Nonresidential New Construction Market Assessment & Evaluation

Market Transformation Barriers and Strategies Study

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This report was prepared as part of a larger program of Market Assessment and Evaluation (MA&E) of energy efficiency programs aimed at the nonresidential new construction market in California. It is intended to inform policymakers and program developers who are involved in the investment of public benefits monies toward market transformation in this market segment.

The four major investor-owned energy utilities of California (Pacific Gas & Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E), Southern California Edison Company (SCE), and Southern California Gas Company (SCG)) have divided among themselves the responsibilities for statewide studies of the various energy efficiency program markets. The responsibility for developing and implementing studies of the nonresidential new construction program area has been assigned to SCE. Marian Brown has overall responsibility for this MA&E area, and she has delegated management of the area to the Heschong Mahone Group (HMG), Douglas Mahone, Partner-in-Charge.

This study is one of several studies that have been designed to provide baseline and market characterization data on nonresidential new construction. This study was developed following consultations with nonresidential new construction program managers from the three electric utilities, and with the advice and concurrence of the other MA&E program area managers. The study was conducted by HMG staff over a six month period. Catherine Chappell was the Project Manager. She was supported by other HMG staff, including Nehemiah Stone, Kalpana Kuttaiah, Douglas Mahone, and Jacqueline Burton.

The following individuals contributed to this report with their review and feedback: Roger Wright, RLW Analytics, Inc.; Janith Johnson, SCE; and Misti Bruceri, PG&E.

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1. EXECTUIVE SUMMARY

1.1 Study Overview

The general purpose of this study is to develop a better understanding of the process of and impediments to energy efficient design in new nonresidential buildings. Within this context, we also wanted:

- To examine the market model and the nature of market barriers from the Nonresidential New Construction Baseline Study (Baseline Study)[1].
- To assess market actor response to possible market interventions and program strategies.
- To assess the acceptance and preliminary success of Savings By Design, the newly launched statewide new construction program.
- To provide recommendations on additional methods for positively influencing the energy efficiency design process.

We gained insight into these four areas through a series of focus group discussions with architects, engineers, owners and developers. The findings from these discussions, along with our analysis of those findings, form the basis of this report.

The qualitative information contained in this report complements the quantitative information developed in the Baseline Study. Taken together, these two reports provide a clear picture of the nonresidential new construction market in California in the late 1990's.

The primary research method for this study was the focus group. One of the keys to learning from focus groups is the thoughtful interpretation of what the participants say. For this study, the interpretation was done by people trained in the construction industry (as architects, engineers and builders), who have had many years of experience with energy efficiency and programs to promote efficient design practices in California. The focus groups were designed to identify the key market players in new construction, explore their relationships, and describe how these relationships affect energy efficiency decision making.

1.2 Major Findings

The major findings of this study concern the dynamics of the design process and decision making by key players which determine the ultimate energy efficiency of

[1] The Nonresidential New Construction Baseline Study, conducted by RLW Analytics, Inc., for Southern California Edison on behalf of the California utilities and the California Board for Energy Efficiency (CBEE). The relevant sections of the report are provided in Section 5.1.1 and Appendix A..

a given new construction project, described in terms of a market model. The market model describes the structure of design teams, relationships with the owners and builders, and methods of making decisions about energy efficiency.

The most important finding in our study is that the market model concept is more complex than was defined in the Baseline Study. There are actually several market models based on the type of project, each requiring different market intervention strategies. The applicable market model for a given project is closely linked to the type of building and to the involvement and motivation of the owner.

The major differences in the market models boil down to three points:

1) the relationship between the owner and the ultimate occupant may be weak or strong, affecting the tradeoff between first cost and operation cost (comfort etc),
2) the relationship between the design team and the builder can be weak (competitive bid) or strong (design-build),
3) a construction manager can provide continuity between the design team and the builder.

It is important, for any given project intervention, to understand how these relationships are set up. Likewise, at the program design level, it is important that there be sufficient flexibility in program options to accommodate the variations in project structure.

1.2.1 Findings about Decision-making by Key Players

Owners make fundamental decisions, but rely on designers for guidance and technical information.

1) Owners are the ultimate decision-makers for all projects. Their goals directly impact the actions of the designers.
2) Owner experience and sophistication are important variables – if knowledgeable on energy efficiency, they may direct designers to incorporate it; if not, they are more likely to actively discourage designers from exploring energy efficient options.
3) When owners are most concerned with project budget and schedule, and if energy efficiency will adversely affect either, interest in energy-efficiency is low.
4) Owners tend to think their designers are already providing them the most energy efficient design that makes economic sense. Therefore, they feel it is unnecessary to explore additional options or pay additional fees to designers.
5) Owners decide how much the design team effort will be coordinated – some organize projects with an integrated team (usually lead by architect), while others contract for design services separately by discipline (which discourages coordination).

6) Owners opinions are affected by the needs, or assumed needs, of the occupants or tenants.

Architects tend to lead the design team more than any other designer.

1) Architects are generalists and view energy efficiency as one more aspect of the project to coordinate.
2) Architects are generally interested in energy conservation. Some will investigate energy efficiency options at no additional charge to the client, others will not investigate energy efficiency options because they have not been asked, or paid, to do so by the owner.
3) Architects tend to view energy efficiency as part of an integrated whole, and to closely link it with issues of sustainability and "doing the right thing."
4) Most architects consider themselves knowledgeable about energy conservation, however many have little specific knowledge of energy efficiency aspects of buildings, and tend to consider details the realm of their engineers.
5) Architects have a general awareness of energy simulation techniques but typically little awareness of specific design tools.
6) Architects, as per owners, don't have enough practical knowledge of equipment and material costs.

Engineers are most knowledgeable about efficient equipment, controls and designs, but are less interested than architects in the sustainability dimensions of building energy efficiency.

1) Engineers tend to limit their scope of involvement to their specialty areas, and are least enthusiastic about coordinated team efforts.
2) Some engineers are familiar with building simulation and energy design tools, but most limit their tools to a small number of tried-and-true ones that they know and understand.
3) Because their roles on design projects are usually limited, engineers are most concerned about the extra costs and efforts for energy efficient design.
4) Engineers typically deal with the owner through the architect.

Builders are responsible for constructing the buildings designed by the architects and engineers.

1) Builders are generally not considered part of the team by designers, but rather are responsible for the construction phase of the project.
2) Builders are more familiar with construction practices and material costs than designers or owners.
3) The lack of communication between the builder and the design team is significant and critical.

4) Builders, according to many designers, will present the owner with change orders intended to save construction costs that frequently negatively impact the design intent for energy efficiency.

5) Builders generally have the owner's attention at the time when the designers are no longer, or minimally, involved.

6) Builders can often get owners to make design changes during the construction phase without consulting the designers.

Tenants needs are included in design decisions.

1) Tenants are typically not directly involved in the decision-making process, but rather the project developer assesses their needs and brings them to the designers.

2) When the tenant is involved in the design process, the benefits of energy efficiency are more likely to be considered than in cases when there is no direct recipient of the benefits.

3) Long-term tenants can be brought into the design phase and convinced to pay for energy efficiency options.

4) Speculative projects have no tenant at the design phase, and therefore energy efficiency options are usually not considered.

Materials and Equipment Manufacturers and Suppliers have the greatest influence on the engineers.

1) Manufacturers and suppliers can also influence architects, owners and developers, but at a less technical level.

2) Manufacturers and suppliers are a good source for product information and energy savings calculations.

3) Manufacturers need incentives to "buy down" the costs of energy efficient equipment and materials; else they tend to treat more efficient equipment as high-end, specialty products with low volume sales and high mark-ups.

4) Suppliers need incentives to stock energy efficient equipment and materials for the same reasons.

Operations and Maintenance (O&M) Staff can be included in the design phase for some project types, including large institutional or government projects.

1) O&M staff can advice on what design options will work in the real world.

2) O&M staff commitment and education greatly affect the success of the project once it is operational.

3) O&M staff can influence future project designs. This can adversely influence future energy efficiency aspects of projects, if they push for a "keep it simple" approach that rules out more efficient measures.

Building Departments influence the level of energy efficiency based on their enforcement of Title 24 energy standards.

1) Building departments that do not effectively enforce the standards allow projects to be built that don't meet minimum requirements.
2) Building departments that do enforce the standards play a major role in transforming standards of practice to include energy efficiency.
3) Building departments, and local governments, can have additional influence if they require additional energy measures and practices beyond Title 24.

Utility Programs have had a positive impact on energy efficiency.

1) Utility programs have been the most successful with owners, developers and design teams already committed to energy efficiency.
2) Utility programs lend credibility to energy efficiency efforts.
3) Owners are sometimes more persuaded by utilities than they are by their own designers on energy efficiency measures, provided that utilities have knowledgeable spokespersons and design assistance.
4) Designers rely on utility "experts" to assist in selling their designs to their clients.
5) Negative experience with past utility programs jeopardizes the success of current programs.

1.2.2 Findings about Market Intervention Strategies

A major finding is that the utility services are of most interest to those that are already committed to and interested in energy efficiency and energy conservation. Not surprisingly, people who lack this interest were least interested in potential program services.

Owners need information and want financial assistance.

1) Committed and educated owners are key to a successful project.
2) Owners and developers are primarily concerned with project schedule and budget, and do not want "assistance" to negatively impact either.
3) Owners are interested in financing options that address long payback issues.
4) Owners are interested in programs that address better comfort control and improved flexibility for the occupants.
5) Owners still see incentives as perhaps the most effective program offering.

Architects need design assistance and support from their clients.

1) Architects often cannot afford to explore energy efficient alternatives due to project time and budget constraints.
2) Architects experience constant design fee pressures because there are other firms willing to provide design services at a lower fee.

3) Architects need their clients to be educated on the benefits of energy efficiency design and for their clients to ask for additional energy efficiency services.

Engineers want a more integrated design role and need technical support when trying new efficiency measures.

1) Engineers support the idea of utilizing analysis tools, but need to be paid for the service.
2) Many engineers, and some architects, would like assistance, either direct or financial, for energy simulation modeling.
3) Engineers want an integrated and modular tool so that various design elements can be pulled together without redundancy.

Utilities have a generally good record of intervention (with some failures that are remembered).

1) Program failures tend to be remembered more than successes. This can negatively impact utility efforts even when the programs have been completely redesigned.
2) Owners, developers, and designers encourage utility assistance and services, as long as they don't hinder the design and construction process.
3) Owners expressed the desire for more one-on-one communication with their utility representatives.
4) Owners think it's important that the utility programs also be marketed, and provide services, to design professionals; while design professionals indicated that they would have an easier time if the programs were marketed more vigorously to the owners and developers.
5) Utility staff providing design assistance needs to be involved at the beginning and throughout the design and construction process.
6) Utility design assistance needs to be timely and project specific.

1.2.3 Findings about Savings By Design Program[2]

1) The program effectively serves certain projects and certain types of client. The program pushes the good to better, but not the bad to good.
2) The integration aspect of the program, recognizing and requiring a design team approach is important for achieving program goals.
3) The owner or developer needs to be committed to energy efficiency in order for it to work

[2] Savings By Design is the current NRNC statewide program, which was rolled out by SCE, SDG&E and PG&E in mid 1999.

4) Owners and developers see the program as a value-added service for their properties.
5) Owner incentives alone are not large enough to guarantee energy efficiency improvements in a project.
6) Utility design assistance is welcome by owners and developers. The reaction from designers was mixed; some were enthusiastic about it, while others were resentful.
7) Designers believe that the program enhances quality and reliability of the energy efficiency aspect of their projects.
8) Most focus group participants were optimistic about the program, but had a few specific concerns:
    a) Required savings levels will be difficult to achieve.
    b) The program, which will end in December 2001, does not fit into the timeframe of most new projects.
    c) Linking the design team incentive to completion of the project is unfair because designers have no control over the construction phase of the project.
    d) The design team incentive may create a conflict of interest, or a perceived conflict of interest.
9) To overcome these concerns, the participants offered the following suggestions:
    a) Provide design team incentives in increments throughout design and construction.
    b) Some suggested providing builder incentives in addition to designer and owner incentives. Others said this wouldn't help.
    c) Provide design team incentives through the owner.
    d) Include builders into the design team structure as a prerequisite for any incentives.

1.3 Market Model

In order to develop effective market interventions for improving energy efficiency, it is necessary to have a clear understanding of how the target market functions. It is useful to cast this understanding in the form of a market model, *or models*, which describe(s) the roles of the different market actors, how they and their actions interrelate, and what their different needs and priorities might be.

We began this study with a re-examination of the market model developed in the Nonresidential New Construction Statewide Baseline Study (Baseline Study) and then expanded the market model to include several variations that are prevalent in the nonresidential new construction market. The most important finding in our

study is that the market model concept is more complex than was defined in the Baseline Study. Although we can create a single, more complex, diagram to describe the model(s), as shown in Figure 1, there are actually several market models based on the type of project. Each will require different market intervention strategies.

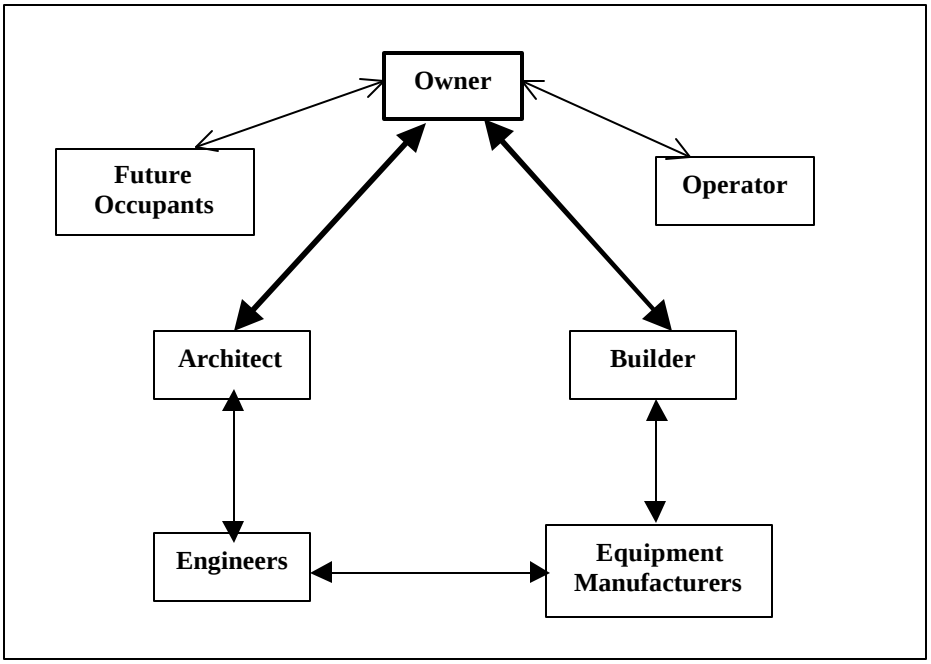

Figure 1: Revised NRNC Market Model

1.4 Market Barriers to Energy Efficiency

From the market model discussion, we can summarize project drivers and propose options for overcoming the barriers to energy efficient design.

1.4.1 Project Drivers

In order to understand how to make energy efficiency a more important influence in nonresidential new construction, we need to understand the key drivers of a commercial new construction project. These drivers are listed in order below.

Budget. The project budget, in terms of first cost, is the primary project driver.

Schedule. The project schedule is almost as important as budget; and in some cases, may be more important.

***Owner's Sophistication*.** The sophistication and education of the owner has a very big impact on the project and the opportunity of investigating energy efficiency options.

Experience and Education. The experience of all of the stakeholders, not just the owners, is critical to a successful project.

Construction Bid Process. The type of project and nature of the construction bid process have an impact on the successful implementation of an energy efficient design.

Identification of End-User. When the tenant(s) of the building are identified energy efficiency can be effectively incorporated.

1.4.2 Reducing Barriers

After discussing the project drivers and barriers to energy-efficiency, we asked the focus group participants to suggest ways to reduce or overcome the barriers.

Educated/committed Owner. An educated and committed building owner is thought to be critical to addressing and overcoming most of the barriers associated with energy efficiency.

Financial Assistance to Owners/developers. Financial assistance to owners and developers to cover extra cost was identified as the most important assistance that utilities and other entities could provide to ensure that energy efficiency features are incorporated.

***Financial Assistance to Manufacturers*.** Financial assistance should be offered to manufacturers to reduce the initial cost of their products as an alternative to owner and designer incentives.

Other Financing Options. Low-interest loans provided by federal and state agencies, utilities, and private entities were suggested as a means for financing energy efficiency options.

Mandatory Regulations. Designers in particular felt that mandatory regulations are an effective way of improving energy efficiency.

Construction Loan Underwriting. Construction loan underwriting by the utilities could take the form of cosigning for a small percentage of the project budget for program participants.

Cost/Payback Analysis Support. Designers requested assistance in the form of a tool, or presentation template, that could be used to show their clients cost-payback analysis.

Promoting Non-energy Benefits. Several designers indicated that non-energy issues, such as occupant comfort and productivity, are much easier to sell to the building owners.

Building Relationships. Several designers commented that the key to ensuring that their designs are actually implemented is a strong relationship with the owner. This includes staying close to the owner throughout the construction process.

Improved Communication. Bringing the builder in at the design phase for cost-estimating support helps with the communication problem between designers and builders.

Energy Efficiency as Environmental Movement. Several of the designers associated energy efficiency with a broader context of sustainability and environmental protection and suggested the need for a "movement".

2. INTRODUCTION & OVERVIEW

The general purpose of this study is to develop a better understanding of the process of and impediments to energy efficient design in new nonresidential buildings. Within this context, we also wanted:

- To examine the market model and the nature of market barriers from the Nonresidential New Construction Baseline Study (Baseline Study)[3].
- To assess market actor response to possible market interventions and program strategies.
- To assess the acceptance and preliminary success of Savings By Design, the newly launched statewide new construction program.
- To provide recommendations on additional methods for positively influencing the energy efficiency design process.

We gained insight into these four areas through a series of focus group discussions with architects, engineers, owners and developers. The findings from these discussions, along with our analysis of those findings, form the basis of this report.

The qualitative information contained in this report complements the quantitative information developed in the Baseline Study. Taken together, these two reports provide a clear picture of the nonresidential new construction market in California in the late 1990's.

2.1 Summary of Study Approach

The primary research method for this study was the focus group. While not useful for obtaining quantitative or statistically rigorous data, focus groups are an excellent means for learning about attitudes, practices and relationships among the actors in new construction design and construction projects. This method was, therefore, deemed the most useful for developing insights into this market segment, for understanding the nature of the barriers to energy efficient buildings, and for exploring alternative approaches to overcoming those barriers.

One of the keys to learning from focus groups is the thoughtful interpretation of what the participants say. For this study, the interpretation was done by people trained in the construction industry (as architects, engineers and builders), who have had many years of experience with energy efficiency and programs to promote efficient design practices in California. Another key to focus group success is to provide pertinent information to the participants, so that it is clear

[3] The Nonresidential New Construction Baseline Study, conducted by RLW Analytics, Inc., for Southern California Edison on behalf of the California utilities and the California Board for Energy Efficiency (CBEE). The relevant sections of the report are provided in Section 5.1.1 and Appendix A..

that they are reacting in an informed manner to a consistent set of information. All of the focus groups included structured presentations of information and a logical progression of topics through the subject of energy efficient building design. Two HMG senior staff moderated each discussion group and took turns leading the discussion. While one person led the discussion, the other took notes. All of the sessions were audio taped.

We feel that by using senior staff familiar with commercial new construction issues, and utility program offerings, including Savings By Design, we were able to explore important issues and ask for clarification of important points as they were brought up.

We conducted eight focus groups with designers, owners and developers. We contacted decision-makers responsible for new commercial projects (managers and business owners) to ensure that we were getting "high level" respondents. The focus groups were held in various locations in California chosen so as to cover the service territories of the three major electric utilities, Southern California Edison, San Diego Gas & Electric and Pacific Gas & Electric, concentrating on major metropolitan areas. The focus groups were two hours long and held at various times throughout the day.

The focus groups were designed to identify the key market players in new construction, explore their relationships, and describe how these relationships affect energy efficiency decision making. In our discussions, we probed further into the relationships described in the Baseline Study and allowed the group to share ideas, presenting opposing or common perspectives. By inviting owners and developers, we were able to get their opinions directly. In contrast, the Baseline Study relied on designers' observations of owners and developers attitudes.

In addition to the Baseline study, we used the following sources as the starting point for our discussions with the focus group participants:

- A summary of general program options offered by the utilities.
- A summary of Savings By Design, the statewide new construction program being offered by SCE, PG&E and SDG&E.

Copies of the discussion materials are found in the Appendices.

The discussion started with introductions and a short, 10 to 15 minutes, discussion of the importance of energy efficiency. We then discussed the Market Model and key players in energy efficiency decision-making. This portion, which took 30 to 45 minutes, is discussed in detail in Chapter 5. From the Market Model discussion, we switched gears, and moderators, and discussed utility program offerings. The information and incentive offerings included actual and potential services offered by utilities, not just those offered by the local utility. This discussion lasted for 45 minutes to an hour. Following the general program offerings discussion, we presented a short (10 minute) overview of the statewide commercial new construction program, Savings by Design. The group then spent another 10 to 15 minutes discussing the benefits and drawbacks of the program.

Discussion of the utility programs, including Savings By Design, is presented in Chapter 6.

2.2 Focus Group Participants

In this section we provide a general description of the focus group participants. Because the nonresidential new construction market is heterogeneous in terms of the types, scale and structuring of building projects, it was important that the focus groups cover a broad cross section of the market actors in this segment. It was also important to cover the different geographic regions of California.

Although the construction industry is very busy in these times of prosperity, and recruiting focus group participants was difficult as a result, we believe that the groups we recruited represent a good cross-section of the audience we were attempting to reach.

2.2.1 Summary of Owner/Developer Participants

We conducted a total of three owner/developer focus groups. The eleven owner and developer focus group participants represented a range of small to medium commercial owners, developers, and builders. (We were unable to get large owner/developers to attend any of the focus group sessions.)

The group consisted of:

- Developer/builders representing small and medium size firms.
- Managers of full service, facility planning development companies.
- A vice-president of a medium-size construction and development firm, specializing in retail projects.
- A manager of pre-construction services for a large construction/development firm.
- Owner/developers who build new projects every few years.

They represent development/construction companies and small commercial property owners who build and lease a few properties. Some of the companies they represent build and manage the buildings, while others build and sell the buildings.

With a few exceptions, the owner/developer participants were familiar with utility program offerings (primarily incentives) but did not have a firm understanding of the practices and the knowledge of architects and engineers.

2.2.2 Summary of Designer Participants

The designer focus group participants included a total of 20 architects and 17 engineers. Of the engineers, 7 were electrical engineers, 7 were mechanical engineers and 3 indicated they were both. We conducted a total of five designer

focus groups. Three of the five included both engineers and architects. One focus group consisted primarily of architects and one group consisted primarily of engineers.

The participant designers provided a broad range of knowledge and opinions regarding commercial new construction, in general, and energy efficiency in particular.

The group consisted of project engineers and architects from design and consulting firms, as well as principals of small design firms. They had been involved with projects ranging from large multi-story buildings, to medium-sized public schools, to small retail strip centers.

Their experience level ranged from those with over 30 years experience in their field, to those with less than 5 years.

