NONRESIDENTIAL REMODELING AND RENOVATION STUDY

Final and Summary Report

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1. INTRODUCTION

This report is the final report for the Nonresidential Remodeling and Renovation (NRRR) Study. The overall purpose of the NRRR Study was to collect and analyze data with which to characterize nonresidential remodeling and renovation market activity in California. The data and analysis produced through this study are to be used in evaluating energy efficiency and/or market transformation efforts, in assessing the effectiveness of individual programs, and in preparing strategic planning efforts.[1]

The significance of the NRRR Study is that remodeling and renovation of existing nonresidential buildings is expected to become increasingly important. For example, in a study on changes in construction markets that was published in 1996[2], the chief economist for the American Institute of Architects projected that a growing share of nonresidential construction spending will be earmarked for improvements to the aging stock of nonresidential buildings. This study pointed out that as recently as the mid-1980s additions and alterations to existing buildings together accounted for less than a third of nonresidential construction activity. In the first half of the 1990s, nearly 25 percent of all construction dollars went for alterations and another 20 percent for additions. The study projected that by 2010 the market for work on existing buildings will be even larger than for new construction. Thus, one motivation for the NRRR Study has been to describe and delineate the market for remodeling and renovation of nonresidential buildings in California.

A major question underlying the NRRR Study has been whether remodeling and renovation of nonresidential buildings is sufficiently different from new construction and retrofit activities to warrant treating remodeling and renovation as a separate area for developing and implementing programs to improve energy efficiency. For example, although many of the same market actors are involved in both new construction and remodeling, are building owner decision-making and energy efficiency savings opportunities likely to be the same?

To answer this and other questions about the market for remodeling and renovating of nonresidential buildings, the NRRR Study had four major goals:

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[1] The California Energy Commission managed the NRRR Study on behalf of the California Public Utilities Commission, using California Public Goods Charge Energy Efficiency and Gas Demand Side Management Funds.

[2] Baker, Kermit, *Changes in Construction Markets: The Next 15 Years Growth Opportunities for Architects,* American Institute of Architects, 1996.

- To characterize the decision-making process for purchases of energy using equipment during remodeling or renovation of nonresidential buildings;
- To describe the level and types of remodeling and renovation activity by market segment, define segments useful to program planning and implementation and quantify characteristics for segments within the NRRR market;
- To identify specific markets with a high potential to save energy; and
- To develop new strategies and program designs to promote market transformation.

Data and analysis to address these objectives were developed and presented in two previous reports (i.e., *Remodeling and Renovation: A Qualitative View* and *Nonresidential Remodeling and Renovation Study: Quantitative Survey Report*.)[3] This Final Report summarizes and interprets the data presented in those two reports. Throughout this Final Report references are made back to those two reports for fuller detail and information regarding the development of the underlying data.

This report is organized as follows.

- Chapter 2 discusses definitions and taxonomies for nonresidential remodeling and renovation activity.
- Chapter 3 presents and discusses information on the size of the NRRR market.
- Chapter 4 discusses structural characteristics of NRRR market.
- Chapter 5 discusses in decision-making in the NRRR market.
- Chapter 6 discusses potential for improving energy efficiency in NRRR market segments.
- Chapter 7 summarizes major findings and implications from the study.
- Appendix A identifies the counties included in CIRB regions.

[3] Both reports are available for downloading on the CALMAC website at www.calmac.org..

2. DEFINITIONS AND TAXONOMIES FOR NONRESIDENTIAL REMODELING AND RENOVATION ACTIVITY

As background for the subsequent discussion of the nonresidential remodeling and renovation (NRRR) market, this chapter begins with discussions of the definitions, the taxonomies and the extant data for studying nonresidential remodeling and renovation activities.

2.1 DEFINITIONS FOR NRRR ACTIVITIES

Different types of construction activities occur as a building moves through its life cycle. This life cycle begins when a new building is constructed on a piece of land where there is no existing building. Once a building has been built, construction activities can be undertaken to change the building.

One finding from the focus groups that were held at the start of the NRRR Study is that there is no consensus on the terminology used to describe the construction activities that occur for existing buildings. Building professionals said that they typically apply whatever term the client uses to describe a project. Although they may not use the terminology, building professionals tend to distinguish between maintenance and operations, replacement, tenant improvements, shell projects that include tenant improvements, additions, and new construction. The major distinction is between tenant improvements and shell projects.

Further review showed that definitions for construction activities for existing buildings have been developed from three different perspectives:

- For designing energy efficiency programs;
- For complying with Title 24 energy efficiency standards; and
- For building permitting.

The similarities and differences in the definitions from these three perspectives are discussed in the following sections.

2.1.1 Defining Construction Activities from the Perspective of Energy Efficiency Program Design

In their study of market barriers to energy efficiency, Golove and Eto noted that there are various types of construction activities in existing buildings:

> "Construction activities in existing buildings can generally be classified according to the following list: (1) expansion or renovation, which are essentially forms of new construction; (2) remodeling, which consists of major alterations to an existing space; (3) retrofit, which here refers to

> equipment replacement specifically for the purpose of energy efficiency; (4) planned equipment replacement; and (5) emergency equipment replacement."[1]

The California Board for Energy Efficiency (CBEE) drew upon this taxonomy in developing a market segmentation scheme for designing energy efficiency programs. The CBEE described the various activities as market events and distinguished between two types of events.

> "In general, lost opportunity events occur when customers install or replace equipment for reasons not having to do with energy or energy efficiency, and failure to encourage them to consider energy efficiency in their purchase decision has the potential to make it more expensive to improve the energy efficiency of the new equipment later on. Discretionary retrofits, by contrast, occur when customers install new equipment or replace working equipment primarily to improve the energy efficiency of their building or facility."[2]

In this characterization, remodeling and renovation of nonresidential buildings are "lost opportunity events" that are not energy driven.

Drawing on this line of work, the California Public Utilities Commission has provided the following definitions for remodeling and for renovation for energy efficiency programs in California.[3]

> "Remodeling: Modifications to the characteristics of an existing residential or nonresidential building or energy-using equipment installed within it.
>
> Renovation: Modifications to the characteristics of an existing residential or nonresidential building itself, including, but not limited to, windows, insulation, and other modifications to the building shell."

2.1.2 Defining Construction Activities from the Perspective of Title 24 Compliance

Construction activities for existing nonresidential buildings have also been defined from the perspective of complying with California's Title 24 energy efficiency

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[1] Golove, W.H. and Eto, J.H., "Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency," Lawrence Berkeley National Laboratory, Report No. LBL-38059, March 1996, p. 45.

[2] Prahl, R. et al., "Alternative Approaches to Segmenting Administrators' Responsibilities," Issue paper prepared for CBEE by Technical Services Consultants, August 29, 1997, p. 18.

[3] California Public Utilities Commission, Energy Division, *Energy Efficiency Policy Manual*, October 2001.

standards. From this perspective, changes in an existing building that trigger the requirement to comply with Title 24 are characterized either as additions or as alterations. Additions and alterations are defined for Title 24 purposes as follows:

> **"**Addition is any change to a building that increases conditioned floor area and conditioned volume. Additions involve either the construction of new, conditioned space and conditioned volume, or the installation of space conditioning in a previously unconditioned space."[4]
>
> "Alteration is any change to a building's water heating system, space conditioning system, lighting system, or envelope that is not an addition."[5]

Additions or alterations to existing nonresidential buildings require compliance with the Title 24 energy efficiency standards according to the following rules.

- An addition involves either the construction of new, conditioned space and conditioned volume, or the installation of space conditioning in a previously unconditioned space. The mandatory Title 24 measures, and either the prescriptive or the performance requirements apply to such additions. The heating, lighting, envelope, and water heating systems of additions are treated the same as for new buildings. The only exception is if the existing systems are simply extended into the addition.
- Alterations are changes to a building's water heating system, space conditioning system, lighting system, or envelope that do not represent an addition. For alterations, the following Title 24 rules apply:
  - The Title 24 standards apply only to those portions of the systems being altered; un-touched portions need not comply with the standards.
  - Alterations must comply with the mandatory measures for the changed components.
  - New systems in the alteration must comply with the current standards.
  - If an envelope or lighting alteration increases the energy use of the altered systems, the alteration must comply with the current standards.

It was noted in focus group discussions for the NRRR Study that a change in an existing nonresidential building is often for a tenant improvement. Examples of tenant improvements include the completion of the interior of a shell building; conversion of warehouse space to office use; installation of a commercial exhaust

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[4] California Energy Commission, *Nonresidential Manual for Compliance with the 1998 Energy Efficiency Standards for Nonresidential Buildings, High-Rise Residential Buildings, Hotels [Motels]*, July 1999, p. 2-11.

[5] Ibid., p. 2-9.

hood for a restaurant; window and door awnings; facade work; plumbing, mechanical, and electrical additions, and similar items that generally don't affect the structural components of a building.

If tenant improvements that require alterations are made in buildings that previously have not had Title 24 compliance (e.g., buildings with no heating), then compliance with Title 24 is required for shell, lighting, or HVAC alterations. This case applies to most of the low-rise buildings that were originally built for speculative purposes and then converted to tenant use through additional improvements. In an existing semi-conditioned building, altered lighting must meet mandatory measures for the changed lighting component. Alterations that increase the connected lighting load or replace more than 50 percent of the lighting fixtures must meet current standards.

There are some cases of changes to an existing building for which compliance with Title 24 energy efficiency requirements is not required. These cases include the following:

- if the total capacities of existing lighting do not change; or
- if the total capacities of existing HVAC equipment do not change; or
- if evaporative cooling is added in an existing, unconditioned building (making the building semi-conditioned), the existing unaltered envelope and lighting do not need to be brought into compliance with current standards.

2.1.3 Defining Construction Activities from the Perspective of Building Permitting

For most local government jurisdictions in California (i.e., cities, counties), a nonresidential building that is regulated by the local building code cannot be erected, constructed, enlarged, altered, repaired, improved, converted, permanently relocated or partially demolished unless a separate building permit is first obtained for the structure from a designated building official. That is, these construction activities need to be reviewed for compliance with the non-structural provisions of the Uniform Building Code for such areas of concern as exiting, disabled accessibility to the improved area, the specific use of the area of improvements, framing of the interior walls and suspended ceilings, lighting, electrical layout and wiring, duct work, plumbing, energy compliance, zoning and parking requirements, and water and sewer requirements.

Information developed during the NRRR Study shows that local jurisdictions can differ in the terms that they may apply within their own locales to describe construction activities for existing nonresidential buildings. However, to report on the magnitude of such activities to central statistical agencies local jurisdictions usually follow the nomenclature established by the U.S. Bureau of the Census for

the Nonresidential Building Permits Survey that it previously conducted. (The survey was suspended after 1995.)

In the nomenclature and coding defined by the Census Bureau, changes to existing nonresidential buildings are characterized as "additions, alterations, or conversions" and assigned a Structure Code of 437. This code includes permits issued for additions, alterations and conversions to nonresidential and nonhousekeeping buildings and for conversions of housekeeping buildings to nonresidential or nonhousekeeping buildings. Not included under this code are special "installation" permits issued to cover electrical, plumbing, heating, air-conditioning, or similar mechanical work. Also excluded are the installation of fire escapes, elevators, signs, etc., and conversions to residential housekeeping buildings.

Within California, the Census Bureau nomenclature and definitions are used by the Construction Industry Research Board (CIRB) in collecting data on permitting activity from local jurisdictions throughout the state. Although not exactly following the Census definitions, F.W. Dodge distinguishes between new/addition projects (i.e., projects in which new building area is produced) and alteration projects (i.e., projects which include remodeling, renovation, tenant improvement, or retrofit).

2.2 A TAXONOMY FOR RELATING NRRR ACTIVITY TO OTHER CONSTRUCTION ACTIVITIES

One of the issues for the NRRR Study has been how to differentiate remodeling and renovation of nonresidential buildings from other construction activities (e.g., new construction, equipment replacement). At an early stage of the NRRR Study, a taxonomy was developed that provides a way of thinking about the renovation and remodeling market in relation to other construction markets. This taxonomy is shown in Figure 2-1.

Two dimensions define the taxonomy.

- The first dimension is the degree to which systems are designed or redesigned and the number of systems that are being changed. The design effort can range from collecting the information needed to replace a system or component with an identical or nearly identical item to a completely new specification or system design.
- The second dimension is the number of affected building systems, which can range from a component of a system to all building systems.

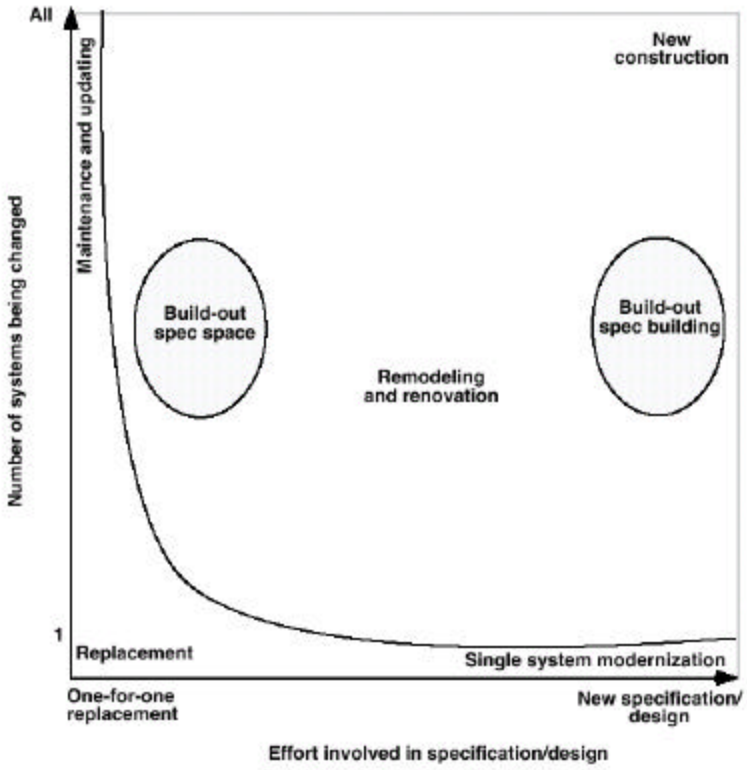

Figure 2-1. Taxonomy for Relating Remodeling and Renovation to Other Construction Activities

With the taxonomy shown in Figure 2-1, remodeling and renovation takes a middle position between replacement (which falls in the lower left corner) and new construction (which falls in the upper right corner). However, Figure 2-1 illustrates that it is difficult to define sharp differences between remodeling and new construction in terms of design and construction practices. From this perspective, renovation and remodeling is defined by the number of systems and the extent of specification and design activities rather than by the nature of the activities that are undertaken.

2.3 ASSESSING DATA SOURCES FOR NRRR ACTIVITY

The discussions of terminology and of the relationship of remodeling and renovation activity to other construction activities are important in understanding and assessing the different sources of data that can be used to measure nonresidential remodeling and renovation construction activity. The preceding discussion has shown that construction activities that result in changes to an existing nonresidential building may be described differently from different perspectives (i.e., as renovation or remodeling from one perspective or as additions or alterations from other perspectives). Moreover, the taxonomy has suggested that

there are not always sharp distinctions between remodeling and renovation activity and other types of construction activities.

While the conceptual world for considering remodeling and renovation activities can accommodate some fuzziness in definitions, real world data collection usually imposes a structure that does not accommodate fuzziness. Data are for categorizing, and the categories need to be defined. Accordingly, it is useful to consider the data categorizations from some of the more important sources of data that pertain to construction activities for existing nonresidential buildings.

The Construction Industry Research Board (CIRB) is a major source of time series data for permitting activity for nonresidential construction in geographical locales across California. CIRB, which was established in 1974, is a nonprofit research center that provides statistical information on the California building and construction industry. CIRB collects and updates California building-permit data monthly from information obtained from the permit-issuing offices for counties and cities throughout the state. The data provided by CIRB are aggregated across buildings within a county or city and do not pertain to individual buildings.

The data reported by CIRB on permitting for construction activity that results in changes to existing nonresidential buildings covers all renovation to private nonresidential buildings. As conceptually defined by Golove and Eto, both remodeling and renovation represent alterations to an existing building. Additions, however, represent an expansion to a building and are more akin to new construction. In its reporting, CIRB combines data on additions with data on alterations; it does not report the data on the two types of activity in two separate categories. Thus, there is a question as to the proportion of permitting activity for alterations and additions that is represented by alterations alone.

The data that CIRB reports on alterations and additions to nonresidential buildings are aggregated across the two types of construction activity because those data are provided to it in aggregated form from local jurisdictions that are applying the codes for structures established by the U.S. Census Bureau. Disaggregated data on the different types of construction activity may be maintained at the local level by the building departments. However, individual departments have their own recordkeeping procedures for differentiating among different types of construction projects. The classifications used by local building departments to describe construction activity may differ significantly. Moreover, classification of particular projects as to type of construction activity can be arbitrary even among personnel within a given building department.

Early analysis of the CIRB data showed that there was a relatively low correlation between the CIRB data series for permitting activity for nonresidential alterations/additions and for new commercial construction. This low correlation

provided evidence that additions represent a relatively low percentage of the combined total for alterations/additions. As discussed above, additions represent the building of new space for a building and are similar to new construction. Therefore, if additions were a major proportion of the reported permitting activity for alterations/additions combined, one would expect a higher correlation between that data series and the data series for new commercial construction.

Given this evidence that additions are a relatively small percentage of the total of alterations and additions, it was determined that the CIRB data could be used in subsequent analysis as a proxy indicator for remodeling and renovating activity. There are, however, some additional caveats.

- Those types of nonresidential buildings for which building permits are required to undertake construction activities are not included in the CIRB data.
- Combining data on additions with data on alterations in the CIRB data series will somewhat overstate the magnitude of the activity involved in making changes to nonresidential buildings.

F. W. Dodge also reports on remodeling and renovation activity for nonresidential buildings and separates such activity from additions. Indeed, studies of new construction that focus on individual projects have often made use of data from F.W. Dodge. However, the CIRB data were used more extensively in the analysis than F.W. Dodge data because the CIRB data permitted examination of trends over a longer span of time.

Moreover, there was concern about the coverage of remodeling and renovation activity in the Dodge data. Dodge reports on alterations and additions only for projects considered major, where a major renovation project is defined to be one where three or more alterations are made on one structure. A major concern then is that the Dodge data may underrepresent remodeling and renovating activity. As noted by one industry observer:

> ”[F]orecasters do not project modernization (or “building improvements”) because, for one thing, it’s almost impossible. While F.W. Dodge (a McGraw-Hill operation) does a spectacular job of tracking new construction, it basically ignores small- to medium-sized modernization jobs.”[6]

[6] Salimando, Joe, “Construction 2000: No Boom, No Bust . . . Maybe Not Even ‘An Ebbing’”, *ACEOnLine*, January/February 2000.

Elsewhere, this same observer notes:

> "McGraw-Hill owns a lot of interesting construction industry properties, including F.W. Dodge and Engineering News-Record (and Sweet's)(and Design-Build magazine)(and even more). They use the data generated by Dodge to predict construction contracting. I've interviewed the McGraw-Hill construction economists, and they admit that, while Dodge is probably right-on concerning the new construction market, it's not necessarily as easy to track less-than-major renovations. And maintenance, service, and repair is right off of the map."[7]

Because several different sources of data have been used in the NRRR Study, the terminology used in different chapters of this report to refer to NRRR activity will depend on the major source of data used for the particular type of analysis reported in the chapter. That is, the terminology used is tied to the source of the data used for the analysis. For example, when data reported by the CIRB are used for the analysis, the reference generally will be to nonresidential alterations and additions. However, when focus group or survey data are used for analysis, reference will generally be made to remodeling and/or renovating, since these were the terms used in collecting that data.

