture, for a production builder, was lower in 2008 than in 2006. [RANDOMIZE A-E]
- a. [IF YES TO ANY OF Q#.35-13] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q#.35-13] have/has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - b. [IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR 16] have/has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

- c. How much influence would you say changes in building code have had on this in decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - d. How much influence would you say increasing energy prices have had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - e. How much influence would you say the decline in the housing market has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
48. Which distributors would you say account for the greatest market share of lighting fixtures and controls installed in single family new homes in California? [MULTIPLE RESPONSE—TRY TO GET NAME AND LOCATION]
49. Do you know any other distributors of lighting fixtures and controls who have been involved with homes participating in the investor-owned utility-sponsored new construction programs?
- Yes
  - No [Thank and end interview]
  - DK/refused [Thank and end interview]
50. Have you discussed energy efficient lighting fixtures and controls with distributors who have been involved with homes participating in the investor-owned utility-sponsored programs?
- Yes
  - No [Thank and end interview]
  - DK/refused [Thank and end interview]
51. In what venue or setting have you discussed energy efficient lighting fixtures and controls with distributors who have been involved with homes participating in the investor-owned utility-sponsored programs? [MULTIPLE RESPONSE, DO NOT READ]
- Phone conversations
  - Conferences
  - Building sites
  - Via email
  - Other [SPECIFY: \_\_\_\_\_]

**That concludes the interview. Thank you very much!**

## **A.7 Insulation Distributor Interview Guide**

### **Insulation Distributor Interview Guide for IOU RNC Codes & Standards Programs— Market Effects (Final)**

Interviewer:

Date:

Subject Name:

Organization:

Program(s) responsible for:

Hello, my name is \_\_\_\_\_ from Itron, Inc and I am calling on behalf of the California Public Utilities Commission (CPUC). The CPUC has asked us to conduct interviews with insulation distributors and manufacturers' representatives in order to better understand the residential new construction market, energy efficiency and the California utilities' residential new construction programs. This survey is extremely important to the CPUC's understanding of the new construction market. May I please speak with the person who knows the most about insulation your firm sells for installation in new homes in California?

Yes [CONTINUE]

No/DK [TERMINATE]

Refused [TERMINATE]

May I please have the person's name and job title?

[RECORD NAME AND JOB TITLE]

[WHEN CORRECT PERSON IS ON-LINE:]

Hello, my name is \_\_\_\_\_ from Itron, Inc. and I am calling on behalf of the California Public Utilities Commission (CPUC). The CPUC has asked us to conduct interviews with insulation distributors and manufacturers' representatives in order to better understand the residential new

construction market, energy efficiency and the California utilities' residential new construction programs. Can I confirm that you're the person who knows the most about insulation your firm sells for installation in new homes in California?

Yes [CONTINUE]

No/DK [ASK TO SPEAK WITH CORRECT PERSON, OR TERMINATE]

Refused [TERMINATE]

This survey is extremely important to the CPUC's understanding of the new construction market. All your answers are held confidential--that is, we never link any information to a particular person or company.

Is now a good time?

Yes [CONTINUE]

No [SET UP CALLBACK]

DK/refused [TERMINATE]

[IF INTERVIEWEE ASKS ABOUT THE STUDY'S SPONSORSHIP, REFER TO AYAT OSMAN, CPUC, AT (415) 703-5953]

## Introduction

1. I'd like to begin by learning a little more about your company. How many branches do you have for residential insulation in California?

Branches \_\_\_\_\_

2. How many employees do you have?

Employees \_\_\_\_\_

3. [IF MORE THAN ONE BRANCH TO Q.#1] Which geographic areas of California does your location serve?

Geographic areas served \_\_\_\_\_

4. Does your company also install insulation, or are you strictly a distributor?

Yes, install  
 No, strictly a distributor

5. What types of insulation do you distribute for residential use?

Type of Insulation	Distribute (Y / N)
a. Fiberglass batts / rolls	
b. Blown fiberglass	
c. Blown cellulose	
d. Spray foam	
e. Rigid board	
f. Other [specify: ]	
g. Other [specify: ]	

[IF DO NOT SELL INSULATION FOR RESIDENTIAL USE TERMINATE.]

**Segments Served and Sales Data**

I now have a few questions about the markets you serve in California.

6. Approximately what percentage of the insulation your company sold in 2005 in the single family new construction market in California was [INSERT INSULATION DISTRIBUTED FROM Q#5.a-5.e]? Your best estimate is fine. [REPEAT FOR ALL INSULATION DISTRIBUTED IN Q#5.a-5.e] How about 2006? How about 2007? How about what you expect to sell in 2008? [NOTE: IF THEY SAY THEY CANNOT SPEAK FOR ALL OF CALIFORNIA, ASK THEM TO SPEAK FOR THE GEOGRAPHIC ARE SERVED BY THEIR OFFICE THROUGHOUT THE REST OF THE INTERVIEW]

Type of Insulation	2005	2006	2007	2008
a. Fiberglass batts / rolls				
b. Blown fiberglass				
c. Blown cellulose				
d. Spray foam				
e. Rigid board				
f. Other [specify: ]				
g. Other [specify: ]				
<b>TOTAL</b>	100%	100%	100%	100%

7. Of the insulation your company sold that was used for ceiling insulation applications in 2005 in the single family new construction market California,

approximately what percentage was [INSERT INSULATION DISTRIBUTED FROM Q#5.a-5.e]? Your best estimate is fine. [REPEAT FOR ALL INSULATION DISTRIBUTED IN Q#5.a-5.e] How about 2006? How about 2007? How about what you expect to sell in 2008?

Type of Insulation	2005	2006	2007	2008
a. Fiberglass batts / rolls				
b. Blown fiberglass				
c. Blown cellulose				
d. Spray foam				
e. Rigid board				
f. Other [specify: ]				
g. Other [specify: ]				
TOTAL	100%	100%	100%	100%

8. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?
  
9. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?
  
10. Of the insulation your company sold that was used for wall insulation applications in 2005 in the single family new construction market California, approximately what percentage was [INSERT INSULATION DISTRIBUTED FROM Q#5.a-5.e]? Your best estimate is fine. [REPEAT FOR ALL INSULATION DISTRIBUTED IN Q#5.a-5.e] How about 2006? How about 2007? How about what you expect to sell in 2008?

Type of Insulation	2005	2006	2007	2008
a. Fiberglass batts / rolls				
b. Blown fiberglass				
c. Blown cellulose				
d. Spray foam				
e. Rigid board				
f. Other [specify: ]				
g. Other [specify: ]				
TOTAL	100%	100%	100%	100%

11. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?

12. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?

I'd like your help breaking overall residential sales into efficiency levels.

13. Approximately what percentage of the insulation your company sold that was used to insulate ceilings in the single family new construction market California during 2005, 2006, 2007, and 2008 had R-values of ... [READ EACH CATEGORY; FILL IN BLANK FOR EACH]. Your best estimate is fine.

<u>2005 Percent</u>	<u>2006 Percent</u>	<u>2007 Percent</u>	<u>2008 Percent</u>	<u>R-values</u>
_____	_____	_____	_____	Below R-30
_____	_____	_____	_____	R-30 to R-37
_____	_____	_____	_____	R-38 or higher
100%	100%	100%	100%	

14. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?

15. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?

16. Approximately what percentage of the insulation your company sold that was used to insulate ceilings in the single family new construction market California during 2005, 2006, 2007, and 2008 was better than the minimum U-value for Title 24. Your best estimate is fine.

<u>2005 Percent</u>	<u>2006 Percent</u>	<u>2007 Percent</u>	<u>2008 Percent</u>	
_____	_____	_____	_____	Better than the min. U-value

17. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?

18. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?

19. Approximately what percentage of the insulation your company sold that was used to insulate walls in the single family new construction market California during 2005, 2006, 2007, and 2008 had R-values... [READ EACH CATEGORY; FILL IN BLANK FOR EACH]. Your best estimate is fine.

<u>2005 Percent</u>	<u>2006 Percent</u>	<u>2007 Percent</u>	<u>2008 Percent</u>	<u>R-value</u>
_____	_____	_____	_____	Below R-13
_____	_____	_____	_____	R-13 to R-20
_____	_____	_____	_____	R-21 or higher
100%	100%	100%	100%	

20. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?

21. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?

22. Approximately what percentage of the insulation your company sold that was used to insulate walls in the single family new construction market California during 2005, 2006, 2007, and 2008 was better than the minimum U-value for Title 24. Your best estimate is fine.

<u>2005 Percent</u>	<u>2006 Percent</u>	<u>2007 Percent</u>	<u>2008 Percent</u>	
_____	_____	_____	_____	Better than the min. U-value

23. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?

24. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?

**Installation Practices**

[ASK ‘INSTALLATION PRACTICES’ SERIES IF RESPONDED ‘YES’ TO Q#4. OTHERWISE, SKIP TO Q#29]



Now I have a few questions about typical installation practices in new single family homes in California.

25. [ASK FOR MOST COMMONLY DISTRIBUTED CEILING INSULATION IN Q#7]  
What does proper installation of [MOST COMMONLY DISTRIBUTED CEILING INSULATION IN Q#7] in ceiling applications consist of? [PROBE FOR SPECIFICS]
  
26. Based on your definition, about what percentage of [MOST COMMONLY DISTRIBUTED CEILING INSULATION IN Q#7] insulation you installed for ceiling applications in California single family new construction was properly installed in 2005. How about 2006? 2007? 2008?  
\_\_\_\_\_ % 2005  
\_\_\_\_\_ % 2006  
\_\_\_\_\_ % 2007  
\_\_\_\_\_ % 2008
  
27. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?
  
28. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?
  
29. [ASK FOR MOST COMMONLY DISTRIBUTED WALL INSULATION IN Q#10]  
What does proper installation of [MOST COMMONLY DISTRIBUTED CEILING INSULATION IN Q#10] in wall applications consist of? [PROBE FOR SPECIFICS]
  
30. Based on your definition, about what percentage of [MOST COMMONLY DISTRIBUTED WALL INSULATION IN Q#10] insulation you installed for wall applications in California single family new construction were properly installed in 2005. How about 2006? 2007? 2008?  
\_\_\_\_\_ % 2005  
\_\_\_\_\_ % 2006  
\_\_\_\_\_ % 2007  
\_\_\_\_\_ % 2008
  
31. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?

32. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006]] What factors are behind the shifts from 2005 to 2006? What others?

33. Are you familiar with the Quality Insulation Installation (QII) compliance option for Title 24?

Yes

No

Don't know

34. [IF YES TO Q#33] Approximately what percentage of the insulation your company installed in single family new construction was installed and certified as meeting QII standards, 2005 to 2008?

\_\_\_\_\_ % 2005

\_\_\_\_\_ % 2006

\_\_\_\_\_ % 2007

\_\_\_\_\_ % 2008

### **Insulation Costs**

Now I'd like to talk to you about insulation costs.

35. [ASK FOR MOST COMMONLY DISTRIBUTED CEILING INSULATION IN Q#7] For [MOST COMMONLY DISTRIBUTED CEILING INSULATION IN Q#7] insulation, what was the typical increase in the price to a production builder to improve from R-30 to R-38 ceiling insulation in 2005? Your best estimate is fine. How about 2006? 2007? 2008?

Year	R-30 TO R-38 Ceiling Insulation Price Difference
2005	\$
2006	\$
2007	\$
2008	\$

36. [IF THE PRICE DIFFERENCE CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?

37. [IF THE PRICE DIFFERENCE CHANGED FROM 2005 TO 2006] What factors are behind the changes from 2005 to 2006? What others?

38. [ASK FOR MOST COMMONLY DISTRIBUTED WALL INSULATION IN Q#10] For [MOST COMMONLY DISTRIBUTED WALL INSULATION IN Q#10] insulation, what was the typical increase in the price to a production builder to improve from R-13 to R-21 wall insulation in 2005? How about 2006? 2007? 2008?

Year	R-13 TO R-21 Wall Insulation Price Difference
2005	\$
2006	\$
2007	\$
2008	\$

39. [IF THE PRICE DIFFERENCE CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?

40. [IF THE PRICE DIFFERENCE CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?

## RNC PROGRAM AWARENESS AND PARTICIPATION

Now I'm going to read you the names of some programs that encourage the installation of energy-efficient features in new homes, and I'm going to ask you if you have heard of them. [RANDOMIZE q#35-14]

41. LEED for Homes
42. ENERGY STAR Homes
43. Solar Initiative
44. Environments for Living
45. ComfortWise
46. Federal Tax Credits for efficient new homes
47. Programs sponsored by municipal utilities such as SMUD (Sacramento Utility District) and LADWP (Los Angeles Department of Water and Power)
48. Building America
49. Smart Home

50. Now I'm going to ask you about some Investor-owned Utility-sponsored programs.

GG. Have you heard of any Investor-owned Utility residential new construction programs sponsored by PG&E, SCE, SCG&E or SCG? [IF YES, CONTINUE; IF NO, SKIP TO Q#45]

HH. Which investor-owned utility-sponsored residential new construction programs have you heard of? [MULTIPLE RESPONSE; DO NOT READ]

NO/NONE/DK [SKIP TO Q#45]

PG&E Residential New Construction

SCE New Homes

SDG&E and SCG Advanced Home

Other [SPECIFY]: \_\_\_\_\_

[IF RESPONDENT DOES **NOT** NAME ONE OF THE THREE PROGRAMS, GO TO Q#45]

51. [IF NO TO Q#15a] Have you heard of any of the following investor-owned utility-sponsored programs? [READ LIST]

PG&E Residential New Construction

SCE New Homes

SDG&E and SCG Advanced Home

## Reasons for changes in the market

[RANDOMIZE Q.#19- 36]

52. [IF CEILING INSULATION EXCEEDING TITLE 24 IN 2008 GT EXCEEDING TITLE 24 IN 2006 TO Q.#16] You said that the market share of ceiling insulation that was better than the minimum U-value for Title 24 in new single family housing was greater in 2008 than in 2006. [RANDOMIZE A-G, KEEPING B &C&D TOGETHER]
- a. [IF YES TO ANY OF Q#.35-13] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q#.35-13] have/has had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - b. [IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16] Do you think there has been an increase in the market share of ceiling insulation was better than the minimum U-value for Title 24 among homes **not participating** in the [SAY NAMES OF IOU PROGRAMS MENTIONED IN Q.#15b OR 16]?
  - c. [IF YES TO B] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR 16] have/has had on this increase in market share of ceiling insulation that was better than the minimum U-value for Title 24 among homes **not participating** in the programs? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - d. [IF GREATER THAN 5 TO C] Are there any regions in California where you believe the program has had more influence than in the state as a whole on the market share of ceiling insulation that was better than the minimum U-value for Title 24 among homes **not participating** in the programs? [IF YES] Which regions?
  - e. How much influence would you say changes in building code have had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - f. How much influence would you say increasing energy prices have had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - g. How much influence would you say the decline in the housing market has had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
53. [IF WALL INSULATION EXCEEDING TITLE 24 IN 2008 GT WALL INSULATION EXCEEDING TITLE 24 IN 2006 TO Q.#22] You said that the market share of wall insulation that was better than the minimum U-value for Title 24 in new single family housing was greater in 2008 than in 2006. [RANDOMIZE A-G, KEEPING B &C&D TOGETHER]
- a. [IF YES TO ANY OF Q#.35-13] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q#.35-13] have/has had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

- b. [IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16] Do you think there has been an increase in the market share of wall insulation that was better than the minimum U-value for Title 24 among homes **not participating** in the [SAY NAMES OF IOU PROGRAMS MENTIONED IN Q.#15b OR 16]?
  - c. [IF YES TO B] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR 16] have/has had on this increase in market share of wall insulation that was better than the minimum U-value for Title 24 among homes **not participating** in the programs? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - d. [IF GREATER THAN 5 TO C] Are there any regions in California where you believe the program has had more influence than in the state as a whole on the market share of wall insulation that was better than the minimum U-value for Title 24 among homes **not participating** in the programs? [IF YES] Which regions?
  - e. How much influence would you say changes in building code have had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - f. How much influence would you say increasing energy prices have had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - g. How much influence would you say the decline in the housing market has had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
54. [IF % 2008 GT % IN 2006 TO Q.#34] You said that the percentage of the insulation your company installed in single family new construction that was installed and certified as meeting Quality Insulation Installation standards was higher in 2008 than in 2006. [RANDOMIZE A-G, KEEPING B & C & D TOGETHER]
- a. [IF YES TO ANY OF Q#.35-13] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q#.35-13] have/has had on this increase in certified Quality Insulation Installations? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - b. [IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16] Do you think there has been an increase in certified Quality Insulation Installations among homes **not participating** in the [SAY NAMES OF IOU PROGRAMS MENTIONED IN Q.#15b OR 16]?
  - c. [IF YES TO B] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR 16] have/has had on this increase in certified Quality Insulation Installations among homes **not participating** in the programs? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - d. [IF GREATER THAN 5 TO C] Are there any regions in California where you believe the program has had more influence than in the state as a whole on the percentage certified Quality Insulation Installations among homes **not participating** in the programs? [IF YES] Which regions?

- e. How much influence would you say changes in building code have had on this increase in certified Quality Insulation Installations? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - f. How much influence would you say increasing energy prices have had on this increase in certified Quality Insulation Installations? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - g. How much influence would you say the decline in the housing market has had on this increase in certified Quality Insulation Installations? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
55. [IF \$ CEILING INSULATION R-30 to R-38 Price Difference IN 2008 LT \$ IN 2006 TO Q.#29] For [MOST COMMONLY DISTRIBUTED CEILING INSULATION IN Q#7] insulation , you said that the price difference between R-30 and R-38 ceiling insulation, for a production builder, was lower in 2008 than in 2006. [RANDOMIZE A-E]
- a. [IF YES TO ANY OF Q#.35-13] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q#.35-13] have/has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - b. [IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR 16] have/has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - c. How much influence would you say changes in building code have had on this in decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - d. How much influence would you say increasing energy prices have had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - e. How much influence would you say the decline in the housing market has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
56. [IF \$ WALL INSULATION R-13 to R-21 PRICE DIFFERENCE IN 2008 LT \$ IN 2006 TO Q.#33] For [MOST COMMONLY DISTRIBUTED WALL INSULATION IN Q#10], You said that the price difference between a R-13 and R-21 wall insulation, for a production builder, was lower in 2008 than in 2006. [RANDOMIZE A-E]
- a. [IF YES TO ANY OF Q#.35-13] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q#.35-13] have/has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - b. [IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR

- 16] have/has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
- c. How much influence would you say changes in building code have had on this in decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - d. How much influence would you say increasing energy prices have had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - e. How much influence would you say the decline in the housing market has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
57. Which distributors would you say account for the greatest market share of insulation installed in single family new homes in California, or in your part of California?  
[MULTIPLE RESPONSE—TRY TO GET NAME AND LOCATION]
58. Do you know any other distributors of insulation who have been involved with homes participating in the investor-owned utility-sponsored new construction programs?
- Yes
  - No [Thank and end interview]
  - DK/refused [Thank and end interview]
59. Have you discussed energy efficient insulation or insulation practices with distributors who have been involved with homes participating in the investor-owned utility-sponsored programs?
- Yes
  - No [Thank and end interview]
  - DK/refused [Thank and end interview]
60. In what venue or setting have you discussed energy efficient insulation or insulation practices with distributors who have been involved with homes participating in the investor-owned utility-sponsored programs? [MULTIPLE RESPONSE, DO NOT READ]
- Phone conversations
  - Conferences
  - Building sites
  - Via email
  - Other [SPECIFY: \_\_\_\_\_]



**That concludes the interview. Thank you very much!**

## A.8 Window Distributor Interview Guide

### Window Distributor Interview Guide for IOU RNC Codes & Standards Programs— Market Effects

Interviewer:

Date:

Subject Name:

Organization:

Program(s) responsible for:

Hello, my name is \_\_\_\_\_ from Itron, Inc and I am calling on behalf of the California Public Utilities Commission (CPUC). The CPUC has asked us to conduct interviews with window distributors and manufacturers' representatives in order to better understand the residential new construction market, energy efficiency and the California utilities' residential new construction programs. This survey is extremely important to the CPUC's understanding of the new construction market. May I please speak with the person who knows the most about windows your firm sells for installation in new homes in California?

Yes [CONTINUE]

No/DK [TERMINATE]

Refused [TERMINATE]

May I please have the person's name and job title?

[RECORD NAME AND JOB TITLE]

[WHEN CORRECT PERSON IS ON-LINE:]

Hello, my name is \_\_\_\_\_ from Itron, Inc. and I am calling on behalf of the California Public Utilities Commission (CPUC). The CPUC has asked us to conduct interviews with window distributors and manufacturers' representatives in order to better understand the residential new construction market, energy efficiency and the California utilities' residential new construction

programs. Can I confirm that you're the person who knows the most about windows your firm sells for installation in new homes in California?

Yes [CONTINUE]

No/DK [ASK TO SPEAK WITH CORRECT PERSON, OR TERMINATE]

Refused [TERMINATE]

This survey is extremely important to the CPUC's understanding of the new construction market. All your answers are held confidential--that is, we never link any information to a particular person or company.

Is now a good time?

Yes [CONTINUE]

No [SET UP CALLBACK]

DK/refused [TERMINATE]

[IF INTERVIEWEE ASKS ABOUT THE STUDY'S SPONSORSHIP, REFER TO AYAT OSMAN, CPUC, AT (415) 703-5953]

## Introduction

1. I'd like to begin by learning a little more about your company. How many branches do you have for residential windows in California?

Branches

---

2. How many employees do you have?

Employees

---

3. [IF MORE THAN ONE BRANCH TO Q.#1] Which geographic areas of California does your location serve?

Geographic areas served

---

4. Which brands do you distribute that have residential product lines?

---

---

- 
5. Are there any specialty or niche window markets that you serve? [IF YES] What are they?

---



---



---

**Segments Served and Sales Data**

I now have a few questions about the markets you serve in California.

6. Approximately how many residential window units did your company sell in 2005 in the single family new construction market California? Your best estimate is fine. How about 2006? How about 2007? How many do you expect to sell in 2008? [NOTE: IF THEY SAY THEY CANNOT SPEAK FOR ALL OF CALIFORNIA, ASK THEM TO SPEAK FOR THE GEOGRAPHIC ARE SERVED BY THEIR OFFICE THROUGHOUT THE REST OF THE INTERVIEW]

2005 Unit Sales	2006 Unit Sales	2007 Unit Sales	2008 Unit Sales	
_____	_____	_____	_____	Window units

[IF DO NOT SELL WINDOWS TERMINATE.]

I'd like your help breaking overall residential sales into efficiency levels.

7. Approximately what percentage of the residential window units you sold in the single family new construction market California during 2005, 2006, 2007, and 2008 had U-factor ratings of... [READ EACH CATEGORY; FILL IN BLANK FOR EACH]. Your best estimate is fine.

<u>2005 Percent</u>	<u>2006 Percent</u>	<u>2007 Percent</u>	<u>2008 Percent</u>	<u>U-Factor Rating</u>
_____	_____	_____	_____	0.35 U-factor or less

_____	_____	_____	_____	0.36 to 0.40 U-factor
_____	_____	_____	_____	0.41 to 0.60 U-factor
_____	_____	_____	_____	0.61 U-factor or higher
100%	100%	100%	100%	

8. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?
  
9. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?
  
10. Approximately what percentage of the residential window units you sold in the single family new construction market California during 2005, 2006, 2007, and 2008 exceeded Title 24 requirements for U-Factor ratings? Your best estimate is fine.

	<u>2005 Percent</u>	<u>2006 Percent</u>	<u>2007 Percent</u>	<u>2008 Percent</u>	
_____	_____	_____	_____	_____	Exceeded Title 24
requirements					

11. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?
  
12. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?
  
13. Approximately what percentage of the residential window units you sold in the single family new construction market California during 2005, 2006, 2007, and 2008 were single pane... [READ EACH CATEGORY; FILL IN BLANK FOR EACH]. Your best estimate is fine.

<u>2005 Percent</u>	<u>2006 Percent</u>	<u>2007 Percent</u>	<u>2008 Percent</u>	<u># of panes</u>
_____	_____	_____	_____	Single pane
_____	_____	_____	_____	Double pane
_____	_____	_____	_____	Triple pane

_____	_____	_____	_____	Quadruple pane
100%	100%	100%	100%	

14. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?
15. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?
16. Approximately what percentage of the multi-pane residential window units you sold in the single family new construction market California during 2005, 2006, 2007, and 2008 were argon filled. Please tell me the percentages for double pane windows first... [READ EACH CATEGORY; FILL IN BLANK FOR EACH]. Your best estimate is fine.

<u>2005 Percent</u>	<u>2006 Percent</u>	<u>2007 Percent</u>	<u>2008 Percent</u>	<u># of panes</u>
_____	_____	_____	_____	Double pane
_____	_____	_____	_____	Triple pane
_____	_____	_____	_____	Quadruple pane

17. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?
18. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?
19. Approximately what percentage of the residential window units you sold in the single family new construction market California during 2005, 2006, 2007, and 2008 were wood frame windows... [READ EACH CATEGORY; FILL IN BLANK FOR EACH]. Your best estimate is fine.

<u>2005 Percent</u>	<u>2006 Percent</u>	<u>2007 Percent</u>	<u>2008 Percent</u>	<u>Type of frame</u>
_____	_____	_____	_____	Wood
_____	_____	_____	_____	Vinyl
_____	_____	_____	_____	Vinyl covered wood
_____	_____	_____	_____	Aluminum

100%                      100%                      100%                      100%

20. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?

21. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?

22. Approximately what percentage of the residential window units you sold in the single family new construction market California during 2005, 2006, 2007, and 2008 had Solar Heat Gain Coefficient (SHGC) ratings of... [READ EACH CATEGORY; FILL IN BLANK FOR EACH]. Your best estimate is fine.

<u>2005 Percent</u>	<u>2006 Percent</u>	<u>2007 Percent</u>	<u>2008 Percent</u>	<u>SHGC Rating</u>
_____	_____	_____	_____	0.40 or below
_____	_____	_____	_____	0.41 to 0.64
_____	_____	_____	_____	0.65 or higher
100%	100%	100%	100%	

23. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?

24. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?

25. Approximately what percentage of the residential window units you sold in the single family new construction market California during 2005, 2006, 2007, and 2008 exceeded Title 24 requirements for Solar Heat Gain Coefficient (SHGC) ratings? Your best estimate is fine.

<u>2005 Percent</u>	<u>2006 Percent</u>	<u>2007 Percent</u>	<u>2008 Percent</u>	
_____	_____	_____	_____	Exceeded Title 24 requirements

26. [IF THE PERCENTAGES CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?

27. [IF THE PERCENTAGES CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?

**Costs**

Now I'd like to talk to you about window costs.

28. Holding framing, SHGC, and all other factors constant, what was the typical increase in the price to a production builder to improve from a 0.60 U-Factor window to a 0.35 U-Factor window in 2005? Your best estimate is fine. How about 2006? 2007? 2008?

Year	0.60 to 0.35 U-Factor Price Difference
2005	\$
2006	\$
2007	\$
2008	\$

29. [IF THE PRICE DIFFERENCE CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?

30. [IF THE PRICE DIFFERENCE CHANGED FROM 2005 TO 2006] What factors are behind the changes from 2005 to 2006? What others?

31. Holding framing, U-Factor and all other factors constant, what was the typical increase in the price to a production builder to improve from a 0.65 SHGC window to a 0.40 SHGC window in 2005? How about 2006? 2007? 2008?



Year	0.65 SHGC to 0.40 SHGC Price Difference
2005	\$
2006	\$
2007	\$
2008	\$

32. [IF THE PRICE DIFFERENCE CHANGED FROM 2006 TO 2008] What factors are behind the shifts from 2006 to 2008? What others?
33. [IF THE PRICE DIFFERENCE CHANGED FROM 2005 TO 2006] What factors are behind the shifts from 2005 to 2006? What others?

### RNC PROGRAM AWARENESS AND PARTICIPATION

Now I'm going to read you the names of some programs that encourage the installation of energy-efficient features in new homes, and I'm going to ask you if you have heard of them. [RANDOMIZE q#35-14]

- 34. LEED for Homes
  - 35. ENERGY STAR Homes
  - 36. Solar Initiative
  - 37. Environments for Living
  - 38. ComfortWise
  - 39. Federal Tax Credits for efficient new homes
  - 40. Programs sponsored by municipal utilities such as SMUD (Sacramento Utility District) and LADWP (Los Angeles Department of Water and Power)
  - 41. Building America
  - 42. Smart Home
43. Now I'm going to ask you about some Investor-owned Utility-sponsored programs.
- II. Have you heard of any Investor-owned Utility residential new construction programs sponsored by PG&E, SCE, SCG&E or SCG? [IF YES, CONTINUE; IF NO, SKIP TO Q#45]
  - JJ. Which investor-owned utility-sponsored residential new construction programs have you heard of? [MULTIPLE RESPONSE; DO NOT READ]

NO/NONE/DK [SKIP TO Q#45]

PG&E Residential New Construction

SCE New Homes

SDG&E and SCG Advanced Home

Other [SPECIFY]: \_\_\_\_\_

[IF RESPONDENT DOES **NOT** NAME ONE OF THE THREE PROGRAMS,  
GO TO Q#45

44. [IF NO TO Q#15a] Have you heard of any of the following investor-owned utility-sponsored programs? [READ LIST]

PG&E Residential New Construction

SCE New Homes

SDG&E and SCG Advanced Home

### Reasons for changes in the market

[RANDOMIZE Q.#19-47]

45. [IF WINDOWS WITH U-FACTOR EXCEEDING TITLE 24 IN 2008 GT WINDOWS WITH U-FACTOR EXCEEDING TITLE 24 IN 2006 TO Q.#15] You said that the market share of windows with U-factors that exceed Title 24 requirements in new single family housing was greater in 2008 than in 2006. [RANDOMIZE A-G, KEEPING B & C&D TOGETHER]
- [IF YES TO ANY OF Q#.35-13] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q#.35-13] have/has had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - [IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16] Do you think there has been an increase in the market share of windows with U-factors that exceed Title 24 requirements among homes **not participating** in the [SAY NAMES OF IOU PROGRAMS MENTIONED IN Q.#15b OR 16]?
  - [IF YES TO B] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR 16] have/has had on this increase in market share of windows with U-factors that exceed Title 24 requirements among homes **not participating** in the programs? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

- d. [IF GREATER THAN 5 TO C] Are there any regions in California where you believe the program has had more influence than in the state as a whole on the market share of windows with U-factors that exceed Title 24 requirements among homes **not participating** in the programs? [IF YES] Which regions?
  - e. How much influence would you say changes in building code have had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - f. How much influence would you say increasing energy prices have had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - g. How much influence would you say the decline in the housing market has had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
46. [IF WINDOWS WITH SHGC EXCEEDING TITLE 24 IN 2008 GT WINDOWS WITH SHGC EXCEEDING TITLE 24 IN 2006 TO Q.#25] You said that the market share of windows with SHGC that exceed Title 24 requirements in new single family housing was greater in 2008 than in 2006. [RANDOMIZE A-G, KEEPING B & C&D TOGETHER]
- a. [IF YES TO ANY OF Q#.35-13] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q#.35-13] have/has had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - b. [IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16] Do you think there has been an increase in the market share of windows with SHGC that exceed Title 24 requirements among homes **not participating** in the [SAY NAMES OF IOU PROGRAMS MENTIONED IN Q.#15b OR 16]?
  - c. [IF YES TO B] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR 16] have/has had on this increase in market share of windows with SHGC that exceed Title 24 requirements among homes **not participating** in the programs? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - d. [IF GREATER THAN 5 TO C] Are there any regions in California where you believe the program has had more influence than in the state as a whole on the market share of windows with SHGC that exceed Title 24 requirements among homes **not participating** in the programs? [IF YES] Which regions?
  - e. How much influence would you say changes in building code have had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - f. How much influence would you say increasing energy prices have had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - g. How much influence would you say the decline in the housing market has had on this increase in market share? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

47. [IF \$ 0.60 to 0.35 U-Factor Price Difference IN 2008 LT \$ IN 2006 TO Q.#29] You said that the price difference between a 0.60 U-Factor window and 0.35 U-Factor window, for a production builder, was lower in 2008 than in 2006. [RANDOMIZE A-E]
- a. [IF YES TO ANY OF Q#.35-13] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q#.35-13] have/has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - b. [IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR 16] have/has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - c. How much influence would you say changes in building code have had on this in decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - d. How much influence would you say increasing energy prices have had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - e. How much influence would you say the decline in the housing market has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
48. [IF \$ 0.65 SHGC AND 0.40 SHGC PRICE DIFFERENCE IN 2008 LT \$ IN 2006 TO Q.#31] You said that the price difference between a 0.65 SHGC window and 0.40 SHGC window, for a production builder, was lower in 2008 than in 2006. [RANDOMIZE A-E]
- a. [IF YES TO ANY OF Q#.35-13] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q#.35-13] have/has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - b. [IF PG&E RESIDENTIAL NEW CONSTRUCTION, SCE NEW HOMES, OR SDG&E/SCG ADVANCED HOME MENTIONED TO Q.#15b OR 16] How much influence would you say [INSERT PROGRAM NAMES WITH YES FROM Q.#15b OR 16] have/has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - c. How much influence would you say changes in building code have had on this in decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - d. How much influence would you say increasing energy prices have had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”
  - e. How much influence would you say the decline in the housing market has had on this decrease in the price difference? Use a scale from 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence.”

49. Which distributors would you say account for the greatest market share of windows installed in single family new homes in California? [MULTIPLE RESPONSE—TRY TO GET NAME AND LOCATION]

50. Do you know any other distributors of windows who have been involved with homes participating in the investor-owned utility-sponsored new construction programs?

Yes

No [Thank and end interview]

DK/refused [Thank and end interview]

51. Have you discussed energy efficient windows with distributors who have been involved with homes participating in the investor-owned utility-sponsored programs?

Yes

No [Thank and end interview]

DK/refused [Thank and end interview]

52. In what venue or setting have you discussed energy efficient windows with distributors who have been involved with homes participating in the investor-owned utility-sponsored programs? [MULTIPLE RESPONSE, DO NOT READ]

Phone conversations

Conferences

Building sites

Via email

Other [SPECIFY: \_\_\_\_\_]

**That concludes the interview. Thank you very much!**

## **A.9 Program Manager of Other Voluntary Efficiency Programs Interview Guide**

### **Other Program Manager Interview Guide for IOU RNC Codes & Standards Programs— Market Effects (Final)**

Interviewer:

Date:

Subject Name:

Organization:

Program(s) responsible for:

Hello, my name is \_\_\_\_\_ from Nexus Market Research. I'm conducting interviews for the Residential New Construction Market Effects Evaluation Team, under a contract with the CPUC. Do you have some time to discuss the residential new construction market and California utilities' residential new construction programs? Our conversation should last about 30 minutes. [IF YES CONTINUE; IF NO:] Is there a more appropriate time that we could schedule for this conversation? [RECORD TIME]

[IF INTERVIEWEE ASKS ABOUT THE STUDY'S SPONSORSHIP, REFER TO AYAT OSMAN, CPUC, AT (415) 703-5953]

#### **Roles and Responsibilities**

1. First, I just want to verify that you work on [PROGRAM/S]. Is that correct?
2. How long have you been working on [PROGRAM/S]? How long have you worked for [ORGANIZATION]?
3. What is your specific role with [PROGRAM/S]?

#### **Program Description**

[MINIMIZE OR SKIP THESE QUESTIONS DEPENDING ON WHAT CAN BE GLEANED FROM PROGRAM WEBSITES BEFOREHAND; OR VERIFY WHAT IS FOUND ON WEBSITE]

4. What is the overall, primary goal of the \_\_\_\_\_ program in California? How will you know when this goal has been achieved?
5. What are the program's activities in California—that is, what does the program do? [PROBES: market actor group, technology/equipment, behavior, installation practice]
6. How have program activities changed over the years? Have you made these program changes in response to changes in the market, or for other reasons?
7. How is the program involved with an individual home? That is, does the program provide a certification of the efficiency of the home?
8. [IF CERTIFICATION OR SIMILAR PROVIDED] What qualifies a home for certification in California?
9. [IF CERTIFICATION OR SIMILAR PROVIDED] What and who does the process of certification in California involve? [PROBE IF HERS RATER IS INVOLVED AND WHAT THEY CHECK FOR]

### **Level of Participation**

10. [IF CERTIFICATION OR SIMILAR PROVIDED] How many newly constructed residential housing units, not buildings or developments but housing units, did \_\_\_\_\_ program certify in 2006 in California? 2007? How many do you expect to certify in 2008? [IF NECESSARY:] Your best estimate is fine.  
M. 2006\_\_\_\_ new housing units in California  
N. 2007\_\_\_\_ new housing units in California  
O. 2008\_\_\_\_ new housing units in California
11. [IF CERTIFICATION OR SIMILAR PROVIDED] About what percent of these housing units were tract-built detached single family homes, custom built detached single family homes, attached single family homes(Duplex/Townhouse), and condos or apartments (Multifamily units)? [FOR 2006-2008] [IF NECESSARY:] Your best estimate is fine.  
% \_\_\_\_ Tract-built detached single family homes  
% \_\_\_\_ Custom built detached single family homes

%\_\_ Attached single family homes (Duplex/Townhouse)

%\_\_ Condos or Apartments (Multifamily unit)

### Relation to IOU Programs

12. How does \_\_\_\_\_ program differ from the residential new construction programs run by the California investor-owned utilities?
13. In what ways, if any, does \_\_\_\_\_ program work with the residential new construction programs run by the California investor-owned utilities?
14. In what ways, if any, are \_\_\_\_\_ program and the California IOUs' programs complementary?
15. In what ways, if any, do \_\_\_\_\_ program and the California IOUs' programs overlap or compete with each other?

### Effects of the IOU Programs

16. [IF APPROPRIATE FOR PROGRAM] How much effect would you say the California IOUs' programs have had on the efficiency criteria used by \_\_\_\_\_ program in California? Please use a scale from 0 to 10, where 0 is "no effect at all" and 10 is "a great effect."
17. [IF GT 5 TO Q.#16] Why do you think IOUs' program have had an effect on the \_\_\_\_\_ program in California? What aspects of the IOUs' programs have had an effect?
18. [IF GT 5 TO Q.#16] Which criteria would you say have been affected by the IOUs' programs? [PROBE]
  - a. Overall level of efficiency above Title 24 requirements
  - b. Insulation R-values
  - c. Quality of insulation installation
  - d. Windows
  - e. High-SEER air conditioners or heat pumps
  - f. High-EER air conditioners or heat pumps to help meet the TDV target
  - g. High-AFUE furnaces
  - h. HVAC installation
  - i. Water heating equipment
  - j. Lighting
  - k. Framing materials and techniques



- l. Orientation and shading
  - m. Photovoltaics
  - n. Duct sealing
  - o. Duct testing
  - p. Air sealing
  - q. In some other area [PLEASE SPECIFY]
19. [IF APPROPRIATE FOR PROGRAM] What effect would you say the California IOUs' programs have had on the level of participation in the \_\_\_\_\_ program?
- Decreased participation a lot
  - Decreased participation a little
  - Had no effect on participation
  - Increased participation a little
  - Increased participation a lot
20. [IF APPROPRIATE FOR PROGRAM] Why do you think the California IOUs' programs decreased/increased/had no effect on participation in the \_\_\_\_\_ program?

**THANKS VERY MUCH!**

## A.10 Building Code Official Interview Guide

### Building Code Officials Interview Guide for IOU RNC Codes & Standards Programs

Interviewer:

Date:

Subject Name:

Organization:

Jurisdiction:

Hello, my name is \_\_\_\_\_ from the Cadmus Group and I am calling on behalf of the California Public Utilities Commission (CPUC). We are conducting a study of energy savings in new buildings and the CPUC has asked us to interview building code officials to get a better picture of the code enforcement and compliance process. This survey is extremely important to the CPUC's ability to estimate energy savings from new building standards and it will take only about 5 minutes. We would like to speak to a person in your office who has a lot of experience with residential code enforcement, but also some familiarity with commercial building compliance. Can you connect me with a person in your office who can provide this information?

Yes [CONTINUE]

No/DK [TERMINATE]

Refused [TERMINATE]

May I please have the person's name and job title?

[RECORD NAME AND JOB TITLE]

[WHEN CORRECT PERSON IS ON-LINE:]

Hello, my name is \_\_\_\_\_ from the Cadmus Group and I am calling on behalf of the California Public Utilities Commission (CPUC). We are conducting a study of energy savings in new buildings and the CPUC has asked us to interview building code officials to get a better picture

of the code enforcement and compliance process. This survey is extremely important to the CPUC's ability to estimate energy savings from new building standards and it will take only about 5 minutes. Is this a good time for you to talk?

Yes [CONTINUE]

No [ASK FOR A TIME TO CALL BACK]

Refused [TERMINATE]

[IF INTERVIEWEE ASKS ABOUT THE STUDY'S SPONSORSHIP, REFER TO AYAT OSMAN, CPUC, AT (415) 703-5953]

## INTRODUCTION

1. It is our understanding that some measures covered by Title 24 in existing residential buildings may be installed in relatively large numbers without being permitted. I would like your best estimate of what percent of the three following alterations covered by Title 24 are being done without permits.
  - a. Added or replacement windows (record percentage)\_\_\_\_\_%
  - b. Installation or replacement of ducts in unconditioned space (record percentage)\_\_\_\_\_%
  - c. Installation or replacement of major heating or cooling system components (record percentage)\_\_\_\_\_%
  
2. In those cases when the alterations occur without permits, what is your best estimate of the percent of the time they do not comply with Title 24?
  - a. Added or replacement windows (record percentage)\_\_\_\_\_%
  - b. Installation or replacement of ducts in unconditioned space (record percentage)\_\_\_\_\_%
  - c. Installation or replacement of major heating or cooling system components (record percentage)\_\_\_\_\_%

As part of this study, we would like to get your estimate of the lag time between when a building permit is applied for and when construction is actually completed.

3. In your experience, for single family residential buildings how long does it usually take between when a permit is applied for and the certificate of occupancy is issued? \_\_\_\_\_

months

4. How about for multifamily residential buildings? How does the number of units in the building affect the timing? \_\_\_\_\_ months
5. Lastly, how about for non-residential buildings? \_\_\_\_\_ months
  - a. Does the time vary significantly by type and size of non-residential building?  
Yes [CONTINUE]  
  
No/Don't know [GO TO END]
  - b. How does the lag vary by building type and size?
6. Now I'm going to read you two statements about code compliance and possible upgrades to Title 24 requirements. I would like you to tell me if you agree or disagree with each statement by using a scale from 0 to 10, where 0 is disagree strongly and 10 is agree strongly.
  - a. Compliance with the current code is so widespread that builders at the low end of the market could comply with the proposed 2008 code upgrade within a reasonable time
  - b. Utility energy-efficiency training programs have helped improve code compliance

Those are all of the questions I have for you today. Thank you for your time!