While each participant had his/her unique qualities, many of their experiences were similar or connected, and therefore convinced us that we had a good representation of the designer population. Some of the unique experiences are highlighted below:

- An architect, who is a principal of a small design firm, had served on an energy advisory board for a Southern California city to establish citywide energy codes that exceed Title 24.
- Project architects who specialize in school projects and other public buildings.
- A mechanical engineer who specializes in controls and building commissioning.
- A lead technical architect for a large firm that has been involved with state energy codes in another state.
- Mechanical engineers who deal primarily with institutional projects.
- A mechanical engineer that deals primarily with process-driven projects, where the building is secondary.

We had architects committed to energy efficiency and sustainable design. These designers tend to feel that it is their responsibility to incorporate energy efficiency into all their designs. We had other architects and engineers who believe that their job is to provide the client only what is requested.

3. FINDINGS

3.1 Major Findings

The major findings of this study concern the dynamics of the design process and decision making which determine the ultimate energy efficiency of a given new construction project. There is no single market model that describes the structure of design teams, relationships with the owners and builders, and methods of making decisions about energy efficiency.

Although we believe there are three basic market models that can describe most types of projects, there are multiple variations of each. The three basic models are:

- Speculative projects
- Build-to-suit projects
- Owner-occupant projects

For any speculative project, the owner or developer is generally looking to build and sell or lease the building as quickly as possible. First cost and schedule drive speculative projects. Any additional design element that adds time and money will typically not be considered.

The build-to-suit model, in which a developer initiates a project with a specific tenant in mind, is more accommodating to design alternatives. The tenant, while not directly involved in the design process, is considered during the course of the decision-making.

The owner-occupant model is the best model in terms of considering energy efficiency design options. In this model, the owner is an active participant in the design process and directly impacts the direction of the project.

The interaction of the key players varies for each model. Their variations and the roles of the players are described in Chapter 5 of this report. The diversity of these models must be understood and addressed by energy efficiency programs that seek to transform energy efficiency practices in nonresidential new construction.

A corollary to this finding is that a variety of persistent market interventions must be deployed in order to have a significant market transformation impact on the nonresidential new construction market. These interventions must be applied consistently over a period of several years in order to affect the market in any sustainable manner, because nonresidential new construction projects have life cycles (from start of design to occupancy) varying from one year to more than five years. Interventions applied for only a year or two will only affect a limited number of projects whose timing happens to coincide with the program's timing.

Another corollary is that different types of interventions are needed for the different market actors. For example, the kinds of interventions that could influence the decisions of a speculative developer (up-front cash or marketing support) are very different from the interventions that would influence a mechanical engineer (technical information or specification assistance).

One approach to program design for this market would be to address only the owner-occupied sector, and to address the more difficult sectors through energy code requirements. However, though it may be easier to attract the owner-occupants to efficiency programs, it is important to develop intervention strategies that address the other two sectors because of their long-term influence on the market. They will continue to represent major segments of the market, and true market transformation will take much longer if they do not change their energy efficiency design practices. This study examines the many barriers to changing practices in these market segments, and suggests various interventions that could be used to overcome those barriers.

3.1.1 Findings about Decision-making by Key Players

Owners make fundamental decisions, but rely on designers for guidance and technical information.

1) Owners are the ultimate decision-makers for all projects. Their goals directly impact the actions of the designers.
2) Owner experience and sophistication are important variables – if knowledgeable on energy efficiency, they may direct designers to incorporate it; if not, they are more likely to actively discourage designers from exploring energy efficient options.
3) When owners are most concerned with project budget and schedule, and if energy efficiency will adversely affect either, interest in energy-efficiency is low.
4) Owners tend to think their designers are already providing them the most energy efficient design that makes economic sense. Therefore, they feel it is unnecessary to explore additional options or pay additional fees to designers.
5) Owners decide how much the design team effort will be coordinated – some organize projects with an integrated team (usually lead by architect), while others contract for design services separately by discipline (which discourages coordination).
6) Owners opinions are affected by the needs, or assumed needs, of the occupants or tenants.

Architects tend to lead the design team more than any other designer.

1) Architects are generalists and view energy efficiency as one more aspect of the project to coordinate.

2) Architects are generally interested in energy conservation. Some will investigate energy efficiency options at no additional charge to the client, others will not investigate energy efficiency options because they have not been asked, or paid, to do so by the owner.
3) Architects tend to view energy efficiency as part of an integrated whole, and to closely link it with issues of sustainability and "doing the right thing."
4) Most architects consider themselves knowledgeable about energy conservation, however many have little specific knowledge of energy efficiency aspects of buildings, and tend to consider details the realm of their engineers.
5) Architects have a general awareness of energy simulation techniques but typically little awareness of specific design tools.
6) Architects, as per owners, don't have enough practical knowledge of equipment and material costs.

Engineers are most knowledgeable about efficient equipment, controls and designs, but are less interested than architects in the sustainability dimensions of building energy efficiency.

1) Engineers tend to limit their scope of involvement to their specialty areas, and are least enthusiastic about coordinated team efforts.
2) Some engineers are familiar with building simulation and energy design tools, but most limit their tools to a small number of tried-and-true ones that they know and understand.
3) Because their roles on design projects are usually limited, engineers are most concerned about the extra costs and efforts for energy efficient design.
4) Engineers typically deal with the owner through the architect.

Builders are responsible for constructing the buildings designed by the architects and engineers.

1) Builders are generally not considered part of the team by designers, but rather are responsible for the construction phase of the project.
2) Builders are more familiar with construction practices and material costs than designers or owners.
3) The lack of communication between the builder and the design team is significant and critical.
4) Builders, according to many designers, will present the owner with change orders intended to save construction costs that frequently negatively impact the design intent for energy efficiency.
5) Builders generally have the owner's attention at the time when the designers are no longer, or minimally, involved.
6) Builders can often get owners to make design changes during the construction phase without consulting the designers.

Tenants needs are included in design decisions.

1) Tenants are typically not directly involved in the decision-making process, but rather the project developer assesses their needs and brings them to the designers.
2) When the tenant is involved in the design process, the benefits of energy efficiency are more likely to be considered than in cases when there is no direct recipient of the benefits.
3) Long-term tenants can be brought into the design phase and convinced to pay for energy efficiency options.
4) Speculative projects have no tenant at the design phase, and therefore energy efficiency options are usually not considered.

Materials and Equipment Manufacturers and Suppliers have the greatest influence on the engineers.

1) Manufacturers and suppliers can also influence architects, owners and developers, but at a less technical level.
2) Manufacturers and suppliers are a good source for product information and energy savings calculations.
3) Manufacturers need incentives to "buy down" the costs of energy efficient equipment and materials; else they tend to treat more efficient equipment as high-end, specialty products with low volume sales and high mark-ups.
4) Suppliers need incentives to stock energy efficient equipment and materials for the same reasons.

Operations and Maintenance (O&M) Staff can be included in the design phase for some project types, including large institutional or government projects.

1) O&M staff can advice on what design options will work in the real world.
2) O&M staff commitment and education greatly affect the success of the project once it is operational.
3) O&M staff can influence future project designs. This can adversely influence future energy efficiency aspects of projects, if they push for a "keep it simple" approach that rules out more efficient measures.

Building Departments influence the level of energy efficiency based on their enforcement of Title 24 energy standards.

1) Building departments that do not effectively enforce the standards allow projects to be built that don't meet minimum requirements.
2) Building departments that do enforce the standards play a major role in transforming standards of practice to include energy efficiency.
3) Building departments, and local governments, can have additional influence if they require additional energy measures and practices beyond Title 24.

Utility Programs have had a positive impact on energy efficiency.

1) Utility programs have been the most successful with owners, developers and design teams already committed to energy efficiency.
2) Utility programs lend credibility to energy efficiency efforts.
3) Owners are sometimes more persuaded by utilities than they are by their own designers on energy efficiency measures, provided that utilities have knowledgeable spokespersons and design assistance.
4) Designers rely on utility "experts" to assist in selling their designs to their clients.
5) Negative experience with past utility programs jeopardizes the success of current programs.

3.1.2 Findings about Market Intervention Strategies

A major finding is that the utility services are of most interest to those that are already committed to and interested in energy efficiency and energy conservation. Not surprisingly, people who lack this interest were least interested in potential program services.

Owners need information and want financial assistance.

1) Committed and educated owners are key to a successful project.
2) Owners and developers are primarily concerned with project schedule and budget, and do not want "assistance" to negatively impact either.
3) Owners are interested in financing options that address long payback issues.
4) Owners are interested in programs that address better comfort control and improved flexibility for the occupants.
5) Owners still see incentives as perhaps the most effective program offering.

Architects need design assistance and support from their clients.

1) Architects often cannot afford to explore energy efficient alternatives due to project time and budget constraints.
2) Architects experience constant design fee pressures because there are other firms willing to provide design services at a lower fee.
3) Architects need their clients to be educated on the benefits of energy efficiency design and for their clients to ask for additional energy efficiency services.

Engineers want a more integrated design role and need technical support when trying new efficiency measures.

1) Engineers support the idea of utilizing analysis tools, but need to be paid for the service.
2) Many engineers, and some architects, would like assistance, either direct or financial, for energy simulation modeling.

3) Engineers want an integrated and modular tool so that various design elements can be pulled together without redundancy.

Utilities have a generally good record of intervention (with some failures that are remembered).

1) Program failures tend to be remembered more than successes. This can negatively impact utility efforts even when the programs have been completely redesigned.
2) Owners, developers, and designers encourage utility assistance and services, as long as they don't hinder the design and construction process.
3) Owners expressed the desire for more one-on-one communication with their utility representatives.
4) Owners think it's important that the utility programs also be marketed, and provide services, to design professionals; while design professionals indicated that they would have an easier time if the programs were marketed more vigorously to the owners and developers.
5) Utility staff providing design assistance needs to be involved at the beginning and throughout the design and construction process.
6) Utility design assistance needs to be timely and project specific.

3.1.3 Findings about Savings By Design Program[4]

1) The program effectively serves certain projects and certain types of client. The program pushes the good to better, but not the bad to good.
2) The integration aspect of the program, recognizing and requiring a design team approach is important for achieving program goals.
3) The owner or developer needs to be committed to energy efficiency in order for it to work
4) Owners and developers see the program as a value-added service for their properties.
5) Owner incentives alone are not large enough to guarantee energy efficiency improvements in a project.
6) Utility design assistance is welcome by owners and developers. The reaction from designers was mixed; some were enthusiastic about it, while others were resentful.
7) Designers believe that the program enhances quality and reliability of the energy efficiency aspect of their projects.

[4] Savings By Design is the current NRNC statewide program, which was rolled out by SCE, SDG&E and PG&E in mid 1999.

8) Most focus group participants were optimistic about the program, but had a few specific concerns:
   a) Required savings levels will be difficult to achieve.
   b) The program, which will end in December 2001, does not fit into the timeframe of most new projects.
   c) Linking the design team incentive to completion of the project is unfair because designers have no control over the construction phase of the project.
   d) The design team incentive may create a conflict of interest, or a perceived conflict of interest.
9) To overcome these concerns, the participants offered the following suggestions:
   a) Provide design team incentives in increments throughout design and construction.
   b) Some suggested providing builder incentives in addition to designer and owner incentives. Others said this wouldn't help.
   c) Provide design team incentives through the owner.
   d) Include builders into the design team structure as a prerequisite for any incentives.

3.2 Observations

In addition to the findings about the key market players, we discovered other important observations from the groups. These reoccurring issues were brought up in the context of both the market models and the program offerings, and are important to keep in mind while reading the rest of the report. They may be useful in developing future program offerings.

3.2.1 Improving Communications

There is generally poor communication between members of the design team, the team seldom includes the builders, and there is little or no communication between the design team and the owner or builder once construction has begun. The Savings By Design (SBD) requirement, which provides for design team incentives after completion of construction and installation of equipment, tries to encourage this communication and the on-going involvement of the designers. However, most of the designers felt that this requirement was impractical with the current design/construction structure. If the design team incentive structure is to remain as is, then a mechanism must be developed to involve the builder and improve communication.

The idea of an "integrated team", including the builder, was discussed by some group participants as an effective means of addressing the issue. Some

designers experienced with the proposed approach admit that builders can provide benefit to the process with their knowledge of material and equipment costs. On occasion, the owners' construction manager, or cost-estimator, serves the purpose of a building mediator to the construction team.

A possible program requirement could be for the builder, or construction manager, to be part of the design team in order to qualify for program participation. Another option is to use the builders' participation on the team as a requirement for receiving the incentive early. Much has been said recently about taking an integrated approach to design; using modeling tools to analyze the impact of various system options on the whole building. From the experience of the designers, it appears that an emphasis on integrating the design and build phases of construction would be equally valuable. This means greater inclusion of the builder in the design of the building and greater involvement of the architects and engineers during the construction phase.

3.2.2 Importance of Utility Energy Programs

Participants were asked the impact of eliminating the utility energy efficiency services. In general, designers felt little impact would occur on them or on overall design practices. Many designers value the services available through the energy centers, particularly for those in San Francisco and surrounding areas serviced by the PG&E Pacific Energy Center. They commented that they would miss the services, but that it most likely would not impact their design practices significantly. They also indicated that consistency in programs is important. If programs change dramatically from year to year, the developers, and even designers, get frustrated and tend to ignore new offerings.

Owners, on the other hand, thought that it would be very detrimental to their projects if the utility programs were eliminated. Further questioning made it evident that they were speaking primarily about direct incentives. This corresponds to the designers' view that program incentives are an important element for motivating owners.

These responses can be interpreted in several ways. First, the designers' comments can mean several things:

1) the program has little effect on practice,
2) the program has transformed general practice,
3) the designers are claiming to know more than they really do, or
4) the designers feel that they, personally, are well educated on energy efficiency, but that other designers may need the services, yet may not be using them.

All of these reasons came up in the context of our discussions, but we believe the second reason is the most valid. This effect is seen in the interaction of utility programs and energy standards as explained in the following sections of this chapter.

The owners' comments indicate that program incentives are still very important to them. Without utility program incentives, there would be very little interest in energy efficiency among the owners. Without utility credibility and support for designers, owners would not be inclined to emphasize energy efficiency in their projects.

The differing responses of the owners and designers indicate that an educational element that brings the owners and designers together is critical to a successful program.

3.2.3 Importance of Energy Standards

Participants were asked the impact of relaxing or eliminating the state's Title 24 energy efficiency standards. Designers hypothesized that relaxed energy standards would unfortunately cause lowest first cost to increase in importance. Their most common reaction to the suggestion of energy standards "going away", was, "Disastrous." They all concurred that energy efficiency standards are necessary to maintain a minimum level of efficiency. One designer suggested that the way to overcome the barriers to energy efficiency is to "make it like a law." He continued with, "unless you mandate it, no one will adhere to it." We were unable to clarify with him how his statement related to or differed from Title 24 requirements, but it supported a common theme by most of the designers that the most likely means of impacting long-term energy efficiency improvements is through government regulations. Many focus group participants specifically said that standards need to be pushed a little further every few years. It is perhaps significant that the totality of the designers' comments led us to believe that they were talking about other designers, not themselves, relaxing their energy efficiency levels in the absence of standards. They virtually all portrayed themselves as currently going beyond the standards.

Owners categorized Title-24 as normal conditions, claiming that its removal would not cause significant change. They pointed to the fact that T-8 lamps have become the norm and that it would be very unlikely that they would "downgrade" lighting now. In this context they specifically spoke of lighting, as opposed to HVAC equipment or other requirements. They acknowledged, however, that some items might slip due to "lowest first cost" considerations. Lighting controls and switching requirements were repeatedly mentioned as falling into this category.

3.2.4 Link between Programs and Standards

There is an explicit connection between utility programs and energy standards. We conclude, from comments made during the focus groups, that utility programs (within California and beyond) are transforming general building design practice.

It is important to understand how utility programs influence energy standards and how the energy standards function in relation to utility programs and building

practices. A discussion of the evolution of, and connection between, energy standards, building practice and utility programs is provided in the Appendix.

As mentioned by the focus group participants, there are usually economic incentives for builders to cut as many corners as possible. The energy standards, which should represent current good practice, prevent the least efficient practices from being widespread. If the standards start to lag good practice, however, the energy code could become a drag on practice, by allowing people to build at levels that are actually below current good practice. With a code upgrade, the newer, more efficient building practices are "locked in," and made a permanent part of the building code.

Energy codes affect building practices, and hopefully improve them. At the same time, the state of current building practice puts a limit on what can be accomplished through codes and standards. Utility new construction programs have historically led the way to higher efficiency designs, by providing incentives to promote building practices that go beyond the current code requirements. This complementary relationship between voluntary programs and mandatory standards has ensured that new technologies are promoted and specified to the extent necessary to achieve market transformation.

These market mechanisms were confirmed throughout the focus group discussions. While few participants described the relationship between utility programs and energy standards, the participants cited numerous practical examples from the real world of building design and construction that supported this model of market transformation.

4. MARKET BARRIERS TO ENERGY EFFICIENCY

During our focus group sessions, we discussed the various market models that exist. After the models were described and the relationships of the key players determined (as discussed in the following chapter), we discussed the barriers to energy efficient design.

During our market model discussions, we tried to learn from the participants, which problems associated with energy efficiency are restricted to certain market models and which are applicable to all of them. We started with a general discussion of project drivers, then related those to energy efficiency designs and technologies.

Based on the comments from our focus group participants, we can explain the significance of the market models in relation to energy efficiency decision-making. In this section, we will present comments made by the participants, as well as provide some insight into how these opinions and influences can help shape the design and direction of energy efficiency programs.

4.1 Project Drivers

In order to understand how to make energy efficiency a more important influence in nonresidential new construction, we need to understand the key drivers of a commercial new construction project. These drivers are listed in order below.

Budget. The project budget, in terms of first cost, is the primary project driver. Designers feel constant budget pressure from their clients, both in terms of a tight original project budget and a tightening of the budget during the construction phase, as unexpected costs crop up. Long term O&M budgets are not considered during the design phase for most types of projects, therefore, there is little opportunity to trade-off between first costs and O&M costs. This disconnect is becoming even more common with owner/builders as more corporate owners build like developers.

Schedule. Several designers and developers mentioned that project schedule is almost as important as budget; indeed, in many cases, it seems to be more important. All designers complained that the project schedule is almost always a short time frame. Buildings are designed and built too quickly to adequately consider energy efficiency and other long-term issues. Several developers indicated that they are often talking to designers before they have purchased the property. Both designers and developers agreed that during construction booms, this issue is especially pronounced, and building quality tends to suffer because of the demand to get buildings up quickly.

***Owner's Sophistication*.** The sophistication and education of the owner has a very big impact on the project and the opportunity of investigating energy efficiency options. Having an educated and committed building owner can often

mean that most of the barriers associated with energy efficient alternatives either never come up or are more easily eliminated. From the viewpoint of designers, this is the most significant criteria for a successful, energy efficient project.

Experience and Education. The experience of all of the stakeholders, not just the owners, is critical to a successful project. An educated and experienced design team can educate its client on design issues. An experienced team can incorporate energy efficiency features into the design, sometimes even without the owner's knowledge. An experienced builder is also important to a successful project completion.

Construction Bid Process. The type of project and nature of the construction bid process have an impact on the successful implementation of an energy efficient design. As discussed in Chapter 5, there are variations to the market model that affect how the construction bid process impacts energy efficient decision-making. The options are typically design/build, where the builder is selected prior to the design phase and is closely involved in the design, or a competitive bid process where the contractor or builder is selected after design is complete. The design/build process can be more energy efficient than competitive bid because of more communication with the builder and less value engineering. The design-build situation can also provide a design that is improved through replication and refinement.

Identification of End-User. Whether, or more accurately when the tenant(s) of the building are identified has a great influence on how the project is developed and whether energy efficiency can be effectively incorporated. Speculative projects with no known or idealized tenant in mind tend more toward the generic.

4.2 Barriers to Energy Efficient Design

In the context of the market models, we discussed with the focus groups the barriers to energy efficiency and how barriers are surmounted. All of the participants agreed that if the owner is interested, and the budget and schedule allow, then an energy efficient design would have the greatest likelihood of successful completion and operation. However, it is rare for all of these to come together. Although most designers felt that the owners' requirements drive the projects, many of them were of the opinion that the decisions of other market actors hampered energy efficiency design.

The market barriers discussion took many forms based on the dynamics of the group, however, the same major conclusion was reached by all groups - first cost constraints are the biggest barrier to energy efficiency. This and other barriers are discussed below.

Equipment and Design Costs. Several cost-related issues were identified as common barriers, with first cost of equipment being the most common. Additional design costs to research and analyze the technologies were also considered barriers to the widespread implementation of energy efficient technologies. As one designer stated, "We are not paid to learn new information. The client

assumes that you know the latest and greatest." Owners said they think their designers are already considering energy efficient options and recommending those that are cost-effective.

Hassle Costs. Research costs are closely linked to "hassle costs." The designers often experience hassle costs related to convincing clients to approve an energy efficiency design. There are also hassle costs associated with obtaining information about specific high efficiency equipment and building components, or obtaining the equipment and materials themselves. Often, hassle costs are as much schedule issues, as they are budget issues. The pace of the project may not accommodate the additional time needed to locate and purchase specialized components.

Schedule. Another strong barrier is related to project schedule and timeframe. Timeliness is very important. It matters almost as much as budget. The schedule is a constant issue for the design team. Designers are always pressed to finish their work in a short time frame. According to many architects, clients are concentrating on project completion with a pre-determined end date, often before the design even begins. Explanations given for this include both the high cost of construction money and lost revenue due to construction delays. The schedules are typically unyielding, not allowing time for extra research or energy savings cost analysis.

Budget Constraints. Closely associated with first costs are overall or general budget issues. Fixed or limited budgets are identified as the restraining element of first cost issues. A limited design budget may constrain how much alternative design effort the team can make. Design decisions are usually based on budget constraints and on priorities among many competing design considerations. Most financing options require an upper limit budget amount. For speculative buildings in particular, life cycle costs and benefits, and quality are not part of the financing decision.

The practice of mixing first cost and O&M budgets is limited, which means that trade-off options between the two are limited. For many project types, mixing of design, construction and maintenance budgets is not an option. For example, public schools have fixed budgets based on voter-approved bonds, therefore the option of borrowing from the O&M budget to increase the construction budget is not legally available.

Lack of Professionalism. Many architects feel that their profession as a whole is too acquiescent to clients' demands and too willing to give away design services. The architects in our groups felt that lowest cost competition among architects hampers their ability to provide any additional services, including energy efficient design options.

Related to this is the ability of designers to sell their services. Some architects indicated discomfort or inability to promote the "softer" service of energy efficiency design. One architect characterized the market by saying, "there is a market for 'morally correct' sustainable design", however the client may not be

willing to pay higher fees for the service." The architect feels that it is hard to absorb learning costs in a competitive market.

Lack of Knowledge. Lack of knowledge shows up as a barrier both in terms of designers' lack of knowledge, as well as owners' lack of knowledge. The designers' clients - owners and developers - are inexperienced in requesting energy efficiency options and ignorant or unconcerned about the long-term consequences and energy costs. Designers feel this is a barrier to their ability to promote energy efficiency.