[7] Salimando, Joe, "Industry Growth is going to be Stupendous…I Think"; *TED Online,* December 14, 1999.

3. SIZE OF THE NRRR MARKET

This chapter provides macro-level information regarding the levels and types of activity in the market for remodeling and renovating of nonresidential buildings.

3.1 SURVEY DATA ON THE SIZE OF THE NRRR MARKET

Nationwide data collected by the U.S. Bureau of the Census in the *Annual Capital Expenditures Survey* (ACES) demonstrate the importance of capital expenditures made for the remodeling and renovating of nonresidential buildings. In the ACES for 1994 and 1998, data were collected on capital expenditures both for new construction and for remodeling/renovating of various types of nonresidential buildings. Using the data from the 1998 survey, the nationwide capital expenditures on new construction and remodeling/renovating and the percentages of these expenditures that are accounted for by remodeling/renovating expenditures have been calculated for different types of nonresidential buildings. This information is presented in Table 3-1.

Table 3-1. Percentage of Capital Expenditures for New Construction and Remodeling/Renovating of Different Types of Nonresidential Buildings Accounted for by Remodeling/Renovating (1998 data for U.S.)

Type of Nonresidential Building	***Capital Expenditures (Million $)***	***Expenditures on R&R***	***R&R Percentage***
Offices	$ 29,592	$16,540	55.9%
Manufacturing plants	$ 33,754	$12,869	38.1%
Hospitals	$ 11,083	$ 6,967	62.9%
Multiretail stores	$ 12,723	$ 6,503	51.1%
Educational buildings*	$ 8,894	$ 4,239	47.7%
Warehouse and distribution centers	$ 8,130	$ 3,005	37.0%
Stores	$ 7,971	$ 2,767	34.7%
Special care facilities	$ 11,028	$ 2,566	23.3%
Amusement and recreational facilities	$ 4,361	$ 2,251	51.6%
Other commercial stores/buildings	$ 3,981	$ 1,908	47.9%
Medical offices	$ 3,787	$ 1,794	47.4%
Hotels	$ 6,130	$ 1,548	25.3%
Religious buildings	$ 9,090	$ 1,474	16.2%
Total	$ 153,282	$65,329	42.6%

*Includes preschools, primary/secondary schools, and higher education facilities.

Table 3-1 shows the following:

- The highest absolute amount of expenditures on remodeling and renovating is for offices, followed by expenditures for manufacturing plants, for stores (both individual and multiretail), and for hospitals.
- The percentages of capital expenditures that go for remodeling and renovating vary across the different types of buildings. For example, expenditures for remodeling or renovating account for nearly two-thirds of capital expenditures that hospitals make for new construction, remodeling, or renovating, but for only about one-sixth of such expenditures that are made for religious buildings. About 56 percent of the capital expenditures made for office buildings went for remodeling and renovating. For multiretail stores, just over half of the capital expenditures went for remodeling and renovating.

State-level data pertaining to construction expenditures for nonresidential buildings are available for California in the Censuses of Construction conducted in 1987, 1992 and 1997. Table 3-2 reports the data from the Census of Construction for 1997 pertaining to new construction and alterations and additions for different types of commercial buildings in California. The bulk of the value of construction for alterations and additions to nonresidential buildings in California was associated with office buildings, other commercial buildings (which includes retail stores) and manufacturing buildings.

Table 3-2. Percentage of Value of Construction for New Construction and Alterations/Additions/Reconstruction of Different Types of Nonresidential Buildings in California Accounted for by Alterations and Additions (1997 data for California)

Type of Nonresidential Building	***Value of Construction (Million $)***	***Value of A&A***	***A&A Percentage***
Office buildings	9,493	3,623	38.2%
All other commercial buildings, nec	6,648	2,380	35.8%
Manufacturing and light industrial buildings	6,386	1,808	28.3%
Educational buildings	3,780	1,366	36.1%
Health care and institutional buildings	2,481	873	35.2%
Manufacturing and light industrial warehouses	1,934	515	26.6%
Commercial warehouses	2,184	502	23.0%
Hotels and motels	1,416	416	29.4%
Amusement, social, and recreational buildings	1,385	319	23.0%
Other building construction	1,395	317	22.7%
Religious buildings	425	170	39.9%
Public safety buildings	830	159	19.2%
Farm buildings, nonresidential	211	44	20.7%
Totals	38,565	12,491	32.4%

3.2 TRENDS IN NRRR ACTIVITY IN RELATION TO NEW CONSTRUCTION TRENDS

Survey data apply to a single time period. Data to assess trends in the remodeling and renovating of nonresidential buildings are available from the Construction Industry Research Board. The major data series from CIRB that can be used to examine trends in remodeling and renovation activity are value of permits issued for (1) commercial new construction and (2) nonresidential alterations and additions.

Figure 3-1 compares the statewide levels of permitting activity for commercial new construction, industrial new construction, and nonresidential alterations and additions from 1967 through 2000. The time trends for the three series differ. These differences are confirmed by the simple correlations calculated for the three series that are reported in Table 3-3. While the correlation between the two new construction series (commercial and industrial) is moderately high, the correlations of the nonresidential alterations and additions series with the new construction series are relatively low.

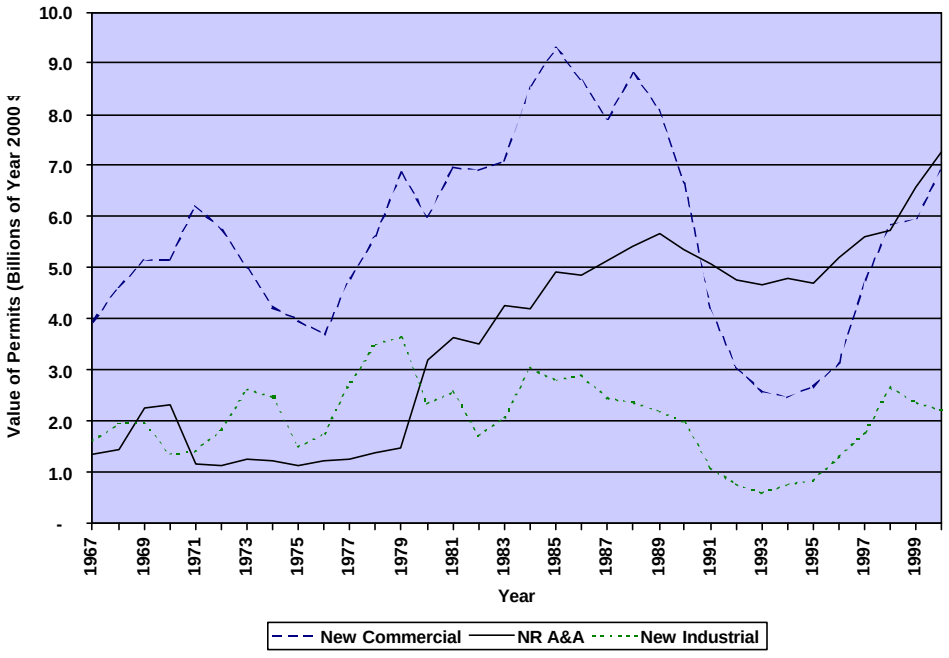

Figure 3-1. Comparison of Statewide Annual Permitting Activity for Commercial New Construction and Nonresidential Alterations and Additions

Table 3-3. Simple Correlations among New Construction and Alterations and Additions Time Series (1967-2000)

Series Correlated	***Correlation***
NR A&A with New Commercial	0.2554
NR A&A with New Industrial	-0.1367
New Commercial with New Industrial	0.6828

An alternative view of the statewide trend in NRRR activity can be had by considering the share of expenditures on new construction, alterations and additions that are accounted for by alterations and additions. This trend in is shown in Figure 3-2. As can be seen, the relative importance of permits issued for alterations or additions to nonresidential buildings in California has risen steadily over time.

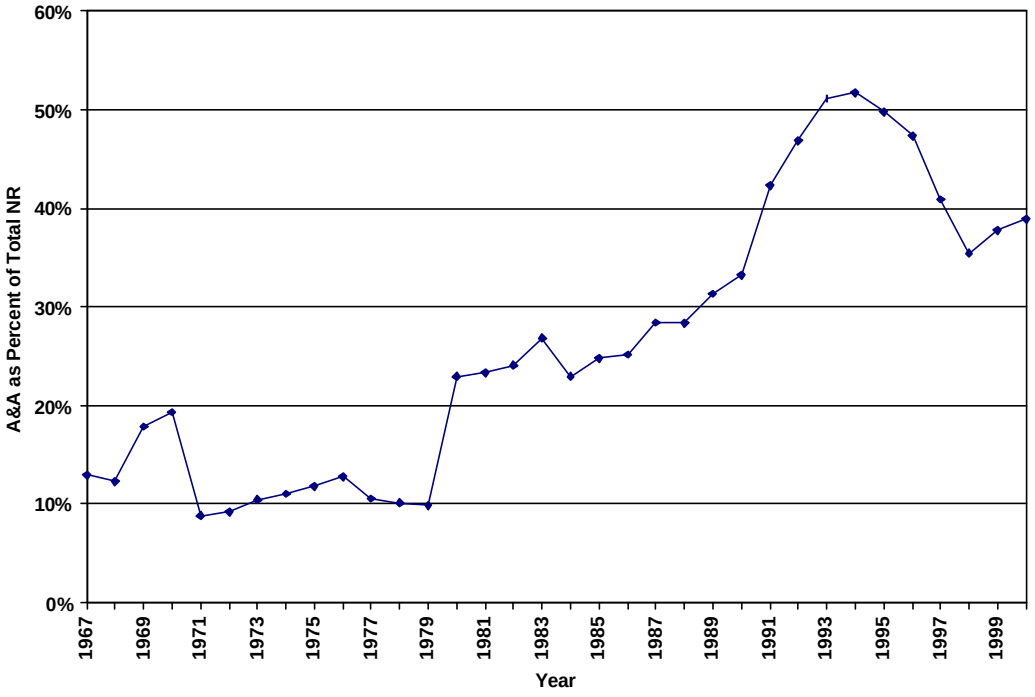

Figure 3-2. Trend in the Share of Total Value of Nonresidential Permits Accounted for by Alterations and Additions

3.3 REGIONAL NRRR MARKETS

Section 3.2 showed that statewide trends for the value of permits issued for alterations or additions to nonresidential buildings differed from the trends for new commercial construction and new industrial construction. This section extends that analysis by examining regional markets for nonresidential remodeling and renovating activity. Regional trends may differ because commercial real estate markets are generally local, with rents and other market conditions that can differ among regions. Climate conditions and energy prices may also differ among regions.

Although our interest is in remodeling and renovating activity, primary data have not been collected under this rubric for regional markets within California. However, data have been collected by the CIRB for nonresidential alterations and additions in different regions of the state. The CIRB data provide good coverage of activity taken to change nonresidential buildings.

CIRB data on the value of permits issued for commercial new construction and for nonresidential additions and alterations for counties from 1967 through 2000 have been used to examine geographical market segments for NRRR activity. The time series data on permits issued by cities and counties have been aggregated to nine regions (as defined by CIRB)[1]. These data are used to examine whether there are correlations in permit issuing activity among regions and how remodeling and renovation activity correlates with new construction activity. (The counties in each region are shown in Appendix A.)

The relative importance of the regions in terms of both commercial new construction and nonresidential alterations and additions is shown in Table 3-4 and Figure 3-3. In 2000, two regions (i.e., San Francisco Bay and Los Angeles) accounted for about 71 percent of the value of permits issued for commercial new construction and for about 79 percent of the value of permits issued for nonresidential alterations and additions. Taken over the period from 1967 through 2000, these two regions accounted for about 70 percent of the value of permits issued for commercial new construction and for about 75 percent of the value of permits issued for nonresidential alterations and additions.

[1] The regions defined correspond to the regions for which CIRB calculates cost indexes.

Table 3-4. Value of Permits Issued for Commercial New Construction and Nonresidential Alterations and Additions for Different Regions (Year 2000, Value of permits in million $)

CIRB Region	***Commercial New Construction***		***Nonresidential Alterations & Additions***	
	Value of Permits	***Percent of Total***	***Value of Permits***	***Percent of Total***
Bakersfield	43	0.6%	52	0.7%
Central	187	2.8%	153	2.2%
Eureka	11	0.2%	23	0.3%
Los Angeles	1,915	28.2%	2,262	32.0%
Riverside	555	8.2%	287	4.1%
Sacramento	697	10.3%	500	7.1%
San Diego	487	7.2%	502	7.1%
SF Bay	2,897	42.7%	3,301	46.6%
Balance of State	169	2.5%	172	2.4%
Totals	6,793		7,080	

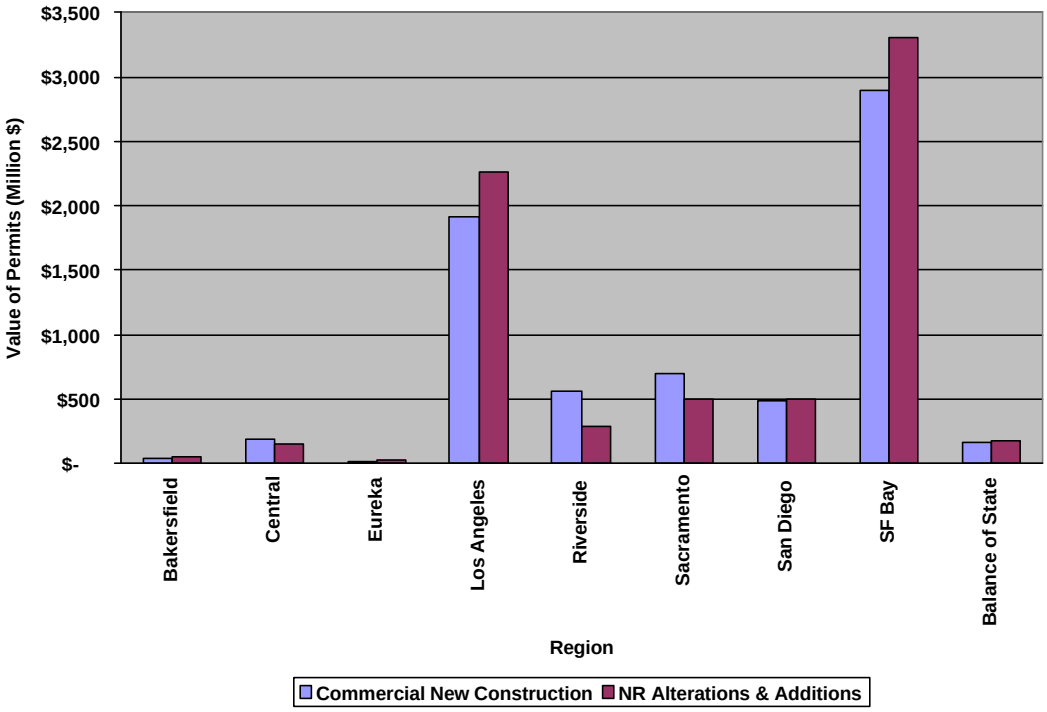

Figure 3-3. Comparison across Regions of Value of Permits Issued during 2000 for Commercial New Construction and Nonresidential Alterations and Additions

3.3.1 Correlation of New Commercial Construction and NR A&A Activity across Regions

One issue of interest is whether the pattern of activity for nonresidential alterations and additions over time corresponds to that for commercial new construction. A divergence between the two series would indicate that different factors are at work in determining the two kinds of activity.

Figures 3-4 and 3-5 compare these patterns for the two regions with the greatest amount of activity: San Francisco Bay and Los Angeles. As can be seen for both regions, there is a divergence in the patterns of activity beginning in the late 1980's. While permitting activity for nonresidential alterations and additions stays steady or increases during the 1990's, commercial new construction activity declines in the early 1990's and then resumes growth in the mid 1990's.

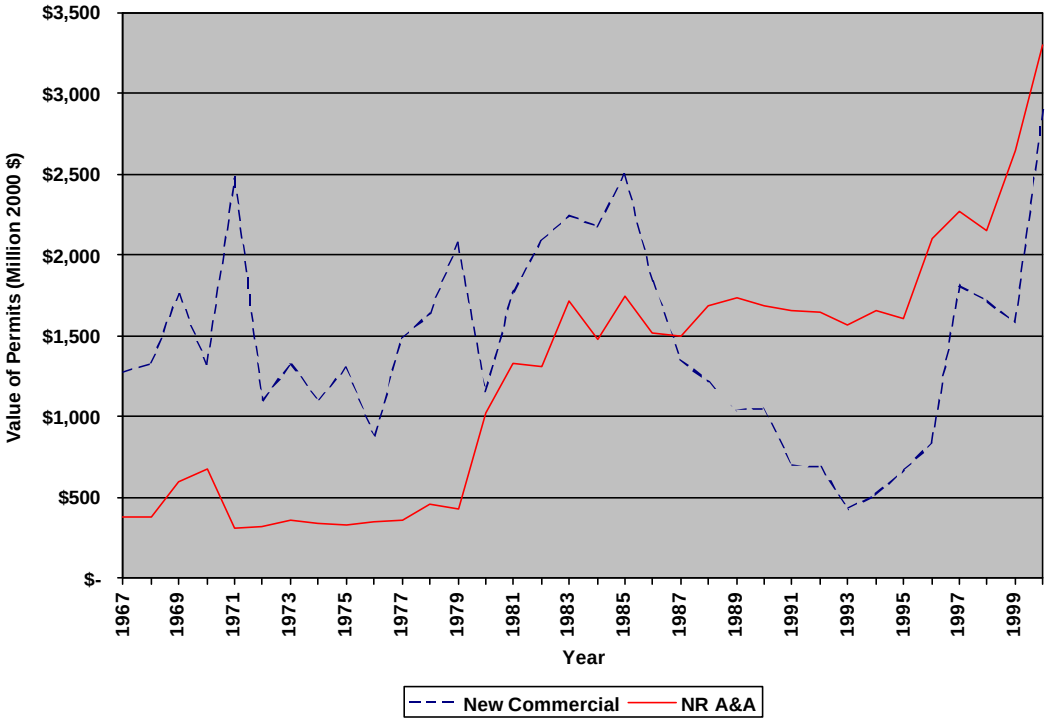

Figure 3-4. Comparison of Trends over Time for Permitting Activity for Commercial New Construction and Nonresidential Alterations and Additions for San Francisco Bay Region

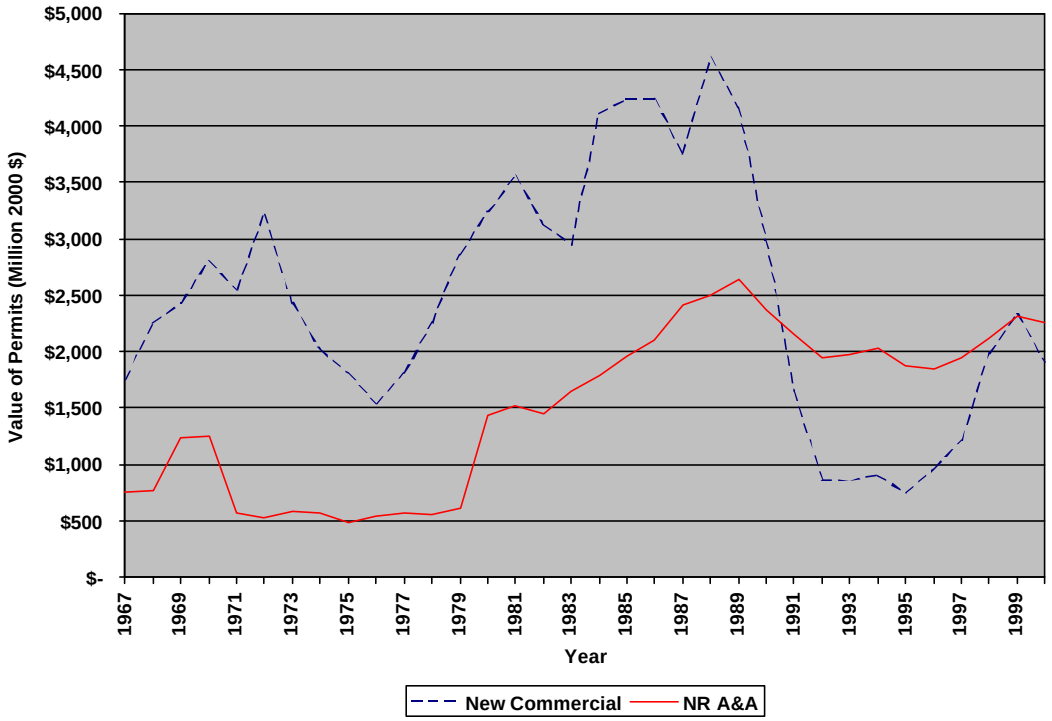

Figure 3-5. Comparison of Trends over Time for Permitting Activity for Commercial New Construction and Nonresidential Alterations and Additions for Los Angeles Region

Correlations that were calculated between the time series for commercial new construction and nonresidential alterations and additions for the nine regions are reported in Table 3-5. As was implied by Figures 3-4 and 3-5, the correlations for San Francisco Bay and Los Angeles are relatively low (less than .2). The correlations for Riverside and Sacramento are moderately high (about .7). The correlations suggest that the factors affecting commercial new construction and nonresidential alterations and additions for the two largest regions appear to be different, particularly during the 1990's. Moreover, this is evidence that additions are a relatively small percentage of the total data for alterations/additions. A higher correlation with new construction would be expected if additions were a high proportion of alterations/additions combined.