## A.11 New Home Buyer Questionnaire

Reference to Questions Below:

1. **RN series:** Verbatim or adapted from “Statewide Residential New Construction Utility Program Comparison Study: Final Report,” May 31, 2000 (CAL0003). Prepared for PGE by Quantum Consulting, Shel Feldman, and Lori Megdal.
2. **MA series:** Verbatim or adapted from “Evaluation of the Massachusetts ENERGY STAR Homes Program: Findings and Analysis Final Report,” May 2007. Prepared for the Investor Owned Utilities of MA by NMR and Dorothy Conant.
3. **AW series:** Verbatim or adapted from “Statewide Residential New Construction Utility Program Comparison Study: Final Report,” May 31, 2000 (CAL0003). Prepared for PGE by Quantum Consulting, Shel Feldman, and Lori Megdal.
4. **PE series:** Verbatim or adapted from “Statewide Residential New Construction Utility Program Comparison Study: Final Report,” May 31, 2000 (CAL0003). Prepared for PGE by Quantum Consulting, Shel Feldman, and Lori Megdal.

MA5. Which of the following best describes how you purchased your home?

1. Purchased land and worked with an architect and/or builder to design and build the home.
2. Had a house plan and a lot and hired a contractor/builder to build the home.
3. Purchased a lot from a builder, selected one of several house plans offered by the builder and selected from various available upgrade options.
4. Purchased a home that was under construction and selected from various available upgrade options.
5. Purchased a finished home
6. (Other [SPECIFY: \_\_\_\_\_])
7. (Don’t know)

RN014. As I mentioned earlier, this survey is about your home’s energy usage. On a scale from 1 to 10, where 1 is not at all important and 10 is extremely important, how important was energy efficiency to you in the selection of this home?

#	1-10	RN015
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99	Don't know/refused	RN015
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RN015. Some government agencies and utilities sponsor programs that are designed to encourage the installation of energy-efficient features in new homes. Have you heard of any government-sponsored or utility-sponsored programs like these?

1	Yes, aware of government- or utility-sponsored programs	RN016
2	No, not aware of programs	RN017
99	Don't know/refused	RN017

RN016. What program names can you recall, if any? [DO NOT READ]

1 *	Energy Star / Energy Star Homes Program	RN017
2 *	PG&E/Pacific Gas & Electric – Residential New Construction Program or other/unspecified program	RN017
3 *	SCE/Southern California Edison – New Homes Program or other/unspecified program	RN017
4 *	SoCalGas – Advanced Home Program or other/unspecified program	RN017
5 *	SDG&E/San Diego Gas & Electric – Advanced Home Program or other/unspecified program	RN017
6	EPA/DOE/US Gov't - other/unspecified program	RN017
88	Other [SPECIFY:] _____	RN017
99	None/don't know/refused	RN017

[ASK #RN017 FOR EACH "\*" PROGRAM NOT MENTIONED AT #RN016.] RN017. Have you heard of the [PROGRAM] as one that encourages installation of energy-efficient features in new homes? [READ LIST, RECORD ALL "YES" RESPONSES.]

1 *	Energy Star Homes Program	RN018
2 *	[ASK IN PG&E TERRITORY ONLY] PG&E Residential New Construction Program	RN018
3 *	[ASK IN SCE TERRITORY ONLY] Southern California Edison New Homes Program	RN018
4 *	[ASK IN SCG TERRITORY ONLY] SoCalGas Advanced Home Program	RN018
5 *	[ASK IN SDG&E TERRITORY ONLY] San Diego Gas &	RN018

	Electric Advanced Home Program	
6	New Home Energy Savers Program	RN018
99	[DO NOT READ:] None/refused	RN018

[ASK #RN018 FOR EACH “\*” RNC PROGRAM MENTIONED AT #RN016 OR #RN017, ELSE SKIP TO #RN024]

RN018. Were you familiar with the [PROGRAM—USE NAME FROM #RN017] before you first viewed your new home or first saw the plans?

1. Yes
2. No
3. (Don’t know)

RN020. As far as you know, was your home built under (this/these) program(s)? [RECORD MULTIPLE RESPONSES—THE FOLLOWING OPTIONS MENTIONED AT #RN016 OR #RN017—USE NAMES FROM #RN017.]

1	Yes, Energy Star Homes Program	RN021
2	[ASK IN PG&E TERRITORY ONLY] Yes, PG&E Residential New Construction Program	RN021
3	[ASK IN SCE TERRITORY ONLY] Yes, Southern California Edison New Homes Program	RN021
4	[ASK IN SoCalGas TERRITORY ONLY] Yes, SoCalGas Advanced Home Program	RN021
5	[ASK IN SDG&E TERRITORY ONLY] Yes, SDG&E Advanced Home Program	RN021
6	Yes, New Home Energy Savers Program	RN021
7	No, home not built under any programs	MA46
99	None/don’t know/refused	MA46

RN021. [IF YES TO ANY #RN020] How important was this program sponsorship in your decision to purchase or build this home? Please give me a 1 to 10 rating, where 1 is not at all important, and 10 is extremely important. [ASK ONLY ONCE FOR ALL PROGRAMS]

#	1-10	MA46
99	Don’t know/refused	MA46

MA46 Did you ask anyone about [INSERT ALL “\*” PROGRAMS FROM #RN016 AND #RN017—USE NAMES FROM #RN17] when you were making your plans for building or buying a home? [ASK ONLY ONCE—MENTION ALL PROGRAM NAMES]

- 1. Yes [CONTINUE]
- 2. No [SKIP TO #MA48]
- 3. (Don’t know/refused) [SKIP TO #MA48]

MA47 [IF YES TO #MA46] Who did you ask about [INSERT ALL “\*” PROGRAMS FROM #RN016 AND #RN017]? [ASK ONLY ONCE—MENTION ALL PROGRAM NAMES]  
[DO NOT READ]

1	Architect/designer(s)	MA48
2	Builder(s) / builder or development sales agents	MA48
3	Home inspector (buyer’s inspector)	MA48
4	Lenders	MA48
5	Realtors	MA48
6	Family	MA48
7	Friends	MA48
8	Neighbors	MA48
9	Work colleagues	MA48
10	Utility representatives	MA48
88	Other [SPECIFY:] _____	MA48
99	None/don’t know/refused	MA48

MA48. Did anyone bring up the subject of [INSERT ALL “\*” PROGRAMS FROM #RN016 AND #RN017—USE NAMES FROM #RN017 ] when you were making your plans for



building or buying a home? [ASK ONLY ONCE—MENTION ALL PROGRAM NAMES]

1. Yes
2. No
3. (Don't know/refused)

New49. [IF YES TO #MA48] Who brought up the subject of [INSERT ALL "\*" PROGRAMS FROM #RN016 AND #RN017]? [ASK ONLY ONCE—MENTION ALL PROGRAM NAMES] [DO NOT READ]

1	Architect/designer(s)
2	Builder(s) / builder or development sales agents
3	Home inspector (buyer's inspector)
4	Lenders
5	Realtors
6	Family
7	Friends
8	Neighbors
9	Work colleagues
10	Utility representatives
88	Other [SPECIFY:] _____
99	None/don't know/refused

MA50. [IF “YES” TO #MA46 OR #MA48] What did they tell you about homes built under [INSERT ALL “\*” PROGRAMS FROM #RN016 AND #RN017]? [ASK ONLY ONCE—MENTION ALL PROGRAM NAMES] [PROBE FOR SPECIFICS; DO NOT READ RESPONSES; MULTIPLE RESPONSE]

1. (More or better insulation)
2. (More efficient central air conditioning)
3. (More efficient furnace or boiler/heating system)
4. (Better ductwork)
5. (Better sealing of air leaks)
6. (More efficient appliances)
7. (More efficient lighting)
8. (More efficient windows)
9. (Better framing materials)
10. (Better comfort/fewer drafts)
11. (Less moisture buildup)
12. (A higher level of efficiency for the house as a whole)
13. (Higher quality construction in general)
14. (No better than other homes—all new homes are energy efficient)
15. (Homes is tested to verify its energy efficiency)
16. (Other [SPECIFY: \_\_\_\_\_])
99. (Don’t know)

RN024. Were there any contacts or information sources that actively emphasized the topic of energy efficiency when you were shopping for or building your home?

1	Yes	RN025
2	No	New26
99	Don’t know/refused	New26

RN025. Which contacts or information sources actively emphasized energy efficiency? [DO NOT READ]

1	Energy Star program brochures/model homes/website
2	EPA/DOE/Other U.S. government source (other/miscellaneous)
3	Architect/designer(s)
4	Builder(s) / builder or development sales agents
5	Home inspector (buyer’s inspector)
6	Lenders
7	Newspapers/magazines (general)
8	Realtors
9	“Consumer Reports” magazine
10	Family
11	Friends
12	Neighbors
13	Work colleagues
14	PG&E program brochures/model homes/website
15	SCE/Southern California Edison program brochures/model homes/website
16	SoCalGas program brochures/model homes /website
17	SDG&E program brochures/model homes/website
18	Program brochures/model homes/websites – non-specific
19	Home show
88	Other [SPECIFY:] _____
99	None/don’t know/refused

New26. How influential would you say each of the following was on the decisions you made about the features of the home you bought or built? Please give me a 1 to 10 rating, where 1 is not influential at all, and 10 is extremely influential. [RANDOMIZE LIST]

#	1-10
99	Don’t know/refused

- a. Family
- b. Friends
- c. Neighbors
- d. Work colleagues

New27. When you were making plans to buy or build your home, how frequently did you discuss energy efficiency with [INSERT FROM BELOW]: never, only occasionally, fairly often, or very often? [RANDOMIZE LIST]

SCALE: 1. Never, 2. Only occasionally, 3. Fairly often, 4. Very often, 9. (Don’t know)

- a. Family
- b. Friends
- c. Neighbors
- d. Work colleagues

AW030. Based on what you may have seen or heard, would you say that all new homes in your area and price range have about the same level of energy efficiency overall, or are there some new homes that are more energy-efficient than others?

1	Most new homes same/similar level of energy efficiency	AW031
2	Some new homes more energy-efficient than others	AW031
99	None/don't know/refused	AW031

AW031. Based on what you may have seen or heard, are most new homes in your area and price range about as energy-efficient as they can be, or are there ways they could be built more energy-efficiently?

1	Most new homes about as EE as they can be	PE049
2	New homes could be more energy-efficient	PE049
99	None/don't know/refused	PE049

PE049. I'm going to read you a few brief statements, and ask you to rate each of them on a scale from 1 to 10, where 1 means you disagree completely, and 10 means you agree completely.  
[RANDOMIZE; READ STATEMENTS AND RECORD RATING]

- a. Energy-efficient features in a new home cost more than they're worth
- b. It takes too much time and hassle to find information about energy efficiency when I'm buying a home
- c. I have a hard time believing energy efficiency information provided by new home builders
- d. To interest me in energy-efficient features, the cost would have to be rolled into the mortgage
- e. I am willing to invest in home features that will reduce my monthly costs

## **Appendix B    Historic Trends in Awareness and Attitudes**

### **B.1    Builders**

#### **B.1.1    Overview**

This section provides an historic account of California builder awareness, attitudes, and self-reported practices concerning the IOUs' RNC programs and energy efficiency in newly built homes prior to 2005. Because interview data from both participating and non-participating builders were almost always consolidated in previous evaluation reports, no firm conclusions can be made as to the impacts on non-participating builders.

Overall, from the early 1990s to 2005 it appears that the programs have been effective in promoting energy-efficient equipment and techniques, most notably energy-efficient air conditioning, duct installation, duct sealing and duct testing procedures. In some cases, participating builders have used building practices that exceed Title 24 standards in non-program homes because of their participation in the program. Participating builders have consistently identified the marketing benefits associated with participating in the program as a benefit of participation in the programs. In addition, the programs have increased and maintained participating builder awareness of Title 24 requirements and changes in Title 24 building standards, and that the programs had a positive influence on builder attitudes to Title 24 requirements and changes in the standards.

Non-participating builders are believed to have been indirectly influenced by the program either through changes in the market (such as increased consumer demand for efficiency or perceptions of increased consumer demand) or through conversations with participating builders.

The primary sources of data are evaluation studies conducted between 1993 and 2005 for the IOUs' RNC energy efficiency programs sponsored by PG&E, SCE, SDG&E and SCG. Because there are limited data available for non-participant builders, specific trends in non-participant builder awareness, attitudes and practices could not be established.

#### **B.1.2    Awareness of the IOUs' RNC Programs and the Influence of Programs on Energy-Efficient Building Practices**

The following is a summary of builder awareness of and attitudes towards the IOUs' RNC programs, Title 24 requirements, changes in Title 24 standards from the mid-1990s to 2005, and the impact of the IOUs' RNC programs on energy-efficient building practices. A summary of the major findings, organized by time period and report, follows.

### **1993-1996: Impact Evaluation of Pacific Gas & Electric Company's 1996 RNC Program**

- PG&E's 1996 RNC Program successfully introduced participating builders to energy-efficient building practices as 42% of participating builders were introduced to efficient air conditioning and 71% learned about enhanced duct installation procedures, including duct sealing and testing procedures, by participating in the program (XENERGY Inc., Eley Associates, 1998, Table 6-1, pg 6-2).

### **1997 Residential New Construction: Market Transformation Study (PG&E and SCE Programs)**

- Participating builders were found to exceed Title 24 standards as a result of utility programs; there was no evidence of similar effects on non-participants' building practices. In addition, participating builders had a higher interest in the marketability of energy efficiency measures compared to non-participants (Barakat & Chamberlain, 1997, Table ES-1, pg ix).

### **1998 PG&E Comfort Home Program Market Baseline and Market Effects Study**

The 1998 PG&E Comfort Home Program Market Baseline and Market Effects Study interviewed both participating and non-participating builders. The interview data from both types of builders were consolidated, so no firm conclusions can be made as to the impacts on non-participating builders. The 1998 report concluded that the program had the following impacts on builders:

- The awareness of the IOU's RNC programs and the ENERGY STAR Homes program was high, as all of the California builders interviewed were aware of the Comfort Home Program and 77% of participating builders were aware of the ENERGY STAR New Homes Program (RER, 1999, pg 4-18).
- The Comfort Home Program appeared to have increased builder awareness of duct testing. Moreover, the Comfort Home Program and its predecessors apparently diminished the lack of information and hassle costs to the point where they were no longer perceived as serious barriers (RER, 1999, pg ES-10).
- Nearly all builders reported that energy efficiency was "low down on the [consumer's] list of reasons to buy [a home]" and that buyers are more concerned about up-front costs and perceived value rather than energy efficiency (RER, 1999, pg ES 14, 4-18).
- Though builders reported that buyers rate other features of the home as more important than energy efficiency, 80% of all builders interviewed in PG&E's service territory believed that consumer demand for energy efficiency had increased, mostly due to the increased awareness resulting from media advertising, the Internet and builder competition (RER, 1999, pg 4-16).
- Forty percent of participating builders noted that they would remain with the program for its marketing benefits if the rebate was no longer offered (RER, 1999, pg 4-19).

- While the Comfort Home Program offered marketing support for the promotion of Comfort Homes, it did not convince builders that customers were willing to pay for energy efficiency. On average, PG&E builders estimated that home buyers were willing to pay for 31% of the cost of improving efficiency in new homes. The builder's perception of home buyer willingness to pay (for energy efficiency) was identified as a critical barrier to future programs (RER, 1999, pg ES 10-11).
- Some builders had learned about their current duct sealing and testing practices as a result of being in the program. (RER, 1999, pg 4-20)
- Table B.1-1 reports the participating builder's awareness of Title 24 energy efficiency standards and related practices. All the PG&E builders interviewed for this study were aware of Title 24, and nearly 90% claimed to have a working knowledge of the standards. Builders reported that nearly half of their single-family homes exceeded the 1998 Title 24 requirements (It is important to point out that because participating builders are included in these results, the percentage of non-program homes built to exceed Title 24 is unknown). (RER, 1999, pg 4-20/4-21)

**Table B.1-1: Awareness and Practices Relating to Codes and Standards**

Indicator	Builders in PG&E Area (SE)*	Builders in Control Area (SE)* <sup>92</sup>
Aware of energy efficiency code (Title 24 in CA) requirements for residential new construction	1.0 (0.0)	0.5 (0.1)
Have working knowledge of energy efficiency code (Title 24 in CA) requirements	0.9 (0.1)	1.0 (0.0)
Proportion of single-family homes that exceed energy efficiency code (Title 24) standards in 1998	47.2 (8.5)	51.6 (7.4)
Of those that exceeded code (Title 24) in 1998, proportion that were tract homes	99.5 (1.3)	74.7 (7.5)
Report that proportion of houses built that exceed code has increased since 1991	0.2 (0.1)	0.4 (0.1)
Will company continue to build homes that (intentionally) exceed code (Title 24)?	1.0 (0.0)	0.8 (0.1)

Source: RER 1999.

\*Responses are weighted by self-reported number of homes built in 1998; Standard errors are in parentheses.

### 1998-2000: Statewide RNC Utility Program Comparison Study

As with the 1998 PG&E Comfort Home Program Market Baseline and Market Effects Study, the 2000 Statewide RNC Utility Program Comparison Study interviewed both participating and non-participating builders. The interview data from both types of builders was consolidated, so no firm conclusions can be made as to the impacts on non-participating builders.

<sup>92</sup> The control area was comprised of 14 regions outside of California found in the states of Arizona, Colorado, Florida, Georgia, Nevada, New York, North Carolina and Texas (RER, 1999, pg 3-3 – 3-4).

- Half of the 14 builders interviewed were able to name the RNC program in their territory. In addition, three of the 14 builders were aware of the ENERGY STAR Homes Program on an unaided basis, while seven more were aware of it on an aided basis.<sup>93</sup> Half of the builders reported awareness of energy efficient mortgages (EEMs) (Quantum Consulting Inc., 2000, pg 3-9).
- On average, both participating and non-participating builders said they “sometimes” promoted energy efficiency (representing a mean response of 4 on a 1-to-5 scale). All but two of the 14 builders reported that they always integrated HVAC and duct design (Quantum Consulting Inc., 2000, pg 3-19).

### **2002/2003: Evaluation, Measurement & Verification of the 2002 & 2003 California Statewide ENERGY STAR New Homes Program**

- The ENERGY STAR Program influenced participating builders to use HERS measures and HERS inspectors more frequently; participant builders were more likely to use HERS measures than non-participating builders. Increased use of HERS measures helped develop the HERS rating industry and helped prepare builders for future changes to Title 24 standards that might include more HERS measures and inspections (RLW Analytics, 2006, pg 11).

### **2004/2005: Evaluation, Measurement & Verification of the 2004 & 2005 California Statewide ENERGY STAR New Homes Program and 2006 Statewide RNC Program Strategy Assessment**

- There was a moderate level of program influence on participant builders resulting in an increased use of ENERGY STAR practices; 32% of the participating builders indicated that the program had influenced their building practices used in non-program homes. There were no data presented on non-participant builders (RLW Analytics, 2007, pg 50-51).
- About 50% of the non-participants interviewed believed that the program had influenced them to upgrade their energy-efficient building practices, and 67% of participants reported that they believed either that non-participants were influenced by the program, or that they had talked to non-participant builders to encourage ENERGY STAR practices (RLW Analytics, 2007, pg 95).
- Twelve out of 16 builders were aware of impending Title 24 changes; builders who were aware of the upcoming changes understood that the changes entailed lower energy budgets and more prescriptive measures (RLW Analytics, 2005, pg 8 & 51).
- The majority of builders believed that energy efficiency was an important factor in marketing their homes (RLW Analytics, 2005, pg 10).

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<sup>93</sup> Unaided awareness is when a respondent names the program without being prompted while aided awareness is when a respondent recognizes a program after being prompted with its name



- Roughly half of the builders believed that the importance of energy efficiency for marketing new homes would increase with the implementation of the Title 24 revisions (RLW Analytics, 2005, pg 10).
- The majority of builders believed that the most important value of participating in the ENERGY STAR Homes program was differentiation in the market place (RLW Analytics, 2005, pg 11).

### **B.1.3 Influence of Title 24 Standards**

Title 24 has had a significant influence on design specifications for key energy components. A study of PG&E's 1998 Comfort Home program indicated that Title 24 compliance, as well as market competition and program rebates, were the most important influences on builder practices (RER, 1999, pg 4-12). For tract development homes, efficiency levels of equipment and shell measures, such as HVAC equipment, water heaters and insulation, were found to be heavily influenced by California's Title 24 requirements (RER, 1998, pg 5-49, 5-50, 5-51). More recent studies found that Title 24 continued to be the driving influence on builder specifications, particularly for HVAC equipment, water heaters, and insulation levels, and to a lesser extent, window selection (Quantum Consulting Inc., 2000, pg 9 &52).

### **B.1.4 Market actors influence on builder choice of energy efficiency levels**

Title 24 Consultants, architects, and HVAC contractors were reported to influence builders' decisions on Title 24 compliance, energy efficiency levels, and HVAC systems (RER, 1999, pg 4-14) (RER, 1998, pg 5-46, 5-47, 5-61, 5-62).

## **B.2 Other Market Actors**

### **B.2.1 Overview**

Other market actors are affected by Title 24 standards, and they influence the mainstream acceptance of energy efficiency measures.<sup>94</sup> These other market actors include the following:

- Equipment manufacturers
- Equipment distributors and wholesalers
- Architects
- Title 24/energy consultants
- HVAC contractors
- Plumbing contractors
- Building inspectors
- Sales and real estate agents
- Lenders
- Government and non-government agencies

Title 24 consultants, architects, and HVAC contractors “have the most substantial influence on builder decisions” (RER, 1998, pg 5-2). These three actors are highlighted because of their high degree of interaction with builders, the primary drivers of energy-efficient homes in the RNC market. The following sections identify these market actors’ position, their awareness, attitudes and perceptions of energy efficiency, the market barriers that they face, their awareness of and participation in utility-sponsored programs, and their sources of information for the RNC market.

Because the data from the literature for these market actors (i.e., Title 24 consultants, architects, and HVAC contractors) are scarce and limited to findings from the late 1990s, no firm conclusions can be drawn. However, a few key observations can be made. First, the other market actors had high levels of awareness of energy efficiency features in new homes in the late 1990s. However, their limited influence over building practices that exceed Title 24 and the unwillingness of buyers and builders to absorb upfront costs prevented RNC homes from exceeding Title 24 standards. Second, like builders, all market actors perceived (in the late 1990s) increasing buyer demand for energy efficiency, indicating its importance in the market at the time. However, other market actors, like builders, believed that buyers rated energy efficiency as less important than other home features such as square footage, location and style. Finally, market actors were moderately aware of utility-sponsored RNC programs, resulting in limited, if any, effects on their standard business practices and awareness of energy efficient building practices and technologies.

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<sup>94</sup> For a complete list of market actors, see RER, 1998, pg 5-2.

## **B.2.2 Market Position and Influence on Decision Making**

This section briefly describes the functions and influence on energy efficiency of Title 24 consultants, architects, and HVAC contractors in the RNC market. The following information is based on the findings from the *1998 Market Effects Study* and the *PG&E 1998 Comfort Home Market Baseline and Market Effects*, conducted by RER.

### ***Title 24 Consultants***

The role of Title 24 consultants in the RNC process is to “provide the builder with the most cost-effective options for compliance” (RER, 1998, pg 5-55). Although the ultimate decision to implement energy efficiency rests in the hands of the builder, the Title 24 consultant is in the best position of all market actors to influence the adoption of energy-efficient technologies. This is supported by builder interviews conducted for the *1998 Market Effects Study*, which states: “Over half of the builders indicated that recommendations by Title 24 consultants were *very influential* in their decision process, while the remainder of the sample considered their recommendations at least *somewhat influential*” (RER, 1998, pg 5-56). In addition, “the Title 24 consultant is very influential in the specification of equipment and shell measures” but “not very influential in the decision to build homes that exceed Title 24 requirements” (RER, 1999, pg 4-56).

### ***Architects***

The architect or designer works closely with builders and Title 24 consultants. This interaction with energy consultants results in a “good working knowledge of Title 24 requirements” (RER, 1998, pg 5-54). Therefore, the awareness levels for architects should be relatively high. However, architects are rarely directly involved with decisions related to energy efficiency levels and thus have little influence on a builder’s decision to exceed energy standards compared to Title 24 consultant, as energy efficiency falls outside of most architect’s scope of responsibilities. The exception appears to be with custom home builders and high-end tract homes. The *PG&E 1998 Comfort Home Market Baseline and Market Effects Study* noted that 60% of architects, all of whom worked mostly with custom and high-end tract homes, made suggestions that exceeded Title 24 requirements, the majority of which were followed by the builder (RER, 1999, pg 4-22).

### ***HVAC Contractors***

HVAC contractors are responsible for the design of the air distribution system and the purchasing and installation of HVAC equipment, but they do not choose equipment efficiency or duct insulation values (RER, 1998, pg 5-58). The latter are normally specified by the builder and the Title 24 consultant. Once these specifications are identified, the HVAC contractor is responsible for the design and installation of an efficient air distribution system. This includes equipment sizing, duct installation and sealing. Therefore, the HVAC contractors’ influence over

equipment efficiency is limited. Their main contribution to energy efficiency is in the acquisition of cost-effective equipment and an efficient air distribution system.

### **B.2.3 Awareness**

The discussion of the awareness levels of these market actors with respect to energy efficiency technologies and programs is limited to three studies spanning the time frame of 1998-2000. These studies include the following: the *1998 Market Effects Study* and the *PG&E 1998 Comfort Home Market Baseline and Market Effects Study conducted by RER*, and the *2000 Statewide RNC Utility Program Comparison Study*, conducted by Quantum Consulting. Overall, these market actors were relatively aware of energy efficiency measures. However, there are still market barriers these actors face that prevent the growth of energy efficiency in the RNC market.

The *1998 Market Effects Study* reported on self-reported awareness levels for efficiency measures for Title 24 consultants, architects, and HVAC contractors. Table B.2-1 displays the awareness levels of these market actors on a scale of 1 to 5, where 1 indicates “not at all aware,” 3 indicates “somewhat aware”, and 5 indicates “very aware.” Interviews were specific to Southern California, as the purpose of the study was to report on RNC programs for this region. The control population represented the cities of Austin, TX and San Antonio, TX. As Title 24 is applicable to California only, there was no control population for Title 24 consultants. Results for architect awareness from the PG&E study are incorporated as well for comparison purposes.

Overall, Title 24 consultants were “very aware” of energy-efficient features in RNC and had the highest awareness levels of the three market actors (Table B.2-1). This was expected as their primary job is to ensure compliance with energy standards in RNC. Comparison of architects and HVAC contractors shows that the former had a greater awareness of shell measures, while the latter had a greater awareness of duct testing and sealing. This was expected as well, due to these measures being important to each actor’s respective responsibilities. Compared to the control area, architects had a better understanding of efficiency measures, while HVAC contractors had a slightly lower understanding of their control counterparts. The difference in HVAC contractor awareness was most likely due to greater HVAC needs in the control area.

**Table B.2-1: Self Reported Awareness of Other Market Actors\***

	Gas Furnaces	Gas H2O Heaters	Windows	Insulation	Duct Testing	Duct Sealing
<b>Title 24 Consultants</b>						
S. Cal <sup>95</sup>	4.9	4.6	4.9	4.9	3.9	3.7
PG&E <sup>96</sup>	4.5	4.7	5	4.9	4.4	4.4
<b>Architects</b>						
S. Cal <sup>97</sup>	3.7	3.7	4.9	4.9	1.7	1.5
Control <sup>98</sup>	2.9	2.9	3.1	3.1	1.6	1.6
PG&E <sup>99</sup>	2.6	N/A	3.8	3.7	1.7	1.6
<b>HVAC Contractor</b>						
S. Cal <sup>100</sup>	3.8	2.8	3.1	3.1	3.1	3.5
Control <sup>101</sup>	5	1.1	4.8	5	3.8	4.7

\*The numbers in the table reflect awareness levels of these market actors on a scale of 1 to 5, where 1 indicates “not at all aware,” 3 indicates “somewhat aware”, and 5 indicates “very aware.”

The *PG&E 1998 Comfort Home Market Baseline and Market Effects Study* also provided insight into the awareness levels of these market actors. Regarding program awareness, the study noted that all HVAC contractors partaking in interviews were aware of RNC programs, but few could identify specific details of the program (RER, 1999, pg 4-50). For architects, 90% were aware of the PG&E Comfort Homes program and 20% were aware of the Comfort Homes Plus Program<sup>102</sup> and ENERGY STAR New Homes Program (RER, 1999, pg 4-23). Specific program awareness levels for Title 24 consultants were not provided.

In addition, those HVAC contractors with Title 24 consultants on staff cited higher awareness levels of all energy-related features, compared to those without Title 24 consultants (RER, 1999, pg 4-50). Values for Title 24 consultants were similar to those of the 1998 Market Effects Study, with slightly higher levels for duct sealing and testing, as displayed in Table B.2-1. Awareness of energy efficiency-related features was not provided for architects.

<sup>95</sup> RER, 1998, Table 7-4, pg. 7-19

<sup>96</sup> RER, 1999, Table 4-16, pg 4-57

<sup>97</sup> RER, 1998, Table 7-4, pg. 7-19

<sup>98</sup> RER, 1998, Table 7-4, pg. 7-19

<sup>99</sup> RER, 1999, Table 5-8, pg 5-18

<sup>100</sup> RER, 1998, Table 7-4, pg. 7-19

<sup>101</sup> RER, 1998, Table 7-4, pg. 7-19

<sup>102</sup> At the time of the study, the Comfort Homes Plus Program was a new program that encouraged builders to exceed Title 24 requirements by 30% (RER, 1999, pg ES-1).

The statewide study conducted in 2000 provided the most recent insight into awareness levels of these market actors (Quantum Consulting Inc., 2000). Awareness levels for particular programs are displayed in Table B.2-2. Compared to the previous Comfort Homes report, this study showed lower awareness levels for the Comfort Home program for these market actors. All HVAC contractors were aware in the former, compared to 38% in the latter. Awareness among architects decreased from 90% to 71%. There is not enough information to draw a conclusion as to why this apparent drop in awareness occurred. However, the statewide study implied lower awareness levels among all market actors, especially without unaided awareness.

**Table B.2-2: Market Actor Program Awareness Levels**

	Unaided	PG&E Comfort Homes	Comfort Wise	SoCalGas Energy Advantage Homes	ENERGY STAR Homes
<b>Title 24 Consultants</b>	25%	38%	13%	13%	25%
<b>Architects</b>	13%	71%	29%	57%	47%
<b>HVAC Contractors</b>	33%	N/A	N/A	N/A	40%

Source: Quantum Consulting Inc., 2000, Exhibit 3-4, pg 3-7

#### **B.2.4 Market Barriers**

Although awareness levels of various market actors may be high, the implementation of energy efficiency is limited by market barriers. Market barriers, such as performance uncertainty, information search and hassle costs, asymmetric information, and bounded rationality, mainly affect demand side-actors (RER, 1998, pg 7-7). This section reviews the market barriers affecting Title 24 consultants and HVAC contractors. Information on market barriers is based on the 1996 *RNC Market Characterization* report and the 1997 *Residential New Construction: Market Transformation Study* conducted by Barakat & Chamberlain, as well as the *PG&E 1998 Comfort Home Market Baseline and Market Effects Study* conducted by RER.

##### ***Title 24 Consultants***

The market barrier affecting Title 24 consultants is information search costs, which are the costs associated with the time required to identify and learn about energy-efficient products or services (RER, 1998, pg 7-7) (Eto, 1996, pg 13). However, while Title 24 consultants can face limitations due to their analysis tools (i.e., software), interaction with peers and professional training can reduce the impact of this market barrier (Barakat & Chamberlain, 1996, pg 23).

##### ***Architects***

The key market barriers for architects are organizational practices and information search cost. (RER, 1999, pg 5-17). Organizational practices barrier can be understood as behavior or systems of practice that discourage or hamper cost-effective energy efficiency investments and decisions

(Eto, 1996, pg 15). These barriers are generally interrelated as a lack of information often leads to inefficient designs that become standard practice. While architects may be aware of some energy-efficient measures such as high efficiency air conditioning, windows and insulation, they are often not aware of high efficiency gas furnaces, duct testing, and duct sealing methods (RER, 1999, pg 5-17). The *PG&E 1998 Comfort Home Market Baseline and Market Effects Study* found no evidence for a hypothesized market effect of lowering information costs on energy efficient technologies and practices (and in turn reducing the organizational practices barrier) by working with builders on energy efficient homes (RER, 1999, pg 5-19).

### ***HVAC Contractors***

The key market barriers for HVAC contractors include information costs, hassle or transaction costs, organizational practices and performance uncertainties. Hassle or transaction costs can be understood as indirect costs associated with acquiring energy-efficient technologies and practices, including time, materials and labor needed to acquire and install equipment or learn new practices. Performance uncertainties can be understood as the challenge of evaluating the claims of future savings and benefits derived from energy-efficient equipment and practices (Eto, 1996, pg 13 – 14). The *PG&E 1998 Comfort Home Market Baseline and Market Effects Study* found that program training helped reduce information costs, hassle costs, performance uncertainty costs, and organizational practices costs (RER, 1999, pg 5-70).

### **B.2.5 Attitudes and Perceptions**

This section discusses changes in attitudes and market actor perceptions with regard to the importance of energy efficiency. The 1997 *RNC Market Transformation Study* conducted by Barakat & Chamberlain and the *PG&E 1998 Comfort Home Market Baseline and Market Effects Study*, conducted by RER, are the primary sources of information for this section. Overall, these market actors perceived a high buyer demand for energy efficiency. However, as seen in the discussion of home buyer attitudes, (see section B.3), other building characteristics often take priority when evaluating the price of a home. In addition, the primary barrier as viewed by these market actors was the reluctance of builders and buyers to absorb the costs of energy-efficient technologies.

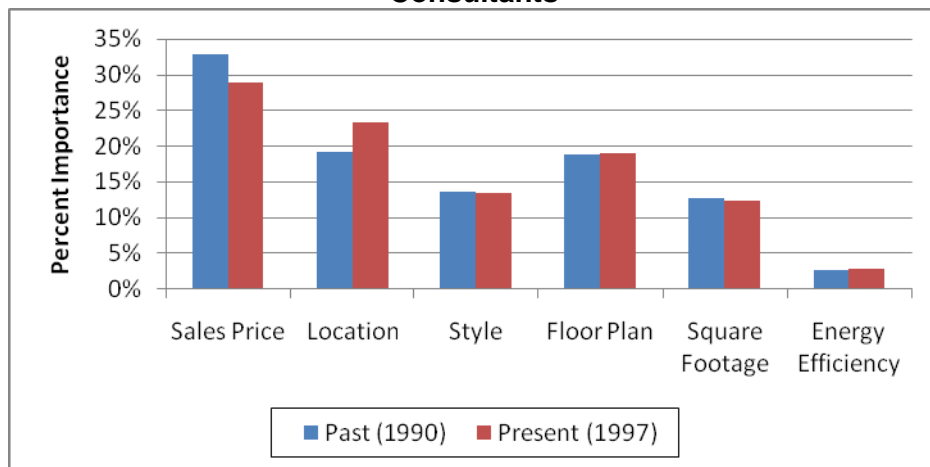
### ***Title 24 Consultants***

The 1997 RNC Market Transformation Study conducted by Barakat & Chamberlain presents attitudes of Title 24 consultants with respect to marketability of energy efficiency features in new homes. The analytical methodology conducted in this study is known as the Analytical Hierarchy Procedure (AHP). The AHP consists of market actor ranking the relative importance of home characteristics thought to affect the marketability of a home, including energy efficiency, price, and location, on a scale of 1 to 9. A ranking of 1 identifies two criteria as “equally important” and a 9 identifies one criterion as being “extremely more important” than the criterion with which it is being compared (Barakat & Chamberlain, 1997, pg 16). The findings from this study

were based on a very small subsection of the population, i.e., interviews with four consultants. Therefore, concrete conclusions cannot be drawn; however, the overall perceptions can be used as a starting point for this discussion.

Figure B.2-1 displays the Title 24 consultants' importance perceptions of the marketability of several features of new homes in 1990 and 1997. Of the six marketability features, energy efficiency is perceived as the least important by consultants. This echoes the perception of builders who said that home buyers rank other features of the home, such as price, location, and style, as more important features (see Section B.1). With regard to time frame, it appears that there was an increase in the perceived importance of energy efficiency between 1990 and 1997 - e.g., the importance of energy efficiency among Title 24 consultants increased 5% (Barakat & Chamberlain, 1997, pg 76).

**Figure B.2-1: Perceived Importance of Marketability of Features of New Homes - Title 24 Consultants**



Source: Barakat & Chamberlain, 1997, Tables 14 and 15, pgs 71 and 73

In addition, the Statewide study identified Title 24 consultants as viewing “buyer unwillingness to absorb up-front costs” as the primary barrier in the mainstream adoption of tract homes that exceeded energy efficiency standards (Quantum Consulting Inc., 2000, pg 3-15). Thus, this group of market actors did not expect an increase in homes exceeding energy efficiency standards.

### **Architects**

The statewide study found that architects rated builder sensitivity to added costs of energy efficiency and home buyers' unwillingness to pay the incremental costs associated with energy efficient features in a home as the primary barriers in the development of homes that exceeded energy efficiency standards. (Quantum Consulting Inc., 2000, pg 3-15 – 3-16). Nonetheless, architects perceived high buyer demand for energy-efficient homes.



## **HVAC Contractors**

The statewide study found that HVAC contractors perceived a high buyer demand for energy efficiency as well, and expected the efficiency of HVAC systems to increase as a result. In addition, the statewide study noted that HVAC contractors viewed “incremental costs and builder conservatism as primary barriers to greater HVAC efficiency” (Quantum Consulting Inc., 2000, pg 3-15).

### **B.2.6 Business Practices**

This section presents program participation rates and changes in business practices of these market actors due to energy standards, RNC programs and improved building technologies.

#### **Program Participation**

Table B.2-3 presents the results from the 2000 *Statewide RNC Utility Program Comparison Study*, regarding program and training participation, as well as a measure of how often each market actor promotes energy efficiency. Overall, program participation among those interviewed was low, with HVAC contractors doubling that of Title 24 consultants and architects. However, consultants attended training or received educational material sponsored by a utility more frequently than other market actors. All actors appeared to promote energy efficiency on a moderate basis.

**Table B.2-3: Market Actor Program Participation**

	<b>Program Participation</b>	<b>Training Attendance/ Educational Material</b>	<b>EE Promotion<sup>103</sup></b>
Title 24 Consultants	13%	33%	3.4
Architects	13%	7%	3.6
HVAC Contractors	27%	20%	3.9

Source: Quantum Consulting Inc., 2000, Exhibit 3-8, pg 3-17

#### **Business Practice**

Changes in building practice for HVAC contractors, as based on the *PG&E 1998 Comfort Home Market Baseline and Market Effects Study*, focused on duct sealing and testing. The study noted that contractors had shifted in “the last few years” (RER., 1999, pg 4-49) to the use of improved, Underwriters Laboratory (UL)-approved duct tape.<sup>104</sup> This shows a positive response and awareness of new energy efficiency technologies among HVAC contractors. The study also found that duct testing was not performed on the majority of new homes,<sup>105</sup> but was done

<sup>103</sup> Defines how often a market actor promotes energy efficiency where 1 is “never” and 5 is “always.”

<sup>104</sup> Underwriters Laboratory has certification standards for the safety and performance of duct tape used in sealing HVAC duct systems (Sherman and Walker, 2004).

<sup>105</sup> Interviews show that duct testing is performed in 0-30% of new homes. (RER, 1999, pg 4-49)

primarily for compliance purposes for those participating in programs such as Comfort Homes and ENERGY STAR Homes. Although the rate of duct testing was low, it appears as though the residual effects of duct testing did lead to duct sealing improvements in homes where duct blaster tests were not conducted (Quantum Consulting Inc., 2000, pg 4-49). The *1998 Market Effects Study* also found that RNC programs had a significant effect on HVAC contractor practices, stating that “because of the programs’ duct testing and sealing requirements, [HVAC] contractors recognized the importance of improved duct installation methods and high quality duct sealing products” (RER, 1998, pg 7-24). The business practices of architects and Title 24 Consultants, however, remained mostly unchanged.

### **B.2.7 Sources of Information**

The increased awareness among RNC market actors is highly dependent on their sources of information. The previously mentioned market actors obtained most of their technical information from manufacturer’s sales representatives and literature and industry trade shows. In addition, Title 24 consultants obtained certification and training from the California Association of Building Energy Consultants (CABEC), although certification was not required to fulfill Title 24 Standards (RER, 1998, pg 5-54, 5-55). Architects often obtained their information from the close interactions with Title 24 consultants. HVAC contractors also obtained much of their information from educational training classes on duct installation and sealing, system design, and indoor air quality (RER, 1998, pg 5-63).

## B.3 Home Buyers

### B.3.1 Overview

There is limited data for tracking levels of home buyer awareness and attitudes with regard to energy efficiency measures in RNC in California over time. As a result, specific trends in home buyer awareness could not be well defined, leaving the analysis to a generalized discussion. The primary sources of data used in this section were based on studies conducted in 1998 and 2000 for programs sponsored by PG&E, SCE, SDG&E and SCG.

The literature review shows that home buyers are aware of energy efficiency measures and have a relatively high demand for their implementation. Awareness, however, is largely limited to the existence of energy standards, not to the variations in efficiency levels and their effects on operating costs. In addition, building characteristics such as aesthetics, size, and cost are often considered more important than energy efficiency, limiting the influence of energy efficiency on the purchasing process.

The following sections provide an historic account of California home buyer awareness and attitudes concerning energy efficiency in newly built homes prior to 2005. In addition, informational sources and their affects on home buyer decisions are explored.

### B.3.2 Awareness

The following section presents results from studies examining home buyer awareness related to energy-efficient technologies, standards, and programs. The three primary sources of information are the *1998 Residential Market Effects Study*, *1998 PG&E Comfort Home Program Market Baseline and Market Effects Study* both conducted by Regional Economic Research (RER), and the *2000 Statewide RNC Utility Program Comparison Study* conducted by Quantum Consulting.

