Phase II Report
Residential New Construction (Single-Family Home) Market Effects Study

FINAL

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E. Executive Summary

The California Public Utilities Commission's (CPUC) Market Effects Evaluation Protocol follows the definition of market effects offered by Eto, Prahl, and Schlegel (1996): "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)." (Eto et al. 1996; CPUC 2006)

The objectives of the overall market effects study are as follows:

- Understand the market effects of the 2006-2008 California investor-owned utilities' (IOU) residential new construction (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.[1]
- Assess the effects of pre-2006 IOU programs on the adoption of more efficient technologies and practices in the 2005 Title 24 code.
- 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.

The study was performed in two phases. The first phase covered the market and attribution analysis of the California IOU's RNC programs. Phase I, using primarily qualitative methods, established that there was sufficient qualitative evidence of market effects that may reasonably be attributed to the IOU's RNC programs.[2]

Phase II, reported in this document, was designed to quantify the energy savings caused by the market effects.

[1] 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.

[2] The IOU's RNC programs include SCG's Advanced Home Program, SDGE's Advanced Home Program, SCE's California New Homes Program, PG&E's Residential New Construction Program and PG&E's Duct & Cover Program. The programs are described in more detail in section 1: Introduction.

E.1. Research Activities and Data Sources

The primary research activities conducted in Phase II were the development of a baseline of RNC efficiency trends by estimating code compliance for non-program homes, estimating gross energy savings among non-program homes, estimating net savings from market effects that are attributable to the IOU's RNC programs, and assessing the sustainability and persistence of the market effects. The primary activities are outlined in Table E.1-1.

Table E.1-1: Summary of Tasks in Residential New Construction Market Effects Study—Phase II

Task	Research Activities
Plan	• Develop a plan for Phase II

1. Estimate Gross Energy Savings	• Develop a hypothetical baseline of RNC efficiency trends in California by estimating code compliance for non-program homes built from 2006-2008
	  o Utilize onsite data from inspection of homes
	• Estimate gross energy savings for the following:
	  o Above-code non-program homes compared to non-program homes just meeting code
	  o Non-program homes just meeting code compared to below code non-program homes

2. Attribution Analysis, Estimation of Net Energy Savings, Sustainability Assessment	• Using the Delphi technique[3], interview a panel of Title 24 consultants and home building industry experts to estimate the role of the IOU's RNC programs in causing the observed market effects. • Convert market effects to estimated energy savings. o Systematically analyze the uncertainty surrounding the results. • Develop recommendations regarding treatment of any RNC market effects savings in next program cycle. • 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).

E.2. Findings

We found that energy savings associated with the observed market effects in non-participant homes were large and quantifiable, but also found that the gross savings overlap with the gross standard savings from the Codes and Standards evaluation (see Appendix F for more details). Even so, this study is important because it provides an example of how market effects can be measured and how the scoping study, logic model and the results of a market effects pilot evaluation can identify the mechanisms behind program effects.

[3] The Delphi technique is often characterized as a group communication process or forecasting method that relies upon panels of experts to develop an estimate or group judgment on a topic or issue. It is an iterative process that involves at least two rounds of questions or interviews with the panels. The Delphi technique is based on the principle that structured responses from experts will be more accurate than unstructured responses from individuals (Hsu and Sandford, 2007; Linstone and Turoff, 1975; Ludwig, 1997).

This is one of three market effects studies that were selected to in order to demonstrate in varying markets that non-participant spillover was measurable and quantifiable.[4] The purpose of this and the other market effects studies was to test the reliability of quantifying market effects. The finding that the spillover savings overlap with savings counted in the Codes and Standards evaluation provides valuable corroboration of the scope and size of the impact of the IOU's RNC programs on non-participants. In addition, the RNC market effects study provides valuable insights as to how the IOU's RNC programs made a difference above and beyond naturally occurring market adoption of improved efficiency, to better understand why the non-participant spillover occurred and why the average non-participant home built during the 2006 to 2008 time period was built to exceed the requirements of Title 24.

Phase II of the market effects evaluation quantifies the non-participant spillover, examines the aspects of the IOU's RNC programs that are responsible for the savings, and examines the sustainability of the savings.

E.2.1 Introduction

Phase I of this evaluation found that the 2006-2008 IOU programs appear to have had discernible effects on improved code compliance of non-program homes and on increased above-code practices. Phase II quantifies the energy savings associated with the observed market effects, estimates the net energy savings from market effects that are attributable to the IOU's RNC programs, and assesses the sustainability or persistence of the net energy savings in the future. Phase II focuses on two of the three ways that the IOU programs can lead to reduced energy use:[5]

1. By improving compliance with existing code
2. By facilitating construction that is more efficient than required by the current code

E.2.2 Methodology

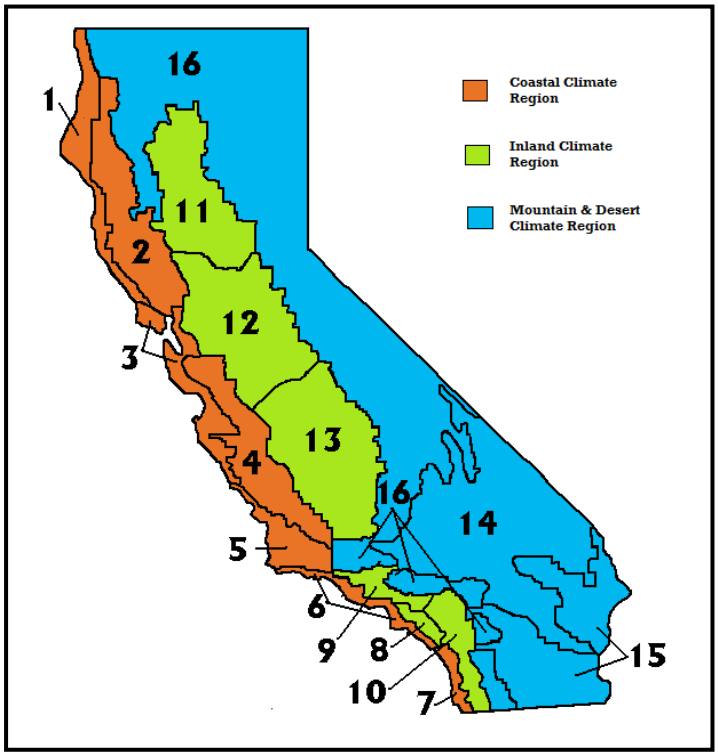
The research team estimated code compliance and gross energy savings using the Residential New Construction Baseline Study (RNC Baseline) conducted as part of the 2006-08 California Residential New Construction Program Evaluation and the Codes and Standards (C & S) Program evaluation. For the 194 homes included in both the baseline and the C & S evaluation, the team conducted a full site audit at each home, and built a compliance model from the field-observed building characteristics. Based on the outcomes of these models, we were able to determine:

[4] The other market effects studies examined CFLs (Cadmus et al., 2010) and High Bay lighting (KEMA et al., 2010).
[5] The IOU programs can also reduce energy use by contributing to code upgrades.

- The proportion of non-program homes that are code-compliant, above-code, and below-code[6]
- Overall compliance margin of all non-program homes and compliance margins for above-code homes, below-code homes and code-compliant homes

Code compliance and gross energy savings were estimated statewide and for three climate regions (climate zones were aggregated based on the similarity of their Title 24 requirements) (see Figure E.2-1).

Figure E.2-1: CEC Climate Zones and Climate Regions



Source: California Energy Commission.

In order to estimate the gross savings attributable to the IOU's RNC programs, the evaluation team began by estimating the number of non-program single-family homes (172,553) built in the IOU territories during the 2006-2008 time period. Next, the evaluation team examined the compliance margins and rates, both statewide and by the three climate regions. The evaluation team estimated the overall compliance margins statewide and by the three climate regions—Coastal, Inland, and the Mountain and Desert Region.

[6] Homes that are code-compliant are defined as those homes within the compliance model error bound estimated in the 2003 Baseline Study—i.e., homes with compliance margins above -5% and below +4% code requirements (for more details on the 2003 Baseline Study, see Itron, Inc. and KEMA – XENERGY. 2004. *Residential New Construction Baseline Study of Building Characteristics Homes Built After 2001 Codes*. CALMAC Study ID PGE0181.01). Homes that are above-code are defined as those homes that have a compliance margin greater than 4% above-code requirements. Homes that are below-code are defined as those homes with compliance margins below -5% of code requirements.

Finally, based on the number of non-program single-family homes in each region, the regional compliance rates and the regional compliance margins, the evaluation team calculated the gross savings for two categories of non-program homes:

- Homes built above-code compared to homes just meeting code
- Homes just meeting code (i.e., code-compliant homes) compared to below-code homes

In order to convert the gross savings estimates into net savings estimates, the evaluation team employed two Delphi panels, consisting of 24 Title 24 consultants and seven building industry experts. The Delphi technique is often characterized as a group communication process or forecasting method that relies upon panels of experts to develop an estimate or group judgment on a topic or issue. It is an iterative process that involves at least two rounds of questions or interviews with the panels. The Delphi technique is based on the principle that structured responses from experts will be more accurate than unstructured responses from individuals (Hsu and Sandford, 2007; Linstone and Turoff, 1975; Ludwig, 1997).

Each panelist completed two rounds of detailed surveys; the second round provided comparison with other panelists' responses and provided them the opportunity to change their answers. The evaluation team analyzed the Title 24 consultant responses (both weighted and unweighted) and used the building industry expert responses as a qualitative check on the responses of the Title 24 consultants.

Delphi panelists were presented with detailed data pertaining to code compliance, compliance margins, and estimates of annual gross energy savings in non-program homes at the state level and by the three climate regions (i.e., Coastal, Inland and Mountain & Desert). After reviewing the compliance and gross savings data, panelists were asked the following:

- Estimate the proportion of the electricity and natural gas savings that is attributable to the IOU programs and other factors (i.e., market effects of the IOU's RNC programs),
- Estimate the percentage of net savings in non-program homes attributable to the IOU programs that comes from different IOU program elements,
- Assess the extent to which the market effects are likely to persist in the absence or reduction of the IOU programs (i.e., the sustainability of the market effects), and
- Estimate the percentage of homes that would have been below-code in the absence of the IOU's RNC programs and other factors and to estimate the compliance margin of the below-code homes in the absence of each factor.

E.2.3 Code Compliance and Gross Energy Savings

Table E.2-1 reports the overall compliance margins of single-family non-program homes built during the 2006 to 2008 time period for the entire state of California and by the three climate regions. Statewide, the average compliance margin is 7.4% above-code. In other words, the average new home built during the 2006 to 2008 time period uses 7.4% **less** energy than it is permitted to use under the California State Building Code (i.e. Title 24). Homes in the Mountain

and Desert region have the highest compliance margin (10.4% compliance margin), followed by the Inland Region (6.4%) and the Coastal Region (4.4% compliance margin).

Table E.2-1: Overall Compliance Margins for Non-Program Homes, 2006-2008

Region	Average Compliance Margin
Statewide	7.4%
Coastal	4.4%
Inland	6.4%
Mountain & Desert	10.4%

Figure E.2-2 presents the distribution of compliance rates statewide and by region of single-family non-program homes. Statewide, 58% of homes are above-code, 29% of homes are code-compliant and 13% are below-code. While the overall compliance margin is above code, a sizeable percentage of homes, 13%, are below code and thus do not meet Title 24 requirements. The distribution of compliance is relatively uniform in the Coastal and Inland regions, but the Mountain and Desert region has a higher percentage of above-code homes and no homes were found to be below-code in this region.

Figure E.2-2: Compliance Rates by Region for Single-Family Non-Program Homes

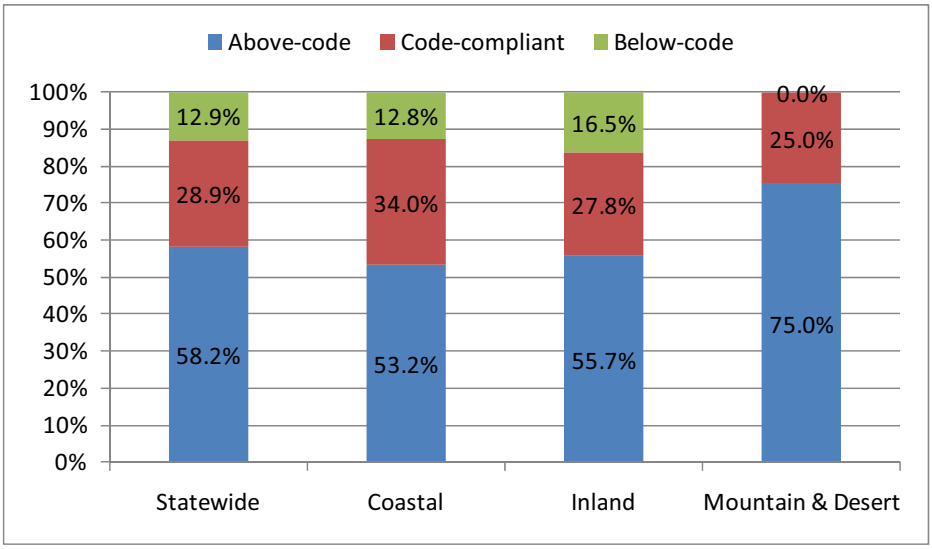


Figure E.2-3 presents the compliance margins statewide and by region. Compliance margins are relatively uniform across the three climate regions with the exception of the lack of below-code homes in the Mountain and Desert region. Above-code homes exceed code requirements by 12% to 13%, whereas below-code homes use 9% to 13% **more** energy than is permitted under Title 24.

Figure E.2-3: Compliance Margins by Region

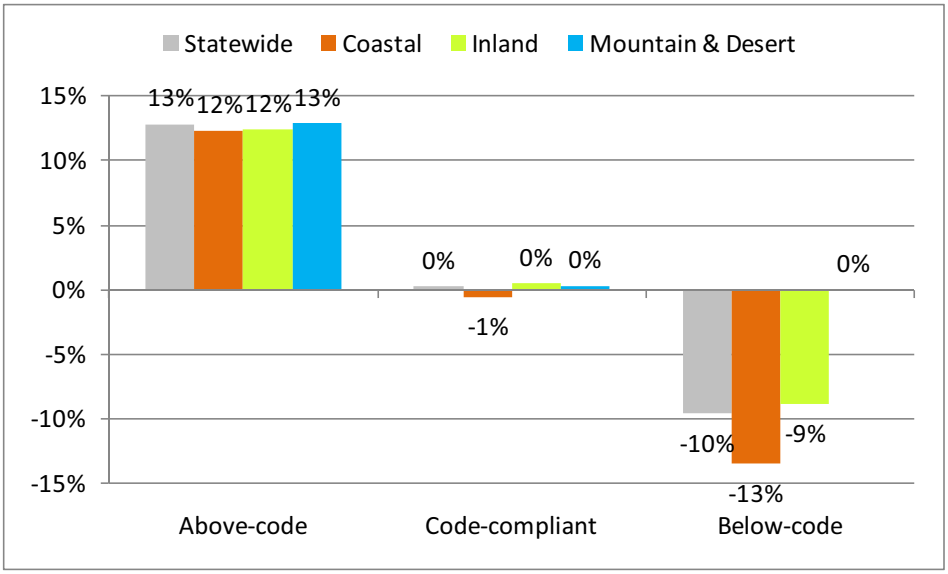


Table E.2-2 presents data on the electricity and natural gas savings due to homes built above-code compared to homes just meeting code, statewide and by region. The average above-code home will result in 17% savings in electricity usage and 11% savings in natural gas usage over the average code-compliant home. The savings realized in terms of total MWh and MDth vary widely across the regions as a function of the number of homes built in the region and the permitted energy budget under Title 24. For example, there were far fewer homes built in the Coastal Region compared to the Inland Region, and a home in the Coastal Region uses much less electricity than a home in the Inland Climate Region, so that while an above-code home in the Coastal Region uses, on average, 22% less electricity than a code-compliant home, total electricity savings for above-code homes in the Coastal Region are far less than savings for above-code homes in the Inland Region. Overall, above-code homes in the study sample will save 39,225 MWh of electricity annually and 711 MDth[7] of natural gas annually.

Table E.2-2: Annual Gross Energy Savings of Above-Code Non-Program Homes Compared to Code-Compliant Non-Program Homes, 2006-2008

Energy Savings		Statewide	Coastal Climate Region	Inland Climate Region	Mountain & Desert Climate Region
Savings on Electricity Usage	%	17%	22%	16%	16%
	MWh	39,225	864	18,659	19,702
Savings on Natural Gas Usage	%	11%	11%	11%	11%
	MDth	711	97	399	215

[7] MDth is an abbreviation for thousand decatherms

Gross energy savings vary quite dramatically by region, with the Mountain and Desert region being responsible for 50% of the gross electricity savings while only representing 23% of the non-program homes, and with the Coastal region being responsible for only 2% of the gross electricity savings (Figure E.2-4). This is likely due to the disparity in cooling needs between the two regions. Gross natural gas savings are distributed more proportionately across the three regions.

Figure E.2-4: Percentage of Non-Program Homes and Percentage of Annual Gross Energy Savings Due to Above-Code Homes, 2006-2008

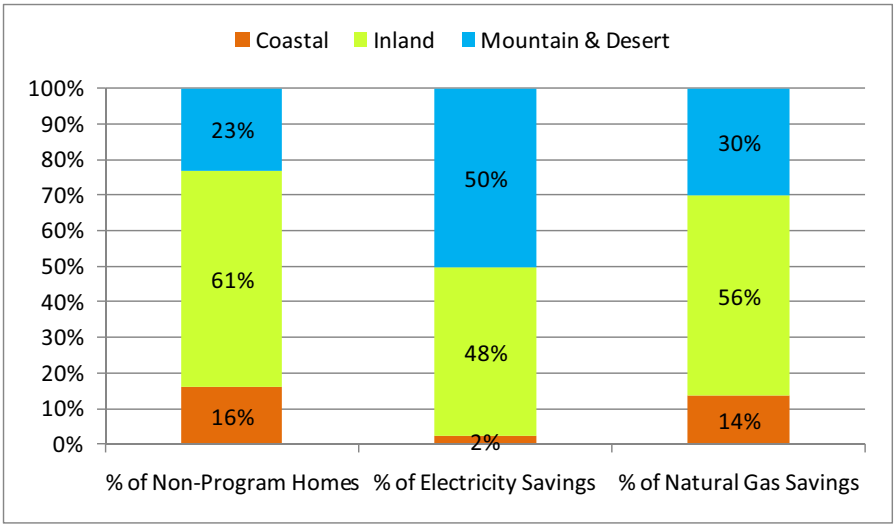


Table E.2-3 presents data on the electricity and natural gas savings due to homes just meeting code compared to below-code homes, statewide and by region. The average code-compliant home will result in 27% savings in electricity usage and 5% savings in natural gas usage over the average below-code home. Overall, code-compliant homes in the study sample will save 5,471 MWh of electricity annually and 78 MDth of natural gas annually compared to below-code homes.

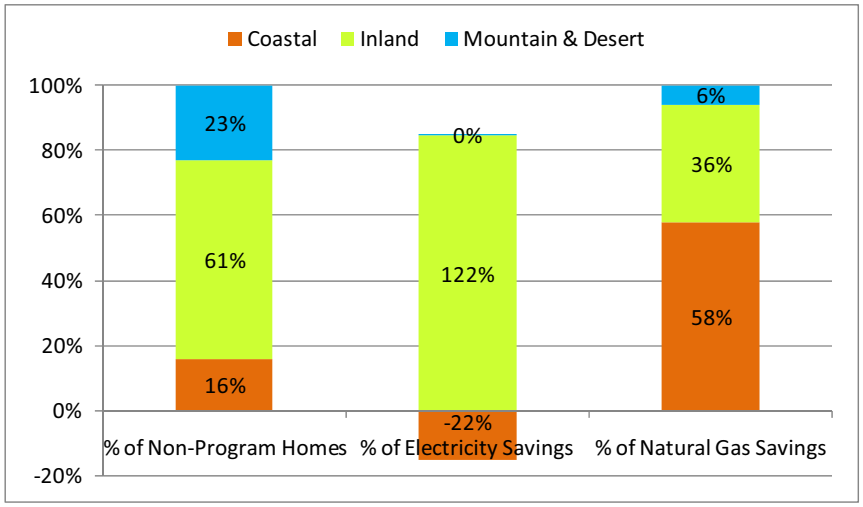
Table E.2-3: Annual Energy Savings of Code-Compliant Non-Program Homes Compared to Below-Code Non-Program Homes, 2006-2008

Energy Savings		Statewide	Coastal Climate Region	Inland Climate Region	Mountain & Desert Climate Region[1]
Savings on Electricity Usage	%	27%	-54%	31%	0%
	MWh	5,471	-1,193	6,658	6
Savings on Natural Gas Usage	%	5%	19%	2%	1%
	MDth	78	45	29	5

[1] Savings for the Mountain and Desert Region are compared to compliance with the code

As with above-code homes, gross energy savings from code-compliant homes vary quite dramatically by region, with the Inland region accounting for 122% of the gross electricity savings but only 61% of the non-program homes (Figure E.2-5). Interestingly, code-compliant homes in the Coastal Region use more electricity than below-code homes, but they use substantially less natural gas than below-code homes so that the overall energy budget of the home complies with Title 24.

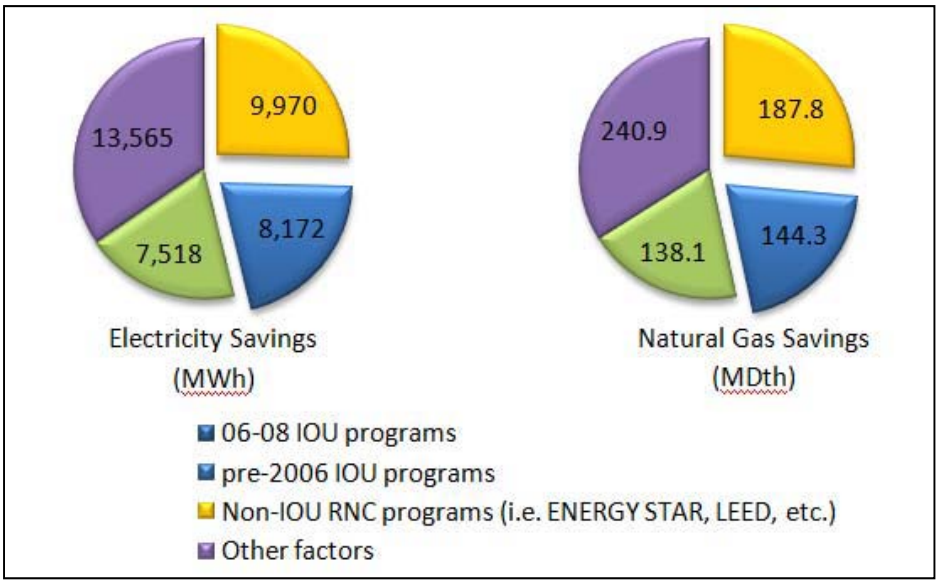
Figure E.2-5: Percentage of Non-Program Homes and Percentage of Annual Gross Energy Savings Due to Code-Compliant Homes, 2006-2008



E.2.4 Net Energy Savings

Based on the unweighted Title 24 consultant responses, the Delphi panel estimated that the 2006-2008 IOU's RNC programs are responsible for 25%[8] (9,970 MWh) of the gross electricity savings and 26%[9] (187.8 MDth) of the gross natural gas savings due to above-code homes compared to code-compliant homes (Figure E.2-6). In addition, the Delphi panel estimated that 21% (8,172 MWh) of the gross electricity savings and 20% (144.3 MDth) of the gross natural gas savings are due to the pre-2006 IOU programs. *The 2006-2008 and pre-2006 IOU programs taken together, then, account for nearly half of gross electricity and natural gas savings in above-code non-program homes.* Both panels identified the various elements of training (builders, subcontractors, Title 24 and code officials) as the most important elements of the IOU'S RNC programs.

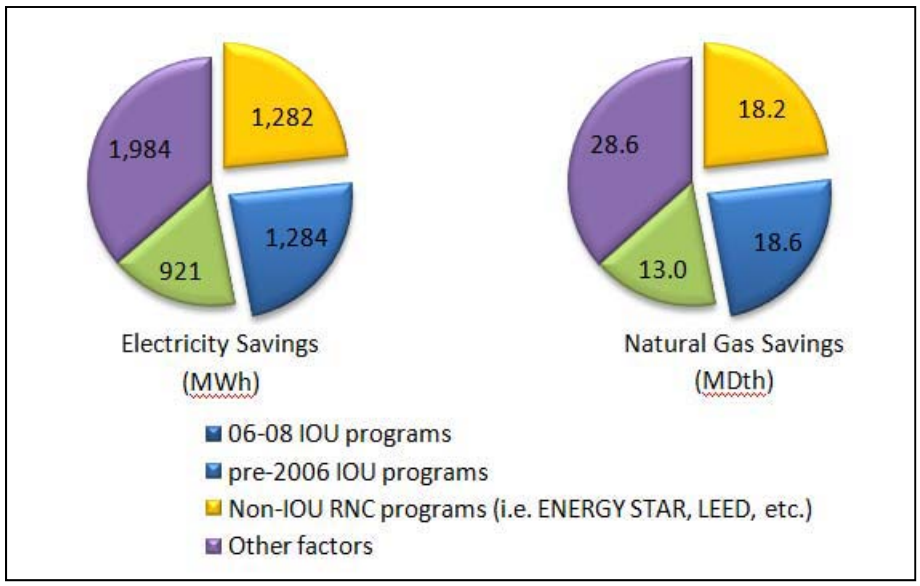
Figure E.2-6: Net Savings Above-Code Homes Compared to Code-Compliant Homes



[8] The 90% confidence interval ranges from 20% to 31% of gross electricity savings
[9] The 90% confidence interval ranging from 21% to 32% of gross natural gas savings

Based on the unweighted Title 24 consultant responses, the Delphi panel estimated that the 2006-2008 IOU'S RNC programs are responsible for 23%[10] (1,282 MWh) of the gross electricity savings and 23%[11] (18.2 MDth) of the gross natural gas savings in code-compliant homes compared to below-code homes (Figure E.2-7). In addition, the Delphi panel estimated that 23% (1,284 MWh) of the gross electricity savings and 24% (18.6 MDth) of the gross natural gas savings are due to the pre-2006 IOU programs. *Thus the 2006-2008 and pre-2006 IOU programs taken together account for nearly half of gross electricity and natural gas savings from achieving code compliance in non-program homes.* Both panels identified the various elements of training (builders, subcontractors, Title 24 and code officials) as the most important elements of the IOU'S RNC programs.

Figure E.2-7: Net Savings Code-Compliant Homes Compared to Below-Code Homes



[10] The 90% confidence interval ranging from 18% to 29% of gross electricity savings
[11] The 90% confidence interval ranging from 17% to 29% of gross natural gas savings

In addition to net energy savings, Delphi panelists were asked to estimate the percentage of homes that would have been below-code in the absence of the IOU'S RNC programs and other factors (but assuming all other factors remain unchanged from what actually occurred), and the compliance margin of the below-code homes in the absence of each factor.

The panels had fairly divergent views of the effect on compliance rates (i.e., the percentage of homes that would be below-code) if IOU'S RNC programs were eliminated but similar estimates of the effects on compliance *margins* if the IOU programs or other factors did not exist or did not occur (Table E.2-4). For example, Title 24 consultants estimated, on average, that the percentage of homes that were below-code would increase from 22% of homes to 27% of homes, and that the average below-code home would be 17% below code instead of 12% below code if the 2006-08 IOU'S RNC programs did not exist.[12] The building industry panel estimated, on average, that the percentage of below-code homes would increase from 22% of homes to 43% of homes if the 2006-08 IOU'S RNC programs did not exist, and that the average below-code home would be 18% below code instead of 12% below code.

It is interesting to note that these results, which indicate IOU'S RNC program factors and non-IOU program factors, would have approximately the same impact if they were absent (i.e., their absence would have about equivalent impacts) provide a consistency check with the net savings results, which showed that the IOU'S RNC programs and non-IOU program factors were each responsible for about one-half of the observed impact.

[12] For the Delphi survey, the evaluation team, having developed a preliminary estimate that 22% of homes were below code and that the average below-code home was 12% below code, asked respondents to estimate the percentage of homes that would have been below-code in the absence of the IOU'S RNC programs and other factors (but assuming all other factors remain unchanged from what actually occurred), and also to estimate the compliance margin of the below-code homes in the absence of each factor. After completing the Delphi survey, the evaluation team revised the estimates of code compliance to match the Codes and Standards (C & S) evaluation findings, which leads to an estimate of 13% of homes below code by an average of 10%. The results reported here are based on the preliminary estimates of non-compliance presented to the Delphi panelists rather the final estimates discussed elsewhere in this report.

Table E.2-4: Code Compliance in the Absence of IOU Programs and Other Factors-Statewide

	Title 24 Consultants, Unweighted (n = 24)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
If the 2006-2008 IOU Residential New Construction programs did not exist							
Proportion of below-code homes	27%	25%	30%	28%	25%	31%	43%
Average percentage below code	17%	15%	19%	20%	18%	22%	18%
If non-IOU Residential New Construction programs did not exit[*]							
Proportion of below-code homes	25%	23%	28%	24%	23%	25%	27%†
Average percentage below code	16%	14%	18%	18%	16%	20%	16%†
If other factors did not occur[‡]							
Proportion of below-code homes	25%	22%	28%	22%	21%	23%	25%†
Average percentage below code	15%	13%	16%	12%	12%	13%	14%†

[*] Programs such as ENERGY STAR homes, LEED for homes, programs sponsored by municipal utilities such as SMUD and LADWP, Environments for Living, ComfortWise, and the Solar Initiative.

† Only four Building Industry Experts were able to provide responses for non-IOU and other factors.

[‡] Factors such as the downturn in the housing market, changes in energy prices, global warming and naturally occurring advances in the residential new construction industry.

E.2.5 Sustainability – Persistence of Net Savings

Overall, it appears that the Delphi panelists estimate that energy savings realized in non-program homes are likely to diminish substantially in the future without further program support. Both Delphi panels said there would be substantial reductions in the savings attributable to the IOU programs from above-code homes and from improved code compliance. However, both panels said that at least some of the program-related savings would continue, largely because of increased awareness of energy efficiency in general as well as increased awareness and knowledge of energy-efficient building techniques and technologies (each of which are at least partially attributable to the IOU'S RNC programs).

Both panels said that not all the savings from above-code homes attributable to the program would persist without continuing the programs. Instead, program savings would decline significantly if the programs are cut or eliminated. However, the Title 24 consultants and building industry experts did not agree on the magnitude of the reduction in savings, particularly if program funding is completely eliminated (Table E.2-5).

Table E.2-5: Above-Code Non-Program Homes, Decline in Electricity and Natural Gas Savings IOU Budgets Are Cut or Eliminated – Statewide

		Title 24 Consultants, Unweighted (n = 22)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Budget cut		Electricity Savings						
50%	%	33%	27%	40%	57%	49%	65%	53%
	MWh	3,337	2,668	4,006	8,740	7,513	9,968	5,972
100%	%	54%	45%	64%	79%	73%	86%	83%
	MWh	5,431	4,447	6,415	12,193	11,171	13,216	9,385
Budget cut		Natural Gas Savings						
50%	%	33%	26%	39%	57%	49%	65%	50%
	MDth	61.2	48.3	74.0	166.9	143.4	190.4	103.1
100%	%	54%	45%	64%	79%	73%	86%	83%
	MDth	102.3	83.7	121.0	233.1	213.5	252.6	170.1

As with above-code homes, both panels said that the most of the savings attributable to the programs from code-compliant homes would not persist without continuing the programs. Instead, program savings would decline significantly if the programs are cut or eliminated. However, the Title 24 consultants and building industry experts did not agree on the magnitude of the reduction in savings (Table E.2-6).

Table E.2-6: Code-Compliant Non-Program Homes, Decline in Electricity and Natural Gas Savings IOU Budgets Are Cut or Eliminated – Statewide

		Title 24 Consultants, Unweighted (n = 21)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 7)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Budget cut		Electricity Savings						
50%	%	37%	30%	45%	65%	57%	73%	44%
	MWh	479	385	574	1,588	1,398	1,778	626
100%	%	55%	44%	65%	86%	79%	93%	73%
	MWh	699	565	833	2,094	1,929	2,260	1,038
Budget cut		Natural Gas Savings						
50%	%	37%	30%	44%	65%	57%	73%	41%
	MDth	6.8	5.4	8.1	22.7	20.0	25.5	8.4
100%	%	54%	43%	64%	86%	79%	93%	73%
	MDth	9.8	7.9	11.7	30.0	27.6	32.3	14.9

E.2.6 Comparing Phase I and Phase II Findings

Code compliance under the 2005 building standards support the findings from the Phase I report pertaining to code compliance and above-code building practices. In the Phase I report, we found that Title 24 consultants and HERS raters reported that they had observed increased rates of code compliance during the 2006-2008 period and that the IOU programs appeared to have had a fairly strong effect on improved code compliance, particularly through training. Further, in the Phase I report, we found that there was 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.

The gross savings analysis shows that statewide average compliance margin increased in homes built under the 2005 standards compared to the 2001 standards. Moreover, for homes built under the 2005 standards, every climate region had a positive average compliance margin, while two climate regions had negative compliance margins for homes built under the 2001 standards. Above-code building practices and code compliance also improved for homes built under the 2005 standards. Over one-half (58%) of homes built under the 2005 standards exceeded code requirements, compared to 13% of homes built under the 2001 standards. Further, 13% of homes

were below-code under the 2005 standards, whereas 27% of homes were below-code under the 2001 standards.

The attribution analysis (see section 4.3: Net Energy Savings) was generally quite consistent with the findings from Phase I. Overall, Title 24 consultants and building industry experts said the IOU'S RNC programs were responsible for significant percentages of the observed savings due to above-code homes and increased code compliance. As in Phase I, Title 24 consultants and building industry experts consistently identified training as key elements of the programs. Title 24 consultants said that trainings of builders, Title 24 consultants and subcontractors were responsible for nearly 40% of the energy savings attributable to the IOU programs for both above-code homes and code-compliant homes. The reach of the IOU training centers during the 2006-2008 time period further corroborates the reach of IOU-sponsored training, as the nine IOU training centers offered 840 unique courses which were taken by 39,793 unique attendees, including nearly 5,000 builders (4,987) and over 7,000 HVAC contractors (7,064) (Opinion Dynamics et al., 2010).

However, the Delphi panels also attributed savings to incentives and demand effects, such as increased availability and reduced prices of energy efficient technologies, which were not identified in Phase I. In addition, during Phase I, respondents indicated that the IOU'S RNC programs influenced builders to use HERS raters for Quality Insulation Installations (QII) in non-program homes, which contributed to the construction of above-code homes. However, this program element was not identified by any of the Delphi panelists.

E.2.7 Recommendations

Recommendations for the IOU'S RNC Programs

The recommendations for the IOU'S RNC programs from the Phase II market effects research largely echo the recommendations from Phase I:

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 efficient homes if they perceive efficiency 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.

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.

Recommendations for Future Evaluations

As stated in the Phase I report, because market transformation is a program goal, market effects research should occur on a regular basis; 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.

Related to the need for regular market effects evaluations, the protocols call for the collection of baseline and longitudinal indicators. This market effects research benefited from the collection of the Residential New Construction Baseline as part of the 2006-08 California Residential New Construction Program Evaluation and previous baseline studies that allowed for the comparison of building practices and code compliance over time. Baseline studies should continue in the future on a regular basis to allow continued examination of efficiency trends over time.

As IOU-sponsored training programs were consistently identified as being critical to the observed market effects, the CPUC should consider coordinating the evaluation of education and training programs to include elements of market effects evaluations to better understand what building techniques and technologies are being applied to non-program homes.

The evaluation team had some difficulty identifying and recruiting building industry experts for the Delphi panel. For future program cycles, perhaps the CPUC could identify and recruit building industry experts who could serve on a similar Delphi panel at the conclusion of the program cycle. Panelists would be asked to follow the programs during the program cycle, paying particular attention to non-participant spillover.

Recommendations for Changes to the Market Effects Evaluation Protocol

The evaluation team suggests that the Market Effects Evaluation Protocol could be modified for estimating the net impacts of new construction programs. In the California residential new construction market, distinctive and continually changing state building codes, multiple and varied climates, and the prevalence of local market actors preclude a cross-sectional modeling approach for causation; new construction in California simply is not comparable enough to new construction in any other area—or even a combination of areas—to allow valid comparisons. In addition, the diversity and complexity of the end-uses and practices involved in new construction make a modeling approach problematic. This is in contrast to other types of markets that are relatively similar across areas, with relatively uniform technologies, in which quasi-experimental designs taking into account differences over time and across areas are more feasible. Hence, the Market Effects Evaluation Protocol could be modified to provide the following requirement for estimating the net impacts of new construction programs:

Table E.2-7: Required Protocol for Estimating Net Market Effects

Level of Rigor	Net Market Effects Approach Requirements
Basic	A Delphi or expert panel approach, in which gross savings and penetration of technologies and practices are estimated and presented to panel members, who are then asked to attribute savings to energy efficiency programs and other factors; it is essential that there be at least two rounds of Delphi surveys, with the first round results summarized and presented in the second round survey so panel members can understand and learn from each other in developing the final attribution estimates.

Recommendations for Treatment of Non-Participant Spillover

A goal of this study was to "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."

An important factor bearing on the reliability of the non-participant spillover savings estimate is determining the extent to which the savings were counted in other utility program evaluations, in particular, the Codes and Standards Program evaluation, in order to avoid double-counting of savings. The evaluation team found that all of the energy savings from non-participant spillover had been counted in the Codes and Standards evaluation.

The Codes and Standards Program evaluation captured all spillover savings in non-program (baseline) homes (i.e., improved compliance with code and facilitating the construction of above-code homes) from 2006-2008 utility programs, because such savings contribute to compliance with Title 24. The RNC market effects (ME) study measured savings in homes exceeding the 2005 code relative to homes just meeting the code and in homes just meeting the 2005 code relative to homes not meeting the code. The Codes and Standards (C & S) Program evaluation measured savings in all homes using the 2001 code as baseline. Therefore, all gross savings in

the RNC ME study are a strict subset of and should have been counted in the C & S Program evaluation's gross standard savings (see Appendix F for more details).

It is important to point out that while it is likely that there is overlap in savings with the C & S Programs, the market effects research helps program administrators understand how and why the savings were achieved and where they should consider concentrating their efforts in future program cycles. While the gross savings overlap, the RNC ME study was important because it provides another example of how market effects could be measured and how the scoping study, logic model and the results of a market effects pilot evaluation could identify the mechanisms behind program effects. The purpose of this and the other market effects studies was to test the reliability of quantifying market effects. The finding that the spillover savings overlap with savings counted in the Codes and Standards evaluation provides valuable corroboration of the scope and size of the impact of the IOU's RNC programs on non-participants. Also, unlike the C &S evaluation, the RNC ME study identifies the *mechanisms* by which non-participant spillover is achieved and the relative importance of these mechanisms.

1 Introduction

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 the 2006-2008 time period. 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 was a separate California Public Utilities Commission (CPUC) evaluation conducted to estimate the direct impacts (energy savings and peak demand reductions) stemming from IOU new construction program participation during the 2006-2008 period (referred to as the New Construction Evaluation).[13]

The CPUC's 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)" (Eto et al., 1996).

For the 2006-2008 program cycle, the CPUC did not allow for crediting the IOU programs with any savings from market effects (CPUC, 2006).[14] 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 examined possible market effects in three areas: RNC, CFLs, and high-bay lighting.[15] Working with the CPUC, the California Institute for Energy and Environment (CIEE) developed Study Plans for (and assisted in overseeing) each of these market effect studies.

[13] See KEMA et al. 2010 for more details

[14] The California Impact Evaluation Protocol refers to non-participant spillover as follows: "Impact evaluations are limited to addressing the direct impacts of the program on participants and estimating participant spillover impacts. These studies do not include documenting program influences on the operations of a market or the program's impacts on non-participants. Program-induced changes on the way a market operates or on non-participants are addressed in the Market Effects Evaluation Protocol (California Public Utilities Commission, 2006, p. 20).

[15] The CFL and high-bay lighting market effects studies have been completed: see Cadmus et al. (2010) and KEMA and Itron (2010), respectively.

The IOUs' RNC programs consist of a portfolio of activities designed to increase the adoption of energy-efficient equipment and practices in the single-family and multifamily building industry and include the following:[16]

- Incentives for meeting efficiency criteria;
- Program Plan Check;[17]
- 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.

The Residential New Construction (Single-Family Home) Market Effects Study has the following 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. Assess the effects of pre-2006 IOU programs on the adoption of more efficient technologies and practices in the 2005 Title 24 code.

[16] The IOU's RNC programs include SCG's Advanced Home Program, SDGE's Advanced Home Program, SCE's California New Homes Program, PG&E's Residential New Construction Program and PG&E's Duct & Cover Program

[17] 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 members 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.

4. 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 (RLW Analytics et al. 2008) outlined a plan for conducting the research in two phases.

Phase I 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 impact of the 1998-2005 IOU programs on the 2005 code change. Phase I established that there was sufficient qualitative evidence of market effects that may reasonably be attributed to the IOU'S RNC programs (KEMA et al. 2009).

Phase II, reported in this document, was designed to quantify the market effects. The Phase II activities are outlined in Table 1-1.

Table 1-1: Summary of Tasks in Residential New Construction Market Effects Study—Phase II

Task	Research Activities
Plan	• Develop a plan for Phase II

1. Estimate Gross Energy Savings	• Develop a hypothetical baseline of RNC efficiency trends in California by estimating code compliance for non-program homes built from 2006-2008
	  o Utilize onsite data from inspection of homes
	• Estimate gross energy savings for the following:
	  o Above-code non-program homes compared to non-program homes just meeting code
	  o Non-program homes just meeting code compared to below code non-program homes

2. Attribution Analysis, Estimation of Net Energy Savings, Sustainability Assessment	• Using the Delphi technique, interview a panel of Title 24 Consultants and home building industry experts to estimate the role of the IOU'S RNC programs in causing the observed market effects. • Convert market effects to estimated energy savings. o Systematically analyze the uncertainty surrounding the results. • Develop recommendations regarding treatment of any RNC market effects savings in next program cycle. • 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).

2 Methodology

This evaluation was designed to quantify the market effects of the IOU'S RNC programs identified in Phase I. The Phase II activities are outlined above in Table 1-1 and described in more detail throughout the rest of this chapter.

2.1 Estimating Code Compliance and Calculating Gross Energy Savings

2.1.1 CEC Climate Zones and Climate Regions

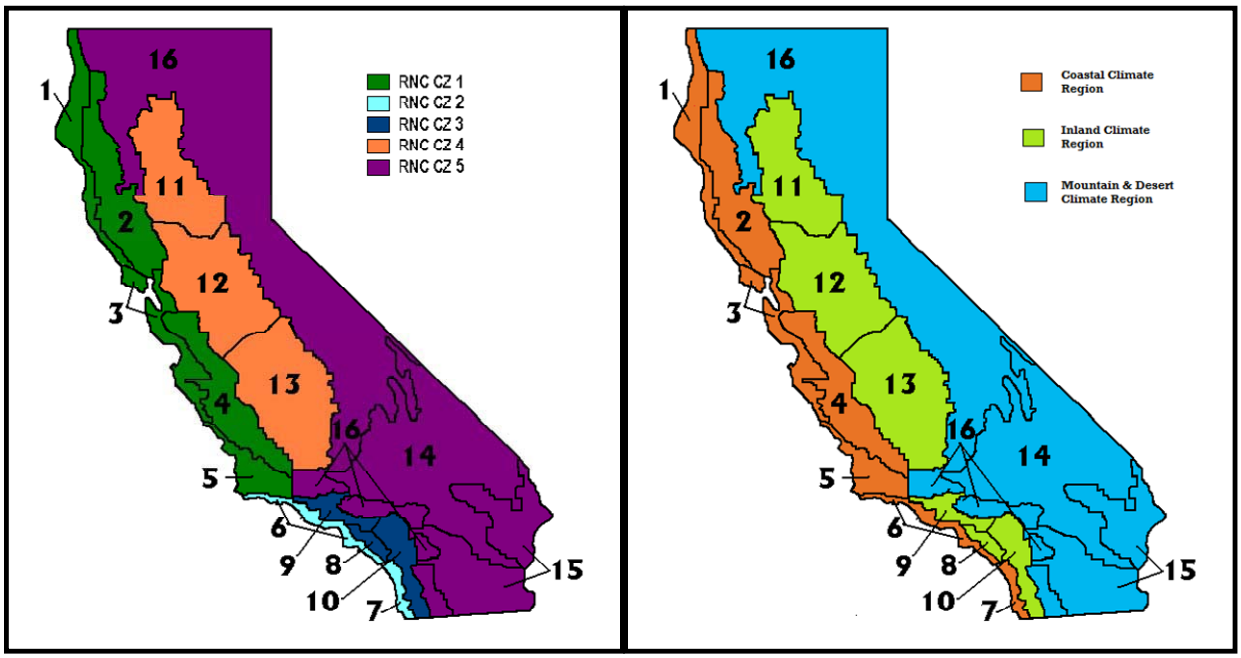
Building practices and Title 24 requirements vary across the 16 California Energy Commission (CEC) Climate Zones.[18] For this report, these zones were collapsed into three regions (for the Phase I report (KEMA et al., 2009), these zones were collapsed into five regions). The criterion for the aggregation of the climate zones was that the Title 24 requirements across these climate zones be the same or vary in only one component. Figure 2.1-1 shows the five climate regions used in the Phase I report and the three climate regions used in this report as well as the individual climate zones. Using this approach, climate zones were aggregated as follows:

- Coastal Climate Region encompasses CEC Climate Zones 1, 2, 3, 4, 5, 6 and 7 (Climate Regions 1 and 2 from the Phase I report)
- Inland Climate Region encompasses CEC Climate Zones 8, 9, 10, 11, 12 and 13 (Climate Regions 3 and 4 from the Phase I report)
- Mountain and Desert Region encompasses CEC Climate Zones 14, 15, and 16 (Climate Region 5 from the Phase I report)

Code compliance and gross energy savings were estimated statewide and for each climate region in order to examine any regional variations in construction practices and energy savings.