Table 3-5. Correlations between Value of Permits for Commercial New Construction and Nonresidential Alterations and Additions by Region for 1967-2000

CIRB Region	***Correlation***	***CIRB Region***	***Correlation***
Bakersfield	0.492	Sacramento	0.697
Central	0.465	San Diego	0.465
Eureka	0.218	SF Bay	0.149
Los Angeles	0.190	Balance of State	0.257
Riverside	0.739		

3.3.2 Correlation of NR A&A Activity across Regions

A reason for considering geographical regions is that the factors affecting activity in one region may be different from those in other regions. To examine whether permitting activity for nonresidential alterations and additions differs markedly across regions, correlations were calculated among the alterations and additions series for the various regions. The correlations, which are reported in Table 3-6, are relatively high for the most part. This indicates that the factors that affect nonresidential alteration and additions activity are similar across the various regions of the state.

Table 3-6. Correlations of Nonresidential Alterations and Additions Permitting Activity among Regions

CIRB Regions	Bakersfield	Central	Eureka	Los Angeles	Riverside	Sacramento	San Diego	SF Bay	Balance of State
Bakersfield	1.000								
Central	0.708	1.000							
Eureka	0.861	0.771	1.000						
Los Angeles	0.909	0.767	0.832	1.000					
Riverside	0.851	0.874	0.845	0.928	1.000				
Sacramento	0.886	0.885	0.871	0.935	0.961	1.000			
San Diego	0.915	0.806	0.877	0.914	0.903	0.947	1.000		
SF Bay	0.841	0.885	0.839	0.875	0.915	0.961	0.931	1.000	
Balance of State	0.865	0.847	0.826	0.936	0.936	0.963	0.918	0.935	1.000

3.3.3 Correlation of Commercial New Construction Activity among Regions

The relatively high correlations of nonresidential alterations and additions activity among regions become more noteworthy when compared to a similar set of correlations for commercial new construction activity reported in Table 3-7. The correlations among the regions for the commercial new construction series are noticeably lower than for the nonresidential alterations and additions series. This is indicative of differences across the regions in the factors that affect new construction of commercial buildings. That is, regions differ in the trends and patterns of commercial new construction activity.

Table 3-7. Correlations of Commercial New Construction Permitting Activity among Regions

CIRB Regions	Bakersfield	Central	Eureka	Los Angeles	Riverside	Sacramento	San Diego	SF Bay	Balance of State
Bakersfield	1.000								
Central	0.061	1.000							
Eureka	0.287	0.260	1.000						
Los Angeles	0.516	-0.159	0.038	1.000					
Riverside	0.633	0.308	0.305	0.514	1.000				
Sacramento	0.439	0.418	0.295	0.395	0.794	1.000			
San Diego	0.636	0.065	0.221	0.880	0.775	0.648	1.000		
SF Bay	0.160	0.027	-0.151	0.451	0.127	0.146	0.425	1.000	
Balance of State	0.544	0.218	0.309	0.553	0.571	0.542	0.655	0.397	1.000

3.4 EFFECTS OF NRRR ACTIVITY ON ELECTRICITY USE

One reason for interest in nonresidential remodeling and renovation activity is related of course to the effects that can be made on electricity use. Analysis of data on electricity use in commercial buildings shows that nonresidential remodeling and renovation activity does affect electricity use.

3.4.1 A Model for Analyzing Effects of NRRR Activity on Electricity Use

A simple model relating electricity use to the stock of commercial buildings can be used to analyze the effect of NRRR activity on electricity use. Suppose that electricity use at an initial point in time 0 is given by the formula:

$$E_0 = \alpha K_0$$

where E_0 is electricity use at time 0 and K_0 is the capital stock of energy using equipment embodied in buildings at time 0, and α is an electricity-to-capital coefficient. For the analysis here, K represents the capital of nonresidential structures and equipment. Over time electricity use will change from (1) changes to the initial stock of capital through remodeling and renovation and (2) additions to the capital stock.

- Remodeling or renovating part of the K_0 reduces the stock to which the α coefficient applies and creates a remodeled stock to which a different electricity-to-capital coefficient β applies.
- Additions to the capital stock can be assumed to have an electricity-to-capital coefficient of δ.

Following this line of argument, the formula above can be modified as follows:

$$E_t = \alpha(K_0 - K_{Rt}) + \beta K_{Rt} + \delta K_{Nt} = \alpha K_0 - (\alpha - \beta)K_{Rt} + \delta K_{Nt}$$

where K_{Rt} is the stock of remodeled/renovated nonresidential capital at time t and K_{Nt} is the stock of new nonresidential capital.

3.4.2 Analysis of Effects of NRRR Activity Using Statewide Data on Commercial Electricity Use

A regression analysis of this relationship was made using statewide data on electricity use compiled by the Energy Information Administration and the CIRB permit value data. Because the CIRB data represent investment in each year, the remodeled/renovated stock and the new capital stock at time t were determined by summing annual totals from time 0 to time t. The regression analysis was then conducted for both commercial electricity use and industrial electricity use, using data for the period 1967-1999. Two different regressions were run for each sector, one regression without a time trend variable and a second with a time trend variable.

The results of the regression analysis for commercial electricity use are reported in Tables 3-8 and 3-9. For the commercial regressions, CumNRAltVal is the variable for the altered capital stock, calculated as the cumulative sum over time of the value of permits issued for nonresidential alterations or additions. CumNRAltVal has a coefficient that is statistically significant at the 1 percent level for both regressions and that has the expected negative sign, implying that remodeling or renovating part of the existing stock does reduce electricity use. Moreover, inclusion of the time trend variables does not affect the statistical significance of CumNRAltVal. However, inclusion of the time trend variable reduces the magnitude of the coefficient on CumCommVal, the variable for the new construction capital stock. With the time trend included, CumCommVal remains statistically significant at the 5 percent level.

Table 3-8. Results of Commercial Electricity Use Regression, No Time Trend

Variables	***Coefficients***	***Standard Error***	***t Statistic***	***P-value***
Intercept	35.809	1.343	26.670	0.000
CumCommVal	0.431	0.039	11.021	0.000
CumNRAltVal	(0.200)	0.064	(3.137)	0.004
Number of observations = 33 R-squared = 0.972				

Table 3-9. Results of Commercial Electricity Use Regression, With Time Trend

Variables	***Coefficients***	***Standard Error***	***t Statistic***	***P-value***
Intercept	33.015	1.472	22.427	0.000
CumCommVal	0.194	0.082	2.351	0.026
CumNRAltVal	(0.254)	0.058	(4.344)	0.000
Time trend	1.637	0.518	3.163	0.004
Number of observations = 33 R-squared = 0.979				

The results of the regression analysis for industrial electricity use are reported in Tables 3-10 and 3-11. For the industrial regressions, CumNRAltVal (the variable for the altered capital stock) has a coefficient that has the expected negative sign. Although CumNRAltVAl is not statistically significant at the 10 percent level in the regression with no time trend, it does become statistically significant at the 1 percent level when the time trend is included. Inclusion of the time trend variable reduces the statistical significance of CumIndVal, the variable for the newly constructed industrial capital stock and also changes the sign.

Table 3-10. Results of Industrial Electricity Use Regression, No Time Trend

Variables	***Coefficients***	***Standard Error***	***t Statistic***	***P-value***
Intercept	40.065	1.124	35.634	0.000
CumIndVal	0.318	0.073	4.373	0.000
CumNRAltVal	(0.006)	0.042	(0.141)	0.889
Number of observations = 33 R-squared = 0.857				

Table 3-11. Results of Industrial Electricity Use Regression, With Time Trend

Variables	*Coefficients*	*Standard Error*	*t Statistic*	*P-value*
Intercept	36.582	1.321	27.695	0.000
CumIndVal	(0.383)	0.197	(1.948)	0.061
CumNRAltVal	(0.173)	0.057	(3.041)	0.005
Time trend	2.118	0.565	3.747	0.001
Number of observations = 33 R-squared = 0.904				

3.4.3 Analysis of Effects of NRRR Activity Using County-Level Data on Electricity Use in Commercial Buildings

Annual county-level data on electricity use for different types of commercial buildings have been collected by the California Energy Commission since 1983. These data, which were provided by CEC staff,[2] were used to analyze further the effects of nonresidential remodeling and renovating activity on electricity use in commercial buildings.

The CEC obtains county-level data from utilities that are categorized by SIC codes. The CEC aggregates the data to represent ten commercial building types:

- Small Office
- Large Office
- Restaurant
- Retail Store
- Food/Liquor
- School
- College
- Health Care
- Hotel
- Miscellaneous

The electricity use data have been collected for all 58 counties in California for the years 1983 through 2000.

Analysis of this electricity use data was focused on office buildings and retail stores, because (as will be shown in following chapters) these are the building types that account for most remodeling and renovating activity in California.

[2] Andrea Gough of the CEC staff made these data available for this study.

For purposes of the analysis, the electricity use data had to be matched with data on the stocks of new buildings and of remodeled/renovated buildings. These stock estimates were developed from county-level CIRB data on the value of permits issued for office buildings and retail stores and for nonresidential alterations and additions. The CIRB data did not separate nonresidential alterations and additions by building type.

Following the line of argument presented, the regression model to be estimated for each building type is as follows:

$$E_{it} = \alpha(K_0 - K_{Rit}) + \beta K_{Rit} + \delta K_{Nit} = \alpha K_0 - (\alpha - \beta)K_{Rit} + \delta K_{Nit}$$

where E_{it} is the electricity use for the particular building type (i.e., office or retail) in county i during year t, K_{Nit} is the stock of new nonresidential capital for the particular building type in county i during year t, and K_{Rit} is the stock of remodeled/renovated nonresidential capital in county i at time t.

Although the electricity use data were available from 1983 through 2000, the CIRB data for developing the stock estimates were available only from 1990 through 2000. Thus, a panel data set was used for the analysis that consisted of electricity use and stock estimates for 58 counties for 11 years (i.e., 638 observations). Because of the cross section/time series nature of the data set, a fixed effects regression model was used in which dummy variables for the different counties were entered into the regression analysis to capture county-specific effects.

The results of the regression analysis of electricity use for office and retail buildings are summarized here; they are reported in detail in the Quantitative Survey Report of the NRRR Study.

For office buildings, the regression results showed that the stock of office buildings has a statistically significant, positive effect on electricity use. The regression results implied that adding $100 (in Year 2000 dollars) to the capital stock of office buildings increases electricity use by about 36 kWh per year.. An increase of $100 in the stock of remodeled/renovated nonresidential buildings reduces office building electricity use by about 3.8 kWh per year.

For retail stores, the regression results showed that the stock of retail buildings has a statistically significant, positive effect on electricity use. The regression results implied that adding $100 (in Year 2000 dollars) to the capital stock of retail buildings increases electricity use by about 14 kWh per year. However, the variable for the stock of buildings with alteration or additions activity had an estimated coefficient that was statistically significant at the 1 percent level, but the sign was positive implying that remodeling or renovating part of the existing retail stock increases electricity use in retail stores. An increase of $100 in the stock of

remodeled/renovated nonresidential buildings increases retail building electricity use by about 1 kWh per year.

Thus, new construction of offices increases energy usage while renovation decreases electricity use. In the retail sector, both new construction and remodeling and renovation increase electricity use but the increase for new construction is very small.

4. STRUCTURAL CHARACTERISTICS OF NRRR MARKET

This chapter uses the information developed during the NRRR Study to describe the structural characteristics of the nonresidential remodeling and renovation market.

4.1 DEMAND SIDE DRIVERS OF NRRR ACTIVITY

A key finding from the survey of decision-makers that was conducted during the NRRR Study is that a change in tenant and/or a tenant changing their operation drives the remodeling and renovation market. Moreover, most commercial remodeling and renovation projects are completed in buildings occupied by firms leasing space.[1] Various information collected during the survey of decision makers confirms these conclusions.

- Sixty-eight percent of the survey respondents indicated that the remodeling and renovation project was completed in buildings occupied by lessees, 3 percent in buildings occupied by owners and lessees, and 29 percent in owner-occupied buildings.
- For those projects completed in leased space, the project was completed for the lessee in nearly 90 percent of the cases. In the remaining 10 percent of the cases, the project was completed for the developer or a commercial real estate firm.
- When survey respondents were given a list of six reasons for remodeling or renovating a building and asked what precipitated the remodeling and renovation activity for the building identified in the survey, the most commonly cited motivation was to alter space to account for changes in tenancy or tenant operations. (This was cited for 81 percent of the cases.) Additional reasons included a general updating of the building (46 percent of the cases) or an upgrading the quality or functionality of the space (37 percent of the cases). About a sixth of the respondents were motivated by the need to complete unfinished space or changing from one use to another.

Because respondents to the decision-maker survey often indicated multiple reasons for renovating and remodeling buildings, the reasons for modifying buildings were examined in relation to each other.

- A change of tenancy is accompanied by a general updating of the building in 35 percent of all cases. This includes replacing aging equipment, extending the

[1] For purposes here, the term "tenant" is used broadly to mean an occupant, whether owner or lessee. Throughout this document the word "lessee" is used to refer to a tenant who leases space and the word "tenant" is used to refer to either an owner or lessee.

life of the building, and/or freshening a building's look without changing the class of the building. In about 15 percent of all cases, a change of tenancy and a general updating of the building is accompanied by a general upgrade to the quality and/or functionality of space in order to change the class of the building and/or increase the lease value of the building.

- When a tenancy change is not a precipitating factor for a change to a building then a general updating and/or upgrading the class of a building is most often the motivation or motivations for making the change. Changing the use of a building or finishing space in a building is almost always done in conjunction with other reasons for changing the building.
- Sometimes a tenancy change triggers an upgrade to the class of the building (14 percent of all cases) without a general updating. A tenancy change and upgrading the class of a building occur together about 29 percent of the time regardless of other motivations for change. In 11 percent of the cases, tenancy changes are accompanied by a change in use or a change in use and a general updating, 17 percent of the time.

The survey respondents reported that tenants are likely to continue to occupy a renovated space for six years or more. Less than a quarter of the respondents reported that tenants would occupy space for five years or less. For those who answered the payback question in this study, more than 60 percent indicated that the desired payback should be 5 years or less.

From an energy policy standpoint, this finding suggests that roughly three quarters of the tenants occupy renovated space for a period of sufficient length so that tenants paying their own energy bills can recover the costs of typical energy efficiency measures.

4.2 SUPPLY SIDE PLAYERS IN NRRR MARKET

In a recent report on the building of new commercial buildings, Lutzenhiser et al.[2] defined six major industry groups involved in commercial building markets:

- Providers of capital;
- Developers;
- Design and delivery firms;
- Community/political/regulatory interests;
- Real estate service providers, and

[2] Lutzenhiser, L. et al., *Market Structure and Energy Efficiency: The Case of New Commercial Buildings*, Report prepared for California Institute for Energy Efficiency, 2001.

- Users

The first five industry groups also operate on the supply side of the market for remodeling and renovating of nonresidential buildings.

Further qualitative information on the construction market as it pertains to remodeling and renovating of nonresidential buildings was gathered during the NRRR Study through a series of focus groups that were conducted throughout California.[3] These focus groups showed that although many of the same types of players identified by Lutzenhiser et al. as involved in new construction are also involved in remodeling and renovating, the key players vary depending on the situation.

For large firms that own and operate large commercial buildings, there are several actors who influence decision-making when changes to a building are being considered. Tenants can dictate the layout of the space and any special requirements that they might have (e.g., improved lighting design). However, effectuating the changes is usually the responsibility of a corporate planning and design staff that is called upon to develop recommendations and to do the design work. Depending on the size of the staff and the amount of work, planning and design may be done in-house or through a consultant. Typically, outside contractors are used for projects that go beyond general maintenance.

Although a corporate design staff and facility engineers for large property owners are key actors, what they can do is limited by investment criteria and budgets established by upper level managers, including investment managers and corporate operations managers. The building and planning staff, the facility manager, and the facility engineer are aware of the criteria and plan projects accordingly.

Smaller firms that own and manage commercial property typically have less elaborate management structures. An owner and his/her staff may work directly with facility managers to operate buildings. Operators working at this scale do not have planning and design staff, but there may be an individual who deals with technical and operational issues. In planning changes to a building, there will be a heavy reliance on consultants or contractors who can provide design assistance. Depending on training and inclination, the facilities engineer (if there is one) may play a more prominent role in determining what is done and work directly with the contractor.

[3] The results of those focus groups are described in detail in the report that TecMRKT Works has prepared.

Fee-managed properties are those where a property owner uses a property manager who manages, operates, and maintains buildings on behalf of the owner for a fee. Arrangements can vary. Some owners rely on a property management firm to provide comprehensive services, leasing as well as maintenance and operations. Other property owners have internal facility managers who contract for individual services such as maintenance, HVAC, security, and others.

There are also owner-users of commercial properties, although the proportion of owners who manage and maintain their own buildings appears to be declining. Self-management is being displaced by the use of property management firms or service contractors. For this owner/user market segment, however, owners are the key actors. Owners will make efficiency changes if they see opportunities to significantly reduce costs. However, owners don't typically have an interest in building issues and energy efficiency is often near the bottom of the list both in terms of priority and return on investment. Smaller owners who still manage their own buildings may not have sophisticated staff who understand or will promote energy efficiency. Even when facilities staff do understand, they may have difficulties in getting the attention of the owners or managers and convincing them of the wisdom of energy efficiency.

The various market players who are involved in directing commercial property renovation and remodeling can be described as follows.