Energy is Non-tangible. Designers feel that it is difficult to emphasize the importance of energy efficiency to building owners and occupants, because it is non-tangible, especially relative to architectural features. Only when energy rates increase significantly, will there be real interest in energy conservation. When energy costs are stable, and artificially low, energy conservation is not a priority.

Energy Efficiency Add-ons. Energy efficiency features are still thought of as accessories instead of essentials. During our discussions, it was evident that most of the participants did not look at energy efficiency alternatives and analysis as part of the design process. These elements were always discussed in the context of additional or extra services. Some designers feel obligated to call out design and analysis of energy efficiency options as an additional fee because the extra work takes extra time. They feel that the owner needs to be asked if they want the extra service.

Calling out the energy efficiency measures as a separate "add-on" has the additional disadvantage of identifying them as discreet elements that can be cut if/when the construction budget needs to be pared. One architect stated, "clients have told us 'you can put it all in, as long as we can take it all back out.'"

When the problem is cast in this way, the owners place all the risk, and none of the rewards, on the designers. Lacking support from the owners, few designers choose to take the risk of extra design effort. This is especially true when the subject of energy efficient design entails a costly learning curve for designers.

When the owner is interested in investing in energy efficiency, they can split the risk with the designers: the owner invest in the efficiency measures and pays for the extra design effort, while the designer invests time in learning new methods.

Aversion to Risk. Aversion to risk was described by designers as a psychological barrier both for themselves and their clients. There is risk associated with specifying new, more expensive, untested equipment and systems. The influence of one bad experience with a "new" energy efficient technology in the past[5] seems to have a profound and lasting impact resulting in an attitude of "let others prove the technology before I sell it to my clients." Without proper compensation, designers are reluctant to devote time and money to learning about the latest technologies or analysis methods. This is

[5] In some cases cited, "the past" was as long as twenty years ago.

compounded by the lack of resources and expert information for new technologies.

There have also been problems with previous utility programs contributing to their risk aversion. Because past failures tend to be remembered more acutely than current successes, any negative experience with energy efficiency programs will have a harmful impact on energy efficiency program activities, regardless of changes that occur in the interim, and in spite of different program designs. In addition to problems with past programs, there is a general lack of awareness of current energy efficiency programs.

Split Incentive. The economic driver to install energy efficient technologies is removed when the party responsible for the initial installation of the product does not reap the rewards of the investment. This is known as a split-incentive. The dynamics of the development, ownership and occupancy of commercial buildings creates problems with energy efficiency alternatives because of split-incentive issues. A significant split incentive is created with typical lease agreements. In many lease agreements, especially in retail situations, tenants are responsible for their own utility bills. While some large tenants can be convinced that it is cost-effective to make energy efficient upgrades, small tenants are generally not willing to absorb the extra expense of upgrades to buildings they do not own. Because building owners are not connected to ongoing energy costs and will not receive the energy-savings benefits, they have no motivation to consider energy efficiency upgrades.

Short term ownership and multiple, small tenants within one building compound the problem. For many commercial projects, the owner keeps the building for less than five years, making investment in long-term energy strategies unlikely. Leasing and marketing needs, not long-term operating issues, drive speculative projects in particular. However, one designer said that her clients are actually using energy efficiency features as part of their exit strategy for short-term ownership. Their opinion is that high profile energy efficiency features enhance the “resale” of the building and shorten the amount of time the property is on the market.

Some designers felt that even building owners who pay the utility bills may have a disincentive to install energy efficiency measures. This is fairly typical for large companies or government agencies. The organization owns the building, however the decision-makers in the construction phase are different from the decision-makers that have control over the building operation and the operating budget.

Construction Bid Process. The impact of the construction bid processes on energy efficient design varies by project type. The competitive low-bid process is usually detrimental to an energy efficient design, because it discourages including the builder as part of the team. A design/build contract has a greater likelihood of effectively incorporating energy efficiency, but can also have limitations. Some designers feel that the design/build process often emphasizes the build part of the process, over design. The pace and timing of this bid

process may actually preclude any meaningful input to the design from the builder, and the pace of the construction may preclude any meaningful input from the design team during construction.

Communication. All of the participants recognized that communication between the designers and builders needs improvement. In general, the designers do not communicate with the builder and vice-versa. This seems to stem from a common design scenario where the architect is "off the job" once the plans are done and the permit issued. Lack of communication between designers and builders leads to problems with the installation of energy efficiency measures.

Sellers' Market. One developer group in Northern California described a "sellers' market" as a barrier. In the sellers' market, the abundance of "buyers" (in this case, lessors), allows sellers to dictate the product. For example, if the tenant requests upgrades, and the owner or developer feels s/he can lease the property without the added expense, the tenant will be asked to look elsewhere. Because this issue came up in the final focus group, we were unable to explore whether this condition exists in other parts of the state. However, it is probably true that during periods of an expanding economy, the market can be described as a sellers' market and buildings will tend to find a lower common denominator.

Non-Energy Issues. Long term comfort and productivity are more important to owners than energy costs. If the owner perceives a choice between energy efficiency versus comfort and productivity, s/he will always select the latter. A well designed building and its systems will enhance both comfort and productivity. However, several of the owners, developers and designers we spoke with viewed energy efficiency as being in conflict with these other goals. When we pursued this issue, it was apparent that they had prior experience with energy conservation options that had a negative impact on comfort and productivity. These included lighting controls that did not work properly and lighting designs that, in their opinion, did not provide enough light to the occupants. As noted above, one or two negative experiences can, apparently, damage energy efficient building design efforts for years.

4.3 Reducing Barriers

After discussing the barriers to energy-efficiency, we asked the focus group participants to suggest ways to reduce or overcome them. All the designers mentioned "a committed owner" as the most important element for over-coming barriers to energy efficient design. Several financial options were also suggested as methods to reducing barriers. These and other suggestions are discussed below.

Educated/Committed Owner. As mentioned previously, an educated and committed building owner is thought to be critical to addressing and overcoming most of the barriers associated with energy efficiency.

Financial Assistance to Owners/developers. Financial assistance to owners and developers to cover extra cost was identified as the most important

assistance that utilities could provide to ensure that energy efficiency features are incorporated. This includes both incremental first cost of the equipment, which was identified as the most important barrier, as well as the additional design costs.

***Financial Assistance to Manufacturers*.** Both developers and designers suggested financial assistance to manufacturers to reduce the initial cost of their products as an alternative to owner and designer incentives. The suggestion was made to provide incentives to manufacturers to "buy-down" equipment costs. Reducing the production cost of the equipment helps the manufacturer to increase the product volume, which serves to further reduce costs.

Other Financing Options. Both owners/developers and designers suggested low-interest loans provided by federal and state agencies, utilities, and private entities as a means for financing energy efficiency options. Many focus group participants also suggested tax breaks from state or federal governments. In most cases when this option was brought up, it was discussed in the context of the solar tax credits of the early 1980s. Other financing services were suggested, however the particulars of these strategies were not discussed.

Offering free, or low-cost, land for high efficiency buildings as an incentive to owners and developers was suggested in the context of alternatives to traditional incentives. The designer who suggested this option described it as an incentive from the city or local jurisdiction. The practicalities of such an offering were not discussed in detail.

Mandatory Regulations. Designers in particular felt that mandatory regulations are an effective way of improving energy efficiency. They believe that T-24 energy standards have helped reduce most barriers, and feel that relaxing or eliminating the standards would have disastrous impacts on the level of energy efficiency in buildings.

Conversely, owners and developers felt that if the energy standards were relaxed or eliminated, the current level of energy efficiency would remain. This opinion suggests that the current design requirements are acceptable to them, and in essence, are a part of doing business. A contrary opinion was that energy standards are not cost-effective, because they don't save enough energy to over-ride additional costs. This opinion clearly suggests that owners and developers would not be building to code if they were not required to do so.

Construction Loan Underwriting. Construction loan underwriting by the utilities could take the form of cosigning for 10% to 15% of the project budget for program participants. This utility involvement says to the lender "the utility and I are Energy Partners". The developer who made this suggestion argued that there wasn't much risk to the utility since most construction projects that fail are sold to other developers who will finish the project.

Cost/Payback Analysis Support. Designers requested assistance in the form of a tool, or presentation template, that could be used to show their clients cost-payback analysis. They emphasized that they need to demonstrate cost

effectiveness in simple terms with quick calculations and clear and simple graphical presentations. While this will not be effective for projects where long-term cost-effectiveness considerations are not pertinent, it will be effective in helping the designers to "close the sale" with an owner who is receptive.

Promoting Non-energy Benefits. Several designers indicated that non-energy issues, such as occupant comfort and productivity, are much easier to sell to the building owners. Long term comfort and other employee-related issues are important to building owners. The productivity benefits of an energy efficiency upgrade can be orders of magnitude larger than the energy cost savings themselves.

Building Relationships. Several designers commented that the key to ensuring that their designs are actually implemented is a strong relationship with the owner. This includes staying close to the owner throughout the construction process. One designer also emphasized that a good, long-lasting relationship with the general contractor or builder is an important element for successful energy-efficiency design. Other designers described building relationships as "building a team early in the project and including the owner, the builder and the building operator."

Improved Communication. Bringing the builder in at the design phase for cost-estimating support helps with the communication problem between designers and builders. The builder may be brought in as a consultant to the design process or may ultimately build the project. The designers prefer that the builder who will construct the project is involved in the project from the beginning. Owners and developers acknowledge that there is a communication problem between the design and build elements of the project and expressed interest in finding solutions to the problem.

Energy Efficiency as Environmental Movement. Several of the designers associated energy efficiency with a broader context of sustainability and environmental protection and suggested the need for a "movement". These designers believe that the key to increasing energy efficiency importance is promoting it as a cultural issue, such as global warming. This requires a concerted, full-scale effort of rebates, standards, and tax incentives. The issue must be transformed into a movement, advocated, coordinated and publicized by government, the utilities and/or private enterprise. There needs to be a general awareness that will set trends and make efficiency more important. It was described in terms of environmental values including stewardship, "doing the right thing" and public awareness.

This spirited answer came from the designers interested in green architecture and sustainability. Despite the obvious bias, the comments have merit because the people who gave them are knowledgeable about the issues. There were similar, although not as concrete, responses from other design groups and some owner/developer groups. They pointed to economics as the primary driver for influencing energy efficiency through increased energy prices and/or another energy crisis.

5. MARKET MODELS AND ACTORS

In order to develop effective market interventions for improving energy efficiency, it is necessary to have a clear understanding of how the target market functions. It is useful to cast this understanding in the form of a market model, *or models*, which describe(s) the roles of the different market actors, how they and their actions interrelate, and what their different needs and priorities might be.

We began this study with a re-examination of the market model developed in the Nonresidential New Construction Statewide Baseline Study (Baseline Study) and then expanded the market model to include several variations that are prevalent in the nonresidential new construction market.

In the Baseline Study, 56 designers[6] were interviewed via telephone, and 160 responded to an Internet-administered survey. These findings led to development of a market model that identifies the key players and explains their relationships.

Understanding the relationships and interactions of the key players in new construction provides insight into the dynamics of the decision making process. This information is important for program development because it allows program designers to understand which market intervention strategies will be effective. In order to successfully transform a market, we must be familiar with the basic structure of the market and all of its subtleties. We believe that the CBEE Baseline Study conducted by RLW Analytics was a good first step in understanding the basic structure. In this follow-on research, we are able to describe the complexities and subtleties in greater detail.

We were able to learn, among other things, who makes decisions, the timing of decisions in the design and construction phases, the level of communication between designers and builders, and the level of communication between the owner and all members of the design and construction team.

The first section of this chapter summarizes the findings from both the Baseline Study and this Focus Group Study. Further descriptions of each of the key players and the supporting players are provided in following sections.

5.1 Market Model Summaries

5.1.1 Market Model Summary from the Baseline Study

This section summarizes the hypothesis of the market model research, resulting from RLW's work. A more complete discussion of the RLW research results is presented in Appendix A.

[6] "Designers" is a general term for architects, mechanical engineers, electrical engineers, lighting designers and others who design and specify building components.

The key actors in the non-residential new construction market are:

- Owners
- Designers (Architects and Engineers)
- Builders (Contractors and Subcontractors)
- Equipment manufacturers

The Baseline study looked at the relationship between the market actors. These groups are inter-related in the new construction market in a variety of possible relationships. The original model of the relationships between market actors is shown in Figure 2. In this structure, the architect is assumed to be the primary contact with the owner and is the project leader.

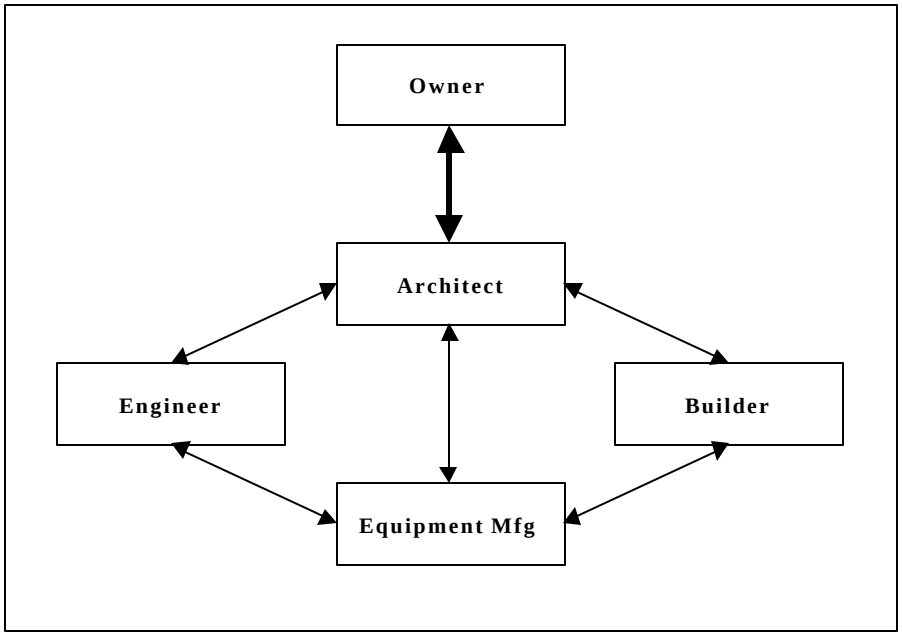

Figure 2: Basic Relationships in New Construction

Each of the market actors has a specific role in the process of designing and constructing buildings. They can be summarized as follows:

Owners The owners originate the project but may or may not be the ultimate users of the building. Because this group provides the financing for the work, final approval of construction details, including any energy efficiency options, and budgets falls to this group. Building owners have traditionally received the incentives provided by utility sponsored programs in new construction.

Architects Architects are the principal designers of the building and traditionally the leaders of the design teams. The architect is responsible for the overall conceptual design, detailed design for the construction trades, project management, and interface with the building owner.

Engineers Mechanical, structural, and electrical engineers support the architects on technical aspects of the design. Of specific interest to energy efficiency are the mechanical and electrical engineers that specify the major energy using systems in the buildings.

Builders The builders (general contractor and sub-contractors) will physically construct the building. The experience, knowledge, and skill of the builders will affect the installation and operation of energy efficient equipment.

Equip. Mfg. Equipment manufacturers supply the new construction market with the components and systems to build the structures. The availability of efficient equipment and components from manufacturers affects the ability of architects and owners to build more efficient buildings.

Based on the key findings from the Baseline study, a revised market actors model was postulated. The revised Baseline model is summarized in Figure 3. The differences between the original and revised models are important:

- The relationship between the owner and architect is strong but not as strong as expected. Generally, the owner makes the final decisions whenever costs are affected.
- The owner sometimes works directly with the builder and overrides the recommendations of the architect. This may lead to occasional violations of Title 24 requirements.
- The operator and/or maintenance contractor may be an indirect but still significant factor in the process. The owner's decisions may be affected by concern about the operator's ability to manage innovative equipment. Unfortunately, the architects and engineers may have little opportunity to train the operators because of operator turnover and other factors.
- The architects depend on the engineers for their technical knowledge about equipment and often about technical options that may improve energy efficiency. But, unfortunately, the engineers may be excluded from the design team working with the owners.

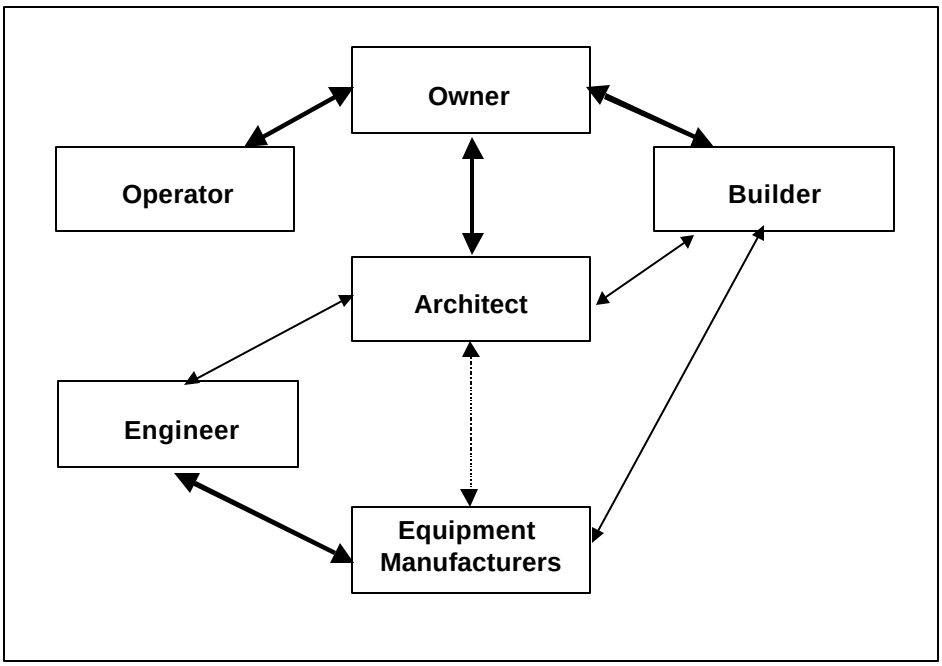

Figure 3: Revised Baseline Model for the NRNC Market

The most important implication of the revised model is the following:

> *Due to the relatively weak link between the architects and engineers, and the even weaker link between the architects and equipment manufacturers, there is a weakened connection between (a) the engineers and equipment manufacturers who possess the technical knowledge about energy efficiency, and (b) the owners, architects, and builders who make the crucial decisions about the buildings.*

In our focus group discussions we presented the simple relationship illustrated in Figure 2, above, and probed for confirmation of the more detailed model. In particular, we probed for aspects of the relationships that might create barriers to energy efficiency.

5.1.2 Market Models Summary from the Focus Groups

We used an approach to develop information that was complementary to that of the Baseline Study. It proved to be very useful for developing greater insight into the dynamics among the key players.

The most important finding in our study is that the market model concept is more complex than was defined in the Baseline Study. Although we can create a single, more complex, diagram to describe the model(s), as shown in Figure 4, there are actually several market models based on the type of project. Each will require different market intervention strategies.

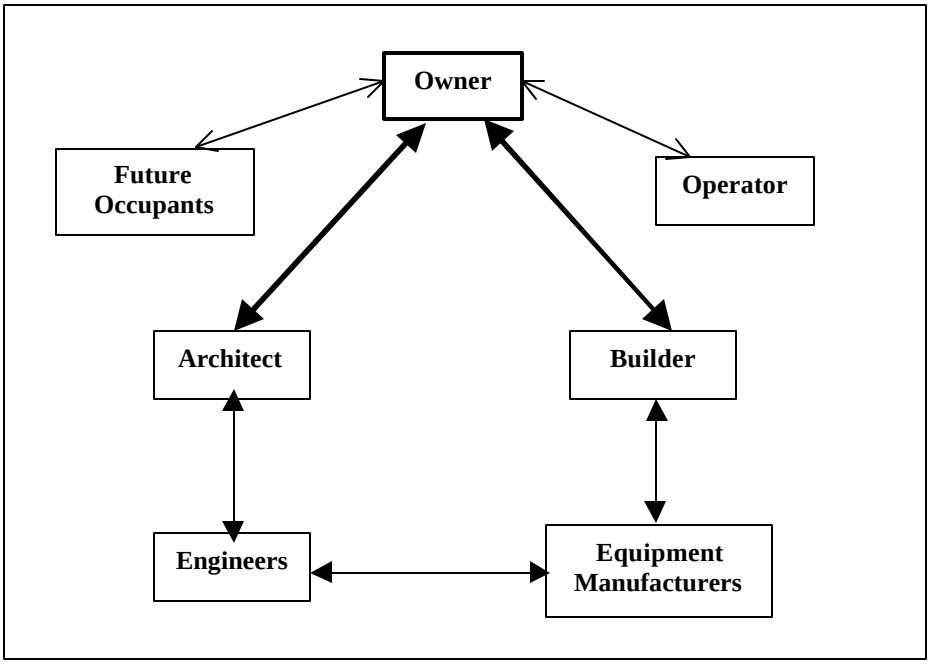

Figure 4: Revised NRNC Market Model

The applicable market model for a given project is closely linked to the type of building and to the involvement and motivation of the owner. For example, owners, designers and builders of a large owner-occupied projects work together very differently than would the same three professions involved in a "fast tracked", speculative project. Their motivations and limitations likewise differ markedly. Thus, the intervention techniques must be different.

Project types can be summarized by ownership type, by building size and type, or by construction bid process. We will discuss the variations in general, then provide some examples to describe particular arrangements.

Design Phase

Ownership types, as described in the Baseline Study, include publicly owned, owner-occupied, and speculative development. Public buildings are typically buildings owned and operated by federal, state, or local governments. Owner-occupied buildings are funded and constructed by private organizations for private use. Speculative projects are developed for the purpose of selling or leasing the building for profit. From our group discussions, we learned that while these three categories cover the range of ownership types, there are variations and subtleties within each.

Speculative Projects. In speculative projects the variation comes in terms of what the developer plans to do with the building once it is built. We can describe these variations as:

- build – sell,
- build – lease – sell, or

- build – lease – own.

The first option is the traditional speculative project arrangement where the developer buys the land, finances the design and construction, then sells the project to someone else. The other two variations also are speculative in nature because the developer is assuming the risk of financing the project without a guaranteed tenant.

For any speculative project, the owner or developer is generally looking to build and sell or lease the building as quickly as possible. Any additional feature or operation that adds time and money will not be considered if it does not increase the rent or result in faster leasing. Developers indicated that this latter effect was more important than other factors including energy efficiency. The requirements of the speculative project directly impact the relationship that the owner has with the other players. The owner deals directly with the architect and builder and sometimes with the engineer. There are typically fewer interactions among the players, and therefore no opportunity for design integration. The strong and weak links of these relationships are shown in Figure 5.