[18] See Chapter 3 "Historical Trends" of KEMA et al. 2010 for more details on building practices and Title 24 requirements across climate zones and regions.

Figure 2.1-1: CEC Climate Zones and Climate Regions



Source: California Energy Commission.

2.1.2 Estimation of the Code Compliance of Non-program Homes

The estimation of code compliance among non-program homes necessitated a baseline study. The New Construction Baseline Study (RNC Baseline) was conducted as part of the 2006-08 California Residential New Construction Program Evaluation and the Codes and Standards (C & S) Program evaluation. For the 194 homes included in both the baseline as well as the C & S evaluation, the team conducted a full site audit at each home, and built a compliance model from the field-observed building characteristics. Based on the outcomes of these models, we were able to determine code compliance among non-program homes and estimate the following:

- The proportion of non-program homes that are code-compliant
    - Homes that are code-compliant are defined as those homes within the compliance model error bound estimated in the 2003 Baseline Study; i.e., homes with compliance margins above -5% and below +4% [19]
- The proportion of non-program homes that are above-code
    - Homes that are above-code are defined as those homes that have a compliance margin greater than 4% above standard

[19] For more details on the 2003 Baseline Study, see Itron, Inc. and KEMA – XENERGY. 2004. *Residential New Construction Baseline Study of Building Characteristics Homes Built After 2001 Codes*. CALMAC Study ID PGE0181.01).

- The proportion of non-program homes that are below-code
    - Homes that are below-code are defined as those homes with compliance margins below -5%
- Overall average code compliance of all non-program homes
- The average proportion above-code of above-code homes (compliance margins)
- The average proportion below code of below-code homes (negative compliance margins)

We estimated compliance statewide and for each of the three climate regions.

2.1.3 Estimating Savings

We developed savings estimates for homes built above-code vis-à-vis homes built to code and homes built to code vis-à-vis homes that do not meet code, both statewide and for each of the three climate regions. We used the following steps in the RNC Baseline study to determine the savings estimates:

Step 1: Collection of On-Site Surveys. From utility new meter hook-up data, 194 non-participant sites were chosen. We collected building characteristic data in the on-site surveys, including data on lighting, appliances, heating/ventilation/air-conditioning (HVAC) systems, orientation, construction characteristics, insulation, windows, and occupant demographics. The data were quality controlled by KEMA engineering staff to ensure that the data were suitable for compliance modeling.

Step 2: Build on-site adjusted compliance models. The team built MICROPAS[20] models for the 194 non-participant sites.[21] The models were built using the actual orientation of the non-participant home, with the standard climate zone weather files built in to the simulator. The building characteristics used in the models included square footage, insulation types, wall construction, window area, and HVAC system information. The models simulate the energy consumption of the cooling, heating, and water heating end-uses for the home (as-built) and a similar home meeting code (standard). The individual end-use consumption estimates are combined and the standard and as-built usages are compared to determine the overall margin of compliance.

Step 3: Classify homes by level of code compliance or non-compliance. We classified homes into three categories: homes "just meeting code" were defined as those within the compliance model error bound estimated in the 2003 Baseline Study, with compliance margins above -5%

[20] MICROPAS is an energy simulation software program that estimates annual energy usage for heating, cooling and water heating for a home. MICROPAS is a California Energy Commission (CEC)-approved Title 24 software program. http://micropas.nittler.us/

[21] The metered energy ratios developed for the 2006-08 RNC impact evaluation were not applied in the Market Effects (ME) analysis because the ME analysis is based on compliance level, similar to the analysis approach used in the 2006-08 Codes and Standards impact evaluation. The compliance level was determined using outputs from the compliance software and estimated relative to consumption estimated for just meeting the 2001 and 2005 Title 24 standards.

and below 4%. Homes with compliance margins below -5% were classified as "below code," while those with a compliance margin greater than 4% above standard were labeled "above-code."

Step 4: Estimate the total savings. Using the assumption that the sampled homes are representative of the larger population of non-program new homes,[22] the savings for each home, compared to code, were projected to the population using the case weights derived in the original sample design from the RNC Impact Evaluation.[23] Two totals were calculated from this projection:

1. Gross electricity and natural gas savings from observed above-code homes, compared to observed code-compliant homes
2. Gross electricity and natural gas savings from observed code-compliant homes compared to observed noncompliant homes

2.2 Net Savings: Attribution of Gross Energy Savings by Title 24 Consultants and Building Industry Experts

In order to estimate net energy savings attributable to the IOU programs and other factors, the evaluation team employed the Delphi method, an approach recommended by the CPUC Evaluation Protocols (CPUC, 2006). The Delphi method is often characterized as a group communication process or forecasting method that relies upon panels of experts to develop an estimate or group judgment on a topic or issue. It is an iterative process that involves at least two rounds of questions or interviews with the panels. The Delphi technique is based on the principle that structured responses from experts will be more accurate than unstructured responses from individuals (Hsu and Sandford, 2007; Linstone and Turoff, 1975; Ludwig, 1997).

Data collection using the Delphi technique generally uses the following steps. First, panelists, who are experts in the field or topic of interest, are recruited to participate in the Delphi panel. Next, the panelists are presented with a topic or scenario, supporting data, and a questionnaire. The questionnaire typically includes both structured, or close-ended, questions and open-ended questions. The open-ended questions are used to solicit respondents' assumptions or reasoning they made in their responses to the close-ended questions of the survey. Next, the data are summarized, and a second questionnaire is sent to the panelists. Data summaries generally include measures of central tendency, such as a median or mean, and measures summarizing the dispersion of the data, such as inter-quartile ranges and outlier responses, and assumptions and reasoning offered by fellow panelists from their first-round responses. In the second questionnaire, respondents are asked to review the data summary and their own original

[22] The assumption is that the homes built within the territories of the four IOUs are representative of all homes built in California. We believe this is a valid assumption for two reasons: first, because almost all homes have service from at least one IOU, even if their gas or electricity comes from a municipal utility; and second, because the same builders building homes in utility territories also build the homes in non-IOU territories.

[23] The sample design methodology is discussed in detail in the RNC Impact Evaluation (KEMA et al., 2010).

responses, provide revisions to their original responses (if necessary), and provide their reasoning for revising (or retaining) their original responses. Subsequent rounds of data collection follow the pattern of the second round survey (Hsu and Sandford, 2007; Linstone and Turoff, 1975; Ludwig, 1997).

For this evaluation, we recruited two panels: a panel of Title 24 consultants and a panel of building industry experts. A total of 24 Title 24 consultants participated in the first panel. The panel comprised 18 Title 24 consultants who were interviewed for Phase I and six additional Title 24 Consultants who were recruited to the panel.[24] The Title 24 consultants had consulted on 61,390 of non-program homes built during the 2006 - 2008 time period, or roughly 36% of the 172,553 built during the 2006 – 2008 time period. The building industry experts panel included seven respondents.[25] It should be noted two Title 24 consultants are responsible for disproportionate numbers of non-program homes. One Title 24 consultant had consulted on 40% of all non-program homes accounted for by the Title 24 sample and a second had consulted on 33% of the homes. Respondents included experts on the RNC industry interviewed for the Scoping Study of Phase I (see KEMA et al., 2009). The evaluation team would like to point out that one of the building industry experts was not confident in the Delphi process, expressing skepticism in the ability to isolate the attribution of net energy savings due to the IOU's RNC programs and other factors.

2.2.1 Round One of the Delphi Survey

The survey for round one of the Delphi panel was developed in Microsoft Excel, pre-tested with the help of four Title 24 consultants, and administered via email. In an effort to increase the number of respondents, the evaluation team followed-up with non-respondents through numerous emails, phone calls and a letter, printed on CPUC letterhead, sent via priority mail.[26]

The survey presented the panelists with data on code compliance and estimates of annual gross energy savings from non-program homes exceeding code compared to homes just meeting code, and energy savings from non-program homes just meeting code compared to below-code homes in the 2006 to 2008 period, statewide and by climate region.

[24] For the panel of Title 24 consultants the evaluation team contacted and recruited all 45 Title 24 consultants who were interviewed for the Phase I report. Of those 45, 18 agreed to participate in the panel while the others indicated that they did not have the time to participate, or they lacked the expertise required to participate, or they simply did not respond to multiple emails, phone calls and priority mailings. In addition, the evaluation team contacted and recruited another 122 Title 24 consultants who were in the sample of Title 24 consultants from Phase I (but did not participate in the Phase I interviews). Of these 122 Title 24 consultants, 21 expressed interest in participating in the panel and six participated in the panel.

[25] A total of 21 building experts were contacted and recruited to participate in the Delphi panel with seven agreeing to participate. Seven building experts were unable to participate, indicating that they either did not have the time to participate or the expertise required to participate. Four others never responded to multiple emails, phone calls and priority mailings.

[26] Copies of the survey and correspondence are available in Appendix A.

After reviewing the compliance and gross savings data, panelists were asked to identify the climate regions of California for which they were familiar with current building practices, to identify the building practices or technologies used to help non-program homes exceed or meet

code, and to estimate the proportion of the electricity and natural gas savings that is attributable to the following factors:

- The 2006-2008 IOU'S RNC programs
- The pre-2006 IOU's RNC programs
- Non-IOU'S RNC programs such as ENERGY STAR Homes, LEED for Homes and the Solar Initiative
- Other factors, including the downturn in the housing market, changes in energy prices, global warming/climate change, and naturally occurring advances in the RNC industry

These responses provided initial estimates of net savings from increased above-code practices and increased compliance.

In addition, the survey instrument asked the panelists to estimate how much of the net savings in non-program homes that they attribute to the IOU programs came from different IOU program elements: outreach, training of local code officials, other program elements, training of builders, incentives, training of Title 24 consultants, advertising, training of subcontractors, and design assistance. This provided an indication of the importance of specific program elements, and separate estimates of the effects of different types of training, as well as separation of training from the effects of Plan Check review.

Next, in order to assess the extent to which market effects are likely to persist in the absence or reduction of the IOU programs, respondents were asked to estimate how much the net savings attributable to the IOU programs would be reduced in homes built in the future if the budget available to the IOU'S RNC programs were reduced by 50% and if the IOU'S RNC programs were eliminated. These questions were intended to assess the sustainability of the observed market effects.

Last, Delphi panelists were asked to estimate the percentage of homes that would have been below-code in the absence of the IOU'S RNC programs and other factors(but assuming all other factors remain unchanged from what actually occurred), and the compliance margin of below-code homes in the absence of each factor.

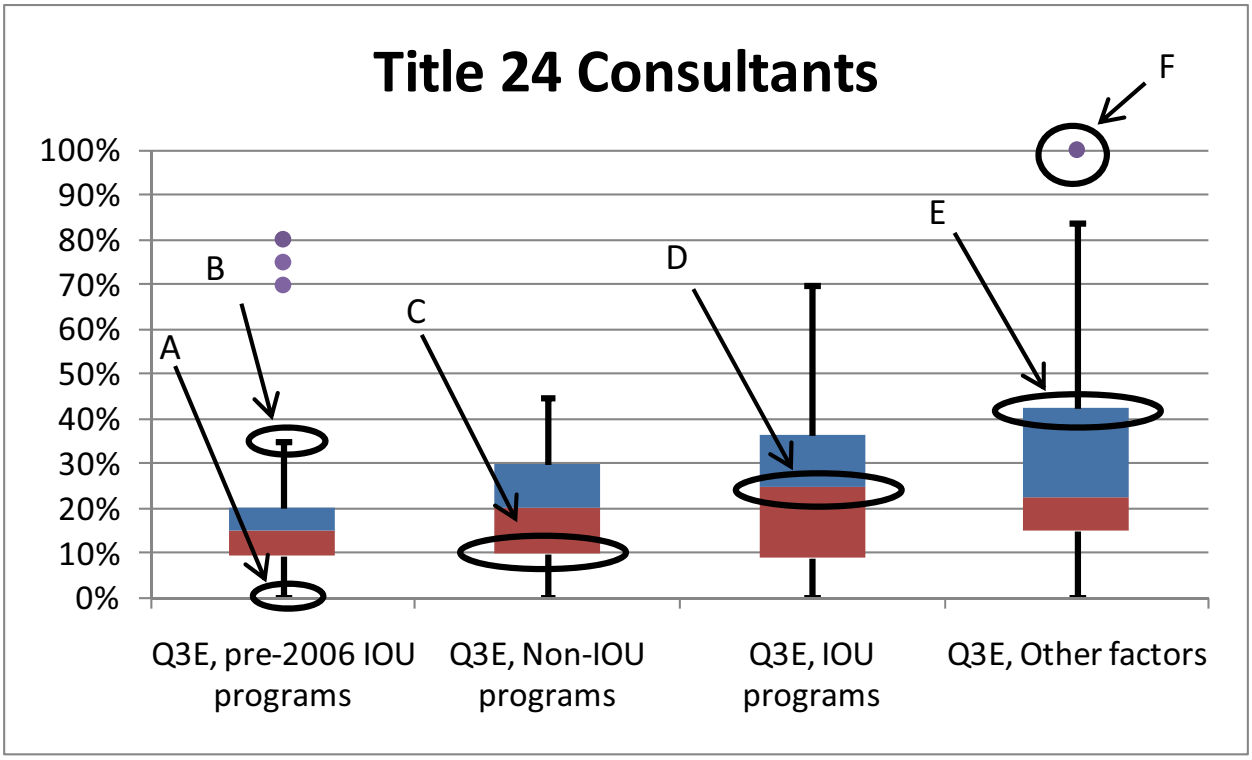
2.2.2 Round Two of the Delphi Survey

The evaluation team analyzed both panels' responses to the round one survey and presented summaries as box and whisker plots for each panel. A box and whisker plot is a way of graphically summarizing the distribution of a set of numerical data. Figure 2.2-1 is an example of a box and whisker plot presented to the panelists. The figure summarizes the responses by Title

24 Consultants in their attribution of electricity savings from above-code homes compared to homes just meeting code. The box plot identifies several key data points:

- The smallest response (the bottom whisker, labeled "A" in Figure 2.2-1)
- The largest response (the top whisker, labeled "B" in Figure 2.2-1)
- The first quartile response (the bottom of the box (red), labeled "C" in Figure 2.2-1)
- The median response (the midpoint of the distribution, labeled "D" in Figure 2.2-1)
- The third quartile response (the top of the box (blue), labeled "E" in Figure 2.2-1)
- In some cases, responses that are significantly larger or smaller than nearly all other responses are presented outside of the box plot (labeled "F" in Figure 2.2-1)
- The box represents 50% of all responses (i.e., responses ranging from the first quartile to the third quartile)
- A smaller box, such as the box of responses attributing savings to the pre-2006 IOU programs, indicates that responses are clustered across a relatively small range
- A larger box, such as the box of responses attributing savings to the IOU programs, indicates that responses are spread across a relatively large range

Figure 2.2-1: Above-code Homes, Attribution of Electricity Savings by Title 24 Consultants



In addition, the round two survey included the assumptions and reasoning offered by fellow panelists from their first round responses as well as the respondent's original responses from the round one survey.

In the second questionnaire, respondents were asked to review the data summary and their own original responses, provide revisions to their original responses (if necessary), and provide their reasoning for revising (or retaining) their original responses. For each set of responses, respondents were asked to assess their level of confidence in their own responses, the responses of Title 24 consultants and the responses of building industry experts on a scale from 0 to 10, with zero meaning "not at all confident" and 10 meaning "extremely confident." [27] All Delphi panelists provided responses to round two of the Delphi process.

From the round two survey responses the evaluation team calculated mean values with a 90% confidence interval in order to estimate the net energy savings attributable to the IOU'S RNC programs and other factors, the relative importance of the individual elements of the program, the sustainability of the observed market effects, and the effect on compliance rates and compliance margins in the absence of the program.

The responses of Title 24 consultants are reported as both weighted and unweighted, with weights based on the percentage of non-program homes each Title 24 consultant reported they had consulted on.[28] Responses from building industry experts are reported unweighted and serve as a qualitative check on the responses of the Title 24 consultants

2.3 Potential Overlapping Nonparticipant Spillover

The evaluation team conducted a review of the evaluations and claimed savings of other IOU programs, including the Codes and Standards (C&S) Program. While we found that there is no double counting of savings and currently no potential overlapping nonparticipant spillover in the claimed savings from the Government Partnership Programs, the Builder Energy Code Training (BECT) Program, or the Green Building Technical Support Services (Build it Green) Program, there does appear to be overlap in savings with the C&S Program. In addition, there may be potential for overlap with the other programs in the future, particularly if nonparticipant spillover is considered a resource in future program cycles.[29]

In order to account for any potential overlapping nonparticipant spillover from other IOU programs (excluding the C&S Program), NMR conducted a review of the evaluations and claimed savings for the following programs:

- SCE2519, SCG3521, SCE2525, SCE2567, SCE2568: Title 24 Codes and Standards Workshops (Government Partnerships Programs)
- PGE 2044: Builder Energy Code Training (BECT)

[27] This method of rating confidence in estimates has been used in other Delphi studies to better assess the panelists' confidence in providing estimates (Linstone and Turoff, 1975).

[28] As noted earlier, two Title 24 consultants are responsible for disproportionate numbers of non-program homes. One Title 24 consultant had consulted on 40% of all non-program homes consulted on by the Title 24 sample and a second had consulted on 33%.

[29] A more complete review of potential overlap with the Government Partnership Programs, the Builder Energy Code Training (BECT) Program and the Green Building Technical Support Services (Build it Green) Program is available in Appendix D

- PGE 2057: Green Building Technical Support Services (Build it Green)

Of these programs, only the Title 24 Codes and Standards Workshops, Government Partnership Programs (SCE2519, SCE2525, SCE2567 and SCE2568) claimed any savings. The claimed savings totaled 1,933 kW and 9,783,517 kWh for the 2006 to 2008 program year cycle. However, upon further review of savings reports submitted through the Energy Efficiency Groupware Application (EEGA)[30] and through data reported in the CPUC Energy Division's Evaluation Reporting Tools / Database (ERT), it became apparent that none of the claimed savings were for the RNC sector.[31]

The Builder Energy Code Training program (BECT, PGE 2044) and the Green Building Technical Support Services (Build it Green; PGE 2057) did not have explicit energy savings goals and did not claim any savings as part of the ERT.[32] It should be noted that non-impact evaluations of the programs found that the programs were responsible for energy savings during the 2006-2008 cycle. The Green Building Technical Support Services (Build it Green; PGE 2057) achieved savings in existing homes rather than new homes, while the Builder Energy Code Training program (BECT, PGE 2044) achieved savings in new homes through improved code compliance. Again, because these were non-resource programs, these savings were not claimed, so there is no overlap in savings.

However, if energy savings from nonparticipant spillover are treated as a resource in future program cycles, it may be necessary to take into account savings from programs such as the Builder Energy Code Training program (BECT, PGE 2044) in order to avoid double counting of savings.

The evaluation team found that all of the energy savings from non-participant spillover had been counted in the Codes and Standards evaluation. The Codes and Standards Program evaluation captured all spillover savings in non-program (baseline) homes (i.e., improved compliance with code and facilitating the construction of above-code homes) from 2006-2008 utility programs, because such savings contribute to compliance with Title 24. The RNC market effects (ME) study measured savings in homes exceeding the 2005 code relative to homes just meeting the code and in homes just meeting the 2005 code relative to homes not meeting the code. The Codes and Standards (C & S) Program evaluation measured savings in all homes using the 2001 code as baseline. Therefore, all gross savings in the RNC ME study are a strict subset of and should have been counted in the C & S Program evaluation's gross standard savings (see Appendix F for more details).

[30] http://eega2006.cpuc.ca.gov/Default.aspx

[31] Of the 9,783,517 kWh in savings, 9,742,510.8 kWh were from the non-residential sector and 41,006.7 kWh were from the residential retrofit and residential replace on burnout sectors.
http://www.edcentralserver.com/ERT/ERT%20(v5_3_5)_2003.exe

[32] The Builder Energy Code Training program (BECT, PGE 2044) was a non-resource program and therefore savings are not claimed.

It is important to point out that while it is likely that there is overlap in savings with the C & S Programs, the market effects research helps program administrators understand how and why the savings were achieved and where they should consider concentrating their efforts in future program cycles. While the gross savings overlap, the RNC ME study was important because it provides an example of how market effects can be measured and how the scoping study, logic model and the results of a market effects pilot evaluation can identify the mechanisms behind program effects. The purpose of this and the other market effects studies was to test the reliability of quantifying market effects. The finding that the spillover savings overlap with savings counted in the Codes and Standards evaluation provides valuable corroboration of the scope and size of the impact of the IOU's RNC programs on non-participants. .

2.4 Additional Data Collection and Analysis Tasks

In addition to the Delphi surveys, several other data collection and analysis tasks were included in this evaluation.

The evaluation team re-examined the estimates from Phase I of the influence of the IOU'S RNC programs on the building practices of non-program homes, by comparing estimates of above-code building practices and market effects provided by Title 24 contractors, HERS raters, builders and HVAC contractors in Phase I with estimates of code compliance, gross savings, and net program effects from Phase II.

Based on all the work conducted in the Scoping Study, Phase I, and Phase II, the team qualitatively assessed the sustainability of market effects by answering the questions about market transformation posed by Hewitt: [33]

- Is someone making money by offering it?
- Has a private market developed to continue its facilitation?
- Has the profession or trade adopted it as a standard practice?
- Would it be difficult or costly to revert to earlier equipment or practices?
- Are end-users requesting or demanding it?
- Have the risks to private market actors been reduced or removed?

Finally, based on a review of the CPUC Market Effects Evaluation Protocol as well as the evaluation process and findings from Phases I and II of the Residential New Construction (Single-Family Home) Market Effects study, the evaluation team provided recommended changes to the protocol.

[33] Hewitt, 2000.

3 Summary of Findings from Phase I Report

This chapter presents a summary of the results of Phase I of the Residential New Construction (RNC), Single Family Home Programs Market Effects Study.[34]

3.1 Overview of Phase I Report

Phase I covered the market and attribution analysis of the IOU's RNC programs. Phase I, using primarily qualitative methods, aimed to establish whether or not there was 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. In addition, Phase I was designed to assess the historical context of RNC design and construction practices in California, and to analyze the cumulative impact of the 1998-2005 IOU programs on the 2005 code change. Phase I established that there was sufficient qualitative evidence of market effects that may reasonably be attributed to the IOU'S RNC programs.

The key findings and recommendations of this research are summarized in Table 3.1-1 below.

Table 3.1-1: Key Findings and Recommendations —Phase I

Finding	Recommendation
There is evidence for discernible non-participant spillover from the 2006-2008 IOU'S 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.	Continue (and as feasible, expand) the successful training of builders and other market actors.
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.[35]	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[36]
	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

[34] See KEMA et al., 2009 for the full Phase I report.

[35] 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'S 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.

[36] http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_2011_comments

	ask for efficiency and ENERGY STAR certification.
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 systematically aimed at transforming the market.	Since market transformation is a program goal, design the programs to achieve market transformation.
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.
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.

The primary research activities conducted in Phase I were an analysis of historical trends in energy efficiency in the RNC market in California, 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 3.1-2 below summarizes the research activities carried out in Phase I.

Table 3.1-2: Summary of Residential New Construction Market Effects Study—Phase I

Task	Research Activities
1. Analysis of Market Evolution	• Reconstruct historical trends concerning energy efficiency in the RNC market in California o Identify trends in RNC efficiency practices in California o Identify trends in builders' awareness, attitudes, and practices o Identify trends in other market actors' awareness, attitudes, and practices o Identify trends in home buyers' awareness and attitudes o Identify trends in incremental costs of efficiency measures
2. Analysis of Expected Outcomes	• Analyze the possible market effects of IOU'S RNC programs on homes whose builders did not receive incentives from the IOU programs (from here on, referred to as non-program homes[37]), and on the RNC market for years 2006-2008 o Interview non-participating builders, home buyers, and other market actors
3. Analysis of Code Changes	• Analyze cumulative impact of utility RNC programs (not C&S programs *per se)* on 2005 Title 24 o Interview experts in the homebuilding industry.
4. Attribution Analysis	• Sift through the evidence collected to make a case regarding the role of utility RNC programs in causing the observed market effects.

[37] 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 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'S 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.[38] 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.

3.2 Phase I Findings – Program Participation and New Construction Activity

A major backdrop to the Phase I RNC market effects evaluation is the low level of participation in the IOU'S 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 permitted in the IOU territories, compared to just 0.4% in 2006—but meanwhile, the total market shrank, from 106,479 permitted homes in 2006 to 32,664

[38] 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.

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.

Table 3.2-1 and Figure 3.2-1present the total number of single-family homes with permits to build in California by year since 1998.[39] Table 3.2-1 (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.[40]

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 the data represent building permits and 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. During the 2006-2008 time period it appears that this lag was even longer as new meter hookup data provided by the IOUs suggests that 172,553 homes were built in the IOU territories during the 2006-2008 time period. Despite this lag, because the permit data cover a 10-year time period, it is useful to review the permit data to examine changes in housing permits over time.

The Whole House Participants column for 2002 to 2005 shows the number of participant homes committed under the IOU programs, not the number actually constructed during that time frame. However, for the 2006-2008 program cycle, the CPUC required the IOUs to only report units that had been 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.

[39] Construction Industry Research Board (CIRB). This does not represent the total number of homes built during the time period, but rather the number of permits for home construction. The evaluation team estimates that there were 172,553 homes built in the IOU territories during the 2006-2008 time period, based on new meter hookup requests reported by the IOUs to the evaluation team.

[40] Participant data were collected from the following sources: RLW Analytics, 2006; RLW Analytics, 2007 and California IOU program tracking data for 2006-2007.

Figure 3.2-1: Single-Family Home Building Permits in California since 1998

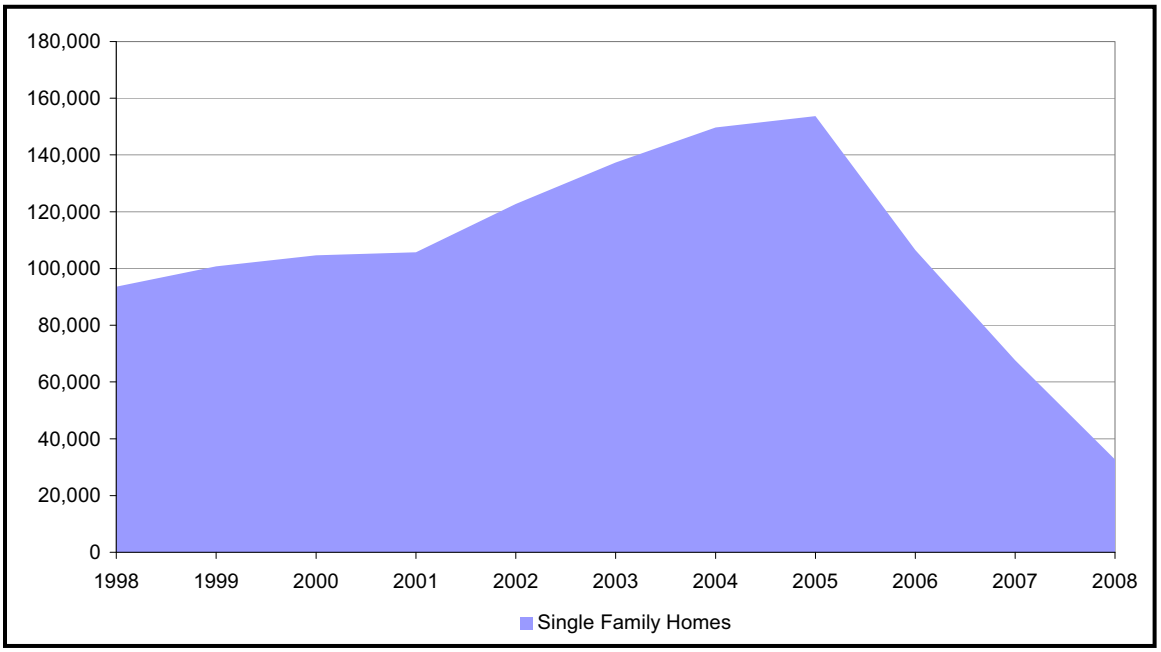


Table 3.2-1: California Single-Family Home Building Permits and Participation in IOU'S RNC Programs

Year	ENERGY STAR Homes	Whole House Participants in IOU'S RNC Programs	Whole House Participants, % of New Home Market	All New Homes Permitted 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	5,381	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'S RNC Programs to All New Homes Built in IOU Territories.

3.3 Phase I Findings – Efficiency in the Residential New Construction Market

Another important backdrop to the Phase I 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[41] 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[42] 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[43] 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[44] increased from 0% of water heaters in homes built under the 1995 standards to 25% in homes built under the 2005 standards

[41] Glazing area equals window area divided by exterior wall area.
[42] 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.
[43] 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.
[44] 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[45] 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[46] 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[47] 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 and increased to 5.4% under the 2005 standards.[48] Of course, standards became progressively more stringent during this time.
  - The percentage of below-code 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 and decreased to 22% of homes built under the 2005 standards. Again, standards became progressively more stringent during this time.

3.4 Phase I Findings – Analysis of Expected Outcomes

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 3.4-1. 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 3.4-1 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

[45] R-value indicates insulation's resistance to heat flow; the higher the R-value, the greater the insulating effectiveness.
[46] 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
[47] 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
[48] 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

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 were largely qualitative. The intent was to examine the available data, and make inferences based on the preponderance of evidence.

Figure 3.4-1 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 the Phase I study we 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, but those effects are addressed by the Residential New Construction Impact Evaluation (see KEMA et al., 2010).

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.

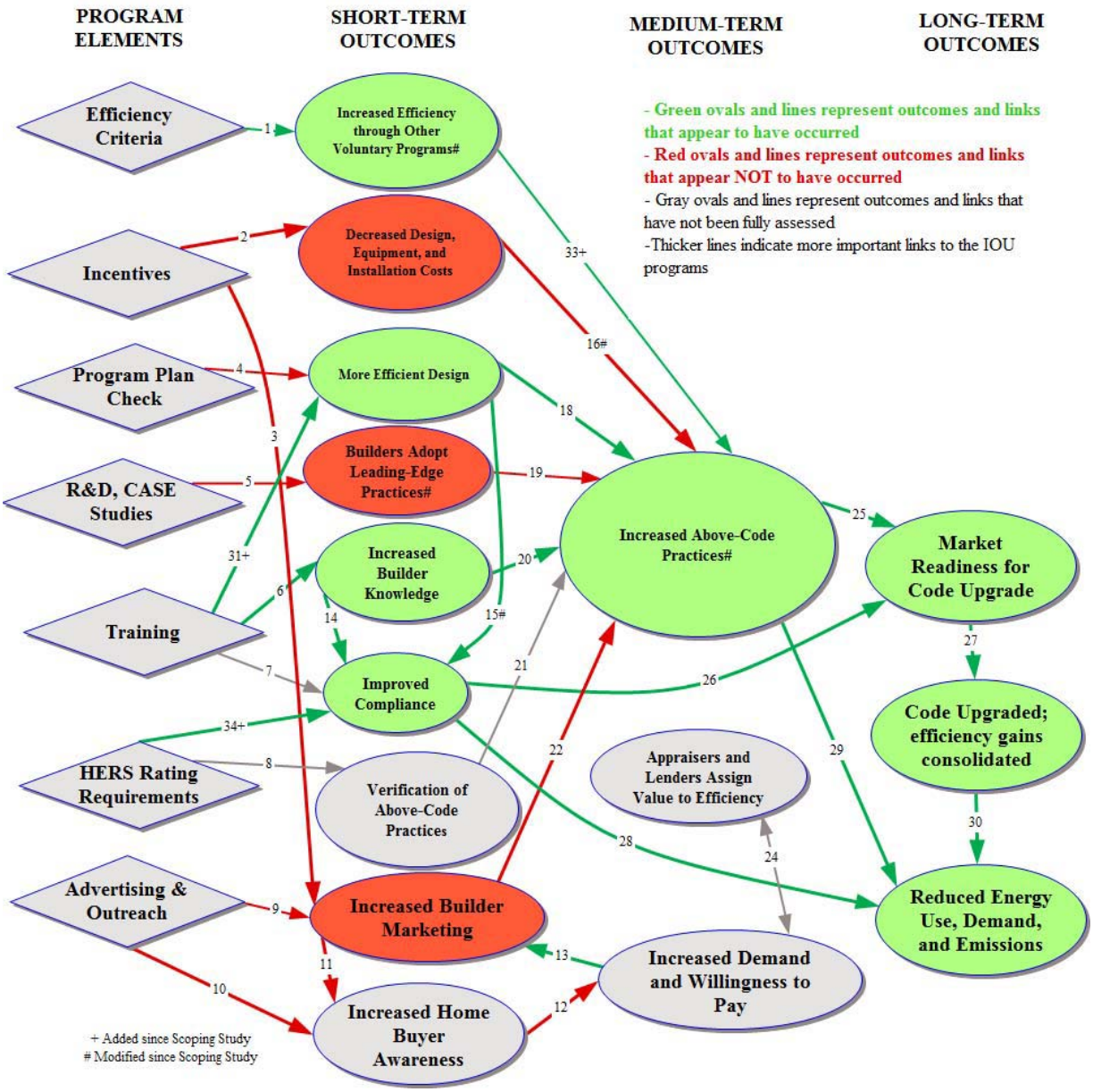
The 2006-2008 IOU programs also appear to have had observable effects—both direct and indirect—on market readiness for a future code upgrade (to occur in 2011), with the indirect effects coming primarily from contributions to improved code compliance and increased above-code practices (Link 25), primarily 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.

Phase II provides data that appears to confirm that the observed effects of above-code practices, improved code-compliance and market readiness for a code upgrade have led to observed energy savings in non-participant homes.

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 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.

Figure 3.4-1: Outcomes and Links to the IOU Programs



4 Phase II Findings

4.1 Introduction

Phase I of this evaluation found that the 2006-2008 IOU programs appeared to have had discernible effects on improved code compliance of non-program homes and on increased above-code practices.

This section reports on the gross and net energy savings attributable to the IOU'S RNC programs from Phase II and focuses on two of the three ways that the IOU programs can lead to reduced energy use:[49]

1. By improving compliance with existing code
2. By facilitating construction that is more efficient than required by the current code

4.1.1 Gross Savings Analysis

In order to determine the gross savings attributable to the IOU's RNC programs, the evaluation team first estimated the number of non-program single-family homes (172,553) built in the IOU territories during the 2006-2008 time period. Next, the evaluation team estimated compliance rates and the overall compliance margins statewide and by the three climate regions—Coastal, Inland and the Mountain and Desert Region.

Finally, based on the number of non-program single-family homes in each region, the regional compliance rates and the regional compliance margins, the evaluation team calculated the gross savings for two categories of non-program homes:

- Homes built above-code compared to homes just meeting code
  - 39,225 MWh of electricity savings annually
  - 711 MDth of natural gas savings annually
- Homes just meeting code compared to below-code homes
  - 5,471MWhs of electricity savings annually
  - 78 MDth of natural gas savings annually

Additional details of the gross savings analysis are found in Section 4.2: Code Compliance and Gross Energy Savings.

4.1.2 Net Savings Analysis

In order to convert the gross savings estimates into net savings estimates, the evaluation team employed two Delphi panels, consisting of 24 Title 24 consultants and seven building industry experts. The evaluation team analyzed the Title 24 consultant responses both weighted and

[49] The IOU programs can also reduce energy use by contributing to code upgrades.

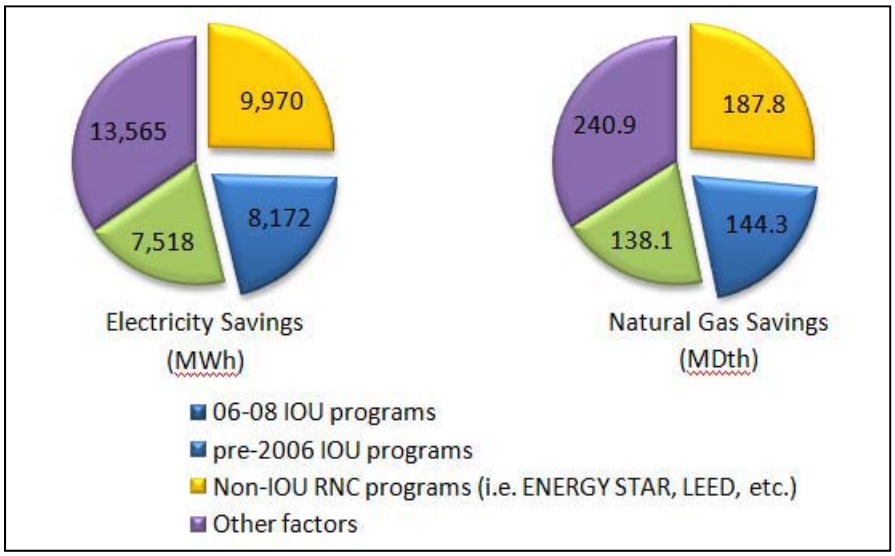
unweighted and used the building industry expert responses as a qualitative check on the responses of the Title 24 consultants. The evaluation team has more confidence in the unweighted than the weighted responses of the Title 24 consultants because there is generally more agreement between the unweighted responses and the responses of the building industry experts, and also because the weighted responses are largely dependent upon the responses of three Title 24 consultants who together are responsible for 87% of the non-program homes consulted on by the Title 24 sample.

4.1.2.1 Net Savings, Above-Code Homes Compared to Homes Just Meeting Code

Based on the unweighted Title 24 consultant responses, the Delphi panel estimated that the 2006-2008 IOU'S RNC programs are responsible for 25%[50] (9,970 MWh) of the gross electricity savings and 26%[51] (187.8 MDth) of the gross natural gas savings due to above-code homes compared to code-compliant homes (Figure 4.1-1). In addition, the Delphi panel estimated that 21% (8,172 MWh) of the gross electricity savings and 20% (144.3 MDth) of the gross natural gas savings are due to the pre-2006 IOU programs. *The 2006-2008 and pre-2006 IOU programs taken together, then, account for nearly half of gross electricity and natural gas savings in above-code non-program homes.* Both panels identified the various elements of training (builders, subcontractors, Title 24 and code officials) as the most important elements of the IOU'S RNC programs. Both panels also said that the savings attributable to the program would not persist without continuing the programs. Instead, program savings would decline significantly if the programs are cut or eliminated.

A complete analysis of net savings, including building measures and practices responsible for above-code homes, verbatim responses on the role of IOU programs and other factors in savings from above-code homes, attribution of energy savings to IOU program elements, and the persistence of energy savings from above-code homes in the absence or reduction of the IOU programs are contained in Section 4.3: Net Energy Savings.

Figure 4.1-1: Net Savings, Above-Code Homes Compared to Homes Just Meeting Code



[50] The 90% confidence interval ranging from 20% to 31% of gross electricity savings
[51] The 90% confidence interval ranging from 21% to 32% of gross natural gas savings

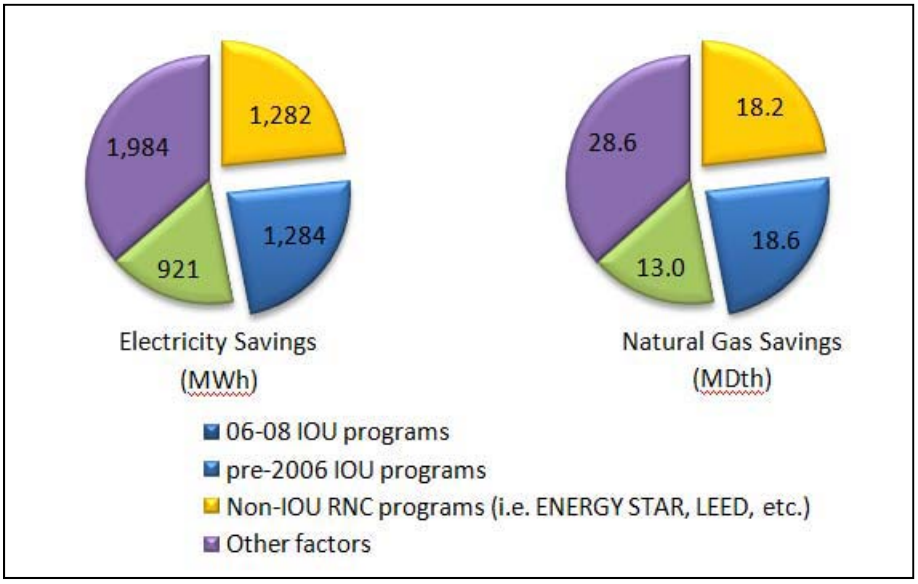
4.1.2.2 Net Savings Code-Compliant Homes Compared to Below-Code Homes

Again, based on the unweighted Title 24 consultant responses, the Delphi panel estimated that the 2006-2008 IOU'S RNC programs are responsible for 23%[52] (1,282 MWh) of the gross electricity savings and 23%[53] (18.2 MDth) of the gross natural gas savings in code-compliant homes compared to below-code homes (Figure 4.1-2). In addition, the Delphi panel estimated that 23% (1,284 MWh) of the gross electricity savings and 24% (18.6 MDth) of the gross natural gas savings are due to the pre-2006 IOU programs. *Thus, the 2006-2008 and pre-2006 IOU programs taken together account for nearly half of gross electricity and natural gas savings from achieving code compliance in non-program homes.* Both panels identified the various elements of training (builders, subcontractors, Title 24 and code officials) as the most important aspects of the IOU'S RNC programs. Both panels also said that the savings attributable to the program would not persist without continuing the programs. Instead, program savings would decline significantly if the programs are cut or eliminated.

A complete analysis of net savings, including building measures and practices responsible for code-compliant homes, verbatim responses on the role of IOU programs and other factors in savings from code-compliant homes, attribution of energy savings to IOU program elements, and the persistence of energy savings from code-compliant homes in the absence or reduction of the IOU programs are contained in Section 4.3: Net Energy Savings.

