

# **CONSISTENCY IS GOLDEN: THE NON RESIDENTIAL NEW CONSTRUCTION MARKET ASSESSMENT IN CALIFORNIA**

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## **Objective**

An on-going, publicly-funded effort to develop market assessment and evaluation (MA&E) information to support energy efficiency programs in California has produced a wealth of valuable data and insights into the workings of the non residential new construction (NRNC) market. The NRNC market, and the programs developed to improve its energy efficiency, is one of the most complex targets for both resource acquisition and market transformation efforts. The decision-making structures and the long-term nature of building design and construction make it a complicated market to assess. Only with a long-term outlook can the market be fully analyzed.

This paper provides an overview of this market research, and will discuss the value of a consistent data collection and evaluation effort over an extended period of time. The paper reports on a series of evaluation studies that have been conducted to provide a complete and long-term perspective on the non residential new construction market in California. It also discusses how these coordinated and consistent efforts have improved program design and implementation and how this effort could be replicated in other areas of the country.

## **Introduction**

In order to improve the energy efficiency of the California non residential new construction (NRNC) market, a statewide publicly-funded effort developed the Savings By Design program.. Administered by the California Investor Owned Utilities (IOUs), Savings By Design and its educational element, Energy Design Resources, encourages the understanding and use of energy efficient and integrated design techniques through incentives, design assistance and tools, publications, and training programs.

Market assessment and evaluation studies were completed to better understand Savings By Design and Energy Design Resources, the NRNC market and the effect of the programs on the market. Studies profiled the characteristics of the NRNC market, the effect of the programs on the market, energy analysis comparison of program participants to non-participants, and process evaluations of the program.

## **Savings By Design**

Savings By Design is the California statewide non residential new construction (NRNC) energy efficiency program, administered by PG&E, SCE, SCG and SDG&E.<sup>1</sup> The Savings by Design (SBD) program seeks to change the design practice of professionals in the construction industry by promoting the understanding and use of energy efficient and integrated design techniques in commercial building construction; to increase awareness of building owners of the benefits associated with integrated designs; and to increase the penetration of energy efficient materials, equipment, and systems in the commercial building market.

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<sup>1</sup> Pacific Gas and Electric Company, Southern California Electric, Southern California Gas and San Diego Gas and Electric.

The program offers design assistance and financial incentives to improve the energy efficiency of non residential new construction projects. The incentive structure targets both the building owner and the building design team. The incentive program has two participation paths, the Systems Approach and the Whole Building (performance) Approach.

The Systems Approach uses a set of pre-calculated energy savings values for efficient systems that are broadly available though not standard practice. In general, the Systems Approach is used for projects where design of the energy systems is done at different phases: where one energy system predominates, where intervention occurs late in the design, or for buildings with simple system interactions.

The Whole Building Approach offers a comprehensive package of services designed to analyze energy-efficient, cost-effective design alternatives. The Whole Building Approach is not limited to particular measures, but provides incentives based on reduced energy consumption relative to Title-24, the California Building Efficiency Standards. The Whole Building Approach is used for complex projects where the design team can work closely to integrate the energy systems.

The California statewide market assessment and evaluation (MA&E) activity in the non residential new construction sector has compiled a small library of studies on the workings of this market and the successes of the statewide Savings By Design program. There are two foundation studies which have been conducted on an on-going basis since 1999, that are addressed in this paper:

- Market Characterization and Program Activity Tracking (MCPAT)
- Building Energy Assessment (BEA)

### ***Market Characterization and Program Activity Tracking***

Market Characterization and Program Activity Tracking (MCPAT) studies<sup>2</sup> provide two types of time-series data on the NRNC market. First, the data describe construction activity by building type, utility service territory and county. This includes numbers of projects, square footage of both new and remodeling activity, and listings of the most active market actors (architects, engineers). This part of the study provides an understanding of the characteristics of the market and its segments. Second, the data summarize the activities of the statewide Savings By Design program. This includes the numbers, types and sizes of projects participating in the program, and the estimated savings, by utility service territory and statewide. This information allows for an assessment of the performance of the program relative to the overall market. Specifically, the data are used in conjunction to determine market penetration by region and by measure.