Information from the *1998 Residential Market Effects Study* regarding home buyer awareness was limited to interviews with market actors in the SDG&E and SCG service areas, as well as a group of control respondents.<sup>106</sup> The key findings from this report were the following:

- Consumers had a “generic” and limited understanding of energy efficiency. Therefore, they did not consider, nor did they understand, energy efficiency with respect to specific equipment and shell measures (RER, 1998, pg 5-84).
- Consumers tended to think of the energy efficiency of a home in terms of quality and comfort rather than operating costs. One government agent interviewed commented that consumers, in general, did not think of the Title 24 standards as a minimum requirement

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<sup>106</sup> The Austin/San Antonio area of Texas was chosen as the control area because “ it exhibits heating requirements very similar to those in Southern California; and ... it has no utility DSM programs relating explicitly to gas efficiencies” (RER, 1998, pg 7-1).

but instead thought that a home built to meet building standards was as “energy-efficient” as possible (RER, 1998, pg 5-85).

- Home buyers were typically not aware of the reductions in operating costs that result from increasing the efficiency levels of equipment and shell measures (RER, 1998, pg 5-84).

This study suggests that, as of 1998, although home buyers had a broad sense of energy efficiency, they were unaware of specific technologies and how the technologies affect operating costs of a home. Table B.3-1 shows that 69% of participants and 66% of non-participants were aware of standards for appliances, windows, and insulation, and 44% of participants and 48% of non-participants were aware of minimum efficiency standards for gas water heaters and furnaces. While the study did not speculate as to why there were similar awareness levels between participants and non-participants, it does suggest that the similar levels among the control group might be due to “successful information and training seminars for builders, HVAC Contractors, inspectors, architects, and other market participants” (RER, 1998, pg 7-2).<sup>107</sup>

**Table B.3-1: Self Reported Consumer Awareness of Efficiency Standards**

	Aware of energy efficiency standards for appliances, windows, and insulation	Aware of minimum efficiency standards for gas water heaters and furnaces
<b>Participants</b>	<b>69.0%</b>	<b>43.5%</b>
SDG&E	84.4%	68.8%
SCG	66.4%	39.4%
<b>Nonparticipants</b>	<b>65.6%</b>	<b>48.1%</b>
SDG&E	79.3%	65.2%
SCG	63.8%	45.9%
<b>Control</b>	<b>64.2%</b>	<b>31.4%</b>

Source: RER, 1998, Table 7-9, pg. 7-34

However, as shown in Table B.3-2, the percentage of the population that was aware of different equipment efficiency levels was much lower, suggesting that with regard to energy efficiency standards, home buyers misinterpret energy efficiency standards as an upper limit to efficiency requirements. As a result, home buyers may overlook the possibility of efficiency upgrades. Builders also noted that first-time home buyers were often more concerned with up-front costs, primarily due to unfamiliarity with home operating costs, further suggesting limited knowledge of the impacts of energy efficiency upgrades (RER, 1998, pg 5-84).

One thing to note is the differences in awareness of efficiency levels between California homeowners and the control group. The control group appeared to be more aware of efficiency levels with regard to windows, but less aware for gas related features such as furnaces. While the

<sup>107</sup> At the time of the study, the city of Austin offered successful information and training seminars to builders, HVAC contractors, inspectors, architects and other market participants (RER, 1998, pg 7-2).

1998 study did not suggest a reason for this explicitly, it suggested that the control area may be “imperfect” due to the higher cooling loads of Austin/San Antonio (RER, 1998, pg 7-1). Windows influence cooling loads, and they may be more prominent in the information sessions provided by the utilities of the control area (RER, 1998, pg 7-1, 7-2).

**Table B.3-2: Self-Reported Consumer Awareness of Efficiency Levels**

	Same Levels of Efficiency	Different Levels of Efficiency	Do Not Know	Did Not Answer
<i>Awareness of differences in energy efficiency levels of gas furnaces</i>				
<b>Participants</b>	<b>17.7%</b>	<b>44.1%</b>	<b>35.8%</b>	<b>2.4%</b>
SDG&E	11.5%	54.2%	32.3%	2.1%
SCG	18.7%	42.5%	36.4%	2.4%
<b>Nonparticipants</b>	<b>14.1%</b>	<b>44.9%</b>	<b>39.4%</b>	<b>1.6%</b>
SDG&E	6.5%	51.6%	38.6%	3.3%
SCG	15.1%	44.0%	39.5%	1.4%
<b>Control</b>	<b>9.2%</b>	<b>35.4%</b>	<b>53.3%</b>	<b>2.2%</b>
<i>Awareness of differences in energy efficiency levels of gas water heaters</i>				
<b>Participants</b>	<b>23.1%</b>	<b>46.4%</b>	<b>28.1%</b>	<b>2.4%</b>
SDG&E	21.9%	53.1%	24.0%	1.0%
SCG	23.3%	45.3%	28.8%	2.6%
<b>Nonparticipants</b>	<b>20.0%</b>	<b>47.4%</b>	<b>31.3%</b>	<b>1.4%</b>
SDG&E	12.5%	53.3%	33.2%	1.1%
SCG	20.9%	46.6%	31.1%	1.4%
<b>Control</b>	<b>17.9%</b>	<b>42.4%</b>	<b>38.9%</b>	<b>0.9%</b>
<i>Awareness of differences in energy efficiency levels of windows</i>				
<b>Participants</b>	<b>10.9%</b>	<b>77.7%</b>	<b>9.3%</b>	<b>2.0%</b>
SDG&E	4.2%	89.6%	5.2%	1.0%
SCG	12.0%	75.8%	10.0%	2.2%
<b>Nonparticipants</b>	<b>8.6%</b>	<b>81.4%</b>	<b>9.3%</b>	<b>0.7%</b>
SDG&E	3.8%	84.8%	8.7%	2.7%
SCG	9.2%	80.9%	9.4%	0.5%
<b>Control</b>	<b>6.6%</b>	<b>89.5%</b>	<b>3.5%</b>	<b>0.4%</b>

Source: RER, 1998, Table 7-10, pg. 7-35

The 1998 PG&E Comfort Home Program Market Baseline and Market Effects Study found slightly higher levels of home buyer awareness. According to this study, 95% of PG&E customers<sup>108</sup> were aware of energy efficiency standards compared to 85% of survey participants in the control area.<sup>109</sup> In addition, the PG&E study found higher levels of home buyer awareness of energy efficiency levels for windows (Table B.3-3).

**Table B.3-3: Consumer Awareness of Energy Efficiency Programs and Standards**

<b>Indicator</b>	<b>PG&amp;E Customers</b>	<b>Control Area</b>
Aware of energy efficiency levels relating to appliances, windows, and insulation levels	95.1%	85.4%
Aware of minimum energy efficiency standards for air conditioners	67.8%	71.3%
Aware of differences in windows	78.1%	80.9%
Aware of ENERGY STAR Program	15.4%	8.9%
Awareness of energy-efficient mortgages	20.5%	13.8%

Source: RER, 1999, Table 4-11, pg. 4-32<sup>110</sup>

Overall, 67.8% of all survey participants identified standards specific to air conditioners, and 78.1% identified differences in efficiency standards for windows, implying knowledge among home buyers with respect to efficiency measures. In addition, 48% of customers were aware of the Comfort Homes Program and 15% were aware of the ENERGY STAR Homes Program, exceeding awareness of the latter program for the rest of the country (RER, 1999, pg 4-31, 4-32).

<sup>108</sup> PG&E customers were split evenly among program participants and non-participants.

<sup>109</sup> The control area consists of interviews with the following utilities: Arizona Public Service (AZ), Tucson Electric (AZ), Fort Collins Light and Power (CO), Florida Power & Light (FL), Tampa Electric (FL), Georgia Power (GA), Nevada Power (NV), Sierra Pacific Power (NV), Rochester (NY), Duke Power Company (NC), Houston Power and Light (TX), Texas Utilities (TX), Austin Electric Department (TX), San Antonio City Public Service Board (TX) (RER, 1999, pg 3-28).

<sup>110</sup> Responses are weighted means

The *Statewide RNC Utility Program Comparison Study*, conducted in 2000 by Quantum Consulting, provides awareness levels with regard to energy efficiency programs, building features, and efficiency levels. This study found that of 226 surveyed home buyers, 3% were aware of RNC energy efficiency programs by name (Quantum Consulting Inc., 2000, pg 3-6). However, when programs were associated with a specific utility, awareness increased to 19% (Quantum Consulting Inc., 2000, pg 3-6). Table B.3-4 displays the aided awareness levels of RNC energy efficiency programs offered by California utilities.

**Table B.3-4: Aided Awareness of Utility RNC Programs**

<b>Utility Program</b>	<b>Percent Awareness</b>
PG&E Comfort Home	21%
SCE/SDG&E ComfortWise	3%
SoCalGas Energy Advantage Homes	11%
ENERGY STAR Homes	18%

Source: Quantum Consulting Inc., 2000, Exhibit 3-4, pgs. 3-7 and 3-8

Table B.3-5 displays the awareness levels among home buyers for specific energy efficiency features, and **Error! Reference source not found.** displays awareness of specific efficiency criteria for each feature. These tables show that while home buyers were aware of energy efficiency impacts of building features, specific knowledge of energy efficiency criteria was low except for windows, for which there were moderate levels of awareness.

**Table B.3-5: Awareness of Energy Efficiency Features**

<b>Building Feature</b>	<b>Percent Awareness</b>
Windows	44%
Non-Specific Insulation	27%
Appliances	23%
Air Conditioners	22%
Roof/Ceiling Insulation	20%

Source: Quantum Consulting Inc., 2000, Exhibit 3-5, pg. 3-9

**Table B.3- 6: Home Buyer Awareness of Energy Efficiency Criteria**

<b>Energy Efficiency Feature</b>	<b>Percent Awareness</b>
HVAC	4%
Gas Furnace	2%
Gas Water Heater	3%
Electric Water Heater	0%
Ceiling Insulation	8%
Wall Insulation	8%
Window	46%

Source: Quantum Consulting Inc., 2000, Exhibit 3-5, pg. 3-9

While there is limited data to define the baseline of home buyer awareness, it appears as though home buyers were aware of efficiency standards but less aware of efficiency levels for specific building measures or equipment in the late 1990s. Overall, awareness of efficiency levels for windows was much higher than those for other features, such as insulation, appliances, and HVAC equipment. In addition, as of 2000, the awareness of RNC programs did not exceed 21%, indicating a large potential for increased awareness (Quantum Consulting Inc., 2000 pg 3-7, 3-8).

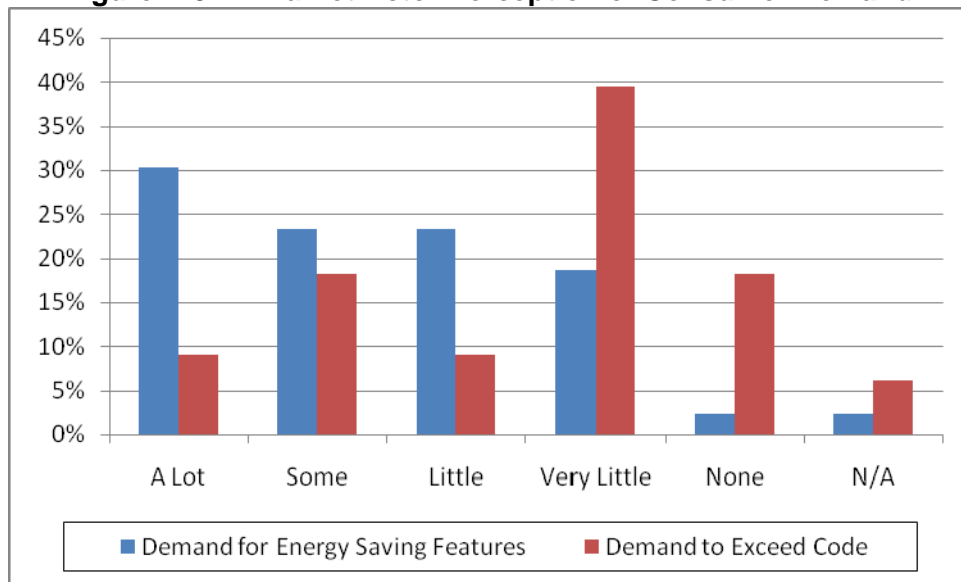
### **B.3.3 Attitudes**

Consumer demand for energy-efficient homes and ratings of the importance of efficiency are discussed in this section. First, the results of the 1997 *RNC Market Transformation Study* conducted by Barakat & Chamberlain are discussed, followed by findings of the 1998 *PG&E Comfort Home Program Market Baseline and Market Effects Study* conducted by RER.



As of 1997, 63% of surveyed market actors<sup>111</sup> said that demand for energy efficiency had increased since 1993, reflecting increased home buyer awareness. However, only 27% of those surveyed felt that there was “a lot” or “some” buyer demand for features that exceed energy standards (Barakat & Chamberlain, 1997, pg 35). This information is depicted graphically in **Error! Reference source not found.** The study suggests that diminished market barriers related to buyer attitudes may partially be attributed to PG&E and SCE programs.

**Figure B.3- 1: Market Actor Perception of Consumer Demand**



(Source: Barakat & Chamberlain, 1997, Table 7, pg. 25)

Regarding the cost of energy efficiency measures, 73% of Northern California home buyers and 66% of Southern California home buyers preferred an “environmentally friendly” home (Barakat & Chamberlain, 1997, pg 30). However, of those who preferred such a home, only 22% in Northern California and 19% in Southern California were willing to pay the associated cost (Barakat & Chamberlain, 1997, pg 30).

Ninety-one percent of PG&E consumers agreed that energy efficiency was important or very important, and 54% indicated that its importance had increased since the early 1990s (RER, 1999, pg 4-31).<sup>112</sup>

Overall, these studies suggest that while home buyers were very accepting of energy-efficient homes, few were concerned with exceeding energy efficiency standards. Furthermore, there was evidence that most home buyers were unaware of the possibility of exceeding energy efficiency

<sup>111</sup> Surveyed market actors include builders, builders’ sales agents, realtors and Title 24 consultants (Barakat & Chamberlain, 1997, pg 25).

<sup>112</sup>Results are based on a scale of 1 through 5, where 1 is “Not Important At All”, 3 is “Somewhat Important”, and 5 is “Very Important.”

standards, as standards were often interpreted as being the highest level of efficiency. Although acceptance was widespread, as discussed in the next section, cost was a factor in the purchases of energy-efficient homes.

### **B.3.4 Decision Making Process**

The following section discusses the primary influences on home buyers' decisions in purchasing energy-efficient homes. The *1996 Market Characterization Study* conducted by Barakat & Chamberlain, the *1998 Residential Market Effects Study* and the *1998 PG&E Comfort Home Program Market Baseline and Market Effects Study* conducted by RER, the *2000 Statewide RNC Utility Program Comparison Study* conducted by Quantum Consulting, and the *Evaluation, Measurement, & Verification of the 2004 & 2005 California Statewide ENERGY STAR New Homes Program* by RLW are used as the basis for the discussion. These studies provide evidence that the prominence of energy efficiency in home buyers' purchase decisions relies heavily on buyer awareness, which is linked to the awareness of their sales agent and/or mortgage lender. In addition, energy efficiency is often sacrificed for building characteristics related to space, location, and functionality, as well as aesthetics.

Based on professional expertise, the findings of other RNC studies, and interviews with market experts, the market characterization study identified realtors and lenders as the primary influences on home buyers' purchasing decision, though they have very limited influence on the efficiency of the home (Barakat & Chamberlain, 1996, pg 18-20). Other market actors, such as builders, manufacturers, and designers, were found to have limited influence on the buyers' purchasing decision.

Realtors hold the most influence by controlling the homes shown and, thus, the energy-efficient features available. In addition, the expected additional cost of energy efficiency translates directly into a larger commission, providing an incentive to influence the buyer for such upgrades. However, this incentive is limited to the buyer's financial options, driven primarily by the mortgage lender (Barakat & Chamberlain, 1996, pg 19).

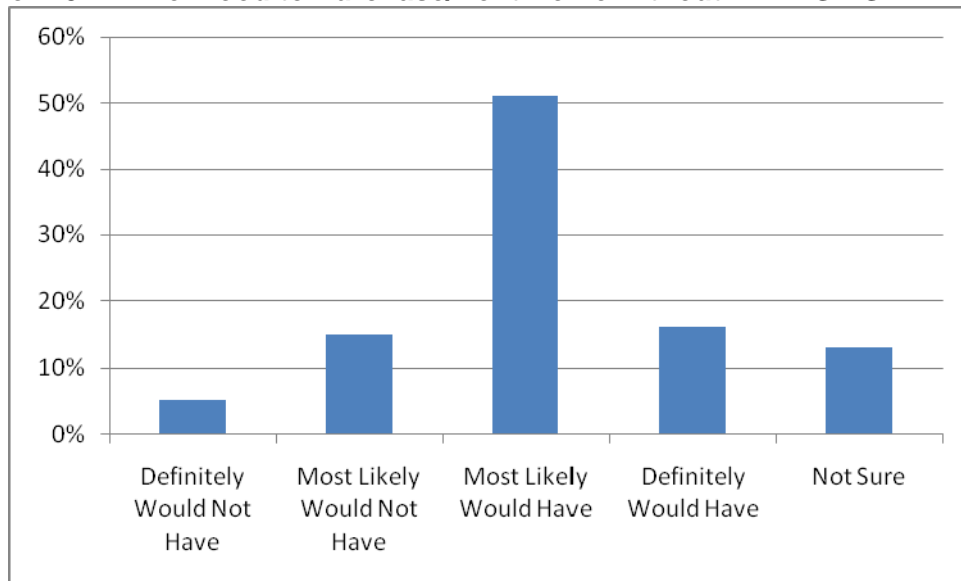
In 1998, approximately 70% of PG&E consumers indicated that energy efficiency influenced their decision in purchasing or renting their home (RER, 1999, pg 4-30, 4-31). However, survey results showed that operating costs were often secondary to attributes such as "price, floor plan, location, square footage, and the number of rooms," as well as aesthetic qualities including "style, flooring, color scheme, and kitchen appliances" (RER, 1998, pg 5-84). "In addition, the mild climate of Southern California diminished the importance of energy efficiency (RER, 1998, pg 5-84).

The results of the 2000 Quantum Consulting study showed different results. On a statewide level, only 27% of home buyers rated energy efficiency as very important, with 9% taking the lengths to investigate energy efficiency features (Quantum Consulting Inc., 2000, pg 3-12). This might imply that the importance of energy efficiency varies geographically or possibly by service area. However, the differences may also be due to what was considered "very important" in the 2000

study and “influential” in the 1998 study. Furthermore, the 2000 study stated that “home buyers’ greatest barriers include access to financing and a desire to invest only in energy efficiency features whose value can be capitalized in the home’s market value (Quantum Consulting Inc., 2000, pg 3-11).” This suggests that financial payback highly influences a home buyer’s decision to invest in energy efficiency. Finally, the study showed that 7% of those surveyed “assign high importance to the ENERGY STAR label” in their next home purchase (Quantum Consulting Inc., 2000, pg 3-12).

The study of the ENERGY STAR Homes program, completed in 2005, provides the most recent insight into buyer attitudes towards energy efficiency. Figure B.3-2 displays the responses from the study pertaining to the influence of the ENERGY STAR rating on the home buyer’s decision to purchase a home. Fifty-one percent of the ENERGY STAR Home program participants surveyed stated that they would “most likely” have purchased the home regardless of the ENERGY STAR rating, and 16% “definitely would have” purchased the home without the ENERGY STAR rating. Twenty percent of respondents reported that they most likely or would not have purchased the home without the ENERGY STAR rating and 13% were unsure (RLW Analytics, 2007, pg 237). These findings suggest that the ENERGY STAR Home label does not have a drastic affect on a majority of those who bought an ENERGY STAR rated home (RLW Analytics, 2007, pg 237). However, it did show a slight increase over the influence of ENERGY STAR, when compared to the statewide 2000 study.

**Figure B.3-2: Likelihood to Purchase/Rent Home without ENERGY STAR Rating**



(Source: RLW Analytics, 2007, Figure 91, pg. 237)

### **B.3.5 Sources of Information for Home buyers**

As noted in the previous sections, home buyers are aware of energy efficiency technologies and have developed opinions that inform their purchasing decisions. However, the 1996 Market Characterization Study stated that “lack of awareness, insufficient information, and bounded rationality” were the key market barriers affecting home buyers (Barakat & Chamberlain, 1996, pg 18-19). Effectively informing home buyers would help to diminish these barriers. This section presents the primary sources from which home buyers obtain their information.

The *1998 Residential Market Effects Study* noted that consumers were limited in their knowledge of energy-efficient technologies, relying heavily on intermediaries such as sales agents and builders (RER, 1998, pg 5-84). This implies that ten years ago, limited resources were available to home buyers, or at least reaching them. This statement was supported by the 2000 Quantum consulting study which stated “only 22 percent of home buyers indicated that any of their contacts or information sources had actively emphasized energy efficiency (Quantum Consulting Inc., 2000, pg 3-19).” The *1998 Residential Market Effects Study* hypothesized that utility-based programs would diminish the “bounded rationality” market barrier by educating the homeowner (RER, 1998, pg 7-40). However, as concluded by the study, “evidence was not found to support the hypotheses that residential new construction programs effectively lowered information search and hassle costs and increased consumer awareness and satisfaction of energy-efficient products (RER, 1998, pg 7-40).”

### **B.3.6 Summary**

The limited data provide a tentative description of home buyer awareness. Overall, home buyers were aware of the importance of energy efficiency and were often in favor of implementing appropriate technologies. However, the presence of such measures was often overshadowed by other factors, such as aesthetics, size, and cost. It appears that most home buyers had a general awareness of energy efficiency standards; however, they generally did not appear to understand how efficiency affects operating costs. As a result, buyers relied heavily on their realtor or sales agent for this information.

## Appendix C Additional Analysis for Chapter 4

This section of the appendix is composed of additional tables that support the analysis and conclusions presented in Chapter 4. For ease of reference, the tables are organized under the same subchapters as Chapter 4.

### C.1 Introduction

For this analysis, builders and HVAC contractors were divided into three categories based on their familiarity with and participation in the IOU programs: Partial participants, Aware Nonparticipants, and Unaware Nonparticipants. Partial participants were defined as builders or HVAC contractors who built or installed HVAC equipment into some, but not all, of their homes with the help of the IOU programs. Aware Nonparticipants are builders or HVAC contractors who were aware of the IOU programs but did not build or install HVAC equipment into any homes with the help of the IOU programs. Unaware Nonparticipants are builders or HVAC contractors who were not aware of the IOU programs and did not build or install HVAC equipment into any homes with the help of the program.

Title 24 consultants and HERS raters were also divided into three categories: Majority Participants, Minority Participants and Nonparticipants. Majority Participants are Title 24 consultants or HERS raters for which more than 50% of the homes they consulted on or rated were program homes. Minority Participants are Title 24 consultants or HERS raters for which less than 50% of the homes have consulted on or rated were program homes. Nonparticipants are Title 24 consultants or HERS raters who did not consult on or rate any program homes.

Most tables reporting responses from builders, HVAC contractors, Title 24 consultants and HERS raters include responses weighted by the percentage of non-program homes. Weights were developed from the responses of each builder, Title 24 consultant and HERS rater asking them to estimate the overall number of homes they built, consulted or rated as well as the number of homes they built, consulted or rated through the IOU programs from 2006 through 2008.<sup>113</sup>

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<sup>113</sup> It should be noted that for builders, HVAC contractors, Title 24 consultants and HERS raters there are a few respondents who are responsible for disproportionate numbers of non-program homes. For example, one builder built 61% of builder non-program homes, one HVAC contractor installed HVAC equipment into 78% of HVAC contractor non-program homes, one HERS rater rated 58% of HERS rater non-program homes and one Title 24 consultant consulted on 23% of Title 24 consultant non-program homes.

Nineteen of 32 builders, responsible for 94% of non-program homes, said they were aware of the IOU RNC programs, and ten builders said they had built some homes through the program between 2006 and 2008 (Table C.1-1). Note that partial participants—those who build both program and non-program homes—were responsible for the vast majority of non-program homes in the 2006-2008 period; the majority of non-participants built fewer than 300 homes (Table C.1-2). The 31,561 non-program homes accounted for by the builders in the sample amount to about 15% of all non-program homes in California during the 2006-2008 period. Seven of 32 builders had participated in the IOU programs before 2006. The fact that partial participants report building 2,814 program homes from 2006 to 2008, and there were only 5,592 claimed by the IOUs for 2006 through 2008 suggests that some builders may have counted IOU program homes committed (and thus already counted) under the 2004-2005 program, but completed in 2006.

**Table C.1-1: Awareness of and Participation in IOU Residential New Construction Programs before 2006 and from 2006 to 2008**

(Builders)

	Builders (% of Non-program Homes)			Total
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	
n	13	9	10	32
Unaware of IOU Programs	13 (6%)	0 (0%)	0 (0%)	13 (6%)
Aware of IOU Programs	0 (0%)	9 (10%)	10 (84%)	19 (94%)
Participated before 2006	0 (0%)	3 (5%)	4 (13%)	7 (17%)
Participated, 2006 to 2008	0 (0%)	0 (0%)	10 (84%)	10 (84%)
Number of program-supported housing units, 2006 to 2008	0	0	2,814	2,814
Number of non-program housing units, 2006 to 2008	1,952 (6%)	3,231 (10%)	26,378 (84%)	31,561 (100%)

**Table C.1-2: Distribution of Builders Interviewed, by Number of Non-Program Homes**

(Builders)

Number of Non-Program Homes	Builders			Total
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	
n	13	9	10	32
Fewer than 20	6	3	1	10
80 to 299	4	3	3	10
300 to 999	3	2	3	8
1,000 to 3,000	0	1	2	3
>10,000	0	0	1	1

Seven of nine HVAC contractors, responsible for 97% of non-program homes, said they were aware of the IOU RNC programs and three contractors installed HVAC systems in homes built through the program between 2006 and 2008 (Table C.1-3). As with builders, partial participant HVAC contractors—those who had worked on both program and non-program homes—were responsible for a large majority of non-program homes. As with builders, non-participant HVAC contractors tend to be smaller firms (Table C.1-4). The 52,997 non-program homes accounted for by the HVAC contractors in the sample amount to about 25% of all non-program homes in California during the 2006-2008 period. Again, the number of IOU program homes reported by HVAC contractors suggests respondents' conflation of the IOU programs with the ENERGY STAR program.

**Table C.1-3: Awareness of and Participation in IOU Residential New Construction Programs before 2006 and from 2006 to 2008**  
(HVAC Contractors)

	Number of HVAC Contractors (% of All Non-program Homes)			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	2	4	3	9
Unaware of IOU Programs	2 (3%)	0 (0%)	0 (0%)	2 (3%)
Aware of IOU Programs	0 (0%)	4 (13%)	3 (83%)	7 (97%)
Participated before 2006	0 (0%)	0 (0%)	2 (78%)	2 (78%)
Participated, 2006 to 2008	0 (0%)	0 (0%)	3 (83%)	3 (83%)
Number of program-supported housing units, 2006 to 2008	0	0	4,012	4,012
Number of non-program housing units, 2006 to 2008	1,794 (3%)	6,985 (13%)	44,219 (83%)	52,997 (100%)

**Table C.1-4: Distribution of HVAC Contractors Interviewed, by Number of Non-Program Homes**  
(HVAC Contractors)

Number of Non-Program Homes	Number of HVAC Contractors			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	2	4	3	9
60 or fewer	0	2	1	3
61 to 249	1	1	0	2
250 to 1599	0	0	0	0
1,600 to 3,000	1	0	1	2
6,700	0	1	0	1
>10,000	0	0	1	1

Thirty-six of 45 Title 24 consultants, responsible for 75% of non-program homes, said they were aware of the IOU RNC programs and 23 had consulted on homes built through the program between 2006 and 2008 (Table C.1-5). In this case, Title 24 consultants who worked mostly on program homes account for a small portion of non-program homes. Most Title 24 consultants (35 of 45), including all majority participants, consulted on fewer than 1,000 homes, with the remaining ten consulting on 1,000 to 10,000 homes or more than 16,000 homes (Table C.1-6). The 106,809 non-program homes accounted for by the Title 24 contractors in the sample amount to about 50% of all non-program homes in California during the 2006-2008 period. The number of IOU program homes reported by Title 24 consultants again suggests respondents' conflation of the IOU programs with the ENERGY STAR program.

**Table C.1-5: Awareness of and Participation in IOU Residential New Construction Programs before 2006 and from 2006 to 2008**

(Title 24 Consultants)

	Number of Title 24 Consultants (% of All Non-program Homes)			Total
	Non-participants	Minority participants	Majority Participants	
n	22	20	3	45
Unaware of IOU Programs	9 (25%)	0 (0%)	0 (0%)	9 (25%)
Aware of IOU Programs	13 (6%)	20 (68%)	3 (1%)	36 (75%)
Provided Title 24 consulting before 2006	1 (0%)	8 (30%)	2 (1%)	11 (31%)
Provided Title 24 consulting, 2006 to 2008	1 (1%)	20 (68%)	3 (1%)	24 (70%)
Number of program-supported housing units, 2006 to 2008	0	0	8,477	8,477
Number of non-program housing units, 2006 to 2008	32,886 (31%)	72,812 (68%)	1,110 (1%)	106,809 (100%)

**Table C.1-6: Distribution of Title 24 Consultants Interviewed, by Number of Non-Program Homes**

(Title 24 Consultants)

Number of Non-Program Homes	Number of Title 24 Consultants			Total
	Non-participants	Minority participants	Majority Participants	
n	22	20	3	45
Fewer than 100	5	4	1	10
100 to 199	3	3	0	6
200 to 499	7	4	1	12
500 to 999	4	2	1	7
1,000 to 9,999	2	4	0	6
10,000 to 15,999	0	0	0	0
16,000 to 25,000	1	3	0	4



Twenty-six of 29 HERS raters, responsible for 99% of non-program homes, said they were aware of the IOU RNC programs and 16 had provided HERS ratings for homes built through the program between 2006 and 2008 (Table C.1-7). Most HERS raters had rated at least some program homes as well as non-program homes, but few of them get most of their business from rating program homes. Note that HERS raters provided ratings for homes going through the IOU programs, but also for homes outside the IOU programs that may have received certification from other programs, such as ENERGY STAR Homes or LEED; in addition, HERS ratings can be used to verify QII and thus earn energy credits within Title 24. Most HERS raters (24 of 29) rated fewer than 511 non-program homes, while one large HERS rater rated more than 11,000 homes during the 2006 to 2008 time period (Table C.1-8). The 20,011 non-program homes accounted for by the HERS raters in the sample amount to about 10% of all non-program homes in California during the 2006-2008 period, but HERS ratings are not required for all non-program homes, so this could represent a high percentage of non-program homes that received HERS ratings. Once again, the number of IOU program homes reported by HERS raters suggests respondents' conflation of the IOU programs with the ENERGY STAR program.

**Table C.1-7: Awareness of and Participation in IOU Residential New Construction Programs before 2006 and from 2006 to 2008**  
(HERS Raters)

	Number of HERS Raters (% of All Non-program Homes)			
	Non-participants	Minority participants	Majority Participants	Total
n	13	10	6	29
Unaware of IOU Programs	3 (1%)	0 (0%)	0 (0%)	3 (1%)
Aware of IOU Programs	10 (10%)	10 (76%)	6 (13%)	26 (99%)
Provided HERS rating before 2006	2 (6%)	2 (58%)	1 (13%)	5 (77%)
Provided HERS Rating, 2006 to 2008	0(0%)	10 (76%)	6 (13%)	16 (89%)
Number of program-supported housing units, 2006 to 2008	0	0	0	9,379
Number of non-program housing units, 2006 to 2008	2,148 (11%)	15,319 (76%)	2,644 (13%)	20,111 (100%)

**Table C.1-8: Distribution of HERS Raters Interviewed, by Number of Non-Program Homes**  
(HERS Raters)

Number of Non-Program Homes	Number of HERS Raters			Total
	Non-participants	Minority participants	Majority Participants	
n	13	10	6	29
Fewer than 10	4	1	4	9
10 to 26	3	1	1	5
27 to 66	0	0	0	0
67 to 259	4	2	0	6
260 to 999	1	3	0	4
1,000 to 3,000	1	2	1	4
>10,000	0	1	0	1

## **C.2 Homes Built through Other Voluntary Efficiency Programs**

The eight programs represented by other program manager interviews—including municipal utility programs, programs offered by private organizations, and national and state government programs—all certify new homes in California based on energy-efficiency criteria; in addition, six of the eight programs also support photovoltaics, and two of them support broader “green” building practices. Five of these programs entail a criterion that certified homes must be 15% more efficient than Title 24 requirements, similar to Tier 1 in the IOU programs; two of these five programs explicitly call this set of criteria Tier 1, and they also offer a Tier 2 that is 35% above Title 24 requirements, also like the IOU programs. The other three programs require specific measures or allow the builder to choose from among a list of measures, with one program aiming specifically for 20% above Title 24 requirements, another achieving 23% to 42% savings above Title 24, and the third having no overall savings target.

One possible way in which the IOU programs can influence other programs is through their efficiency criteria (Indicator 1A in Table 2.3-1). Table C.2-1 shows that four of the eight managers of non-IOU programs interviewed for the study gave ratings of 7 to 10 on a 0-to-10 scale, indicating that the IOU programs have had a strong effect on the efficiency criteria used by their programs. The four managers giving 7-to-10 ratings represent programs accounting for approximately 43,000 homes, or about 93% of the 46,000 homes certified by these programs and not by the IOU programs (except possibly for gas measures in municipal electric territories).<sup>114</sup> As one respondent said, “The utilities had a lot of input in the stakeholder process to develop specifications, because they knew what was sellable to mainstream builders.” And another said that “the utilities were major players in establishing energy efficiency criteria, and hugely influential in driving those criteria in the market.” In contrast, another respondent said that “the IOUs don't drive the regulatory and legislative environment—it's the other way around.” Some of these effects probably came from pre-2006 versions of the IOU programs, when participation in the IOU programs was greater (see Table C.2-1).

**Table C.2-1: Effect of IOU Programs on Efficiency Criteria Used in Other Programs**  
(Other Program Manager Interviews; 0 to 10 scale; 0= “no effect at all” and 10= “a great effect”)

<b>Rating</b>	<b>Respondents</b>	<b>% of all SFH homes certified by other programs, minus overlap w IOU programs</b>
0 to 3	3	2%
4 to 6	1	5%
7 to 10	4	93%
Total	8	+/-46,000

<sup>114</sup> There was not a census of the other RNC programs, so there could be additional homes certified by other programs that have been affected by IOU efficiency criteria.

Another way in which the IOU programs can influence other programs is by increasing participation in those programs (Indicator 1B in Table 2.3-1). Table C.2-2 shows that two respondents, whose programs account for 90% of the homes certified by the eight programs, say the IOU programs have increased participation in their programs a lot. The two managers giving 7-to-10 ratings represent programs account for approximately 42,000 homes, or 90% of the 46,000 homes certified by these programs and not by the IOU programs (except possibly for gas measures in municipal electric territories).<sup>115</sup> One manager whose program overlaps with the IOU programs says there is a lot of synergy between them, and they contribute to each other's participation. Another manager whose program overlaps with the IOUs' program said that "everything is attributable to the utility." A manager of a program certifying some non-participating (in IOU program) homes said that the effect of the IOU programs on participation in their program is "huge," and another said that some builders had started with the IOU programs, which led to participation in their program. Again, some of these effects probably came from pre-2006 versions of the IOU programs.

**Table C.2-2: Effect of IOU Programs on Participation in Other Programs**

(Other Program Manager Interviews)

<b>Effect on Participation</b>	<b>Respondents</b>	<b>% of all SFH homes certified by other programs, minus overlap w IOU programs</b>
Decreased a lot	0	0%
Decreased a little	0	0%
Had no effect	2	5%
Increased a little	4	4%
Increased a lot	2	90%
Total	8	+/-46,000

Table C.2-3 through Table C.2- 6 provide additional data about awareness of and participation in other RNC programs encouraging energy efficiency.

<sup>115</sup> Note that this was not a census of other RNC programs, so there could be additional homes certified by other programs that have been affected by IOU efficiency criteria.

**Table C.2-3: Awareness of and Participation in RNC Programs Encouraging Energy Efficiency**  
(Builders)

n	Unaware Nonparticipants				Aware Nonparticipants			
	Aware of Program	Participated		Units built, 2006 – 08 (% of all homes)	Aware of Program	Participated		Units built, 2006 – 08 (% of all homes)
		Before 2006	2006-08			Before 2006	2006-08	
		13			9			
IOU RNC Programs	0	0	0	0	9	3	0	0
LEED for Homes	6	0	1	<1%	4	0	0	0%
ENERGY STAR Homes	9	1	2	1%	8	2	2	1%
Solar Initiative	7	0	0	0%	7	0	0	0%
Environments for Living	2	1	1	1%	2	1	0	0%
ComfortWise	2	1	0	0%	4	1	0	0%
Federal tax credits	6	2	3	0%	7	1	2	5%
Municipal utility-sponsored programs	5	0	0	0%	6	3	3	5%
Building America	1	na	na	na	2	na	na	na
Smart Home	8	1	0	0%	7	0	0	0%

**Table C.2-3: Awareness of and Participation in RNC Programs Encouraging Energy Efficiency (continued)**  
(Builders)

n	Partial Participants				Total			
	Aware of Program	Participated		Units built, 2006 – 08 (% of all homes)	Aware of Program	Participated		Units built, 2006 – 08 (% of all homes)
		Before 2006	2006-08			Before 2006	2006-08	
		10				32		
<b>Program</b>								
IOU RNC Programs	10	4	10	8%	19	7	10	8%
LEED for Homes	9	1	1	8%	19	1	2	8%
ENERGY STAR Homes	10	3	6	38%	27	6	10	41%
Solar Initiative	8	1	3	<1%	22	1	3	<1%
Environments for Living	4	1	0	0%	8	3	1	1%
ComfortWise	7	3	3	32%	13	5	3	32%
Federal tax credits	10	4	8	50%	23	7	13	55%
Municipal utility-sponsored programs	7	2	2	6%	18	5	5	11%
Building America	1	na	na	na	4	na	na	na
Smart Home	5	0	2	5%	20	1	2	5%

**Table C.2- 4: Awareness of and Participation in RNC Programs Encouraging Energy Efficiency**  
(Title 24 Consultants)

Program	Nonparticipants					Minority Participants				
	n	22		20		n	20		20	
	Aware of Program	Participated		Units consulted, 2006-08 (% of all homes)	Base models consulted, 2006-08 (% of all base models))	Aware of Program	Participated		Units consulted, 2006-08 (% of all homes)	Base models consulted, 2006-08 (% of all base models)
	Before 2006	2006-08				Before 2006	2006-08			
IOU RNC programs	9	1	1	0%	1%	20	8	20	5%	78%
LEED for Homes	17	0	3	0%	0%	17	1	8	0%	1%
ENERGY STAR Homes	22	4	11	0%	<1%	20	7	11	7%	37%
Solar Initiative	18	0	7	<1%	<1%	17	0	14	3%	7%
Environments for Living	4	0	1	<1%	<1%	7	2	1	3%	5%
ComfortWise	11	0	0	0%	0%	10	2	2	6%	28%
Federal tax credits	20	2	6	<1%	<1%	20	3	10	5%	29%
Municipal utility-sponsored programs	13	1	1	<1%	<1%	16	3	5	4%	17%
Building America	4	0	0	na	na	9	3	4	na	na
Smart Home	15	0	1	<1%	<1%	14	2	2	4%	15%



**Table C.2- 4: Awareness of and Participation in RNC Programs Encouraging Energy Efficiency (continued)**  
(Title 24 Consultants)

Program	Majority Participants					Total				
	n	3			45					
	Aware of Program	Participated		Units consulted, 2006-08 (% of all homes)	Base models consulted, 2006-08 (% of all base models)	Aware of Program	Participated		Units consulted, 2006-08 (% of all homes)	Base models consulted, 2006-08 (% of all base models)
	Before 2006	2006-08				Before 2006	2006-08			
IOU RNC Programs	3	2	3	2%	12%	36	11	24	7%	91%
LEED for Homes	3	0	0	0%	0%	37	1	11	0%	1%
ENERGY STAR Homes	3	1	2	<1%	<1%	45	12	24	7%	38%
Solar Initiative	1	0	1	<1%	0%	36	0	22	3%	7%
Environments for Living	1	0	0	0%	0%	12	2	2	3%	5%
ComfortWise	2	1	1	4%	4%	23	3	3	11%	32%
Federal tax credits	3	0	2	3%	3%	43	5	18	8%	33%
Municipal utility-sponsored programs	2	1	1	<1%	1%	31	5	7	4%	18%
Building America	2	1	1	na	na	15	4	5	na	na
Smart Home	1	0	0	0%	0%	30	2	3	4%	16%

**Table C.2- 5: Awareness of and Participation in RNC Programs Encouraging Energy Efficiency**  
(HERS Raters)

n	Nonparticipants				Minority Participants			
	Aware of Program	Participated		Percent of all SFH rated, 2006-08	Aware of Program	Participated		Percent of all SFH rated, 2006-08
		Before 2006	2006-08			Before 2006	2006-08	
		13				10		
<b>Program</b>								
IOU RNC Programs	10	2	0	0%	10	2	10	18%
LEED for Homes	13	0	4	<1%	10	0	3	<1%
ENERGY STAR Homes	13	4	6	1%	10	2	8	14%
Solar Initiative	13	0	5	<1%	10	0	9	5%
Environments for Living	5	0	0	0%	6	1	1	5%
ComfortWise	9	1	1	<1%	8	0	0	0%
Federal tax credits	13	0	7	2%	10	0	9	4%
Municipal utility-sponsored programs	13	0	3	2%	7	1	2	2%
Building America	10	0	1	N/A	7	0	0	N/A
Smart Home	7	0	0	0%	5	0	0	0%

**Table C.2- 5: Awareness of and Participation in RNC Programs Encouraging Energy Efficiency (continued)**  
(HERS Raters)

n	Majority Participants				Total			
	Aware of Program	Participated		Percent of all SFH rated, 2006-08	Aware of Program	Participated		Percent of all SFH rated, 2006-08
		Before 2006	2006-08			Before 2006	2006-08	
		<b>6</b>				<b>29</b>		
<b>Program</b>								
IOU RNC Programs	6	1	6	14%	26	5	16	32%
LEED for Homes	6	1	4	1%	29	1	11	1%
ENERGY STAR Homes	6	1	5	9%	29	7	19	24%
Solar Initiative	5	0	4	2%	28	0	18	7%
Environments for Living	2	0	1	<1%	13	1	2	5%
ComfortWise	5	1	1	24%	22	2	2	24%
Federal tax credits	6	0	3	6%	29	0	19	13%
Municipal utility-sponsored programs	4	1	1	1%	24	2	6	9%
Building America	6	1	1	N/A	23	1	2	N/A
Smart Home	4	0	0	0%	16	0	0	0%

**Table C.2- 6: Awareness of and Participation in RNC Programs Encouraging Energy Efficiency**  
(HVAC Contractors)

n	Unaware Nonparticipants				Aware Nonparticipants			
	Aware of Program	Participated		Units installed HVAC equip., 2006 – 08 (% of all homes)	Aware of Program	Participated		Units installed HVAC equip., 2006 – 08 (% of all homes)
		Before 2006	2006-08			Before 2006	2006-08	
IOU RNC Programs	0	0	0	0%	1	0	0	0%
LEED for Homes	2	1	1	<1%	3	1	1	5%
ENERGY STAR Homes	0	0	0	0%	2	1	1	<1%
Solar Initiative	0	0	0	0%	1	0	0	0%
Environments for Living	1	1	1	1%	1	0	0	0%
ComfortWise	2	0	1	<1%	3	0	1	3%
Federal tax credits	0	0	0	0%	3	0	0	0%
Municipal utility-sponsored programs	0	na	na	na	0	na	na	na
Building America	1	1	0	0%	3	3	1	<1%
Smart Home	0	0	0	0%	1	0	0	0%

**Table C.2- 6: Awareness of and Participation in RNC Programs Encouraging Energy Efficiency (continued)**  
(HVAC Contractors)

n	Partial Participants				Total			
	Aware of Program	Participated		Units installed HVAC equip., 2006 – 08 (% of all homes)	Aware of Program	Participated		Units installed HVAC equip., 2006 – 08 (% of all homes)
		Before 2006	2006-08			Before 2006	2006-08	
		3				9		
IOU RNC Programs	2	0	0	7%	3	2	3	7%
LEED for Homes	3	2	3	11%	8	4	5	16%
ENERGY STAR Homes	2	0	2	<1%	4	1	3	1%
Solar Initiative	2	1	1	5%	3	1	1	5%
Environments for Living	2	2	1	<1%	4	3	2	1%
ComfortWise	3	1	2	4%	8	1	4	7%
Federal tax credits	1	1	1	18%	4	1	1	18%
Municipal utility-sponsored programs	1	na	na	na	1	na	na	na
Building America	0	0	0	0%	4	4	1	<1%
Smart Home	2	0	0	0%	3	0	0	0%

### C.3 Costs of Increased Efficiency

Overall, builders in the current study estimated that the incremental cost to exceed Title 24 by ten percent is 8% beyond the base cost of the home (to meet Title 24)—considerably less than the incremental cost estimated by builders in the 1998 PG&E study (Table C.3-1). Partial participants, who may have been more familiar than nonparticipants with the costs of building homes to exceed Title 24, estimated the incremental cost to be an average of 12% beyond the base price of the home.