[52] The 90% confidence interval ranging from 18% to 29% of gross electricity savings
[53] The 90% confidence interval ranging from 17% to 29% of gross natural gas savings

Figure 4.1-2: Net Savings Code-Compliant Homes Compared to Below-code Homes



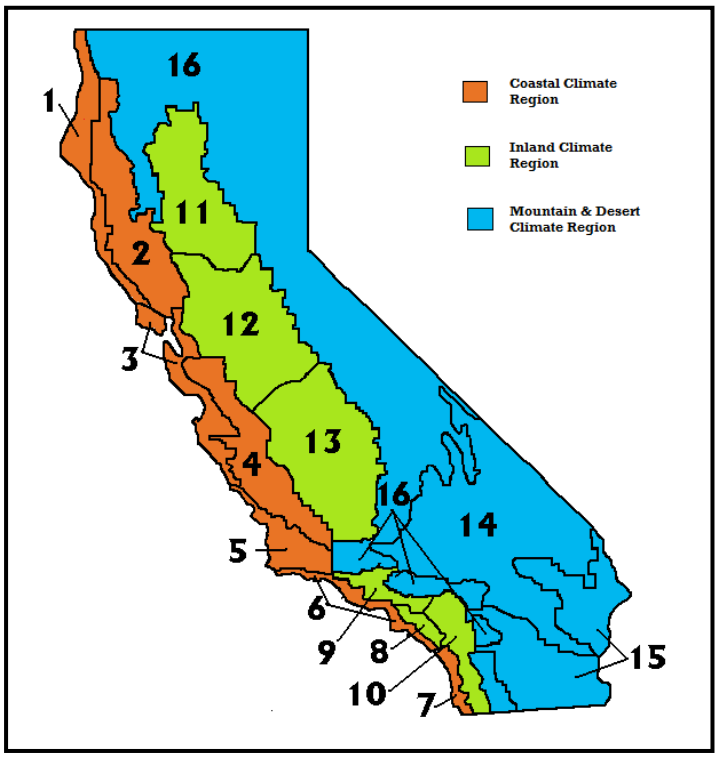
4.2 Code Compliance and Gross Energy Savings

The team estimated code compliance and gross energy savings statewide and for each of the three climate regions (see Figure 4.2-1) in order to examine any regional variations in construction practices and energy savings. The evaluation team was able to estimate the following:

- The proportion of non-program homes that are code-compliant, above-code and below code, statewide and by climate region[54]
- The average proportion above-code of above-code homes (compliance margins), statewide and by climate region
- The average proportion below code of below-code homes (negative compliance margins), statewide and by climate region
- Overall average code compliance of all non-program homes, statewide and by climate region
- Gross electricity and natural gas savings from observed above-code homes, compared to observed code-compliant homes
- Gross electricity and natural gas savings from observed code-compliant homes compared to observed noncompliant homes

[54] Homes that are code-compliant are defined as those homes within the compliance model error bound estimated in the 2003 Baseline Study; i.e., homes with compliance margins above -5% and below +4% (for more details on the 2003 Baseline Study, see Itron, Inc. and KEMA – XENERGY. 2004. *Residential New Construction Baseline Study of Building Characteristics Homes Built After 2001 Codes*. CALMAC Study ID PGE0181.01). Homes that are above-code are defined as those homes that have a compliance margin greater than 4% above standard. Homes that are below code are defined as those homes with compliance margins below -5%.

Figure 4.2-1: CEC Climate Zones and Climate Regions



Source: California Energy Commission.

Overall, there were 172,553 non-program single-family homes built in the IOU territories during the 2006-2008 time period (Table 4.2-1).[55] Over six in ten homes (61%) were built in the Inland Region, followed by the Mountain and Desert Region (23%) and the Coastal Region (16%).

Table 4.2-1: Number of Single-Family Non-Program Homes Built in the California IOU Territories, 2006-2008

Region	Number of Homes	Percentage of Homes
Coastal	27,572	16%
Inland	106,002	61%
Mountain & Desert	38,979	23%
Statewide	172,553	100%

[55] Home construction data are based on IOU data for new meter hookup requests during the 2006-2008 time period. In the Phase I report the evaluation team estimated that 201,196 non-program single-family homes built in the IOU territories during the 2006-2008 time period. The Phase I report data were based on new permit data provided by the Construction Industry Research Board (CIRB). Because the CIRB data represent permits rather than completed homes, and the new meter hookup requests provided by the IOUs represent completed homes, we have more confidence in the new meter hookup data.

Table 4.2-2 reports the overall compliance margins of single-family non-program homes built during the 2006 to 2008 time period for the entire state of California and by the three climate regions. Statewide, the average compliance margin is 5.4% above-code, with homes in the Coastal region having the highest compliance margin (11.1% compliance margin), followed by the Mountain and Desert Region (5.8% compliance margin) and the Inland Region (4.5% compliance margin).

Table 4.2-2: Overall Compliance Margins for Non-Program Homes, 2006-2008

Region	Average Compliance Margin
Statewide	7.4%
Coastal	4.4%
Inland	6.4%
Mountain & Desert	10.4%

Table 4.2-3 presents the distribution of compliance rates and compliance margins statewide and by region of single-family non-program homes. Statewide, 58% of homes are above-code, 29% of homes are code-compliant and 13% are below-code. Above-code homes are, on average, 13% above-code and below-code homes are, on average, 10% below code. The distribution of compliance is relatively uniform in the Coastal and Inland regions, but the Mountain and Desert region has a higher percentage of above-code homes and no homes were found to be below-code. Compliance margins are relatively uniform across the three climate regions with the exception of the lack of below-code homes in the Mountain and Desert region.

Table 4.2-3: Compliance Rates and Compliance Margins for Non-Program Homes, 2006-2008

Region	Compliance Type	Percent of Homes in Region	Average Compliance Margin
Statewide	Above-code	58%	12.8%
	Code-compliant	29%	0.3%
	Below-code	13%	-9.6%
Coastal	Above-code	53%	12.3%
	Code-compliant	34%	-0.6%
	Below-code	13%	-13.5%
Inland	Above-code	56%	12.4%
	Code-compliant	28%	0.5%
	Below-code	17%	-8.9%
Mountain & Desert	Above-code	75%	12.8%
	Code-compliant	25%	0.3%
	Below-code	0%	0.0%

Table 4.2-4 presents data on the electricity and natural gas savings due to homes built above-code compared to homes just meeting code, statewide and by region. The average above-code home will result in 17% savings in electricity usage and 11% savings in natural gas usage over the average code-compliant home. Overall, above-code homes will save 39,225 MWh of electricity annually and 711 MDth[56] of natural gas annually.

Table 4.2-4: Annual Gross Energy Savings of Above-Code Non-Program Homes Compared to Code-Compliant Non-Program Homes, 2006-2008

Energy Savings		Statewide	Coastal Climate Region	Inland Climate Region	Mountain & Desert Climate Region
Savings on Electricity Usage	%	17%	22%	16%	16%
	MWh	39,225	864	18,659	19,702
Savings on Natural Gas Usage	%	11%	11%	11%	11%
	MDth	711	97	399	215

Gross energy savings vary quite dramatically by region, with the Mountain and Desert region being responsible for 50% of the gross electricity savings while representing only 23% of the non-program homes, and the Coastal region being responsible for only 2% of the gross electricity savings (Table 4.2-5). This is likely due to the disparity in cooling needs between the two regions. Gross natural gas savings are distributed more proportionately across the three regions.

Table 4.2-5: Percentage of Gross Savings by Region and Savings Per Home, Above-Code Non-Program Homes Compared to Code-Compliant Non-Program Homes, 2006-2008

Region	Percentage of Non-Program Homes	Annual Savings		Percentage of statewide electricity savings	Percentage of statewide natural gas savings	Average savings per above-code home	
		Electricity (MWh)	Natural Gas (MDth)			Electricity (kWh)	Natural Gas (Therms)
Coastal	16%	864	97	2%	14%	59	66
Inland	61%	18,659	399	48%	56%	316	68
Mountain & Desert	23%	19,702	215	50%	30%	674	73
Statewide	100%	39,225	711	100%	100%	390	71

[56] MDth is an abbreviation for thousand decatherms

Table 4.2-6 presents data on the electricity and natural gas savings due to homes just meeting code compared to below-code homes, statewide and by region. The average code-compliant home will result in 27% savings in electricity usage and 5% savings in natural gas usage over the average below-code home. Overall, code-compliant homes will save 5,471 MWh of electricity annually and 78 MDth of natural gas annually compared to below-code homes.

Table 4.2-6: Annual Energy Savings of Code-Compliant Non-Program Homes Compared to Below-code Non-Program Homes, 2006-2008

Energy Savings		Statewide	Coastal Climate Region	Inland Climate Region	Mountain & Desert Climate Region
Savings on Electricity Usage	%	27%	-54%	31%	0%
	MWh	5,471	-1,193	6,658	6
Savings on Natural Gas Usage	%	5%	19%	2%	1%
	MDth	78	45	29	5

Gross energy savings vary quite dramatically by region, with the Inland region being responsible for 122% of the gross electricity savings but just 61% of the non-program homes (Table 4.2-7). Counter-intuitively, in the Coastal region, the average code-compliant home uses more electricity than the average below-code home, although the average code-compliant home uses less natural gas than the average below-code home.[57]

Table 4.2-7: Percentage of Gross Savings by Region and Savings Per Home, Code-Compliant Non-Program Homes Compared to Below-Code Non-Program Homes, 2006-2008

Region	Percentage of Non-Program Homes	Annual Savings		Percentage of statewide electricity savings	Percentage of statewide natural gas savings	Average savings per code-compliant home	
		Electricity (MWh)	Natural Gas (MDth)			Electricity (kWh)	Natural Gas (Therms)
Coastal	16%	-1,193	45	-22%	58%	-127	48
Inland	61%	6,658	29	122%	36%	226	10
Mountain & Desert	23%	6	5	0%	6%	1	5
Statewide	100%	5,471	78	100%	100%	110	16

[57] Under the performance approach, compliance with Title 24 depends upon meeting or exceeding energy performance goals (e.g., on a kBtu/ft2/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). Because code compliance depends upon total energy usage, not electricity usage or natural gas usage individually, it is possible for the average code-compliant home to use more electricity but less natural gas than the average below-code home.

4.3 Net Energy Savings

4.3.1 Above-Code Homes Compared to Code-Compliant Homes

4.3.1.1 Attribution of Energy Savings from above-Code Homes Compared to Code-Compliant Homes

Responses of Title 24 consultants are reported as both weighted and unweighted, with weights based on the percentage of non-program homes each Title 24 consultant reported they had consulted on. Responses from building industry experts are reported unweighted and serve as a qualitative check on the responses of the Title 24 consultants. The evaluation team has more confidence in the unweighted than weighted responses of the Title 24 consultants because there is generally more agreement between the unweighted responses and the responses of the building industry experts, and also because the weighted responses are largely dependent upon the responses of three Title 24 consultants who together are responsible for 87% of the non-program homes consulted on by the Title 24 sample. The weighted results are included to provide additional information but were not used to calculate net savings.

Title 24 consultants estimate that the 2006-2008 IOU'S RNC programs are responsible for 25% (9,970 MWh) of the gross electricity savings due to homes built above-code, with the 90% confidence interval ranging from 20% to 31% of gross electricity savings (Figure 4.3-1, Table 4.3-1). Building industry experts attribute savings (29%) that are similar to the savings attributed by the unweighted Title 24 Consultants' responses (25%), though the weighted Title 24 consultants attribute a larger percentage of gross electricity savings (39%) than the building industry experts. In addition, Title 24 consultants estimate that 21% of the gross electricity savings are due to the pre-2006 IOU programs; according to the Title 24 consultants, then, the IOU programs (the 2006-2008 programs and the pre-2006 programs together) are responsible for nearly half (46%) of the gross electricity savings associated with above-code homes.[58]

[58] Analysis of net energy savings by region is presented in Appendix B.

Figure 4.3-1: Unweighted Title 24 Consultants' Attribution of Annual Electricity Savings in Above-Code Non-Program Homes Compared to Homes Just Meeting Code, 2006-2008 (MWh)

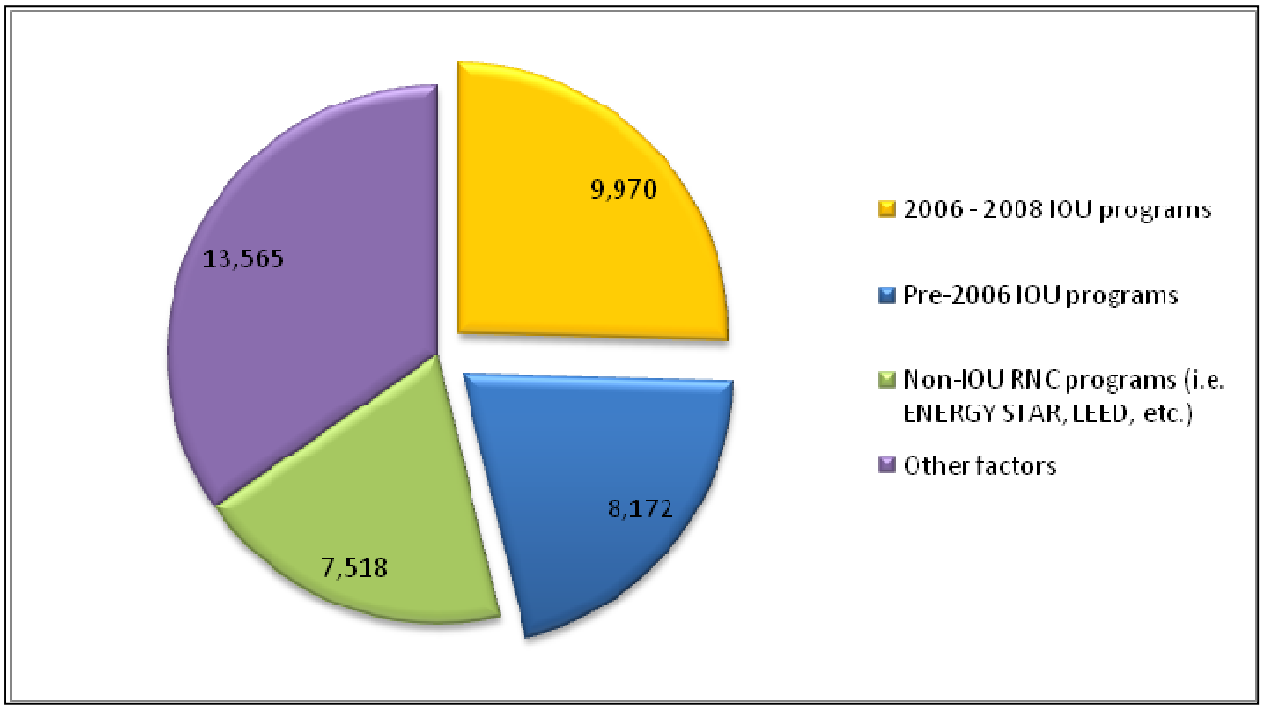


Table 4.3-1: Attribution of Annual Electricity Savings from above-Code Non-Program Homes to Homes Just Meeting Code, 2006-2008 – Statewide

Attribution Factors		Title 24 Consultants, Unweighted (n = 24)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
2006 – 2008 IOU programs	%	25%	20%	31%	39%	34%	44%	29%
	MWh	9,970	7,739	12,201	15,382	13,476	17,288	11,375
Pre-2006 IOU programs	%	21%	15%	27%	19%	15%	22%	29%
	MWh	8,172	5,889	10,455	7,257	5,910	8,604	11,375
Non-IOU programs	%	19%	16%	23%	21%	19%	23%	20%
	MWh	7,518	6,126	8,910	8,088	7,268	8,909	7,845
Other factors	%	35%	27%	42%	22%	17%	26%	23%
	MWh	13,565	10,761	16,370	8,498	6,630	10,366	9,022

The Delphi panels attributed gross natural gas savings in a very similar way as they attributed electricity savings. Title 24 consultants estimate that the 2006-2008 IOU'S RNC programs are responsible for 26% (187.8 MDth) of the gross natural gas savings due to above-code homes compared to code-compliant homes, with the 90% confidence interval ranging from 21% to 32% of gross natural gas savings (Figure 4.3-2, Table 4.3-2). Building industry experts attribute a similar percentage of savings (29%), though the weighted Title 24 consultants attribute a larger percentage of gross natural gas savings (41%) than the building industry experts to the 2006-2008 IOU programs. In addition, Title 24 consultants estimate that 20% of the gross natural gas savings are due to the pre-2006 IOU programs; according to the Title 24 consultants, then, the IOU programs (the 2006-2008 programs and the pre-2006 programs together) are responsible for nearly half (46%) of the gross natural gas savings associated with above-code homes.

Figure 4.3-2: Unweighted Title 24 Consultants Attribution of Natural Gas Savings in Above-Code Non-Program Homes Compared to Code Homes, 2006-2008 (MDth)

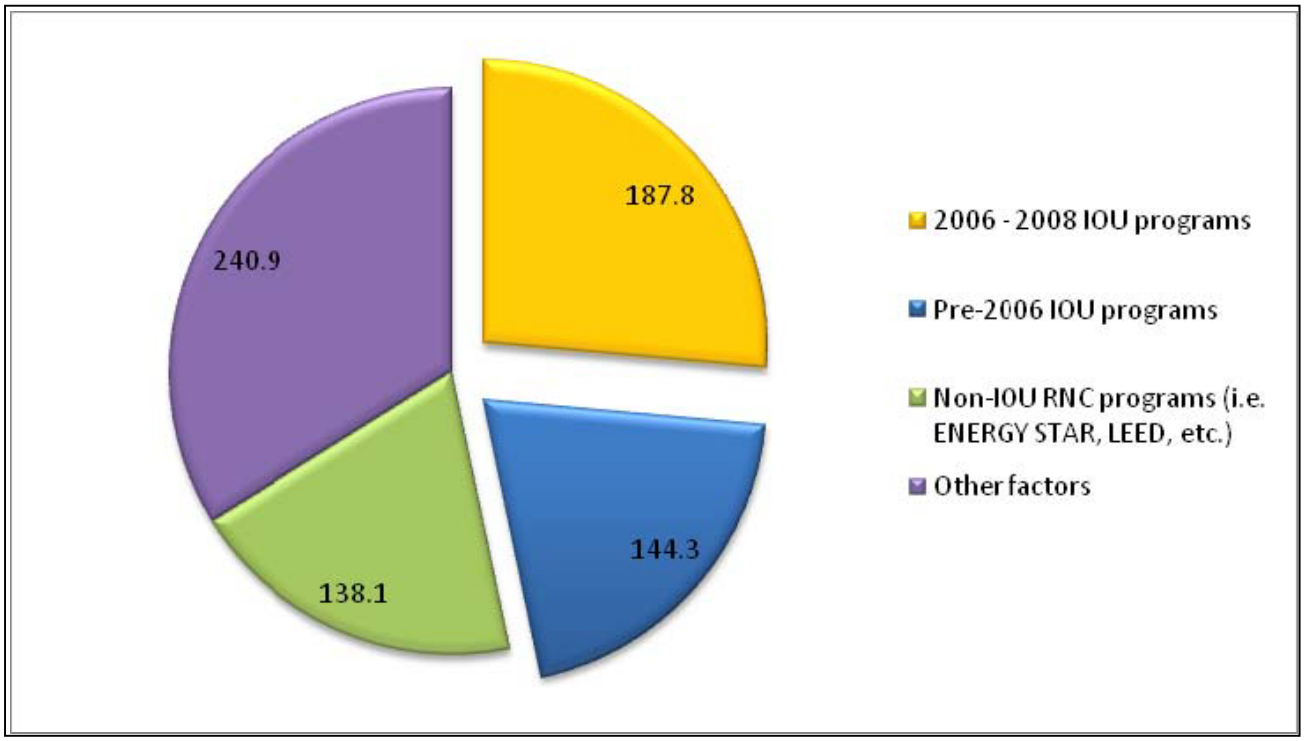


Table 4.3-2: Attribution of Annual Natural Gas Savings from Above-Code Non-Program Homes to Homes Just Meeting Code, 2006-2008 – Statewide

Attribution Factors		Title 24 Consultants, Unweighted (n = 24)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
2006 – 2008 IOU programs	%	26%	21%	32%	41%	36%	47%	29%
	MDth	187.8	147.4	228.3	293.9	254.7	333.2	206.2
Pre-2006 IOU programs	%	20%	14%	26%	16%	12%	20%	28%
	MDth	144.3	100.3	188.2	116.9	88.2	145.6	199.1
Non-IOU programs	%	19%	16%	23%	23%	20%	25%	20%
	MDth	138.1	111.4	164.8	161.2	142.3	180.0	142.2
Other factors	%	34%	26%	41%	20%	14%	25%	24%
	MDth	240.9	186.7	295.0	139.0	101.3	176.8	170.7

When asked to identify the building measures being installed or building practices being used to make non-program homes exceed code and realize the savings compared to homes just meeting code, respondents were most likely to identify HVAC systems (71% of respondents) and windows (65%), followed by insulation (26%) and radiant barriers (26%) as being responsible for electricity savings (Table 4.3-3). For natural gas savings, respondents were most likely to identify HVAC systems (68% of respondents) and water heaters (61%), followed by windows (42%) and insulation (35%).

Table 4.3-3: Building Measures and Practices Responsible for Above-code Homes
(Multiple Response)

Building Measure or Technique	Type of Savings	
	Electricity	Natural Gas
n (multiple response)	25	25
HVAC	71%	68%
Windows	65%	42%
Insulation	26%	35%
Radiant Barrier	26%	3%
Lighting	6%	0%
Air sealing / infiltration	6%	6%
Doors	3%	0%
Appliances	3%	0%
Water heater	3%	61%
Orientation	3%	0%
Thermal mass	3%	0%

When asked to identify other factors that contributed to energy savings from above-code homes, respondents most commonly identified increased use of building technologies (often adding that increased use was due to lower prices, increased availability or improved cost effectiveness), the downturn in the economy (making energy prices more salient to homeowners), proactive builders and owners, and greater awareness of energy-efficient technologies or building practices (Table 4.3-4).

Table 4.3-4: Other Factors that Contributed to Energy Savings from Above-code Homes
(Multiple Response)

Building Measure or Technique	Type of Savings	
	Electricity	Natural Gas
n (multiple response)	26	26
Building technologies (i.e., lighting, HVAC) - lower prices, increased availability and improved cost effectiveness	39%	39%
Economy	16%	13%
Proactive builders / owners	13%	13%
Greater awareness of energy efficiency, technologies and green building practices	13%	13%
Energy Prices	10%	10%
Differentiate homes through energy efficiency	6%	6%
Global Warming	3%	3%
Incentive program (unspecified)	3%	3%
Local requirements (city / county)	3%	0%
Build-it-Green	3%	3%
NSHP New Solar Homes Partnership	3%	3%
Changes in building design practices	3%	0%
Standardize building design for a development	3%	3%

A number of respondents elaborated on the role of the IOU programs and other factors in savings from above-code homes. One common theme in respondents' comments was the positive effect that the trainings have on builders and contractors, allowing them to apply building techniques and technologies to non-program homes. One Title 24 consultant described this as a "ripple effect". Another Title 24 consultant identified training and education as the key to continued building of above-code homes:

> *Educating builders & sub-contractors is the key for non-program homes to continue to exceed code compliance.*

A second theme was the effect of the IOU programs on homeowner awareness, interest and demand for energy efficiency. A Title 24 consultant expressed the effect of homeowner education as follows:

> *I believe that the IOU programs provide a great platform to educate homeowners about energy efficiency regardless of their participation in any program.*

Several building industry experts said that the IOU'S RNC programs played a significant role in encouraging the installation of energy-efficient technologies into non-program homes and thus helping to encourage the construction of non-program homes that exceeded code. One industry expert commented:

> *I believe that you receive benefits in "non-program" homes due to a certain amount of "pull-through"; if your program tends to encourage 14 SEER units, some builders who are not participating will follow the "new standard" of 14 SEER, to remain comparable.*

Another industry expert commented:

> *I believe the IOU Residential New Construction programs have had a significant impact on the energy efficiency of new homes in California. The impacts have increased over time and have been responsible for the adoption of efficiency by builders, which leads to adoption of these measures into Title 24, thereby making the savings permanent across the state.*

Another industry expert also commented on the effect of the programs on the availability and use of energy-efficient equipment and the effect of trainings:

> *If lots of homes use high efficiency equipment, that fact will make the equipment more available and cheaper, potentially providing the analytic basis for future equipment efficiency standards that apply to ALL homes including older ones. Also, the behavioral practice of builders' learning to build above-code should make such practices more likely in the future. It is likely that the program participants in the 06-08 IOU programs are also constructing/designing non-program homes during the same period (in which case the knowledge and design assistance from the 06-08 programs influenced the design of the non-program homes as well).*

Some respondents commented on the importance of other factors, such as code enforcement and new technologies, in the building of energy-efficient homes. For example, one Title 24 consultant commented:

> *Code enforcement plays a big part in saving energy. Making sure the building department, including inspectors, knows what it takes to make sure energy conservation measures are followed…builders and subcontractors need to be educated to make sure insulation, HVAC, etc. are installed properly. As these people become more educated, buildings will be built more energy efficient.*

We should also point out that one of the building industry experts was very skeptical of the process of isolating attribution of net energy savings to the programs or any other individual factor. While the expert said the IOU'S RNC programs were very influential, the same expert was not confident in the Delphi process:

> *As I indicate in several places here, the questions in this survey are framed in a way that is inappropriate to a market transformation program, by which I mean a program whose goal is to introduce new technologies or design methods into a market in which they are absent at the beginning of the program. The IOU new construction programs are aimed at levels of efficiency that are not found in more than 100 homes statewide, if that many, before the program. The failures of the market that they are trying to overcome are complex and interactive. A linear model of attribution just can't work because too many different things must come together for success. If applicable at all, such a linear model, that implicitly assumes that there is one barrier to consumer choice (leaving out the issue of producer choice altogether) might be appropriate for a 1970s style program where the utility offers a rebate on an off-the-shelf product like attic insulation batts and raises the market share from 10% to 20%. In such case, it would not be unreasonable to assume that the net to gross ratio is 50% and that you can attribute the savings to the utility to the extent that their rebate and marketing are a given share of overall efficiency budgets. But new construction is both a builder and buyer decision, with strong influence on the suppliers who provide the goods and services needed to comply. If these services are unavailable, which is the case for a lot of the measures in question, then the point of the utility program is to make them available as well as to encourage builders to use them and buyers to accept the final product. The leak free ducts that I refer to below are only available because California has an infrastructure of trained and certified third party raters who can inspect and test for these measures. And the main reason this infrastructure exists is past and ongoing utility program support for it.*

Despite the one panelist's expressed reservations, we are confident that the results from the Delphi panels are reasonably valid. Title 24 consultants expressed high levels of confidence in their own responses, as well as those of their fellow Title 24 Consultants and the Building

Experts (see Appendix E for more details). Building Experts as a group, despite the single dissenter, are also confident—though not as confident as the Title 24 consultants—in their own responses, the responses of their fellow Building Experts and the Title 24 Consultants.

Moreover, the Delphi technique is a research method that is intended to be applied to complex and difficult questions such as this (i.e., the market effects of the IOU'S RNC programs). The Delphi method is intended to take advantage of panelists' expertise in a given area—in this case, expertise in the California single-family home market, and have them take into account as many influences on the outcome as they are aware of. Initially, the panelists may not be aware of all these influences, but through the multiple iterations of the Delphi surveys and the shared knowledge and learning of the group, the expectation is that their expertise on the topic can allow reasonable estimation of the influence of various factors (Hsu and Sandford, 2007; Linstone and Turoff, 1975; Ludwig, 1997).

Please note that additional respondent quotes are available in Appendix C.

4.3.1.2 Attribution of Energy Savings to IOU Program Elements

Respondents attributed nearly identical savings to the various IOU program elements for both electricity and gas (Table 4.3-5, Table 4.3-6). Training (of builders, subcontractors, Title 24 and code officials) was the most important program element for both Title 24 consultants and building industry experts (45% of IOU program savings for the unweighted Title 24 consultants' responses and 50% for the building industry experts). However, the panels unsurprisingly differed slightly in the way they attributed savings to each sub-element of training, with Title 24 consultants emphasizing the importance of trainings for Title 24 consultants and builders, while building experts emphasized training of builders and subcontractors. Both Title 24 consultants and building industry experts identified program incentives as the single most important program element. Finally, Title 24 consultants attributed a higher proportion of savings to Program Plan Check and design assistance than did the building industry experts.

Table 4.3-5: Above-Code Non-Program Homes, Attribution of Electricity Savings to IOU Program Elements - Statewide

Attribution Factors	Title 24 Consultants, Unweighted (n = 23)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 5)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Plan Check	9%	5%	12%	16%	11%	22%	4%
Outreach	5%	4%	7%	5%	3%	6%	10%
Training of local code officials	7%	5%	9%	3%	2%	4%	11%
Other program elements	2%	1%	3%	2%	1%	3%	0%
Training of builders	14%	11%	16%	12%	10%	15%	16%
Incentives	25%	18%	33%	39%	34%	44%	23%
Training of T24 consultants	17%	14%	20%	13%	12%	15%	8%
Advertising	7%	5%	9%	5%	3%	7%	10%
Training of subcontractors	8%	6%	10%	2%	1%	3%	15%
Design assistance	6%	3%	8%	2%	1%	3%	3%

Table 4.3-6: Above-Code Non-Program Homes, Attribution of Natural Gas Savings to IOU Program Elements- Statewide

Attribution Factors	Title 24 Consultants, Unweighted (n = 23)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 5)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Plan check	9%	5%	12%	16%	11%	22%	4%
Outreach	5%	4%	7%	5%	3%	6%	10%
Training of local code officials	6%	4%	8%	3%	2%	4%	11%
Other program elements	2%	1%	3%	2%	1%	3%	0%
Training of builders	13%	11%	15%	12%	10%	14%	16%
Incentives	26%	19%	34%	16%	3%	29%	23%
Training of T24 consultants	18%	14%	21%	13%	12%	15%	8%
Advertising	7%	5%	10%	5%	3%	7%	10%
Training of subcontractors	8%	6%	11%	2%	1%	3%	15%
Design assistance	6%	3%	8%	2%	1%	3%	3%

Two building industry experts commented on the importance of having different program elements and strategies for increasing the adoption of energy-efficient technologies and practices into home building.

The first commented:

> *Different people respond to different stimuli. It's probably very good that the existing programs take multi-faceted approaches.*

The second building industry expert went further, saying:

> *…The way these programs work is that even if [only] one or two of the ten elements listed are very influential, it still may be true that the programs would fail if ALL TEN elements were not there.*

4.3.1.3 Sustainability: Persistence of Energy Savings from above-Code Homes

In order to assess the extent to which market effects are likely to persist in the absence or reduction of the IOU programs, respondents were asked to estimate how much of the net savings attributable to the IOU programs would be reduced in homes built in the future if the budget available to the IOU'S RNC programs were reduced by 50% and if the IOU'S RNC programs were eliminated. Overall, both Title 24 consultants and building industry experts said there would be substantial reductions to the savings attributable to the IOU programs, but that at least some savings would persist. However, the Title 24 consultants and building industry experts did

not agree on the magnitude of the reduction in savings (Table 4.3-7). Title 24 consultants said that a 50% reduction in the IOU program budgets would result in a 33% reduction (3,337 MWh and 61.2 MDth) in the 9,970 MWh of electricity savings and 187.8 MDth of natural gas savings attributable to the IOU programs. However, the building industry experts said that a 50% reduction in the IOU program budgets would result in a 53% reduction in electricity savings and a 50% reduction in natural gas savings (5,972 MWh and 103.1 MDth, respectively) of the 9,970 MWh of electricity savings and 187.8 MDth of natural gas savings attributable to the IOU programs. If the IOU programs were eliminated, Title 24 consultants said that savings attributable to the IOU programs would be reduced by 54% while building industry experts said that savings would be reduced by 83%.

Table 4.3-7: Above-Code Non-Program Homes, Decline in Electricity and Natural Gas Savings IOU Budgets Are Cut or Eliminated – Statewide

		Title 24 Consultants, Unweighted (n = 22)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Budget cut		Electricity Savings						
50%	%	33%	27%	40%	57%	49%	65%	53%
	MWh	3,337	2,668	4,006	8,740	7,513	9,968	5,972
100%	%	54%	45%	64%	79%	73%	86%	83%
	MWh	5,431	4,447	6,415	12,193	11,171	13,216	9,385
Budget cut		Natural Gas Savings						
50%	%	33%	26%	39%	57%	49%	65%	50%
	MDth	61.2	48.3	74.0	166.9	143.4	190.4	103.1
100%	%	54%	45%	64%	79%	73%	86%	83%
	MDth	102.3	83.7	121.0	233.1	213.5	252.6	170.1

Some respondents provided their thoughts as to why program savings would decline over time or why at least some of the program savings would persist over time if IOU'S RNC program budgets were reduced or eliminated (Table 4.3-8). When identifying reasons that program savings would decline over time, respondents said that without the IOU'S RNC programs promoting, educating, training and incentivizing efficiency, builders and buyers would focus exclusively on lowest cost or inexpensive options. However, some respondents said that some program savings would persist over time because builders, home buyers and building inspectors are more aware of energy efficiency both because of the programs as well as because of market forces such as energy prices and global warming making efficiency more important in the RNC market.

Table 4.3-8: Reasons for Persistence or Lack of Persistence in Savings if IOU'S RNC Program Budgets Are Reduced or Eliminated

Reasons for persistence or lack of persistence of savings	Percentage of Respondents
n (multiple response)	22
Savings will decline over time:	
Buyers and/or builders look at the lowest cost	14%
Lack of incentives will decrease persistence	9%
Builders respond to competitive forces (lack of high efficient program homes results in lower efficiency throughout the market)	9%
Economic downturn results in lower persistence	5%
Inefficient / less expensive options will be chosen	5%
Supply will drop off as demand for equipment falls off	5%
Lack of 3rd party verification	5%
Other	14%
Don't know	14%
Some savings will persist over time:	
Increased awareness / knowledge among builders / buyers will persist	9%
Local codes / building inspectors	9%
Few homes participate in the program currently (so cuts in program budgets will not have large effect on savings)	3%
Savings driven by desire to reduce energy costs	3%
Greenhouse Gas Emissions / Global Warming - driving consumers to more efficient homes	5%

Several building industry experts and Title 24 consultants elaborated as to how or why energy savings would be reduced if IOU'S RNC program budgets were reduced or eliminated, largely because they see the IOU'S RNC programs as raising the standard of efficiency that the building market responds to or because of the loss of training and education. A building industry expert commented:

> *If you stop or reduce the program, my assumption is that builders will begin reverting back to "base T-24" requirements, and these non-program homes will tend to follow that trend as well.*

Another expert stated:

> *Builders are typically price responsive and will build homes the cheapest way legally possible. With the removal or reduction of utility new construction programs, builders will go back to the old way of doing things.*

A third expert noted:

> *Builders respond to competitive forces. Those not participating in programs are doing the least-cost houses they can. If their competitors no longer are as energy efficient and if the utilities signal that energy efficiency is not important by cutting programs, these builders will fall back to code or below.*

One Title 24 consultant commented:

> *If funding is cut, yes, the benefits of these programs will be reduced. I think that since the programs are just beginning to solidify and to cut them now would stop the momentum growth that has started to happen. To stop a project when it's only beginning to gain an audience is a poor choice. I hope that instead of cuts, these programs are supported and grown. I think there is potential there with more exposure and training.*

Another building industry expert offered an explanation as to why the two panels diverge in their assessment of the effects of reducing or eliminating the programs:

> *It doesn't surprise me to see the divergence in opinion between panels or the direction of divergence. Direct participants in a market always tend to see whatever is happening in the real world markets as being natural or inevitable. So they would see less damage potential in reducing IOU program budgets because it appears to them that the market wants efficiency. Which it does. But this desire is unlikely to be realized without the programs continuing….. With continuing programs, there can be continuing progress towards more efficiency through codes, other types of programs, and market effects. Without continuing programs, progress will cease or slow, as we see from the experience of other times and other states and countries.*

In contrast, several Title 24 consultants said that the savings will largely persist or that other factors are responsible for above-code construction:

> *I believe that incentives are "momentum starters" and that most of the builders and consumers will come to expect a higher level of construction and energy efficiency as the new standard – regardless of the incentive programs in place. Knowledge and awareness are powerful tools. Additionally, the building/energy codes are constantly mandating higher efficiency in our homes and appliances.*

> *Hence, I do not feel that the loss of an incentive program will result in a mass abandonment (more than 20%) of energy efficient construction or practices. For example, if I had to choose between a house that minimally complied with Title 24 in 1980 versus one that complies minimally in 2010 – I'd choose the 2010 house knowing that the past 30 years have yielded tremendous advancements in construction systems and energy efficiency.*

A second Title 24 consultant said that the effects of the programs will persist:

> *I feel that the prior benefits of the residential new construction programs and the recent greater awareness of the general population (including builders & code officials) of energy efficiency issues will allow some of the savings to persist even if the programs are fully eliminated.*

Another Title 24 consultant said that local codes will lead to above-code homes:

> *Locally, above-code homes are mandated by buyers or owners, I don't think cuts in the programs will have an appreciable difference.*

4.3.2 Code-Compliant Homes Compared to Below-Code Homes

4.3.2.1 Attribution of Energy Savings from Code-Compliant Homes Compared to Below-Code Homes

Title 24 consultants estimate that the 2006-2008 IOU'S RNC programs are responsible for 23% (1,282 MWh) of the gross electricity savings due to code-compliant homes compared to non-compliant homes, with the 90% confidence interval ranging from 18% to 29% of gross electricity savings (Figure 4.3-3, Table 4.3-9). Building industry experts attribute a similar percentage of savings (26%), while the weighted Title 24 consultants attribute a larger percentage of gross electricity savings (45%). In addition, Title 24 consultants estimate that 23% of the gross electricity savings are due to the pre-2006 IOU programs. *Thus, the 2006-2008 and pre-2006 IOU programs taken together account for nearly half of gross electricity savings from achieving code compliance in non-program homes*.[59]

[59] Analysis of net energy savings by region is presented in Appendix B.

Figure 4.3-3: Unweighted Title 24 Consultants Attribution of Electricity Savings from Non-Program Homes Just Meeting Code Compared to Below-Code Homes, 2006-2008 (MWh)

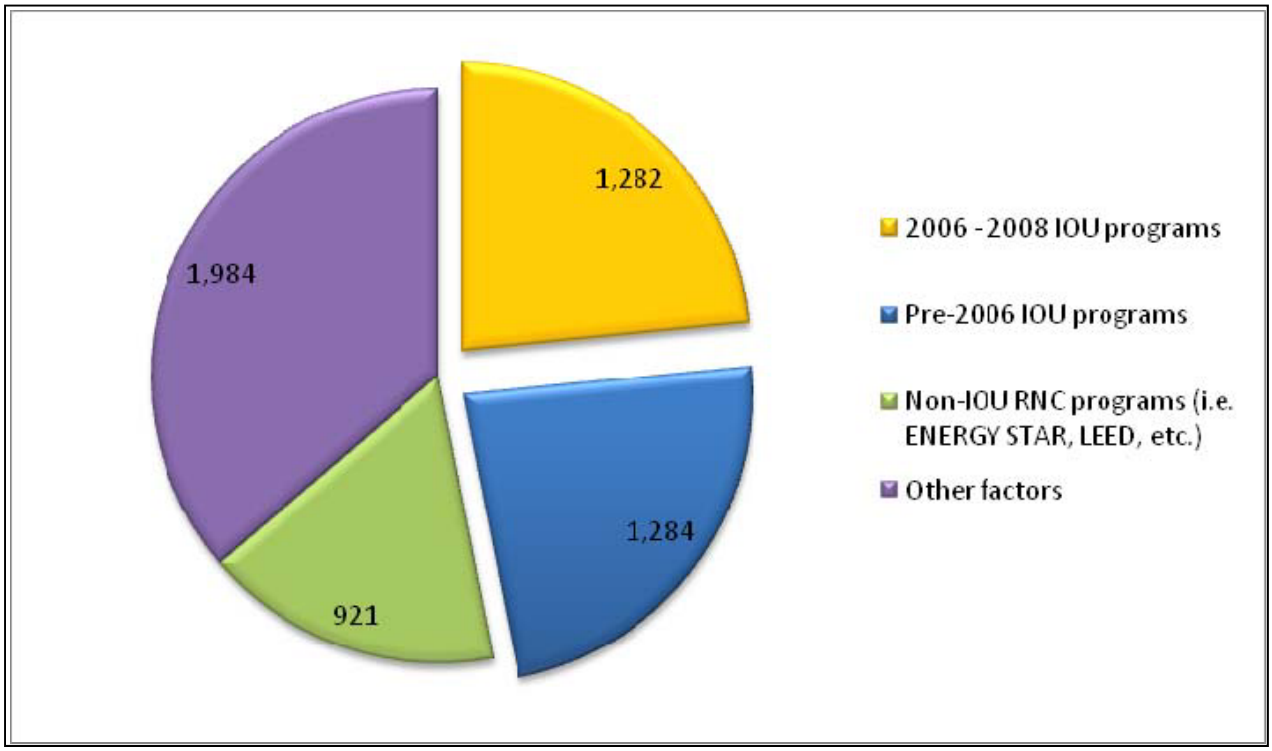


Table 4.3-9: Attribution of Electricity Savings from Non-Program Homes Just Meeting Code Compared to Below-Code Homes, 2006-2008 (MWh) – Statewide

Attribution Factors		Title 24 Consultants, Unweighted (n = 23)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 7)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
2006 – 2008 IOU programs	%	23%	18%	29%	45%	39%	50%	26%
	MWh	1,282	959	1,605	2,437	2,161	2,714	1,422
Pre-2006 IOU programs	%	23%	16%	31%	24%	20%	29%	22%
	MWh	1,284	855	1,714	1,336	1,102	1,570	1,204
Non-IOU programs	%	17%	12%	22%	13%	9%	17%	9%
	MWh	921	634	1,207	701	476	927	492
Other factors	%	36%	27%	46%	18%	12%	25%	43%
	MWh	1,984	1,468	2,500	996	640	1,352	2,353

The Delphi panels attributed gross natural gas savings in a very similar way as they attributed electricity savings. Title 24 consultants estimate that the 2006-2008 IOU'S RNC programs are responsible for 23% (18.2 MDth) of the gross natural gas savings due to above-code homes compared to code-compliant homes, with the 90% confidence interval ranging from 17% to 29% of gross natural gas savings (Figure 4.3-4, Table 5.2-2). Building industry experts attribute a similar percentage of savings (26%), while the weighted Title 24 consultants attribute a larger percentage of gross natural gas savings (44%). In addition, Title 24 consultants estimate that 24% of the gross natural gas savings are due to the pre-2006 IOU programs. *Thus, the 2006-2008 and pre-2006 IOU programs taken together account for nearly half of gross natural gas savings from achieving code compliance in non-program homes*.

Figure 4.3-4: Unweighted Title 24 Consultants Attribution of Natural Gas Savings from Non-Program Homes Just Meeting Code Compared to Below-Code Homes, 2006-2008 (MDth)

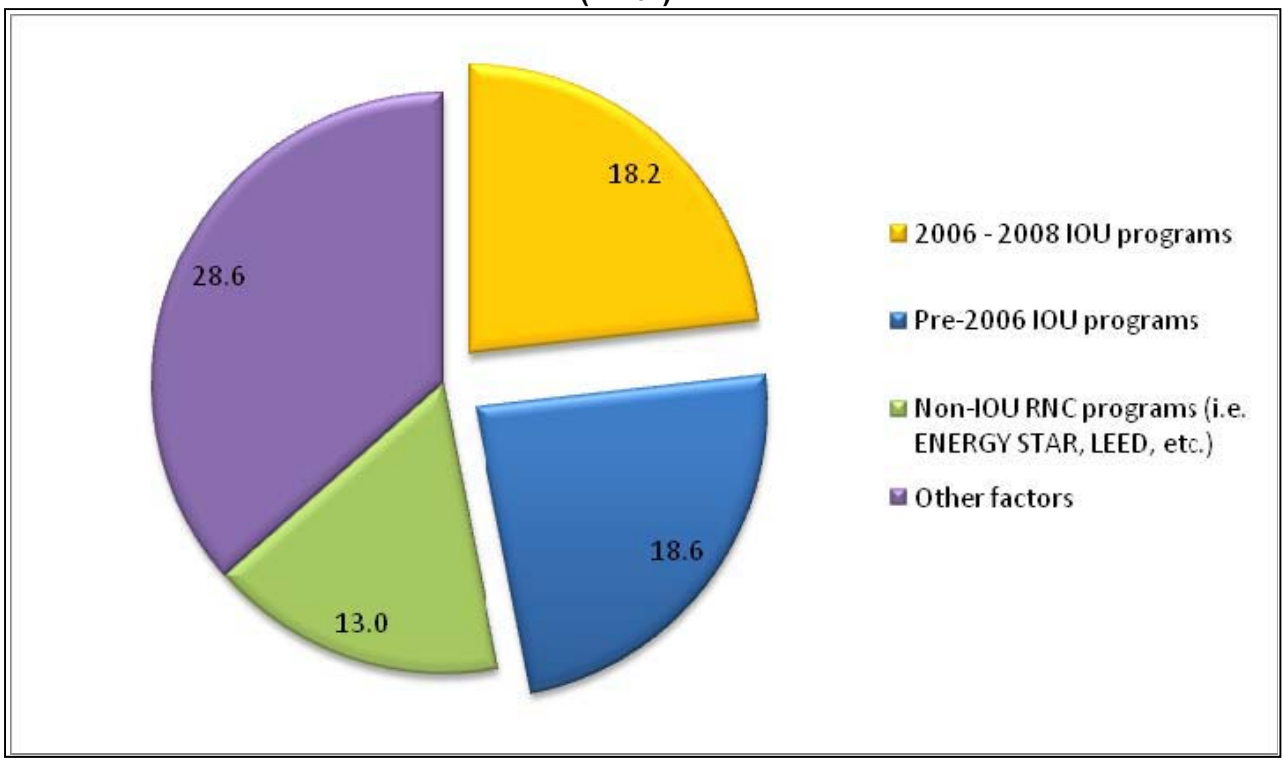


Table 4.3-10: Attribution of Natural Gas Savings from Non-Program Homes Just Meeting Code Compared to Below-Code Homes, 2006-2008 (MDth) – Statewide

Attribution Factors		Title 24 Consultants, Unweighted (n = 23)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n =7)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
2006 – 2008 IOU programs	%	23%	17%	29%	44%	39%	50%	26%
	MDth	18.2	13.6	22.8	34.9	30.9	38.9	20.4
Pre-2006 IOU programs	%	24%	16%	32%	24%	20%	29%	22%
	MDth	18.6	12.4	24.8	19.2	15.8	22.6	17.3
Non-IOU programs	%	17%	11%	22%	13%	9%	17%	9%
	MDth	13.0	8.9	17.2	10.0	6.8	13.3	7.1
Other factors	%	36%	27%	46%	18%	12%	25%	43%
	MDth	28.6	21.2	36.0	14.3	9.2	19.4	33.7

When asked to identify the building measures being installed or building practices being used to make non-program homes meet code and realize the savings compared to below-code homes, respondents were most likely to identify windows (68% of respondents), HVAC systems (52%) followed by insulation (32%) as being responsible for electricity savings (Table 4.3-11). For natural gas savings, respondents were most likely to identify HVAC systems (61% of respondents), water heaters (42%) and windows (42%), followed by insulation (29%).