A summary of yearly market activity, by number of projects and square footage is provided in Table 1. Overall SBD program penetration by year is presented in Figure 1. The table and figure presents the results for both new construction, which includes additions, and renovations and remodels (R&R) Additional details of the market and program activity are provided in the reports.

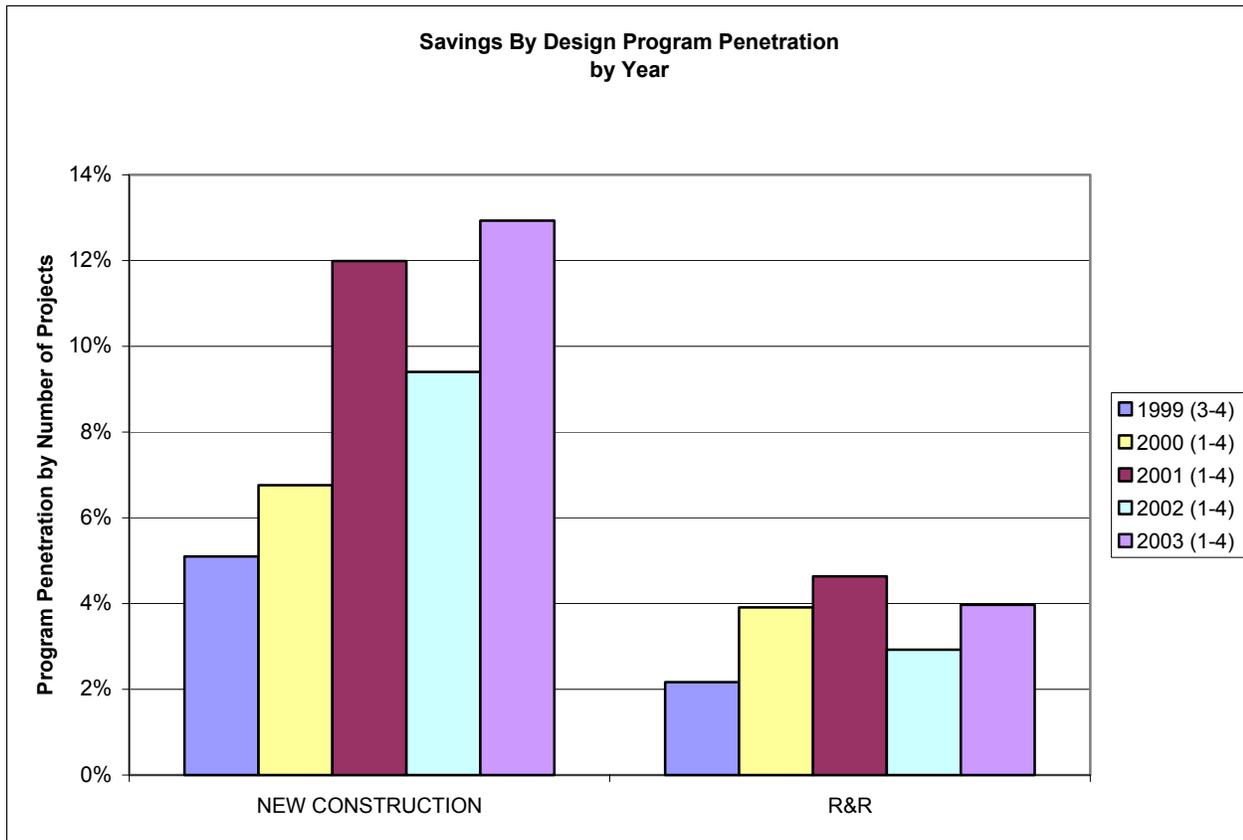
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<sup>2</sup> NRNC Market Characterization and Program Activities Tracking Reports, 2000 – 2003 by Quantum Consulting, for Southern California Edison, available on the CALMAC web site ([www.calmac.org](http://www.calmac.org)).