**Table C.3-1: Incremental Cost to Exceed Title 24 by 10 Percent**  
(Builders)

	Builders (% of All Non-Program Homes)					
	1998 PG&E Study <sup>116</sup>	2000 Statewide RNC Study <sup>117</sup>	Unaware Nonpart.	Aware Nonpart.	Partial Participants	Total
n	31	14	13	9	10	32
2% or less	NA	NA	4 (3%)	2 (4%)	4 (12%)	10 (19%)
3% to 5%	NA	NA	5 (1%)	4 (5%)	2 (61%)	11 (67%)
10% to 20%	NA	NA	1 (<1%)	2 (1%)	2 (3%)	5 (4%)
25% to 50%	NA	NA	0 (0%)	0 (0%)	2 (7%)	2 (7%)
Don't know	NA	NA	3 (2%)	1 (<1%)	0 (0%)	4 (3%)
Average percentage increase (SD)	31% (NA)	NA	4% (4.1)	8% (7.8)	12% (15.8)	8% (10.8)

<sup>116</sup> Builders were interviewed from northern and central California for the 1998 PG&E Comfort Home Program Market Baseline and Market Effects Study. Data source: p. 4-17.

<sup>117</sup> Production builders and developers were interviewed for the 2000 Statewide Residential New Construction Utility Program Comparison Study. Data source: p. 3-12.

Twenty-four of 32 builders, representing 96% of non-program homes, reported that the incremental cost to exceed the efficiency requirements of Title 24 had increased over the previous five years, while five builders reported that the incremental costs had stayed the same and three reported a decrease (Table C.3-2). Respondents who reported an increase in the incremental cost estimated the increase to be 26%, while those reporting a decrease estimated the decrease to be 13%. Of course, it should be noted that Title 24 requirements have changed during this period.

**Table C.3-2: Change in Incremental Cost over the Last Five Years for Efficiency Improvements that Exceed Title 24**

	Number of Builders (% of All Non-program Homes)			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	13	9	10	32
Increased	8 (5%)	7 (10%)	9 (81%)	24 (96%)
Decreased	2 (<1%)	0 (0%)	1 (3%)	3 (3%)
Stayed same	3 (1%)	2 (<1%)	0 (0%)	5 (1%)
Percent incremental cost has increased (Mean %)	15.0%	17.1%	42.2%	26.3%
Percent incremental cost has decreased (Mean %)	12.5%	NA	15%	13.3%

When asked why the incremental costs had decreased, two respondents reported that the decrease was due to increased use of energy-efficient features leading to lower prices of these features, while one respondent identified the downturn in the housing market (Table C.3-3). Builders indicating an increase in incremental costs most often said that the increase was due to the increased costs of labor and materials (ten builders), while four builders said that the greater stringency of Title 24 makes it more costly to exceed the requirements.

**Table C.3-3: Reasons for Changes in Incremental Cost over the Last Five Years for Efficiency Improvements that Exceed Title 24**

	Number of Builders			Total
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	
n	13	9	10	32
<b>Decrease in costs</b>				
Increased used of features led to lower prices	1	0	1	2
Downturn in market has led to lower prices	1	0	0	1
<b>Increase in costs</b>				
Increased cost of labor and materials	4	3	3	10
Code has gotten so high that exceeding it is very expensive	2	1	1	4
New products are simply more expensive	0	2	1	3
Newer products are more desirable, making them more expensive	1	0	1	2
Newer products are not mass-produced and their use is less widespread, making them more expensive	1	0	1	2
Newer products save less and less energy, so they cost more for what they accomplish	0	0	1	1
Cost of developing technology is added to new products, making them more expensive	0	0	1	1



Six HVAC distributors were interviewed in total and were asked to estimate the typical increase in the price to a production builder to improve from a 13 SEER, three-ton central air conditioner to a 16 SEER unit (Table C.3-4). Distributors reported that the incremental cost increased from 2005 to 2008, from \$900 to \$1,125.<sup>118</sup>

**Table C.3-4: Incremental Cost to Improve from 13 SEER, Three Ton Central Air Conditioner (CAC) to 16 SEER, Three Ton CAC<sup>119</sup>**  
(HVAC Distributors)

	2005	2006	2007	2008
n	4	4	4	4
\$500 to \$1,000	3	3	3	2
\$1,001 to \$1,500	1	0	0	1
More than \$1,500	0	1	1	1
Mean price increase	\$900	\$975	\$1,075	\$1,125

HVAC distributors were asked to estimate the typical increase in the price to a production builder to improve from an 80 AFUE, 80,000 BTU gas furnace to a 95 AFUE unit (Table C.3-5). On average, distributors indicated that the price difference did not change from 2006 to 2008.<sup>120</sup>

**Table C.3-5: Incremental Cost to Improve from 80 AFUE, 80,000 BTU Gas Furnace to 95 AFUE Unit<sup>121</sup>**  
(HVAC Distributors)

	2005	2006	2007	2008
n	4	4	4	4
Less than \$700	3	3	2	3
\$700 to \$1,000	0	0	1	0
More than \$1,000	1	1	1	1
Mean price increase	\$700	\$737	\$750	\$737

<sup>118</sup> One respondent reported price differences in percentage increases of 300% for 2005, 2006, 2007, and 2008. His responses are not included in calculating the mean price increase shown in **Error! Reference source not found.** The sixth respondent did not provide an estimate.

<sup>119</sup> Costs are in nominal dollars not adjusted for inflation.

<sup>120</sup> Two gave their answers as percentages: one respondent said 7%, 8%, 10%, and 10% for 2005, 2006, 2007, and 2008, respectively; the other said 250% for all four years. Their responses are not included in calculating the mean price increase shown in **Error! Reference source not found.**

<sup>121</sup> Costs are in nominal dollars not adjusted for inflation.

HVAC distributors were asked to identify factors influencing the change in price differences between lower and higher efficiency central air conditioning (CAC) and furnaces. Most respondents reported price increases, attributing the increases to the cost of materials, cost of shipping or the economy (Table C.3-6). In addition, one respondent said the price difference for CAC decreased between 2005 and 2006 and again between 2006 and 2008. He attributed this to more units with higher SEER ratings becoming available. One respondent said the price difference for gas furnaces decreased between 2005 and 2006 and again between 2006 and 2008. He attributed this to more units with higher AFUE ratings becoming available. A second respondent also said the price difference for gas furnaces decreased between 2006 and 2008. He attributed this to the economic slowdown, leading competitors to cut prices. When asked to rate the influence of a variety of RNC programs and other factors on price decreases, none was rated as having a great deal of influence (rating of 7 to 10 on a scale of 0 to 10, where zero is “no influence at all” and ten is “a great deal of influence”).

**Table C.3-6: Factors Influencing Increase in HVAC Equipment Price Differences**  
(HVAC Distributors)

Equipment Type	Factors	2005 to 2006	2006 to 2008
n (multiple response)		2	3
CAC, 13 SEER, Three Ton to 16 SEER	Cost of copper and other metals	2	3
	Gas prices and other costs of shipping	0	1
n		3	1
Gas Furnace, 80,000 BTU, 80 AFUE to 95 AFUE	Cost of materials	2	1
	Cost of shipping	0	1
	Manufacturers pass more of raw materials cost increases into top of line equipment	1	0
	Economy more robust raising prices	1	0

Window distributors estimated that the cost to improve from a 0.60 U-factor window to a 0.35 U-factor window declined slightly from 2006 to 2008 (Table C.3-7). On average, the incremental cost declined from 2006 to 2008.

**Table C.3-7: Incremental Cost to Improve from 0.60 U-Factor Window to 0.35 U-Factor Window**  
(Insulation Distributors)

	2005	2006	2007	2008
n	10	9	9	9
15% or less	4	4	4	6
16% to 30%	4	4	4	2
Over 30%	2	1	1	1
Mean price increase	22%	19%	19%	18%

Window distributors estimated the cost to improve from a 0.65 SHGC window to a 0.40 SHGC window (Table C.3-8). On average, the incremental cost did not change from 2006 to 2008, though more respondents reported an incremental cost of 10% or less in 2008 than in 2006. One respondent said the incremental cost was \$1.00 per square foot in 2005 and 2006, rising to \$1.25 in 2007 and \$1.50 in 2008. His responses are not included in Table C.3-8 because they could not be matched to the other responses.

**Table C.3-8: Incremental Cost to Improve from 0.65 SHGC Window to 0.40 SHGC Window**  
(Insulation Distributors)

	2005	2006	2007	2008
n	8	8	8	9
10% or less	5	4	4	6
10% to 20%	2	3	3	2
Over 20%	1	1	1	1
Mean price increase	14%	15%	16%	15%

Window distributors were asked to identify factors influencing the change in price differences between lower and higher efficiency windows; responses indicating a decrease in incremental costs are shown in Table C.3-9. Factors influencing the decrease in incremental cost include low-e glass becoming more standard, driving down the price of more efficient windows, and manufacturers either dropping prices to stay competitive in a declining housing market or selling more aggressively. In addition, two respondents noted that price differences for 0.35 U-Factor and 0.60 U-Factor windows increased between 2005 and 2006, since there was high demand for new windows, and homes with larger, fancier windows were being built. Two respondents noted that price differences for 0.65 SHGC windows and 0.40 SHGC windows increased from 2005 to 2006 (and one noting an increase from 2006 to 2008) due to price increases from manufacturers and the building boom during the 2005 to 2006 time period.

**Table C.3-9: Factors Influencing Decrease in Window Price Differences**  
(Window Distributors)

Window feature	Factors (multiple response)	2005 to 2006	2006 to 2008
n		1	2
0.60 U-Factor window to 0.35 U-Factor window	Low-e windows becoming more standard and less expensive	1	1
	Manufacturers more aggressive in selling windows	0	1
n		0	3
0.65 SHGC window to 0.40 SHGC window	Manufacturers have dropped prices to stay competitive as the housing market in California dried up	0	2
	Low-e windows becoming more standard and less expensive	0	1

Window distributors who indicated a decline in price differences between lower and higher efficiency windows between 2006 and 2008 were asked to rate the influence of a variety of RNC programs and other factors on the decrease (Table C.3-10) Two of seventeen distributors rated the IOU RNC programs as having a great deal of influence on the decrease in price difference between a 0.60 and 0.35 U-factor window (seven to ten rating on a zero to ten scale, where zero is “no influence at all” and ten is “a great deal of influence”). Other factors rated as having a great deal of influence by more than one distributor include changes to the building codes, increasing energy prices, and the decline in the housing market.

**Table C.3-10: Factors Influencing Decrease in Price Difference of Windows with More Efficient U-Factor and SHGC Ratings, 2006 to 2008**

(Window Distributors; 0-10 scale; 0= “No influence at all” and 10= “A great deal of influence”)

	<b>7 to 10 rating</b>	
	Decrease in price difference between 0.60 and 0.35 U-factor windows	Decrease in price difference between 0.65 and 0.40 SHGC windows
n	17	17
IOU Residential New Construction programs	2	1
Municipal utility-sponsored programs	0	1
LEED for Homes	0	0
ENERGY STAR Homes	0	1
Solar Initiative	0	0
Environments for Living	0	0
ComfortWise	0	0
Federal Tax Credits for efficient new homes	0	0
Building America	0	0
Smart Home	0	1
Changes in building codes	2	1
Increasing energy prices	2	1
Decline in the housing market	3	2

Insulation distributors were asked about the cost to improve from R-30 to R-38 using their most commonly distributed insulation (Table C.3-11). For Respondents 1 and 2, this consists of fiberglass batts or rolls; for Respondent 3, it consists of rigid board expanded polystyrene. The other two respondents did not answer the question; one reported that he does not do installations, only sales.

**Table C.3-11: Incremental Cost to Improve from R-30 to R-38 of Most Commonly Distributed Ceiling Insulation<sup>122</sup>**  
(Insulation Distributors)

	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>
Respondent 1	\$100	\$100	\$100	\$100
Respondent 2	\$0.13 / sq ft	\$0.14 / sq ft	\$0.15 / sq ft	\$0.13 / sq ft
Respondent 3	25%	25%	25%	20%

Respondents were asked about the cost to improve wall insulation from R-13 to R-21 using their most commonly distributed insulation. For Respondent 1, it consists of rigid board expanded polystyrene. He said the improvement would be 88% of the R-13 cost for 2005, 2006, and 2007; in 2008, it would be 64% of R-13 cost.

One respondent reported that there was an *increase* in insulation prices from 2005 to 2006 and that increases from the manufacturers were a factor influencing the increase. No other respondents reported an increase in the insulation price difference for wall insulation going from R-13 to R-21.

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<sup>122</sup> Costs are in nominal dollars not adjusted for inflation.

Insulation distributors who indicated a decline in price differences in higher efficiency levels between 2006 and 2008 were asked to rate the influence of a variety of RNC programs and other factors on the decrease (Table C.3-12). The only factors rated as having a great deal of influence (rating of 7 to 10 on a scale of 0 to 10, where zero is “no influence at all” and ten is “a great deal of influence”) were changes in the building code and the decline in the housing market.

**Table C.3-12: Factors Influencing Decrease in Price Difference, 2006 to 2008**

(Insulation Distributors; 0-10 scale; 0= “No influence at all” and 10= “A great deal of influence”)

	7 to 10 rating	
	R-30 to R-38 of Most Commonly Distributed Ceiling Insulation	R-13 to R-21 of Most Commonly Distributed Wall Insulation
n	5	5
LEED for Homes	0	0
ENERGY STAR Homes	0	0
Solar Initiative	0	0
Environments for Living	0	0
ComfortWise	0	0
Federal Tax Credits for efficient new homes	0	0
Programs sponsored by municipal utilities	0	0
Building America	0	0
Smart Home		
IOU RNC Programs	0	0
Changes in building codes	1	1
Increasing energy prices	0	0
Decline in the housing market	1	1

Lighting fixture and control distributors estimated the cost to change from an interior screw-based lighting fixture to a pin-based CFL fixture (Table C.3-13). On average, the incremental cost declined slightly from 2006 to 2008, and a majority of respondents (eight of 14) reported the cost difference to be \$20 or less per fixture in 2008.

**Table C.3-13: Incremental Cost to Change from an Interior Screw-Based Fixture to a Pin-Based CFL Fixture<sup>123</sup>**

(Lighting Fixtures and Controls Distributors)

	2005	2006	2007	2008
n	12	12	13	14
\$20 or less	5	6	7	8
\$21 to \$50	6	5	5	5
Over \$50	1	1	1	1
Mean price increase	\$30	\$28	\$27	\$26

<sup>123</sup> Costs are in nominal dollars not adjusted for inflation.

Lighting fixture and controls distributors estimated the cost to change from an exterior screw-based fixture to a pin-based CFL fixture (Table C.3-14). On average, the incremental cost did not change from 2006 to 2008. One respondent reported that the cost of pin-based fixtures was 150% of the screw-based fixture cost in 2008. His response is not included in Table C.3-14 because it could not be matched to the other responses.

**Table C.3-14: Incremental Cost to Change from an Exterior Screw-Based Fixture to a Pin-Based CFL Fixture**<sup>124</sup>

(Lighting Fixtures and Controls Distributors)

	2005	2006	2007	2008
n	11	12	13	13
\$20 or less	6	7	7	7
\$21 to \$50	4	4	5	5
Over \$50	1	1	1	1
Mean price increase	\$27	\$26	\$26	\$26

Lighting fixture and controls distributors estimated the cost to add an occupancy sensor to an interior screw-based fixture (Table C.3-15). On average, the incremental cost increased slightly from 2006 to 2008. One respondent reported that the cost of adding an occupancy sensor to an interior screw-based fixture was 180% of the screw-based fixture cost in 2008. His response is not included in Table C.3-15 because it could not be matched to the other responses.

**Table C.3-15: Incremental Cost to Add an Occupancy Sensor to an Interior Screw-based Fixture**<sup>125</sup>

(Lighting Fixtures and Controls Distributors)

	2005	2006	2007	2008
n	6	5	6	6
\$20 or less	3	2	2	2
\$21 to \$50	2	2	3	3
Over \$50	1	1	1	1
Mean price increase	\$28	\$30	\$31	\$31

<sup>124</sup> Costs are in nominal dollars not adjusted for inflation.

<sup>125</sup> Costs are in nominal dollars not adjusted for inflation.

Lighting fixture and controls distributors estimated the cost to add photocontrols and motion sensors to exterior screw-based fixtures (Table C.3-16). On average, the incremental cost did not change from 2006 to 2008, although more respondents estimated the price difference to be \$20 or less per fixture in 2008 than in 2006. One respondent reported that the cost of adding photocontrols and motion sensors to an exterior screw-based fixture was 180% of the screw-based fixture cost in 2008. His response is not included in Table C.3-16 because it could not be matched to the other responses.

**Table C.3-16: Incremental Cost to Add Photocontrols and Motion Sensors to an Exterior Screw-based Fixture<sup>126</sup>**

(Lighting Fixtures and Controls Distributors)

	2005	2006	2007	2008
n	10	10	9	9
\$20 or less	2	2	3	4
\$21 to \$50	6	6	4	3
Over \$50	2	2	2	2
Mean price increase	\$43	\$43	\$43	\$43

<sup>126</sup> Costs are in nominal dollars not adjusted for inflation.



Lighting distributors were asked to identify factors influencing the change in price differences between fixtures; responses indicating a decrease are show in Table C.3-17. The most commonly cited factor influencing the decrease in price difference between both interior and exterior screw-based fixtures and pin-based CFL fixtures was the rise in production levels leading to lower costs. Other factors include competition among manufacturers and more manufacturers locating facilities on the West Coast. However, three respondents noted that price differences for interior fixtures increased between 2006 and 2008 due to increased manufacturing costs, while two also noted increases in the price of steel and copper as well as fuel used for transportation. One respondent said the switch from two-pin to four-pin fixtures contributed to increased price differences. For exterior fixtures, three respondents said the price difference increased from 2006 to 2008 due to the rising cost of materials. No distributors reported a price decrease for adding an occupancy sensor to an interior screw-based fixture; two distributors reported a price increase due to rising material costs while one attributed price increases to rising demand. Distributors reporting a decrease in price differences for photocontrols and motion sensors identified increased usage and volume as well as improved technologies as reasons for the decrease. However, one distributor reported a price increase for photocontrols and motion sensors due to increases in materials and production costs.

**Table C.3-17: Factors Influencing Decrease in Lighting Fixtures and Controls Price Difference**

(Lighting Fixtures and Controls Distributors)

Fixture Types	Factors (multiple response)	2005 to 2006	2006 to 2008
n		3	3
Interior Screw-Based Fixture to Pin-Based CFL Fixture	Rising production leading to lower costs	3	3
	Competition among manufacturers	1	1
	More manufacturers come online in the West Coast	0	1
n		3	4
Exterior Screw-Based Fixture to Pin-Based CFL Fixture	Rising production leading to lower costs	3	4
	Competition among manufacturers	0	1
Adding an Occupancy Sensor to an Interior Screw-based Fixture	<i>NA (No distributors reported a price decrease)</i>		
n		3	1
Adding Photocontrols and Motion Sensors to Exterior Fixture	Increase in usage due to Title 24 led to decrease in price	1	1
	Increased volume	0	2
	Improved technology	0	1

Lighting distributors who indicated a decline in price differences between interior and exterior screw-based fixtures and pin-based CFL fixtures between 2006 and 2008 were asked to rate the influence of a variety of RNC programs and other factors on the decrease (Table C.3-18). None of the distributors rated the IOU RNC programs as having a great deal of influence on the decrease in price difference (seven to ten rating on a zero to ten scale, where zero is “no influence at all” and ten is “a great deal of influence”). Factors rated as having a great deal of influence by more than one distributor include changes to the building codes and the decline in the housing market.

**Table C.3-18: Factors Influencing Decrease in Price Difference of the Cost to Change from a Screw-based Fixture to a Pin-based CFL Fixture, 2006 to 2008**

(Lighting Fixtures and Controls Distributors; 0-10 scale;  
0= “No influence at all” and 10= “A great deal of influence”)

Factor	7 to 10 Rating	
	Interior Fixtures	Exterior Fixtures
n	18	18
IOU Residential New Construction programs	0	0
Municipal utility-sponsored programs	0	0
LEED for Homes	0	0
ENERGY STAR Homes	0	0
Solar Initiative	0	0
Environments for Living	0	0
ComfortWise	0	0
Federal Tax Credits for efficient new homes	0	0
Building America	0	0
Smart Home	0	0
Changes in building codes	2	3
Increasing energy prices	1	1
Decline in the housing market	1	2

## **C.4 Modeling of Efficiency**

As shown in Table C.4-1, Title 24 consultants most commonly recommended above-code windows (39% of non-program homes), duct testing (38%), duct sealing (37%), high-EER air conditioner or heat pump (32%), water heating equipment (28%), insulation installation practices (27%), and insulation R-values (26%). Overall, 38 out of 45 Title 24 consultants recommended at least one above-code practices. (Whether the measures are actually installed is another matter, as discussed in Section 4.12.)

**Table C.4-1: Percentage of Non-Program Homes Consulted on from 2006 to 2008 for which Title 24 Consultant Recommended Using Above-Code Practices and Technologies**  
(Title 24 Consultants)

n	Nonparticipants		Minority participants		Majority Participants		Total	
	22		20		3		45	
	Mean	% of All Non- Prog. Homes	Mean	% of All Non- Prog. Homes	Mean	% of All Non- Prog. Homes	Mean	% of All Non- Prog. Homes
Insulation R-values	40%	19 (4%)	32%	12 (22%)	13%	1 (<1%)	34%	32 (26%)
Quality of insulation installation	11%	6 (1%)	17%	10 (26%)	3%	1 (<1%)	13%	17 (27%)
Windows	56%	17 (3%)	61%	16 (35%)	25%	1 (<1%)	56%	34 (39%)
High-SEER air conditioner or heat pump	38%	19 (2%)	35%	14 (21%)	5%	1 (<1%)	35%	34 (24%)
High-EER air conditioner or heat pump	36%	15 (2%)	44%	15 (29%)	22%	2 (<1%)	38%	32 (32%)
High-AFUE furnace	44%	18 (3%)	37%	15 (17%)	12%	2 (<1%)	38%	35 (20%)
HVAC installation	24%	9 (2%)	27%	9 (20%)	38%	2 (1%)	26%	20 (23%)
Water-heating equipment	52%	18 (3%)	57%	15 (24%)	65%	3 (<1%)	55%	36 (28%)
Lighting	24%	11 (2%)	22%	8 (5%)	33%	2 (0%)	24%	21 (7%)
Framing materials and techniques	8%	6 (1%)	16%	6 (8%)	0%	0 (0%)	11%	12 (9%)
Orientation and shading	11%	8 (<1%)	26%	11 (17%)	3%	1 (<1%)	17%	20 (17%)
Photovoltaics	5%	4 (<1%)	9%	4 (16%)	33%	1 (0%)	9%	9 (16%)
Duct sealing	26%	16 (2%)	42%	11 (36%)	50%	2 (<1%)	35%	29 (37%)
Duct testing	24%	13 (1%)	45%	12 (36%)	42%	2 (1%)	34%	27 (38%)
Air sealing	1%	5 (<1%)	19%	5 (18%)	3%	1 (<1%)	9%	11 (19%)
Any recommendation	NA	19	NA	16	NA	3	NA	38

Seventeen Title 24 consultants who recommended above-code practices said the IOU programs in general had a great deal of influence on their recommendations for at least one of those practices, most commonly for high-SEER air conditioners or heat pumps, QII, duct sealing, duct testing, and water heating equipment (Table C.4-2).

**Table C.4-2: Influence of IOU Programs on Recommendations of Above-Code Practices and Technologies in Non-Program Homes**

(Title 24 Consultants, 0-10 Scale; 0= “No influence at all” and 10= “A great deal of influence”)

	7 to 10 Rating (% of All Non-program Homes)			
	Non-participants	Minority participants	Majority Participants	Total
n	22	20	3	45
Insulation R-values	1 (0%)	4 (7%)	0 (0%)	5 (7%)
Quality of insulation installation	1 (0%)	4 (8%)	0 (0%)	5 (8%)
Windows	2 (0%)	5 (4%)	0 (0%)	7 (4%)
High-SEER air conditioner or heat pump	1 (0%)	6 (9%)	0 (0%)	7 (9%)
High-EER air conditioner or heat pump	1 (0%)	5 (8%)	1 (0%)	7 (8%)
High-AFUE furnace	1 (0%)	3 (4%)	0 (0%)	4 (4%)
HVAC installation	0 (0%)	3 (6%)	0 (0%)	3 (6%)
Water-heating equipment	0 (0%)	5 (11%)	1 (0%)	6 (11%)
Lighting	1 (0%)	3 (2%)	1 (0%)	5 (2%)
Framing materials and techniques	0 (0%)	1 (<1%)	0 (0%)	1 (<1%)
Orientation and shading	0 (0%)	2 (1%)	0 (0%)	2 (1%)
Photovoltaics	2 (0%)	3 (5%)	1 (0%)	6 (5%)
Duct sealing	1 (0%)	5 (18%)	1 (0%)	7 (18%)
Duct testing	1 (0%)	5 (19%)	0 (0%)	6 (19%)
Air sealing	0 (0%)	3 (5%)	0 (0%)	3 (5%)
Any influence	4	11	2	17

When asked how the program influenced the recommendations of above-code measures for non-program homes, Title 24 consultants most commonly identified program training, program incentives, the accuracy of the data associated with energy savings provided by the program, energy savings of the measure and the quality of the measure (Table C.4-3). Title 24 consultants also said that some above-code measures, such as insulation, were often needed to make the entire home code compliant.

**Table C.4-3: Ways Program Influenced Recommendations of Above-Code Measures in Non-Program Homes**  
(Title 24 Consultants)

	<b>Non- participants</b>	<b>Minority participants</b>	<b>Majority Participants</b>	<b>Total</b>
n (multiple response)	22	20	3	45
Training	0	14	0	14
Incentives	1	13	0	14
Measure necessary for code compliance	0	11	0	11
Accuracy of data provided by program	9	0	0	9
Energy cost savings associated with measure	1	4	3	8
Quality of measure	0	8	0	8
Measure is better for the environment	0	1	2	3
Measure helps with homes overall budget	1	1	0	2
Programs requirement of measure caused consultant to seek out information on it	0	1	0	1
Measure contributes to overall quality of home	0	1	0	1
Better availability of product	0	1	0	1
Measure has been available for a long time and use has increased	0	1	0	1
Inexpensive cost of measure	0	1	0	1

Title 24 consultants most commonly identified global warming, the energy crisis, market conditions, inflation and code enforcement as the outside conditions that influenced their recommendation of above-code measures (Table C.4-4).

**Table C.4-4: Outside Conditions that Would Influence Consultants' Recommendation of Above-Code Practices and Measures**

(Title 24 Consultants)

	Non-participants	Minority participants	Majority Participants	Total
n (multiple response)	22	20	3	45
Global warming	6	19	2	27
Energy crisis	4	21	0	25
Market conditions	0	19	1	20
Inflation	0	13	1	14
Enforcement	0	10	0	10
Overall home quality	0	6	1	7
Right thing to do	0	4	0	4
Consultant will continue to recommend quality features	0	2	1	3
Technology has improved	0	2	0	2
Consumers more environmentally conscious	1	0	0	1
Consumers more aware of green building	1	0	0	1
Recommendations don't work without incentives	1	0	0	1

For those Title 24 consultants who did not recommend any above-code practices and technologies, the most common reason was the builders' desire just to meet code and not go beyond it (Table C.4-5).

**Table C.4-5: Reasons for Not Recommending Above-Code Building Practices and Technologies in Non-Program Homes**

(Title 24 Consultants)

	Number of Title 24 Consultants			
	Non-participants	Minority participants	Majority Participants	Total
n	22	20	3	45
Builders just want the minimum - no extra cost	3	3	0	6
Builders only want above-code if there are incentives	0	2	0	2
Just starting to "get into" above-code homes	0	1	0	1

Twenty-four of 32 builders were **not** aware of Program Plan Check, limiting the effect that the review process could have on modeling and building homes above-code (Table C.4-6). Of those builders who were aware of Program Plan Check, only five, responsible for 7% of non-program homes, reported that the review process helped a great deal in modeling and building above-code. It is also possible that builders are not familiar with the term “Program Plan Check” but are familiar with the review process.

**Table C.4-6: Amount of Help that “Program Plan Check” Feedback Provides in Modeling and Building above-code**

	(Builders)			
	Number of Builders (% of All Non-Program Homes)			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	13	9	10	32
Unfamiliar with Program Plan Check	10 (4%)	8 (6%)	6 (13%)	24 (22%)
7-10 rating, Amount of help Program Plan Check helps model and build above-code (10= “a great deal of help”)	3 (2%)	1 (4%)	1 (<1%)	5 (7%)



As with builders, nearly all Title 24 consultants (42 of 45) and HVAC contractors (seven of nine) were **not** familiar with Program Plan Check (Table C.4-7 and Table C.4-8). None of the Title 24 consultants said Program Plan Check provided a great deal of help in catching modeling errors in program supported homes or in helping non-program homes meet code, while only one HVAC contractor, responsible for fewer than 1% of all non-program homes, reported that the review process helped a great deal in modeling and building above-code. As with builders, it is possible that Title 24 consultants and HVAC contractors are not familiar with the term “Program Plan Check” but are familiar with the review process.

**Table C.4-7: Amount of Help that “Program Plan Check” Provides**  
(Title 24 Consultants)

	Number of Title 24 Consultants (% of All Non-Program Homes)			Total
	Non- participants	Minority Participants	Majority Participants	
n	22	20	3	45
Unfamiliar with Program Plan Check	20 (29%)	20 (68%)	2 (1%)	42 (98%)
7-10 rating, Amount of help Program Plan Check helps catch modeling errors in program supported homes (10= “a great deal of help”)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
7-10 rating, Amount of help Program Plan Check helps meet code in non-program homes (10= “A great deal of help”)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

**Table C.4-8: Amount of Help that “Program Plan Check” Provides**  
(HVAC Contractors)

	Number of HVAC Contractors (% of All Non-Program Homes)			Total
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	
n	2	4	3	9
Unfamiliar with Program Plan Check	2 (3%)	3 (13%)	2 (83%)	7 (100%)
7-10 rating, Amount of help Program Plan Check helps model and build above-code (10= “a great deal of help”)	0 (0%)	1 (<1%)	0 (0%)	0 (<1%)

While Program Plan Check appears not to have had much effect on modeling and building above-code, the opposite is the case with IOU training. As shown in Table C.4-9, 35 out of 45 Title 24 consultants had attended IOU-sponsored training, and 23 of 45, representing 42% of non-program homes, said the IOU training influenced their recommendations of energy efficiency building practices or technologies (not necessarily above-code), especially HVAC, windows, and duct sealing and testing.

**Table C.4-9: Attendance of IOU-Sponsored Trainings and Types of Energy-efficient Technologies or Practices Typically Recommended as a Result**  
(Title 24 Consultants)

	Number of Title 24 Consultants (% of All Non-Program Homes)			
	Non- participants	Minority Participants	Majority Participants	Total
n	22	20	3	45
Did not attend IOU-sponsored training	4 (2%)	5 (13%)	1 (0%)	10 (15%)
7-10 rating, influence of IOU training on recommendations of energy-efficient building practices and technologies (10= "a great deal of influence")	12 (3%)	10 (38%)	1 (1%)	23 (42%)
<b>Practices or technologies recommended as a result of the training:</b>				
Insulation practices	5	4	0	9
HVAC practices	7	7	0	14
Duct sealing and testing practices	6	5	0	11
Air sealing practices	4	2	0	6
Framing practices	2	1	0	3
Window installations	4	8	0	12
Electrical practices	6	4	0	10
Photovoltaic installations	3	3	0	6

Thirty-three out of 45 Title 24 consultants received training from other organizations, most commonly the training offered by California Association of Energy Consultants (CABEC).

**Table C.4-10: Training Sessions Pertaining to Energy-Efficiency Sponsored by Other Organizations**  
(Title 24 Consultants)

Attended Trainings Sponsored By:	Number of Title 24 Consultants (% of All Non-Program Homes)			
	Non-participants	Minority Participants	Majority Participants	Total
n	22	20	3	45
Have not received training from any other organizations	6 (26%)	5 (20%)	1 (0%)	12 (46%)
<b>Received training from:</b>				
California Energy Commission/CEC	3 (1%)	1 (0%)	0 (0%)	4 (1%)
California Association of Energy Consultants / CABEC	11 (4%)	10 (24%)	2 (1%)	23 (29%)
California Home Energy Efficiency Rating Services	2 (0%)	1 (0%)	0 (0%)	3 (0%)
Local government	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Municipal utility	0 (0%)	2 (0%)	0 (0%)	2 (0%)
USGBC, LEED	1 (0%)	2 (20%)	0 (0%)	3 (20%)
Build It Green	1 (0%)	3 (10%)	0 (0%)	4 (10%)
Micropas	0 (0%)	3 (15%)	0 (0%)	3 (15%)
Other	3 (1%)	6 (19%)	0 (0%)	9 (21%)

## C.5 Adoption of New Technologies and Practices

Few builders, five of 32, were aware of the IOUs' R&D and CASE Study programs that seek to demonstrate the feasibility of energy-efficient technologies and practices. While four of the five builders who were aware of the programs (responsible for 1% of non-program homes) had adopted technologies tested by the R&D program or demonstrated in the CASE studies, only one builder reported that the program had a great deal of influence on their adoption of the technology or practice. When asked what energy-efficient building practices or technologies they now typically use because of the program, only one respondent was able to identify specific technologies (ENERGY STAR appliances, CFLs and energy-efficient lighting fixtures). (See Table C.5-1.)

**Table C.5-1: Influence of IOU R&D and CASE Study Programs on Energy-Efficient Building Practices or Technologies**  
(Builders)

	Number of Builders (% of All Non-Program Homes)			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	13	9	10	32
Unaware of IOU R&D and CASE Studies	10 (6%)	9 (10%)	8 (83%)	27 (99%)
Have adopted practices or technologies	2 (<1%)	0 (0%)	2 (1%)	4 (1%)
Have not adopted technologies (aware of R&D and CASE Studies)	1 (<1%)	0 (0%)	0 (0%)	1 (<1%)
7-10 rating, Influence of IOU R&D and CASE Studies on Adoption of Energy-Efficient Building Practices (10= "A great deal of influence")	1 (<1%)	0 (0%)	0 (0%)	1 (<1%)

Compared to builders, a higher proportion of Title 24 consultants (17 of 45) were aware of the IOUs' R&D and CASE Study programs (Table C.5-2). In addition, a higher proportion of Title 24 consultants—11 of 45 who are responsible for 12% of non-program homes—had recommended technologies tested by the R&D program or demonstrated in the CASE Studies. Overall, eight Title 24 consultants, responsible for 3% of non-program homes, reported that the program had a great deal of influence on their recommendations of the technologies or practices.

**Table C.5-2: Influence of IOU R&D and CASE Study Programs on Recommendations of Energy-Efficient Building Practices or Technologies**

(Title 24 Consultants)

	Title 24 Consultants (% of All Non-Program Homes)			
	Non-participants	Minority Participants	Majority Participants	Total
n	22	20	3	45
Unaware of IOU R&D and CASE Studies	12 (27%)	13 (39%)	1 (0%)	26 (66%)
Have recommended practices or technologies	7 (3%)	4 (9%)	0 (0%)	11 (12%)
Have not adopted/recommended technologies / Don't know	3 (1%)	3 (20%)	2 (1%)	8 (21%)
7-10 rating, Influence of IOU Programs' R&D and CASE Studies on Adoption/Recommendation of Energy-Efficient Building Practices (10= "A great deal of influence")	6 (2%)	2 (1%)	0 (0%)	8 (3%)

## C.6 Builder Knowledge

Builders' self-rated awareness of the energy-efficient equipment and building practices was relatively high for most equipment and building practices, particularly for windows, duct testing, and quality of insulation installation (Table C.6-1). Awareness was lower, however, for photovoltaics, orientation and shading, and HVAC installation.

**Table C.6-1: Awareness of Energy-efficient Equipment and Building Practices**

(Builders; "not aware at all," "somewhat aware," "very aware")

Reasons	Number of Builders "Very Aware" (% of All Non-program Homes)			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	13	9	10	32
Types of insulation	9 (5%)	7 (9%)	7 (78%)	23 (91%)
Quality of insulation installation	11 (6%)	6 (9%)	8 (74%)	25 (88%)
Windows	9 (5%)	9 (10%)	9 (83%)	27 (98%)
High-SEER air conditioner or heat pump	8 (5%)	6 (8%)	7 (76%)	21 (89%)
High-AFUE furnace	8 (4%)	5 (8%)	6 (73%)	19 (85%)
HVAC installation	8 (5%)	1 (4%)	7 (80%)	16 (89%)
Water-heating equipment	8 (3%)	6 (9%)	9 (83%)	23 (95%)
Lighting	7 (4%)	6 (9%)	6 (75%)	19 (88%)
Framing materials and techniques	9 (4%)	2 (4%)	8 (74%)	18 (82%)
Orientation and shading	5 (3%)	4 (4%)	4 (6%)	13 (13%)
Photovoltaics	5 (2%)	3 (3%)	4 (6%)	12 (22%)
Duct sealing	8 (5%)	7 (9%)	8 (22%)	23 (37%)
Duct testing	10 (6%)	7 (10%)	9 (83%)	26 (98%)
Air sealing	9 (6%)	5 (6%)	7 (19%)	21 (31%)

When asked to identify their primary source of information on new energy-efficient technologies and building practices, builders most commonly identified subcontractors (30 of 32 builders) and other builders (12 of 32 builders), followed by the IOU RNC programs (nine of 32 builders) and utilities or utility trainings (eight of 32 builders) (Table C.6-2).

**Table C.6-2: Primary Sources of Information on New Energy-efficient Technologies and Building Practices**  
(Builders)

	Number of Builders			
	Unaware Non-participants	Aware Non-participants	Partial Participants	Total
n	13	9	10	32
Subcontractors	12	9	9	30
Other builders	0	6	6	12
IOU RNC programs	1	4	4	9
Utilities and utility trainings	1	4	3	8
Title 24 consultants	3	0	3	6
Trade magazines	2	2	0	4
Green building programs and organizations	2	1	1	4
Trade organizations	1	2	1	4
Code / Title 24	3	0	0	3
New equipment; changing equipment standards	2	0	0	2
Architects	1	0	1	2
Internet	0	2	0	2
Industry knowledge	0	0	1	1
Seminars and training	0	1	0	1
CPUC	1	0	0	1
City	1	0	0	1
Homeowners	1	0	0	1
HERS raters	1	0	0	1

Nearly all HVAC contractors rated themselves as ‘very aware’ of all energy-efficient equipment and building practices pertaining to HVAC systems (Table C.6-3).