Table 4.3-11: Building Measures and Practices Responsible for Homes Meeting Code
(Multiple Response)

Building Measure or Technique	Type of Savings	
	Electricity	Natural Gas
n (multiple response)	27	25
Windows	68%	42%
HVAC	52%	61%
Insulation	32%	29%
Radiant Barrier	13%	0%
Lighting	10%	0%
Air sealing / infiltration	3%	6%
Appliances	3%	0%
Water heater	3%	42%
Easy / low cost measures (unspecified)	3%	3%
Orientation	3%	0%
Fixtures (unspecified)	3%	0%
Doors	0%	3%

When asked to identify other factors that contributed to energy savings from homes just meeting code, respondents most commonly identified increased use of building technologies (often adding that increased use was due to lower prices, increased availability or improved cost effectiveness), costs in general (which often prevented homes from exceeding code or meeting code), energy prices, the downturn in the economy (making energy prices more salient to homeowners), and improved enforcement of the code (Table 4.3-12).

Table 4.3-12: Other Factors that Contributed to Energy Savings from Code-Compliant Homes
(Multiple Response)

Building Measure or Technique	Type of Savings	
	Electricity	Natural Gas
n (multiple response)	26	26
Building technologies (i.e., lighting, HVAC) - lower prices, increased availability and improved cost effectiveness	39%	39%
Economy	16%	13%
Proactive builders / owners	13%	13%
Greater awareness of energy efficiency, technologies and green building practices	13%	13%
Energy Prices	10%	10%
Differentiate homes through energy efficiency	6%	6%
Global Warming	3%	3%
Incentive program (unspecified)	3%	3%
Local requirements (city / county)	3%	0%
Build-it-Green	3%	3%
NSHP New Solar Homes Partnership	3%	3%
Changes in building design practices	3%	0%
Standardize building design for a development	3%	3%

A number of respondents elaborated on the role of the IOU programs and other factors in savings from homes just meeting code. Several common themes emerged, including the influence of IOU programs on building practices, inspectors, and increased availability of the energy-efficient technologies. Interestingly, Phase I did not find evidence of these demand-side effects.

One building industry expert said that training programs improve compliance:

> *The main factors in all cases are training programs or other learning processes for builders, subcontractors, and building officials.*

One Title 24 consultant said that trainings are also responsible for improved compliance:

> *I do believe there is some influence from the IOU programs on how the homes meet minimum compliance. Somehow, this influence is transmitted to decision-making people by training or workshops that are provided by the IOU. It does create consciousness on energy saving in California.*

According to one Title 24 consultant, the IOU programs affect code compliance through the trainings of modelers and field inspectors:

> *For houses that barely meet code, it is nearly always a situation where builders or owners are making choices according to "lowest first cost." The IOU Residential Programs only have a "rub off" effect on plan checkers and inspectors. Better plan checking means gradual acceptance of the building code by builders, designers, and some owners. Plan checkers and field inspectors receive significant shared knowledge from their interaction with the IOU programs.*

One building industry expert said that the programs help improve compliance of non-program homes through increased awareness and marketing of energy efficiency:

> *Again, the IOU programs tend to have an influence on non-program homes, due to awareness and marketing benefits of certain features.*

Two experts said that the "demand side" effects help improve compliance. For example, one expert commented:

> *I still feel that the major reason that non-participating homes are "better than they would be" is due to enhanced products and methods in the market, through the whole distribution chain, that has been empowered significantly by the advancements related to numerous factors, including naturally occurring improvements, and also program promoted improvements.*

A second building industry expert commented:

> *EE [energy efficiency] programs create more demand for EE [energy efficient] products, which reduces their cost as volumes increase. This creates a spillover effect as other highly cost conscious builders opt to pay the reduced (or zero) premium for a better product to keep up with competitors.*

One Title 24 consultant is skeptical of the influence of the IOU's RNC programs on code compliance:

> *In general, I think most respondents are over-estimating the effects of IOU's RNC programs on code-minimum homes that are outside the programs. I'm sure there is some kind of competitive effect where production builders are building tracts in the vicinity of an in-program tract; however, I would question how many of the crews and subcontractors have had any training attributable to the IOU programs, and out of those how many actually get a chance to apply their knowledge when pressured by the mantra of "lowest first cost."*

Additional open-ended responses are available in Appendix C.

4.3.2.2 Attribution of Energy Savings to IOU Program Elements

Title 24 consultants attributed nearly identical savings to the various IOU program elements for both electricity and gas and largely agreed with the assessment of building industry experts (Table 4.3-13, Table 4.3-14). The elements of training (of builders, subcontractors, Title 24 and code officials) combined to be the most important program element for both Title 24 consultants and building industry experts, though building industry experts emphasized the importance of training even more than the Title 24 consultants, particularly for natural gas savings. Title 24 consultants attributed 47% of IOU program electricity savings and 48% of natural gas savings to training, with training of Title 24 consultants considered the most important element of training. Building industry experts attributed 66% of IOU program electricity savings and 82% of natural gas savings to training. For natural gas savings, building industry experts considered training of code officials as the most important element of training. Title 24 consultants and building industry experts did not agree on their assessment of the effect of incentives on code-compliant homes. Whereas Title 24 consultants identified program incentives as the single most important program element, building industry experts attributed almost no savings (2%) to program incentives.[60].

[60] This is interpreted by the authors as being a result of programs lowering prices and increasing availability of efficient products and technologies

Table 4.3-13: Code-Compliant Non-Program Homes, Attribution of Electricity Savings to IOU Program Elements - Statewide

Attribution Factors	Title 24 Consultants, Unweighted (n = 21)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Plan check	9%	6%	13%	7%	2%	11%	7%
Outreach	7%	3%	11%	13%	8%	18%	6%
Training of local code officials	9%	6%	12%	3%	2%	5%	12%
Other program elements	4%	2%	5%	8%	7%	9%	0%
Training of builders	12%	9%	15%	4%	2%	6%	18%
Incentives	21%	15%	27%	46%	37%	56%	2%
Training of T24 consultants	17%	13%	22%	4%	2%	7%	18%
Advertising	8%	5%	10%	7%	4%	9%	3%
Training of subcontractors	9%	7%	11%	6%	5%	8%	18%
Design assistance	5%	2%	7%	1%	0%	2%	17%

Table 4.3-14: Code-Compliant Non-Program Homes, Attribution of Natural Gas Savings to IOU Program Elements- Statewide

Attribution Factors	Title 24 Consultants, Unweighted (n = 21)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Plan check	10%	7%	14%	7%	2%	12%	7%
Outreach	5%	2%	8%	13%	7%	18%	6%
Training of local code officials	9%	6%	12%	3%	2%	5%	28%
Other program elements	3%	2%	5%	8%	7%	9%	0%
Training of builders	12%	9%	15%	4%	2%	6%	18%
Incentives	21%	15%	27%	46%	37%	56%	2%
Training of T24 consultants	18%	13%	23%	4%	2%	7%	18%
Advertising	7%	5%	9%	7%	4%	9%	3%
Training of subcontractors	9%	7%	12%	6%	5%	8%	18%
Design assistance	5%	3%	8%	1%	0%	2%	2%

A building industry expert offered a summary as to how the IOU'S RNC programs can affect code compliance:

> *When robust programs are in place, the entire market is affected. Greater availability of energy saving products, increased competition from other builders building above-code homes, and greater buyer awareness all impact "Just Code" builders and raise their performance (a little) as they respond to the market.*

4.3.2.3 Sustainability: Persistence of Energy Savings from Code-Compliant Homes

In order to assess the extent to which market effects are likely to persist in the absence or reduction of the IOU programs, we asked respondents to estimate how much the net savings attributable to the IOU programs would be reduced in homes built in the future if the budget available to the IOU'S RNC programs were reduced by 50% and if they IOU'S RNC programs were eliminated. Overall, both Title 24 consultants and building industry experts said there would be substantial reductions to the savings attributable to the IOU programs, but that at least some savings would persist. However, the Title 24 consultants and building industry experts did not agree on the magnitude of the reduction in savings (Table 4.3-15). Title 24 consultants said that a 50% reduction in the IOU program budgets would result in a 37% reduction (479 MWh and 6.8 MDth) in the 1,282 MWh of electricity savings and 18.2 MDth of natural gas savings

attributable to the IOU programs. However, the building industry experts said that a 50% reduction in the IOU program budgets would result in 44% reduction in electricity savings and 41% reduction in natural gas savings (626 MWh and 8.4 MDth, respectively) out of the 1,282 MWh of electricity savings and 18.2 MDth of natural gas savings attributable to the IOU programs. If the IOU programs were eliminated, Title 24 consultants said that electricity savings attributable to the IOU programs would be reduced by 55% and natural gas savings by 54%, while building industry experts said savings would be reduced by 73%.

Table 4.3-15: Code-Compliant Non-Program Homes, Decline in Electricity and Natural Gas Savings IOU Budgets Are Cut or Eliminated – Statewide

		Title 24 Consultants, Unweighted (n = 21)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 7)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Budget cut		Electricity Savings						
50%	%	37%	30%	45%	65%	57%	73%	44%
	MWh	479	385	574	1,588	1,398	1,778	626
100%	%	55%	44%	65%	86%	79%	93%	73%
	MWh	699	565	833	2,094	1,929	2,260	1,038
Budget cut		Natural Gas Savings						
50%	%	37%	30%	44%	65%	57%	73%	41%
	MDth	6.8	5.4	8.1	22.7	20.0	25.5	8.4
100%	%	54%	43%	64%	86%	79%	93%	73%
	MDth	9.8	7.9	11.7	30.0	27.6	32.3	14.9

Some respondents provided their thoughts as to why savings would decline over time or why at least some of the savings would persist over time (if IOU'S RNC program budgets were reduced or eliminated) (Table 4.3-19). When identifying reasons that savings would decline over time, respondents said, without the IOU'S RNC programs promoting, educating, training and incentivizing efficiency, that builders, local code officials and buyers would lose an important source of information and training and builders and buyers would focus on lowest cost or inexpensive (and often less efficient) options.

Table 4.3-16: Reasons for Persistence or Lack of Persistence in Savings if IOU'S RNC Program Budgets Are Reduced or Eliminated

Reasons for persistence or lack of persistence of savings	Percentage of Respondents
n (multiple response)	26
Savings will decline over time:	
Lower awareness and knowledge due to lack of training and advertizing	19%
Inefficient / less expensive options will be chosen	12%
Lack of training of local codes / building inspectors (decline in savings)	12%
Lack of incentives will decrease persistence	8%
Builders respond to competitive forces (lack of high efficient program homes results in lower efficiency throughout the market)	4%
Economic downturn results in lower persistence	4%
Supply of energy efficient equipment will drop off as demand for equipment falls off	4%
Buzz of energy efficiency will wear off without the programs	4%
Disagree with the question	4%
Builders respond to competitive forces	4%
Don't know	35%
Some savings will persist over time:	
Never had a problem with a home not meeting code	4%

Several Title 24 consultants and building industry experts elaborated as to how or why energy savings would be reduced if IOU'S RNC program budgets were reduced or eliminated. According to one Title 24 consultant, if the IOU'S RNC program budgets were reduced or cut, it would negatively affect compliance largely due to the loss of training and knowledge for building department inspectors and modelers:

> *In this area, the "rub off" effect is more apportioned to plan checkers and inspectors than it is to low-end builders, designers, and home buyers. Plan checkers and field inspectors receive significant shared knowledge from their interaction with the IOU programs. Should the IOU programs lose market share or be eliminated entirely, this source of knowledge for building officials would fall away.*

One building industry expert said that reducing or eliminating IOU'S RNC program budgets would result in less efficient homes:

> *Again, the IOU programs tend to have an influence on non-program homes, due to awareness and marketing benefits of certain features, and if the IOU programs are reduced or eliminated, those spillover impacts will correspondingly reduce.*

Another building industry expert commented:

> *Builders are typically price responsive and will build homes the cheapest way legally possible. With the removal or reduction of utility new construction programs, builders will go back to the old way of doing things. I believe most of the efficiency improvements in non-participating homes are due to long-term utility involvement in new construction programs and their work to improve codes and standards.*

Another building industry expert said that with IOU'S RNC program budget cuts, there would be declines in savings because training is so critical to energy efficiency:

> *Training must be ongoing due to the large turn over in builder and subcontractor staff–also true for jurisdiction staff, but less so.*

4.3.3 Code Compliance in the Absence of the IOU Programs

In addition to net energy savings, we asked Delphi panelists to estimate, for the 2006-2008 time period, the percentage of non-program homes that would have been below-code in the absence of the IOU'S RNC programs (but assuming all other factors remain unchanged from what actually occurred). Next, the panelists were asked to estimate the compliance margin of the below-code homes in the absence of each factor.[61]

The panels had fairly divergent views of the effect on compliance rates (i.e., the percentage of homes that would be below-code) **if IOU'S RNC programs were eliminated** but similar estimates of the effects on compliance *margins* if the IOU programs or other factors did not exist or did not occur (Table 4.3-17). For example, Title 24 consultants estimated, on average, that the percentage of below-code homes would have increased from 22% of homes to 27% of homes, and that the average below-code home would have been 17% below code instead of 12% below code if the 2006-08 IOU'S RNC programs had not existed. The building industry panel estimated, on average, that the percentage of below-code homes would have increased from 22%

[61] For the Delphi survey, the evaluation team, having developed a preliminary estimate that 22% of homes were below code and that the average below-code home was 12% below code, asked respondents to estimate the percentage of homes that would have been below-code in the absence of the IOU'S RNC programs (but assuming all other factors remain unchanged from what actually occurred), and also to estimate the compliance margin of the below-code homes in the absence of each factor. After completing the Delphi survey, the evaluation team revised the estimates of code compliance to match the C & S evaluation findings, which leads to an estimate of 13% of homes below code by an average of 10%. The results reported here are based on the preliminary estimates of non-compliance presented to the Delphi panelists rather the final estimates discussed elsewhere in this report.

of homes to 43% of homes if the 2006-08 IOU'S RNC programs had not existed, and that the average below-code home would have been 18% below code instead of 12% below code.

Title 24 consultants expected a smaller effect **if non-IOU programs had not existed**, estimating that non-compliance would have increased to 25% and the average below-code home would have been 16% below code. However, building industry experts expected a smaller effect if non-IOU programs had not existed (compared to their estimates if the IOU programs had not existed), estimating that non-compliance would have increased to 27% of homes and the average below-code home would have been 16% below code.

Title 24 consultants expected the **absence of other factors** would have had a similar effect as the absence of non-IOU programs, estimating that non-compliance would have increased to 25% of homes and the average below-code home would have been 15% below code. Building industry experts expected the absence of other factors would have had a similar effect, estimating non-compliance would have increased to 25% of homes and the average below-code home would have been 14% below code.

It is interesting to note that these results, which indicate IOU'S RNC program factors and non-IOU program factors would have approximately the same impact if they were absent (i.e., their absence would have about equivalent impacts) provide a consistency check with the net savings results, which showed that the IOU'S RNC programs and non-IOU program factors were each responsible for about one-half of the observed impact.

Table 4.3-17: Code Compliance in the Absence of IOU Programs and Other Factors- Statewide

	Title 24 Consultants, Unweighted (n = 24)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
If the 2006-2008 IOU Residential New Construction programs did not exist							
Proportion of below-code homes	27%	25%	30%	28%	25%	31%	43%
Average percentage below code	17%	15%	19%	20%	18%	22%	18%
If non-IOU Residential New Construction programs did not exist*							
Proportion of below-code homes	25%	23%	28%	24%	23%	25%	27%†
Average percentage below code	16%	14%	18%	18%	16%	20%	16%†
If other factors did not occur‡							
Proportion of below-code homes	25%	22%	28%	22%	21%	23%	25%†
Average percentage below code	15%	13%	16%	12%	12%	13%	14%†

* Programs such as ENERGY STAR homes, LEED for homes, programs sponsored by municipal utilities such as SMUD and LADWP, Environments for Living, ComfortWise, and the Solar Initiative.

† Only four Building Industry Experts were able to provide responses for non-IOU and other factors.

‡ Factors such as the downturn in the housing market, changes in energy prices, global warming and naturally occurring advances in the residential new construction industry.

Respondents identified a number of other factors that would have affected both the percentage of below-code homes and the average percentage below code for below-code homes if the factors did not occur (Table 4.3-18). The most commonly identified factors include the downturn in the economy, energy prices, poor training and installations, and poor code enforcement.

Table 4.3-18: Other Factors that Affect Compliance Rates and Compliance Margins
(Multiple Response)

Factors	Factors Would Affect	
	Percentage of Below-Code Homes	Average Percentage Below Code
n (multiple response)	14	14
Downturn in the economy (increasing non compliance and use of low efficiency technologies and practices)	13%	16%
Energy Prices	10%	13%
Poor training / bad installations	10%	3%
Poor code enforcement	10%	10%
Building technologies (i.e., lighting, HVAC) - lower prices, increased availability and improved cost effectiveness	6%	3%
Global Warming	3%	3%
Lack of awareness	3%	3%
Opportunities that make the house more marketable such as replacing kitchens, bathrooms	3%	3%
Cheating and non-permitted projects	3%	3%
Design input from architects	3%	3%
CEC training of builders	3%	3%

Respondents also identified a number of non-IOU programs that would have affected both the percentage of below-code homes and the average percentage below code for below-code homes if the programs did not exist (Table 4.3-19). The most commonly identified non-IOU programs include ENERGY STAR Homes, LEED for Homes, municipal programs, the Solar Initiative, and Build it Green.

Table 4.3-19: Non-IOU Programs that Contributed to Energy Savings from Above-Code Homes
(Multiple Response)

Non-IOU Programs	Non-IOU Programs Would Affect	
	Percentage of Below-Code Homes	Average Percentage Below Code
n (multiple response)	15	15
ENERGY STAR Homes	35%	29%
LEED for homes	23%	23%
Municipal programs	19%	16%
The Solar Initiative	13%	10%
Build it Green / Green Point Rated (GPR)	13%	16%
Comfort Wise	10%	3%
Environments for Living	10%	6%
Federal tax credits	6%	3%
Local ordinances	3%	3%
CA Green Builders	0%	3%

5 Comparison to Phase I Findings

5.1 Comparing Phase II to Phase I Findings

In order to re-examine the estimates of the influence of the IOU'S RNC programs on the building practices of non-program homes from Phase I, the evaluation team compared estimates of above-code building practices and market effects provided by Title 24 contractors, HERS raters, builders and HVAC contractors in Phase I with estimates of code compliance and net energy savings attributable to the IOU'S RNC programs from Phase II.

Code compliance under the 2005 building standards, presented in detail in Table 5.2-1 and Table 5.2-2, support the findings from the Phase I report pertaining to code compliance and above-code building practices. In the Phase I report, we found that Title 24 consultants and HERS raters had observed increased rates of code compliance during the 2006-2008 period and that the IOU programs appeared to have had a fairly strong effect on improved code compliance, particularly through training. Further, in the Phase I report we found that there was 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.

Analysis of code compliance confirmed that the statewide average compliance margin increased in homes built under the 2005 standards compared to the 2001 standards (Table 5.2-1).[62] In addition, for homes built under the 2005 standards, every climate region had a positive average compliance margin while two climate regions had negative compliance margins for homes built under the 2001 standards. Also, above-code building practices and code compliance improved for homes built under the 2005 standards. Over one-half (52%) of homes built under the 2005 standards exceeded code requirements compared to 13% of homes built under the 2001 standards (Table 5.2-2). Further, 22% of homes were below-code under the 2005 standards, whereas 27% of homes were below-code under the 2001 standards.

The attribution analysis (see section 4.3: Net Energy Savings) was generally quite consistent with the findings from Phase I. Overall, Title 24 consultants and building industry experts said that the IOU'S RNC programs were responsible for significant percentages of the observed savings due to above-code homes and increased code compliance. As in Phase I, Title 24 consultants and building industry experts consistently identified trainings as a key element of the programs. Title 24 consultants said that trainings of builders, Title 24 consultants and subcontractors were responsible for nearly 40% of the energy savings attributable to the IOU

[62] For more details on compliance data from earlier time periods, see the Phase 1 report (KEMA et al, 2009). For more details on compliance data for non-program homes built during the 2006-2008 time period, see section 4.1.1: Gross Savings Analysis.

programs for both above-code homes and code-compliant homes. The reach of the IOU training centers during the 2006-2008 time period further corroborates the reach of IOU-sponsored training, as the nine IOU training centers offered 840 unique courses which were taken by 39,793 unique attendees, including nearly 5,000 builders (4,987) and over 7,000 HVAC contractors (7,064) (Opinion Dynamics et al., 2010)

However, the Delphi panels also attributed savings to incentives and demand effects, such as increased availability and reduced prices of energy efficient technologies, which were not identified as key factors in Phase I. In addition, during Phase I respondents indicated that the IOU'S RNC programs influenced builders to use HERS raters for Quality Insulation Installations (QII) in non-program homes, contributing to the construction of above-code homes. However, this program element was not identified by any of the Delphi panelists.

5.2 RNC Baseline Compliance Margins and Compliance Rates Over Time

Table 5.2-1 presents the average compliance margin for single-family non-program homes built under the 1995, 1998, and 2001 standards (as reported in the Phase 1 report[63]) and the average compliance data margins for single-family non-program homes built under the 2005 standards during 2006 to 2008. The average compliance margin increased statewide for homes built under the 1998 standards, decreased for homes built under the 2001 standards and increased again for homes built under the 2005 standards. Compliance margins in Regions 1 and 2 increased under the 1998 and 2001 standards but declined slightly under the 2005 standards. Homes built in regions three and four are on average above-code as are homes in region five. However, when interpreting results it is important to note that regions one and two were combined into one larger "coastal" region for the purposes of this report, and regions three and four were combined for one larger "inland" region. In addition, one should bear in mind that each successive standard was stricter than the last.

Table 5.2-1: Average Compliance Margins of Single-Family Homes

Analysis Parameter Description	Statewide	Region 1	Region 2	Region 3	Region 4	Region 5
Average Compliance Margin						
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%
	Statewide	**Region 1 and 2**		**Region 3 and 4**		**Region 5**
Homes Built under 2005 Standards[1]	7.4%	4.4%		6.4%		10.4%

[1] For this report, Regions 1 and 2 were combined into the Coastal Climate Region and Regions 3 and 4 were combined into the Inland Climate Region.

[63] KEMA et al., 2009

Table 5.2-2 presents the distribution of compliance by region for homes built under the 1995, 1998, 2001 and 2005 standards. For 1995, 1998 and 2001, the table presents the percentage of homes that were compliant, overly compliant, and below-code, and homes with undetermined compliance levels, while for the 2005 standards the table presents the percentage of homes that were compliant, overly compliant, and below-code. 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 and rose again under the 2005 standards. Also, the number of homes considered "overly compliant" increased under the 1998 and again under the 2001 and increased dramatically under the 2005 standards. The portion of homes statewide considered "non-complaint" fell under the 1998 standards, increased under the 2001 standards and fell again under the 2005 standards.

Table 5.2-2: Compliance of Single-Family Homes with Title 24 Standards

Analysis Parameter Description	Statewide	Region 1	Region 2	Region 3	Region 4	Region 5
Homes Built under 1995 Standards						
% 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%
% Below-Code	15.7%	8.8%	7.5%	6.2%	30.0%	37.2%
Homes Built under 1998 Standards						
% 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%
% Below-Code	14.4%	3.2%	0.0%	17.4%	17.2%	45.0%
Homes Built under 2001 Standards						
% 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%
% Below-Code	27.0%	3.0%	1.0%	11.0%	24.0%	55.0%
Homes Built under 2005 Standards	**Statewide**	**Region 1 and 2**		**Region 3 and 4**		**Region 5**
% Overly Compliant	58.2%	53.2%		55.7%		75.0%
% Compliant	28.9%	34.0%		27.8%		25.0%
% Below-Code	12.9%	12.8%		16.5%		0.0%

6 Sustainability Assessment

Overall, it appears that the energy savings realized in non-program homes are likely to diminish substantially in the future without further program support. Both Delphi panels said that there would be substantial reductions in the savings attributable to the IOU programs from above-code homes (see Table 4.3-7) and from improved code compliance (see Table 4.3-15). However, we should also point out that both panels said that at least some of the program related savings would continue, largely because of increased awareness of energy efficiency in general as well as increased awareness and knowledge of energy efficient building techniques and technologies (each of which are at least partially attributable to the IOU'S RNC programs).

To further qualitatively assess the sustainability of market effects attributable to the IOU'S RNC programs, the evaluation team has answered the questions about market transformation posed by Hewitt: [64]

- Is someone making money by offering it?
- Has a private market developed to continue its facilitation?
- Has the profession or trade adopted it as a standard practice?
- Would it be difficult or costly to revert to earlier equipment or practices?
- Are end-users requesting or demanding it?
- Have the risks to private market actors been reduced or removed?

The building industry in California has consistently built non-program homes that exceed Title 24 requirements since the adoption of the 1998 Title 24 standards, with 5.1% of homes built under the 1998 standards, increasing to 12.5% of homes built under the 2001 standards and over half, 58.2%, of homes built above-code under the 2005 standards (see Table 5.2-2). Clearly, a private market has developed to continue the practice of building above-code homes and the building industry is making money by offering above-code homes, including builders, Title 24 consultants, architects, HVAC contractors, and HERS raters.

It appears that there is relatively strong evidence that end-users (homebuyers) are requesting or demanding energy-efficient homes. The Phase I report found that there is strong evidence that non-participating homebuyers express demand for and willingness to pay for energy efficiency, though there was only a weak linkage to the IOU programs.[65] And while the Phase I report found

[64] Hewitt, 2000.

[65] Two-thirds (68%) of non-participating new homebuyers 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 homebuyers actually paying more for more efficient homes when given a choice. In addition, thirty-one of 32 builders in the Phase I report 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

that it is not clear whether this expressed demand and willingness to pay results in the actual demand for energy-efficient new homes, the sheer number of above-code non-program homes built during the 2006-2008 time period suggests that expressed demand may have helped lead to a large percentage of non-program homes being built to exceed code requirements.

While a private market, i.e., the building industry, has developed to profitably produce above-code homes and end-users are expressing demand, it is clearly not the standard practice as nearly 13% of homes are below code by an average of 10% (Table 4.2-3). Therefore, it appears as though it would be relatively easy for the building industry to revert to less energy-efficient building practices and technologies. In addition, a number of Title 24 consultants and building industry experts commented during the Delphi process that without the programs, builders would revert to less energy-efficient home designs.

Though the risks to private market actors has been reduced or removed, with the abundance of below-code homes it does not appear that the current level of above-code building practices and code compliance would continue without the IOU'S RNC programs.

In short, while there is evidence of some transformation of the RNC market in California, the market appears to be at least somewhat dependent on the IOU'S RNC programs to continue that transformation. Indeed, with their long history and close involvement with many market actors, it is not inaccurate to say that the IOU'S RNC programs are now part of the market, and that the market would clearly be disrupted if they were withdrawn or curtailed.

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 homebuyer 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).

7 Recommendations

7.1 Recommendations for the IOU'S RNC Programs

The recommendations for the IOU'S RNC programs from the Phase II market effects research largely echo the recommendations from Phase I:

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 efficient homes if they perceive efficiency 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.

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.

7.2 Recommendations for Future Evaluations

As stated in the Phase I report, because market transformation is a program goal, market effects research should occur on a regular basis; 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.

Related to the need for regular market effects evaluations, the protocols call for the collection of baseline and longitudinal indicators. This market effects research benefited from the collection of the Residential New Construction Baseline as part of the 2006-08 California Residential New Construction Program Evaluation and previous baseline studies that allowed for the comparison

of building practices and code compliance over time. Baseline studies should continue in the future on a regular basis to allow continued examination of efficiency trends over time.

As IOU-sponsored training programs were consistently identified as being critical to the observed market effects, the CPUC should consider coordinating the evaluation of education and training programs to include elements of market effects evaluations to better understand what building techniques and technologies are being applied to non-program homes.

The evaluation team had some difficulty identifying and recruiting building industry experts for the Delphi panel. For future program cycles, perhaps the CPUC could identify and recruit building industry experts who could serve on a similar Delphi panel at the conclusion of the program cycle. Panelists would be asked to follow the programs during the program cycle, paying particular attention to non-participant spillover.

7.3 Recommendations for Changes to the Market Effects Evaluation Protocol

The evaluation team suggests that the Market Effects Evaluation Protocol could be modified for estimating the net impacts of new construction programs. In the California residential new construction market, distinctive and continually changing state building codes, multiple and varied climates, and the prevalence of local market actors preclude a cross-sectional modeling approach for causation; new construction in California simply is not comparable enough to new construction in any other area—or even a combination of areas—to allow valid comparisons. In addition, the diversity and complexity of the end-uses and practices involved in new construction make a modeling approach problematic. This is in contrast to other types of markets that are relatively similar across areas, with relatively uniform technologies, in which quasi-experimental designs taking into account differences over time and across areas are more feasible. Hence, the Market Effects Evaluation Protocol could be modified to provide the following requirement for estimating the net impacts of new construction programs:

Table 7-1: Required Protocol for Estimating Net Market Effects

Level of Rigor	Net Market Effects Approach Requirements
Basic	A Delphi or expert panel approach, in which gross savings and penetration of technologies and practices are estimated and presented to panel members, who are then asked to attribute savings to energy efficiency programs and other factors; it is essential that there be at least two rounds of Delphi surveys, with the first round results summarized and presented in the second round survey so panel members can understand and learn from each other in developing the final attribution estimates.

7.4 Recommendations for Treatment of Non-Participant Spillover

A goal of this study was to "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."

An important factor bearing on the reliability of the non-participant spillover savings estimate is determining the extent to which the savings were counted in other utility program evaluations, in particular, the Codes and Standards Program evaluation, in order to avoid double-counting of savings. The evaluation team found that all of the energy savings from non-participant spillover had been counted in the Codes and Standards evaluation.

The Codes and Standards Program evaluation captured all spillover savings in non-program (baseline) homes (i.e., improved compliance with code and facilitating the construction of above-code homes) from 2006-2008 utility programs, because such savings contribute to compliance with Title 24. The RNC market effects (ME) study measured savings in homes exceeding the 2005 code relative to homes just meeting the code and in homes just meeting the 2005 code relative to homes not meeting the code. The Codes and Standards (C & S) Program evaluation measured savings in all homes using the 2001 code as baseline. Therefore, all gross savings in the RNC ME study are a strict subset of and should have been counted in the C & S Program evaluation's gross standard savings (see Appendix F for more details).

It is important to point out that while it is likely that there is overlap in savings with the C & S Programs, the market effects research helps program administrators understand how and why the savings were achieved and where they should consider concentrating their efforts in future program cycles. While the gross savings overlap, the RNC ME study was important because it provides another example of how market effects could be measured and how the scoping study, logic model and the results of a market effects pilot evaluation could identify the mechanisms behind program effects. The purpose of this and the other market effects studies was to test the reliability of quantifying market effects. The finding that the spillover savings overlap with savings counted in the Codes and Standards evaluation provides valuable corroboration of the scope and size of the impact of the IOU's RNC programs on non-participants. Also, unlike the C &S evaluation, the RNC ME study identifies the *mechanisms* by which non-participant spillover is achieved and the relative importance of these mechanisms.

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Appendix A Delphi Panel Questionnaires and Correspondences

A.1 Recruitment Script for Pre-Test of Delphi Panel Instrument, Title 24 Consultants Panel

Dear [RESPONDENT]

Hello, my name is Greg Clendenning from NMR and I am contacting you on behalf of the California Public Utilities Commission (CPUC). I am contacting you because of your knowledge of the residential new construction market, energy efficiency and the California investor-owned utilities' (IOU) residential new construction (RNC) programs.

The CPUC has asked us to conduct a set of interviews with Title 24 consultants in order to help determine the extent to which increases in the energy efficiency in the residential new construction market are attributable to investor owned utility (IOU) programs that encourage the installation of energy-efficient features in new homes.

Because these interviews are a follow-up to previous interviews, we are asking you to help us pre-test our interview guide in order to provide feedback and help improve the interview guide. We are offering $150 to you for completing our survey, which will likely require about 30 to 45 minutes of your time.

This survey is extremely important to the CPUC's understanding of the new construction market.

We are conducting our survey by email, using a Microsoft Excel spreadsheet. If you agree to participate I will email you the survey with instructions for completing the survey. Are you willing to help us pre-test our survey?

If you have any questions about our data collection efforts, please do not hesitate to contact Ayat Osman of the CPUC at 415-703-5953 or myself either by email (gclendenning@nmrgroupinc.com) or phone (617-284-6230 x3).

Thank you for your help.

Greg Clendenning

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A.2 Recruitment Email for Delphi Panel of Title 24 Consultants

Dear [Title 24 Consultant],

Hello, my name is Greg Clendenning from NMR and I am contacting you on behalf of the California Public Utilities Commission's (CPUC) Energy Division. I am contacting you because of your knowledge of the residential new construction market, energy efficiency and the California investor-owned utilities' (IOU) residential new construction (RNC) programs and because you participated in our first set of interviews in the fall of 2008.

The CPUC has asked us to conduct a second set of interviews with Title 24 consultants in order to help determine the extent to which increases in the energy efficiency in the residential new construction market are attributable to investor owned utility (IOU) programs that encourage the installation of energy-efficient features in new homes.

We are offering $150 to you for completing our survey, which involves two rounds. The first round will likely require about 30 to 45 minutes of your time. For the second round, once you and the rest of the Title 24 consultants participating in our study have completed the surveys, we will summarize the responses and provide you with your original responses and the summarized responses of all survey participants; the second round will probably require about 20 minutes of your time. We will ask you to review both your original responses and the summarized responses and provide you an opportunity to modify any of your original responses if necessary.

This survey is extremely important to the CPUC's understanding of the new construction market. All your answers will be held confidential—that is, we will never link any information to a particular person or company.

We are conducting our survey by email, using a Microsoft Excel spreadsheet. If you agree to participate I will email you the survey with instructions for completing the survey.

Are you willing to participate in our study?

If you have any questions about our data collection efforts, please do not hesitate to contact Ayat Osman of the CPUC at 415-703-5953 or myself either by email (gclendenning@nmrgroupinc.com) or phone (617-284-6230 x3).

Thank you for your help.

Greg Clendenning

Greg Clendenning, Ph.D.
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Home page: www.nmrgroupinc.com

A.3 Recruitment Email for Delphi Panel of Building Industry Experts

Dear [Building Industry Expert]

Hello, my name is Greg Clendenning from NMR and I am contacting you on behalf of the California Public Utilities Commission's (CPUC) Energy Division. I am contacting you because of your knowledge and expertise in the California residential new construction market, energy efficiency and the California investor-owned utilities' residential new construction programs.

The CPUC is seeking input from building industry experts in order to help determine the extent to which increases in the energy efficiency in the residential new construction market are attributable to investor owned utility (IOU) programs that encourage the installation of energy-efficient features in new homes.

We are offering $150 to you for completing our survey, which involves two rounds. The first round will likely require about 30 to 45 minutes of your time. For the second round, once you and the rest of the building industry experts participating in our study have completed the surveys, we will summarize the responses and provide you with your original responses and the summarized responses of all survey participants; the second round will probably require about 20 minutes of your time. We will ask you to review both your original responses and the summarized responses and provide you an opportunity to modify any of your original responses if necessary.

This survey is extremely important to the CPUC's understanding of the residential new construction market. All your answers will be held confidential—that is, we will never link any information to a particular person or company.

We are conducting our survey by email, using a Microsoft Excel spreadsheet. If you agree to participate we will email you the survey with instructions for completing the survey.

If you have any questions about our data collection efforts, please do not hesitate to contact Ayat Osman of the CPUC at 415-703-5953, myself either by email (gclendenning@nmrgroupinc.com) or phone (617-284-6230 x3), or my colleague David Barclay either by email (dbarclay@nmrgroupinc.com) or phone (617-284-6230 x1).

Thank you for your help.

Greg Clendenning

Greg Clendenning, Ph.D.
Senior Project Manager
NMR
Phone: 617-284-6230 x3
Fax: 617-284-6239
Email: gclendenning@nmrgroupinc.com
Home page: www.nmrgroupinc.com

A.4 Follow-up Letter to Non-Responding Title 24 Consultants, First Round of the Delphi Panel

STATE OF CALIFORNIA ARNOLD SCHWARZENEGGER, *Governor*

PUBLIC UTILITIES COMMISSION

505 VAN NESS AVENUE

SAN FRANCISCO, CA 94102-3298

Dear [Title 24 Consultant],

Recently you have been contacted about a study being sponsored by the California Public Utilities Commission's (CPUC) Energy Division. I am contacting you again because your participation in this study is very important and as of Tuesday, April 20th, we had not received a response from you. If you have already responded to the survey please accept our sincere thanks.

The CPUC is seeking input from Title 24 consultants in order to help determine the extent to which increases in the energy efficiency in the residential new construction market are attributable to investor owned utility (IOU) programs that encourage the installation of energy-efficient features in new homes.

We are offering $150 to you for completing our survey, which involves two rounds. The first round will likely require about 30 to 45 minutes of your time. For the second round, once you and the rest of the Title 24 consultants participating in our study have completed the surveys, we will summarize the responses and provide you with your original responses and the summarized responses of all survey participants; the second round will probably require about 20 minutes of your time. We will ask you to review both your original responses and the summarized responses and provide you an opportunity to modify any of your original responses if necessary.

This survey is extremely important to the CPUC's understanding of the residential new construction market. All your answers will be held confidential—that is, we will never link any information to a particular person or company.

We are conducting our survey by email, using a Microsoft Excel spreadsheet. If you agree to participate we will email you the survey with instructions for completing the survey.

If you are willing to participate, please contact me or Greg Clendenning of NMR (our evaluation contractor) either by email (gclendenning@nmrgroupinc.com) or phone (617-284-6230 x3). If we do not hear from you, Greg or his colleague David Barclay of NMR will contact you; please accept calls and emails from them.

Thank you for your help.

Ayat Osman
Energy Division
Energy Efficiency Section
California Public Utilities Commission
Phone (415) 703-5953
e-mail: aeo@cpuc.ca.gov

A.5 Follow-up Letter to Non-Responding Building Industry Experts, First Round of the Delphi Panel

STATE OF CALIFORNIA ARNOLD SCHWARZENEGGER, *Governor*

PUBLIC UTILITIES COMMISSION

505 VAN NESS AVENUE

SAN FRANCISCO, CA 94102-3298

Dear [Building Expert],

Recently you have been contacted about a study being sponsored by the California Public Utilities Commission's (CPUC) Energy Division. I am contacting you again because your participation in this study is very important and as of Tuesday, April 20th, we had not received a response from you. If you have already responded to the survey please accept our sincere thanks.

The CPUC is seeking input from building industry experts in order to help determine the extent to which increases in the energy efficiency in the residential new construction market are attributable to investor owned utility (IOU) programs that encourage the installation of energy-efficient features in new homes.

We are offering $150 to you for completing our survey, which involves two rounds. The first round will likely require about 30 to 45 minutes of your time. For the second round, once you and the rest of the building industry experts participating in our study have completed the surveys, we will summarize the responses and provide you with your original responses and the summarized responses of all survey participants; the second round will probably require about 20 minutes of your time. We will ask you to review both your original responses and the summarized responses and provide you an opportunity to modify any of your original responses if necessary.

This survey is extremely important to the CPUC's understanding of the residential new construction market. All your answers will be held confidential—that is, we will never link any information to a particular person or company.

We are conducting our survey by email, using a Microsoft Excel spreadsheet. If you agree to participate we will email you the survey with instructions for completing the survey.

If you are willing to participate, please contact me or Greg Clendenning of NMR (our evaluation contractor) either by email (gclendenning@nmrgroupinc.com) or phone (617-284-6230 x3). If we do not hear from you, Greg or his colleague David Barclay of NMR will contact you; please accept calls and emails from them.

Thank you for your help.

Ayat Osman
Energy Division
Energy Efficiency Section
California Public Utilities Commission
Phone (415) 703-5953
e-mail: aeo@cpuc.ca.gov

A.6 Instructions for Round One of the Delphi Panels

Dear [Delphi Panelist],

Thank you for participating in this study for the CPUC Energy Division, your help and feedback are greatly appreciated.

Attached is the survey instrument. The survey can be found on the tab titled "Survey." Background data are presented throughout the survey; the data are also summarized on the tab titled "Background Data."

For this survey, we would like you to do the following:

1) Respond to the survey to the best of your abilities
2) Provide any comments or questions you may have in Column E ("Comments and Questions").

Below is an introduction to the survey as well as some instructions (most of the same information is also included in the Excel file).

The goal of this study is to determine the extent to which increases in the energy efficiency in the residential new construction market (RNC) are attributable to investor owned utility (IOU) programs, and to determine whether energy savings from increases in energy efficiency in non-program homes can be quantified with sufficient reliability to be treated as a resource. The IOU programs include programs that encourage the installation of energy-efficient features in new homes (i.e., PG&E Residential New Construction program, SCE New Homes program, and SDG&E and SDG Advanced Home program), as well as programs that may otherwise affect the residential new construction market (e.g., Flex Your Power). The IOU'S RNC programs provide incentives as well as design assistance, design review, education, and training components to the RNC industry.

For the duration of this survey, we would like you to answer for NON-PROGRAM single-family ATTACHED and DETACHED homes IN CALIFORNIA only—NOT multifamily buildings, built from 2006 to 2008 in the IOU territories, but built without any direct participation in the IOU new construction programs. By single-family attached, we mean a townhouse or duplex, with a wall separating the units from basement to roof, and with separate utilities meters for each unit. By NON-PROGRAM homes we mean homes built WITHOUT the assistance of the IOU'S RNC programs.

The survey is divided into 3 sections:

(1) Assessing the energy savings from homes exceeding code compared to homes just meeting code;

(2) Assessing the energy savings from homes just meeting code compared to below-code homes; and

(3) The proportion of below-code homes in California

Please respond to the questions in each section to the best of your ability. Please record your responses in the cells shaded in blue.

For your convenience, this worksheet has been protected - you will only be able to enter data in cells shaded in blue, and you can enter comments in column E (shaded light grey).

Please note that as you respond to the survey, some questions may be shaded out based on your responses to questions that appear earlier in the survey. If a question is shaded dark grey with red font crossed out, please skip it.

Thank you again for your help. Please do not hesitate to email or call with any questions.