**Table 1**

<i>Project Type</i>	<i>Year (Qtr)</i>	<i>Number of Project Starts</i>	<i>Area of Project Starts (Mil. sf)</i>
<b>New Construction, incl. Addns.</b>	1999 (3-4)	2,511	88
	2000 (1-4)	4,674	180
	2001 (1-4)	4,805	178
	2002 (1-4)	4,626	144
	2003 (1-4)	3,782	129
<b>Renovation &amp; Remodel (R&amp;R)*</b>	1999 (3-4)	2,400	-
	2000 (1-4)	4,654	-
	2001 (1-4)	4,791	-
	2002 (1-4)	4,343	-
	2003 (1-4)	3,880	-

\* square footage estimates for remodels are unavailable



**Figure 1**

## ***Building Energy Assessment***

Building Energy Assessment (BEA) studies<sup>3</sup> report on the as-built energy efficiency of the Savings By Design program participants, compared to the energy efficiency of other, nonparticipating projects. The data is based on detailed on-site surveys of newly constructed projects, energy simulation models of their performance and net energy analysis. The study methodology builds on the analysis used for several impact evaluations of NRNC programs conducted in the mid-90s through late '90s . The data from these previous studies were used for the California Non Residential New Construction Baseline Study<sup>4</sup> (Baseline Study), which was used as the foundation of the BEA analysis. The BEA studies also included decision maker surveys, or both participants and non-participants, which determine how project energy efficiency decisions are made by the market actors. The results of these surveys were used in the self-reported net savings analysis and the program process evaluation.

### ***BEA Savings Analysis***

The building characteristics and energy savings data are compiled in a comprehensive database of more than 1000 projects, which are representative of the population of new construction in California. A breakdown of the number of program participants and non-participants by study year is presented in Table 2. Note that the program participants in the Baseline Study participated in prior new construction programs, not Savings By Design.

**Table 2**

<b><i>Study</i></b>	<b><i>Program Participants</i></b>	<b><i>Non-Participants</i></b>	<b><i>Total</i></b>
1999 Baseline	407	260	667
1999-2001 BEA	109	109	218
2002 BEA*	79	68	147
<b>Total</b>	<b>595</b>	<b>437</b>	<b>1,032</b>

\*Part. incl. 10 industrial sites

Table 3 shows the results of the BEA analysis. The table presents the program tracking savings for all program participants, the gross savings estimated by the study and the resulting realization rate (Gross RR). The realization rates of greater than 100% indicate that the program is slightly under-estimating energy savings. The table also presents the net savings estimated by the program and the associated net-to-gross ratio (NTGR). The NTGR suggests that only 60% of the program savings is due to the influence of the program, while the remaining 40% is free-ridership. However, many other program elements such as EDR training and design assistance, as well as other utility-sponsored general awareness campaigns have influenced the overall market. Non-participants were asked about prior program influence or influence from the current SBD program representatives and material. This information was used to estimate non-participant spillover. The total net savings includes participant net savings and non-participant spillover. The resulting comprehensive net-to-gross ratio (Comp. NTGR) is shown in the last column.

<sup>3</sup> Building Efficiency Assessment, 1999–2001 and 2002, by RLW Analytics, for Southern California Edison

<sup>4</sup> California Non Residential New Construction Baseline Study, by RLW Analytics, Inc. for Southern California Edison, July, 1999. It is important to note that the study included only four predominant market segments: schools, offices, retail, and public assembly. The study also evaluated the buildings against the applicable code at that time which was 1995 Title-24.

