

# Final Report

## 2006 Statewide Residential New Construction Program Strategy Assessment

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# Acknowledgements

## **Project Oversight**

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## Table of contents

<b>INTRODUCTION .....</b>	<b>1</b>
BACKGROUND AND KEY ISSUES.....	1
OBJECTIVES.....	2
<b>EXECUTIVE SUMMARY.....</b>	<b>3</b>
INTERVIEW FINDINGS AND THE ENERGY STAR HOMES PROGRAM.....	3
ENERGY EFFICIENCY MEASURES.....	4
<b>SINGLE FAMILY SUMMARY OF FINDINGS.....</b>	<b>8</b>
AWARENESS AND CONCERNS REGARDING 2005 TITLE 24 CHANGES .....	8
CURRENT BUILDING PRACTICES AND COMPLIANCE STRATEGIES .....	9
PREDICTED BUILDING PRACTICES AND COMPLIANCE STRATEGIES .....	10
EFFECT OF CHANGES IN TITLE 24 ON THE IMPORTANCE OF ENERGY EFFICIENCY IN MARKETING HOMES .....	10
VALUE OF THE CURRENT ENERGY STAR HOMES PROGRAM.....	11
POTENTIAL CHANGES TO CESNHP AND SUGGESTIONS FOR IMPROVEMENT.....	11
THE ENERGY STAR NEW HOMES LABEL .....	11
<b>MULTIFAMILY SURVEYS AND SUMMARY OF FINDINGS .....</b>	<b>13</b>
INTRODUCTION .....	13
DESCRIPTION OF RESPONDENTS .....	13
DEVELOPER AWARENESS OF CHANGES IN TITLE 24 .....	14
IMPORTANCE OF EXCEEDING TITLE 24 BY 15% .....	15
ATTITUDES TOWARD COMMON ENERGY EFFICIENCY MEASURES .....	17
<i>Most/Least Likely Measures</i> .....	17
HERS INSPECTIONS .....	18
COMBINED/SHARED CENTRAL HOT WATER.....	19
ELECTRIC (BASEBOARD) RESISTANCE HEATING .....	20
ENERGY STAR HOMES PROGRAM.....	21
<i>ENERGY STAR Homes Program – Qualification Alternatives</i> .....	23
<i>ENERGY STAR Homes Program – Incentive Alternatives</i> .....	25
OTHER DEVELOPER RECOMMENDATIONS .....	27
<b>SINGLE FAMILY TITLE 24 TURNKEY SERVICE PROVIDERS &amp; TITLE 24 CONSULTANTS. 30</b>	
INTRODUCTION .....	30
TYPES OF FIRMS INTERVIEWED .....	30
ISSUES ADDRESSED .....	30
TITLE 24 TURNKEY SERVICE PROVIDERS.....	31
<i>Description of Respondents</i> .....	31
<i>Current Builder Practices: Differences in Prototype Designs by Climate Zone</i> .....	31
<i>Builder Awareness and Concern Regarding Title 24 Revisions</i> .....	31
<i>Effects of Title 24 Changes on Building Practices</i> .....	32
<i>Other Potential Compliance Measures</i> .....	35
<i>Measures not currently included in compliance calculations</i> .....	36
<i>Effect of Title 24 Changes on Strategic Importance of Energy Efficiency and Utility Programs</i> .....	36
<i>Response to Potential Changes in Program</i> .....	38
<i>Changes in Business Operations in Response to 2005 Title 24 Changes</i> .....	39
TITLE 24 CONSULTANTS .....	39
<i>Description of Respondents</i> .....	39
<i>Perceptions of Builder Awareness and Practices</i> .....	40

<i>Current Compliance Approaches</i> .....	40
<i>Predictions of Effects on Recommendations to Exceed the 2005 Title 24 Requirements</i> ...	42
<i>Effect of HERS Inspection Requirements</i> .....	43
<i>Program Changes to Qualification Approach</i> .....	44
<i>Program Changes to Incentive</i> .....	45
<i>Additional Information</i> .....	46
<b>SINGLE FAMILY BUILDER SURVEYS .....</b>	<b>47</b>
INTRODUCTION .....	47
DESCRIPTION OF RESPONDENTS .....	47
CURRENT BUILDING PRACTICES .....	48
<i>Coastal vs. Inland Prototype Plans</i> .....	48
<i>Energy-Related Home Features</i> .....	49
<i>HERS Infiltration Testing and Certification, Thermal Expansion Valves, and Tight Duct Certification</i> .....	50
<i>Builder Awareness of Changes in Title 24 and Projected Changes in Building Practices</i> ...	51
<i>Effect of Changing Standards on Business Importance of Energy Efficiency</i> .....	53
<i>ENERGY STAR Program Participation</i> .....	54
<i>Responses to Alternative Program Qualifying Approaches</i> .....	55
<i>Responses to Alternative Program Incentive Approaches</i> .....	56
<i>Additional Information</i> .....	57
<b>SINGLE FAMILY MEASURE ANALYSIS .....</b>	<b>59</b>
INTRODUCTION .....	59
BASELINE .....	59
MEASURES .....	60
INCREMENTAL MEASURE COST .....	62
COST EFFECTIVENESS.....	62
ENERGY SAVINGS.....	63
NATURAL GAS ENERGY SAVINGS .....	65
<b>MULTIFAMILY MEASURE ANALYSIS .....</b>	<b>67</b>
INTRODUCTION .....	67
BASELINE .....	67
MEASURES.....	69
INCREMENTAL MEASURE COST .....	69
COST EFFECTIVENESS.....	69
ELECTRICAL ENERGY SAVINGS .....	70
NATURAL GAS ENERGY SAVINGS .....	73
<b>MARKETING THE ENERGY STAR HOMES PROGRAM .....</b>	<b>75</b>
INTRODUCTION .....	75
UTILITY WEBSITES.....	75
THE FEDERAL ENERGY STAR WEBSITE.....	76
SUMMARY .....	77
<b>APPENDIX I: SURVEY INSTRUMENTS .....</b>	<b>78</b>
TURNKEY INTERVIEW GUIDE.....	78
SINGLE FAMILY PRODUCTION BUILDER SURVEY INSTRUMENT .....	90
MULTIFAMILY DEVELOPER SURVEY.....	106
<b>APPENDIX II: TURNKEY INTERVIEW ESTABLISHMENT DATA.....</b>	<b>120</b>
<b>APPENDIX III: NIGHTBREEZE ENDORSEMENTS.....</b>	<b>121</b>

# Introduction

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## Background and Key Issues

This document is the final report for the 2006 Residential New Construction Program Strategy Assessment. The 2006 Strategy Assessment was conducted on behalf of California's four investor owned utilities, including Pacific Gas and Electric, Southern California Edison Company, Southern California Gas Company, and San Diego Gas and Electric. RLW Analytics was the prime contractor on this project; KEMA-Xenergy was a subcontractor to RLW. KEMA was responsible for interviews with Title 24 turnkey providers, Title 24 consultants, and single family production builders, while RLW's responsibilities included multifamily interviews, energy efficiency measure identification, measure analysis and overall project management and coordination. RLW also contracted a portion of the measure simulations to Itron who also created the modeling methodology used by the Residential Potential Study.

This study was conducted at the request of the California Public Utilities Commission. The study was managed by Pacific Gas and Electric. It was funded through the public goods charge (PGC) for energy efficiency and is available for download at [www.calmac.org](http://www.calmac.org).

The 2006 Residential New Construction Strategy Assessment was undertaken in order to address important changes in the new construction sector that will greatly impact the existing California Statewide ENERGY STAR New Homes Program (CESNHP). The CESNHP has been implemented in California by the investor owned utilities since 2002. Although the program is currently funded through 2006, upcoming modifications to Title 24's low-rise residential energy code will greatly impact the current program design. In October of 2005, the California Energy Commission will adopt the 2005 Title 24 Standards, to which all newly constructed residential and commercial buildings in California must comply.

The CESNHP uses Title 24 as the baseline for calculating energy savings resulting from program activities, therefore the impending changes to Title 24 also impact the CESNHP program theory. Analysis of the differences between 2001 and 2005 Title 24 demonstrate a range of effects. The changes appear to have the greatest impact in the inland climate zones for new single family homes, while most low-rise multifamily projects are affected regardless of location. There are two primary explanations for this, the first is the change to Time Dependant Valuation (TDV) of energy use. Prior to TDV, Title 24 gave equal weight to energy use during all times of the day. With the implementation of TDV, energy use is weighted to reflect the cost of generation and delivery by time of day and location. As a result of TDV weighting, energy conservation measures that work to reduce consumption when TDV multipliers are high (summer on-peak) produce much greater "bang for the buck" than measures that contribute less during peak periods. TDV will have an impact on both single family and multifamily projects. The second notable difference affects only multifamily. Two loopholes associated with hot water heating and fenestration area have been closed in the 2005 low-rise multifamily code. These changes will most likely increase the compliance cost for all low-rise multifamily projects.

It is important to note that while single family and multifamily structures are well defined in Title 24, they are defined differently and less formally in CESNHP. Sometimes entire projects are classified single family or multifamily, when in fact the buildings are of mixed types. As a result, while looking at the results of this study, keep in mind that “single family” findings may have some applicability to “multifamily” projects and vice a versa.

From a cost perspective, the result of having “the bar” raised will greatly impact the cost associated with the program’s 15% compliance margin, which will likely become a significant program barrier. Table 1 shows incremental costs based on the 2004-05 Statewide Residential New Construction Potential Study.

	Single Family		Multifamily	
	Coastal	Inland	Coastal	Inland
Incremental cost from 2001 Base to 2005 Base Title 24	\$0 - 616	\$50 - 1927	\$45 - 549	\$54 - 1179
Incremental cost from 2001 Base to 15% over 2005 Title 24	\$0 - 2421	\$1216 - 4571	\$320-1627	\$370-2112

**Table 1: Incremental costs of Title 24 compliance. Ranges show least compliance cost over all 16 California climate zones.**

## Objectives

In light of these impending changes, the Strategy Assessment Study was designed primarily to provide the IOUs with strategic planning information that will assist them in their program planning activities for 2006 and beyond. The key tasks of the study were to:

- Interview key market actors, including single family builders, multifamily developers, architects, Title 24 consultants, and Title 24 turnkey service providers, to assess:
  - Knowledge of the 2005 Title 24 changes, potential effect on their business, and planned construction practices
  - Energy efficiency measures that may be used to meet and/or exceed the 2005 Title 24
  - HERS inspection usage and possible barriers
  - Overall knowledge, value and importance of the ENERGY STAR Homes (ESH) Program regarding current and future business plans
  - The value of the ENERGY STAR label for new homes
  - Feedback on program design alternatives especially with regard to qualification levels and incentive levels
  - Differences in the RNC (residential new construction) single family versus multifamily markets
- Consider various energy efficiency measures that could be included in a prescriptive or performance based residential new construction program, and for each measure assess:
  - Potential energy savings (gas and electric)
  - Gross incremental measures cost
  - Measure cost effectiveness
- Synthesize the information learned through the Strategy Assessment research activities into key findings that utility program planners can use as a tool when making program design planning decisions.



## Executive Summary

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The upcoming 2005 Title 24 code change will have a major impact on California builders, particularly for multifamily new construction. Although the energy efficiency requirements are being tightened for both single family and multifamily new construction, the biggest impact will be felt in multifamily projects, since there have not been multifamily specific energy efficiency code revisions in over 30 years.

For multifamily new construction, the significant code changes could result in an initial shock while developers work to make projects meet the new code. *Exceeding* the new code, in some cases, may prove to be both difficult and of secondary importance, possibly impacting participation in programs such as the California ENERGY STAR New Homes Program (CESNHP). However, multifamily projects often have critical funding sources or tax credits that require exceeding Title 24 by 15%, which would push builders to find ways to achieve higher efficiency.

For single family new construction, the impact will likely be higher construction costs and a longer plan review process, as more plan revisions may be necessary.

### Interview Findings and the ENERGY STAR Homes Program

Interviews were conducted with Title 24 turnkey providers, Title 24 consultants, single family builders, and multifamily builders, to assess various possible changes to CESNHP. While the sample sizes were small for each group of interviews, they still provide some insight into market awareness and attitudes. Key findings included:

- Builders and developers were generally aware that Title 24 is changing in October 2005, resulting in tightened energy efficiency requirements, and that compliance will probably cost more. However they were not generally aware of the details of the changes or how they will impact their business in terms of specific costs and practices.
- Of the more knowledgeable builders (regarding the Title 24 changes), their concerns focused on increased costs for mandatory lighting, increased installation costs, and time constraints associated with more inspections. Several multifamily interviewees were concerned about higher compliance costs, which could result in cancellation of some projects.
- There was a uniform response that the CESNHP is a valuable program and the name/brand is well recognized, although several interviewees thought the ENERGY STAR label is better associated with appliances than with homes.
- The value of the ENERGY STAR label for product differentiation is dependent on the housing market and type of housing. For certain housing, such as market rate for sale single family new construction, the value of the ENERGY STAR label can be very high – possibly even more important than incentives. However given the current overheated California housing market, the value of this differentiation is significantly diminished.
- Feedback on potential changes to CESNHP were mixed in the areas of qualification levels and incentives between the single family and multifamily interviews. Perhaps the only area of uniform agreement was for a program which is simple, easy and consistent.

- The current qualification method of 15% better than baseline Title 24 was popular, and varying the compliance margins for coastal and inland regions was generally considered fair in both single family and multifamily projects. However, multifamily builders liked a strictly prescriptive approach best for its ease and simplicity, while the single family market liked this approach least, although both were concerned about flexibility and continuity.
- Alternative incentive methods also received mixed reviews. The single family market liked the current system best, while the multifamily developers thought an incentive that increases with energy savings was best and fairest, although it would increase complexity in the budgeting process somewhat.
- Builders typically do not change floor plans between coastal and inland areas, however the building characteristics may vary. For example, insulation levels, window properties and HVAC efficiency may be different, while the overall home size and layout would remain the same.
- Builders/developers consistently wanted to know “what works best...” and “which measures are most cost effective to meet and exceed code?”

## Energy Efficiency Measures

One of the major goals of this study was to see which energy efficiency measures would be the most cost effective and yield the highest energy savings. Feedback from developers and consultants echoed a strong desire for this information. However, it is important to note that with the Title 24 implementation of time dependent valuation (TDV), builders really need to know “the most *cost effective TDV-modeled* energy efficiency measures.”

Once the new Title 24 code takes effect in October 2005, the metrics for evaluating builders will be TDV dependent, while the metrics for evaluating the 2006-08 CESNHP for cost-effectiveness will not be<sup>1</sup>. The “most effective” energy efficiency measures will therefore depend on who is asking the question. We believe it is important to understand both metrics of energy savings, actual and TDV modeled, which will tell builders what they want to know, and will inform the utilities of the differences between their program metrics and Title 24.

This report contains energy savings (non-TDV) and cost effectiveness results for each energy measure, for both single family and multifamily, by RNC<sup>2</sup> climate zones. Many assumptions and estimates go into the models to create these results. For example, cost effectiveness ratings are very dependent on each measure’s incremental cost, which can be difficult to estimate and subject to rapid market changes, so the results should be viewed only as a guide.

A “short list” of energy efficiency measures was created, with input from each utility, for evaluation of energy savings and cost effectiveness. To make the list, consideration

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<sup>1</sup> Current CPUC procedures for determining energy efficiency program cost-effectiveness (total resource cost test) do not take into consideration the timing of energy savings (i.e., demand savings by costing period).

<sup>2</sup> See the RNC climate zone map, Figure 2.

was given to measure cost, potential for builder acceptance, and costs associated with third party testing, yielding a final measures list<sup>3</sup>:

1. **Ducts in Conditioned Space** - has supply and return ducting within the thermal envelope of the residence
2. **Duct Insulation** - duct insulation of R-8
3. **Insulation Installation Credit** - modeling credit available for quality insulation installation (requires HERS inspection)
4. **AFUE92, AFUE90, High Efficiency Furnaces** - high efficiency furnaces with ratings of 90 and 92 AFUE
5. **Instantaneous Water Heater** - Instantaneous gas (tankless) water heater with Energy Factor of 84 and recovery efficiency of 0.85
6. **Radiant Barrier** - radiant barrier installed on the inside of the roof sheathing
7. **EER13, EER14, EER15** - High efficiency air conditioners
8. **SEER14, SEER15, SEER16** - High efficiency air conditioners
9. **Super Low Emissivity Windows** - High performance glazing modeled with an SHGC of 0.25 and a U-Value of 0.30, also called Low-E 140
10. **NightBreeze**<sup>4</sup> - Technology that takes advantage of free nighttime cooling via "smart" ventilation. Similar products include SmartVent and NightVent

**Table 2** provides a summary of the top energy efficiency measures by cost effectiveness and energy savings.

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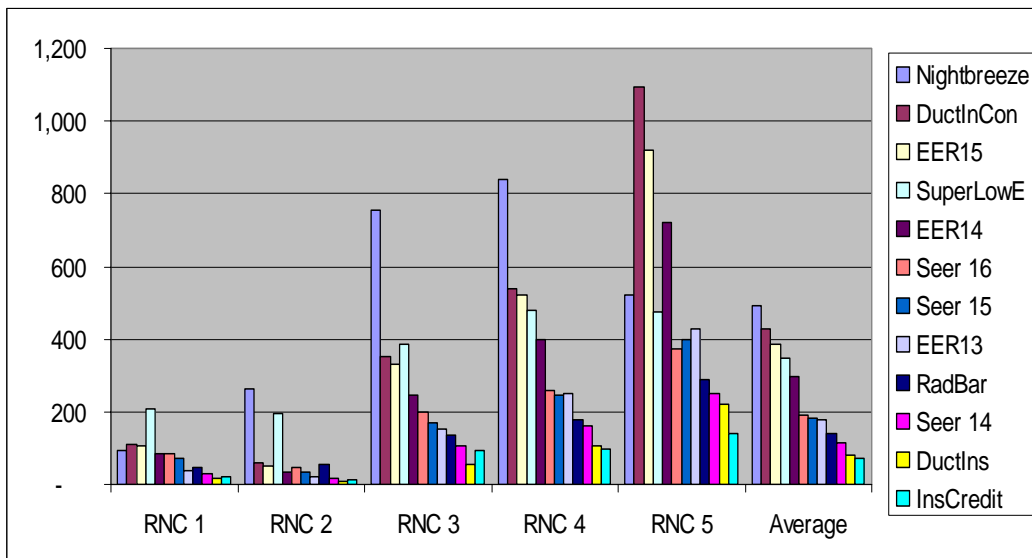
<sup>3</sup> RLW was directed to exclude any measure that would require third-party testing (e.g., duct sealing requires duct blaster test), which eliminated a number of possible measures.

<sup>4</sup> NightBreeze data was provided by Davis Energy Group and is based on a DOE-2.1e calibrated model of an actual NightBreeze installation in a Zero Energy New Home. In support of this analysis Davis Energy Group modified the building characteristics of the calibrated model to represent a home built to the 2005 Title 24 energy code.

		Single Family Measures	Multifamily Measures
<b>Cost<sup>5</sup> effectiveness</b>	1	Ducts in conditioned spaces	Ducts in conditioned spaces
	2	Insulation installation credit	Insulation installation credit
	3	AFUE92 high efficiency furnace	Super low E windows
	4	Instantaneous gas hot water heater	Instantaneous gas hot water
<b>Electric energy savings</b>	1	NightBreeze	Ducts in conditioned spaces
	2	Ducts in conditioned spaces	EER15 high efficiency A/C
	3	EER15 high efficiency A/C	Super low emissivity windows
	4	Super low E windows	EER14 high efficiency A/C
<b>Gas (therms) energy savings</b>	1	Ducts in conditioned spaces	Instantaneous gas hot water
	2	Instantaneous gas hot water heater	Ducts in conditioned spaces
	3	Insulation installation credit	Insulation installation credit
	4	AFUE92 high efficiency furnace	Duct insulation (R-8)

**Table 2: Top measures by cost effectiveness, energy savings, and therms savings averaged over RNC<sup>6</sup> (Residential New Construction) climate zones**

When considering total source energy saved, the largest savings are possible in the cooling dominated climate zones, since these homes use significantly more source energy than homes in milder climates. RNC zones 3, 4 and 5 are the cooling dominated zones, evidenced by the electric energy savings potential shown for these zones in Figure 1.

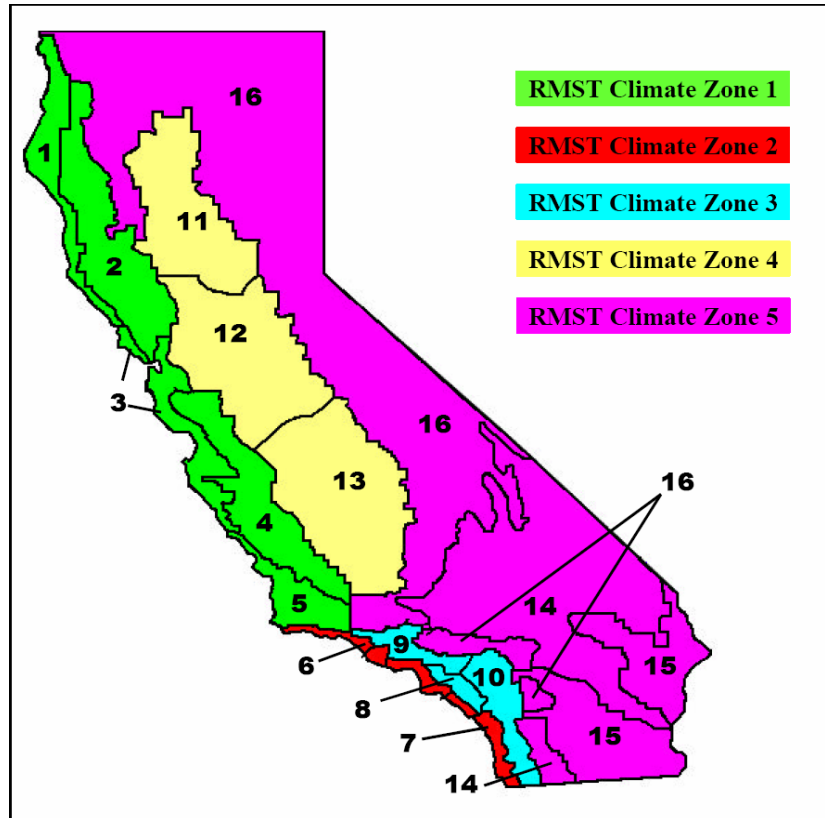


**Figure 1: Single family energy savings (KWh/yr-unit) by measure and RNC climate zones (Greatest energy savings possible in zones with highest energy usage.)**

Energy efficiency measures were evaluated across five climate zones as shown in Figure 2.

<sup>5</sup> Cost effectiveness varies by climate zone, rankings are averaged across climate zones. Cost effectiveness is defined in terms of energy savings per dollar per year (kBTU/yr-\$), where kBTU is source energy. The unit kBTU of source energy is a combined method for comparing natural gas and electrical energy savings measures. To convert kWh saved to kBTU of source energy saved, kWh is multiplied by 3.0, which accounts for the average inefficiency of electrical power generation, transmission, and distribution.

<sup>6</sup> There are five RNC climate zones assignments; see Figure 2.



**Figure 2: RNC (RMST<sup>7</sup>) Climate Zone Assignments to the Sixteen California climate Zones**

Generally there is fairly good agreement between our findings for the most effective energy efficiency measures, and builders' current practice, in both single family and multifamily housing. In further support of builders, higher CESNHP participation, and California energy efficiency, we recommend a more detailed analysis of the top energy efficiency measures, as modeled by the Title 24 approved modeling software, for each of the sixteen California climate zones. Measure bundles could also be considered as measure interaction may exist. This would give builders exactly the information needed for each new project, by climate zone.

The most common theme throughout this study is that one size does not fit all. This applies to specific energy efficiency measures across climate zones, and to market differences in single family vs. multifamily. As a result, separate programs for single family and multifamily markets may be most appropriate. However, the goal of any future program design changes should consider the differences between single family and multifamily, while maintaining a reasonable level of simplicity, consistency, cost effectiveness, and energy savings.

<sup>7</sup> Residential Market Share Tracking

## Single Family Summary of Findings

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This chapter summarizes the findings of three sets of interviews all related to the single family new construction market including:

- **Title 24 Turnkey Service Providers.** KEMA interviewed three of the five major firms that provide a broad range of energy-efficiency related services primarily to larger production builders. In addition to plan review for Title 24 documentation, these services include HERS inspections, assistance to builders seeking ENERGY STAR Homes certification, design and marketing assistance, and proprietary labeling programs.
- **Title 24 Consultants.** KEMA interviewed nine Title 24 Consultants. These firms and individuals offer primarily Title 24 compliance documentation, as well as advice to builders on how best to achieve compliance.
- **Single-Family Builders.** KEMA interviewed 16 single-family production builders who appeared on the list of firms participating in the sponsors' ENERGY STAR Homes programs. Of these, 15 had received rebates from the program in the past year.

### Awareness and Concerns Regarding 2005 Title 24 Changes

- **Builder awareness of impending Title 24 changes is spotty and related to size of the firm.** Among the 16 builders we interviewed, 12 reported being aware of the upcoming changes to Title 24. However, it should be recalled that these are program participants who would likely be attuned to these issues. Turnkey providers reported that virtually all of their clients (production builders) were aware of the changes, whereas the Title 24 consultants who dealt with smaller builders reported that no more than 25 percent of their customers were aware of the changes.
- **Builders who are aware of the upcoming changes understand that they entail lower energy budgets and more prescriptive measures.**
- **Builder concerns focus primarily on higher costs.** Builders report that, among the potential consequences of the changes in Title 24, they are most concerned by increased costs for compliance. They also mentioned being worried about longer lead times for plan review and its effect on schedules. Title 24 consultants and turnkey service providers noted the high costs and low availability of lighting fixtures needed to meet prescriptive lighting requirements.

## Current Building Practices and Compliance Strategies

- **Builders do not currently alter prototype plans to account for differences between climate regions in Title 24 compliance approaches.** However, one Title 24 turnkey service provider reported that such an approach might be cost-effective after implementation of the 2005 Title 24 revisions. Specifically, plan changes would be needed to accommodate location of ducts in conditioned space. According to the measure analysis conducted for this report, location of ducts in conditioned space is highly cost effective and can contribute significant levels of energy savings.
- **Builders use a wide range of measures to achieve compliance with the current Title 24, including some that require HERS inspection for compliance credit.** As Table 3 shows, builders report using a larger number of measures to achieve compliance in Inland v. Coastal Zones.

Measure	Inland Zones	Coastal Zones
Vinyl Frame, double pane, low-e windows (Low E 170)	X	X
Super high efficiency vinyl frame, double pane, low windows (Low E2 140)		
Wall Insulation R 19 or above	X	
Roof Insulation R 38 or above		
Radiant Barrier		
Housewrap (Tyvek)		
ACCA Duct Design	X	
Duct Insulation of R 4.2 or greater	X	X
High Efficiency Furnaces: AFUE 90 or higher	X	
Central A/C: SEER 12 or higher	X	
HE Water Heater: Energy Factor >.575 for 50 gallon tank	X	X
Infiltration Testing and Certification	X	
Thermal Expansion Valves	X	
Tight Duct Certification	X	X
n =	14	6

**Table 3: Measures Used by Builders to Meet Current Title 24 Standards**

- **Builders report that HERS inspection requirements do not constitute a major barrier to inclusion.**

## Predicted Building Practices and Compliance Strategies

In previous studies we have found that Title 24 consultants and turnkey service providers are better than individual builders in characterizing the compliance strategies of the general construction industry and in commenting in an informed way on the likelihood of changes in compliance strategies. This is due to the broad view of energy efficiency issues that they are able to achieve from their vantage point. We therefore sought information from the consultants and turnkey service providers on their opinions regarding likely builder response to the changes in Title 24. Table 4 displays the measures that the majority of sample turnkey providers and consultants believe will be used to meet the revised Title 24 requirements.