Greg Clendenning, Ph.D.
Senior Project Manager
NMR
Phone: 617-284-6230 x3
Fax: 617-284-6239
Email: gclendenning@nmrgroupinc.com
Home page: www.nmrgroupinc.com

A.7 Delphi Panel Survey Instrument, Round 1

The Role of the California Investor Owned Utility (IOU) Residential New Construction (RNC) Programs on the 2006 to 2008 California single-family Home Construction Market	**Comments and Questions**
Thank you for participating in our study. The goal of this study is to determine the extent to which increases in the energy efficiency in the residential new construction market (RNC) are attributable to investor owned utility (IOU) programs. This would include programs that encourage the installation of energy-efficient features in new homes (i.e., PG&E Residential New Construction program, SCE New Homes program, and SDG&E and SDG Advanced Home program), as well as programs that may otherwise affect the residential new construction market (e.g., Flex Your Power). The IOU RNC programs provide incentives as well as design assistance, design review, education, and training components to the RNC industry.	
For the duration of this survey, we would like you to answer for NON-PROGRAM single-family ATTACHED and DETACHED homes IN CALIFORNIA only—NOT multifamily buildings. By single-family attached, we mean a townhouse or duplex, with a wall separating the units from basement to roof, and with separate utilities meters for each unit. By NON-PROGRAM homes we mean homes built WITHOUT the assistance of the IOU RNC programs.	
The survey is divided into 3 sections:	
(1) Assessing the energy savings from homes exceeding code compared to homes just meeting code;	
(2) Assessing the energy savings from homes just meeting code compared to non-compliant homes; and	
(3) The proportion of non-compliant homes in California	
Please respond to the questions in each section to the best of your ability. Please record your responses in the cells shaded in blue. For your convenience, this worksheet has been protected - you will only be able to enter data in cells shaded in blue	
Please note that as you respond  y, some questions may be shaded out based on your responses to questions that appear earlier in the survey. If a question is shade with red font crossed out, please skip it.	
Before asking any questions, we .o present some data pertaining to the energy efficiency and code compliance of new single-family homes in California, and associated energy savings from homes exceeding code.	
Please note that all data are also presented in the worksheet named "Background Data"	
Section 1: Savings from Homes Exceeding Code Compared To Homes Just Meeting Code	
In the following, when we talk about non-program homes, we mean single-family homes built from 2006 through 2008 in the IOU territories, but without any direct participation in the IOU new construction programs.	
The following estimates are based on an on-site analysis of 422 new single-family homes and metering of the three compliance-related end uses—heating, cooling and domestic hot water—in 131 of those homes conducted for the California Residential New Construction Baseline study. (The report is available at http://www.energydataweb.com/cpuc/default.aspx)	
We estimate that the population of non-program single-family homes built in California IOU territories between 2006 and 2008 to have the following characteristics:	
• 27% of non-program single-family homes are code compliant (that is, just meet code, but do not exceed it)	
• 52% of non-program single-family homes exceed code	
o On average, above-code non-program homes exceed code by 12%	

- Compared to homes just meeting code, we estimate that the average above-code home will provide the following annual savings:
  - o 16% savings on electricity usage
  - o 11% savings on natural gas usage

Please note that all data on compliance rates and energy savings are summarized on the worksheet "Background Data"

In addition, we have estimated compliance rates and energy savings for 3 regions in California: Coastal, Inland, and Mountain & Desert. A map of the climate regions can be seen below and on the worksheet "Background Data." For the Coastal, Inland, and Mountain & Desert Climate Regions, we estimate that the population of non-program single-family homes built in California IOU territories between 2006 and 2008 to have the following characteristics:

	Coastal Climate Region	Inland Climate Region	Mountain & Desert Climate Region
Percentage of code compliant homes	25%	28%	25%
Percentage of above code homes	58%	48%	54%
Above code homes exceed code by:	24%	11%	12%

- Compared to homes just meeting code, we estimate that the average above-code home will provide the following annual savings in each region:

	Coastal Climate Region	Inland Climate Region	Mountain & Desert Climate Region
Savings on electricity usage	20%	10%	24%
Savings on natural gas usage	22%	12%	6%

BEGIN QUESTIONS HERE. Again, pleaase note that throughout this survey, cells requiring a responses are shaded blue.

Q1. First we would like you to indicate the climate regions of the state with which you are familiar with current building practices. Please review the map and mark each region with an "X". A larger map can be viewed in the worksheet "Background Data."

Climate Region	Familiar with Building Practices (Mark with an "X")
Coastal	*Response Here*
Inland	*Response Here*
Mountain & Desert	*Response Here*

Next we would like to ask you a series of questions pertaining to the energy efficiency and code compliance of **non-program single-family homes** built from 2006 through 2008 in California, and associated energy savings from homes exceeding code.

Q2. Please briefly describe the building measures being installed or building practices being used to make non-program homes exceed code and realize the savings compared to homes just meeting code.	
Type of Savings	**Building measures or practices:**
Savings on electricity usage:	*Please Write Your Response Here:*
Savings on natural gas usage:	*Please Write Your Response Here:*

Q3. Savings from non-program homes EXCEEDING code compared to homes JUST MEETING code:

Based on the data just provided to you, please estimate the proportion of savings—in the average non-program home built from 2006 through 2008 that exceeds code compared to the average home that just meets code—that is attributable to each of the following factors.

For example, if you think a given factor is responsible for one-half of the savings listed in the first row, a second factor is responsible for two-tenths of the savings, and a third factor is responsible for three-tenths, you would record 50%, 20%, and 30% for the three factors, respectively.

THE TOTAL AMOUNT SHOULD SUM TO 100%

FACTORS: non-program homes EXCEEDING code compared to homes JUST MEETING code	**Electricity Energy Savings**	**Natural Gas Savings**
Please do your best to make an estimate of savings. If you do not know for any of the savings, please place an "X" in the appropriate box of this row and skip any questions that are shaded dark grey with red font crossed out.		
The pre-2006 IOU Residential New Construction programs, excluding any effect the programs may have had on changes to codes and standards (i.e., Title 20 and Title 24)	0%	0%
Non-IOU Residential New Construction programs such as ENERGY STAR homes, LEED for homes, and the Solar Initiative	0%	0%
The 2006-2008 IOU Residential New Construction (RNC) programs, excluding any effect the programs may have had on changes to codes and standards (i.e., Title 20 and Title 24).	0%	0%
Other factors, including the downturn in the housing market, changes in energy prices, global warming/climate change, and naturally occurring advances in the residential new construction industry	0%	0%
TOTAL	0%	0%

PLEASE MAKE SURE ALL THREE TOTAL SAVINGS = 100% BEFORE CONTINUING

~~Q3A. You attributed some ELECTRICITY ENERGY Savings to Other Factors. What factors are you taking into account in your estimate, other than the ones mentioned above?~~	~~*Please Write Your Response Here:*~~
~~Q3B. You attributed some NATURAL GAS Savings to Other Factors. What factors are you taking into account in your estimate, other than the ones mentioned above?~~	~~*Please Write Your Response Here:*~~

Q4. Savings from individual 2006-2008 IOU Residential New Construction program elements

Of the savings—in non-program homes built from 2006 through 2008 that EXCEED code (by an average of 14%) compared to homes JUST MEETING code—that you attributed to the 2006-2008 IOU Residential New Construction programs (as opposed to the savings you attributed to other factors), please estimate the proportion of the savings that is attributable to each of the following elements of the 2006-2008 IOU Residential New Construction programs.

THE TOTAL AMOUNT SHOULD SUM TO 100%

	Electricity Energy Savings	Natural Gas Savings
You estimated that the program was responsible for the following percentage of savings from non-program homes EXCEEDING code compared to homes JUST MEETING code:	0%	0%

Factors: Program Elements	Electricity Energy Savings	Natural Gas Savings
Please do your best to make an estimate of savings. If you do not know for any of the savings, please place an "X" in the appropriate box of this row and skip any questions that are shaded dark grey with red font crossed out.		
Plan check review for program homes. This is the review process in which IOU staff reviews participating builders' plans and Title 24 compliance documentation to ensure accurate modeling, and, if necessary, provide revised models to builders and energy consultants	0%	0%
Outreach	0%	0%
Training of local code officials	0%	0%
Other program elements	0%	0%
Training of builders	0%	0%
Incentives	0%	0%
Training of Title 24 Consultants	0%	0%
Advertising	0%	0%
Training of subcontractors	0%	0%
Design Assistance	0%	0%
TOTAL	0%	0%

Q5. Persistence of savings from non-program homes EXCEEDING code in the future

Of the savings—in non-program homes built from 2006 through 2008 that exceed code compared to homes just meeting code—that you attributed to the 2006-2008 IOU Residential New Construction programs (as opposed to the savings you attributed to other factors), please estimate how much the savings would be reduced in homes built in the future if the budget available to the IOU Residential New Construction programs were reduced by 50% OR if the IOU Residential New Construction programs were eliminated. Please assume no code changes occur in the future.

For example, if the IOU program budget were reduced by 50% and you think the electricity energy savings would be reduced by 25% as a result of the budget reduction, please respond 25% in column B.

	Electricity Energy Savings		Natural Gas Savings
You estimated that the program was responsible for the following percentage of savings from non-program homes EXCEEDING code compared to homes JUST MEETING code:	0%		0%

	Electricity Energy Savings	Natural Gas Savings
50% reduction in IOU Residential New Construction Program Budget	0%	0%
Elimination of the IOU Residential New Construction Programs	0%	0%

~~Q6. Please provide an explanation of your response to the persistence (or lack of persistence) of savings from future non-program homes EXCEEDING code. Please assume no code changes occur in the future~~

~~*Please Write Your Response Here:*~~

~~*If you have any additional thoughts or comments, please write them here:*~~

Section 2: Savings from Homes JUST MEETING Code Compared To NON-COMPLIANT Homes

Next we would like to ask you another series of questions pertaining to non-program single-family homes not meeting code compared to homes that just meet code but do not exceed it. As you can see in the data below, even though compliance with the code is the law, some homes are not code compliant and a number of factors may contribute to the percentage of homes that are code compliant. As we reported previously, according to the California Residential New Construction Baseline study, we estimate that the population of non-program single-family homes built in California from 2006 through 2008 has the following characteristics:

- 52% of non-program single-family homes exceed code
- 27% of non-program single-family homes are code compliant (that is, just meet code, but do not exceed it)
- 22% of non-program single-family homes are non-compliant
  - o On average, non-compliant homes are 12% below code
- Compared to non-compliant homes, we estimate that the average home just meeting code will provide the following annual savings:
  - o 17% savings on electricity usage
  - o 10% savings on natural gas usage

In addition, we have estimated compliance rates and energy savings for 3 regions in California: Coastal, Inland, and Mountain & Desert. A map of the climate regions can be seen on the worksheet "Background Data." For the Coastal, Inland, and Mountain & Desert Climate Regions, we estimate that the population of non-program single-family homes built in California IOU territories between 2006 and 2008 to have the following characteristics:

	Coastal Climate Region	Inland Climate Region	Mountain & Desert Climate Region
Percentage of above code homes	58%	48%	54%
Percentage of code compliant homes	25%	28%	25%
Percentage of non-compliant homes	18%	24%	21%
non-compliant homes are below code by:	-24%	-11%	-9%

- Compared to non-compliant homes, we estimate that the home just meeting code home will provide the following annual savings in each region:

	Coastal Climate Region	Inland Climate Region	Mountain & Desert Climate Region
Savings on electricity usage	-18%	23%	7%
Savings on natural gas usage	30%	6%	10%

Q7. Please briefly describe the building measures being installed or building practices being used to make non-program homes meet code	
Type of Savings	**Building measures or practices:**
Savings on electricity usage:	*Please Write Your Response Here:*
Savings on natural gas usage:	*Please Write Your Response Here:*

Q8. Savings from non-program homes JUST MEETING code compared to NON-COMPLIANT homes
Based on the data just provided to you, please estimate the proportion of savings—in the average non-program home built from 2006 through 2008 that just meets code compared to the average non-compliant home—that is attributable to each of the following factors.
For example, if you think a given factor is responsible for one-half of the savings listed in the first row, a second factor is responsible for two-tenths of the savings, and a third factor is responsible for three-tenths, you would record 50%, 20%, and 30% for the three factors, respectively.

THE TOTAL AMOUNT SHOULD SUM TO 100%

FACTORS: non-program homes JUST MEETING code compared to NON-COMPLIANT homes	**Electricity Energy Savings**	**Natural Gas Savings**
Please do your best to make an estimate of savings. If you do not know for any of the savings, please place an "X" in the appropriate box of this row and skip any questions that are shaded dark grey with red font crossed out.		
The pre-2006 IOU Residential New Construction programs, excluding any effect the programs may have had on changes to codes and standards (i.e., Title 20 and Title 24)	0%	0%
Non-IOU Residential New Construction programs such as ENERGY STAR homes, LEED for homes, and the Solar Initiative	0%	0%
The 2006-2008 IOU Residential New Construction (RNC) programs, excluding any effect the programs may have had on changes to codes and standards (i.e., Title 20 and Title 24).	0%	0%
Other factors, including the downturn in the housing market, changes in energy prices, global warming/climate change, and naturally occurring advances in the residential new construction industry	0%	0%
TOTAL	0%	0%

PLEASE MAKE SURE ALL THREE TOTAL SAVINGS = 100% BEFORE CONTINUING

~~**Q8A. You attributed some ELECTRICITY ENERGY Savings to Other Factors. What factors are you taking into account in your estimate, other than the ones mentioned above?**~~	~~*Please Write Your Response Here:*~~
~~**Q8B. You attributed some NATURAL GAS Savings to Other Factors. What factors are you taking into account in your estimate, other than the ones mentioned above?**~~	~~*Please Write Your Response Here:*~~

~~**Q9. Savings from individual 2006-2008 IOU Residential New Construction program elements**~~

Of the savings – in non-program homes built from 2006 through 2008 that JUST MEET code compared to NON-COMPLIANT homes - that you attributed to the 2006-2008 IOU Residential New Construction programs (as opposed to the savings you attributed to other factors), please estimate the proportion of the savings that is attributable to each of the following elements of the 2006-2008 IOU Residential New Construction programs.

THE TOTAL AMOUNT SHOULD SUM TO 100%

	Electricity Energy Savings	Natural Gas Savings
You estimated that the program was responsible for the following percentage of savings from non-program homes JUST MEETING code compared to NON-COMPLIANT homes:	0%	0%
Factors: Program Elements	**Electricity Energy Savings**	**Natural Gas Savings**
Please do your best to make an estimate of savings. If you do not know for any of the savings, please place an "X" in the appropriate box of this row and skip any questions that are shaded dark grey with red font crossed out.		
Plan check review for program homes. This is the review process in which IOU staff reviews participating builders' plans and Title 24 compliance documentation to ensure accurate modeling, and, if necessary, provide revised models to builders and energy consultants	0%	0%
Outreach	0%	0%
Training of local code officials	0%	0%
Other program elements	0%	0%
Training of builders	0%	0%
Incentives	0%	0%
Training of Title 24 Consultants	0%	0%
Advertising	0%	0%
Training of subcontractors	0%	0%
Design Assistance	0%	0%
TOTAL	0%	0%

Q10. Persistence of savings from non-program homes JUST MEETING code in the future

Of the savings – in non-program homes built from 2006 through 2008 that JUST MEET code compared to NON-COMPLIANT homes – that you attributed to the 2006-2008 IOU Residential New Construction programs (as opposed to the savings you attributed to other factors), please estimate how much the savings would be reduced in homes built in the future if the budget available to the IOU Residential New Construction programs were reduced by 50% and if the IOU Residential New Construction programs were eliminated. Please assume no code changes occur in the future.

For example, if the IOU program budget were reduced by 50% and you think the electricity energy savings would be reduced by 25% as a result of the budget reduction, please respond 25% in column B.

	Electricity Energy Savings	Natural Gas Savings
You estimated that the program was responsible for the following percentage of savings from non-program homes JUST MEETING code compared to NON-COMPLIANT homes:	0%	0%
	Electricity Energy Savings	**Natural Gas Savings**
50% reduction in IOU Residential New Construction Program Budget	0%	0%
Elimination of the IOU Residential New Construction Programs	0%	0%

~~Q11. Please provide an explanation of your response to the persistence (or lack of persistence) of savings from future non-program homes JUST MEETING code. Please assume no code changes occur in the future~~
~~*Please Write Your Response Here:*~~
~~*If you have any additional thoughts or comments, please write them here:*~~

Proportion of Non-compliant Homes

Q12. As mentioned earlier, the residential new construction baseline study found that 22% of non-program homes built from 2006 to 2008 in California are non-compliant, and that, on average, non-compliant homes are 12% below code.

How would non-compliance be changed by the absence of the IOU programs and other factors?

Please estimate the proportion of non-program homes built from 2006 through 2008 that would have been non-compliant and the average proportion below code those non-compliant homes would have been in the absence of each of the following factors individually (but assuming all other factors remain unchanged from what actually occurred).

For example, if a program or factor did not exist, and as a result you think the percentage of non-compliant homes would increase from 27% to 30% of non-program homes, please respond 30% in column B. And if, without the program or factor, you think that the average non-compliant home would be 25% below code instead of 17% below code, please respond 25% in column D.

	Please Note: 22% of non-program homes built from 2006 to 2008 in CA are non-compliant	*Please Note: on average, non-compliant homes are 12% below code*
Factors	**The proportion of non-program homes (2006 to 2008) that would have been non-compliant in the absence of each factor**	**The average percentage below code for non-compliant homes (2006 - 2008) in the absence of each factor**
Please do your best to make an estimate of non-compliant homes and the average percentage below code. If you do not know, please place an "X" in the appropriate box of this row and skip any questions that are shaded dark grey with red font crossed out.		
The 2006-2008 IOU Residential New Construction (RNC) programs DID NOT EXIST		
Non-IOU Residential New Construction programs such as ENERGY STAR homes, LEED for homes, programs sponsored by municipal utilities such as SMUD and LADWP, Environments for Living, ComfortWise, and the Solar Initiative DID NOT EXIST		
Any other factors, for example, the downturn in the housing market, changes in energy prices, global warming and naturally occurring advances in the residential new construction industry DID NOT OCCUR		

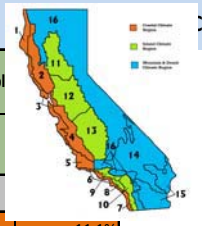
	Other Factors
~~Q12A. You attributed the proportion of non-compliant homes to Other Factors. What factors are you taking into account in your estimate, other than the ones mentioned above?~~	~~*Please Write Your Response Here:*~~
~~Q12B. You attributed the average percentage a non-compliant home would be below code to Other Factors. What factors are you taking into account in your estimate, other than the ones mentioned above?~~	~~*Please Write Your Response Here:*~~

	Other Programs
~~Q12C. You attributed the proportion of non-compliant homes to Non-IOU Residential New Construction programs. What Non-IOU Residential New Construction programs are you taking into account in your estimate?~~	~~*Please Write Your Response Here:*~~

	Other Programs
~~Q12C. You attributed the proportion of non-compliant homes to Non-IOU Residential New Construction programs. What Non-IOU Residential New Construction programs are you taking into account in your estimate?~~	~~*Please Write Your Response Here:*~~
~~Q12D. You attributed the average percentage a non-compliant home would be below code to Non-IOU Residential New Construction. What Non-IOU Residential New Construction programs are you taking into account in your estimate?~~	~~*Please Write Your Response Here:*~~
Thank you for your cooperation! Please feel free to add any additional thoughts in the space below.	

Comments: *Please write your response here:*

Compliance Rates:



Region	n	Overall Compl
Statewide	422	
Coastal	125	11.1%
Inland	240	4.5%
Mountain & Desert	57	5.8%

		By Compliance Type			
Region	Compliance Type	n	Compliance Margin	Percent of Region	Percent of Sample
Statewide	Above Code	218	12.2%	52%	52%
	Non-compliant	91	-11.8%	22%	22%
	Code compliant	113	-0.4%	27%	27%
Coastal	Above Code	72	21.2%	58%	17%
	Non-compliant	22	-26.6%	18%	5%
	Code compliant	31	-2.5%	25%	7%
Inland	Above Code	115	11.3%	48%	27%
	Non-compliant	57	-11.0%	24%	14%
	Code compliant	68	-0.1%	28%	16%
Mountain & Desert	Above Code	31	11.2%	54%	7%
	Non-compliant	12	-9.5%	21%	3%
	Code compliant	14	-0.6%	25%	3%

Energy savings, above code homes vs. code compliant homes:

	Percentage Savings			
Type of Savings	Statewide	Coastal Climate Region	Inland Climate Region	Mountain & Desert Climate Region
Savings on electricity usage	15.9%	19.7%	10.3%	23.6%
Savings on natural gas usage	11.0%	21.9%	11.9%	6.0%

Energy savings, code compliant homes vs. non-compliant homes:

	Percentage Savings			
Type of Savings	Statewide	Coastal Climate Region	Inland Climate Region	Mountain & Desert Climate Region
Savings on electricity usage	16.5%	-17.8%	22.7%	7.4%
Savings on natural gas usage	9.6%	29.5%	6.4%	9.8%

A.8 Delphi Panel Survey Instrument, Round 2

Delphi Panelist Response Summary

The Role of the California Investor Owned Utility (IOU) Residential New Construction (RNC) Programs on the 2006 to 2008 California Single-Family Home Construction Market

Dear [REPLACE],

Thank you again for your assistance in the first round of our Delphi study.

In consideration of your time we are offering an additional $250 to you or a charity of your choice for completing round two of this Delphi study

This document contains your original responses to the survey plus a summary of the estimates made by you and your fellow panel members. In this second and final round, we request that you review and reflect on that summary, and, if necessary, provide revisions to your estimates from the first round.

We estimate that this second, and final, round should take less of your time than the first round. **We would like to have your final responses by July 23, 2010**. We will be contacting you in the next few days by phone to ensure you received the study and see if you have any questions. In the meantime, if you have any questions at all, please call Greg Clendenning at 617-284-6230, Ext 3 or David Barclay at 617-284-6230, Ext 1. Or email us at gclendenning@nmrgroupinc.com or dbarclay@nmrgroupinc.com.

Best Regards,

Greg Clendenning, Ph.D.
Senior Project Manager
NMR

Phone: 617-284-6230 x3

Fax: 617-284-6239

Email: gclendenning@nmrgroupinc.com

A.8.1 Review of Delphi Study Objectives and Process

A.8.1.1 Objective

The goal of this study is to determine the extent to which increases in the energy efficiency in the residential new construction (RNC) market are attributable to investor-owned utility (IOU) programs. This would include programs that encourage the installation of energy-efficient features in new homes (i.e., PG&E Residential New Construction program, SCE New Homes program, and SDG&E and SDG Advanced Home program), as well as programs that may otherwise affect the residential new construction market (e.g., Flex Your Power). The IOU'S RNC programs provide incentives as well as design assistance, design review, education, and training components to the RNC industry.

A.8.1.2 Process

Previously, we presented data on the compliance rates and energy savings of single-family new homes built from 2006 to 2008 in the IOU territories to you and members of two panels, a panel of Title 24 consultants (n = 24) and a panel of building industry experts (n = 7). We asked you and your fellow panel members to attribute energy savings from homes exceeding code (compared to homes just meeting code) and energy savings from homes just meeting code (compared to below-code homes) to a variety of factors, including the IOU'S RNC programs.

In this document, we have summarized the estimates and comments made by you and your fellow panel members. The summary estimates are organized by Title 24 consultants and building industry experts. Please note, this document contains only some illustrative comments while an extended list of comments is included in the accompanying appendix. Our final request is as follows:

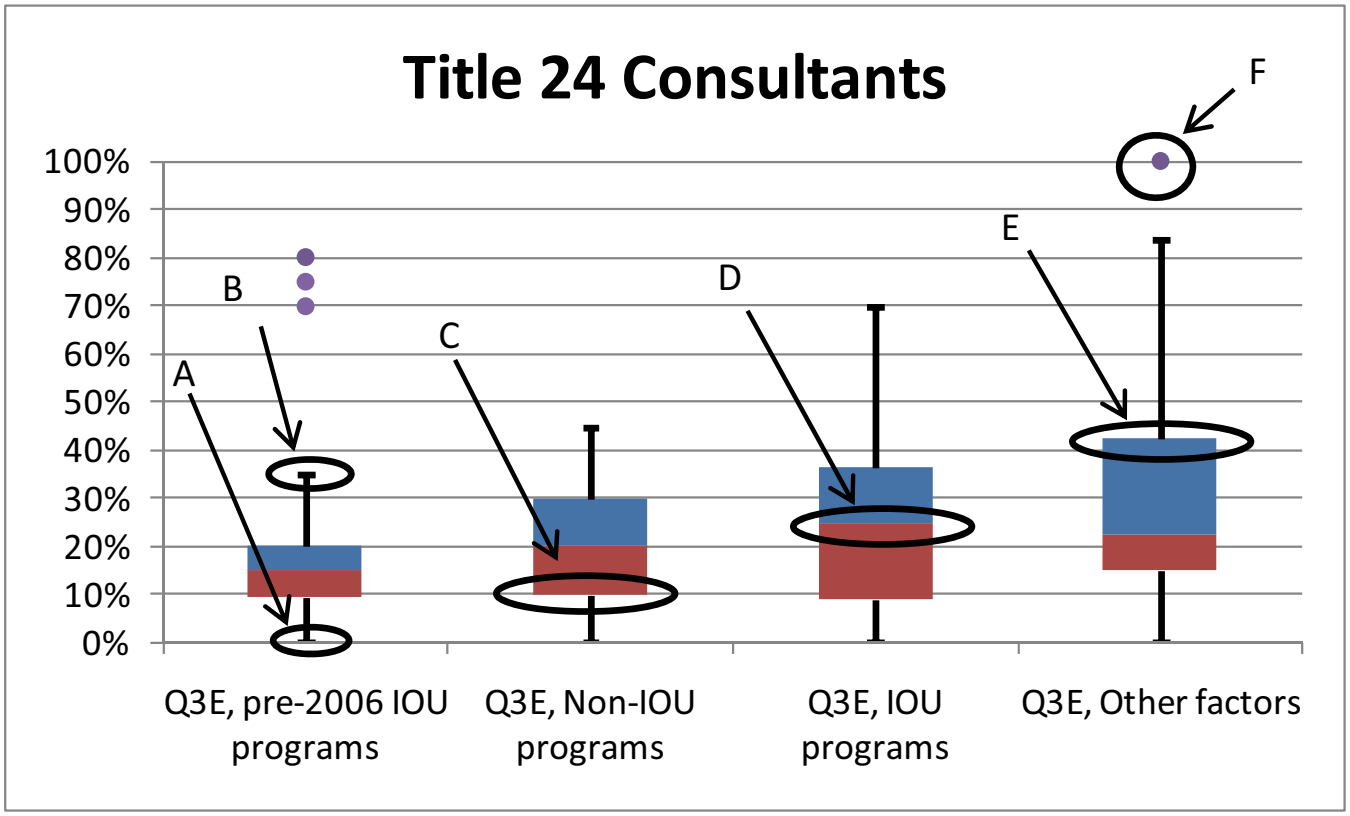
- ***Please review the summary of estimates by other panel members, the accompanying comments, and your initial estimates.***
  - In doing so, please consider carefully the estimates and comments of the other respondents.
  - A summary of the compliance data is provided at the end of this document
- ***If you wish to modify your projections and assumptions****:*
  - Enter your revised estimates in the tables provided and please state any reasons for changing your projections. Please understand, however, that we are most interested in what you believe is most likely, and we are not interested in trying to achieve a consensus. If you find some estimates or comments simply off the mark, please consider only those which you believe are plausible and tell us why.
- ***If you do not wish to modify your projections or assumptions***
  - For each set of estimates, mark the box labeled "No."
- ***Please add any comments on the appropriateness of the other assumptions and comments listed.***
- ***Return your completed survey***
  - Simply save your responses and email the document to us (gclendenning@nmrgroupinc.com or dbarclay@nmrgroupinc.com). Alternatively, you may fax or mail the document to us (Fax: 617-284-6239; Mailing address: 50-2 Howard St., Somerville, MA 02144.

A.8.2 Overview of the Data Summary Figures: Box and Whisker Plots

We have summarized the numerical responses with a box and whisker plot, which is a way of graphically summarizing the distribution of a set of numerical data. Figure A.8-1 (below) is an example of a box and whisker plot for responses by Title 24 Consultants to question 3, the attribution of electricity savings from above-code homes compared to homes just meeting code. The box plot identifies several key data points:

- The smallest response (the bottom whisker, labeled "A" in Figure A.8-1)
- The largest response (the top whisker, labeled "B" in Figure A.8-1)
- The first quartile response (the bottom of the box (red), labeled "C" in Figure A.8-1)
- **The median response (the midpoint of the distribution, labeled "D" in Figure A.8-1)**
- The third quartile response (the top of the box (blue), labeled "E" in Figure A.8-1)
- In some cases, responses that are significantly larger or smaller than nearly all other responses are presented outside of the box plot (labeled "F" in Figure A.8-1)
- The box represents 50% of all responses (i.e., responses ranging from the first quartile to the third quartile)
- A smaller box, such as the box of responses attributing savings to the pre-2006 IOU programs, indicates that responses are clustered across a relatively small range
- A larger box, such as the box of responses attributing savings to the IOU programs, indicates that responses are spread across a relatively large range

Figure A.8-1: Q3E, Above-code Homes, Attribution of Electricity Savings by Title 24 Consultants



A.8.3 Data Summary: Above-Code Homes Compared to Homes Just Meeting Code

In this section, we present a summary of responses to questions pertaining to savings associated with above-code homes compared to homes just meeting code.

A.8.3.1 Building Measures and Practices Responsible for Above-code Homes

Respondents were most likely to identify HVAC systems (71% of respondents) and windows (65%), followed by insulation (26%) and radiant barriers (26%) as being responsible for electricity savings (Table A.8-1). For natural gas savings, respondents were most likely to identify HVAC systems (68% of respondents) and water heaters (61%), followed by windows (42%) and insulation (35%).

Table A.8-1: Building Measures and Practices Responsible for Above-code Homes

(Multiple Response)

Building Measure or Technique	Type of Savings	
	Electricity	Natural Gas
n	*25*	*25*
HVAC	71%	68%
Windows	65%	42%
Insulation	26%	35%
Radiant Barrier	26%	3%
Lighting	6%	0%
Air sealing / infiltration	6%	6%
Doors	3%	0%
Appliances	3%	0%
Water heater	3%	61%
Orientation	3%	0%
Thermal mass	3%	0%

A.8.3.2 Comments Pertaining to Attribution of Energy Savings from Above-code Homes

When asked to identify other factors that contributed to energy savings from above-code homes, respondents most commonly identified increased use of building technologies (often adding that increased use was due to lower prices, increased availability or improved cost effectiveness), the downturn in the economy (making energy prices more salient to homeowners), proactive builders and owners, and greater awareness of energy efficient technologies or building practices (Table A.8-2).

Table A.8-2: Other Factors that Contributed to Energy Savings from Above-code Homes
(Multiple Response)

Other factors responsible for energy savings	Type of Savings	
	Electricity (% of respondents)	Natural Gas (% of respondents)
n	*26*	*26*
Building technologies (i.e., lighting, HVAC) - lower prices, increased availability and improved cost effectiveness	39%	39%
Economy	16%	13%
Proactive builders / owners	13%	13%
Greater awareness of energy efficiency, technologies and green building practices	13%	13%
Energy Prices	10%	10%
Differentiate homes through energy efficiency	6%	6%
Global Warming	3%	3%
Incentive program (unspecified)	3%	3%
Local requirements (city / county)	3%	0%
Build-it-Green	3%	3%
NSHP New Solar Homes Partnership	3%	3%
Changes in building design practices	3%	0%
Standardize building design for a development	3%	3%

A number of respondents elaborated on the role of the IOU programs and other factors in savings from above-code homes. We provide three illustrative comments below; the remaining comments are included in the separate Appendix document (included in the same email as this document).

One Title 24 consultant identified code enforcement as well as builder and contractor education as being critical to building efficient homes:

> *Code enforcement plays a big part in saving energy. Making sure the building department, including inspectors, knows what it takes to make sure energy conservation measures are followed…builders and subcontractors need to be educated to make sure insulation, HVAC, etc. are installed properly. As these people become more educated, buildings will be built more energy efficient.*

A second Title 24 consultant provided comments pertaining to the education of homeowners, builders and sub-contractors:

> *I believe that the IOU programs provide a great platform to educate homeowners about energy efficiency regardless of their participation in any program. Educating builders & sub-contractors is the key for non-program homes to continue to exceed code compliance.*

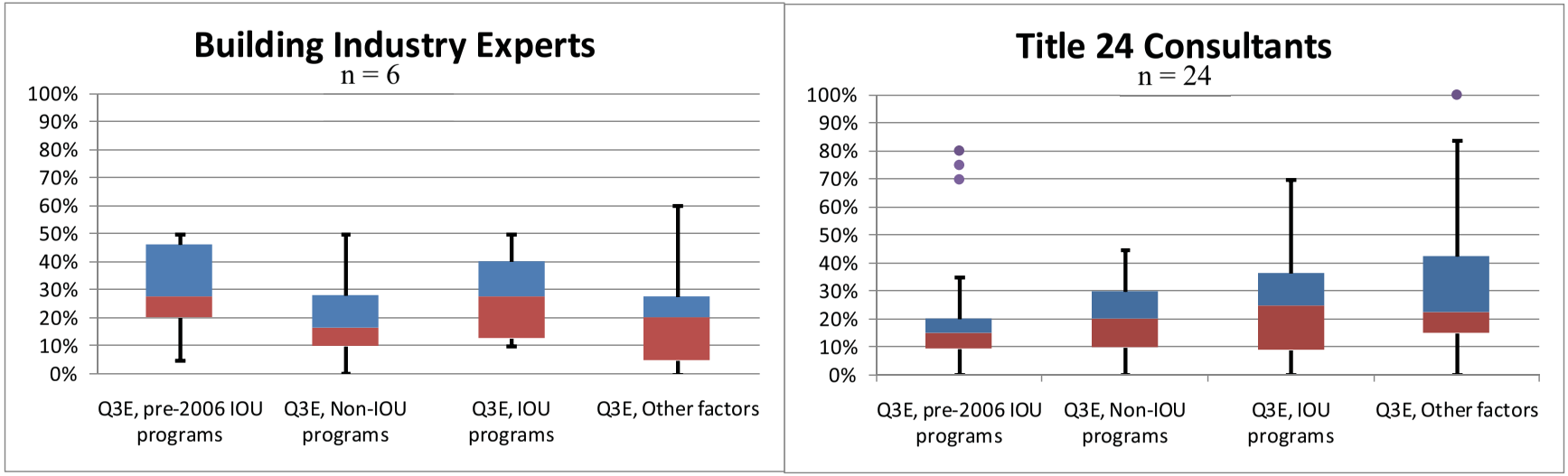
Several building industry representatives elaborated as to how the IOU programs played a significant part in the construction of non-program homes that exceeded code. One commented as follows:

> *I believe that you receive benefits in "non-program" homes due to a certain amount of "pull-through"; if your program tends to encourage 14 SEER units, some builders who are not participating will follow the "new standard" of 14 SEER, to remain comparable.*

A.8.3.3 Attribution of Energy Savings from Homes Exceeding Code Compared to Homes Just Meeting Code

Respondents attributed nearly identical savings for both electricity and gas (Figure A.8-2, Figure A.8-3). On average, both panels attribute similar percentages of savings to the 2006-08 IOU'S RNC programs. The median attribution score for the building industry experts' panel was 28% of both electricity and natural gas savings while the median attribution score for the Title 24 consultants' panel was 25% for electricity savings and 28% for natural gas savings. The building industry experts attributed more savings to the pre-2006 IOU programs (median score of 28%) than the Title 24 consultants (median score of 15%), though three Title 24 consultants assigned 70% or more of the savings to the pre-2006 programs. Both panels assigned similar levels of savings to non-IOU programs (median score of 17% for building industry experts and 20% for Title 24 consultants) and other factors (median score of 20% for building industry experts and 23% for Title 24 consultants). However, Title 24 consultants' attribution for other factors has a very large range, including one respondent who attributed all (100%) energy savings to other factors.

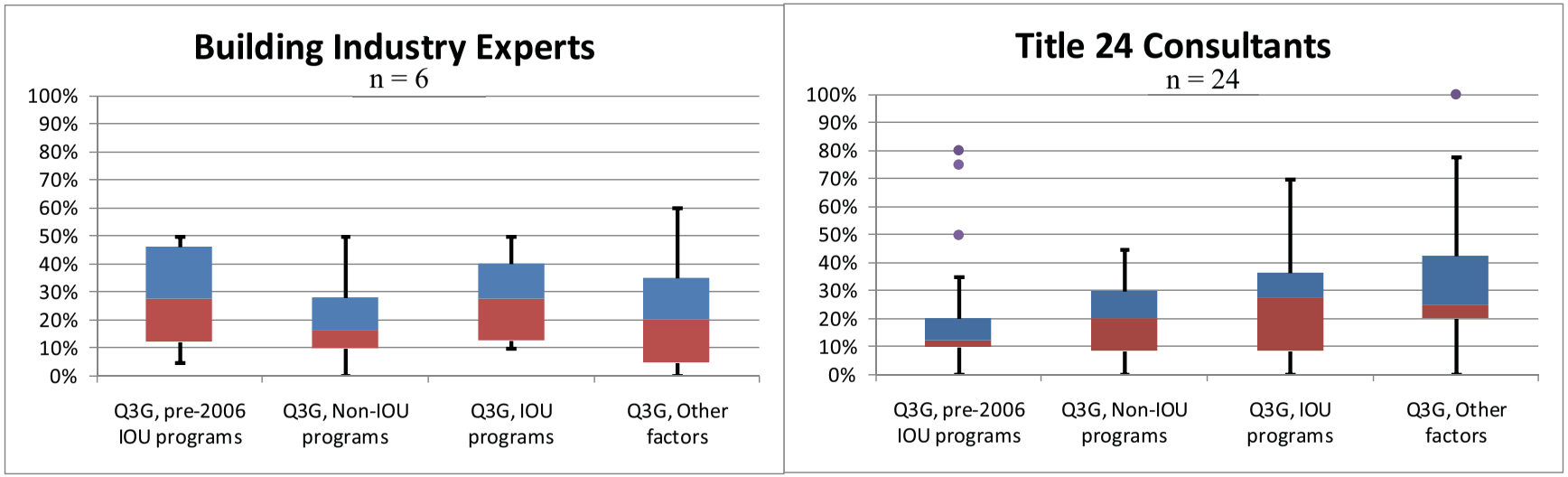
Figure A.8-2: Q3E, Above-code Homes, Attribution of Electricity Savings



1. Now that you have reviewed the summary of estimates made by you and your fellow panel members (Figure A.8-2), please review your own estimates below (shaded in green). If you would you like to modify your original responses, please indicate with an '**X**' in the appropriate box below and modify your responses (shaded in blue).

Factor	Your Original Estimates: Electricity Energy Savings	Indicate YES or NO if you want to modify your responses	Enter New Responses Here
The pre-2006 IOU Residential New Construction programs, excluding any effect the programs may have had on changes to codes and standards (i.e., Title 20 and Title 24)			
Non-IOU Residential New Construction programs such as ENERGY STAR homes, LEED for homes, and the Solar Initiative			
The 2006-2008 IOU Residential New Construction (RNC) programs, excluding any effect the programs may have had on changes to codes and standards (i.e., Title 20 and Title 24).			
Other factors, including the downturn in the housing market, changes in energy prices, global warming/climate change, and naturally occurring advances in the residential new construction industry			
TOTAL	100%		Sum to 100%

Figure A.8-3: Q3G, Above-code Homes, Attribution of Natural Gas Savings



2. Now that you have reviewed the summary of estimates made by you and your fellow panel members (Figure A.8-3), please review your own estimates below (shaded in green). If you would you like to modify your original responses, please indicate with an '**X**' in the appropriate box below and modify your responses (shaded in blue).

Factor	Your Original Estimates: Natural Gas Energy Savings	Indicate YES or NO if you want to modify your responses	Enter New Responses Here
The pre-2006 IOU Residential New Construction programs, excluding any effect the programs may have had on changes to codes and standards (i.e., Title 20 and Title 24)			
Non-IOU Residential New Construction programs such as ENERGY STAR homes, LEED for homes, and the Solar Initiative			
The 2006-2008 IOU Residential New Construction (RNC) programs, excluding any effect the programs may have had on changes to codes and standards (i.e., Title 20 and Title 24).			
Other factors, including the downturn in the housing market, changes in energy prices, global warming/climate change, and naturally occurring advances in the residential new construction industry			
TOTAL	100%		Sum to 100%

3. How much confidence do you have in your own responses as well as the responses of the panels? In the table below, please use an "X" to indicate your level of confidence in the estimates of attribution of energy savings by using a scale from 0 to 10, where 0 means "not at all confident" and 10 means "extremely confident."

Estimates	Not at All Confident (0)	1	2	3	4	5	6	7	8	9	Extremely Confident (10)	Don't Know
Your own estimates												
Building industry experts' estimates												
Title 24 consultants' estimates												

4. Why did you modify (or not modify) your original responses?

Please type your response here:

5. Do you have any additional thoughts or comments?

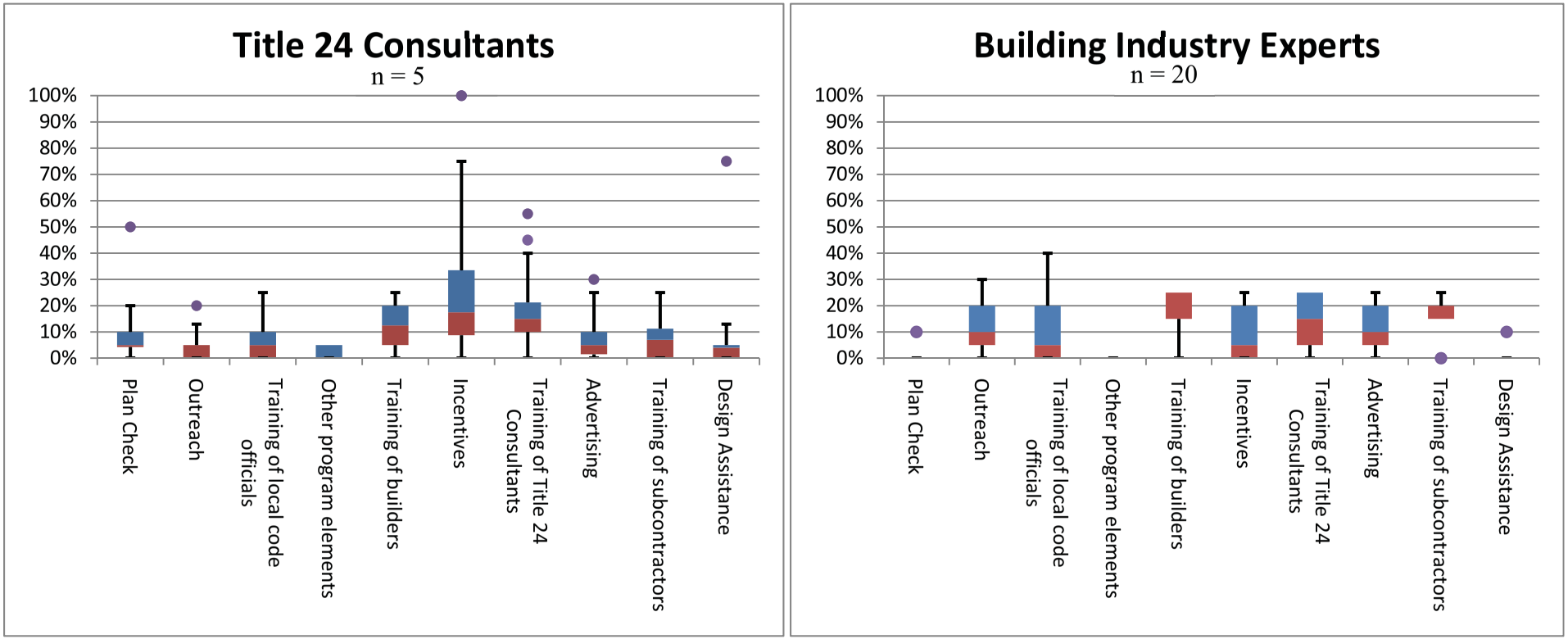
Please type your response here:

A.8.3.4 Attribution of Energy Savings to IOU Program Elements

Respondents attributed nearly identical savings for both electricity and gas (Figure A.8-4,

Figure A.8-5). However, the panels differed slightly in the way they attributed savings to the various elements of the IOU'S RNC programs. For example, on average, building experts attribute the highest portion of savings to the training of builders, subcontractors and Title 24 consultants (median scores of 25%, 20% and 15%, respectively) while on average, Title 24 consultants attribute the highest portion of savings to incentives and the training of Title 24 consultants and builders (median scores of 18%, 15% and 13%, respectively). Title 24 consultants attribute savings to Program Plan Check and design assistance while building industry experts attribute no savings to those program elements.