- Developers who buy/renovate/sell are almost entirely interested in improvements that will payback with a profit within the timeframe in which they may intend to hold the building (usually 1 to 3 years) or that will allow them to increase lease rates and thereby the sale value of the building.
- Developers who buy/renovate/hold make investments that have longer paybacks, 4 to 5 years, and sometimes take a longer view and will incorporate energy efficiency improvements. They may also make improvements, such as energy efficiency improvements, for reasons other than profit, for instance, to burnish their image as good corporate citizens.
- Owners are much like developers who buy and hold, and they can be encouraged to make energy efficient investments. Owners significantly influence decisions usually by establishing a budget, approving design changes, and approving change orders. (Investors may influence decisions through some of these same mechanisms.)
- Tenants can influence decision-making in situations where the tenant is willing to pay for improvements through increased lease rates.
- Architects and engineers have the most influence in remodeling and renovation projects when they have overall responsibilities for managing the project. Architects and engineers operate more like consultants in design/build

situations and are less able to influence equipment and design decisions that influence energy efficiency.

4.3 CHANGES MADE DURING REMODELING OR RENOVATION

The major changes that are made during a remodeling or renovation project include changes to the space and changes to equipment.

4.3.1 Types of Space That Are Remodeled/Renovated

Based on responses from the survey of decision makers, remodeled or renovated space is most likely to be used for offices, followed by retail, warehouse, industrial and other uses. Remodeling or renovation to office space accounted for about half of the projects, with retail space accounting for about a fifth.

About 12 percent of the respondents to the decision maker survey reported multiple uses of the space subsequent to the renovation. Nearly two-thirds of these project combinations are for offices combined with other functions. Another quarter of the combinations are for retail combined with some functional use of space for other than offices. About a fifth of the combinations that involved office space had retail space as the other function, while about half of the office combinations were associated with changes to industrial and warehouse space. Retail and restaurant combinations also are of note.

About 15 percent of the survey respondents reported that the function of at least some of the space in the building that was remodeled or renovated was "completely changed" to a different function following remodeling and renovation. In about 20 percent of these cases (3 percent of the total), it appears that space had multiple uses prior to the renovation and that the changes to the spaces represented a change from one type of pre-existing usage to another type of pre-existing usage (e.g., a shift to more office space in an office-warehouse combination). For about two-thirds of the cases where the space was "completely changed", the reported change was from one use to another. In about half of these cases, the respondents reported no change in the functional category of space. About half of these cases were unfinished or unused space prior to the renovation or remodeling that was completed.

4.3.2 Equipment Changes during NRRR

During remodeling or renovating of a building, the system most commonly changed is the lighting system, followed by the HVAC distribution system, interior partitions, and HVAC components. Changes to exterior elements occur less than 20 percent of the time. The most common changes to exterior elements were to windows (although the data suggest that some window changes are related to interior rather than exterior changes).

Data collected on-site for the Quantitative Survey Report indicate that the lighting installed as a result of remodeling or renovation is primarily fluorescent. Survey data indicated that fluorescent lighting accounted for about 72 percent of installed wattage, incandescent for about 19 percent, and compact fluorescent lighting for about 4. Most of the fluorescent lighting was T8 fluorescent, which alone accounted for 59 percent of the installed wattage for a sample of sites with lighting changes. Based on data on allowed and planned lighting wattages, planned lighting wattage for remodeled or renovated spaces was about 12 percent less than allowed by Title 24 standards (i.e., lighting was 12 percent more efficient).

Most of the sites making HVAC changes made changes that involved packaged single-zone equipment or heat pumps. The relative efficiencies of packaged units and heat pumps that were installed during remodeling or renovating are fairly similar. That is, when the average efficiencies of units installed during remodeling and renovating were compared to the average efficiencies of units installed during new construction, the averages were fairly similar.

5. DECISION-MAKING IN THE NRRR MARKET

This chapter presents and discusses information on the factors influencing energy-related decisions on the remodeling or renovating of nonresidential buildings. The data and analysis on which this chapter is based are described more fully in the Quantitative Survey Report. The data were gathered through a telephone survey of 341 decision makers for remodeling or renovation projects throughout the state. These projects represent a random sample that was drawn using permit data from permit-issuing offices throughout California.

5.1 CHARACTERISTICS OF NRRR DECISION MAKERS

A general characterization of decision makers for remodeling or renovation projects was provided in Chapter 4, focusing on different types of firms. However, the survey of decision makers was used to gather more specific information with which to identify and understand who are the actual decision makers within a firm. Each respondent was asked to describe his/her firm and to provide his/her job title.

Based on the survey of decision makers, the types of firms involved in remodeling and renovation projects included contractors, real estate developers, building owners, architecture and engineering firms. Figure 5-1 shows the relative frequency of different types of firms among decision makers for remodeling and renovation projects, based on the survey data.

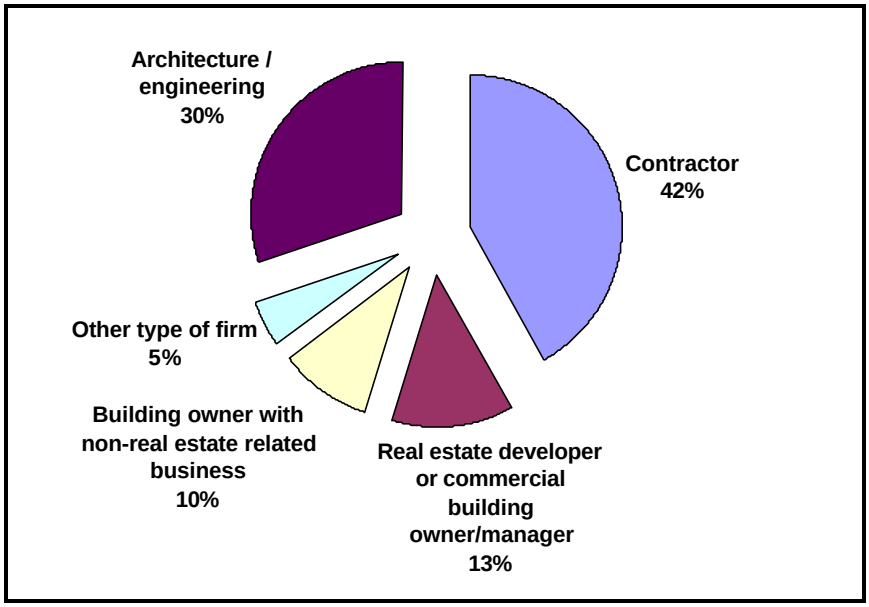

Figure 5-1. Relative Frequency of Different Types of Firms among Decision Makers for Remodeling and Renovation Projects

Job titles for those who are decision makers within firms for remodeling and renovation projects include engineering/architecture managers, construction managers, owners and partners, operation managers, senior officers, and purchasing/administrative managers. Figure 5-2 shows the relative frequency of these job titles among decision makers for remodeling and renovation projects.

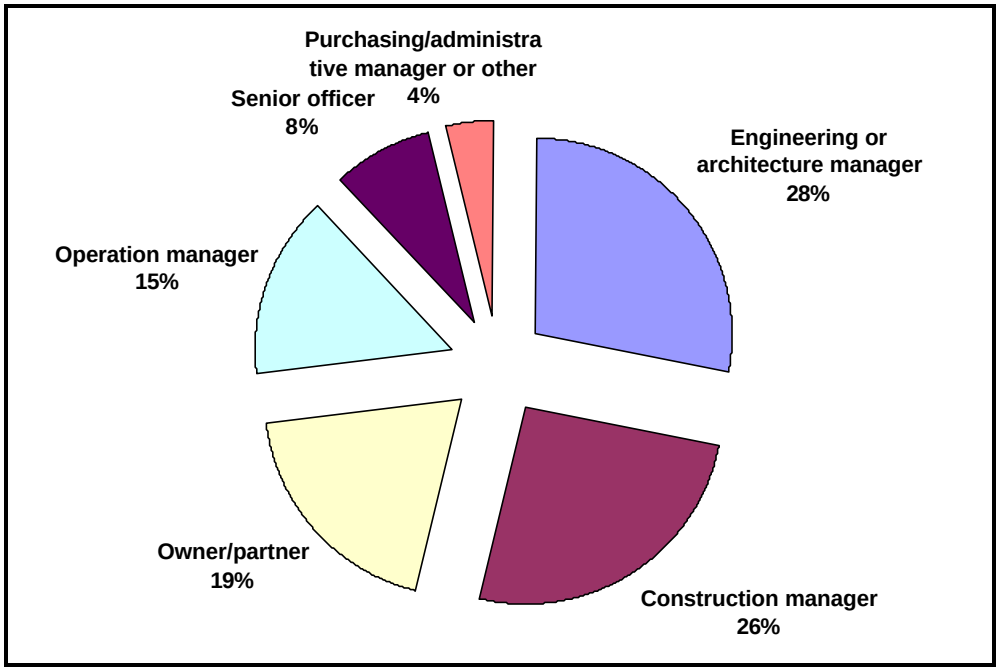

Figure 5-2. Relative Frequency of Job Titles for Decision Makers within Firms for Remodeling and Renovation Projects

Architects and engineers may be employed not only by architecture/engineering firms but by different types of firms, such as real estate developers. Owners and partners work mostly for real estate developers or engineering or architecture firms. Senior officers work mostly for real estate firms, followed by engineering or architecture firms. Construction managers work primarily for real estate firms, while operation managers work for contractors, real estate developers, or commercial building owners.

Eighty percent of the respondents to the survey of decision makers said that an architect was involved in the design for remodeled or renovated space. In just under half of these cases, the architect and/or associated consultants hired by the owner or developer were primarily responsible for producing the designs and specifications for the renovation. In about a sixth of the cases, the lessee or the lessee's architect was primarily responsible for producing designs and specifications. Contractors and subcontractors were the least likely to be primarily responsible for producing the renovation designs and specifications.

There is some variation in who prepares the design, depending on whether the remodeled structure is occupied by the owner or by a lessee. Remodel designs for lessee and for owner-occupied buildings are completed about equally by hired architects and consultants. An owner or developer's in-house staff is more likely to design and plan remodels for owner-occupied spaces than for tenant-occupied spaces. A tenant's architect is involved in about a fifth of lessee-occupied remodels.

5.2 SETTING A PROJECT BUDGET

The budget for a remodeling or renovation project is the key determinant of what can or cannot be done in the project. Managers who are involved in a great deal of remodeling and renovation may start with a fairly clear idea of what they want and know how much they are willing to spend per square foot. In other circumstances, those initiating a project may start with a concept and develop a realistic budget after several iterations with developers, architects, and planners. At some point the budget becomes more or less fixed after which changes to the plans and designs are usually completed within the constraints of that fixed budget.

Respondents to the survey of decision makers were asked who is primarily responsible for determining the overall budget. About three-fourths of respondents indicated that it was the owner or the owner's staff.

The lessee or the lessee's architect was primarily responsible for determining the budget in about 13 percent of the cases. The survey data showed that lessees are much more likely to have budget responsibility for retail spaces than for office spaces. Lessees are responsible for the budget in about 21 percent of retail projects but in only about 12 percent of office projects. For example, a chain store or franchise that leases space may use its own image architect to develop the plans for the space.

About ten percent of the decision makers surveyed reported that owners worked with developers, architects or contractors to establish a budget. In only about two percent of cases did it appear that developers mostly determined the budget.

The budget that owners set for a remodeling or renovation project forms a constraint within which other decisions are made. The process by which trade-offs are made is often called "value engineering." The data collected through the survey of decision makers showed that value engineering is done in about 25 percent of all projects. Within the 25 percent of projects that are subject to value engineering, the lighting and HVAC systems are most often changed.

- When a lighting system is subject to value engineering, the typical response is to replace fewer lighting fixtures. About a third of the time less efficient fixtures are used or the number of controls are reduced.
- A similar pattern occurs when a HVAC system is subjected to value engineering. The most common response is to replace fewer components. In about 25 percent of cases the number of zones and controls are reduced or less efficient components are introduced.

5.3 CRITERIA USED IN DECISION MAKING

A review of prior studies identified a number of criteria that decision makers for a remodeling or renovation project might apply when making a decision about changes to lighting and HVAC systems during the project. Data with which to examine the application of such criteria were collected through the survey of decision makers. The results from examining those data are summarized in this section.

5.3.1 Criteria for Changes to Lighting System

Decision makers who had made substantial changes to lighting systems were asked to rate the importance of eight such criteria, using a 1 to 10 scale where 1 was "not at all important" and 10 was "very important". The average ratings for the various criteria are shown in Figure 5-3.

On average, all criteria were viewed as having some importance (i.e., a score of 5.0 or better). Title 24 (with a mean score of 8.7) was the most important criterion, followed by improving lighting quality, energy efficiency and high equipment reliability. Price, experience with the equipment, and recapturing the cost of the item were at the bottom of the list.

Because decision makers may mix and match these criteria in a variety of ways, factor analysis[1] was used to explore how the criteria relate to each other. When the eight criteria variables were subjected to a factor analysis, three factors emerged that explained 58 percent of the total variance within the data.

- The first factor designates a "payback and reliability group". People who score high on this factor are concerned about high reliability, payback, having experience with the technology or practice, first cost, and lighting quality. Those in this group attach low importance to energy efficiency and Title 24.

[1] Factor analysis relates the criteria to each other and then summarizes which criteria are similar by reducing the criteria to a small number of factors. It is customary to examine the variables with high loadings on each factor and then to assign a name to the factor.

For this group, Title 24 is probably something that one just deals with in the course of business and energy efficiency is probably "nice to have."

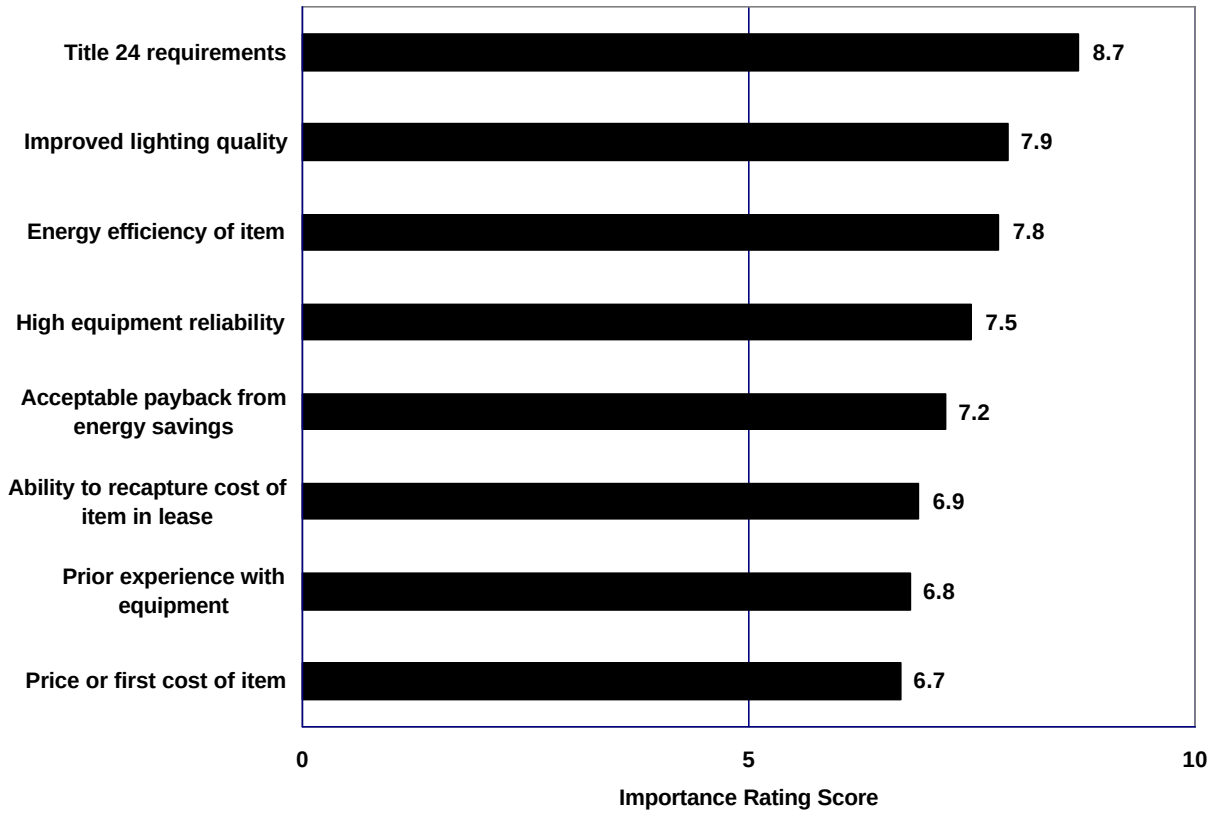

Figure 5-3. Importance of Various Criteria When Making Substantial Changes to Lighting Systems

- The second factor designates a "Title 24 efficiency sensitive group", which represents people for whom Title 24 and energy efficiency are key decision factors. Payback, recapturing the cost of the technology, and first cost are negatively related to this factor, meaning that people who score high on this factor attach considerably less importance to these items than other decision-makers. One might imagine that people who score high on this factor may recommend equipment or build buildings that exceed the Title 24 standards and who, in describing a building to others, might talk about its efficiency characteristics.
- The third factor designates a "Title 24 cost sensitive group", which represents people who are concerned about Title 24 from the standpoint of the burdens of first cost and payback. Note that decision makers identified by this factor are much less concerned about efficiency, lighting quality, reliability, and prior experience with equipment than other decision makers. Someone scoring high on this factor might be someone who would express concerns about the costs of complying with Title 24.

Those who *had not* made substantial changes to the lighting system were asked to rate the importance of various reasons that may have prevented them from making changes to the lighting system.[2] Figure 5-4 shows the average ratings for these reasons. For the most part, the ratings are near the middle of the scale, suggesting that lighting, or at least these reasons for making a decision not to make lighting energy efficiency improvements, were not terribly important.

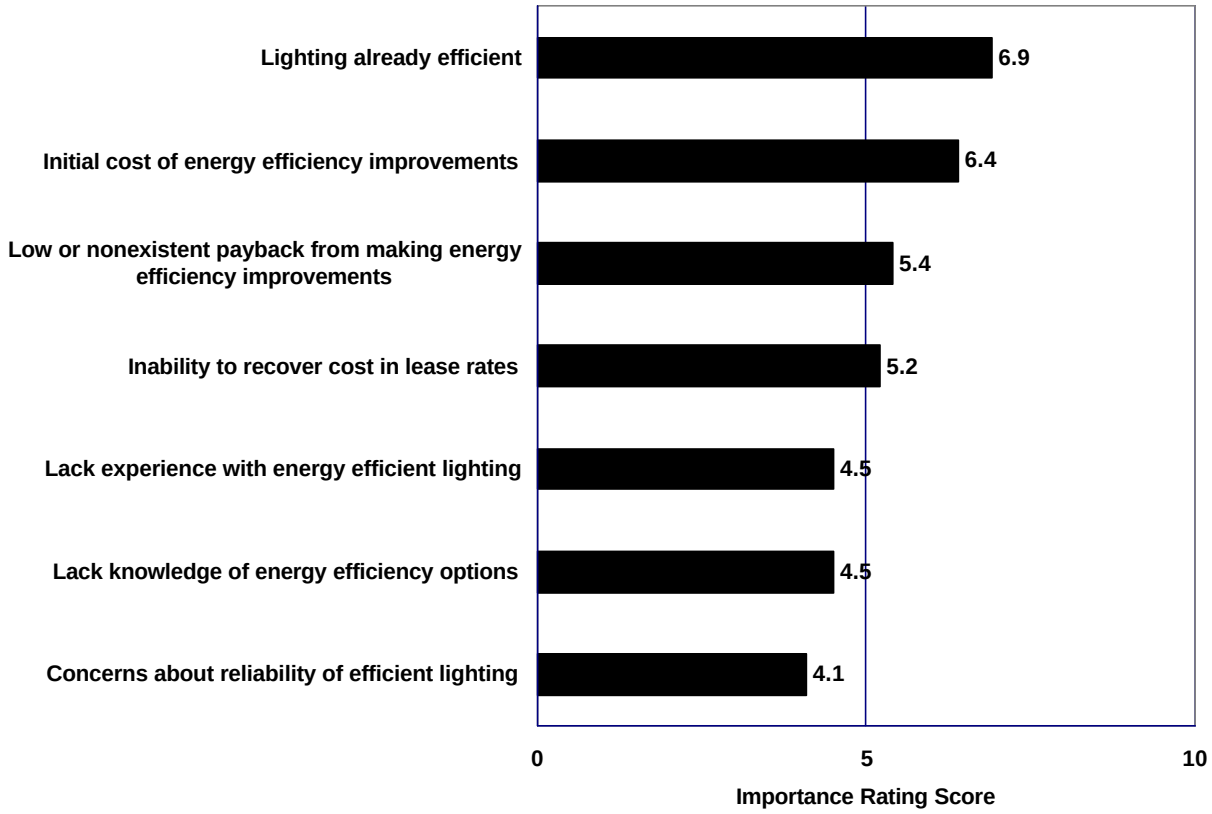

Figure 5-4. Average Importance Ratings for Reasons Preventing Lighting-Related Energy Efficiency Improvements:

If decision makers had not made substantial changes to lighting during their remodeling or renovation project, they were asked if they would have been very likely, somewhat likely, or not very likely to choose more efficient lighting if offered various incentives.[3] Figure 5-5 shows that the average ratings for all of the incentives were between two and three, suggesting that none of the incentives or interventions would have made a difference

[2] These reasons were rated on a 1 to 10 scale, where 1 was "not at all important", 5 was "neither important nor unimportant", and 10 was "very important".