Measure	Turnkey Providers		T24 Consultants	
	Inland	Coastal	Inland	Coastal
Vinyl Frame, double pane, low-e windows (Low E 170)	X	X	X	X
Super high efficiency vinyl frame, double pane, low windows (Low E2 140)	X	X	X	
Wall Insulation R 19 or above	X			
Roof Insulation R 38 or above	X	X	X	
Radiant Barrier			X	
ACCA Duct Design				
Duct Insulation of R 4.2 or greater	X		X	X
High Efficiency Furnaces: AFUE 90 or higher			X	X
Central A/C: SEER 14 or higher			X	
HE Water Heater: Energy Factor > .575 for 50 gallon tank	X		X	X
Tight Ducts	X	X		
Thermal Expansion Valve	X			

**Table 4: Measures that Builders will Use to Meet the 2005 Title 24 as Predicted by Title 24 Turnkey Providers and Consultants**

## Effect of Changes in Title 24 on the Importance of Energy Efficiency in Marketing Homes

- **The majority of sampled builders believe that energy efficiency is currently an important factor in marketing their homes.** Seven of the nine large builders (>450 units per year) and 3 of six smaller builders interviewed reported that they felt that energy efficiency was important or very important in marketing their homes.
- **Roughly half the sampled builders believe that the importance of energy efficiency in marketing new homes will increase with the implementation of the Title 24 revisions.**
- **Consultants and turnkey providers had mixed views on the effect of Title 24 changes on the importance of energy efficiency.** Some of the market actors reported that energy efficiency was of relatively little marketing importance given the overheated housing market in California, and that



energy efficiency was basically viewed as a regulatory cost to be passed through to customers rather than a potential vehicle for differentiation. Others thought that builders would attempt to use energy efficiency as a differentiator and product upgrade in order to be able to pass through to buyers the increased costs of compliance.

### **Value of the Current ENERGY STAR Homes Program**

- **The majority of sampled builders believe that the most important value of participating in the current ENERGY STAR Homes program is differentiation in the market place.** Seven of 15 builders interviewed named product differentiation as the most important reason for participating in the program. Seventeen of 28 “Other” mentions also involved product differentiation and marketing advantages. By contrast, only 3 builders mentioned financial incentives as the main reason for participating. These findings are consistent with the results of evaluations of ENERGY STAR Homes programs in other jurisdictions.
- **Turnkey providers and consultants also endorsed the value of ENERGY STAR as a product differentiator.** Many of these market actors made a point of the strong value that has been built up in the ENERGY STAR brand. Several also mentioned that the value is enhanced by its ‘portability’ between jurisdictions and areas for both the customer and builder.

### **Potential Changes to CESNHP and Suggestions for Improvement**

- **Neither builders nor Title 24 professionals were enthusiastic about potential changes in approach to qualifying homes for ENERGY STAR status.** Most builders and Title 24 professionals preferred retention of a performance versus a prescriptive approach. Most felt that different compliance margins for coastal and inland regions was justified and workable.
- **Builders were not enthusiastic about potential changes in incentive payment structures.** Builders were not interested in incentive structures that paid for kBtus saved or ‘front loaded’ payments to the first few homes completed in a subdivision. They preferred a uniform payment per qualifying home. This response was consistent with many comments concerning the reliability of payments as a key criterion for program quality and continued participation.
- **Most suggestions for program improvement involved increased program marketing and consumer education to elevate the value that customers accord to the ENERGY STAR Label and energy efficient homes in general.**

### **The ENERGY STAR New Homes Label**

RLW has learned through secondary research that builders in California are no different from participant builders of similar ENERGY STAR New Homes programs offered in other parts of the country (Oncor, Centerpoint, P.A. Govt. Services 2003). Findings in California, Texas, and Wisconsin indicate that motivation for participation is equally

divided between incentives and the advertising partnerships and market differentiation ENERGY STAR branding delivers. Respondents in this study weighted the ENERGY STAR brand higher than the participation incentives. These findings suggest that the utilities may have the ability to continue offering the ENERGY STAR program with lower incentives, which would improve program cost-effectiveness.

# Multifamily Surveys and Summary of Findings

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## Introduction

This chapter presents the results of interviews with 20 multifamily “developers”. Throughout this section we will refer to the respondents as developers, however the surveys were also conducted with architects, designers, and others. Most, but not all, of the individuals interviewed attended a multifamily training class held at either the Pacific Energy Center or CTAC. The class focus was on the upcoming 2005 Title 24 code changes to multifamily structures.

Responses to this survey were not weighted. However, since not every respondent answered every question, due to inapplicability or other reasons, the sample size (number of legitimate answers) varies for each question, and is indicated. Where verbal answers were recorded, we have included a sample in this report, but always included common responses, and select others we felt were particularly useful.

The interview covered the following topics:

- Current fraction of business related to multifamily development
- Approximate fraction of coastal vs. inland projects
- Multifamily training evaluation (results not included in this report)
- The value of the ENERGY STAR Homes label
- Knowledge and awareness of impending changes in Title 24 and planned construction practices
- Characterization of energy efficiency measures that may be used to meet and/or exceed the new 2005 Title 24 code
- Understand overall desire to exceed Title 24 by 15%, and why
- HERS inspection usage
- Approximate current multifamily projects in design or construction (not included in this report)
- Familiarity with the ESH program and past/current participation
- Feedback on alternative program approaches/designs

## Description of Respondents

Under the revised Scope of Work for this part of the evaluation, the multifamily builder quota was set at 20. Table 34 displays key information about the respondents including:

- Company Name
- Title of individual or role of company
- Whether the interviewee attended the multifamily Title 24 training
- Approximate portion of their firm’s projects which are multifamily
- Approximate percentage of projects that are coastal versus inland
- Number of current projects

In all cases, the firms were “involved in the design, energy consulting and/or construction of multifamily housing” and the individual interviewed “personally makes or influences energy efficiency design decisions in multifamily projects.”

The coastal vs. inland breakdown for multifamily projects is a little more than 50% coastal. (The terms “coastal” and “inland” were used during the survey without definition or reference to climate zones.)

Company Name	Company Role/Title	Attended MF Training	Projects Related to Multifamily	Percent Coastal	Percent Inland	Number Current Projects
A Community of Friends	Developer	Yes	All or almost all	20%	80%	9
Affordable Housing Advocates	Developer	Yes	All or almost all	100%	0%	5
AMCAL	Dir. of Construction	No	All or almost all	0%	100%	11
Central Valley Coalition	Developer	No	All or almost all	50%	50%	7
Irvine Apartment Communities	Developer	No	All or almost all	100%	0%	10
Livable Places, Inc.	Developer	Yes	All or almost all	100%	0%	2
Richard Barron AIA	Architect	Yes	All or almost all	1%	99%	6
Sorcinelli Architects Inc	Architect	Yes	All or almost all	0%	100%	0
The Related Companies of CA	Developer	Yes	All or almost all	75%	25%	9
Cogenesis Design Dev	Designer	Yes	Most	100%	0%	2
KTGY Group	Architect	Yes	Most	DK	DK	DK
Levy Designs	Designer	Yes	Most	100%	0%	12
Van Meter, Williams , Pollack AIA	Architect	No	Most	100%	0%	7
Verdigris, Patina & Rust, Inc	Architect	Yes	Most	100%	0%	1
BCV Architects	Architect	Yes	Little	DK	DK	1
Claremont Energy Design Group	Designer	No	Little	33%	67%	3
Grandview Palms	Developer	No	Little	100%	0%	1
Jerde Partnership	Architect	Yes	Little	20%	80%	6
National Park Service	Designer for NPS	Yes	Little	50%	50%	3
Res-Com Inspections	Planning & Inspection	Yes	Little	100%	0%	1

**Table 5: Respondent Profile (MF=Multifamily DK=don't know)**

### Developer Awareness of Changes in Title 24

To get a sense for developer awareness of the Title 24 multifamily code change (effective October 2005), developers were asked to rate themselves directly. Most of the respondents felt they were somewhat knowledgeable regarding the Title 24 2005 changes. This is not surprising since most of individuals contacted attended the multifamily training. Originally when the survey was designed, the intent was to also contact developers who had not attended the training, to compare their knowledge level, however as mentioned in the introduction, the number of surveys was reduced. Of the six individuals who did not attend the training, two rated themselves as “not at all knowledgeable” and four said “somewhat knowledgeable”.

	Frequency of Response
Not at all knowledgeable	2
Very little knowledge	4
Somewhat knowledgeable	13
Very knowledgeable	1
Sample Size	20

**Table 6: 2005 Title 24 changes knowledge level**

When asked what they were most concerned about regarding the new code responses included,

*“The new code is going to make it tougher and more expensive to build multi-family dwellings. It may result in a lot of projects don’t get developed because the developers are not anticipating the increased costs.”* (Three similar to this)

*“Increased rent for affordable housing tenants and there is the question of whether or not we can continue to develop this type of housing -- we are already at our limit.”* (Two similar to this)

*“That these new requirements actually do save energy and that the design team follows through with the requirements.”*

*“It’s going to radically alter the buildings we currently produce and require them to be more efficient especially lighting. The big one is going to be the envelope efficiency requirements and additional third party inspectors.”*

*“There has not been enough cost element research done to know how much more it will run us to build these types of projects.”*

## Importance of Exceeding Title 24 by 15%

In addition to the ENERGY STAR Homes program requiring exceeding Title 24 energy consumption by 15%, some funding sources and tax credits also have the same requirement. That is, the “15% bar” sometimes has multiple benefits. Since some new program qualification proposals include a lower energy bar (for example 10% better than Title 24 for inland developments) it is important to understand how helpful that may be, so we asked developers directly the importance of exceeding Title 24 by 15%, and why.

Overwhelmingly exceeding code by 15% was of high importance. Of the 13 who said it was very important, 7 specifically stated tax credits and/or funding sources require meeting the 15% bar. Typical comments were:

*“Our funding sources provide us extra money to exceed code by fifteen percent.”*

*“Ninety percent of our projects are financed through TCAC; fifteen percent better than code is required.”*

*“The majority of our financing is tax credit so it’s very important to be energy efficient.”*

*“It is essential to get the tax credit.”*

Others who responded “very important” for other reasons said:

*“We think the new code is a good thing. Some people need codes to force their projects to be energy-efficient -- we are motivated either way.”*

*“We are seeking LEED certification in our buildings.”*

*“It's very important to us because we will be paying to operate the facility.”*

*“For the energy savings and the future of our environment.”*

Only 3 respondents said it was not important at all; with only one offering an explanation:

*“It is too expensive.”*

	Frequency of Response
Very important	13
Sometimes important	4
Not at all important	3
Sample Size	20

**Table 7: Importance for projects to exceed Title 24 by 15% or more**

The real test of these answers came next, when respondents were asked:

*“If there is a considerable increase (\$500-\$1,000 per unit) in the cost to build your projects 15% or more energy efficient than the new code, then how important will it be that your projects exceed code by 15%?”*

The answers were virtually identical. A few illuminating comments included:

*“We support the changes, should have tighter energy efficiency goals, but it will drive up the cost of housing and make it more difficult to build affordable. For us, we'll continue to exceed the code requirements regardless of the cost because of the tax credits.”*

*“If the housing is market rate then no, it's not important; if it's affordable housing then yes, it's going to be somewhat important. You have to look at how the project is subsidized and those requirements. Non-profits compete for federal dollars so they're more likely to make housing more energy efficient.”*

*“If there are long term savings for an additional \$500 it's worth the cost to do it.”*

*“An extra \$1000 per unit is almost nothing. Often our projects are over budget and unfortunately it's the energy efficiency features that get value engineered. If there were more incentives and we could immediately recoup our investment we would install them, but we can't operate on a long term payback.”*

	Frequency of Response
Very important	11
Sometimes important	3
Not at all important	1
Don't know	1
Sample Size	16

**Table 8: Importance to exceed Title 24 by 15% or more if there is an incremental cost of \$500-\$1000 more per unit to do so**

Overwhelmingly there is a common need for developers to meet the 15% bar regardless of the ENERGY STAR Homes program. Not only should this be considered in alternative program designs, but in evaluating program free-ridership.

## **Attitudes Toward Common Energy Efficiency Measures**

Developers were read a list of twenty common energy efficiency design options and asked to rate how likely they would consider using each, on a scale of 1-5. Not every developer was familiar with every measure, nor gave an answer for each. Table 9 shows the results.

### ***Most/Least Likely Measures***

There were six measures that received high average scores ( $>4$ ):

- Vinyl or wood frame, double pane, low-e windows
- Wall Insulation R 19 or greater
- Ducts in conditioned spaces
- High Efficiency Furnaces: AFUE 90 or higher
- Housewrap (Tyvek)
- HE Water Heater: Energy Factor  $> .575$  for 50 gal tank

And two measures that scored low ( $< 2$ ):

- Infiltration testing and certification
- Electric instantaneous hot water heater

Generally most respondents knew what the measures were, however two stuck out as unfamiliar to four or five (out of twenty):

- EER Credit
- Low E2 140 (Super High Efficiency windows)

Item	Measure	Average Score 1=very unlikely 5=very likely	Number Unfamiliar with measure	Sample Size
1	Vinyl or wood frame, double pane, low-e windows	4.8	0	18
2	Wall Insulation R 19 or greater	4.3	0	18
3	Roof Insulation R 38 or above	3.8	0	18
4	Radiant Barrier	3.4	2	15
5	Housewrap (Tyvek)	4.1	1	15
6	Ducts in conditioned spaces	4.3	0	15
7	Duct Insulation greater than R 4.2	3.3	2	10
8	High Efficiency Furnaces: AFUE 90 or higher	4.4	0	14
9	Central Air Conditioning: Greater than SEER 13	3.7	0	16
10	HE Water Heater: Energy Factor > .575 for 50 gal tank	4.3	1	13
11	Common/shared/central hot water and heating system	3.9	0	18
12	DHW controls of any type credits	3.6	2	13
13	EER Credit	3.1	4	10
14	Low E2 140 (Super High Efficiency windows)	3.0	5	11
15	Insulation installation credit	3.3	2	15
16	Infiltration testing and certification	1.9	1	13
17	Thermal expansion valves	3.4	3	13
18	Tight duct certification	3.0	2	15
19	Gas instantaneous hot water heater	2.7	0	18
20	Electric instantaneous hot water heater	1.8	0	17

**Table 9: Likelihood of considering energy efficiency measures**

(Sample size is comprised of numerical answers only. "Don't know" and other non-numerical answers are excluded.)

Developers were asked,

*"Are there any other energy efficiency measures or building design changes you are considering in order to comply...?"*

*"We rely on a good passive solar design, natural ventilation, and landscape for microclimates." (Three similar to this)*

*"Photovoltaic applications, and overhangs where appropriate on southern exposures." (Three similar to this)*

*"Overhangs, tree shading, and some alternate flooring insulation techniques."*

## HERS Inspections

Several of the energy efficiency measures require HERS inspections and/or testing for credit. The survey included three questions specifically regarding HERS inspections to see how often they were used, why, and if developers recently had difficulty in finding an inspector.

*"For multifamily projects completed in 2004, were HERS inspections required on any of*



your projects?”

	Frequency of Response
Yes	7
No	9
Sample Size	16

**Table 10: One or more 2004 projects required HERS inspections**

Developers with at least one project requiring a HERS inspection were asked whether the inspection was conducted to comply with Title 24, or for compliance with the ENERGY STAR Homes Program.

	Frequency of Response
To comply with Title 24	0
To comply with the ESH program	7
Sample Size	7

**Table 11: Reason one or more 2004 projects required HERS inspections**

*“Have you recently had trouble finding a multifamily HERS inspector?”*

	Frequency of Response
Yes	2
No	6
Sample Size	8

**Table 12: Recently had trouble finding a HERS inspector**

In our small sample about half the project required HERS inspections and 100% were done for ENERGY STAR Homes program compliance.

## Combined/shared central hot water

We asked respondents how often they specify combined/shared central hot water and heating systems (usually hydronic), and how willing and able their clients are to specify the same, and why. The average scores are shown in Table 13, but the numerical results are washed out. Instead, the verbal responses were very illuminating as to barriers for these systems. These quotes reflect the common responses.

*“This equipment is very expensive; we are not heating (air) much in this climate. The system would be used more for water heating and it's cheaper in the long run to replace just a water heater than replacing a combined hydronic system.”*

*“We spec central/shared systems in about 20% of our projects. These systems are driven by cost and we often don't want to pay for gas piping to each unit.”*

*“Buildings that are more spread out are difficult for this type of system.”*

*“We feel that these types of systems don't promote conservation (since not individually metered) and we haven't determined a method to split the cost to bill tenants. Our projects are all driven by cost and this is a costly system to install.”*

*“There is a high initial cost for piping it to each unit, no system can compete with the initial cost of electric baseboard.”*

The two most common concerns were system initial cost and inability to meter each dwelling unit. On March 1, 2005 Utility Submeter Applications Inc. and Master Meter announced the introduction of the USA Cal Hot meter, which the companies claim to be the first and only California-approved hot-water meter. This is a new product and we do not have price and performance information, however this product specifically addresses the individual unit metering.

Finally, a couple respondents indicated there can be some cost savings with combined systems when cooking ranges are electric, since there may not be a need to install gas piping to each unit.

Type	How Often (avg. score) 1=Never 2=Sometimes 3=Often	Sample size	How willing (avg. score) 1=Not at all 2=Somewhat 3=Very willing	Sample size
Multifamily affordable housing/special needs	2.2	15	2.1	15
Multifamily market-rate housing for sale	1.7	9	1.9	10
Multifamily market-rate housing for rent	2.0	10	1.8	9

**Table 13: Frequency and willingness to specify combined/shared central hot water and heating systems (usually hydronic)**  
(Sample size only includes numerical answers.)

## Electric (baseboard) Resistance Heating

There was a desire to understand how often and why electric resistance heating is specified, so we asked respondents,

*“For each type of multifamily housing you work with, how often do you specify electric resistance heating (baseboard) systems? How willing are your clients to specify other types of heating systems? For your clients that prefer electric resistance heating systems, can you tell me why you think that is?”*

Generally the responses fell into two categories and were the same across all housing types. There were those that don't like it, don't specify it, and understand the operating costs are very high, and then there are those that do specify it, and use it for various reasons including:

*“First cost driven; if other systems were as cheap they would use them.”*

*“Electric resistant heat is useful to install in small spaces such as bathrooms. We haven't found a more affordable alternative.”*

*“Equipment costs are about the same but the design factor (simplicity) is the most common reason.”*

*“Not our preference, too costly for end user, but used frequently in other states like Nevada.”*

Type	How Often (avg. score) 1=Never 2=Sometimes 3=Often	Sample size	How willing (avg. score) 1=Not at all 2=Somewhat 3=Very willing	Sample size
Multifamily affordable housing/special needs	1.4	14	2.5	14
Multifamily market-rate housing for sale	1.5	10	2.3	10
Multifamily market-rate housing for rent	1.7	10	2.4	10

**Table 14: Frequency of developer specifying electric resistance heating, and willingness of clients to specify other types of heating systems**  
(Sample size only includes numerical answers.)

### ENERGY STAR Homes Program

The core of the survey was to get specific feedback on alternative program design options especially for qualification and incentives. Prior to asking these questions, a few general questions were asked about their ESH program knowledge and their company’s participation in the program.

*“How familiar are you with the CA ENERGY STAR New Homes Program?”*

While 15 out of 20 were “very” or “somewhat familiar” with the ESH program, 5 out of 20 were “not very” or “not at all familiar” with the program. Looking to see if there was a pattern to the groups, we found that of the five who were not very familiar with the ESH program, four were architects and one was a designer. Alternatively, 100% of the developers we spoke with were at least somewhat familiar with the program. While this discovery may not be statistically sound, it may point to a likely trend.

	Frequency of Response
Very familiar	7
Somewhat familiar	8
Not very familiar	3
Not at all familiar	2
Sample Size	20

**Table 15: Familiarity with the California ENERGY STAR Homes Program**

*“Have any of your multifamily projects participated in the CA ENERGY STAR New Homes Program? If so, about how many?”*

Eleven out of 19 respondents had no multifamily projects participate in the ESH program. This included several respondents who were somewhat or very familiar with the program. Of those who indicated that they have had projects in the ESH program,

we asked if any projects had ever dropped out. All respondents answering the question said no.

	Frequency of Response
None	11
1	3
2-3	3
4-6	1
7 or more	1
Sample Size	19

**Table 16: Approximate number of past and current multifamily projects in ESH program**

*“What sort of impact would you say that the ENERGY STAR label has had on the marketability of your projects?”*

While no one indicated any kind of a negative impact, only 10 out of 20 could claim a positive impact, with the other 10 out of 20 being neutral, not applicable, or didn’t know.

	Frequency of Response
Strong negative impact	0
Somewhat negative impact	0
Neutral impact	3
Somewhat positive impact	5
Strong positive impact	5
Not applicable	4
Don't know	3
Sample Size	20

**Table 17: ENERGY STAR label impact on marketability of developer projects**

*“How important do you believe it is that the utilities maintain ENERGY STAR as the branding for their program?”*

	Frequency of Response
Not at all important	1
Somewhat important	0
Neutral	4
Important	4
Very important	11
Sample Size	20

**Table 18: Importance for utilities to maintain ENERGY STAR branding for the program**

When asked why, the responses were mostly consistent hitting on a few key points, including:

*“They should continue to use the name because it’s widely recognized and it would be confusing if they changed it.”*

*“ENERGY STAR brand name is primarily recognized when purchasing appliances, but I think the idea can be applied to housing as well.”*

*“Not sure that it is recognized as a brand name for efficient homes.”*

*“Our clients express deep concern for this (acquiring ENERGY STAR ratings) and we compete with other companies to achieve these ratings, so it’s an advantage for us both.”*

*“Easily recognized and its intent is understood.”*

### **ENERGY STAR Homes Program – Qualification Alternatives**

With the upcoming 2005 Title 24 code change, alternative qualification methods are being considered to participate in the ENERGY STAR Homes program. Respondents were read all the methods, and then asked to rate each, including the current method. Results are in **Table 19**.

There were many spirited comments and opinions on this subject, but the vast majority of respondents wanted something that made it simple and easy to qualify. Fairness, while important, was usually secondary. The simple and easy message was reinforced by the scores, which had the exclusively prescriptive approach scoring highest. Presumably this is the simplest qualification for developers since they know exactly what they have to do to qualify.

We feel it’s appropriate to remind readers here that the sample size for this survey was reduced from 80 to 20, so small differences in results may be due to random error. Having said that, the most popular qualification approaches were D, A, B, C, in that order, but all were rated in a fairly narrow range (3.1 to 3.8 average score) as shown in **Table 19**. Summarizing the attractiveness of the different qualification approaches reveals developers care about three things most.

1. Keep it simple and easy.
2. Lowering the bar below 15% may not help some developers since they need to be 15% better than Title 24 for funding requirements.
3. Fairness is important, but less than simplicity and ease. Also, what is considered fair by some, may be considered unfair by others. (If qualification changes are incorporated, the rationale should be explained so as not to alienate certain developers.)

General comments applying to all options included:

*“All of the approaches sound plausible but keep it simple.”*

*“We are required to do so (exceed code by 15%) for tax purposes; anything that encourages higher density and affordability we are in favor of.”*

*“I don’t think that the results/benefits are coming out of this program. Our state is so diverse there shouldn’t be the same set of standards statewide.”*

Comments regarding option A, current program qualification approach included:

*“The even rating of 15% state-wide is not very fair. It should take into account the climate zones. Not a very desirable option.”*

*“Simple, more understandable, but in terms of climate it's not the most accurate.”*

*“I would rather see a varied approach (or set-up) based on climate.”*

*“There were better options mentioned than this.”*

*“Easiest thing to do.”*

#### Comments regarding option B, different compliance margins for coastal and inland:

*“Slightly better than the current approach.”*

*“It can be technical to model by climate zone as the lines are not always clearly defined.”*

*“More complicated; would prefer other approaches.”*

*“Easiest to use for us because most of our projects are in the inland zones and it's a smaller margin to comply under this method.”*

*“Good idea, but the zones are so vague where to you draw the line? They are not mapped out very closely.”*

*“Don't agree with climate zones approach because we discourage air conditioning. The inland zones use way too much. Builders need to use other strategies and more shading.”*

*“We have never had a problem in either climate zone exceeding code.”*

*“We build mostly in the costal zone so it would be more difficult to achieve 20% better than the 2005 code.”*

*“Location driven is a great, although the best case scenario would be to merge location with the different building types (high-rise and low-rise).”*

#### Comments regarding option C, different compliance margins for one/two story and three story multifamily buildings:

*“Makes good sense.” (Four responses like this)*

*“This approach promotes less energy efficiency by lowering the requirement on low-rise buildings, and could also discourage high-rise projects due to the higher efficiency requirement.”*

*“I like this idea as well but coupled with climate zones would be the best.”*

*“Discourages energy-efficient high-rise buildings.”*

*“Makes sense, it's going to be easier to comply with the shared walls, ceilings & floors.”*

*“We ought to encourage high density housing; they shouldn't give low density a break.”*

*“We build 3-4 story almost exclusively so it would be much more difficult to achieve 15% better than 2005 standards.”*

#### Select comments regarding option D, exclusively prescriptive approach, with different lists of prescriptive measures for coastal and inland climate zones:

*“Easiest of the approaches mentioned.” (Four responses like this)*

*“What would the measures be? Would they be flexible?”*

*“This is a good approach as long as it's simple and flexible.”*

*“Don't like this idea, the prescriptive approach doesn't recognize passive solar design innovations.”*

*“Easier to present to people who fund projects to simply show them a list of measures or options.”*

*“Don't know enough information on how this would work.”*

	<b>Qualification Approach</b>	<b>Average Score 1=not attractive at all 5=very attractive</b>	<b>Sample Size</b>
A	<u>As program is now</u> : Use Title 24 software performance calculations to determine compliance margin. Compliance margin would be a consistent value, such as 15% better than code.	3.6	19
B	Use performance calculations, only <u>with different compliance margins for coastal and inland zones</u> . For example, the compliance margin for inland zones would be 10 percent more efficient than Title 24; for coastal zones, 20 percent more efficient.	3.4	18
C	Use performance calculations only <u>with different compliance margins for one/two story and three story multifamily buildings</u> . For example, the compliance margin for 1-2 story buildings would be 10 percent more efficient than Title 24; for 3 story buildings, 15 percent more efficient.	3.1	18
D	Use an <u>exclusively prescriptive approach</u> , with different lists of prescriptive measures for coastal and inland climate zones.	3.8	16

**Table 19: Developer ratings of alternate qualification approaches**

### ***ENERGY STAR Homes Program – Incentive Alternatives***

Several alternative methods were suggested for providing incentives.

“According to recent analyses of baseline new construction, the costs required to upgrade from current practices to efficiency levels that exceed the 2005 title 24 by 10% range from a few hundred dollars in some coastal climate zones to about \$1000 in some inland zones, per dwelling unit. How interested would you be in participating in the program if the incentive were set as a percentage of the estimated cost of meeting the program requirements, rather than as a fixed sum?”

	Frequency of Response
1=Not at all interested	0
2	0
3	2
4	5
5=Very interested	12
Average score	<b>4.5</b>
Sample Size	19

**Table 20: Developer interest in incentives as a percentage of incremental cost**

*“Roughly speaking, what percent of the incremental cost would you need the incentive to cover before you would become interested in participating in the program?”*

Note that many didn’t answer, didn’t know, or don’t develop that type of housing. All the average incentives were between half and two-thirds of the incremental cost.