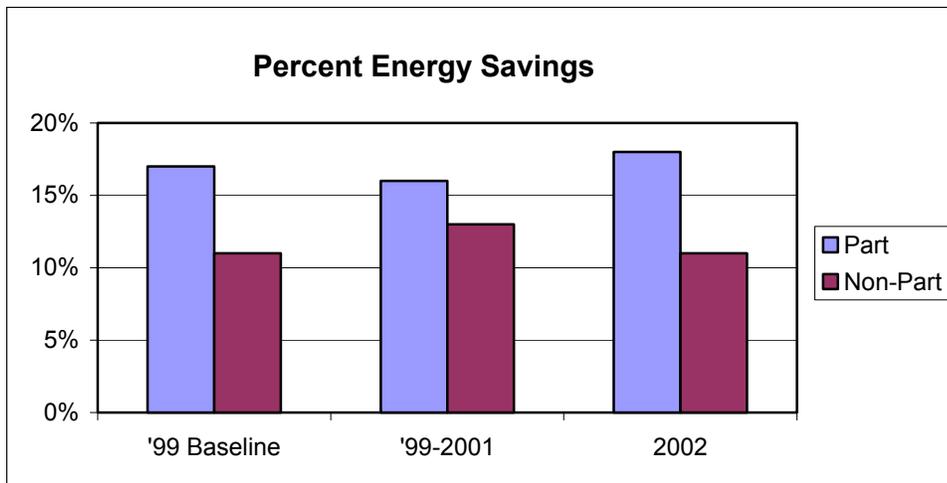
**Table 3**

Program Year		Program Savings	Gross Savings	Gross RR	Net Savings	NTGR	Total Net Savings	Comp. NTGR
1999-2001	Energy (MWh)	90,288	96,244	107%	57,092	0.59	78,489	0.82
	Demand (MW)	26.7	27.4	103%	16.8	0.61	23.5	0.86
2002	Energy (MWh)	121,531	127,216	105%	76,296	0.60	82,697	0.65
	Demand (MW)	26.6	28.6	108%	17.7	0.62	18.5	0.65

Figure 2 compares participant and non-participant efficiency as a percentage of baseline energy consumption from the Baseline Study and the two BEA studies<sup>5</sup>. The Baseline Study found that participant efficiency relative to Title 24 baseline was 17%, while non-participants efficiency was 11%. The 1999-2001 BEA study found that the participant efficiency was 16% better than baseline, while non-participants were 13% better. The 2002 BEA study found that participants consumed 18% less energy, and non-participants consumed 11% less energy.

The increased efficiency among the non-participants during the 1999-2001 study period may be due to events that took place in the energy market influences. The NRNC industry was first impacted beginning in 2000 with rolling blackouts and steep price increases in the SDG&E service territory, followed by planned SCE/PG&E rate increases and widespread speculation of price manipulation that was created by a planned deregulation of the energy industry. This uncertainty in the market likely increased interest in making buildings more efficient. This was further fueled by numerous and effective advertising campaigns such as “Flex Your Power” and the “20/20” program.

The drop in non-participant efficiency between the two BEA studies may be attributed to strengthening the Title 24 codes and possibly to a fading sense of urgency related to the “California energy crisis”.