[3] The three response types were recoded into numeric values of one, two, and three, respectively, where one was very likely and three was not very likely.

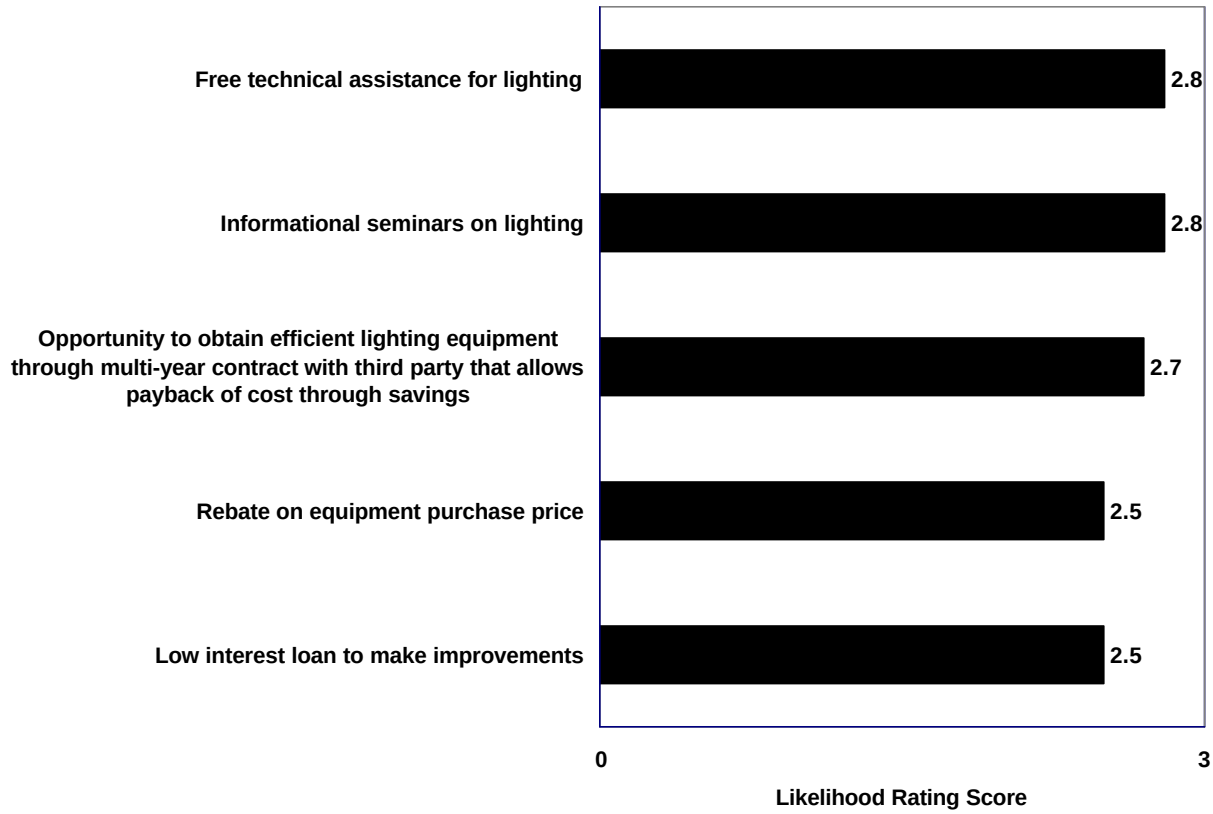

Figure 5-5. Likelihood of Choosing More Efficient Lighting If Offered Different Incentives

5.3.2 Criteria for Changes to HVAC System

A similar analysis was made of the criteria that might influence decision-making on changes to HVAC systems.

Figure 5-6 shows the results when various criteria that might influence changes to a HVAC system were rated in importance on a scale of 1 to 10.[4] Title 24, which had an average importance rating of 8.9, was clearly the most important criteria shaping thinking with respect to HVAC systems. Improved tenant comfort, the energy efficiency of the HVAC system, and equipment reliability were the next most important criteria. Cost, payback, experience and recapturing cost received the lowest importance ratings. Given the widely held belief that cost is a key barrier to implementing energy efficiency, the fact that cost and payback received such low ratings is somewhat of a surprise.

[4] The criteria were rated on a 1 to 10 scale, where 1 was "not at all important", 5 was "neither important nor unimportant", and 10 was "very important".

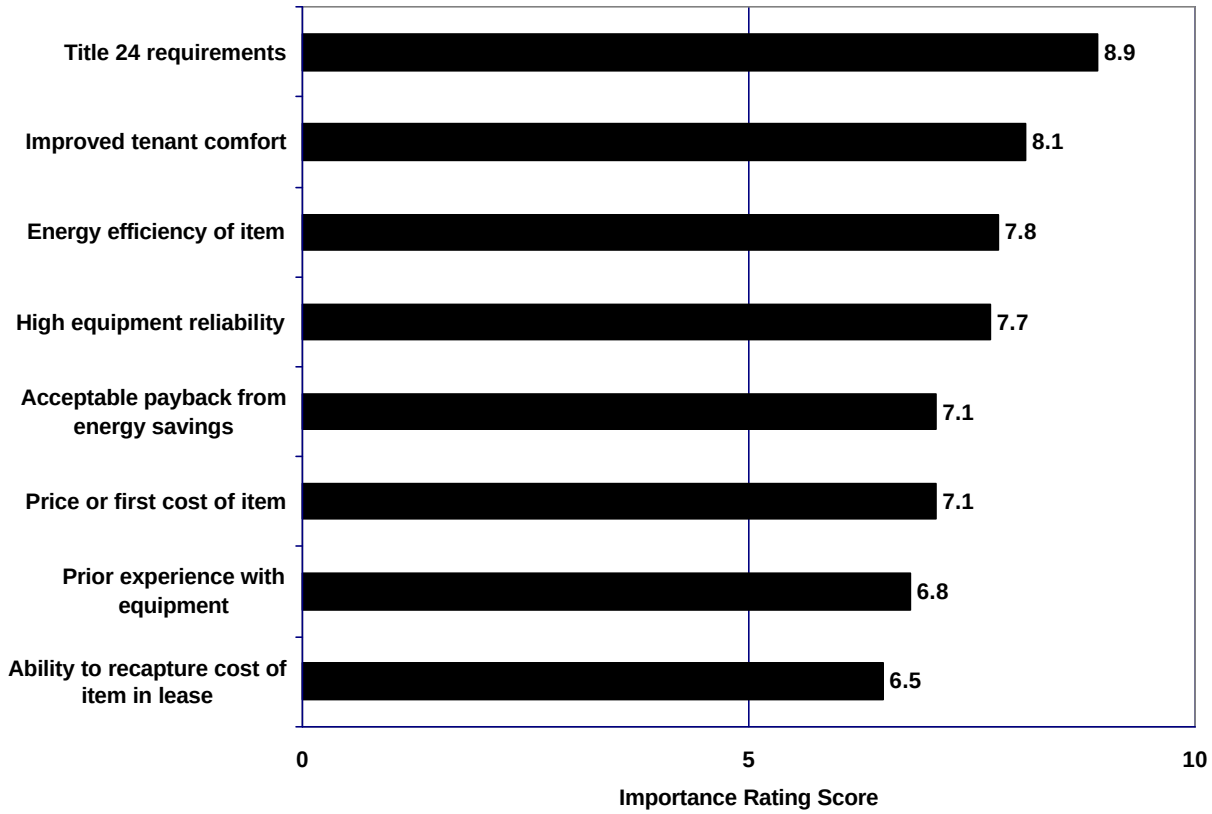

Figure 5-6. Importance of Various Criteria When Making Substantial Changes to HVAC System

As with the analysis of lighting criteria, a factor analysis was completed for the HVAC decision criteria. This factor analysis produced three factors that explain about 62 of the variance (30, 19 and 13 percent of the variance respectively).

- The first factor pertains to efficiency, comfort, and reliability. People scoring high on this factor combine multiple criteria in making their assessment of HVAC systems. Their goal is to get efficiency, comfort, and reliability at a reasonable first cost. In effect, what appears to drive people scoring high on this factor is to maximize comfort, owner value, and energy efficiency.
- The second factor pertains to cost recovery and experience. Persons scoring high on this factor are highly interested in recovering their costs and are likely to want to have had experience with the equipment or with the persons installing the equipment. Conversely they attach less importance than other decision makers to energy efficiency or equipment reliability.
- The third factor is a Title 24 cost insensitivity factor. These decisions makers tend to focus most on the importance of Title 24 while viewing first cost as a less important factor than other decision makers do. These decision makers pay

little attention to other criteria. Someone scoring high on this factor is concerned with complying with Title 24 with low regard for cost.

Those who *had not* made substantial changes to the HVAC system were asked to rate the importance of various reasons that may have prevented them from making changes to the HVAC system.[5] Figure 5-7 shows the average ratings for these reasons. The most important reason was that the HVAC was already efficient (average rating of 7.3). This was closely followed by concerns about having to meet Title 24 requirements if the system was changed. Having to cut costs and concerns about reliability were identified as slightly important. The remaining reasons were rated as being neither important nor unimportant.

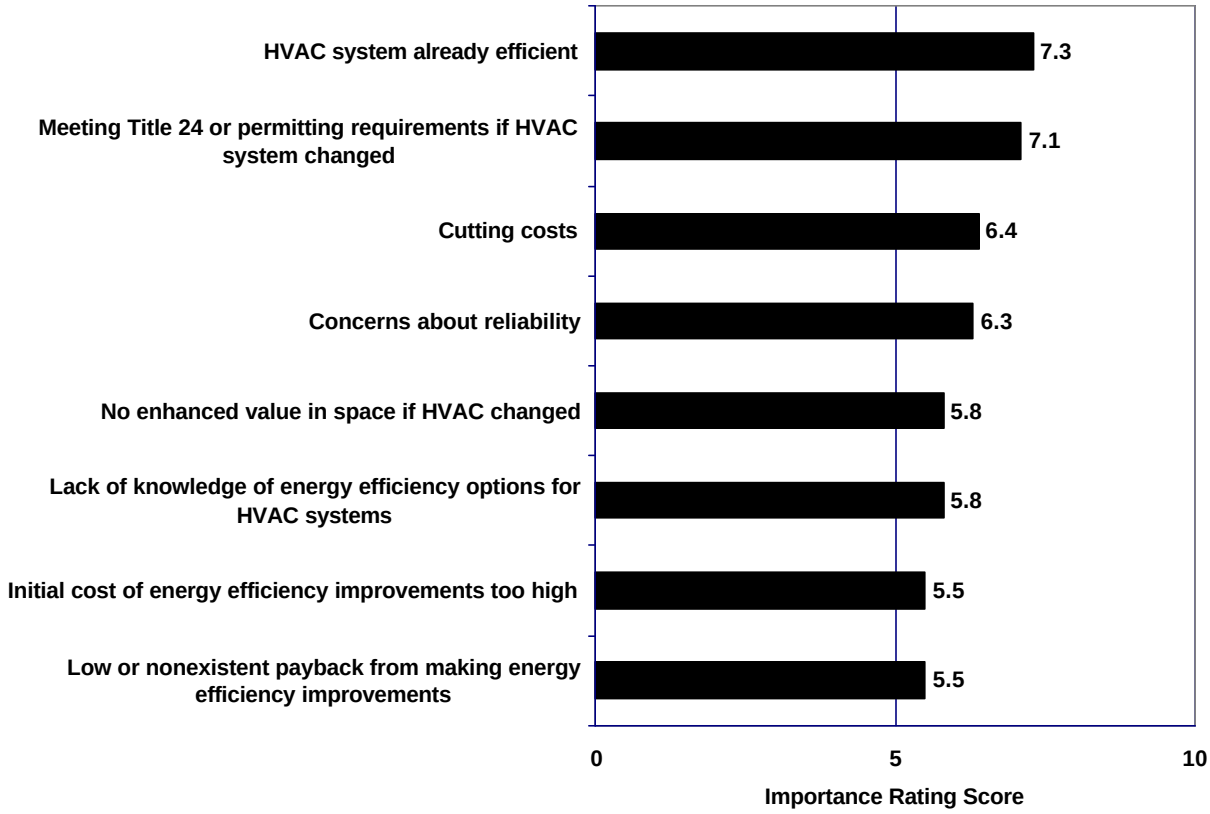

Figure 5-7. Average Importance Ratings for Reasons Preventing Lighting-Related Energy Efficiency Improvements:

[5] These reasons were rated on a 1 to 10 scale, where 1 was "not at all important", 5 was "neither important nor unimportant", and 10 was "very important".

The respondents who had not made changes to the HVAC system were also asked if they would have been more likely to have modified the HVAC systems if they had received technical assistance, information, rebates, or low interest loans.[6] Figure 5-8 shows the results. All of the marketing incentives have an average score that is between two and three. This means that none of these marketing incentives is likely to have resulted in an increased interest in improving the efficiency of an HVAC system.

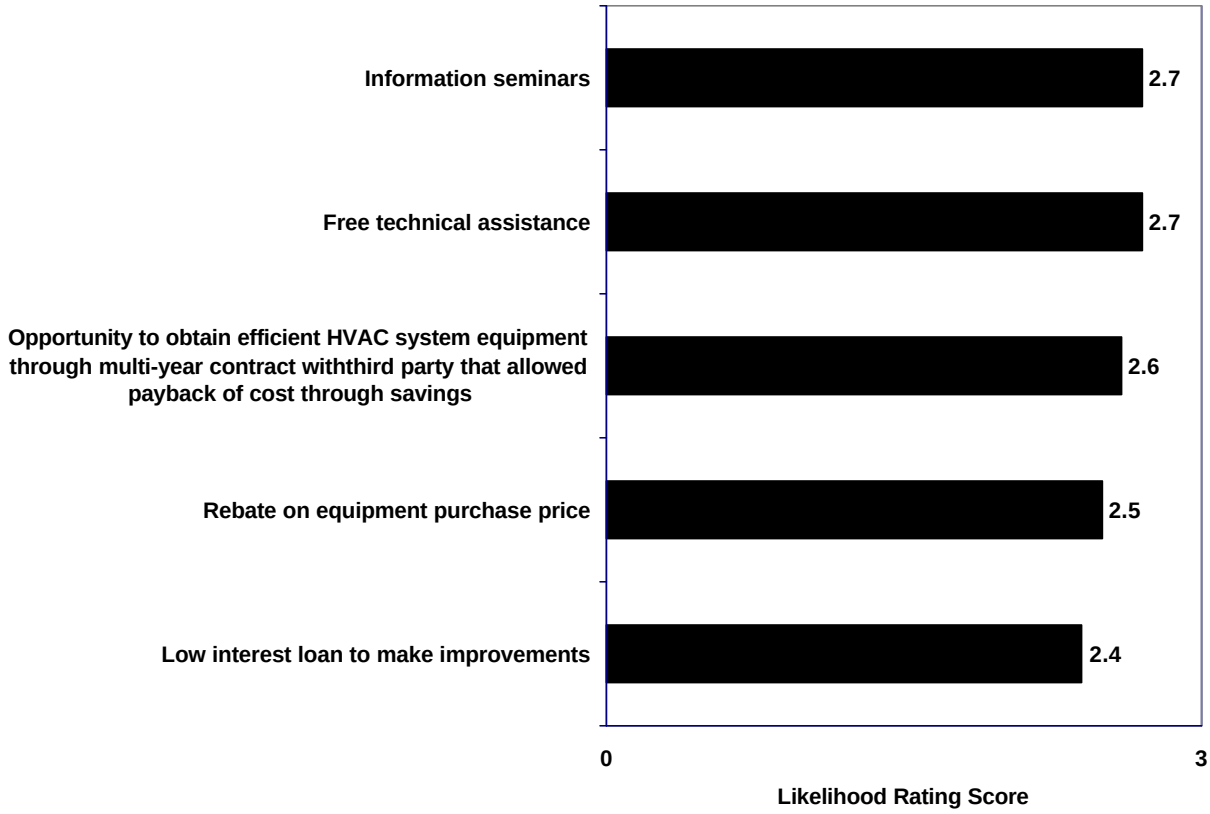

Figure 5-8. Likelihood of Modifying HVAC System If Offered Different Incentives

[6] Respondents were asked if they would have been very likely, somewhat likely, or not very likely to choose more efficient HVAC equipment if offered various incentives The three response types were recoded into numeric values of one, two, and three, respectively, where one was very likely and three was not very likely.

5.4 SOURCES OF INFORMATION

If implementation of energy efficiency programs is to be effective, information is needed about the channels through which decision makers receive information. Accordingly, decision makers were asked in the survey about their sources of information when they undertook the remodeling or renovation of a building where the lighting and/or HVAC systems were to be changed.

About three-fourths of the respondent decision makers who reported making substantial changes to lighting systems during remodeling indicated that the information they used came from a single source. Just about half of the respondents said that they obtained information from electrical engineers. Much less frequently (i.e., 5 to 13 percent of the cases), they identified other professionals such as lighting designers, architects, consultants, and consulting engineers as sources of information. Contractors are included among building professionals because electrical contractors often have electrical engineers on their staff. However, contractors represent only eight percent of the total sources cited.

If where information came from is examined in terms of all sources, just under three-fourths (71 percent) of the sources could be categorized as external professional sources. Nineteen percent of the information came from internal sources, which were evenly divided between internal maintenance staff and internal design staff. Only 10 percent of the information sources were distributors, tenants, utilities, trade publications and owners.

A similar analysis was completed for information received by respondents in buildings where remodeling and renovation included changes in HVAC equipment and design. The patterns of information sources are somewhat similar to those for lighting. About 80 percent of the respondents identified a single source of information. About three quarters of the sources of information were external building professionals. However, respondent decision makers making HVAC changes were much more likely to use contractors as a source of information than were those making lighting changes. Thus, contractors are an important conduit for information about HVAC systems. The likely reason for this is that HVAC contractors often have engineering staff who do the engineering design work.

Internal staff were used as a source of information in about a fifth of the cases. Manufacturers and distributors were cited as sources in about four percent of the cases.

Taken together, these results indicate that building professionals are the key conduit for the information about lighting and HVAC that is used in remodeling and renovation. Electrical engineers are the most frequently referenced source for lighting information, and mechanical (HVAC) contractors are the most frequently

referenced source for HVAC information. Between a sixth and a quarter of the respondents utilized information from internal maintenance staff.