Housing Type	Minimum Response	Maximum Response	Average Response	Sample Size
Affordable	25%	100%	55%	10
Market rate for sale	15%	100%	55%	7
Market rate for rent	25%	100%	66%	7
Special needs	40%	100%	57%	6

**Table 21: Percentage of incremental cost as incentive for developer interest**

Next interviewees were asked to rate other incentive approaches as outlined in **Table 22**. By far the most popular incentive option was C, providing a fixed incentive per kBtu, with the only negative comments concerning difficulty in budgeting the incentive dollars. Respondents liked that it encourages higher energy efficiency, and provides incentives accordingly, so it is also fairest.

The least popular plan was B, covering full incremental costs, but only for the first project. The main objection here was that no two projects are the same, so presumably developers would have no way to know what would be considered “new” versus “similar,” and therefore they wouldn’t know what would be eligible for incentives.

The current approach (A), fixed incentives per dwelling unit, scored in the middle, with its primary attraction being simplicity and predictability.

Select comments to approach A, fixed incentive per dwelling unit (current method):

*“Simplest Approach.”* (Ten similar to this)

*“We don’t care about incentive programs that require less than 15% better than baseline as this is our requirement.”*

Select comments to approach B, incentive covering full incremental cost, but only on first project:

*“Too complicated -- who designs their project this way? Our designs are never the same from one building to the next.”* (Four similar to this)

*“Full incremental cost is great but we wouldn’t participate on subsequent projects unless the full costs were covered.”*



Select comments to approach C, fixed incentive per kBtu of energy savings:

*“I like this approach the best because it encourages more efficient building design and rewards those who pursue it.” (Ten similar to this)*

*“This is the best approach but complicated to measure what the actual incentive would be when budgeting.”*

*“It’s too complicated and difficult to make assumptions on the incentive when developing the budget at the early stages of design.”*

	Incentive Approach	Average Score 1=not attractive at all, 5=very attractive	Sample Size
A	Fixed incentive paid out per dwelling unit for all projects meeting program requirements. <u>Current approach.</u>	3.7	17
B	Larger incentive covering full incremental cost for project meeting program requirements. There would be no further financial incentives for other projects (or perhaps small incentives for comparable subsequent projects) that utilize similar designs. Under this design there would be a maximum allowable incentive payable to each unique participant.	2.8	16
C	Fixed Incentive per kBtu of energy savings (found on the C2R form). This approach would better track incentive dollars with the estimated energy savings. Minimum compliance margin would be required to participate (such as 10%); incentive dollars would not have a cap since incentives are driven by overall project efficiency relative to code. This approach encourages participation at lower levels of efficiency (10%), but with lesser incentives than those who wish to participate at high levels of efficiency. This addresses the market differences between those who NEED to be 15% better than T24 for tax credit reasons, and those who do not but still wish to be ENERGY STAR. <i>Perhaps there could be thresholds of ES, for example Silver (10%), Gold (15%) and Platinum (20%). This is similar to LEED accreditation.</i>	4.3	19

**Table 22: Developer ratings of alternate incentive approaches**

### Other Developer Recommendations

Wrapping up the survey, interviewees were asked two open-ended questions to improve the ESH program.

*“If you were designing the next ENERGY STAR Homes program, what services would you offer to improve the energy efficiency of multifamily new home construction.”*

*“We want it to be simpler and to know what are the most energy efficient features that will help us exceed code at the least cost. Provide us with a package deal and more guidance on designing these developments.” (Two similar to this)*

*“These smaller incentive programs of (\$150/unit) don’t show up in our radar. They’re insignificant to the amount of funding we get from other sources. (LADWP offered \$400-500K for PV). However, we could use assistance with early on development design assistance and modeling strategies.” (Two similar to this)*

*“The fundamentals of passive solar design and elements are under rated, orientations and landscaping should be part of the incentives.”*

*“The things they're offering now are good but we would like to see more emphasis on design and training to exceed Title-24 with cost benefit analysis on the various options. Post-occupancy support would be helpful by which they would review the operating expense and determine methods to optimize building energy efficiency. Commercial aspects of the building systems such as exhaust/supply fans or pumps ought to have additional incentives for they are independent of the fixed incentive paid out per unit (when using VFDs or similar measures). Similar to the way Savings by Design would provide incentives for these systems. Lastly, the program should lobby for an adjusted rate scale for multi-family dwellings.”*

*The services are a lot better and easier than they were a year or two ago. The gas company helped us by working with our mechanical engineer to achieve the program guidelines, filling out the forms, and finding HERS raters. We find that it's no longer a cumbersome process to participate.”*

*“They should provide incentives to the design team as they do with the Savings by Design program.”*

*“More educational seminars and we'd like for them to elaborate on the cost element for achieving Title-24.”*

*“Make energy conservation a public good. Provide energy efficient developments with incentives or trade-offs towards city and state building requirements. Use title-24 as a measuring device that rewards builders and their projects.”*

*“The utilities need to get developers involved because they're paying for these projects.”  
(Two similar to this)*

*“The bottom line for us is our projects are budget driven; we'll use the energy efficient measures if and when we can afford them in the projects.” (Two similar to this)*

*“You already have a good program now I don't believe it needs significant improvement. I think the main problem is there is not enough awareness.”*

**“Finally, do you have any other suggestions or recommendations for the California ENERGY STAR New Homes program, especially in light of the impending changes to Title 24?”**

*“Make energy conservation a public good. Provide energy efficient developments with incentives or trade-offs towards city and state building requirements. Use Title 24 as a measuring device that rewards builders and their projects.”*

*“Target these programs towards affordable housing (tax credits) vs. market rate.”*

*“Help the local window vendors and small businesses that supply materials to developers. Provide design assistance to estimate the common area expected load for PV applications.”*

*“No, well thought out program, easy to follow and I agree with the necessity for HERS requirements.”*

*“It's going to be too expensive to build; developers are going to have a major shock once the code is in effect. They think in cost per square ft and their not budgeting enough and then projects don't get built. I think we'll see severe cut-backs.”*

*“They should have incentives for solar electric because the cost of materials is going up as a result of import exchange rates.”*

*“Don't make it more difficult to meet ENERGY STAR requirements.”*

*“More involvement at the early design phase.”*

*“Like to see how it plays out in October... should be a learning experience.”*

# Single Family Title 24 Turnkey Service Providers & Title 24 Consultants

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## Introduction

Virtually all single-family homebuilders in California contract out Title 24 compliance functions, in particular the modeling of construction, plans to ensure that they meet minimum permitting requirements. Firms that provide Title 24 compliance support and related services occupy a key position in regard to energy efficiency in the single-family market. Builders often call on them for advice on compliance strategies in advance of plan review. As we will discuss in the next section, builders have little direct knowledge or understanding of the content of Title 24 and its implications for construction practice. Their uncertainty in this regard has increased with the impending implementation of the 2005 revisions of Title 24. Under current market conditions, builders find themselves relying heavily on the advice and services of Title 24 service providers to ensure compliance with statewide codes. These firms thus have an excellent view of current Title 24 compliance practices. They are also best qualified, among the various sets of actors in the single family market, to predict which measures builders will adopt to meet the revised Title 24 because, in many cases, Title 24 service providers will make those decisions.

## Types of Firms Interviewed

Two basic types of firms provide Title 24 compliance services.

- **Title 24 Consultants.** There are dozens of small firms that convert information from construction plans into inputs for standard compliance software packages such as Micropas and provide documentation of compliance. These firms may also advise builders regarding steps they can take if their plans fail to meet standards. The RLW team interviewed nine such firms. Most were small firms that provided services to 2 – 35 builders, with annual volume of 8 – 300 units.<sup>8</sup>
- **Title 24 Turnkey Service Providers.** There are five firms that provide a broader range of services to builders, with particular emphasis on large production builders. Additional services typically provide HERS inspections, assistance to builders seeking ENERGY STAR Homes certification, design and marketing assistance, and proprietary labeling programs. The RLW team attempted to interview representatives of all these firms and completed interviews with three of them. The largest of these firms worked with 80 production builders accounting for an annual volume of 24,000 units. The other two accounted for annual volumes of 3,000 and 500 units respectively.

## Issues Addressed

The guides elicited information on the following issues and aspects of the respondents' operations.

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<sup>8</sup> The exceptions were Title 24 Data Corporation and SMUD's Advantage Homes program.

- Observations of current builder practices in regard to Title 24 compliance, including adoption of specific measures and differences in prototypes and other design approaches used in respect to climate zones.
- Builder awareness and concern regarding Title 24 revisions.
- Measures likely to be used to meet revised Title 24 standards.
- Effect of Title 24 changes on the strategic importance to builders' businesses of energy efficiency and utility programs.
- Value of ENERGY STAR label for new homes.
- Impacts of Title 24 changes on respondents' businesses, and planned changes in services, technical methods, and business approaches.

The business approaches followed by Title 24 turnkey service providers and consultants differ significantly. The turnkey service providers view themselves quite explicitly as market influencers. Each offers extensive design services and promotes proprietary labels that are supposed to represent an element of quality and efficiency beyond that signified by ENERGY STAR Homes. The executives of these firms have been deeply involved in the policy and technical aspects of developing the 2005 revisions. Title 24 consultants generally take on the more limited role of a technical service provider for hire. We thus present the results of the interviews with the two groups separately.

## **Title 24 Turnkey Service Providers**

### ***Description of Respondents***

The RLW team interviewed executives of three Title 24 turnkey service providers that provide consulting services to a large fraction of the builders and projects that represent the residential new construction market: Consol, California Living and Energy, and Energy Inspectors. Mike Hodgson, President, represented Consol, Larry Stubbert, Vice President of Marketing and Sales, represented CA Energy and Living, and John Gillett represented Energy Inspectors. Each of these companies provides turnkey services to builders that participate in the ENERGY STAR New Homes Program. Services provided by these companies encompass Title 24 documentation, HERS inspection, assistance to ENERGY STAR Program applicants, design assistance, marketing assistance, proprietary certification program, Zero Energy Homes, and design and civil engineering.<sup>9</sup>

### ***Current Builder Practices: Differences in Prototype Designs by Climate Zone***

According to all three respondents, builders generally do not account for demands of different climate zones through changes in prototypes (e.g., basic floor plans). Rather, it is done through differing amounts and types of insulation, windows, and HVAC equipment. Consol did mention that this might change with the implementation of the 2005 standards. An example of such a change would be leaving sufficient room for duct chases in conditioned spaces and sufficient room for insulated pipe chases.

### ***Builder Awareness and Concern Regarding Title 24 Revisions***

According to Consol, virtually all builders they work with are aware of the impending changes in Title 24. By comparison CA Energy and Living reported that 50 percent of its

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<sup>9</sup> Please see Attachment A for a detailed breakdown of services by company.

clients were aware of impending changes. The corresponding figure offered by Energy Inspectors was 25 percent. The Title 24 consultants interviewed reported that virtually none of their customers were aware of the impending changes in standards. This result likely reflects the nature of the clientele for these firms. Consol deals almost exclusively with large production builders who can afford to maintain design staff who, as part of their positions, stay current with regulatory requirements.

According to Mike Hodgson of Consol, many of their clients have already incorporated some strategies needed for compliance with higher standards into current practice, especially in regard to insulation and windows. However, in Hodgson's view, builders do not realize the implications of the new indoor lighting standards and the difficulties they will face in meeting them. Specifically, compliant equipment is not available in sufficient volume and at sufficiently low costs for use in production homes. He gave an example of compliant kitchen fixtures that can cost \$130 each, versus a typical fixture budget of \$450 for the whole room. Hodgson believes that other elements of the 2005 changes have been rolled out in fairly orderly fashion with sufficient attention to market conditions. In the case of lighting, issues of availability and cost appear to have received much less attention.

While agreeing with the problems associated with the new lighting standards mentioned above, John Gillett from Energy Inspectors did not agree that builders did not realize the cost implications and compliance difficulties surrounding them. Energy Inspectors reported that the builders' greatest concern with the revised standards is the stricter lighting requirements. Gillett also felt that the greatest impact of the Title 24 changes on builders was going to be the increased expenses associated with reaching the new standards.

CA Energy and Living declined to answer this set of questions.

### ***Effects of Title 24 Changes on Building Practices<sup>10</sup>***

#### **Respondents' views on measures to be used for compliance under 2005 standards**

Table 23 and Table 24 display the results of questions regarding respondents' views on which measures will be used to achieve and surpass compliance with 2005 standards, as well as comments regarding reasons for inclusion and non-inclusion. Interviewers read respondents the full list of measures shown in each of the tables. The second and third columns show which of the respondents identified the measure named in that row as one likely to be used to meet and/or exceed the 2005 Title 24 standards. The right hand column displays important comments we received about each measure. For coastal areas, there was relatively little consistency among the respondents regarding measures that builders would likely adopt. All three mentioned high efficiency windows as a measure used to meet standards, and increased roof insulation as a measure to exceed standards. Otherwise, only duct sealing was mentioned by more than one of the respondents. For inland climate zones, the respondents mentioned more measures overall. High efficiency windows, increased roof insulation, thermal expansion valves on air conditioners, tight ducts, and high-efficiency hot water heaters received multiple

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<sup>10</sup> Only CA Energy and Living answered questions on Multi-family measures. They believe the top candidates for compliance measures in low-rise multi-family will be windows, insulation, duct testing and TXVs.

mentions as means to achieve Title 24 compliance; only increased duct insulation received multiple mentions as a means to exceed compliance standard.

Measure	To Meet Title 24	To Exceed Title 24	Comments
HE Windows	C, I, E	I	C: Go to all vinyl windows; already using low-e glass.
Increased Wall Insulation	I	I	
Increased Roof Insulation	I	C, I, E	C: Would have to change designs to accommodate increased spacing requirements.
Radiant Barrier			I: Not indicated as a generally used measure because builders are unfamiliar with product.
TXV		E	E: Somewhat problematic because it requires 3 <sup>rd</sup> party inspection
Tight Ducts	C, E	I	C: Appears to be very cost effective even with requirement for 3 <sup>rd</sup> party inspection. 1/3 of homes they see already have tight ducts. I: Very cost effective solution E: Tight ducts 'coming on very strong in past 6 months. Only trade that builders are allowing on site.
Infiltration Testing		I	I: Very cost effective solution
HE air conditioner (SEER 12 and 14)			
High SEER/EER Credit		E	
HE Furnace			E: Too high in cost to be attractive.
HE Water Heater	I		I: Very cost effective solution
ACCA Duct Design			I: Not indicated as a generally used measure because builders don't trust the design.
Increased Duct Insulation: (From R4 to R8)		C	C: Highly cost effective but supply not available; may need to make more room in chases.

KEY: C = Consol; E = CA Energy & Living; I = Energy Inspectors  
**Table 23: Measures Used to Meet or Exceed Title 24 Standards - Coastal**

Measure	To Meet Title 24	To Exceed Title 24	Comments
HE Windows	I, E	C	C: Increased spectral selection glass
Increased Wall Insulation	C, I	I	C: Some builders will resist due objections to stucco-on-foam approach. Water infiltration may lead to severe quality problems, lawsuits.
Increased Roof Insulation	C, I, E	I	C: May go for insulation credits
Radiant Barrier	C	E	
TXV	C, I, E	I	I: Very cost effective solution
Tight Ducts	C, E	I	C: Many already doing it
Infiltration Testing	I	I	I: Very cost effective solution
HE air conditioner (12 and 14)	I	I	I: Very expensive solution
High SEER/EER Credit	C	E	C: will depend on the availability and cost of high EER equipment.
HE Furnace		I	
HE Water Heater	C, I		C: Will depend on equipment standards adopted. I: Very expensive solution
ACCA Duct Design		E	
Increased Duct Insulation	I	C, I	

KEY: C = Consol; E = CA Energy & Living; I = Energy Inspectors

**Table 24: Measures Used to Meet or Exceed Title 24 Standards - Inland**

### Cost of Compliance

According to Consol, the California Building Industry Association commissioned a study of the costs of compliance with the 2005 version of Title 24. The results are provided by climate zone for all 16 zones and for performance v. prescriptive approaches.

The average incremental cost for going from 2001 to 2005 compliance in single family homes, statewide, was \$1,239 for the mandatory measures plus \$464 for the required lighting standards for a total of ~\$1,700. The least expensive compliance path yielded an average cost per unit of \$997; the most expensive was \$2,400. Consol feels that the cost estimates were accurate except for lighting, which they considered to be too low.



### Other Potential Compliance Measures

We questioned the respondents about the likelihood that builders would use a specific set of less common measures. Table 25 shows their response to this series of questions.

Measure	Likely to Use	Comments
1. Reduced window area (West facing)	I – low potential C, E – no potential	C: Market will not accept reduced glazing area E: They have tried in value engineering sessions to convince builders and architects to reduce glazing. Always rejected.
2. High SEER/EER AC Credit	C, I, E –some potential	C: Uncertainty around equipment availability and EER ratings for high SEER equipment
3. Super high efficiency AC (SEER 15-16)	C- potential E, I – very low potential	C: Uncertainty around baseline definition I: Raising the SEER on AC is one of the most expensive upgrades a builder can do. The new air conditioning standards going into effect next year will already require builders to move up to 13 SEER, anything more efficient then this will likely only be available with very niche builders.
4. Super high efficiency furnace (AFUE 92)	C, I, E– very low potential	C: Low value for heating savings I: Same as above
5. Solar Hot Water	E: no potential	E: Technology just doesn't appear to work
6. Tankless hot water	C, E– hi potential I – potential	C: Builders are currently selling on comfort basis. Held back by high cost (\$800 - \$1100/unit v. \$270 installed for tank) E: Already seeing a fair amount of this measure
7. Architecturally integrated Shading	C, I, E: no or low potential	E: Often a problem due to zoning, exterior appearance, but Title 24 jockeys could push more
8. Evaporative cooling (direct )	C, I, E – no potential	E: Perceived problems with technology
9. Extra low solar gain low E Windows	E, I – potential	Already used in many cases
10. Shade Screens	C, I, E – low potential	E: Customers don't like them
11. Other: Buried ducts	C, E – potential	C: Could be cost effective. Problem of moving insulation in the attic after installation. E: Being pushed heavily by MASCO

KEY: C = Consol; E = CA Energy & Living; I = Energy Inspectors

**Table 25: Respondent Assessment of Potential Builder Adoption of Other Measures**

**Measures not currently included in compliance calculations**

The survey also asked respondents about the likeness of builders to adopt various energy efficiency measures that are **not** mentioned in the 2005 Title 24 standards that could be used to reduce energy and peak demand. In general, all three respondents felt that these measures were not mainstream enough and wouldn't work under current market conditions. Results are summarized in Table 26 below.

Measure	Likely to use	Comments
1. Indirect-direct Evaporative Cooling		I: Not mainstream enough
2. Whole house fans		C: works against energy efficiency in current compliance calculation programs I: Not mainstream enough
3. Ventilation integrated economizer systems		I: Not mainstream enough
4. Attic venting systems	C	C: Some potential in dry climates to reduce attic temperatures
5. Photovoltaic (PV)		I: Not mainstream enough
6. ENERGY STAR Appliances		No credit, not in compliance calculations

KEY: C = Consol; E = CA Energy & Living; I = Energy Inspectors

**Table 26: Respondent Assessment of Measures not Included in Compliance Calculations**

**Effect of Title 24 Changes on Strategic Importance of Energy Efficiency and Utility Programs**

We asked respondents to assess the importance of energy efficiency and the ENERGY STAR label in marketing new homes under the new standards. We also asked what impact utility programs were likely to have on encouraging builders to increase the energy efficiency of new homes beyond the elevated standards coming into effect. Responses from all three interviewees are summarized below.

**Consol:** In Consol's view, the most important changes occurring in the market and regulatory environment for energy-efficient new construction involve proposed changes in national home energy rating standards currently under consideration by RESNET and the US Department of Energy. These changes would bring the standards used in the rating industry into greater conformance with the International Energy Conservation Code (IECC) and would address end-uses other than space conditioning and water heating. One potential consequence of the proposed changes is that the reference home will be changed. Thus, homes that now meet minimum ENERGY STAR requirements would earn a score of 80 under the proposed revisions, versus the current qualifying score of 86. Mike Hodgson felt this would be confusing for the home buyer and the builder, and could potentially lead to legal liabilities for builders who have sold ENERGY STAR homes that conform to the current standard.

Hodgson believes that the ENERGY STAR brand does have value in the market. The brand's value is enhanced by the fact that it is not associated with a particular utility or builder, and is therefore "portable" from the customer's standpoint. That is, it can be applied no matter where the consumer is looking for a home. Also, the builder can rely on the value of the brand no matter where they are building. Hodges further added that utilities should be concerned to protect the value and meaning of that brand. Introduction of a new brand or certification level would be confusing and counterproductive.

**Energy Inspectors:** In Energy Inspectors view, energy efficiency is not very important in marketing new homes under the current Title 24 standards and market conditions. Gillett also felt that the importance of energy efficiency in marketing new homes would stay the same when the new Title 24 standards take effect. According to Gillett, builders view any government-imposed standards to be more of a regulatory burden than a benefit to the homeowner. Furthermore, builders feel they are in the business of understanding what is important to the homeowner and do not need the government's advice on what that might be.

Unlike Hodgson, Gillett believes that the ENERGY STAR brand does not play an important role in marketing new homes to customers, and feels that this trend will continue once the new Title 24 standards take effect. According to him, until the public is educated about the benefits of owning an ENERGY STAR home there will be little increase in demand for those homes. He went on to further state that builder's currently view it as a way to subsidize upgrades if it makes sense from a cost standpoint.

Gillett did believe that utility programs encouraging builders to increase the energy efficiency of new homes were very important to current market conditions. According to him, most builders in California would not even consider the ENERGY STAR program if it were not for the rebate. They simply do not have any competitive pressure to push ENERGY STAR because homeowners are not asking them about it, and they are operating in a climate in which every home they build is being sold at a rapid pace. Gillett also believes that the importance of utility programs is going to increase when the new Title 24 standards take effect because builders will be looking to offset some of their increased costs.

Of major concern for Energy Inspectors was the thought of utilizing a sliding scale structure for incentives. According to Gillett, builders are very concerned about the reliability of the utility rebate program, and any program that adds level upon level of confusion will only push the builders away from the program altogether.

**CA Energy & Living:** Stubbert believes that the changes in Title 24 will result in stronger demand for turnkey services as compliance with code and utility program requirements becomes more difficult. He also reports that the value that customers attribute to ENERGY STAR and proprietary labels has grown substantially in the past 12 – 18 months after very little change or traction in the prior two years. Many of his clients are saying that they need ENERGY STAR certification to compete effectively. He cites as the main indicator of utility impact the rapid adoption of tight duct installation and acceptance by builders of the costs and inconvenience of 3<sup>rd</sup> party inspection and more subcontractors on the job.

## **Response to Potential Changes in Program**

### *Compliance Methods and Thresholds*

We asked respondents to comment on the potential restructuring of compliance criteria from performance based to prescriptive “adders”. We also asked them to comment on the likely effects of using different performance thresholds for coastal and inland regions. The following paragraphs summarize the responses to this line of questioning.

**Consol:** Consol reports that builders and Title 24 consultants have become used to performance-based compliance methods, and that these should be continued in favor of more prescriptive approaches. This might include extension of more performance-oriented methods to lighting compliance, even though this is not within the purview of the program itself. Also, given the advent of TDV, incentives might be more clearly linked to reductions in cooling energy. This is especially true in Inland Climate Zones.

Hodgson’s main concern in regard to program design and administration is to ensure that incentives are available over the course of the entire year. He realizes that this is difficult given limited budgets and levels of demand. Some practical suggestions in this regard were to eliminate higher incentives for 20% compliance margins. Use one compliance margin and provide incentives to a greater number of builders and units.

**Energy Inspectors:** Declined to answer this series of questions.

**CA Energy & Living:** Stubbert believes that different program compliance thresholds for Coastal and Inland Zones would be appropriate; 15% for coastal and 10 % for inland. For 2001 code, it is not too expensive to beat coastal by 20% and inland by 15%. His staff has not completed technical/costs analyses, but his guess is that a 15% compliance threshold would not be practicable in inland zones. However, to exceed the new requirements, he believes that builders will require incentives and the marketing advantages conferred by using the ENERGY STAR brand.

Stubbert did not feel that requirements for HERS or similar inspections for various measures constituted a serious barrier to their acceptance. Pending changes in Title 24 will not affect this situation.

In terms of general program design, Stubbert reports that it is relatively easy to sell builders on participation in the CESNHP. The problems he has seen with the program have arisen not in design but in execution, and more with the performance of individuals than with procedures in general. Specifically, he reports that some utility program staff are not ‘user friendly’. This comes out mostly in terms of ‘adversarial’ plan review and delays in turning around plan reviews. Production building schedules are such that builders cannot wait 4 – 6 weeks for plan review, but would like to have disposition in advance of building.

### **Changes in Business Operations in Response to 2005 Title 24 Changes<sup>11</sup>**

Neither Consol nor Energy Inspectors anticipate that changes in Title 24 will have significant impacts on the nature of the firm's business because the revisions do not alter the overall structure of regulation and compliance. However, Energy Inspectors did believe they would see an increase in inspection and testing revenue due to the impending Title 24 changes.

CA Energy and Living declined to answer this question.

### **Planned changes in service, technical methods, and business approaches**

None of the three respondents identified planned changes in the roster of services offered in response to changes in Title 24. Consol did state the most significant technical change will have to do with the implementation of the Time Dependent Valuation system. According to Consol, this will place much more emphasis on measures designed to reduce cooling loads, and add urgency to resolve technical issues around baseline EERs. CA Energy and Living just received the new compliance software at the time of the interview and was in the process of reviewing it. They felt it was too early to say how changes will affect business and technical operations.

## **Title 24 Consultants**

### **Description of Respondents**

KEMA completed interviews with nine Title 24 consultants. Table 27 displays the names of the firms interviewed, the number of builders they serve and the number of single family units analyzed in 2004.

<b>Company Name</b>	<b>Number of Builders</b>	<b>Single Family Units</b>
ENERCALC	35	100-200
Sustainable Design	10	10
Title 24 Data Corporation	2000	8000-9500
SMUD: SMUD Advantage Homes	N/A	7000 SMUD
Pacific Energy	15	30
Sustainable Earth Enterprises	2	8
DAREnergy Consulting	25	40
SolData Energy Consulting	N/A	300
Energy Management Services	N/A	10

**Table 27: Title 24 Consultants Interviewed**

Of the nine interviewed consultants seven offer 'Title 24 Compliance Documentation', five offer 'HERS Home Inspections' and 'Housing design assistance', and three offer 'Assistance to ENERGY STAR Program applicants'.

<sup>11</sup> Given the respondents' busy schedules and the priority of gathering information concerning the perceived builder response to changes in Title 24, we asked these questions last. In some cases, respondents declined to answer the questions or had to terminate the interview.

All nine respondents were at least somewhat familiar with the mandatory features and compliance methods for low-rise residential buildings that are included in the Title 24 2005 revisions. Three reported being 'very familiar' and six reported being 'somewhat familiar'.

Five out of nine respondents provide Title 24 consulting services to both inland and coastal regions, three provide services strictly for inland regions, and one provides services only for coastal regions.

### ***Perceptions of Builder Awareness and Practices***

The sample Title 24 consultants generally reported that the builders they work with are **unaware** of the impending changes in Title 24 standards. Three stated that none of the builders they work with are aware of the changes, and the remainder estimated that between ten and twenty-five percent appear to be aware of the changes<sup>12</sup>. Among those builders aware of the changes, most are generally concerned with the increased installation costs and time constraints associated with more inspections due to the overall stricter mandates. One respondent did state that most of the builders he works with are fairly stoic about the changes, know the code cycles, understand the reason for them, and know that they apply to their competitors as well.