**Figure 2**

**BEA Process Evaluation**

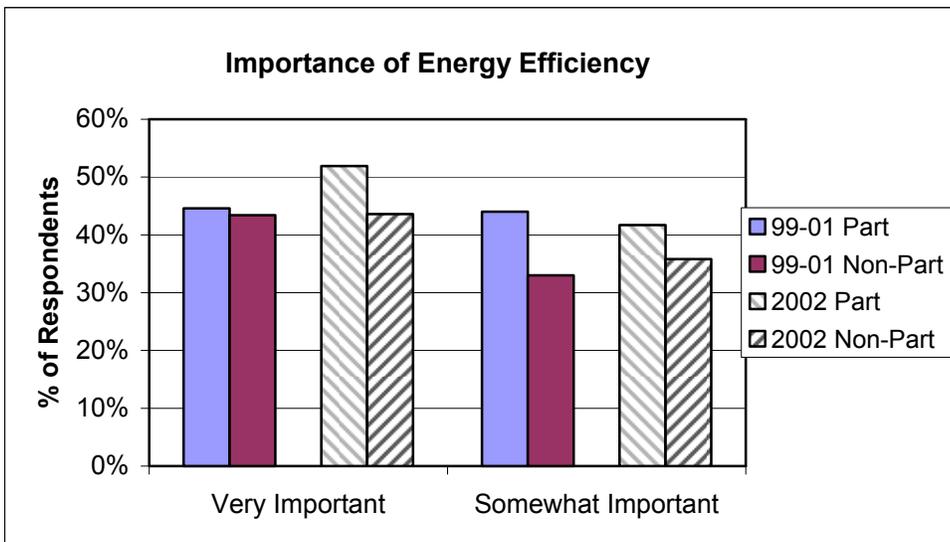
The BEA Study included a process evaluation component in which telephone surveys were conducted with either the building owners, or primary decision makers. The process questions addressed several general categories of interest:

<sup>5</sup> Projects that were permitted prior to June 1, 2001 were subject to the 1998 Title 24 code, while projects permitted after this date were subject to the more strict 2001 Title 24 code requirements.

- **Energy Efficiency Attitudes** – The importance of energy efficiency to the company and any policies used to encourage efficiency
- **Energy Performance** – Decision-makers’ perceptions of the energy efficiency of their building;
- **Savings By Design Program Influences** – Awareness of program, motivations to participate, and barriers to participation.

**Energy Efficiency Attitudes - Participants and non-participants have similar attitudes toward energy efficiency.**

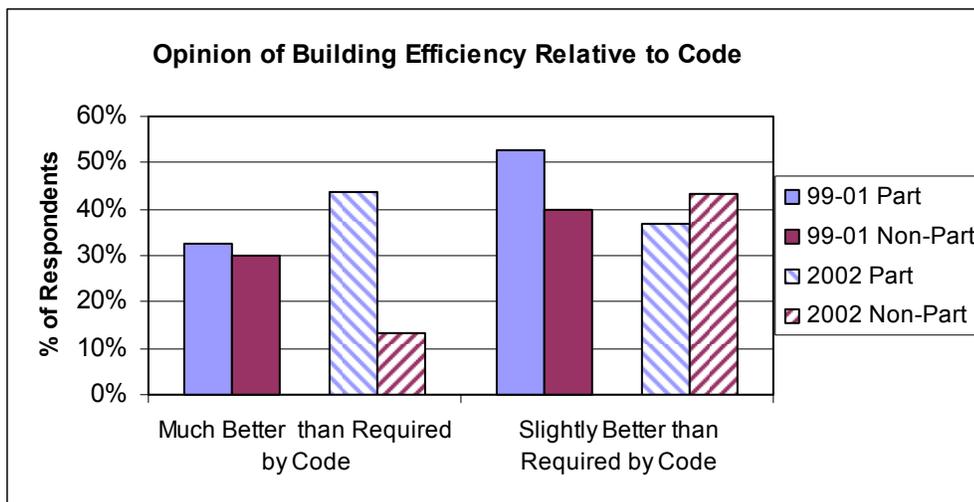
Participants and non-participants alike put a high value on the efficiency of the building during design and construction and also on daily building operation. In the 1999-2001 BEA study approximately 45% of participants and 43% of non-participants considered energy efficiency to be “very important”. In the 2002 study, approximately 51% of participants and 44% of non-participants consider energy efficiency to be “very important”, as shown in Figure 3. Combining the “very important” and “somewhat important” responses, approximately 90% of participants and 80% of non-participants consider efficiency to be important.