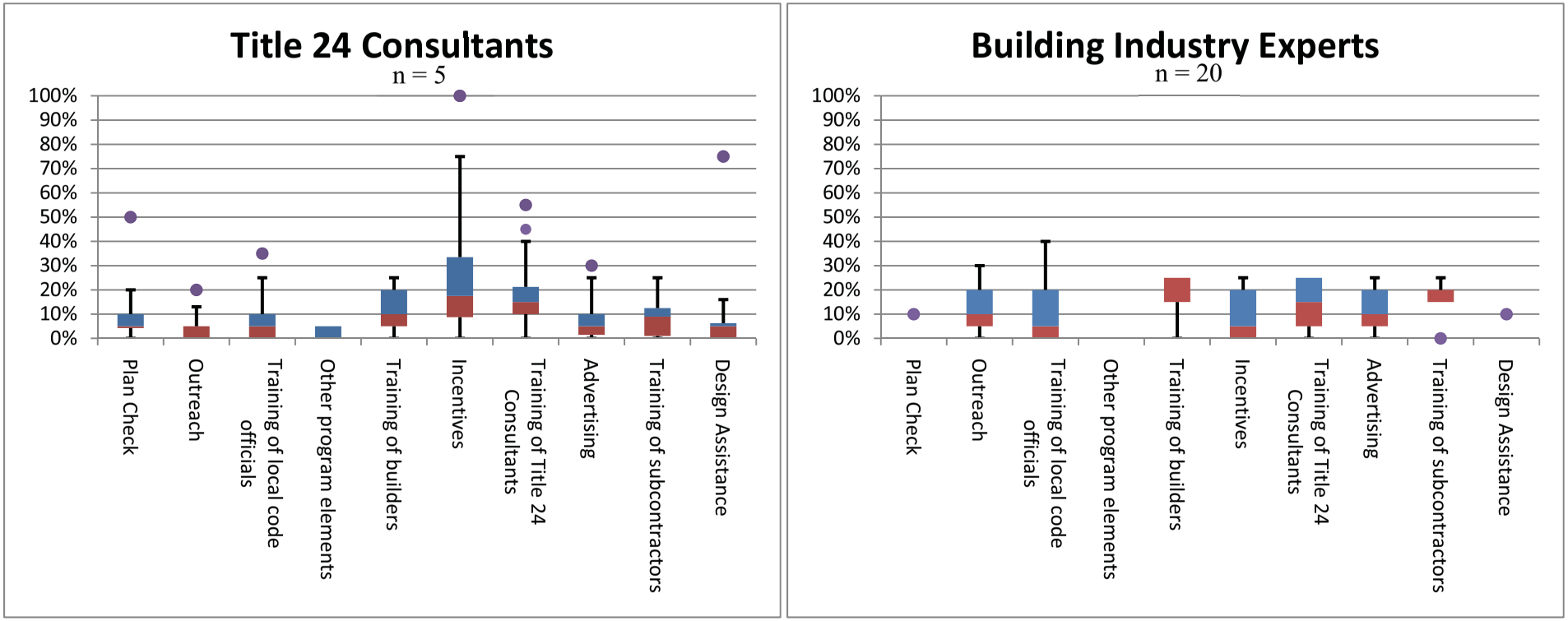
Figure A.8-4: Q4E, Above-code Homes, Attribution of Electricity Savings to IOU Program Elements



6. Now that you have reviewed the summary of estimates made by you and your fellow panel members (Figure A.8-4), please review your own estimates below (shaded in green). If you would you like to modify your original responses, please indicate with an '**X**' in the appropriate box below and modify your responses (shaded in blue).

IOU Program Elements	Your Original Estimates: Electricity Energy Savings	Indicate YES or NO if you want to modify your responses	Enter Your New Responses
Plan check			
Outreach			
Training of local code officials			
Other program elements			
Training of builders			
Incentives			
Training of Title 24 Consultants			
Advertising			
Training of subcontractors			
Design Assistance			
TOTAL	100%		Sum to 100%

Figure A.8-5 Q4G, Above-code Homes, Attribution of Natural Gas Savings to IOU Program Elements



7. Now that you have reviewed the summary of estimates made by you and your fellow panel members (Figure A.8-5), please review your own estimates below (shaded in green). If you would you like to modify your original responses, please indicate with an '**X**' in the appropriate box below and modify your responses (shaded in blue).

IOU Program Elements	**Your Original Estimates: Electricity Energy Savings**	**Indicate YES or NO if you want to modify your responses**	**Enter Your New Responses**
Plan check			
Outreach			
Training of local code officials			
Other program elements			
Training of builders			
Incentives			
Training of Title 24 Consultants			
Advertising			
Training of subcontractors			
Design Assistance			
TOTAL	100%		Sum to 100%

8. How much confidence do you have in your own responses as well as the responses of the panels? In the table below, please use an "X" to indicate your level of confidence in the estimates of attribution of energy savings by using a scale from 0 to 10, where 0 means "not at all confident" and 10 means "extremely confident."

Estimates	**Not at All Confident (0)**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Extremely Confident (10)**	**Don't Know**
Your own estimates												
Building industry experts' estimates												
Title 24 consultants' estimates												

9. Why did you modify (or not modify) your original responses?

Please type your response here:

10. Do you have any additional thoughts or comments?

Please type your response here:

A.8.3.5 Comments Pertaining to Potential Reduction in Energy Savings if IOU'S RNC Program Budgets are Reduced or Eliminated

Some respondents provided their thoughts as to why they thought program savings would decline over time or why at least some of the program savings would persist over time (if IOU'S RNC program budgets were reduced or eliminated) (Table A.8-3). When identifying reasons that program savings will decline over time, respondents believe that without the IOU'S RNC programs promoting, educating, training and incentivizing efficiency, builders and buyers will focus exclusively on lowest cost or inexpensive options. However, some respondents believe that some program savings will persist over time because builders, home buyers and building inspectors are more aware of energy efficiency because of the programs as well as market forces such as energy prices and global warming making efficiency more important in the RNC market.

Table A.8-3: Reasons for Persistence or Lack of Persistence in Savings if IOU'S RNC Program Budgets Are Reduced or Eliminated

Reasons for persistence or lack of persistence of savings	Percentage of Respondents
n	*19*
Savings will decline over time:	
Buyers and/or builders look at the lowest cost	10%
Lack of incentives will decrease persistence	7%
Builders respond to competitive forces (lack of high efficient program homes results in lower efficiency throughout the market)	7%
Economic downturn results in lower persistence	3%
Inefficient / less expensive options will be chosen	3%
Supply will drop off as demand for equipment falls off	3%
Lack of 3rd party verification	3%
Some savings will persist over time:	
Increased awareness / knowledge among builders / buyers will persist	7%
Local codes / building inspectors	7%
Few homes participate in the program currently (so cuts in program budgets will not have large effect on savings)	3%
Savings driven by desire to reduce energy costs	3%
Greenhouse Gas Emissions / Global Warming - driving consumers to more efficient homes	3%

Several building industry experts elaborated as to how or why energy savings would be reduced if IOU'S RNC program budgets are reduced or eliminated. One building industry expert commented as follows:

> *If you stop or reduce the program, my assumption is that builders will begin reverting back to "base T-24" requirements, and these non-program homes will tend to follow that trend as well.*

Another expert offered the following comment:

> *Builders are typically price responsive and will build homes the cheapest way legally possible. With the removal or reduction of utility new construction programs, builders will go back to the old way of doing things.*

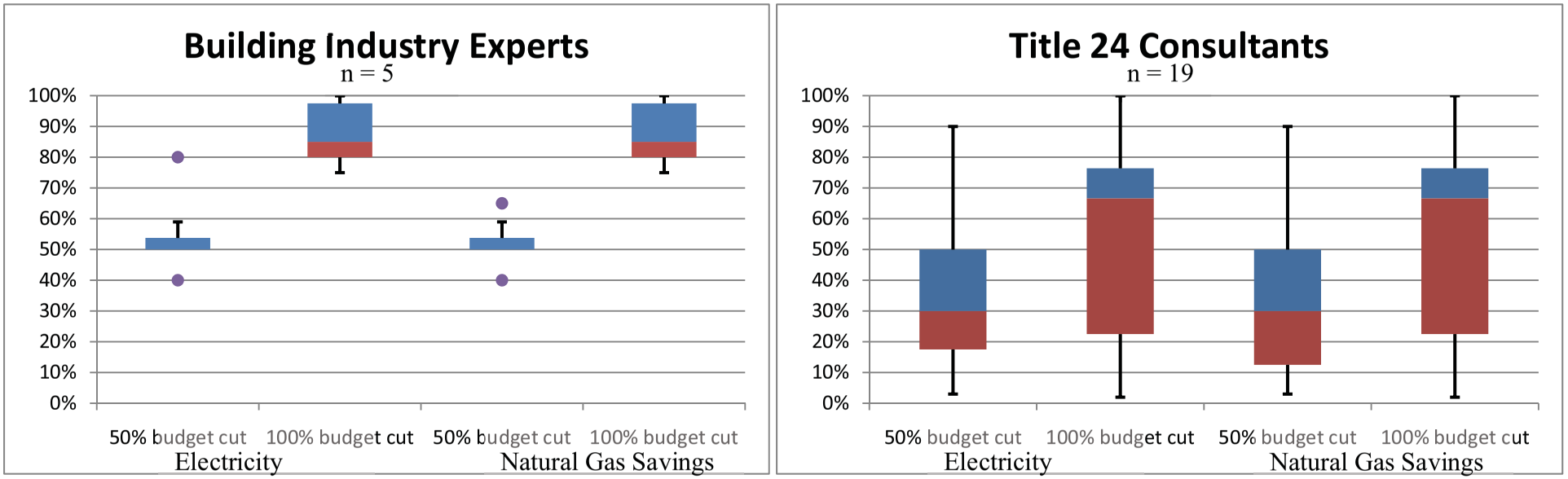
A third expert commented as follows:

> *Builders respond to competitive forces. Those not participating in programs are doing the least cost houses they can. If their competitors no longer are as energy efficient and if the utilities signal that energy efficiency is not important by cutting programs, these builders will fall back to code or below.*

A.8.3.6 Decline in Energy Savings if the IOU'S RNC Program Budget Is Cut or Eliminated

The panels have fairly divergent views on the effect that cutting or eliminating the budget of the IOU'S RNC programs (Figure A.8-6). For example, the building industry panel was relatively consistent in estimating significant effects on energy savings if IOU'S RNC budgets are reduced or eliminated (median reduction of 50% of savings if the programs are cut by 50% and median reduction of 85% if the programs are eliminated). In contrast, Title 24 consultants estimate smaller effects on program cuts and estimated effects range from 2% to 100% reduction in savings.

Figure A.8-6: Q5, Above-code Homes, Decline in Electricity and Natural Gas Savings with IOU Budget Cuts



11. Please review your own estimates below (shaded in green). If you would you like to modify your original responses, please indicate with an '**X**' in the appropriate box below and modify your responses (shaded in blue).

Level of Budget Cuts	Your Original Responses		Indicate YES or NO if you want to modify your responses	Your Revised Responses	
	Electricity Energy Savings	Natural Gas Savings		Electricity Energy Savings	Natural Gas Savings
50% reduction in IOU'S RNC Program Budget					
Elimination of the IOU'S RNC Program Budget					

12. How much confidence do you have in your own responses as well as the responses of the panels? In the table below, please use an "X" to indicate your level of confidence in the estimates of attribution of energy savings by using a scale from 0 to 10, where 0 means "not at all confident" and 10 means "extremely confident."

Estimates	**Not at All Confident (0)**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Extremely Confident (10)**	**Don't Know**
Your own estimates												
Building industry experts' estimates												
Title 24 consultants' estimates												

13. Why did you modify (or not modify) your original responses?

Please type your response here:

14. Do you have any additional thoughts or comments?

Please type your response here:

A.8.4 Data Summary: Homes Just Meeting Code Compared to Below-code Homes

In this section, we present a summary of responses to questions pertaining to savings associated with homes just meeting code compared to below-code homes.

A.8.4.1 Comments Pertaining to Attribution of Energy Savings from Just Code Homes

When asked to identify other factors that contributed to energy savings from homes just meeting code homes, respondents most commonly identified increased use of building technologies (often adding that increased use was due to lower prices, increased availability or improved cost effectiveness), costs in general (which often prevented homes from exceeding code or meeting code), energy prices, the downturn in the economy (making energy prices more salient to homeowners), and improved enforcement of the code (Table A.8-4).[66]

Table A.8-4: Other Factors that Contributed to Energy Savings from Homes Just Meeting Code (Multiple Response)

Other factors responsible for energy savings	Type of Savings	
	Electricity (% of respondents)	Natural Gas (% of respondents)
n	*26*	*26*
Building technologies (i.e., lighting, HVAC) - lower prices, increased availability and improved cost effectiveness	16%	19%
Costs; for code and below-code builders respond to lowest cost / first costs (will only install efficient equipment if it is lowest cost)	13%	13%
Energy Prices	10%	6%
Economy	10%	6%
Improved local requirements / enforcement (city / county)	10%	10%
Greater awareness of energy efficiency, technologies and green building practices	10%	6%
Global Warming	3%	3%
To code builders are more aware of what is going on in the broader market	3%	3%
Builder competition	3%	0%
Lack of awareness	3%	3%
Poor workmanship	3%	3%
Changing life styles, people are using less	3%	3%
Sales efforts by subs and suppliers	3%	3%
Poor code enforcement	3%	3%

A number of respondents elaborated on the role of the IOU programs and other factors on savings from homes just meeting code. We provide three comments below; the remaining comments are included in the separate Appendix document (included in the same email as this document).

[66] There is no statistical difference in the other factors identified for electricity and natural gas

According to one Title 24 consultant, the IOU programs affect code compliance through plan checkers and field inspectors:

> *For houses that barely meet code, it is nearly always a situation where builders or owners are making choices according to "lowest first cost." The IOU Residential Programs only have a "rub off" effect on plancheckers and inspectors. Better planchecking means gradual acceptance of the building code by builders, designers, and some owners. Plancheckers and field inspectors receive significant shared knowledge from their interaction with the IOU programs.*

One building industry expert believes the programs help improve compliance of non-program homes through increased awareness and marketing of energy efficiency:

> *Again, the IOU programs tend to have an influence on non-program homes, due to awareness and marketing benefits of certain features.*

Another building industry expert believes that training programs improve compliance:

> *The main factors in all cases are training programs or other learning processes for builders, subcontractors, and building officials.*

A.8.4.2 Building Measures and Practices Responsible For Homes Just Meeting Code

Respondents were most likely to identify windows (68% of respondents) and HVAC systems (52%), followed by insulation (32%) as being responsible for electricity savings (Table A.8-5). For natural gas savings, respondents were most likely to identify HVAC systems (61% of respondents), water heaters (42%) and windows (42%), followed by insulation (29%).

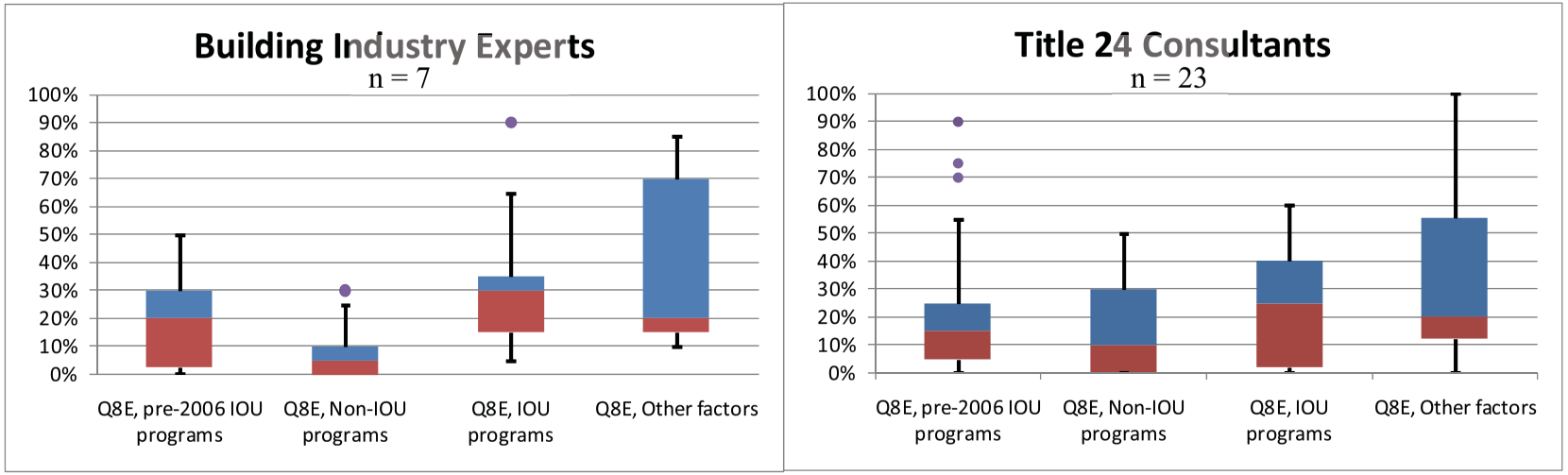
Table A.8-5: Building Measures and Practices Responsible For Homes Just Meeting Code
(Multiple Response)

Building Measure or Technique	Type of Savings	
	Electricity (% of respondents)	Natural Gas (% of respondents)
n	*21*	*25*
Windows	68%	42%
HVAC	52%	61%
Insulation	32%	29%
Radiant Barrier	13%	0%
Lighting	10%	0%
Air sealing / infiltration	3%	6%
Appliances	3%	0%
Water heater	3%	42%
Easy / low cost measures (unspecified)	3%	3%
Orientation	3%	0%
Fixtures (unspecified)	3%	0%
Doors	0%	3%

A.8.4.3 Attribution of Energy Savings from Homes Just Meeting Code Compared to Below-code Homes

Respondents attributed nearly identical savings for both electricity and gas (Figure A.8-7, Figure A.8-7). On average, both panels attribute similar percentages of savings to the 2006-08 IOU'S RNC programs and the other factors. The median attribution score for the building industry experts' panel was 30% for both electricity and natural gas savings while the median attribution score for the Title 24 consultants' panel was 25% for both electricity and natural gas savings. The building industry experts attributed more savings to the pre-2006 IOU programs (median score of 20%) than the Title 24 consultants (median score of 15%), though three Title 24 consultants assigned 70% or more of the savings to the pre-2006 programs. Both panels assigned similar levels of savings to non-IOU programs (median score of 5% for building industry experts and 10% for Title 24 consultants) and other factors (median score of 20% for both building industry experts and Title 24 consultants). However, Title 24 consultants' attribution for other factors has a very large range, including one respondent who attributed all (100%) energy savings to other factors.

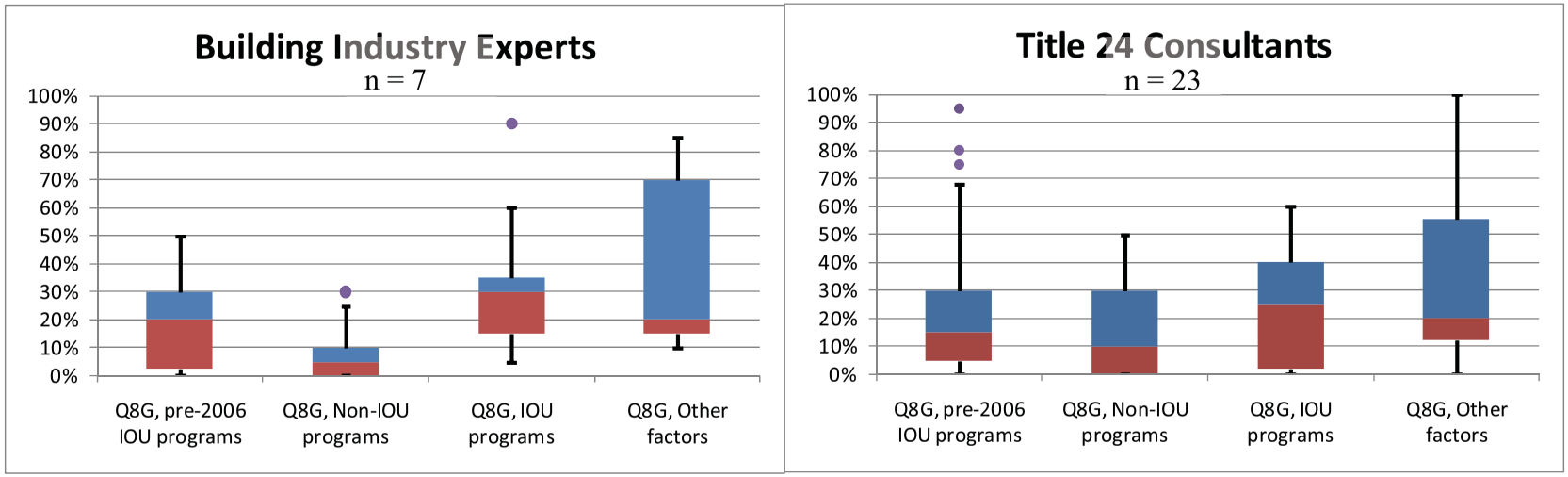
Figure A.8-7: Q8E, Just Code Homes, Attribution of Electricity Savings



15. Now that you have reviewed the summary of estimates made by you and your fellow panel members (Figure A.8-7), please review your own estimates below (shaded in green). If you would you like to modify your original responses, please indicate with an '**X**' in the appropriate box below and modify your responses (shaded in blue).

Factor	Your Original Estimates: Electricity Energy Savings	Indicate YES or NO if you want to modify your responses	Enter New Responses Here
The pre-2006 IOU Residential New Construction programs, excluding any effect the programs may have had on changes to codes and standards (i.e., Title 20 and Title 24)			
Non-IOU Residential New Construction programs such as ENERGY STAR homes, LEED for homes, and the Solar Initiative			
The 2006-2008 IOU Residential New Construction (RNC) programs, excluding any effect the programs may have had on changes to codes and standards (i.e., Title 20 and Title 24).			
Other factors, including the downturn in the housing market, changes in energy prices, global warming/climate change, and naturally occurring advances in the residential new construction industry			
TOTAL	100%		Sum to 100%

Figure A.8-8: Q8G, Just Code Homes, Attribution of Natural Gas Savings



16. Now that you have reviewed the summary of estimates made by you and your fellow panel members (Figure A.8-8), please review your own estimates below (shaded in green). If you would you like to modify your original responses, please indicate with an '**X**' in the appropriate box below and modify your responses (shaded in blue).

Factor	Your Original Estimates: Natural Gas Energy Savings	Indicate YES or NO if you want to modify your responses	Enter New Responses Here
The pre-2006 IOU Residential New Construction programs, excluding any effect the programs may have had on changes to codes and standards (i.e., Title 20 and Title 24)			
Non-IOU Residential New Construction programs such as ENERGY STAR homes, LEED for homes, and the Solar Initiative			
The 2006-2008 IOU Residential New Construction (RNC) programs, excluding any effect the programs may have had on changes to codes and standards (i.e., Title 20 and Title 24).			
Other factors, including the downturn in the housing market, changes in energy prices, global warming/climate change, and naturally occurring advances in the residential new construction industry			
TOTAL	100%		Sum to 100%

17. How much confidence do you have in your own responses as well as the responses of the panels? In the table below, please use an "X" to indicate your level of confidence in the estimates of attribution of energy savings by using a scale from 0 to 10, where 0 means "not at all confident" and 10 means "extremely confident."

Estimates	Not at All Confident (0)	1	2	3	4	5	6	7	8	9	Extremely Confident (10)	Don't Know
Your own estimates												
Building industry experts' estimates												
Title 24 consultants' estimates												

18. Why did you modify (or not modify) your original responses?

Please type your response here:

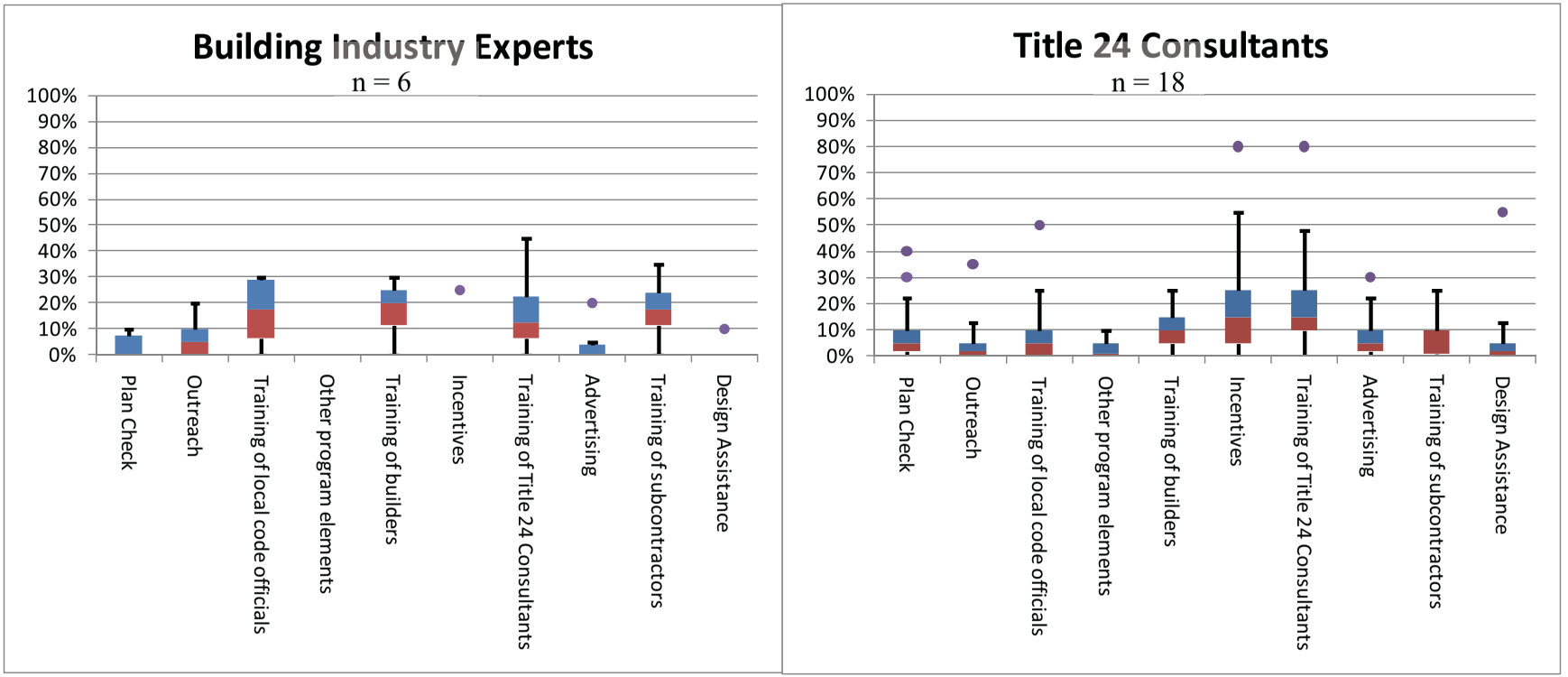
19. Do you have any additional thoughts or comments?

Please type your response here:

A.8.4.4 Attribution of Energy Savings to IOU Program Elements

Respondents attributed nearly identical savings for both electricity and gas (Figure A.8-9, Figure A.8-10). However, the panels differed slightly in the way they attributed savings to the various elements of the IOU'S RNC programs. For example, on average, building experts attribute the highest portion of savings to the training of builders, subcontractors, local officials and Title 24 consultants (median scores of 20%, 18%, 18% and 13%, respectively), while, on average, Title 24 consultants attribute the highest portion of savings to incentives and the training of Title 24 consultants, builders and subcontractors (median scores of 15%, 15%, 10% and 13%, respectively). Title 24 consultants attributed modest savings to Program Plan Check and advertising while, on average, building industry experts attribute no savings to those program elements.

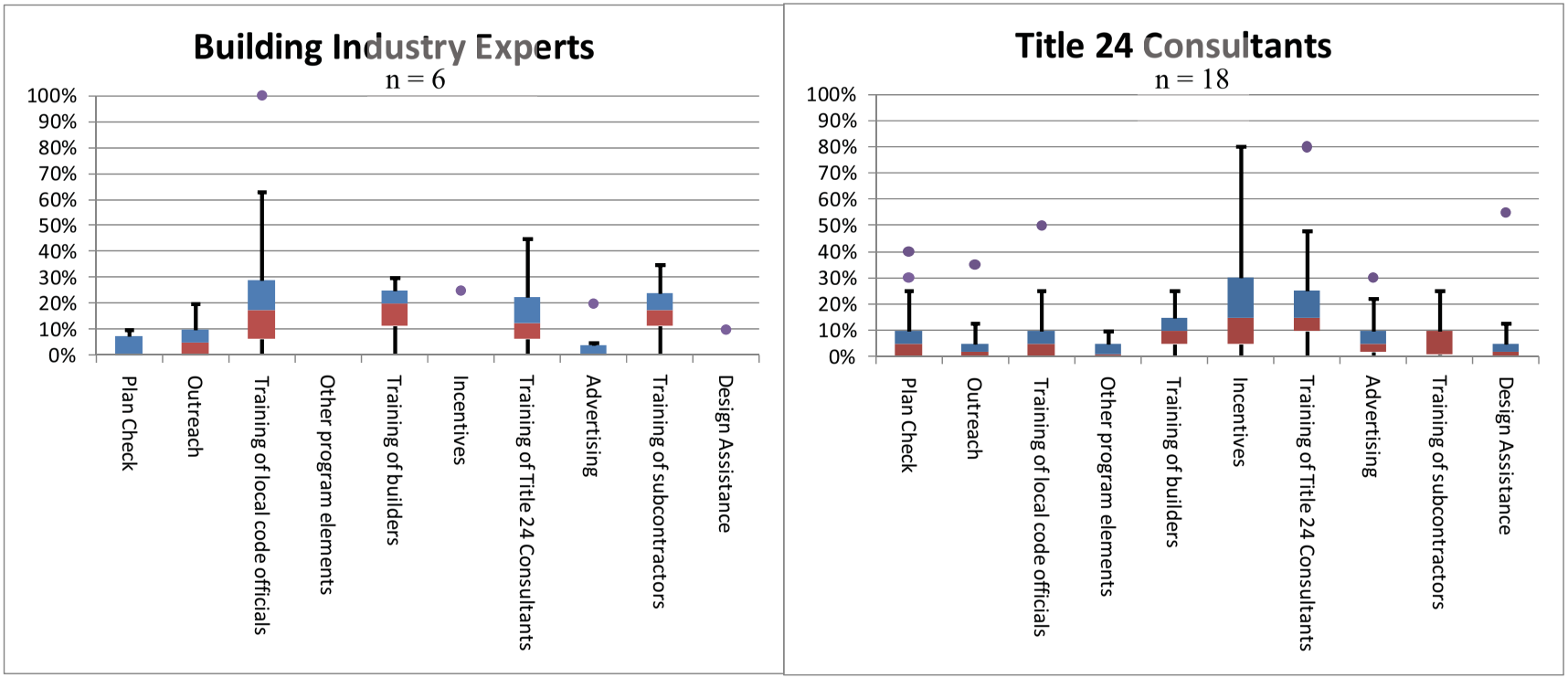
Figure A.8-9: Q9E, Just Code Homes, Attribution of Electricity Savings to IOU Program Elements



20. Now that you have reviewed the summary of estimates made by you and your fellow panel members (Figure A.8-9), please review your own estimates below (shaded in green). If you would you like to modify your original responses, please indicate with an '**X**' in the appropriate box below and modify your responses (shaded in blue).

IOU Program Elements	Your Original Estimates: Electricity Energy Savings	Indicate YES or NO if you want to modify your responses	Enter Your New Responses
Plan check			
Outreach			
Training of local code officials			
Other program elements			
Training of builders			
Incentives			
Training of Title 24 Consultants			
Advertising			
Training of subcontractors			
Design Assistance			
TOTAL	100%		Sum to 100%

Figure A.8-10: Q9G, Just Code Homes, Attribution of Natural Gas Savings to IOU Program Elements



21. Now that you have reviewed the summary of estimates made by you and your fellow panel members (Figure A.8-10), please review your own estimates below (shaded in green). If you would you like to modify your original responses, please indicate with an '**X**' in the appropriate box below and modify your responses (shaded in blue).

IOU Program Elements	Your Original Estimates: Electricity Energy Savings	Indicate YES or NO if you want to modify your responses	Enter Your New Responses
Plan check			
Outreach			
Training of local code officials			
Other program elements			
Training of builders			
Incentives			
Training of Title 24 Consultants			
Advertising			
Training of subcontractors			
Design Assistance			
TOTAL	100%		Sum to 100%

22. How much confidence do you have in your own responses as well as the responses of the panels? In the table below, please use an "X" to indicate your level of confidence in the estimates of attribution of energy savings by using a scale from 0 to 10, where 0 means "not at all confident" and 10 means "extremely confident."

Estimates	Not at All Confident (0)	1	2	3	4	5	6	7	8	9	Extremely Confident (10)	Don't Know
Your own estimates												
Building industry experts' estimates												
Title 24 consultants' estimates												

23. Why did you modify (or not modify) your original responses?

Please type your response here:

24. Do you have any additional thoughts or comments?

Please type your response here:

A.8.5 Energy Savings if IOU'S RNC Program Budgets are Reduced or Eliminated

A.8.5.1 Comments Pertaining to Potential Reduction in Energy Savings

Some respondents provided their thoughts as to why they thought savings would decline over time or why at least some of the savings would persist over time (if IOU'S RNC program budgets were reduced or eliminated) (Table A.8-6). When identifying reasons that savings will decline over time, respondents believe that without the IOU'S RNC programs promoting, educating, training and incentivizing efficiency, builders, local code officials and buyers will lose an important source of information and training and builders and buyers will focus on lowest cost or inexpensive (and often less efficient) options.

Table A.8-6: Reasons for Persistence or Lack of Persistence in Savings if IOU'S RNC Program Budgets Are Reduced or Eliminated

Reasons for persistence or lack of persistence of savings	Percentage of Respondents
n	15
Savings will decline over time:	
Lower awareness and knowledge due to lack of training and advertizing	19%
Inefficient / less expensive options will be chosen	10%
Lack of training of local codes / building inspectors (decline in savings)	10%
Lack of incentives will decrease persistence	6%
Builders respond to competitive forces (lack of high efficient program homes results in lower efficiency throughout the market)	3%
Economic downturn results in lower persistence	3%
Supply of energy efficient equipment will drop off as demand for equipment falls off	3%
Some savings will persist over time:	
Never had a problem with a home not meeting code	3%

Several Title 24 consultants and building industry experts elaborated as to how or why energy savings would be reduced if IOU'S RNC program budgets are reduced or eliminated. According to one Title 24 consultant, if the IOU'S RNC program budgets were reduced or cut, it would negatively impact compliance largely due to the loss of training and knowledge for building department inspectors and plan checkers:

> *In this area, the "rub off" effect is more apportioned to plancheckers and inspectors than it is to low end builders, designers, and home buyers. Plancheckers and field inspectors receive significant shared knowledge from their interaction with the IOU programs. Should the IOU programs lose market share or be eliminated entirely, this source of knowledge for building officials would fall away.*

One building industry expert believes that reducing or eliminating IOU'S RNC program budgets will result in less efficient homes:

> *Again, the IOU programs tend to have an influence on non-program homes, due to awareness and marketing benefits of certain features, and if the IOU programs are reduced or eliminated, those spill-over impacts will correspondingly reduce.*

Another building industry expert commented as follows:

> *Builders are typically price responsive and will build homes the cheapest way legally possible. With the removal or reduction of utility new construction programs, builders will go back to the old way of doing things. I believe most of the efficiency improvements in non-participating homes are due to long-term utility involvement in new construction programs and their work to improve codes and standards.*

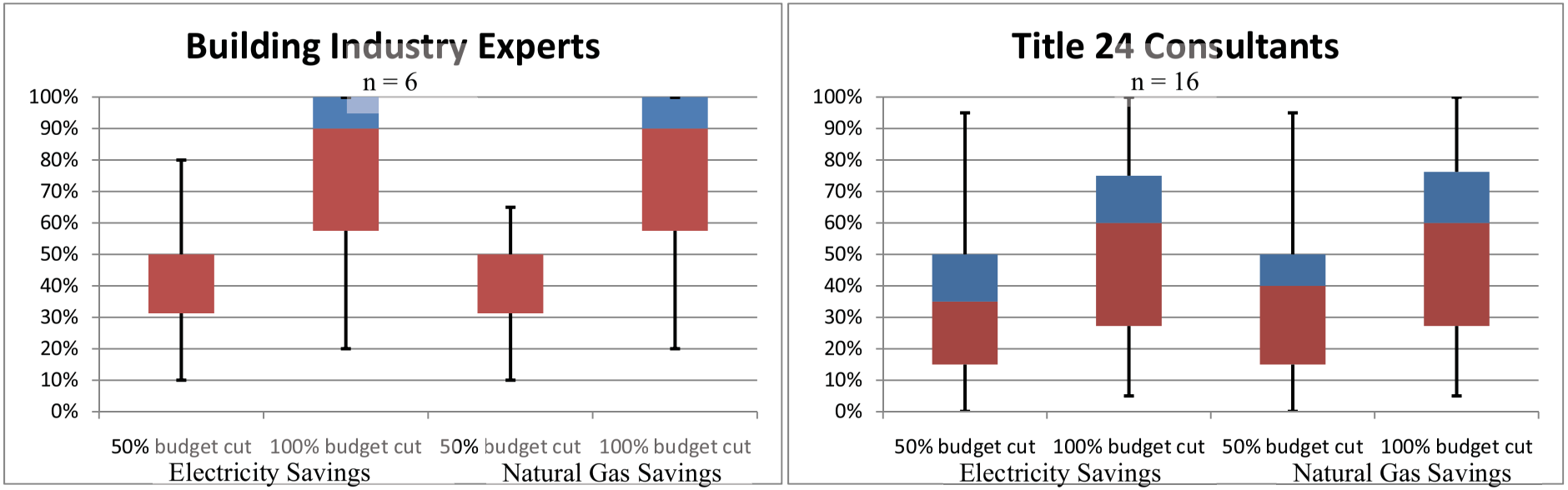
Another building industry expert believes that the with IOU'S RNC program budget cuts, there would be declines in savings because training is so critical to energy efficiency:

Training must be ongoing due to large turn over in builder and subcontractor staff -- also true for jurisdiction staff, but less so.

A.8.5.2 Decline in Energy Savings if the IOU'S RNC Program Budget Is Cut or Eliminated

The panels have fairly divergent views on the impact that cutting or eliminating the budgets of the IOU'S RNC programs (Figure A.8-11). For example, the building industry panel estimated, on average, significant impacts on energy savings if IOU'S RNC budgets are reduced or eliminated (median reduction of 50% of savings if the programs are cut by 50% and median reduction of 90% if the programs are eliminated). In contrast, Title 24 consultants estimated smaller impacts on program cuts (median reduction of 35% and 40% of savings if the programs are cut by 50% and median reduction of 60% if the programs are eliminated). However, while building industry experts were fairly consistent in their estimates of reduced savings from above-code homes, their responses for homes just meeting code were much less consistent, ranging from 10% to 100% reduction in savings. Title 24 consultants' responses also covered a very wide from 0% to 100% reduction in savings.

Figure A.8-11: Q10, Just Code Homes, Decline in Electricity and Natural Gas Savings with IOU Budget Cuts



25. Now that you have reviewed the summary of estimates made by you and your fellow panel members (Figure A-11), please review your own estimates below (shaded in green). If you would you like to modify your original responses, please indicate with an '**X**' in the appropriate box below and modify your responses (shaded in blue).

Level of Budget Cuts	Your Original Responses		Indicate YES or NO if you want to modify your responses	Your Revised Responses	
	Electricity Energy Savings	Natural Gas Savings		Electricity Energy Savings	Natural Gas Savings
50% reduction in IOU'S RNC Program Budget					
Elimination of the IOU'S RNC Program Budget					

26. How much confidence do you have in your own responses as well as the responses of the panels? In the table below, please use an "X" to indicate your level of confidence in the estimates of attribution of energy savings by using a scale from 0 to 10, where 0 means "not at all confident" and 10 means "extremely confident."

Estimates	**Not at All Confident (0)**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Extremely Confident (10)**	**Don't Know**
Your own estimates												
Building industry experts' estimates												
Title 24 consultants' estimates												

27. Why did you modify (or not modify) your original responses?

Please type your response here:

28. Do you have any additional thoughts or comments?

Please type your response here:

A.8.6 Code Compliance in the Absence of IOU Programs and Other Factors

A.8.6.1 Other Factors and Non-IOU Programs That Affect Code Compliance

Respondents identified a number of other factors that would affect both the percentage of below-code homes and the average percentage below code for below-code homes if the factors did not occur (Table A.8-7). The most commonly identified factors affecting non-compliance include the downturn in the economy, energy prices, poor training and installations and poor code enforcement.

Table A.8-7: Other Factors Affecting Code Compliance
(Multiple Response)

Factors	Factors Would Affect:	
	Proportion of Below-code Homes	Average Percentage Below Code
n	*14*	*14*
Downturn in the economy (increasing non compliance and use of low efficiency)	13%	16%
Energy Prices	10%	13%
Poor training / bad installs	10%	3%
Poor code enforcement	10%	10%
Building technologies (i.e., lighting, HVAC) - lower prices, increased availability and improved cost effectiveness	6%	3%
Global Warming	3%	3%
Lack of awareness	3%	3%
Opportunities that make the house more marketable such as replacing kitchens, bathrooms	3%	3%
Cheating and non-permitted projects	3%	3%
Design input from architects	3%	3%
CEC training of builders	3%	3%

Respondents also identified a number of non-IOU programs that would affect both the percentage of below-code homes and the average percentage below code for below-code homes if the programs did not exist (Table A.8-8). The most commonly identified non-IOU programs affecting non-compliance include ENERGY STAR Homes, LEED for Homes, municipal programs, the Solar Initiative, and Build it Green.

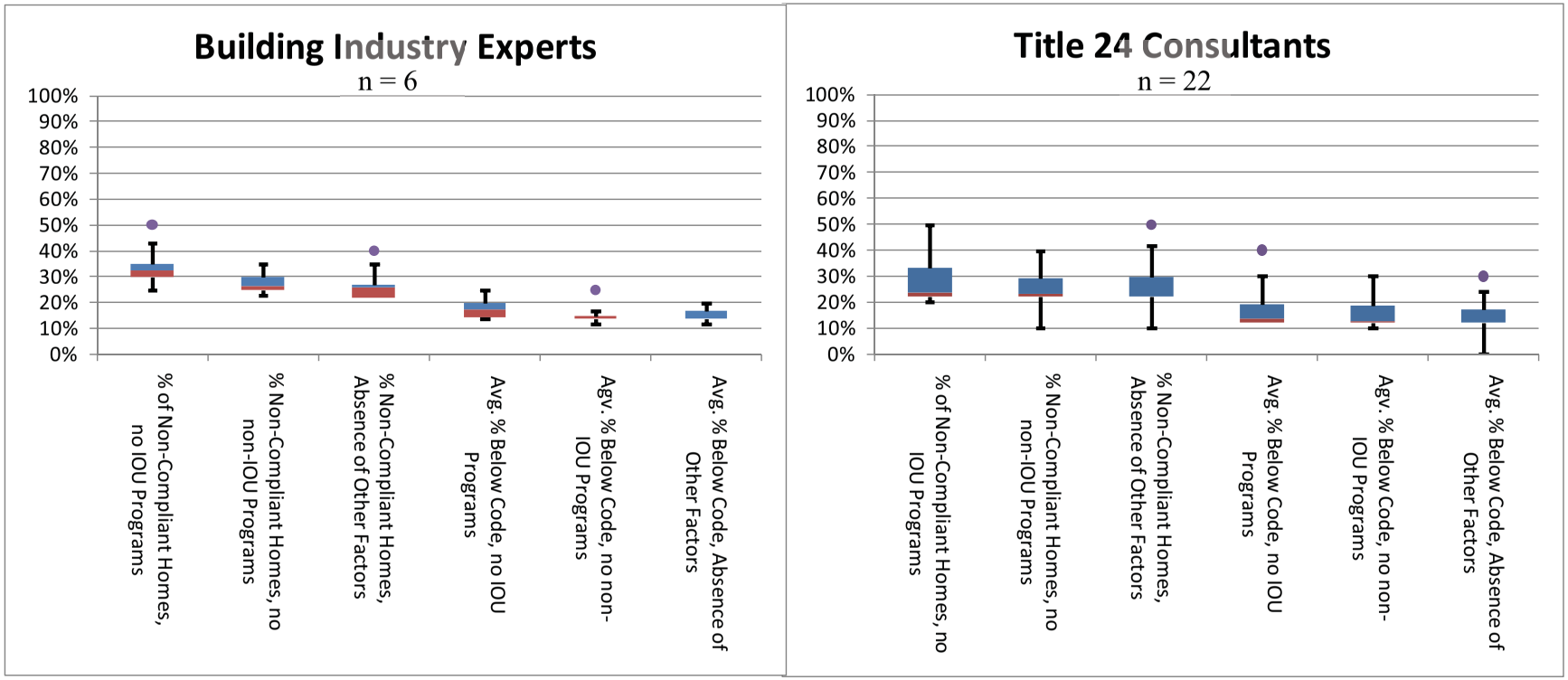
Table A.8-8: Non-IOU'S RNC Programs Affecting Code Compliance (Multiple Response)

Non-IOU Programs	Non-IOU Programs Would Affect:	
	Proportion of Below-code Homes	Average Percentage Below Code
n	*15*	*15*
ENERGY STAR Homes	35%	29%
LEED for homes	23%	23%
Municipal programs	19%	16%
The Solar Initiative	13%	10%
Build it Green / Green Point Rated (GPR)	13%	16%
Comfort Wise	10%	3%
Environments for Living	10%	6%
Federal tax credits	6%	3%
Local ordinances	3%	3%
CA Green Builders	0%	3%

A.8.6.2 Data Summary: Code Compliance in the Absence of IOU Programs and Other Factors

The panels have fairly divergent views of the impact on non-compliance that if the IOU programs or other factors did not exist or did not occur (Figure A.8-12). For example, the building industry panel estimated, on average, that the percentage of homes that were below-code would increase from 22% of homes to 33% of homes if the 2006-08 IOU'S RNC programs did not exist, and that the average below-code home would be 18% below code instead of 12% below code. Title 24 consultants estimated, on average, that the percentage of homes that were below-code would have increase from 22% of homes to 26% of homes, and that the average below-code home would be 19% below code instead of 12% below code. Building industry experts expected a smaller impact if non-IOU programs did not exist, with non-compliance increasing to 26% and the average below-code home being 15% below code. Similarly, Title 24 consultants expected a smaller impact if non-IOU programs did not exist, with non-compliance increasing to 23% and the average below-code home being 14% below code. Building industry experts expected the absence of other factors would have had a similar impact as the absence of non-IOU programs, with non-compliance increasing to 26% and the average below-code home being 14% below code. Title 24 consultants expected the absence of other factors would have had very little impact, with no change in non-compliance and the percentage below code for the average below-code home being.