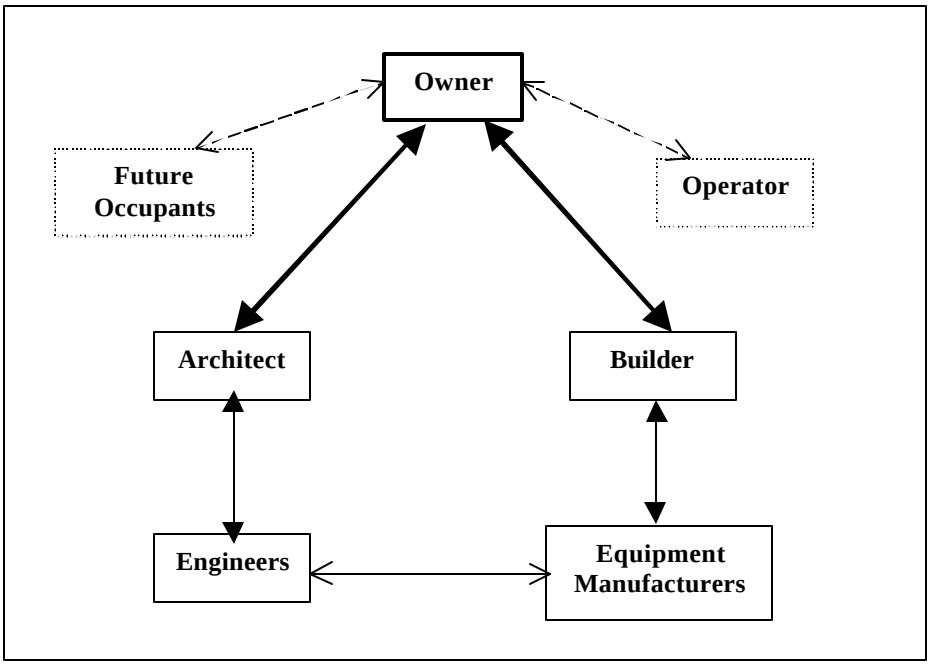

Figure 5: Speculative Development Market Model

Developers of spec buildings tend to use this model in organizing their teams because they typically do not know whom their tenants will be or what the final usage of the building will be. Also, they tend to finance as they go. Because of these factors, they tend to do the project in stages, which makes it difficult to achieve the integrated design or design team that, for example, a corporate owner can assemble.

Another variation of the speculative model is the build-to-suit model in which a developer is building a building with a specific tenant in mind. While this is

technically considered a speculative project due to the risk assumed by the developer, for the purposes of our research we feel this arrangement, in terms of tenant involvement, is more similar to an owner-occupied project. Build-to-suit projects are designed with a specific tenant in mind. The tenant may own the space or lease the space, but is not directly involved with the design process. Typically the developer consults the tenant during the design phase. Build-to-suit projects are a fairly significant portion of new construction projects in the state.

Owner-Occupied. Owner-occupied projects vary in terms of the involvement of the owner in the design and construction phases. In some cases, the owner is very involved in the process and meets regularly with the design and construction team(s). In other cases, the owner hires a development company to handle all project construction. This latter arrangement is similar to a build-to-suit arrangement.

Publicly-Owned. The decision-making process and restrictions on publicly owned buildings also vary. A public assembly space owned by local government, such as a museum, has different restrictions than a public school project owned and operated by the state. In the latter, construction funding is obtained through voter-approved bonds typically with very tight budgets. An example of the former may be a city-owned museum, which will be the cornerstone of redevelopment. In this case, the city council may decide to devote additional resources to “make their mark” on their city.

Usually the greatest interest in energy efficiency occurs in owner-occupied and publicly owned projects and there is greater opportunity for interaction among the players than in a speculative project. With an owner-driven type of arrangements the interaction among all the players may be strong, as shown in Figure 6.

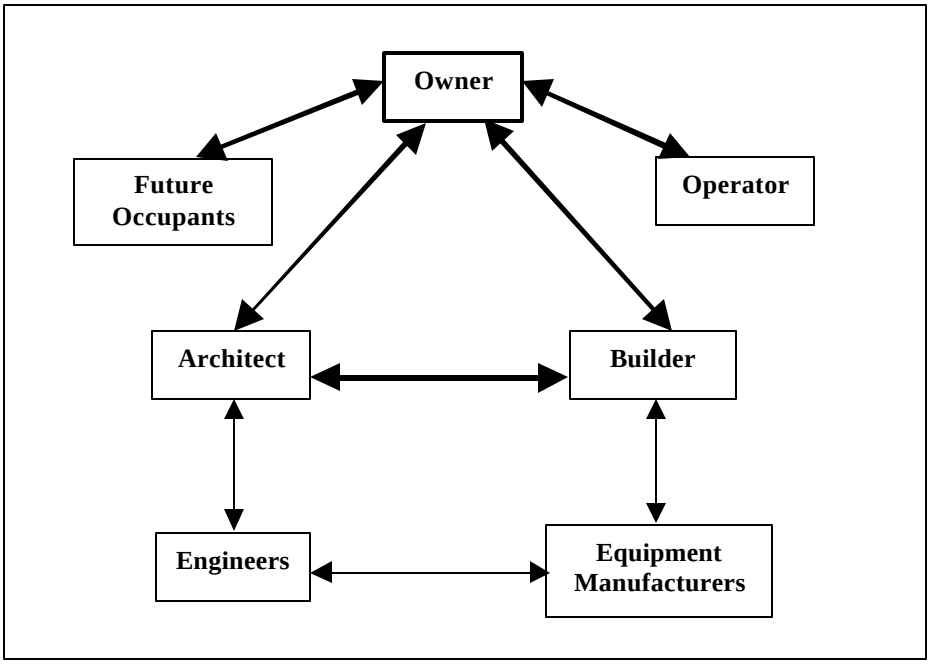

Figure 6: Owner-driven Market Model

Some owners and developers include the tenant as part of the team or consider the tenants' needs during the decision-making process. When the tenant is included the benefits of energy efficiency are more likely to be considered than in cases when there is no direct recipient of the benefits. Particularly when the building occupant is a long-term tenant, there is more interest in long term operating costs. In these circumstances there may be the opportunity to trade off between first costs and operating costs. A sophisticated owner may intermingle the construction and maintenance budgets, realizing that s/he can save on the latter by appropriate additional expenditures in the former. This can happen in institutional projects and government projects. Unfortunately, this does not happen in most public school projects due to construction funding limitations, which preclude mixing of construction and O&M funds. Additionally, many developers do not have the ability to mix budgets because they have little control over maintenance budgets.

The owner's interest in long term costs versus first costs can affect the relationship between the players due to the amount of time they are willing to invest in the design phase. If the owner is interested in optimizing long-term costs, the designers will generally be given more time to interact than if first costs are driving the project. Additionally, more interaction, and time, is necessary to explore the inter-relationships of alternatives for meeting the building's goals. The most effective design cannot be achieved by picking equipment or materials without exploring the effects on other's designs.

The three market models diagrammed in this section show the major variations in the market. They are distinguished by the strengths of the interactions between the various actors. There are, of course, sub-variations unique to individual

projects, depending primarily on how the owner has set up the project team and on how the team members work together. The three models appear to predominate in the market, and they provide a useful mechanism for discussion of the differences in market barriers and the intervention strategies needed to overcome them.

Construction Process

In addition, to differences in ownership type, there are differences based on the bid process used for the construction phase of the project. The options are typically design/build, where the builder is selected prior to the design phase and is closely involved in the design, or a competitive bid process where the contractor or builder is selected after design is complete. These differences in the construction process affect the relationships among the players, and impart different apparent hierarchies.

In a design/build situation, the owners and builders act together as developers. Obviously, in this type of arrangement the owner and builder are closely linked. Some of the designers stated that the design/build process is better than speculative, competitively bid construction, in terms of integration of energy efficiency and actual follow-through. Others thought that a design/build process places too much emphasis on the "build" part, and not enough on "design." As one developer put it: "I look for an architect with design/build experience." This comment indicates that he is looking for a "hands-on" practical architect as opposed to a more "research-oriented" architect. In the design/build case, selection of professionals and design of the building most likely won't be a lowest bid situation.

In a competitive bid process it is not uncommon for the lowest bidder to get the contract. Designers believe that the lowest bid process practically precludes the builder from being part of the team. Owners and developers acknowledge that the lowest bid contracting process hampers any communication between the design and build components of the project. Many times a lowest bid construction process results in the contractor having to eliminate design features during construction including energy efficiency options. Indeed, designers said that even though construction bidders ostensibly are bidding to build to their (the designers) specifications, the builders often argue after the fact that "that wasn't the quality I was bidding. That will cost extra."

Typically, in a competitive bid arrangement there is virtually no communication between the designers and builders because the designers are off the project when the builders begin.

A competitive bid process that is not based on lowest cost allows the owner to select the contractors who best meets the requirements of the project. If the owner desires, the builder's involvement may include project review with the designers.

Market Model Variations

The most common market model arrangement is indeed that described in the Baseline Study, which has the owner working with the design team and the builder. In this context, the term "design team" is used very loosely and refers to the architects and engineers, regardless of whether they actually interact on design decisions. As shown in Figure 4, we have revised the model to identify some of the additional complexities. Typically, the architect acts as the liaison between the owner and the engineers. The architect provides the overall project design to the owner at the beginning of the process. The engineers are brought in later and typically have to work around the basic building layout established by the owner and architect. The architect is then responsible for presenting the engineers' designs to the owner for approval.

In another scenario, which is also fairly common, the owner gets input from each of the other players, but there are not many interactions among the other players. One small commercial owner/developer said that she works directly with the architect and directly with the builder. In her situation, the builder has many subcontractors, including the engineers. Although this structure appears to improve the designer-builder communication, there is still a lack of coordination between the architect and builder. This arrangement is fairly common for design/build projects.

An owner or developer may bring a construction manager, or cost estimator, to the project to serve the role as the design team liaison with the construction team during the design phase. In this arrangement, the construction manager is responsible for supplying product availability and cost information to the design team. Many of the owners and developers feel that having the construction manager as a third party alleviates some of the potential architect/builder conflict. Most designers agree that having this type of person as part of the team is helpful to the overall success of the project. However, some of the designers suggested that the construction manager tries to justify his/her existence and sometimes creates issues where they don't really exist. Other designers explained that every construction manager has different experience and expertise, but it's not usually energy-related.

The builder may be brought in as a consultant to the design process directly. This person, or firm, may or may not ultimately build the project. The designers prefer that the builder who will build the project is involved in the project from the beginning.

The common theme of all of the possible models is that the owner is the head of the team, regardless of the type of project or design "team" arrangement. Details of the relationships between owners and their designers and contractors vary, however, the owner is always the ultimate project coordinator and makes the final decisions. The key to a successful team relationship as mentioned by all players is the owner's commitment to the team and the project. An ideal team includes everyone – architect, engineers, builder, and owner.

If energy efficiency is included, it is typically the owner who requests and implements the energy-efficient design. As one designer put it, "If [the] owner wants energy-efficiency and will spend the money, it will get done." The owner determines whether energy efficiency options are considered or adopted. The owner's level of involvement or interest ranges from: no interest at all; to a general interest in energy efficiency and allowing the team to investigate options; to requesting specific energy features. Having an educated and committed building owner can often mean that most of the barriers associated with energy efficient alternatives either never come up or are more easily eliminated. Designers said that this would most often be a large company or institution, and seldom a small client. These are the types of owners and projects that energy efficiency programs are going to attract.

All of the focus group participants recognize that communication between the designers and builders is the "weak link" in the process and needs improvement. Common market models, which tend to have the architect off the job once the plans are complete and the permit issued, create a disconnect between the architects' initial design and construction, and create communication problems in the process. This arrangement can occur in all market models and construction processes. It is very typical for speculative development, and less so for owner-occupied and publicly owned projects, which do tend to have true "design teams" where all members of the team meet with the owner, or owners representative, on a regular basis.

Focus group participants considered the usual team organization to be a barrier to communication and energy efficiency. Participants agreed the best project has a team effort where everyone, including the builder, is brought into the process early. Unfortunately, this rarely occurs. When designers and builders are doing their work independently of the other players, overall energy efficiency suffers. The segmented design/construction process described above is being addressed by the new statewide nonresidential new construction program, Savings By Design, by requiring the design team to stay involved until the project is complete.

The major differences in the market models boil down to three points:

1) the relationship between the owner and the ultimate occupant may be weak or strong, affecting the tradeoff between first cost and operation cost (comfort etc),

10) the relationship between the design team and the builder can be weak (competitive bid) or strong (design-build),

11) a construction manager can provide continuity between the design team and the builder.

It is important, for any given project intervention, to understand how these relationships are set up. Likewise, at the program design level, it is important that there be sufficient flexibility in program options to accommodate the variations in project structure. The variations of the relationships are described in

detail in the following sections, which present the different perspectives, roles and attitudes of the major market actors.

5.2 Owner's Role and Attitudes

The energy efficiency decision-making process is directly impacted by the sophistication of the project owner. The relationship between owners and their designers and contractors varies; however, in all relationships the owner is the ultimate decision-maker. Regardless of the project type the design and construction processes have gotten fairly complicated. As such, these processes often require more involvement from the owner.

In some cases, particularly if the owner is not experienced, s/he will rely more heavily on her/his design team. In other cases, where the owner is very sophisticated s/he will serve as the project coordinator, and stay involved with all of the details. In many cases this means that the contractor and each of the designers report directly back to the owner. In the best circumstance, the owner pulls everyone together as a team.

In general, all focus group participants agreed that owners and tenants are more sophisticated now than they have been in the past. Both are more often involved with the design. It used to be that owners were much more "hands-off," and would let the architect coordinate the project. Today, the owners still often rely on the architect and engineers, but make more of the decisions themselves based on their designers' recommendations. Several of the owners and developers added that the end users also impact the project either directly or be inclusion of his/her inferred needs and desires. Sometimes the "client team" includes the tenant, but usually not.

Although owners and developers were combined into one group for the purposes of our focus groups[7], we discovered that there are differences between them. Initially we defined owner as the person who owned the land, and hired professionals to help design and construct the building. The owner would then occupy or lease out the building. In many cases, however, the building owner is not involved with the construction of the project, but instead buys a finished building from a developer.

We initially defined a developer as someone who takes the risk of putting the project together, constructing the building and selling it. We have learned from our research that the roles and interactions of developers and owners are much more complex. Sometimes an owner will hire a developer to manage his/her project. Often a developer will build a building and lease it, instead of selling it.

The designers stated that the owners' perspective is very different from the developers'. The owner/developer group agreed that developers care less about

[7] We were unable to get a large enough number of owners or developers to make any significant distinction between the two professions. However we feel we can make some useful observations about what participants said about the differing motives of, and relationships with, the two professions.

energy efficiency than do owners. Some owners see the developer and builder or contractor as one entity. The following sections describe the opinions from the owner/developer groups and of the designers' opinions about the owners' and developers' roles.

5.2.1 Owner/Developer Comments

In general, most of the owners and developers that we talked to were not enthusiastic about or committed to energy efficiency. They acknowledged, and designers confirmed, that owners and developers tend to be more concerned with getting the tenants in than with the design and construction of the building. A few of them mentioned, however, that energy efficiency is beneficial to their business, as indicated by the following comments:

> *"Energy efficiency helps us be more competitive and helps us to hold on to our tenants."*
>
> *"Customers (end-users) are beneficiaries. If customers are interested in energy efficiency, then we will pursue it."*

One developer pointed out that portions of the commercial market are becoming savvy enough that owners have to include energy efficiency upgrades in their developments in order to sell them quickly after construction. Others emphasized that energy efficiency upgrades can actually increase the value of speculative property.

The owner/developer group identified the building owner as ultimately responsible for decisions, but the architect as the most knowledgeable about energy-efficiency. In general they believe that their architects are already examining energy efficiency options and providing the most energy efficient design that makes economic sense. Contradicting this general opinion, several of the owners and developers commented that there is not enough emphasis in the industry on smart design. They believe that more attention is needed on improving design, and using better components and materials.

5.2.2 Designers' View of Owners/Developers

The owner/developer comments are in sharp contrast with the architects' and engineers' reports that owners/developers tend to choose designers based on first cost. Many of the designers stated that owners will not hire teams who take (and charge for) the time to explore alternatives and that there is seldom any money in the design budget for the extra effort.

Designers believe that the owner is influenced by the future occupants' needs, which establish the requirements of the project. In the case of speculative buildings, owners and developers tend to decide what occupants are willing to pay for based on research and experience. The occupant thereby influences the design, even though s/he does not directly participate in the design. Several designers suggested that owners do not care directly about long-term savings,

particularly when they do not occupy the building. This is even more pronounced in speculative projects.

One of the architects argued that the designer's job is to help design buildings to be more energy efficient and sustainable without adding to the construction costs. He continued with, "As designers, we are responsible to bring the ideas to the table, and pursue the ideas, even if the owner doesn't know it. (We need to) specify correct materials (and) give the owners a building that goes beyond their expectations." Another architect concurred adding, "We let the client, and the industry, down when we do not push them to explore how to do it better."

The prevailing theme of our discussions with the designers was that the commitment of the owner is the most important factor influencing energy efficiency. To designers, the best client is one that is interested in, and committed to, quality, not just in terms of energy efficiency, but in all aspects. One architect described what he called, "the best project I ever worked on" as follows: "There was a Quality Assurance coordinator, as the owner's representative, who was present at every meeting and reviewed all of the design material. There was feedback throughout the whole design process, instead of just at the end." In this circumstance, the entire process was successful. It was less time consuming for the designers because they did not have to make major modifications to their drawings at the end of the design process.

5.3 Designers' Roles and Attitudes

The design team consists of architects, electrical engineers, and mechanical engineers. In today's new construction market, sometimes they work together as a team with iterative design discussions. More commonly, however, they work relatively independently with each designer completing his/her own portion of the design. The architect generally serves as the primary contact to the owner. The engineers give their designs to the architect who presents all pieces of the project to the owner. The architect's design sets the foundation of the project and engineers establish the limits with initial options. Engineers are typically not used to the integrated design approach.

Although owners are the final decision-makers on any project, it is clear that designers' experience and knowledge are critical to a successful project. Most of the designers in our groups said they were committed to energy efficiency and conservation. Some of the participants felt that as designers, they are responsible for bringing energy efficiency to the project. However, most acknowledged that they must follow the direction of their clients (the owner). If the client is interested in energy efficiency the designers will pursue it. Some designers indicated that they include energy efficient features in the design without the client's direction, if it does not negatively impact the cost of the project.

Many designers feel that their designs are restricted due to decisions and requirements by the owners, the builders, and sometimes the building operators.

Usually the project budget limits what the designers can do. Several of the designers admitted that they don't have a good idea of current costs. Often prices change rather quickly and drawings can't keep changing as costs change, therefore it is difficult for the designs to stay current. This can hinder their ability to provide design options that don't get cut during the construction phase.

Designers, particularly architects, felt it is their responsibility to educate their clients. However, they also acknowledge that they do not get paid to do research therefore their education opportunities and efforts to stay current with energy efficient materials and equipment may be limited.

Architects do not have good practical knowledge on how to achieve energy efficiency. Engineers have a better understanding, but don't have the access to, or budgets for, design analysis. Most designers, both architects and engineers, think that software tools are too complicated and time consuming. Very few designers use analysis tools.

The following sections describe the various designers (architects and engineers) and present the owner/developers' opinions of the designers.

5.3.1 Owners' and Developers' View of Designers

The owners and developers agree that designers are there to give them the project they want. Owners feel that they need to supervise the design process to guarantee this result. Their comments support the designers' belief that the roles of the architects and engineers depend primarily on the owners' goals. In practice, architects and engineers may interpret this sentiment as a message to just do what is requested and not explore alternatives.

The owners and developers believe that the architect and engineers are more up to date on energy issues than they are themselves. They indicated that architects and engineers lead the owner through energy efficient decisions. However, as indicated by the following designer's quote, it is up to the owners to ask for it, "The architect and engineers will only go beyond the code if they are requested to do so by the owner." This is not a universal opinion, however, and some designers suggested the opposite, indicating that they sometimes pursue energy efficient ideas, even if the owner doesn't know it.

Owner/developer participants expressed several different opinions on the specific roles and knowledge of the architects and engineers, however, most agreed that the architect is at the top of the team and is supported by the engineers. These varying viewpoints are indicated by the following comments:

> *"The architect is responsible for coordinating all consultants, including engineers. The engineer is primarily responsible for energy-efficiency recommendations."*

> *"[The] architect is the one responsible for energy-efficiency."*

> *"[The] owner works out the design with the architect, then brings in the engineer. Sometimes the engineer works directly with the owner."*

The owners and developers acknowledge that designers, particularly architects, are interested in energy conservation, but the design and construction process doesn't allow the time and effort required to pursue it. They made the point that project delays, and the money associated with delays, are of critical importance. Other considerations, of which energy efficiency is one, are of much lesser importance.

Most of the owners and developers believe that architects are becoming very specialized, and are not acting as project coordinators, as they have historically. Many owners and developers see the architects more as the "visionary" and the engineers and builders as the members of the team responsible for making the design work. This opinion is expressed in the following statement: "[The] architect puts the plans together. [The] engineer actually knows more."

Many owners indicated that they don't think architects have enough "practical knowledge" of building construction and operation. As one owner put it, "architects aren't always knowledgeable about O&M. They haven't seen buildings in operation. What they think is a good idea, doesn't always work." While the owners and developers expressed concern that the architects were not "practical", they also said that the architect is responsible for recommending energy efficient measures and design options.

The focus group participants confirmed the relatively weak connection between the owner and the engineer described in the Baseline study market model. While many owners acknowledged that the engineers are knowledgeable about technical issues, they do not seem to want to disrupt the common relationship of the engineer reporting to the architect. In the context of the above discussion of O&M, no one (owners, architects or engineers) ever made the suggestion that the engineer could fill that role if the architect could not. The overwhelming impression was that owners and developers still rely on the architect to provide them with project direction and guidance. This is consistent with the general market model described in the Baseline study, which has a strong connection between the owner and architect.

5.3.2 Architect and Engineer Differences

Three of the five focus groups included both architects and engineers. However, in one city we conducted one focus group comprised primarily of architects and a second comprised primarily of engineers. We did this in order to investigate whether their responses would be different if they were separated.

We think it was helpful to have the one session of separate groups (to get a sense of how much "team" spirit there is), but we don't think we lost anything essential by combining them for the other focus groups. On the other hand, it was important to get the designers by themselves, without owners, developers or

builders. it was clear from the somewhat guarded way they brought up some of the owner/developer issues that they would have been less open about the construction process if their clients had been there. One designer told us at the end of the session, “Thank you for not inviting the builders and developers.”

While the differences were subtle, we did notice different responses from the separated groups compared to the combined groups. The primary difference was that when they were together they tended to talk in terms of “a team.” When they were apart they tended to talk more in terms of “the other guy”. This was more pronounced with the engineers than the architects. We speculate that this is due to the fact that architects are often the engineers’ clients and rarely is the order reversed. It is hard to say whether that is a generalization or is based on the particular dynamics of the individual groups, but it may tend to explain the following issues.

In the engineers-only group, the engineers tended to blame the architect for some of the budget cut and time constraint issues. In the combined groups, engineers didn’t vocalize a feeling that the architects did this to them. Overall the engineers seemed to be more divisive than the architects. Architects wanted to believe that they work as a team, whereas engineers tend to be a little more realistic about the circumstances, including that they follow the architects’ direction.

Engineers seemed to be more negative and cynical about owners listening to their opinions, although one engineer was a notable exception. He felt it was the responsibility of the consultant, be it engineer or architect, to give the client a feeling of confidence so that the consultant would be allowed to be more forceful. However, in general, architects seem to have a much more “take charge” attitude. Architects, more than engineers, tended to see the design process as a “bigger picture” issue in terms of sustainability and the overall built environment. These disparate attitudes likely stem from the traditional team arrangement, where the architect is the “job captain” with overall responsibility for the project.