**Table C.6-3: Awareness of Energy-efficient Equipment and Building Practices**

(HVAC Contractors; “not aware at all,” “somewhat aware,” “very aware”)

Reasons	Number of Builders “Very Aware” (% of All Non-program Homes)			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	2	4	3 (83%)	9
High-SEER air conditioner or heat pump	2 (3%)	2 (13%)	3 (83%)	7 (100%)
High-EER air conditioner or heat pump	2 (3%)	2 (13%)	3 (83%)	7 (100%)
High-AFUE furnace	2 (3%)	3 (13%)	3 (83%)	8 (100%)
HVAC installation for maximum efficiency	2 (3%)	3 (13%)	3 (83%)	9 (100%)
Duct sealing	2 (3%)	4 (13%)	3 (83%)	9 (100%)
Duct testing	2 (3%)	4 (13%)	3 (83%)	9 (100%)
Air sealing	2 (3%)	4 (13%)	3 (83%)	9 (100%)



HVAC contractors' most common source of information on new energy-efficient technologies and building practices was the IOU RNC programs (five of nine contractors), followed by manufacturers and vendors (Table C.6-4). The respondent who identified other HVAC contractors as a source of information about new energy-efficient technologies and building practices reported that he learned about the technologies and practices at trade shows, trainings and Air Conditioning, Heating and Refrigeration News,<sup>127</sup> and Airtime 500.<sup>128</sup>

**Table C.6-4: Primary Sources of Information on New Energy-efficient Technologies and Building Practices**  
(HVAC contractors)

	Number of Builders			Total
	Unaware Non-participants	Aware Non-participants	Partial Participants	
n	2	4	3	9
IOU RNC programs	1	2	2	5
Manufacturers / vendors	1	2	1	4
Trade publications	0	1	1	2
Other HVAC contractors	1	0	0	1
Professional organizations (Refrigeration Engineering Society)	1	0	0	1
Title 24	0	1	0	1
Architectural specs	0	1	0	1
Consultants	0	0	1	1
Personal experience	0	0	1	1

<sup>127</sup> <http://www.achrnews.com/>

<sup>128</sup> <http://www.airtime500.com/>

Sixteen builders, responsible for 25% of non-program homes, attended IOU-sponsored trainings (Table C.6-5). Eleven builders reported that they had adopted more energy-efficient building practices or technologies because of the training and eight rated the training as having had a great deal of influence on their adoption of the more energy-efficient building practices or technologies. Builders most commonly adopted more energy-efficient windows, insulation practices, duct sealing and testing practices, and electrical practices.

**Table C.6-5: Attendance of IOU-Sponsored Trainings and Types of Energy-efficient Technologies or Practices Typically Used as a Result**  
(Builders)

	Builders (% of All Non-Program Homes)			
	Unaware Non-participants	Aware Non-participants	Partial Participants	Total
n	13	9	10	32
Did not attend training	9 (2%)	4 (1%)	3 (73%)	16 (75%)
Did attend training	4 (4%)	5 (10%)	7 (11%)	16 (25%)
Use more energy-efficient building practices or technologies because of the training	2 (3%)	5 (9%)	7 (11%)	11 (23%)
7-10 rating, influence of IOU training on adoption of energy-efficient building practices and technologies (10= “a great deal of influence”)	1 (2%)	2 (5%)	5 (10%)	8 (17%)
Practices or technologies recommended as a result of the training:				
Insulation practices	2 (3%)	2 (5%)	6 (8%)	10 (17%)
HVAC practices	2 (3%)	1 (4%)	6 (8%)	9 (16%)
Duct sealing and testing practices	2 (3%)	1 (4%)	7 (11%)	10 (19%)
Air sealing practices	2 (3%)	1 (4%)	5 (8%)	8 (16%)
Framing practices	1 (3%)	2 (4%)	5 (6%)	8 (14%)
Window installations	2 (3%)	3 (8%)	6 (8%)	11 (20%)
Electrical practices	2 (3%)	2 (5%)	6 (7%)	10 (15%)
Photovoltaic installations	2 (3%)	1 (4%)	5 (6%)	8 (14%)

Eleven builders said they had employed subcontractors who had worked on program homes and changed their building or installation practices as a result (Table C.6-6). In addition, two builders reported that plumbers had changed their practices because of working on program homes, and one builder reported the same for a roofing contractor.

**Table C.6-6: Types of Subcontractors Who Have Changed Their Building or Installation Practices as a Result of Working on Program Homes**

	(Builders)			
	Number of Builders (% of All Non-Program Homes)			
	Unaware Non-participants	Aware Non-participants	Partial Participants	Total
n	13	9	10	32
Builder not aware of program	13 (6%)	0 (0%)	0 (0%)	13 (6%)
Contractors did not work on program homes	0 (0%)	3 (1%)	5 (71%)	8 (73%)
Contractors worked on program homes	0 (0%)	6 (9%)	5 (12%)	11 (21%)
Insulation contractors	0 (0%)	3 (5%)	5 (12%)	8 (17%)
HVAC contractors	0 (0%)	4 (6%)	5 (12%)	9 (18%)
Duct sealing and testing contractors	0 (0%)	3 (6%)	5 (12%)	8 (18%)
Air sealing contractors	0 (0%)	2 (5%)	5 (12%)	7 (18%)
Framing contractors	0 (0%)	2 (5%)	5 (12%)	7 (18%)
Window contractors	0 (0%)	3 (6%)	5 (12%)	8 (18%)
Electrical contractors	0 (0%)	4 (6%)	5 (12%)	9 (18%)
Photovoltaic contractors	0 (0%)	2 (5%)	4 (10%)	6 (15%)

When asked to identify the features of the program that had led to subcontractors changing their practices, builders most commonly identified rebates and energy efficiency (Table C.6-7).

**Table C.6-7: Features of the Program that Were the Main Reasons the Subcontractors Changed Their Building or Installation Practices**

	(Builders)			
	Number of Builders			
	Unaware Non-participants	Aware Non-participants	Partial Participants	Total
n	13	9	10	32
Rebates	0	0	4	4
Energy efficiency	0	3	0	3
Company wants to build energy-efficient homes	0	0	1	1
Knowledge of energy-efficient practices	0	0	1	1
Higher percentage of compliance	0	0	1	1
Customer satisfaction	0	0	1	1
Necessity	0	1	0	1

Six of nine HVAC contractors, responsible for 99% of non-program homes, had attended IOU-sponsored trainings in the 2006-2008 period (Table C.6-8). However, only one contractor, responsible for fewer than one percent of non-program homes, used more energy-efficient HVAC system design, installation, equipment, or testing practices because of the IOU training. Five HVAC contractors, responsible for 92% of non-program homes, had attended non-IOU-sponsored trainings. As with IOU-sponsored trainings, only one contractor, responsible for fewer than one percent of non-program homes, used more energy-efficient HVAC system design, installation, equipment, or testing practices because of the training.

**Table C.6-8: Attendance of Trainings and Types of Energy-efficient Technologies or Practices Typically Used as a Result**  
(HVAC Contractors)

	Number of HVAC Contractors (% of All Non-Program Homes)			
	Unaware Non-participants	Aware Non-participants	Partial Participants	Total
n	2	4	3	9
Did not attend IOU training	1 (<1%)	2 (<1%)	0 (0%)	3 (1%)
Attended IOU training	1 (3%)	2 (13%)	3 (83%)	6 (99%)
Use more energy-efficient HVAC system design, installation, equipment, or testing practices because of the IOU training	0 (0%)	0 (0%)	1 (<1%)	1 (<1%)
7-10 rating, influence of IOU training on adoption of energy-efficient HVAC system design, installation, equipment, or testing practices (10= "a great deal of influence")	0 (0%)	0 (0%)	1 (<1%)	1 (<1%)
HVAC system design, installation, equipment, or testing practices adopted as a result of the IOU training:				
Sub-cool and super-heat charging technique	0	0	1	1
Attended non-IOU training	0 (0%)	3 (13%)	2 (78%)	5 (92%)
Use more energy-efficient HVAC system design, installation, equipment, or testing practices because of the non-IOU training	0 (0%)	0 (0%)	1 (<1%)	1 (<1%)
7-10 rating, influence of non-IOU training on adoption of energy-efficient HVAC system design, installation, equipment, or testing practices (10= "a great deal of influence")	0 (0%)	0 (0%)	1 (<1%)	1 (<1%)
HVAC system design, installation, equipment, or testing practices adopted as a result of the non-IOU training:				
Duct training and duct sizing techniques	0	0	1	1
Training sponsor:				
Municipal utility	0	1	1	2
Manufacturers	0	1	1	2
CHEERS	0	1	0	1
Build it Green	0	1	0	1

All HERS raters had attended IOU-sponsored trainings and trainings sponsored by other organizations (Table C.6-9).

**Table C.6-9: Training Sessions Pertaining to Energy-Efficiency**  
(HERS Raters)

Attended Trainings Sponsored By:	Number of HERS Raters (% of Non-program Homes)			
	Nonparticipants	Minority participants	Majority Participants	Total
n	13	10	6	29
Have attended IOU-sponsored training	13(11%)	10 (76%)	6 (13%)	29 (100%)
Have attended training sessions sponsored by other organizations	13(11%)	10 (76%)	6 (13%)	29 (100%)
<b>Received training from:</b>				
CABEC / CHEERS / CALHERS / CALCERTS	9 (10%)	7 (74%)	3 (13%)	19 (97%)
IOUs	6 (7%)	9 (75%)	2 (13%)	17 (95%)
Other voluntary RNC programs and organizations (Build it Green, LEED for Homes, Comfort Wise, USGBC, ENERGY STAR, NBI)	2 (1%)	6 (68%)	5 (13%)	13 (82%)
RESNET	3 (3%)	5 (66%)	0 (0%)	8 (69%)
Trade associations (IHACI, CBPCA, ACCA etc.)	1 (<0%)	5 (9%)	1 (0%)	7 (9%)
State and local government (CA Energy Dept, AMBAG,CEC)	2 (<0%)	2 (60%)	1 (<0%)	5 (60%)
Municipal utilities (SMUD)	3 (1%)	2 (2%)	0 (0%)	5 (3%)
Other training organizations (BPI, National Comfort Institute)	1 (1%)	1 (5%)	1 (0%)	3 (6%)
ASHRAE	1 (<0%)	1 (2%)	0 (0%)	2 (2%)

## **C.7 Verification of Above-Code Practices**

No additional analysis.

## C.8 Builder Marketing

Builder marketing of energy efficiency does not appear to have changed since the 2000 Statewide RNC Study (Table C.8-1). While comparisons are difficult because of limited comparable data and few breakdowns between participant and nonparticipant builders in the 2000 report, it should be noted that partial participants—that is, those who built both program and non-program homes—were responsible for 83% of non-program homes built in the 2006-2008 period, so comparing the 2008 and 2000 results is largely valid. The average regularity of marketing energy efficiency did not change since the 2000 report (mean of 4.0 or “often”);<sup>129</sup> 14 builders responsible for 75% of non-program homes reported “always” marketing energy efficiency. In addition, 12 builders responsible for 76% of the non-program homes reported that the amount they marketed energy efficiency increased “a lot” over the last five years. Nearly two thirds of builders (19 of 32) said that other builders market energy efficiency “about the same amount” as they did.

**Table C.8-1: Marketing Energy Efficiency and Energy-Efficient Features to Buyers of New Homes**  
(Builders)

	2000 Statewide RNC Study	Number of Builders (% of Non-program Homes)			
		Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	14	13	9	10	32
Market energy-efficient features (Always)	NA*	6 (4%)	3 (5%)	5 (66%)	14 (75%)
Market energy-efficient features, Mean (“Always” = 5, “Never = 1”)	4	4.0	3.8	4.3	4.0
Amount market energy efficiency has increased “A Lot” over last 5 years	NA**	4 (4%)	2 (5%)	6 (67%)	12 (76%)
Other builders market energy efficiency (Yes)	NA**	10 (6%)	9 (10%)	10 (84%)	29 (100%)
Other builders market energy efficiency “A Lot More ” and “More”	NA**	3 (1%)	4 (2%)	2 (7%)	10 (10%)
Other builders market energy efficiency “About the same”	NA**	7 (5%)	5 (9%)	7 (76%)	19 (89%)

\* Not provided in 2000 report

\*\* Not asked in 2000 builder interviews

<sup>129</sup> Builders were asked how regularly they market energy efficiency and energy-efficient features to buyers of new homes in California: Always (5), Often (4); Sometimes (3), Rarely (2) or Never (1).

While half of partial participants and four of nine nonparticipants who were aware of the IOU programs placed strong emphasis on marketing energy efficiency in non-program homes (Table C.8-2), only two partial participants said the programs had a great deal of influence on their strong emphasis on energy efficiency. This suggests weak effects of the IOU programs on the marketing behavior of partial participants.

**Table C.8-2: Marketing Energy Efficiency of Non-Program Homes**  
(Builders)

	Partial Participants		Aware Nonparticipants	
	Number of Respondents	% of Non-Prog. Homes	Number of Respondents	% of Non-Prog. Homes
n	10		9	
Emphasize energy efficiency in marketing non-program homes, 7 to 10 rating (10 = “efficiency receives more emphasis than any other home feature”)	5	64%	4	5%
Influence of the program on emphasis of energy efficiency in marketing, 7 to 10 rating (10 = “a great deal of influence”)	2	1%	0	0%

Further evidence of weak program influence is that, compared to the figures reported in 2000, a higher proportion of partial participants in 2008 (six of ten) reported no difference in the way they market non-program homes. This suggests that partial participants emphasized efficiency as much in non-program homes as they did in program homes (which, in the case of partial participants, is generally “often” or “always”).

**Table C.8-3: Differences in Advertising or Marketing of Program Homes and Non-Program Homes**  
(Builders)

	2000 Statewide RNC Study, Program Participants <sup>130</sup>	Partial Participants	
		Number of Respondents	% of All Non-program homes
n	7	10	84%
No differences	3	6	67%

While builder marketing of energy efficiency to home buyers does not appear to have changed dramatically since the 2000 report, builder perceptions of home buyer demand for energy savings features appear to have increased from both the 1998 PG&E study and the 2000 statewide study (Table C.8-4). Thirty-one of 32 builders (94%) in the 2008 study, representing nearly all non-

<sup>130</sup> Quantum Consulting Inc., 2000, page A-16



program homes, reported that there was “a lot” or “some” demand for energy savings features, compared to 64% of builders who said so in the 1998 study. The mean rating of home buyer demand was substantially higher in 2008 (4.6 on a five point scale) than in 2000 (3.5 on a five point scale). Only one builder in the current study reported that there was little demand for energy-efficient features; when asked why, the builder replied as follows: “They [home buyers] are buying on a cost per square foot basis only.”

**Table C.8-4: Amount of Demand from Home Buyers for Energy-Saving Features**  
(Builders)

	1998 PG&E Study (% of builders) <sup>131</sup>	2000 Statewide RNC Study	Number of Builders (% of Nonparticipating Homes)			
			Unaware Nonpart.	Aware Nonpart.	Partial Part.	Total
n	31	14	13	9	10	32
A lot	23%	NA*	8 (4%)	6 (6%)	7 (67%)	21 (77%)
Some	41%	NA*	4 (2%)	3 (4%)	3 (16%)	10 (22%)
Little	26%	NA*	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Very little		NA*	1 (11%)	0 (0%)	0 (0%)	1 (1%)
None	6%	NA*	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Don't know	4%	NA*	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mean ('A lot' = 5, 'None' = 1)	NA**	3.5	4.5	4.7	4.7	4.6

\* Not provided in 2000 report

\*\* Not provided in 1998 report and not comparable because the 1998 report used a four-point scale while the 2000 report and current study used a five point scale.

<sup>131</sup>RER, 1998,p. 4-16

Builder perceptions of the change in home buyer demand for energy-saving features over the last five years also appears to have increased from both the 1998 PG&E study and the 2000 statewide study (Table C.8-5). Thirty-one of 32 builders (97%) in the current study representing nearly all non-program homes reported that demand had “increased a lot” or “increased a little” over the last previous years, compared to 80% of builders from the 1998 study and eight of 14 builders (57%) from the 2000 study.

**Table C.8-5: Change in Home Buyer Demand for Energy-Saving Features over the Last Five Years**  
(Builders)

	1998 PG&E Study (% of builders) <sup>132</sup>	2000 Statewide RNC Study <sup>133</sup>	Number of Builders (% of Non-program Homes)			
			Unaware Nonpart.	Aware Nonpart.	Partial Part.	Total
n	31	14	13	9	10	32
Increased a lot	80%	8	7 (4%)	7 (9%)	9 (74%)	23 (87%)
Increased a little			5 (1%)	2 (1%)	1 (9%)	8 (12%)
Stayed the same	NA**	NA*	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Decreased a little	NA**	NA*	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Decreased a lot			0 (0%)	0 (0%)	0 (0%)	0 (0%)
Don't know	NA**	NA*	0 (0%)	0 (0%)	0 (0%)	0 (0%)

\* Not provided in 2000 report

\*\* Not provided in 1998 report

<sup>132</sup>RER, 1998, p. 4-16

<sup>133</sup>Quantum Consulting Inc., 2000, page A-11

When asked why home buyer demand for energy-saving features had increased over the previous five years, builders most commonly identified issues related to energy costs and increased home buyer awareness of savings associated with energy efficiency, followed by increased awareness of the link between energy efficiency and the environment (Table C.8-6). Builders in the 2000 study also identified home buyer awareness of the energy savings potential of energy efficiency as a reason for increased demand, while in the 1998 study builders attributed increased demand to media advertising, the Internet and builder competition. (Quantum Consulting Inc., 2000, pg A10 and RER, 1998, pg 4-16)

**Table C.8-6: Why Home Buyer Demand for Energy-Saving Features Has Increased over the Last Five Years<sup>134</sup>**  
(Builders)

Reason why	Number of Builders			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	13	9	10	32
Increased home buyer desire to save money on utility bills	4	3	3	10
Increased awareness of environmental importance of energy efficiency	2	5	1	8
Increased awareness of cost savings associated with energy efficiency	2	2	3	7
Rising cost of energy	3	3	1	7
Weak economy	0	2	2	4
Buyer willing to pay more up front for long-term savings	2	0	0	2
Increased familiarity with energy efficiency	1	0	1	2
Buyer wants energy efficiency, but not willing to pay	1	1	0	2
Greater availability of efficient homes	0	0	1	1
First time, low end buyers more concerned with savings	0	0	1	1
Rebates	1	0	0	1

Builders who reported that home buyer demand for energy-saving features had “increased a lot” or “increased a little” were asked to rate the role of a number of factors in the increase in home buyer demand (Table C.8-7). The IOU RNC programs were identified by seven of 32 builders (responsible for 10% of non-program homes) as “a significant factor” or as “one of the most important factors” in the increase in home buyer demand for energy-saving features over the last

<sup>134</sup> Question only asked of builders who reported that home buyer demand for energy-savings features in homes has “increased a lot” or “increased a little” over the last five years.

five years. Builders were most likely to identify increasing utility rates (25 builders responsible for 38% of non-program homes), increasing gas prices (20 builders responsible for 35% of non-program homes), increased builder marketing (17 builders responsible for 78% of non-program homes), the ENERGY STAR Homes Program (15 builders responsible for 78% of non-program homes), awareness of global warming (14 builders responsible for 76% of non-program homes), and the Flex Your Power campaign (14 builders responsible for 75% of non-program homes). Note that the ENERGY STAR Homes Program has historically been very closely associated with the IOU programs, and that the Flex Your Power campaign is run by the IOUs. Also, twelve builders responsible for 70% of non-program homes said that federal tax credits were one of the most important factors in increasing home buyer demand.

**Table C.8-7: Factors in Increase in Home Buyer Demand for Energy-Saving Features over the Last Five Years<sup>135</sup>**

(Builders, scale of “Not a factor at all” to “One of the most important factors”)

Factors	Number of Builders responding “A significant factor” or “One of the most important factors” (% of All Non-program Homes)			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	13	9	10	32
ENERGY STAR Homes	3 (1%)	4 (6%)	8 (72%)	15 (78%)
Increased builder marketing	5 (1%)	4 (5%)	8 (72%)	17 (78%)
Awareness of global warming	7 (4%)	3 (6%)	4 (66%)	14 (76%)
Flex Your Power	5 (3%)	3 (5%)	6 (67%)	14 (75%)
Federal tax credits	3 (<1%)	3 (5%)	6 (65%)	12 (70%)
Increasing utility rates	8 (5%)	8 (10%)	9 (23%)	25 (38%)
Increasing gasoline prices	8 (5%)	5 (8%)	7 (22%)	20 (35%)
Downturn in housing market	6 (4%)	4 (6%)	5 (15%)	15 (25%)
Solar Initiative	2 (<1%)	4 (8%)	4 (6%)	10 (14%)
IOU RNC programs	0 (0%)	3 (6%)	4 (4%)	7 (10%)
Municipal utility-sponsored programs	3 (2%)	2 (4%)	2 (3%)	7 (10%)
Smart Home	3 (2%)	4 (5%)	1 (2%)	6 (10%)
ComfortWise	0 (0%)	2 (5%)	1 (2%)	3 (8%)
LEED for Homes	0 (0%)	1 (4%)	1 (2%)	2 (7%)
Building America	0 (0%)	1 (4%)	0 (0%)	1 (4%)
Environments for Living	0 (0%)	0 (0%)	1 (3%)	1 (3%)

<sup>135</sup> Question only asked of builders who reported that home buyer demand for energy-savings features in homes has “increased a lot” or “increased a little” over the last five years.

In addition to a perceived increase in home buyer demand for energy-saving features, a higher percentage of builders from the 2008 study compared to 2000 reported that home buyers had asked about homes that are more energy-efficient than code (Table C.8-8). On average, builders estimated that 48% of home buyers asked about homes that were more energy-efficient than code, compared to 21% of home buyers in the 2000 report.

**Table C.8-8: Home Buyers Inquiries about Homes that Are More Energy-efficient than State Building Code**  
(Builders)

	2000 Statewide RNC Study <sup>136</sup>	Number of Builders (% of Non-program Homes)			
		Unaware Non- participants	Aware Non- participants	Partial Participants	Total
n	14	13	9	10	32
Home buyers expect homes built over last 5 years to save energy	12	11 (5%)	8 (7%)	10 (84%)	29 (96%)
Home buyers asked about homes more energy-efficient than code	4	5 (5%)	3 (6%)	5 (6%)	13 (16%)
Mean percent of home buyers that asked about homes more energy-efficient than code	21%	38%	42%	65%	48%

<sup>136</sup>Quantum Consulting Inc., 2000, pg A-13.

Table C.8-9 shows that there was an increase from 2000 to 2008 in builders' perceptions that home buyers associate energy efficiency with quality, but, compared with the 2000 study, about the same level of perception that home buyers associate efficiency with comfort.

**Table C.8-9: Amount Home Buyers Associate Energy Saving Features with Home Quality and Comfort**

(Builders, 1 to 5 scale, 1= "not at all" and 5= "very strongly")

	2000 Statewide RNC Study <sup>137</sup>	Number of Builders (% of Non-program Homes)			
		Unaware Non- participants	Aware Non- participants	Partial Participants	Total
n		13	9	10	32
Home buyers associate energy saving features with home quality, 4 or 5 rating (5 = "very strongly")	NA*	7 (3%)	7 (6%)	8 (14%)	22 (23%)
Home quality, Mean (5 = "very strongly", "1 = not at all")	3.6	3.7	4.1	4.2	4.0
Home buyers associate energy saving features with home comfort, 4 or 5 rating (5 = "very strongly")	NA*	7 (4%)	6 (6%)	9 (83%)	22 (93%)
Home comfort, Mean (5 = "very strongly", "1 = not at all")	4.0	3.6	3.9	4.2	3.9

\* Not provided in 2000 report

<sup>137</sup>Quantum Consulting Inc., 2000, pg A-13

When asked how much extra it would cost to build a home that exceeds Title 24 by 10%, builders on average reported an 8% increase in the cost of the home, with partial participants estimating a 12% increase and unaware nonparticipants estimating a 4% increase (Table C.8-10). On average, builders in the 2008 study estimated that home buyers are willing to pay a higher percentage of the increased cost than builders interviewed for the 1998 and 2000 studies.

**Table C.8-10: Increase in Cost to Build a Home that Exceeds Title 24 by 10% w/o Incentives and Amount Typical Buyer Willing to Pay**  
(Builders)

	1998 PG&E Study <sup>138</sup>	2000 Statewide RNC Study <sup>139</sup>	Number of Builders (% of All Non-program Homes)			
			Unaware Nonpart.	Aware Nonpart.	Partial Part.	Total
n	31	14	13	9	10	32
Mean percentage increase in cost to build a home that exceeds Title 24 by 10% w/o incentives	NA**	NA*	4%	8%	12%	8%
Mean percentage of cost increase a typical buyer is willing to pay	31%	10%	50%	31%	39%	41%

\* Not provided in 2000 report

\*\* Not provided in 1998 report

<sup>138</sup>RER, 1998, pg 4-17

<sup>139</sup>Quantum Consulting Inc., 2000, pg 3-12.

However, when asked to rate the willingness of home buyers to pay for the additional costs that may be associated with energy-efficient measures that exceed Title 24, builders in the 2008 study reported about the same level of willingness as builders interviewed for the 2000 study (Table C.8-11).

**Table C.8-11: Willingness of Home Buyers to Pay for Additional Costs Associated with Energy-Efficient Measures that Exceed Title 24**  
(Builders)

	2000 Statewide RNC Study <sup>140</sup>	Number of Builders (% of All Non-program Homes)			
		Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	14	13	9	10	32
Extremely willing	NA*	1 (<1%)	0 (0%)	0 (0%)	1 (<1%)
Very willing	NA*	1 (<1%)	1 (1%)	0 (0%)	2 (1%)
Somewhat willing	NA*	6 (1%)	5 (6%)	8 (72%)	19 (78%)
Not very willing	NA*	3 (4%)	2 (1%)	2 (11%)	7 (17%)
Not at all willing	NA*	1 (1%)	1 (3%)	0 (0%)	2 (4%)
Don't know/refused	NA*	1 (<1%)	0 (0%)	0 (0%)	1 (<1%)
Mean ('extremely willing' = 5, 'not at all willing' = 1)	2.9	2.8	2.7	2.8	2.8

\* Not provided in 2000 report

Builders who reported that home buyers are not willing to pay for the additional costs associated with energy efficiency were asked why not. Three builders reported that home buyers are unwilling to spend the extra money on efficiency measures while one reported that buyers are more interested in home features that are more tangible, providing a “wow” factor that energy savings does not provide.

<sup>140</sup>Quantum Consulting Inc., 2000, pg A-12



## C.9 Home Buyer Awareness

One aspect of awareness is realizing that some homes are more efficient than others. Most of the non-participating home buyers said that new homes in their area and price range generally had similar levels of energy efficiency (Table C.9-1). Just over one-quarter of respondents (26%) said that some new homes in their area and price range were more efficient than others.

The results, however, point to a large change from the 2000 *Statewide RNC* study. In that study, 70% of non-participating home buyers (n=208) said that some new homes were more efficient than others (Quantum Consulting Inc., 2000, Exhibit A-2, pg A-4), while a significantly smaller proportion—26%—said the same in the current study. In the current study a greater percentage of respondents (60%) said that all new homes had the same or similar level of energy efficiency.

**Table C.9-1: Comparative Efficiency of New Homes in Area by Climate Region**  
(Consumer Survey; See Figure 3.1-2 for a map of regions)

	Region 1	Region 2	Region 3	Region 4	Region 5	Overall
n	65	107	352	264	188	976
New homes same/similar level of energy efficiency	51%	60%	69%*	58%	52%*	60%
Some new homes more energy-efficient than others	31%	26%	18%	28%	34%	26%
Don't know/Refused <sup>a</sup>	18%	14%	13%	14%	15%	14%

\* Significantly different from Overall at the 90% confidence level

<sup>a</sup> One individual refused to answer this question.

Table C.9-2 shows home buyer awareness by IOU.

**Table C.9-2: Comparative Efficiency of New Homes in Area by IOU**  
(Consumer Survey)

	PG&E	SCE	SCG	SDG&E	Overall
N	308	235	252	181	976
New homes same/similar level of energy efficiency	55%	54%*	71%*	56%	60%
Some new homes more energy-efficient than others	30%	30%	17%	29%	26%
Don't know/Refused <sup>a</sup>	15%	16%	12%	15%	14%

\* Significantly different from Overall at the 90% confidence level

<sup>a</sup> One individual refused to answer this question.

Overall, non-participating home buyers did not consistently express strong opinions as to whether or not most new homes in their area and price range were as energy-efficient as they could be (Table C.9-3). Just over one-third (37%) said homes were as efficient as they could be while just under one-half (47%) said new homes could be more efficient. Sixteen percent did not know if homes were as energy-efficient as they could be. A statistically greater percentage of respondents in the current study (47%) than in the 2000 study (34%, n = 208) said that new homes could be more energy-efficient (Quantum Consulting Inc., 2000, Exhibit A-2, pg A-4).

**Table C.9-3: Perceived Efficiency of New Homes in Area by Climate Region**

(Consumer Survey; See Figure 3.1-2 for a map of regions)

	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>	<b>Overall</b>
n	65	107	352	264	188	976
Most homes are as energy-efficient as they can be	41%	25%	36%	44%	34%	37%
New homes could be more energy-efficient	39%	56%*	44%	42%	56%*	47%
Don't know	20%	19%	19%	15%	10%	16%
Refused	0%	0%	<1%	0%	<1%	<1%

\* Significantly different from Overall at the 90% confidence level

Table C.9-4 reports home buyer perceptions of the energy efficiency of new homes by utility.

**Table C.9-4: Perceived Efficiency of New Homes in Area by Utility**

(Consumer Survey)

	<b>PG&amp;E</b>	<b>SCE</b>	<b>SCG</b>	<b>SDG&amp;E</b>	<b>Overall</b>
n	308	235	252	181	976
Most homes are as energy efficient as they can be	44%	30%	39%	34%	37%
New homes could be more energy efficient	40%*	53%*	46%	53%	47%
Don't know	16%	17%	15%	12%	16%
Refused	<1%	0%	0%	<1%	<15

\* Significantly different from Overall at the 90% confidence level

Consistent with the fact that most buyers of non-program homes said that most new homes in their area and price range share a similar level of energy efficiency, most of these respondents also asserted that their home was about as energy efficient as other new homes (75%). Most of the remaining respondents said that their home was more energy efficient than others in the area (19%). A comparable question was not asked in the 2000 study.

**Table C.9-5: Perceived Energy Efficiency Respondent's New Home by Climate Region**  
(Consumer Survey; See Figure 3.1-2 for a map of regions)

	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>	<b>Overall</b>
n	65	107	352	264	188	976
More efficient than other new homes	35%*	18%	12%*	18%	26%*	19%
About the same efficiency as other new homes <sup>a</sup>	61%	74%	83%	73%	68%	75%
Less efficient than other new homes	2%	2%	2%	3%	3%	3%
Don't know	2%	4%	2%	5%	3%	3%
Refused	0%	0%	<1%	<1%	0%	<1%

\* Significantly different from Overall at the 90% confidence level

<sup>a</sup> Includes those who responded in that all new homes have the same or similar level of energy efficiency.

Table C.9-6 reports home buyer perceptions of the energy efficiency of their home by utility.

**Table C.9-6: Perceived Energy Efficiency Respondent's New Home by IOU**  
(Consumer Survey)

	<b>PG&amp;E</b>	<b>SCE</b>	<b>SCG</b>	<b>SDG&amp;E</b>	<b>Overall</b>
n	308	235	252	181	976
More efficient than other new homes	23%	23%	12%*	24%	19%
About the same efficiency as other new homes <sup>a</sup>	69%	72%	83%	69%	75%
Less efficient than other new homes	4%	2%	3%	4%	3%
Don't know	5%	3%	2%	4%	3%
Refused	<1%	0%	0%	<1%	<1%

\* Significantly different from Overall at the 90% confidence level

<sup>a</sup> Includes those who responded that all new homes have the same or similar level of energy efficiency.

Another aspect of home buyer awareness and knowledge is knowledge of what makes a home more energy efficient. When asked what would make a home more energy-efficient, non-participating home buyers mentioned more or better insulation (49%), efficient windows (40%), or energy-efficient products that they could use in their home to reduce energy usage (e.g., efficient appliances, 24%; cooling equipment, 16%; lighting, 15%; or heating equipment, 11%) (Table C.9-7). However, over one-third of respondents (37%) also cited installing and using solar power or photovoltaic panels among the ways to make a home more energy efficient, which has more to do with the source of energy than with saving energy. The results pointed to similar patterns when broken down by climate region, so we have not reported those data here. No comparable question was asked in the 2000 study.

**Table C.9-7: What Would Make a Home More Energy-efficient**  
(Consumer Survey)

	<b>Percentage of Respondents</b>
n	976
More or better insulation	49%
More efficient windows	40%
Use of solar power or photovoltaics	37%
More efficient appliances	24%
More efficient central air conditioning	16%
More efficient lighting	15%
More efficient furnace or heater	11%
Tankless water heater, other water heating measures	9%
Better framing materials/Higher quality construction	9%
Better sealing of air leaks/Better ductwork	8%
Ceiling or whole house fans	7%
Misc. green building, water conservation, or other energy-efficient technologies	6%
General use less energy/higher level of efficiency	6%
Conservation behavior, including use of timers, controls, and cycling of equipment use	5%
House orientation, shade trees, wide eaves, etc.	5%
Lower utility bills	3%
ENERGY STAR label	3%
Home is tested; receives high HERS rating	1%
Something else	1%
Don't know	5%

The source of awareness of energy efficiency is important for linking it to the IOU programs. Most non-participating home buyers (73%) reported that no one they had interacted with during the home buying process had stressed energy efficiency (Table C.9-8). Only 4% mentioned the builder, developer, or realtor, and only 3% mentioned the utility.

**Table C.9-8: People Emphasizing Energy Efficiency to the Home Buyer by Climate Region**  
(Consumer Survey, multiple response; See Figure 3.1-2 for a map of regions)

	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>	<b>Overall</b>
n	65	107	351	264	188	975
No one emphasized energy efficiency	57%*	74%	76%	72%	74%	73%
Media, including home building magazines	6%	6%	5%	5%	6%	6%
Builder, developer, or realtor	7%	7%	5%	2%	2%	4%
Model home salesperson	3%	3%	3%	6%	3%	4%
Various retailers (building material, appliance store)	3%	5%	4%	4%	3%	4%
Utility representative or literature	6%	3%	3%	1%	4%	3%
Internet	0%	2%	3%	1%	4%	2%
Friends, Family, Co-workers, etc.	3%	3%	1%	2%	2%	2%
Solar companies, HVAC contractors	2%	2%	0%	2%	0%	1%
Home Show	3%	2%	1%	1%	0%	1%
Someone else	2%	1%	0%	4%	2%	2%
Don't know/refused	6%	0%	0%	0	0	<1%

\* Significantly different from Overall at the 90% confidence level

Table C.9-9 reports the sources of awareness of energy efficiency by utility.

**Table C.9-9: People Emphasizing Energy Efficiency to the Home Buyer by IOU**  
(Consumer Survey, multiple response)

	<b>PG&amp;E</b>	<b>SCE</b>	<b>SCG</b>	<b>SDG&amp;E</b>	<b>Overall</b>
n	308	235	251	181	975
No one emphasized energy efficiency	64%*	73%	81%*	73%	73%
Media, including home building magazines	7%	6%	4%	6%	6%
Builder, developer, or realtor	4%	1%	7%	5%	4%
Model home salesperson	5%	2%	4%	5%	4%
Various retailers (building material, appliance store)	4%	5%	2%	3%	4%
Utility representative or literature	3%	4%	2%	2%	3%
Internet	1%	5%	1%	3%	2%
Friends, Family, Co-workers, etc.	1%	3%	0%	2%	2%
Solar companies, HVAC contractors	1%	1%	1%	3%	1%
Home Show	2%	0%	0%	3%	1%
Someone else	5%	2%	0%	1%	2%
Don't know/refused	3%	0%	0%	0%	<1%

\* Significantly different from Overall at the 90% confidence level

The percentage of non-participating home buyers who said that someone emphasized energy efficiency to them increased from 21% in the 2000 study to 27% in the 2008 study, suggesting that energy efficiency was at least something addressed more commonly in conversations about home buying than in the past (Table C.9-10) (Quantum Consulting Inc., 2000, Exhibit A-2, pg A-4). The 2000 study did not ask respondents who it was who had emphasized energy efficiency to the home buyer, so we cannot provide a comparison of whether or not the sources of information have changed over time.

**Table C.9-10: Someone Emphasized Energy Efficiency to the Home Buyer over Time**

	<b>n</b>	<b>Percentage of Respondents</b>
2000 study	208	21%*
2008 study	975	27%

\* Significantly different from Overall at the 90% confidence level

Another aspect of awareness is knowing about the efficiency programs for new homes. About one-half of non-participating homeowners (49%) said they were aware of the programs sponsored by governments or IOUs that encouraged energy-efficient features in new homes (Table C.9-11). This represents a statistically significant increase in awareness from 39% in the 2000 study (n=208) (Quantum Consulting Inc., 2000, Exhibit A-2, pg A-4). There were no statistically significant differences in awareness of IOU programs across service territories or climate regions.

**Table C.9-11: Awareness of IOU Programs by Climate Region**

(Consumer Survey; See Figure 3.1-2 for a map of regions)

	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>	<b>Overall</b>
n	65	107	351	264	188	975
Aware of programs	59%	47%	48%	44%	54%	49%
Not aware of programs	38%	53%	51%	54%	45%	50%
Don't know	3%	0%	1%	1%	1%	1%

Table C.9-12 shows awareness of IOU programs by utility.

**Table C.9-12: Awareness of IOU Programs by IOU**

(Consumer Survey)

	<b>PG&amp;E</b>	<b>SCE</b>	<b>SCG</b>	<b>SDG&amp;E</b>	<b>Overall</b>
n	308	235	251	181	975
Aware of programs	51%	50%	47%	44%	49%
Not aware of programs	46%	49%	52%	56%	50%
Don't know	2%	1%	1%	0%	1%

Table C.9-13 presents program awareness for the ENERGY STAR Homes Programs, individual IOU programs, and the New Home Energy Savers Program (a non-existent program). The table lists three types of awareness: 1) Unaided awareness is when a respondent names the program without being prompted; 2) Aided awareness is when a respondent recognizes a program after being prompted with its name; and 3) Overall Awareness is the combination of the two. The results shown in Table C.9-13 are limited to respondents served by the specific IOU sponsoring the individual program (i.e., awareness of the PG&E New Construction Programs is reported only for respondents from the PG&E service territory).

Unaided awareness is fairly low for all programs. At the high end, about one-fifth (21%) of PG&E respondents named the new construction program or knew that the IOU had an energy-efficient new homes program. Likewise, about 17% of SCE respondents were aware of that IOUs' program. However, fewer respondents named the ENERGY STAR Homes (4%), SCG Advanced Homes (3%), and SDG&E Advanced Homes (5%) programs.

Only respondents who did not voice unaided awareness were asked the aided awareness questions. Therefore, aided awareness should be seen as *additive* to unaided awareness. With this in mind, an *additional* 48% of respondents were aware of the ENERGY STAR Homes Program,

once the interviewer read the name during the survey. Another 16% of PG&E respondents, 26% of SCE respondents, 13% of SCG respondents, and 22% of SDG&E respondents would name their IOU programs when specifically questioned about them. Furthermore, 13% of respondents said they had heard of the New Homes Energy Savers Program (a non-existent program).

The overall levels of awareness—the sum of unaided and aided awareness—were 53% for ENERGY STAR Homes, but far lower for the individual IOU programs, ranging from 43% for the SCE program to just 16% for the SCG program. The greater recognition of the ENERGY STAR Homes program may reflect a greater awareness of the ENERGY STAR label generally, as it applies not only to homes but to electronics, appliances, and heating and cooling systems as well. It is also worth noting that there were fifteen times as many ENERGY STAR homes (24,899) as IOU program homes (1,616) claimed in 2006 and 2007 in the IOU territories—after the IOU programs separated from the national ENERGY STAR program. (However, since ENERGY STAR reports homes when they are committed while the IOU programs report them when completed, some of the homes reported by ENERGY STAR may not have been completed in the same year for which they were claimed.) In 2004 and 2005, in contrast, the number of IOU program homes (31,113) was nearly as great as the number of ENERGY STAR homes (33,401)—and, in fact, most of these homes were in both programs. The IOU programs may have lost a considerable amount of consumer recognition after separating from the national ENERGY STAR program.

**Table C.9-13: Unaided and Aided Awareness of IOU Programs**  
(Consumer Survey)

Type of Awareness	Program	Survey Group	n	Percentage of Respondents
Unaided	ENERGY STAR Homes	All home buyers	975	4%
	New homes program for their IOU <sup>a</sup>	All home buyers	975	13%
	PG&E New Construction Program	PG&E home buyers	308	21%
	SCE New Homes Program	SCE home buyers	235	17%
	SCG Advanced Home Program	SCG home buyers	251	3%
	SDG&E Advanced Home Program	SDG&E home buyers	181	5%
Aided	ENERGY STAR Homes	All home buyers	975	48%
	New Home Energy Savers Program	All home buyers	975	13%
	New homes program for their IOU	All home buyers	975	19%
	PG&E New Construction Program	PG&E home buyers	308	16%
	SCE New Homes Program	SCE home buyers	235	26%
	SCG Advanced Home Program	SCG home buyers	251	13%
Overall Awareness	SDG&E Advanced Home Program	SDG&E home buyers	181	22%
	ENERGY STAR Homes	All home buyers	975	53%
	New homes program for their IOU <sup>a</sup>	All home buyers	975	32%
	PG&E New Construction Program	PG&E home buyers	308	38%
	SCE New Homes Program	SCE home buyers	235	43%
	SCG Advanced Home Program	SCG home buyers	251	16%
	SDG&E Advanced Home Program	SDG&E home buyers	181	28%

<sup>a</sup> Not able to separate out responses from respondents who exactly named the specific IOU program name from those who generally knew that their IOU had an energy-efficient new homes program.



A historical comparison of data from the 2000 and current studies shows varying patterns in how awareness of new homes programs has changed over time (Table C.9-14) (Quantum Consulting Inc., 2000, Exhibits A-1, A-2, pg A-1, A-4). Unaided awareness of the ENERGY STAR Homes Program increased slightly from just 1% as reported in the 2000 study to 4% in the current study.<sup>141</sup> However, respondents' unaided awareness of their individual utility's program dropped from 19% to 13% from 2000 to 2008. Aided awareness varied to a greater extent. The ENERGY STAR Homes program enjoyed the greatest increase in aided awareness, jumping from just 18% in 2000 to 48% in 2008 (again, perhaps reflecting a greater awareness of the ENERGY STAR label in general, but also in keeping with the much greater number of ENERGY STAR homes sold). Keeping in mind that program names have changed since 2000, the small sample sizes, and the fact that the 2000 results included responses from program participants, the percentage of respondents recognizing the name of the SCE program increased from 8% in 2000 to 26% in 2008 and the SDG&E program increased from 3% to 22%. In contrast, aided awareness of the SCG program decreased from 21% to 13%, and aided awareness of the PG&E program decreased from 41% in 2000 to 16%, a result that is balanced by its higher levels of unaided awareness. In all, it appears that overall awareness levels (i.e., unaided and aided considered jointly) have increased greatly for the ENERGY STAR Homes program, but conclusions are difficult to draw for the individual IOUs due to changes in the names of programs and the inclusion of participants in the reporting of the 2000 data.