**Figure 3**

**Energy Performance - Participants and non-participants believe that their buildings are efficient.**

Survey respondents were asked to evaluate how efficient they thought their buildings were compared to code. The majority of respondents (both participants and non-participants in both studies) believed their buildings were at least slightly better than code. In the '99-'01 study approximately 30% of both participants and non-participants believed their buildings were much more efficient than required by code. In the 2002 study 44% of participants and 14% of non-participants believe their buildings are much better than code as shown in Figure 4.



**Figure 4**

### Savings By Design Program Influences -

**The Savings By Design incentive is the key factor that influences energy efficient building design and construction.**

- Sixty percent (60%) of participant owners claim that the owner incentive was instrumental in changing their design practices to be more energy efficient.
- Non-participants expressed a strong interest in the Savings By Design program incentives. Eighty five percent (85%) of non-participants in the '99-01 study and 42% of non-participants in the 2002 study who were completely unaware of SBD before their project started reported a high likelihood of designing their building to perform better than Title-24 had they known about the availability of Savings By Design incentives.

**The most common source of program awareness for program participants is previous participation in the Savings By Design, or NRNC programs.**

Nearly half of all participants report that they became aware of the program through previous program participation. This suggests that past participants must be satisfied with the program's services.

**There is an increased awareness of the Savings By Design program among non-participants.**

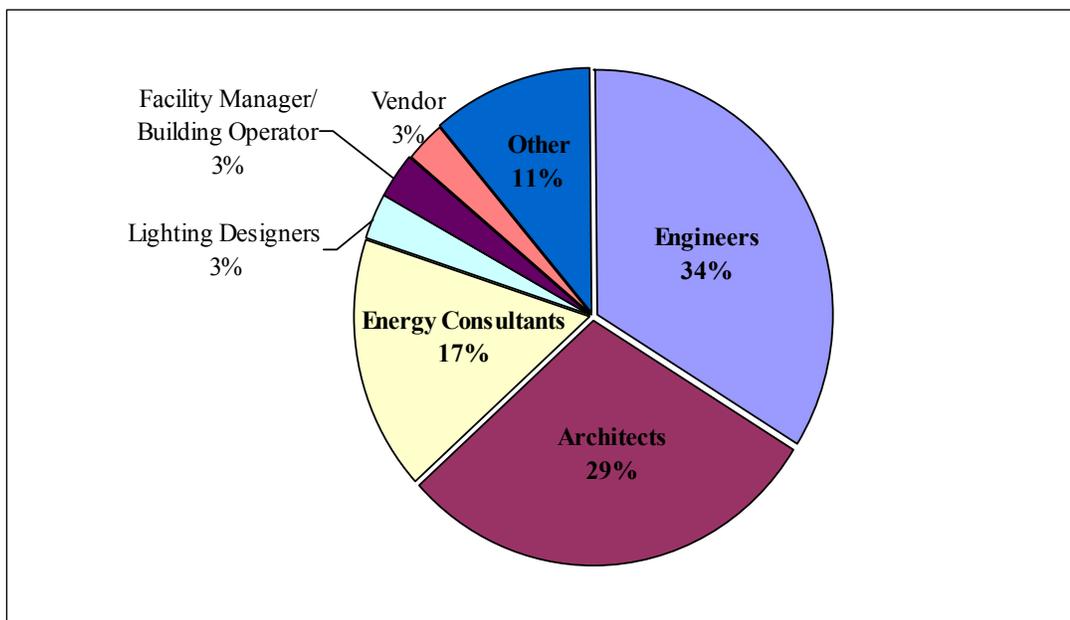
In the 99-01 study 37% of non-participants were aware of SBD before construction began. The 2002 study reveals nearly 55% of non-participants were aware of SBD prior to beginning design and construction. This sharp increase in program awareness suggests effective marketing (e.g., awareness building) of the program.