Many of the architects, especially in the architects-only group, seemed to be committed to energy efficiency, “green” building design and sustainability, but actually had very little practical knowledge about how to analyze integrated systems. This is consistent with a common opinion of owners and developers that architects are the visionaries of the project team and the engineers are more practical, considering economics and other design constraints in their work.

Engineers seemed to be a little more skeptical about whole-building energy analysis. The architects-only group believed that the engineers are not used to the integrated design process. Most of the engineers confirmed this, indicating that they do their own piece of the energy analysis isolated from direct knowledge of the other pieces. Electrical engineers, in particular, seemed very insular and isolated. Many of them commented that they do their Title-24 documentation by hand, and feel it would be too much trouble to get their information entered into an integrated tool. We were surprised at how few designers, engineers or architects used simulation tools. Indeed, most of the

architects were unaware that simulation tools existed. This is especially significant since we believe the focus group architects and engineers are among the more sophisticated designers, in terms of energy efficiency.

All agreed that the architect/engineer (A/E) team communication has gotten better over time. Both architects and engineers believe it costs more to bring engineers into the design process early, but they also agree that it is a good thing to do. All concurred that the ideal team situation is to have everyone brought in early, however that rarely happens.

As with the market models, we learned that integrated design, or the lack of it, among engineers and architects has several variations. Sometimes the process depends on the owner hiring them together and asking them to coordinate their efforts. Sometimes it depends on the leadership of the architect to bring the team's efforts together. Sometimes it depends on the engineer being willing to collaborate, rather than working alone in a discrete part of the design. Often it depends on the existing relationships of the designers. Many of the designers said that they coordinate their design efforts even without the owner's request. This concerted effort by designers and the knowledge that their design decisions are interconnect are the first steps to sustained design integration.

5.4 Builder's Role and Attitudes

Opinions of the designers and the owners/developers groups were the most divergent regarding the role of the builder. The owner group viewed the builder as part of their project team, and felt that they interact with the builder in a similar manner as they do with the architect and engineers. To the designers, the builders are the "bad guys" who take out everything good that they (the designers) put in the project. They said that often the builder makes substitutions that compromise the design intent.

All of the participants recognized that communication between the designers and builders needs improvement. As one developer put it, "There really isn't much communication between the builder and designers." This seems to stem from a common design scenario where the architect is "off the job" once the plans are done and the permit is issued.

Bringing the builder in for cost-estimating support during the design phase helps with the communication issues. In this case, his/her responsibility is to inform the team on first cost comparisons as well as whole building design options (such as the cost of glazing upgrades compared to HVAC equipment choices). Designers indicated that having cost information available during the design phase is very helpful. The builder may be brought in as a consultant to the design process only, or may remain on the project and ultimately build it. The designers prefer that the builder who will construct the project is involved in the project from the beginning. Designers believe that the lowest bid process is antithetical to the idea of the builder as part of the team. Owners and developers acknowledge that the

lowest bid contracting process hampers communication between the design and build components of the project.

The "Value Engineering" role of builders was the most contentious. Owners and developers believe that builders will follow the design and only make equal substitutions as cost-saving options. Designers argue that the builder doesn't follow the plans but makes substitutions that are not equal to specifications in the original design. The owners and developers view value engineering as a service provided by the builder. They do not recognize its negative impact on the design intent. Designers believe that value engineering can cut out the energy efficiency (and other features) that the design team puts into the project. To the designers, value engineering simply means cost cutting. According to the designers, when their contracts do not extend through the construction process, they are typically not consulted about changes proposed by the builder. They have very little control over construction changes, even if they clearly say "no substitutions" on the drawings.

There was some disagreement with this opinion. Some designers believe that it is possible for them to stay involved and argued that if the owners trust their designers, they will consult with the design team on proposed construction changes. However, most designers indicated that even when consulted about the builder's recommended changes, they are not willing to argue with their client about possible change orders. There are several reasons for this resistance by the designers. Although we did not investigate this issue in-depth, designers gave several suggestions for this reaction, including:

- perception of a conflict of interest between the designer's goals and the owner's goals,
- lack of additional resources (time and money) to devote to discussing (consulting on) alternatives,
- perception by the designers that the owner's goals on projects are generally more closely aligned with the builder's, and,
- lack of a "communication loop" to include designers during the construction phase.

This last issue was a common response, with the designers feeling removed from the construction phase.

An owner or developer may bring a construction manager, or cost estimator, to the project to serve the role as the design team liaison with the construction team, during the design phase. In these arrangements, the construction manager is responsible for supplying product availability and cost information to the design team. Many of the owners and developers feel that having the construction manager as a third party alleviates some of the potential architect/builder conflict. Most designers agree that having this type of person as part of the team is helpful to the overall success of the project and mitigates many of the problems from value engineering. However, some of the designers suggested that the construction manager tries to justify his/her existence and sometimes creates

issues where they don't really exist. Other designers explained that every construction manager has different experience and expertise, but it's not usually energy-related.

5.4.1 Owners' and Developers' View of Builders

Owners and builders are connected through the bid process. There are several forms that the bid process can take. The type of arrangement depends on the requirements of the owner and the type of project proposed, and conversely will dictate the product that the owner gets.

If the owner is looking for the lowest cost bid, then energy efficiency options will most likely be eliminated due to actual or perceived higher first costs. If the owner chooses a low-bid process, then s/he is knowingly or unknowingly giving more consideration to first cost than to other factors, such as long term energy savings.

The owner or developer may work with a builder on an on-going basis. It is not uncommon for developers to have an in-house construction team. In these cases, the builder is typically consulted during the design phase for cost-estimating or other "reality checks."

Most of the owners and developers see the builder as part of the process, and involved with the design teams. The owners and developers we talked to believe that builders are more involved in design than they have been in the past. Most of the owners and developers, and some of the designers, stated that the builder is the one who has the most current information regarding costs and product availability. Based on this, they feel that the builder is in the best position to provide relevant feedback on design options. The problem with this approach is that the builder's criteria is usually driven by first cost and immediate availability, and often does not include performance and energy efficiency.

5.4.2 Designers' View of Builders

According to the designers, there is a fundamental difference in the motivations of the builders and the designers. They believe that builders are driven by the financial rewards of the project. The designers are driven more by the design vision and are concerned about the "look and feel" of the resulting building. This fundamental difference, or at least the perception of one, may be a contributing factor of the communication problem. Given this view, it appears that the designers may be a bit contemptuous of the builders; they tend to see themselves as motivated by higher aspirations.

Designers acknowledged however that there has been a shift in the market so that now builders are much more involved in the design of buildings. This is evidenced by the rise in popularity of design/build projects. Owners and developers echoed the designers' belief that builders are more involved in design and communicating with the owner/end-user on a design/build basis than they used to be. This may be a direct result of the owner being more involved in the

process and bringing the builder into the design phase of the project. The designers believe that in general, the goals and philosophy of the owner heavily influence the builder's input.

Improving communication between the builder and designers is the key to receiving the greatest value from the builder's expertise. If the builder is involved in the design process s/he is more likely to understand and value the design intent. Likewise, if the designers believe that the builder understands the design intent, they are more likely to value the builder's suggestions.

5.5 Team Effort

Participants agreed that a team effort by all of the key players makes a project work better. This only happens when the owner instigates it, or at least is supportive of the idea. Bringing the design team, construction team and owner's team together early on leads to more positive exchanges and mutual cooperation, and results in a better project. The participants believe that team efforts happen more often now, than in the past. Many of the developers and owner's representatives have previous experience in the design and construction fields, as architects, builders, property managers, etc. These professionals have a good understanding of the process and are able to lead the team successfully.

As mentioned previously, bringing the design team (architect and engineers) together to discuss design options promotes the concept of integrated design and gets all players thinking of the project as a whole, rather than an assembly of parts.

Bringing the builder, or construction team, into the process particularly at the design phase increases the chances that the integrated project will get built as designed.

The team approach greatly improves communication. One of the designers put the issue very eloquently:

> *"As buildings get more complex, so do the design teams. Communication is the essence of the whole thing. Different stakeholders define their different goals, it is explicit and on the table. The team can decide to deal with it or not. When the communication works, then the team is a success and the project is a success. If the communication breaks down, then you lose all sorts of things."*

5.6 Other Players

In addition to the key players, the focus group participants identified other players that are involved in or affect the design process. Most of these players impact the actions of the owners and developers, however some of them also impact the designers and builders.

5.6.1 End User

Owners and developers indicated that their decisions are driven by the needs of the tenant (their customer). However these needs are defined more in terms of a "generic" future tenant than an actual tenant. The owners' and developers' past experience drives their impressions of the future tenants. Typically, there is no direct representation of the tenants during the design phase.

The designers feel that their decisions are driven by the demands of the owner and developer (their clients). The designers had the impression that the tenant needs were not always an important factor. Designers felt that most tenants do not have any influence on the design phase, because they typically are neither permanent nor long-term tenants, nor are they generally identified during the design phase. Most of the designers concluded that tenants should have an impact on the building design, and especially those choices that affect comfort, usefulness of the space, and energy costs.

Further probing of this issue revealed that the influence of the end-user is highly dependent on the type of building and the type of end-user. Sometimes the owner is influenced by the occupants' needs, but the occupants usually aren't included directly in design decisions. The primary factors are the size of the building, the size of the end-user, and the type of leasing arrangement.

Only large, sophisticated tenants are involved directly in the design process. One developer put it this way: "Tenants, as end-users of the building, will be involved at the design phase if they are long term tenants." He could have added, "and if they are savvy and can afford to have personnel to devote to the design and construction of the project." These are three of the characteristics the focus groups seemed to apply to larger tenants.

Other developers had different views because they have multi-tenant buildings, such as strip retail centers, where tenants have separate meters and pay their own utility bills. For these developers, individual tenants do not influence the design process. Marketing greater energy efficiency to developers of these types of projects is difficult. There is insufficient incentive for the building owners to participate in the program because they don't realize the savings (split incentive). Smaller tenants have little incentive to participate because they do not realize significant savings in their energy bills, nor do they own the building in which they make their energy efficiency investments.

Larger tenants (end-users) are an easier sale for energy efficient technology. It is easier to convince larger more sophisticated tenants to pay more for energy efficient building features because they have much larger energy bills, and will realize greater savings. Larger tenants also are more likely to understand and appreciate the other benefits of energy efficiency upgrades, such as improved comfort and increased productivity.

A key issue for the new construction market is the relative timing of when the building is built versus when the tenants are selected. If the building is not being designed for a specific end–user, then its design will be generic. However,

developers said that if the tenants were known in time, they would make modifications to accommodate their needs. These differing arrangements are supported by the following quotes:

> *"We tend to build generic buildings, which don't [always] fit the application of the tenant."*
>
> *"The builders will build whatever the end-user asks for."*

To the owners and developers of speculative buildings, the most important factor regarding tenants is faster occupancy. If a more efficient building attracts tenants faster, then the owner considers an energy efficient building a good investment. However, if the tenant spaces of a standard building are filling up without any additional improvements, then the owner has no motivation to add extra features, including energy efficiency. This was stated best in the following quote:

> *"If the developer feels there is a good chance of getting better tenants faster, then he will go for upgrades for comfort and energy efficiency. But, if he thinks the units will all be leased anyway, then he generally won't spend the extra dollars."*

In general, all focus group participants agreed that tenants are more sophisticated now than they have been in the past. Some participants pointed out that this is resulting in certain developers of speculative buildings striving for highly visible energy efficiency upgrades because some segments of the rental market are beginning to actively seek energy efficient rental space. These developers tend to push the envelope a little and are the desired customers for the progressive designers.

One developer suggested that utility programs should try to reach the end-user to educate them on energy efficiency. If tenants desire more energy efficiency, then developers will become interested. The developer thought that facility managers (O&M staff) in particular should be targeted.

5.6.2 O&M Staff

According to owners, developers and designers, the operations and maintenance (O&M) staff are an important element in the design process in some types of projects, such as large campus projects, high-tech. manufacturing and high-rise, owner-occupied office projects. The designers feel that long-term O&M is seldom of interest to their clients, the building owner. These designers suggested that the owner or developer views O&M as a fixed, overhead cost, that is not an important consideration, especially during the design phase. Additionally, for most types of construction projects, the construction budget is entirely separate from the O&M budget, so input from these professionals is not sought during the design phase.

Typically the design engineer or contractor trains the building operator on the details of the installed system. Both owners and designers expressed concern

on the effectiveness and persistence of training the staff, because when there is changeover, a promotion, or a job transfer the expertise often gets lost.

The level of commitment and education of the O&M staff greatly affects the success of the project once it is built. A highly committed and well-educated staff ensures the success of the design, particularly for a complicated HVAC system or lighting control strategy. An unsophisticated and uneducated O&M staff can have a negative impact on the project outcome. If a complicated system is not operated correctly it will most likely be replaced with a simpler system. This influence also has long term consequences because it tends to lessen the potential energy efficiency of designs. O&M staff influence future project designs as well, if they push for the "keep it simple" approach.

The owners and design team often feel pressured into using the same simple equipment for every job to minimize potential O&M problems. An example mentioned by one of the architects is the practice of using unitary HVAC equipment instead of central, built-up equipment. The simpler packaged equipment is used because the equipment can be removed and replaced easily when it starts to wear out.

Commissioning services help to ensure that the staff receives adequate training on the building systems. However, most designers and owners/developers are not familiar with commissioning services. Those participants that are familiar with commissioning acknowledged that it is difficult to sell the service. Owners believe they are already getting assurance that the systems are correctly installed and operational as part of the design service.

5.6.3 Equipment Manufacturer or Supplier

Equipment manufacturers were mentioned fairly often as impacting energy efficiency decisions. They are not part of the design team, but influence different members of the team. Depending on the product, manufacturers can educate and influence architects, engineers, owners or all three.

Some designers expressed the opinion that equipment manufacturers and suppliers are a good source of product information and energy savings calculations. Others suggested that manufacturers are biased toward their particular product. Designers indicated that they prefer, and often are required, to write equipment specifications in such a way as to allow multiple manufacturers to bid on the project. One of the designers stated that this has a tendency to push efficiency down to a common denominator. When this strategy is used because of the importance of lower first costs, the influence of a specific manufacturer is diminished, and energy efficiency may be diminished in importance.

Some of the owners and developers indicated that they deal directly with suppliers. Many of the owners have had difficulty in getting non-standard equipment from suppliers, so are reluctant to order or purchase high efficiency equipment that they view as non-standard.

The suggestion for incentives to manufacturers to "buy-down" equipment costs was made in approximately half of the focus groups. Those who made this suggestion believed that the initial cost of premium equipment was prohibitive, and that if high efficiency equipment were less expensive, it would become more common. One designer felt that this type of incentive would go a long way toward eliminating the first cost barrier. By buying down the cost of the equipment, the utility helps the manufacturer to increase the product volume, which serves to further reduce costs. The designer who proposed this idea felt that this strategy would make the equipment much more cost competitive and cost effective, therefore making the product self-sustaining in the long term.

5.6.4 Code Officials

The subject of Title 24 energy standards and code officials came up in many contexts during our discussions. Most of the designers think that Title 24 is a relatively easy standard to meet. However, they also believe that if enforcement is lax, builders will take advantage of it with cheaper design substitutions. In contrast, the owners and developers, in general, felt that the energy standards were fairly difficult to meet. There were exceptions in both groups, but these opinions represented the majority in each. Several of the owners and developers do not support the energy standards nor think that the resulting energy savings justify the additional design and material costs. Many of the designers, on the other hand, view Title 24 as a minimum standard and believe there is great room for improvement.

Both groups agreed however, that the local government enforcement agencies influence the designers and have an impact on the overall design results. They suggested that because areas with lax enforcement experience lower initial design requirements and more frequent site substitutions than areas with stricter enforcement, that building energy efficiency levels are lower in those jurisdictions.

Often the discussion of the code officials' relationship to the energy efficiency requirements led to a larger discussion about the negative economic impact that local jurisdictions have on construction. The developers in particular seemed to view the local jurisdictions as causing problems, such as permitting and scheduling delays, and excessive fees, that drive up the cost of the projects. These feelings, although possibly engendered from non-energy related areas of the developer/building department relationship, seemed to impact how builders and developers relate to Title 24 requirements and enforcement.

5.6.5 Lender

Lenders were mentioned as supporting players by all of the groups. Lenders affect energy efficiency decisions indirectly because they impact financial decisions. The lenders influence the construction budget through control of the loan amount. The lending institution requires that the proposed budget be below the loan amount plus demonstrated capital. One developer stated, however, that

lenders involvement in design decisions are more limited than they used to be because of lender liability.[8]

Overall, it seems that lenders have limited influence on energy efficiency decisions in nonresidential new construction. Lenders influence the process only through control of the amount and timing of the money lent to the owner. Still, to many designers and owners, this is not insignificant. A few designers commented that the lender restricts the energy efficiency options of a project by limiting the funding. One designer said that the lender could sometimes be approached to provide additional funding for energy efficiency measures. He believed that the owner can negotiate with the lender to get more money for upgrades, including energy efficiency, if s/he proves to the lender that it will help the building lease more quickly.

[8] A recent California court decision held that by involving itself in the budget setting process for a construction project on which it was a lender, the bank became in essence a fully liable partner in the project and had to share the financial burden of any suits arising therefrom.

6. UTILITY PROGRAM OFFERINGS

In addition to understanding the market actors and the market barriers to energy efficiency, we wanted to learn how the market actors would likely respond to different types of market intervention strategies. First, market interventions were discussed in the context of services that the utilities could offer, including past, current and potential services. We then presented the offerings of the Savings By Design program, as an example of a specific implementation of some of the general services discussed. The discussion material is presented in the Appendices to this report. The results of the discussion are presented in the same order that they were discussed. As appropriate, however, we will pull information together from different pieces of the discussion, for consistency and continuity.

6.1 General Program Offerings

A major finding is that the utility services are of most interest to those that are already committed to and interested in energy efficiency and energy conservation. Not surprisingly, people who lack this interest were least interested in potential program services.

All of the participants agreed that the utility assistance is a good service to provide to the design community. The owners and developers thought it was useful for designers. The designers in our focus groups thought it was a good idea in general, but many felt that they did not personally need the assistance. While this may be a common human reaction linked to an individual's perception that "I am above average," there is also some inherent self-selection on the part of the focus group participants that impacts are findings. The topic of the discussion tends to attract individuals interested in energy efficiency. Those individuals will tend to be more aware of the services provided by the utilities. While, we acknowledge that some self-selection was evident, we believe that overall we achieved a good cross-section of the design community in our discussions. The utility services are of most interest to those who are already committed and interested in energy efficiency and energy conservation.

One of the primary limitations of any program's success expressed by all of the participants was the potentially negative impact on project schedule of the utilities' services. If the owner/developer and the design team are already committed to exploring energy efficiency, then a certain amount of extra time commitment is expected. Otherwise, the time limitation is a significant barrier. The primary implication is that utility programs may have less impact in converting those designers and owners not already interested in energy efficiency and more impact in helping the "early adopters" meet, or even expand, their energy efficiency goals. This suggests a "trickle down" theory of market transformation, where the programs serve the most receptive parts of the

audience first, and then gradually expand to serve the others. In order to do so, there needs to be continuing outreach efforts to the non-participants, stressing the benefits of participation and pointing to the successes of the early adopters.

Somewhat surprisingly, each of the groups at one time or another questioned the motivation of the utilities in providing energy efficiency services. A typical comment was as follows:

> *"What is in it for them? If the utilities are in the business of selling energy, why are they promoting energy conservation?"*

Most implied that they thought there was some catch to the whole thing. Others expressed concern that the utility programs have been too sporadic. Some of the participants were somewhat confused about restructuring issues and who was included in the "utilities" umbrella. Participants who had projects in more than one utility service territory were even confused with which utility offered which services. Many owners and developers expressed that one-on-one time with utility personnel was very valuable to them.

In our discussions of utility services we learned that there is a general lack of mutual understanding between the designers and owners, and what each thinks the other does or does not know. The designers believe that they already know how to do energy efficient design and that the owners need to be educated on the benefits so that they will ask their designers for energy efficiency services. On the other hand, the owners commented, "You should sell this to our designers, I don't think they know about it." This suggests there is not only a lack of awareness and knowledge of the programs, but also a lack of coordination and communication between owners and their designers.

6.1.1 Information Services

We described utility information services both in terms of the material and the methods for disseminating it. The information provided by the utilities includes:

- technical bulletins of products and equipment,
- discussion of design alternatives,
- visual aides that illustrate what a product will look like in a building,
- documentation of energy cost savings, and cost-effectiveness analysis associated with design options, and
- examples of projects that have implemented energy efficient technologies.

The following sources were discussed:

- web sites,
- energy centers,
- design guidelines,
- demonstration projects,

- case studies, and
- seminars.

Most of the participants expressed interest or appreciation for the materials provided by the utility. However, one designer said, “It is stuff I already know.” The other designers, and the owners and developers, indicated that the information and the active dissemination of the information are valuable, with comments such as, “Availability of information is important.” The participants cautioned that the material must be available to the appropriate people. As one developer said, “Dissemination of information is always a good thing. How do you get it to the right people?” Others argued that there is too much information, as indicated by one architect, “It’s overwhelming the information that’s out there. It’s hard to get through it all.” Other designers concurred and indicated that there is not enough time in the week to look at all the information. Many of the designers were unwilling to give up their personal time to get through all the information.

Many designers felt that the information provided by the utility needs to be specific to their project, not general, in order for it to be useful. For example, an architect may be looking for technical information on high performance glazing material for a specific application. General energy efficiency information that talks about the benefits of high-performance glazing is not going to be helpful. The owners and developers tended to be satisfied with the general information. Contradictory to what the designers said, the owners suggested that their designers would also find this information very useful. One architect thought that the technical information provided by the utilities is useful but has to be one of several resources because it may be slanted toward a particular technology or energy source.

One of the architects indicated that energy savings and cost-effectiveness information needs to be presented clearly, and relatively simply, so owners can make informed choices. He suggested two- or three-dimensional charts that simply, yet effectively convey the cost versus savings information to the owner. He was not sure who would be the best person to do it, but mused that it needed to be a neutral disinterested party. He elaborated that he has received conflicting information from different sources. He prefers receiving technology specific information from an unbiased source that does not have a product to sell.

Some designers were also asked about the usefulness of newsletters, both paper copies and electronic. The response was lukewarm and non-committal, based on the overriding issue of too much information and too little time.

Web Site

The energy efficiency sections of utility web sites provide information about the utilities’ efficiency programs and design and measurement tools, and promote demonstration projects and case studies. Web sites are used to promote other forms of information dissemination as well, such as energy centers, seminars, case studies and demonstration projects. They typically provide a calendar of events, contacts for further assistance, plus links to other energy-related sites.

In general the groups were very supportive of web sites as a means of information dissemination. The designers tended to be more familiar with the specifics of the utilities' web sites and more informed about the applicability of web-based information than owners and developers. However, there was a wide range of knowledge. Familiarity ranged from not having any idea that utilities maintain web sites to raving about information recently downloaded from a utility web site. The designers acknowledged that there is a great range of the quality of web sites. They need to be high quality and well maintained to be useful.