### ***Current Compliance Approaches***

#### ***Measures with Required HERS Inspection***

KEMA was directed to ask a series of questions concerning the respondents' likelihood to recommend four specific measures for which HERS inspections are required. The four measures were: infiltration testing and certification, thermal expansion valves, tight duct certification and insulation installation quality certification. Once again, measures recommended by Title 24 consultants to builders varied based on inland and coastal zone projects.

#### ***Coastal Climate Zones***

The majority of Title 24 consultants did not recommend any of the measures with HERS requirements measures to coastal builders. Three did list 'thermal expansion valves' as a measure they recommend for some projects. Three builders also mentioned that they recommended duct sealing certification in some or all projects. See Table 28.

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<sup>12</sup> Responses: Consultant #1 – zero percent, Consultant #2 – ten percent, Consultant #3 – eight percent, Consultant #4 – fifteen percent, Consultant #5 – twenty-five percent, Consultant #6 – zero percent, Consultant #7 – zero percent, Consultant #8 – fifteen percent, Consultant #9 – didn't know.

Measure	Frequency of Recommendation				
	All Projects	Most Projects	Some Projects	No Projects	Don't Know
Infiltration Testing and Certification			1	4	1
Thermal Expansion Valves			3	2	1
Tight Duct Certification	1	1	1	3	
Insulation Installation Quality Certification	1			4	1

**Table 28: Current Compliance Recommendations: Measures that Require HERS Inspections/Coastal Regions**

### Inland Climate Zones

A larger number of Title 24 consultants reported recommending measures that require HERS inspections to builders in inland zones. The measures recommended most frequently were thermal expansion valves and tight duct insulation. See Table 29.

Measure	All Projects	Most Projects	Some Projects	No Projects	Don't Know
Infiltration Testing and Certification			2	4	
Thermal Expansion Valves		5	1	1	
Tight Duct Certification	1	3	1	3	
Insulation Installation Quality Certification		1		4	1

**Table 29: Current Compliance Recommendations: Measures that Require HERS Inspections/Inland Regions**

### ***Effect of 2005 Standards on Recommendations of Measures with HERS Inspection Requirements***

We next asked respondents, if they would recommend these four measures more frequently, less frequently, or just as frequently as they currently do once the 2005 standards take effect. The respondents generally reported that they would recommend the measures requiring HERS inspections for compliance credit more frequently once the new standards went into effect. See Table 30.

Measure	Change in Recommendation Practice			
	More Frequent	Less Frequent	No Change	Don't Know
<b>Coastal Zones</b>				
Infiltration Testing and Certification	5		2	1
Thermal Expansion Valves	3			1
Tight Duct Certification	5			1
Insulation Installation Quality Certification	4			
<b>Inland Zones</b>				
Infiltration Testing and Certification	5		1	1
Thermal Expansion Valves	5		1	1
Tight Duct Certification	5		2	1
Insulation Installation Quality Certification	5			1

**Table 30: Predicted Change in Recommendation Practices: Measures with HERS Requirements**

### ***Predictions of Effects on Recommendations to Exceed the 2005 Title 24 Requirements***

The questionnaire contained a series of items designed to ascertain which specific measures Title 24 consultants were likely to recommend to builders to **exceed** the 2005 requirements (and thereby qualify for utility program support). We posed the questions separately for coastal and inland climate zones, addressing the series only to Title 24 consultants who reported being active in the particular zone. In the first group of questions, we prompted the respondents with specific measures that *do not require HERS inspections* for compliance credit. In the second series, we prompted the respondents with four specific measures that *do require HERS inspections*.

### ***Measures with No HERS Inspection Required***

#### **Coastal vs. Inland**

The most notable differences between coastal and inland recommendations were: a much greater number of recommendations for 'Super high efficiency vinyl frame, double pane, low windows (Low E2 140)', 'Radiant Barrier' and 'Central A/C: SEER 14 or higher' measures for inland builders. See Table 9.

#### **Coastal Measures**

Of the listed measures that do not require HERS inspection, all six respondents that work in coastal regions listed 'Vinyl Frame, double pane, low-e windows (Low E 170)' as a measure they would recommend to exceed with the 2005 standards. Five respondents also listed 'Duct Insulation of greater than R 4.2', 'High Efficiency Furnaces: AFUE 90 or higher', and 'HE Water Heater: Energy Factor > .575 for 50 gallon tank' as a measure they would recommend. All other responses are listed in Table 5.



### Inland Measures

All Title 24 consultants (eight of eight) that worked with inland builders listed 'Duct Insulation of greater than R 4.2' as a measure they would likely recommend. Seven of eight respondents also listed 'Super high efficiency vinyl frame, double pane, low-e windows (LowE2 140)' and 'HE Water Heater: Energy Factor > .575 for 50 gallon tank'. See Table 31.

Measure	Number of Consultants Mentioning	
	Coastal	Inland
Vinyl Frame, double pane, low-e windows (Low E 170)	6	5
Super high efficiency vinyl frame, double pane, low windows (Low E2 140)	2	7
Wall Insulation R 19 or above	4	3
Roof Insulation R 38 or above	3	6
Radiant Barrier	1	6
ACCA Duct Design	3	4
Duct Insulation of R 4.2 or greater	5	8
High Efficiency Furnaces: AFUE 90 or higher	5	6
Central A/C: SEER 14 or higher	0	5
HE Water Heater: Energy Factor > .575 for 50 gallon tank	5	7

**Table 31: Sample Title 24 Consultants Likely to Recommend Measures with No HERS Requirement**

Overall, we note that the respondents reported that they would recommend a significantly higher aggregate number of measures to exceed Title 24 requirements in inland versus coastal zones. This is consistent with the more severe conditions and cooling loads in inland regions.

### ***EER Credit***

All nine respondents were aware of provisions in the 2005 Title 24 standards that provide compliance credit for high EER cooling equipment with HERS inspections. The respondents were more likely to recommend high EER cooling equipment in inland than in coastal zones.

### ***Effect of HERS Inspection Requirements***

The next sequence of questions attempted to further explore builders' responses to HERS inspection requirements.

### **HERS Inspection as a Barrier**

Seven out of the nine Title 24 consultants believed that under the current Title 24 standards, HERS inspection requirements posed something of a barrier to builders' use of HERS measures for compliance credit. One respondent thought it posed a severe barrier and one thought the requirement was relatively unimportant.

### **HERS Inspection Under the 2005 Title 24 Requirements**

When asked if they believed builders would be more likely, less likely, or just as likely to implement measures that require HERS inspection under the new standards, seven consultants felt they would be more likely. One respondent thought they would be just as likely, and one respondent didn't know.

### **Coastal vs. Inland Compliance**

Finally, we asked respondents if they thought they would be able to gain compliance for single-family homes in coastal and inland zones without using measures that require HERS inspections once the Title 24 revisions take effect.

- Four of the six respondents that worked in **coastal** zones reported that they believed they could achieve compliance with the 2005 standards without using measures that required HERS inspections.
- Three of the eight respondents active in **inland** zones believed they could achieve compliance with the 2005 standards without using measures that required HERS inspections. Three believed that would not be possible, and 2 did not know.

### **Program Changes to Qualification Approach**

The nine respondents were given three scenarios for altering the criteria to qualify homes for program support, and asked which approaches they found most attractive and which of the approaches they found least attractive. Four out of eight<sup>13</sup> respondents thought that using a performance calculation with different compliance margins for coastal and inland zones was the best approach, three felt a uniform compliance margin for all climate zones was the best approach, and one respondent felt that an exclusively prescriptive approach, with different lists of measures for coastal and inland zones was the best qualifying approach. See Table 32.

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<sup>13</sup> One consultant had difficulty understanding the differences in qualifying approaches and declined to answer.

<b>Approach to Home Qualification</b>	<b>Most Attractive</b>	<b>Least Attractive</b>
Use performance calculations only with different compliance margins for coastal and inland zones. For example, the compliance margin for inland zones would be 10 percent more efficient than Title 24; for coastal zones, 20 percent more efficient.	4	3
Use a uniform compliance margin for all climate zones – for example 15 percent more efficient than title 24, but require additional sets of prescriptive features for coastal zones.	3	2
Use an exclusively prescriptive approach, with different lists of measures for coastal and inland climate zones	1	3

**Table 32: Title 24 Consultants' Views of Alternative Program Compliance Approaches**

The three respondents that listed the performance calculation approach as least attractive thought that it was too complicated, and believed that it created an un-level playing field for certain climate zones, especially desert climates. Those that listed the exclusively prescriptive approach (option three), as least attractive thought it was too inflexible, would be too restrictive, and that not having a set percent for compliance margins would not be attractive to builders because “they don’t like hidden or vague numbers”.

**Program Changes to Incentive**

The interviewers then described how the California utilities were considering a number of alternative methods for allocating incentives. Based on the premise that builders would receive the same total amount of incentives under all methods, respondents were asked to choose one option that would be most attractive to them, and one that would be least attractive to them. Consultants responding to this question had mixed views. Three felt a fixed incentive per kBtu of energy savings would be most attractive, two felt that a fixed incentive per home would be most attractive, and two felt a larger incentive covering full incremental costs be most attractive to builders. See Table 11. As we will see, builders were quite emphatic in expressing their preference for a system of fixed incentives per qualifying home.

<b>Incentive Approach</b>	<b>Most Attractive</b>	<b>Least Attractive</b>
Fixed incentive paid out per home for all homes meeting program requirements. Current approach.	2	
Larger incentive covering full incremental costs, but for a limited number of homes completed first in a subdivision. Compared to the first alternative, this approach would accelerate the payout of incentives. However program requirements for all homes in the subdivision would stay in place	2	3
Fixed incentive per kBtus of energy savings (found on the C2R form). This approach would better track incentive dollars with the estimated energy savings	3	4

**Table 33: Title 24 Consultants' Views of Alternative Program Compliance Approaches**

## **Additional Information**

### **Importance of ENERGY STAR Label**

All nine Title 24 consultants were told that the upcoming changes in Title 24 are in some cases more stringent than current efficiency requirements for homes that meet the federal ENERGY STAR standards, and that unless the federal standards are changed, utilities may need to develop their own label to designate homes that are more efficient than the Title 24 standards. Respondents were then asked whether the development of a different label for qualifying homes would encourage, discourage, or have no effect on builders' decision to participate in the program. Seven out of the nine respondents thought that a change in labeling would discourage builders from participating in utility programs<sup>14</sup>. These seven builders believed that the program should continue to use the ENERGY STAR label because it has widespread brand recognition amongst consumers, and because any change in program name would only confuse the public and decrease the program's market recognition.

### **California Utility Assistance**

Respondents were then asked what kinds of information the utilities could provide that would help them serve their Title 24 clients as the changes in standards take effect. The majority of respondents felt that the utilities could take a more proactive role in educating builders and homeowners on the process and the benefits of the program. According to the sample Title 24 Consultants, increased training programs for builders and consumer education on the new codes would have a positive impact on their ability to serve their Title 24 clients. One respondent also suggested that utilities should update their websites more frequently, and make it easier for consultants to "find rebates".

### **Additional Suggestions**

At the end of the interview, all respondents were given the opportunity to provide any suggestions or recommendations about how the California ENERGY STAR New Homes Program could be improved, especially in light of the impending changes in Title 24. Aside from some general comments about increasing funding levels and increasing program training and marketing, most consultants didn't have specific suggestions on improving the program. One respondent did suggest working up a list of values for specific improvements over Title 24 minimums (e.g., insulation improvements, HVAC efficiency, High Efficiency Water Heaters, etc.) and then listing the kBtu/square foot /year benefit of each improvement in a chart. According to him, this would be a quick "At-a-glance" chart that would speed up his ability to assist builders.

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<sup>14</sup> One respondent thought it would have no effect on program participation, and one respondent didn't know.

# Single Family Builder Surveys

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## Introduction

This section presents the results of interviews with 16 single-family homebuilders who are actively involved in the ESH program. The interviews were designed to collect information useful for the initial ESH strategy assessments as well as baseline information for the longer-term evaluation. The interview guide covered the following topics:

- Current energy-related building practices.
- Perceptions of the marketing and business value of energy efficiency.
- Participation in the statewide RNC and other programs.
- The value of the ENERGY STAR label for new homes, relative to other labels or no label at all.
- Knowledge of impending changes in Title 24 and planned construction practices.
- Characterization of measures and measure bundles that will be used to meet 2005 code, and those that would be implemented to exceed 2005 code.
- Practices regarding prototype plans that are built in different climate zones (e.g., do builders change EE characteristics based on CZ).
- Assessment of the impact of changes in Title 24 on building practices, the marketing and business value of energy efficiency homes they build, and participation in energy efficiency programs.
- Response to alternative program approaches.

## Description of Respondents

Under the initial Scope of Work for this part of the evaluation, the participant builder interview quota was set at 20. The project sponsors furnished eighty-eight participant builder names and contact information to the RLW project team. Of these, only fifty-six proved to be reliable. The remaining thirty-two names had incorrect or inactive phone numbers/email addresses. In some cases the contact information was correct but the firm had little or no direct contact with the ENERGY STAR New Homes Program, and was unable to answer many of the key questions in the interview guide.

The RLW team was able to complete sixteen builder interviews. Table 34 displays key information about the respondents

<b>Builder Name</b>	<b>Number of Units Built in 2004</b>	<b>Percent in ES Program</b>	<b>Percent Coastal</b>
William Lyon Homes Inc	650	N/A	0
Warmington Homes	N/A	0	10%
John Laing Homes	150	0	100%
Pulte Homes (PG&E)	593	100%	0
Zink Timmons	50	50%	0
Pacific Scene Homes	75	100%	85%
Pardee Homes	1400	100%	28%
Centex Homes N. CA Div.	460	25%	0
Lennar Homes of CA	609	0	0
Greenbriar Homes	186	100%	100%
Barratt American	600	75%	10%
Focus Realty	18	100%	0
D.R. Horton Sacramento Div.	677	100%	0
KB Homes	3500	N/A	0
Pulte Homes Corp (SDG&E)	1550	50%	0
New Urban West	150	100%	0

**Table 34: Respondent Profile**

The following sections summarize the results from the telephone and email interviews with the sixteen builders listed above. Whenever possible we present and compare the viewpoints of all sixteen respondents. For some issues, we explore the differences in response patterns between larger and smaller builders<sup>15</sup>.

### **Current Building Practices**

After ascertaining general information about each of the sixteen companies (e.g., type of construction projects, units per project, etc.), we began the more detailed interview process by asking the builders the percentage of single-family homes they built in 2004 that were located in coastal, as opposed to inland regions. Of the sixteen interviewed builders, twelve primarily worked in inland zones, two worked in both coastal and inland zones, and two worked strictly in coastal zones. This information was used to determine if builders altered compliance approaches and prototype plans based on different climate zones.

### **Coastal vs. Inland Prototype Plans**

Based on the initial findings of the survey, those builders that constructed single-family homes in both coastal and inland zones did not use different prototype plans, but rather built same basic configurations with different features. We present detailed information on differences between inland and coastal homes in terms of inclusion of energy efficiency features in the following section.

<sup>15</sup> Larger builders were defined as having built more than 450 single-family units in 2004. Of the sixteen interviewed builders, nine are considered large, six are considered small and one builders' size is unknown.

### Energy-Related Home Features

Interviewers read a list of possible features and asked respondents if they included the feature in all of the units they built in 2004, most of the units, some of the units, or none of the units. Respondents that reported building homes in both climate zones were asked to differentiate the inclusion of measures by zone. Builders that reported primarily working in one climate zone were only asked to respond based on their building practices in that particular zone.

#### Inland Zones

For inland zones, the majority of respondents (twelve out of fourteen) listed 'Vinyl Frame, double pane, low-e windows (Low E 170)' as a measure they included in all units. Ten respondents also listed 'Tight Duct Certification'. 'ACCA Duct Design' was included in all units by nine of the respondents, and 'HE Water Heater: Energy Factor >.575 for 50 gallon tank' and 'Duct Insulation of R 4.2 or greater' were included by eight. See Table 2.

Measure	Frequency of Inclusion				
	All Units	Most Units	Some Units	No Units	Don't Know
Vinyl Frame, double pane, low-e windows (Low E 170)	12			2	
Super high efficiency vinyl frame, double pane, low windows (Low E2 140)	4		3	3	3
Wall Insulation R 19 or above	5	2	1	6	
Roof Insulation R 38 or above	6		4	3	1
Radiant Barrier	1		4	7	2
Housewrap (Tyvek)	1		1	9	3
ACCA Duct Design	9			1	4
Duct Insulation of R 4.2 or greater	8		1	2	3
High Efficiency Furnaces: AFUE 90 or higher	6	2	2	3	1
Central A/C: SEER 12 or higher	7	1	4	1	1
HE Water Heater: Energy Factor >.575 for 50 gallon tank	8		2	1	3
Infiltration Testing and Certification	7	1	3	2	1
Thermal Expansion Valves	4	3	2	1	4
Tight Duct Certification	10	1	2	1	

Table 35: Inland Zones – Energy Related Home Features

#### Coastal Zones

Responses concerning energy-related home features from coastal builders mirrored those from inland builders. For example, all four coastal respondents listed 'Vinyl Frame, double pane, low-e windows (Low E 170)' as a measure that is included in all units. Furthermore, the majority of coastal builders also listed 'Duct Insulation of R 4.2 or greater', 'HE Water Heater: Energy Factor >.575 for 50 gallon tank', and 'Tight Duct Certification' as a measures included in all units built in 2004. See Table 2.

Measure	Frequency of Inclusion				Don't Know
	All Units	Most Units	Some Units	No Units	
Vinyl Frame, double pane, low-e windows (Low E 170)	4				
Super high efficiency vinyl frame, double pane, low windows (Low E2 140)	1			2	1
Wall Insulation R 19 or above	1		2		
Roof Insulation R 38 or above	1		1	1	1
Radiant Barrier				3	1
Housewrap (Tyvek)				3	1
ACCA Duct Design	2			1	1
Duct Insulation of R 4.2 or greater	3		1		
High Efficiency Furnaces: AFUE 90 or higher	2		1	1	
Central A/C: SEER 12 or higher	1	1		1	1
HE Water Heater: Energy Factor >.575 for 50 gallon tank	3				1
Infiltration Testing and Certification	2			1	1
Thermal Expansion Valves			1	1	2
Tight Duct Certification	3		1		

**Table 36: Coastal Zones – Energy Related Home Features**

### ***HERS Infiltration Testing and Certification, Thermal Expansion Valves, and Tight Duct Certification***

The sponsors requested that the RLW team assess builder use of three specific measures for which HERS inspections are required in order to receive Title 24 credit. The three measures were: infiltration testing and certification, thermal expansion valves, and tight duct certification.

### **Use of Measures Over Last Two Years**

Twelve of sixteen respondents reported including infiltration testing and certification in at least some of the units they built in 2004. Nine reported including thermal expansion valves, and fifteen reported including tight duct certification. The survey then asked respondents if over the past two years, the percentage of homes in which they applied these measures increased, decreased or stayed the same. Responses indicate a fairly even split between increased inclusion of these measures and no change. None of the sixteen respondents reported decreased inclusion of these measures over the last two years. See Table 4.



Measure	Frequency of Inclusion			Don't Know
	Increased	Decreased	No Change	
Infiltration Testing and Certification	6		8	2
Thermal Expansion Valves	6		4	6
Tight Duct Certification	7		8	1

**Table 37: Trends in Including Measures with HERS Requirements**

### Obtain HERS Inspection

The second question was aimed at determining the extent to which builders obtained HERS inspections for these measures. Responses to this question were equally distributed between all categories and did not show any distinct tendencies. Among those using inspections for at least some homes, there is also little difference in the pattern of response between large builder and small builders. Four large builders and three small builders reported obtaining inspections for infiltration testing and certification, and four large builders and four small builders reported the same for both thermal expansion valves and tight duct certification. See Table 5.

Measure	Frequency of Inspections				Don't Know
	All Units	Most Units	Some Units	No Units	
Infiltration Testing and Certification	3	2	2	3	4
Thermal Expansion Valves	3	3	2	3	3
Tight Duct Certification	3	3	2	2	4

**Table 38: Inland Zones – Energy Related Home Features**

**Table 5. Current Use of HERS Inspection**

### HERS Inspection as a Barrier

Finally, we asked builders if they thought that the requirement for HERS inspections constituted a barrier for the inclusion of these three measures in homes they built. Most builders felt that the HERS inspections associated with each of the three measures constituted little or no barrier for inclusion in single-family homes. Among those that reported HERS inspections to be at least something of a barrier, 10 out of 11 total responses came from large builders.

### ***Builder Awareness of Changes in Title 24 and Projected Changes in Building Practices***

The next sequence of questions explored in more detail the level of builder awareness of changes in Title 24 standards, and changes they anticipated in building design and energy efficiency measures to comply with the new standards.

### Builder Awareness

Twelve of the sixteen respondents reported being aware of the impending changes in Title 24 (eight large builders and four small builders). These respondents were asked what the most important difference between the 2001 and 2005 versions of Title 24 was.

Aside from general cost implications associated with the new standards, half of the respondents (six out of twelve) listed the 'prescriptive requirements for high efficiency lighting' as the most important difference in the upcoming standards. Additional responses can be seen in Table 6.

Reported differences between standards (unprompted)	Frequency of Mention	
	First Response	Additional Responses
Don't Know	4	
Lower energy budgets/ Generally more stringent standards	1	2
Higher required duct insulation levels		2
New Federal standards for heating and cooling equipment		3
Prescriptive requirements for high efficiency lighting	6	2
Requirements of HVAC system sizing documentation		1
Compliance credit for high EER equipment	1	1
Compliance credit for improved insulation installation		1
Other: General HVAC Efficiency		1
Other: Higher Costs		1

**Table 39: Builder Perceptions of Differences between 2001 and 2005 Standards**

#### Anticipated Changes in Building Practices

Respondents who were aware of the impending changes and able to list two or more changes in the new standards (eight out of twelve) were then asked a series of questions pertaining to specific measures that could be used to meet the new standards. Based on the results of previous surveys and informal polls of builders and Title 24 consultants, we explored prospective use of three specific measures: gas instantaneous hot water heaters, electric instantaneous hot water heaters, and high efficiency HVAC equipment. The results from this series of questions suggest that out of these three choices, builders will most likely use high EER HVAC equipment to meet the revised 2005 code. Results also indicate that builders are very unlikely to install electric instantaneous hot water heaters to comply with the new standards.

Measure	Likelihood Rating				
	Very Unlikely 1	2	3	4	Very Likely 5
Gas instantaneous hot water heater	2	1	2	1	
Electric instantaneous hot water heater	5		1		
High EER HVAC equipment	1		1	2	3

**Table 40: Prospective Use of Measures to Meet Title 24 Requirements**

**Projected Costs of Compliance**

Results from the survey indicate that most builders do not have a very good idea of what complying with the new standards is going to cost. Seven builders were unable to venture a guess on estimated costs, and those that did, estimated costs ranging from \$200 up to \$2,500 per home.

**Concerns with Impending Changes**

When asked if they had any concerns about how the impending changes in Title 24 would affect their business; four builders didn't know (two large and two small), five builders replied that they had no concern (four large and one small), and seven builders had strong concerns over impacts on their business practices (three large and four small). The most prevalent concern among builders was the expected increase in direct construction costs, and the additional costs for more extensive plan review and approvals due to more complicated efficiency measures. Builders also brought up scheduling issues as a major concern, as they anticipate longer build times to incorporate inspections. One builder was also very concerned with the new lighting measures that are going to be required. According to her, the new lighting measures are going to make it harder to sell homes because fluorescent lighting tends to make the home feel more like a work environment.

**Effect of Changing Standards on Business Importance of Energy Efficiency**

**Importance of ENERGY STAR Label**

Respondents were asked their opinions on the importance of the ENERGY STAR label or other energy efficiency labels in marketing new homes. Responses to this show that the majority of builders feel that the ENERGY STAR label or other energy efficiency label is at least somewhat important in marketing new homes. Results also indicate that larger builders find energy efficiency labels more important than smaller builders. Responses are listed in Table 8

Builder Size	Importance Rating					Refused
	Not at all Important 1	2	3	4	Very Important 5	
Large > 450 Units		1		4	3	1
Small < 450 Units	1		3	2	1	

**Table 41: Ratings of Importance of Energy Efficiency Labels for Marketing New Homes**

When given a scenario in which energy analysts estimated the cost per house of upgrading current practices to the 2005 standards to be \$0 to \$600 in coastal areas and \$400 to \$1,900 in inland areas, seven respondents felt that the importance of energy efficiency in marketing new homes would increase, six felt that it would stay the same, and three didn't know. None of the respondents thought that the importance of energy efficiency in marketing new homes would decrease. Of those that felt it would increase (seven of sixteen) the main reasons given were that energy savings can help sell homes, and that builders would try to sell increased costs as increased efficiency measures. According to one builder, they will need to pitch all the benefits of energy efficiency upgrades to justify the additional costs.

## **ENERGY STAR Program Participation**

### **Received Incentives**

Of the sixteen builders interviewed, fifteen acknowledged having received incentives from PG&E, SCE or SDG&E for building one or more homes that qualify for the utilities' ENERGY STAR New Homes program. We posed a series of questions concerning participation in the program to those 15 builders.

### **Reasons for Participating**

According to the survey, the two most important reasons why builders participate in the program are the financial incentives and differentiation of their firms from others in the marketplace. 22 out of 43 total responses were distributed amongst these two options. Differentiation was listed as the main reason six times, and financial incentives three times. See Table 9.

<b>Reasons</b>	<b>Main Reason</b>	<b>Additional Reasons<sup>16</sup></b>
Receive financial incentives	3	8
Differentiation in marketplace	6	6
Advertising partnership		6
Means to achieve Title 24 compliance	2	1
Third Party Inspections and recognized label	1	5
Other: Accidentally Qualified	1	
Other: Future efficiency for buyers, marketing	1	
Other: Right way to build a house, from an engineers perspective	1	
Other: Environmental, Energy Conservation		2

**Table 42: Reasons for Participation n = 15**

Respondents were asked to rate the importance of the availability of financial incentives in their decision to participate in the program. Of the fifteen builders, eight rated the financial incentives as very important (five large and three small). See Table 10

<sup>16</sup> Multiple responses accepted, but not all builders listed additional reasons.

Builder Size	Importance Rating					Don't Know
	Not at all Important 1	2	3	4	Very Important 5	
Large > 450 Units	1		2		5	1
Small < 450 Units	1	1			3	

**Table 43: Importance of Financial Incentives in Program Participation Decision**

#### **Impact of ENERGY STAR Label**

Builders were asked to characterize the impacts of the ENERGY STAR label on the marketability of the typical home that they build. An overwhelming majority (thirteen out of fifteen) stated that the ENERGY STAR label had a positive impact on the marketability of their homes. The remaining two builders stated that it had no impact on marketability at all. Among those respondents that felt ENERGY STAR had a positive effect on marketability, the main reason given for this perception was that customers recognize and trust the ENERGY STAR label.

#### **Responses to Alternative Program Qualifying Approaches**

The fifteen respondents who recalled participating in the program were given three scenarios for altering the criteria to qualify homes for program support. We asked which of the approaches they found most attractive and which of the approaches they found least attractive. Eight out of fifteen respondents thought that using a performance calculation with different compliance margins for coastal and inland zones was the best approach (six large and two small). Five thought that an exclusively prescriptive approach with different lists of measures for coastal and inland zones was most attractive (two large and three small). See Table 11.