6. POTENTIAL FOR IMPROVING ENERGY EFFICIENCY IN NRRR MARKET SEGMENTS

This chapter addresses the potential for improving energy efficiency in different segments of the NRRR market.

6.1 CONCEPTUAL DEFINITIONS OF NRRR MARKET SEGMENTS

The market for nonresidential remodeling and renovation derives from the stock of existing nonresidential buildings. Based on estimates prepared by the California Energy Commission, the total floorspace of existing nonresidential buildings in California in 2000 was about 5.7 billion square feet.[1] The distribution of this floorspace by type of building is shown in Figure 6-1.

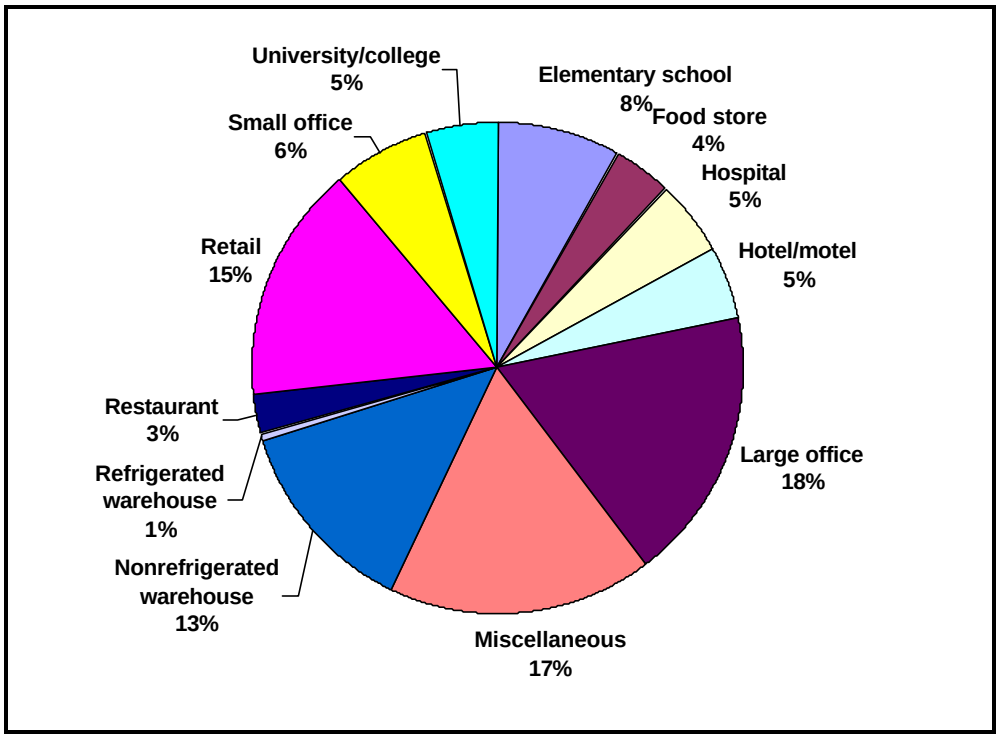

Figure 6-1. Percentage Distribution of Nonresidential Building Floor Space by Building Type

There are other segmentation factors that can come into play to differentiate buildings within a given building type segment. Some key factors that differentiate the segments are whether the space is for the owner's use or for lease by the owner;

[1] California Energy Commission, Data prepared for forecast in *California Energy Demand, 2000-2010,* Publication # 200-00-002,. July 14, 2000

the degree to which the owner exerts control over the space; and the investment strategy that the owner follows with respect to the space. Applying these factors, a given building type segment can be divided into five sub-segments:

- Developer buy/renovate/sell segment, in which developer buys building, adds value to it and then sells the building;
- Developer buy/renovate/hold segment, which developer buys building, renovates it and holds buildings;
- Triple net operator segment;
- Owner-occupied buildings segment; and
- Ground lease segment.

Figure 6-2 depicts the location of these segments in terms of whether an owner uses or leases a building and the time horizon of the building holders investment strategy. (Tenants are also included on this figure for comparison purposes.) The segments in the upper right quadrant can be considered most amenable to making investments in energy efficiency. Segments in other parts of this graphic are less amenable and need something other than payback to motivate them to make efficiency investments. The segments most amenable to energy efficiency are the owner occupied segment, the commercial real estate firms who renovate and hold property, and the ground lease segment. The triple net operator segment is probably the smallest and also the most difficult to penetrate. There are some opportunities in the commercial buy and sell market.

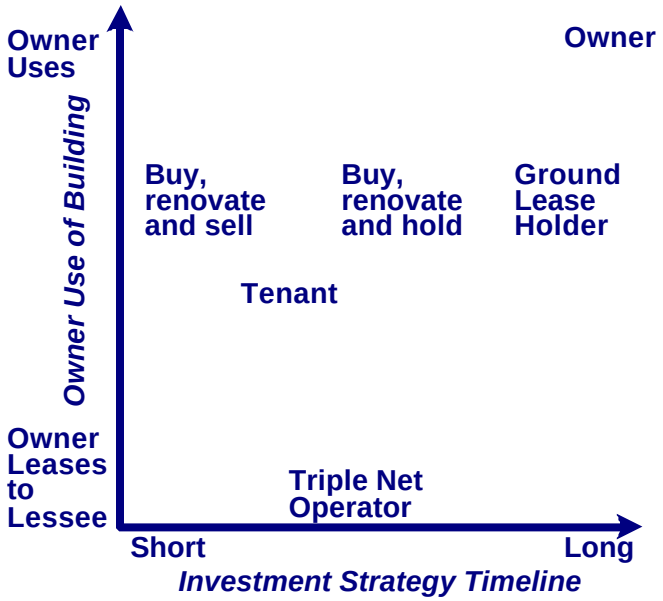

Figure 6-2. Remodeling and Renovation Segments in Terms of Investment Time Line and Ownership Status

Data are not yet available to quantify the sizes of various market segments defined according to all of the possible segmentation factors. However, as discussed in the next section, available data do allow for quantitatively defining and estimating the sizes of nonresidential remodeling and renovation market segments in two dimensions: building type and ownership status.

6.2 ESTIMATES OF SIZE AND IMPORTANCE OF NRRR MARKET SEGMENTS

This section develops quantitative estimates of the sizes of different NRRR market segments defined by building type and ownership status. Particular attention is given to the office and retail building types, because the examination of the various data gathered during the NRRR Study indicated that the majority of remodeling and renovating activity occurs in these two types of nonresidential buildings.[2]

- Office buildings that are undergoing alterations, additions, or tenant improvements account for most of the remodeling and renovating activity. This is consistent with the fact that existing office floorspace (for small and large offices) as of 2000 was about 1,385 million square feet (about 24 percent of the total floorspace). This existing floorspace represents a significant market for remodeling and renovation.
- Retail buildings are also likely candidates for remodeling and renovating, but the level of activity for these buildings is noticeably lower than for office buildings. Existing retail space in 2000 was about 882 million square feet (about 15 percent of the total).

Within each building type, floorspace can be divided between owner-occupied space and leased space. Evidence on the percentages of floorspace for each building type that fall into these two categories is available from the commercial building surveys that Southern California Edison and Pacific Gas and Electric conducted in their service areas in the mid 1990's. Although the absolute data on number of buildings and total square footage from those surveys are somewhat dated, the breakdown of square footage by whether the space is owned or leased should still be informative.

Figure 6-3 provides a comparison of the distribution of owned *versus* leased floor space for both office and retail buildings in the service areas of PG&E and SCE. As can be seen, a higher percentage of the office floor space for both PG&E and SCE is owner-occupied than is leased. For retail buildings, however, leased space constitutes a higher percentage of floor space than does owned space.

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[2] As discussed in the Quantitative Survey Report, remodeling and renovating of industrial or manufacturing buildings is significant in some geographic markets. In permitting data examined for activity during the year 2000, this was particularly true for buildings located in the Silicon Valley (i.e, San Jose and Sunnyvale).

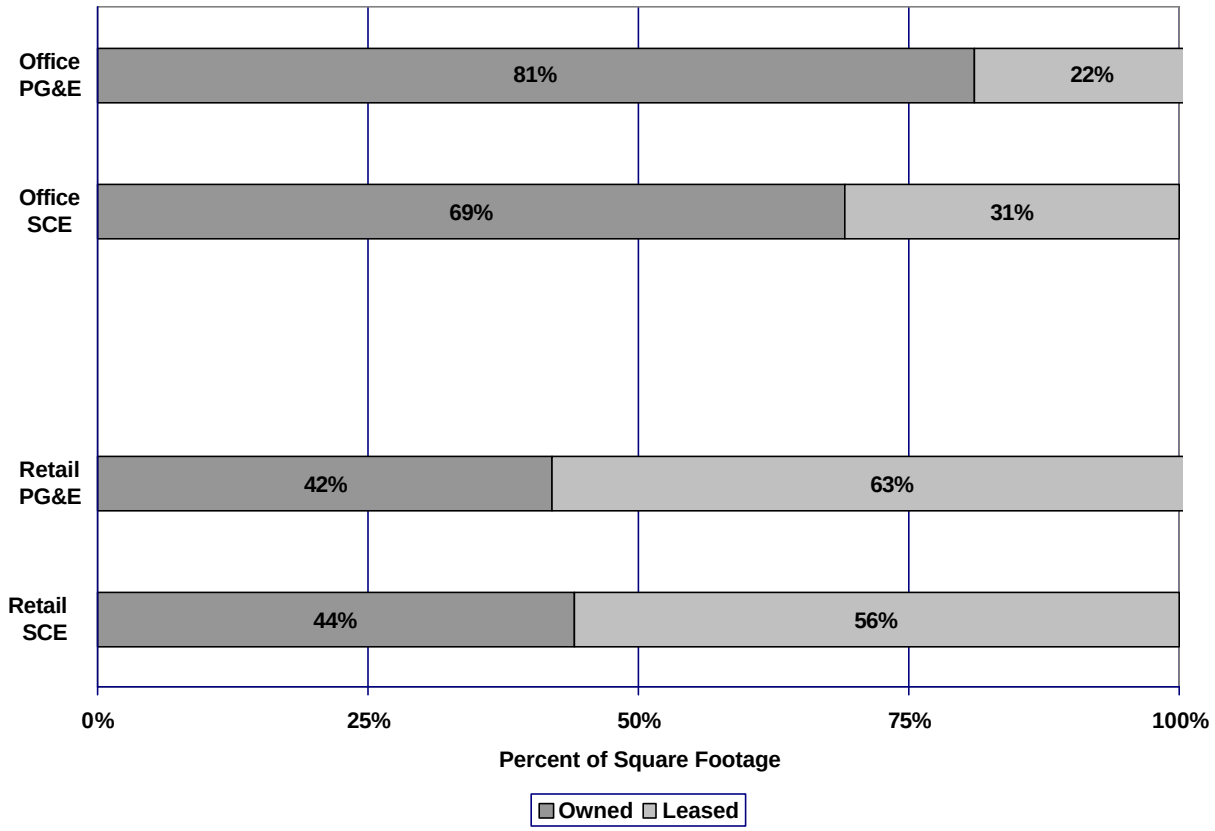

Figure 6-3. Comparison of Owned versus Leased Floor Space for Office and Retail Buildings in Service Areas of PG&E and SCE[3]

Percentages for the split of building type floorspace between owned space and leased space were developed using information from the PG&E and SCE commercial building surveys and applied to the CEC's floorspace estimates to arrive at estimates of the floorspace for NRRR market segments defined by building type and ownership status. The resulting estimates, shown in Table 6-1, characterize the existing stock of nonresidential floor space by building type and ownership status.

[3] PG&E data are from PG&E, *Commercial Building Survey Report: 1999.* Data for SCE are from ADM Associates, Inc., *Commercial Saturation Survey: Final Report*, May 1997. For both, data pertain to mid 1990's for the most part (i.e., 1992-1996).

Table 6-1. Year 2000 Floorspace Estimates for NRRR Market Segments Defined by Building Type and Ownership Status

CEC Building Type	Million SF	Owned Space		Leased Space	
		Percent Owned	SF Owned	Percent Leased	SF Leased
Office	1,385	76%	1,048	24%	337
Retail	882	42%	372	58%	510
Restaurant	145	33%	47	67%	98
Grocery	231	31%	71	69%	160
Refrigerated Warehouse	43	92%	40	8%	3
Warehouse	745	62%	460	38%	284
School	457	95%	437	5%	21
College	270	96%	258	4%	12
Hospital	279	94%	261	6%	18
Hotel/motel	271	88%	238	12%	33
Miscellaneous	993	72%	718	28%	274
Totals	5,700		3,951		1,749

Not all of the existing floorspace comes up for remodeling and renovation each year. Rather, remodeling and renovation occurs for some percentage of the existing stock each year. Rough estimates of these percentages are reported in a study of the commercial lighting market that Xenergy has prepared.[4] Xenergy used data from the commercial building surveys of PG&E and SDG&E to estimate the percentages of square footage for different types of existing buildings that underwent remodeling, renovation or retrofit over the period 1992-1997. Xenergy's estimates are reproduced in Table 6-2. Because these percentages represent a six-year period, annual percentages are estimated by dividing by six.

Table 6-2. Remodeling, Renovation or Retrofit Activity during 1992-1997 as Percentage of Total Floorspace

Xenergy Market Segment	New Construction / Remodeling	Renovation	Retrofit	Percentage of All Space
Office/owner	11.2%	31.6%	8.4%	51.2%
Office/leased	2.8%	22.5%	39.0%	64.3%
Retail/sole	12.9%	5.5%	6.6%	25.0%
Retail/multisite	19.9%	12.6%	10.9%	43.5%
Institutional	1.1%	40.5%	30.7%	72.3%
Other	8.9%	11.0%	4.1%	23.9%

[4] Xenergy, Inc., *PG&E and SDG&E Commercial Lighting Market Effects Study: Final Report, Volume I*, Prepared for Pacific Gas and Electric Company, July 1998.

The market segments that Xenergy defined can be related to the CEC building type characterization as follows.

- Xenergy's office market segments correspond directly to CEC's office building type, but with a differentiation by ownership status.
- Xenergy's retail market segments contain not only the CEC's retail building type but also some food sales/service and restaurant facilities. Xenergy differentiated the two retail market segments by whether a building was the sole location of the retailer or was one sites for a retailer with multiple sites.
- Xenergy's institutional market segment includes CEC's building types for elementary and secondary schools, colleges and universities, hospitals, religious, and government buildings.
- Xenergy's other market segment includes CEC's warehouse and other building types.

Drawing on Xenergy's estimates of remodeling and renovation activity, estimates were prepared of the amount of square footage that becomes available for remodeling and renovation each year. These estimates are shown in Table 6-3.

Table 6-3. Estimates for Annual Square Footage Undergoing Remodeling or Renovation for NRRR Market Segments Defined by Building Type and Ownership Status

CEC Building Type	***Owned Space***			***Leased Space***		
	Million SF	***Annual Percent of R&R***	***Annual R&R SF***	***Million SF***	***Annual Percent of R&R***	***Annual R&R SF***
Office	1,048	7.1%	74.7	337	4.2%	14.2
Retail	372	2.7%	10.2	510	2.7%	13.9
Restaurant	47	2.7%	1.3	98	2.7%	2.7
Grocery	71	2.7%	1.9	160	2.7%	4.4
Refrigerated Warehouse	40	3.3%	1.3	3	3.3%	0.1
Warehouse	460	3.3%	15.3	284	3.3%	9.4
School	437	6.9%	30.3	21	6.9%	1.4
College	258	6.9%	17.9	12	6.9%	0.8
Hospital	261	6.9%	18.1	18	6.9%	1.2
Hotel/motel	238	3.3%	7.9	33	3.3%	1.1
Miscellaneous	718	3.3%	23.9	274	3.3%	9.1
Totals	3,951		202.8	1,749		58.3

To illustrate the relative size of the NRRR market segments, the total annual square footages for remodeling and renovation for each building type (from Table 6-3) are compared in Table 6-4 to the CEC estimates for floorspace additions in 2000. For every building type except warehouses, the amount of square footage estimated to be undergoing remodeling or renovation in the year is greater than the CEC estimate of additions through new construction.

Table 6-4. Comparison of Estimates for Annual Square Footage Undergoing Remodeling or Renovation to CEC Estimates for Year 2000 Floorspace Additions (Square Feet in Millions)

CEC Building Type	***Estimate of Annual SF for R&R***	***CEC Estimate of Annual SF Additions***
Office	89.0	42.5
Retail	24.1	22.6
Restaurant	4.0	3.6
Grocery	6.3	5.7
Refrigerated Warehouse	1.4	1.2
Warehouse	24.7	25.5
School	31.7	10.5
College	18.7	4.3
Hospital	19.3	5.8
Hotel/motel	9.0	7.7
Miscellaneous	33.0	23.7
Totals	261.2	153.1

From an energy efficiency perspective, it is the amount of electricity that buildings use rather than just their square footage that is important. Accordingly, Table 6-5 shows the annual electricity use associated with the buildings likely to undergo remodeling or renovation in a year for each of the NRRR market segments. Totaled across the market segments in Table 6-5, buildings likely to undergo remodeling and renovation within a year use about 3,909 million kWh per year. Of this total, just over 40 percent is accounted for by the office segments, making those segments of high potential.

Table 6-5. Estimates for Annual Electricity Use of Buildings Undergoing Remodeling or Renovation for NRRR Market Segments Defined by Building Type and Ownership Status

CEC Building Type	*EUI (kWh/SF)**	*Owned Space*		*Leased Space*		*All Million kWh Annual Usage*
		Million SF	*Million kWH Annual Usage*	*Million SF*	*Million kWh Annual Usage*	
Office	18.41	74.7	1,375.33	14.2	261.44	1,636.77
Retail	12.63	10.2	128.80	13.9	175.52	304.32
Restaurant	46.25	1.3	60.12	2.7	124.87	184.99
Grocery	36.54	1.9	69.42	4.4	160.76	230.18
Refrigerated Warehouse	24.29	1.3	31.58	0.1	2.43	34.01
Warehouse	6.26	15.3	95.82	9.4	58.87	154.69
School	8.07	30.3	244.38	1.4	11.29	255.67
College	10.82	17.9	193.68	0.8	8.66	202.33
Hospital	19.66	18.1	355.77	1.2	23.59	379.36
Hotel/motel	12.33	7.9	97.39	1.1	13.56	110.95
Miscellaneous	12.61	23.9	301.28	9.1	114.71	415.99
Totals		202.8	2,953.56	58.3	955.70	3,909.26

*Calculated from sector electricity use and floorspace data for 1997, as compiled by California Energy Commission.

Determining which of the other NRRR market segments have high potential for energy efficiency improvements requires taking into account current saturations of energy efficiency technologies in the different segments. However, the usual source for data has been the commercial building surveys that the utilities have conducted. The most recent surveys are now dated, having been conducted in the mid 1990's. The CEC is currently fielding a commercial energy use survey that will provide more up-to-date information on the saturations of energy efficient technologies in different nonresidential building segments.

Identifying high potential market segments also requires taking note that some of the institutional market segments (e.g., schools, colleges/universities, hospitals) that are relatively large users of electricity have also received considerable attention in previous and current programs sponsored by the federal and state governments and by utilities. For schools, for example, there are both federal and state government initiatives underway to improve energy efficiency in schools.

- At the federal level, the U. S. Department of Energy's Rebuild America Program is issuing a series of design guidelines for improving energy efficiency in schools. The first of these guidelines, *Hot and Dry Climate Energy Design Guidelines for High Performance Schools*, was issued early in 2000. This and the other guidelines are aimed at architects, planners, K-12 administrators,

facility maintenance professionals and others who influence decisions about the design of new school buildings and the upgrading of existing ones.