Figure A.8-12: Q12, Code Compliance in the Absence of IOU Programs and Other Factors



29. Now that you have reviewed the summary of estimates made by you and your fellow panel members (Figure A.8-12), please review your own estimates below (shaded in green). If you would you like to modify your original responses, please indicate with an '**X**' in the appropriate box below and modify your responses (shaded in blue).

Level of Budget Cuts	Your Original Responses		Indicate YES or NO if you want to modify your responses	Your Revised Responses	
	Proportion of Below-code Homes	Average Percentage Below Code		Proportion of Below-code Homes	Average Percentage Below Code
The 2006-2008 IOU Residential New Construction (RNC) programs DID NOT EXIST					
Non-IOU Residential New Construction programs such as ENERGY STAR homes, LEED for homes, programs sponsored by municipal utilities such as SMUD and LADWP, Environments for Living, ComfortWise, and the Solar Initiative DID NOT EXIST					
Any other factors, for example, the downturn in the housing market, changes in energy prices, global warming and naturally occurring advances in the residential new construction industry DID NOT OCCUR					

30. How much confidence do you have in your own responses as well as the responses of the panels? In the table below, please use an "X" to indicate your level of confidence in the estimates of attribution of energy savings by using a scale from 0 to 10, where 0 means "not at all confident" and 10 means "extremely confident."

Estimates	Not at All Confident (0)	1	2	3	4	5	6	7	8	9	Extremely Confident (10)	Don't Know
Your own estimates												
Building industry experts' estimates												
Title 24 consultants' estimates												

31. Why did you modify (or not modify) your original responses?

Please type your response here:

32. Do you have any additional thoughts or comments?

Please type your response here:

A.9 Appendix to Delphi Panel Survey Instrument, Round 2

A.9.1 Above-Code Homes Compared to Homes Just Meeting Code

This Appendix contains respondent comments that elaborated on their responses to questions throughout the survey as well as a summary of the code compliance and energy savings data presented in the survey.

A.9.1.1 Comments Pertaining to Attribution of Energy Savings from above-Code Homes

Several Title 24 consultants elaborated on the role of the IOU programs in savings due to homes exceeding code. The first commented as follows:

> *The IOU Residential Programs contribute to overall "Green Building" awareness on the part of the public. People read the flyers that come with their utility bills. They visit their utility's website, they get educated, and some of what they learn "rubs off" on them, even though they may not ultimately participate in the programs. The IOU programs contribute to the general "buzz" about energy efficient homes. This is more of a factor at the higher end of the market. The low end of the market is forced to accept whatever the tract builders build.*

Another Title 24 consultant discussed the role of the IOU programs, non-IOU programs and the economic downturn on energy efficiency:

> *These [IOU] programs had a large impact on homeowners taking an interest in their energy savings and were effective. Most of these [non-IOU] programs did not have as high of an impact as the IOU programs, but the Municipal Utilities and Solar Initiative were starting to have an impact. People's pocketbooks speak and the rise in energy prices, as well as uncertainty in the future of oil got people thinking.*

Another Title 24 consultant suggested that HERs inspections of program homes results in energy savings in non-program homes.

Another Title 24 consultant attributes efficiency gains largely to technological advances:

> *The largest single contributor for energy efficiency in new homes are the advances and lower cost of high performance windows and air conditioning systems. Increases in energy costs may also be a contributing factor.*

One title 24 consultant provided comments about the varying abilities of building departments and Title 24 consultants:

> *Not only are there building departments with wildly different levels of competency, but the field of Title 24 energy analysis is wide open to untrained, unlicensed individuals... many of whom consider it their job to cheat. This state of affairs makes the economic difference between what will get a building permit and what the IOU programs require much greater than it should be. Energy Analysts should be licensed, and all licensed engineers and designers should have their work spot checked by the licensing authorities. The "owner/builder exemption" should be rescinded. The baseline level of professional practice needs to be brought up at least to code.*

Finally, one Title 24 consultant believes that the downturn in the economy is driving efficiency practices:

> *The downturn in the economy has had a real effect. Builders are coming to me and asking me to help them make their homes more energy efficient so that they really stand out.*

A building industry expert commented as follows:

> *I believe most of the efficiency improvements in non-participating homes are due to long-term utility involvement in new construction programs and their work to improve codes and standards. Through this involvement, suppliers are stocking higher efficiency equipment, the cost of higher efficiency equipment has come down and non-participating builders are benefiting from these factors and are mostly likely, inadvertently building homes that exceed standards. The utility involvement has brought this about. Equipment suppliers will have no incentive to continue stocking high efficiency equipment if the demand dries up--and this would happen if utility incentives are no longer available to builders.*

Another building industry expert provided the following comment:

> *It is very odd to have so many houses beating code: compared to other states it is a remarkable achievement that must be due to some cause. The utility programs are the most obvious candidate.*

Finally, one building industry expert provided extensive comments on the impacts of the IOU programs and other factors on energy efficiency in the RNC market:

> *Overall, I think the programs had a positive impact on compliance. The IOU programs have large in-direct impacts through training, but this is limited by the number of builders that can be trained and by staff turnover*
>
> *I believe non-compliance is closer to 60% [as measured by prescriptive measures rather than performance. This study uses a different method for estimating*

compliance than we do. This study looks at performance, while we're looking at the installation of prescriptive measures such as insulation and ductwork. While it is encouraging that, by performance measurement, compliance is higher than by prescriptive measurement, we are also discouraged because savings could be that much higher if insulation and other measures were installed properly.

In our field inspections, we are finding installed measures that do not meet code. In addition, we have recently worked with some large production builders to do field inspections of their homes that are "passing" 3rd party inspections provided by others, and we have found that they should not have passed based on our inspections and tests. We believe this to be widespread in the market, based on our own field experience. Furthermore, we have found that the HERS providers are not performing the required amounts of field verifications of the rater industry, leaving that industry without the controls that are built in by code.

Non-IOU programs have a minimal impact because for most of the programs, inspections of participating homes are rare. Exceptions would be SMUD and ComfortWise

The economic downturn had had a negative impact on efficiency. Builders are more price conscious so that installers are in turn more price conscious and may not do a good job. In addition, CHEERS AND calCERTS should be doing more inspections of inspected homes, to test the raters, but they are not doing the random inspections.

A.9.2 Homes Just Meeting Code Compared to Below-code Homes

A.9.2.1 Comments Pertaining to Attribution of Energy Savings from Just Code Homes

Building industry expert provide some thoughts as to why homes just meet code or are below-code:

Minimally compliant homes and those that do not meet code are due to several factors:

1) *Poor enforcement from building officials--typically due to understaffing/training so officials are forced to focus on health and safety and ignore energy issues and/or they are not properly trained to understand and recognized energy code violations;*
2) *Regional enforcement variations--some regions (politicians/building code enforcement officials) are more focused on efficiency, while others don't care;*
3) *Poor economy--in the economic downturn, builders are unwilling to spend additional dollars on efficiency measures;*

4) *Unaware of utility programs and incentives that will help reduce first costs;*
5) *Poor workmanship on the jobsite--the highest efficiency equipment can perform poorly if not installed correctly;*

Another building industry expert commented as follows:

> *Since these homes are minimally compliant, it is clear that the utility programs either had little or no impact (because there are no savings over code) or efficiency measures are being installed incorrectly and the savings are not accruing as expected. Alternately, one could assume the homes would be below-code and the energy performance would be worse in the absence of utility programs, e.g., the utility programs help improve the energy performance of minimally compliant homes…Builders are typically price responsive and will build homes the cheapest way legally possible. With the removal or reduction of utility new construction programs, builders will go back to the old way of doing things. I believe most of the efficiency improvements in non-participating homes are due to long-term utility involvement in new construction programs and their work to improve codes and standards.*

Another building industry expert commented as follows:

> *I have heard discussions of local officials paying more attention to code compliance recently; so this could also be a factor in meeting the code. It may not be independent of the IOU programs, however.*
>
> *There is a strong likelihood that the utility technical/design assistance received by pre-2006 program participants would spill over into construction design of homes during the 2006-2008 period (whether directly involved in the 06-08 programs or not). Once a business or individual has been trained to meet high energy efficiency standards for one project, they have the ability and one of the components of the motivation to do it again, even if for some projects the extent of efficiency they use is not up to qualification with the 2006-8 IOU programs.*
>
> *It is likely that the program participants in the 06-08 IOU programs are also constructing/designing non-program homes during the same period (in which case the knowledge and design assistance from the 06-08 programs influenced the design of the non-program homes as well)*

A.9.3 Compliance Data

The following estimates are based on an on-site analysis of 422 new single-family homes and metering of the three compliance-related end uses—heating, cooling and domestic hot water—in 131 of those homes conducted for the California Residential New Construction Baseline study.

Table A.9-1: Overall Compliance Margins[67]

Region	n	Compliance Margin
Statewide	422	5.4%
Coastal	125	11.1%
Inland	240	4.5%
Mountain & Desert	57	5.8%

Table A.9-2: Compliance Margins by Region

Region	Compliance Type	n	Compliance Margin	Percent of Region	Percent of Sample
Statewide	Above-code	218	12.2%	52%	52%
	Below-code	91	-11.8%	22%	22%
	Code-compliant	113	-0.4%	27%	27%
Coastal	Above-code	72	21.2%	58%	17%
	Below-code	22	-26.6%	18%	5%
	Code-compliant	31	-2.5%	25%	7%
Inland	Above-code	115	11.3%	48%	27%
	Below-code	57	-11.0%	24%	14%
	Code-compliant	68	-0.1%	28%	16%
Mountain & Desert	Above-code	31	11.2%	54%	7%
	Below-code	12	-9.5%	21%	3%
	Code-compliant	14	-0.6%	25%	3%

Table A.9-3: Compliance Margins by Region

Type of Savings	Statewide	Coastal Climate Region	Inland Climate Region	Mountain & Desert Climate Region
Electricity usage	15.9%	19.7%	10.3%	23.6%
Natural gas usage	11.0%	21.9%	11.9%	6.0%

Table A.9-4: Energy Savings, Code-Compliant Homes vs. Below-Code Homes

Type of Savings	Statewide	Coastal Climate Region	Inland Climate Region	Mountain & Desert Climate Region
Electricity usage	16.5%	-17.8%	22.7%	7.4%
Natural gas usage	9.6%	29.5%	6.4%	9.8%

[67] Homes that are code-compliant will be defined as those homes within the compliance model error bound estimated in the 2003 Baseline Study; i.e., homes with compliance margins above -5% and below +4% (for more details on the 2003 Baseline Study, see Itron, Inc. and KEMA – XENERGY. 2004. Residential New Construction Baseline Study of Building Characteristics Homes Built After 2001 Codes. CALMAC Study ID PGE0181.01).

Appendix B Additional Analysis: Net Savings by Climate Region

This appendix contains our analysis of net energy savings by region. During the round one survey, panelists were asked to identify the climate regions of California with which they were familiar with current building practices, the tables in this appendix are based on these regions of familiarity. While the evaluation team has chosen to present these data in the appendix it is important to note the limitations of reporting net savings by region: 1) While panelists were asked to identify which regions they were familiar with, they were not asked to provide response for each region separately and therefore their responses best represent the sum of the regions they are familiar with. 2) Due to varying levels of familiarity among panel members the sample sizes represented in each region vary considerably (Table B-1). Finally, during round two of the survey, panelists reviewed and adjusted their responses based on the responses of other panelists who may or may not have been familiar with the same climate zones they were familiar with.

Table B-1: Regional Diversity of Panel Familiarity

Regions Familiar With	Number of Panel Member	
	Title 24 Consultant	Building Industry Expert
Statewide	24	7
Coastal	18	5
Inland	21	7
Mountain & Desert	14	3

Similarly to the tables presented in Section 4.3, responses of Title 24 consultants are reported as both weighted and unweighted, with weights based on the percentage of non-program homes each Title 24 consultant reported they consulted. Responses from building industry experts are reported unweighted and serve as a qualitative check on the responses of the Title 24 consultants. The evaluation team has more confidence in the unweighted responses of the Title 24 consultants because there is generally more agreement between the unweighted responses and the responses of the building industry experts and also because the weighted responses are largely dependent upon the responses of a few Title 24 consultants who together are responsible for the large majority of the Title 24 consultants non-program homes.

B.1 Above-Code Homes Compared to Code-Compliant Homes

Title 24 consultants' estimates of the gross electricity savings attributable to 2006-2008 IOU'S RNC programs due to above-code homes compared to code-compliant homes, do not vary

greatly by climate region. Estimates range from 25% to 29%, not surprisingly this is nearly the same as estimated statewide (25%). Similarly, building industry experts' regional estimates are similar to their statewide estimate (29%), ranging from 23% to 30% (Table B.1-1, Table B.1-2 and Table B.1-3). The Delphi panelists' regional natural gas savings estimates are also similar to their statewide estimates. Title 24 consultant estimates range from 26% to 31%, compared to 26% statewide and building industry experts' estimates range from 23% to 30%, compared to 29% statewide (Table B.1-4, Table B.1-5 and Table B.1-6).

B.1.1 Attribution of Energy Savings from above-Code Homes Compared to Code-Compliant Homes

Table B.1-1: Attribution of Annual Electricity Savings from above-Code Non-Program Homes to Homes Just Meeting Code, 2006-2008 – Coastal

Attribution Factors		Title 24 Consultants, Unweighted (n = 18)			Title 24 Consultants, Weighted (n = 23)			Building Industry Experts (n = 4)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
2006 – 2008 IOU programs	%	29%	23%	36%	40%	35%	45%	23%
	MWh	11,550	9,095	14,004	15,606	13,702	17,510	9,022
Pre-2006 IOU programs	%	19%	15%	23%	18%	15%	21%	29%
	MWh	7,409	5,813	9,005	7,162	5,951	8,374	11,375
Non-IOU programs	%	20%	17%	23%	20%	19%	22%	25%
	MWh	7,736	6,602	8,870	7,736	6,602	8,756	9,806
Other factors	%	32%	26%	38%	22%	17%	26%	24%
	MWh	12,530	10,191	14,870	8,441	6,554	10,329	9,414

Table B.1-2: Attribution of Annual Electricity Savings from above-Code Non-Program Homes to Homes Just Meeting Code, 2006-2008 – Inland

Attribution Factors		Title 24 Consultants, Unweighted (n = 21)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
2006 – 2008 IOU programs	%	25%	19%	31%	39%	34%	44%	29%
	MWh	9,806	7,367	12,246	15,415	13,510	17,320	11,375
Pre-2006 IOU programs	%	20%	14%	26%	18%	15%	22%	29%
	MWh	7,938	5,504	10,373	7,251	5,912	8,590	11,375
Non-IOU programs	%	19%	15%	22%	21%	19%	23%	20%
	MWh	8,060	7,266	8,855	9,806	7,367	12,246	11,375
Other factors	%	36%	28%	44%	22%	17%	26%	23%
	MWh	14,196	11,060	17,332	8,500	6,625	10,375	9,022

Table B.1-3: Attribution of Annual Electricity Savings from Above-Code Non-Program Homes to Homes Just Meeting Code, 2006-2008 – Mountain / Desert

Attribution Factors		Title 24 Consultants, Unweighted (n = 14)			Title 24 Consultants, Weighted (n = 15)			Building Industry Experts (n = 2)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
2006 – 2008 IOU programs	%	26%	19%	33%	45%	38%	51%	30%
	MWh	10,367	7,620	13,113	17,522	14,949	20,094	11,768
Pre-2006 IOU programs	%	20%	14%	26%	12%	10%	14%	35%
	MWh	7,845	5,593	10,097	4,827	4,009	5,645	13,729
Non-IOU programs	%	23%	18%	27%	21%	18%	24%	25%
	MWh	88,826	7,209	10,442	8,193	7,012	9,373	9,806
Other factors	%	31%	24%	38%	22%	15%	30%	10%
	MWh	12,188	9,544	14,832	8,684	5,789	11,578	3,923

Table B.1-4: Attribution of Annual Natural Gas Savings from Above-Code Non-Program Homes to Homes Just Meeting Code, 2006-2008 – Coastal

Attribution Factors		Title 24 Consultants, Unweighted (n = 18)			Title 24 Consultants, Weighted (n = 23)			Building Industry Experts (n = 4)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
2006 – 2008 IOU programs	%	31%	24%	37%	42%	36%	48%	23%
	MDth	216.9	172.4	261.3	298.4	259.0	337.9	163.5
Pre-2006 IOU programs	%	18%	13%	23%	16%	12%	20%	29%
	MDth	129.2	94.4	163.9	114.7	87.8	141.5	206.2
Non-IOU programs	%	20%	17%	23%	23%	20%	25%	25%
	MDth	143.8	120.6	167.0	160.4	142.3	178.5	177.8
Other factors	%	31%	24%	38%	19%	14%	25%	24%
	MDth	221.2	174.1	268.3	137.5	99.2	175.8	170.7

Table B.1-5: Attribution of Annual Natural Gas Savings from Above-Code Non-Program Homes to Homes Just Meeting Code, 2006-2008 – Inland

Attribution Factors		Title 24 Consultants, Unweighted (n = 21)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
2006 – 2008 IOU programs	%	26%	20%	32%	41%	36%	47%	29%
	MDth	185.9	141.6	230.2	294.7	255.4	333.9	206.2
Pre-2006 IOU programs	%	19%	13%	25%	16%	12%	20%	28%
	MDth	136.1	91.2	181.0	116.5	88.1	145.0	199.1
Non-IOU programs	%	19%	15%	22%	23%	20%	25%	20%
	MDth	132.1	105.5	158.6	160.8	142.2	179.3	142.2
Other factors	%	36%	27%	44%	20%	14%	25%	24%
	MDth	255.0	194.6	315.3	139.1	101.1	177.0	170.7

Table B.1-6: Attribution of Annual Natural Gas Savings from Above-Code Non-Program Homes to Homes Just Meeting Code, 2006-2008 – Mountain / Desert

Attribution Factors		Title 24 Consultants, Unweighted (n = 14)			Title 24 Consultants, Weighted (n = 15)			Building Industry Experts (n = 2)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
2006 – 2008 IOU programs	%	30%	22%	37%	48%	41%	55%	30%
	MDth	210.3	159.8	260.7	341.7	289.8	393.6	213.3
Pre-2006 IOU programs	%	18%	12%	24%	9%	6%	12%	35%
	MDth	128.0	84.6	171.3	64.2	44.5	83.8	248.9
Non-IOU programs	%	23%	19%	28%	24%	20%	28%	25%
	MDth	164.6	132.6	196.5	171.4	144.0	198.9	177.8
Other factors	%	29%	22%	36%	19%	11%	27%	10%
	MDth	208.2	158.3	258.2	133.8	75.1	192.5	71.1

B.1.2 Attribution of Energy Savings to IOU Program Elements

As with the statewide tables, panelists attributed nearly identical savings to the various IOU program elements for both electricity and gas (Table B.1-7 through Table B.1-12). The elements of training (builders, subcontractors, Title 24 and code officials) combined were the most important program element for Title 24 consultants (both statewide and in each region). Among building industry experts, the elements of training combined to be the most important program

element statewide (50%) and for two of the regions—55% Coastal, 50% Inland, however, in the Mountain and Desert region incentives were the most important program element (50%).[68]

Table B.1-7: Above-code Homes, Attribution of Electricity Savings to IOU Program Elements- Coastal

Attribution Factors	Title 24 Consultants, Unweighted (n =18)			Title 24 Consultants, Weighted (n = 23)			Building Industry Experts (n = 3)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Plan check	9%	5%	13%	17%	11%	22%	2%
Outreach	5%	3%	8%	5%	3%	6%	8%
Training of local code officials	7%	5%	10%	3%	2%	4%	8%
Other program elements	2%	1%	3%	2%	1%	3%	0%
Training of builders	14%	11%	16%	12%	10%	15%	18%
Incentives	24%	17%	30%	40%	34%	45%	23%
Training of T24 consultants	19%	15%	22%	13%	12%	15%	12%
Advertising	7%	4%	9%	4%	3%	6%	10%
Training of subcontractors	8%	5%	11%	2%	1%	3%	17%
Design assistance	6%	3%	9%	2%	1%	3%	2%

[68] For the Mountain and Desert Region only one building industry expert responded to questions regarding attribution of energy savings to the various IOU program elements.

Table B.1-8: Above-code Homes, Attribution of Electricity Savings to IOU Program Elements- Inland

Attribution Factors	Title 24 Consultants, Unweighted (n = 20)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 5)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Plan check	9%	5%	13%	16%	11%	22%	4%
Outreach	5%	3%	7%	5%	3%	6%	10%
Training of local code officials	7%	5%	9%	3%	2%	4%	11%
Other program elements	2%	1%	3%	2%	1%	3%	0%
Training of builders	13%	10%	15%	12%	10%	14%	16%
Incentives	27%	19%	35%	39%	34%	45%	23%
Training of T24 consultants	17%	13%	20%	13%	12%	15%	8%
Advertising	7%	5%	10%	5%	3%	7%	10%
Training of subcontractors	8%	5%	10%	2%	1%	3%	15%
Design assistance	6%	2%	9%	2%	1%	3%	3%

Table B.1-9: Above-code Homes, Attribution of Electricity Savings to IOU Program Elements- Mountain / Desert

Attribution Factors	Title 24 Consultants, Unweighted (n = 14)			Title 24 Consultants, Weighted (n = 15)			Building Industry Experts (n = 1)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Plan check	11%	5%	16%	25%	18%	31%	0%
Outreach	5%	2%	7%	2%	1%	3%	5%
Training of local code officials	8%	5%	11%	2%	1%	4%	0%
Other program elements	2%	1%	3%	1%	0%	1%	0%
Training of builders	15%	12%	17%	16%	13%	18%	15%
Incentives	20%	13%	27%	37%	29%	45%	50%
Training of T24 consultants	19%	14%	24%	12%	10%	14%	0%
Advertising	8%	4%	11%	2%	0%	3%	15%
Training of subcontractors	8%	5%	12%	2%	0%	4%	15%
Design assistance	6%	1%	10%	2%	1%	3%	0%

Table B.1-10: Above-code Homes, Attribution of Natural Gas Savings to IOU Program Elements- Coastal

Attribution Factors	Title 24 Consultants, Unweighted (n = 18)			Title 24 Consultants, Weighted (n = 23)			Building Industry Experts (n = 3)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Plan check	9%	5%	14%	17%	11%	22%	2%
Outreach	5%	3%	7%	5%	3%	6%	8%
Training of local code officials	7%	4%	9%	3%	2%	4%	8%
Other program elements	2%	1%	3%	2%	1%	3%	0%
Training of builders	13%	11%	15%	12%	10%	14%	18%
Incentives	24%	18%	31%	40%	34%	45%	23%
Training of T24 consultants	19%	15%	23%	13%	12%	15%	12%
Advertising	6%	4%	9%	4%	3%	6%	10%
Training of subcontractors	8%	6%	11%	2%	1%	3%	17%
Design assistance	6%	3%	10%	2%	1%	3%	2%

Table B.1-11: Above-code Homes, Attribution of Natural Gas Savings to IOU Program Elements- Inland

Attribution Factors	Title 24 Consultants, Unweighted (n = 20)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 5)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Plan check	9%	5%	13%	16%	11%	22%	4%
Outreach	5%	3%	6%	5%	3%	6%	10%
Training of local code officials	6%	4%	8%	3%	2%	4%	11%
Other program elements	2%	1%	3%	2%	1%	3%	0%
Training of builders	12%	9%	14%	12%	10%	14%	16%
Incentives	28%	20%	36%	39%	34%	45%	23%
Training of T24 consultants	17%	13%	21%	13%	12%	15%	8%
Advertising	7%	5%	10%	5%	3%	7%	10%
Training of subcontractors	8%	5%	11%	2%	1%	3%	15%
Design assistance	6%	3%	9%	3%	2%	4%	3%

Table B.1-12: Above-code Homes, Attribution of Natural Gas Savings to IOU Program Elements- Mountain / Desert

Attribution Factors	Title 24 Consultants, Unweighted (n = 14)			Title 24 Consultants, Weighted (n = 15)			Building Industry Experts (n = 1)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Plan check	10%	5%	16%	25%	18%	31%	0%
Outreach	4%	2%	6%	2%	1%	3%	5%
Training of local code officials	7%	4%	9%	2%	1%	4%	0%
Other program elements	2%	1%	3%	1%	0%	1%	0%
Training of builders	14%	11%	16%	16%	13%	18%	15%
Incentives	21%	14%	27%	37%	29%	45%	50%
Training of T24 consultants	21%	15%	26%	12%	10%	15%	0%
Advertising	7%	4%	10%	2%	0%	3%	15%
Training of subcontractors	9%	5%	13%	2%	0%	4%	15%
Design assistance	6%	2%	10%	3%	3%	4%	0%

B.1.3 Sustainability: Persistence of Energy Savings from Above-Code Homes

In order to assess the extent to which market effects are likely to persist in the absence or reduction of the IOU programs, respondents were asked to estimate the reduction in the net savings attributable to the IOU programs would be reduced in homes built in the future if the budget available to the IOU'S RNC programs were reduced by 50% and if they IOU'S RNC programs were eliminated.

As with the statewide estimates, both Title 24 consultants and building industry experts said there will be substantial reductions to the savings attributable to the IOU programs, if the budget available to the IOU'S RNC programs were reduced or eliminated. However, at both the statewide and regional level, the Title 24 consultants and building industry experts do not agree in the magnitude of the reduction in savings (Table B.1-13, Table B.1-14 and Table B.1-15).

Table B.1-13: Above-code Non-Program Homes, Decline in Electricity and Natural Gas Savings with IOU Budget Cuts- Coastal

		Title 24 Consultants, Unweighted (n = 17)			Title 24 Consultants, Weighted (n = 23)			Building Industry Experts (n = 4)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Budget cut		Electricity Savings						
50%	%	37%	29%	44%	58%	50%	66%	54%
	MWh	36,56	2,894	4,417	8,902	7,674	10,130	6,114
100%	%	62%	52%	72%	81%	75%	87%	85%
	MWh	6,196	5,211	7,180	12,443	11,520	13,367	9,669
Budget cut		Natural Gas Savings						
50%	%	35%	28%	43%	58%	50%	66%	50%
	MDth	66.7	51.8	81.5	170.0	146.5	193.5	103.1
100%	%	62%	52%	72%	81%	75%	87%	85%
	MDth	116.7	98.0	135.4	237.8	220.2	255.5	175.3

Table B.1-14: Above-code Non-Program Homes, Decline in Electricity and Natural Gas Savings with IOU Budget Cuts- Inland

		Title 24 Consultants, Unweighted (n = 19)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Budget cut		Electricity Savings						
50%	%	34%	26%	41%	57%	49%	65%	53%
	MWh	3,348	2,599	4,096	8,870	7,556	10,003	5,972
100%	%	54%	43%	65%	80%	73%	86%	83%
	MWh	5,408	4,328	6,488	12,237	11,230	13,244	9,385
Budget cut		Natural Gas Savings						
50%	%	33%	25%	40%	57%	49%	65%	50%
	MDth	61.1	46.7	75.5	167.7	144.3	191.1	103.1
100%	%	54%	43%	65%	80%	73%	86%	83%
	MDth	101.9	81.4	122.4	233.9	214.6	253.1	170.1

Table B.1-15: Above-code Non-Program Homes, Decline in Electricity and Natural Gas Savings with IOU Budget Cuts- Mountain / Desert

		Title 24 Consultants, Unweighted (n = 23)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 7)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Budget cut		Electricity Savings						
50%	%	33%	26%	40%	41%	38%	44%	48%
	MWh	3,311	2,622	4,001	6,354	5,897	6,810	5,403
100%	%	55%	44%	67%	71%	65%	77%	80%
	MWh	5,509	4,360	6,659	10,874	9,925	11,823	9,100
Budget cut		Natural Gas Savings						
50%	%	33%	26%	39%	41%	38%	44%	48%
	MDth	61.0	48.1	74.0	121.4	112.6	130.1	97.9
100%	%	55%	43%	66%	71%	65%	77%	80%
	MDth	102.5	81.3	123.7	207.8	189.6	225.9	165.0

B.2 Code-Compliant Homes Compared to Below-code Homes

B.2.1 Attribution of Energy Savings from Code-Compliant Homes Compared to Below-code Homes

Title 24 consultants' estimates of the gross electricity savings attributable to 2006-2008 IOU'S RNC programs due to code-compliant homes compared to below-code homes, do not vary greatly by climate region. Estimates range from 23% to 27%, not surprisingly this is nearly the same as estimated statewide (23%). Similarly, building industry experts' regional estimates are nearly the same as the statewide estimate (26%), ranging from 23% to 26% (Table B.2-1, Table B.2-2 and Table B.2-3). The Delphi panelists' regional natural gas savings estimates are also similar to their statewide estimates. Title 24 consultant estimates range from 23% to 27%, compared to 23% statewide and building industry experts' estimates range from 23% to 26%, compared to 26% statewide (Table B.2-4, Table B.2-5 and Table B.2-6).

Table B.2-1: Attribution of Electricity Savings from Non-Program Homes Just Meeting Code Compared to Below-code Homes, 2006-2008 – Coastal

Attribution Factors		Title 24 Consultants, Unweighted (n = 17)			Title 24 Consultants, Weighted (n = 23)			Building Industry Experts (n = 5)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
2006 – 2008 IOU programs	%	26%	20%	33%	45%	40%	50%	23%
	MWh	1,445	1,077	1,813	2,473	2,199	2,747	1,258
Pre-2006 IOU programs	%	23%	15%	31%	24%	20%	28%	25%
	MWh	1,239	800	1,678	1,335	1,111	1,559	1,368
Non-IOU programs	%	17%	12%	23%	12%	8%	16%	10%
	MWh	956	642	1,270	673	453	894	547
Other factors	%	33%	25%	42%	18%	12%	25%	42%
	MWh	1,831	1,362	2,300	989	630	1,349	2,298

Table B.2-2 Attribution of Electricity Savings from Non-Program Homes Just Meeting Code Compared to Below-code Homes, 2006-2008 – Inland

Attribution Factors		Title 24 Consultants, Unweighted (n = 20)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 7)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
2006 – 2008 IOU programs	%	23%	17%	30%	45%	40%	50%	26%
	MWh	1,283	918	1,648	2,447	2,171	2,722	1,422
Pre-2006 IOU programs	%	23%	15%	32%	24%	20%	29%	22%
	MWh	1,272	796	1,748	1,338	1,104	1,571	1,204
Non-IOU programs	%	15%	9%	20%	13%	9%	17%	9%
	MWh	812	519	1,106	692	469	914	492
Other factors	%	38%	28%	49%	18%	12%	25%	30%
	MWh	2,104	1,522	2,685	995	638	1,352	1,641

Table B.2-3: Attribution of Electricity Savings from Non-Program Homes Just Meeting Code Compared to Below-code Homes, 2006-2008 – Mountain / Desert

Attribution Factors		Title 24 Consultants, Unweighted (n = 14)			Title 24 Consultants, Weighted (n = 15)			Building Industry Experts (n = 3)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
2006 – 2008 IOU programs	%	27%	20%	34%	48%	41%	55%	25%
	MWh	1,481	1,095	1,867	2,627	2,224	3,030	1,368
Pre-2006 IOU programs	%	17%	11%	23%	16%	14%	18%	32%
	MWh	938	618	1,257	883	786	980	1,751
Non-IOU programs	%	19%	15%	25%	19%	15%	23%	5%
	MWh	1,043	705	1,382	1,026	798	1,255	274
Other factors	%	37%	27%	46%	17%	7%	27%	38%
	MWh	2,009	1,475	2,543	935	382	1,488	2,079

Table B.2-4: Attribution of Natural Gas Savings from Non-Program Homes Just Meeting Code Compared to Below-code Homes, 2006-2008 – Coastal

Attribution Factors		Title 24 Consultants, Unweighted (n = 17)			Title 24 Consultants, Weighted (n = 23)			Building Industry Experts (n = 5)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
2006 – 2008 IOU programs	%	26%	19%	32%	45%	40%	50%	23%
	MDth	20.0	14.7	25.3	35.4	31.4	39.3	18.0
Pre-2006 IOU programs	%	24%	15%	33%	25%	20%	29%	25%
	MDth	18.9	12.0	25.8	19.2	16.0	22.5	19.6
Non-IOU programs	%	17%	12%	23%	12%	8%	16%	10%
	MDth	13.7	9.2	18.2	9.7	6.5	12.8	7.8
Other factors	%	33%	24%	42%	18%	12%	25%	42%
	MDth	25.8	18.8	32.8	14.2	9.0	19.4	32.9

Table B.2-5: Attribution of Natural Gas Savings from Non-Program Homes Just Meeting Code Compared to Below-code Homes, 2006-2008 – Inland

Attribution Factors		Title 24 Consultants, Unweighted (n = 20)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 7)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
2006 – 2008 IOU programs	%	23%	17%	30%	45%	40%	50%	26%
	MDth	18.2	13.0	23.4	35.0	31.0	39.0	20.4
Pre-2006 IOU programs	%	23%	14%	32%	25%	20%	29%	22%
	MDth	18.0	11.3	24.8	19.2	15.9	22.6	17.3
Non-IOU programs	%	15%	9%	20%	13%	9%	17%	9%
	MDth	11.5	7.2	15.7	9.9	6.7	13.1	7.1
Other factors	%	39%	29%	50%	18%	12%	25%	43%
	MDth	30.7	22.4	39.0	14.3	9.2	19.4	33.7

Table B.2-6 Attribution of Natural Gas Savings from Non-Program Homes Just Meeting Code Compared to Below-code Homes, 2006-2008 – Mountain / Desert

Attribution Factors		Title 24 Consultants, Unweighted (n = 14)			Title 24 Consultants, Weighted (n = 15)			Building Industry Experts (n = 3)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
2006 – 2008 IOU programs	%	27%	20%	34%	48%	40%	55%	25%
	MDth	21.0	15.4	26.5	37.5	31.7	43.4	19.6
Pre-2006 IOU programs	%	16%	12%	21%	16%	15%	18%	32%
	MDth	12.9	9.5	16.2	12.7	11.4	14.0	25.1
Non-IOU programs	%	19%	12%	25%	19%	15%	23%	5%
	MDth	14.7	9.7	19.6	14.7	11.4	18.0	3.9
Other factors	%	38%	29%	48%	17%	7%	27%	38%
	MDth	29.9	22.5	37.4	13.5	5.6	21.4	29.8

B.2.2 Attribution of Energy Savings to IOU Program Elements

As with the statewide tables, panelists attributed nearly identical savings to the various IOU program elements for both electricity and gas (Table B.2-7 through Table B.2-12). The elements of training (builders, subcontractors, Title 24 and code officials) combined were the most important program element for Title 24 consultants and building industry experts (both statewide and in each region).

Table B.2-7: Code-Compliant Non-Program Homes, Attribution of Electricity Savings to IOU Program Elements - Coastal

Attribution Factors	Title 24 Consultants, Unweighted (n =17)			Title 24 Consultants, Weighted (n = 23)			Building Industry Experts (n = 4)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Plan check	9%	5%	13%	7%	2%	11%	5%
Outreach	7%	3%	11%	13%	8%	18%	6%
Training of local code officials	8%	5%	12%	3%	1%	5%	24%
Other program elements	3%	1%	4%	8%	7%	9%	0%
Training of builders	11%	8%	14%	4%	2%	5%	18%
Incentives	24%	16%	31%	47%	37%	57%	0%
Training of T24 consultants	19%	13%	24%	4%	2%	7%	21%
Advertising	7%	4%	10%	7%	4%	9%	4%
Training of subcontractors	8%	5%	10%	6%	5%	8%	20%
Design assistance	5%	2%	8%	1%	0%	2%	3%

Table B.2-8: Code-Compliant Non-Program Homes, Attribution of Electricity Savings to IOU Program Elements - Inland

Attribution Factors	Title 24 Consultants, Unweighted (n = 18)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Plan check	9%	6%	13%	7%	2%	11%	7%
Outreach	6%	2%	10%	13%	8%	18%	6%
Training of local code officials	9%	6%	12%	3%	1%	5%	28%
Other program elements	4%	2%	5%	8%	7%	9%	0%
Training of builders	11%	8%	13%	4%	2%	5%	18%
Incentives	23%	16%	29%	46%	37%	56%	2%
Training of T24 consultants	18%	12%	23%	4%	2%	7%	18%
Advertising	8%	6%	11%	7%	4%	9%	3%
Training of subcontractors	8%	6%	11%	6%	5%	8%	18%
Design assistance	5%	2%	7%	1%	0%	2%	2%

Table B.2-9: Code-Compliant Non-Program Homes, Attribution of Electricity Savings to IOU Program Elements - Mountain / Desert

Attribution Factors	Title 24 Consultants, Unweighted (n = 14)			Title 24 Consultants, Weighted (n = 15)			Building Industry Experts (n = 2)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Plan check	10%	5%	15%	10%	3%	17%	5%
Outreach	4%	1%	8%	2%	0%	3%	5%
Training of local code officials	10%	6%	14%	4%	1%	6%	28%
Other program elements	2%	1%	4%	8%	6%	9%	0%
Training of builders	11%	8%	15%	3%	1%	5%	28%
Incentives	23%	14%	31%	56%	42%	69%	0%
Training of T24 consultants	19%	12%	26%	5%	1%	9%	18%
Advertising	7%	4%	11%	4%	3%	5%	0%
Training of subcontractors	9%	6%	12%	9%	7%	10%	18%
Design assistance	5%	1%	8%	2%	1%	3%	0%

Table B.2-10: Code-Compliant Non-Program Homes, Attribution of Natural Gas Savings to IOU Program Elements - Coastal

Attribution Factors	Title 24 Consultants, Unweighted (n = 17)			Title 24 Consultants, Weighted (n = 23)			Building Industry Experts (n = 4)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Plan check	10%	4%	16%	7%	2%	12%	5%
Outreach	5%	2%	9%	13%	8%	18%	6%
Training of local code officials	8%	5%	12%	3%	1%	5%	24%
Other program elements	3%	1%	4%	8%	7%	9%	0%
Training of builders	11%	8%	14%	4%	2%	5%	18%
Incentives	24%	16%	31%	47%	37%	57%	0%
Training of T24 consultants	20%	14%	25%	4%	2%	7%	21%
Advertising	6%	3%	9%	7%	4%	9%	4%
Training of subcontractors	8%	5%	10%	6%	5%	8%	20%
Design assistance	5%	2%	8%	1%	0%	2%	3%

Table B.2-11: Code-Compliant Non-Program Homes, Attribution of Natural Gas Savings to IOU Program Elements - Inland

Attribution Factors	Title 24 Consultants, Unweighted (n = 18)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Plan check	11%	6%	15%	7%	2%	12%	7%
Outreach	4%	1%	7%	13%	7%	18%	6%
Training of local code officials	9%	6%	12%	3%	1%	5%	28%
Other program elements	4%	2%	5%	8%	7%	9%	0%
Training of builders	11%	8%	13%	4%	2%	5%	18%
Incentives	22%	15%	29%	46%	37%	56%	2%
Training of T24 consultants	18%	12%	24%	4%	2%	7%	18%
Advertising	7%	5%	10%	7%	4%	9%	3%
Training of subcontractors	9%	6%	12%	6%	5%	8%	18%
Design assistance	5%	2%	8%	1%	0%	2%	2%

Table B.2-12 Code-Compliant Non-Program Homes, Attribution of Natural Gas Savings to IOU Program Elements - Mountain / Desert

Attribution Factors	Title 24 Consultants, Unweighted (n = 14)			Title 24 Consultants, Weighted (n = 15)			Building Industry Experts (n = 2)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Plan check	11%	6%	17%	10%	3%	17%	5%
Outreach	2%	1%	3%	2%	1%	3%	5%
Training of local code officials	10%	6%	14%	4%	1%	6%	28%
Other program elements	2%	1%	4%	8%	6%	9%	0%
Training of builders	11%	8%	15%	3%	1%	5%	28%
Incentives	22%	13%	31%	56%	42%	69%	0%
Training of T24 consultants	20%	12%	27%	5%	1%	9%	18%
Advertising	6%	3%	10%	2%	0%	4%	0%
Training of subcontractors	10%	6%	14%	9%	7%	10%	18%
Design assistance	5%	2%	9%	2%	1%	3%	0%

B.2.3 Sustainability: Persistence of Energy Savings from Code-Compliant Homes

In order to assess the extent to which market effects are likely to persist in the absence or reduction of the IOU programs, respondents were asked to estimate the reduction in the net savings attributable to the IOU programs would be reduced in homes built in the future if the budget available to the IOU'S RNC programs were reduced by 50% and if they IOU'S RNC programs were eliminated.

As with the statewide estimates, both Title 24 consultants and building industry experts said there will be substantial reductions to the savings attributable to the IOU programs, if the budget available to the IOU'S RNC programs were reduced or eliminated. However, at both the statewide and regional level, the Title 24 consultants and building industry experts do not agree in the magnitude of the reduction in savings (Table B.2-13, Table B.2-14 and Table B.2-15).

Table B.2-13: Code-Compliant Non-Program Homes, Decline in Electricity and Natural Gas Savings IOU Budgets Are Cut or Eliminated - Coastal

		Title 24 Consultants, Unweighted (n = 17)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 5)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Budget cut		Electricity Savings						
50%	%	40%	32%	48%	66%	59%	74%	49%
	MWh	513	405	621	1,619	1,433	1,805	697
100%	%	59%	48%	71%	88%	81%	94%	82%
	MWh	761	617	906	2,133	1,983	2,283	1,166
Budget cut		Natural Gas Savings						
50%	%	40%	31%	48%	66%	59%	74%	46%
	MDth	7.2	5.7	8.8	23.2	20.5	25.8	9.4
100%	%	59%	47%	70%	88%	81%	94%	82%
	MDth	10.7	8.6	12.7	30.5	28.4	32.7	16.7

Table B.2-14: Code-Compliant Non-Program Homes, Decline in Electricity and Natural Gas Savings IOU Budgets Are Cut or Eliminated - Inland

		Title 24 Consultants, Unweighted (n = 18)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 7)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Budget cut		Electricity Savings						
50%	%	39%	31%	47%	66%	58%	73%	44%
	MWh	499	394	603	1,597	1,408	1,785	626
100%	%	55%	44%	67%	86%	80%	93%	73%
	MWh	711	564	857	2,104	1,943	2,265	1,038
Budget cut		Natural Gas Savings						
50%	%	39%	30%	47%	66%	58%	73%	41%
	MDth	7.0	5.6	8.5	22.9	20.2	25.6	8.4
100%	%	55%	43%	66%	86%	80%	93%	73%
	MDth	9.9	7.9	12.0	30.1	27.8	32.4	14.9

Table B.2-15: Code-Compliant Non-Program Homes, Decline in Electricity and Natural Gas Savings IOU Budgets Are Cut or Eliminated - Mountain / Desert

		Title 24 Consultants, Unweighted (n = 14)			Title 24 Consultants, Weighted (n = 15)			Building Industry Experts (n = 3)
		Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
			Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Budget cut		Electricity Savings						
50%	%	36%	28%	44%	52%	46%	57%	47%
	MWh	458	357	559	1,258	1,133	1,383	669
100%	%	52%	38%	65%	81%	72%	89%	87%
	MWh	662	490	834	1,967	1,757	2,176	1,238
Budget cut		Natural Gas Savings						
50%	%	52%	47%	57%	35%	28%	43%	47%
	MDth	6.4	5.0	7.8	18.0	16.3	19.8	9.6
100%	%	51%	37%	64%	81%	72%	89%	87%
	MDth	9.2	6.8	11.6	28.1	25.1	31.1	17.7

B.3 Code Compliance in the Absence of the IOU Programs

In addition to net energy savings, Delphi panelists were asked to estimate the percentage of homes that would have been below-code in the absence of the IOU'S RNC programs and other factors (but assuming all other factors remain unchanged from what actually occurred). Next, the panelists were asked to estimate the compliance margin of the below-code homes in the absence of each factor.