**Table C.9-14: Unaided and Aided Awareness of IOU Programs over Time**

(Consumer Survey and Quantum Consulting Inc., 2000)

Type of Awareness	Program	2000 Study		Current Study	
		n	% of respondents	n	% of respondents
Unaided	ENERGY STAR Homes program	226 <sup>c</sup>	1%	975	4%
	New homes program for their IOU <sup>a</sup>	226 <sup>c</sup>	19%	975	13%
Aided	ENERGY STAR Homes program	208	18%	975	48%
	All IOU programs	NA	NA	975	19%
	PG&E program <sup>b</sup>	75 <sup>d</sup>	41%	308	16%
	SCE program <sup>b</sup>	40 <sup>d</sup>	8%	235	26%
	SCG program <sup>b</sup>	35 <sup>d</sup>	21%	251	13%
	SDG&E program <sup>b</sup>	76 <sup>d</sup>	3%	181	22%

<sup>a</sup> The 2000 study separately recorded responses for those respondents who exactly named the program from those who knew that their IOU had a new homes program. The current study grouped these responses, counting an individual as "aware" if they knew their IOU had a program.

<sup>b</sup> Note that the program names have changed between 2000 and 2008.

<sup>c</sup> Unaided awareness includes responses for 18 participants and 208 non-participants.

<sup>d</sup> Includes an unknown but small number of participants.

<sup>141</sup> Please note that the 2000 data include some participants, limiting the comparability to the current study.

Non-program home buyers were also asked if anyone had mentioned the IOU programs to them when they were making plans to build or buy a home. Only 10% of respondents overall (with only slight variation by climate region) said that anyone mentioned the program to them (Table C.9-15). Just over one-half of respondents (52%) were aware of the programs but reported that no one else mentioned them when they were making plans to build or buy their home. Respondents in the SCG service territory were significantly less likely to report that the program was not mentioned, but this is driven by the fact that significantly more of them had no knowledge of the program. Significantly fewer Region 1 respondents reported having no knowledge of IOU programs. This question was not asked in the 2000 study.

**Table C.9-15: Mentions of IOU Programs to Home Buyers when Making Plans for Buying or Building Home**

(Consumer Survey; See Figure 3.1-2 for a map of regions)

	Region 1	Region 2	Region 3	Region 4	Region 5	Overall
n	65	107	351	264	188	975
No knowledge of IOU programs	26%*	38%	33%	40%	40%	36%
Program was mentioned	11%	9%	11%	8%	8%	10%
Program was not mentioned	61%	50%	53%	48%	50%	52%
Don't know	2%	3%	3%	4%	2%	3%

\* Significantly different from Overall at the 90% confidence level

Table C.9-16 reports the percentage of respondents who stated that someone had mentioned the IOU programs to them when they were making plans to build or buy a home, by utility.

**Table C.9-16: Mentions of IOU Programs to Home Buyers when Making Plans for Buying or Building Home by IOU**

(Consumer Survey)

	PG&E	SCE	SCG	SDG&E	Overall
n	308	235	251	181	975
No knowledge of IOU programs	31%	33%	43%*	42%	36%
Program was mentioned	10%	10%	9%	9%	10%
Program was not mentioned	55%	55%	45%*	47%	52%
Don't know	4%	2%	3%	3%	3%

\* Significantly different from Overall at the 90% confidence level

The few respondents who recalled someone mentioning an IOU program typically heard about it from the builder or development sales agent (49% overall) (Table C.9-17). Friends, family, and co-workers represent a distant second source of mentions at 17%. Groups garnering less than ten percent of responses include realtors (6%), retailers (6%), and architects and designers (5%), among others. These patterns hold across IOUs, although the exact percentages vary somewhat (e.g., realtors made up 20% of mentions in the SCG service territory). Due to small sample sizes, no statistical significance tests were conducted, and the results are not reported by climate region.

**Table C.9-17: Person(s) Mentioning IOU Programs to Home Buyers when Making Plans for Buying or Building Home by IOU**  
(Consumer Survey; multiple response)

<b>Persons Mentioning Programs</b>	<b>PG&amp;E</b>	<b>SCE</b>	<b>SCG</b>	<b>SDG&amp;E</b>	<b>Overall</b>
n	30	21	23	16	90
Builder or Development Sales Agent	55%	43%	53%	40%	49%
Friends, Family, Co-workers, etc.	12%	20%	24%	0%	17%
Realtors	6%	3%	20%	5%	9%
Retailer	3%	7%	4%	25%	6%
Architects and Designers	0%	15%	0%	11%	6%
Utility Representatives	7%	9%	0%	0%	5%
City or local government	0%	3%	0%	11%	2%
Home Inspector	0%	0%	0%	5%	0%
Lenders	0%	0%	0%	5%	0%
Don't know/recall	24%	0%	0%	0%	8%

The individuals mentioning energy efficiency usually discussed more efficient appliances (22%), general higher level of efficiency for the house (20%), more or better insulation (16%), more efficient central air conditioning (15%), or more efficient windows (12%) (Table C.9-18). Patterns differ somewhat across IOUs, but this is more due to small sample sizes than to varying responses. Likewise, due to small sample sizes, results are not reported by climate region. This question was not asked in the 2000 study.

**Table C.9-18: Information Mentioned about Homes Built through IOU Programs by Utility**  
(Consumer Survey; multiple response)

<b>Energy Efficiency Information</b>	<b>PG&amp;E</b>	<b>SCE</b>	<b>SCG</b>	<b>SDG&amp;E</b>	<b>Overall</b>
n	30	21	23	16	90
More efficient appliances	14%	25%	30%	9%	22%
Higher level of efficiency for the house	22%	21%	15%	24%	20%
More or better insulation	18%	8%	24%	14%	16%
More efficient central air conditioning	0%	29%	17%	0%	15%
More efficient windows	8%	3%	28%	4%	12%
Rebates	3%	17%	8%	0%	9%
Lower utility bills	7%	6%	9%	14%	7%
Better air sealing/ductwork	5%	9%	8%	0%	7%
More efficient lighting	3%	4%	12%	10%	6%
More efficient heater or furnace	0%	9%	10%	0%	6%
Energy efficiency general	12%	3%	0%	0%	5%
Higher quality construction/Better framing	6%	0%	4%	10%	3%
Builder offered energy efficiency options	0%	0%	9%	0%	3%
Solar panels, water conservation, etc.	0%	4%	3%	0%	3%
ENERGY STAR	0%	3%	2%	14%	2%
House orientation, shade trees, wide eaves	2%	4%	0%	0%	2%
Something else	20%	3%	4%	10%	9%
Don't know	15%	28%	17%	17%	20%

Twenty-nine percent of the non-program homeowners said they were familiar with IOU programs prior to viewing the home or seeing plans for their new home (Table C.9-19). Prior familiarity centered closely around 30% for all service territories and climate regions, but prior familiarity with the programs is significantly higher in the SCE service territory and lower in the SCG service territory.

**Table C.9-19: Home Buyers' Familiarity w/ IOU Programs Prior to Viewing or Seeing Plans for New Home**

(Consumer Survey; See Figure 3.1-2 for a map of regions)

	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>	<b>Overall</b>
n	65	107	351	264	188	975
No knowledge of IOU programs	26%*	38%	33%	41%	40%	36%
Familiar w/ program prior	30%	32%	31%	26%	28%	29%
Unfamiliar w/ program prior	41%	28%	35%	33%	31%	34%
Don't know	3%	2%	1%	1%	1%	1%

\* Significantly different from Overall at the 90% confidence level

Table C.9-20 shows the percentage of respondents who were familiar with the IOU programs prior to viewing the home or seeing the plans for their home, by utility.

**Table C.9-20: Home Buyers' Familiarity w/ IOU Programs Prior to Viewing or Seeing Plans for New Home**

(Consumer Survey)

	<b>PG&amp;E</b>	<b>SCE</b>	<b>SCG</b>	<b>SDG&amp;E</b>	<b>Overall</b>
n	308	235	251	181	975
No knowledge of IOU programs	31%	33%	43%*	42%	36%
Familiar w/ program prior	31%	26%	31%	29%	29%
Unfamiliar w/ program prior	37%	40%*	25%*	29%	34%
Don't know	2%	1%	1%	0%	1%

\* Significantly different from Overall at the 90% confidence level

## C.10 Home Buyer Demand and Willingness to Pay

Overall, very few non-participating home buyers (10%) sought out information about the IOU programs when making plans to build or buy their new homes (Table C.10-1).

**Table C.10-1: Home Buyers Seeking Information on IOU Programs when Making Plans for Building or Buying Home**

(Consumer Survey; See Figure 3.1-2 for a map of regions)

	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>	<b>Overall</b>
n	65	107	351	264	188	975
No knowledge of IOU programs	26%*	38%	33%	41%	40%	36%
Sought information	22%*	7%	9%	8%	11%	10%
Did not seek information	51%	55%	58%	52%	49%	53%
Don't know	2%	0%	0%	1%	0%	10%

\* Significantly different from Overall at the 90% confidence level

Table C.10-2 shows the percentage of home buyers who sought out information about the IOU programs, by utility.

**Table C.10-2: Home Buyers Seeking Information on IOU Programs when Making Plans for Building or Buying Home by IOU**

(Consumer Survey)

	<b>PG&amp;E</b>	<b>SCE</b>	<b>SCG</b>	<b>SDG&amp;E</b>	<b>Overall</b>
n	308	235	251	181	975
No knowledge of IOU programs	31%	33%	43%*	42%	36%
Sought information	14%*	9%	8%	9%	10%
Did not seek information	54%	57%	49%	50%	53%
Don't know	1%	0%	0%	0%	10%

\* Significantly different from Overall at the 90% confidence level

The few people who sought information on IOU programs generally did so from three sources: utility representatives (37%), the internet (32%), and the builder or development sales agent (28%) (Table C.10-3). The findings are fairly consistent across IOU service territories, especially considering the small sample sizes. This question was not asked in the 2000 study.

**Table C.10-3: Persons from Whom Home Buyers Sought Information on IOU Programs When Making Plans for Building or Buying Home**  
(Consumer Survey)

Persons Mentioning Programs to Home Buyer (multiple response)	PG&E	SCE	SCG	SDG&E	Overall
n	34	21	20	15	90
Utility Representatives	40%	46%	24%	19%	37%
Internet	33%	24%	43%	14%	32%
Builder or Development Sales Agent	39%	11%	31%	44%	28%
Architects and Designers	11%	9%	2%	4%	8%
Material Supply Store	9%	11%	0%	10%	7%
Realtors	4%	7%	4%	14%	6%
Friends, Family, Co-workers, etc.	2%	16%	0%	0%	6%
HVAC Contractor	3%	0%	0%	10%	1%
Home Inspector	2%	0%	0%	0%	1%
Solar Company	0%	0%	0%	10%	<1%
Lenders	0%	0%	0%	4%	<1%

Overall, about two-thirds of non-participating home buyers interviewed for the survey (68%) rated energy efficiency as very important to the selection of their home (seven or higher on a zero-to-ten scale where zero was ‘not at all important’ and ten was “extremely important”; Table C.10-4). Respondents from Region 2 (57%) were statistically less likely to give a very important rating. The average rating for those responding to the question was 7.1.

**Table C.10-4: Importance of Energy Efficiency in Home Selection by Climate Region**  
(Consumer Survey; See Figure 3.1-2 for a map of regions)

	Region 1	Region 2	Region 3	Region 4	Region 5	Overall
n	65	107	351	264	188	975 <sup>a</sup>
0-3	7%	16%	10%	11%	10%	11%
4-6	17%	26%	25%	17%	19%	21%
7-10	76%	57%*	64%	71%	70%	68%
Don't know	0%	1%	0%	1%	1%	1%
Mean/SD	7.2/2.5	6.3/3.0*	7.0/2.7	7.2/2.7	7.3/2.7	7.1/2.7

\* Significantly different from Overall at the 90% confidence level

<sup>a</sup> After the initial series of introductory questions, one individual refused to answer all questions in the survey, and therefore the sample size of all home buyers in the study drops from 976 to 975.

Table C.10-5 shows the importance of energy efficiency in home selection by utility.

**Table C.10-5: Importance of Energy Efficiency in Home Selection by IOU**

	<b>PG&amp;E</b>	<b>SCE</b>	<b>SCG</b>	<b>SDG&amp;E</b>	<b>Overall</b>
n	308	235	251	181	975 <sup>a</sup>
0-3	11%	9%	11%	18%	11%
4-6	17%	24%	21%	21%	21%
7-10	71%	66%	67%	60%*	68%
Don't know	1%	1%	0%	1%	1%
Mean/SD	7.2/2.7	7.2/2.7	7.0/2.7	6.5/3.0*	7.1/2.7

\* Significantly different from Overall at the 90% confidence level

<sup>a</sup> After the initial series of introductory questions, one individual refused to answer all questions in the survey, and therefore the sample size of all home buyers in the study drops from 976 to 975.

Examining the changing importance over time of energy efficiency in the home selection process is complicated by slight changes made to the questionnaire used in the current study and the way in which the results were reported in the 2000 study (Table C.10-6). The questionnaire used in the 2000 study asked respondents to rate the importance of energy efficiency in their home selection on a one-to-ten scale, while the current study uses a zero-to-ten scale. Furthermore, the results for this question in the 2000 study did not separate participants from non-participants (although non-participants comprised 208 of the 226 respondents). Keeping these issues in mind, Table C.10-6 demonstrates that the percentage of people saying that energy efficiency was very important (i.e., nine or ten on the scales) to their home selection increased from 27% in the 2000 study to 32% in the 2008 study (Quantum Consulting Inc., 2000, Exhibit 3-6, pg 3-12). The difference is not statistically significant.

**Table C.10-6: Importance of Energy Efficiency in Home Selection over Time**

	<b>n</b>	<b>Extremely Important (9 or 10)</b>
2000 study	226 <sup>a</sup>	27%
2008 study	975	32%

<sup>a</sup> Includes 18 participants and 208 non-participants



One sign of consumer demand would be increased willingness to pay for efficiency. The survey also asked non-program home buyers to rate their agreement with five different statements regarding energy efficiency (Table C.10-7). The ratings were given on a zero-to-ten scale where zero indicated ‘disagree completely’ and ten indicated ‘agree completely.’ Most respondents strongly disagreed (54%) with the statement that energy-efficient features in a new home cost more than they are worth, while three-fourths of respondents strongly agreed (75%) with the statement that they are willing to invest in home features that will reduce monthly energy bills. Respondents were more evenly split on their opinions regarding perceived time and hassle to find information about energy efficiency when buying a home, trusting home builder information about energy efficiency, and whether or not it would interest them to have the added costs of energy efficiency measures rolled in their mortgage. Overall, home buyers said they value energy efficiency enough that they are willing to pay for it, but the results presented previously in Table C.10-6 suggest that this willingness has probably not increased over time.

**Table C.10-7: Home Buyers’ Attitudes toward Energy-Efficient Features in New Homes**

(Consumer Survey; 0-10 Scale; 0= “Disagree completely” and 10= “Agree Completely”)

<b>Statement (n=976)</b>	<b>0-3</b>	<b>4-6</b>	<b>7-10</b>	<b>Don’t know/ Refused</b>	<b>Mean/SD</b>
Energy-efficient features in a new home cost more than they’re worth	54%	24%	17%	5%	3.4/3.1
It takes too much time and hassle to find information about energy efficiency when I’m buying a home	28%	36%	29%	7%	4.8/3.0
I have a hard time believing energy efficiency information provided by new home builders	29%	39%	25%	7%	4.7/3.0
To interest me in energy-efficient features, the added cost of these measures would have to be rolled into the mortgage	28%	27%	36%	8%	5.1/3.2
I am willing to invest in home features that will reduce my monthly energy bills	7%	15%	76%	2%	7.9/2.6

Table C.10-8 and Table C.10-9 summarize the results of a series of question aimed at determining the importance that energy efficient new homes programs played in the non-participant respondent's decision to build or purchase their new home. Together, the series of questions suggested that just over one-third of all the respondents (36%) had no knowledge of the IOU program. An additional question determined that about one-half of all respondents (49%) were aware of the programs but did not have a home built under one (which is to be expected based on this non-participant survey). The few respondents who *self-reported* that they had a home built under the IOU programs were asked to rate on a zero-to-ten scale (where zero was 'not at all important' and ten was 'extremely important') the importance of the program sponsorship on their decision to build or purchase their particular home. Taking all the information together, just six percent of the non-participant respondents said that the IOU programs were very important (i.e., rated importance at seven or higher) to their decision to build or buy their newly constructed home. The average rating *among the few respondents who self-reported in the survey that they had a home built under the program* was 5.0, suggesting that the program was only moderately important in their decision. Respondents from the PG&E and SCE service territories (53% each) and from Region 1 (60%) were the most likely to be aware of the programs but not have purchased a home built under one. The average difference in the rating of the importance of the program does not vary greatly between IOUs, but Region 5 respondents gave a higher average rating of the importance of the program (6.6) than did respondents from other regions of the state (the closest is 5.1 for Region 2).

**Table C.10-8: Importance of IOU Program Sponsorship in Decision to Build or Purchase Home by IOU**

(Consumer Survey; 0-10 Scale, 0= "Not at all important" and 10= "Extremely Important")

	PG&E	SCE	SCG	SDG&E	Overall
N	308	235	251	181	975
No knowledge of IOU programs	31%	33%	43% <sup>*</sup>	42%	36%
Home not built under any IOU programs	53%	53%	43% <sup>*</sup>	47%	49%
0-3	6%	5%	5%	5%	5%
4-6	5%	3%	2%	1%	3%
7-10	4%	6%	7%	5%	6%
Don't know	<1%	<1%	<1%	<1%	<1%
Mean/SD	4.5/3.4	5.1/3.6	5.2/3.5	4.7/3.8	5.0/3.5

<sup>\*</sup> Significantly different from Overall at the 90% confidence level

<sup>a</sup> Based on the subset of respondents who provided ratings.

**Table C.10-9: Importance of IOU Program Sponsorship in Decision to Build or Purchase Home by Climate Region**

(Consumer Survey; 0-10 Scale, 0= "Not at all important" and 10= "Extremely Important")

	<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 5</b>
n	65	107	351	264	188
No knowledge of IOU programs	26% <sup>*</sup>	38%	33%	41%	40%
Home not built under any IOU programs	63% <sup>*</sup>	47%	50%	44%	51%
0-3	4%	6%	6%	6%	1%
4-6	4%	0%	4%	4%	2%
7-10	2%	10%	7%	4%	5%
Don't know	<1%	<1%	<1%	<1%	0%
Mean/SD	4.1/3.6	5.1/3.9	4.9/3.5	4.3/3.3	6.6/3.2 <sup>*</sup>

<sup>\*</sup> Significantly different from Overall at the 90% confidence level<sup>a</sup> Based on the subset of respondents who provided ratings.**Table C.10-10: Home Buyers Seeking Information on IOU Programs when Making Plans for Building or Buying Home by IOU**

(Consumer Survey)

	<b>PG&amp;E</b>	<b>SCE</b>	<b>SCG</b>	<b>SDG&amp;E</b>	<b>Overall</b>
n	308	235	251	181	975
No knowledge of IOU programs	31%	33%	43% <sup>*</sup>	42%	36%
Sought information	14% <sup>*</sup>	9%	8%	9%	10%
Did not seek information	54%	57%	49%	50%	53%
Don't know	1%	0%	0%	0%	10%

<sup>\*</sup> Significantly different from Overall at the 90% confidence level

## C.11 Code Compliance

Twenty-five out of 45 Title 24 consultants, representing 55% of non-program homes, said that rates of compliance with Title 24 increased from 2006 to 2008. Only 4 Title 24 consultants, representing 2% of non-program homes, said that rates of compliance decreased (Table C.11-1).

**Table C.11-1: Change in Rates of Compliance with Title 24 from 2006 to 2008**  
(Title 24 Consultants)

	Number of Title 24 Consultants (% of All Non-Program Homes)			
	Non-participants	Minority Participants	Majority Participants	Total
n	22	20	3	45
Increased a lot	4 (2%)	4 (28%)	0 (0%)	8 (30%)
Increased somewhat	7 (4%)	8 (20%)	2 (1%)	17 (25%)
Stayed about the same	8 (24%)	6 (19%)	1 (0%)	15 (44%)
Decreased somewhat	1 (1%)	0 (0%)	0 (0%)	1 (1%)
Decreased a lot	1 (0%)	2 (0%)	0 (0%)	3 (1%)
Don't know/refused	1 (0%)	0 (0%)	0 (0%)	1 (0%)

When asked why the rates of compliance had increased, Title 24 consultants appear to be divided between those who said compliance had improved because building department officials were not familiar enough with code (so that officials pass building plans without adequately verifying that the plans meet code) and those who said there was more code enforcement and improved understanding of code on the part of building departments. In addition, several Title 24 consultants attributed improved compliance to builder participation in incentive programs as well as awareness of and marketability of energy efficiency.

**Table C.11-2: Reasons for Increased Rates of Compliance with Title 24 from 2006 to 2008**  
(Title 24 Consultants reporting increased rates of compliance with Title 24, 2006 to 2008)

Reasons	Number of Title 24 Consultants			
	Non-participants	Minority Participants	Majority Participants	Total
n	22	20	3	45
Building departments aren't familiar enough with codes	2	4	0	6
More code enforcement	4	1	0	5
Building departments have a better understanding of codes	0	3	1	4
Better awareness of energy efficiency	1	2	0	3
More builder participation in incentive programs	1	2	0	3
Easy to meet requirements	1	2	0	3
Builders are more familiar with requirements	0	2	0	2
Efficiency helps in marketing of homes	1	1	0	2
More third party verifications, HERS rating	1	0	0	1
Industry follows regulations	0	1	0	1
More training	1	0	0	1
Low-e glass is now the standard	0	1	0	1
Codes are more strict	0	1	0	1
Compliance has become more cost-effective	1	0	0	1
Improved building materials and installation	0	1	0	1

Twenty out of 29 HERS raters, representing 82% of non-program homes, said that rates of compliance with Title 24 increased from 2006 to 2008, and none of them said that rates of compliance decreased (Table C.11-3).

**Table C.11-3: Change in Rates of Compliance with Title 24 from 2006 to 2008**  
(HERS Raters)

	HERS Raters (% of Nonparticipating Homes)			
	Nonparticipants	Minority participants	Majority Participants	Total
n	13	10	6	29
Increased a lot	4 (8%)	4 (67%)	2 (<1%)	10 (75%)
Increased somewhat	5 (1%)	3 (6%)	2 (<1%)	10 (7%)
Stayed about the same	1 (<1%)	2 (2%)	2 (13%)	5 (15%)
Decreased somewhat	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Don't know/refused	0 (0%)	0 (0%)	0 (0%)	0 (0%)

When asked why rates of compliance had increased, HERS raters most commonly identified HERS rating and improved education and awareness of Title 24, followed by program rebates and builders' desire to market energy efficiency, and increased consumer interest in energy efficiency (Table C.11-4).

**Table C.11-4: Reasons for Increased Rates of Compliance with Title 24 from 2006 to 2008**  
(HERS Raters)

Reasons	HERS Raters			
	Nonparticipants	Minority participants	Majority Participants	Total
n	13	10	6	29
HERS rating has improved compliance	0	3	1	4
Improved education/awareness of Title 24	3	1	0	4
Program rebates	1	2	0	3
Builders' desire to market efficient homes	2	0	1	3
More consumer interest in energy efficiency	1	0	1	2
Other programs	3	0	1	1
Code has gotten more strict	1	0	0	1
Compliance is necessary for building permits	1		0	1
Increase in number of program homes, decrease in overall number of homes built	0	1	0	1

Nine out of 32 builders, responsible for 26% of non-program homes, said that IOU training had helped to improve code compliance, while five builders, responsible for 11% of non-program homes, said that other (non-IOU) training had helped to improve code compliance (Table C.11-5).

**Table C.11-5: IOU and Other Training Programs Have Helped to Improve Code Compliance**

(Builders; 0-10 Scale; 0= “Disagree strongly” and 10= “Agree strongly”)

	Builders (% of Nonparticipating Homes)			
	Unaware Non-participants	Aware Non-participants	Partial Participants	Total
n	13	9	10	32
Unaware of IOU programs	13 (6%)	0 (0%)	0 (0%)	13 (6%)
Utility training programs have helped to improve code compliance (7 to 10 rating, 10 = “agree strongly)	0 (0%)	4 (9%)	5 (17%)	9 (26%)
Other training programs have helped to improve code compliance (7 to 10 rating, 10 = “agree strongly)	0 (0%)	3 (7%)	2 (3%)	5 (11%)

Three out of nine HVAC contractors, responsible for 1% of non-program homes, said that IOU training had helped improve code compliance. Two HVAC contractors who were responsible for most non-program homes (78%) said that other (non-IOU) training programs had helped to improve code compliance (Table C.11-6).

**Table C.11-6: IOU and Other Training Programs Have Helped Improve Code Compliance**

(HVAC Contractors; 0-10 Scale; 0= “Disagree strongly” and 10= “Agree strongly”)

	HVAC Contractors (% of Nonparticipating Homes)			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	2	4	3	9
Unaware of IOU programs	2 (3%)	0 (0%)	0 (0%)	2 (3%)
Utility training programs have helped improve code compliance (7 to 10 rating, 10 = “agree strongly)	0 (0%)	3 (1%)	0 (0%)	3 (1%)
Other training programs have helped improve code compliance (7 to 10 rating, 10 = “agree strongly)	0 (0%)	1 (<1%)	1 (78%)	2 (78%)

Thirteen out of 45 Title 24 consultants, responsible for 25% of non-program homes, said that IOU training had helped to improve code compliance, while five Title 24 consultants, responsible for 35% of non-program homes, said that other (non-IOU) training had helped to improve code compliance (Table C.11-7).

**Table C.11-7: IOU and Other Training Programs Have Helped to Improve Code Compliance**

(Title 24 Consultants; 0-10 Scale; 0= “Disagree strongly” and 10= “Agree strongly”)

	Number of Title 24 Consultants (% of All Non-Program Homes)			
	Non-participants	Minority Participants	Majority Participants	Total
n	22	20	3	45
Usually/Always unaware of level of builder acceptance of Title 24 compliance advice	9 (26%)	13 (37%)	1 (0%)	23 (63%)
Utility training programs have helped to improve code compliance (7 to 10 rating, 10 = “agree strongly)	4 (2%)	8 (23%)	1 (0%)	13 (25%)
Other training programs have helped to improve code compliance (7 to 10 rating, 10 = “agree strongly)	0 (0%)	5 (35%)	0 (0%)	5 (35%)

Fifteen out of 29 HERS raters, responsible for 92% of non-program homes, said that IOU training had helped to improve code compliance, while 11 HERS raters, responsible for 86% of non-program homes, said that other (non-IOU) training had helped to improve code compliance (Table C.11-8).

**Table C.11-8: IOU and Other Training Programs Have Helped to Improve Code Compliance**

(HERS Raters; 0-10 Scale; 0= “Disagree strongly” and 10= “Agree strongly”)

	HERS Raters (% of Nonparticipating Homes)			
	Non-participants	Minority participants	Majority Participants	Total
n	13	10	6	29
Unaware of IOU programs and do not know about energy efficiency technologies and practices used by builders about half the time or more	3 (1%)	1 (2%)	0 (0%)	4 (3%)
Utility training programs have helped to improve code compliance (7 to 10 rating, 10 = “agree strongly)	4 (6%)	6 (73%)	5 (13%)	15 (92%)
Other training programs have helped to improve code compliance (7 to 10 rating, 10 = “agree strongly)	6 (9%)	3 (64%)	2 (13%)	11 (86%)



Five of 14 building code officials and inspectors agreed that the IOU programs had helped improve compliance. Several respondents stated that they had very little or no record of the utility programs even being offered. Another pointed out that when builders went through the IOU training it helped, but that not enough actually participated. Four of 14 building code officials/inspectors agreed that non-IOU programs had helped to improve code compliance. Reasons cited for not agreeing that non-IOU programs had helped to code compliance were primarily that the respondent was unaware of any programs outside of what is offered by the utilities; one said that the material offered in non-IOU programs was too technical for the average builder that attends. Several of the respondents who agreed that non-IOU programs have helped to increase code compliance referred to programs offered by the CEC and local builder exchanges<sup>142</sup> as being particularly helpful.

**Table C.11-9: IOU and Other Training Programs Have Helped to Improve Code Compliance**

(Title 24 Building Code Officials/Inspectors; 0-10 Scale; 0= “Disagree strongly” and 10= “Agree strongly”)

	<b>Number of Building Code Officials/Inspectors</b>
n	14
IOU training programs have helped to improve code compliance	5
Other training programs have helped to improve code compliance	4

In addition, as reported in section 5.4, twenty-three out of 45 Title 24 consultants, representing 42% of non-program homes, said IOU training had a strong influence on their recommendation of energy-efficient building practices and technologies in the 2006-2008 period, which in turn likely helped to improve the code compliance of non-program homes (see Table C.11-9). However, almost no Title 24 consultants were aware of Program Plan Check review process offered by the IOUs, while only eight of 32 builders were aware of the review process, and five builders, responsible for 7% of non-program homes, reported that the review process helped a great deal in modeling and building above-code (see Table C.4-6 and Table C.4-7).

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<sup>142</sup> Builder exchanges are member-operated, not-for-profit associations serving construction-related companies in specific areas, such as one county or a few contiguous counties.

Twenty HERS raters, responsible for 99% of non-Program homes, verified Quality Insulation Installations (QII) to earn energy credits for Title 24 compliance during the 2006-2008 period (Table C.11-10). Four HERS raters, responsible for 19% of non-program homes, said that the IOU RNC programs had a strong influence on the use of QII in non-program homes.

**Table C.11-10: Quality Insulation Installation (QII) for Non-Program Homes, 2006 to 2008**  
(HERS Raters)

	HERS Raters (% of Nonparticipating Homes)			
	Nonparticipants	Minority participants	Majority Participants	Total
n	13	10	6	29
Verified Quality Insulation Installation (QII) to earn energy credits for Title 24 compliance	8 (10%)	9 (76%)	3 (13%)	20 (99%)
Number of housing units provided QII verification to earn energy credits for Title 24 compliance (Mean)	167.1	522.8	418.5	341.8
Influence of IOU program on use of QII on non-program homes, 7-10 rating (10 = "A great deal of influence")	1 (6%)	1 (<0%)	2 (13%)	4 (19%)

When asked to explain their ratings of the influence of the program, HERS raters who attributed little or no influence to the program said the lack of influence was due to: (1) the low levels of awareness of QII (although some added that the program was raising awareness), (2) builders avoiding QII because of the verification requirements, (3) QII being needed to meet Title 24 (and thus the influence was from meeting code, not from the program), or (4) QII was being used to meet program requirements and not relevant for non-program homes (Table C.11-11). HERS raters who said the program had a strong influence explained that awareness and use of QII was due to: (1) the program, (2) that QII was needed to qualify for IOU RNC programs or other RNC programs, or (3) that insulation contractors had become experienced with QII requirements because of ENERGY STAR Homes program, and energy consultants are now comfortable recommending QII in non-program homes.

**Table C.11-11: Reasons for Rating Influence of IOU RNC Programs on Use of QII in Non-Program Homes**  
(HERS Raters)

Reason	HERS Raters			Total
	Non-participants	Minority Participants	Majority Participants	
n	13	10	6	29
<b>Influence of IOU program on use of QII on non-program homes, 0 to 6 rating; (0 = “no influence at all,” 10 = “A great deal of influence”)</b>				
	3	4	1	8
Little awareness of QII and program raises awareness and understanding of QII	2	2	0	4
QII verification takes too much time, so builders are unlikely to seek it without program incentives	0	2	0	2
QII credit needed to qualify for program rebates	1	0	0	1
Builders and general public are not aware of IOU RNC programs	0	0	1	1
QII credit often needed to meet Title 24 requirements	1	0	0	1
<b>Influence of IOU program on use of QII on non-program homes, 7 to 10 rating; (0 = “no influence at all”, 10 = “A great deal of influence”)</b>				
	1	1	2	4
Little awareness of QII and program raises awareness and understanding of QII	1	0	0	0
QII credit needed to qualify for program rebates	0	0	1	0
To qualify for other RNC programs (ENERGY STAR Homes and Solar Initiative)	0	1	1	0
Insulation contractors experienced with QII requirements because of ENERGY STAR Homes program and energy consultants are comfortable recommending QII	0	0	1	1

Nearly two-thirds of all Title 24 consultants (29 of 45, responsible for 72% of non-program homes) report that they are the primary decision maker for meeting the Time Dependent Valuation (TDV) requirements of Title 24 (Table C.11-12).

**Table C.11-12: Decision Maker for Time Dependent Valuation (TDV) Requirements**  
(Title 24 Consultants)

	Number of Title 24 Consultants (% of All Non-Program Homes)			
	Non- participants	Minority Participants	Majority Participants	Total
n	22	20	3	45
Title 24 Consultant	13 (5%)	15 (66%)	1 (1%)	29 (72%)
Architect	0 (0%)	0 (0%)	1 (0%)	1 (0%)
Client and respondent/consultant	2 (1%)	2 (1%)	1 (0%)	5 (2%)
Client	2 (0%)	2 (1%)	0 (0%)	4 (1%)
Built into software program	3 (2%)	1 (0%)	0 (0%)	4 (2%)
No specific performance TDV requirement	1 (23%)	0 (0%)	0 (0%)	1 (23%)

Title 24 consultants report that the building features most commonly used to meet TDV requirements are high efficiency windows and glazing, particularly as these features impact cooling loads, high efficiency HVAC equipment and insulation (Table C.11-13). Title 24 consultants also report using software program calculations and the performance method to make trade-offs on building materials and equipment to meet the TDV requirements.

**Table C.11-13: Most Common Way TDV Requirements are Met**  
(Title 24 Consultants)

	Number of Title 24 Consultants			Total
	Non-participants	Minority Participants	Majority Participants	
n	22	20	3	45
Windows, Glazing	4	6	-	10
Software Program Calculations, Performance Method	6	2	-	8
HVAC Equipment	3	2	-	5
Insulation	1	2	-	3
Depends on Climate Zone	2	-	1	3
High-Efficiency Equipment	1	1	-	2
Water Heaters	-	2	-	2
Unnecessary if unit is efficient enough	-	-	1	1
Trade-Off	1	-	-	1
Cannot answer question	1	-	-	1
Envelope Construction	-	1	-	1
Thermal Mass	1	-	-	1
Depends on Builders' Preferences	-	1	-	1
Radiant Barriers	-	1	-	1
UCM Motors in Mechanical Equipment	1	-	-	1
No One Common Way	-	-	1	1
No Specific Performance TDV Requirement	1	-	-	1
Overhangs and Shading Devices	-	1	-	1
Prescriptive Method	-	1	-	1

Only five builders are aware of TDV requirements, and all five rely upon their Title 24 consultant to decide how to meet TDV requirements (Table C.11-14).

**Table C.11-14: Awareness of and Decision Maker for Time Dependent Valuation (TDV) Requirements**  
(Builders)

	Number of Builders (% of Non-program Homes)			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	13	9	10	32
Aware of TDV	1 (<1%)	1 (1%)	3 (62%)	5 (63%)
Decision maker to meet TDV requirements:				
Title 24 Consultant	1 (<1%)	1 (1%)	3 (62%)	5 (63%)
Most common way to TDV requirements are met:				
Through subcontractors	1	0	0	1
Varies depending on location	0	0	1	1
Meet consultant calculations / requirements	0	0	2	2
Heating and water system	0	1	0	1

Builders are nearly evenly divided in their use of the performance, prescriptive and trade-off methods for compliance with Title 24 (Table C.11-15).

**Table C.11-15: Methods Commonly Used to Typically Comply with Title 24**  
(Builders)

	Number of Builders (% of Non-program Homes)			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	13	9	10	32
Performance	5 (4%)	2 (7%)	3 (62%)	10 (74%)
Prescriptive	4 (<1%)	2 (1%)	5 (17%)	11 (18%)
Trade-off	2 (<1%)	3 (2%)	2 (5%)	7 (7%)

Nearly all (43 of 45) Title 24 consultants use the performance method to comply with Title 24 (Table C.11-16).

**Table C.11-16: Methods Commonly Used with Builders to Comply with Title 24**  
(Title 24 Consultants)

	Number of Title 24 Consultants (% of All Non-Program Homes)			
	Non- participants	Minority Participants	Majority Participants	Total
n	22	20	3	45
Performance	21 (30%)	19 (68%)	3 (1%)	43 (99%)
Prescriptive	0 (0%)	1 (0%)	0 (0%)	1 (0%)
Trade-off	1 (0%)	0 (0%)	0 (0%)	1 (0%)

When working with builders on Title 24 compliance, two-thirds of Title 24 consultants, responsible for 51% of non-program homes, typically develop a compliance approach for the builder during the design stage and are then not involved in decisions during the construction phase, while eleven Title 24 consultants, responsible for 44% of non-program homes, continue to be involved with the builder in making decisions during the construction stage (Table C.11-17).

**Table C.11-17: Ways Consultants Work With Builders on Title 24 Compliance**  
(Title 24 Consultants)

	Number of Title 24 Consultants (% of All Non-Program Homes)			
	Non- participants	Minority Participants	Majority Participants	Total
n	22	20	3	45
Develops a compliance approach for the builder during the design stage and is not involved in decisions during the construction phase	15 (29%)	14 (21%)	1 (1%)	30 (51%)
After developing the initial compliance approach, continues to be involved with the builder in making decisions during the construction stage	6 (1%)	4 (43%)	1 (0%)	11 (44%)
About 50/50 of each	0 (0%)	1 (4%)	1 (0%)	2 (4%)
Other	1 (0%)	1 (0%)	0 (0%)	2 (0%)

Twenty-two of 45 Title 24 consultants, responsible for 50% of non-program homes, know about half of the time or more whether the builders they work with ultimately followed their advice on compliance with Title 24 (Table C.11-18).

**Table C.11-18: Frequency with Which Consultants Know Whether Builders Have Followed Advice on Compliance with Title 24**

(Title 24 Consultants)

	Number of Title 24 Consultants (% of All Non-Program Homes)			
	Non- participants	Minority Participants	Majority Participants	Total
n	22	20	3	45
Almost never	5 (25%)	6 (16%)	1 (0%)	12 (41%)
Usually do not	8 (3%)	2 (5%)	1 (1%)	11 (9%)
About half the time	3 (1%)	4 (26%)	0 (0%)	7 (27%)
Usually do	2 (0%)	1 (0%)	1 (0%)	4 (1%)
Almost always	4 (1%)	7(21%)	0 (0%)	11 (22%)

Twenty-five of 29 HERS raters, responsible for 97% of non-program homes, know about the energy efficiency technologies and practices of the builders they work with half of the time or more (Table C.11-19).

**Table C.11-19: Frequency with Which HERS Raters Know About the Energy Efficiency Technologies and Practices Used by Builders**

(HERS Raters)

	Number of HERS Raters (% of All Non-Program Homes)			
	Non- participants	Minority Participants	Majority Participants	Total
n	13	10	6	29
Almost never	1 (1%)	1 (2%)	0 (0%)	2 (2%)
Usually do not	2 (<0%)	0 (0%)	0 (0%)	2 (<0%)
About half the time	0 (0%)	2 (8%)	1 (0%)	3 (8%)
Usually do	2 (1%)	1 (58%)	2 (<0%)	5 (59%)
Almost always	8 (8%)	6 (9%)	3 (13%)	17 (30%)



## C.12 Above-Code Practices

Table C.12-1 lists the efficiency levels of selected building measures for homes built under the 1995, 1998, 2001 and 2005 standards, based on on-site observations. High-SEER central air conditioners and high-AFUE gas furnaces increased steadily from homes built under the 1995 standards to homes built under the 2005 standards. The average R-value for ceiling and wall insulation is higher in homes built under the 2005 standard compared to all previous years, but the percentage of homes with above-code levels of insulation are relatively low because of changes to Title 24.

**Table C.12-1: Efficiency Levels of Selected Building Measures, 1995 to 2005 Standards**  
(On-site home inspections, Residential New Construction Baseline and Codes and Standards Evaluations)

Building Measure	Percentage of Homes			
	1995 Standards	1998 Standards	2001 Standards	2005 Standards
Higher than 14 SEER	0%	0%	0%	13%
90% AFUE furnace or higher	2%	3%	11%	16%
Above-code window glazing	64%	58%	68%	91%
Average R-value, ceiling insulation	29.1	30.7	31.8	33.3
Above-code, ceiling insulation	5%	1%	3%	3%
Average R-value, wall insulation	14.4	15.6	14.0	20.3
Above-code, wall insulation	12%	26%	6%	2%
Average percent of glazing	17%	17%	16%	14%
Percentage of two-paned vinyl, low-e glass windows	5%	8%	79%	86%
Percentage of instantaneous water heaters	0%	<1%	1%	25%
Percentage of homes with radiant barriers	2%	4%	4%	13%

Thirty-eight of 45 Title 24 consultants, 17 of 29 HERS raters, 14 of 19 partial participant builders and non-participating builders who were aware of the IOU programs, and all nine HVAC contractors reported that they had recommended, rated, built, or installed equipment into non-program homes using above-code building practices and technologies.<sup>143</sup> The most common above-code practices and technologies identified by all four groups of respondents include duct sealing and testing, windows, insulation R-values and quality insulation installation, high efficiency air conditioners, furnaces, and water heating equipment (Table C.12-2).