### Energy Design Resources

Energy Design Resources (EDR) is the educational component of Savings By Design. It offers a variety of energy design tools and resources that make it easier to design and build energy-efficient commercial and industrial buildings. These resources include the EDR web site, publications, software, training program and associated reference material. The goal of the EDR effort is to educate architects, engineers, lighting designers, and developers about techniques and technologies that contribute to energy efficient new construction.

Evaluation research was conducted to assist the utility staff with the design and implementation of Energy Design Resources efforts. The study objective was to determine the level of usage of the EDR tools by examining who uses the tools, how the tools are used, and the extent to which they are used. Additionally the study investigated the usefulness of the tools among designers who may not be actively using the tools. Implicit in this research is an investigation of who is not using the tools and why they are not using the tools. Based on the results of the research, program implementation staff have worked hard to adapt EDR so that they can more effectively deliver resources to design professionals.

➤ **Who is EDR Reaching?** EDR is primarily reaching engineers (34%), architects (29%), and energy consultants (17%), as shown in Figure 5. Notably, EDR is not reaching lighting designers, developers, buildings owners, or facility managers in great numbers, despite the fact that EDR offers tools specifically for these groups.

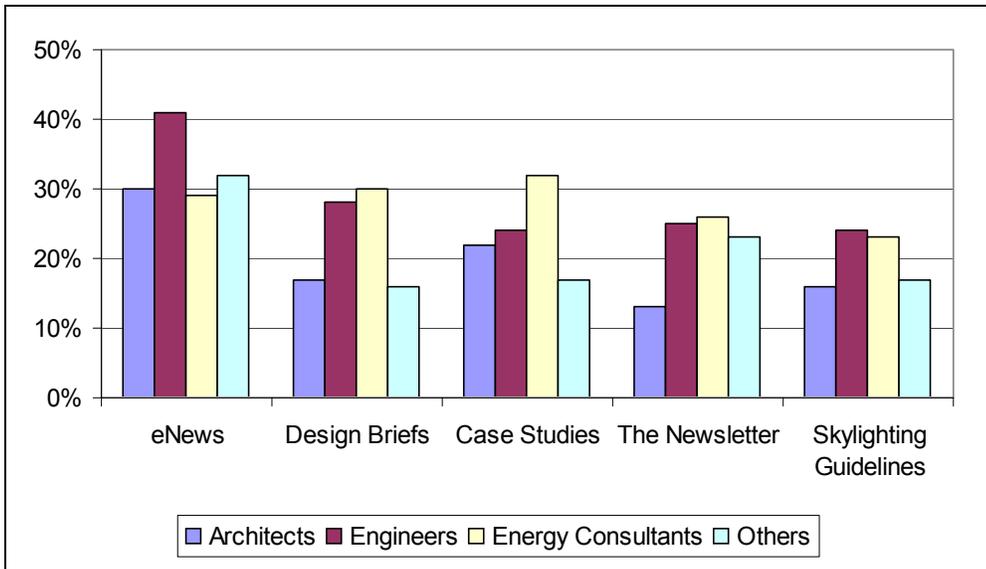


**Figure 5**

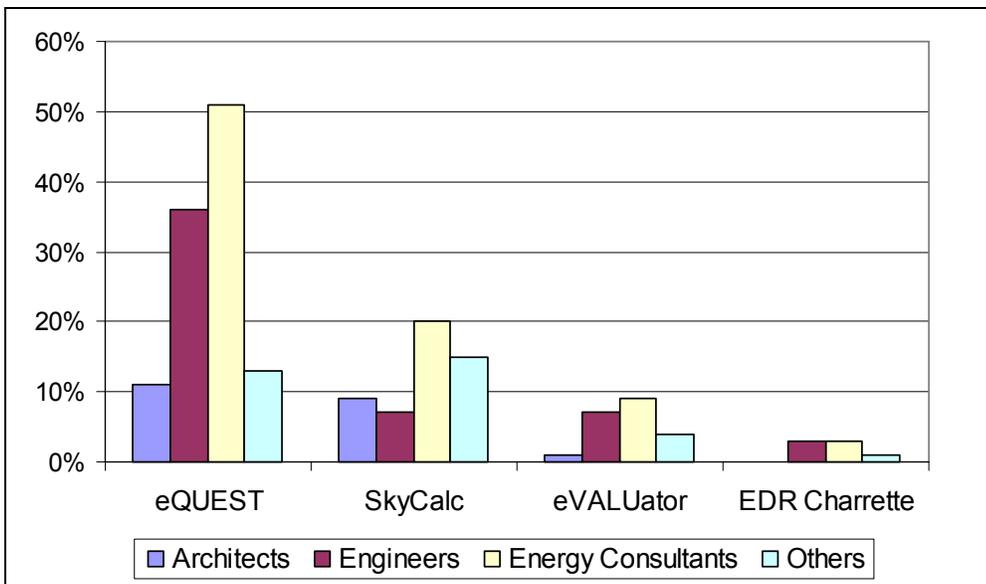
➤ **Who is Using the Tools the Most?** While EDR has reached over 2,300 market actors in the new construction market, unfortunately, more than a quarter of the people reached by EDR are not using the tools provided to them. Some respondents are not using the tools because the tools are not applicable to the work that they do, others represent missed opportunities to affect the new construction market. Engineers and energy consultants appear to be the primary users of many of the EDR tools such as the publications and software. Architects are less likely than other market groups to use many of the tools, despite the fact that they are probably the most important market actor group because they are in closest contact with end-users, such as the building owner or manager. The percentage of respondents in each group using the Publications and the Software are shown in Figure 6 and Figure 7.