<b>Qualifying Approach</b>	<b>Most Attractive<sup>17</sup></b>	<b>Least Attractive</b>
Use performance calculations only with different compliance margins for coastal and inland zones. For example, the compliance margin for inland zones would be 10 percent more efficient than Title 24; for coastal zones, 20 percent more efficient	6 - Large Builders 2 - Small Builders	3 – Large Builders 3 – Small Builders
Use a uniform compliance margin for all climate zones – for example 15 percent more efficient than title 24, but require additional sets of prescriptive features for coastal zones.	1 – Large Builder 1 – Small Builder	3 – Large Builders 1 – Small Builder
Use an exclusively prescriptive approach, with different lists of measures for coastal and inland climate zones	2 – Large Builder 3 – Small Builders	1 – Large Builder 1 – Small Builder
Other: Suggested by Builder Prescriptive approach for entire state – no distinction between coastal and inland	1 – Large Builder	

**Table 44: Builder Response to Alternative Qualifying Approaches**

The six respondents that listed the performance calculation approach as least attractive thought that it was too complicated, and believed that it would cause problems for both climate zones. They also thought it might give unplanned advantage to builders who work in one climate zone or another and were unsure of the impacts climate zones have on compliance. Those that listed a uniform compliance method (Option 2) as least attractive, felt that differentiation between coastal and inland measures made sense because the zones and their appropriate energy efficiency strategies differ greatly.

**Responses to Alternative Program Incentive Approaches**

**Percentage of Incremental Cost**

We asked respondents: “How interested would you be in participating in the program if the incentive were set as a percentage of the estimated cost of meeting program requirements, rather than a fixed sum per home?” Three out of fifteen respondents stated that they would be very interested in this approach, while five others expressed some level of interest. Four respondents didn’t have an answer to this question. See Table 12.

<b>Builder Size</b>	<b>Level of Interest</b>					<b>Don't Know</b>
	<b>Not at all Interested 1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>Very Interested 5</b>	
Large > 450 Units		2	2	1	1	3
Small < 450 Units	1			2	2	1

<sup>17</sup> One builder listed Option 1 and Option 3 as equally attractive

**Table 45: Respondent Interest in Alternative Incentive Payout Method**

Respondents who reported that they would be interested in incentives calibrated to program costs were asked what level of payment would be needed to induce their participation. When asked if an incentive set to fifty percent of incremental costs was sufficient, three respondents stated they would decline to participate, three responded that they would participate, and three builders weren't sure. When the percentage was raised to seventy-five percent of incremental costs, five out of the six respondents that wouldn't participate at fifty percent stated that they would participate.

**Alternative Approaches to Allocating Incentives**

The interviewers then described how the California utilities were considering a number of alternative methods for allocating incentives. Based on the premise that builders would receive the same total amount of incentives under all methods, respondents were asked to choose one option that would be most attractive to them, and one that would be least attractive to them. Builders responding to this question preferred the current approach of a fixed incentive amount per completed home slightly more than a fixed incentive per kBtus of energy savings approach. Half (six out of twelve) found the allocation of the incentive to a limited number of homes least attractive. See Table 13.

Incentive Allocation Approach	Most Attractive	Least Attractive <sup>18</sup>
Fixed incentive paid out per home for all homes meeting program requirements. Current approach.	2 – Large 2 – Small 1 - Unknown	1 – Small
Larger incentive covering full incremental costs, but for a limited number of homes completed first in a subdivision. Compared to the first alternative, this approach would accelerate the payout of incentives. However program requirements for all homes in the subdivision would stay in place	2 – Large	4 – Large 1 – Small 1 - Unknown
Fixed incentive per kBtus of energy savings (found on the C2R form). This approach would better track incentive dollars with the estimated energy savings	2 – Large 2 – Small	3 – Large 2 – Small

**Table 46: Alternative Incentive Approaches – by Builder Size**

**Additional Information**

**Importance of ENERGY STAR Label**

All sixteen builders were told that the upcoming changes in Title 24 are in some cases more stringent than current efficiency requirements for homes that meet the federal ENERGY STAR standards, and that unless the federal standards are changed, utilities may need to develop their own label to designate homes that are more efficient than the Title 24 standards. Builders were then asked whether the development of a different label for qualifying homes would encourage, discourage, or have no effect on their decision to participate in the program. Seven builders stated that the label change would have no effect on their decision to participate; four builders said it would discourage their participation; and five builders didn't know. The three respondents that stated it would discourage participation believed that the program should make every

<sup>18</sup> One large builder listed both option 2 and option 3 as least attractive.

effort to use the nationally recognized ENERGY STAR label because additional names would only confuse the public and diminish the ability to easily brand the energy efficiency enhancements. They also felt that trying to re-educate buyers would only cause problems and add additional costs to an already costly program.

**Additional Suggestions**

At the end of the interview, all respondents were given the opportunity to provide any suggestions or recommendations about how the California ENERGY STAR New Homes Program could be improved, especially in light of the impending changes in Title 24. Aside from some general comments about increasing funding levels, the main suggestion from builders involved increasing marketing and education efforts to reach out to potential homebuyers. According to several builders, the public needs to be more aware of the program (e.g., what it is about, what it does, what are the benefits, etc.), and builders simply don't have the expertise or time to do it. For them, the program would be more beneficial if the public was already clamoring for it, and this should be the responsibility of the utilities.

One respondent also expressed concern over the man-hours builders needed to put into the application process. According to him, application requirements are a deterrent to program participation, not the needed measures.



# Single Family Measure Analysis

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## Introduction

In this section we present results from the single family measure analysis. RLW worked closely with Itron to develop the individual measure level results. The measure level analysis presented in this section was done in concert with the New Construction Potential Study, managed by Itron. The purpose of this analysis was to determine the cost effectiveness of individual measures in support of prescriptive type program, while Itron studied least cost measure packages in support of a performance type program. Due to the structure of the contracts the findings of these two analyses are compiled in separate reports.

## Baseline

The analysis began with baseline models of two sets of single family homes, one story and two story model for each of the sixteen CEC climate zones. The square footage of the prototypes were based on research findings from the Residential New Construction Baseline Study, also conducted by Itron. The Strategy Assessment analysis began by using the least cost measure package to comply with the 2005 Title 24 standards. Next, measures that were studied as part of the Strategy Assessment were backed-out of each prototype, if they were included in the least cost measure packer. This process provided the ability to study each measure uniquely for all prototypes. As the following two tables show, some characteristics were uniform throughout for all prototypes, as shown in Table 47, while others varied across the climate zone and home type, as shown in Table 48. Also shown in the final column of Table 48 are the compliance margins for each of the 16 baseline prototype models.

Insulation Certification	No
Radiant Barrier	No
TXV	Yes
Infiltration Testing	No
HouseWrap	No
AC SEER	13
Furnace AFUE	80
Duct Insulation	No

**Table 47: Static Baseline Characteristics**

RNC_CZ	CEC_CZ	Story	FIArea	Window Type	Wall	Roof	Tight Ducts	EF	Duct Design	2005 Baseline for 2006
1	01	1	2,400	2VL	19	38	No	0.63	No	-8.8%
1	02	1	2,400	2VL	19	30	No	0.63	No	-0.2%
1	03	1	2,400	2VL	13	30	No	0.62	No	4.3%
1	04	1	2,400	2VL	13	30	Yes	0.63	No	-0.6%
1	05	1	2,400	2VL	19	30	No	0.60	No	9.6%
2	06	1	2,450	2VC	13	30	No	0.63	No	2.2%
2	07	1	2,450	2VL	13	38	No	0.60	No	11.9%
3	08	1	2,150	2VS	13	38	Yes	0.63	No	0.1%
3	09	1	2,150	2VS	19	38	Yes	0.63	No	6.2%
3	10	1	2,150	2VS	19	38	Yes	0.63	No	8.6%
4	11	1	1,800	2VS	19	38	Yes	0.63	No	-1.4%
4	12	1	1,800	2VS	19	38	Yes	0.63	No	-0.7%
4	13	1	1,800	2VS	19	38	Yes	0.63	Yes	2.7%
5	14	1	2,000	2VS	19	38	Yes	0.63	Yes	2.6%
5	15	1	2,000	2VS	19	38	Yes	0.63	No	-1.3%
5	16	1	2,000	2VL	19	38	Yes	0.63	No	1.5%
1	01	2	2,450	2VL	19	30	No	0.62	No	-1.8%
1	02	2	2,450	2VL	19	30	No	0.62	No	8.7%
1	03	2	2,450	2VL	13	30	No	0.62	No	12.9%
1	04	2	2,450	2VL	13	30	No	0.62	No	3.2%
1	05	2	2,450	2VL	19	30	No	0.60	No	23.6%
2	06	2	2,900	2VL	13	30	No	0.60	No	7.7%
2	07	2	2,900	2VL	13	13	No	0.60	No	-5.4%
3	08	2	2,900	2VS	13	38	No	0.63	No	2.7%
3	09	2	2,900	2VS	13	30	Yes	0.63	No	3.4%
3	10	2	2,900	2VL	19	30	Yes	0.63	No	12.5%
4	11	2	2,900	2VL	19	30	Yes	0.63	No	1.0%
4	12	2	2,900	2VL	19	30	No	0.63	Yes	5.7%
4	13	2	2,900	2VS	19	49	Yes	0.63	No	8.9%
5	14	2	2,800	2VS	19	38	Yes	0.63	No	1.1%
5	15	2	2,800	2VS	19	38	Yes	0.63	No	3.6%
5	16	2	2,800	2VL	19	30	No	0.63	No	-8.6%

Table 48: Variable Baseline Characteristics

The window type codes shown in column five as noted in the “window type” fields are defined with the performance characteristics shown in Table 49.

Code	U-Factor	SHGC
2VL	0.37	0.41
2VC	0.60	0.65
2VS	0.37	0.35

Table 49: Window Property Values

## Measures

As an early task in the project RLW identified a list of measures that could be included in the Strategy Assessment analysis. The original list included measures applicable to Title 24 (e.g., windows, EER, insulation, etc.) and measures not applicable to Title 24 (e.g.,

ENERGY STAR appliances, NightBreeze, whole house fans, etc.) The original list of measures also included C-HERS measures that require third party testing and verification. The following measures were all part of the original assessment:

- Evaporative Cooling
- Attic venting systems
- Whole house fans
- Ventilation integrated economizers
- High SEER (14, 15, 16P)
- High EER (13, 14, 15)
- Tankless Hot Water Heater
- Solar hot water
- Cool roofs
- High AFUE heating (AFUE 90 and 92)
- Super Low E Windows (LowE 140)
- Shading - Architecturally integrated
- ENERGY STAR appliances
- Lighting
- Insulation Inspection Credit
- Radiant Barrier
- Ducts in conditioned space

Based on discussions with the project stakeholders, and review of the key market actor interviews and surveys, the original list of measures shown above was narrowed to 10. The narrowing considered measure cost, potential of builder acceptance, and costs associated with third party testing. In the end, only one non-Title 24 measure was retained, ventilation integrated economizers, and all measures requiring third party testing were excluded. The following list describes the measures that were studied in more detail; analysis results for the selected measures follow this discussion.

1. **DuctInCon – Ducts in Condition Space.** This measure refers to a home that has supply and return ducting within the thermal envelope of the residence.
2. **DuctIns – Duct Insulation.** This measure is duct insulation of R-8
3. **InsCred – Insulation Credit.** This measure takes the modeling credit available for quality insulation installation as defined by the 2005 standards.
4. **AFUE92, AFUE90, High Efficiency Furnaces.** These measures model the energy usage of high efficiency furnaces with ratings of 90 and 92 AFUE.
5. **InstWH - Instantaneous Water Heater.** This measure consists of an instantaneous or tankless water heater with an Energy Factor of 84 and a recovery efficiency of 0.85.
6. **RadBar – Radiant Barrier.** The measure is a radiant barrier installed on the inside of the roof sheathing.
7. **EER13, EER14, EER15 - High EER air conditioners.** These measures are for high EER air conditioners. Each was modeled with a corresponding SEER rating, 14, 15 and 16 respectively. The SEER ratings were determined from a market correlation of SEER from high EER air conditioners.
8. **SEER14, SEER15, SEER16. High SEER air conditioners.** These were modeled with corresponding EERs of 12.2, 12.5, and 12.2 respectively. The EERs represent the mean EER of market available air conditioners for each given SEER. A minor adjustment was made for market share considerations.
9. **SuperLowE. Low Emissivity Windows.** This measure is high performance glazing modeled with an SHGC of 0.25 and a U-Value of 0.30, also called Low-E 140<sup>2</sup>.

10. **NightBreeze** – The NightBreeze is a technology that takes advantage of free nighttime cooling via a “smart” ventilation system. Similar products include SmartVent and NightVent.<sup>19</sup>

### Incremental Measure Cost

The following table shows the average gross incremental measure costs that were used in the analysis. Most costs in the table were gathered through an informal survey of equipment distributors. All modeled residences had cooling loads that warranted 3 to 4 ton air-conditioning units.

Measure	Cost (\$)	Notes
AFUE90	\$ 350.00	Per unit average incremental cost for properly sized units
AFUE92	\$ 400.00	Per unit average incremental cost for properly sized units
DuctInCon	\$ 100.00	Design phase measure, actual incremental cost uncertain, requires a HERS inspection
DuctIns	\$ 350.00	Per home from Itron New Construction Potential Study
EER13	\$ 500.00	\$500 per SEER increase for properly sized units
EER14	\$ 1,000.00	\$500 per SEER increase for properly sized units
EER15	\$ 2,500.00	\$500 per SEER increase for properly sized units
InsCredit	\$ 100.00	Requires Inspection, blown-in cellulose insulation same cost as batt insulation.
InstWH	\$ 650.00	\$650 incremental over 50 gallon EF 60 storage unit
Nightbreeze	\$ 1,500.00	\$1,500 per unit (per Davis Energy Group)
RadBar	\$0.15	Per square foot of installed radiant barrier
Seer 14	\$ 500.00	\$500 per SEER increase for properly sized units
Seer 15	\$ 1,000.00	\$500 per SEER increase for properly sized units
Seer 16	\$ 1,500.00	\$500 per SEER increase for properly sized units
SuperLowE	\$0.12	\$0.12/sf of CFA, analysis assumes 16-17% window/CFA. (Approximately \$0.80/SF of glass)

**Table 50: Incremental Measure Costs**

### Cost Effectiveness

Table 51 ranks the fifteen measures by cost effectiveness in each of the five RNC climate zones in terms of kBTU/yr-\$. The unit kBTU of source energy is a combined method for comparing natural gas and electrical energy savings measures. To convert kWh to kBTU a multiplier of three is applied, which accounts for the efficiency of electrical power generation. The order of the measures is presented in order by the “sum of the ranking” column. However, it is perhaps more important to review the measure rankings by climate zone, which illustrates the variation of measure performance across the five RNC climate zones.

The most cost effective measure, ducts in conditioned space, gets the highest rating, 1, although this measure is probably not as suitable for single family new construction as it is for multifamily new construction. The next most cost effective measure is insulation installation credit, scoring second in terms of cost effectiveness in all RNC zones. Super Low E windows, high AFUE furnaces and instantaneous hot water heaters also rank in the top five measures in many of the five climate zones.

<sup>19</sup> NightBreeze data was provided by Davis Energy Group and is based on a DOE-2.1e calibrated model of an actual NightBreeze installation in a Zero Energy New Home. In support of this analysis Davis Energy Group modified the building characteristics of the calibrated model to represent a home built to the 2005 Title 24 energy code. For more details on the NightBreeze project refer to the following report, Alternatives to Compressor Cooling, Phase V: Integrated Ventilation Cooling, California Energy Commission, Public Interest Energy Research Program, February 2004. P500-04-009.

At the bottom of the cost effectiveness list is SEER 14, 15 and 16, mainly because increased SEER has little effect on the performance of an air-conditioner when temperatures exceed 95 degrees. EER measures perform better than SEER measures because the performance of high EER units is improved at high temperatures (i.e., 95 degrees and higher). However, high incremental costs appear to be a barrier for this measure, as well as other measures with high on-peak electrical savings potential, such as NightBreeze and EER 15.

Measure	RNC 1	RNC 2	RNC 3	RNC 4	RNC 5	Sum of Ranking
DuctInCon	1	1	1	1	1	5
InsCredit	2	2	2	2	2	10
AFUE92	3	4	7	4	3	21
InstWH	5	3	3	6	8	25
AFUE90	4	5	8	5	4	26
RadBar	7	6	5	7	6	31
DuctIns	6	8	9	8	5	36
SuperLowE	15	15	4	3	7	44
EER13	9	9	10	10	9	47
Nightbreeze	11	7	6	9	14	47
EER14	8	11	11	11	10	51
Seer 14	12	10	12	12	11	57
Seer 15	10	12	13	13	12	60
EER15	14	14	15	14	13	70
Seer 16	13	13	14	15	15	70

Table 51: Ranking of Cost Effectiveness for Measure by RNC Zone

## Energy Savings

Table 52 shows the kWh savings per square foot of conditioned floor area, by RNC climate zone. The savings are shown by each RNC zone, in addition to the simple average of the five zones. Notice the striking difference in measure savings between RNC zones 1 and 2 versus 3-5. RNC zones 1 and 2 are considered coastal climate zones with little air-conditioning load, whereas RNC zones 3, 4 and 5 are cooling dominated. With little cooling load in coastal zones it is more difficult to save electrical energy because the other two end-use categories considered by Title 24, heating and water heating, are primarily gas end-uses.

NightBreeze ranks the highest in four of the five climate zones in terms of kilowatt-hours/square foot, saving 0.30 to 0.36 kWh/sf in the inland climate zones (3 and 4), where cooling demand is the greatest. Excluding ducts in conditioned space, EER 15, EER 14 and SuperLowE windows save the second most electrical energy per square foot of conditioned floor area, except in RNC zone 5 where high EER units outperform NightBreeze. As noted above, it is the incremental measure cost of these measures that constitute the largest barrier for widespread application of these promising technologies.

Interestingly, the measure shown as the second most cost effective in Table 51, insulation installation credit, saves the least kWh per square foot of any measure considered. Moreover, the data illustrates how little value SEER 14 brings in terms of energy savings

Measure	RNC 1	RNC 2	RNC 3	RNC 4	RNC 5	Average
Nightbreeze	0.04	0.10	0.30	0.36	0.22	0.20
DuctInCon	0.05	0.02	0.14	0.23	0.46	0.18
EER15	0.04	0.02	0.13	0.22	0.38	0.16
SuperLowE	0.08	0.07	0.15	0.20	0.20	0.14
EER14	0.04	0.01	0.10	0.17	0.30	0.12
Seer 16	0.03	0.02	0.08	0.11	0.15	0.08
Seer 15	0.03	0.01	0.07	0.10	0.17	0.08
EER13	0.02	0.01	0.06	0.11	0.18	0.07
RadBar	0.02	0.02	0.05	0.08	0.12	0.06
Seer 14	0.01	0.01	0.04	0.07	0.11	0.05
DuctIns	0.01	0.00	0.02	0.05	0.09	0.03
InsCredit	0.01	0.00	0.04	0.04	0.06	0.03
AFUE90	-	-	-	-	-	-
AFUE92	-	-	-	-	-	-
InstWH	-	-	-	-	-	-

**Table 52: Electrical Energy Savings (kWh/yr) per Square Foot of CFA by Measure and RNC Zone**

In order to provide an idea of the magnitude of energy savings these measures would have in the typical newly constructed home we present the following. Table 53 shows the kWh savings per home for each measure and RNC climate zone. Home square footage is taken from the baseline findings for single family one story and two story detached buildings. The CFA multiplier values used in this analysis are shown in Table 48 in the field labeled FLAREA. Excluding ducts in conditioned space, the greatest energy savings would result from an EER 15 air-conditioner in RNC 5. The next greatest savings come from the NightBreeze system in RNC 3 and 4.

Measure	RNC 1	RNC 2	RNC 3	RNC 4	RNC 5	Average
Nightbreeze	92	262	753	839	520	493
DuctInCon	110	59	350	538	1,092	430
EER15	108	49	330	524	919	386
SuperLowE	206	196	388	479	476	349
EER14	85	35	247	397	722	297
Seer 16	84	48	199	259	372	192
Seer 15	71	33	171	245	398	184
EER13	38	19	151	249	427	177
RadBar	47	57	136	177	287	141
Seer 14	30	19	106	159	252	113
DuctIns	18	9	56	106	221	82
InsCredit	19	12	95	99	141	73
AFUE90	-	-	-	-	-	-
AFUE92	-	-	-	-	-	-
InstWH	-	-	-	-	-	-

**Table 53: Electrical Energy Savings (kWh/yr) per Home by Measure and RNC Zone**

Figure 3 presents the data shown in Table 53 in a graphical format. In this form, the data clearly shows the relative impact of electrical savings for these measures in the coastal climate zones (e.g. RNC 1,2) as opposed to the inland climate zones (e.g. RNC 3,4,5). Moreover, the figure also demonstrates the potential for NightBreeze energy savings in RNC 3 and 4, in addition to high EER 14 and 15 measures in RNC 5.

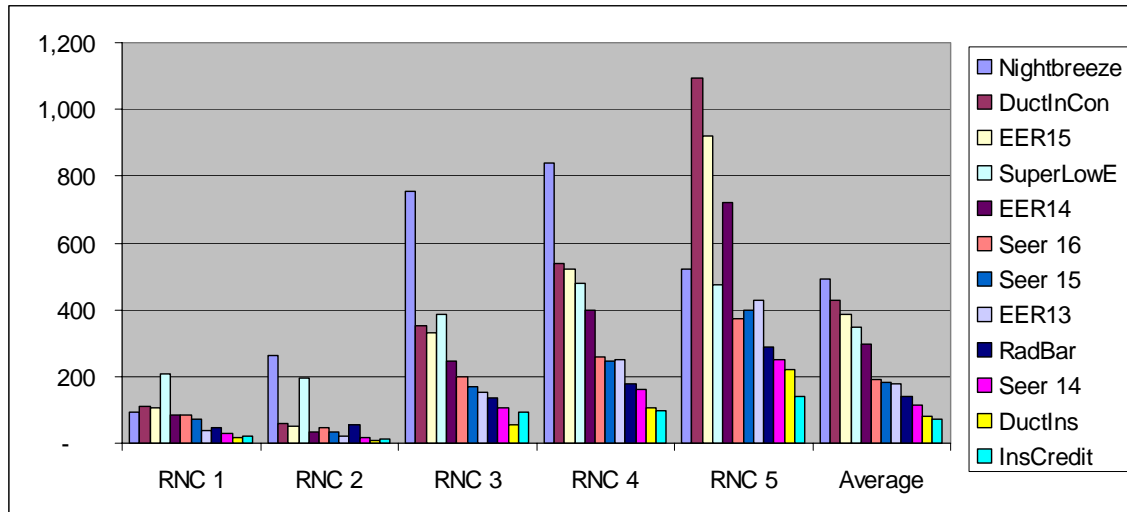


Figure 3: Graphical Representation of Table 53 Data

### Natural Gas Energy Savings

Table 54 shows the annual therms savings per square foot of conditioned floor area, by RNC climate zone. The savings are shown by each RNC zone, in addition to the simple average of the five zones. As stated earlier, we have concluded that ducts in conditioned space is not a measure builders would likely adopt, however do present the measure results for informational purposes. Here again, ducts in conditioned space leads all other measures in terms of annual therms saved based on the average of all RNC zones. However, instantaneous hot water heaters save the most energy in RNC zones 2 and 3, and the second most in zones 1 and 4. In the hot desert region of RNC 5, the quality insulation installation credit saves the second most therms of any measure.

Super Low-E windows produce negative savings due to their ability to reject solar gains, making these windows a poor choice in heating dominated climates. Falling last on the list of measures that produce measurable savings is Radiant Barrier.

Measure	RNC 1	RNC 2	RNC 3	RNC 4	RNC 5	Average
DuctInCon	0.049	0.014	0.016	0.039	0.072	0.038
InstWH	0.028	0.027	0.026	0.027	0.027	0.027
InsCredit	0.025	0.010	0.011	0.020	0.029	0.019
AFUE92	0.021	0.006	0.008	0.020	0.030	0.017
AFUE90	0.018	0.005	0.007	0.017	0.026	0.014
DuctIns	0.008	0.002	0.003	0.008	0.015	0.007
RadBar	0.002	0.001	0.001	0.001	0.002	0.001
EER13	-	-	-	-	-	-
EER14	-	-	-	-	-	-
EER15	-	-	-	-	-	-
Nightbreeze	-	-	-	-	-	-
Seer 14	-	-	-	-	-	-
Seer 15	-	-	-	-	-	-
Seer 16	-	-	-	-	-	-
SuperLowE	-0.010	-0.010	-0.004	-0.002	-0.007	-0.007

Table 54 Gas Savings (therms/yr) per Square Foot of CFA by Measure and RNC Zone

In order to provide an idea of the magnitude of energy savings these measures would have in the typical newly constructed home we present the following. Table 55 shows the annual therms savings per home for each measure and RNC climate zone. Home square footage is taken from the baseline findings for single family one story and two story detached buildings. The CFA multiplier values used for this analysis are shown in Table 48 in the field labeled FLAREA.

Measure	RNC 1	RNC 2	RNC 3	RNC 4	RNC 5	Average
DuctInCon	20.89	6.25	5.96	14.20	26.01	14.66
InstWH	12.14	12.14	9.78	9.99	9.63	10.74
InsCredit	10.94	4.23	4.38	7.11	10.43	7.42
AFUE92	9.14	2.57	3.10	7.10	10.82	6.55
AFUE90	7.79	2.18	2.64	6.04	9.21	5.57
DuctIns	3.54	0.80	1.09	2.85	5.25	2.71
RadBar	0.91	0.29	0.22	0.45	0.74	0.52
EER13	-	-	-	-	-	-
EER14	-	-	-	-	-	-
EER15	-	-	-	-	-	-
Nightbreeze	-	-	-	-	-	-
Seer 14	-	-	-	-	-	-
Seer 15	-	-	-	-	-	-
Seer 16	-	-	-	-	-	-
SuperLowE	-4.18	-4.51	-1.52	-0.80	-2.40	-2.68

Table 55: Natural Gas Savings (therms/yr) per Home by Measure and RNC Zone

Table 48 presents the data shown in Table 55 in a graphical format. Unlike the electric savings analysis, this figure demonstrates more uniformity in therms savings across the five RNC zones. While the measures in this analysis produce similar amounts of savings, the data does illustrate instantaneous hot water heaters as one of the more effective measures applicable to all climate zones.

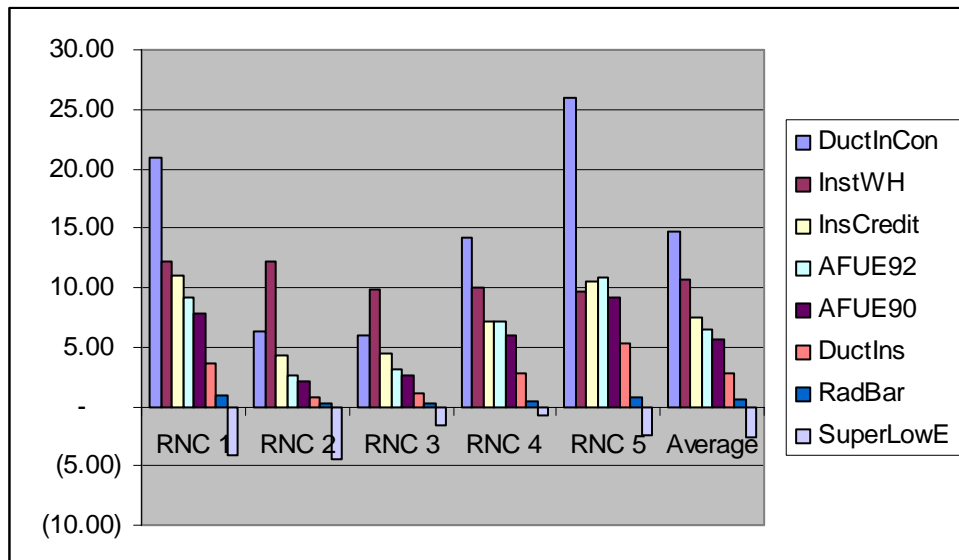


Figure 4: Graphical Representation of Table 55



# Multifamily Measure Analysis

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## Introduction

In this section we present results from the multifamily measure analysis. As with single family measure analysis, RLW worked closely with Itron to develop the individual measure level results. The measure level analysis presented in this section was done in parallel with the New Construction Potential Study, managed by Itron. The purpose of this analysis was to determine the cost effectiveness of individual measures in support of prescriptive type program, while Itron studied least cost measure packages in support of a performance program. Due to the structure of the contracts, the findings of these two analyses are compiled in separate reports.