- At the state level, the Collaborative for High Performance Schools (CHPS) is working to increase the energy efficiency of public schools in California by marketing information, service, and incentive programs directly at school districts and designers. This includes preparing a *High Performance Schools Manual*, which describes the need, relevance, viability, process, and design issues surrounding the creation of High Performance Schools in California.

Because of such attention, existing institutional facilities are likely to have saturations of energy efficient technologies that are higher than for other market segments.

6.3 CAPTURING ENERGY SAVINGS POTENTIAL

The previous section provided evidence of the potential for energy savings for nonresidential buildings undergoing remodeling or renovation. This section discusses issues associated with capturing that energy savings potential

6.3.1 Conceptual Characterization of Energy Savings Potential

Conceptually, the potential for improving energy efficiency during remodeling and renovation activity in nonresidential facilities can be evaluated in at least two ways.

A first way of evaluating energy savings potential is through a bottom-up engineering/cost-effectiveness evaluation. In this type of approach, energy savings potential is generally evaluated at several levels: technical potential, economic potential, market potential, and achievable potential.

- Technical potential represents the improvement in energy efficiency that could be achieved by using technologies in all applications in which their adoption could be technically feasible, without consideration of costs or practical feasibility. Technical potential for improvements in energy efficiency in NRRR projects represents the maximum savings, which could be achieved with energy-efficient technologies or measures if cost is not a factor. That is, technical potential is estimated without taking account of cost or other factors that may limit the application of an energy efficiency technology or measure.
- Economic potential is defined as that portion of the technical potential that remains after measures costs are taken into account in determining the cost-effectiveness of different measures. (However, the costs of programs to encourage measure adoption are not considered in estimating economic potential.) The economic potential represents energy-efficiency improvements that could be achieved cost-effectively in the absence of market barriers.

Because it includes energy savings only from measures that are cost-effective, economic potential is less than technical potential. As usually estimated, economic potential is not annualized but represents an aggregate savings that can be captured over time (e.g., as the equipment stock turns over).

- Some of economic potential is captured through naturally occurring market forces. This market potential represents the energy-efficiency improvements that are being achieved under existing market conditions, with no policies and measures to encourage energy efficiency other than those already in place. Market potential takes into consideration limitations to customer acceptance and the rate at which efficiency resources can be acquired.
- Achievable potential represents that portion of the economic potential that remains after market potential is accounted for. Achievable potential is generally thought of in terms of implementing policies and programs that can capture economic potential that is not being captured through normal market forces.

An alternative way to estimate the potential for energy efficiency when nonresidential buildings are remodeled or renovated is to consider the magnitude by which electricity use would be reduced if the level of energy efficiency for the buildings was brought from their current "average practice" level to a more energy efficient "best practice" level. (This approach is often used in economics to study, for example, differences in productivity levels among firms and what can be done to improve overall efficiency and productivity.) This approach builds on the fact that there is a distribution for the level of energy efficiency across buildings and that improvements in efficiency can be gained if lower efficiency buildings are brought to the level of higher efficiency buildings. This premise underlies projects to develop benchmarking procedures (e.g., Energy Star) so that building owners and/or managers can compare their building to other buildings and identify ways in which they can reduce energy use.

6.3.2 Estimated Technical and Economic Potential for NRRR

A bottom-up energy savings potential study has recently been conducted by Xenergy to develop estimates of the various types of energy efficiency potential for existing commercial buildings in California.[5] That study involved analysis of how the potential for energy efficiency in existing commercial buildings is affected by such factors as measure costs, measure savings, baseline population forecasts, and saturations of existing equipment.

[5] Rufo, M., "Analysis of Statewide Commercial Energy-Efficiency Potential," Presentation at *ACEEE National Conference on Energy Efficiency and Reliability: Lessons Learned in 2001*, October 2001.

Initial findings that Xenergy has reported for their study indicate that significant economic potential for energy efficiency improvements still remain for existing commercial buildings in California. The economic potential estimated by Xenergy is 11,000 GWh and 2,400 MW.

- In Xenergy's estimation of technical and economic potential, indoor lighting is the end use accounting for a significant part of the technical and economic potential among existing commercial buildings.
- Most of the economic potential is accounted for by five types of lighting measures: T8 lamps/fixtures with electronic ballasts; perimeter dimming; occupancy sensors; T8 lamps/fixtures with electronic ballasts and reflectors; and compact fluorescent lamps.

6.3.3 Estimated Market Potential for NRRR

Some of the economic potential for energy efficiency improvements in existing commercial and other nonresidential buildings will be captured through the effects of natural market forces, of existing energy efficiency standards for buildings, and of previous and current utility programs. For example, the regression analysis discussed in Chapter 3 produced results that imply that expenditures on remodeling and renovation of nonresidential buildings do reduce commercial electricity use in California.

This reduction essentially represents the combined effects of natural market forces, existing energy efficiency standards, and previous and current utility programs. Assigning relative magnitudes to the separate effects of the different factors is somewhat problematic. However, some perspective on the effects of the various factors can be explored more particularly by considering lighting, which is the end use with the greatest technical and economic potential for savings in existing buildings.

Consider first the effects of the Title 24 energy efficiency standards during the 1990's. There is a discussion above in Section 5.3 concerning criteria used in making decisions to change lighting or HVAC equipment during remodeling or renovation of a nonresidential building. Data collected during a survey of decision makers showed that Title 24 requirements were considered to be the most important criterion when deciding to make lighting or HVAC changes.

Under provisions of the Title 24 standards in effect during the 1990's, changes in lighting systems that occurred during alterations to existing space had to meet Title 24 requirements if more than 50 percent of the existing lighting systems or circuits was modified. The force of this provision can be seen by comparing the lighting power densities in existing buildings to the power densities required by Title 24. This comparison is provided for office buildings in Figure 6-4, which compares

average lighting power densities for different vintage office buildings (i.e., existing small and large office buildings {circa 1995} and newly constructed office buildings {1994-1998}) and the allowed lighting power density for office buildings under the 1992 and 1999 Title 24 standards.[6]

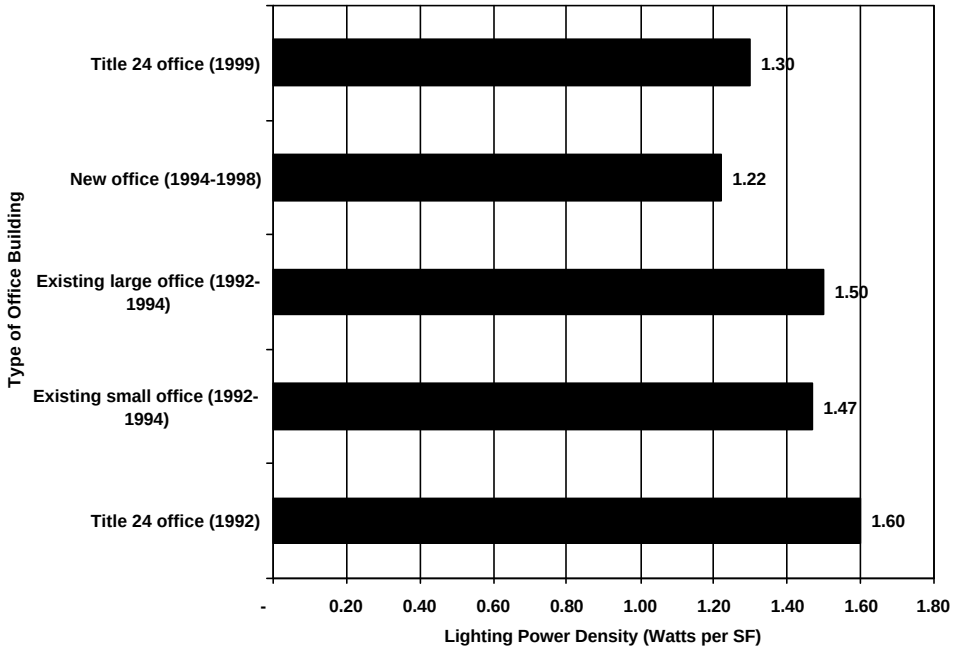

Figure 6-4. Comparison of Lighting Power Densities for Existing, New and Proposed Office Buildings

The comparison presented in Figure 6-4 suggests that a typical existing office building that was remodeled or renovated during the 1990's would not have had to change lighting power densities significantly to satisfy the 1992 Title 24 standards that were in effect during that period. That is, the average office building with a lighting power density of 1.47 to 1.50 watts per square foot would already be meeting the Title 24 requirement of 1.60 watts per square foot, even with a like-for-like change to the lighting system.

A comparison of the lighting power densities in existing retail buildings to the power densities required by Title 24 is provided in Figure 6-5. Average lighting power densities are shown for different vintage retail buildings (i.e., existing retail {circa 1992-1994} and newly constructed retail buildings {1994-1998}) and the

[6] The lighting power density estimates for existing office buildings were taken from Heschong-Mahone Group, Inc., *Lighting Efficiency Technology Report: Volume I, California Baseline,* Report prepared for California Energy Commission, September 1999. The LPD estimate for newly constructed office buildings was taken from RLW Analytics, Inc., *California Non-Residential Construction Baseline Report,* 1997.

allowed lighting power density for retail space under the 1992 and 1999 Title 24 standards.[7]

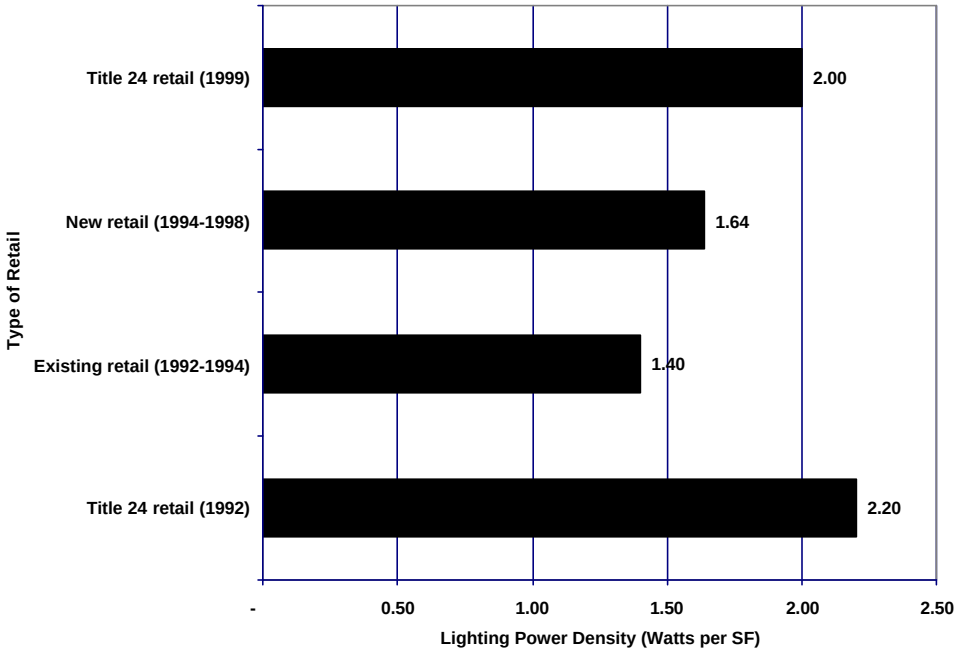

Figure 6-5. Comparison of Lighting Power Densities for Existing, New and Proposed Retail Buildings

As with office buildings, the comparison presented in Figure 6-5 for retail space suggests that a typical existing retail building that was remodeled or renovated during the 1990's would not have had to change lighting power densities significantly to satisfy the 1992 Title 24 standards that were in effect during that period. That is, an existing retail building with a lighting power density of 1.40 watts per square foot would already be meeting the Title 24 requirement of 2.20 watts per square foot, even with a like-for-like change to the lighting system.

It should also be noted that the average lighting power density for existing retail buildings was lower than the average lighting power density for newly constructed retail buildings (i.e., 1.40 versus 1.64). This may be part of the explanation for why the regression analysis of the effects of nonresidential remodeling and renovation activity on retail electricity use (as reported in Chapter 3) showed a positive relationship between NRRR expenditures and retail electricity use. If retail establishments were matching the practices underway in newly constructed retail facilities, lighting power densities for remodeled facilities would be increased.

[7] Ibid.

This argument, although *a priori*, would suggest that Title 24 requirements during the 1990's did not have a significant effect in improving energy efficiency in remodeled or renovated buildings. That is, although meeting Title 24 requirements was important, the standards in effect were not constraining as to what could be done. The standards' lighting power density requirements could be met even with like-for-like changeouts of lighting equipment. From their study of the commercial lighting market in the service areas of PG&E and SDG&E for the period 1992-1997, Xenergy made a similar observation:

> "…the fact that these [Title 24] code levels have been in place since 1987, but little improvement occurred in T-8 lamp and electronic ballast penetration between then and 1990, indicates that these codes were not the key drivers. The 1987 code levels were met for years by 3-lamp fixtures with efficient magnetic ballast and 34-watt, T-12 lamps. It is more likely that as the barriers to electronic ballasts were reduced in the mid 1990's, designers began switching over to those technologies to produce more room for decorative and task lighting under the LPD limits."[8]

Utility programs that promoted high efficiency energy-using equipment might also have been at work during the 1990's to improve efficiency of remodeled or renovated nonresidential buildings. The question here, however, is the extent to which the utility programs actually influenced equipment decisions when buildings were being remodeled or renovated. For example, few of the decision makers for remodeling and renovation projects who were surveyed for this NRRR Study identified utilities as a source of information when they were making their decisions about lighting or HVAC for the remodeled/renovated space.

Moreover, penetration data for the current Savings by Design programs suggests that influence of a utility program on remodeling and renovation projects is of a lower level than the influence on new construction projects. Figure 6-6 shows the percentages of new construction and of remodeling and renovation projects that were participants in the Savings by Design program during 2000.[9] Participation rates are shown for different building types. Except for the storage and other building types, the percentages of remodeling and renovation projects participating in Savings by Design are lower than for new construction projects.

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[8] Xenergy, *PG&E and SDG&E Commercial Lighting Market Effects Study: Final Report, Volume I*, July 1998, p. 4-37.

[9] Data are from Quantum Consulting, *NRNC Market Characterization and Program Activities Tracking Report: PY2000, Final*, April 2001.

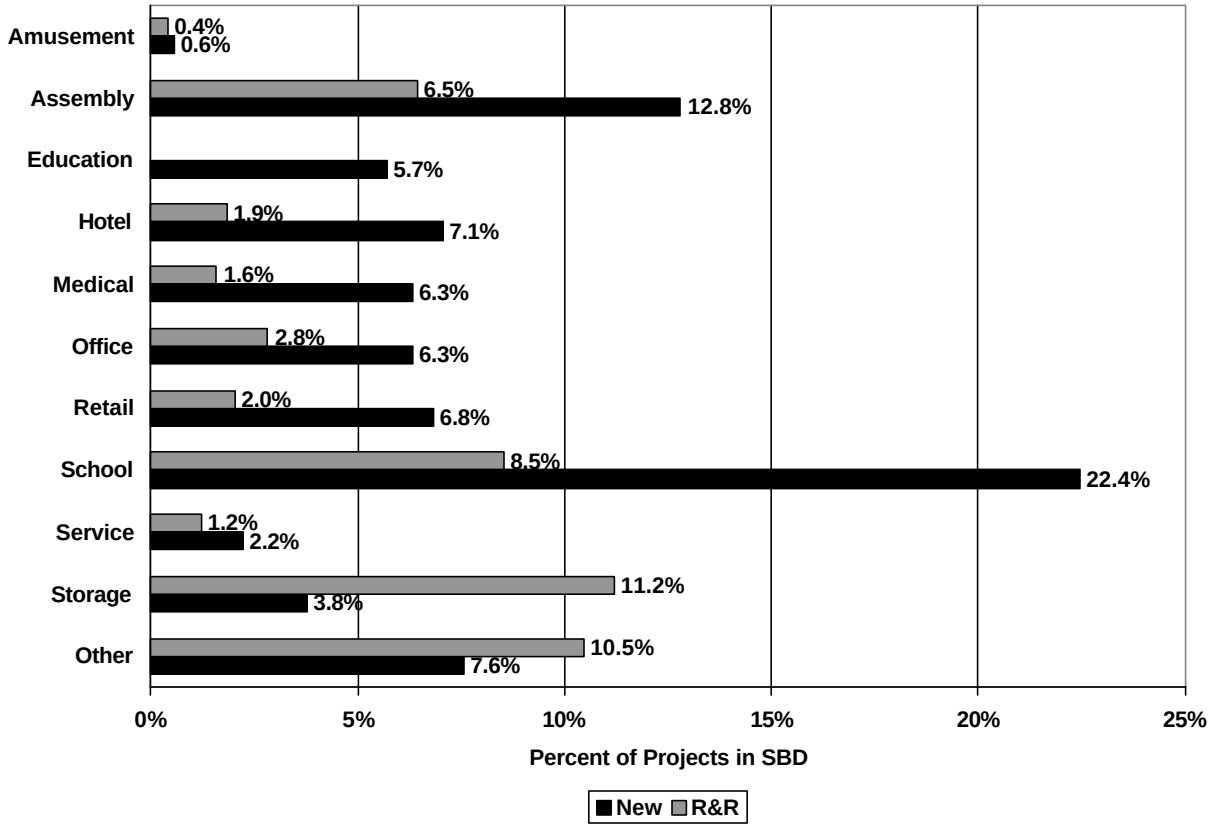

Figure 6-6. Percentages of New Construction and R&R Projects Participating in Savings by Design Program during 2000

This evidence for the lower penetration of the Savings by Design program into the NRRR market is consistent with the findings from the focus groups. In the focus groups it was noted that firms were making use of Savings by Design for new construction projects but not as much for remodeling and renovation projects. In Savings by Design, greater emphasis may be needed on the applicability of Savings by Design to remodeling and renovation projects to increase the penetration into the NRRR market.

6.3.4 Estimated Achievable Potential for NRRR

The discussion in the previous section has implications for determining the achievable potential for improving energy efficiency in nonresidential remodeling or renovation projects. That is, achievable potential essentially represents potential savings that are not being achieved under normal market conditions. The assumption is that policies or programs can be implemented to encourage the incorporation of energy efficiency improvements into projects to claim some of the savings that would otherwise not be realized. Thus, achievable potential depends on the features of the proposed policies or programs.

To project the achievable potential for remodeling and renovation of nonresidential buildings requires taking account of the effects of the likely changes in the Title 24 standards. The discussion in the previous section suggested that the standards may not have had significant impacts on remodeling and renovation projects during the 1990's, but this was because both new construction practice and existing practice resulted in lighting power densities that were "better" (i.e., lower) than Title 24 required.

However, Figure 6-4 shows that the Title 24 standards that came into effect in 1999 required lighting power densities that were lower than shown for either existing office buildings or for new office buildings constructed during the 1990's. Thus, implementation of those standards for office buildings would be a way of capturing some of the achievable savings potential. Moreover, the revisions to the Title 24 standards that are now under consideration for 2005 will apparently tighten the standards even more. For example, the standards may be changed so that they take effect when any part of a building is remodeled or renovated, in contrast to the current requirement that the standards be adhered to only if more than 50 percent of the space is being remodeled or renovated.

Besides standards, programs can be used to capture some of the achievable savings potential. Such programs usually use either enhanced marketing approaches or financial incentives. However, the results of the survey of decision makers conducted for this study suggests that usual program approaches may have to be modified and adapted to have any impact in improving energy efficiency when buildings are remodeled or renovated. In particular, high proportions of the respondents who had not changed either lighting or HVAC systems during their remodeling and renovation projects indicated that *none* of the following incentives would have caused them to change their minds

- Low interest loans;
- Rebates;
- Performance contracts;
- Technical assistance; or
- Seminars.