The owners and developers were less informed about the actual content of the web sites but felt that internet access and use were very important, because they make information available. The owners and developers felt that the content of the web sites, especially regarding energy efficiency information from utilities, was more useful for their designers. As one developer said, "developers and builders aren't very computer literate. Our interaction is more with the building, the materials and the actual running of the building. We are not in front of our computers all day, like many designers."

Energy Centers

Utility companies have created energy centers to provide central locations for customers to attend seminars, view demonstration projects, and browse resource libraries.

Many owners and developers and a few designers were unfamiliar with the energy centers. Several sophisticated designers and a minority of the owner/developers were familiar with at least one of the utilities' energy centers. Surprisingly, all participants were generally most familiar with the Pacific Energy Center, followed by energy centers in their area. The San Diego participants were not as familiar with energy centers, since SDG&E doesn't have one.

The designers in Northern California (San Francisco Bay area) were most familiar with, and very complimentary of, PG&E's Pacific Energy Center (PEC). One architect, who feels that the PEC has done an excellent job, says that he likes to take his clients there to educate them. He said it is important to let the clients see the centers' demonstrations. The clients get a better understanding of the technology and know that he is not just trying to push the product or his services. It gives him more credibility in the client's eyes. We heard the same theme from several people.

Design Guidelines

Design guidelines are developed to provide designers with detailed information on specific technologies, individual systems and certain project types. During the discussion several examples of design guidelines were passed around the table for review.

Owners and developers have very little use for design guidelines, but felt they were helpful to their designers as indicated by the following comments.

"I have seen them, and know that my engineers use them. I assume they are probably pretty valuable."

"Engineers utilize them for new products."

"They need to be given to the engineers and architects."

The concept of design guidelines was attractive to most of the designers. They qualified their interest by emphasizing that the guidelines need to be educational, up-to-date, and not too complicated. They suggested that simple design guidelines work best, because they allow the designers to convey their information to clients in a concise format. As one engineer put it, "I don't talk 'architecture' very well. I talk 'engineering' better. The guidelines help me sell the projects by educating the architect and owner in terms they can understand." His opinion is that the design guidelines can often promote and explain his design ideas better than he can.

Designers said that one of the benefits of design guidelines is that they give designers confidence. Design guidelines assure them that they are not alone with their "new" ideas and can be used as supporting material for the clients.

Demonstration Projects

Demonstration projects were described as projects where the utility works with industry to design and build a building to demonstrate energy efficient features. No one was overly enthusiastic about demonstration projects. The designers recognize that practical examples are important and many support demonstration projects in theory, but feel that demonstration projects are often out of date. Conversely, some said that demonstration projects often also demonstrate impractical technologies that they cannot use. The owners did not know much about demonstration projects, and did not have a strong opinion one way or another.

Case Studies

Case studies were described as documents that illustrate successful application and implementation of state-of-the-art energy efficient technologies. Designers can use case studies to present examples of specific energy efficient design ideas. In general the participants were lukewarm about case studies as well. Most did not distinguish between case studies and demonstration projects. One engineer suggested that case studies are important in developing and verifying guidelines. Another supported case studies, saying that practical examples are important.

Seminars

Utilities offer seminars to promote their programs and to educate the design community, the construction industry and building owners on energy efficiency issues. On average, we had a fairly lukewarm reaction to seminars, however

some participants felt they were very helpful, as indicated in the following comments.

> *"That's how we're going to find out, is through utility seminars."*
>
> *"Seminars are the best way to learn the information. I dedicate the time to attend the seminars. I don't take the time to look through the information myself."*
>
> *"The most effective seminars are lunch-time seminars that are brought to the firm."*

Others however, felt that it was difficult to commit the time, and preferred to research the information at their own pace and schedule. However these people may not actually get through the information on their own time.

According to several of the designers in San Francisco, seminars at the PEC are very helpful. One engineer said that he tries to get the owners more involved and get them to attend the seminars. Although not always in this context, the designers' connection with the owner came up in most of the groups. The designers are looking for ways for the owner, their client, to become more educated, and more interested in energy efficiency.

In the context of seminars, a few owners and developers mentioned that booths at tradeshows, such as the Pacific Coast Builders Conference (PCBC), are good ways to disseminate information. In their opinion one reason trade show booths are effective is that "it is a very aware group who attends these shows."

As mentioned throughout the meetings, the designers felt that educating themselves was important, but that the key to implementing their knowledge was getting the owner to ask for the services. This was stated in several different ways, but the underlining issue was always the same, as suggested by the following designer comments:

> *"All of these services are okay, they serve a purpose. However, the engineer already knows it, we need to get the information to the owners."*
>
> *"Anything that gets the owner educated is good."*
>
> *"All of these are very good tools, but how do you disseminate the information?"*

Paradoxically, the owners talked about dissemination of information to their designers. As one developer put it, "Word needs to get out to the architects and engineers. They're the ones who utilize the programs. The engineer will translate to the owner."

The discussion around dissemination of information took on several forms. The design groups talked about dissemination of the information to their clients, and

also about dissemination within their own firms. As one architect described it, her firm, and most others, are not set up to share the information around the office. The person who learns it first and goes to the seminars becomes the expert. The level of interest and the size of the firm dictate the quantity and quality of staff training.

6.1.2 Expert Assistance

The following types of utility expert assistance were described:

- Design Assistance
- Project Coordination Assistance
- Commissioning Assistance

The owners and developers' opinions were widely mixed on the idea of utility assistance. Primarily based on their experience and sophistication, some of them felt the services were helpful, while others did not. One sophisticated developer thought that design coordination and construction assistance services were particularly useful. She added, "assistance in design and selling of energy efficiency would be invaluable. Utilities' personnel time is the biggest factor, it is worth a lot. We need to address better comfort control and improved flexibility for the occupants. Anything is helpful." Another developer added that the expert assistance would be helpful as long as the "expert" is part of the design team. She thought that an independent contractor, paid for by the utility, might be more appropriate than utility staff, concluding with, "you can't trust that the utility has your best interests in mind."

Other owners and developers said that one of the most valuable things the utilities could do is spend more time with them. They said that they appreciate having the utility program representatives contact them and establish a consistent relationship with them. Making that connection with a person at the utility appeared to be very important to them. They said that it used to happen frequently, but that such contact has decreased or even ceased in recent years. They also said that they wish the utility program people would spend more time with their architects and engineers.

A small owner/developer said that she would not find any of it helpful. Another small owner/developer defined "expert assistance" as "the guy who knows how the material and equipment are installed and operated." He did not think that the utility could provide this service, unless someone was on-site to make it work.

Many of the designers were skeptical and untrusting of the utilities, particularly in the Los Angeles area. A few explanatory factors came out in the discussions:

- Apparently, many designers and developers have had unpleasant experiences with LADWP and attribute their attitudes to other utilities in the area, especially SCE.
- Program participants in the LA area became frustrated with what they perceived as constantly changing program offerings and requirements.

- Designers experienced (or at least perceived) a marked decline in outreach from the utilities, especially SCE, over recent years.
- The decline appears to have been accompanied by unmet expectations resulting from inconsistent contact between the utility program representatives and the designers, owners, developers and others involved in nonresidential new construction.

Design Assistance

We described design assistance as providing a broad range of services to the design teams based on the needs of the team and the project. The services can range from providing data on specific type of equipment to having someone provide building simulation support for a project.

There were mixed reactions by the participants to utility design assistance services. The owners and developers thought it was a good service to provide to the design community. The designers thought that expert assistance in general was a good idea, but that they did not need it personally.

There was a dichotomy of designers' opinions about how the utility design assistance affected them directly. On one hand they feel the utility involvement gives their energy efficiency efforts credibility and better informs the process. On the other hand, many of the designers thought that the utility "expert assistance" service was implying that the designers did not have the requisite expertise. One architect said she resents having to use the utilities' design assistance, and experts. She would like to get utility assistance with paying the fees of experts on her own team. She wants specific services, not general advice. She feels that it is inappropriate for the utility to step in and push out potential or existing members of the design team with whom she has a long-standing relationship. Valuable design interaction and efficacy have been gained by getting to know one another over the course of many projects. It is better for the utility to subsidize the extra effort of the existing team. Others agreed as is evident in the following comments:

> *"Negative connotation that the designers are not the experts in their field. Not that there isn't a value, but [the utility] needs to find a balance."*
>
> *"We don't need expert assistance."*
>
> *"It's hard to get the [utility's] experts associated with the stuff in the beginning and to get them integrated at the right time. Usually, it is either too late, or it's a thin layer. To practice integrated design, you need the folks who are there all the time."*

Many designers would like assistance, either direct or financial, for energy simulation modeling. Most owners and several designers were unfamiliar with simulation modeling and other energy analysis tools. However, the issue of

modeling assistance was brought up in almost all of the designer groups, as shown by the following comments:

> *"It would be nice to be able to afford DOE-2 modeling of alternatives, there usually isn't budget. It would be nice if the utility paid for an energy consultant."*
>
> *"DOE-2 modeling assistance would be very helpful."*

An engineer said that he gets design assistance (even building modeling) from his product vendors. One designer expressed another view of expert assistance by stating, "It would be helpful to have peer review. Expert assistance is definitely a value in that sense."

Some of the designers have had negative experience with the utility service representatives (reps.) on projects in the past, while others indicated that it was hard to get a hold of the utility reps. to provide adequate design assistance. An architect with such an experience, said, "If it really works, it would be great." But she was skeptical that the utility "experts" could be there at the right time, and provide the right services.

Project Coordination

Project coordination was described as help in finding the people that need to be part of the team. As project coordinator, the utility can pull the various members together and coordinate their efforts.

The owners and developers were interested in the idea of the utility providing project coordination. Some designers were also interested in the possibility, although most thought that project coordination was primarily of benefit to the owner. As one architect put it, "It is exciting, [it] pulls everybody together." An electrical engineer in the same group elaborated with, "I don't know that the rep. would be able to tell us anything of value about electrical engineering or mechanical engineering, but the utility could play the role of pulling the team together." Others in the same group supported this idea and thought that utilities were a good objective third party to provide assistance. The perceived benefit of the service was conditional as indicated by the following dialog:

> *Engineer – "The utility is the only one not with a vested interest."*
>
> *Moderator – "Is that important?"*
>
> *Engineer – "Only if it doesn't slow down the process."*

Others had similar reservations about the usefulness of the project coordination and assistance. The project design and construction schedules often limit the applicability and effectiveness of any utility program influence. To be effectively utilized, it is clear that the utilities' design assistance services will have to very responsive and not cause delays. One developer put it this way:

> *"(Utility energy efficiency services) are a good thing as long as they don't result in higher costs and don't slow down the process."*

An architect commented that the services would have to come into the process early in order to be beneficial. An engineer in the same group was much less optimistic, as indicated by his comment, "Budget and schedule make these services useless." The reaction of other designers was that they would need these services right at the beginning, before the budget and schedule were settled, to help establish their real value against later value engineering.

A mechanical engineer suggested adding "Sales Assistance" to the list, meaning that the utility could assist the designers in selling the service to their clients, and provide confirmation that there is a real benefit to the extra design efforts. This suggestion has some validity, given the general opinions of many owners and developers. It is emphasized by the following comment from a small owner/developer, "Dollars are the bottom line. I want the best product that won't cost me more." In the context of this statement, it was clear that she was talking about first cost, not long-term costs.

A developer in the same group reinforced this opinion with the following comment, "I would rather get the components (equipment) than spend the time and money on using the tools, or hiring someone else to use them. This distracts from the real job of building the building. I don't have time to think about how it gets done." We have tended to think of developers as being primarily driven by first-cost considerations. The above statement, and many others, provides an important distinction to this "common wisdom". Time may be a more important factor than other first cost components. The time it takes to get through the design phase, and then to accomplish the construction directly affects how long it is until tenants are secured, the building is occupied, and rents are received. Time considerations emerged as perhaps the largest decision criteria in the design process.

Commissioning Services

One of the specific assistance services presented was commissioning assistance. We explained that commissioning often means different things to different people, but defined it as helping to make sure that the building operates according to the design intent. One participant described it as the hand off between the designer and the building operator.

A few of the engineers provide the service, while other designers didn't really understand commissioning services. Those who were familiar with commissioning thought it was a good thing for utilities to be involved in. Many designers acknowledged that it is a young industry, and therefore needs some assistance. One architect stated that the whole process of commissioning is undefined, therefore she has a very difficult time getting her clients to agree to the service. She said that the lack of clarity on what commissioning is leads

some of her clients to ask, “Well, isn’t that part of the service that I’m already paying you for?”

Most designers thought that the clients expected the service as part of the normal scope of work and that most owners don’t want to spend the extra money. Several engineers said that they always include commissioning in their specifications, however they indicated that there is a general lack of interest in the service on the part of the owners and contractors. As one architect put it, “Ultimately, a lack of commissioning reflects badly on you as a designer, especially for engineers. If it doesn’t function as it was defined, the engineer suffers.” Another designer in the group countered that they really don’t have control over what happens with installation and operation.

Few of the owners and developers felt that commissioning assistance would be very helpful. As suggested by the designers, the owners felt that they were already getting this type of service from their designers. When the specific elements of commissioning were described, they had a better understanding of the extra services, but still were not overly enthusiastic about the support from the utility.

6.1.3 Design Tools

Design tools were described as computer software and physical models that assist designers in quantifying the benefits (and costs) of design alternatives. We discussed the following types of tools:

- Energy Savings Spreadsheets,
- Energy Analysis Software, and
- Physical Models.

Simple spreadsheets can be used for estimating the savings of straightforward technologies, such as lighting, particularly in relatively simple projects. Energy simulation software is used for estimating the energy savings associated with integrated design. Physical models such as a sun angle calculator or heliodon sun-shading table, can be used to examine shading patterns, natural lighting and solar access.

Design tools are not as commonly used as we had originally thought; even among designers who describe themselves as “energy savvy.” A minority of the architects and engineers indicated any experience or comfort with DOE-2 or other sophisticated design tool. Many seem to have found simplified rules-of-thumb or pencil and paper tools.

Not many of the designers use integrated simulation software. A few mechanical engineers use simulation tools, but very few architects use them. However, the more sophisticated designers indicated that they prefer the tools, instead of expert assistance. The problem they face is that there typically is not any budget to perform multiple energy simulations, so they can’t afford to do them.

One architect argued that the use of design tools is directly related to the size of the firm. The resources and fees of the firm affect their ability to purchase and utilize design tools. Smaller firms don't have the resources to implement some of the options, or to spend the time to get educated. We concluded that building the right design team is important to this issue, as well as to the needs of the project overall.

Ironically, the designers who were the most committed to energy efficiency and sustainability were the least likely to have used any design tools. As one of the architects said, "Do we really need a simulation to tell us what we already know is a good thing to do?" While most other designers disagreed with this assessment, they also indicated that they did not typically use tools to determine the energy savings associated with their designs and equipment. Most suggested that their designs are based on a general assumption about what makes sense, not on any analysis supporting the assumptions.

Most architects are aware of the tools, but usually rely on their engineers instead of using the tools themselves. The engineers generally said that "someone else in their office" does the simulations. The participants in the "engineers-only" group said the software is too complicated and too time consuming. According to most of the engineers, DOE-2 in particular is time consuming. The majority of the designers, both architects and engineers, were familiar with Title 24 compliance software and knew that these tools weren't always appropriate for analysis of alternative designs and equipment. An engineer suggested that the design tools be put on the web so that upgrades are available and accessible. The engineers expressed interest in an integrated tool that is straightforward to use. One engineer indicated a need for a "good" integrated tool with modules that can be used for compliance as well as for investigating different efficiency options. Another designer concurred saying that design tools need to look at efficiency options, not just compliance. An architect stated that interface with the design is a key element to the attractiveness and usefulness of any tool.

Many designers mentioned the learning curves associated with software tools as barriers to their use. Several designers had suggestions for increasing the use of these tools. For example, one architect suggested that tutorials for the tools would make them more attractive. He added that hands-on software training would be helpful to designers.

Part of the explanation for engineers' perception that the available software tools are too complex may be that the people we invited to the discussion groups are not the ones using the software. We tried to recruit project managers and senior decision-makers. Their comments suggested that junior level staff typically utilize the energy analysis tools. However, their lack of knowledge and advocacy of the tools suggests that they, or perhaps their companies, don't put a high level of importance on energy simulations in general. Although no one said so specifically, their comments suggested that spreadsheets and worksheets are more useful to the designer, in general, than simulation tools.

Several designers said that the most useful help with regard to design tools that utilities could give is not training, nor even dollars to cover their extra time, but an expert to do the simulations for them. They would most appreciate having the utility hire a DOE-2 consultant to be part of the design team.

An architect suggested that owners need to know about the tools and ask the designers for them. He thought that it was more important to educate the owners, because then the owners would ask the designers to utilize the available tools. However, the responses from the owners didn't support this assessment. Owners and developers did not have any strong opinions or much knowledge about the available design tools, or much apparent inclination to find out. Many felt that the design tools could be useful for their designers, as indicated by the following statement:

> *"I think the engineers would use these; developers are not as interested in this."*

Many owners, and several designers, said that design tools don't fit into the timeframe and budget of the design and construction process. As one engineer put it, "It takes time, so even if it is free, it might hurt the schedule, and therefore would not be helpful." This comment in particular is sensitive to the difference between various design/construction paradigms; some project types are on a more critical "fast track" than others.

6.1.4 Incentives

Incentives are arguably the most commonly recognized utility program offering. The incentives were summarized as money that is given to the owner, or the design team, to buy down incremental costs, and pay for the additional time and effort required for design and installation. Four basic types of incentives were discussed:

- to owners to offset first cost,
- to owners for additional effort required,
- to the design team for additional effort required, and
- for commissioning plans or services.

Not surprisingly, the participants were overwhelmingly in favor of utility incentives. Surprising to us though, overall, designers were not enthusiastic about design team incentives. Most designers thought that the design team incentives create a perception of conflict of interest or negative credibility issue. Many designers thought it looked like they were getting paid to do what the owners thought they already should be doing. Others believed it made it appear their advocacy for energy efficiency features in the face of builders' value engineering suggestions, was self-serving to protect their own incentive payments. Still others pointed out that design team incentives acknowledge that

the designers need to be compensated for their extra effort, and extra coordination time. Some of the specific comments are as follows:

"Design team incentives present a conflict of interest."

"Looks like a kick-back."

"If owners know about them, our fee may be reduced."

"It gets back to the owner. The architect needs to justify additional fees to the owner."

The designer groups were asked, "which of these incentives is the most helpful?" Overwhelmingly, the groups said that incentives to owners, particularly to cover additional first costs, are the most helpful and effective. In response to the question, designers had the following comments:

"Clients (owners) like the incentive."

"The more the better. Incentives prime the pump. Eventually, energy-efficiency may become self-sustaining."

"Incentives hamper long term sustainability, but are a necessary evil."

Although we were discussing incentives in general, several designers familiar with the program mentioned the particular issues associated with Savings By Design. These designers mentioned that they don't like that the design team incentive is given at the end of the construction process. Individuals in both the designers' and owners' groups felt that it was too much trouble to go through the program if the money doesn't come until completion of the project. One developer felt that the lender would cut the loan amount by the same amount as the incentive, therefore the incentive wouldn't give them any more money for the project.

Additionally, designers may lose their incentive due to construction changes beyond their control. Even if they put in the extra effort, they are not contractually able to "assure" that the energy efficient measures are installed. They also were troubled by the idea of trying to assure the measures' installation in the face of other concerns by the owner or arguments by the builders regarding construction cost savings.

Several designers thought that the design team incentive should be given to the designers via the owner, so that the owner recognizes the need, both for the services and for the additional compensation. Some participants, both owners and designers, were apprehensive about incentives as suggested by the following comments:

"If energy costs go up, we [wouldn't] need this stuff."

"Make energy prices market driven and that would create a demand for energy efficiency [without incentives]."

"Incentives won't make or break a project. Price will drive the decisions."

This last idea was also described in another way. First costs, not life cycle costs nor even return on investment, are the primary drivers of most project decisions. Utility program incentives are too small to offset the incremental cost of expensive equipment or the additional cost for added design time.

One developer suggested adding a category for "maintenance costs" to the list of incentives. She felt there was a need for extra incentives for additional maintenance costs, believing that the maintenance of high efficiency equipment is more expensive than standard equipment. She stated that equipment maintenance is very important, and she needs some confidence about the product before she will use it, even if she gets money for it. It seemed to be the general perception that even if the equipment or product was going to need less maintenance than a lower efficiency counterpart, the cost of the maintenance would be higher since there are limited technicians qualified to work on the equipment.

One group of owners and developers was specifically asked, "if utility incentives go away will energy efficiency go away?" The initial reactions were mixed, they ranged from "Absolutely" to "Absolutely not." However the group agreed that the more expensive energy efficiency options would go away. They concurred that it would depend on the cost and to a lesser extent the availability of the products. They thought that certain products that have proven themselves, such as T-8s, would remain. Others, such as lighting controls, would disappear.

The other groups were asked a more general question relating to the utility services, not just incentives. Owners and developers had the general opinion that elimination of the utility programs would have a significant impact on energy efficiency design. Designers on the other hand, felt that if utility programs were eliminated, they would miss some of the assistance and tools, but their designs would not significantly change.

6.1.5 Financial Services

We described financial services in the context of:

- Financing assistance, and
- Appraisals.

Financing assistance was described as helping owners and developers get larger loan amounts, quicker processing or better loan terms due to an energy efficient project that can be shown to have reduced operating costs.

Appraisal services were described as linking energy efficiency to the value of the property and creating a value for energy efficient projects in terms that are

meaningful to (and recognized by) the market. The appraisal could value the improvements either in terms of increased costs for upgrades or decreased operation costs. The utility can help appraisers understand the increased value and make allowances for the improvement in the appraisal.

In most groups, the consensus was that financing and appraisals were very attractive options in theory, particularly for the owner, as indicated by the following comments:

> *"Financing is great."*
>
> *"Financing may be the key to solving some of the perception problems with long-term paybacks."*

However, few had a clear idea of how this could actually happen. They indicated that if the utility could arrange for them to get lower interest rates or lower closing costs, based on energy efficiency, this would be a significant encouragement. Owners and developers felt financing assistance would be more valuable than the architects and engineers thought it would be to them.

The reactions were more mixed on the appraisal services. Some were skeptical of the service and were afraid it would backfire because they would end up getting taxed on a higher value. Others thought it was a good idea. They recognized the potential taxation problem, but felt that the appraisal structure could be set up so as to add value in terms of the qualifying loan, but not increase the tax assessment value. One of the architects said that all of the financial services are important, but she felt that the appraisal service is the most important because it creates a value for energy efficiency in a metric that is directly related to the real estate and development market. However, she felt that appraisers need to recognize the value of life cycle costs to make the service work. Another architect thought that appraisals should be market-driven to make them effective.

One developer prefaced his support for financial services, saying, "as long as it doesn't hinder the process, extra funding is good." One of the engineers suggested adding insurance premium reductions as part of financial assistance. Another developer believed that the utility needs to find a way to get at the tenant or end-user's financial interests more, because the rest of the players will step up to meet their needs. Others concurred, but also reinforced that the tenant does not always have the final word.

6.1.6 Other

Other services that utilities have or could provide included:

- Permitting assistance, and
- Recognition.