## Baseline

The analysis began with baseline models of two sets of multifamily buildings, one two-story and one three-story model for each of the sixteen CEC climate zones. The square footages of the prototypes were based on research findings from the Residential New Construction Baseline Study, also conducted by Itron. The Strategy Assessment analysis began by using the least cost measure package that enabled the model to comply with the 2005 Title 24 standards via the performance approach for a baseline. Next, measures that were studied as part of the Strategy Assessment were removed from each baseline prototype, if they were part of the least cost measure package. This process provided the ability to study each measure uniquely for all prototypes while maintaining the roughly same baseline for all simulations.

<b>Wall Insulation</b>	R-13
<b>Insulation Certification</b>	No
<b>Radiant Barrier</b>	No
<b>HouseWrap</b>	No
<b>Duct Insulation</b>	No

**Table 56: Uniform Baseline Characteristics**

Table 56 shows the building characteristics that are uniform throughout all prototypes. Many characteristics that varied across the climate zone and prototypes are shown in Table 57.

RNC CZ	CEC CZ	Story	Bldg Floor Area	Units/ Bldg	Unit Floor Area	Window Type	Roof	TXV	Tight Ducts	Cooling	Heating	Water Heater EF	Duct Design
1	01	2	10,800	12	900	2VL	49	No	No	SSAC	CHFC1	0.63	No
1	02	2	10,800	12	900	2VL	30	Yes	No	SSAC	CHFC1	0.63	No
1	03	2	10,800	12	900	2VC	19	Yes	No	SSAC	CHFC2	0.60	No
1	04	2	10,800	12	900	2VL	30	Yes	No	SSAC	CHFC2	0.60	No
1	05	2	10,800	12	900	2VC	19	Yes	No	SSAC	CHFC2	0.60	No
2	06	2	12,000	8	1,500	2VL	19	Yes	No	SSHP	SSHP	0.63	No
2	07	2	12,000	8	1,500	2VL	19	Yes	No	SSHP	SSHP	0.60	No
3	08	2	8,400	8	1,050	2VL	19	Yes	No	SSAC	CHFC2	0.63	No
3	09	2	8,400	8	1,050	2VL	38	Yes	No	SSAC	CHFC2	0.63	No
3	10	2	8,400	8	1,050	2VL	38	Yes	No	SSAC	CHFC1	0.63	No
4	11	2	13,936	12	1,161	2VS	38	Yes	No	SSAC	CHFC2	0.63	No
4	12	2	13,936	12	1,161	2VL	38	Yes	Yes	SSAC	CHFC2	0.63	No
4	13	2	13,936	12	1,161	2VS	38	Yes	Yes	SSAC	CHFC2	0.63	No
5	14	2	13,936	12	1,161	2VS	30	Yes	Yes	SSAC	CHFC1	0.63	No
5	15	2	13,936	12	1,161	2VS	30	Yes	Yes	SSAC	CHFC1	0.63	Yes
5	16	2	13,936	12	1,161	2VL	30	Yes	Yes	SSAC	CHFC2	0.63	Yes
1	01	3	21,000	20	1,050	2VL	19	No	No	PTAC	ER	0.76	No
1	02	3	21,000	20	1,050	2VL	19	No	No	PTAC	ER	0.76	No
1	03	3	21,000	20	1,050	2VC	19	No	No	PTAC	ER	0.76	No
1	04	3	21,000	20	1,050	2VL	19	No	No	PTAC	ER	0.76	No
1	05	3	21,000	20	1,050	2VL	19	No	No	PTAC	ER	0.76	No
2	06	3	21,528	17	1,266	2VC	19	Yes	No	SSAC	CHFC2	0.60	No
2	07	3	21,528	17	1,266	2VL	19	Yes	No	SSAC	CHFC2	0.60	No
3	08	3	75,000	62	1,210	2VL	19	No	No	PTHP	PTHP	0.76	No
3	09	3	75,000	62	1,210	2VL	19	No	No	PTHP	PTHP	0.76	No
3	10	3	75,000	62	1,210	2VL	19	No	No	PTHP	PTHP	0.76	No
4	11	3	22,800	24	950	2VS	38	No	Yes	SSAC	SSHP	0.76	Yes
4	12	3	22,800	24	950	2VS	49	No	Yes	SSAC	SSHP	0.76	Yes
4	13	3	22,800	24	950	2VS	38	No	Yes	SSAC	SSHP	0.76	No
5	14	3	22,800	24	950	2VS	38	No	Yes	SSAC	SSHP	0.76	Yes
5	15	3	22,800	24	950	2VS	38	No	Yes	SSAC	SSHP	0.76	Yes
5	16	3	22,800	24	950	2VL	49	No	Yes	SSAC	SSHP	0.76	Yes

**Table 57: Variable Baseline Characteristics**

The window type codes shown in column five as noted in the “window type” fields are defined with the performance characteristics shown in Table 58.

Code	U-Factor	SHGC
2VL	0.37	0.41
2VC	0.60	0.65
2VS	0.37	0.35

**Table 58: Window Property Values**

The codes shown in column ten of Table 57 as noted in the “Heating” and “Cooling” columns are defined with the performance characteristics shown in Table 59.

Code	Type	Efficiency
CHFC1	Combined Hydronic Fan Coil	80 Recovery Factor
CHFC2	Combined Hydronic Fan Coil	75 Recovery Factor
ER	Electric Resistance	3.4 HSPF
PTHP	Packaged Terminal Heat Pump	8.5 EER / 6.8 HPSF
SSHP	Split System Heat Pump	8.5 EER
SSAC	Split System Air Conditioner	13 SEER
PTAC	Packaged Terminal Air Conditioner	8.8 EER / 3.4 HSPF

**Table 59: Heating and Cooling System Types and Ratings**

## Measures

The same list of measure categories were evaluated as the single family analysis. The only difference was that the NightBreeze™ was not evaluated as the feasibility of this technology for multifamily buildings has not been confirmed.

## Incremental Measure Cost

The average gross incremental measure costs that were used in the analysis are shown in Table 60. Most costs in the table were gathered through an informal survey of equipment distributors. All modeled residences had individual unit cooling loads that warranted air-conditioning systems with a capacity of 1.5 tons or less.

Measure	Cost (\$)	
DuctInCon	100	Design phase measure actual incremental uncertain if any, requires a HERS inspection
DuctIns	150	150 per unit from Itron New Construction Potential Study
EER13	500	\$500 per SEER increase over 13 for properly sized units
EER14	1,000	\$500 per SEER increase over 13 for properly sized units
EER15	2,000	Incremental Cost of EER 15 unit with water cooled condenser
InsCredit	100	Requires Inspection
InstWH	650	\$650 incremental over 50 gallon EF 60 storage unit
RadBar	67	0.15 per square foot installed cost of barrier
Seer 14	500	\$500 per SEER increase over 13 for properly sized units
Seer 15	1,000	\$500 per SEER increase over 13 for properly sized units
Seer 16	1,500	\$500 per SEER increase over 13 for properly sized units
SuperLowE	88	Installed Cost 08 per square foot of CFA

**Table 60: Incremental Measure Costs**

## Cost Effectiveness

Table 61 ranks the twelve measures by cost effectiveness in each of the five RNC climate zones in terms of kBTU/yr-\$. The unit kBTU of source energy is a combined method for comparing natural gas and electrical energy savings measures. To convert kWh to kBTU a multiplier of three is applied, which accounts for the efficiency of electrical power generation. The measures are presented in order by the “average of ranking” column. Since heating fuel type has a dramatic impact on measure effectiveness, the rankings are segregated by heating fuel of the models.

The electrically heated ranking matrix has blank spaces where the measure was not evaluated for that climate zone. Ductless electric conditioning systems were modeled for RNC 1 and 3, so no duct related measures were evaluated for these climate zones. We could not find specifications for a PTHP that had high enough efficiency for a measure. High efficiency PTACs were only modeled and evaluated in RNC1, a climate zone with little cooling load, and the results for that zone presented alone would not present a fair comparison. A more comprehensive evaluation of these measures statewide is desirable, but the scope was limited by modeling strategies for the New Construction Potential Study.

Ducts in conditioned space received the highest ranking among measures that were modeled in each of the five RNC climate zones for both heating fuel types. The next most cost effective measure is insulation installation credit, scoring second in terms of cost effectiveness when averaging all of the RNC zones. Gas instantaneous hot water heaters, although this measure was only modeled for RNC 2 gas heated homes, but similar results are expected in other climate zones due to fact that water heating is not a

weather dependent enduses. Duct insulation, and radiant barrier also rank in the top five measures in each of the five climate zones. Super Low E windows had the most variability across heating fuel types and climate zone, due to negative savings for the heating end-use.

Cooling equipment such as high Seer and High EER air conditioning units are at the bottom of the cost effectiveness list. The cooling load on these multifamily building are proportionally lower due to lower window to floor ratio that single family units, which results in decreased cooling load on the units. Our costing research indicated that even though these units have much lower capacity that single family units, incremental costs would be similar, resulting in lower overall cost effectiveness for these measures

Measure	Gas Heating					
	DuctInCon	1	1	1	1	1
InsCredit	2	2	3	2	2	2.2
InstWH		3				3.0
SuperLowE	3	4	2	3	3	3.0
RadBar	4	5	4	4	4	4.2
DuctIns	5	6	5	5	5	5.2
EER13	6	7	6	6	6	6.2
EER14	7	9	7	7	7	7.4
Seer 14	8	8	8	8	10	8.4
Seer 15	9	10	9	10	9	9.4
EER15	11	12	10	9	8	10.0
Seer 16	10	11	11	11	11	10.8
Electric Heating						
DuctInCon		1		1	1	1.0
InsCredit	1	2	2	2	2	1.8
RadBar	3	3	3	4	5	3.6
SuperLowE	2	11	1	3	3	4.0
DuctIns		4		5	4	4.3
EER13		5		6	6	5.7
EER14		6		7	7	6.7
Seer 14		7		8	8	7.7
EER15		10		9	9	9.3
Seer 15		8		10	10	9.3
Seer 16		9		11	11	10.3

Table 61: Ranking of Cost Effectiveness for Measure by RNC Zone

## Electrical Energy Savings

Table 62 shows the kWh savings per square foot of conditioned floor area, by RNC climate zone. The savings are shown by each RNC zone and simple average of the five zones and heating fuel type. There is an obvious difference in measure savings between RNC zones 1 and 2 versus 3-5. RNC zones 1 and 2 are largely coastal climate zones with lesser cooling load, whereas RNC zones 3, 4 and 5 are cooling dominated.

Ducts in conditioned space is the measure that rates highest in terms of electric savings, especially for systems with ducted electrical heating. The Super Low E glazing measure performs well in for both heating fuel types. Other high ranking measures were EER 15 and EER 14 air conditioning units, which performed well in the heating climates on RNC 3, 4 and 5. As noted above, it is the incremental measure cost of these measures that constitute the largest barrier for widespread application of these technologies.

	RNC 1	RNC 2	RNC 3	RNC 4	RNC 5	Average
<b>Measure</b>	<b>Gas Heated Homes</b>					
DuctInCon	0.04	0.01	0.14	0.17	0.30	0.13
EER15	0.04	0.01	0.11	0.16	0.30	0.12
SuperLowE	0.08	0.06	0.13	0.14	0.13	0.11
EER14	0.03	0.01	0.08	0.12	0.23	0.09
Seer 16	0.03	0.01	0.06	0.08	0.12	0.06
EER13	0.02	0.01	0.05	0.07	0.15	0.06
Seer 15	0.02	0.01	0.06	0.07	0.13	0.06
RadBar	0.02	0.01	0.05	0.05	0.09	0.04
Seer 14	0.01	0.00	0.03	0.05	0.09	0.04
DuctIns	0.01	0.00	0.01	0.03	0.07	0.02
InsCredit	0.01	0.01	0.03	0.03	0.04	0.02
	<b>Electric Heated Homes</b>					
DuctInCon		0.18		0.67	1.14	0.66
InsCredit	0.08	0.11	0.09	0.23	0.29	0.16
SuperLowE	0.04	(0.01)	0.52	0.13	0.11	0.16
EER15		0.01		0.16	0.26	0.15
EER14		0.01		0.12	0.20	0.11
DuctIns		0.02		0.08	0.19	0.10
EER13		0.01		0.08	0.13	0.07
Seer 16		0.01		0.08	0.11	0.07
Seer 15		0.01		0.07	0.11	0.07
RadBar	0.02	0.03	0.05	0.05	0.08	0.04
Seer 14		0.00		0.05	0.08	0.04

**Table 62: Electrical Energy Savings (kWh/yr) per Square Foot of CFA by Measure and RNC Zone**

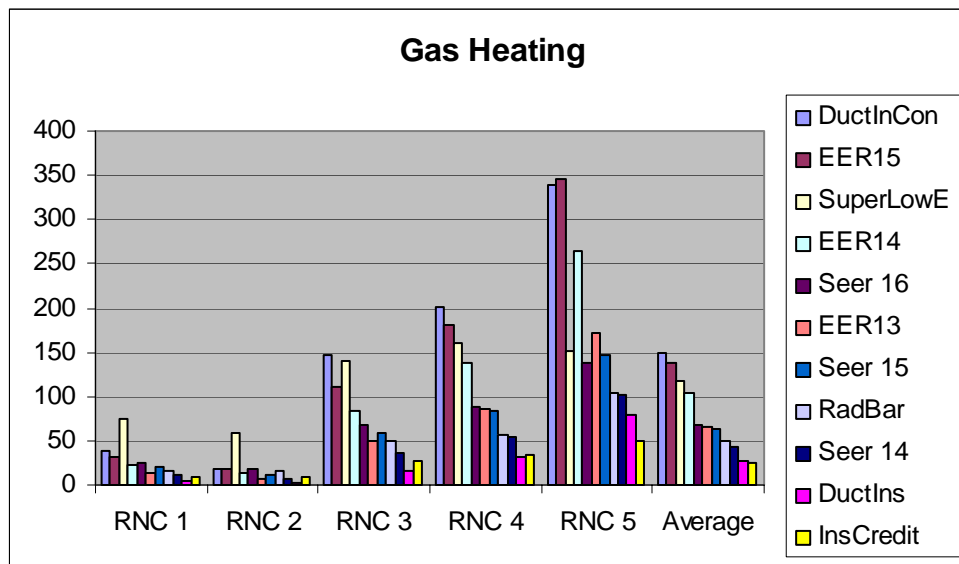
In order to provide an idea of the magnitude of energy savings these measures would have in the typical newly constructed multifamily home we present the following. Table 63 shows the kWh savings per dwelling unit for each measure and RNC climate zone. Unit square footage is taken from the baseline findings for multifamily two story and three story buildings. The Unit Floor Area multiplier values used in this analysis are shown in Table 57.

This table and associated graphs, show the superior performance of the ducts in conditioned space measure. Super Low E windows shows the next best savings across heating fuel types and climate zones, the electrically heated RNC 3 3-story prototype responded particularly well to this measure.

	RNC 1	RNC 2	RNC 3	RNC 4	RNC 5	Average
<b>Measure</b>	<b>Gas Heated Homes</b>					
DuctInCon	38	17	146	202	338	148
EER15	32	18	111	181	345	138
SuperLowE	75	58	140	161	150	117
EER14	23	13	83	137	265	104
Seer 16	25	17	68	89	139	68
EER13	14	7	51	86	171	66
Seer 15	19	12	58	84	148	64
RadBar	16	17	50	57	103	49
Seer 14	11	7	36	55	102	42
DuctIns	5	2	16	32	80	27
InsCredit	10	9	26	34	49	26
	<b>Electric Heated Homes</b>					
DuctInCon		277		636	1083	665
SuperLowE	39	-18	629	120	102	175
InsCredit	82	171	112	214	274	171
EER15		21		151	251	141
EER14		15		114	192	107
DuctIns		24		79	182	95
EER13		8		72	124	68
Seer 16		20		75	104	66
Seer 15		14		71	109	65
RadBar	19	38	63	47	73	48
Seer 14		7		46	75	43

**Table 63: Electrical Energy Savings (kWh/yr) per Unit by Measure and RNC Zone**

Figure 5 presents the data shown in Table 63 in a graphical format. The graph illustrates the relative impact of electrical savings for these measures in the coastal climate zones (e.g. RNC 1, 2) as opposed to the inland climate zones (e.g. RNC 3, 4, 5). Moreover, the figure also demonstrates the potential for energy savings from ducts in conditioned space and EER 15 air conditioning units in RNC 3, 4, and 5. Additionally, it shows high energy savings potential for EER 14 units in RNC 4 and 5.



**Figure 5: Per Unit Energy Savings (kWh/yr) of Gas Heated Multifamily Homes**

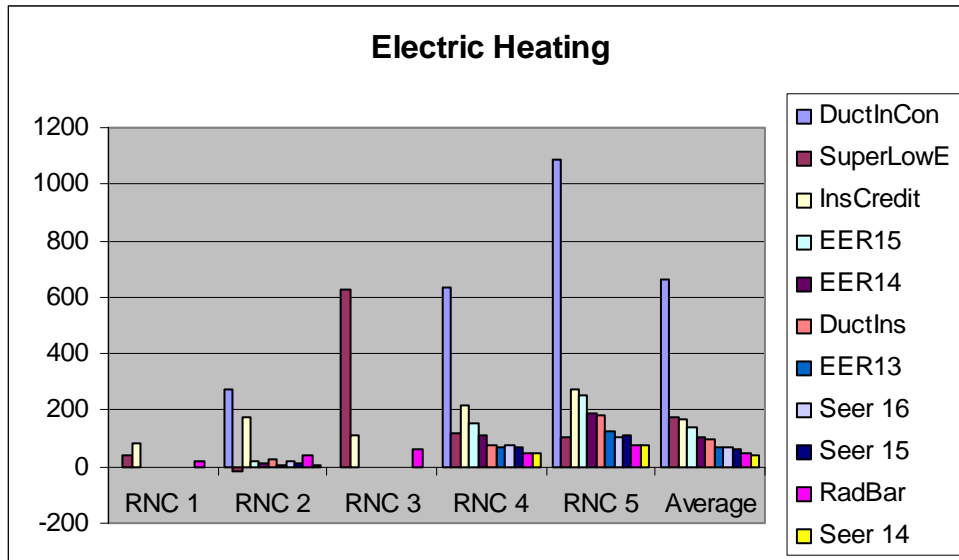


Figure 6: Per Unit Energy Savings (kWh/yr) of Electrical Heated Multifamily Homes

### Natural Gas Energy Savings

Table 64 shows the annual therms savings per square foot of conditioned floor area, by RNC climate zone for the natural gas heated prototypes. The savings are shown by each RNC zone, in addition to the simple average of the five zones. As pointed out in Table 61, Instantaneous water heaters lead all measures by a large margin in terms of therms saved. Although they were only tested in one climate zone RNC 2, similar results would be expected in all five zones since instantaneous water heaters are not weather dependent. Excluding Instantaneous water heaters, ducts in conditioned space was the leading energy saver in each of the five climate zones. Although this measure is less likely to be adopted in single family homes due to the number of furnaces that are attic installed and have attic run ducting, it is much more feasible to be employed in multifamily homes with of the number of closet installed furnaces and ducting runs between floors and in the walls. The next highest ranking measure was the insulation installation credit, which demonstrated the second largest savings in each of the five climate zones.

Since Super Low-E windows only impact the natural gas heating end-use, negative savings are found in all gas heated prototypes due to reduced passive solar heating that these windows produce. Falling last on the list of measures that produce measurable savings is Radiant Barrier.

Measure	RNC 1	RNC 2	RNC 3	RNC 4	RNC 5	Average
InstWH		0.058				0.058
DuctInCon	0.033	0.008	0.010	0.027	0.046	0.025
InsCredit	0.017	0.004	0.006	0.013	0.018	0.012
DuctIns	0.004	0.000	0.001	0.004	0.008	0.003
RadBar	0.002	0.000	0.001	0.001	0.001	0.001
SuperLowE	-0.005	-0.003	-0.003	-0.001	-0.003	-0.003

Table 64: Gas Savings (therms/yr) per Square Foot of CFA by Measure and RNC Zone

In order to demonstrate of the magnitude of energy savings these measures would have in the typical newly constructed home we present the following. Table 65 shows the

annual therms savings per unit for each measure and RNC climate zone. Unit square footage is taken from the baseline findings for multifamily two story and three story buildings. The CFA multiplier values used for this analysis are shown in Table 57 in the field labeled Unit Floor Area.

Measure	RNC 1	RNC 2	RNC 3	RNC 4	RNC 5	Average
InstWH		73.5				73.5
DuctInCon	29.3	9.9	10.7	31.5	53.3	26.9
InsCredit	15.5	4.9	6.6	15.3	20.4	12.5
DuctIns	3.3	0.6	1.0	4.5	9.2	3.7
RadBar	1.6	0.5	0.6	1.0	1.5	1.0
SuperLowE	-4.1	-3.8	-2.9	-0.9	-3.8	-3.1

Table 65: Natural Gas Savings (therms/yr) per Unit by Measure and RNC Zone

Figure 7 presents the data shown in Table 65 in a graphical format. Unlike the electric savings analysis, this figure demonstrates more consistency in the ranking of each measure in terms of therms savings across the five RNC zones.

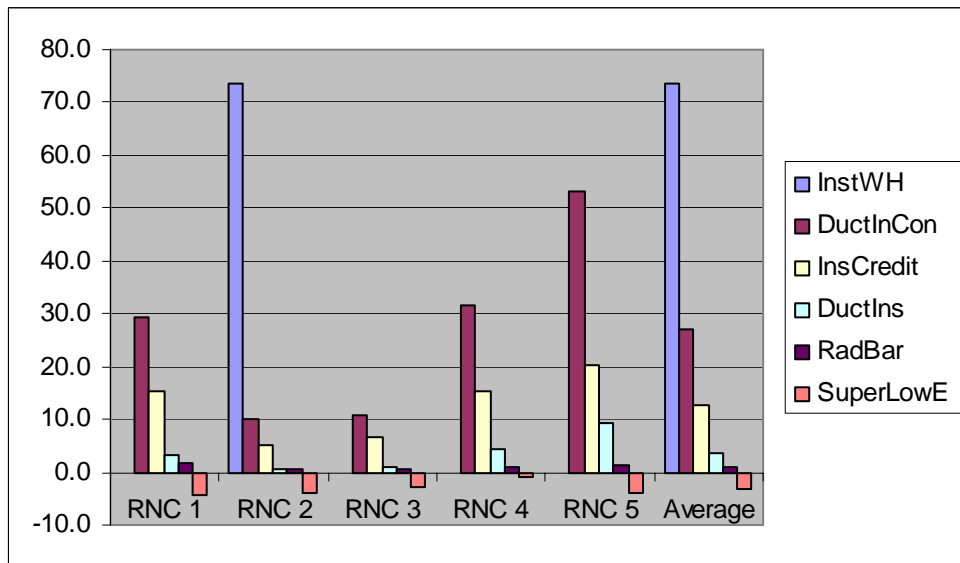


Figure 7: Graphical Representation of Table 65



# Marketing the ENERGY STAR Homes Program

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## Introduction

As a direct result of the KEMA single family builder interviews, there was a desire from several builders for,

*“the public to be more aware of the program (i.e. what it is about, what it does, what are the benefits, etc.), and builders simply don’t have the expertise or time to do it.”*

*“... the program would be more beneficial if the public was already clamoring for it...”*

While this feedback was single family specific, the comments struck a cord with us in our work and general knowledge of other energy efficiency programs. Furthermore in the context of the survey questions regarding incentives, we saw this as an opportunity to take a quick look at this “alternative” incentive.

As “pull” from the public increases, “push” (incentives) from the ENERGY STAR Homes Program could be decreased, or re-directed into further marketing activities. If the public’s value of an ENERGY STAR Home is high enough, incentives could be eliminated, in theory, with the incremental cost of program participation being more than recovered in increased home valuation. This effect would likely be most visible in market rate for-sale housing, and possibly for-rent housing as well.

While a home with 15% less energy usage may be desirable by most buyers, it is unlikely to be the primary home buying decision factor. More likely, it plays into the overall home valuation as compared to a similar non ENERGY STAR Home.

Although not the primary focus of this report, in response to the survey feedback, RLW has reviewed the marketing materials readily available from the IOU websites (and collateral materials when available) and the federal ENERGY STAR website. Here is what we found.

## Utility Websites

To simplify the results we looked for four key pieces of information (at each IOU’s website) to support the builders:

1) A Basic Package of homebuyer targeted ESH marketing information including:

- Basic program description
- ESH features and benefits
- How to find new ESHs

2) An Advanced Package of homebuyer targeted ESH materials including:

- Explanation of ESH energy efficiency measures
- Financial analysis of utility savings over time
- Video or slideshow with a features and benefits focus
- Other materials

3) A link to the Federal ENERGY STAR website

4) Builder program information and/or tools

We performed a quick search, similar to what a homebuyer may do, at each IOU website (PG&E, SDG&E, SoCalGas, SCE) for the above ESH program homebuyer information. The table below summarizes the results:

Information	Number of IOUs
IOUs providing a Basic Package	2 of 4
IOUs providing an Advanced Package	1 of 4
IOUs with link to the federal website	2 of 4
IOUs with Builder Program information	4 of 4

**Table 66: Number of utility websites providing ENERGY STAR information**

It is possible that we were not able to find some of the information at each IOU website, however then we must assume potential homebuyers would also have difficulty finding it as well.

One IOU offered a homebuyer's kit including:

- A video featuring testimonials from ENERGY STAR New Homeowners.
- A brochure describing these homes' energy-saving features and how they work.
- Information about developments near you, including descriptions, maps and sales office hours.
- Valuable coupons that can save you hundreds of dollars on products and services for your new home.

We reviewed the brochure and video and feel they are useful and effective.

## The Federal ENERGY STAR Website

The federal website at: <http://www.energystar.gov/index.cfm?c=home.index> is a good resource for general information about the ENERGY STAR program, including the ENERGY STAR Homes program. There is information for many different user groups, but information specifically targeting homebuyers is not comprehensive. The website does cover the Basic Package, as defined above, and includes some elements of an Advanced Package.

The website also contains a set of marketing tools intended for those *marketing to homebuyers*, rather than homebuyers directly. The following resource list was copied from: [http://www.energystar.gov/index.cfm?c=bldrs\\_lenders\\_raters.pt\\_Resources](http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.pt_Resources).

### Marketing & Sales Materials

Materials that can be used by program participants in an assortment of marketing efforts.