➤ **Why are Some Tools Underutilized?** Low level of awareness is one of the major reasons why some of these tools are not being used. In general, respondents appear to be much more aware of the software tools than of EDR publications. Respondents are least aware of the trainings offered by EDR. For several specialty-type publications or software tools, like the Commissioning Handbook or SkyCalc, the low levels of awareness and use are due almost entirely to the fact that there are very few building owners, developers, and lighting designers among the current EDR participants.

➤ **What are the Largest Barriers To Use of EDR?** The largest barriers to achieving the goals of EDR are the limited amount of active promotion<sup>6</sup> resulting in the low levels of awareness of EDR, the overwhelming amount of competing information that inundates design professionals, the fact that EDR is not currently thought of as ‘the virtual education center for energy efficient integrated design,’ and the hesitancy of design professionals to change current practices.



**Figure 6**



**Figure 7**

<sup>6</sup> Note that since the time of this evaluation, utility staff have worked to actively promote EDR.

## **Additional Studies**

In addition to these foundation studies, the NRNC MA&E activity has prepared a number of more specialized reports. These were designed to focus on specific topics that were most important to the energy efficiency programs in the NRNC market sector.

- Non-Residential New Construction Baseline Study, by RLW Analytics, 7/8/99.
- Market Transformation Barriers and Strategies Study, by Heschong Mahone Group, 2/29/00.
- Updated Baseline compared to 1998 T-24 Code & End Use Savings, by RLW Analytics, 11/15/00.
- Prescriptive vs. Performance Projects Comparison, by RLW Analytics, 1/29/01.
- Lighting Quality & Measurement Error Assessment, by Heschong Mahone Group, 2/14/01.

## **Conclusions**

The statewide programs and market assessment and evaluation studies undertaken to improve the energy efficiency of the California non residential new construction market have been successful in providing a better understanding of the current standard practice of building design and construction. The key to success has been the consistency of gathering information on the market and the program to improve program design, implementation and penetration.

The Market Characterization and Program Activity Tracking and Building Energy Assessment studies are on-going projects with the expectation that further information will only serve to benefit the statewide programs.