Permitting assistance was described as utility involvement in the review of energy issues related to the building permit. Through an arrangement with local

jurisdictions, the utility may be able to offer an expedited permit review or inspection schedule for projects that participate in an energy efficiency program.

Permitting assistance received a mixed response from the participants. Some of the designers said it's great, while others said it doesn't matter. Many of the designers were skeptical that it would actually save time, yet some were very enthusiastic. The designers who favored permit assistance made it clear they did so because they thought that the time it would save the owner would be of great value to him/her. Some of the owners liked the idea, while others were very non-committal. The following quotes illustrate the differing opinions:

> *Owner/developer - "Anything to help the permitting process is welcome."*
>
> *Architect – "I'm not sure I understand how the permitting services would work. It sounds like it would add another layer of review, not less review."*

Another architect said permitting is dealing with the bureaucracy and utility assistance won't make a difference, it will just add more bureaucracy. An engineer in the same group agreed saying that getting another layer of bureaucracy involved is not good. Again, the major emphasis from all participants was that to be useful, the service would have to add value without adding time to the project.

Recognition was described in terms of receiving awards, certificates, and/or publicity for energy efficient showcase projects. This utility offering also got mixed reviews. One architect said she doesn't really care if she gets recognition in a magazine or a plaque for her wall, but for her client the recognition is very important.

One of the developers supported this opinion with the following statement, "Awards for energy efficiency are good. They are interesting to see, and make a great marketing tool. They are definitely worth something to me as a developer."

One architect summarized the general lack of enthusiasm for these services with the following assessment, "These issues are so far down the road when you're designing, that you are not thinking about it. It's nice, but it's not a motivating factor."

In addition to services we described, we also encouraged suggestions for other services. One architect suggested that buildings get assigned grades, similar to how health departments grade restaurants. His justification for such a procedure was that grading buildings provides a base comparison for designers. This is a way for designers to get recognition and to prove that their designs are superior to others in terms of energy efficiency. As he explained it, all designers, or design teams, submit qualifications for a project under the auspice of promising an energy efficient building. Most owners assume that they will be getting an energy efficient building because of Title 24 requirements, but it is often difficult for the owner to compare promises of energy efficiency among different proposals. He

saw the grading system as a way to prove his design experience is better than his competition's.

One of the architects, in the "architects only" group suggested that the architects get a royalty each time the building gets sold throughout the life of the building. Most of the other architects in the group thought it was a great idea. Perhaps this indicates a desire by architects to have a greater stake in the financial rewards of their projects, but it would require a fairly fundamental restructuring of the way architectural services are offered and paid for.

Several architects and engineers suggested that the utilities work directly with the manufacturers to help lower the cost of the product, which will in turn increase the demand. One developer described it as getting something to reduce the delta between expenses and income. They repeatedly reinforced the notion that the biggest factor in not choosing more efficient measures is the incremental cost; and on this specific issue said that effective efforts to get manufacturers to reduce the cost would be particularly beneficial.

An architect described it as creating natural market economics by paying the manufactures with ratepayer dollars to lower product costs. That way, no selling of energy efficiency per se is involved. He believes that many of the technologies would payback by themselves, without additional incentives. Interestingly, the recommendation for manufacturer "buy down" was generally presented by the least informed members of the group, in terms of utility services. We believe that these people may have the "cleanest" perspective in that they are not influenced by existing or previous experience with the programs and therefore did not have any preconceived ideas about what the utilities should provide.

One of the architects suggested a general category of "time saving services" that reiterated an issue that came up repeatedly in the discussions: anything that speeds up the process is good.

6.2 Savings By Design

After the general "shopping list" of potential utility services was presented and discussed as a list of theoretical options, the 1999 Commercial New Construction Program, *Savings By Design* (SBD), was described as an example of the utilities' current package of services. Our objectives were to obtain some immediate feedback on the program (most of the participants were not yet familiar with it), and to evaluate its combination of services in light of the earlier discussion of all potential services.

6.2.1 Program Description

We presented a brief description of the program to put some of the process and principles of development into perspective. The following general overview was provided to all groups. A copy of the presentation is provided in the Appendix.

The program promotes increased comfort and productivity, system integration, and long-term changes to the design process. The program offers two approaches to energy efficient design: whole building approach or systems approach. The choice of which to use is largely dependent on the size and type of the project.

The program has three program elements:

- Design Assistance,
- Design Team Incentives, and
- Owner Incentives.

Design Assistance

In addition to the traditional customer service efforts of the utilities' field staff, Design Assistance can include:

- *Help locating information*: introduction of new technologies, case studies, seminars, energy centers, sample specifications, and/or design guidelines
- *Connections for team*: references to other projects and designers, references to product suppliers, energy simulation services
- *Design tools*: including spreadsheets, simulation software and physical models

The specific assistance offered is tailored to the needs of the design team and the project, and varies somewhat between the three utilities.

Owner Incentives

The program provides incentives to the owners to help offset the extra first costs of energy efficient buildings and buy support for design team efforts. In Savings By Design, the owners' incentives are always larger than the design team's. The owners' incentives begin at 10% energy reduction, and are calculated at an accelerating rate based on the savings and the analysis approach.

Design Team Incentives

The program provides incentives to the design team, in addition to the owners' incentives, as rewards for meeting ambitious energy efficiency targets and it encourages follow-through by the design team. Incentives are paid directly to the design team if they achieve a 15% efficiency improvement. Eligibility varies slightly between the three utilities, but in general, the design team for any project that is in its schematic phase, is eligible.

6.2.2 Reactions to the Program

In general the participants felt that the program is good for certain projects, but it depends on the type of project and type of owner. In order for it to work, the owner needs to be committed. It is not attractive enough for developers who are

not already energy conscious. In other words, many developers can't be bothered with energy efficiency, if it adversely impacts budget or schedule.

Overall, the designers felt that the program enhances quality and reliability issues of energy efficiency. However, many of them felt that it will be difficult to get the savings, and expressed apprehension in signing on to the program this year. These feelings were expressed in the following comments:

> *"It is extremely difficult to beat T-24 by 10%, and it is expensive. Less than 10% is pretty easy. I don't think it is possible to get to 15%. I would like to know who can do it."*

> *"It's great in theory, but we need to wait about a year to see how it really works."*

One of the larger, fairly sophisticated developers, who is familiar with SBD, thinks that it is difficult to do, because it is a gamble. The design team may not get enough money to adequately compensate designers for the extra time they need to spend. He also believed that the program is promoting a lot of the things that the designers are doing anyway. His company does not benefit directly, but their customers do. He sees energy efficiency, and the program, as value-added service for their properties.

Another concern was that the program does not fit into the timeframe of most projects. Since the majority of the projects that would participate in the program tend to be larger and have multi-year schedules, it is possible that they will not be constructed by the time the program ends at the end of 2001. Corresponding with this issue, the designers said that the incentive should be given in increments, rather than holding the whole incentive until after completion of the project. Some of the participants said that, in addition to the owner's incentive and the design team incentive, the builder also needs to be given some incentive to make the process work. Others said a builder's incentive wouldn't help.

Another major concern expressed by designers, as mentioned in the previous discussion of incentives (Section 6.1.4) that the design team incentive may create a conflict of interest, or a perception of a conflict.

The designers tended to be skeptical about the motivation behind the program. This was not a prominent issue, but it was consistent in that it came up at all five designer groups. In each case, a light of recognition seemed to go on when we explained the utilities motivation in terms of: (a) the cost vs. value of capacity, (b) the regulatory mandate, and (c) the philosophical bent of the energy efficiency people inside the utilities.

One of the owners, unfamiliar with the program, said that he sees it as coming from the architect to the owner. If the owner is looking for the cheapest options, then they probably won't be interested. He also emphasized that he needs the money up front, before the building gets built. If it comes at the end of the project, it is not worth it. All participants agreed that the owner incentives alone are not large enough to secure the improvements because incremental costs for energy

efficient measures are much higher than the actual incentive received. Most of the small owner/developers said the effort is not worth their time, because the incentives are too small.

However, if financing assistance were available it could help change the equation and make participation in the program worthwhile. As one owner of retail centers said, “most all of our tenants pay the (energy) bills, but we would have to pay for the upgrades, so we would loose.” He suggested that if there was some coordination of tenants to act as a block, it might help the process to get the tenants interested in participating. He seemed to be thinking more in terms of a retrofit program, since presumably with new construction, there aren’t any tenants lined up, especially for multi-tenant strip centers. But his idea does reinforce the issue of tenant input and participation in the program.

A few of the small owners and developers, in one group, had specific issues with the program brochure. They felt that the brochure is “too spiffy.” They prefer a simpler brochure. One of them said, “Give some catchy straight-forward message up front, to convince me to read more. Otherwise, I probably won’t read it.”

Even many of the designers felt that they might not read it if it got sent to them unsolicited. We passed the brochures around to see if anyone recognized the brochure by sight. Several of the participants said they had seen it, but had not read it. Others had specifically requested it, so were anticipating its arrival. One designer said she had called her utility for information on a program for a gut rehab (major renovation). When she received the brochure, she thought they had sent her the wrong information, since it said new construction, so she had not looked at it.

Paradoxically, one of the developers said that he thought that the brochure should be sent to all architects and engineers. As indicated, by the comments above, it is apparent that this would not be a good use of resources, as many of the brochures would end up being thrown out without being read.

Some participants had very specific comments, that at times conflicted with the general opinions, as follows:

> *“Bad lighting decisions in past will still haunt some decision-makers, even though lighting systems are much better now. Better HVAC control needs to be emphasized.”*
>
> *“The only drawback is that getting a 15% energy savings requires a cost increase of 25%.”*
>
> *“It is smart to promote whole building, because it is important to integrate.”*
>
> *“The idea sounds fine, but this program just doesn’t work out. The money is just not there.”*

"The problem is, you need to start with the program too early. Projects move too fast for that."

"The time frame is driving what we are doing. There isn't the time to think about the program and energy efficiency options. I support the idea, and think it is great, but on the practical side, I don't know if it can work."

"The owner needs to be the one distributing the money."

"Changing the direction that the owners are going is a laudable effort."

"I think it is a great program, I'm excited about it and it looks like something that is achievable."

"Helps get things in the project we think are important."

There were also questions about how project completion is determined, and how measure installation is verified. Several electrical engineers expressed concern that it is extremely difficult to get 10% better than the 1998 Title 24 lighting requirements.

One architect and one engineer had already experienced the program on their most recent project together. They were enthusiastic about the program primarily because of the extra attention and assistance they received from the utility (SDG&E). They clearly expect the same level of assistance in future encounters with Savings By Design.

One of the smaller developers got hung up on trying to understand the incentive table in the brochure. We spent some time with the group explaining the details of the incentive options and structure. He felt that it was not intuitive enough. He indicated that he would like to see something more blunt and straightforward, and expressed it as: "You do this, you get this amount of money."

One of the developers suggested that the greatest program benefit comes from assistance from utility personnel in the design. She thinks this assistance is critical because it helps stimulate a new thought process and demonstrates how it can be done. The integration aspect of the program was also identified as being very important. One of the developers said that assistance in the design is critical, because, "we tend to use what has worked and not innovate, without help." Another developer concurred, saying that energy efficiency needs to be approached in terms of technology advancement, not just energy savings. The program and resulting building must promote flexibility, improved comfort and improved control. The program needs a marketing effort to promote these. If the program focuses on that, then it will help to push the market.

One developer said that the utilities should demand that the architects and engineers provide integrated energy efficiency design alternatives. Although this

may be an extreme reaction it is somewhat indicative of the common feeling among the participants that it is somehow the utility's responsibility to solve all the energy efficiency related construction problems that exist. His may simply have been the most extreme manifestation of the shared opinion.

Our general assessment of the program based on our research is that it is still serving as a reward to those designers, owners and builders who push for energy efficiency. It pushes the good to the better, but not the bad to the good. However, as described in the Baseline Study, there is a large energy savings potential from moving from good to better, so this may be an appropriate role for energy efficiency programs. Historically, the utility programs have pulled the market toward greater energy efficiency, while energy standards serve to move the lowest performers forward.

Further, because of the additional time that is required for exploring options to meet the qualifying levels in the program, it is likely that certain types of construction will never participate in the program. Design/build construction for example leaves no opening for a whole building design analysis. Nor does fast track speculative construction lend itself to the timing of the program.

7. LOGISTICS

This section discusses how the information gathering focus groups were set up and conducted in this study. The primary activity of this study was intended to assess opinions of those involved in new construction by conducting a series of focus groups. The focus groups were designed to identify the key market players in new construction, explore their relationships, and describe how these relationships affect energy efficiency decision making. The focus groups were meant to include the key decision-makers: architects, engineers, building owners and developers. The intention was to cover the service territories of the three major electric utilities, Southern California Edison, San Diego Gas & Electric and Pacific Gas & Electric, concentrating on major metropolitan areas. As discussed below, we modified our plan to combine owners and developers in one group and architects and engineers in another group.

7.1 Sources for Contacts

We used several sources to identify possible participants for these focus groups. They were:

- "Market Actors" data developed by RLW Analytics, Inc., from the F. W. Dodge, New Construction Database for Non-Residential projects. [9],
- The Internet Yellow Pages,
- Utility Nonresidential New Construction program contact lists, and
- Referred contacts from the above sources.

Originally, we planned to rely exclusively on the RLW Market Actors data, but due to the limitations of the data, we had to resort to additional sources.

RLW Analytics used the Dodge New Construction Database data for their recently concluded Market Actors study to describe the community of architectural and engineering firms that worked on nonresidential new construction projects in California. The Dodge database for a given year contains a listing of construction projects that were initiated during that year. The Dodge database provides limited information about each project including its location and a list of the architectural and engineering firms associated with the project. From this, RLW compiled a list of designers associated with specific projects. The Market Actors database is a refined compilation of the Dodge data and provides contact names of designers for projects constructed between 1995 and

[9] For simplicity sake, we refer to the RLW cleaned data as "Market Actors" data, although it is essentially F. W. Dodge data. When it is necessary to talk about the source data they used, we will refer to it as the "Dodge" data.

1998. Hence it was appropriate to start with the Market Actors database as a contact list. The criteria for our selection were:

- The firms had to be located in California,
- They had to be involved in Nonresidential New Construction, and
- The firms' projects should be located in one or more of the utility's service territory.

We first filtered the Market Actors data removing all contacts located outside of California. We then sorted the remaining contacts by region, either Northern California or Southern California, using telephone area code as the determinant. The data was further sorted by metropolitan area, again by area code, to obtain contacts in the areas of interest.

Although the Market Actors database was supposed to cover only designers, in sorting and reviewing the data, we identified names that appeared to be developers and owners. Discovering this, we hoped that the Market Actors list would provide us sufficient owner and developer contacts. While trying to contact the developers and owners listed in the Market Actors database, we found that the majority of the phone numbers had been changed, disconnected, or re-assigned to different businesses. We surmised that the contacts and phone numbers listed for owners and developers were valid only for the construction phase of the project. While not as common, this problem also existed for the designers.

We investigated other sources including mailing list services and Internet sources to reach developers and owners. After researching mailing list services, we were unconvinced of their usefulness for this application and concerned with the reliability, cost and timely delivery of the mailing lists. Ultimately, we chose to use the Internet Yellow Pages. The Internet appeared to have more current and updated information. This was particularly desirable in light of our criteria for the professionals in the focus groups to be currently involved with commercial new construction projects. However, this came with its own limitations. Using the Internet Yellow Pages, we were unable to find building owners and concentrated instead on developers.

The database maintained by the Internet Yellow Pages is broader in context than the Dodge database. The Internet source did not clearly distinguish between professionals who work on commercial projects and those who work on residential projects. After searching the list by business type and city, we screened each contact for appropriateness to the study parameters. The goal of the screening was to identify decision-makers associated with commercial new construction projects.

We also asked each of the utility program managers to give us lists of people who had contacted them about their programs. We asked them to identify any of the people on their lists who had participated in earlier focus groups. Given the relatively small number of contacts achieved through focus groups, we wanted to avoid getting input that was already recorded.

In another attempt to reach more potential participants, we asked the people we contacted to suggest other professionals. We asked them to recommended firms and individuals that dealt with commercial new construction. We took this approach only with contacts that said they would not be able to attend, as we didn't want input from the same design team.

7.2 Location Selection Criteria

We selected focus group locations based on two criteria:

1. Cities serviced by the three IOUs offering the Savings by Design Nonresidential New Construction program, and
2. Cities that had the largest number of potential contacts.

The cities with definitively the greatest concentration of designers were Los Angeles, San Francisco and San Diego. Since we wanted to cover four areas, and had planned to have two in southern California and two in northern California, we selected San Jose as the fourth location. Once we established the preferred locations, we contacted focus group facilities in those cities. Due to availability of the focus group facilities, the San Jose focus group was held in the adjacent city of Sunnyvale.

7.3 Recruiting Process

After having determined the locations, we focused our recruiting efforts on these specific cities. We attempted to identify and invite the senior decision-makers and project managers in firms and business that were involved with commercial new construction projects. We wanted the mix to include large and small business, as well as designers who worked on large or small projects. We also attempted to recruit designers who were familiar with a range of utility programs, as well as some that were not aware of any programs.

We intentionally restricted our contacts to a relatively small radius surrounding the city, as we did not want travel time and scheduling conflicts to impact the participation rate. As shown in Table 1, we were fairly successful. The average attendance rate, defined as the number who attended compared to the number of respondent, for owners and developers was 65% and for designers, 74%

Date	Location	Time	Group*	Incentive Amount	Total Contacted	Responded	Attendees	% Attendance
10/13/99	San Diego	7:00 - 9:00 p.m.	O/D	$100	177	6	5	83
10/14/99	San Diego	8:00 - 10:00 a.m.	A/E	$100	50	11	6	55
10/19/99	San Francisco	4:00 - 6:00 p.m.	E	$200	71	10	9	90
10/19/99	San Francisco	7:00 - 9:00 p.m.	A	$200	69	10	8	80
11/2/99	Los Angeles	7:00 - 9:00 p.m.	O/D	$100	77	6	4	67
11/3/99	Los Angeles	8:00 - 10:00 a.m.	A/E	$100	57	12	9	75
11/8/99	Sunnyvale	7:00 - 9:00 p.m.	O/D	$100	127	5	2	40
11/9/99	Sunnyvale	8:00 - 10:00 a.m.	A/E	$100	75	5	4	80

Note: ** In this column, O/D stands for Owners / Developers and A/E stands for Architects / Engineers (Designers)*

Table 1: Focus Group Information

Table 1 provides information on all of the focus groups including, date, location, time, group, incentive amount, total number of people contracted, number of respondents, number of attendees and percent attendance, or attendance rate.

The "Total Contacted" column refers to the number of contacts we actually made. This does not account for the attempts we made with the following outcomes:

- change in area codes for entire regions,
- new number out of the our immediate contact area, or
- disconnected numbers with no new number given.

Although we found it difficult to make an initial contact, approximately 70% of the firms we attempted to reach resulted in a contact. It often took six or more calls to determine a real sense of their commitment, due to one or more of the following: 1) we traded voice mail messages; 2) we were asked to fax them more information and call back; 3)our attempt to speak to a decision-maker was screened by the receptionist; and 4) we would have to wait for verification of their acceptance.

7.3.1 Recruitment Issues

While implementing our recruitment plan we encountered several issues associated with focus group participation. We feel that these issues are not unique to our particular project, and are important to consider in conducting future focus groups. Some of the issues we addressed were the following:

- What would motivate a professional to accept an invitation to a focus group meeting?

- If a financial incentive had to be offered, how much would be appropriate?
- How many days prior to the meeting should they be contacted? When is too early, or too late?
- What is the best time of day to reach them?
- How many times can you call them, before deciding you are wasting your time, or you risk annoying them?
- Is faxing information helpful? … as a first contact? …or follow-up?
- How far would they be willing to travel?
- How much time would they be willing to spend at a focus group?
- What time of day for a meeting is best?

Although we tried to determine "an answer" to each of these questions, we found a lot of variance in the answers. From these initial questions we arrived at a few conclusions:

- We would begin contacting them about two weeks prior to the scheduled meeting day. However, in some cases we did not receive final confirmation until the day before the meeting,
- We would offer a $100 incentive as a compensation for their time, and provide refreshments,
- We would have the meetings in a central location in each of the cities, and,
- We would conduct two hours meetings, either at the beginning of the business day, the end of the business day or in the evening.

We believe that the primary factors for declining an invitation to participate were the following:

- They were the wrong business type (not involved with nonresidential new construction projects).
- They were not interested.
- They were interested, but unable to attend due to schedule conflicts.

7.3.2 Changes in the Recruitment Approach

In attempting to contact people for the San Francisco focus group, we experienced a unique set of problems. Based on responses from our calls, we had to make some changes to our initial recruitment approach. Most of the offices we contacted were far too busy, and weren't able to send a participant for any of our scheduled times. It was especially difficult to get commitments from owners and developers. We tried several tactics to improve our "hit rate," including increasing the incentive amount and reorganizing the focus groups.

We decided to double the incentive amount to $200. In retrospect, it's unclear that the additional incentive increased the participation.

We also decided to restructure the groups, foregoing the owner/developer group and splitting up the designer category into separate groups of architects and engineers. This had the added benefit of helping us identify whether each group would give us any different perspectives outside the presence of the other design profession.

As discussed in Chapter 5, there were some differences between responses of architects and engineers separately versus combined. However, we do not feel the responses differed enough that we would recommend having separate groups in the future. We believe that the combined group provides a good design dynamic that was helpful in fully exploring the issues.

8. APPENDIX A: NON-RESIDENTIAL NEW CONSTRUCTION BASELINE STUDY MARKET ACTORS FINDINGS

This appendix contains the section of the Baseline Study that addresses market actors. It is reprinted verbatim, as it appears in the final Baseline Study report.

The key question from the preceding section is this. Why are some buildings in California so much more efficient than the norm? To look for an answer, we turn to the key players in the market. As a starting point, Figure 7 summarizes the market participants and their expected relationships. We discussed this figure in Chapter 1, postulating that the strongest relationship was between the owner and the architect.

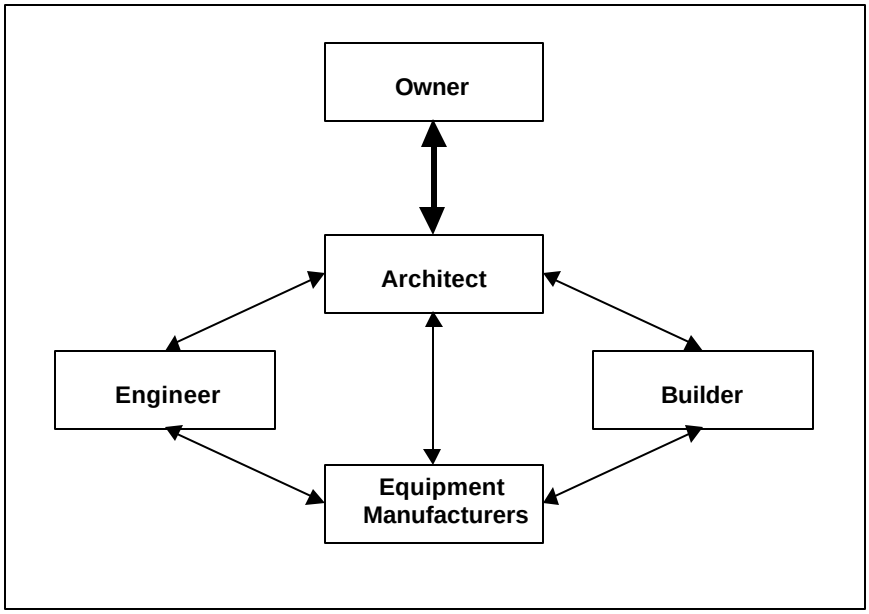

Figure 7: Prinicipal Actors in the NRNC Market

8.1.1 The Role of Owners

When we asked the architects and engineers who was responsible for designing buildings to be energy efficient, we obtained the answers shown in Figure 8. About 30% of both architects and engineers indicated that the owners have the primary responsibility for the energy efficiency of buildings. One engineer put it this way:

> "*Ultimately, efficiency decisions are up to the owners since they are the people who must pay the cost of the equipment as well as the utility bills.*"

It may be that the most efficient buildings are due to pull by the owners. Perhaps a small number of owners are willing to accept the extra cost in the design process or to invest in the more expensive measures and options.