- [2005 Advertising Partnership Program](#)
- [Consumer Fact Sheets](#)
- [Downloadable Logos](#)
- [NEW Sales Toolkit](#)
- [NEW HomeCalc](#)
- [Marketing and Sales Presentation](#)
- [Sample Web Content for Homebuilders and Raters](#)
- [Sample Ads](#)
- [Builder Publicity Kit](#)
- [Modifiable Press Releases](#)

[News Articles](#)  
[Point of Purchase Marketing Examples](#)  
[PSAs](#)  
[ENERGY STAR brochures](#)  
[Plaques and Other Promotional Items](#)  
[Checklist for Homebuyers](#)

## Summary

The value of the ENERGY STAR Homes program to builders increases as homebuyers are more aware of the value of ENERGY STAR Homes. Builders feel limited in their desire and ability to promote the ESH program to homebuyers and would like to see another organization take a bigger role.

IOU website homebuyer-targeted marketing varies widely within California – from almost nothing to comprehensive. Surprisingly we could only find a link to the federal website at two of the four California IOUs, but all four had information for builders.

The federal ENERGY STAR website makes it easy to find information with their New Homes button, which contains useful information, but not California specific. It is unknown what percentage of new homebuyers visit this site prior to buying a home; certainly links to it would help.

Websites are not the end-all of marketing to homebuyers, although probably used more by California homebuyers than those in other states. Advertising or other promotional campaigns within California could also play a significant role in educating homebuyers; however an analysis of these efforts was outside the scope of this report. Hopefully the website review and comparison we have conducted provides some insights while admittedly not comprehensive.

Finally, the builder's feedback in the KEMA surveys and our own research raises several questions:

1. The ESH program is a partnership between the federal government, IOUs and builders. What perceptions exist regarding marketing and promotional responsibilities for the ESH program?
2. Are the builders fully utilizing the ESH marketing materials/tools currently available? Why or why not?
3. Do builders feel the ESH marketing materials/tools could be more effective?
4. To what degree are ESH marketing materials reaching homebuyers?
5. When they do, through what channels are homebuyers receiving them?
6. What incremental value do home buyers place on ENERGY STAR Homes?
7. Could that incremental value be increased?

Clearly, there is more that could be done in marketing the ESH program since,

*“...the public is not already clamoring for it.”*

## Appendix I: Survey Instruments

### Turnkey Interview Guide

**CALIFORNIA RESIDENTIAL NEW CONSTRUCTION PROGRAM EVALUATION  
TURNKEY PROGRAM OPERATOR QUESTIONNAIRE**

**Contact Name:** \_\_\_\_\_  
**Company:** \_\_\_\_\_  
**Address:** \_\_\_\_\_  
**City, State, Zip** \_\_\_\_\_  
**Telephone:** \_\_\_\_\_  
**E-mail:** \_\_\_\_\_  
**Date/Interviewer:** \_\_\_\_\_

**LEAD-IN:** Hello, my name is \_\_\_\_\_ and I am calling from KEMA Inc. We are working with the California utilities to evaluate the Statewide Residential New Construction Program and to support planning for new initiatives. As part of our work we are interviewing residential new construction experts to gather their views on the likely effects of changes in Title 24 on construction practices and builder interest in energy efficiency programs.

**ESTABLISHMENT DATA**

I'd like to begin with a few general questions about your company.

**E.1 [ASK ONLY IF CANNOT BE ASCERTAINED FROM PREVIOUS WORK OR THE INTERNET.]** In which states does your company operate?

\_\_\_\_\_

E.2 Which of the following services does your company provide?

Service	E.2
Title 24 Documentation	
HERS Home Inspections	
Assistance to ENERGY STAR Program applicants	
Design assistance	
Marketing assistance	
Proprietary certification program	
Other 1 (Specify)	
Other 2 (Specify)	

E.2.a To how many California builders did you provide these services in the past 12 months?

ENTER NUMBER \_\_\_\_\_

E.2.b Roughly how many single-family units were covered by these services?

ENTER NUMBER ..... \_\_\_\_\_

E.2.c And roughly how many multi-family buildings were covered by these services?

ENTER NUMBER ..... \_\_\_\_\_

E.2.d What portion of these multifamily buildings were high rise?

ENTER PERCENT ..... \_\_\_\_\_

E.3 Roughly what percentage of your Title 24 related business involves homes built in Coastal Climate zones versus Inland zones?<sup>20</sup>

ENTER PERCENT COASTAL ..... \_\_\_\_\_

E.4 Based on your experience, do builders alter their prototype plans depending on the location of the project: coastal v. inland? IF YES: What kinds of changes do builders most often make adjust for different requirements in the coastal and inland zones?

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**TURNKEY PROGRAM RESPONSE TO 2005 TITLE 24 CHANGES**

T.0.a Generally speaking, what do you think will be the most significant impacts of the impending changes in Title 24 on your business?

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T.1 Are you planning to make any changes in the roster of services that you offer builders in response to the impending changes in Title 24? IF YES, What are those changes?

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<sup>20</sup> If needed: Coastal climate zones are 1 – 7. Inland are 8 – 16.

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T.2 Are you planning to make any changes in the technical methods used to deliver Title 24 and energy efficiency-related services in response to changes in Title 24? IF YES, What are those changes?

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T.3 Are you planning to make any changes to marketing and other commercial elements of your operations in response to changes in Title 24? IF YES, What are those changes?

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**BUILDER AWARENESS & CONCERN RE: 2005 CHANGES**

B.1 What percentage of the builders you work with regularly appear to be aware of the impending changes in Title 24?

ENTER PERCENT ..... \_\_\_\_\_

B.2 What concerns have they voiced regarding these changes?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

B.3 What do you think will be the greatest impact of the changes in Title 24 on builders of single-family homes?

\_\_\_\_\_  
\_\_\_\_\_

B.4 How about for builders of low-rise multi-family buildings?

\_\_\_\_\_  
\_\_\_\_\_

B.5 And for builders of high-rise multi-family buildings?

\_\_\_\_\_  
\_\_\_\_\_

B.6 Do you think that changes in Title 24 standards for multifamily buildings will have a different effect on owner-occupied versus rental buildings? IF YES: What do you think those differences will be?

\_\_\_\_\_  
\_\_\_\_\_

**EFFECTS ON BUILDING PRACTICES**

Next, I'd like to ask you a few questions about changes in design and construction practices that you anticipate as a result of the implementation of the 2005 Title 24 standards. Let's begin with changes you anticipate in **single-family** homes built in the **Coastal Zones**.

- C.1.a First, in the Coastal Zones, what measures do you think single-family home builders will use most frequently to just meet but not significantly exceed the 2005 Title 24 standards?
- C.1.b What measures, in addition to those you just mentioned, will builders use most frequently to significantly exceed the 2005 Title 24 standards?
- C.1.c **[ASK FOR ALL MEASURES MENTIONED IN C.1.a AND C.1.b.]** Using a scale of 1 to 5 where 1 is insignificant and 5 is very significant: What impact will the inclusion of [NAME OF MEASURE] have on construction costs?
- C.1.d **[ASK FOR ALL MEASURES MENTIONED IN C.1.a AND C.1.b.]** Are there barriers other than cost that may inhibit builders from using this measure? IF YES, RECORD VERBATIM.

**ANSWER GRID: COASTAL CLIMATE ZONES: SINGLE FAMILY**

Measure	C.1.a	C.1.b	C.1c	C.1.d
HE Windows	1	1		
Increased Wall Insulation	2	2		
Increased Roof Insulation	3	3		
Radiant Barrier	4	4		
TXV	5	5		
Tight Ducts	6	6		
Infiltration Testing	7	7		
HE air conditioner (12 and 14)	8	8		
High SEER/EER Credit	9	9		
HE Furnace	10	10		
HE Water Heater	11	11		
ACCA Duct Design	12	12		
Increased Duct Insulation	13	13		
Other 1	14	14		
Other 2	15	15		



- C.2.a Now, in the **Inland Zones** what measures do you think single-family home builders will use most frequently to just meet but not significantly exceed the 2005 Title 24 standards?
- C.2.b What measures, in addition to those you just mentioned, will builders use most frequently to significantly exceed the 2005 Title 24 standards?
- C.2.c **[ASK FOR ALL MEASURES MENTIONED IN C.2.a AND C.2.b.]** Using a scale of 1 to 5 where 1 is insignificant and 5 is very significant: What impact will the inclusion of [NAME OF MEASURE] have on construction costs?
- C.2.d **[ASK FOR ALL MEASURES MENTIONED IN C.2.a AND C.2.b.]** Are there barriers other than cost that may inhibit builders from using this measure? **IF YES, RECORD VERBATIM.**

**ANSWER GRID: INLAND CLIMATE ZONES: SINGLE FAMILY**

Measure	C.2.a	C.2.b	C.2c	C.2.d
HE Windows	1	1		
Increased Wall Insulation	2	2		
Increased Roof Insulation	3	3		
Radian Barrier	4	4		
TXV	5	5		
Tight Ducts	6	6		
Infiltration Testing	7	7		
HE air conditioner (12 and 14)	8	8		
HE Furnace (.90 AFUE)	9	9		
HE Water Heater	10	10		
ACCA Duct Design	11	11		
Increased Duct Insulation	12	12		
Insulation Installation Certification	13	13		
Other 1	14	14		
Other 2	15	15		

- C.3.a **[ASK THIS SEQUENCE ONLY IF FIRM'S PRACTICE ADDRESSES LOW-RISE MULTIFAMILY BUILDINGS.** For low-rise multi-family buildings regardless of location within California, what measures do you think builders will use most frequently to just meet but not significantly exceed the 2005 Title 24 standards?
- C.3.b What measures, in addition to those you just mentioned, will builders use most frequently to significantly exceed the 2005 Title 24 standards?
- C.3.c **[ASK FOR ALL MEASURES MENTIONED IN C.3.a AND C.3.b.]** Using a scale of 1 to 5 where 1 is insignificant and 5 is very significant: What impact will the inclusion of [NAME OF MEASURE] have on construction costs?
- C.3.d **[ASK FOR ALL MEASURES MENTIONED IN C.3.a AND C.3.b.]** Are there barriers other than cost that may inhibit builders from using this measure? **IF YES, RECORD VERBATIM.**

**ANSWER GRID: LOW RISE MULTI-FAMILY**

C.3.a	C.3.b	C.3c	C.3.d
1	1		
2	2		
3	3		
4	4		
5	5		
6	6		
7	7		
8	8		

- C.3.e Do you think that there will be differences between owner-occupied and rental developments in terms of strategies used to meet or exceed the revised Title 24 requirements? IF YES: What do you think those differences will be?

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- C.4.a **[ASK THIS SEQUENCE ONLY IF FIRM'S PRACTICE ADDRESSES HIGH - RISE MULTIFAMILY BUILDINGS.]** Finally, for high-rise multi-family buildings regardless of location within California, what measures do you think builders will use most frequently to just meet but not significantly exceed the 2005 Title 24 standards?
- C.4.b What measures, in addition to those you just mentioned, will builders use most frequently to significantly exceed the 2005 Title 24 standards?
- C.4.c **[ASK FOR ALL MEASURES MENTIONED IN C.4.a AND C.4.b.]** Using a scale of 1 to 5 where 1 is insignificant and 5 is very significant: What impact will the inclusion of [NAME OF MEASURE] have on construction costs?
- C.4.d **[ASK FOR ALL MEASURES MENTIONED IN C.4.a AND C.4.b.]** Are there barriers other than cost that may inhibit builders from using this measure? **IF YES, RECORD VERBATIM.**

**ANSWER GRID: HIGH RISE MULTI-FAMILY**

C.4.a	C.4.b	C.4.c	C.4.d
1	1		
2	2		
3	3		
4	4		
5	5		
6	6		
7	7		
8	8		

- C.4.e Do you think that there will be differences between owner-occupied and rental developments in terms of strategies used to meet or exceed the revised Title 24 requirements? IF YES: What do you think those differences will be?

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C.5.a I am going to read a list of other potential energy efficiency measures that are mentioned in the 2005 version of Title 24 that builders could use to meet performance standards. On a scale of 1 to 5, where 1 is not at all likely and 5 is very likely, which of the following measures are builders likely to include in compliance packages for the 2005 standards?

C.5.b PROBE REASONS FOR ITEMS RATED 1 OR 5

Measure	C.5.a	C.5.b
1. Reduced window area (West facing)		
2. High SEER/EER AC Credit		
3. Super high efficiency AC (SEER 15-16)		
4. Super high efficiency furnace (AFUE 92)		
5. Solar Hot Water		
6. Tankless hot water		
7. Architecturally integrated Shading		
8. Evaporative cooling (direct )		
9. Extra low solar gain low E Windows		
10. Shade Screens		
11. Other		

C.5.c I am going to read a list of other potential energy efficiency measures that are **not** mentioned in the 2005 Title 24 standards that builders could use to reduce energy and peak demand. On a scale of 1 to 5, where 1 is not at all likely and 5 is very likely, which of the following measures are builders likely to use?

C.5.d PROBE REASONS FOR ITEMS RATED 1 OR 5

Measure	C.5.c	C.5.d
1. Indirect-direct Evaporative Cooling		
2. Whole house fans		
3. Ventilation integrated economizer systems		
4. Attic venting systems		
5. Photovoltaic (PV)		
6. Energy Star Appliances		
8. Passive Solar Design Strategies		

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C.6 Are any of the builders you work with seeking to use the early compliance option for the lighting standard?

C.6.a IF C.6 = YES: What portion of the builders you work with have applied for the early compliance credit?  
ENTER PERCENT ..... \_\_\_\_\_

C.6.b How strong a motivation does the performance standard credit provide for early compliance?  
\_\_\_\_\_  
\_\_\_\_\_

C.6.d Why do you say that?  
\_\_\_\_\_  
\_\_\_\_\_

EFFECT OF TITLE 24 CHANGES ON STRATEGIC IMPORTANCE OF ENERGY EFFICIENCY & RELATED PROGRAMS

S.1 Under the current Title 24 standards and market conditions, how important is energy efficiency in marketing new homes? Use a scale of 1 to 5.

Not at all important					Very Important	(Don't know)	(Refused)
1	2	3	4	5	8	9	

S.2 When the new Title 24 standards take effect, do you think that the importance of energy efficiency in marketing new homes will increase, decrease, or stay the same?

Increase.....	1
Decrease.....	2
Stay the same.....	3
Don't know.....	4

S.3 IF S.2 = 1,2, OR 3, ASK: Why do you say that?  
\_\_\_\_\_  
\_\_\_\_\_

S.4 Under current Title 24 standards and market conditions, how important is the ENERGY STAR label in marketing new homes? Use a 1 – 5 scale.

Not at all important					Very Important	(Don't know)	(Refused)
1	2	3	4	5	8	9	

S.4.a Why do you say that?

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S.5 When the new Title 24 standards take effect, do you think the importance of the ENERGY STAR label in marketing new homes will increase, decrease, or stay the same?

Increase.....	1
Decrease .....	2
Stay the same.....	3
Don't know.....	4

S.6 **IF S.5 = 1,2, OR 3, ASK:** Why do you say that?

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S.6.a Do you think another label that denotes an even higher level of energy efficiency will be useful in marketing new homes?

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S.6.b Why do you say that?

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S.7 Under current Title 24 standards and market conditions, how important are utility programs in encouraging builders to increase the energy efficiency of new homes? Use a 1 – 5 scale.

Not at all important					Very Important	(Don't know)	(Refused)
1	2	3	4	5	8	9	

S.7.a Why do you say that?

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S.8 When the new Title 24 standards take effect, do you think the importance of utility programs in encouraging builders to increase the energy efficiency of new homes will increase, decrease, or stay the same?

Increase.....	1
Decrease .....	2
Stay the same.....	3
Don't know.....	4

S.9 Why do you say that?

**RESPONSE TO POTENTIAL PROGRAM FEATURES**

**In this final part of the interview I'd like to ask you for your response to a number of current and potential features of the program.**

P.1 Currently, all projects participating in the California Energy Star New Homes Program must exceed Title 24 compliance using performance criteria by a minimum of 15 percent to qualify for any financial incentives. If they exceed Title 24 by 20 percent or more, they are eligible for higher levels of incentives. The “compliance margins” are uniform statewide, but incentives vary with climate zone and building type. The utility sponsors of the statewide program are considering alternatives for restructuring compliance criteria for the California ENERGY STAR NEW HOMES program. Please tell me what you think are the main advantages and disadvantages of the following alternative approaches compared to the current structure of uniform performance-based compliance margins.

Alternative Approach	Advantages	Disadvantages/
a. Performance based with varying compliance targets across state dependent upon climate zone. For example, the coastal requirement may be 20% vs. the inland requirement of 10%		
b. A combination performance based program with prescriptive “adders”.		
c. Prescriptive based program		

P.1.d Do you think you would need to adjust any of your services or your business practices in response to such potential changes in the compliance approach? IF YES: What kinds of changes would you need to make?

P.2 Many programs have a sliding scale structure for incentives. The sponsoring utilities are also considering a sliding scale structure, for example full incentive for first five buildings of a particular plan, 20% less incentive for next 10 buildings built using same plan, 40% less next 20, etc. The purpose of this change is to expand the capacity of the program to support greater numbers of projects.

On a scale of 1 to 5 where 1 is insignificant and 5 is very significant: How significant do you think the effect of such a change will be on the number of homes submitted for ENERGY STAR labeling by builders who currently participate in the program?

Not at all important 1      2      3      4      Very Important 5      (Don't know) 8      (Refused) 9

P.2.a Why do you say that?

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P.3. Finally, in the last round of evaluation interviews you and your colleagues identified the need for HERS verification as a major barrier to participation in the program, as well as to the adoption of certain measures such as duct sealing. Do you believe that this is still the case?

Yes ..... 1  
No ..... 2  
Don't know..... 3

P.3.a Do you think the changes in Title 24 will increase, decrease, or not affect the importance of HERS verification inspections as a barrier to program participation and measure adoption?

Increase..... 1  
Decrease ..... 2  
Not affect ..... 3  
Don't know..... 4

P.4 Do you have any suggestions or recommendations about how the California Energy Star Homes program could be improved, especially in light of the impending changes in Title 24?

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**THANK YOU VERY MUCH FOR YOUR TIME AND COOPERATION!**

## Single Family Production Builder Survey Instrument

### California Residential New Construction Program Evaluation



### Single Family Builder Questionnaire

**Contact Name:** \_\_\_\_\_  
**Company:** \_\_\_\_\_  
**Address:** \_\_\_\_\_  
**City, State, Zip** \_\_\_\_\_  
**Telephone:** \_\_\_\_\_  
**E-mail:** \_\_\_\_\_  
**Date/Interviewer:** \_\_\_\_\_

**LEAD-IN:** Hello, my name is \_\_\_\_\_ and I am calling from KEMA Inc. We are working with the California utilities to help assess potential changes for the 2006 California Energy star New Homes Program. As part of our work we are interviewing homebuilders to gather their views on the current construction practices and interest in energy efficiency programs.

**Establishment Data**

I'd like to begin with a few general questions about your company.

E.1 Which of the following kinds of construction projects does your company undertake?

E.1.a ASK FOR EACH TYPE OF PROJECT NAMED IN E.1: Roughly how many \_\_\_\_\_ units did your company complete in 2004 in the state of California?

E.1.b And roughly how many separate projects or developments do these units represent?

Service	E.1	E.1.a	E.1.b
Single Family Custom Homes: built according to plans developed or modified specifically for the owner.			
Single Family production homes			
Low-rise Multifamily for sale product			
Low-rise Multifamily for rent product			
High-rise Multifamily			

My questions today concern only the work you did on single-family homes in California.

E.2 What percentage of the single-family homes that you built this year were located in coastal, as opposed to inland regions?

ENTER PERCENTAGE COASTAL, 997 FOR DK \_\_\_\_\_

**Current Building Practices**

IF RESPONDENT BUILT HOMES IN COASTAL AND INLAND REGIONS, ASK P.1.a AND P.1.B. IF RESPONDENT BUILT IN ONLY ONE REGION, ASK THE APPROPRIATE QUESTION.

P.1.a **Coastal.** I am going to read you a list of energy-related home features. Thinking about the homes you built this year in **coastal** regions, please tell me whether you included these features ...[READ MEASURES]

- In all of the units ..... 1
- In most of the units ..... 2
- In some of the units ..... 3
- In none of the units ..... 4
- Don't know ..... 5

P.1.b **Inland.** Thinking about the homes you built this year in **inland** regions, please tell me whether you included these features ...[READ MEASURES]

- In all of the units ..... 1
- In most of the units ..... 2
- In some of the units ..... 3
- In none of the units ..... 4
- Don't know ..... 5

Item #	Measure	P.1.a Coastal	P.1.b Inland
1	Vinyl Frame, double pane, low-e windows (Low E 170)		
2	Super high efficiency vinyl frame, double pane, low-e windows (LowE2 140)		
3	Wall Insulation R 19 or above		
4	Roof Insulation R 38 or above		
5	Radiant Barrier		
6	Housewrap (Tyvek)		
7	ACCA Duct Design		
8	Duct Insulation of R 4.2 or greater		
9	High Efficiency Furnaces: AFUE 90 or higher		
10	Central Air Conditioning: SEER 12 or higher		
11	HE Water Heater: Energy Factor > .575 for 50 gal tank		
12	Infiltration Testing and Certification		
13	Thermal Expansion Valves		
14	Tight Duct Certification		

P.2 Over the past two years, has the percentage of homes in which you apply the following measures ...

- increased 1
- decreased 2
- or stayed about the same? 3
- Don't know/refused 4

		P.2
a.	Infiltration Testing and Certification	
b.	Thermal Expansion Valves	
c.	Tight Duct Certification	

**IF RESPONDENT REPORTS USING THE ABOVE 3 MEASURES IN LESS THAN “ALL UNITS” (SEE RESPONSE TO P.1) ASK P.3.**

P.3 For these measures, please tell me if you obtained HERS inspections for...

- All installations 1
- Most installations 2
- Some installations 3
- None of the installations 4
- Don't know/refused 5

		P.3
a.	Infiltration Testing and Certification	
b.	Thermal Expansion Valves	
c.	Tight Duct Certification	

P.4 For the same three measures, would you say that the requirement for HERS inspections constitutes...

A serious barrier for their inclusion in homes you build 1

Something of a barrier, or 2

Little or no barrier to their inclusion 3

Don't know/refused 4

		P.4
a.	Infiltration Testing and Certification	
b.	Thermal Expansion Valves	
c.	Tight Duct Certification	

**BUILDER AWARENESS OF CHANGES IN TITLE 24 AND PROJECTED CHANGES IN BUILDING PRACTICES**

B.1 Have you heard about changes in Title 24 that are scheduled to take effect in October 2005?

Yes ..... 1  
 No ..... 2  
 Don't know..... 3

**IF B.1 = YES, ASK B.2. ELSE SKIP TO B.6.**

B.2.a From your point of view, what is the most important difference between the 2001 and 2005 versions of Title 24?

B.2.b **IF RESPONDENT ANSWERS B.2.a OTHER THAN DON'T KNOW, ASK:** Are there other important differences between the two versions?

Difference	B.2.a	B.2.b
Don't know	1	
Lower energy budgets/Generally more stringent standards	2	2
Infiltration barrier replaced by air retarding wrap	3	3
Higher required duct insulation levels	4	4

Higher required pipe insulation levels	5	5
Reduced fenestration in hot climate zones	6	6
Low Solar Heat Gain glass required	7	7
New Federal standards for heating and cooling equipment	8	8
Prescriptive requirements for high efficiency lighting	9	9
Compliance credit for high EER equipment	10	10
Compliance credit for improved insulation installation	11	11
Credit for verified central AC refrigerant charge & air flow	12	12
Requirements for HVAC system sizing documentation	13	13
Other (Specify)	14	14

**IF RESPONDENT CAN NAME 2 OR MORE CHANGES IN B.2, ASK B.3. ELSE SKIP TO B.7.**

B.3 Do you think you will be able to meet the 2005 Title 24 requirements without using any measures that require HERS inspections?

- Yes 1
- In some cases or climate zones 2
- No 3
- Don't know 4

**IF B.3 = IN SOME CASES or NO, ASK B.4. ELSE SKIP TO B.5.**

B.4.a Which of the following measures are you most likely to include in future projects to meet the 2005 Title 24 standards? [READ MEASURES.]

B.4.b Which measure are you least likely to include?

		B.4.a	B.4.b
1.	Infiltration Testing and Certification		
2.	Thermal Expansion Valves		
3.	Tight Duct Certification		

B.5 On a scale of 1 to 5 where 1 is “very unlikely” and 5 is “very likely”: How likely are you to install the following measures to meet the revised 2005 code? [ENTER 8 FOR DK; 9 FOR REFUSED.]

		<b>B.5</b>
a.	Gas instantaneous hot water heater	
b.	Electric instantaneous hot water heater	
c.	High EER HVAC equipment	

B.6 What other changes in building design or installation of energy efficiency measures are you planning to make in order to comply with the 2005 Title 24 standards?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

B.6.a Compared to the typical home you now build, how much additional do you think it will cost per home to comply with the new Title 24 standards?

ENTER AMOUNT, 9 FOR DK ..... \_\_\_\_\_

B.7 Do you have any concerns about how the impending changes in Title 24 will affect your business?

- Yes            1
- No             2
- Don't know   3

**IF B.7 = YES ASK B.8. ELSE SKIP TO S.1.**

B.8 What are those concerns?

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**Effect of Changing Standards on Business Importance of Energy Efficiency**

S.1 Under the current Title 24 standards and market conditions, how important are the Energy Star label or other energy efficiency labels in marketing new homes? Please use a scale of 1 to 5 where 1 is “not at all important” and 5 is “very important”.

Not at all important					Very Important	(Don't know)	(Refused)
1	2	3	4	5	8	9	

**READ:** The impending changes to Title 24 will reduce the allowable energy budgets in single-family homes by up to 20 percent in coastal regions and 30 – 40 percent in inland regions. They will also require extensive use of energy efficient lighting. Energy analysts estimate the average cost per house of upgrading current practices to the 2005 standards to range from \$0 to \$600 in coastal areas and \$400 to \$1,900 in inland areas.

S.2 Taking this information into account, do you think that the importance of energy efficiency in marketing new homes will increase, decrease, or stay the same when the new standards take effect?

- Increase..... 1
- Decrease ..... 2
- Stay the same..... 3
- Don't know..... 4

S.3 **IF S.2 = 1,2, OR 3, ASK:** Why do you say that?

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**Energy Star Program Participation**

R.1 Has your company ever received incentives from Pacific Gas & Electric, Southern California Edison, or San Diego Gas & Electric for building one or more homes that qualify for the utilities' Energy Star New Homes program?

- Yes            1
- No             2
- Don't know   3

**IF R.1 = YES, ASK R.1.a. ELSE SKIP TO R.13.a.**

R.1.a        What was the main reason you decided to participate in the program?  
[ACCEPT ONE ONLY.]

R.1.b        Were there other reasons? [ACCEPT MULTIPLES.]

Reason	R.1.a	R.2.b
Receive financial incentives	1	1
Differentiation in the market place	2	2
Advertising partnership	3	3
Third-party inspections and recognized label	4	4
Means to achieve Title 24 compliance	5	5
Other (Specify):	6	6
Don't know	7	7

R.4        What percentage of the homes you built this year received rebates from the Energy Star New Homes Program?

ENTER NUMBER        \_\_\_\_\_

R.5 On average, how much did it cost per home to participate in the Energy Star New Homes program

ENTER AMOUNT, 997 FOR DK ..... \_\_\_\_\_



R.6 Among the homes you built this year that did not receive rebates from the Energy Star Homes program, what percentage would you say met the program's energy efficiency standards?

ENTER PERCENT \_\_\_\_\_

R.7 Did you obtain California HERS ratings for any of those homes?