On the other hand, enhanced marketing that is aimed at reaching decision makers early might be effective in encouraging greater interest in energy efficiency when buildings are remodeled or renovated. A key finding of the survey of decision makers was that remodeling and renovation activities are usually driven by a change in tenant and/or a tenant changing their operation. If program implementers want to capture more of the NRRR market, they may need to focus on tenancy changes as a key to identifying space that is likely to be renovated.

One possible strategy for identifying space that is to be renovated is to work with leasing agents who specialize in commercial lease space. There are also real estate statistical consulting services that maintain databases identifying cases where leases are expiring. For example, CoStar Realty Information, Inc. provides its CoStar Tenant™ service that allows identifying tenants by various characteristics, including lease expiration date. By working with such firms, program implementers can identify space that is coming to market in sufficient time to promote energy efficiency when changes to space are being made. Landlords and/or tenants who are candidates for an energy efficiency program can be identified on a continuous basis and marketed to directly with mailings that describe the program and the benefits that they can realize from installing energy efficient equipment.

Further market research is needed to determine what incentives would be most effective with landlords or tenants who are remodeling or renovating space. Perhaps the incentives listed above could be modified to appeal more favorably to the decision makers. Moreover, because remodeling and renovation projects often are conducted over shorter periods of time than new construction projects, incentives that address time constraints may be effective. Examples of such incentives might include expedited plan checking and permitting services.

Another aspect of enhanced marketing that might be considered is the "enhanced value" strategy that has been suggested for new construction programs. According to its proponents:

> "An enhanced value strategy would seek to overcome barriers to efficient construction practices by increasing the perceived value that decision-makers place on efficient construction practices. For most building owners, reducing operating costs is not a major motivation. An enhanced value strategy would focus on demonstrating and promoting construction strategies that provide multiple benefits in addition to energy savings. These benefits include improved occupant comfort (both in a thermal and aesthetic sense), reduced construction costs, improved equipment durability and ease of operations, improved worker productivity, and reduced impacts on the environment. Specific benefits to an enhanced value building could be promoted to owners through marketing programs, case studies, and financial incentives."[10]

Consideration needs to be given as to whether the elements that would be included in an enhanced strategy for remodeling and renovation would be the same as for

[10] Johnson, J. and Nadel, S., "Commercial New Construction Programs: Results from the 90's, Directions for the Next Decade", *Proceedings, 2000 ACEEE Summer Study on Energy Efficiency in Buildings, Panel 4,* 2000.

new construction. Moreover, it should be noted that an "enhanced value strategy should be viewed as a long-term effort and not a quick route to success."[11]

[11] Ibid.

7. MAJOR FINDINGS AND IMPLICATIONS

This chapter brings together the major findings from the NRRR Study and summarizes the implications of these findings for program designs and strategies. The discussion is organized to summarize the findings with respect to the four major goals of the NRRR Study. These goals were as follows:

- To describe the level and types of remodeling and renovation activity by market segment, define segments useful to program planning and implementation and quantify characteristics for segments within the NRRR market;
- To characterize the decision-making process for purchases of energy using equipment during remodeling or renovation of nonresidential buildings;
- To identify specific markets with a high potential to save energy; and
- To develop new strategies and program designs to promote market transformation.

7.1 UNIQUE CHARACTERISTICS OF NRRR MARKET

A key issue addressed by the NRRR Study was whether new construction and remodeling and renovation in the nonresidential sector are fundamentally different activities or segments that require different program initiatives to encourage energy efficiency or if they are essentially the same activity that can then be addressed by energy efficiency program managers with the same set of programs. As is so often the case, the answer is not nearly as straight forward as the question. What has been discovered in the course of this research is that the answer depends on the level at which one is viewing the problem.

In the macro level economic analysis, the correlation of a nonresidential alterations and additions data series with the new construction data series results in a low correlation. New construction and remodeling and renovation follow quite different trends. This is consistent with an argument that remodeling and renovating activity for nonresidential buildings is governed by factors that are different from those that govern new construction of nonresidential buildings. Remodeling and renovation generally increase over time with modest changes during economic downturns that result in decreases in building construction. The general trend for new construction shows much more dramatic shifts when the economy is in decline.

Two regions of the state (i.e., Los Angeles region and San Francisco Bay region) account for most of the activity for both new construction and for remodeling/renovating of commercial buildings. When correlations between the data series for nonresidential alterations and additions and for commercial new construction were calculated for these two (and other) regions, relatively low

correlations between the data series for the two largest regions suggested that the factors affecting decisions on commercial new construction are different from those affecting nonresidential alterations and additions. While permitting activity for nonresidential alterations and additions stayed steady or increased during the 1990's for the two largest regions, commercial new construction activity declined in the early 1990's and then resumed growth in the mid 1990's.

Further evidence that factors affecting nonresidential alteration and addition activity are different from those affecting new construction of commercial facilities was provided when the data series for the two types of construction activity were correlated across regions. For nonresidential alterations and additions, the correlations across regions were relatively high, implying that the factors affecting this activity are similar across regions. For commercial new construction, however, correlations across regions were generally lower, indicating that there are differences across regions in the factors affecting new construction of commercial buildings.

Remodeling and renovating activity and new construction appear to have different effects on energy consumption. The macro analysis shows that remodeling and renovating activity has statistically significant effects in reducing electricity use. The exception was an analysis for retail buildings, where remodeling and renovating activity appear to increase electricity use. Electricity consumption appears to increase with new construction.

If the discussion stopped here, it might be concluded that remodeling and renovation and new construction are different activities and different segments of the market. However, when this issue was discussed with building professionals, a different perspective emerged. Building professionals who design and construct buildings see few differences between remodeling and renovation and new construction. They report that they use the same techniques and materials and that they address problems using the same methods.

Building professionals do report some differences in the constraints with which they must deal when doing remodeling and renovation and new construction. The existing structure and codes often limit what can be done in an existing building. However, those who build new buildings say that they also face constraints in terms of siting, the footprint that can be used, the views, and "restrictions" based on the surrounding natural and built environment. Thus, the issue is more one of the scale at which the constraints are imposed than whether or not there are constraints. Thus, for building professionals we conclude that there are few differences in how they see remodeling and renovation.

There is however another micro perspective that is important: the view of the developer/owner and the approach that is applied to buildings as investments. Five owner/developer segments within the overall NRRR market have been identified

- Developer segment that buys buildings, adds value to them and then sells the buildings;
- Developer segment that buys, renovates, and holds buildings;
- Triple net operator segment;
- Owner-occupied buildings segment; and
- Ground lease segment.

The differences between these segments is in the way owners derive income from their investments and how they own/use the building or how long they are willing to hold their investments. For one example, if a building is purchased by a developer whose goal is to quickly increase its capital value with a view to realizing a gain on a sale of the building, that owner/developer is only likely to be interested in doing those things to a building that will result in short term gain in the value of the building. On the other hand, if a building is purchased for long term owner use, the owner may be willing to invest in improvements to a building that have long term value.

Thus, within the remodeling and renovation sector, there may be several segments that are related to the investors and the investors strategy. There may be similar segments in the new construction market. What is important is not so much whether there is a difference between new construction and remodeling and renovation, but that there are sub-segments within the remodeling and renovation market that must be approached differently if one wants to affect energy use in buildings that are being remodeled or renovated. Indeed, it may be very difficult to encourage energy efficiency in some of these segments (e.g., the triple net operator segment) unless the cost of efficient equipment is less than that of standard equipment. Even then, the market opportunity is only for those things which the investor is willing to install.

7.2 CHARACTERISTICS OF DECISION MAKING FOR NRRR PROJECTS

There are several findings coming out of the NRRR Study regarding decision making for remodeling and renovation of nonresidential buildings.

7.2.1 Why Remodel or Renovate?

Most renovation and remodeling is done in response to tenancy changes, either changes in the occupancy of a space or changes in tenants' needs that require changes to the space or the size of the space. There are other reasons for

remodeling and renovation, such as freshening the look of the space or upgrading the quality or functionality of the space. However, freshening the look or upgrading the quality of the space is usually done in conjunction with a tenancy change (except in about 20 percent of the cases).

Some of the literature, especially the literature on measure life, suggests that there is a high turnover rate in commercial space. However, data collected in the NRRR Study survey of decision makers indicates that more than three quarters of the tenants expect to remain in the space six or more years. This suggests that most tenants are in the space a sufficient length of time so that the return on investments in energy efficient equipment can be realized within the timeframes associated with other types of business decisions. Thus, turnover does not appear to influence rate of return requirements.

7.2.2 What Gets Remodeled and Renovated?

Various data were examined to identify the types of nonresidential buildings that account for the majority of remodeling and renovating activity.

- For most markets, alterations, additions, and tenant improvements to office buildings account for most of the remodeling and renovating activity.
- Retail buildings are also likely candidates for remodeling and renovating, but the level of activity for these buildings is noticeably lower than for office buildings.
- In some markets, remodeling and renovating of industrial or manufacturing buildings is significant. In the data examined, this was particularly true for buildings located in the Silicon Valley (i.e., San Jose and Sunnyvale).

7.2.3 Who Are the Decision-Makers?

According to the survey of decision makers, an architect is involved in 80 percent of all of the remodeling and renovation activities. About half the time the architect is an outside consultant. About a third of the time the architect is a part of the owner or developers in-house staff. One third of the time the architect works for the lessees. The developer's staff, a lessee's staff (e.g., the design staff for a retail chain) or commercial architects are important targets for energy efficiency information.

Budgets are the key driver of activity. Budgets are set by the owner for about three-fourths of remodeling and renovation projects. A lessee's architect determines the budget for about 15 percent of the projects. While the owner may not be directly involved in detailed decision-making, it is clear that owners or their staff set the constraints and that they may become involved in making trade-offs among amenities.

Lighting decisions are heavily influenced by external building professionals, especially electrical engineers. Internal staff are reported to have influence in about a quarter of the cases but about half of these were cases where there were internal design staff. Information from utilities or distributors is used much less frequently.

HVAC decisions are also heavily influenced by external building professionals with HVAC contractors and HVAC consultants or engineers being cited about equally as often. Internal maintenance staff are consulted more often in HVAC decision-making than in decision-making about lighting. Manufacturers and distributors appear to influence only a few players.

Thus, budgets are a key driver of activity and owners control budget. Architects are involved in the great majority of remodels and renovations. External professionals are important in the decision-making for nonresidential remodeling and renovation projects. In the case of HVAC decisions, the internal maintenance professionals sometimes play important roles. Influence is seldom attributed to manufacturers and distributors.

7.2.4 What Are the Decision Making Criteria?

A number of criteria that might influence decision making were examined. For lighting decisions, Title 24 is the most important criterion followed by improving lighting quality, energy efficiency and high equipment reliability. Price, experience with the equipment and recapturing the cost of the item are at the bottom of the list. This ordering of the criteria does not conform the widely expressed idea that price or first cost are the key drivers of choice.

When interactions among the criteria were examined, there were three different sets of factors that influence lighting decision-making. Title 24 plays a different role in each of the factors.

- Some people make decisions based on a "payback and reliability factor" where the concerns are for high reliability, payback, having experience with the technology or practice, first cost, and lighting quality. This group attaches low importance to energy efficiency and Title 24. For this group, Title 24 is probably something that one just deals with in the course of business, and energy efficiency is probably "nice to have."
- Another decision grouping is the "Title 24 efficiency sensitive group" where Title 24 and energy efficiency are key decision factors. Payback, recapturing the cost of the technology, and first cost are negatively related to this factor, meaning that people who score high on this factor attach considerably less importance to these items than other decision-makers. One might imagine that people who score high on this factor may recommend equipment or build

buildings that exceed the Title 24 standards and who, in describing a building to others, might talk about its efficiency characteristics.

- The third grouping, which can be designated as the "Title 24 cost sensitive group," represents people who are concerned about Title 24 from the standpoint of the burdens of first cost and pay back. Decision makers who relate to this factor are much less concerned about efficiency, lighting quality, reliability, and prior experience with equipment than other decision makers. Someone scoring high on this factor might be someone who would express concerns about the costs of complying with Title 24.

Among those who did not make changes to lighting, there were some who already thought their lighting was efficient or indicated cost concerns, but most reported no significant barriers. Various forms of incentives, for example, technical assistance, low interest loans, information, would have had little effect on their decisions.

The criteria that are important in HVAC decision-making are similar to those for lighting; these criteria include Title 24 requirements, improved tenant comfort, energy efficiency, and equipment reliability,. Although some decision makers base decisions on a broad set of criteria, Title 24 is cited as the single most important in decision making. However, the response to Title 24 is not uniform. Some decision makers focus mostly on the efficiency aspects of Title 24 while others focus on the cost effects of Title 24.

When HVAC decision makers are classified according to the factors related to their decision criteria, three groups can be identified: people concerned about efficiency comfort, savings, and cost; people concerned about cost and experience; and people concerned about Title 24 who are cost insensitive. These are somewhat different factor groupings than for lighting, suggesting that the criteria used in the decision-making for the systems differ.

Those who did not change their HVAC systems indicate at least two relatively important obstacles to installing efficient HVAC systems. Some reported perceiving that their systems are already efficient. Others reported that they did not make changes because of Title 24 or permitting requirements. Those who did not make changes reported that various types of incentives would have made no difference in their decisions.

7.3 IMPLICATIONS FOR PROGRAM STRATEGIES AND DESIGN

The findings from the NRRR Study have several implications for strategies and designs for programs to encourage energy efficiency when NRRR activities take place. Those implications are discussed here.

7.3.1 Early Identification of NRRR Projects

One key finding from the NRRR Study has been that remodeling and renovation activities are usually driven by a change in tenant and/or a tenant changing their operation. If program implementers want to capture more of the NRRR market, they may need to focus on tenancy changes as a key to identifying space that is likely to be renovated. If implementers can track potential tenancy changes, they can then anticipate remodeling and renovation activities. Being able to anticipate remodeling and renovation increases the possibility that program implementers can capture market driven projects in the early implementation stages, which in turn increases the potential for introducing energy efficient design and equipment.

A possible strategy for identifying space that is to be renovated is to work with leasing agents who specialize in commercial lease space. There are also real estate statistical consulting services that maintain databases identifying cases where leases are expiring. By working with such firms, program implementers can identify space that is coming to market in sufficient time to promote energy efficiency when changes to space are being made. Landlords and/or tenants who are candidates for an energy efficiency program can be identified on a continuous basis and marketed to directly with mailings that describe the program and the benefits that they can realize from installing energy efficient equipment.

7.3.2 Focused Marketing to NRRR Market Segments

Another set of key findings from the NRRR Study regarding program implementation is that there are distinct groups of actors in the NRRR market. These groups can be distinguished by such factors as (1) their investment outlooks and strategies and (2) their relative emphasis on cost versus other factors as criteria in their decision making.

A program to influence remodeling and renovation toward greater energy efficiency must be based on an understanding of different investment strategies. Program efforts must be tuned to match the investment strategies. For example:

- Incentives might work with building owners who buy, renovate and sell, but design assistance and performance contracting are not likely to be effective
- The owners who use the buy, renovate, hold, and lease strategy also may be influenced by incentives, but design assistance and performance contracting may not be effective
- Owners who use their buildings can be influenced by almost any program strategy, and incentives may not be necessary
- Triple net operators may not be touchable.
- Parties with ground leases are probably like owners to a certain extent.

An important element in any investment calculation is the length of time over which the returns from the investment are to be realized. For example, if space were expected to turn over rapidly, then investments in higher efficiency but also higher cost measures might not be attractive. However, the survey of decision makers conducted for the NRRR Study showed that tenants are likely to continue to occupy a renovated space for six years or more. Less than a quarter of the respondents reported that tenants would occupy space for five years or less. For those who answered a question regarding their payback criterion, more than 60 percent indicated that the desired payback should be 5 years or less. From a program design perspective, these findings suggest that roughly three quarters of tenants occupy renovated space for a period of sufficient length so that tenants paying their own energy bills can recover the costs of typical energy efficiency measures. The returns from higher efficiency measures can be realized.

Other findings from the NRRR Study show that project cost is important for some people but not for others. There are multiple criteria that people apply in decision-making. People respond differently to Title 24. For some, it is an efficiency issue. For others it is a cost driver. For still others, Title 24 is simply a requirement that must be met. Moreover, value engineering can rob the savings, so energy efficiency needs to be carefully fostered in the design stages.

7.3.3 Using Distinct Marketing Messages for NRRR Market Segments

The findings from the NRRR Study regarding decision-making criteria for NRRR projects imply that decision-makers have different buttons and that a single message focused on energy savings is not sufficient to influence decisions for the many. Marketing messages and strategies are needed that appeal to each group.

For example, reaching the decision makers in the different NRRR market segments may require marketing messages (and even program designs) different from those that have been used for new construction. For example, it was found during the NRRR Study that participants in the NRRR market did not recognize *Savings By Design* (*SBD*) as an NRRR program, although that program addresses NRRR activities as well as new construction. Indeed, the penetration of the *SBD* program into the NRRR market was shown to be lower than its penetration into the new construction market.

To gain greater penetration of the *SBD* program into the NRRR market, greater emphasis on the applicability of the program to NRRR projects may be needed in marketing the program. Moreover, the marketing message needs to be attuned to the reasons that firms with NRRR projects do not participate in the program. These reasons may include that building professionals do not know that the program is available for remodeling and renovation projects or that they do not perceive it to be applicable to many NRRR projects. Marketing to the external professionals that

influence decision-making may be another strategy for increasing awareness of program offerings. For example, information could be channeled through electrical engineers in the case of lighting and contractors in the case of HVAC.

Marketing strategies that address time constraints may be effective for certain segments of this market. For example, a program that collaborates with building departments might use expedited plan checking and permitting services as more meaningful incentives to decision-makers.

In directing marketing at the different NRRR market segments, consideration might also be given to how the "enhanced value" strategy that has been suggested for new construction programs might also be applied to remodeling or renovation. In applying an "enhanced value" strategy to remodeling and renovation, however, it needs to be determined whether the elements that would be included in an enhanced strategy for remodeling and renovation would be the same as for new construction. Moreover, it should be noted that an enhanced value strategy requires a long-term effort.

While marketing messages may need to be distinct for market segments defined by investment strategies and decision-making criteria, the message for a given market segment defined by these factors can probably be uniform statewide. This is implied by the results from the analysis of CIRB data on trends in permitting activity for new construction and for alterations and additions across different geographical regions of California. On one hand, the relative low correlations across regions with respect to new construction activity suggest that tailored regional program approaches are a better strategy for new construction programs. On the other hand, the relatively high correlations across regions with respect to NRRR activity suggest that program planners can approach NRRR market activity on a more uniform statewide basis.

APPENDIX A: COUNTIES INCLUDED IN CIRB REGIONS

CIRB Region	*Counties Included in Region*	*CIRB Region*	*Counties Included in Region*
Bakersfield	Kern	San Diego	San Diego
Central	Fresno Kings Madera Merced Tulare	San Francisco Bay	Alameda Contra Costa Marin Napa San Francisco San Mateo Santa Clara Solano Sonoma
Eureka	Del Norte Humboldt Lake Mendocino		
Los Angeles	Los Angeles Orange Ventura	Balance of State	Alpine Amador Calaveras Inyo Lassen Mariposa Modoc Mono Monterey Nevada Plumas San Benito San Luis Obispo Santa Barbara Santa Cruz Sierra Siskiyou Trinity Tuolumne
Riverside	Imperial Riverside San Bernardino		
Sacramento	Butte Colusa El Dorado Glenn Placer Sacramento San Joaquin Shasta Stanislaus Sutter Tehama Yolo Yuba		