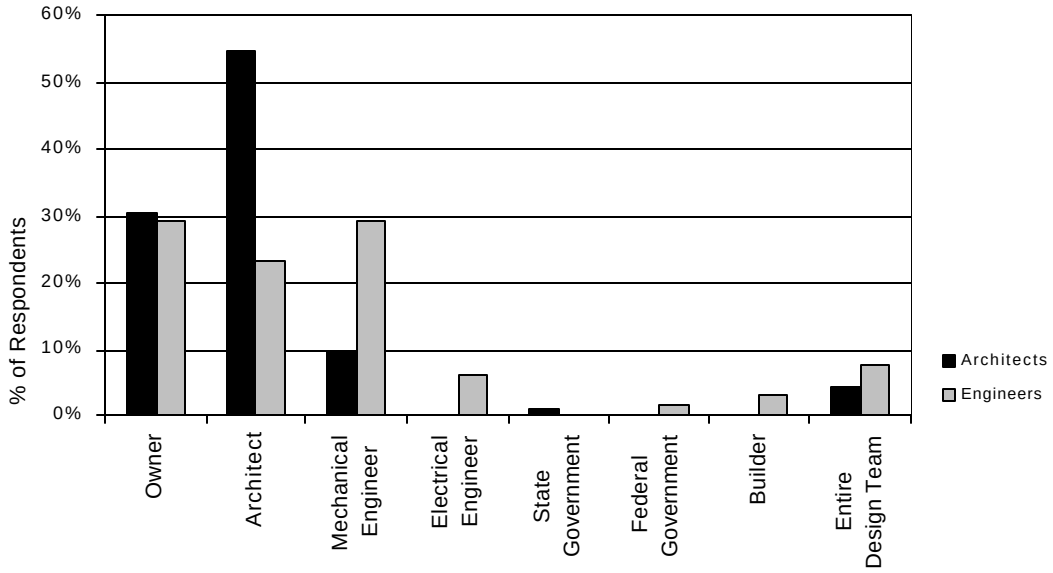

Figure 8: Who has the Primary Responsibility for Efficient Design?

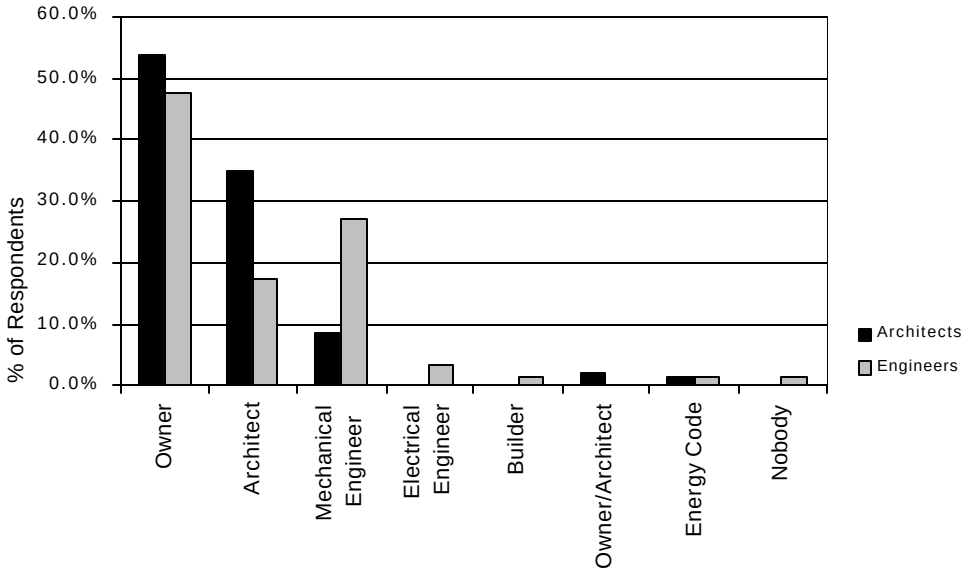

Figure 9: Who Makes the Primary Decisions?

However, when we asked who is the primary decision-maker, we got the responses shown in Figure 9. About 50% of the architects and engineers

responded that the primary decision-maker was the owner. It is interesting that 30% of the architects and engineers felt that owners have the primary *responsibility*, whereas about 50% thought that they made the primary *decisions*. It may be that the architects and engineers often find themselves outvoted by the owners.

To summarize:

Some owners may provide crucial leadership in energy efficiency but others may override the recommendations of their architects and engineers.

8.1.2 Educating the Owners

Many of the architects and engineers emphasized the importance of educating the owners about energy-efficient options.

> *"Many clients don't understand about the choices. Some clients are very environmentally aware and the cost benefit is secondary, while other clients aren't as aware and the cost benefit is the primary consideration. We need easy to understand information to explain the benefits to both client types."*

The vast majority of the architects and engineers try to educate their clients about energy efficiency. The majority said they found the most effective approach to be to discuss O&M costs relative to initial costs. This reinforces the impression that owners are primarily concerned about cost.

We also asked them what they thought were the most useful tools in educating their clients. Surprisingly, both the architects and engineers preferred newsletters to seminars, utility reps, utility guidelines, databases, software, web sites, and prototype demonstrations.

Architects and engineers both found it more useful to educate owners using newsletters than more high-cost, hi-tech options such prototype demonstrations and software tools.

8.1.3 Role of the Builder

When we asked architects and engineers why some buildings fail to comply with Title 24, they pointed to changes by the owner and cost-cutting during bidding and construction. They told us that they have seen contractors and subcontractors recommend changes to less efficient options in order to reduce cost, simplify construction, or improve maintenance. Some suggested that these changes were made as part of the 'value engineering' process, as the owners sought to stay in budget and the contractors and subcontractors competed for the winning bid.

The architects and engineers also suggested that lax enforcement of Title 24 contributes to the problem. It may be that building inspectors need training on how to spot these design alterations.

8.1.4 Operators and Maintenance Staff

The architects and engineers mentioned another group of actors, the operator staff and maintenance contractors. They pointed out the need to educate the facilities people on the advantages of energy-efficient equipment and on its proper operation.

> *"Steps need to be taken to educate the people who run the building, the facilities people. Educating the facilities people on the long-term benefits of certain equipment will encourage the client to select certain equipment for the building."*

> *"The training of the operators is sometimes futile because of job turnover. The knowledge of the system never gets transferred. I have also seen cases where the system is configured, and the main person knows how to use it, but they never train the people who are going to actually use the systems."*

> *"The operator of facilities used to be aware of how the system was intended to operate. Now, many people are manipulating the controls on systems. I am not sure people are being educated on how to use the systems. The issue that arises for the owners is: do you spend more time helping your staff learn the system or keep the money in the bank (by installing standard systems)."*

> *"My practice is located in a rural area; most contractors in the area are not knowledgeable about maintaining energy efficient equipment. Usually the same contractor is responsible for installation and maintenance of the equipment, so it would require significantly more effort and dollars in this area. However, I have worked on several industrial projects near San Francisco. I have found that more people are willing to try new equipment, primarily because the contractors can handle the complexity of system maintenance."*

8.1.5 Interaction between Architects and Engineers

Architects and engineers may sometimes fail to act as a team.

Returning to Figure 8 we can get another insight. The majority of architects said that they had the primary responsibility for the efficiency of the design. By contrast, the engineers seem to believe that their role is more important than the architects. Figure 9 shows a similar divergence. Both architects and engineers felt more important in the decision-making process than their counterpart.

The divergence in these two results is striking. It suggests an imbalance in the relationship between these two vital elements of the design process. These findings suggest that architects and engineers may not always respect each other's role in the design process.

Some of the engineers that we talked to also felt that they did not have as much influence on the design process as they wanted because they did not have an

opportunity to meet with the owners, i.e., the architects controlled the relationship with the owners.

However, some architects and engineers recognize the role of an integrated design approach. 4% of the architects and 8% of the engineers that we surveyed wrote in the answer that the entire team was responsible for designing energy efficiency into buildings. Since this was not one of the available answers it is likely that the observed percentages understate this attitude. We will explore this promising issue in a following section.

8.1.6 Equipment Manufacturers

Another agent in the market is the equipment manufacturer. The architects and engineers generally feel that good, energy-efficient equipment was available. This information tended to be more familiar to the engineers than the architects. However, both groups voiced some concern about the accuracy of information provided to them by the manufacturers.

> *"Information about the equipment is not trustworthy. Good research, forthrightly shown from a trusted source is needed for me to believe the documentation. I tend to just go with the equipment that I know and trust."*

> *"I feel clients want a more trustworthy source of information from someone with experience using the systems instead of the current information from manufacturers they have now."*

8.1.7 A New Model for the NRNC Market

Based on the preceding key findings and other information from the surveys and onsite visits, we believe that the relationship between the market actors is different than we postulated in Figure 7. Our new model is summarized in Figure 10. The differences between our original model and our current model are important:

- The relationship between the owner and architect is strong but not as strong as expected. Generally, the owner makes the final decisions whenever costs are affected.
- The owner sometimes works directly with the builder and overrides the recommendations of the architect. This may lead to occasional violations of Title 24 requirements.
- The operator and/or maintenance contractor may be an indirect but still significant factor in the process. The owner's decisions may be affected by concern about the operator's ability to manage innovative equipment. Unfortunately, the architects and engineers may have little opportunity to train the operators because of operator turnover and other factors.

- The architects depend on the engineers for their technical knowledge about equipment and often about technical options that may improve energy efficiency. But, unfortunately, the engineers may be excluded from the design team working with the owners.

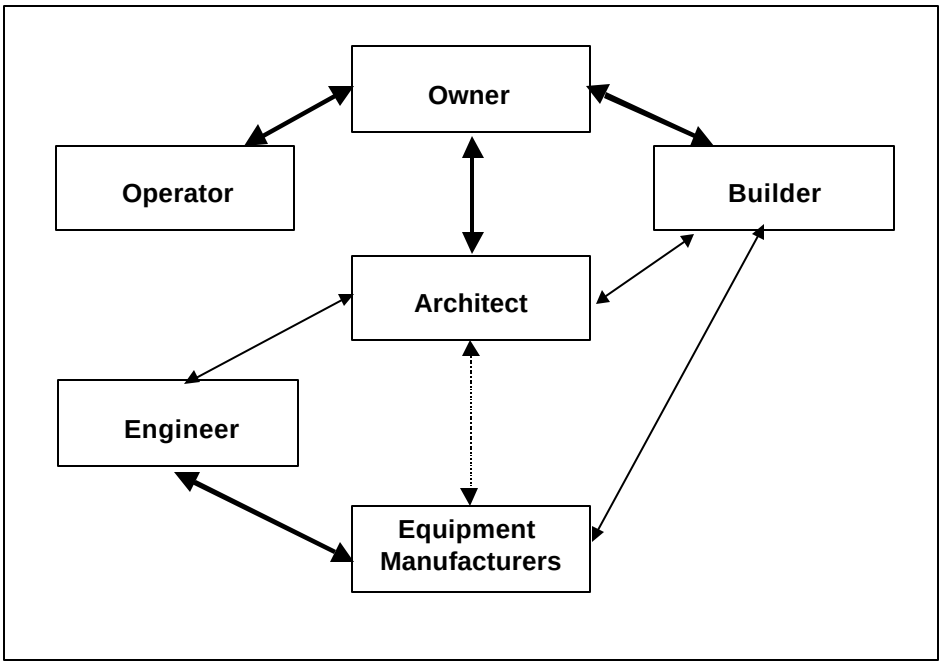

Figure 10: A New Model for the NRNC Market

The most important implication of the new model is the following.

Due to the relatively weak link between the architects and engineers, and the even weaker link between the architects and equipment manufacturers, there is a weakened connection between (a) the engineers and equipment manufacturers who possess the technical knowledge about energy efficiency, and (b) the owners, architects, and builders who make the crucial decisions about the buildings.

9. APPENDIX B: ENERGY STANDARDS AND BUILDING PRACTICES

To gain a complete understanding of energy codes, it is important to understand how energy codes function in relation to building practices, and utility programs. Building practices are not static, nor are they consistent throughout the industry at any given point in time. Energy codes affect building practices, and hopefully improve them. At the same time, the state of current building practices puts a constraint on what can be accomplished through codes and standards; with the exception of voluntary standards, codes cannot be too far ahead of current practice.

The graph in Figure 11 depicts a hypothesized relationship between building energy efficiency on the horizontal axis, and building area (square footage or number of buildings) on the vertical axis. If all buildings had equal efficiency, the graph would simply be one large, vertical bar. In actuality, however, the efficiency within the population of buildings varies. The solid dark line in the shape of a bell curve represents an idealized distribution of building efficiencies. It shows the greatest building area having average efficiency. As we move to the left, and toward lower energy use or greater energy efficiency, the building area gets smaller, because there are relatively few high efficiency buildings. Likewise, there are relatively few inefficient buildings at the right end of the curve. While this is an idealized curve, the general point is that there is a range of efficiencies in the building population.

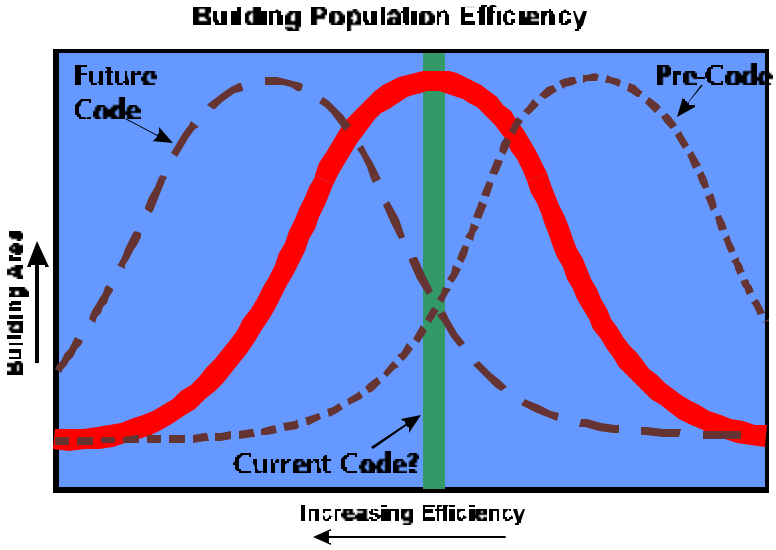

Figure 11: Building Population Efficiency Over Time

The vertical bar in the middle of the graph represents the level of efficiency established by the current energy code. It corresponds to a level of efficiency that most buildings can meet or exceed. Buildings that fall on the right half of the

curve fail to fully meet the energy code, although most are close to the code level of efficiency. There are two other curves on the graph that represent changes in efficiency over time. In the past, buildings were not as efficient as they are now, and there is reason to believe that they will be more efficient in the future as the efficiency of products improve and as designers include more efficiency considerations into their buildings. We expect the population efficiency curve to gradually move toward the left.

The vertical line of energy code efficiency is set by the state or other adopting authority at a point in time, and it remains there for some years until the next code revision. Meanwhile, the population curve is shifting toward the left. If the code remains fixed, eventually, the population efficiency might be far to the left. At that point, only a small percentage of buildings will fall below the code (right of the vertical line), and most buildings will have no trouble meeting the code requirements. It would then be time to upgrade the code (move the vertical bar to the left, toward the middle of the new curve). Without a code upgrade, the energy code could actually become a drag on practice, by allowing people to build at levels that are actually below current good practice. Unfortunately, there are usually economic incentives for builders to cut as many corners as possible. With a code upgrade, the newer, more efficient building practices are "locked in," and made a permanent part of the building code.

Results from the Baseline Study support the validity of our hypothesized curve. As shown in the Figure 12 the actual energy efficiency of the building population sample closely follows our theory. The graph shows that the majority of buildings have overall efficiencies close to code requirements (represented by the vertical dotted line at an energy ratio of 1.0), with fewer buildings leading or lagging current practice. It is worth noting that the data points in the graphs, connected by lines for clarity, each represent the center of a band of efficiencies. For example, the data point at 0.9 for offices means that 60% of office buildings have energy use that is between 0.8 and 1.0 times the energy use required by the energy code (Title 24). The graph also shows that between 10% and 20% of the buildings use from 1.0 to 1.2 times the allowable Title 24 energy usage, and a smaller percentage are even less efficient. These represent new buildings whose energy efficiency is not meeting code; they also indicate that enforcement of Title 24 could be more effective. Overall, however, the graph shows the large majority of nonresidential buildings are at least as efficient as Title 24 requires.

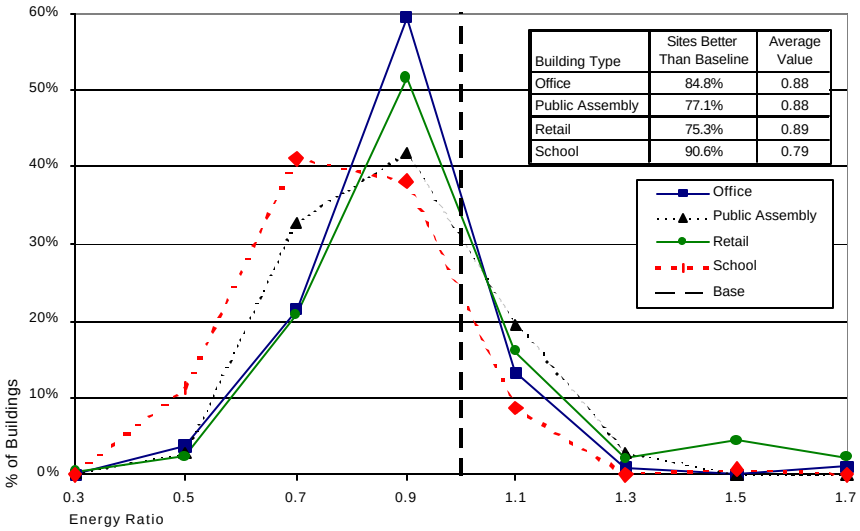

Figure 12: Actual Building Population Efficiency Relative to Title 24

Note: Lower energy usage, and increased efficiency, is to the left on the x-axis

The following example illustrates how utility programs and energy codes work together to transform the market.

Lighting Technologies and Practices. Lighting power densities, expressed in watts per square foot, form the basis for the way the Title 24 Standards regulate lighting energy consumption in nonresidential buildings. These values provide the designer with a performance specification for the overall lighting system.

The lighting power density requirements contained in the Standards are based on the "standard economic solution," which is defined as designs that are generally practiced and are energy-efficient[10].

Utility rebate programs that operated in the late 1980's and early 1990's provided an incentive for designers to lower lighting power densities in two ways; the use of automatic lighting controls like occupancy sensors and the use of more efficient lighting equipment, such as solid-state electronic ballasts and T-8 lamps. At the time, relatively energy efficient magnetic ballasts and T-12 lamps were considered the standard economic solution in new construction. Primarily through the influence of utility programs, gradually, T-8's and electronic ballasts became commonplace in new construction projects.

The Baseline study found a variation between installed lighting power densities and those allowed for building types covered by the 1992 and 1995 Standards and built between 1994 and 1998. This variation showed that new lighting technologies and practices were being used in most new buildings in California. Furthermore, it demonstrated that more efficient practices were also replacing

[10] Life-Cycle Cost Analysis: Energy Conservation Measures - Nonresidential Buildings, March 1992. Prepared for the California Energy Commission by Eley Associates under CEC Contract 400-89-009.

less efficient practices in the population of buildings that were not involved in utility rebate programs. This "spillover" effect, was responsible for a substantial portion of new buildings being built more efficiently than the 1992 Standards.

The combined effect of new technologies and new practices has resulted in California mandating higher energy efficiency in nonresidential lighting systems, which now primarily use 4' and 8' energy efficient fluorescent lamps and electronic ballasts. There is a clear link between the voluntary standards and market transformation efforts of the utility programs, and the final adoption of new lighting efficiency standards in the energy code.

10. APPENDIX C: DISCUSSION OUTLINE

Outline for Focus Group
(2 hours)

1) Introductions & Round of Questions (15 - 20 mins.)

a) Who we are and why we called you here.

b) Who you are?

i) Is energy efficiency important to you?

ii) Why or why not?

c) What will help make buildings more energy efficient?

d) What needs to change to make energy efficiency more sustainable?

2) NRNC Market Model (20 – 30 mins.)

a) Diagram from the Baseline study

i) key players – owners, builders, arch., engrs.

ii) add others as they are brought up – equipment manufacturers, operators, lenders, appraisers

b) What are their connections? – which are the strongest?

i) (designers only) owner type differences

ii) (owners only) owners view of design team

c) Who is responsible for energy efficiency recommendations?

d)) Who is responsible for energy efficiency decision making?

e) Does energy-efficiency work in this type of arrangement? Why or why not

f) Other possible questions or topics

i) role of builders

ii) role of Value Engineering

iii) role of O&M staff

iv) role of energy code

v) (designers only) Discussion of optimized energy design

vi) (designers only) educating owners

g) Barriers – (list as back-up)

i) which are most important?

ii) how can they be addressed?

iii) who should lead the effort in overcoming the barriers?

3) Offerings (45 mins.)

a) Info.
   i) web sites
   ii) design guidelines – Briefs and Case Studies
   iii) seminars
   iv) Energy Centers
   v) demonstration projects

b) Expert Assistance
   i) design assistance
   ii) utility construction assistance
   iii) commissioning assistance
   iv) project coordination

c) Tools
   i) energy savings software – i.e. *eQuest*
   ii) energy savings spreadsheets – i.e. *Skycalc*
   iii) physical models

d) Incentives
   i) to owners to offset first cost
   ii) to owners for additional effort reqd.
   iii) to designers for additional effort reqd.
   iv) for Cx plans

e) Recognition
   i) Professional recognition for designers
   ii) Bldg. and community recognition for owners & developers

f) Financing

g) Appraisals

h) Permitting

4) **Discussion of SBD program** (20 mins.)

a) Overview

b) Reaction

c) Other experience

5) **Ending Questions and "What Else?"** (10 mins)

a) Other benefits of energy efficiency – productivity, increased comfort

b) If the programs went away, would you change your design practices?

If the standards or enforcement were relaxed, would you change your design practices?

11. APPENDIX D: SAVINGS BY DESIGN PRESENTATION