Yes 1

No 2

Don't know 3

**IF R.7 = YES, ASK R.7.a. ELSE SKIP TO R.8.**

R.7.a Roughly speaking, for how many non-Energy Star Homes did you obtain California HERS ratings?

ENTER NUMBER \_\_\_\_\_

R.7.b What was the main reason you sought California HERS ratings for these homes?

R.7.c Were there any other reasons?

\_\_\_\_\_  
\_\_\_\_\_ Main Reason:

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

R.8 How would you characterize the impact of the Energy Star label on the marketability of the typical home that your build? Would you say that the Energy Star label has...

A positive impact 1

No impact, or 2

A negative impact 3

[Don't Know] 4

on the marketability of the home?

R.8.a Why do you say that?

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R.8.b Has participation in the Energy Star New Homes program helped your company gain marketing exposure?

Yes 1

No 2

Maybe 3

Don't know 4

R.9 Do you plan to continue participating in the program in 2005?

Yes 1

No 2

Maybe 3

Don't know 4

R.9.a On a scale of 1 to 5 where 1 is “not at all important” and 5 is “very important”: How important was the availability of financial incentives in your decision to participate in the program?

Not at all important 1 2 3 4 Very Important 5 (Don't know) 8 (Refused) 9

R.10.a Under the current program design, new homes must consume 15 percent less than the allowed energy budget under Title 24 in order to qualify for program incentives, regardless of the climate zone in which they are located. In response to the impending changes in Title 24, the utilities are considering several alternative criteria to qualify homes for program support. Which of the following three approaches would be most attractive to you?

R.10.b Which would be least attractive to you?

R.10.c **IF RESPONDENT NAMES ONE ALTERNATIVE AS ‘LEAST ATTRACTIVE’ ASK:** Why is this alternative unattractive to you?

Qualification Approach	R.10.a	R.10.b	R.10.c
Use performance calculations only with different compliance margins for coastal and inland zones. For example, the compliance margin for inland zones would be 10 percent more efficient than Title			



**IF R.12 = YES, ASK R.12.a. ELSE ASK R.12.b.**

R.12.a Would you be interested in participating if the incentive were set at 25 percent of the estimated cost of meeting program requirements?

Yes 1

No 2

Don't know 3

**GO TO R.13.a.**

R.12.b Would you be interested in participating if the incentive were set at 75 percent of the estimated cost of meeting program requirements?

Yes 1

No 2

Don't know 3

R.13.a The California utilities are considering a number of alternative methods for allocating incentives. Assuming you would receive the same total amount of incentives under all methods, could you tell me which of the following three alternatives would be most attractive to you? [READ ALTERNATIVES FROM GRID.]

R13.b Which would be least attractive?

Incentive Approach	R.13.a	R.13.b
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Reason	O.2.a	O.2.b
Receive marketing support	1	1
Differentiation in the market place	2	2
Technical services and support	3	3
Third-party inspections and recognized label	4	4
Means to achieve Title 24 compliance	5	5
Other (Specify):	6	6
Don't know	7	7

O.3 In your view, how did the benefits you gained from participating in [NAME OF OTHER PROGRAM(S)] compare to the benefits of participating in the Energy Star Homes Program?

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O.4. The upcoming changes in Title 24 are in some cases more stringent than current efficiency requirements for homes that meet the federal Energy Star standards. Unless the federal standards are changed, utilities may need to develop their own label to designate homes that are more efficient than the Title 24 standards.

If the program stopped using the Energy Star label and substituted a California-specific label, would this change...

- Encourage you to continue participating in utility-sponsored program 1
- Discourage you from participating in the program..... 2
- Have no effect on your decision to participate..... 3
- Don't know..... 4

**IF O.4 = 1, 2, OR 3, ASK O.5. ELSE SKIP TO O.6.**

O.5. Why do you say that?

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O.6 Finally, do you have any suggestions or recommendations about how the California Energy Star Homes program could be improved, especially in light of the impending changes in Title 24?

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**THANK YOU VERY MUCH FOR YOUR TIME AND COOPERATION.**

## **Multifamily Developer Survey**

**CALIFORNIA RESIDENTIAL NEW CONSTRUCTION PROGRAM EVALUATION**

**MULTIFAMILY BUILDER, ARCHITECT AND DEVELOPER QUESTIONNAIRE**

**Contact Name:** \_\_\_\_\_

**Company:** \_\_\_\_\_

**Address:** \_\_\_\_\_

**City, State, Zip** \_\_\_\_\_

**Telephone:** \_\_\_\_\_

**E-mail:** \_\_\_\_\_

**Date/Interviewer:** \_\_\_\_\_

**LEAD-IN:** Hello, my name is \_\_\_\_\_ and I am calling from RLW Analytics Inc. We are working with the California utilities to help assess potential changes for the 2006 California ENERGY STAR New Multifamily Homes Program. As part of our work we are interviewing builders, architects, and Title 24 consultants to gather their views on the current construction practices and interest in energy efficiency programs.

### **ESTABLISHMENT DATA**

I'd like to begin with a few general questions.

Q1. Is your firm involved in the design, energy consulting and or construction of



multifamily housing?

- 01 Yes
- 02 No THANK AND TERMINATE
- 98 Don't Know/Refused

Q2. How much of your business is related to multifamily housing project development and construction?

- 01 All of, or the great majority are multifamily housing projects
- 02 Most are multifamily housing projects
- 03 A small amount are multifamily housing
- 04 We/I don't do any multifamily housing currently (Terminate)
- 98 DK
- 99 Refused

Q3. Do you personally make or influence energy efficiency design decisions in multifamily projects?

- 01 Yes Title: \_\_\_\_\_
- 02 No
- 98 Don't Know/Refused

If no or don't know, who should I speak with in your organization?

Name \_\_\_\_\_ Title: \_\_\_\_\_ Phone: \_\_\_\_\_

### **MF Training Assessment (Participated in Training <<YES OR NO>> Merged**

**Our records show that you participated in a multifamily training session that was held at << \_\_\_\_\_ >> (Pacific Energy Center or CTAC).**

Q4. Do you recall going to this training session?

- 01 Yes
- 02 No
- 98 Not Sure/Do not Know/Refused (**Skip to Q10**)

Q5. How did you hear about this training session?

- 01 Utility Representative
- 02 Email from the PEC
- 03 Internet Research
- 04 Friend or Colleague
- 05 HMG Representative
- 06 Other: \_\_\_\_\_
- 98 Not Sure/ Do not Know

Q6. What were your main motivations for participating in the training? Please rank in order of top three reasons for attending the training.

- 01 \_\_\_\_\_ To earn AIA credits

- 02 \_\_\_\_\_ To learn more about energy efficient MF construction practices
- 03 \_\_\_\_\_ To learn about the upcoming changes to the 2005 Title 24
- 04 \_\_\_\_\_ Other

Q7. On a scale of 1-5, with 1 being very useful, and 5 being very un-useful, how useful was this training?

1      2      3      4      5      98      99

If 1, 4, 5

Why? \_\_\_\_\_

\_\_\_\_\_

Q8. How interested are you in attending future training sessions similar to these?

- 01 Very interested, why
- 02 Interested
- 03 Not interested, why
- 98 Not Sure/DK

Why? \_\_\_\_\_

\_\_\_\_\_

Q9. Do you think the training will have an impact on future design decisions related to building energy efficiency?

- 01 Yes (**How so?**)
- 02 No (Why not?)
- 98 DK (**Skip to** )
- 99 Refused

Why? \_\_\_\_\_

\_\_\_\_\_

## **BUILDER AWARENESS OF CHANGES IN TITLE 24 AND PROJECTED CHANGES IN BUILDING PRACTICES**

Q10. To what degree are you knowledgeable of the Title 24 building code changes that are scheduled to take effect in October 2005? Not at all knowledgeable

- 01 Not at all knowledgeable (SKIP TO Q15)
- 02 Very little knowledge (SKIP TO Q15)
- 03 Somewhat knowledgeable
- 04 Very knowledgeable
- 98 Don't know
- 99 Refused

**[If Q10 = 1 “not knowledgeable at all”, Skip to Q15, else continue]**

Q11. In general, what have you heard about the new 2005 version of Title 24?

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Q12. What are you most concerned about with the new 2005 version of Title 24?

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Q13. Now I'm going to read through a list of common energy efficiency design options, please rate the options on a scale of 1 to 5, where 1 is "very unlikely" and 5 is "very likely" that you would consider the option in a design. If you're unfamiliar with any of the options I mention please let me know when I address the measure.

1-5 Very unlikely to Very likely    6= Unfamiliar with measure    98 = Don't know likelihood  
 (If standard practice code as "1")  
 [READ MEASURES.]

Item	Measure	Code 1-6, 98	Why? (Input when response is a 1 or a 5)
1	Vinyl or wood frame, double pane, low-e windows		
2	Wall Insulation R 19 or greater		
3	Roof Insulation R 38 or above		
4	Radiant Barrier		
5	Housewrap (Tyvek)		
6	Ducts in conditioned spaces		
7	Duct Insulation greater than R 4.2		
8	High Efficiency Furnaces: AFUE 90 or higher		
9	Central Air Conditioning: Greater than SEER 13		
10	HE Water Heater: Energy Factor > .575 for 50 gal tank		
11	Common/shared/central hot water and heating system (if yes, then ask...)		
12	DHW controls of any type credits		
13	EER Credit		
14	Low E2 140 (Super High Efficiency windows)		
15	Insulation installation credit		
16	Infiltration testing and certification		
17	Thermal expansion valves		
18	Tight duct certification		
19	Gas instantaneous hot water heater		
20	Electric instantaneous hot water heater		

Q14. Are there any other energy efficiency measures or building design changes you are considering in order to comply with, or exceed the upcoming 2005 Title 24 standards?

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Q15. For each type of multifamily housing you work with, how often do you specify combined/shared central hot water and heating systems (usually hydronic heating)? IF SOMETIMES OR NEVER. On a scale of 1-3, How willing and able are your clients to specify combined/shared central hot water and heating systems? For your clients that would not consider central hot water and heating systems as a viable design option, can you tell me why you think that is?

Type	How Often 1= Never 2=Sometimes 3=Often 9= DK	How willing... 1= Not at all 2= somewhat willing 3= very willing 9=DK	If 1 or 2 for barrier, what are the barriers?
Multifamily affordable housing / special needs housing			
Multifamily market rate housing for sale			
Multifamily market rate housing for rent			

Q16. For each type of multifamily housing you work with, how often do you specify electric resistance heating (baseboard) systems? How willing are your clients to specify other types of heating systems? For your clients that prefer electric resistance heating systems, can you tell me why you think that is?

Type	How Often 1= Never 2=Sometimes 3=Often 9= DK	How willing... 1= Not at all 2= somewhat willing 3= very willing 9=DK	If 1 or 2 for barrier, what are the barriers?
Multifamily affordable housing / special needs housing			
Multifamily market rate housing for sale			
Multifamily market rate housing for rent			

Q17. How important is it that your projects exceed Title 24 by 15% or more?

- 01 Very Important
- 02 Sometimes Important
- 03 Not at all important (Skip 0)
- 98 Don't know (Skip to 0)

Q18. Why do you say that?

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Q19. If there is a considerable increase (\$500-\$1,000 per unit) in the cost to build your projects 15% or more energy efficient than the new code, then how important will it be that your projects exceed code by 15%?

- 01 Very Important
- 02 Sometimes Important (why?)
- 03 Not at all important
- 98 Don't know

**Why?** \_\_\_\_\_

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**2004 Project Summary Data**

Q20. Now I'd like to ask about multifamily projects your firm completed in 2004. Approximately how many {type} projects were completed in 2004 of the following type....? [Fill out table.]

Type	Total # projects							
	0	1-2	3-5	6-10	11-20	20 or more	98	99
Multifamily affordable housing and special needs	0	1-2	3-5	6-10	11-20	20 or more	98	99
Multifamily market rate housing for sale	0	1-2	3-5	6-10	11-20	20 or more	98	99
Multifamily market rate housing for rent	0	1-2	3-5	6-10	11-20	20 or more	98	99
Mixed use	0	1-2	3-5	6-10	11-20	20 or more	98	99
High-rise (defined as 4 stories or more)	0	1-2	3-5	6-10	11-20	20 or more	98	99

Q21. On average, how many different clients do these projects represent? \_\_\_\_\_  
(Ask only of A & E)

Q22. On average, what % of your multifamily projects are located in coastal regions, as opposed to inland regions?

- 01 % Coastal \_\_\_\_\_
- 02 % Inland \_\_\_\_\_
- 98 Don't Know

Q23. Do you currently have any multifamily housing projects in design or construction?

- 01 If Yes, approximately how many? \_\_\_\_\_
- 02 No
- 98 Don't Know/Refused

Q24. For projects currently in design and construction can you approximate the following information for each project?

Project 1 City _____	1	2	3	4	5	98
Project 2 City _____	1	2	3	4	5	98
Project 3 City _____	1	2	3	4	5	98
Project 4 City _____	1	2	3	4	5	98
Project 5 City _____	1	2	3	4	5	98

1= Project Conception 2=Project Development Phase 3 = Schematic Design Phase  
4=Construction Documents Phase 5=During Construction

Q25. To what degree are you aware of, and familiar with, Home Energy Rating System or HERS inspections (3rd Party Inspections and Verification)? (If not sure, provide an explanation.) Use a scale of 1 to 5 where 1 is "not aware" and 5 is "very aware" [ENTER 98 FOR Don't Know; 99 FOR REFUSED. ]

01 \_\_\_\_\_

Q26. For multifamily projects completed in 2004, were HERS inspections required on

any of your projects?

- 01 Yes
- 02 No **If No or don't know, skip to 0.**
- 98 Don't know **If No or don't know, skip to 0.**

Q27. Why were the HERS inspections conducted?

- 01 To comply with Title 24
- 02 To comply with the ENERGY STAR Program
- 98 Don't know

Q28. Have you recently had trouble finding a multifamily HERS inspector?

- 01 Yes
- 02 No
- 03 Sometimes
- 04 Never tried to find one
- 98 Don't know



**Indicate if contact is from List of Program Dropouts: YES / NO**

**PROGRAM DESIGN**

Q29. How familiar are you with the CA ENERGY STAR New Homes Program?

- 01 Very familiar
- 02 Somewhat Familiar
- 03 Not very familiar
- 04 Not at all familiar
- 98 DK
- 99 Refused

Q30. Have any of your multifamily projects participated in the CA ENERGY STAR New Homes Program? If so, about how many?

- 01 None **(Skip to Q37)**
- 02 1 **(Skip to Q37)**
- 03 2-3
- 04 4-6
- 05 7 or more
- 06 Began to participate, but then decided to dropout of program
- 98 DK **(Skip to Q37)**
- 99 Refused

Q31. Have you ever had a multifamily project drop out of the program?

- 01 Yes
- 02 No **(Skip to Q34)**
- 98 Don't Know/Refused

Q32. Can you explain why the project dropped out of the program?

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Q33. Can you explain how the program could have kept the project from dropping out of the program?

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Q34. Before continuing any further in this discussion, what recommendations would you have for improving the ENERGY STAR New Homes Program based upon the experiences you have had with the projects you just mentioned?

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Q35. Do you plan to continue participating in the program in 2005?

- 01 Yes
- 02 No (why)
- 98 Maybe
- 99 Don't know (why)

Q36. Why do you say that?

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**READ:** Due to the upcoming changes in Title 24 energy code, which will have an extreme impact on the energy efficiency characteristics of multifamily dwellings, the utilities are looking to redesign the ENERGY STAR New Homes Program for 2006 in order to better meet the needs of program participants. We'd like to ask you a few questions and get your feedback regarding various program design options that are currently being considered. Your responses will be carefully reviewed and considered by the utilities. Do you feel you are the best person to speak with in your organization regarding input on the design of the next generation of ENERGY STAR New Homes Programs?

- 01 Yes
- 02 No      Name: \_\_\_\_\_ Phone: \_\_\_\_\_
- 98 Don't know      Title: \_\_\_\_\_
- 99 Refused

Q37. What sort of impact would you say that the ENERGY STAR label has had on the marketability of your projects

- 01 Strong negative impact,
- 02 Somewhat negative impact,
- 03 Neutral impact
- 04 Somewhat positive impact
- 05 Strong positive impact
- 06 Not Applicable
- 98 DK
- 99 Refused

Q38. How important do you believe it is that the utilities maintain ENERGY STAR as the branding for their program?

- 01 Not at all important (WHY)
- 02 Somewhat important
- 03 Neutral, neither important or unimportant
- 04 Important
- 05 Very Important (why)
- 98 Don't Know

Q39. Why do you say that?

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Q40. Under the current program design, new multifamily housing must consume 15 percent less than the allowed energy budget under Title 24 in order to qualify for program incentives, regardless of the climate zone in which they are located. In response to the impending changes in Title 24, the utilities are considering several alternative criteria to qualify multifamily housing for program support. On a scale of 1 to 5, how would you rate each alternative, where 1 is “not attractive at all” and 5 is “very attractive”? [Fill out table]

Qualification Approach	Q40	Q40 Why?
As program is now: Use Title 24 software performance calculations to determine compliance margin. Compliance margin would be a consistent value, such as 15% better than code.		
Use performance calculations, only with different compliance margins for coastal and inland zones. For example, the compliance margin for inland zones would be 10 percent more efficient than Title 24; for coastal zones, 20 percent more efficient.		
Use performance calculations only with different compliance margins for one/two story and three story multifamily buildings. For example, the compliance margin for 1-2 story buildings would be 10 percent more efficient than Title 24; for 3 story buildings, 15 percent more efficient.		
Use an exclusively prescriptive approach, with different lists of prescriptive measures for coastal and inland climate zones.		

Q41. According to recent analyses of baseline new construction, the costs required to upgrade from current practices to efficiency levels that exceed the 2005 Title 24 by 10 percent range from a few hundred dollars in some coastal climate zones to about \$1,000 in some inland zones, per dwelling unit. Using a scale of 1 to 5 where 1 is “not at all interested” and 5 is “very interested”: How interested would you be in participating in the program if the incentive were set as a percentage of the estimated cost of meeting program requirements, rather than as a fixed sum?

Not at all Interested				Very Interested	(Don't know)	(Refused)
1	2	3	4	5	8	9

Q42. Roughly speaking, what % of the incremental cost would you need the incentive to cover before you would become interested in participating in the program? ASK FOR EACH OF THE FOLLOWING MULTIFAMILY HOUSING TYPES?

Type	% of Incremental
Affordable housing	
Market rate housing for sale	
Market rate housing for rent	
Special needs housing	

Q43. The California utilities are considering a number of alternative methods for allocating incentives. Assuming you would receive the same total amount of incentives under all methods, could you tell me which of the following three alternatives would be most attractive to you? Use a scale of 1 to 5 where 1 is “not attractive at all” and 5 is “very attractive” [ENTER 8 FOR Don’t Know; 9 FOR REFUSED.]

Incentive Approach	Q43
Fixed incentive paid out per dwelling unit for all projects meeting program requirements. Current approach.	
Larger incentive covering full incremental cost for project meeting program requirements. There would be no further financial incentives for other projects (or perhaps small incentives comparable speaking for subsequent projects) that utilize similar designs. Under this design there would be a maximum allowable incentive payable to each unique participant.	
Fixed Incentive per kBtus of energy savings (found on the C2R form). This approach would better track incentive dollars with the estimated energy savings. Minimum compliance margin would be required to participate (such as 10%), incentive dollars would not have a cap since incentives are driven by overall project efficiency relative to code. This approach encourages participation at lower levels of efficiency (10%), but with lesser incentives than those who wish to participate at high levels of efficiency. This addresses the market differences between those who NEED to be 15% better than T24 for tax credit reasons, and those who do not but still wish to be ENERGY STAR. Perhaps there could be thresholds of ES, for example Silver (10%), Gold (15%) and Platinum (20%). This is similar to LEED accreditation.	

Q44. If you were designing the next ENERGY STAR New Homes program, what program services would you offer to improve the energy efficiency of multifamily new home construction?

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Q45. Finally, do you have any other suggestions or recommendations for the California ENERGY STAR New Multifamily Homes program, especially in light of the impending changes to Title 24?

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## Appendix II: Turnkey Interview Establishment Data

	Consol	CA Energy & Living	Energy Inspectors
Contact	Mike Hodgson President	Larry Stubbert VP Marketing & Sales	John Gillett
Address	7407 Tam o'Shanter Stockton, CA	Livermore, CA 94550	1036 Commerce St Suite B San Marcos, CA
Phone	209-526-6756	925-447-0273	760-761-3695
email	<a href="mailto:mhodgson@consols.com">mhodgson@consols.com</a>		<a href="mailto:gillett@energyinspectors.com">gillett@energyinspectors.com</a>
Active States	CA, NV	CA, NV, AZ	CA, NV, AZ
Services	Title 24 Documentation HERS Inspection Assistance to ENERGY STAR Program applicants Design Assistance Marketing Assistance Proprietary Certification Program Zero Energy Homes	Title 24 Documentation HERS Inspection Assistance to ENERGY STAR Program applicants Design Assistance Marketing Assistance Proprietary Certification Program Design & Civil Engineering	Title 24 Documentation HERS Inspection Assistance to ENERGY STAR Program applicants Design Assistance Marketing Assistance Proprietary Certification Program
# of Builders	80 – mostly large production builders	50 – 60	6
# of Units	24,000	2,500 – 3,000	500
% multi-family	< 5% <sup>21</sup>	3 – 5 developments	0
% Coastal	40% Coastal	15% Coastal	30%

<sup>21</sup> Consol intentionally avoids Title 24 work in multi-family situations due to liability issues. According to Hodgson, large numbers of multi-family projects end up in lawsuits of one kind or another with potentially large settlements. This would greatly affect the price of professional liability insurance that they must carry as licensed engineers.

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## Appendix III: NightBreeze Endorsements

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STATE OF CALIFORNIA – THE RESOURCES AGENCY

ARNOLD SCHWARZENEGGER, Governor

### CALIFORNIA ENERGY COMMISSION

ARTHUR H. ROSENFELD  
COMMISSIONER  
1516 NINTH STREET, MS 35  
SACRAMENTO, CA 95814-5512  
(916) 654-4930  
(916) 653-3478 FAX



January 19, 2005

To: Potential Investors in Advanced Energy Products

Subject: CEC experience with Davis Energy Group/Advanced Energy Products

Over the past 15 years, I have come to know the Davis Energy Group and their principals well in my capacities as Director of the Center for Building Science at Lawrence Berkeley National Laboratory, and more recently at the California Energy Commission where I have been a Commissioner since 2000. DEG is now launching Advanced Energy Products Corporation to commercialize innovative, low- energy cooling and heating products and technologies, many of them developed with co-funding from the CEC's Public Interest Energy Research (PIER) program. These products enhance comfort while reducing energy consumption, goals long promoted by the CEC and valued in the marketplace.

The CEC's PIER program evaluates many proposals from a myriad of public and private organizations, including companies of all sizes and national energy laboratories. DEG is a frequent proposer. Although we do not always choose their proposals, we frequently find their offerings intriguing, cutting edge and very attractive. DEG completes its work in a professional manner and their results nearly always meet the objectives set.

The NightBreeze residential ventilation cooling system is a good example. This technology enhances indoor ventilation, provides natural cooling to reduce (or eliminate) conventional air-conditioning, and cuts energy use by about 50%. With today's tighter houses, this technology is much needed in the marketplace. We are proud to have co-funded the development of NightBreeze starting with the "Alternatives to Compressor Cooling Program," and look forward to its commercialization.

Similarly, the OASys two-stage evaporative cooler provides 100% ventilation air, dramatic energy savings of 80% to 90%, and is the result of diligent R&D supported by the CEC. We look forward to seeing its wide use in schools, portable housing and warehouses.

The California Energy Commission is in the business of co-funding the development of technologies that fill a market need by enhancing California's lifestyle and reducing its use of resources. When the resulting products are ready for commercialization, the CEC's role recedes, making way for the private sector to profit by bringing these products to market. In the case of DEG and its spin-off company, Advanced Energy Products, we are very supportive of this process and believe the outlook for NightBreeze and OASys is quite positive.

If you have any questions in this regard, please feel free to contact me at 916-654-4930, or [ARosenfe@energy.state.ca.us](mailto:ARosenfe@energy.state.ca.us).

Sincerely,

A handwritten signature in cursive script that reads "Art Rosenfeld".

ARTHUR ROSENFELD, Ph.D  
Commissioner

## CENTEX HOMES

February 17, 2005

Mark Berman, President  
Advanced Energy Products  
123 C Street  
Davis, CA 95616

Dear Mark:

As you know, Centex Homes Northern California Division has installed prototype NightBreeze-Hydronic units on a home in our Los Olivos subdivision in Livermore as part of our participation in the Department of Energy's Zero Energy Homes Program. We have also installed advanced Smart Vent prototype units in two model homes in our Windemere subdivision in San Ramon. In all instances, we are pleased with the performance of the product and the buyers of the Livermore home have also been very happy with the comfort and low energy bills they enjoy.

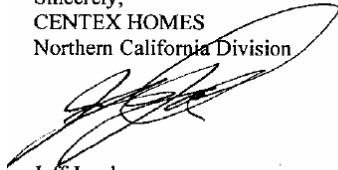
We understand that Davis Energy Group recently formed Advanced Energy Products Corp. to commercialize and market NightBreeze, Smart Vent and other low energy cooling and heating products. Unquestionably, there is a need in the marketplace for these kinds of products. Enhancing fresh air ventilation and cutting energy use are increasingly important to us and our customers. Installed cost is also critical.

At Windemere, the addition of Smart Vent adds approximately \$3,000 to the buyer's cost of a home. The energy savings more than offsets the buyer's incremental mortgage cost. With improved availability of the pieces and parts that make up the Smart Vent system and additional consumer and sales staff education, Smart Vent will become a meaningful inclusion in our option program. As Advanced Energy Products is able to lower incremental costs for its products and as possible utility incentive programs are put in place, AEP projects incremental costs for Smart Vent and NightBreeze will drop by 25% or more. Obviously, as the incremental costs come down, the marketability of these systems will increase.

I look forward to working closely with AEP to customize offerings that enhance the comfort, health and economics for Centex Homes buyers and to continue developing educational materials that will assure our buyers that investing in energy efficient features is an intelligent inclusion for their new homes. I am optimistic that with the right combination of equipment, features and pricing, AEP's products will be well accepted in the marketplace.

Sincerely,

Sincerely,  
CENTEX HOMES  
Northern California Division



Jeff Jacobs  
Project Manager

Northern California • 2527 Camino Ramon, Suite 100 • San Ramon, California 94583 • Main: 925 415-1600 • Fax: 925 415-1601





1756 Picasso Avenue, Suite C • Davis, California 95616  
(530)757-9289 • fax (530)757-2985  
530 756-6608 Direct

Mark Berman  
Advanced Energy Products  
123 C Street  
Davis, CA 95616

February 22, 2005

(OA\_EID:8174\_OA)  
Dear Mark,

I am writing to support your efforts at AEP with the "Nightbreeze" ventilation system. Covell Village is a 1500 unit development planned for Davis, CA (in the Sacramento area). It is primarily residential development and currently going through the entitlement process.

A number of the developers of Covell Village have been active in the industry for over 40 years, and have built and sold thousands of homes. Over the years we have become familiar with Davis Energy Group and its spin-off Advanced Energy Products. We are also familiar with NightBreeze residential ventilation cooling system.

We intend to require installation of NightBreeze type systems in every residential unit in Covell Village. We believe it enhances our ability to get entitlements and quickly sell units. We foresee a great future for NightBreeze. It provides controlled, filtered ventilation and cuts energy use. These are 2 growing issues for all builders.

Sincerely,

A handwritten signature in cursive script that reads "Blaine Juchau".

Blaine Juchau, CEO

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