As with the statewide estimates, the panels have fairly divergent views of the impact on compliance rates (i.e., the percentage of homes that would be below-code) but similar estimates of the impacts on compliance margins if the IOU programs or other factors did not exist or did not occur (Table B.3-1, Table B.3-2 and Table B.3-3).

Table B.3-1: Code Compliance in the Absence of IOU Programs and Other Factors- Coastal

	Title 24 Consultants, Unweighted (n = 18)			Title 24 Consultants, Weighted (n = 23)			Building Industry Experts (n = 4)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
If the 2006-2008 IOU Residential New Construction programs did not exist							
Proportion of below-code homes	28%	25%	31%	28%	25%	31%	49%
Average percentage below code	17%	15%	20%	20%	18%	23%	19%
If non-IOU Residential New Construction programs did not exit[*]							
Proportion of below-code homes	25%	23%	28%	24%	23%	25%	30%[†]
Average percentage below code	16%	14%	18%	18%	16%	20%	20%[†]
If other factors did not occur[‡]							
Proportion of below-code homes	23%	20%	27%	22%	21%	23%	26%[†]
Average percentage below code	14%	13%	15%	12%	12%	13%	16%[†]

[*] Programs such as ENERGY STAR homes, LEED for homes, programs sponsored by municipal utilities such as SMUD and LADWP, Environments for Living, ComfortWise, and the Solar Initiative.

[†] Only two Building Industry Experts were able to provide responses for non-IOU and other factors.

[‡] Factors such as the downturn in the housing market, changes in energy prices, global warming and naturally occurring advances in the residential new construction industry.

Table B.3-2: Code Compliance in the Absence of IOU Programs and Other Factors- Inland

	Title 24 Consultants, Unweighted (n = 21)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
If the 2006-2008 IOU Residential New Construction programs did not exist							
Proportion of below-code homes	27%	24%	30%	28%	25%	31%	43%
Average percentage below code	16%	14%	18%	20%	18%	22%	18%
If non-IOU Residential New Construction programs did not exit[*]							
Proportion of below-code homes	27%	25%	29%	24%	24%	25%	27%[†]
Average percentage below code	16%	14%	18%	18%	16%	20%	16%[†]
If other factors did not occur[‡]							
Proportion of below-code homes	25%	21%	28%	22%	21%	23%	25%[†]
Average percentage below code	15%	13%	16%	12%	12%	13%	14%[†]

[*] Programs such as ENERGY STAR homes, LEED for homes, programs sponsored by municipal utilities such as SMUD and LADWP, Environments for Living, ComfortWise, and the Solar Initiative.

[†] Only four Building Industry Experts were able to provide responses for non-IOU and other factors.

[‡] Factors such as the downturn in the housing market, changes in energy prices, global warming and naturally occurring advances in the residential new construction industry.

Table B.3-3: Code Compliance in the Absence of IOU Programs and Other Factors- Mountain / Desert

	Title 24 Consultants, Unweighted (n = 14)			Title 24 Consultants, Weighted (n = 15)			Building Industry Experts (n = 3)
	Mean	90% Confidence Interval for the Mean		Mean	90% Confidence Interval for the Mean		Mean
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
If the 2006-2008 IOU Residential New Construction programs did not exist							
Proportion of below-code homes	28%	25%	31%	31%	26%	35%	57%
Average percentage below code	17%	15%	20%	25%	22%	27%	20%
If non-IOU Residential New Construction programs did not exit[*]							
Proportion of below-code homes	27%	25%	30%	26%	24%	27%	35%[†]
Average percentage below code	18%	15%	21%	21%	18%	23%	25%[†]
If other factors did not occur[‡]							
Proportion of below-code homes	25%	20%	30%	22%	21%	24%	27%[†]
Average percentage below code	14%	12%	17%	12%	12%	13%	17%[†]

[*] Programs such as ENERGY STAR homes, LEED for homes, programs sponsored by municipal utilities such as SMUD and LADWP, Environments for Living, ComfortWise, and the Solar Initiative.

[†] Only one Building Industry Expert was able to provide responses for non-IOU and other factors.

[‡] Factors such as the downturn in the housing market, changes in energy prices, global warming and naturally occurring advances in the residential new construction industry.

Appendix C Additional Open-Ended Responses to Delphi Surveys

This Appendix contains additional comments from Delphi panelists that elaborated on their responses to the Delphi surveys.

C.1 Above-Code Homes Compared to Homes Just Meeting Code

C.1.1 Comments Pertaining to Attribution of Energy Savings from above-Code Homes

Several Title 24 consultants elaborated on the role of the IOU programs in savings due to homes exceeding code. One commented as follows:

> *The IOU Residential Programs contribute to overall "Green Building" awareness on the part of the public. People read the flyers that come with their utility bills. They visit their utility's website, they get educated, and some of what they learn "rubs off" on them, even though they may not ultimately participate in the programs. The IOU programs contribute to the general "buzz" about energy efficient homes. This is more of a factor at the higher end of the market. The low end of the market is forced to accept whatever the tract builders build.*

Another Title 24 consultant discussed the role of the IOU programs, non-IOU programs and the economic downturn on energy efficiency:

> *These [IOU] programs had a large impact on homeowners taking an interest in their energy savings and were effective. Most of these [non-IOU] programs did not have as high of an impact as the IOU programs, but the Municipal Utilities and Solar Initiative were starting to have an impact. People's pocketbooks speak and the rise in energy prices, as well as uncertainty in the future of oil got people thinking.*

One Title 24 consultant suggested that HERs inspections of program homes results in energy savings in non-program homes.

Another Title 24 consultant attributes efficiency gains largely to technological advances:

> *The largest single contributor for energy efficiency in new homes are the advances and lower cost of high performance windows and air conditioning systems. Increases in energy costs may also be a contributing factor.*

One title 24 consultant provided comments about the varying abilities of building departments and Title 24 consultants:

> *Not only are there building departments with wildly different levels of competency, but the field of Title 24 energy analysis is wide open to untrained, unlicensed individuals... many of whom consider it their job to cheat. This state of affairs makes the economic difference between what will get a building permit and what the IOU programs require much greater than it should be. Energy Analysts should be licensed, and all licensed engineers and designers should have their work spot checked by the licensing authorities. The "owner/builder exemption" should be rescinded. The baseline level of professional practice needs to be brought up at least to code.*

Another Title 24 consultant said that code enforcement and first cost are the driving factors determining efficiency levels in new homes:

> *I was recently at a training session with mostly building inspectors and they instructor was talking about enforcing Title 24 and the general response was that didn't have time or resources to worry about meeting code or reducing utility costs. So we have a lot of work in front of us, we need to do a better job of educating the building inspectors, contractors and the consumer. First-cost is still king, let's go with the lowest bid that meets the minimum requirements.*

Finally, one Title 24 consultant said that the downturn in the economy is driving efficiency practices:

> *The downturn in the economy has had a real effect. Builders are coming to me and asking me to help them make their homes more energy efficient so that they really stand out.*

A building industry expert provided extensive comments on the impact of the IOU'S RNC programs:

> *I believe most of the efficiency improvements in non-participating homes are due to long-term utility involvement in new construction programs and their work to improve codes and standards. Through this involvement, suppliers are stocking higher efficiency equipment, the cost of higher efficiency equipment has come down and non-participating builders are benefiting from these factors and are mostly likely, inadvertently building homes that exceed standards. The utility involvement has brought this about. Equipment suppliers will have no incentive to*

> *continue stocking high efficiency equipment if the demand dries up--and this would happen if utility incentives are no longer available to builders.*

Another building industry expert provided the following comment:

> *It is very odd to have so many houses beating code: compared to other states it is a remarkable achievement that must be due to some cause. The utility programs are the most obvious candidate.*

Finally, one building industry expert provided extensive comments on the impacts of the IOU programs and other factors on energy efficiency in the RNC market:

> *Overall, I think the programs had a positive impact on compliance. The IOU programs have large in-direct impacts through training, but this is limited by the number of builders that can be trained and by staff turnover*
>
> *I believe non-compliance is closer to 60% [as measured by prescriptive measures rather than performance. This study uses a different method for estimating compliance than we do. This study looks at performance, while we're looking at the installation of prescriptive measures such as insulation and ductwork. While it is encouraging that, by performance measurement, compliance is higher than by prescriptive measurement, we are also discouraged because savings could be that much higher if insulation and other measures were installed properly.*
>
> *In our field inspections, we are finding installed measures that do not meet code. In addition, we have recently worked with some large production builders to do field inspections of their homes that are "passing" 3rd party inspections provided by others, and we have found that they should not have passed based on our inspections and tests. We believe this to be widespread in the market, based on our own field experience. Furthermore, we have found that the HERS providers are not performing the required amounts of field verifications of the rater industry, leaving that industry without the controls that are built in by code.*
>
> *Non-IOU programs have a minimal impact because for most of the programs, inspections of participating homes are rare. Exceptions would be SMUD and ComfortWise*
>
> *The economic downturn had had a negative impact on efficiency. Builders are more price conscious so that installers are in turn more price conscious and may not do a good job. In addition, CHEERS AND calCERTS should be doing more inspections of inspected homes, to test the raters, but they are not doing the random inspections.*

The building industry expert who is skeptical of the Delphi process provided further explanation of his reservations:

> *The methodology and framing of many of the questions in this form does not make sense in the context of a program that tries to commercialize levels of efficiency that simply didn't exist in the new homes market 5 years ago. You cannot divide up 100% credit linearly among a number of factors, because they are all interactive on multiple levels. For example, to answer how much of the savings from above-code new homes is due to Energy Star, you have to recognize that Energy Star is tied to Title 24, so any influence past utility programs had on the code, and any influence they had in getting Energy Star to base its California spec on Title 24 and not IECC is also reflected in Energy Star's influence on the code. And the fact that the utilities and the CEC developed the methodologies that could calculate savings compared to the reference home enabled the federal tax credit to be set up the way it was. So the factors will add to much more than 100%. Also, a market as difficult as new construction of homes, where your data show some 20% of the homes built are illegal, it often takes several influencing factors at once in order to create an effect. So perhaps the influence of all programs except the utility programs would not be enough to get the compliance margins you observe, but the addition of these programs achieves the critical mass. Then on one hand the utility programs get 100% of the credit, since the results would not have been achieved without them, but on the other the additional programs such as the EPACT federal tax credit also contribute more than 0% to the outcome. The fact that over half of non-program homes beat the code is remarkable. I doubt whether this effect has been observed anywhere else in the country. Since all the other programs are nationwide, the only thing that I can see that is different in California is the utility programs. One might argue that Energy Star has achieved 50% market share in a few other markets (the average nationwide is about 20%) but the compliance margins reported here are not big enough to qualify the homes for Energy Star. The question of what share of the credit for code-compliant homes goes to past and present utility programs is divided in my response between past and present utility programs and stepped up code awareness and enforcement efforts, in an attempt to try to answer the question as framed as much as possible. There is essentially nowhere in the country that achieves 100% compliance. A previous study of compliance margins showed a shortfall of savings of about 8% based on inspections (and not on meter readings, which may have made the final answer worse). This would be consistent with about 50% noncompliance and 20% margins or similar combination. The point is that the results are much better now. This may be due to better enforcement infrastructure, but due to tight budgets this is not likely to be the major factor. Other programs could not get much credit since they focus on a*

higher level of efficiency than code and (except for tax credits) don't have financial incentives that would change the availability or cost of advanced efficient designs or building supplies/components. If they did have some influence in California, they would also be influencing other states, yet I have not heard a single report of code compliance increasing over the last few years in other states. In sum, it would be useful to compare this data set to one gathered for a state that did not have IOU programs or other economically incentivized programs. Success stories like this do not happen on their own. It would also be useful to know what fraction of the market DID participate in the utility programs and what their compliance margins were.

C.2 Homes Just Meeting Code Compared to Below-code Homes

C.2.1 Comments Pertaining to Attribution of Energy Savings from Just Code Homes

A building industry expert provided some thoughts as to why homes just meet code or are below-code:

Minimally compliant homes and those that do not meet code are due to several factors:

1) *Poor enforcement from building officials--typically due to understaffing/training so officials are forced to focus on health and safety and ignore energy issues and/or they are not properly trained to understand and recognized energy code violations;*
2) *Regional enforcement variations--some regions (politicians/building code enforcement officials) are more focused on efficiency, while others don't care;*
3) *Poor economy--in the economic downturn, builders are unwilling to spend additional dollars on efficiency measures;*
4) *Unaware of utility programs and incentives that will help reduce first costs;*
5) *Poor workmanship on the jobsite--the highest efficiency equipment can perform poorly if not installed correctly;*

Another building industry expert commented as follows:

Since these homes are minimally compliant, it is clear that the utility programs either had little or no impact (because there are no savings over code) or efficiency measures are being installed incorrectly and the savings are not accruing as expected. Alternately, one could assume the homes would be below-code and the energy performance would be worse in the absence of utility programs, e.g., the utility programs help improve the energy performance of minimally compliant homes…Builders are typically price responsive and will

> *build homes the cheapest way legally possible. With the removal or reduction of utility new construction programs, builders will go back to the old way of doing things. I believe most of the efficiency improvements in non-participating homes are due to long-term utility involvement in new construction programs and their work to improve codes and standards.*

A building industry expert believes that code enforcement and IOU sponsored trainings had a positive effect on code compliance:

> *I have heard discussions of local officials paying more attention to code compliance recently; so this could also be a factor in meeting the code. It may not be independent of the IOU programs, however.*
>
> *There is a strong likelihood that the utility technical/design assistance received by pre-2006 program participants would spill over into construction design of homes during the 2006-2008 period (whether directly involved in the 06-08 programs or not). Once a business or individual has been trained to meet high energy efficiency standards for one project, they have the ability and one of the components of the motivation to do it again, even if for some projects the extent of efficiency they use is not up to qualification with the 2006-8 IOU programs.*
>
> *It is likely that the program participants in the 06-08 IOU programs are also constructing/designing non-program homes during the same period (in which case the knowledge and design assistance from the 06-08 programs influenced the design of the non-program homes as well)*

A second Title 24 consultant identified code enforcement and code official training is very important:

> *Reaching the field inspectors is hard, but well worth it to improve effectiveness.*

One Title 24 consultant believes that energy savings are attributable to making Title 24 more stringent (rather than due to the IOU'S RNC programs):

> *I have found that any increase in energy savings has come from the increase in the Title 24 requirements, a greater awareness of energy products by the home builder and the decreasing cost of energy efficient products*

C.3 Persistence of Savings

A Title 24 cautioned against cutting or eliminating the IOU'S RNC programs:

> *Whether monetary incentives are included in a program, or not, the education and training helps keep the building industry and public awareness focused on products, improvements and habits that can save energy – and money for the consumer. The SMUD "Flex Your Power" program is a great example of this type of public awareness effort.*

A second Title 24 also cautioned against cutting or eliminating the IOU'S RNC programs:

> *Once the incentive rebates/programs are eliminated, there will be very little desire from the builders to go above and beyond the minimum compliance code. There will be some conscious builders making the effort to go above and beyond but the percentage from existing programs to non existing programs will be highly reduced.*

Appendix D Memo Accounting for Potential Overlapping Nonparticipant Spillover Energy Savings

MEMO

To: Residential New Construction Market Effects Working Group

From: Greg Clendenning, David Barclay and Lynn Hoefgen, NMR

Date: May 10, 2010

Re: Accounting for Overlapping Nonparticipant Spillover Energy Savings

---

NMR conducted a review of the evaluations and claimed savings of other IOU programs and found that there is no double counting and currently no potential overlapping nonparticipant spillover in the claimed savings from other IOU programs. However, there is potential overlap in the future, particularly if nonparticipant spillover is considered a resource in future program cycles.

In order to account for any potential overlapping nonparticipant spillover from other IOU programs, NMR conducted a review of the evaluations and claimed savings for the following programs:

- SCE2519, SCG3521, SCE2525, SCE2567, SCE2568: Title 24 Codes and Standards Workshops (Government Partnerships Programs)
- PGE 2044: Builder Energy Code Training (BECT)
- PGE 2057: Green Building Technical Support Services (Build it Green)

Of these programs, only the Title 24 Codes and Standards Workshops, Government Partnership Programs (SCE2519, SCE2525, SCE2567 and SCE2568) claimed savings. The claimed savings totaled 1,933 kW and 9,783,517 kWh for the 2006 to 2008 program year cycle. However, upon further review of savings reports submitted through the Energy Efficiency Groupware Application (EEGA)[69] and through data reported in the CPUC Energy Division's Evaluation

[69] http://eega2006.cpuc.ca.gov/Default.aspx

Reporting Tools / Database (ERT), none of the claimed savings were for residential new construction sector.[70]

The Builder Energy Code Training program (BECT, PGE 2044) and the Green Building Technical Support Services (Build it Green; PGE 2057) did not have explicit energy savings goals and did not claim any savings as part of the ERT.[71]

It should be noted that non-impact evaluations of the programs found that the programs were responsible for energy savings during the 2006-2008 cycle. The Green Building Technical Support Services (Build it Green; PGE 2057) achieved savings in existing homes rather than new homes, while the Builder Energy Code Training program (BECT, PGE 2044) achieved savings in new homes through improved code compliance. Again, because these were non-resource programs, these savings were not claimed so there is no overlap in savings.

However, if energy savings from nonparticipant spillover are treated as a resource in future program cycles, it may be necessary to take into account savings from programs such as the Builder Energy Code Training program (BECT, PGE 2044) in order to avoid double counting of savings.

Next we provide a brief description of the Title 24 Codes and Standards Workshops, Government Partnership Programs (SCE2519, SCG3521, SCE2525, SCE2567 and SCE2568) and a brief overview of the evaluations The Builder Energy Code Training program (BECT, PGE 2044) and the Green Building Technical Support Services (Build it Green; PGE 2057).

Program: Title 24 Codes and Standards Workshops, Government Partnership Programs (SCE2519, SCG3521, SCE2525, SCE2567, SCE2568)[72]

Program Description: Southern California Edison (SCE) and Southern California Gas (SCG) implemented two hour workshops which were designed to update participants of the latest Title 24 codes and standards, particularly building envelope, lighting, and mechanical requirements. The workshops targeted market actors, such as architects, engineering firms and contractors, as well as end use customers.

Program: Builder Energy Code Training (BECT, PGE 2044)[73]

Program Description: Pacific Gas & Electric (PG&E) implemented the BECT Program during program years 2006 to 2008. The BECT Program provided training to the building industry to

[70] Of the 9,783,517 kWh in savings, 9,742,510.8 kWh were from the non-residential sector and 41,006.7 kWh were from the residential retrofit and residential replace on burnout sectors.
http://www.edcentralserver.com/ERT/ERT%20(v5_3_5)_2003.exe

[71] The Builder Energy Code Training program (BECT, PGE 2044 was a non-resource program and therefore savings are not claimed).

[72] Summit Blue Consulting, PA Consulting Group *(2010) Government Partnerships Programs. Effectiveness and Impacts for Non-Resource Elements of the 2006-2008 Government Partnerships Programs.* Submitted January 26, 2010.

[73] Opinion Dynamics Corp., Summit Blue Consulting, Jai J. Mitchell Analytics *(2010) PY2006-2008 Indirect Impact Evaluation of the Statewide Education & Information Programs. Volumes I through III.* Submitted March 2010.

improve compliance with Title 24 energy codes for residential new construction. BECT has been in operation for over 20 years, run by a third party, ConSol. Classroom and on-site trainings were conducted by building code experts. The program targeted contractors, subcontractors and local code officials.

2006-2008 Net Annual Energy Savings: 16,950 MWh, 1,555,350 Therms

2006-2008 Program Budget: $1.4 million

Methodology: For the PY2006-2008 Opinion Dynamics reviewed program documents and databases, observed a classroom training session and a construction site training session, conducted several depth interviews with course attendees while on-site, and completed 107 telephone surveys with builders (44) and code officials (63) who attended a BECT course between 2006 and 2008. The surveys included questions regarding awareness and knowledge of energy efficient building practices as well as behavioral changes resulting from BECT participation.

Energy Savings Analysis: Energy savings were estimated for homes built by participating builders during the 2006 to 2008 time period. For the BECT program three primary end uses were analyzed for energy savings: lighting, water heating, and HVAC. To estimate deemed energy savings from BECT the evaluators made the following assumptions:

- To estimate unit savings for lighting, evaluators assumed a baseline of new construction lighting at 90% of compliance and assumed the savings was the difference between 90% and 100% compliant—a savings of 133 kWh per home.
- To estimate unit savings for water heating, evaluators took baseline consumption from DEER for new construction and calculated estimated savings based on additional water heater and pipe insulation—a savings of 250 kWh and 24 Therms per home.
- To estimate unit savings for bringing HVAC up to code, evaluators assumed an increase of 5% savings above baseline practices (based on DEER 2008)—a savings of 67 kWh and 12 Therms per home.

In addition, the evaluation examined several other behavior changes that resulted in savings that could be attributed to the program. Builders were asked about changes in the following areas: insulation, windows and doors, lighting, HVAC, duct work, water heating, and air infiltration.

To calculate annual energy savings for the program, the assumed savings from lighting, water heating and HVAC were combined with the number of builders who made behavior changes, the average number of homes built per year per builder, and the estimate of reported behavior changes that could be attributed to the program.

Important Evaluation Findings: The following offers a summary of the key findings from the March 2010, PY2006-2008 Indirect Impact Evaluation prepared by Opinion Dynamics Corp.

- The 2006 to 2008 BECT Program cycle focused on the 2005 Title 24 changes. Due to the program's focus on training buildings and code officials to meet Title 24, it is not

expected that participant's knowledge of energy efficiency or behavior changes would increase beyond the Title 24 code.

- BECT made Title 24 code information more accessible to a wider audience. While the building community receives Title 24 code information and change notification through many sources the BECT program brought the trainings to builders instead of having the training at a fixed location.
- Between 2006 and 2008 the BECT program conducted a total of 167 trainings and trained a total of 1,978 builders and code officials. BECT participants build or inspect a large number of new residential homes each year—on average, a participating builder might construct 275 homes and a code official might inspect up to 300 homes per year.
- Participants are typically large, well-established builders that tend to be very knowledgeable about the Title 24 code and attend the trainings only to add "small bits" of information to their current knowledge.
- The BECT Program does not seek to promote or channel participants into utility programs. Less than half of the participants strongly agreed with the statement that they were more aware of utility programs after attending the training.
- Among builders, 70% applied the course concepts to their jobs and 55% recommended energy savings actions learned in the training.
- Among code officials, 87% applied the course concepts to their jobs and 73% required energy saving actions learned in the training.

Program: Green Building Technical Support Services (Build it Green, PGE 2057[74]

Program Description: The program is run by Build it Green, a non-profit whose mission is to promote healthy, durable, energy and resource efficient buildings in California. Build it Green connects consumers and building professionals with the tools and technical expertise they need to build quality green buildings. The program runs workshops, green home tours, and presents a variety of community events. According to the program's development director the "backbone" of the program is the GreenPoint Rated Checklist. The Checklist captures all of the program's information and education and underlines program activities. Build it Green defines "green" across five aspects: livable communities, indoor air quality, resource conservation, water conservation, and energy efficiency. The GreenPoint rating system assigns points based on the Checklist and to become GreenPoint rated, homes must achieve a minimum number of points. The program covers three types of homes: existing single-family remodel, single-family new construction, and multi-family new construction. According to the PY2006-2008 evaluation report, any project that is GreenPoint certified is considered at least 15% more energy efficient than Title 24 standards.

[74] Opinion Dynamics Corp., Summit Blue Consulting, Jai J. Mitchell Analytics *(2010) PY2006-2008 Indirect Impact Evaluation of the Statewide Education & Information Programs. Volumes I through III.* Submitted March 2010.

2006-2008 Net Annual Energy Savings: 98 MWh, 23,666 Therms

2006-2008 Program Budget: $1.6 million

Methodology: For the PY2006-2008 Opinion Dynamics reviewed program documents and databases, conducted in-depth interviews with participants and program staff, and completed 338 Internet surveys--195 with Green Home Tour participants and 143 with council members. The surveys included questions regarding the program's influence on actions taken by participants.

Energy Savings Analysis: The PY2006-2008 evaluation only analyzed energy savings for residents who reported retrofitting existing homes. Therefore the energy savings reported do not have any overlapping spillover.

Important Evaluation Findings: The following offers a summary of the key findings from the March 2010, PY2006-2008 Indirect Impact Evaluation prepared by Opinion Dynamics Corp.

- The GreenPoint rating system is similar to the Leadership in Energy and Environmental Design (LEED) system, however, the LEED certification standards are more rigorous and costly than the Build it Green rating system. The Build it Green program may appeal to residents who want to take action but are not quite ready to meet LEED certification requirements.
- In addition to funding from the CPUC, the program receives funding from the Public Goods Charge and other sources. However, the program does not differentiate activities based on funding source.
- The evaluators found that 4,464 total residents were reached through the Green Home Tours.
- The Green Home Tours offer hands-on experience and one-on-one education in a real home setting. Participants are also provided with resources needed to take action on the products and features they see in each home by providing them with a list of local and regional building resources.
- The Green Home Tours attract a pool of residents that already possess knowledge of energy saving opportunities and are interested in learning more. However, respondents still reported that the tour was useful and that their knowledge regarding energy efficiency increased due to participation.
- The vast majority of residents (95%) reported taking an energy-related action since attending a Green Home Tour. Actions included behaviors such as installing energy efficient measures, turning off lights before leaving a room, and purchasing energy efficient equipment such as lighting, insulation/air barriers, windows, thermostats, refrigerators, and water heaters.

Appendix E Delphi Panelists' Confidence in Responses

This appendix contains our analysis of the questions in which we asked respondents to rate their confidence in their own responses, the responses of Title 24 Consultants and Building Industry Experts. The data are organized into three main categories—unweighted Title 24 responses, weighted Title 24 responses and Building Expert Responses—and three subcategories—confidence in their own responses, confidence in Building Expert responses, and confidence in Title 24 Consultant responses. We present the breakdown by ratings of zero to two, three to six, and seven to ten as well as the median and mean for each sub category.

Title 24 Consultants report high levels of confidence for all of the questions and they are confident in their own responses, those of their fellow Title 24 Consultants and the Building Experts. For two questions, regarding the decline in savings due to IOU budget cuts, they report relatively lower levels of confidence for Building Experts.

Building Experts appear to be less confident overall in their own responses, the responses of their fellow Building Experts and the Title 24 Consultants.

Table E-1: Confidence in Responses Regarding Attribution of Energy Savings from Above-code Homes

Confidence	Title 24 Consultants, Unweighted (n = 24)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 7)		
	Own Responses	Building Experts	Title 24 Consultants	Own Responses	Building Experts	Title 24 Consultants	Own Responses	Building Experts	Title 24 Consultants
0 to 2	0%	0%	0%	0%	0%	0%	0%	0%	0%
3 to 6	29%	42%	50%	43%	7%	45%	29%	60%	83%
7 to 10	71%	58%	50%	57%	93%	55%	71%	40%	17%
Median	7.0	7.0	6.5	7.0	8.0	7.0	7.0	6.0	6.0
Mean	7.3	7.0	6.8	7.3	8.3	6.8	7.3	6.2	5.5

Table E-2: Confidence in Responses Regarding Attribution of Energy Savings from IOU Program Elements for Above-code Homes

Confidence	Title 24 Consultants, Unweighted (n = 24)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)		
	Own Responses	Building Experts	Title 24 Consultants	Own Responses	Building Experts	Title 24 Consultants	Own Responses	Building Experts	Title 24 Consultants
0 to 2	0%	0%	0%	0%	0%	0%	0%	0%	0%
3 to 6	29%	47%	36%	4%	10%	4%	67%	83%	83%
7 to 10	71%	53%	64%	96%	90%	96%	33%	17%	17%
Median	7.5	7.0	7.0	8.0	8.0	8.0	5.5	5.0	5.5
Mean	7.3	6.7	7.0	8.1	8.0	7.8	6.5	5.5	5.3

Table E-3: Confidence in Responses Regarding Decline in Savings with IOU Budget Cuts for Above-code Homes

Confidence	Title 24 Consultants, Unweighted (n = 23)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)		
	Own Responses	Building Experts	Title 24 Consultants	Own Responses	Building Experts	Title 24 Consultants	Own Responses	Building Experts	Title 24 Consultants
0 to 2	0%	10%	0%	0%	1%	0%	0%	0%	33%
3 to 6	35%	53%	52%	5%	12%	46%	29%	33%	67%
7 to 10	65%	37%	48%	95%	87%	54%	71%	67%	0%
Median	7.0	6.0	6.0	8.0	10.0	8.0	8.0	7.0	3.5
Mean	7.2	5.9	6.8	8.2	9.2	7.7	7.3	6.8	3.3

Table E-4: Confidence in Responses Regarding Attribution of Savings for Homes Just Meeting Code

Confidence	Title 24 Consultants, Unweighted (n = 23)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 7)		
	Own Responses	Building Experts	Title 24 Consultants	Own Responses	Building Experts	Title 24 Consultants	Own Responses	Building Experts	Title 24 Consultants
0 to 2	0%	0%	0%	0%	0%	0%	0%	0%	0%
3 to 6	35%	50%	52%	5%	11%	47%	57%	100%	83%
7 to 10	65%	50%	48%	95%	89%	53%	43%	0%	17%
Median	7.0	6.5	6.0	7.0	9.0	7.0	6.0	5.5	5.0
Mean	6.9	6.7	6.7	7.7	8.5	7.2	6.3	5.5	5.0

Table E-5 Confidence in Responses Regarding Attribution of Energy Savings from IOU Program Elements for homes Just Meeting Code

Confidence	Title 24 Consultants, Unweighted (n = 23)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)		
	Own Responses	Building Experts	Title 24 Consultants	Own Responses	Building Experts	Title 24 Consultants	Own Responses	Building Experts	Title 24 Consultants
0 to 2	0%	5%	0%	0%	1%	0%	0%	0%	0%
3 to 6	30%	32%	48%	4%	6%	46%	83%	100%	100%
7 to 10	70%	63%	52%	96%	93%	54%	17%	0%	0%
Median	8.0	7.0	7.0	9.0	9.0	8.2	5.0	5.0	5.0
Mean	7.4	6.7	7.1	8.0	8.8	7.6	5.5	5.0	4.6

Table E-6: Confidence in Responses Regarding Decline in Savings from Just Code Homes with IOU Budget Cuts

Confidence	Title 24 Consultants, Unweighted (n = 23)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 7)		
	Own Responses	Building Experts	Title 24 Consultants	Own Responses	Building Experts	Title 24 Consultants	Own Responses	Building Experts	Title 24 Consultants
0 to 2	0%	5%	0%	0%	1%	0%	0%	0%	0%
3 to 6	44%	47%	38%	7%	12%	6%	43%	67%	100%
7 to 10	56%	47%	62%	93%	87%	94%	57%	33%	0%
Median	7.0	6.0	7.0	9.0	9.0	8.6	7.0	5.5	3.5
Mean	7.1	6.4	7.3	8.4	8.7	8.0	6.0	5.5	3.8

Table E-7: Confidence in Responses Regarding Code Compliance in the Absence of IOU Programs and Other Factors

Confidence	Title 24 Consultants, Unweighted (n = 23)			Title 24 Consultants, Weighted (n = 24)			Building Industry Experts (n = 6)		
	Own Responses	Building Experts	Title 24 Consultants	Own Responses	Building Experts	Title 24 Consultants	Own Responses	Building Experts	Title 24 Consultants
0 to 2	0%	0%	0%	0%	0%	0%	0%	0%	0%
3 to 6	29%	45%	36%	4%	12%	44%	33%	80%	80%
7 to 10	71%	55%	64%	96%	89%	56%	67%	20%	20%
Median	7.0	7.0	7.0	8.0	8.0	8.0	7.0	5.0	5.0
Mean	7.3	6.8	7.0	7.7	8.2	7.2	6.2	5.0	5.0

Appendix F Comparing Gross Energy Savings Estimates in the Residential New Construction Market Effects Study and the Codes and Standards Program Evaluation

F.1 Summary

This appendix describes the relationship between the savings estimates in the Residential New Construction Market Effects (RNC ME) study and the Codes and Standards Program (C & S Program) evaluation. The RNC ME study measured savings in homes exceeding the 2005 code relative to homes just meeting the code and in homes just meeting the 2005 code relative to homes not meeting the code. The C & S Program evaluation measured savings in all homes using the 2001 code as baseline.

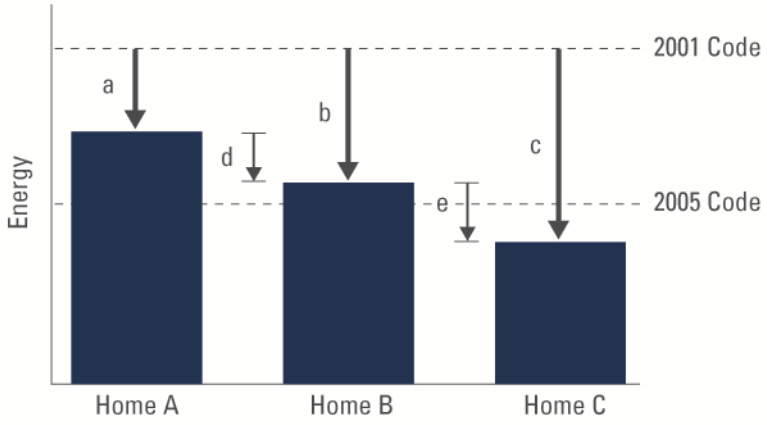
The analysis below shows the following:

- In theory, all gross savings in the RNC ME study are a strict subset of and should have been counted in the C & S Program evaluation's gross standard savings.
- C & S Program evaluation gross savings are not directly comparable to RNC ME evaluation gross savings because of differences in their baselines and end uses covered.
- RNC ME study electricity gross savings are about 10% less than C & S Program evaluation gross savings. RNC ME gas savings are estimated to be about equal to C&S Program evaluation gross savings. Making such direct comparisons is difficult because of the factors noted above, as well as possible measurement error in the ME or C&S estimation of gross savings, and differences in adjustments to C & S Program gross savings to make them comparable to RNC ME gross savings.

F.2 Are Gross Savings in RNC ME Study Counted in the C & S Program Evaluation?

If the C&S and ME evaluations had made identical assumptions about end uses included in their analyses, the amount of new construction, the types of dwellings covered, etc., all gross savings in the RNC ME evaluation would be counted in the C & S Program evaluation.[75] Figure F.2-1 below demonstrates this. It compares how savings are calculated in the two evaluations. In this simplified example, there are three homes. Home A consumes significantly more energy than the 2005 code allows and would be a Home Below Code in the RNC ME study. Home B consumes energy within 5% of the amount allowed by code and would be a Home Just Meeting Code. Home C is a home consuming significantly less energy than allowed by the 2005 code and would be a Home Above Code.

Figure F.2-1: Energy Savings in the Codes and Standards Program and RNC Market Effects Evaluations



The C & S Program evaluation uses the 2001 code as the baseline in calculating gross standard savings. Accordingly, gross standard savings in this example is the sum of the difference between consumption allowed under the 2001 code and actual consumption for each home (a + b + c).

In the RNC ME evaluation, gross savings are measured in Homes Just Meeting Code using consumption in Homes Below Code as a baseline and in Homes Above Code using consumption in Homes Just Meeting Code as baseline. Savings in Homes Just Meeting Code are given by the difference between consumption in Homes Below Code and consumption in Homes Just Meeting Code (d). Savings in Homes Above Code are the difference between consumption in Homes Just Meeting Code and Homes Above Code (e). Total gross savings in the RNC ME evaluation is d + e.

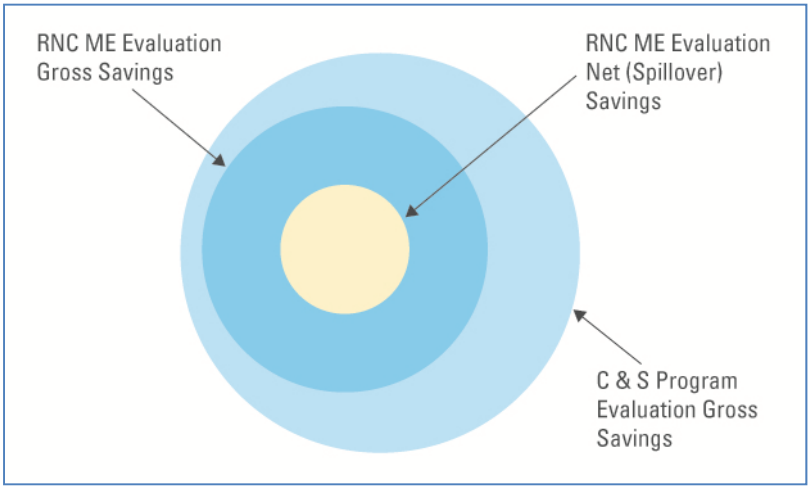
[75] As discussed in the next section, the RNC ME evaluation included savings from federal air conditioning and water heating standards in the estimate of gross savings. The C & S Program excluded these in the estimate of gross standard savings because they were not California standards.

The figure shows that Savings in Homes Just Meeting Code (represented by d) contribute to compliance with the 2005 code in Home B (b) and are counted as gross standard savings in the C & S Program evaluation. Similarly, Savings in Homes Above Code (e) contribute to Home C reducing its energy consumption below what the 2005 code allows and are counted as gross standard savings in the C & S Program evaluation (c).

It is clear from the figure that the RNC ME gross savings are a strict subset of and should be less than the C & S Program gross savings. This will be true in general if Home A has consumption that is strictly greater than that of Home B or Home C has consumption that is strictly less than the consumption of Home B.

Figure F.2-2 depicts the relationship between the gross savings definitions in the evaluations. It shows further that RNC program spillover (net) savings are strictly contained in RNC ME gross and C & S Program savings.[76]

Figure F.2-2: Gross Energy Savings



F.3 Are Gross Savings in RNC ME Study Counted in the C & S Program Evaluation?

Three differences between the evaluations in the estimation of savings complicate any direct comparison of gross savings[77]:

[76] The RNC ME study estimated that IOU RNC programs are responsible for 25% (9,970 MWh) of the gross electricity savings and 26% (187.8 MDth) of the gross natural gas savings due to above-code homes compared to code-compliant homes. The study also estimated that the 2006-2008 IOU RNC programs are responsible for 23% (1,282 MWh) of the gross electricity savings and 23% (18.2 MDth) of the gross natural gas savings in code-compliant homes compared to non-compliant homes.

1. The RNC ME and C & S Program evaluations included different end uses in their analyses. The RNC ME study covers space heating, space cooling, and water heating. The C & S Program evaluation includes savings from hardwired lighting in addition to these three end uses.
2. The RNC ME study included only single family homes, while the C & S Program evaluation included single family and low and high rise multi-family buildings.
3. The evaluations made different assumptions about the amount of new single family construction between 2006 and 2008. The RNC ME study used a lower forecast than the C & S Program study.[78]

All these differences increase the C & S Program evaluation savings in the same direction relative to the RNC ME savings estimates. To compare the gross savings estimates on the same basis, we made the following adjustments to the C & S Program evaluation gross savings:

1. Subtract electricity savings for lighting end uses from the C & S Program evaluation estimate of residential electricity savings.
2. Adjust the number of housing units to account for the inclusion of multi-family homes and the difference in forecasts of housing units.
3. Add in gross savings from the federal air conditioning (electricity) and water heating (gas) standards. These savings were omitted from the C & S Program evaluated gross savings estimate. The RNC ME study may include a small amount of savings from federal standards.[79]

Table F.3-1 compares the C & S Program evaluation and RNC ME evaluation electric and gas gross savings estimates. In Panel A, Lines 1-5 show the adjustments to C & S Program evaluation gross electricity savings for federal air conditioning standards and hardwired lighting standards. Line 6 makes the final adjustment excluding multifamily homes and the lower forecast of new construction. Line 9 reports the RNC ME gross electricity savings estimate, which is the sum of gross electricity savings in Homes Above Code and Homes Just Meeting Code (lines 7 and 8).

[77] The RNC ME evaluation estimated gross savings in Homes Above Code and Homes Just Meeting Code using the same sample of 194 buildings that the C & S Program used.

[78] The RNC ME evaluation assumed 172,553 single-family homes were built between 2006 and 2008. The C & S Program evaluation assumed that there were 226,673 new single-family and 350,811 single- plus multi-family homes constructed in the same period.

[79] If new homes built between 2006 and 2008 complied with the new federal air conditioning standard (SEER 13), no savings from the standard would be included in RNC ME gross savings. However, if, for example, some homes below code did not comply with the federal standard, consumption in these homes would be greater than they otherwise would be and the baseline for measuring savings in Homes Just Meeting code would be lowered. Some RNC ME gross savings would therefore be due to the federal standard. Approximately 5 percent of new homes in the estimation sample installed air conditioners with SEER less than 13, so savings from federal standards counted as market effects are likely to be small.

The model of gross savings in Figure 1 predicts that C & S Program evaluation gross savings would be more than RNC ME evaluation gross savings. As Panel A shows, this is the case. The RNC ME evaluation gross savings estimate is approximately 3.5 GWh less than the C&S evaluation gross savings.

Table F.3-1: Comparison of C & S Program and RNC ME Gross Electricity Savings Estimates

	Panel A: Electricity Savings, 2006-2008	**GWh**
1	C & S Program Evaluation Gross Standard Savings	163.1
2	C & S Program Evaluation Gross Savings from Federal Air Conditioning Standard	73.7
3	C & S Program Evaluation Gross Standard and Federal AC Standard Savings	236.8
4	C & S Program Evaluation Gross Standard Savings for Lighting End uses	138.8
5	C & S Program Evaluation Gross Standard and Federal AC Standard Savings for Non-lighting End uses	97.9
6	C & S Program Evaluation Gross Standard and Federal AC Standard Savings for Non-lighting End Uses in Single Family Homes and Using Lower Forecast of New Construction	48.2
7	RNC ME Evaluation Gross Savings in Homes Above Code	39.2
8	RNC ME evaluation gross savings in Homes Just Meeting Code	5.5
9	RNC ME Evaluation Total Gross Savings	44.7

Panel B of Table F.3-2 performs the same comparison for gas. Rows 1-4 show adjustments to the C & S Program evaluation of gross standard gas savings. After making the adjustments, RNC ME gross savings are slightly larger than C & S Program evaluation gross savings. This result could be due to measurement error in the estimation of savings in the evaluations or error in adjustments to C & S Program gross savings to make it comparable to RNC ME gross savings or error in the RNC ME estimate.

Table F.3-2 Comparison of C & S Program and RNC ME Gross Gas Savings Estimates

	Panel B: Gas Savings, 2006-2008	**Millions of therms**
1	C & S Program Gross Standard Savings	6.7
2	C & S Program Evaluation Gross Savings from Federal Water Heating Standard	9.1
3	C & S Program Evaluation Gross Standard and Federal WH Standard Savings	15.9
4	C & S Program Gross Standard and Federal WH Standard Savings for SF homes and using lower forecast of new construction	7.8
5	RNC ME evaluation gross savings in Homes Above Code	7.1
6	RNC ME evaluation gross savings in Homes Just Meeting Code	0.8
7	RNC ME Evaluation Total Gross Savings	7.9

F.4 The Exact Relationship between C & S Program Evaluation Gross Savings and RNC ME Evaluation Gross Savings

It is possible to derive the exact relationship between the savings by expressing gross standard savings as a function of savings in Homes Above Code and in Homes Just Meeting Code.[80] This relationship can be used as a further check on the consistency of the savings estimates:

Gross Standard Savings = Savings in Homes Above Code - Savings in Homes Just Meeting Code + 3*(Maximum Allowable Consumption Under 2005 Code in Homes Just Meeting Code – Actual Consumption in Homes Just Meeting Code) + (KWH 2001 Code - KWH 2005 Code) (1)

- Gross Standard Savings are gross standards savings in the Codes and Standards Program evaluation, which uses the 2001 code as a baseline
- Savings in Homes Above Code are savings in Homes Above Code (2005 Code) in the RNC ME evaluation
- Savings in Homes Just Meeting Code are savings in Homes Just Meeting Code (2005 Code) in the RNC ME evaluation

The second to last term in the expression accounts for any deviation from code compliance for Homes Just Meeting Code. It would disappear if Homes Just Meeting Code exactly complied with the 2005 code. The last term is the potential savings in the Codes and Standards Program evaluation. It is the difference in maximum allowable consumption between the 2001 and 2005 codes.

[80] It is evident from the figure that gross savings in the RNC ME study will be less than gross savings in the C & S Program evaluation. This will be true if Home A has consumption that is strictly greater than that of Home B or Home C has consumption that is strictly less than the consumption of Home B.