Seventeen of 45 Title 24 consultants estimated that 24% of the non-program homes they consulted on exceeded Title 24 requirements,<sup>144</sup> while 18 HERS raters estimated that 77% of the non-program homes they consulted on exceeded Title 24 requirements (Table C.12-2).<sup>145</sup>

Eleven of 45 Title 24 consultants estimated that 10% of the non-program homes they consulted on met program standards<sup>146</sup> while 12 HERS raters estimated that 6% of all non-program homes they had rated were built to program standards (Table C.12-2). Four builders estimated that 1% of all non-program homes met program standards, while three HVAC contractors estimated that 79% of the homes they worked on met program standards.<sup>147</sup>

When asked to describe the factors determining whether they design a particular home to exceed Title 24, two builders reported that exceeding Title 24 adds value to the home and helps to distinguish the home from competing homes, one builder said that the market demands higher efficiency homes, one builder said it was his building philosophy, and one builder determined the measures by a cost/value benefit analysis. HVAC contractors most commonly reported that they used above-code measures for the following reasons: to meet Title 24 requirements, because it is the company standard, because of the quality of the feature, because of the efficiency of the feature, and because of homeowner demand for efficiency

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<sup>143</sup> We can identify only the number of builders, not the numbers of homes, with above-code practices because respondents reported the number of homes with a specific practice or technology, and there may be overlap between these practices and technologies in individual homes.

<sup>144</sup> In comparison, the 2000 statewide study reports that only one Title 24 consultant reported reviewing home designs that purposely exceeded Title 24. (Quantum Consulting Inc., 2000, pg A-27).

<sup>145</sup> Because HERS raters rate program homes, homes enrolled in other voluntary energy efficiency programs, and rate QII in non-program homes for code compliance, it is possible that HERS raters work on higher efficiency non-program homes.

<sup>146</sup> When asked to identify the program standards that the non-program homes built to program standards met, only one Title 24 consultant was able to identify the particular standard: exceeding the required U-values and shading coefficient on the windows.

<sup>147</sup> Because HVAC contractors only work on part of the home, it is not clear how accurate their assessments of homes meeting program standards are.

**Table C.12-2: Percentage of Non-Program Homes Using Above-Code Practices and Technologies, 2006 to 2008**

(Title 24 Consultants, HERS Raters, Builders, HVAC Contractors)

	Number of Respondents (% of all non-program homes with above-code feature or built to standard)			
	Title 24 Consultants	HERS Raters	Builders	HVAC Contractors
n	45	29	32	9
Insulation R-values	32 (10%)	13 (22%)	7 (1%)	NA
Quality of insulation installation	17 (17%)	13 (16%)	9 (11%)	NA
Windows	34 (20%)	13 (1%)	10 (8%)	NA
High-SEER air conditioner or heat pump	34 (10%)	14 (23%)	14 (14%)	7 (15%)
High-EER air conditioner or heat pump	32 (15%)	14 (20%)	NA	7 (9%)
High-AFUE furnace	35 (6%)	14 (18%)	8 (8%)	7 (1%)
HVAC installation	20 (7%)	13 (14%)	9 (11%)	5 (5%)
Water-heating equipment	36 (13%)	12 (20%)	8 (3%)	NA
Lighting	21 (2%)	6 (5%)	5 (12%)	NA
Framing materials and techniques	12 (2%)	7 (5%)	6 (1%)	NA
Orientation and shading	20 (4%)	9 (4%)	5 (4%)	NA
Photovoltaics	9 (5%)	7 (3%)	4 (5%)	NA
Duct sealing	29 (30%)	12 (20%)	8 (11%)	8 (19%)
Duct testing	27 (33%)	15 (23%)	5 (7%)	5 (11%)
Air sealing	11 (5%)	9 (4%)	3 (<1%)	NA
Any practice	38 (NA)	17 (NA)	14 (NA)	9 (NA)
Entire home exceeds Title 24	17 (24%)	18 (77%)	NA	NA
Home built to program standards	11 (10%)	12 (6%)	4 (1%)	3 (79%)

Table C.12-3 through Table C.12-10 provide additional data on the above code practices of builders, HVAC contractors, Title 24 consultants and HERS raters.

**Table C.12-3: Percentage of Non-Program Homes Used Above-Code Practices and Technologies, 2006 to 2008**  
(Builders)

n	Unaware Nonparticipants		Aware Nonparticipants		Partial Participants		Total	
	13		9		10		32	
	Number of Builders (% of Non-Program Homes)	Mean	Number of Builders (% of Non-Program Homes)	Mean	Number of Builders (% of Non-Program Homes)	Mean	Number of Builders (% of Non-Program Homes)	Mean
Insulation R-values	NA	NA	4 (<1%)	22%	3 (1%)	21%	7 (1%)	22%
Quality of insulation installation	NA	NA	5 (5%)	26%	4 (6%)	19%	9 (11%)	22%
Windows	NA	NA	6 (5%)	44%	4 (3%)	31%	10 (8%)	37%
High-SEER air conditioner or heat pump	NA	NA	8 (5%)	33%	6 (10%)	25%	14 (14%)	28%
High-AFUE furnace	NA	NA	3 (<1%)	9%	5 (8%)	29%	8 (8%)	20%
HVAC installation	NA	NA	3 (5%)	18%	6 (6%)	21%	9 (11%)	20%
Water-heating equipment	NA	NA	4 (<1%)	9%	4 (3%)	24%	8 (3%)	17%
Lighting	NA	NA	2 (5%)	13%	3 (7%)	18%	5 (12%)	16%
Framing materials and techniques	NA	NA	3 (<1%)	10%	3 (<1%)	18%	6 (1%)	14%
Orientation and shading	NA	NA	2 (3%)	19%	3 (<1%)	14%	5 (4%)	17%
Photovoltaics	NA	NA	2 (5%)	13%	2 (<1%)	10%	4 (5%)	12%
Duct sealing	NA	NA	4 (5%)	34%	4 (7%)	23%	8 (11%)	28%
Duct testing	NA	NA	1 (<1%)	1%	4 (7%)	23%	5 (7%)	13%
Air sealing	NA	NA	2 (<1%)	7%	1 (<1%)	10%	3 (<1%)	8%
Any practice or technology	NA	NA	8 (NA)		6 (NA)		14 (NA)	

**Table C.12-4: Percentage of Non-Program Homes Used Above-Code Practices and Technologies, 2006 to 2008**  
(HVAC Contractors)

	Unaware Nonparticipants		Aware Nonparticipants		Partial Participants		Total	
n	2		4		3		9	
	Number of HVAC contractors (% of Non-Program Homes)	Mean	Number of HVAC contractors (% of Non-Program Homes)	Mean	Number of HVAC contractors (% of Non-Program Homes)	Mean	Number of HVAC contractors (% of Non-Program Homes)	Mean
High-SEER air conditioner or heat pump	2 (<1%)	43%	3 (13%)	53%	2 (2%)	34%	7 (15%)	44%
High-EER air conditioner or heat pump	2 (1%)	38%	3 (6%)	40%	2 (2%)	34%	7 (9%)	37%
High-AFUE furnace	2 (<1%)	28%	3 (<1%)	53%	2 (1%)	5%	7 (1%)	31%
HVAC installation	1 (<1%)	30%	2 (<1%)	50%	2 (5%)	67%	5 (5%)	51%
Duct sealing	2 (1%)	60%	4 (13%)	100%	2 (5%)	67%	8 (19%)	80%
Duct testing	2 (1%)	35%	2 (10%)	21%	1 (1%)	7%	5 (11%)	19%
Duct insulation	2 (1%)	50%	3 (13%)	75%	1 (<1%)	33%	6 (14%)	56%
Any practice or technology	2 (NA)		4 (NA)		3 (NA)		9 (NA)	

**Table C.12-5: Percentage of Non-Program Homes Consulted on from 2006 to 2008 for which Builder Actually Used Above-Code Practices and Technologies**

(Title 24 Consultants)

	Nonparticipants		Minority participants		Majority Participants		Total	
n	22		20		3		45	
	Number of T24 Consultants (% of Non-Program Homes)	Mean	Number of T24 Consultants (% of Non-Program Homes)	Mean	Number of T24 Consultants (% of Non-Program Homes)	Mean	Number of T24 Consultants (% of Non-Program Homes)	Mean
Insulation R-values	19 (1%)	13%	12 (9%)	11%	1 (0%)	0%	32 (10%)	11%
Quality of insulation installation	6 (<1%)	3%	10 (17%)	5%	1 (0%)	0%	17 (17%)	4%
Windows	17 (1%)	15%	16 (19%)	29%	1 (0%)	0%	34 (20%)	20%
High-SEER air conditioner or heat pump	19 (<1%)	7%	14 (9%)	19%	1 (0%)	0%	34 (10%)	12%
High-EER air conditioner or heat pump	15 (1%)	11%	15 (14%)	19%	2 (0%)	0%	32 (15%)	14%
High-AFUE furnace	18 (1%)	13%	15 (5%)	13%	2 (0%)	0%	35 (6%)	12%
HVAC installation	9 (1%)	11%	9 (6%)	12%	2 (0%)	0%	20 (7%)	10%
Water-heating equipment	18 (1%)	12%	15 (13%)	28%	3 (0%)	0%	36 (13%)	18%
Lighting	11 (<1%)	5%	8 (2%)	8%	2 (0%)	0%	21 (2%)	6%
Framing materials and techniques	6 (<1%)	1%	6 (2%)	5%	0 (0%)	0%	12 (2%)	3%
Orientation and shading	8 (0%)	0%	11 (4%)	12%	1 (0%)	0%	20 (4%)	6%
Photovoltaics	4 (<1%)	0%	4 (5%)	5%	1 (0%)	0%	9 (5%)	2%
Duct sealing	16 (<1%)	4%	11 (30%)	18%	2 (0%)	0%	29 (30%)	10%
Duct testing	13 (<1%)	3%	12 (33%)	22%	2 (0%)	0%	27 (33%)	11%
Air sealing	5 (0%)	0%	5 (5%)	5%	1 (0%)	0%	11 (5%)	2%
Any practice or technology	19 (NA)	NA	16 (NA)	NA	3 (NA)	NA	38 (NA)	NA

**Table C.12-6: Percentage of Non-Program Homes Rated by HERS Rater that Used Above-Code Practices and Technologies, 2006 to 2008**  
(HERS Raters)

	Nonparticipants		Minority participants		Majority Participants		Total	
n	13		10		6		29	
	Number of HERS Raters (% of Non-Program Homes)	Mean	Number of HERS Raters (% of Non-Program Homes)	Mean	Number of HERS Raters (% of Non-Program Homes)	Mean	Number of HERS Raters (% of Non-Program Homes)	Mean
Insulation R-values	3 (3%)	18%	7 (8%)	41%	3 (11%)	39%	13 (22%)	31%
Quality of insulation installation	3 (1%)	6%	7 (4%)	16%	3 (11%)	31%	13 (16%)	15%
Windows	4 (0%)	27%	6 (1%)	44%	3 (0%)	48%	13 (1%)	37%
High-SEER air conditioner or heat pump	6 (3%)	29%	6 (9%)	34%	2 (11%)	19%	14 (23%)	29%
High-EER air conditioner or heat pump	6 (3%)	22%	6 (6%)	18%	2 (11%)	19%	14 (20%)	20%
High-AFUE furnace	5 (2%)	14%	6 (4%)	25%	3 (11%)	38%	14 (18%)	23%
HVAC installation	3 (2%)	10%	7 (5%)	26%	3 (7%)	12%	13 (14%)	16%
Water-heating equipment	4 (1%)	14%	5 (7%)	21%	3 (11%)	34%	12 (20%)	21%
Lighting	1 (<1%)	1%	4 (5%)	15%	1 (0%)	<0%	6 (5%)	5%
Framing materials and techniques	3 (<1%)	7%	3 (1%)	8%	1 (4%)	5%	7 (5%)	7%
Orientation and shading	2 (1%)	12%	4 (1%)	12%	3 (2%)	5%	9 (4%)	11%
Photovoltaics	0 (0%)	0%	4 (1%)	4%	3 (2%)	19%	7 (3%)	5%
Duct sealing	4 (3%)	22%	6 (5%)	36%	2 (12%)	32%	12 (20%)	29%
Duct testing	4 (3%)	18%	8 (8%)	40%	3 (12%)	32%	15 (23%)	28%
Air sealing	2 (<1%)	10%	6 (4%)	13%	1 (0%)	3%	9 (4%)	9%
Any practice or technology	6 (NA)	NA	8 (NA)	NA	3 (NA)	NA	17 (NA)	NA

**Table C.12-7: Reasons Whether or Not a Particular Non-Program Home Would Be Designed to Exceed Title 24**

(Title 24 Consultants)

Reason	Number of Title 24 Consultants			
	Non-participants	Minority Participants	Majority Participants	Total
n	22	20	3	45
Dependent on homeowner's preference	5	5	0	10
Dependent on clients preference	5	2	1	8
All homes must meet or exceed code, and since meeting it exactly is nearly impossible, almost all exceed	4	0	0	4
Clients are interested in energy efficiency	2	2	0	4
Clients are only interested in saving money	1	2	0	3
Home is outside of program jurisdiction	1	1	1	3
Local jurisdiction requirements	1	2	0	3
All, almost all code-exceeding homes are those with program support	1	1	1	3
Clients are interested in long-term savings	0	2	0	2
Green initiatives	1	0	1	2
Home exceeds code but doesn't meet program requirements	1	1	0	2
Consultants do not design homes	2	0	0	2
Builders desire to market energy efficiency in homes	0	2	0	2
Other incentive programs	1	0	1	2
Lack of awareness of available programs	1	0	0	1
Consultant tries to save clients money	0	1	0	1
Dependent on whether consultant can convince client to build above-code	1	0	0	1
The right thing to do	0	1	0	1
Standard building practices for certain firms	0	1	0	1
Consultant tries to get all qualifying homes into a program	1	0	0	1
Tax credits	0	0	1	1
Owners applying for special financing from banks or lending agencies	1	0	0	1
Owners of qualifying homes don't want to go through bureaucracy necessary for certification	0	1	0	1



**Table C.12-8: Influence of Title 24 Consultants on Design and Construction of Home to Exceed Title 24**

(Title 24 Consultants; 1 to 5 scale, 1 = “Not influential at all” and 5 = “Extremely influential”)

	2000 Statewide RNC Study <sup>148</sup>	Number of Title 24 Consultants (% of All Non-Program Homes)			Total
		Non- participants	Minority Participants	Majority Participants	
n		22	20	3	45
Influence of T24 consultant determining <b>whether</b> a home is designed and built to exceed T24, extremely or very influential	0	3 (2%)	6 (22%)	2 (1%)	11 (25%)
Influence of T24 consultant determining <b>how</b> a home is designed and built to exceed T24, extremely or very influential	NA	6 (3%)	9 (25%)	2 (1%)	17 (29%)

**Table C.12-9: HVAC Contractors Work with Builders Who Specify Above-Code HVAC Equipment or Installation Practices**

(HVAC Contractors)

Year	Average Percentage of Homes Installed Above-Code Duct Insulation			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	2	4	3	9
Builders specify above-code HVAC equipment or installation practices	1 (3%)	2 (13%)	2 (83%)	5 (99%)
Above-code HVAC equipment or installation practice specified:				
High-SEER air conditioner or heat pump	0 (0%)	2 (13%)	1 (78%)	3 (91%)
High-EER air conditioner or heat pump	0 (0%)	2 (13%)	1 (78%)	3 (91%)
High-AFUE furnace	1 (3%)	2 (13%)	2 (83%)	5 (99%)
HVAC installation for maximum efficiency	0 (0%)	1 (<1%)	1 (5%)	2 (5%)
Duct sealing	0 (0%)	2 (13%)	1 (5%)	3 (18%)
Duct testing	1 (3%)	1 (13%)	0 (0%)	2 (16%)
Duct insulation	0 (0%)	2 (13%)	0 (0%)	2 (13%)

<sup>148</sup>Quantum Consulting Inc., 2000, pg A-27.

**Table C.12-10: Why HVAC Contractor Uses Above-Code Measures in Non-Program Homes**

(HVAC Contractors)

	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n (multiple response)	2	4	3	9
Title 24 requirements	5	11	0	16
Company standard	0	6	3	9
Quality of feature	2	1	5	8
Efficiency of feature	5	1	1	7
Homeowner request; homeowner wants energy-efficient home	1	2	2	5
Difficulty of installing feature	1	0	1	2
Low cost of feature	0	2	0	2
Climate zone requirements	0	2	0	2
Consumer approves use of measure and willing to pay	0	2	0	2
Builder request	0	0	1	1
High cost of feature	0	0	1	1
Being green	0	1	0	1
Marketability of energy efficiency	0	1	0	1
Comfort of home	1	0	0	1

Table C.12-11 lists the efficiency levels of select building measures as reported by HVAC contractors, HVAC distributors, window distributors, lighting distributors, and insulation distributors. HVAC contractors estimated that the percentage of 14 SEER or higher (above-code) central air conditioning systems they installed increased from 17% to 21% of installations from 2006 to 2008, while the percentage of furnaces with an AFUE of 90% or higher (above the code minimum of 78% AFUE) they installed increased from 20% in 2006 to 25% in 2008; the bulk of furnaces (65%) were AFUE 80% or below. On average, HVAC contractors reported a slight decline in the installation of above-code duct insulation, while the percentage of homes on which HVAC contractors conduct duct tests increased from 46% of homes in 2006 to 56% of homes in 2008.

HVAC distributors, unlike HVAC contractors, reported a decline in the percentage of 14 SEER or higher (above-code) central air conditioning systems sold from 2006 to 2008, but HVAC distributors estimated that the percentage of furnaces with an AFUE of 90% or higher (above the code minimum of 78% AFUE) they sold increased from 7% to 14% between 2006 and 2008; the bulk of furnaces sold (86%) were AFUE 80% or below.

Window distributors estimated that the percentage of windows sold exceeding Title 24 requirements for U-Factor and SHGC ratings declined between 2006 and 2008. Insulation

distributors reported a slight increase in the sale of the above-code insulation and insulation installations meeting QII standards between 2006 and 2008.<sup>149</sup>

Lighting distributors estimated an increase in the percentage of interior and exterior pin-based CFL fixtures, a decrease in the percentage of screw-based incandescent fixtures, an increase in the percentages of interior lighting fixtures sold with occupancy sensors, and an increase in the number of exterior lighting fixtures with photocontrols and motion sensors sold between 2006 and 2008.

When asked why the shift to high-SEER central air conditioners had occurred, one HVAC contractor attributed the shift to the IOU RNC rebate programs and tax credits, another suggested cost and a third said it was the change in code. For high-AFUE furnaces, one HVAC contractor attributed the shift to the IOU RNC rebate programs and federal tax credits, while two others reported that it was due to the builder. One distributor who reported an increase in the percentage of 14 SEER or higher central air conditioning systems attributed the increase to greater consumer demand and decreasing price differences between 13 and 14 SEER equipment, and two distributors attributed the shift to higher efficiency furnaces to changes in code requirements.

For U-Factors of windows, one distributor attributed the decline to changes in the types of homes, suggesting that older, Mediterranean-style homes had thicker walls and smaller windows so the insulation values were not as dependent on the glazing, while newer, modern-style homes have much larger windows, making it harder to meet Title 24 requirements. The second respondent said the city requirements had gotten tougher. For SHGC, one respondent said the percentage of windows exceeding Title 24 requirements increased in 2008 due to the availability of new glass offered at cost-effective rates for consumers.

Insulation distributors attributed the increase in above-code insulation to customer demand, builder awareness and DOE recommendations, and the increase in proper installation of insulation to training, inspections, and an increased focus on insulation. When asked to rate a variety of factors influencing the increased use of above-code insulation and quality insulation installation, none of the distributors rated the IOU RNC programs as having a great deal of influence; two identified building codes as an important factor in the increase in QII.

Lighting distributors were most likely to attribute the shifts in exterior lighting fixtures sold to Title 24, followed by consumer awareness and preferences, new products and technology improvements; one distributor attributed the shift to IOU rebate programs and promotions. When asked to rate a variety of factors influencing the increased use of pin-based CFL fixtures, none of the distributors rated the IOU RNC programs as having a great deal of influence, although three identified the ENERGY STAR Homes program as a strong influence on the increased use of

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<sup>149</sup> One respondent claims that 100% of his ceiling insulation is better than minimum requirement although his product does not meet specs of Title 24. His responses are not included in the table.

interior CFL fixtures; building codes and increasing energy prices were most frequently identified as the most important factors.

**Table C.12-11: Efficiency levels of Selected Building Measures**

(HVAC Contractors, HVAC Distributors, Window Distributors, Lighting Distributors, Insulation Distributors)

Building Measure (Data Source)	Percentage of Homes Installed or Units Sold			
	2005	2006	2007	2008
14 SEER higher CAC (HVAC contractors)	16%	16%	21%	21%
14 SEER higher CAC (HVAC distributors)	NA	19%	15%	15%
90% AFUE furnace or higher (HVAC contractors)	19%	20%	22%	25%
90% AFUE furnace or higher (HVAC distributors)	7%	10%	14%	14%
80% AFUE furnace or below (HVAC contractors)	71%	71%	69%	65%
90% AFUE furnace or below (HVAC distributors)	93%	90%	86%	86%
Above-code duct insulation (HVAC contractors)	55%	55%	55%	52%
Duct tests (HVAC contractors)	NA	46%	50%	56%
Better than minimum U-Factor for Title 24 (window distributors)	69%	68%	66%	63%
Better than minimum SHGC for Title 24 (window distributors)	76%	75%	73%	74%
Better than minimum U-value for Title 24, ceiling insulation (insulation distributors)	2%	3%	4%	7%
Better than minimum U-value for Title 24, wall insulation (insulation distributors)	68%	68%	69%	70%
Insulation installed meeting QII standards (insulation distributors)	0%	0%	2%	5%
Pin-based CFL, interior (lighting distributors)	18%	22%	31%	36%
Screw-based fixture, interior (lighting distributors)	62%	58%	51%	43%
Pin-based CFL, exterior (lighting distributors)	21%	27%	36%	45%
Screw-based fixture, exterior (lighting distributors)	69%	62%	55%	46%
Interior lighting fixtures with occupancy sensors (lighting distributors)	4%	7%	13%	13%
Exterior lighting fixtures with photo controls and motion sensors (lighting distributors)	15%	18%	27%	35%

Table C.12-12 through Table C.12-32 provide additional data on the efficiency levels of select building measures and reasons why any shifts in the efficiency levels between 2006 and 2008 have occurred, as reported by HVAC contractors, HVAC distributors, window distributors, lighting distributors, and insulation distributors.

**Table C.12-12: SEER-Ratings of Central Air Conditioning Systems Installed in New Homes**  
(HVAC Contractors)

Year	SEER Level	1998 PG&E Study <sup>150</sup>	2000 Statewide RNC Study <sup>151</sup>	Percentage of CAC Systems Installed			
				Unaware Nonpart.	Aware Nonpart.	Partial Part.	Total
n				2	4	3	9
2005	13 SEER or higher	10%	14%	NA	NA	NA	NA
	13 SEER or less	NA	NA	85%	84%	82%	84%
	14 SEER	NA	NA	8%	13%	18%	14%
	15 SEER	NA	NA	3%	0%	0%	1%
	16 SEER	NA	NA	5%	2%	0%	2%
2006	13 SEER or less	NA	NA	85%	84%	82%	84%
	14 SEER	NA	NA	8%	13%	18%	14%
	15 SEER	NA	NA	3%	0%	0%	1%
	16 SEER	NA	NA	5%	2%	0%	2%
2007	13 SEER or less	NA	NA	85%	73%	78%	79%
	14 SEER	NA	NA	8%	24%	16%	16%
	15 SEER	NA	NA	3%	1%	5%	3%
	16 SEER	NA	NA	5%	4%	0%	2%
2008	13 SEER or less	NA	NA	85%	73%	78%	79%
	14 SEER	NA	NA	8%	24%	16%	16%
	15 SEER	NA	NA	3%	1%	5%	3%
	16 SEER	NA	NA	5%	4%	0%	2%

<sup>150</sup> 1998 PG&E Market Effects Study, p. 4-72

<sup>151</sup> 2000 Statewide Residential New Construction Study Exhibit A-7, p. A-37

**Table C.12-13: AFUE Ratings of Furnaces Installed in New Homes**  
(HVAC Contractors)

Year	AFUE Level	2000 Statewide RNC Study <sup>152</sup>	Percentage of Furnaces Installed			
			Unaware Nonpart.	Aware Nonpart.	Partial Part.	Total
n			2	4	3	9
	90% AFUE or higher	6%				
2005	80% AFUE or below		85%	45%	97%	71%
	81% to 89% AFUE		5%	19%	2%	10%
	90% to 94% AFUE		8%	36%	2%	18%
	95% AFUE or higher		3%	0%	0%	1%
2006	80% AFUE or below		85%	45%	95%	71%
	81% to 89% AFUE		5%	19%	2%	10%
	90% to 94% AFUE		8%	36%	3%	19%
	95% AFUE or higher		3%	0%	0%	1%
2007	80% AFUE or below		85%	45%	90%	69%
	81% to 89% AFUE		5%	19%	2%	10%
	90% to 94% AFUE		8%	36%	8%	21%
	95% AFUE or higher		3%	0%	0%	1%
2008	80% AFUE or below		85%	27%	90%	65%
	81% to 89% AFUE		5%	23%	2%	11%
	90% to 94% AFUE		8%	50%	8%	24%
	95% AFUE or higher		3%	0%	0%	1%

<sup>152</sup>Quantum Consulting Inc., 2000, Exhibit A-7, pg A-37

**Table C.12-14: Efficiency Levels of HVAC Equipment Sold in the Single Family New Construction Market**  
(HVAC Distributors)

Equipment	Efficiency	Mean percent of equipment sold, 2005	Mean percent of equipment sold, 2006	Mean percent of equipment sold, 2007	Mean percent of equipment sold, 2008
n		na	6	6	6
Central air conditioning	13 SEER	na	81%	85%	85%
	14 SEER	na	12%	10%	10%
	15 SEER	na	2%	2%	2%
	16 SEER or higher	na	5%	3%	3%
n		6	6	6	6
Gas furnaces	AFUE 80% or below	93%	90%	86%	86%
	AFUE 81% to 89%	0%	0%	0%	0%
	AFUE 90% to 94%	6%	9%	12%	12%
	AFUE 95% or higher	1%	1	2%	2%

**Table C.12-15: Percentage of Homes HVAC Contractors Installed Above-Code Duct Insulation**  
(HVAC Contractors)

Year	Percentage of Homes Installed Above-Code Duct Insulation			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	2	4	3	9
2005	60%	69%	33%	55%
2006	60%	69%	33%	55%
2007	60%	69%	33%	55%
2008	60%	63%	33%	52%

**Table C.12-16: Percentage of Homes HVAC Contractors Conducted Duct Tests**  
(HVAC Contractors)

Year	Average Percentage of Homes Conducted Duct Tests			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	2	4	3	9
Conduct duct tests	2	2	3	7
2006	55%	45%	40%	46%
2007	55%	60%	40%	50%
2008	55%	80%	40%	56%

**Table C.12-17: U-Factors of Windows Sold in the Single Family New Construction Market**  
(Window Distributors)

<b>U-Factor</b>	<b>Mean percent of windows sold, 2005</b>	<b>Mean percent of windows sold, 2006</b>	<b>Mean percent of windows sold, 2007</b>	<b>Mean percent of windows sold, 2008</b>
n	14	14	14	14
0.35 or less	60%	61%	61%	62%
0.36 to 0.40	23%	23%	22%	22%
0.41 to 0.60	15%	15%	15%	15%
0.61 or higher	2%	1%	2%	1%

**Table C.12-18: SHGC Ratings of Windows Sold in the Single Family New Construction Market**

(Window Distributors)

<b>SHGC Rating</b>	<b>Mean percent of windows sold, 2005</b>	<b>Mean percent of windows sold, 2006</b>	<b>Mean percent of windows sold, 2007</b>	<b>Mean percent of windows sold, 2008</b>
n	13	13	13	13
0.40 or less	83%	83%	83%	83%
0.41 to 0.64	8%	8%	8%	7%
0.65 or higher	9%	9%	9%	10%

**Table C.12-19: Windows Exceeding Title 24 Requirements for U-Factor and SHGC Ratings in the Single Family New Construction Market**

(Window Distributors)

<b>Better than minimum U-Factor for Title 24</b>	<b>Mean percent of windows sold, 2005</b>	<b>Mean percent of windows sold, 2006</b>	<b>Mean percent of windows sold, 2007</b>	<b>Mean percent of windows sold, 2008</b>
n	12	12	12	12
Better than minimum U-Factor for Title 24	69%	68%	66%	63%
Better than minimum SHGC for Title 24	76%	75%	73%	74%



**Table C.12-20: R-Values of Insulation Sold in the Single Family New Construction Market**  
(Insulation Distributors)

Insulation	R-Factor	Mean percent of insulation sold, 2005	Mean percent of insulation sold, 2006	Mean percent of insulation sold, 2007	Mean percent of insulation sold, 2008
n		2	2	2	2
Ceiling insulation	Below R-30	0%	0%	0%	1%
	R-30 to R-37	93%	93%	90%	87%
	R-38 or Higher	7%	7%	10%	12%
n		3	3	3	3
Wall Insulation	Below R-13	0%	0%	0%	0%
	R-13 to R-20	64%	63%	60%	60%
	R-21 or Higher	36%	37%	40%	40%

**Table C.12-21: Insulation Exceeding Minimum U-value of Title 24 in the Single Family New Construction Market**<sup>153</sup>  
(Insulation Distributors)

Better than minimum U-value for Title 24	Mean percent of insulation sold, 2005	Mean percent of insulation sold, 2006	Mean percent of insulation sold, 2007	Mean percent of insulation sold, 2008
n	2	2	2	2
Ceiling Insulation	2%	3%	4%	7%
n	4	4	4	4
Wall Insulation	68%	68%	69%	70%

<sup>153</sup> In the 2000 statewide study, only one Title 24 consultant reported reviewing home designs that purposely exceeded Title 24. (Quantum Consulting Inc., 2000, pg A-27)

**Table C.12-22: Factors Influencing Shifts in the Percent of Insulation Used Better than Minimum U-Value of Title 24**  
(Insulation Distributors)

<b>Insulation</b>	<b>Factors</b>	<b>2005 to 2006</b>	<b>2006 to 2008</b>
n		1	2
Ceiling Insulation	Respondents' sales representatives promoting it	1	
	Customer requests	1	1
	More energy awareness by builders or consumers		1
	Increased r-value recommendations by DOE		1
n		1	1
Wall Insulation	Respondents' sales representatives promoting it	1	
	Customer requests	1	1
	Increased r-value recommendations by DOE		1

**Table C.12-23: Insulation Properly Installed in the Single Family New Construction Market**  
(Insulation Distributors)

	<b>Mean percent of insulation sold, 2005</b>	<b>Mean percent of insulation sold, 2006</b>	<b>Mean percent of insulation sold, 2007</b>	<b>Mean percent of insulation sold, 2008</b>
n	3	3	3	3
Ceiling insulation properly installed	90%	94%	97%	89%
n	4	4	4	4
Wall insulation properly installed	90%	93%	97%	98%
n	2	2	2	2
Insulation installed meeting QII standards	0%	0%	2%	5%

**Table C.12-24: Factors Influencing Shifts in the Percent of Insulation Properly Installed**  
(Insulation Distributors)

Insulation	Factors	2005 to 2006	2006 to 2008
n		2	2
Ceiling Insulation	More training	1	1
	More inspections	1	1
	More focus on insulation	1	1
	Different inspectors requesting proper installation		1
n		2	2
Wall Insulation	More training	1	1
	More inspections	1	1
	More focus on insulation	1	1
	Changes in the building code	1	
	Stringent inspections		1

**Table C.12-25: Factors Influencing Increase in Market Share of Insulation Exceeding Title 24 and Increase in Market Share of Insulation Meeting QII Standards, 2006 to 2008**  
(Insulation Distributors; 0-10 scale; 0= "No influence at all" and 10= "A great deal of influence")

Factor	7 to 10 rating		
	Ceiling insulation better than minimum U-value	Wall insulation better than minimum U-value	Certified QII standards
n	5	5	5
IOU Residential New Construction programs	0	0	0
Municipal utility-sponsored programs	0	0	0
LEED for Homes	1	1	0
ENERGY STAR Homes	1	0	0
Solar Initiative	0	0	0
Environments for Living	0	0	0
ComfortWise	0	0	0
Federal Tax Credits for efficient new homes	0	0	0
Building America	0	0	0
Smart Home	0	0	0
Changes in building codes	0	1	2
Increasing energy prices	0	0	0
Decline in the housing market	0	0	0

**Table C.12-26: Types of Interior Lighting Sold in the Single Family New Construction Market**

(Lighting Fixture and Control Distributors)

Type of Interior Lighting	Mean percent of interior lighting sold, 2005	Mean percent of interior lighting sold, 2006	Mean percent of interior lighting sold, 2007	Mean percent of interior lighting sold, 2008
n	16	16	16	17
Pin-based CFL	18%	22%	31%	36%
Fluorescent tube	14%	14%	12%	15%
Screw-based fixture	62%	58%	51%	43%
Halogen	6%	6%	6%	4%
LED	0%	0%	0%	1%
HID	0%	0%	0%	1%

**Table C.12-27: Factors Influencing Shifts in the Types of Interior Lighting Sold**

(Lighting Fixture and Control Distributors)

Factors	2005 to 2006	2006 to 2008
n (multiple response)	8	13
Consumer awareness and preferences	3	6
Title 24	4	5
Technology improvement	1	4
Rebate programs and utility promotion	1	2
Greater availability	1	2
Introduction of new products	2	0
More advertising	1	1
More affordable	0	1

**Table C.12-28: Types of Exterior Lighting Sold in the Single Family New Construction Market**

(Lighting Fixture and Control Distributors)

Type of Exterior Lighting	Mean percent of exterior lighting sold, 2005	Mean percent of exterior lighting sold, 2006	Mean percent of exterior lighting sold, 2007	Mean percent of exterior lighting sold, 2008
n	16	15	15	16
Pin-based CFL	21%	27%	36%	45%
Fluorescent tube	9%	9%	7%	6%
Screw-based fixture	69%	62%	55%	46%
Halogen	1%	1%	1%	1%
LED	0%	1%	1%	2%

**Table C.12-29: Factors Influencing Shifts in the Types of Exterior Lighting Sold**

(Lighting Fixture and Control Distributors)

Factors	2005 to 2006	2006 to 2008
n (multiple response)	8	11
Title 24	5	7
Consumer awareness and preferences	4	2
Introduction of new products	2	2
Technology improvement	0	2
Greater availability	1	0

**Table C.12-30: Factors Influencing Increase in Market Share of Pin Based CFL Fixtures, 2006 to 2008**

(Lighting Fixture and Control Distributors; 0-10 scale; 0= "No influence at all" and 10= "A great deal of influence")

Factor	7 to 10 Rating	
	Interior Fixtures	Exterior Fixtures
n	18	18
IOU Residential New Construction programs	0	0
Municipal utility-sponsored programs	1	1
LEED for Homes	1	0
ENERGY STAR Homes	3	1
Solar Initiative	0	0
Environments for Living	0	0
ComfortWise	0	0
Federal Tax Credits for efficient new homes	0	0
Building America	0	0
Smart Home	1	0
Changes in building codes	8	4
Increasing energy prices	6	2
Decline in the housing market	3	1

**Table C.12-31: Lighting Fixtures with Sensor Controls Sold in the Single Family New Construction Market**

(Lighting Fixture and Control Distributors)

Type of Lighting Fixture	Mean percent of lighting fixtures sold, 2005	Mean percent of lighting fixtures sold, 2006	Mean percent of lighting fixtures sold, 2007	Mean percent of lighting fixtures sold, 2008
n	16	16	16	17
Interior lighting fixtures with occupancy sensors	4%	7%	13%	13%
Exterior lighting fixtures with photocontrols and motion sensors	15%	18%	27%	35%

**Table C.12-32: Factors Influencing Increase in Percentage of Lighting Fixtures with Sensor Controls Sold**

(Lighting Fixture and Control Distributors)

<b>Factors</b>	<b>2005 to 2006</b>	<b>2006 to 2008</b>
n (multiple response)	4	8
<b>Interior lighting fixtures with occupancy sensors</b>		
Title 24	3	6
Consumer awareness and preferences	1	2
Interest in saving energy or money	2	1
Technology improvement	1	1
Rebate programs and utility promotion	0	1
Greater availability	0	1
More affordable	0	1
<b>Exterior lighting fixtures with photocontrols and motion sensors</b>		
Title 24	3	7
Consumer awareness and preferences	1	3
Technology improvement	2	1
Manufacturer suggestions	1	0
Greater availability	0	1
Interest in saving energy or money	0	1

Seven of 45 Title 24 consultants, responsible for 23% of non-program homes, said that the number of non-program homes they consulted on that exceeded Title 24 had increased between 2006 and 2008. The question was asked only of Title 24 consultants who knew whether the builders they worked with had followed their advice, amounting to 41% of non-program homes in total, so the 23% is more than half of that. Twelve of 29 HERS raters, responsible for 7% of non-program homes, reported that the number of non-program homes they rated that exceeded Title 24 had increased between 2006 and 2008. This question was limited to HERS raters who knew about the energy efficiency technologies and practices used by the builders they worked with. However, three of 29 HERS raters, responsible for 18% of non-program homes, said the number of homes exceeding code had gone down (Table C.12-33).

Title 24 consultants said that the increase in the number of non-program homes exceeding Title 24 was due to more interest in energy savings or efficiency as well as code compliance. HERS raters said that the increase in the number of non-program homes exceeding Title 24 was due to increased awareness of energy efficiency and environmental concerns, followed by rebates, tax credits and the IOU programs. In addition, one HERS rater said it was because of more widespread adoption and use of above-code practices and materials.

**Table C.12-33: Change in Number of Non-Program Homes Consulted on or Rated from 2006 to 2008 Exceeding Title 24**  
(Title 24 Consultants and HERS Raters)

	Number of Title 24 Consultants / HERS Raters (% of All Non-Program Homes)	
	Title 24 Consultants	HERS Raters
n	45	29
Increased a lot	2 (1%)	4 (4%)
Increased somewhat	5 (22%)	8 (3%)
Stayed about the same	9 (18%)	3 (59%)
Decreased somewhat	0 (0%)	0 (0%)
Decreased a lot	1 (0%)	3 (18%)
Don't know / refused	0 (0%)	11 (16%)



Table C.12-34 through Table C.12-39 provide additional data about above-code practices and non-program homes that exceed Title 24, as reported by Title 24 consultants and HERS raters.

**Table C.12-34: Change in Number of Non-Program Homes Consulted on from 2006 to 2008 Exceeding Title 24**<sup>154</sup>  
(Title 24 Consultants)

	Number of Title 24 Consultants (% of All Non-Program Homes)			Total
	Non-participants	Minority Participants	Majority Participants	
n	22	20	3	45
Increased a lot	0 (0%)	2 (1%)	0 (0%)	2 (1%)
Increased somewhat	2 (0%)	3 (22%)	0 (0%)	5 (22%)
Stayed about the same	4 (1%)	5 (17%)	0 (0%)	9 (18%)
Decreased a lot	1 (0%)	0 (0%)	0 (0%)	1 (0%)

**Table C.12- 35: Reasons for Increase in Number of Non-Program Homes Consulted on from 2006 to 2008 Exceeding Title 24**  
(Title 24 Consultants)

Reason	Number of Title 24 Consultants			Total
	Non-participants	Minority Participants	Majority Participants	
n	22	20	3	45
More interest in energy savings and environmental issues	1	2	0	3
Better salesmanship by consultant	1	0	0	1
Market conditions dictate more efficient homes	0	1	0	1
All homes must meet or exceed code, and since meeting it exactly is nearly impossible, almost all exceed	0	1	0	1
Code compliance has improved	0	1	0	1

<sup>154</sup> Title 24 consultants who do not know whether a builder follows their advice on how to comply to Title 24 were not asked this question.

**Table C.12-36: Change in Number of Non-Program Homes Consulted on from 2006 to 2008 Exceeding Title 24**  
(HERS Raters)

	Number of HERS Raters (% of All Non-Program Homes)			Total
	Non-participants	Minority Participants	Majority Participants	
n	13	10	6	29
Increased a lot	1 (3%)	2 (1%)	1 (<1%)	4 (4%)
Increased somewhat	4 (1%)	3 (2%)	1 (<1%)	8 (3%)
Stayed about the same	0 (0%)	2 (59%)	1 (<1%)	3 (59%)
Decreased somewhat	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Decreased a lot	1 (<1%)	1 (5%)	1 (13%)	3 (18%)
Don't know / refused	7 (7%)	2 (9%)	2 (<0%)	11 (16%)

**Table C.12-37: Reasons for Changes in Number of Non-Program Homes Consulted on from 2006 to 2008 Exceeding Title 24**  
(HERS Raters)

Reason	HERS Raters			Total
	Non-participants	Minority Participants	Majority Participants	
n (multiple response)	13	10	6	29
<b>Number of homes company rated that exceed Title 24 has ‘Increased a lot’ or ‘Increased Somewhat’</b>				
Increased awareness of efficiency/environmental concerns	2	2	1	5
Rebates/tax credits	1	1	0	2
More widespread adoption of above-code practices/materials	0	2	0	2
Influence of programs	0	0	1	1
Consumer demand for efficient homes	0	1	0	1
Home may be above code because meeting code exactly is almost impossible	1	0	0	1
All homes rater is involved with exceed code	0	0	1	1
Increased awareness of HERS testing	0	1	0	1
Decline in economy/number of new homes being built	1	0	0	1
<b>Number of homes company rated that exceed Title 24 has ‘Stayed the same’</b>				
Home may be above code because meeting code exactly is almost impossible	0	1	1	2
Don’t know	0	1	0	1
<b>Number of homes company rated that exceed Title 24 has ‘Decreased a lot’ or ‘Decreased Somewhat’</b>				
Decline in economy/number of new homes being built	1	1	0	2
Rebates/tax credits	0	0	1	1
Builders looking to cut costs since decline in housing market	0	0	1	1

**Table C.12-38: Recommending Above-Code Practices and Non-Program Homes that Exceeded Title 24** <sup>155, 156</sup>  
(Title 24 Consultants)

	Number of Title 24 Consultants (% of All Non-Program Homes)			
	Non-participants	Minority participants	Majority Participants	Total
n	22	20	3	45
Recommend above-code practices and technologies	19	16	3	38
Mean percentage of non-program homes consulted that exceeded Title 24	31%	44%	0%	35%
Percentage of all non-program homes consulted that exceeded Title 24	2%	22%	0%	24%

**Table C.12-39: Percentage of Non-Program Homes Consulted that Exceeded Title 24**  
(HERS Raters)

	Number of Title 24 Consultants (% of All Non-Program Homes)			
	Non-participants	Minority Participants	Majority Participants	Total
n	13	10	6	29
Rated homes with any above-code practices and technologies	6	8	3	17
Mean percentage of non-program homes rated that exceeded Title 24	43%	65%	63%	55%
Percentage of all non-program homes rated that exceeded Title 24	4%	63%	10%	77%

Seventeen of 45 Title 24 consultants, ten of 29 HERS raters, eight of 32 builders and two of nine HVAC contractors said the IOU programs in general had a great deal of influence on their recommendations for or use of at least one of those practices, most commonly for high-SEER air conditioners or heat pumps, QII, duct sealing, and duct testing and sealing, and water heating equipment (Table C.12-40). The program appears to have had little impact on the practices of HVAC contractors. For builders, partial participants were more likely to report that the program had a great deal of influence on their use of above-code practices and technologies on non-program homes.

<sup>155</sup> Title 24 consultants in the 2000 statewide study report that they ‘sometimes’ or ‘often’ promote tract designs that exceed code. (Quantum Consulting Inc., 2000, pg A-29).

<sup>156</sup> In the 2000 statewide study, only one Title 24 consultant reported reviewing home designs that purposely exceeded Title 24. (Quantum Consulting Inc., 2000, pg A-27)

HERS raters said that the program influenced builders to use above-code measures in non-program homes through training and education, as well as public awareness and advertising. Four HVAC contractors said they had worked with builders who had built program homes, but only one HVAC contractor reported that the builder had changed their building practices in non-program homes as a result. When asked how the builder's building practices had changed, the HVAC contractor reported that the builder had begun to specify R8 duct insulation. The program influenced partial participant builders to use above-code measures for non-program homes because the measure or practice saves energy or lowers energy costs, through program rebates, through consumer education and the cost of the feature. Non-participants aware of the IOU programs say that the programs had influenced them by marketing the long-term savings to home buyers and through consumer education. Two builders also noted that the IOU programs provide energy savings data that are easy to use, while another builder pointed to his experience using the measure in a program home that convinced him to use the measure in non-program homes.

**Table C.12-40: Influence of the IOU RNC Program on the Adoption of or Recommendation of Above-Code Practices and Technologies, 2006 to 2008**

(Title 24 Consultants, HERS Raters, Builders, HVAC Contractors; 0-10 Scale; 0= "No influence at all" and 10= "A great deal of influence")

<b>7 to 10 Rating (% of All non-program homes with above-code feature or built to standard)</b>				
	Title 24 Consultants (Recommendation)	HERS Raters	Builders	HVAC Contractors
n	45	29	32	9
Insulation R-values	5 (7%)	3 (12%)	1 (<1%)	NA
Quality of insulation installation	5 (8%)	5 (12%)	4 (5%)	NA
Windows	7 (4%)	5 (13%)	2 (4%)	NA
High-SEER air conditioner or heat pump	7 (9%)	4 (15%)	4 (7%)	0 (0%)
High-EER air conditioner or heat pump	7 (8%)	4 (15%)	NA	0 (0%)
High-AFUE furnace	4 (4%)	4 (12%)	4 (7%)	1 (<1%)
HVAC installation	3 (6%)	2 (2%)	4 (9%)	1 (<1%)
Water-heating equipment	6 (11%)	5 (13%)	2 (2%)	NA
Lighting	5 (2%)	1 (2%)	2 (4%)	NA
Framing materials and techniques	1 (<1%)	0 (0%)	0 (0%)	NA
Orientation and shading	2 (1%)	0 (0%)	2 (3%)	NA
Photovoltaics	6 (5%)	4 (2%)	1 (4%)	NA
Duct sealing	7 (18%)	7 (15%)	3 (8%)	0 (0%)
Duct testing	6 (19%)	8 (15%)	3 (4%)	0 (0%)
Air sealing	3 (5%)	0 (0%)	0 (0%)	NA
Any practice	17 (NA)	10 (NA)	8 (NA)	2 (NA)

Table C.12-41 through Table C.12-45 provide additional data about the influence of IOU programs on the adoption of above-code practices in non-program homes.

**Table C.12-41: Influence of IOU Programs on Adoption of Above-Code Practices and Technologies in Non-Program Homes**

(Builders, 0-10 Scale; 0= “No influence at all” and 10= “A great deal of influence”)

<b>7 to 10 Rating (% of All Non-program Homes)</b>				
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	13	9	10	32
Insulation R-values	NA	0 (0%)	1 (<1%)	1 (<1%)
Quality of insulation installation	NA	2 (5%)	2 (<1%)	4 (5%)
Windows	NA	1 (4%)	1 (<1%)	2 (4%)
High-SEER air conditioner or heat pump	NA	1 (4%)	3 (3%)	4 (7%)
High-AFUE furnace	NA	0 (0%)	4 (7%)	4 (7%)
HVAC installation	NA	1 (4%)	3 (5%)	4 (9%)
Water-heating equipment	NA	0 (0%)	2 (2%)	2 (2%)
Lighting	NA	1 (4%)	1 (<1%)	2 (4%)
Framing materials and techniques	NA	0 (0%)	0 (0%)	0 (0%)
Orientation and shading	NA	2 (3%)	0 (0%)	2 (3%)
Photovoltaics	NA	1 (4%)	0 (0%)	1 (4%)
Duct sealing	NA	1 (4%)	2 (4%)	3 (8%)
Duct testing	NA	1 (<1%)	2 (4%)	3 (4%)
Air sealing	NA	0 (0%)	0 (0%)	0 (0%)
Any influence	0	4 (NA)	4 (NA)	8 (NA)

**Table C.12-42: Influence of IOU Programs on Adoption of Above-Code Practices and Technologies in Non-Program Homes**

(HVAC Contractors, 0-10 Scale; 0= “No influence at all” and 10= “A great deal of influence”)

<b>7 to 10 Rating (% of All Non-program Homes)</b>				
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	2	4	3	9
High-SEER air conditioner or heat pump	0 (0%)	0 (0%)	0 (0%)	0 (0%)
High-EER air conditioner or heat pump	0 (0%)	0 (0%)	0 (0%)	0 (0%)
High-AFUE furnace	0 (0%)	1 (<1%)	0 (0%)	1 (<1%)
HVAC installation	0 (0%)	0 (0%)	1 (<1%)	1 (<1%)
Duct sealing	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Duct testing	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Duct insulation	0 (0%)	0 (0%)	0 (0%)	0 (0%)

**Table C.12-43: Influence of IOU Programs on Use of Above-Code Practices and Technologies in Non-Program Homes**

(HERS Raters, 0-10 Scale; 0= “No influence at all” and 10= “A great deal of influence”)

	<b>7 to 10 Rating (% of All Non-program Homes)</b>			
	<b>Non-participants</b>	<b>Minority participants</b>	<b>Majority Participants</b>	<b>Total</b>
n	13	10	6	29
Insulation R-values	0 (0%)	1 (1%)	2 (11%)	3 (12%)
Quality of insulation installation	1 (1%)	1 (<1%)	3 (11%)	5 (12%)
Windows	0 (0%)	2 (2%)	3 (11%)	5 (13%)
High-SEER air conditioner or heat pump	2 (3%)	1 (1%)	1 (11%)	4 (15%)
High-EER air conditioner or heat pump	1 (<1%)	2 (4%)	1 (11%)	4 (15%)
High-AFUE furnace	1 (<1%)	1 (1%)	2 (11%)	4 (12%)
HVAC installation	0 (0%)	2 (2%)	0 (0%)	2 (2%)
Water-heating equipment	2 (1%)	1 (1%)	2 (11%)	5 (13%)
Lighting	0 (0%)	1 (2%)	0 (0%)	1 (2%)
Framing materials and techniques	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Orientation and shading	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Photovoltaics	0 (0%)	1 (<1%)	3 (2%)	4 (2%)
Duct sealing	2 (1%)	3 (2%)	2 (12%)	7 (15%)
Duct testing	2 (1%)	3 (2%)	3 (12%)	8 (15%)
Air sealing	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Any influence	3 (NA)	4 (NA)	3 (NA)	10 (NA)

**Table C.12-44: Ways Program Influenced Use of Above-Code Measures in Non-Program Homes**  
(Builders)

	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n (multiple response)	13	9	10	32
Saves energy; lower energy costs	NA	0	7	7
Able to market long-term savings to buyers	NA	4	1	5
Rebates; program paid for feature	NA	0	5	5
Consumer education as to energy-saving benefits; advertising	NA	2	3	5
Cost of feature	NA	0	3	3
Quality of feature	NA	1	1	2
Program provides energy savings data that is easily accessible and easy to use	NA	1	1	2
Know the feature is energy-efficient; have used the feature in program homes	NA	0	1	1
Going green	NA	0	1	1
Project exceeded Title 24	NA	0	1	1
Continuity between program and non-program home building	NA	0	1	1
Contractor education as to energy-saving benefits	NA	0	1	1

**Table C.12-45: Ways Program Influenced the Use of Above-Code Measures in Non-Program Homes**  
(HERS Raters)

Reason	HERS Raters			Total
	Non-participants	Minority Participants	Majority Participants	
n (multiple response)	13	10	6	29
Training/education	2	2	1	5
Increased public awareness/advertising	0	2	1	3
Title 24/code requirements	1	1	1	3
Compliance testing	0	0	2	2
Feature becoming standard practice	1	0	1	2
Rebates/Incentives	0	0	1	1
Builder participation in programs	0	0	1	1
Energy efficiency	0	1	0	1
Increased availability of product/feature	0	0	1	1



Four builders reported that their discussions with other builders had a great deal of influence on their use of above-code building practices and technologies (Table C.12-46). For partial participant builders with multiple offices, other offices are most likely to have a great deal of influence on the use of high-SEER air conditioners or heat pumps, HVAC installation techniques, high AFUE furnaces, duct sealing and testing. Four non-participating builders aware of the IOU programs had discussed energy-efficient building practices and technologies with participating builders, although only one reported that these discussions had a great deal of influence on their use of above-code building practices and technologies.

**Table C.12-46: Influence of Other Offices in the Company or Participating Builders on Adoption of Above-Code Practices and Technologies in Non-Program Homes**

(Builders, 0-10 Scale; 0= “No influence at all” and 10= “A great deal of influence”)

	7 to 10 Rating (% of All Non-program Homes)			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	13	9	10	32
Have other offices in company	NA	4 (6%)	6 (82%)	6 (82%)
Discussed IOU RNC programs with participating builders	NA	4 (6%)	NA	4 (6%)
Insulation R-values	NA	0 (0%)	0 (0%)	0 (0%)
Quality of insulation installation	NA	1 (4%)	1 (6%)	2 (11%)
Windows	NA	1 (4%)	1 (2%)	2 (6%)
High-SEER air conditioner or heat pump	NA	1 (4%)	3 (9%)	4 (14%)
High-AFUE furnace	NA	0 (0%)	3 (8%)	3 (8%)
HVAC installation	NA	1 (4%)	3 (5%)	4 (10%)
Water-heating equipment	NA	0 (0%)	0 (0%)	0 (0%)
Lighting	NA	1 (4%)	1 (6%)	2 (11%)
Framing materials and techniques	NA	0 (0%)	0 (0%)	0 (0%)
Orientation and shading	NA	1 (3%)	0 (0%)	1 (3%)
Photovoltaics	NA	1 (4%)	0 (0%)	1 (4%)
Duct sealing	NA	1 (4%)	2 (6%)	3 (11%)
Duct testing	NA	0 (0%)	2 (6%)	2 (6%)
Air sealing	NA	0 (0%)	0 (0%)	0 (0%)
Any influence	NA	1 (NA)	3 (NA)	4 (NA)

Twelve Title 24 consultants, five HERS raters, and all 14 builders using above-code practices said that builders would be extremely likely to continue using at least one above-code practice or technology in the absence of the IOU programs (Table C.12-47). Title 24 consultants were most likely to say that builders would continue using above-code practices and technologies in the areas of windows, high-SEER air conditioners or heat pumps, water heating equipment and lighting while HERS raters were most likely to say that builders would continue using above-code practices and technologies in the areas of duct testing, windows, insulation R-values and installation practices, high-EER air conditioners or heat pumps, and high-AFUE furnaces. Builders said they were most likely to continue using above-code practices and technologies without the IOU programs in the areas of high-SEER air conditioners and heat pumps, windows, quality of insulation installation, high-AFUE furnaces, HVAC installation and duct insulation.

Partial participant builders who reported that they planned to continue using above-code practices and technologies said they would do so because it would save the customer energy and because of the quality of the feature, while non-participants aware of the program would do so in order to be able to market the homes as energy efficient, followed by increasing the efficiency of the home. In addition, four builders would continue to use the practice because home buyers demand energy efficiency. HERS raters most commonly identified changes to code requirements, consumer demand, energy prices and increased efficiency, and environmental concerns as the outside conditions that influence their recommendation of above-code measures.

**Table C.12-47: Intention to Continue Using or Recommending Above-Code Practices and Technologies in Absence of Programs**

(Title 24 Consultants, HERS Raters, Builders, HVAC Contractors)

	Number of Respondents (% of All non-program homes)			
	Title 24 Consultants	HERS Raters	Builders	HVAC Contractors
n	45	29	32	9
Insulation R-values	4 (20%)	2 (15%)	7 (2%)	NA
Quality of insulation installation	4 (20%)	2 (13%)	9 (68%)	NA
Windows	5 (20%)	3 (15%)	10 (18%)	NA
High-SEER air conditioner or heat pump	5 (22%)	1 (2%)	12 (82%)	NA
High-EER air conditioner or heat pump	3 (20%)	2 (15%)	NA	NA
High-AFUE furnace	4 (20%)	2 (15%)	8 (75%)	NA
HVAC installation	2 (20%)	1 (2%)	9 (80%)	NA
Water-heating equipment	5 (20%)	3 (2%)	8 (9%)	NA
Lighting	5 (4%)	1 (2%)	5 (17%)	NA
Framing materials and techniques	0 (0%)	0 (0%)	6 (2%)	NA
Orientation and shading	1 (0%)	0 (0%)	4 (5%)	NA
Photovoltaics	4 (20%)	1 (2%)	4 (6%)	NA
Duct sealing	4 (20%)	3 (3%)	8 (20%)	NA
Duct testing	4 (20%)	4 (16%)	5 (15%)	NA
Air sealing	3 (20%)	0 (0%)	3 (1%)	NA
Any practice	12 (24%)	5 (16%)	14 (85%)	NA

Table C.12-48 through Table C.12-51 provide additional data about intentions of continuing to use or recommend above-code practices or technologies in the absence of the IOU programs.

**Table C.12-48: Intention to Continue Above-Code Practices and Technologies in Absence of Programs**  
(Builders)

	Number of Builders (% of All Non-program Homes)			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	13	9	10	32
Insulation R-values	NA	4 (1%)	3 (1%)	7 (2%)
Quality of insulation installation	NA	5 (7%)	4 (62%)	9 (68%)
Windows	NA	6 (8%)	4 (10%)	10 (18%)
High-SEER air conditioner or heat pump	NA	7 (7%)	5 (75%)	12 (82%)
High-AFUE furnace	NA	3 (1%)	5 (75%)	8 (75%)
HVAC installation	NA	3 (5%)	6 (75%)	9 (80%)
Water-heating equipment	NA	4 (4%)	4 (5%)	8 (9%)
Lighting	NA	2 (7%)	3 (9%)	5 (17%)
Framing materials and techniques	NA	3 (1%)	3 (1%)	6 (2%)
Orientation and shading	NA	2 (4%)	2 (1%)	4 (5%)
Photovoltaics	NA	2 (5%)	2 (1%)	4 (6%)
Duct sealing	NA	4 (5%)	4 (14%)	8 (20%)
Duct testing	NA	1 (1%)	4 (14%)	5 (15%)
Air sealing	NA	2 (1%)	1 (<1%)	3 (1%)
Continue using any practice or technology	NA	8 (10%)	6 (75%)	14 (85%)

**Table C.12-49: Why Builders Intend to Continue to Use of Above-Code Measures in Non-Program Homes without the Program**

(Builders)

	<b>Unaware Nonparticipants</b>	<b>Aware Nonparticipants</b>	<b>Partial Participants</b>	<b>Total</b>
n (multiple response)	13	9	10	45
Ability to market homes energy efficiency	NA	23	4	27
Saves customers energy; lower energy costs	NA	0	23	23
Quality of feature; adds to quality of the home	NA	3	18	21
Increases home overall energy efficiency	NA	7	4	11
Does not add cost	NA	4	2	6
Required feature, by climate zone or local government	NA	4	1	5
Buyers' expectations; demand	NA	2	2	4
Decrease in cost for feature; cost effective feature	NA	2	1	3
Increased availability of feature	NA	0	2	2
Less material waste	NA	0	2	2
More efficiency in production	NA	0	2	2
Would not use above code; code is already high enough	NA	0	2	2
Forces contractors to do job correctly	NA	0	1	1
Company standard	NA	0	1	1

**Table C.12-50: Likelihood of Continuing to Recommend Above-Code Practices and Technologies in Absence of Programs**

(Title 24 Consultants, 0-10 Scale; 0= “Extremely unlikely” and 10= “Extremely likely”)

	<b>7 to 10 Rating (% of All Non-program Homes)</b>			
	<b>Non-participants</b>	<b>Minority participants</b>	<b>Majority Participants</b>	<b>Total</b>
n	22	20	3	45
Insulation R-values	1 (0%)	3 (20%)	0 (0%)	4 (20%)
Quality of insulation installation	1 (0%)	3 (20%)	0 (0%)	4 (20%)
Windows	1 (0%)	4 (20%)	0 (0%)	5 (20%)
High-SEER air conditioner or heat pump	1 (0%)	4 (22%)	0 (0%)	5 (22%)
High-EER air conditioner or heat pump	0 (0%)	3 (20%)	0 (0%)	3 (20%)
High-AFUE furnace	1 (0%)	3 (20%)	0 (0%)	4 (20%)
HVAC installation	0 (0%)	2 (20%)	0 (0%)	2 (20%)
Water-heating equipment	0 (0%)	4 (20%)	1 (0%)	5 (20%)
Lighting	1 (0%)	3 (4%)	1 (0%)	5 (4%)
Framing materials and techniques	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Orientation and shading	0 (0%)	1 (0%)	0 (0%)	1 (0%)
Photovoltaics	1 (0%)	3 (20%)	0 (0%)	4 (20%)
Duct sealing	0 (0%)	4 (20%)	0 (0%)	4 (20%)
Duct testing	0 (0%)	4 (20%)	0 (0%)	4 (20%)
Air sealing	0 (0%)	3 (20%)	0 (0%)	3 (20%)
Any measure	3 (0%)	8 (24%)	1 (0%)	12 (24%)

**Table C.12-51: Likelihood that Builder Would Continue Using Above-Code Practices and Technologies in Absence of Programs**

(HERS Raters, 0-10 Scale; 0= “Extremely unlikely” and 10= “Extremely likely”)

	<b>7 to 10 Rating (% of All Non-program Homes)</b>			
	<b>Non-participants</b>	<b>Minority participants</b>	<b>Majority Participants</b>	<b>Total</b>
n	13	10	6	29
Insulation R-values	0 (0%)	1 (2%)	1 (13%)	2 (15%)
Quality of insulation installation	0 (0%)	1 (<0%)	1 (13%)	2 (13%)
Windows	0 (0%)	1 (2%)	2 (13%)	3 (15%)
High-SEER air conditioner or heat pump	0 (0%)	1 (2%)	0 (0%)	1 (2%)
High-EER air conditioner or heat pump	0 (0%)	1 (2%)	1 (13%)	2 (15%)
High-AFUE furnace	0 (0%)	1 (2%)	1 (13%)	2 (15%)
HVAC installation	0 (0%)	1 (2%)	0 (0%)	1 (2%)
Water-heating equipment	1 (1%)	1 (2%)	1 (0%)	3 (2%)
Lighting	0 (0%)	1 (2%)	0 (0%)	1 (2%)
Framing materials and techniques	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Orientation and shading	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Photovoltaics	0 (0%)	1 (2%)	0 (0%)	1 (2%)
Duct sealing	1 (1%)	2 (2%)	0 (0%)	3 (3%)
Duct testing	1 (1%)	2 (2%)	1 (13%)	4 (16%)
Air sealing	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Any measure	1 (1%)	2 (2%)	2 (13%)	5 (16%)

Only one Title 24 consultant and one HERS rater rated the program as having a great deal of influence on non-program homes built to IOU program standards—that is, at least 15% more efficient than Title 24 requires; the program influenced 1% or less of the non-program homes the Title 24 consultants and HERS raters worked on (Table C.12-52). The Title 24 consultant reported that the program had influenced the builder to upgrade insulation levels, use quality insulation installation techniques, and upgrade the furnace, appliances and the EER of the air conditioner. None of the builders and HVAC contractors said that the IOU programs had a great deal of influence on their decisions to build non-program homes to program standards.

One Title 24 consultant and one HERS rater reported that the builders would continue to build non-program homes to IOU program standards, while three builders and two HVAC contractors reported that they planned to continue building non-program homes to IOU program standards.

When asked why builders would continue to build non-program homes to IOU program standards, HERS raters reported the builders would do so because homes built to IOU program standards are better quality homes and have lower operating costs and better efficiency. While one builder said that he would continue to build non-program homes to IOU program standards to meet customer demand (ostensibly for energy-efficient homes), another builder would do so because it saves their customers energy, and a third reported that company policy has recently been modified to build all homes to program standards. HVAC contractors would continue to build to IOU program standards in order to meet customer demand, in order to be as green and energy efficient as possible and because it is the company standard.

**Table C.12-52: Influence of the IOU RNC Program on Building Non-program Homes to Program Standards and Intention to Continue Building Non-program Homes to Program Standards**

(Title 24 Consultants, HERS Raters, Builders, HVAC Contractors)

	<b>Builders (% of All Non-program Homes)</b>			
	Title 24 Consultants	HERS Raters	Builders	HVAC Contractors
n	45	29	32	9
Influence of IOU programs on building non-program homes built to program standards, 7 to 10 rating (10 = “a great deal of influence)	1 (1%)	1 (<1%)	0 (0%)	0 (0%)
Builders or HVAC contractors will continue to build non-program homes to program standards without IOU program	1 (1%)	1 (<1%)	3 (<1%)	2 (79%)



Table C.12-53 through Table C.12-58 provide additional data about non-program homes built to program standards.

**Table C.12-53: Building Non-program Homes to Program Standards**  
(Builders)

	Builders (% of All Non-program Homes)			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	13	9	10	32
Have used any practice or technology that exceeds Title 24 on non-program homes	NA	8	6	1
Have built non-program homes to program standards	NA	2 (<1%)	2 (1%)	4 (1%)
Influence of IOU programs on building non-program homes built to program standards, 7 to 10 rating (10 = “a great deal of influence)	NA	0 (0%)	0 (0%)	0 (0%)
Would continue to build non-program homes to program standards without IOU program	NA	2 (<1%)	1 (<1%)	3 (<1%)

**Table C.12-54: Installing HVAC Systems into Non-program Homes to Program Standards**  
(HVAC Contractors)

	Number of HVAC Contractors (% of All Non-program Homes)			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	2	4	3	9
Have installed above-code HVAC systems into non-program homes	2	4	3	9
Have installed above-code HVAC systems that help non-program homes meet program standards	NA	NA	2 (79%)	2 (79%)
Influence of IOU programs on HVAC system design, installation, equipment and testing practices in non-program homes built to program standards, 7 to 10 rating (10 = “a great deal of influence)	NA	NA	0 (0%)	0 (0%)
Would continue to install program standard HVAC systems into non-program homes without IOU program	NA	NA	2 (79%)	2 (79%)
Would continue to install above code HVAC systems into non-program homes without IOU program	1 (3%)	4 (13%)	1 (4%)	6 (20%)

**Table C.12-55: Consulting on Non-program Homes that Met Program Standards**

(Title 24 Consultants)

	Number of Title 24 Consultants (% of All Non-program Homes)			Total
	Non- participants	Minority Participants	Majority Participants	
n	22	20	3	45
Always or usually do <u>not</u> know if builder followed respondents advice on Title 24 compliance	13 (28%)	8 (21%)	2 (100%)	23 (50%)
Consulted on non-program homes built to program standards (% of all homes consulted)	0 (0%)	11 (10%)	0 (0%)	11 (10%)
Influence of IOU programs on design and construction of non-program homes built to program standards, 7 to 10 rating (10 = “a great deal of influence)	0 (0%)	1 (1%)	0 (0%)	1 (1%)
Builder would continue to build non-program homes to program standards without IOU program	0 (0%)	1 (1%)	0 (0%)	1 (1%)

**Table C.12-56: Rating Non-program Homes that Met Program Standards**

(HERS Raters)

	Number of HERS Raters			Total
	Non- participants	Minority Participants	Majority Participants	
n	13	10	6	29
Rated non-program homes built to program standards ((% of all Non-program homes))	1 (0%)	7 (6%)	4 (<1%)	12 (6%)
Influence of IOU programs on design and construction of non-program homes built to program standards, 7 to 10 rating (10 = “a great deal of influence); (% of all Non-program homes)	0 (0%)	1 (2%)	0 (0%)	1 (<1%)
Builders will continue to build non-program homes to program standards without IOU program (% of all Non-program homes)	0 (0%)	1 (2%)	0 (0%)	1 (<1%)

**Table C.12-57: HVAC Contractors Work with Builders Who Have Built Program Homes**  
(HVAC Contractors)

Year	Average Percentage of Homes Installed Above-Code Duct Insulation			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	2	4	3	9
Builders have built homes through IOU RNC program	0 (0%)	1 (13%)	3 (83%)	4 (96%)
Builders have changed building practices for non-program homes	0 (0%)	0 (0%)	1 (<1%)	1 (<1%)

**Table C.12-58: Program Standards that Non-program Homes Met that Were Built to Program Standards**  
(HERS Raters)

Program Standard	Number of HERS Raters			Total
	Non-participants	Minority Participants	Majority Participants	
n	13	10	6	29
15% above-code	0	4	4	8
Title 24	0	2	0	2
ENERGY STAR	0	2	0	2
Depends on program	0	1	0	1
40% cooling reductions	0	0	1	1
30% improvement in building envelope	0	0	1	1
35% above-code	0	0	1	1
Solar power	0	0	1	1
New Solar Homes Partnership	0	1	0	1
PG&E Residential New Construction	0	1	0	1
Don't know	1	0	0	1

Builders were asked to rate the importance of various factors on their choice of energy efficiency levels in non-program homes (Table C.12-59). On average, builders rated the recommendations of Title 24 consultants as the most important factor, followed by the practices and technologies used by other offices in their company and decreasing incremental costs. Home buyers' willingness to pay was rated as moderately important—about the same level as knowledge gained through utility programs. Compared to the 2000 statewide study, builders rated the recommendations of Title 24 consultants, product distributors, product manufacturers and architects as more important.

**Table C.12-59: Influence of Various Factors on Choice of Energy Efficiency Levels in Non-Program Homes**

(Builders; 1-5 Scale; 1= "Not at all important" and 5= "Very important")

Factors	1998 PG&E Study, weighted % rating of 4 or 5 <sup>157</sup>	2000 Statewide RNC Study <sup>158</sup>	Mean Rating			
			Builders (% of Non-program Homes, rating of 4 and 5)			
			Unaware Nonpart.	Aware Nonpart.	Partial Part.	Total
n			13	9	10	32
Buyer willingness to pay for incremental cost	N/A	3.6	3.2 (1%)	3.7 (4%)	3.5 (15%)	3.4 (21%)
Added cost for improvement are decreasing over time	N/A	N/A	3.7 (2%)	4.4 (9%)	3.8 (17%)	3.9 (28%)
Recommendation of Title 24 consultants	79%	3.1	4.5 (5%)	4.3 (10%)	4.4 (84%)	4.4 (99%)
Recommendation of HVAC contractors	55%	3.1	N/A	N/A	N/A	N/A
Recommendation of subcontractors	N/A	N/A	3.9 (3%)	4.1 (9%)	3.6 (80%)	3.9 (92%)
Recommendation of product distributors	0%	2.5	3.5 (3%)	3.2 (6%)	3.4 (75%)	3.4 (84%)
Recommendation of product manufacturers	0%	2.8	3.8 (4%)	3.4 (6%)	3.7 (78%)	3.7 (88%)
Recommendation of architects or designers	<1%	3.0	4.0 (5%)	4.0 (10%)	3.8 (72%)	3.9 (86%)
Recommendation of sales agents or realtors	9%	2.3	2.4 (2%)	2.0 (4%)	3.2 (66%)	2.5 (73%)
Recommendation of lending institutions	N/A	2.8	1.9 (0%)	2.1 (3%)	2.4 (<1%)	2.1 (3%)
Competition from other builders	46%	N/A	N/A	N/A	N/A	N/A
Product offerings by competing builders	N/A	2.7	2.8 (1%)	3.7 (6%)	3.5 (8%)	3.3 (16%)
Marketing by competing builders	N/A	N/A	3.2 (5%)	3.2 (5%)	3.3 (7%)	3.2 (17%)
Practices and technologies used by other offices in company	N/A	N/A	N/A	4.0 (4%)	4.3 (16%)	4.1 (20%)
Knowledge gained through utility programs	N/A	N/A	N/A	3.8 (10%)	3.5 (12%)	3.6 (22%)
Own personal experience	93%	3.9	N/A	N/A	N/A	N/A
Support of relevant government agencies	N/A	3.3	N/A	N/A	N/A	N/A
Educational / informational support from utilities	N/A	3.4	N/A	N/A	N/A	N/A

<sup>157</sup>RER, 1998, Table 4-4, pg 4-14<sup>158</sup>Quantum Consulting Inc., 2000, Exhibit A-7, pg A-15

In contrast to builders, HVAC contractors rated home buyers' willingness to pay as the most important factor influencing the choice of energy efficiency level of HVAC equipment in non-program homes, followed by recommendations of Title 24 consultants, the home buyers' desire to have the lowest cost HVAC system and builder recommendations (Table C.12-60). Interestingly, non-participating HVAC contractors not aware of the program placed much greater importance on the recommendations of product distributors and other HVAC contractors than did partial participants and non-participants aware of the program, suggesting that they perceived themselves as less knowledgeable of efficiency levels of HVAC equipment and practices than other HVAC contractors.

**Table C.12-60: Influence of Various Factors on Choice of Energy Efficiency Levels in Non-Program Homes**

(HVAC Contractors; 1-5 Scale; 1= "Not at all important" and 5= "Very important")

Factors	Mean Rating			
	HVAC Contractors (% of Non-program Homes, rating of 4 and 5)			
	Unaware Nonpart.	Aware Nonpart.	Partial Part.	Total
n	2	4	3	9
Home buyers' willingness to pay for incremental cost	5.0 (3%)	4.0 (13%)	4.7 (83%)	4.4 (100%)
Home buyers' desire to have lowest cost HVAC system	4.0 (3%)	3.3 (13%)	4.0 (83%)	3.7 (100%)
Added cost for improvement are decreasing over time	4.0 (<1%)	3.3 (<1%)	2.0 (<1%)	3.0 (1%)
Recommendation of Title 24 consultants	5.0 (5%)	4.3 (1%)	2.7 (3%)	3.9 (9%)
Recommendation of builders	5.0 (3%)	3.3 (<1%)	3.0 (78%)	3.6 (82%)
Recommendation of product distributors	4.0 (<1%)	2.3 (0%)	1.3 (0%)	2.3 (<1%)
Recommendation of product manufacturers	4.0 (<1%)	2.5 (0%)	3.3 (83%)	3.1 (84%)
Recommendation of architects or designers	4.0 (<1%)	3.8 (1%)	2.7 (<1%)	3.4 (1%)
Product offerings by competing HVAC contractors	3.5 (<1%)	2.8 (<1%)	1.3 (0%)	2.4 (<1%)
Recommendations of other HVAC contractors	4.0 (<1%)	2.0 (<1%)	1.0 (0%)	2.1 (<1%)
Educational / informational support from utilities	2.0 (0%)	2.5 (<1%)	2.3 (0%)	2.4 (<1%)

Table C.12-61 provides additional data about the influence of various factors on the choice of energy efficiency levels in non-program homes.

**Table C.12-61: Outside Conditions that Influence Builders' Continued Use of Above-Code Practices and Measures**  
(HERS Raters)

Outside Conditions	HERS Raters			Total
	Non-participants	Minority Participants	Majority Participants	
n (multiple response)	13	10	6	29
Code changes/requirements	1	1	1	3
Consumer demand	0	1	2	3
Energy prices	0	1	1	2
Environmental concerns	0	1	1	2
Increased energy efficiency	0	1	1	2
Housing market	1	0	0	1
Political climate	0	0	1	1
Incentives/rebates	1	0	0	1

### C.13 Code Upgrades

Section 4.12 suggests, from market actor self-reports and on-site visits to non-program homes, that above-code practices and technologies were used in substantial numbers of homes in the 2006-2008 period, which gave builders experience that should help them be prepared for the next code upgrade.

Nineteen of 32 builders, responsible for 79% of non-program homes, said that there was adequate knowledge and availability of energy-efficient technologies and practices such that most builders could comply with the proposed 2008 code upgrade within a reasonable time. Twenty of 32 builders, responsible for 22% of non-program homes, said that the low end of the market could comply with the proposed 2008 code upgrade within a reasonable time (Table C.13-1).

**Table C.13-1: Market Readiness for Code Upgrade**  
(Builders; 0-10 Scale; 0= “Disagree strongly” and 10= “Agree strongly”)

	Number of Builders (% of Nonparticipating Homes)			
	Unaware Non-participants	Aware Non-participants	Partial Participants	Total
n	13	9	10	32
There is adequate knowledge and availability of energy-efficient technologies and practices that most builders could comply with the proposed 2008 code upgrade within a reasonable time (7 to 10 rating, 10 = “agree strongly”)	9 (5%)	5 (6%)	5 (69%)	19 (79%)
Compliance with the current code is so widespread that builders at the low end of the market could comply with the proposed 2008 code upgrade within a reasonable time (7 to 10 rating, 10 = “agree strongly”)	9 (5%)	8 (10%)	3 (7%)	20 (22%)

Ten Title 24 consultants, responsible for 5% of non-program homes, said that there was adequate knowledge and availability of energy-efficient technologies and practices such that most builders could comply with the proposed 2008 code upgrade within a reasonable time, while 12 Title 24 consultants, responsible for 30% of non-program homes, said that the low end of the market could comply with the proposed 2008 code upgrade within a reasonable time (Table C.13-2).

**Table C.13-2: Market Readiness for Code Upgrade**  
(Title 24 Consultants; 0-10 Scale; 0= “Disagree strongly” and 10= “Agree strongly”)

	Number of Title 24 consultants (% of Nonparticipating Homes)			
	Non- participants	Minority participants	Majority Participants	Total
n	22	20	3	45
There is adequate knowledge and availability of energy-efficient technologies and practices that most builders could comply with the proposed 2008 code upgrade within a reasonable time (7 to 10 rating, 10 = “agree strongly)	5 (2%)	5 (3%)	0 (0%)	10 (5%)
Compliance with the current code is so widespread that builders at the low end of the market could comply with the proposed 2008 code upgrade within a reasonable time (7 to 10 rating, 10 = “agree strongly)	2 (1%)	10 (30%)	0 (0%)	12 (30%)



Eleven HERS raters, responsible for 66% of non-program homes, said that there was adequate knowledge and availability of energy-efficient technologies and practices that most builders could comply with the proposed 2008 code upgrade within a reasonable time, while 12 HERS raters, responsible for 69% of non-program homes, said that the low end of the market could comply with the proposed 2008 code upgrade within a reasonable time (Table C.13-3). The responses to the two questions appear to be contradictory, indicating that one or more respondents may not have understood both of the questions.

**Table C.13-3: Market Readiness for Code Upgrade**  
(HERS Raters; 0-10 Scale; 0= “Disagree strongly” and 10= “Agree strongly”)

	Number of HERS Raters (% of Nonparticipating Homes)			
	Non-participants	Minority participants	Majority Participants	Total
n	13	10	6	29
There is adequate knowledge and availability of energy-efficient technologies and practices such that most builders could comply with the proposed 2008 code upgrade within a reasonable time (7 to 10 rating, 10 = “agree strongly”)	5 (1%)	3 (65%)	3 (0%)	11 (66%)
Compliance with the current code is so widespread that builders at the low end of the market could comply with the proposed 2008 code upgrade within a reasonable time (7 to 10 rating, 10 = “agree strongly”)	6 (8%)	3 (60%)	3 (0%)	12 (69%)

Six HVAC contractors, responsible for 82% of non-program homes, said that there was adequate knowledge and availability of energy-efficient technologies and practices such that most builders could comply with the proposed 2008 code upgrade within a reasonable time, and four HVAC contractors consultants, responsible for 82% of non-program homes, said that the low end of the builder market could comply with the proposed 2008 code upgrade within a reasonable time. Similarly, six HVAC contractors, responsible for 82% of non-program homes, said that there was adequate knowledge and availability of energy-efficient technologies and practices such that most HVAC contractors could comply with the proposed 2008 code upgrade within a reasonable time, and seven HVAC contractors, responsible for 82% of non-program homes, said that the low end of the HVAC contractor market could comply with the proposed 2008 code upgrade within a reasonable time.

**Table C.13-4: Market Readiness for Code Upgrade**  
(HVAC Contractors; 0-10 Scale; 0= “Disagree strongly” and 10= “Agree strongly”)

	HVAC Contractors (% of Nonparticipating Homes)			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	2	4	3	9
There is adequate knowledge and availability of energy-efficient technologies and practices such that most builders could comply with the proposed 2008 code upgrade within a reasonable time (7 to 10 rating, 10 = “agree strongly”)	2 (3%)	3 (1%)	1 (78%)	6 (82%)
Compliance with the current code is so widespread that builders at the low end of the market could comply with the proposed 2008 code upgrade within a reasonable time (7 to 10 rating, 10 = “agree strongly”)	2 (3%)	1 (<1%)	1 (78%)	4 (82%)
There is adequate knowledge and availability of energy-efficient technologies and practices such that most HVAC contractors could comply with the proposed 2008 code upgrade within a reasonable time (7 to 10 rating, 10 = “agree strongly”)	2 (3%)	3 (1%)	1 (78%)	6 (82%)
Compliance with the current code is so widespread that HVAC contractors at the low end of the market could comply with the proposed 2008 code upgrade within a reasonable time (7 to 10 rating, 10 = “agree strongly”)	2 (3%)	3 (1%)	2 (78%)	7 (82%)

Four out of 14 building code officials/inspectors agreed that compliance with the current code was so widespread that builders at the low end of the market could comply with a new code upgrade within a reasonable amount of time.

**Table C.13-5: Market Readiness for Code Upgrade**

(Building Code Officials/Inspectors; 0-10 Scale; 0= “Disagree strongly” and 10= “Agree strongly”)

n	
	14
Compliance with the current code is so widespread that builders at the low end of the market could comply with the proposed 2008 code upgrade within a reasonable time (7 to 10 rating, 10 = “agree strongly”)	4

Twelve of 32 builders, responsible for 28% of non-program homes, said that utility programs that encourage code compliance and the installation of energy-efficient features in new homes contributed to market readiness for a code upgrade during the 2006-2008 period (Table C.13-6).

**Table C.13-6: IOU Program Contribution to Market Readiness for Code Upgrade**

(Builders; 0-10 Scale; 0= “Disagree strongly” and 10= “Agree strongly”)

	Number of Builders (% of Nonparticipating Homes)			
	Unaware Non-participants	Aware Non-participants	Partial Participants	Total
n	13	9	10	32
Utility programs that encourage code compliance and encourage the installation of energy-efficient features in new homes have contributed to market readiness for a code upgrade (7 to 10 rating, 10 = “agree strongly”)	0 (0%)	6 (9%)	6 (20%)	12 (28%)

Eleven out of 45 Title 24 consultants, responsible for 22% of non-program homes, said that utility programs that encourage code compliance and encourage the installation of energy-efficient features in new homes have contributed to market readiness for a code upgrade.

**Table C.13-7: IOU Program Contribution to Market Readiness for Code Upgrade**

(Title 24 Consultants; 0-10 Scale; 0= “Disagree strongly” and 10= “Agree strongly”)

	Number of Title 24 consultants (% of Nonparticipating Homes)			
	Non-participants	Minority participants	Majority Participants	Total
n	22	20	3	45
Utility programs that encourage code compliance and the encourage the installation of energy-efficient features in new homes have contributed to market readiness for a code upgrade (7 to 10 rating, 10 = “agree strongly”)	4 (1%)	6 (21%)	1 (0%)	11 (22%)

Nearly half of the HERS raters (14 of 29), responsible for 86% of non-program homes, said that utility programs that encourage code compliance and the installation of energy-efficient features in new homes had contributed to market readiness for a code upgrade.

**Table C.13-8: IOU Program Contribution to Market Readiness for Code Upgrade**

(HERS Raters; 0-10 Scale; 0= “Disagree strongly” and 10= “Agree strongly”)

	Number of HERS Raters (% of Nonparticipating Homes)			
	Non-participants	Minority participants	Majority Participants	Total
n	13	10	6	29
Utility programs that encourage code compliance and the encourage the installation of energy-efficient features in new homes have contributed to market readiness for a code upgrade (7 to 10 rating, 10 = “agree strongly”)	6 (7%)	5 (66%)	3 (13%)	14 (86%)

Only three of nine HVAC contractors, responsible for just 5% of non-program homes, said that utility programs that encourage code compliance and the installation of energy-efficient features in new homes have contributed to market readiness for a code upgrade (Table C.13-9).

**Table C.13-9: IOU Program Contribution to Market Readiness for Code Upgrade**

(HVAC Contractors; 0-10 Scale; 0= “Disagree strongly” and 10= “Agree strongly”)

	HVAC Contractors (% of Nonparticipating Homes)			
	Unaware Nonparticipants	Aware Nonparticipants	Partial Participants	Total
n	2	4	3	9
Utility programs that encourage code compliance and encourage the installation of energy-efficient features in new homes have contributed to market readiness for a code upgrade (7 to 10 rating, 10 = “agree strongly”)	0 (0%)	1 (<1%)	2 (5%)	3 (5%)

Five out of 14 code officials said that utility programs that encourage code compliance and the installation of energy-efficient features in new homes had contributed to market readiness for a code upgrade.

**Table C.13-10: IOU Program Contribution to Market Readiness for Code Upgrade**

(Building Code Officials/Inspectors; ; 0-10 Scale; 0= “Disagree strongly” and 10= “Agree strongly”)

n	14
Utility programs that encourage code compliance and encourage the installation of energy-efficient features in new homes have contributed to market readiness for a code upgrade (7 to 10 rating, 10 = “agree strongly”)	5